GEOTECHNICAL REPORT

Cheshire Short Plat
7615 East Mercer Way
Mercer Island, Washington

Project No. T-8264

Terra Associates, Inc.

Prepared for:

Mr. Derek Cheshire
Mercer Island, Washington

May 12, 2020
4th Revision March 3, 2023

TERRA ASSOCIATES, Inc.

Consultants in Geotechnical Engineering, Geology
and
Environmental Earth Sciences

May 12, 2020
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Project No. T-8264

Mr. Derek Cheshire
7615 East Mercer Way
Mercer Island, Washington 98040

Subject: Geotechnical Report
Cheshire Short Plat
7615 East Mercer Way
Mercer Island, Washington

Dear Mr. Cheshire:

As requested, we have conducted a geotechnical engineering study for the subject project. The attached report presents our findings and recommendations for the geotechnical aspects of project design and construction.

In general, the soil conditions observed in the test boring consists of approximately 4 feet of dense fill material overlying 7 to 13 feet of medium dense to dense silty sand over medium dense to dense silt to the termination of the test borings. An approximately four-foot layer of sand with gravel was observed at a depth of 15 feet in Test Boring B-2. Groundwater seepage and wet soils were observed at depths of 7.5 to 25 feet below current site grades.

In our opinion, the soil conditions observed at the site will be suitable for support of the proposed development, provided the recommendations presented in this report are incorporated into project design and construction.

We trust the information presented in this report is sufficient for your current needs. If you have any questions or require additional information, please call.

Sincerely yours,
TERRA ASSOCIATES, INC.

CAROLYN S. DECKER
47016

Carolyn S. Decker

3-3-2023

Carolyn S. Decker, P.E.
President

TABLE OF CONTENTS

Figures

Appendices

Geotechnical Report
Cheshire Short Plat
7615 East Mercer Way
Mercer Island, Washington

1.0 PROJECT DESCRIPTION

The project consists of constructing a residential structure in the northeast corner of the existing tax parcel. The site is developed with a single-family residence and an accessory dwelling unit in the eastern portion of the site. The focus of this report is the northeast, undeveloped portion of the site. Based on the site plan prepared by CORE Design dated January 2020, the structure will be located in the approximate center of the new building lot with access from Southeast 76th Street. With finish floor elevations of 122 feet and 112 feet, grading will consist of cuts and fills from one to ten feet.

The structure constructed on the lot is expected to be two- to three- story building framed over a crawl space. Foundation loads should be relatively light, in the range of 4 to 6 kips per foot for bearing walls and 50 to 75 kips for isolated columns.

The recommendations in the following sections of this report are based on the design discussed above. If actual features vary or changes are made, we should review the plans in order to modify our recommendations, as required. We should review final design drawings and specifications to verify that our recommendations have been properly interpreted and incorporated into the project design.

2.0 SCOPE OF WORK

On June 27, 2022, we observed soil and groundwater conditions at 2 test borings drilled to depths of 30 and 40 feet below current site grades. Using this data along with laboratory testing, we performed analyses to develop geotechnical recommendations for project design and construction. Specifically, this report addresses the following:

- Soil and groundwater conditions.
- Seismic criteria per the current International Building Code (IBC).
- Geologic hazards per the City of Mercer Island Municipal Code.
- Site preparation and grading.
- Relative slope stability.
- Excavations.
- Foundation support.

- Floor slab-on-grade support.
- Lateral earth pressures on below-grade walls.
- Drainage.
- Utilities.

It should be noted that recommendations outlined in this report regarding drainage are associated with soil strength, design earth pressures, erosion, and stability. Design and performance issues with respect to moisture as it relates to the structure environment are beyond Terra Associates' purview. A building envelope specialist or contractor should be consulted to address these issues, as needed.

3.0 SITE CONDITIONS

3.1 Surface

The project site consists of a single tax parcel totaling approximately 2 acres located at 7615 East Mercer Way in Mercer Island, Washington. The approximate site location is shown on Figure 1.

The site is currently developed with a single-family residence, an accessory dwelling unit, and associated access and landscaping in the eastern half of the site. The western half of the site is a steep slope that is covered with a moderate forest and associated understory. The focus of our study is the northeast corner of the site where the new development is proposed. Site topography in this portion of the site consists of a slope that descends from the west to the east with an overall relief of approximately 26 feet.

3.2 Subsurface

In general, the soil conditions at the site consisted of approximately 4 feet of dense fill material overlying 7 to 13 feet of medium dense to dense silty sand over medium dense to dense silt to the termination of the test borings. An approximately four-foot layer of sand with gravel was observed at a depth of 15 feet in Test Boring B-2.

The *Preliminary Geologic Map of Seattle and Vicinity, Washington,* by H.H. Waldron, B.A. Leisch, D.R. Mullineaux, and D.R. Crandell (1961) maps the site as pre-fraser glacial drift (Qgpc). This mapped description is consistent with the native soils observed in the test borings.

The preceding discussion is intended to be a general review of the soil conditions encountered. For more detailed descriptions, please refer to the Test Boring Logs in Appendix A. The approximate location of the Test Borings is shown on Figure 2.

3.3 Groundwater

Groundwater seepage and wet soils were noted at approximately 7.5 to 25 feet below current site grades within the sandier soils.

3.4 Geologic Hazards/Critical Areas Report

We evaluated site conditions for the presence of geologic hazards including erosion hazard areas, landslide hazard areas, and seismic hazard areas. In addition, we have reviewed Section 19.07.110 of the Mercer Island Municipal Code, Critical Area Study. Our findings are presented below.

3.4.1 Erosion Hazard Areas

Section 19.16.010 of the Mercer Island Municipal Code (MIMC) defines an erosion hazard as "areas greater than 15 percent slope and subject to a severe risk of erosion due to wind, rain, water, slope, and other natural agents including those soil types and/or areas identified by the U.S. Department of Agriculture's Natural Resources Conservation Service as having a "severe" or "very severe" rill and inter-rill erosion hazard."

The soils observed onsite are classified as Kitsap Silt Loam, 15 to 30 percent slopes (KpD) by the United States Department of Agriculture Natural Resources Conservation Service (NRCS), formerly the Soil Conservation Service. With the existing slope gradients, these soils will have a severe potential for erosion when exposed. Therefore, the site is categorized as an erosion hazard area per the MIMC.

Implementation of temporary and permanent Best Management Practices (BMPs) for preventing and controlling erosion will be required and will mitigate the erosion hazard. As a minimum, we recommend implementing the following erosion and sediment control BMPs prior to, during, and immediately following construction activities at the site.

Prevention

- Limit site clearing and grading activities to the relatively dry months (typically May through September).
- Limit disturbance to areas where construction is imminent.
- Locate temporary stockpiles of excavated soils no closer than ten feet from the crest of the slope.
- Provide temporary cover for cut slopes and soil stockpiles during periods of inactivity. Temporary cover may consist of durable plastic sheeting that is securely anchored to the ground surface or straw mulch.
- Establish permanent cover over exposed areas that will not be disturbed for a period of 30 days or more by seeding, in conjunction with a mulch cover or appropriate hydroseeding.

Containment

- Install a silt fence along site margins and downslope of areas that will be disturbed. The silt fence should be in place before clearing and grading is initiated.
- Intercept surface water flow and route the flow away from the slope to a stabilized discharge point. Surface water must not discharge at the top or onto the face of the steep slope.
- Provide onsite sediment retention for collected runoff.

The contractor should perform daily review and maintenance of all erosion and sedimentation control measures at the site.

3.4.2 Landslide Hazard Areas

Section 19.16.010 of the MIMC defines a landslide hazard as "areas subject to landslides based on a combination of geologic, topographic, and hydrologic factors, including:

1. Areas of historic failures.

2. Areas with all three of the following characteristics:

    a. Slopes steeper than 15 percent.

    b. Hillsides intersecting geologic contacts with relatively permeable sediment overlying a relatively impermeable sediment or bedrock.

    c. Springs or groundwater seepage.

3. Areas that have shown evidence of past movement or that are underlain or covered by mass wastage debris from past movements.

4. Areas potentially unstable because of rapid stream incision and stream bank erosion.

5. Steep Slope. Any slope of 40 percent or greater calculated by measuring the vertical rise over any 30-foot horizontal run."

None of these conditions exist on the site. Therefore, the site is not a landslide hazard as defined by the MIMC.

We completed a slope stability analysis throughout the site to determine if the proposed construction can alter the area without causing instability. Our analysis was completed at a location designated as Cross-Section A-A' using the computer program Slide 2. The approximate cross-section location is shown on Figure 2.

Our analysis considered both static and the pseudostatic (seismic) conditions. A horizontal acceleration of 0.31g was used in the pseudostatic analysis to simulate slope performance under earthquake loading. This acceleration is equal to one-half of the peak horizontal ground acceleration with a two percent in 50-year probability of exceedance as defined by the 2018 International Building Code. A groundwater table was also modeled.

Based on our field exploration, laboratory testing, and previous experience with similar soil types, we chose the following parameters for our analysis:

Table 1 – Slope Stability Analysis Soil Parameters

Soil Type	Unit Weight (pcf)	Friction Angle (Degrees)	Cohesion (psf)
Medium Dense SM	120	34	100
Medium Dense SP-SM	120	28	75
Medium Stiff ML	110	28	700
Stiff ML	110	28	1500

The results of our slope stability analysis, as shown by the lowest safety factors for each condition, are presented in the following table:

Table 2 – Slope Stability Analysis Results

Cross Section	**Minimum Safety Factors**	
	Existing Conditions	***Post Construction***
A-A’	2.52 (Seismic FS = 1.07)	1.70 (Seismic FS = 1.16)

Based on our analysis, the proposed project will increase the overall stability of the site and thereby the development has been designed so that the risk to the site and adjacent property is mitigated such that the site is determined to be safe. Therefore, per Section 19.07.160.3.b of the MICI and our opinion, the site can be constructed, as proposed. The results of our analysis are attached in Appendix B.

Per Section 19.07.110.C. of the MIMC “the critical area study requirement may be waived or modified if the applicant demonstrates that the development proposed will not have an impact on the critical area or its buffer in a manner contrary to the purposed and requirements of this chapter”. The purpose of the critical area study from a geotechnical perspective is to determine if and how proposed construction will impact a geologic hazard. The geologic hazard present at this proposed site is the blocky soils that have been outlined on the boring logs. The presence of landslide debris typically indicates past instability. Therefore, a slope stability analysis should be completed based on the proposed construction. Based on the analysis completed above, the proposed construction will increase the overall stability of the site. Therefore, the critical area study should be waived as the proposed developed will not have a negative impact on the critical area or its buffer.

Lateral Spread Analysis

In addition to the slope stability analysis, the City of Mercer Island has requested that a lateral spread analysis be completed for the project. We completed our analysis following the Federal Highway Administration (FHWA) method for calculating lateral spread (FHWA-NHI-11-032, GEC No. 3, August 2011). Per the FHWA lateral spread displacements are determined by “employing the Newmark sliding block approach on an assumed dominant failure plane at the base of a liquified zone…. In this type of analysis, the yield acceleration of the slide mass is evaluated using the post-earthquake undrained residual shear strength of the soil and then the lateral displacement is calculated using this yield acceleration in a conventional Newmark analysis.”

Following this procedure, we have completed the analysis using the same cross section for the slope stability analysis above. However, the post-construction slope stability analysis indicated the minimum factors of safety were located above the upslope retaining wall. The lateral spread would be expected to occur on the downslope portion of the property. Therefore, we have completed the analysis with the failure surfaces limited to the downslope section of the site.

In accordance with FHWA, the following table shows our post-earthquake undrained residual shear strengths for the site soils. The residual soil strengths were determined following FHWA Idress and Boulanger correlations (2007). The calculations are attached in Appendix C:

Table 3 – Lateral Spread Analysis Soil Parameters

Soil Type	**Unit Weight (pcf)**	**Friction Angle (Degrees)**	**Cohesion (psf)**
Medium Dense SM	120	0	243
Medium Dense SP-SM	120	0	204
Medium Stiff ML	110	0	713
Stiff ML	110	28	1500

The results of our slope stability and lateral spread analysis, as shown by the lowest safety factors for each condition, are presented in the following table:

Table 4 – Slope Stability Analysis Results

Cross Section	**Minimum Safety Factors**			
	Post Construction Residual Strength	***Lateral Spread Displacement (inches) Cape Mendocino***	***Lateral Spread Displacement (inches) Daly City***	***Lateral Spread Displacement (inches) Nahanni Canada***
A-A’	1.2	19.69 inches	0.21 inches	9.45 inches

Based on our analysis, the post construction, post-earthquake lateral spread resulting from a subduction zone event would result in a displacement of approximately 19.69 inches. The results of our analysis are attached in Appendix C.

If the proposed project changes, these analyses should be reviewed to determine if any additional analysis is required for the project.

3.4.3 Seismic Hazard Areas

Section 19.16.010 of the MIMC defines a seismic hazard area as “areas subject to severe risk of damage as a result of earthquake induced ground shaking, slope failure, settlement, soil liquefaction or surface faulting.”

Liquefaction is a phenomenon where there is a reduction or complete loss of soil strength due to an increase in water pressure induced by vibrations. Liquefaction mainly affects geologically recent deposits of fine-grained sand that is below the groundwater table. Soils of this nature derive their strength from intergranular friction. The generated water pressure or pore pressure essentially separates the soil grains and eliminates this intergranular friction; thus, eliminating the soil’s strength.

We completed a liquefaction analysis using the computer program LiquefyPro published by CivilTech Corporation. The analysis was completed using a ground acceleration value of 0.62g, which is the ground acceleration for the maximum considered earthquake (MCE) for an earthquake with a 2,500 return-period. The value was determined using the U.S. Geological Survey (USGS) web-based Unified Hazard Tool.

The results of our analysis indicate soil liquefaction could occur during the design earthquake event, resulting in total settlements approaching approximately 2.8 inches, with one-half of that settlement likely being differential in nature. Results of the analysis are attached to in Appendix D.

In our opinion, this amount of settlement would not structurally impact the building but would result in damage of a cosmetic nature. If the owner is not willing to accept the risk of cosmetic building damage requiring repair in the event of seismic-induced settlements occur, foundations would need to be supported on ground improved with stone columns or rammed aggregate piers. Based on our experience with similar sites and structures, structural design elements are also available to mitigate potential damage caused by the seismic-related soil settlements.

3.5 Seismic Design Parameters

Due to the site soils being subject to liquefaction, per the current International Building Code (IBC), the subsurface conditions would be assigned site class “F”, which would require performing a site-specific seismic analysis to determine seismic forces for structural design. However, the current IBC allows for using code derived seismic values for the soil conditions indicated if the building’s fundamental period is equal to or less than 0.5 seconds. We expect the single-family residence will fall into this category. In this case, based on soil conditions encountered and our knowledge of the area geology, site class “E” can be used to determine seismic design forces.

4.0 DISCUSSION AND RECOMMENDATIONS

4.1 General

Based on our study, there are no geotechnical considerations that would preclude development of the site, as currently planned. Due to the loose layer of material observed approximately 25 feet below current site grades, we recommend the building be supported on small diameter pipe piles that are driven to refusal. The floor slab can be support on competent inorganic native soils or on new structural fill placed and compacted above the competent soils.

The native soils encountered contain a sufficient amount of soil fines and will be difficult to compact as structural fill when too wet. The ability to use these native soils from site excavations as structural fill will depend on its moisture content and the prevailing weather conditions at the time of construction. If grading activities will take place during winter, the owner should be prepared to import clean granular material for use as structural fill and backfill.

The following sections provide detailed recommendations regarding the preceding issues and other geotechnical design and construction considerations. These recommendations should be incorporated into the final design drawings and construction specifications.

4.2 Site Preparation and Grading

To prepare the site for construction, all vegetation and organic surface soils should be stripped and removed from below the new construction/remodeling areas. Soil containing organic material will not be suitable for use as structural fill but may be used for limited depths in nonstructural areas.

Once stripping operations are complete, cut and fill operations can be initiated to establish desired grades. Prior to placing fill, all exposed bearing surfaces should be observed by a representative of Terra Associates, Inc. to verify soil conditions are as expected and suitable for support of building foundations or placement of structural fill. If unsuitable yielding areas are observed, they should be cut to firm bearing soil and filled to grade with structural fill. If depth of excavation to remove unstable soils is excessive, use of geotextile fabric such as Mirafi 500X or equivalent in conjunction with structural fill can be considered in order to limit the depth of removal. Our experience has shown that, in general, a minimum of 18 inches of a clean, granular structural fill placed and compacted over the geotextile fabric should establish a stable bearing surface.

Our study indicates that the site soils contain a sufficient percentage of fines, silt size particles that will make them difficult to compact as structural fill if they are too wet or too dry. The ability to use the native soils as structural fill will depend on their moisture content and the prevailing weather conditions when site grading activities take place. If wet soils are encountered, the contractor will need to dry the soils by aeration during dry weather conditions. Alternatively, the use of an additive such as Portland cement or lime to stabilize the soil moisture can be considered. If the soil is amended, additional Best Management Practices (BMPs) addressing the potential for elevated pH levels will need to be included in the Storm Water Pollution Prevention Program (SWPPP) prepared with the Temporary Erosion and Sedimentation Control (TESC) plan.

If grading activities are planned during the wet winter months, or if they are initiated during the summer and extend into fall and winter, the owner should be prepared to import wet weather structural fill. For this purpose, we recommend importing a granular soil that meets the following grading requirements:

U.S. Sieve Size	Percent Passing
6 inches	100
No. 4	75 maximum
No. 200	5 maximum*

* Based on the ¾-inch fraction.

Prior to use, Terra Associates, Inc. should examine and test all materials imported to the site for use as structural fill.

Structural fill should be placed in uniform loose layers not exceeding 6 inches and compacted to a minimum of 95 percent of the soil’s maximum dry density, as determined by American Society for Testing and Materials (ASTM) Test Designation D-698 (Standard Proctor). The moisture content of the soil at the time of compaction should be within two percent of its optimum, as determined by this ASTM standard. In nonstructural areas, the degree of compaction can be reduced to 90 percent.

4.3 Excavations

All excavations at the site associated with confined spaces, such as utility trenches, must be completed in accordance with local, state, and federal requirements. Based on regulations outlined in the Washington Industrial Safety and Health Act (WISHA), the onsite soils would be classified as Type C soil.

Accordingly, temporary excavations in Type C soils should have their slopes laid back at an inclination of 1.5:1 (Horizontal: Vertical) or flatter, from the toe to the crest of the slope. All exposed temporary slope faces that will remain open for an extended period of time should be covered with a durable reinforced plastic membrane during construction to prevent slope raveling and rutting during periods of precipitation.

Groundwater should be expected for excavations that extend ten feet below current site grades. The volume of water could be significant and may need to be dewatered depending upon the final configuration of the grades. The contractor should be prepared to implement active dewatering for any excavation that extends 15 feet below current site grades.

The above information is provided solely for the benefit of the owner and other design consultants and should not be construed to imply that Terra Associates, Inc. assumes responsibility for job site safety. It is understood that job site safety is the sole responsibility of the project general contractor.

4.4 Foundation Support

Due to the loose soil layer observed in the test borings, we recommend supporting the building on three- or four-inch diameter pipe piles. Piles used should consist of a pipe that is galvanized or otherwise coated to reduce corrosion impacts.

Three inch pipe piles driven to refusal can be designed for an allowable vertical compressive axial load of 12 kips. Refusal would be considered as less than 1- inch of penetration following 30 seconds of driving using a hydraulic impact hammer weighting 125 pounds. Four inch pipe piles driven to refusal can be designed for an allowable vertical compressive axial load of 20 kips. Refusal would be considered as less than 1-inch of penetration following 16 seconds of driving using a hydraulic impact hammer weighting 325 pounds. Based on soil conditions observed in the test borings, pile lengths of 30 to 40 feet should be expected.

If the piles will be relied upon to resist lateral loading, they would need to be driven at a batter.

For designing grade beams to resist lateral loads, passive earth pressures acting on the side of the grade beam can be considered. We recommend calculating this lateral resistance using an equivalent fluid weight of 300 pcf. We recommend not including the upper 12 inches of soil in this computation because they can be affected by weather or disturbed by future grading activity. This value assumes the grade beam will be constructed neat against competent native soil or backfilled with structural fill as described in Section 4.2 of this report. The value recommended includes a safety factor of 1.5.

Helical Anchors

Helical anchors will be used to offset the estimated lateral spread displacement from the subduction zone event. The anchors will extend through the potentially liquefiable soils into the stiff silt. Provided the anchors consist of, at a minimum, double 12-inch diameter, 4.5-inch shaft helical anchors, the individual allowable capacity would be 9,000 pounds.

4.5 Floor Slab-on-Grade

Slab-on-grade floors may be supported on a subgrade as recommended in Section 4.2. Immediately below the floor slab, we recommend placing a four-inch-thick capillary break layer composed of clean, coarse sand or fine gravel that has less than five percent passing the No. 200 sieve. This material will reduce the potential for upward capillary movement of water through the underlying soil and subsequent wetting of the floor slab.

The capillary break layer will not prevent moisture intrusion through the slab caused by water vapor transmission. Where moisture by vapor transmission is undesirable, such as covered floor areas, a common practice is to place a durable plastic membrane on the capillary break layer and then cover the membrane with a layer of clean sand or fine gravel to protect it from damage during construction, and to aid in uniform curing of the concrete slab. It should be noted that if the sand or gravel layer overlying the membrane is saturated prior to pouring the slab, it will not be effective in assisting uniform curing of the slab and can actually serve as a water supply for moisture bleeding through the slab, potentially affecting floor coverings. Therefore, in our opinion, covering the membrane with a layer of sand or gravel should be avoided if floor slab construction occurs during the wet winter months and the layer cannot be effectively drained. We recommend floor designers and contractors refer to the current American Concrete Institute (ACI) Manual of Concrete Practice for further information regarding vapor barrier installation below slab-on-grade floors.

4.6 Lateral Earth Pressures on Below-Grade Walls

The magnitude of earth pressure development on retaining walls will partly depend upon the quality of the wall backfill. We recommend placing and compacting wall backfill as structural fill as described in Section 4.2 of this report. To guard against hydrostatic pressure development, drainage must be installed behind the wall. A typical wall drainage detail is shown on Figure 3.

With wall backfill placed and compacted as recommended, and drainage properly installed, we recommend designing unrestrained walls for an active earth pressure equivalent to a fluid weighing 40 pounds per cubic foot (pcf). For restrained walls, an additional uniform load of 100 psf should be added to the 40 pcf. For evaluation of wall performance under seismic loading, a uniform pressure equivalent to 8H psf, where H is the height of the below-grade portion of the wall should be applied in addition to the static lateral earth pressure. These values assume a horizontal backfill condition and that no other surcharge loading, sloping embankments, or adjacent buildings will act on the wall. If such conditions exist, then the imposed loading must be included in the wall design. Friction at the base of foundations and passive earth pressure will provide resistance to these lateral loads. Values for these parameters are provided in Section 4.4 of this report.

4.7 Infiltration Feasibility

Based upon our study, it is our opinion that subsurface conditions are generally not favorable for infiltration of site stormwater. The native soils observed at the site contain a high percentage of soil fines that would impede any downward migration of site stormwater. Even low impact development (LID) techniques would likely fill up and overtop during rain events and cause minor local flooding. Based upon these soil conditions, it is our opinion that the stormwater should be managed using a conventional system.

4.8 Drainage

Surface

Final exterior grades should promote free and positive drainage away from the site at all times. Water must not be allowed to pond or collect adjacent to foundations or within the immediate building areas. We recommend providing a positive drainage gradient away from the building perimeters. If this gradient cannot be provided, surface water should be collected adjacent to the structures and disposed to appropriate storm facilities.

Subsurface

We recommend installing perimeter foundation drains adjacent to exterior shallow foundations. The drains can be laid to grade at an invert elevation equivalent to the bottom of footing grade. The drains can consist of four-inch diameter perforated PVC pipe that is enveloped in washed pea gravel-sized drainage aggregate. The aggregate should extend six inches above and to the sides of the pipe. Roof and foundation drains should be tightlined separately to the storm drains. All drains should be provided with cleanouts at easily accessible locations.

4.9 Utilities

Utility pipes should be bedded and backfilled in accordance with American Public Works Association (APWA) or local jurisdictional requirements. At minimum, trench backfill should be placed and compacted as structural fill as described in Section 4.2 of this report. As noted, soils excavated onsite should generally be suitable for use as backfill material during dry weather. However, the site soils are fine grained and moisture sensitive. Therefore, moisture conditioning may be necessary to facilitate proper compaction. If utility construction takes place during the winter, it may be necessary to import suitable wet weather fill for utility trench backfilling.

5.0 ADDITIONAL SERVICES

Terra Associates, Inc. should review the final design drawings and specifications in order to verify that earthwork and foundation recommendations have been properly interpreted and implemented in project design. We should also provide geotechnical service during construction to observe compliance with our design concepts, specifications, and recommendations. This will allow for design changes if subsurface conditions differ from those anticipated prior to the start of construction.

6.0 LIMITATIONS

We prepared this report in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made. This report is the copyrighted property of Terra Associates, Inc. and is intended for specific application to the Cheshire Short Plat project in Mercer Island, Washington. This report is for the exclusive use of Mr. Derek Cheshire and his authorized representatives.

The analyses and recommendations present in this report are based on data obtained from the subsurface explorations completed onsite. Variations in soil conditions can occur, the nature and extent of which may not become evident until construction. If variations appear evident, Terra Associates, Inc. should be requested to reevaluate the recommendations in this report prior to proceeding with construction.

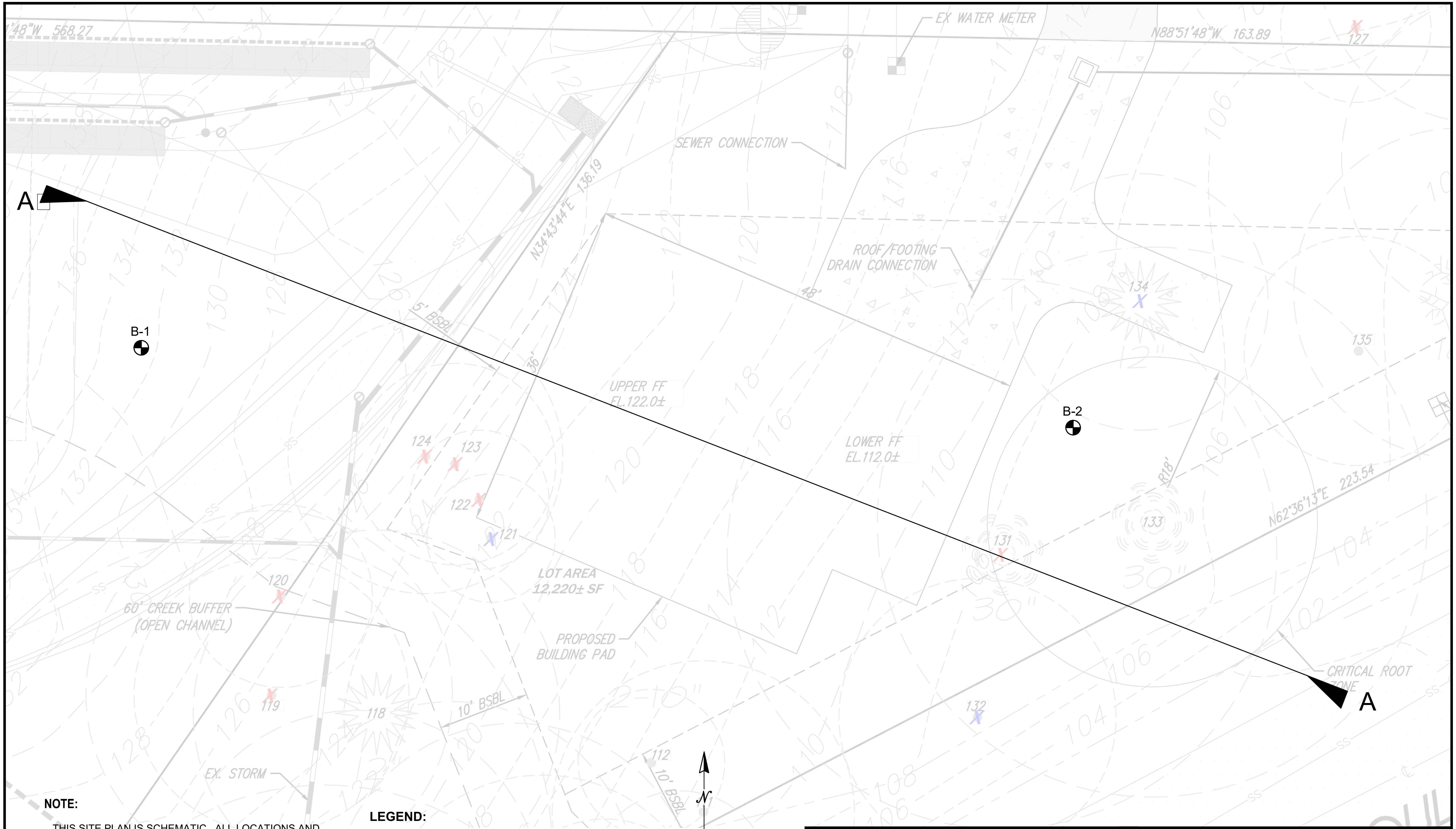
REFERENCE: https://www.bing.com/maps

ACCESSED 5/12/2020

Terra Associates, Inc.
Consultants in Geotechnical Engineering
Geology and
Environmental Earth Sciences

VICINITY MAP
CHESHIRTE SHORT PLAT
MERCER ISLAND, WASHINGTON

Proj.No. T-8264	Date: MAR 2023	Figure 1



NOTE:

THIS SITE PLAN IS SCHEMATIC. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE. IT IS INTENDED FOR REFERENCE ONLY AND SHOULD NOT BE USED FOR DESIGN OR CONSTRUCTION PURPOSES.

REFERENCE: SITE PLAN PROVIDED BY CORE DESIGN.

LEGEND:

⊕	APPROXIMATE BORING LOCATION
◣ ◢	APPROXIMATE CROSS SECTION LOCATION

0 20 40

APPROXIMATE SCALE IN FEET

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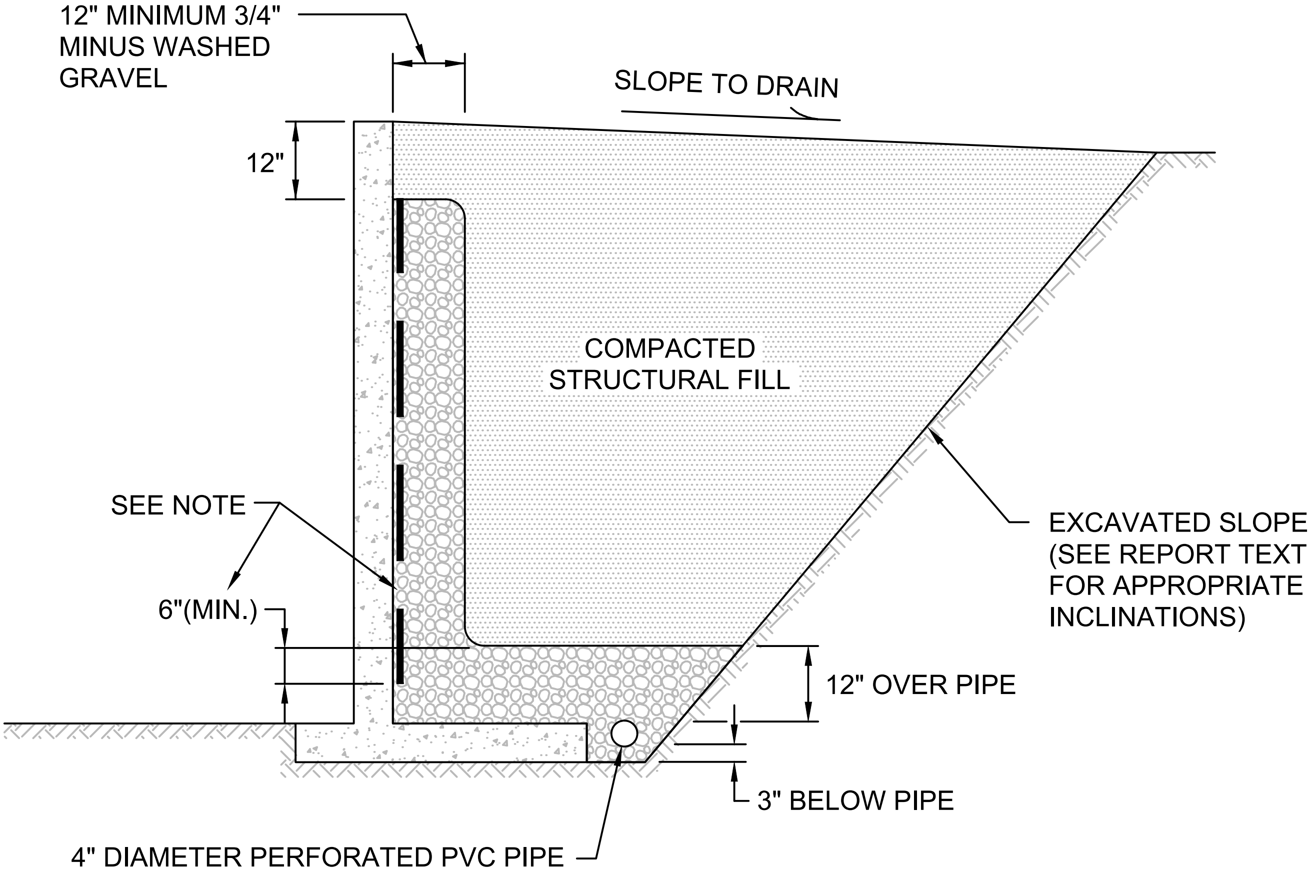
EXPLORATION LOCATION PLAN
CHESHIRE SHORT PLAT
MERCER ISLAND, WASHINGTON

Proj.No. T-8264	Date: MAR 2023	Figure 2



NOT TO SCALE

NOTE:

MIRADRAIN G100N PREFABRICATED DRAINAGE PANELS OR SIMILAR PRODUCT CAN BE SUBSTITUTED FOR THE 12-INCH WIDE GRAVEL DRAIN BEHIND WALL. DRAINAGE PANELS SHOULD EXTEND A MINIMUM OF SIX INCHES INTO 12-INCH THICK DRAINAGE GRAVEL LAYER OVER PERFORATED DRAIN PIPE.

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TYPICAL WALL DRAINAGE DETAIL
CHESHIRE SHORT PLAT
MERCER ISLAND, WASHINGTON

Proj.No. T-8264	Date: MAR 2023	Figure 3

APPENDIX A
FIELD EXPLORATION AND LABORATORY TESTING

Cheshire Short Plat
Mercer Island, Washington

On June 27, 2022, we completed our site exploration by observing soil conditions at 2 test borings drilled to depths of approximately 30 to 40 feet below existing site grades. Test boring locations were determined in the field by measuring from existing site features. The approximate location of the test borings is shown on the attached Exploration Location Plan, Figure 2. Test Boring Logs are presented on Figures A-2 and A-3.

An engineering geologist from our office conducted the field exploration. Our representative classified the soil conditions encountered, maintained a log of each test boring, obtained representative soil samples, and recorded water levels observed during drilling. During drilling, continuous soil samples were obtained during drilling in general accordance with ASTM Test Designation D-6914. Using this procedure, an eight-inch (outside diameter) hollow coring barrel is vibrated into the subsurface at five-foot intervals. A five-foot, continuous section of soil is then emptied into a sampling bag. In addition, Standard Penetration Test (SPT) soil samples were obtained every five-feet in general accordance with ASTM Test Designation D-1586. Using this procedure, a 2-inch (outside diameter) split-barrel sampler is driven into the ground 18 inches using a 140-pound hammer free falling from a height of 30 inches. The number of blows required to drive the sampler 12 inches after an initial 6-inch set is referred to as the Standard Penetration Resistance value or N value. This is an index related to the consistency of cohesive soils and relative density of cohesionless materials. N values obtained for each sampling interval are recorded on the Test Boring Logs, Figures A-2 and A-3. All soil samples were visually classified in accordance with the Unified Soil Classification System (USCS) described on Figure A-1.

Representative soil samples obtained from the test borings were placed in sealed plastic bags and taken to our laboratory for further examination and testing. The moisture content of selected samples was measured and is reported on the corresponding Test Boring Logs. Grain size analyses were also performed on select samples. The results are shown on Figure A-4.

MAJOR DIVISIONS				LETTER SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS	More than 50% material larger than No. 200 sieve size	**GRAVELS** More than 50% of coarse fraction is larger than No. 4 sieve	Clean Gravels (less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
				GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines.
			Gravels with fines	GM	Silty gravels, gravel-sand-silt mixtures, non-plastic fines.
				GC	Clayey gravels, gravel-sand-clay mixtures, plastic fines.
		SANDS More than 50% of coarse fraction is smaller than No. 4 sieve	Clean Sands (less than 5% fines)	SW	Well-graded sands, sands with gravel, little or no fines.
				SP	Poorly-graded sands, sands with gravel, little or no fines.
			Sands with fines	SM	Silty sands, sand-silt mixtures, non-plastic fines.
				SC	Clayey sands, sand-clay mixtures, plastic fines.
FINE GRAINED SOILS	More than 50% material smaller than No. 200 sieve size	**SILTS AND CLAYS** Liquid Limit is less than 50%		ML	Inorganic silts, rock flour, clayey silts with slight plasticity.
				CL	Inorganic clays of low to medium plasticity. (Lean clay)
				OL	Organic silts and organic clays of low plasticity.
		SILTS AND CLAYS Liquid Limit is greater than 50%		MH	Inorganic silts, elastic.
				CH	Inorganic clays of high plasticity. (Fat clay)
				OH	Organic clays of high plasticity.
HIGHLY ORGANIC SOILS				PT	Peat.

DEFINITION OF TERMS AND SYMBOLS

COHESIONLESS

Density	Standard Penetration Resistance in Blows/Foot
Very Loose	0-4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	>50

COHESIVE

Consistancy	Standard Penetration Resistance in Blows/Foot
Very Soft	0-2
Soft	2-4
Medium Stiff	4-8
Stiff	8-16
Very Stiff	16-32
Hard	>32

I	2" OUTSIDE DIAMETER SPILT SPOON SAMPLER
Ⅱ	2.4" INSIDE DIAMETER RING SAMPLER OR SHELBY TUBE SAMPLER
▼	WATER LEVEL (Date)
Tr	TORVANE READINGS, tsf
Pp	PENETROMETER READING, tsf
DD	DRY DENSITY, pounds per cubic foot
LL	LIQUID LIMIT, percent
PI	PLASTIC INDEX
N	STANDARD PENETRATION, blows per foot

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Environmental Earth Sciences

UNIFIED SOIL CLASSIFICATION SYSTEM
CHESHIRE SHORT PLAT
MERCER ISLAND, WASHINGTON

Proj.No. T-8264 | Date: MAR 2023 | Figure A-1

LOG OF BORING NO. 1

Figure No. A-2

Project: Cheshire Short Plat **Project No:** T-8264 **Date Drilled:** June 27, 2022

Client: Mr. Derek Cheshire **Driller:** Boretec **Logged By:** JCS

Location: Mercer Island, Washington **Depth to Groundwater:** 12.5 ft, 25 ft **Approx. Elev:** NA

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows/foot 10 30 50	Moisture Content (%)
0		Fill: Brown silty GRAVEL with sand, fine to coarse gravel, fine to coarse sand, moist. (GM)			
	I		Dense	35	6.8
5	I	Gray-brown silty SAND with gravel, fine sand, fine to coarse gravel, moist. (SM) (Possible fill)		30	6.6
	I	Brown to gray-brown silty SAND with gravel, fine sand, fine to coarse gravel, dry to moist. (SM/SP-SM)	Medium Dense	21	5.7
10	I		Dense	39	5.0
▼	I	Gray silty SAND with gravel, fine sand, fine to coarse gravel, moist (wet below 12.5 feet). (SM)	Very Stiff	16	32.0
15	I	Gray clayey SILT, moist, scattered randomly-oriented, iron-oxide stained fractures. (ML) (Pp=4.5 tons/sf) (LL=49, PI=15)	Medium Dense	23	28.4
		Gray SILT to SILT with sand, fine sand, trace of fine to coarse gravel, moist, nonplastic to low plasticity, trace of brown silty sand pockets, scattered blocky zones. (ML)	Dense		
20	I			37	28.3
		Gray SILT, moist, nonplastic to low plasticity. (ML)	Medium Dense		
▼25	I	- Wet with scattered blocky zones below 25 feet.		20	34.3
30	I	- Scattered high-angle sheared seams with hard, angular silt/clay clasts between 30 and 36.5 feet. (LL=30. PI=4)		12	33.6
35	I			14	33.5
40	I			21	30.2
45		Boring terminated at 41.5 feet. Groundwater encountered between 12.5 and 12.6 feet and below 25 feet.			

NOTE: This borehole log has been prepared for geotechnical purposes. This information pertains only to this boring location and should not be interpeted as being indicative of other areas of the site

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LOG OF BORING NO. 2

Figure No. A-3

Project: Cheshire Short Plat **Project No:** T-8264 **Date Drilled:** June 27, 2022

Client: Mr. Derek Cheshire **Driller:** Boretec **Logged By:** JCS

Location: Mercer Island, Washington **Depth to Groundwater:** 7.5 ft **Approx. Elev:** NA

Depth (ft)	Sample Interval	Soil Description	Consistency/ Relative Density	SPT (N) Blows/foot 10 30 50	Moisture Content (%)
0			Medium Dense		
	I	No sample recovery at 2.5 feet.		16	
5	I	Brown silty SAND with gravel, fine to medium sand, fine to coarse gravel, moist to wet (wet below 7.5 feet). (SM)		14	13.0
▼	I			15	13.3
10	I	No sample recovery at 10 feet.		19	
	I	Gray silty SAND with gravel, fine sand, fine to coarse gravel, wet. (SM)		12	17.8
15	I	Gray SAND with gravel, fine to coarse sand, fine to coarse gravel, wet. (SP)		10	13.7
		Gray SILT, moist to wet, nonplastic to low plasticity. (ML)			
20	I			19	30.5
25	I	- Wet with scattered blocky zones between 25 and 26.5 feet. (LL=29, PI=3)	Loose	9	32.5
30	I		Medium Dense	24	31.4
		Boring terminated at 31.5 feet. Groundwater encountered below 7.5 feet			
35					

NOTE: This borehole log has been prepared for geotechnical purposes. This information pertains only to this boring location and should not be interpeted as being indicative of other areas of the site

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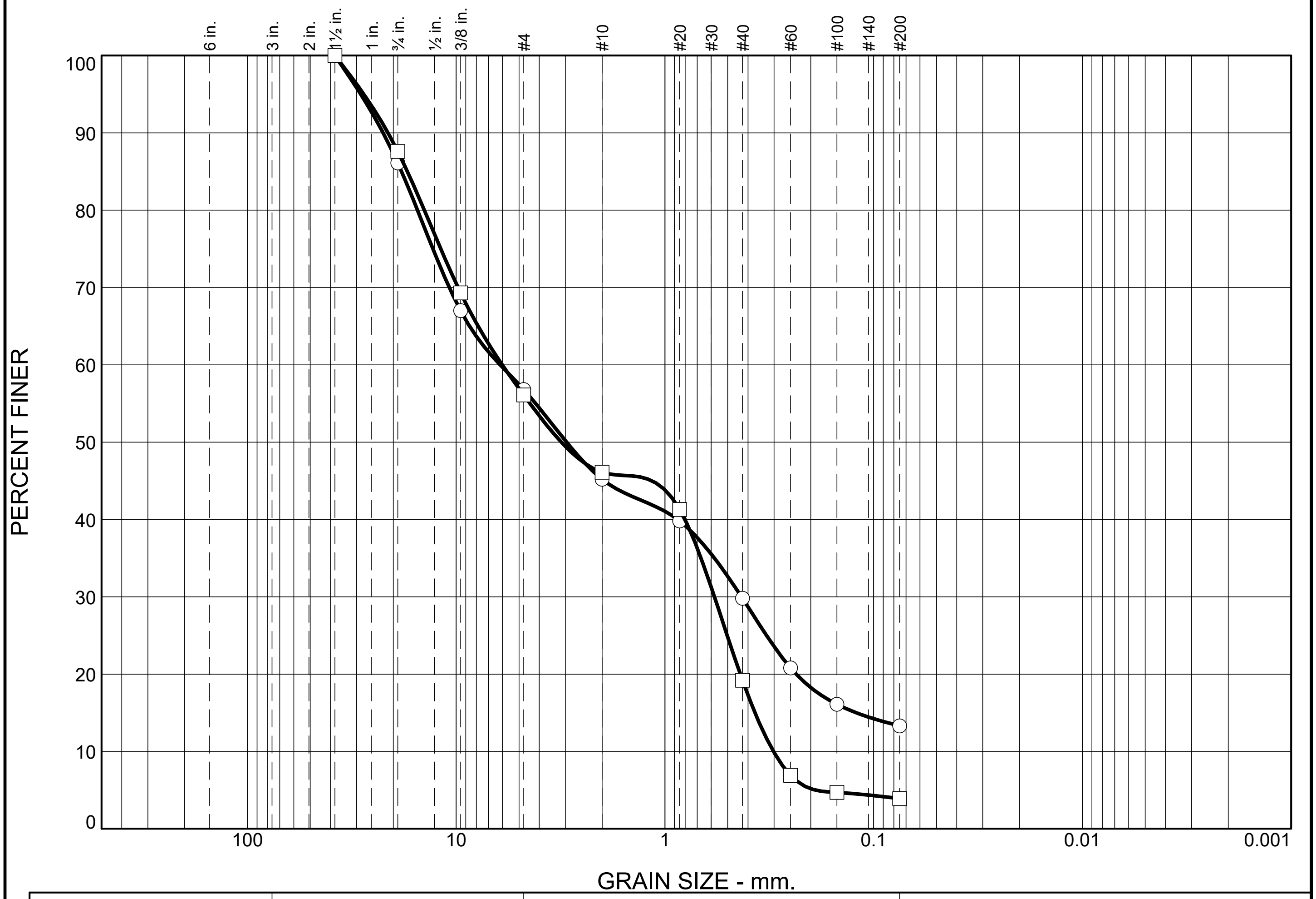
Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	13.9	29.3	11.6	15.4	16.5	13.3	
□	0.0	12.4	31.5	10.0	26.9	15.3	3.9	

☒	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			18.2740	6.1594	2.9592	0.4298	0.1212			
□			17.1334	6.0179	3.1361	0.5789	0.3702	0.3018	0.18	19.94

Material Description	USCS	AASHTO
○ silty SAND with gravel	SM	
□ SAND with gravel	SP	

Project No. T-8264 **Client:** Derek Cheshire

Project: Cheshire Short Plat

Mercer Island, Washington

○ **Location:** B-1 **Depth:** 7.5'

□ **Location:** B-2 **Depth:** 15'

Remarks:

○ Tested July 6, 2022

□ Tested July 6, 2022

Terra Associates, Inc.

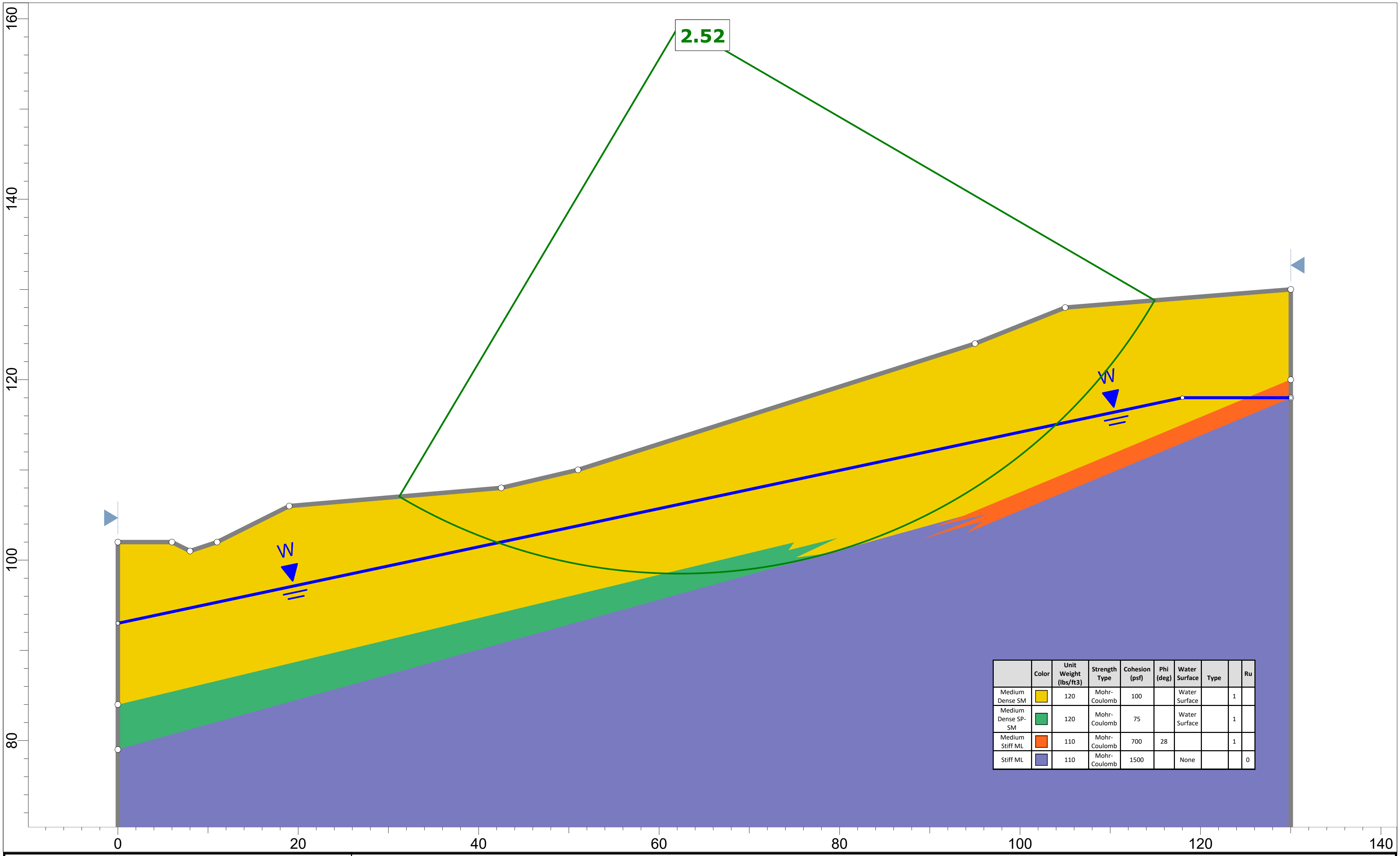
Kirkland, WA

Figure A-4

Tested By: KJ

APPENDIX B

RELATIVE SLOPE STABILITY RESULTS



	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Type		Ru
Medium Dense SM	🟨	120	Mohr-Coulomb	100		Water Surface		1	
Medium Dense SP-SM	🟩	120	Mohr-Coulomb	75		Water Surface		1	
Medium Stiff ML	🟧	110	Mohr-Coulomb	700	28			1	
Stiff ML	🟪	110	Mohr-Coulomb	1500		None			0

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SLIDEINTERPRET 9.024

Project
Cheshire Short Plat

Group
Existing Conditions

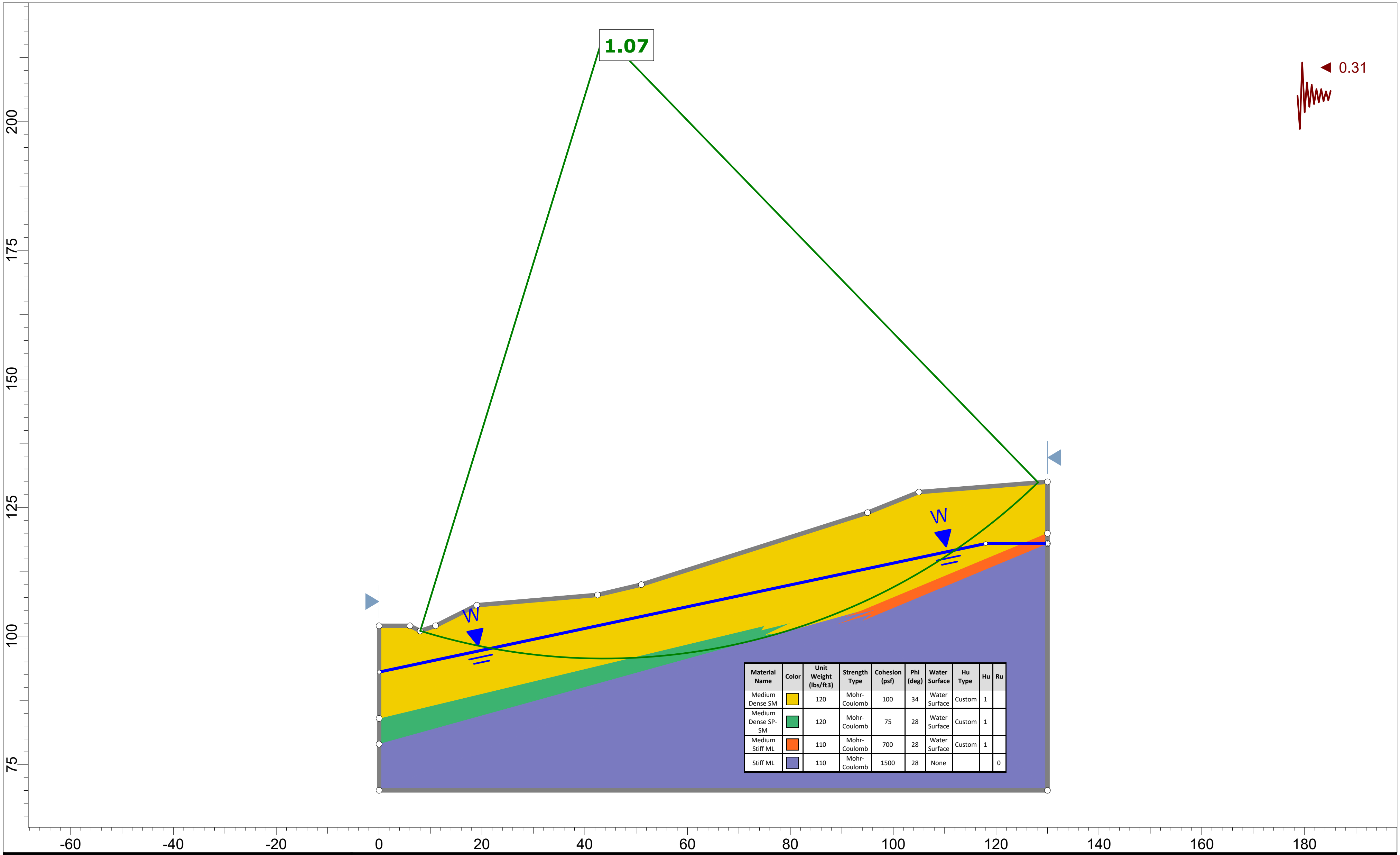
Scenario
Master Scenario

Drawn By
C. Decker

Company
Terra Associates, Inc.

Date
March 2, 2023

File Name
Cross Section A-A' Slope Stability rv 3-2-23.slmd



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Medium Dense SM	🟨	120	Mohr-Coulomb	100	34	Water Surface	Custom	1	
Medium Dense SP-SM	🟩	120	Mohr-Coulomb	75	28	Water Surface	Custom	1	
Medium Stiff ML	🟧	110	Mohr-Coulomb	700	28	Water Surface	Custom	1	
Stiff ML	🟪	110	Mohr-Coulomb	1500	28	None			0

SLIDEINTERPRET 9.024

Project
Cheshire Short Plat

Group
Existing Conditions

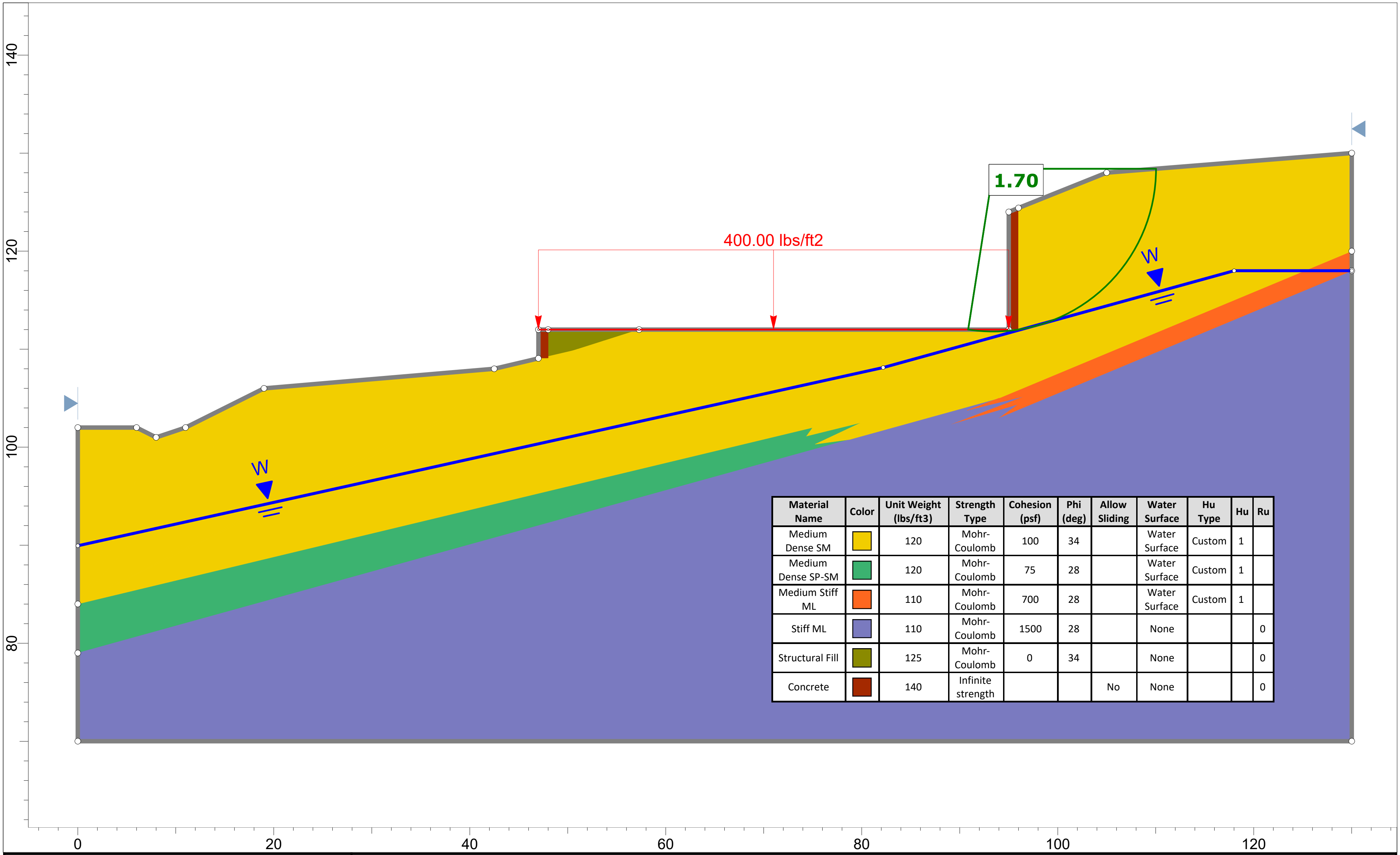
Scenario
Seismic

Drawn By
C. Decker

Company
Terra Associates, Inc.

Date
March 2, 2023

File Name
Cross Section A-A' Slope Stability rv 3-2-23.slmd



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Allow Sliding	Water Surface	Hu Type	Hu	Ru
Medium Dense SM	🟨	120	Mohr-Coulomb	100	34		Water Surface	Custom	1	
Medium Dense SP-SM	🟩	120	Mohr-Coulomb	75	28		Water Surface	Custom	1	
Medium Stiff ML	🟧	110	Mohr-Coulomb	700	28		Water Surface	Custom	1	
Stiff ML	🟪	110	Mohr-Coulomb	1500	28		None			0
Structural Fill	🟫	125	Mohr-Coulomb	0	34		None			0
Concrete	🟥	140	Infinite strength			No	None			0

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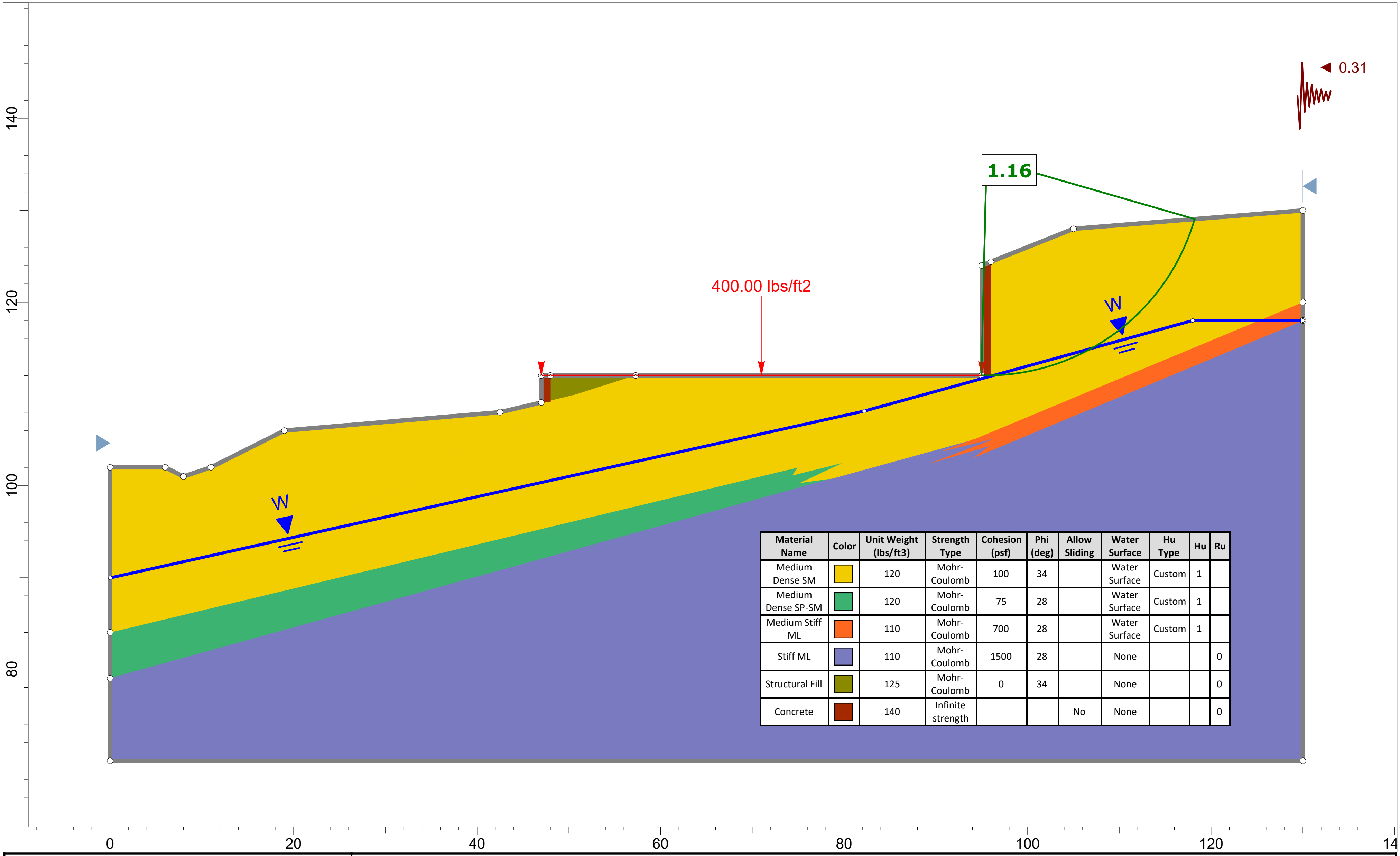
SLIDEINTERPRET 9.024

Project	Cheshire Short Plat		
Group	Post Construction	*Scenario*	Master Scenario
Drawn By	C. Decker	*Company*	Terra Associates, Inc.
Date	March 2, 2023	*File Name*	Cross Section A-A' Slope Stability rv 3-2-23.slmd



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Allow Sliding	Water Surface	Hu Type	Hu	Ru
Medium Dense SM	🟨	120	Mohr-Coulomb	100	34		Water Surface	Custom	1	
Medium Dense SP-SM	🟩	120	Mohr-Coulomb	75	28		Water Surface	Custom	1	
Medium Stiff ML	🟧	110	Mohr-Coulomb	700	28		Water Surface	Custom	1	
Stiff ML	🟪	110	Mohr-Coulomb	1500	28		None			0
Structural Fill	🟫	125	Mohr-Coulomb	0	34		None			0
Concrete	🟥	140	Infinite strength			No	None			0

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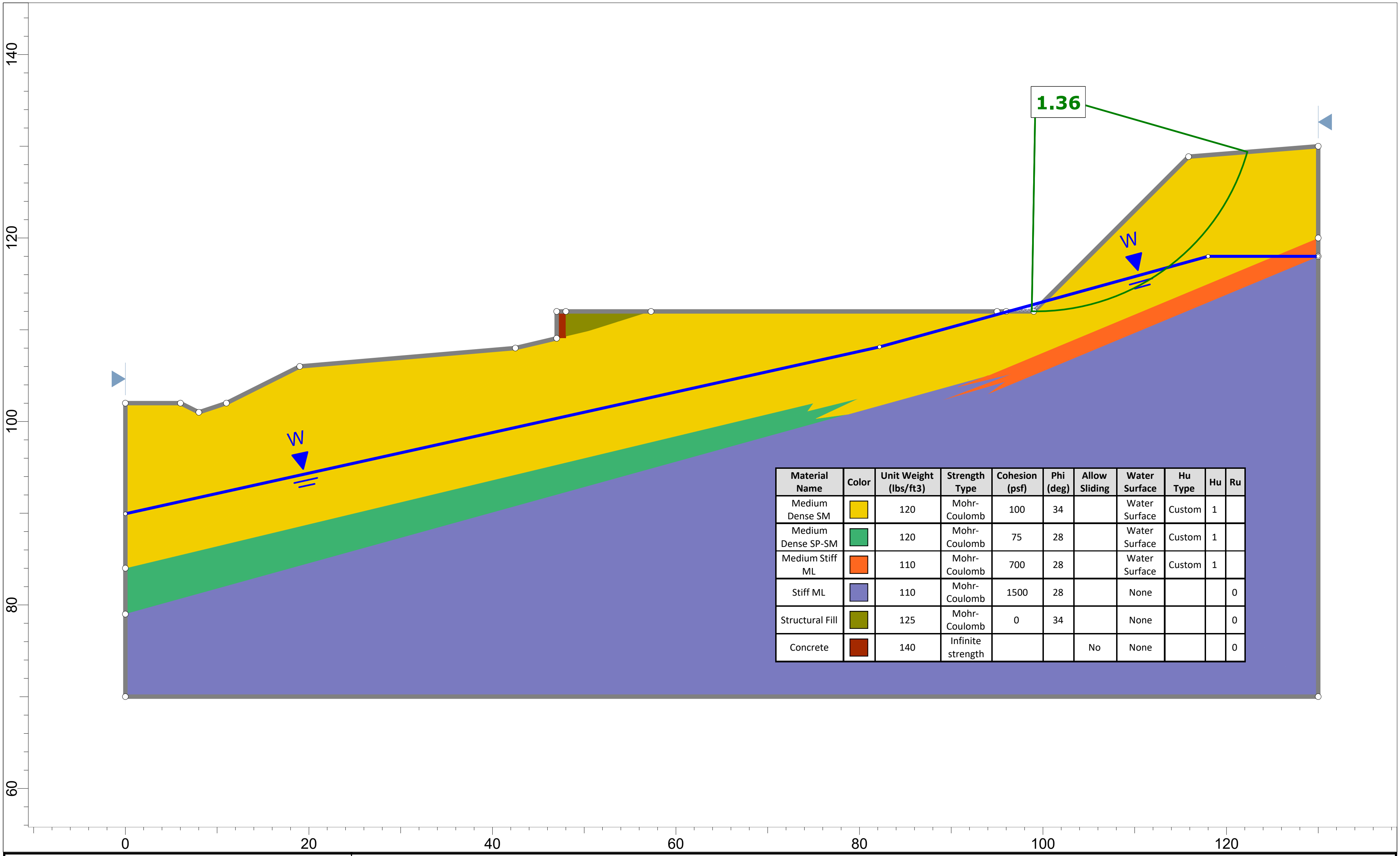
SLIDEINTERPRET 9.024

Project	Cheshire Short Plat		
Group	Post Construction	*Scenario*	Seismic
Drawn By	C. Decker	*Company*	Terra Associates, Inc.
Date	March 2, 2023	*File Name*	Cross Section A-A' Slope Stability rv 3-2-23.slmd



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Allow Sliding	Water Surface	Hu Type	Hu	Ru
Medium Dense SM	🟨	120	Mohr-Coulomb	100	34		Water Surface	Custom	1	
Medium Dense SP-SM	🟩	120	Mohr-Coulomb	75	28		Water Surface	Custom	1	
Medium Stiff ML	🟧	110	Mohr-Coulomb	700	28		Water Surface	Custom	1	
Stiff ML	🟪	110	Mohr-Coulomb	1500	28		None			0
Structural Fill	🟫	125	Mohr-Coulomb	0	34		None			0
Concrete	🟥	140	Infinite strength			No	None			0

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SLIDEINTERPRET 9.024

Project
Cheshire Short Plat

Group
Temporary Excavation

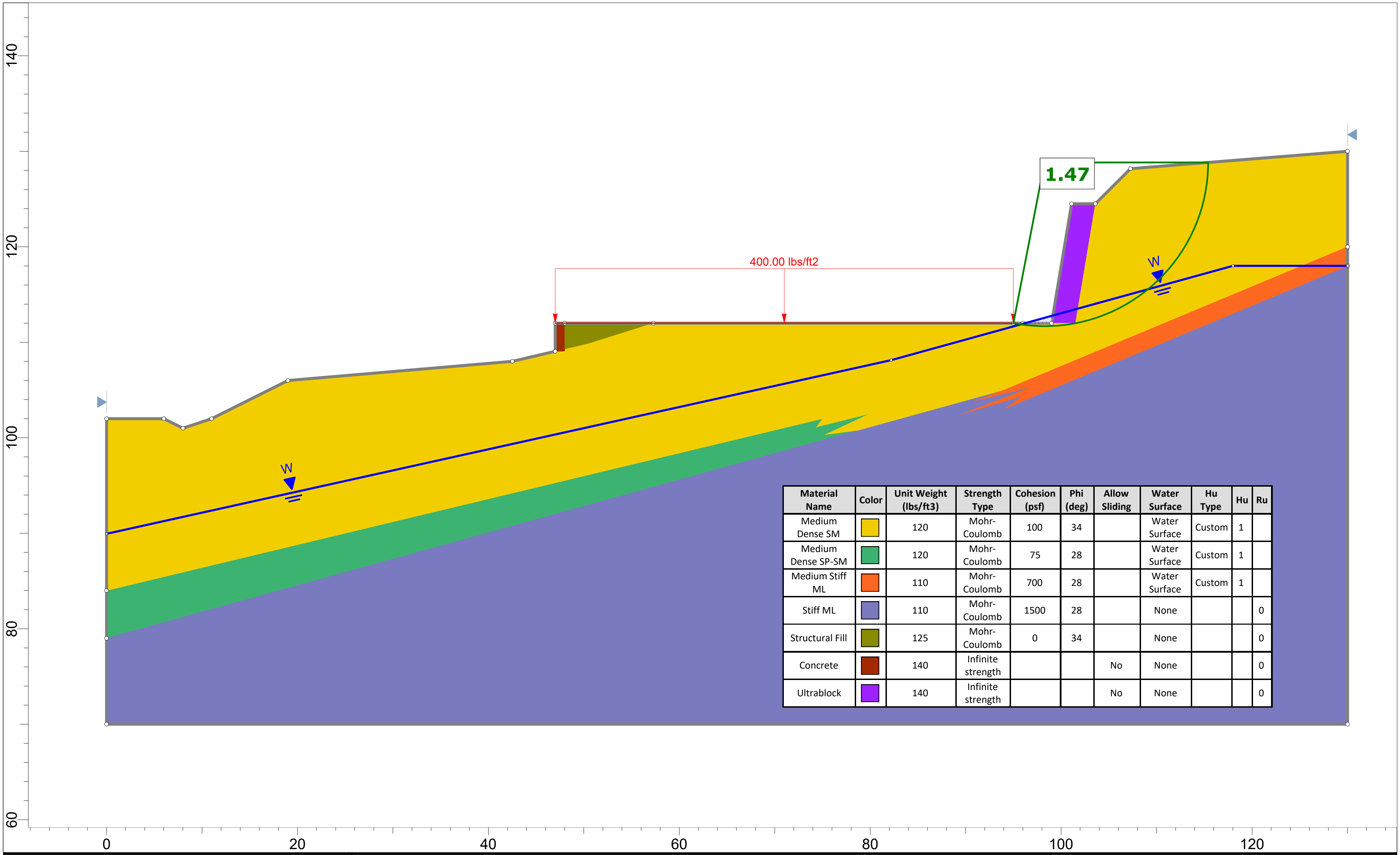
Scenario
Master Scenario

Drawn By
C. Decker

Company
Terra Associates, Inc.

Date
March 2, 2023

File Name
Cross Section A-A' Slope Stability rv 3-2-23.slmd



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Allow Sliding	Water Surface	Hu Type	Hu	Ru
Medium Dense SM	🟨	120	Mohr-Coulomb	100	34		Water Surface	Custom	1	
Medium Dense SP-SM	🟩	120	Mohr-Coulomb	75	28		Water Surface	Custom	1	
Medium Stiff ML	🟧	110	Mohr-Coulomb	700	28		Water Surface	Custom	1	
Stiff ML	🟦	110	Mohr-Coulomb	1500	28		None			0
Structural Fill	🟫	125	Mohr-Coulomb	0	34		None			0
Concrete	🟥	140	Infinite strength			No	None			0
Ultrablock	🟪	140	Infinite strength			No	None			0

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SLIDEINTERPRET 9.024

Project	Cheshire Short Plat
Group	Ultrablock Wall Temporary Shoring
Scenario	Master Scenario
Drawn By	C. Decker
Company	Terra Associates, Inc.
Date	March 2, 2023
File Name	Cross Section A-A' Slope Stability rv 3-2-23.slmd

Cross Section A-A' Slope Stability rv 3-2-23
Cheshire Short Plat
Terra Associates, Inc.
Date Created: March 2, 2023
Software Version: 9.024

Table of Contents

Slide2 Analysis Information

Cross Section A-A' Slope Stability rv 3-2-23

Project Summary

File Name:	Cross Section A-A' Slope Stability rv 3-2-23.slmd
Slide2 Modeler Version:	9.024
Project Title:	Cheshire Short Plat
Analysis:	Cross Section A-A'
Author:	C. Decker
Company:	Terra Associates, Inc.
Date Created:	March 2, 2023

Currently Open Scenarios

Group Name	Scenario Name	Global Minimum	Compute Time
Existing Conditions ◆	Master Scenario	Bishop Simplified: 2.522100 Janbu Simplified: 2.270230	00h:00m:00.750s
	Seismic	Bishop Simplified: 1.074090 Janbu Simplified: 0.998559	00h:00m:00.699s
Post Construction ◆	Master Scenario	Bishop Simplified: 1.699920 Janbu Simplified: 1.515370	00h:00m:00.299s
	Seismic	Bishop Simplified: 1.156940 Janbu Simplified: 0.889085	00h:00m:00.350s
Temporary Excavation ◆	Master Scenario	Bishop Simplified: 1.355090 Janbu Simplified: 1.235630	00h:00m:00.283s
Ultrablock Wall Temporary Shoring ◆	Master Scenario	Bishop Simplified: 1.474130 Janbu Simplified: 1.342910	00h:00m:00.304s

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

All Open Scenarios

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

Groundwater Analysis

All Open Scenarios

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

All Open Scenarios

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

Surface Options

Existing Conditions

Surface Type: Circular
Search Method: Auto Refine Search
Divisions along slope: 20
Circles per division: 10
Number of iterations: 10
Divisions to use in next iteration: 50%
Composite Surfaces: Disabled
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Minimum Area: Not Defined
Minimum Weight: Not Defined

Post Construction

Surface Type: Circular
Search Method: Auto Refine Search
Divisions along slope: 20
Circles per division: 10
Number of iterations: 10
Divisions to use in next iteration: 50%
Composite Surfaces: Disabled
Minimum Elevation: Not Defined
Minimum Depth [ft]: 10
Minimum Area: Not Defined
Minimum Weight: Not Defined

Temporary Excavation

Surface Type: Circular
Search Method: Auto Refine Search
Divisions along slope: 20
Circles per division: 10
Number of iterations: 10
Divisions to use in next iteration: 50%
Composite Surfaces: Disabled
Minimum Elevation: Not Defined
Minimum Depth [ft]: 10
Minimum Area: Not Defined
Minimum Weight: Not Defined

Ultrablock Wall Temporary Shoring

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	10
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Existing Conditions - Master Scenario

Advanced seismic analysis: No
Staged pseudostatic analysis: No

Existing Conditions - Seismic

Advanced seismic analysis: No
Staged pseudostatic analysis: No
Seismic Load Coefficient (Horizontal): 0.31

Post Construction - Master Scenario

Advanced seismic analysis: No
Staged pseudostatic analysis: No

Post Construction - Seismic

Advanced seismic analysis: No
Staged pseudostatic analysis: No
Seismic Load Coefficient (Horizontal): 0.31

Temporary Excavation

Advanced seismic analysis: No
Staged pseudostatic analysis: No

Ultrablock Wall Temporary Shoring

Advanced seismic analysis: No
Staged pseudostatic analysis: No

Loading

◆ Post Construction

Distribution:	Constant
Magnitude [psf]:	400
Orientation:	Normal to boundary

◆ Ultrablock Wall Temporary Shoring

Distribution:	Constant
Magnitude [psf]:	400
Orientation:	Normal to boundary

Materials

Medium Dense SM	
Color	🟨
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	100
Friction Angle [deg]	34
Water Surface	Assigned per scenario
Hu Value	1
Medium Dense SP-SM	
Color	🟩
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	120
Cohesion [psf]	75
Friction Angle [deg]	28
Water Surface	Assigned per scenario
Hu Value	1
Medium Stiff ML	
Color	🟧
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	700
Friction Angle [deg]	28
Water Surface	Assigned per scenario
Hu Value	1
Stiff ML	
Color	🟪
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	1500
Friction Angle [deg]	28
Water Surface	Assigned per scenario
Ru Value	0
Structural Fill	
Color	🟫
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	125
Cohesion [psf]	0
Friction Angle [deg]	34
Water Surface	Assigned per scenario
Ru Value	0
Concrete	
Color	🟥
Strength Type	Infinite strength
Unit Weight [lbs/ft3]	140
Allow Sliding Along Boundary	No

Water Surface	Assigned per scenario
Ru Value	0
Ultrablock	
Color	🟪
Strength Type	Infinite strength
Unit Weight [lbs/ft3]	140
Allow Sliding Along Boundary	No
Water Surface	Assigned per scenario
Ru Value	0

Materials In Use

Material	Existing Conditions	Seismic	Post Construction	Seismic	Temporary Excavation	Ultrablock Wall Temporary Shoring
Medium Dense SM	✓	✓	✓	✓	✓	✓
Medium Dense SP-SM	✓	✓	✓	✓	✓	✓
Medium Stiff ML	✓	✓	✓	✓	✓	✓
Stiff ML	✓	✓	✓	✓	✓	✓
Structural Fill	✗	✗	✓	✓	✓	✓
Concrete	✗	✗	✓	✓	✓	✓
Ultrablock	✗	✗	✗	✗	✗	✓

Global Minimums

Existing Conditions - Master Scenario

Method: bishop simplified

FS	2.522100
Center:	62.288, 159.410
Radius:	60.908
Left Slip Surface Endpoint:	31.193, 107.038
Right Slip Surface Endpoint:	114.943, 128.795
Resisting Moment:	4.51622e+06 lb-ft
Driving Moment:	1.79066e+06 lb-ft
Total Slice Area:	1026.64 ft2
Surface Horizontal Width:	83.75 ft
Surface Average Height:	12.2584 ft

Method: janbu simplified

FS	2.270230
Center:	62.288, 159.410
Radius:	60.908
Left Slip Surface Endpoint:	31.193, 107.038
Right Slip Surface Endpoint:	114.943, 128.795
Resisting Horizontal Force:	65852.6 lb
Driving Horizontal Force:	29007 lb
Total Slice Area:	1026.64 ft2
Surface Horizontal Width:	83.75 ft
Surface Average Height:	12.2584 ft

Existing Conditions - Seismic

Method: bishop simplified

FS	1.074090
Center:	43.706, 217.049
Radius:	121.417
Left Slip Surface Endpoint:	8.002, 101.001
Right Slip Surface Endpoint:	128.201, 129.856
Resisting Moment:	1.18774e+07 lb-ft
Driving Moment:	1.10581e+07 lb-ft
Total Slice Area:	1515.6 ft2
Surface Horizontal Width:	120.198 ft
Surface Average Height:	12.6092 ft

Method: janbu simplified

FS	0.998559
Center:	42.326, 182.980
Radius:	88.827
Left Slip Surface Endpoint:	8.072, 101.024
Right Slip Surface Endpoint:	112.566, 128.605
Resisting Horizontal Force:	76140.7 lb
Driving Horizontal Force:	76250.5 lb
Total Slice Area:	1301.18 ft2
Surface Horizontal Width:	104.493 ft
Surface Average Height:	12.4522 ft

Post Construction - Master Scenario

Method: bishop simplified

FS	1.699920
Center:	93.432, 128.403
Radius:	16.603
Left Slip Surface Endpoint:	90.863, 112.000
Right Slip Surface Endpoint:	110.035, 128.403
Resisting Moment:	277408 lb-ft
Driving Moment:	163189 lb-ft
Total Slice Area:	165.79 ft2
Surface Horizontal Width:	19.1718 ft
Surface Average Height:	8.64764 ft

Method: janbu simplified

FS	1.515370
Center:	93.432, 128.403
Radius:	16.603
Left Slip Surface Endpoint:	90.863, 112.000
Right Slip Surface Endpoint:	110.035, 128.403
Resisting Horizontal Force:	13251.6 lb
Driving Horizontal Force:	8744.84 lb
Total Slice Area:	165.79 ft2
Surface Horizontal Width:	19.1718 ft
Surface Average Height:	8.64764 ft

Post Construction - Seismic

Method: bishop simplified

FS	1.156940
Center:	95.524, 135.618
Radius:	23.624
Left Slip Surface Endpoint:	94.964, 112.000
Right Slip Surface Endpoint:	118.220, 129.058
Resisting Moment:	496232 lb-ft
Driving Moment:	428917 lb-ft
Total Slice Area:	256.692 ft2
Surface Horizontal Width:	23.2555 ft
Surface Average Height:	11.0379 ft

Method: janbu simplified

FS	0.889085
Center:	95.658, 128.580
Radius:	16.595
Left Slip Surface Endpoint:	94.964, 112.000
Right Slip Surface Endpoint:	112.253, 128.580
Resisting Horizontal Force:	13002.6 lb
Driving Horizontal Force:	14624.7 lb
Total Slice Area:	199.059 ft2
Surface Horizontal Width:	17.2888 ft
Surface Average Height:	11.5137 ft

Temporary Excavation

Method: bishop simplified

FS	1.355090
Center:	99.189, 136.030
Radius:	24.033
Left Slip Surface Endpoint:	98.777, 112.000
Right Slip Surface Endpoint:	122.285, 129.383
Left Slope Intercept:	98.777 112.700
Right Slope Intercept:	122.285 129.383
Resisting Moment:	305137 lb-ft
Driving Moment:	225179 lb-ft
Total Slice Area:	147.153 ft2
Surface Horizontal Width:	23.5081 ft
Surface Average Height:	6.25967 ft

Method: janbu simplified

FS	1.235630
Center:	101.035, 130.871
Radius:	18.983
Left Slip Surface Endpoint:	98.980, 112.000
Right Slip Surface Endpoint:	119.943, 129.195
Left Slope Intercept:	98.980 112.756
Right Slope Intercept:	119.943 129.195
Resisting Horizontal Force:	8863.43 lb
Driving Horizontal Force:	7173.22 lb
Total Slice Area:	138.204 ft2
Surface Horizontal Width:	20.9633 ft
Surface Average Height:	6.59265 ft

Ultrablock Wall Temporary Shoring

Method: bishop simplified

FS	**1.474130**
Center:	98.253, 128.832
Radius:	17.143
Left Slip Surface Endpoint:	95.000, 112.000
Right Slip Surface Endpoint:	115.396, 128.832
Resisting Moment:	267500 lb-ft
Driving Moment:	181463 lb-ft
Total Slice Area:	174.878 ft2
Surface Horizontal Width:	20.3956 ft
Surface Average Height:	8.57427 ft

Method: janbu simplified

FS	**1.342910**
Center:	98.253, 128.832
Radius:	17.143
Left Slip Surface Endpoint:	95.000, 112.000
Right Slip Surface Endpoint:	115.396, 128.832
Resisting Horizontal Force:	12165.5 lb
Driving Horizontal Force:	9059.03 lb
Total Slice Area:	174.878 ft2
Surface Horizontal Width:	20.3956 ft
Surface Average Height:	8.57427 ft

Valid and Invalid Surfaces

Existing Conditions - Master Scenario

Method: bishop simplified

Number of Valid Surfaces:	15128
Number of Invalid Surfaces:	79

Error Codes

Error Code -112 reported for 79 surfaces

Method: janbu simplified

Number of Valid Surfaces:	14977
Number of Invalid Surfaces:	230

Error Codes

Error Code -108 reported for 139 surfaces
Error Code -111 reported for 91 surfaces

Existing Conditions - Seismic

Method: bishop simplified

Number of Valid Surfaces:	13116
Number of Invalid Surfaces:	2

Error Codes

Error Code -108 reported for 2 surfaces

Method: janbu simplified

Number of Valid Surfaces:	12928
Number of Invalid Surfaces:	190

Error Codes

Error Code -108 reported for 43 surfaces
Error Code -111 reported for 18 surfaces
Error Code -112 reported for 129 surfaces

Post Construction - Master Scenario

Method: bishop simplified

Number of Valid Surfaces:	1545
Number of Invalid Surfaces:	24

Error Codes

Error Code -112 reported for 24 surfaces

Method: janbu simplified

Number of Valid Surfaces:	1567
Number of Invalid Surfaces:	2

Error Codes

Error Code -108 reported for 1 surface
Error Code -112 reported for 1 surface

Post Construction - Seismic

Method: bishop simplified

Number of Valid Surfaces:	2853
Number of Invalid Surfaces:	0

Method: janbu simplified

Number of Valid Surfaces:	2817
Number of Invalid Surfaces:	36

Error Codes

Error Code -112 reported for 36 surfaces

Temporary Excavation

Method: bishop simplified

Number of Valid Surfaces:	1740
Number of Invalid Surfaces:	22

Error Codes

Error Code -112 reported for 22 surfaces

Method: janbu simplified

Number of Valid Surfaces:	1758
Number of Invalid Surfaces:	4

Error Codes

Error Code -111 reported for 4 surfaces

Ultrablock Wall Temporary Shoring

Method: bishop simplified

Number of Valid Surfaces:	1456
Number of Invalid Surfaces:	33

Error Codes

Error Code -112 reported for 33 surfaces

Method: janbu simplified

Number of Valid Surfaces:	1487
Number of Invalid Surfaces:	2

Error Codes

Error Code -108 reported for 1 surface
Error Code -112 reported for 1 surface

Error Code Descriptions

The following errors were encountered during the computation:

-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

-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.

Entity Information

Existing Conditions

Shared Entities

Type	Coordinates (x,y)
External Boundary	0, 70 130, 70 130, 118 130, 120 130, 130 105, 128 95, 124 51, 110 42.5, 108 19, 106 11, 102 8, 101 6, 102 0, 102 0, 84 0, 79
Material Boundary	0, 84 75, 102
Material Boundary	0, 79 78.7617, 100.785 94, 105 130, 120
Material Boundary	94, 103 130, 118
Material Boundary	94, 103 95.866, 104.343 89.141, 102.356 96.443, 105.148 90.765, 103.766 94, 105
Material Boundary	75, 102 74.342, 101.083 79.786, 102.433 75.265, 100.313 78.7617, 100.785

Scenario-based Entities

Type	Coordinates (x,y)	Master Scenario	Seismic
Water Table	0, 93 118, 118 130, 118	Assigned to: 🟨 Medium Dense SM 🟩 Medium Dense SP-SM 🟧 Medium Stiff ML	Assigned to: 🟨 Medium Dense SM 🟩 Medium Dense SP-SM 🟧 Medium Stiff ML

◆ Post Construction

Shared Entities

Type	Coordinates (x,y)
External Boundary	47, 109.059 42.5, 108 19, 106 11, 102 8, 101 6, 102 0, 102 0, 84 0, 79 0, 70 130, 70 130, 118 130, 120 130, 130 105, 128 96, 124.4 95, 124 95, 112 57.2857, 112 48, 112 47, 112
Material Boundary	0, 84 75, 102
Material Boundary	0, 79 78.7617, 100.785 94, 105 130, 120
Material Boundary	94, 103 130, 118
Material Boundary	94, 103 95.866, 104.343 89.141, 102.356 96.443, 105.148 90.765, 103.766 94, 105
Material Boundary	75, 102 74.342, 101.083 79.786, 102.433 75.265, 100.313 78.7617, 100.785
Material Boundary	47, 109.059 48, 109.294 51, 110 53.7003, 110.859 57.2857, 112
Material Boundary	95, 112 96, 112 96, 124.4
Material Boundary	47, 109.059 48, 109.059 48, 109.294 48, 112

Scenario-based Entities

Type	Coordinates (x,y)	Master Scenario	Seismic
Water Table	0, 89.9411 82.189, 108.126 118, 118 130, 118	Assigned to: 🟨 Medium Dense SM 🟩 Medium Dense SP-SM 🟧 Medium Stiff ML	Assigned to: 🟨 Medium Dense SM 🟩 Medium Dense SP-SM 🟧 Medium Stiff ML
Distributed Load	95, 112 57.2857, 112 48, 112 47, 112	Constant DistributionOrientation: Normal to boundaryMagnitude: 400 lbs/ft2Creates Excess Pore Pressure: No	Constant DistributionOrientation: Normal to boundaryMagnitude: 400 lbs/ft2Creates Excess Pore Pressure: No

Temporary Excavation

Shared Entities

Type	Coordinates (x,y)
External Boundary	47, 109.059 42.5, 108 19, 106 11, 102 8, 101 6, 102 0, 102 0, 84 0, 79 0, 70 130, 70 130, 118 130, 120 130, 130 115.87, 128.87 99, 112 96, 112 95, 112 57.2857, 112 48, 112 47, 112
Material Boundary	0, 84 75, 102
Material Boundary	0, 79 78.7617, 100.785 94, 105 130, 120
Material Boundary	94, 103 130, 118
Material Boundary	94, 103 95.866, 104.343 89.141, 102.356 96.443, 105.148 90.765, 103.766 94, 105
Material Boundary	75, 102 74.342, 101.083 79.786, 102.433 75.265, 100.313 78.7617, 100.785
Material Boundary	47, 109.059 48, 109.294 51, 110 53.7003, 110.859 57.2857, 112
Material Boundary	47, 109.059 48, 109.059 48, 109.294 48, 112

Scenario-based Entities

Type	Coordinates (x,y)	Master Scenario
Water Table	0, 89.9411 82.189, 108.126 118, 118 130, 118	Assigned to: 🟨 Medium Dense SM 🟩 Medium Dense SP-SM 🟧 Medium Stiff ML

Ultrablock Wall Temporary Shoring

Shared Entities

Type	Coordinates (x,y)
External Boundary	99, 112 96, 112 95, 112 57.2857, 112 48, 112 47, 112 47, 109.059 42.5, 108 19, 106 11, 102 8, 101 6, 102 0, 102 0, 84 0, 79 0, 70 130, 70 130, 118 130, 120 130, 130 107.264, 128.181 103.583, 124.5 101.102, 124.5
Material Boundary	0, 84 75, 102
Material Boundary	0, 79 78.7617, 100.785 94, 105 130, 120
Material Boundary	94, 103 130, 118
Material Boundary	94, 103 95.866, 104.343 89.141, 102.356 96.443, 105.148 90.765, 103.766 94, 105
Material Boundary	75, 102 74.342, 101.083 79.786, 102.433 75.265, 100.313 78.7617, 100.785
Material Boundary	47, 109.059 48, 109.294 51, 110 53.7003, 110.859 57.2857, 112
Material Boundary	47, 109.059 48, 109.059 48, 109.294 48, 112
Material Boundary	99, 112 101.5, 112 103.583, 124.5

Scenario-based Entities

Type	Coordinates (x,y)	Master Scenario
Water Table	0, 89.9411 82.189, 108.126 118, 118 130, 118	Assigned to: 🟨 Medium Dense SM 🟩 Medium Dense SP-SM 🟧 Medium Stiff ML
Distributed Load	95, 112 57.2857, 112 48, 112 47, 112	Constant DistributionOrientation: Normal to boundaryMagnitude: 400 lbs/ft2Creates Excess Pore Pressure: No

APPENDIX C

LATERAL SPREAD SLOPE STABILITY RESULTS

Residual Soil Strength

B-1 - Medium Dense SM

$N_{1(60)}$ blow counts : 35, 30, 21, 39, 16 $N_{1(60)\,AVG} = 28$

- Medium Stiff ML

$N_{1(60)}$ blow counts : 23, 37, 20, 12, 14, 21 $N_{(60)}$ AVG = 21

Medium Dense SM

N_{corr} (Table 4-6) = 1

Medium Stiff ML

N_{corr} = 4

Equivalent Clean Sand $N_{1(60)}$

Medium Dense SM = 29 Medium Stiff ML = 25

Overburden

Medium Dense SM = (7.5)(120) = 900 psf

Medium Stiff ML = (31)(110) = 3410 psf

Per Figure 4-19

Medium Dense SM

$S_r / \sigma_{vo} = 0.4$ $S_r = (0.4)(900) = 360$

Medium Stiff ML

$S_r / \sigma'_{vo} = 0.255$ $S_r = (0.255)(3410) = 869$

B-2 - Medium Dense SM

$N_{1\,60}$: 16, 14, 15, 19, 12 $N_{1(60)\,AVG} = 15$ $N_{corr} = 1$

Equivalent Clean Sand = 16

Medium Dense SP-SM

$N_{1\,60}$: 10 $N_{corr} = 0$ Equivalent Clean Sand = 10

TERRA ASSOCIATES

Geotechnical Consultants

PROJECT Cheshire Short Plat | BY | SHEET 1/2

LOCATION | CHECKED

CLIENT | DATE

12220 113th Ave. NE, Ste 130 • Kirkland, WA 98034 • **(425) 821-7777** | JOB NO.

B-2 - Medium stiff ML

N_{160} : 19, 9, 24 N_{160Avg} = 17 N_{corr} = 4

Equivalent Clean Sand = 21

Overburden

Medium Dense SM = (7.5)(120) = 900

Medium Dense SP-SM = (17)(120) = 2040

Medium Stiff ML = (26)(110) = 2860

Per Figure 4-19

Medium Dense SM S_r/σ_{vo} = 0.14 S_r = (0.14)(900) = 126

Medium Dense SP-SM S_r/σ_{vo} = 0.1 S_r = (0.1)(2040) = 204

Medium Stiff ML S_r/σ_{vo} = 0.195 S_r = (0.195)(2860) = 557

Average residual Shear Strength

Medium Dense SM = $\frac{(360+126)}{2}$ = 243

Medium Dense SP-SM = 204

Medium stiff ML = $\frac{(869+557)}{2}$ = 713

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JOB NO.

TABLE 4-6 BLOW COUNT CORRECTION, N_{corr}, FOR THE EQUIVALENT CLEAN SAND BLOW COUNT, $(N_1)_{60\text{-}cs}$

% passing #200 sieve	N_{corr}
0-9	0
10-24	1
25-49	2
50-74	4
>75	5

Idriss and Boulanger (2007) limit the application of their correlations to an effective overburden pressure of 8000 psf. In developing their correlations, Idriss and Boulanger (2007) differentiated between cases where void ratio redistribution may be anticipated due to the presence of an overlying confining pressure, as illustrated in Figure 4-20, and cases where no void ratio redistribution was anticipated. Figure 4-19 shows their suggested correlation for cases where void ratio redistribution is expected. However, this portion of their correlation is supported by few data points and therefore should be used with caution.

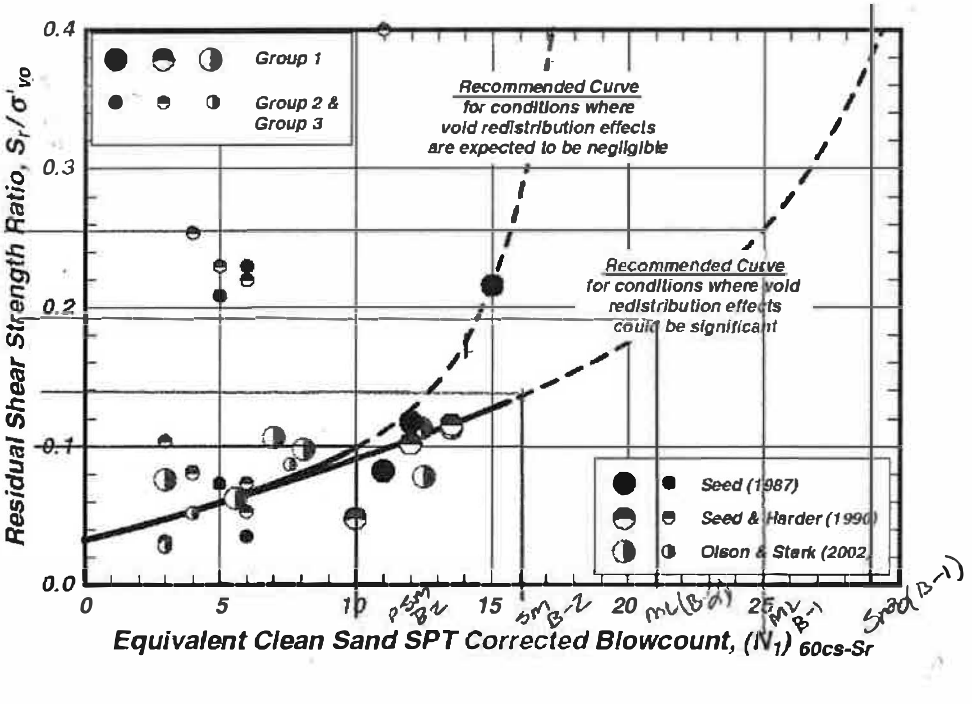
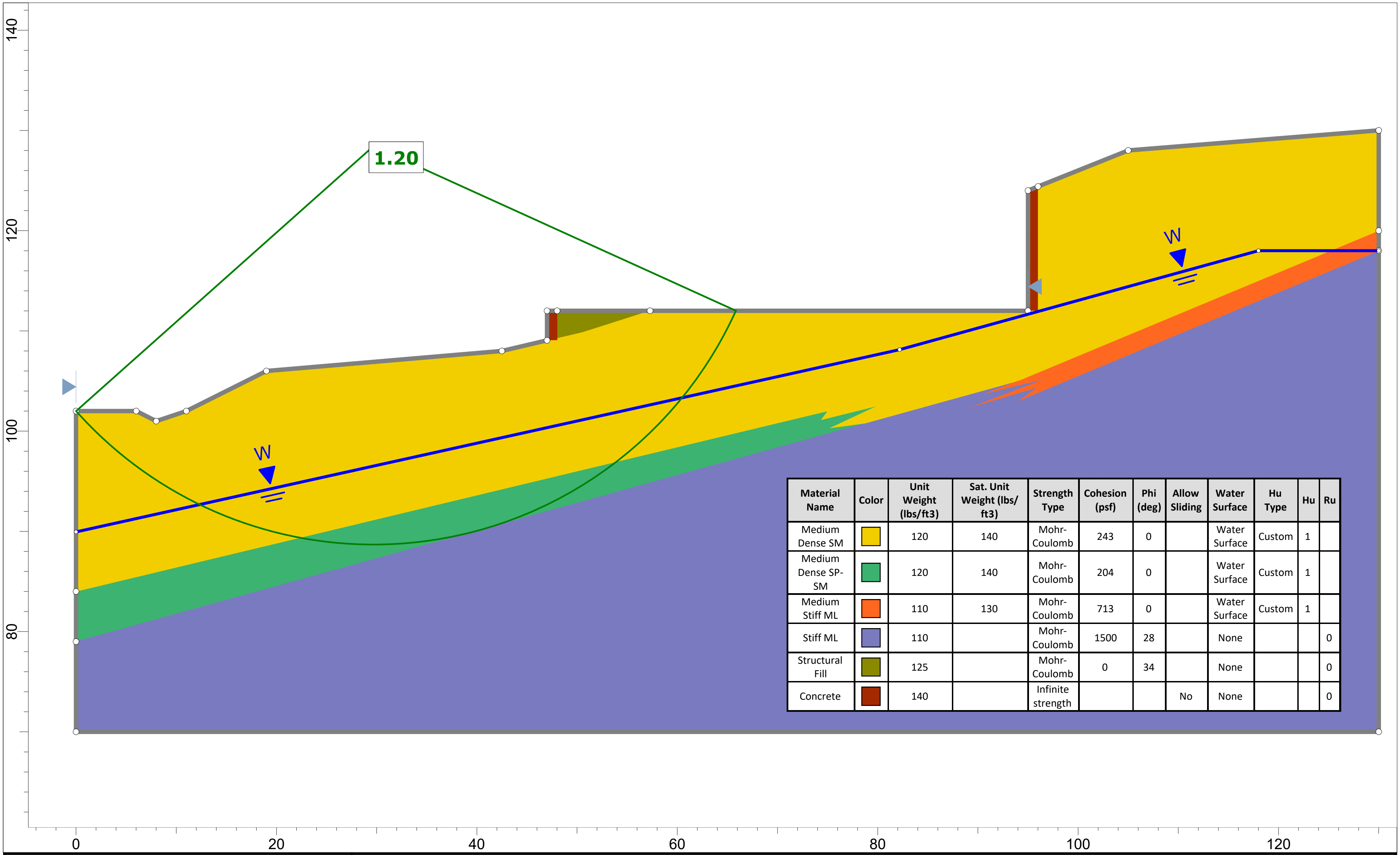


Figure 4-19 Correlation between the Residual Undrained Strength Ratio, S_r/σ'_{vo} and equivalent clean sand SPT blow count, $(N_1)_{60\text{-}CS}$ (Idriss and Boulanger, 2007)



Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Allow Sliding	Water Surface	Hu Type	Hu	Ru
Medium Dense SM	🟨	120	140	Mohr-Coulomb	243	0		Water Surface	Custom	1	
Medium Dense SP-SM	🟩	120	140	Mohr-Coulomb	204	0		Water Surface	Custom	1	
Medium Stiff ML	🟧	110	130	Mohr-Coulomb	713	0		Water Surface	Custom	1	
Stiff ML	🟪	110		Mohr-Coulomb	1500	28		None			0
Structural Fill	🟫	125		Mohr-Coulomb	0	34		None			0
Concrete	🟥	140		Infinite strength			No	None			0

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SLIDEINTERPRET 9.024

Project Cheshire Short Plat

Group Post Construction

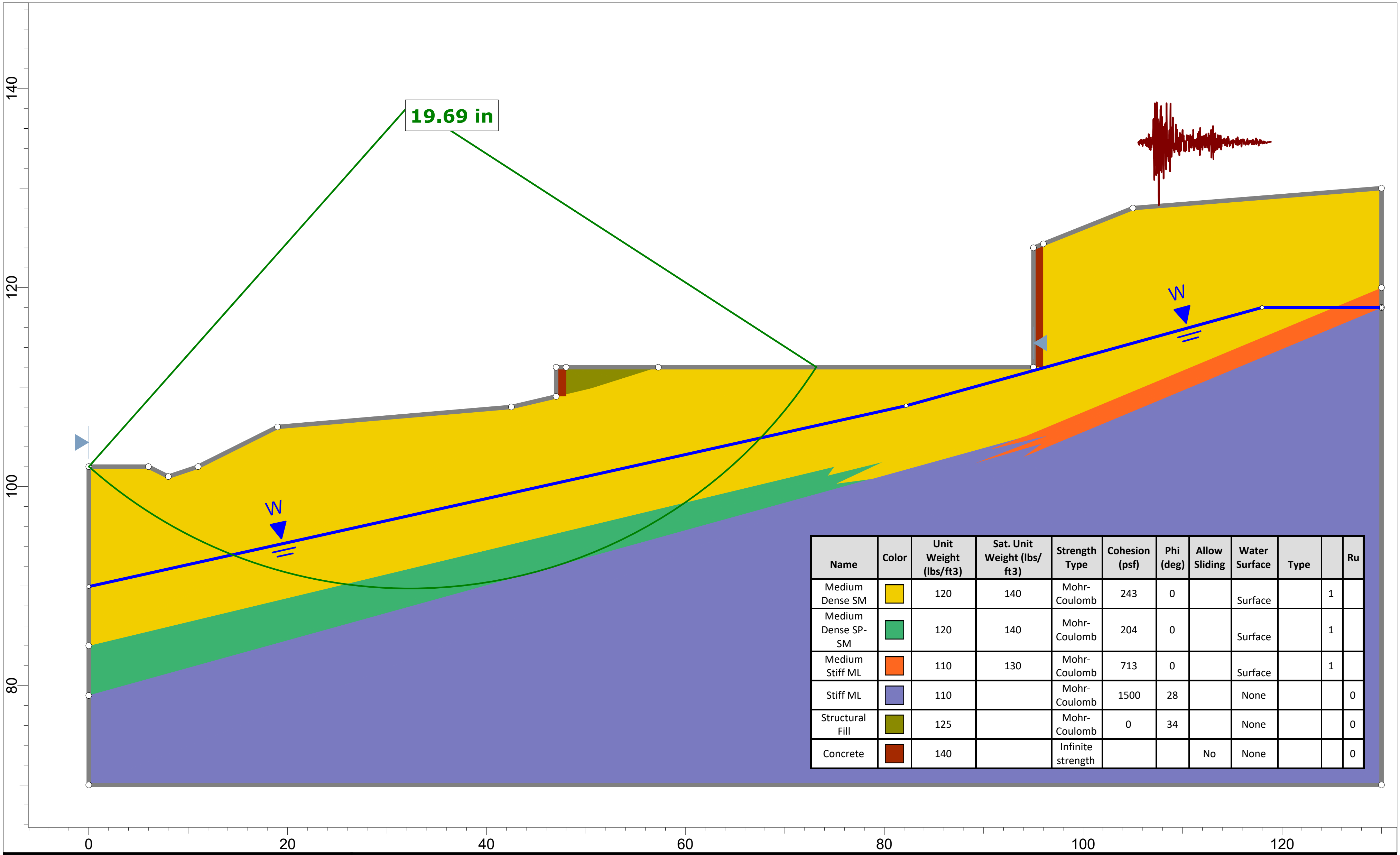
Scenario Master Scenario

Drawn By C. Decker

Company Terra Associates, Inc.

Date March 2, 2023

File Name Cross Section A-A' Lateral Spread rv 3-2-23.slmd



Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Allow Sliding	Water Surface	Type		Ru
Medium Dense SM	🟨	120	140	Mohr-Coulomb	243	0		Surface		1	
Medium Dense SP-SM	🟩	120	140	Mohr-Coulomb	204	0		Surface		1	
Medium Stiff ML	🟧	110	130	Mohr-Coulomb	713	0		Surface		1	
Stiff ML	🟪	110		Mohr-Coulomb	1500	28		None			0
Structural Fill	🟫	125		Mohr-Coulomb	0	34		None			0
Concrete	🟥	140		Infinite strength			No	None			0

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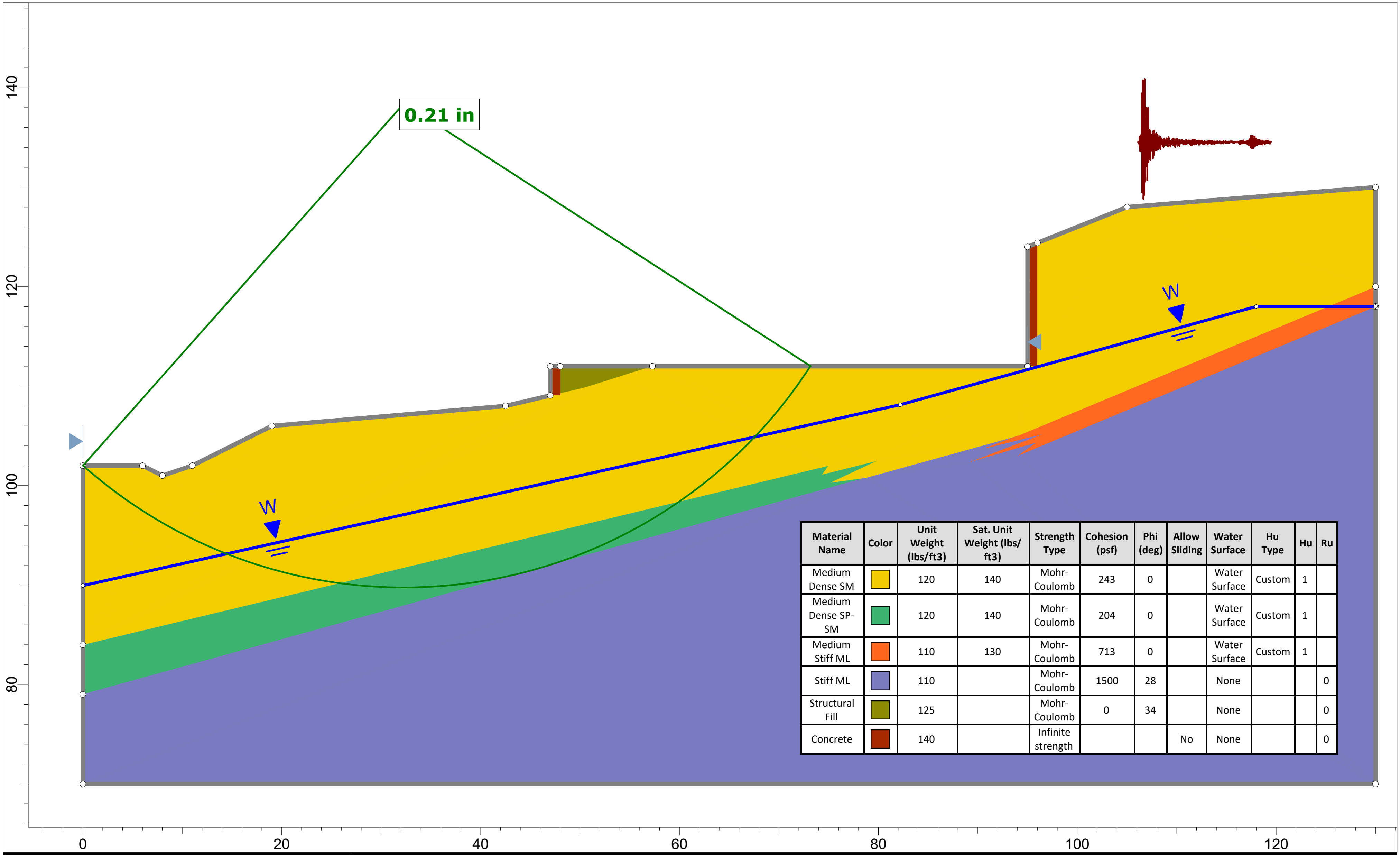
SLIDEINTERPRET 9.024

Project	Cheshire Short Plat		
Group	Lateral Spread Analysis Cape Mendocino	*Scenario*	Master Scenario
Drawn By	C. Decker	*Company*	Terra Associates, Inc.
Date	March 2, 2023	*File Name*	Cross Section A-A' Lateral Spread rv 3-2-23.slmd



Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Allow Sliding	Water Surface	Hu Type	Hu	Ru
Medium Dense SM	🟨	120	140	Mohr-Coulomb	243	0		Water Surface	Custom	1	
Medium Dense SP-SM	🟩	120	140	Mohr-Coulomb	204	0		Water Surface	Custom	1	
Medium Stiff ML	🟧	110	130	Mohr-Coulomb	713	0		Water Surface	Custom	1	
Stiff ML	🟪	110		Mohr-Coulomb	1500	28		None			0
Structural Fill	🟫	125		Mohr-Coulomb	0	34		None			0
Concrete	🟥	140		Infinite strength			No	None			0

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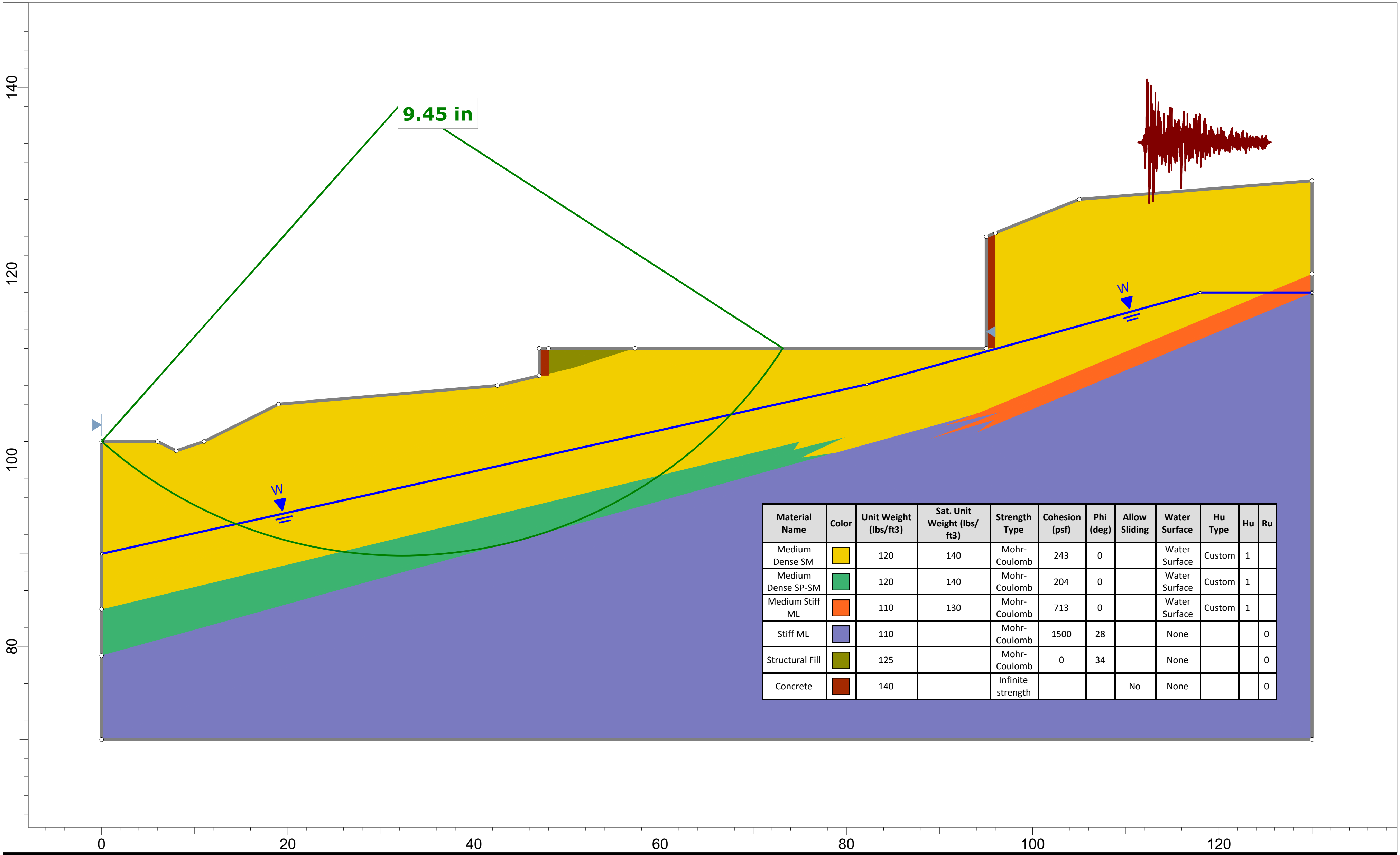
SLIDEINTERPRET 9.024

Project	Cheshire Short Plat
Group	Lateral Spread Analysis Daly City
Scenario	Master Scenario
Drawn By	C. Decker
Company	Terra Associates, Inc.
Date	March 2, 2023
File Name	Cross Section A-A' Lateral Spread rv 3-2-23.slmd



Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Allow Sliding	Water Surface	Hu Type	Hu	Ru
Medium Dense SM	🟨	120	140	Mohr-Coulomb	243	0		Water Surface	Custom	1	
Medium Dense SP-SM	🟩	120	140	Mohr-Coulomb	204	0		Water Surface	Custom	1	
Medium Stiff ML	🟧	110	130	Mohr-Coulomb	713	0		Water Surface	Custom	1	
Stiff ML	🟪	110		Mohr-Coulomb	1500	28		None			0
Structural Fill	🟫	125		Mohr-Coulomb	0	34		None			0
Concrete	🟥	140		Infinite strength			No	None			0

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SLIDEINTERPRET 9.024

Project	Cheshire Short Plat		
Group	Lateral Spread Analysis Nahanni Canada	*Scenario*	Master Scenario
Drawn By	C. Decker	*Company*	Terra Associates, Inc.
Date	March 2, 2023	*File Name*	Cross Section A-A' Lateral Spread rv 3-2-23.slmd

Cross Section A-A' Lateral Spread rv 3-2-23
Cheshire Short Plat
Terra Associates, Inc.
Date Created: March 2, 2023
Software Version: 9.024

Table of Contents

Slide2 Analysis Information

Cross Section A-A' Lateral Spread rv 3-2-23

Project Summary

File Name:	Cross Section A-A' Lateral Spread rv 3-2-23.slmd
Slide2 Modeler Version:	9.024
Project Title:	Cheshire Short Plat
Analysis:	Cross Section A-A'
Author:	C. Decker
Company:	Terra Associates, Inc.
Date Created:	March 2, 2023

Currently Open Scenarios

Group Name	Scenario Name	Global Minimum	Compute Time
Post Construction ◆	Master Scenario	Bishop Simplified: 1.200450 Janbu Simplified: 1.126160	00h:00m:00.543s
Lateral Spread Analysis Cape Mendocino ◆	Master Scenario	Bishop Simplified: 19.688900 Janbu Simplified: 29.785900	00h:00m:04.0s
Lateral Spread Analysis Daly City ◆	Master Scenario	Bishop Simplified: 0.209614 Janbu Simplified: 0.375374	00h:00m:04.343s
Lateral Spread Analysis Nahanni Canada ◆	Master Scenario	Bishop Simplified: 9.445920 Janbu Simplified: 16.529300	00h:00m:04.67s

General Settings

Units of Measurement:	Imperial Units
Time Units:	days
Permeability Units:	feet/second
Data Output:	Standard
Failure Direction:	Right to Left

Analysis Options

All Open Scenarios

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

Groundwater Analysis

All Open Scenarios

Groundwater Method:	Water Surfaces
Pore Fluid Unit Weight [lbs/ft3]:	62.4
Use negative pore pressure cutoff:	Yes
Maximum negative pore pressure [psf]:	0
Advanced Groundwater Method:	None

Random Numbers

All Open Scenarios

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

Surface Options

All Open Scenarios

Surface Type:	Circular
Search Method:	Auto Refine Search
Divisions along slope:	20
Circles per division:	10
Number of iterations:	10
Divisions to use in next iteration:	50%
Composite Surfaces:	Disabled
Minimum Elevation:	Not Defined
Minimum Depth [ft]:	10
Minimum Area:	Not Defined
Minimum Weight:	Not Defined

Seismic Loading

Post Construction

Advanced seismic analysis:	No
Staged pseudostatic analysis:	No

Lateral Spread Analysis Cape Mendocino

Advanced seismic analysis:	Yes
Locate surface with minimum critical horizontal seismic acceleration (Ky):	No
Using Newmark analysis:	Yes
Seismic record used:	Cape Mendocino 1992: RIO-270
Scaling records:	No Scaling
Displacement computed using:	Maximum positive/negative
Analysis type	Rigid
Displacement direction:	Downslope only
Staged pseudostatic analysis:	No

Lateral Spread Analysis Daly City

Advanced seismic analysis:	Yes
Locate surface with minimum critical horizontal seismic acceleration (Ky):	No
Using Newmark analysis:	Yes
Seismic record used:	Daly City 1957: GGP-100
Scaling records:	No Scaling
Displacement computed using:	Maximum positive/negative
Analysis type	Rigid
Displacement direction:	Downslope only
Staged pseudostatic analysis:	No

Lateral Spread Analysis Nahanni Canada

Advanced seismic analysis:	Yes
Locate surface with minimum critical horizontal seismic acceleration (Ky):	No
Using Newmark analysis:	Yes
Seismic record used:	Nahanni, Canada 1985: NS2-330
Scaling records:	No Scaling
Displacement computed using:	Maximum positive/negative
Analysis type	Rigid
Displacement direction:	Downslope only
Staged pseudostatic analysis:	No

Materials

Medium Dense SM	
Color	🟨
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	120
Saturated Unit Weight [lbs/ft3]	140
Cohesion [psf]	243
Friction Angle [deg]	0
Water Surface	Assigned per scenario
Hu Value	1
Medium Dense SP-SM	
Color	🟩
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	120
Saturated Unit Weight [lbs/ft3]	140
Cohesion [psf]	204
Friction Angle [deg]	0
Water Surface	Assigned per scenario
Hu Value	1
Medium Stiff ML	
Color	🟧
Strength Type	Mohr-Coulomb
Unsaturated Unit Weight [lbs/ft3]	110
Saturated Unit Weight [lbs/ft3]	130
Cohesion [psf]	713
Friction Angle [deg]	0
Water Surface	Assigned per scenario
Hu Value	1
Stiff ML	
Color	🟪
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	110
Cohesion [psf]	1500
Friction Angle [deg]	28
Water Surface	Assigned per scenario
Ru Value	0
Structural Fill	
Color	🟫
Strength Type	Mohr-Coulomb
Unit Weight [lbs/ft3]	125
Cohesion [psf]	0
Friction Angle [deg]	34
Water Surface	Assigned per scenario
Ru Value	0
Concrete	
Color	🟥
Strength Type	Infinite strength
Unit Weight [lbs/ft3]	140
Allow Sliding Along Boundary	No
Water Surface	Assigned per scenario
Ru Value	0

Materials In Use

Material		Post Construction	Lateral Spread Analysis Cape Mendocino	Lateral Spread Analysis Daly City	Lateral Spread Analysis Nahanni Canada
Medium Dense SM	🟨	✓	✓	✓	✓
Medium Dense SP-SM	🟩	✓	✓	✓	✓
Medium Stiff ML	🟧	✓	✓	✓	✓
Stiff ML	🟪	✓	✓	✓	✓
Structural Fill	🟫	✓	✓	✓	✓
Concrete	🟥	✓	✓	✓	✓

Global Minimums

◆ Post Construction

Method: bishop simplified

FS	1.200450
Center:	29.680, 128.420
Radius:	39.732
Left Slip Surface Endpoint:	0.005, 102.000
Right Slip Surface Endpoint:	65.861, 112.000
Resisting Moment:	710796 lb-ft
Driving Moment:	592107 lb-ft
Total Slice Area:	866.917 ft2
Surface Horizontal Width:	65.8558 ft
Surface Average Height:	13.1639 ft

Method: janbu simplified

FS	1.126160
Center:	29.680, 128.420
Radius:	39.732
Left Slip Surface Endpoint:	0.005, 102.000
Right Slip Surface Endpoint:	65.861, 112.000
Resisting Horizontal Force:	14772.1 lb
Driving Horizontal Force:	13117.3 lb
Total Slice Area:	866.917 ft2
Surface Horizontal Width:	65.8558 ft
Surface Average Height:	13.1639 ft

◆ Lateral Spread Analysis Cape Mendocino

Method: bishop simplified

Newmark Displacement (in)	19.688900
Center:	32.304, 138.436
Radius:	48.686
Left Slip Surface Endpoint:	0.013, 102.000
Right Slip Surface Endpoint:	73.188, 112.000
Resisting Moment:	923186 lb-ft
Driving Moment:	923186 lb-ft
Total Slice Area:	925.117 ft2
Surface Horizontal Width:	73.1749 ft
Surface Average Height:	12.6426 ft

Method: janbu simplified

Newmark Displacement (in)	**29.785900**
Center:	29.678, 128.412
Radius:	39.716
Left Slip Surface Endpoint:	0.017, 102.000
Right Slip Surface Endpoint:	65.843, 112.000
Resisting Horizontal Force:	14766.9 lb
Driving Horizontal Force:	14766.9 lb
Total Slice Area:	866.097 ft2
Surface Horizontal Width:	65.8262 ft
Surface Average Height:	13.1573 ft

Lateral Spread Analysis Daly City

Method: bishop simplified

Newmark Displacement (in)	**0.209614**
Center:	32.303, 138.437
Radius:	48.688
Left Slip Surface Endpoint:	0.010, 102.000
Right Slip Surface Endpoint:	73.188, 112.000
Resisting Moment:	923256 lb-ft
Driving Moment:	923256 lb-ft
Total Slice Area:	925.174 ft2
Surface Horizontal Width:	73.1779 ft
Surface Average Height:	12.6428 ft

Method: janbu simplified

Newmark Displacement (in)	**0.375374**
Center:	29.744, 128.396
Radius:	39.680
Left Slip Surface Endpoint:	0.117, 102.000
Right Slip Surface Endpoint:	65.878, 112.000
Resisting Horizontal Force:	14752.5 lb
Driving Horizontal Force:	14752.5 lb
Total Slice Area:	865.021 ft2
Surface Horizontal Width:	65.7614 ft
Surface Average Height:	13.1539 ft

Lateral Spread Analysis Nahanni Canada

Method: bishop simplified

Newmark Displacement (in)	**9.445920**
Center:	32.296, 138.436
Radius:	48.686
Left Slip Surface Endpoint:	0.004, 102.000
Right Slip Surface Endpoint:	73.179, 112.000
Resisting Moment:	923207 lb-ft
Driving Moment:	923207 lb-ft
Total Slice Area:	925.033 ft2
Surface Horizontal Width:	73.1749 ft
Surface Average Height:	12.6414 ft

Method: janbu simplified

Newmark Displacement (in)	**16.529300**
Center:	29.725, 128.406
Radius:	39.701
Left Slip Surface Endpoint:	0.078, 102.000
Right Slip Surface Endpoint:	65.878, 112.000
Resisting Horizontal Force:	14760.3 lb
Driving Horizontal Force:	14760.3 lb
Total Slice Area:	865.877 ft2
Surface Horizontal Width:	65.8002 ft
Surface Average Height:	13.1592 ft

Valid and Invalid Surfaces

Post Construction

Method: bishop simplified

Number of Valid Surfaces: 5084
Number of Invalid Surfaces: 1

Error Codes

Error Code -112 reported for 1 surface

Method: janbu simplified

Number of Valid Surfaces: 5046
Number of Invalid Surfaces: 39

Error Codes

Error Code -108 reported for 2 surfaces
Error Code -111 reported for 37 surfaces

Lateral Spread Analysis Cape Mendocino

Method: bishop simplified

Number of Valid Surfaces: 5863
Number of Invalid Surfaces: 0

Method: janbu simplified

Number of Valid Surfaces: 5863
Number of Invalid Surfaces: 0

Lateral Spread Analysis Daly City

Method: bishop simplified

Number of Valid Surfaces: 5935
Number of Invalid Surfaces: 0

Method: janbu simplified

Number of Valid Surfaces: 5935
Number of Invalid Surfaces: 0

Lateral Spread Analysis Nahanni Canada

Method: bishop simplified

Number of Valid Surfaces: 5781
Number of Invalid Surfaces: 0

Method: janbu simplified

Number of Valid Surfaces: 5781
Number of Invalid Surfaces: 0

Slice Data

Post Construction

Global Minimum Query (bishop simplified) - Safety Factor: 1.20045

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	1.37056	120.338	-46.876	Medium Dense SM	243	0	202.424	243	303.936	0	303.936	87.8022	87.8022
2	1.37056	349.725	-44.055	Medium Dense SM	243	0	202.424	243	451.024	0	451.024	255.169	255.169
3	1.37056	558.006	-41.3631	Medium Dense SM	243	0	202.424	243	585.368	0	585.368	407.139	407.139
4	1.37056	747.788	-38.7786	Medium Dense SM	243	0	202.424	243	708.236	0	708.236	545.608	545.608
5	1.37056	899.014	-36.2848	Medium Dense SM	243	0	202.424	243	804.559	0	804.559	655.947	655.947
6	1.37056	955.194	-33.8685	Medium Dense SM	243	0	202.424	243	832.8	0	832.8	696.938	696.938
7	1.37056	1109.84	-31.5189	Medium Dense SM	243	0	202.424	243	933.913	0	933.913	809.776	809.776
8	1.37056	1317.16	-29.2272	Medium Dense SM	243	0	202.424	243	1074.29	0	1074.29	961.036	961.036
9	1.37056	1530.69	-26.9857	Medium Dense SM	243	0	202.424	243	1219.92	0	1219.92	1116.84	1116.84
10	1.25294	1604.84	-24.8808	Medium Dense SM	243	0	202.424	243	1374.75	26.7779	1347.97	1280.87	1254.09
11	1.25294	1803.37	-22.9041	Medium Dense SM	243	0	202.424	243	1524.84	78.7227	1446.12	1439.32	1360.6
12	1.25294	1993.03	-20.9559	Medium Dense SM	243	0	202.424	243	1668.2	127.509	1540.69	1590.68	1463.17
13	1.25294	2174.16	-19.0328	Medium Dense SM	243	0	202.424	243	1805.08	173.265	1631.81	1735.25	1561.98
14	1.25294	2347.08	-17.1317	Medium Dense SM	243	0	202.424	243	1935.65	216.098	1719.56	1873.26	1657.16
15	1.25294	2493.75	-15.2499	Medium Dense SM	243	0	202.424	243	2045.5	256.104	1789.4	1990.32	1734.21
16	1.25294	2576.73	-13.3848	Medium Dense SM	243	0	202.424	243	2104.72	293.363	1811.35	2056.55	1763.19
17	1.25294	2648.28	-11.5341	Medium Dense SM	243	0	202.424	243	2154.97	327.941	1827.03	2113.66	1785.72
18	1.30163	2819.02	-9.65995	Medium Dense SP-SM	204	0	169.936	204	2194.68	360.466	1834.22	2165.76	1805.29
19	1.30163	2880.16	-7.76066	Medium Dense SP-SM	204	0	169.936	204	2235.9	390.884	1845.01	2212.74	1821.85
20	1.30163	2933.32	-5.86992	Medium Dense SP-SM	204	0	169.936	204	2271.04	418.564	1852.48	2253.57	1835.01
21	1.30163	2978.58	-3.98559	Medium Dense SP-SM	204	0	169.936	204	2300.19	443.54	1856.65	2288.35	1844.81
22	1.30163	3016	-2.10557	Medium Dense SP-SM	204	0	169.936	204	2323.35	465.833	1857.51	2317.1	1851.27
23	1.30163	3045.63	-0.227817	Medium Dense SP-SM	204	0	169.936	204	2340.54	485.459	1855.08	2339.86	1854.41
24	1.30163	3067.49	1.64969	Medium Dense SP-SM	204	0	169.936	204	2351.76	502.421	1849.34	2356.65	1854.23
25	1.30163	3081.56	3.52897	Medium Dense SP-SM	204	0	169.936	204	2356.99	516.718	1840.27	2367.47	1850.75

26	1.30163	3087.81	5.41207	Medium Dense SP-SM	204	0	169.936	204	2356.17	528.337	1827.83	2372.27	1843.93
27	1.30163	3086.18	7.30106	Medium Dense SP-SM	204	0	169.936	204	2349.24	537.257	1811.98	2371.01	1833.75
28	1.30163	3076.58	9.19807	Medium Dense SP-SM	204	0	169.936	204	2336.12	543.449	1792.67	2363.64	1820.19
29	1.30163	3058.9	11.1053	Medium Dense SP-SM	204	0	169.936	204	2316.69	546.872	1769.82	2350.05	1803.18
30	1.30163	3032.98	13.0251	Medium Dense SP-SM	204	0	169.936	204	2290.83	547.477	1743.36	2330.14	1782.67
31	1.96842	4517.31	15.4612	Medium Dense SP-SM	204	0	169.936	204	2247.88	543.67	1704.21	2294.89	1751.22
32	1.26715	2853.38	17.8941	Medium Dense SP-SM	204	0	169.936	204	2196.95	536.254	1660.7	2251.82	1715.57
33	1.26715	2815	19.8255	Medium Dense SP-SM	204	0	169.936	204	2160.26	526.73	1633.53	2221.53	1694.8
34	1.26715	2782.01	21.7807	Medium Dense SP-SM	204	0	169.936	204	2127.59	514.174	1613.41	2195.49	1681.32
35	1.26715	2740.05	23.763	Medium Dense SP-SM	204	0	169.936	204	2087.56	498.465	1589.1	2162.38	1663.92
36	1.26715	2926.24	25.776	Medium Dense SP-SM	204	0	169.936	204	2227.26	479.462	1747.8	2309.32	1829.86
37	1.26715	3066.42	27.8238	Medium Dense SP-SM	204	0	169.936	204	2330.25	457	1873.25	2419.94	1962.94
38	1.26715	2929.12	29.911	Medium Dense SP-SM	204	0	169.936	204	2213.83	430.886	1782.94	2311.59	1880.71
39	1.26715	2799.3	32.043	Medium Dense SP-SM	204	0	169.936	204	2102.77	400.891	1701.88	2209.14	1808.25
40	1.26715	2657.2	34.226	Medium Dense SP-SM	204	0	169.936	204	1981.4	366.746	1614.65	2097	1730.25
41	1.26715	2502.22	36.4673	Medium Dense SP-SM	204	0	169.936	204	1849.1	328.127	1520.97	1974.69	1646.57
42	1.31171	2412.13	38.8174	Medium Dense SM	243	0	202.424	243	1676.06	283.785	1392.28	1838.92	1555.13
43	1.31171	2214.34	41.2902	Medium Dense SM	243	0	202.424	243	1510.35	233.028	1277.33	1688.13	1455.1
44	1.31171	1997.96	43.8609	Medium Dense SM	243	0	202.424	243	1328.64	175.867	1152.77	1523.17	1347.3
45	1.31171	1762.26	46.5481	Medium Dense SM	243	0	202.424	243	1129.81	111.449	1018.37	1343.48	1232.03
46	1.31171	1502.34	49.3761	Medium Dense SM	243	0	202.424	243	909.355	38.652	870.703	1145.33	1106.68
47	1.34443	1258.89	52.4185	Medium Dense SM	243	0	202.424	243	673.349	0	673.349	936.378	936.378
48	1.34443	958.815	55.73	Medium Dense SM	243	0	202.424	243	416.1	0	416.1	713.176	713.176
49	1.34443	616.614	59.3538	Medium Dense SM	243	0	202.424	243	116.993	0	116.993	458.644	458.644
50	1.34443	216.787	63.4231	Medium Dense SM	243	0	202.424	243	-243.389	0	-243.389	161.249	161.249

Global Minimum Query (janbu simplified) - Safety Factor: 1.12616

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	1.37056	120.338	-46.876	Medium Dense SM	243	0	215.778	243	319.05	0	319.05	88.6588	88.6588
2	1.37056	349.725	-44.055	Medium Dense SM	243	0	215.778	243	464.721	0	464.721	255.946	255.946
3	1.37056	558.006	-41.3631	Medium Dense SM	243	0	215.778	243	597.832	0	597.832	407.845	407.845
4	1.37056	747.788	-38.7786	Medium Dense SM	243	0	215.778	243	719.612	0	719.612	546.256	546.256
5	1.37056	899.014	-36.2848	Medium Dense SM	243	0	215.778	243	814.952	0	814.952	656.536	656.536
6	1.37056	955.194	-33.8685	Medium Dense SM	243	0	215.778	243	842.305	0	842.305	697.481	697.481
7	1.37056	1109.84	-31.5189	Medium Dense SM	243	0	215.778	243	942.596	0	942.596	810.27	810.27
8	1.37056	1317.16	-29.2272	Medium Dense SM	243	0	215.778	243	1082.21	0	1082.21	961.485	961.485
9	1.37056	1530.69	-26.9857	Medium Dense SM	243	0	215.778	243	1227.13	0	1227.13	1117.25	1117.25
10	1.25294	1604.84	-24.8808	Medium Dense SM	243	0	215.778	243	1381.31	26.7779	1354.53	1281.23	1254.46
11	1.25294	1803.37	-22.9041	Medium Dense SM	243	0	215.778	243	1530.82	78.7227	1452.1	1439.65	1360.93
12	1.25294	1993.03	-20.9559	Medium Dense SM	243	0	215.778	243	1673.63	127.509	1546.12	1590.99	1463.48
13	1.25294	2174.16	-19.0328	Medium Dense SM	243	0	215.778	243	1809.96	173.265	1636.69	1735.52	1562.26
14	1.25294	2347.08	-17.1317	Medium Dense SM	243	0	215.778	243	1940.02	216.098	1723.92	1873.5	1657.41
15	1.25294	2493.75	-15.2499	Medium Dense SM	243	0	215.778	243	2049.36	256.104	1793.26	1990.53	1734.43
16	1.25294	2576.73	-13.3848	Medium Dense SM	243	0	215.778	243	2108.09	293.363	1814.72	2056.74	1763.38
17	1.25294	2648.28	-11.5341	Medium Dense SM	243	0	215.778	243	2157.85	327.941	1829.91	2113.82	1785.88
18	1.30163	2819.02	-9.65995	Medium Dense SP-SM	204	0	181.147	204	2196.7	360.466	1836.24	2165.87	1805.4
19	1.30163	2880.16	-7.76066	Medium Dense SP-SM	204	0	181.147	204	2237.52	390.884	1846.63	2212.83	1821.95
20	1.30163	2933.32	-5.86992	Medium Dense SP-SM	204	0	181.147	204	2272.27	418.564	1853.7	2253.64	1835.08
21	1.30163	2978.58	-3.98559	Medium Dense SP-SM	204	0	181.147	204	2301.02	443.54	1857.48	2288.39	1844.85
22	1.30163	3016	-2.10557	Medium Dense SP-SM	204	0	181.147	204	2323.78	465.833	1857.94	2317.12	1851.28
23	1.30163	3045.63	-0.227817	Medium Dense SP-SM	204	0	181.147	204	2340.59	485.459	1855.13	2339.87	1854.41
24	1.30163	3067.49	1.64969	Medium Dense SP-SM	204	0	181.147	204	2351.41	502.421	1848.99	2356.63	1854.21
25	1.30163	3081.56	3.52897	Medium Dense SP-SM	204	0	181.147	204	2356.25	516.718	1839.53	2367.42	1850.7
26	1.30163	3087.81	5.41207	Medium Dense SP-SM	204	0	181.147	204	2355.04	528.337	1826.7	2372.2	1843.86
27	1.30163	3086.18	7.30106	Medium Dense SP-SM	204	0	181.147	204	2347.72	537.257	1810.46	2370.93	1833.67
28	1.30163	3076.58	9.19807	Medium Dense SP-SM	204	0	181.147	204	2334.19	543.449	1790.74	2363.53	1820.08

29	1.30163	3058.9	11.1053	Medium Dense SP-SM	204	0	181.147	204	2314.36	546.872	1767.49	2349.92	1803.05
30	1.30163	3032.98	13.0251	Medium Dense SP-SM	204	0	181.147	204	2288.08	547.477	1740.6	2329.98	1782.51
31	1.96842	4517.31	15.4612	Medium Dense SP-SM	204	0	181.147	204	2244.59	543.67	1700.92	2294.7	1751.03
32	1.26715	2853.38	17.8941	Medium Dense SP-SM	204	0	181.147	204	2193.11	536.254	1656.86	2251.6	1715.35
33	1.26715	2815	19.8255	Medium Dense SP-SM	204	0	181.147	204	2155.98	526.73	1629.25	2221.28	1694.55
34	1.26715	2782.01	21.7807	Medium Dense SP-SM	204	0	181.147	204	2122.84	514.174	1608.66	2195.22	1681.05
35	1.26715	2740.05	23.763	Medium Dense SP-SM	204	0	181.147	204	2082.33	498.465	1583.87	2162.09	1663.62
36	1.26715	2926.24	25.776	Medium Dense SP-SM	204	0	181.147	204	2221.52	479.462	1742.06	2308.99	1829.53
37	1.26715	3066.42	27.8238	Medium Dense SP-SM	204	0	181.147	204	2323.98	457	1866.98	2419.59	1962.59
38	1.26715	2929.12	29.911	Medium Dense SP-SM	204	0	181.147	204	2207	430.886	1776.11	2311.21	1880.32
39	1.26715	2799.3	32.043	Medium Dense SP-SM	204	0	181.147	204	2095.33	400.891	1694.44	2208.72	1807.83
40	1.26715	2657.2	34.226	Medium Dense SP-SM	204	0	181.147	204	1973.31	366.746	1606.57	2096.54	1729.8
41	1.26715	2502.22	36.4673	Medium Dense SP-SM	204	0	181.147	204	1840.31	328.127	1512.19	1974.19	1646.07
42	1.31171	2412.13	38.8174	Medium Dense SM	243	0	215.778	243	1664.68	283.785	1380.89	1838.28	1554.49
43	1.31171	2214.34	41.2902	Medium Dense SM	243	0	215.778	243	1497.92	233.028	1264.9	1687.42	1454.4
44	1.31171	1997.96	43.8609	Medium Dense SM	243	0	215.778	243	1315.03	175.867	1139.17	1522.4	1346.53
45	1.31171	1762.26	46.5481	Medium Dense SM	243	0	215.778	243	1114.87	111.449	1003.42	1342.64	1231.19
46	1.31171	1502.34	49.3761	Medium Dense SM	243	0	215.778	243	892.855	38.652	854.203	1144.4	1105.74
47	1.34443	1258.89	52.4185	Medium Dense SM	243	0	215.778	243	654.954	0	654.954	935.334	935.334
48	1.34443	958.815	55.73	Medium Dense SM	243	0	215.778	243	395.325	0	395.325	711.999	711.999
49	1.34443	616.614	59.3538	Medium Dense SM	243	0	215.778	243	93.1012	0	93.1012	457.29	457.29
50	1.34443	216.787	63.4231	Medium Dense SM	243	0	215.778	243	-271.686	0	-271.686	159.645	159.645

Lateral Spread Analysis Cape Mendocino

Global Minimum Query (bishop simplified) - Newmark Displacement (in): 19.6889

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	1.44432	106.645	-40.4326	Medium Dense SM	243	0	243	243	280.885	0	280.885	73.8377	73.8377
2	1.44432	311.904	-38.2339	Medium Dense SM	243	0	243	243	407.407	0	407.407	215.952	215.952
3	1.44432	501.789	-36.1	Medium Dense SM	243	0	243	243	524.621	0	524.621	347.422	347.422
4	1.44432	677.555	-34.0227	Medium Dense SM	243	0	243	243	633.165	0	633.165	469.119	469.119
5	1.44432	794.523	-31.995	Medium Dense SM	243	0	243	243	701.919	0	701.919	550.105	550.105
6	1.44432	844.215	-30.0114	Medium Dense SM	243	0	243	243	724.867	0	724.867	584.507	584.507
7	1.44432	1037.39	-28.0667	Medium Dense SM	243	0	243	243	847.828	0	847.828	718.26	718.26
8	1.44432	1252.27	-26.1566	Medium Dense SM	243	0	243	243	986.369	0	986.369	867.027	867.027
9	1.44432	1487.67	-24.2774	Medium Dense SM	243	0	243	243	1139.62	0	1139.62	1030.01	1030.01
10	1.44432	1720.94	-22.4256	Medium Dense SM	243	0	243	243	1291.81	0	1291.81	1191.52	1191.52
11	1.41614	1916.78	-20.6158	Medium Dense SM	243	0	243	243	1444.94	26.3961	1418.54	1353.52	1327.13
12	1.41614	2146.7	-18.845	Medium Dense SM	243	0	243	243	1598.82	77.6494	1521.17	1515.88	1438.23
13	1.41614	2366.98	-17.0926	Medium Dense SM	243	0	243	243	1746.16	125.868	1620.29	1671.44	1545.57
14	1.41614	2546.64	-15.3566	Medium Dense SM	243	0	243	243	1865.04	171.14	1693.9	1798.3	1627.16
15	1.41614	2650.77	-13.6349	Medium Dense SM	243	0	243	243	1930.78	213.544	1717.23	1871.83	1658.29
16	1.41614	2743.83	-11.9258	Medium Dense SM	243	0	243	243	1988.87	253.145	1735.72	1937.54	1684.4
17	1.41614	2828.16	-10.2273	Medium Dense SM	243	0	243	243	2040.94	290	1750.94	1997.09	1707.09
18	1.41614	2903.92	-8.53784	Medium Dense SM	243	0	243	243	2087.07	324.156	1762.91	2050.59	1726.43
19	1.41681	2972.65	-6.85547	Medium Dense SP-SM	204	0	204	204	2122.66	355.661	1767	2098.13	1742.47
20	1.41681	3031.67	-5.17862	Medium Dense SP-SM	204	0	204	204	2158.27	384.542	1773.73	2139.78	1755.24
21	1.41681	3082.39	-3.50621	Medium Dense SP-SM	204	0	204	204	2188.09	410.818	1777.27	2175.59	1764.77
22	1.41681	3124.89	-1.83678	Medium Dense SP-SM	204	0	204	204	2212.12	434.506	1777.62	2205.58	1771.07
23	1.41681	3159.2	-0.168921	Medium Dense SP-SM	204	0	204	204	2230.39	455.615	1774.78	2229.79	1774.18
24	1.41681	3185.32	1.4988	Medium Dense SP-SM	204	0	204	204	2242.89	474.149	1768.74	2248.23	1774.08
25	1.41681	3203.25	3.16779	Medium Dense SP-SM	204	0	204	204	2249.6	490.107	1759.49	2260.89	1770.78
26	1.41681	3212.96	4.83948	Medium Dense SP-SM	204	0	204	204	2250.46	503.48	1746.98	2267.74	1764.26
27	1.41681	3214.4	6.51531	Medium Dense SP-SM	204	0	204	204	2245.46	514.25	1731.21	2268.76	1754.51
28	1.41681	3207.49	8.19677	Medium Dense SP-SM	204	0	204	204	2234.49	522.395	1712.1	2263.88	1741.48

29	1.41681	3192.15	9.88537	Medium Dense SP-SM	204	0	204	204	2217.5	527.885	1689.62	2253.05	1725.17
30	1.41681	3168.99	11.5827	Medium Dense SP-SM	204	0	204	204	2194.89	530.683	1664.21	2236.7	1706.02
31	1.41681	3161.06	13.2904	Medium Dense SP-SM	204	0	204	204	2182.91	530.743	1652.17	2231.1	1700.36
32	2.15234	4787.43	15.4612	Medium Dense SP-SM	204	0	204	204	2167.87	526.365	1641.5	2224.29	1697.93
33	1.5172	3699.76	17.7126	Medium Dense SP-SM	204	0	204	204	2373.39	518.004	1855.38	2438.54	1920.54
34	1.5172	3807.97	19.5975	Medium Dense SP-SM	204	0	204	204	2437.24	506.979	1930.26	2509.87	2002.89
35	1.5172	3688.86	21.5048	Medium Dense SP-SM	204	0	204	204	2350.99	492.422	1858.57	2431.37	1938.94
36	1.5172	3562.58	23.4375	Medium Dense SP-SM	204	0	204	204	2259.69	474.197	1785.49	2348.13	1873.93
37	1.5172	3422.74	25.3989	Medium Dense SP-SM	204	0	204	204	2159.1	452.147	1706.95	2255.96	1803.81
38	1.5172	3269.26	27.3928	Medium Dense SP-SM	204	0	204	204	2049.09	426.089	1623	2154.8	1728.71
39	1.5172	3101.41	29.4234	Medium Dense SP-SM	204	0	204	204	1929.11	395.808	1533.3	2044.17	1648.36
40	1.5172	2919.49	31.4954	Medium Dense SP-SM	204	0	204	204	1799.28	361.054	1438.22	1924.27	1563.21
41	1.5172	2723.76	33.6146	Medium Dense SP-SM	204	0	204	204	1659.64	321.531	1338.11	1795.26	1473.73
42	1.51692	2510.23	35.7871	Medium Dense SM	243	0	243	243	1479.65	276.891	1202.76	1654.82	1377.93
43	1.51692	2278.36	38.0206	Medium Dense SM	243	0	243	243	1311.97	226.713	1085.26	1501.97	1275.25
44	1.51692	2025.89	40.3245	Medium Dense SM	243	0	243	243	1129.27	170.48	958.792	1335.53	1165.05
45	1.51692	1750.66	42.7102	Medium Dense SM	243	0	243	243	929.781	107.564	822.217	1154.1	1046.53
46	1.51692	1450.01	45.1917	Medium Dense SM	243	0	243	243	711.262	37.1727	674.089	955.893	918.721
47	1.39809	1062.86	47.6804	Medium Dense SM	243	0	243	243	493.355	0	493.355	760.225	760.225
48	1.39809	793.362	50.1873	Medium Dense SM	243	0	243	243	275.936	0	275.936	567.463	567.463
49	1.39809	497.962	52.8342	Medium Dense SM	243	0	243	243	35.6363	0	35.6363	356.174	356.174
50	1.39809	171.631	55.6544	Medium Dense SM	243	0	243	243	-232.855	0	-232.855	122.761	122.761

Global Minimum Query (janbu simplified) - Newmark Displacement (in): 29.7859

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	1.37064	120.324	-46.869	Medium Dense SM	243	0	243	243	347.181	0	347.181	87.7866	87.7866
2	1.37064	349.679	-44.0471	Medium Dense SM	243	0	243	243	490.169	0	490.169	255.121	255.121
3	1.37064	557.925	-41.3542	Medium Dense SM	243	0	243	243	620.943	0	620.943	407.055	407.055
4	1.37064	747.668	-38.7688	Medium Dense SM	243	0	243	243	740.645	0	740.645	545.485	545.485
5	1.37064	898.187	-36.2742	Medium Dense SM	243	0	243	243	833.639	0	833.639	655.307	655.307
6	1.37064	954.223	-33.8571	Medium Dense SM	243	0	243	243	859.214	0	859.214	696.189	696.189
7	1.37064	1110.29	-31.5067	Medium Dense SM	243	0	243	243	959.001	0	959.001	810.051	810.051
8	1.37064	1317.57	-29.2142	Medium Dense SM	243	0	243	243	1097.17	0	1097.17	961.278	961.278
9	1.37064	1531.42	-26.9719	Medium Dense SM	243	0	243	243	1240.97	0	1240.97	1117.3	1117.3
10	1.25381	1606.54	-24.8657	Medium Dense SM	243	0	243	243	1393.96	26.784	1367.17	1281.34	1254.55
11	1.25381	1805.28	-22.8871	Medium Dense SM	243	0	243	243	1542.42	78.7385	1463.68	1439.84	1361.1
12	1.25381	1995.11	-20.9369	Medium Dense SM	243	0	243	243	1684.21	127.53	1556.68	1591.24	1463.71
13	1.25381	2176.41	-19.0119	Medium Dense SM	243	0	243	243	1819.57	173.286	1646.28	1735.84	1562.56
14	1.25381	2349.48	-17.109	Medium Dense SM	243	0	243	243	1948.67	216.117	1732.56	1873.88	1657.76
15	1.25381	2495.48	-15.2253	Medium Dense SM	243	0	243	243	2056.46	256.116	1800.35	1990.32	1734.21
16	1.25381	2578.13	-13.3584	Medium Dense SM	243	0	243	243	2113.94	293.363	1820.58	2056.24	1762.87
17	1.25381	2649.67	-11.5058	Medium Dense SM	243	0	243	243	2162.76	327.926	1834.84	2113.3	1785.37
18	1.33759	2897.18	-9.6042	Medium Dense SP-SM	204	0	204	204	2200.49	360.839	1839.65	2165.97	1805.13
19	1.33759	2961.39	-7.65205	Medium Dense SP-SM	204	0	204	204	2241.38	391.975	1849.41	2213.97	1822
20	1.33759	3016.92	-5.70881	Medium Dense SP-SM	204	0	204	204	2275.89	420.222	1855.67	2255.49	1835.27
21	1.33759	3063.89	-3.77214	Medium Dense SP-SM	204	0	204	204	2304.06	445.612	1858.45	2290.61	1845
22	1.33759	3102.36	-1.83979	Medium Dense SP-SM	204	0	204	204	2325.93	468.172	1857.75	2319.37	1851.2
23	1.33759	3132.37	0.0904753	Medium Dense SP-SM	204	0	204	204	2341.48	487.914	1853.57	2341.81	1853.89
24	1.33759	3153.94	2.02084	Medium Dense SP-SM	204	0	204	204	2350.74	504.842	1845.89	2357.94	1853.09
25	1.33759	3167.06	3.9535	Medium Dense SP-SM	204	0	204	204	2353.64	518.953	1834.69	2367.74	1848.79
26	1.33759	3171.67	5.89069	Medium Dense SP-SM	204	0	204	204	2350.14	530.23	1819.91	2371.19	1840.96
27	1.33759	3167.7	7.83466	Medium Dense SP-SM	204	0	204	204	2340.15	538.649	1801.5	2368.22	1829.57
28	1.33759	3155.06	9.78777	Medium Dense SP-SM	204	0	204	204	2323.58	544.175	1779.4	2358.77	1814.59

29	1.33759	3133.58	11.7524	Medium Dense SP-SM	204	0	204	204	2300.28	546.761	1753.52	2342.72	1795.96
30	1.33759	3103.12	13.7313	Medium Dense SP-SM	204	0	204	204	2270.09	546.348	1723.74	2319.94	1773.59
31	0.984303	2258.97	15.4612	Medium Dense SP-SM	204	0	204	204	2238.57	543.685	1694.88	2294.99	1751.31
32	1.31392	2975.12	17.19	Medium Dense SP-SM	204	0	204	204	2201.19	538.374	1662.82	2264.3	1725.93
33	1.31392	2928.01	19.1857	Medium Dense SP-SM	204	0	204	204	2157.46	529.568	1627.89	2228.44	1698.87
34	1.31392	2893.79	21.2059	Medium Dense SP-SM	204	0	204	204	2123.25	517.539	1605.71	2202.4	1684.86
35	1.31392	2851.36	23.2542	Medium Dense SP-SM	204	0	204	204	2082.44	502.158	1580.29	2170.11	1667.95
36	1.31392	2931.35	25.3345	Medium Dense SP-SM	204	0	204	204	2134.41	483.274	1651.13	2230.99	1747.71
37	1.31392	3210.32	27.4513	Medium Dense SP-SM	204	0	204	204	2337.33	460.71	1876.62	2443.3	1982.59
38	1.31392	3054.21	29.6096	Medium Dense SP-SM	204	0	204	204	2208.56	434.258	1774.3	2324.49	1890.24
39	1.31392	2916.15	31.8152	Medium Dense SP-SM	204	0	204	204	2092.86	403.669	1689.19	2219.42	1815.75
40	1.31392	2764.56	34.0749	Medium Dense SP-SM	204	0	204	204	1966.06	368.647	1597.41	2104.05	1735.4
41	1.31392	2598.62	36.3967	Medium Dense SP-SM	204	0	204	204	1827.37	328.839	1498.53	1977.75	1648.92
42	1.31314	2415.92	38.7896	Medium Dense SM	243	0	243	243	1644.5	283.826	1360.67	1839.8	1555.98
43	1.31314	2217.88	41.2651	Medium Dense SM	243	0	243	243	1475.77	233.078	1242.69	1688.99	1455.91
44	1.31314	2001.19	43.8387	Medium Dense SM	243	0	243	243	1290.63	175.917	1114.71	1523.97	1348.06
45	1.31314	1765.13	46.5289	Medium Dense SM	243	0	243	243	1087.87	111.488	976.387	1344.2	1232.71
46	1.31314	1504.8	49.3603	Medium Dense SM	243	0	243	243	862.838	38.6674	824.171	1145.95	1107.29
47	1.34551	1260.63	52.4059	Medium Dense SM	243	0	243	243	621.303	0	621.303	936.912	936.912
48	1.34551	960.189	55.7204	Medium Dense SM	243	0	243	243	357.127	0	357.127	713.624	713.624
49	1.34551	617.538	59.3479	Medium Dense SM	243	0	243	243	48.9222	0	48.9222	458.961	458.961
50	1.34551	217.122	63.4217	Medium Dense SM	243	0	243	243	-324.351	0	-324.351	161.368	161.368

Lateral Spread Analysis Daly City

Global Minimum Query (bishop simplified) - Newmark Displacement (in): 0.209614

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	1.44439	106.657	-40.433	Medium Dense SM	243	0	243	243	280.894	0	280.894	73.8425	73.8425
2	1.44439	311.94	-38.2344	Medium Dense SM	243	0	243	243	407.425	0	407.425	215.967	215.967
3	1.44439	501.846	-36.1004	Medium Dense SM	243	0	243	243	524.647	0	524.647	347.445	347.445
4	1.44439	677.633	-34.023	Medium Dense SM	243	0	243	243	633.194	0	633.194	469.146	469.146
5	1.44439	794.832	-31.9954	Medium Dense SM	243	0	243	243	702.105	0	702.105	550.289	550.289
6	1.44439	844.375	-30.0117	Medium Dense SM	243	0	243	243	724.949	0	724.949	584.587	584.587
7	1.44439	1037.36	-28.067	Medium Dense SM	243	0	243	243	847.766	0	847.766	718.196	718.196
8	1.44439	1252.22	-26.1569	Medium Dense SM	243	0	243	243	986.3	0	986.3	866.956	866.956
9	1.44439	1487.6	-24.2776	Medium Dense SM	243	0	243	243	1139.52	0	1139.52	1029.92	1029.92
10	1.44439	1720.89	-22.4258	Medium Dense SM	243	0	243	243	1291.72	0	1291.72	1191.44	1191.44
11	1.41612	1916.64	-20.6161	Medium Dense SM	243	0	243	243	1444.86	26.396	1418.46	1353.44	1327.05
12	1.41612	2146.56	-18.8453	Medium Dense SM	243	0	243	243	1598.74	77.6492	1521.09	1515.8	1438.15
13	1.41612	2366.83	-17.093	Medium Dense SM	243	0	243	243	1746.07	125.868	1620.2	1671.35	1545.48
14	1.41612	2546.63	-15.3571	Medium Dense SM	243	0	243	243	1865.05	171.14	1693.91	1798.32	1627.18
15	1.41612	2650.81	-13.6355	Medium Dense SM	243	0	243	243	1930.82	213.544	1717.28	1871.87	1658.33
16	1.41612	2743.86	-11.9264	Medium Dense SM	243	0	243	243	1988.92	253.146	1735.77	1937.59	1684.45
17	1.41612	2828.2	-10.228	Medium Dense SM	243	0	243	243	2040.99	290.002	1750.99	1997.14	1707.14
18	1.41612	2903.96	-8.53864	Medium Dense SM	243	0	243	243	2087.12	324.159	1762.96	2050.64	1726.48
19	1.41584	2970.67	-6.85691	Medium Dense SP-SM	204	0	204	204	2122.7	355.654	1767.04	2098.17	1742.51
20	1.41584	3029.61	-5.18127	Medium Dense SP-SM	204	0	204	204	2158.3	384.52	1773.78	2139.8	1755.28
21	1.41584	3080.28	-3.51006	Medium Dense SP-SM	204	0	204	204	2188.1	410.783	1777.32	2175.59	1764.8
22	1.41584	3122.75	-1.84184	Medium Dense SP-SM	204	0	204	204	2212.14	434.46	1777.68	2205.58	1771.12
23	1.41584	3157.03	-0.175184	Medium Dense SP-SM	204	0	204	204	2230.42	455.564	1774.86	2229.8	1774.23
24	1.41584	3183.15	1.49133	Medium Dense SP-SM	204	0	204	204	2242.93	474.096	1768.84	2248.25	1774.15
25	1.41584	3201.09	3.1591	Medium Dense SP-SM	204	0	204	204	2249.66	490.056	1759.6	2260.92	1770.86
26	1.41584	3210.84	4.82956	Medium Dense SP-SM	204	0	204	204	2250.56	503.433	1747.13	2267.8	1764.37
27	1.41584	3212.33	6.50415	Medium Dense SP-SM	204	0	204	204	2245.59	514.212	1731.38	2268.85	1754.64
28	1.41584	3205.49	8.18434	Medium Dense SP-SM	204	0	204	204	2234.68	522.371	1712.31	2264.02	1741.65

29	1.41584	3190.23	9.87166	Medium Dense SP-SM	204	0	204	204	2217.75	527.878	1689.87	2253.25	1725.37
30	1.41584	3167.11	11.5677	Medium Dense SP-SM	204	0	204	204	2195.15	530.697	1664.46	2236.91	1706.21
31	1.41584	3158.97	13.274	Medium Dense SP-SM	204	0	204	204	2183.04	530.782	1652.26	2231.17	1700.39
32	2.18032	4849.68	15.4612	Medium Dense SP-SM	204	0	204	204	2167.87	526.37	1641.5	2224.3	1697.93
33	1.51578	3700.83	17.7288	Medium Dense SP-SM	204	0	204	204	2376.32	517.95	1858.37	2441.53	1923.58
34	1.51578	3803.22	19.6121	Medium Dense SP-SM	204	0	204	204	2436.39	506.907	1929.49	2509.08	2002.18
35	1.51578	3684.74	21.5177	Medium Dense SP-SM	204	0	204	204	2350.49	492.338	1858.15	2430.92	1938.59
36	1.51578	3558.61	23.4486	Medium Dense SP-SM	204	0	204	204	2259.22	474.107	1785.12	2347.71	1873.6
37	1.51578	3418.97	25.4083	Medium Dense SP-SM	204	0	204	204	2158.68	452.057	1706.62	2255.58	1803.53
38	1.51578	3265.72	27.4004	Medium Dense SP-SM	204	0	204	204	2048.73	426.005	1622.72	2154.47	1728.47
39	1.51578	3098.13	29.4291	Medium Dense SP-SM	204	0	204	204	1928.83	395.739	1533.09	2043.92	1648.18
40	1.51578	2916.52	31.4993	Medium Dense SP-SM	204	0	204	204	1799.09	361.007	1438.08	1924.1	1563.09
41	1.51578	2721.13	33.6164	Medium Dense SP-SM	204	0	204	204	1659.58	321.514	1338.07	1795.2	1473.69
42	1.51688	2510.17	35.7878	Medium Dense SM	243	0	243	243	1479.65	276.891	1202.76	1654.83	1377.93
43	1.51688	2278.3	38.0212	Medium Dense SM	243	0	243	243	1311.97	226.712	1085.26	1501.97	1275.26
44	1.51688	2025.84	40.3251	Medium Dense SM	243	0	243	243	1129.27	170.479	958.791	1335.53	1165.05
45	1.51688	1750.63	42.7106	Medium Dense SM	243	0	243	243	929.779	107.562	822.217	1154.1	1046.53
46	1.51688	1449.98	45.192	Medium Dense SM	243	0	243	243	711.262	37.1723	674.089	955.896	918.723
47	1.3981	1062.88	47.6805	Medium Dense SM	243	0	243	243	493.36	0	493.36	760.232	760.232
48	1.3981	793.373	50.1874	Medium Dense SM	243	0	243	243	275.939	0	275.939	567.466	567.466
49	1.3981	497.968	52.8342	Medium Dense SM	243	0	243	243	35.6378	0	35.6378	356.176	356.176
50	1.3981	171.633	55.6543	Medium Dense SM	243	0	243	243	-232.854	0	-232.854	122.762	122.762

Global Minimum Query (janbu simplified) - Newmark Displacement (in): 0.375374

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	1.36831	119.862	-46.8563	Medium Dense SM	243	0	243	243	346.877	0	346.877	87.5984	87.5984
2	1.36831	348.348	-44.0372	Medium Dense SM	243	0	243	243	489.549	0	489.549	254.582	254.582
3	1.36831	555.824	-41.3468	Medium Dense SM	243	0	243	243	620.046	0	620.046	406.213	406.213
4	1.36831	744.881	-38.7638	Medium Dense SM	243	0	243	243	739.501	0	739.501	544.377	544.377
5	1.36831	889.976	-36.2713	Medium Dense SM	243	0	243	243	828.731	0	828.731	650.417	650.417
6	1.36831	945.811	-33.8562	Medium Dense SM	243	0	243	243	854.246	0	854.246	691.226	691.226
7	1.36831	1110.65	-31.5077	Medium Dense SM	243	0	243	243	960.654	0	960.654	811.698	811.698
8	1.36831	1317.27	-29.217	Medium Dense SM	243	0	243	243	1098.6	0	1098.6	962.697	962.697
9	1.36831	1532.58	-26.9765	Medium Dense SM	243	0	243	243	1243.74	0	1243.74	1120.05	1120.05
10	1.25346	1609.37	-24.8704	Medium Dense SM	243	0	243	243	1396.58	26.7804	1369.8	1283.94	1257.16
11	1.25346	1808.01	-22.8905	Medium Dense SM	243	0	243	243	1545.02	78.7272	1466.29	1442.42	1363.69
12	1.25346	1997.75	-20.9391	Medium Dense SM	243	0	243	243	1686.77	127.51	1559.26	1593.79	1466.28
13	1.25346	2178.96	-19.0129	Medium Dense SM	243	0	243	243	1822.09	173.256	1648.83	1738.35	1565.1
14	1.25346	2351.93	-17.1088	Medium Dense SM	243	0	243	243	1951.15	216.075	1735.07	1876.35	1660.27
15	1.25346	2494.36	-15.2239	Medium Dense SM	243	0	243	243	2056.11	256.062	1800.05	1989.98	1733.92
16	1.25346	2575.67	-13.3559	Medium Dense SM	243	0	243	243	2112.54	293.296	1819.24	2054.85	1761.55
17	1.25346	2647.16	-11.5022	Medium Dense SM	243	0	243	243	2161.33	327.845	1833.48	2111.88	1784.03
18	1.35248	2927.84	-9.58828	Medium Dense SP-SM	204	0	204	204	2199.26	360.92	1838.34	2164.8	1803.88
19	1.35248	2993.36	-7.61276	Medium Dense SP-SM	204	0	204	204	2240.51	392.361	1848.15	2213.25	1820.89
20	1.35248	3049.91	-5.64631	Medium Dense SP-SM	204	0	204	204	2275.22	420.846	1854.38	2255.05	1834.21
21	1.35248	3097.6	-3.68653	Medium Dense SP-SM	204	0	204	204	2303.45	446.41	1857.04	2290.31	1843.9
22	1.35248	3136.49	-1.73106	Medium Dense SP-SM	204	0	204	204	2325.24	469.077	1856.16	2319.07	1850
23	1.35248	3166.64	0.222388	Medium Dense SP-SM	204	0	204	204	2340.57	488.861	1851.71	2341.36	1852.5
24	1.35248	3188.05	2.1761	Medium Dense SP-SM	204	0	204	204	2349.44	505.767	1843.67	2357.19	1851.42
25	1.35248	3200.71	4.13235	Medium Dense SP-SM	204	0	204	204	2351.82	519.788	1832.03	2366.55	1846.77
26	1.35248	3204.57	6.09344	Medium Dense SP-SM	204	0	204	204	2347.63	530.907	1816.72	2369.41	1838.5
27	1.35248	3199.54	8.06173	Medium Dense SP-SM	204	0	204	204	2336.8	539.099	1797.7	2365.69	1826.59
28	1.35248	3185.51	10.0397	Medium Dense SP-SM	204	0	204	204	2319.2	544.324	1774.87	2355.31	1810.99

29	1.35248	3162.33	12.0298	Medium Dense SP-SM	204	0	204	204	2294.7	546.534	1748.17	2338.17	1791.64
30	1.35248	3129.81	14.0348	Medium Dense SP-SM	204	0	204	204	2263.14	545.667	1717.47	2314.14	1768.47
31	0.560575	1285.74	15.4612	Medium Dense SP-SM	204	0	204	204	2237.19	543.487	1693.7	2293.61	1750.13
32	1.3336	3024.99	16.8874	Medium Dense SP-SM	204	0	204	204	2206.35	539.094	1667.26	2268.29	1729.19
33	1.3336	2975.9	18.9115	Medium Dense SP-SM	204	0	204	204	2161.59	530.62	1630.97	2231.48	1700.86
34	1.3336	2940.78	20.9604	Medium Dense SP-SM	204	0	204	204	2126.99	518.838	1608.15	2205.14	1686.3
35	1.3336	2898.23	23.0378	Medium Dense SP-SM	204	0	204	204	2086.48	503.617	1582.87	2173.24	1669.62
36	1.3336	2955.03	25.1479	Medium Dense SP-SM	204	0	204	204	2120.06	484.802	1635.26	2215.83	1731.03
37	1.3336	3266.64	27.2951	Medium Dense SP-SM	204	0	204	204	2344.21	462.21	1882	2449.48	1987.27
38	1.3336	3105.03	29.4848	Medium Dense SP-SM	204	0	204	204	2212.96	435.625	1777.33	2328.3	1892.68
39	1.3336	2963.44	31.7229	Medium Dense SP-SM	204	0	204	204	2096.02	404.79	1691.23	2222.13	1817.34
40	1.3336	2807.73	34.0166	Medium Dense SP-SM	204	0	204	204	1967.69	369.399	1598.29	2105.37	1735.97
41	1.3336	2637.05	36.3742	Medium Dense SP-SM	204	0	204	204	1827.13	329.081	1498.05	1977.39	1648.31
42	1.31289	2413.79	38.7862	Medium Dense SM	243	0	243	243	1643.24	283.785	1359.46	1838.52	1554.74
43	1.31289	2215.84	41.2634	Medium Dense SM	243	0	243	243	1474.55	233.053	1241.5	1687.76	1454.7
44	1.31289	1999.28	43.8387	Medium Dense SM	243	0	243	243	1289.46	175.905	1113.55	1522.8	1346.9
45	1.31289	1763.34	46.5309	Medium Dense SM	243	0	243	243	1086.75	111.484	975.265	1343.09	1231.61
46	1.31289	1503.09	49.3645	Medium Dense SM	243	0	243	243	861.706	38.6672	823.039	1144.86	1106.2
47	1.3439	1257.8	52.4109	Medium Dense SM	243	0	243	243	620.266	0	620.266	935.933	935.933
48	1.3439	958.026	55.7249	Medium Dense SM	243	0	243	243	356.314	0	356.314	712.87	712.87
49	1.3439	616.141	59.3517	Medium Dense SM	243	0	243	243	48.3728	0	48.3728	458.473	458.473
50	1.3439	216.63	63.4246	Medium Dense SM	243	0	243	243	-324.586	0	-324.586	161.195	161.195

Lateral Spread Analysis Nahanni Canada

Global Minimum Query (bishop simplified) - Newmark Displacement (in): 9.44592

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	1.44463	106.69	-40.4323	Medium Dense SM	243	0	243	243	280.898	0	280.898	73.8528	73.8528
2	1.44463	312.034	-38.2332	Medium Dense SM	243	0	243	243	407.447	0	407.447	215.996	215.996
3	1.44463	501.994	-36.0989	Medium Dense SM	243	0	243	243	524.681	0	524.681	347.49	347.49
4	1.44463	677.827	-34.0211	Medium Dense SM	243	0	243	243	633.241	0	633.241	469.205	469.205
5	1.44463	795.378	-31.9931	Medium Dense SM	243	0	243	243	702.376	0	702.376	550.573	550.573
6	1.44463	844.705	-30.0091	Medium Dense SM	243	0	243	243	725.07	0	725.07	584.723	584.723
7	1.44463	1037.42	-28.064	Medium Dense SM	243	0	243	243	847.679	0	847.679	718.125	718.125
8	1.44463	1252.3	-26.1536	Medium Dense SM	243	0	243	243	986.189	0	986.189	866.863	866.863
9	1.44463	1487.67	-24.274	Medium Dense SM	243	0	243	243	1139.38	0	1139.38	1029.8	1029.8
10	1.44463	1721.02	-22.4218	Medium Dense SM	243	0	243	243	1291.59	0	1291.59	1191.33	1191.33
11	1.41644	1916.94	-20.6117	Medium Dense SM	243	0	243	243	1444.75	26.3982	1418.35	1353.35	1326.95
12	1.41644	2146.94	-18.8405	Medium Dense SM	243	0	243	243	1598.64	77.655	1520.98	1515.72	1438.07
13	1.41644	2367.29	-17.0879	Medium Dense SM	243	0	243	243	1745.99	125.876	1620.12	1671.29	1545.42
14	1.41644	2547.25	-15.3515	Medium Dense SM	243	0	243	243	1865.06	171.15	1693.91	1798.35	1627.2
15	1.41644	2651.47	-13.6295	Medium Dense SM	243	0	243	243	1930.84	213.554	1717.29	1871.92	1658.37
16	1.41644	2744.53	-11.92	Medium Dense SM	243	0	243	243	1988.92	253.154	1735.77	1937.63	1684.47
17	1.41644	2828.87	-10.2212	Medium Dense SM	243	0	243	243	2040.98	290.008	1750.97	1997.17	1707.16
18	1.41644	2904.63	-8.53145	Medium Dense SM	243	0	243	243	2087.11	324.162	1762.94	2050.65	1726.49
19	1.42424	2988.47	-6.84452	Medium Dense SP-SM	204	0	204	204	2122.77	355.735	1767.03	2098.28	1742.55
20	1.42424	3048.02	-5.15892	Medium Dense SP-SM	204	0	204	204	2158.52	384.744	1773.78	2140.1	1755.36
21	1.42424	3099.17	-3.47779	Medium Dense SP-SM	204	0	204	204	2188.41	411.12	1777.29	2176.01	1764.89
22	1.42424	3141.95	-1.79965	Medium Dense SP-SM	204	0	204	204	2212.46	434.881	1777.58	2206.05	1771.17
23	1.42424	3176.41	-0.123057	Medium Dense SP-SM	204	0	204	204	2230.68	456.036	1774.65	2230.24	1774.21
24	1.42424	3202.56	1.55343	Medium Dense SP-SM	204	0	204	204	2243.07	474.59	1768.48	2248.6	1774.01
25	1.42424	3220.38	3.23125	Medium Dense SP-SM	204	0	204	204	2249.6	490.54	1759.06	2261.12	1770.58
26	1.42424	3229.85	4.91185	Medium Dense SP-SM	204	0	204	204	2250.24	503.876	1746.36	2267.77	1763.9
27	1.42424	3230.92	6.5967	Medium Dense SP-SM	204	0	204	204	2244.93	514.583	1730.34	2268.52	1753.94
28	1.42424	3223.51	8.28731	Medium Dense SP-SM	204	0	204	204	2233.6	522.635	1710.97	2263.32	1740.68

29	1.42424	3207.52	9.98522	Medium Dense SP-SM	204	0	204	204	2216.18	528.003	1688.17	2252.09	1724.09
30	1.42424	3184.09	11.692	Medium Dense SP-SM	204	0	204	204	2193.42	530.647	1662.77	2235.63	1704.99
31	1.42424	3177.14	13.4095	Medium Dense SP-SM	204	0	204	204	2182.13	530.521	1651.61	2230.76	1700.24
32	1.9493	4335.9	15.4612	Medium Dense SP-SM	204	0	204	204	2167.91	526.393	1641.52	2224.34	1697.95
33	1.5279	3686.28	17.5946	Medium Dense SP-SM	204	0	204	204	2347.95	518.458	1829.49	2412.64	1894.19
34	1.5279	3845.21	19.4916	Medium Dense SP-SM	204	0	204	204	2444.45	507.563	1936.89	2516.66	2009.1
35	1.5279	3720.69	21.4111	Medium Dense SP-SM	204	0	204	204	2355.17	493.092	1862.08	2435.16	1942.07
36	1.5279	3593.24	23.3562	Medium Dense SP-SM	204	0	204	204	2263.66	474.909	1788.75	2351.75	1876.84
37	1.5279	3451.95	25.3303	Medium Dense SP-SM	204	0	204	204	2162.71	452.853	1709.86	2259.27	1806.42
38	1.5279	3296.74	27.3371	Medium Dense SP-SM	204	0	204	204	2052.23	426.74	1625.49	2157.69	1730.95
39	1.5279	3126.87	29.3811	Medium Dense SP-SM	204	0	204	204	1931.65	396.351	1535.3	2046.51	1650.16
40	1.5279	2942.58	31.467	Medium Dense SP-SM	204	0	204	204	1801.04	361.431	1439.61	1925.89	1564.46
41	1.5279	2744.23	33.6006	Medium Dense SP-SM	204	0	204	204	1660.54	321.678	1338.86	1796.08	1474.4
42	1.51737	2511.56	35.7807	Medium Dense SM	243	0	243	243	1480.07	276.907	1203.16	1655.2	1378.3
43	1.51737	2279.61	38.0147	Medium Dense SM	243	0	243	243	1312.38	226.73	1085.65	1502.34	1275.61
44	1.51737	2027.03	40.3192	Medium Dense SM	243	0	243	243	1129.66	170.496	959.167	1335.88	1165.39
45	1.51737	1751.7	42.7054	Medium Dense SM	243	0	243	243	930.149	107.575	822.574	1154.43	1046.85
46	1.51737	1450.91	45.1875	Medium Dense SM	243	0	243	243	711.602	37.1769	674.425	956.197	919.021
47	1.39866	1063.67	47.6769	Medium Dense SM	243	0	243	243	493.653	0	493.653	760.49	760.49
48	1.39866	793.976	50.1847	Medium Dense SM	243	0	243	243	276.169	0	276.169	567.668	567.668
49	1.39866	498.355	52.8325	Medium Dense SM	243	0	243	243	35.7901	0	35.7901	356.309	356.309
50	1.39866	171.768	55.6538	Medium Dense SM	243	0	243	243	-232.8	0	-232.8	122.809	122.809

Global Minimum Query (janbu simplified) - Newmark Displacement (in): 16.5293

Slice Number	Width [ft]	Weight [lbs]	Angle of Slice Base [deg]	Base Material	Base Cohesion [psf]	Base Friction Angle [deg]	Shear Stress [psf]	Shear Strength [psf]	Base Normal Stress [psf]	Pore Pressure [psf]	Effective Normal Stress [psf]	Base Vertical Stress [psf]	Effective Vertical Stress [psf]
1	1.36899	120.016	-46.8647	Medium Dense SM	243	0	243	243	347.022	0	347.022	87.6676	87.6676
2	1.36899	348.793	-44.0453	Medium Dense SM	243	0	243	243	489.815	0	489.815	254.782	254.782
3	1.36899	556.532	-41.3547	Medium Dense SM	243	0	243	243	620.421	0	620.421	406.529	406.529
4	1.36899	745.828	-38.7715	Medium Dense SM	243	0	243	243	739.979	0	739.979	544.802	544.802
5	1.36899	893.144	-36.2788	Medium Dense SM	243	0	243	243	830.774	0	830.774	652.411	652.411
6	1.36899	948.921	-33.8636	Medium Dense SM	243	0	243	243	856.219	0	856.219	693.153	693.153
7	1.36899	1110.26	-31.5151	Medium Dense SM	243	0	243	243	960.005	0	960.005	811.006	811.006
8	1.36899	1317.09	-29.2243	Medium Dense SM	243	0	243	243	1098.03	0	1098.03	962.088	962.088
9	1.36899	1531.76	-26.9837	Medium Dense SM	243	0	243	243	1242.63	0	1242.63	1118.9	1118.9
10	1.25302	1607.42	-24.8784	Medium Dense SM	243	0	243	243	1395.52	26.7778	1368.74	1282.83	1256.05
11	1.25302	1805.96	-22.9001	Medium Dense SM	243	0	243	243	1543.93	78.7209	1465.21	1441.28	1362.56
12	1.25302	1995.62	-20.9503	Medium Dense SM	243	0	243	243	1685.68	127.503	1558.18	1592.64	1465.14
13	1.25302	2176.75	-19.0257	Medium Dense SM	243	0	243	243	1820.99	173.252	1647.74	1737.19	1563.94
14	1.25302	2349.66	-17.1231	Medium Dense SM	243	0	243	243	1950.05	216.077	1733.97	1875.19	1659.11
15	1.25302	2493.69	-15.2398	Medium Dense SM	243	0	243	243	2056.34	256.072	1800.27	1990.14	1734.07
16	1.25302	2575.56	-13.3732	Medium Dense SM	243	0	243	243	2113.25	293.316	1819.93	2055.47	1762.16
17	1.25302	2647.07	-11.521	Medium Dense SM	243	0	243	243	2162.08	327.879	1834.2	2112.54	1784.66
18	1.31687	2850.87	-9.63436	Medium Dense SP-SM	204	0	204	204	2199.52	360.563	1838.95	2164.89	1804.32
19	1.31687	2913.29	-7.71154	Medium Dense SP-SM	204	0	204	204	2239.91	391.283	1848.63	2212.29	1821.01
20	1.31687	2967.44	-5.79743	Medium Dense SP-SM	204	0	204	204	2274.12	419.199	1854.92	2253.4	1834.21
21	1.31687	3013.4	-3.8898	Medium Dense SP-SM	204	0	204	204	2302.18	444.345	1857.84	2288.31	1843.96
22	1.31687	3051.25	-1.98648	Medium Dense SP-SM	204	0	204	204	2324.13	466.745	1857.38	2317.05	1850.31
23	1.31687	3081.03	-0.0853594	Medium Dense SP-SM	204	0	204	204	2339.96	486.413	1853.55	2339.66	1853.25
24	1.31687	3102.74	1.81567	Medium Dense SP-SM	204	0	204	204	2349.68	503.353	1846.33	2356.15	1852.8
25	1.31687	3116.39	3.7187	Medium Dense SP-SM	204	0	204	204	2353.26	517.561	1835.7	2366.52	1848.96
26	1.31687	3121.93	5.62586	Medium Dense SP-SM	204	0	204	204	2350.63	529.025	1821.6	2370.72	1841.7
27	1.31687	3119.29	7.53929	Medium Dense SP-SM	204	0	204	204	2341.71	537.721	1803.99	2368.71	1830.99
28	1.31687	3108.38	9.46124	Medium Dense SP-SM	204	0	204	204	2326.44	543.618	1782.82	2360.43	1816.81

29	1.31687	3089.07	11.394	Medium Dense SP-SM	204	0	204	204	2304.66	546.672	1757.99	2345.77	1799.1
30	1.31687	3061.2	13.34	Medium Dense SP-SM	204	0	204	204	2276.23	546.831	1729.4	2324.61	1777.77
31	1.5287	3506.8	15.4612	Medium Dense SP-SM	204	0	204	204	2237.55	543.539	1694.01	2293.98	1750.44
32	1.28719	2904.46	17.5802	Medium Dense SP-SM	204	0	204	204	2191.81	537.062	1654.75	2256.44	1719.38
33	1.28719	2862.63	19.5402	Medium Dense SP-SM	204	0	204	204	2151.54	527.856	1623.68	2223.94	1696.08
34	1.28719	2829.65	21.5243	Medium Dense SP-SM	204	0	204	204	2117.86	515.535	1602.33	2198.32	1682.78
35	1.28719	2787.51	23.5359	Medium Dense SP-SM	204	0	204	204	2076.72	499.975	1576.75	2165.58	1665.6
36	1.28719	2940.62	25.5789	Medium Dense SP-SM	204	0	204	204	2186.89	481.031	1705.86	2284.54	1803.51
37	1.28719	3125.29	27.6573	Medium Dense SP-SM	204	0	204	204	2321.09	458.533	1862.56	2428	1969.47
38	1.28719	2981.33	29.7762	Medium Dense SP-SM	204	0	204	204	2199.44	432.28	1767.16	2316.16	1883.88
39	1.28719	2848.02	31.9409	Medium Dense SP-SM	204	0	204	204	2085.41	402.036	1683.37	2212.59	1810.55
40	1.28719	2701.89	34.1581	Medium Dense SP-SM	204	0	204	204	1960.64	367.52	1593.12	2099.06	1731.54
41	1.28719	2542.28	36.4351	Medium Dense SP-SM	204	0	204	204	1824.47	328.395	1496.07	1975.06	1646.67
42	1.31208	2412.08	38.8047	Medium Dense SM	243	0	243	243	1642.96	283.772	1359.19	1838.37	1554.6
43	1.31208	2214.26	41.2797	Medium Dense SM	243	0	243	243	1474.27	233.03	1241.24	1687.6	1454.57
44	1.31208	1997.85	43.8526	Medium Dense SM	243	0	243	243	1289.21	175.877	1113.33	1522.67	1346.79
45	1.31208	1762.11	46.5423	Medium Dense SM	243	0	243	243	1086.54	111.461	975.083	1342.99	1231.53
46	1.31208	1502.08	49.3731	Medium Dense SM	243	0	243	243	861.572	38.6576	822.914	1144.82	1106.16
47	1.34373	1257.6	52.4173	Medium Dense SM	243	0	243	243	620.166	0	620.166	935.905	935.905
48	1.34373	957.843	55.7294	Medium Dense SM	243	0	243	243	356.208	0	356.208	712.826	712.826
49	1.34373	616	59.3542	Medium Dense SM	243	0	243	243	48.2855	0	48.2855	458.427	458.427
50	1.34373	216.574	63.4246	Medium Dense SM	243	0	243	243	-324.606	0	-324.606	161.174	161.174

Interslice Data

Post Construction

Global Minimum Query (bishop simplified) - Safety Factor: 1.20045

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	0.00485799	102	0	0	0
2	1.37541	100.537	722.206	0	0
3	2.74597	99.2105	1597.73	0	0
4	4.11652	98.0038	2581.55	0	0
5	5.48708	96.9027	3638.83	0	0
6	6.85763	95.8965	4725.82	0	0
7	8.22819	94.9766	5769.33	0	0
8	9.59874	94.1361	6831.72	0	0
9	10.9693	93.3693	7932.96	0	0
10	12.3399	92.6714	9061.77	0	0
11	13.5928	92.0903	10114.2	0	0
12	14.8457	91.5609	11175.1	0	0
13	16.0987	91.0811	12229.2	0	0
14	17.3516	90.6488	13263	0	0
15	18.6045	90.2626	14264.2	0	0
16	19.8575	89.921	15216.6	0	0
17	21.1104	89.6229	16097.7	0	0
18	22.3634	89.3672	16902.3	0	0
19	23.665	89.1457	17609.7	0	0
20	24.9666	88.9683	18227.6	0	0
21	26.2683	88.8344	18752.7	0	0
22	27.5699	88.7438	19182.5	0	0
23	28.8715	88.6959	19514.8	0	0
24	30.1731	88.6907	19748.1	0	0
25	31.4748	88.7282	19881.2	0	0
26	32.7764	88.8085	19913.2	0	0
27	34.078	88.9318	19843.8	0	0
28	35.3797	89.0986	19673.2	0	0
29	36.6813	89.3093	19402	0	0
30	37.9829	89.5648	19031.3	0	0
31	39.2845	89.8659	18562.7	0	0
32	41.253	90.4104	17673.4	0	0
33	42.5201	90.8195	16989.8	0	0
34	43.7873	91.2764	16218.3	0	0
35	45.0544	91.7827	15356.4	0	0
36	46.3216	92.3406	14407.1	0	0
37	47.5887	92.9525	13259.5	0	0
38	48.8558	93.6213	11916.5	0	0
39	50.123	94.3502	10518	0	0
40	51.3901	95.1433	9065.57	0	0
41	52.6573	96.0053	7572.95	0	0
42	53.9244	96.9419	6056.57	0	0
43	55.2361	97.9972	4553.34	0	0
44	56.5478	99.1491	3078.98	0	0
45	57.8596	100.41	1669.66	0	0
46	59.1713	101.794	370.869	0	0
47	60.483	103.323	-754.117	0	0
48	61.8274	105.07	-1658.28	0	0
49	63.1718	107.043	-2207.13	0	0
50	64.5163	109.313	-2200.46	0	0
51	65.8607	112	0	0	0

Global Minimum Query (janbu simplified) - Safety Factor: 1.12616

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	0.00485799	102	0	0	0
2	1.37541	100.537	763.726	0	0
3	2.74597	99.2105	1676.81	0	0
4	4.11652	98.0038	2695.07	0	0
5	5.48708	96.9027	3784.28	0	0
6	6.85763	95.8965	4901.13	0	0
7	8.22819	94.9766	5972.78	0	0
8	9.59874	94.1361	7061.87	0	0
9	10.9693	93.3693	8188.58	0	0
10	12.3399	92.6714	9341.83	0	0
11	13.5928	92.0903	10415.8	0	0
12	14.8457	91.5609	11497.6	0	0
13	16.0987	91.0811	12572	0	0
14	17.3516	90.6488	13625.7	0	0
15	18.6045	90.2626	14646.3	0	0
16	19.8575	89.921	15617.7	0	0
17	21.1104	89.6229	16517.6	0	0
18	22.3634	89.3672	17340.7	0	0
19	23.665	89.1457	18064	0	0
20	24.9666	88.9683	18697.6	0	0
21	26.2683	88.8344	19238.4	0	0
22	27.5699	88.7438	19683.7	0	0
23	28.8715	88.6959	20031.6	0	0
24	30.1731	88.6907	20280.3	0	0
25	31.4748	88.7282	20428.8	0	0
26	32.7764	88.8085	20476.4	0	0
27	34.078	88.9318	20422.6	0	0
28	35.3797	89.0986	20267.8	0	0
29	36.6813	89.3093	20012.4	0	0
30	37.9829	89.5648	19657.8	0	0
31	39.2845	89.8659	19205.5	0	0
32	41.253	90.4104	18341.3	0	0
33	42.5201	90.8195	17674.4	0	0
34	43.7873	91.2764	16919.9	0	0
35	45.0544	91.7827	16075.4	0	0
36	46.3216	92.3406	15144.1	0	0
37	47.5887	92.9525	14015.1	0	0
38	48.8558	93.6213	12691.3	0	0
39	50.123	94.3502	11312.9	0	0
40	51.3901	95.1433	9881.42	0	0
41	52.6573	96.0053	8410.83	0	0
42	53.9244	96.9419	6917.73	0	0
43	55.2361	97.9972	5445.09	0	0
44	56.5478	99.1491	4003.61	0	0
45	57.8596	100.41	2630.02	0	0
46	59.1713	101.794	1370.48	0	0
47	60.483	103.323	289.294	0	0
48	61.8274	105.07	-563.701	0	0
49	63.1718	107.043	-1052.53	0	0
50	64.5163	109.313	-972.615	0	0
51	65.8607	112	0	0	0

Lateral Spread Analysis Cape Mendocino

Global Minimum Query (bishop simplified) - Newmark Displacement (in): 19.6889

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	0.0129546	102	0	0	0
2	1.45727	100.769	692.811	0	0
3	2.90159	99.6314	1496.21	0	0
4	4.34591	98.5782	2381.73	0	0
5	5.79023	97.6032	3325.76	0	0
6	7.23455	96.7008	4281.62	0	0
7	8.67886	95.8666	5207.05	0	0
8	10.1232	95.0965	6173.75	0	0
9	11.5675	94.3871	7179.5	0	0
10	13.0118	93.7357	8219.54	0	0
11	14.4561	93.1396	9278.81	0	0
12	15.8723	92.6069	10324	0	0
13	17.2884	92.1235	11363.9	0	0
14	18.7046	91.6881	12383.6	0	0
15	20.1207	91.2992	13361.7	0	0
16	21.5368	90.9556	14274.1	0	0
17	22.953	90.6566	15114.7	0	0
18	24.3691	90.4011	15878.9	0	0
19	25.7852	90.1885	16562.6	0	0
20	27.2021	90.0181	17106.6	0	0
21	28.6189	89.8897	17564.1	0	0
22	30.0357	89.8029	17932.6	0	0
23	31.4525	89.7575	18210.1	0	0
24	32.8693	89.7533	18395.2	0	0
25	34.2861	89.7904	18486.9	0	0
26	35.7029	89.8688	18484.7	0	0
27	37.1197	89.9887	18388.6	0	0
28	38.5365	90.1505	18199	0	0
29	39.9534	90.3546	17917.1	0	0
30	41.3702	90.6015	17544.1	0	0
31	42.787	90.8919	17082.2	0	0
32	44.2038	91.2266	16527.4	0	0
33	46.3561	91.8219	15504.2	0	0
34	47.8733	92.3065	14531	0	0
35	49.3905	92.8467	13387.5	0	0
36	50.9077	93.4444	12159.4	0	0
37	52.4249	94.1022	10854.9	0	0
38	53.9421	94.8226	9486.32	0	0
39	55.4593	95.6088	8067.63	0	0
40	56.9765	96.4645	6615.19	0	0
41	58.4937	97.394	5147.48	0	0
42	60.0109	98.4026	3685.46	0	0
43	61.5278	99.4961	2346.06	0	0
44	63.0447	100.682	1076.97	0	0
45	64.5617	101.97	-81.0485	0	0
46	66.0786	103.37	-1077.14	0	0
47	67.5955	104.897	-1846.68	0	0
48	68.9936	106.433	-2302.55	0	0
49	70.3917	108.11	-2454.08	0	0
50	71.7898	109.954	-2197.92	0	0
51	73.1878	112	0	0	0

Global Minimum Query (janbu simplified) - Newmark Displacement (in): 29.7859

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	0.0172729	102	0	0	0
2	1.38791	100.537	838.265	0	0
3	2.75855	99.2111	1813.16	0	0
4	4.12919	98.0047	2882.53	0	0
5	5.49984	96.9039	4013.72	0	0
6	6.87048	95.898	5164.69	0	0
7	8.24112	94.9784	6265.92	0	0
8	9.61176	94.1383	7379.18	0	0
9	10.9824	93.3718	8522.92	0	0
10	12.353	92.6743	9686.41	0	0
11	13.6068	92.0932	10764.2	0	0
12	14.8607	91.5639	11843.8	0	0
13	16.1145	91.0842	12910.5	0	0
14	17.3683	90.6522	13951.3	0	0
15	18.6221	90.2662	14954	0	0
16	19.8759	89.925	15903.1	0	0
17	21.1297	89.6273	16778	0	0
18	22.3835	89.372	17573.8	0	0
19	23.7211	89.1457	18278.1	0	0
20	25.0587	88.966	18885.7	0	0
21	26.3963	88.8323	19393.6	0	0
22	27.7338	88.7441	19799.3	0	0
23	29.0714	88.7011	20100.8	0	0
24	30.409	88.7032	20296.8	0	0
25	31.7466	88.7504	20386.2	0	0
26	33.0842	88.8429	20368.7	0	0
27	34.4218	88.9809	20244.4	0	0
28	35.7594	89.1649	20013.8	0	0
29	37.097	89.3957	19678	0	0
30	38.4345	89.674	19238.7	0	0
31	39.7721	90.0008	18698.4	0	0
32	40.7564	90.2731	18237.8	0	0
33	42.0704	90.6795	17542.7	0	0
34	43.3843	91.1367	16757.1	0	0
35	44.6982	91.6465	15876.3	0	0
36	46.0121	92.2111	14903	0	0
37	47.326	92.8332	13776	0	0
38	48.64	93.5158	12374.9	0	0
39	49.9539	94.2625	10923.6	0	0
40	51.2678	95.0776	9418.64	0	0
41	52.5817	95.9664	7875.82	0	0
42	53.8957	96.935	6314.18	0	0
43	55.2088	97.9904	4842.16	0	0
44	56.522	99.1426	3409.91	0	0
45	57.8351	100.404	2055.59	0	0
46	59.1482	101.789	827.25	0	0
47	60.4614	103.319	-208.309	0	0
48	61.8069	105.066	-996.077	0	0
49	63.1524	107.04	-1396.13	0	0
50	64.4979	109.311	-1194.43	0	0
51	65.8434	112	0	0	0

Lateral Spread Analysis Daly City

Global Minimum Query (bishop simplified) - Newmark Displacement (in): 0.209614

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	0.00971598	102	0	0	0
2	1.45411	100.769	692.862	0	0
3	2.8985	99.6313	1496.33	0	0
4	4.34288	98.578	2381.93	0	0
5	5.78727	97.6029	3326.05	0	0
6	7.23166	96.7005	4282.12	0	0
7	8.67605	95.8662	5207.68	0	0
8	10.1204	95.096	6174.4	0	0
9	11.5648	94.3866	7180.17	0	0
10	13.0092	93.7351	8220.21	0	0
11	14.4536	93.1391	9279.5	0	0
12	15.8697	92.6063	10324.7	0	0
13	17.2859	92.123	11364.6	0	0
14	18.702	91.6875	12384.2	0	0
15	20.1181	91.2986	13362.4	0	0
16	21.5342	90.9551	14274.8	0	0
17	22.9503	90.656	15115.4	0	0
18	24.3665	90.4004	15879.7	0	0
19	25.7826	90.1878	16563.5	0	0
20	27.1984	90.0176	17107.2	0	0
21	28.6143	89.8892	17564.6	0	0
22	30.0301	89.8023	17933	0	0
23	31.4459	89.7568	18210.6	0	0
24	32.8618	89.7525	18395.9	0	0
25	34.2776	89.7893	18488	0	0
26	35.6935	89.8675	18486.3	0	0
27	37.1093	89.9871	18390.8	0	0
28	38.5251	90.1485	18202	0	0
29	39.941	90.3522	17920.9	0	0
30	41.3568	90.5985	17549	0	0
31	42.7727	90.8883	17088.1	0	0
32	44.1885	91.2224	16534.6	0	0
33	46.3688	91.8254	15498.1	0	0
34	47.8846	92.31	14523.2	0	0
35	49.4004	92.8501	13380.2	0	0
36	50.9162	93.4477	12152.6	0	0
37	52.4319	94.1052	10848.9	0	0
38	53.9477	94.8252	9481.28	0	0
39	55.4635	95.6109	8063.72	0	0
40	56.9793	96.466	6612.52	0	0
41	58.4951	97.3949	5146.12	0	0
42	60.0108	98.4026	3685.43	0	0
43	61.5277	99.4961	2346.03	0	0
44	63.0446	100.682	1076.95	0	0
45	64.5615	101.97	-81.0555	0	0
46	66.0784	103.37	-1077.13	0	0
47	67.5952	104.897	-1846.66	0	0
48	68.9933	106.432	-2302.54	0	0
49	70.3914	108.11	-2454.08	0	0
50	71.7895	109.954	-2197.91	0	0
51	73.1876	112	0	0	0

Global Minimum Query (janbu simplified) - Newmark Displacement (in): 0.375374

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	0.116592	102	0	0	0
2	1.4849	100.54	836.172	0	0
3	2.85322	99.2169	1808.37	0	0
4	4.22153	98.0129	2874.65	0	0
5	5.58984	96.9141	4002.51	0	0
6	6.95815	95.9101	5146.63	0	0
7	8.32647	94.9921	6241.51	0	0
8	9.69478	94.1534	7354.19	0	0
9	11.0631	93.3881	8497.07	0	0
10	12.4314	92.6916	9660.53	0	0
11	13.6849	92.1106	10739.6	0	0
12	14.9383	91.5813	11820.2	0	0
13	16.1918	91.1017	12887.8	0	0
14	17.4452	90.6698	13929.2	0	0
15	18.6987	90.284	14932.5	0	0
16	19.9522	89.9428	15881	0	0
17	21.2056	89.6452	16755	0	0
18	22.4591	89.3902	17549.9	0	0
19	23.8116	89.1617	18260.9	0	0
20	25.164	88.9809	18872.9	0	0
21	26.5165	88.8472	19382.8	0	0
22	27.869	88.7601	19788.1	0	0
23	29.2215	88.7192	20086.9	0	0
24	30.574	88.7245	20277.6	0	0
25	31.9264	88.7759	20359.3	0	0
26	33.2789	88.8736	20331.8	0	0
27	34.6314	89.018	20194.9	0	0
28	35.9839	89.2095	19949.5	0	0
29	37.3363	89.449	19596.8	0	0
30	38.6888	89.7372	19138.5	0	0
31	40.0413	90.0753	18577.2	0	0
32	40.6019	90.2303	18315.1	0	0
33	41.9355	90.6352	17624.3	0	0
34	43.2691	91.0921	16840.2	0	0
35	44.6027	91.6029	15957.9	0	0
36	45.9363	92.17	14980	0	0
37	47.2699	92.7961	13856.7	0	0
38	48.6035	93.4843	12440.3	0	0
39	49.9371	94.2383	10972.2	0	0
40	51.2707	95.0627	9448.09	0	0
41	52.6043	95.9628	7884.41	0	0
42	53.9379	96.9451	6300.98	0	0
43	55.2508	98.0002	4830.7	0	0
44	56.5637	99.1521	3400.16	0	0
45	57.8766	100.413	2047.51	0	0
46	59.1895	101.798	820.799	0	0
47	60.5024	103.328	-213.065	0	0
48	61.8463	105.073	-998.301	0	0
49	63.1902	107.045	-1396.41	0	0
50	64.5341	109.313	-1193.74	0	0
51	65.878	112	0	0	0

Lateral Spread Analysis Nahanni Canada

Global Minimum Query (bishop simplified) - Newmark Displacement (in): 9.44592

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	0.00431821	102	0	0	0
2	1.44895	100.769	692.972	0	0
3	2.89358	99.631	1496.57	0	0
4	4.3382	98.5776	2382.31	0	0
5	5.78283	97.6024	3326.58	0	0
6	7.22746	96.6999	4282.98	0	0
7	8.67209	95.8655	5208.7	0	0
8	10.1167	95.0953	6175.43	0	0
9	11.5613	94.386	7181.16	0	0
10	13.006	93.7345	8221.16	0	0
11	14.4506	93.1384	9280.38	0	0
12	15.867	92.6057	10325.5	0	0
13	17.2835	92.1223	11365.4	0	0
14	18.6999	91.6869	12384.9	0	0
15	20.1164	91.298	13363	0	0
16	21.5328	90.9546	14275.3	0	0
17	22.9493	90.6556	15115.8	0	0
18	24.3657	90.4002	15879.8	0	0
19	25.7821	90.1877	16563.3	0	0
20	27.2064	90.0168	17109.6	0	0
21	28.6306	89.8882	17568.4	0	0
22	30.0549	89.8016	17937.3	0	0
23	31.4791	89.7569	18214.1	0	0
24	32.9033	89.7538	18397.6	0	0
25	34.3276	89.7924	18486.7	0	0
26	35.7518	89.8728	18480.9	0	0
27	37.1761	89.9952	18380.2	0	0
28	38.6003	90.1599	18185.1	0	0
29	40.0246	90.3674	17896.7	0	0
30	41.4488	90.6181	17516.5	0	0
31	42.873	90.9129	17046.4	0	0
32	44.2973	91.2524	16482.1	0	0
33	46.2466	91.7916	15555.4	0	0
34	47.7745	92.2761	14597.3	0	0
35	49.3024	92.8169	13449.1	0	0
36	50.8303	93.4161	12216.4	0	0
37	52.3582	94.0758	10905.7	0	0
38	53.8861	94.7991	9529.48	0	0
39	55.414	95.5889	8101.98	0	0
40	56.9419	96.4492	6639.83	0	0
41	58.4698	97.3843	5161.87	0	0
42	59.9977	98.3994	3689.45	0	0
43	61.5151	99.493	2349.52	0	0
44	63.0324	100.679	1079.84	0	0
45	64.5498	101.967	-78.789	0	0
46	66.0672	103.367	-1075.52	0	0
47	67.5846	104.895	-1845.68	0	0
48	68.9832	106.431	-2302.12	0	0
49	70.3819	108.108	-2454.08	0	0
50	71.7805	109.953	-2198.1	0	0
51	73.1792	112	0	0	0

Global Minimum Query (janbu simplified) - Newmark Displacement (in): 16.5293

Slice Number	X coordinate [ft]	Y coordinate - Bottom [ft]	Interslice Normal Force [lbs]	Interslice Shear Force [lbs]	Interslice Force Angle [deg]
1	0.0777278	102	0	0	0
2	1.44672	100.539	836.95	0	0
3	2.8157	99.2148	1810.17	0	0
4	4.18469	98.0098	2877.66	0	0
5	5.55368	96.9102	4006.86	0	0
6	6.92267	95.9053	5153.81	0	0
7	8.29165	94.9867	6251.25	0	0
8	9.66064	94.1473	7364.26	0	0
9	11.0296	93.3814	8507.61	0	0
10	12.3986	92.6844	9671.26	0	0
11	13.6516	92.1033	10749.7	0	0
12	14.9047	91.574	11829.9	0	0
13	16.1577	91.0943	12897.3	0	0
14	17.4107	90.6622	13938.6	0	0
15	18.6637	90.2762	14941.9	0	0
16	19.9168	89.9348	15891.1	0	0
17	21.1698	89.6369	16765.9	0	0
18	22.4228	89.3815	17561.8	0	0
19	23.7397	89.1579	18256.7	0	0
20	25.0565	88.9796	18857.8	0	0
21	26.3734	88.8459	19362.4	0	0
22	27.6903	88.7564	19767.9	0	0
23	29.0072	88.7107	20072.6	0	0
24	30.324	88.7087	20275.1	0	0
25	31.6409	88.7505	20374.4	0	0
26	32.9578	88.8361	20370.1	0	0
27	34.2746	88.9658	20262.1	0	0
28	35.5915	89.1401	20050.9	0	0
29	36.9084	89.3595	19737.6	0	0
30	38.2252	89.6249	19323.7	0	0
31	39.5421	89.9372	18811.3	0	0
32	41.0708	90.36	18096.5	0	0
33	42.358	90.7678	17398.5	0	0
34	43.6452	91.2247	16612.4	0	0
35	44.9324	91.7323	15734.8	0	0
36	46.2196	92.293	14769.1	0	0
37	47.5067	92.9091	13616.7	0	0
38	48.7939	93.5837	12241.8	0	0
39	50.0811	94.3202	10816.1	0	0
40	51.3683	95.1226	9339.77	0	0
41	52.6555	95.996	7827.88	0	0
42	53.9427	96.9462	6298.44	0	0
43	55.2548	98.0014	4828.36	0	0
44	56.5668	99.1532	3398.18	0	0
45	57.8789	100.414	2046.02	0	0
46	59.191	101.798	819.861	0	0
47	60.5031	103.328	-213.465	0	0
48	61.8468	105.074	-998.601	0	0
49	63.1905	107.046	-1396.52	0	0
50	64.5342	109.314	-1193.65	0	0
51	65.878	112	0	0	0

Entity Information

◆ Post Construction

Shared Entities

Type	Coordinates (x,y)
External Boundary	47, 109.059
	42.5, 108
	19, 106
	11, 102
	8, 101
	6, 102
	0, 102
	0, 84
	0, 79
	0, 70
	130, 70
	130, 118
	130, 120
	130, 130
	105, 128
	96, 124.4
	95, 124
	95, 112
	57.2857, 112
	48, 112
	47, 112
Material Boundary	0, 84
	75, 102
Material Boundary	0, 79
	78.7617, 100.785
	94, 105
	130, 120
Material Boundary	94, 103
	130, 118
Material Boundary	94, 103
	95.866, 104.343
	89.141, 102.356
	96.443, 105.148
	90.765, 103.766
	94, 105
Material Boundary	75, 102
	74.342, 101.083
	79.786, 102.433
	75.265, 100.313
	78.7617, 100.785
Material Boundary	47, 109.059
	48, 109.294
	51, 110
	53.7003, 110.859
	57.2857, 112
Material Boundary	95, 112
	96, 112
	96, 124.4
Material Boundary	47, 109.059
	48, 109.059
	48, 109.294
	48, 112

Scenario-based Entities

Type	Coordinates (x,y)	Master Scenario
Water Table	0, 89.9411 82.189, 108.126 118, 118 130, 118	Assigned to: 🟨 Medium Dense SM 🟩 Medium Dense SP-SM 🟧 Medium Stiff ML

Lateral Spread Analysis Cape Mendocino

Shared Entities

Type	Coordinates (x,y)
External Boundary	47, 109.059 42.5, 108 19, 106 11, 102 8, 101 6, 102 0, 102 0, 84 0, 79 0, 70 130, 70 130, 118 130, 120 130, 130 105, 128 96, 124.4 95, 124 95, 112 57.2857, 112 48, 112 47, 112
Material Boundary	0, 84 75, 102
Material Boundary	0, 79 78.7617, 100.785 94, 105 130, 120
Material Boundary	94, 103 130, 118
Material Boundary	94, 103 95.866, 104.343 89.141, 102.356 96.443, 105.148 90.765, 103.766 94, 105
Material Boundary	75, 102 74.342, 101.083 79.786, 102.433 75.265, 100.313 78.7617, 100.785
Material Boundary	47, 109.059 48, 109.294 51, 110 53.7003, 110.859 57.2857, 112
Material Boundary	95, 112 96, 112 96, 124.4
Material Boundary	47, 109.059 48, 109.059 48, 109.294 48, 112

Scenario-based Entities

Type	Coordinates (x,y)	Master Scenario
Water Table	0, 89.9411 82.189, 108.126 118, 118 130, 118	Assigned to: 🟨 Medium Dense SM 🟩 Medium Dense SP-SM 🟧 Medium Stiff ML

Lateral Spread Analysis Daly City

Shared Entities

Type	Coordinates (x,y)
External Boundary	47, 109.059 42.5, 108 19, 106 11, 102 8, 101 6, 102 0, 102 0, 84 0, 79 0, 70 130, 70 130, 118 130, 120 130, 130 105, 128 96, 124.4 95, 124 95, 112 57.2857, 112 48, 112 47, 112
Material Boundary	0, 84 75, 102
Material Boundary	0, 79 78.7617, 100.785 94, 105 130, 120
Material Boundary	94, 103 130, 118
Material Boundary	94, 103 95.866, 104.343 89.141, 102.356 96.443, 105.148 90.765, 103.766 94, 105
Material Boundary	75, 102 74.342, 101.083 79.786, 102.433 75.265, 100.313 78.7617, 100.785
Material Boundary	47, 109.059 48, 109.294 51, 110 53.7003, 110.859 57.2857, 112
Material Boundary	95, 112 96, 112 96, 124.4
Material Boundary	47, 109.059 48, 109.059 48, 109.294 48, 112

Scenario-based Entities

Type	Coordinates (x,y)	Master Scenario
Water Table	0, 89.9411 82.189, 108.126 118, 118 130, 118	Assigned to: 🟨 Medium Dense SM 🟩 Medium Dense SP-SM 🟧 Medium Stiff ML

◆ Lateral Spread Analysis Nahanni Canada

Shared Entities

Type	Coordinates (x,y)
External Boundary	47, 109.059 42.5, 108 19, 106 11, 102 8, 101 6, 102 0, 102 0, 84 0, 79 0, 70 130, 70 130, 118 130, 120 130, 130 105, 128 96, 124.4 95, 124 95, 112 57.2857, 112 48, 112 47, 112
Material Boundary	0, 84 75, 102
Material Boundary	0, 79 78.7617, 100.785 94, 105 130, 120
Material Boundary	94, 103 130, 118
Material Boundary	94, 103 95.866, 104.343 89.141, 102.356 96.443, 105.148 90.765, 103.766 94, 105
Material Boundary	75, 102 74.342, 101.083 79.786, 102.433 75.265, 100.313 78.7617, 100.785
Material Boundary	47, 109.059 48, 109.294 51, 110 53.7003, 110.859 57.2857, 112
Material Boundary	95, 112 96, 112 96, 124.4
Material Boundary	47, 109.059 48, 109.059 48, 109.294 48, 112

Scenario-based Entities

Type	Coordinates (x,y)	Master Scenario
Water Table	0, 89.9411 82.189, 108.126 118, 118 130, 118	Assigned to: 🟨 Medium Dense SM 🟩 Medium Dense SP-SM 🟧 Medium Stiff ML

APPENDIX D

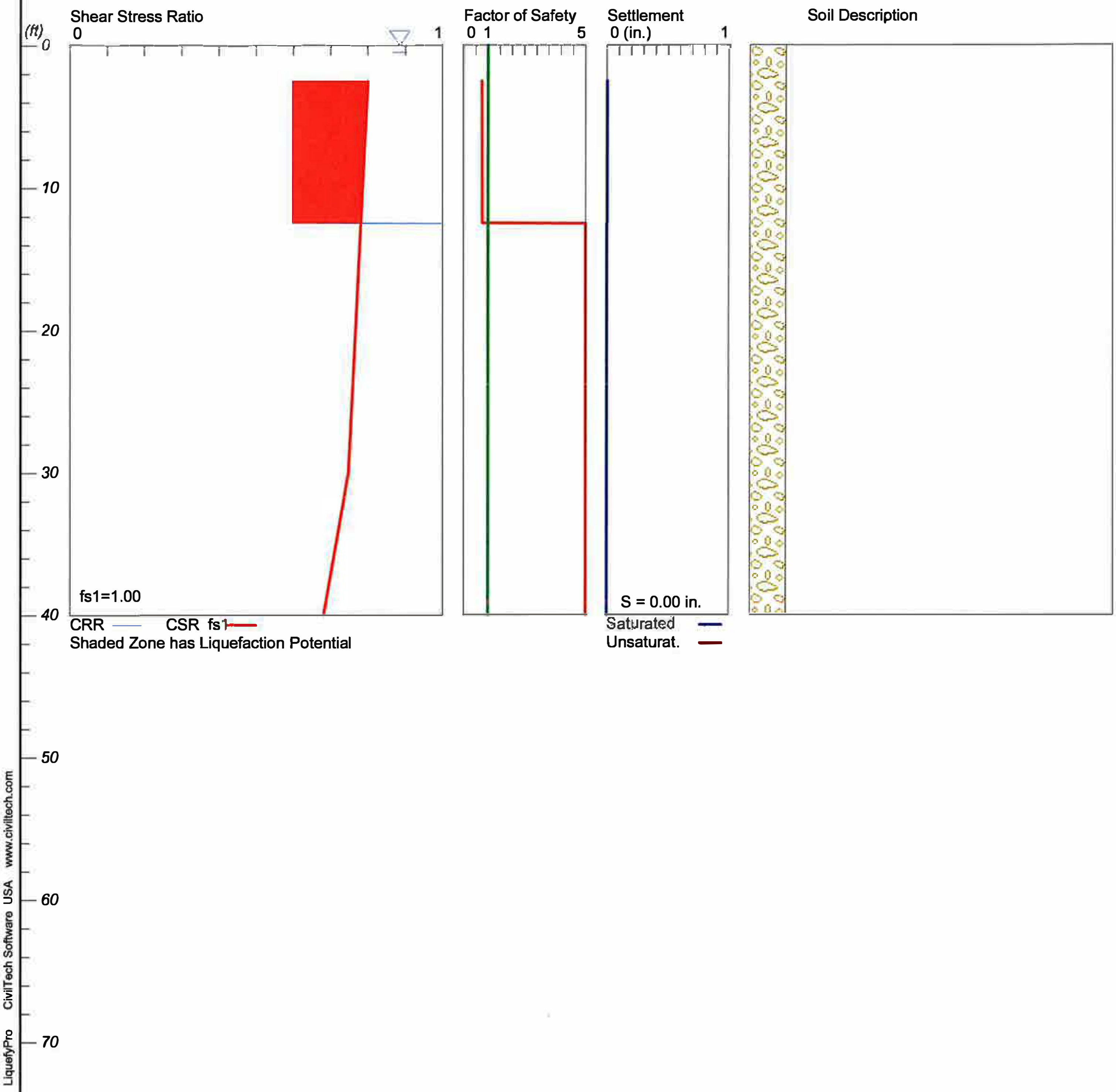
LIQUEFACTION RESULTS

LIQUEFACTION ANALYSIS

Mercer Island Short Plat

Hole No.=B-1

Magnitude=7
Acceleration=0.62g



LIQUEFACTION ANALYSIS

Mercer Island Short Plat

Hole No.=B-2   Water Depth=5 ft

Magnitude=7
Acceleration=0.62g