Attachment H

Geotechnical

Earth Systems Geotechnical Feasibility Report dated 2020-02-25

Attachment – Earth Systems Geotech Feasibility of cabins below landslide 2020-07-08

Attachment - Earth Systems Infiltration Testing Report 2021-03-05

Attachment - Earth Systems Middle Camp Cross Section 2020-04

Attachment - Earth Systems Rock Fall Protection 2020-12-08

County of Ventura
Case No. PL21-0051
Attachment - Earth Systems
Geotechnical Feasibility Report
dated February 25, 2020

GEOTECHNICAL FEASIBILITLY REPORT
FOR PROPOSED REBUILDING OF
LOWER AND MIDDLE CAMPS AT
CAMP HESS KRAMER,
11495 PACIFIC COAST HIGHWAY,
MALIBU AREA,
VENTURA COUNTY, CALIFORNIA

PROJECT NO.: 301529-002
FEBRUARY 25, 2020

PREPARED FOR
STANTEC

BY
EARTH SYSTEMS PACIFIC
1731-A WALTER STREET
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Earth Systems

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February 25, 2020

Project No.: 301529-002
Report No.: 20-2-24

Attention: Hady Izadpanah
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Project: Camp Hess Kramer Lower and Middle Camp Rebuilds
11495 Pacific Coast Highway
Malibu Area
Ventura County, California

As authorized, we have performed a limited geotechnical study for the proposed rebuilding of Camp Hess Kramer at 11495 Pacific Coast Highway in the Malibu area of Ventura County, California. The accompanying Geotechnical Feasibility Report presents the results of our mapping and research programs, as well as conclusions and general recommendations pertaining to geotechnical aspects of project redesign. This report completes the scope of services described within our Proposal No. VEN-20-01-022 (Revised) dated February 6, 2020, and authorized by Stantec Task Order for Project No. 2064134600 on February 6, 2020.

We have appreciated the opportunity to be of service to you on this project. Please call if you have any questions, or if we can be of further service.

Respectfully submitted,

EARTH SYSTEMS PACIFIC

PROFESSIONAL GEOLOGIST
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GEOTECHNICAL
STATE OF CALIFORNIA

2/25/20

Copies: 3 - Hady Izadpanah at Stantec (2 via US mail, 1 via email)
1 - Project File

INTRODUCTION

This report presents results of a study performed to evaluate the geotechnical feasibility of rebuilding the lower and middle camps of Camp Hess Kramer in the Malibu area of Ventura County, California. The majority of structures within the facility were destroyed by the Woolsey Fire of November 2018. This study focused on identifying geologic features that could potentially pose safety hazards to future structures within various areas of the site.

Camp Hess Kramer occupies approximately 55.9 acres bounded by Pacific Coast Highway on the south, Yerba Buena Road on the east, Gindling Hilltop Camp to the north, and open space to the west. The Assessor Parcel Number of the property is 700-0-070-450. The lower camp and much of the middle camp are located in low lying areas within approximately 100 feet of Little Sycamore Creek and 15 feet above the tops of the creek banks. Exceptions in the lower camp include the existing administration building and the camp staff housing building, which are both further from the creek and at higher relative elevations. Exceptions in the middle camp are generally within the northern half, and are further from the creek than 100 feet and at relative elevations greater than 15 feet above the tops of the creek banks.

Most of the areas within the camp that supported structures were located near the toes of relatively steep ascending natural slopes. Slope heights are generally greater than 100 feet above the lower camp area and greater than 200 feet above the middle camp area. Gradients generally range above both camps from about 1:1 (horizontal to vertical) to 2.5:1.

SCOPE OF STUDY

Studies that resulted in this report included performing a reconnaissance of the site, reviewing regional geologic maps, and interpreting aerial photographs taken of the site and surrounding areas between 1945 and 2020.

GENERAL GEOLOGY

The site lies within the Santa Monica Mountains, which comprise one of the western Transverse Ranges. The Santa Monica Mountains and the Transverse Ranges are characterized by ongoing tectonic activity. In the vicinity of the subject site, Tertiary sedimentary and volcanic rocks have been folded and faulted along predominant east-west structural trends. Although there are several faults located within the region, the nearest known fault of significance (the Malibu Coast Fault) is located approximately 4,000 feet south of the southern end of the camp property. The project area is not located within any of the "Fault Rupture Hazard Zones" that have been specified by the State of California (C.D.M.G. 1972, Revised 1999).

Essentially all sloping areas within the camp, and those slopes just outside the property lines, are located within Earthquake-Induced Landslide Areas designated by the California Division of Mines and Geology (CDMG, 2002). (Designation as an Earthquake-Induced Landslide Area does not necessarily mean that there is a landslide. It simply means that these areas should be evaluated prior to developing within them.)

The vast majority of the nearly flat-lying areas adjacent to Little Sycamore Creek are designated as Liquefaction Hazard Zones (CDMG, 2002) that will require evaluation of the hazard if structures are proposed within these zones.

Bedrock underlying the site and exposed in most of the slopes within the camp is a combination of Topanga Formation and Conejo Volcanics units. Topanga Formation units within the area are generally composed of interbeds of indurated sandstones and shales that have been metamorphosed in numerous areas by intrusions of the volcanics. The majority of the volcanic units exposed within the facility are composed of basaltic units, although there is at least one andesitic dike running through the northwestern area of the middle camp.

Some of the older mappings of the area, including Weber, et al. (1973) and C.D.M.G. (1975) show faults trending through the site in a general east-west direction. Although the contacts mapped by Earth Systems generally coincide with those of the earlier mappings, Earth Systems tends to agree with mapping by Dibblee and Ehrenspeck (1990) that interpret these contacts as intrusions of molten Conejo Volcanics into the host Topanga Formation, and do not consider them to be faults. In any case, these features formed during the Miocene epoch, and are not indicative of current geologic activity.

GEOLOGIC HAZARDS

Geologic hazards that may impact a site include seismic shaking, fault rupture, landsliding, debris flows, rock fall, erosion, liquefaction, and flooding.

Seismic Shaking

Although the site is not within a State-designated "fault rupture hazard zone", it is located in an active seismic region where large numbers of earthquakes are recorded each year. Historically, major earthquakes (i.e. those with Richter magnitudes greater than 7.0) felt in the vicinity of subject site have originated from faults outside the area. These include the December 21, 1812 "Santa Barbara Region" earthquake, that was presumably centered in the Santa Barbara Channel, the 1857 Fort Tejon earthquake, the 1872 Owens Valley earthquake, and the 1952 Arvin-Tehachapi earthquake.

Southern Ventura County was mapped by the California Division of Mines and Geology in 1975 to delineate areas of varying predicted seismic response. The alluvium that underlies the majority of the anticipated building areas of the subject site is typically considered to have a probable maximum intensity of earthquake response of approximately IX on the Modified Mercalli Scale. Historically, the highest observed intensity of ground response has been V to VI in the Solromar/Point Mugu area (C.D.M.G., 1975).

It is assumed that the 2019 CBC and ASCE 7-16 guidelines will apply for the seismic design parameters. The 2019 CBC includes several seismic design parameters that are influenced by the geographic site location with respect to active and potentially active faults, and with respect to subsurface soil or rock conditions. It is anticipated that these seismic design parameters will be determined once plans are further developed, but designing based on the appropriate design values is expected to mitigate the potential future hazards posed specifically by seismic shaking.

Fault Rupture

Surficial displacement along a fault trace is known as fault rupture. Fault rupture typically occurs along previously existing fault traces. No faults were observed to be located on or trending into the subject property during the field study, during reviews of the referenced geologic literature, or during interpretation of stereographic pairs of aerial photographs taken of the site in 1945. As a result, it appears that the potential for fault rupture on this site is low.

Landsliding, Rock Fall, and Debris Flows

Landslides are downward mass movements of combinations of rock and/or soil. Landslides pose significant hazards to structures located on or below the slide mass.

As mentioned earlier in this report, slopes ascending from the previously developed areas of the camp facility are relatively steep. Many zones of bedrock exposed in the lower sections of the slopes exhibit deformation by folding when the host Topanga Formation bedrock units were intruded by the molten Conejo Volcanics. Although this deformation and "baking" can harden the host rock, it can also cause fracturing that can weaken the overall strength of the rock. It is suspected that the combination of the steep slopes and limited areas of weakened, fractured rock have resulted in landslides throughout areas of Little Sycamore Canyon.

During mapping of the facility, several areas were identified that included geomorphic features and stratigraphic appearances that are often indicative of landsliding. The approximate limits of those areas are designated as either Qls (for relatively recent appearing landslides) or Qlsa (for ancient landslides) on the attached Geologic Map. There are two slides that may pose the greatest landslide hazards on the slopes ascending to the west side of the camp. The first is west of the bridge over Little Sycamore Creek between the Leadership Grove and Ropes Course. The second is above the fire-destroyed s designated on the plan as Cabin Nos. 20.N through 25.N, and this slide may also project below fire-destroyed Cabin Nos. 31.N through 34.N.

There are also landslides on the slopes ascending to the east of the camp facility, and the approximate limits of these are also plotted on the attached Geologic Map. These are generally located across Little Sycamore Creek from previously developed areas, although the norther limit of the largest landslide complex appears to be above the previous Outdoor Chapel.

Debris Flows

Debris flows are saturated masses of rock fragments, soils, and mud that are typically confined within drainages where they pick up speed and then discharge and disperse when the drainage ends. In the Santa Monica Mountains they typically form in weathered rock zones within steep drainages. Debris flows pose significant hazards to structures located below the bottom of the drainage.

Review of historical aerial photographs and mapping performed as part of this study indicated that every drainage leading down the steep slopes into the facility had generated debris flows at one time or another. The debris flow tracks are identified by "Qdf" on the attached Geologic Map.

The most significant with respect to previously developed areas on the east side of Little Sycamore Canyon included one that discharged what appears to have been dozens of cubic yards of debris toward fire-destroyed Building 1.R, and a similar amount discharged into the area formerly occupied by Building 14.R.

Debris flow tracks identified on the west side of Little Sycamore Creek included one above fire-destroyed Building 18.R, one above the old pool, and one above old Building 20.N. However, the most significant debris flow migrated down the canyon emanating from the drainage entering the middle camp from northwest where it appears to have deposited hundreds of cubic yards of debris between old Buildings 11.N and 9.N.

Rock Fall

Rock fall is a hazard where loose rocks on slopes become dislodged by a seismic event, weathering, precipitation, or some other natural phenomenon. There are areas where loose rocks exist on slopes above previously developed areas of the camp.

Erosion

Erosion at this site was noted below the outlets of storm drain outlet pipes that pass under Yerba Buena Road and discharge onto slopes on the east side of Little Sycamore Creek. One such area is located above the Outdoor Chapel area and a second area was identified near the northeastern corner of the facility. These areas are designated on the attached Geologic Map.

Liquefaction

Strong ground shaking associated with earthquakes can cause liquefaction in which saturated, low cohesion soils lose strength. If the loss of strength occurs in the bearing zone, structures can settle or even overturn. Liquefaction is typically limited to the upper 50 feet of subsurface soils.

Fine sands and silty sands that are poorly graded and lie below the groundwater table are the soils most susceptible to liquefaction. Soils that are sufficiently dense, soils that have plasticity indices greater than 7, and/or soils located above the groundwater table are not generally susceptible to liquefaction.

As mentioned previously, most of the anticipated building areas, i.e. areas where previous structures were located before the Woolsey Fire, are within zones that will require evaluation of the hazard posed by liquefaction.

Review of regional groundwater maps prepared by the CDMG (2002a) indicate that historically highest groundwater levels have been about 10 feet below the existing ground surface throughout most of the anticipated building areas of the site. The extent and severity of the liquefaction hazard, if it actually exists, will not be known until detailed geotechnical studies, including subsurface investigation, laboratory testing, and detailed data analyses are performed for specific locations within the facility.

Areas underlain by bedrock would not be susceptible to the liquefaction hazard. This would include some of the areas in the northwestern area of the middle camp.

Flooding

Earthquake-induced flooding types include tsunamis, seiches, and reservoir failure. The subject site is not within the tsunami inundation zones delineated within the Tsunami Inundation Map for the Trinfo Pass Quadrangle (California Emergency Management Agency, et al., 2009). Therefore, it appears that the hazard posed by tsunami inundation is low.

Seiches do not appear to pose a hazard because there are no nearby lakes.

Any nearby reservoir that may fail would normally drain into established major drainage channels, and away from the site; therefore, earthquake-induced flooding should not be considered a potential hazard.

With the exception of the extreme southern end of the site, the property is located within an area designated by FEMA Flood Map Service Center website as Zone X, which is designated as an “area of minimal flood hazard". However, significant flooding occurred after the slopes within the Little Sycamore Canyon area were denuded by the Woolsey Fire and the winter rains came. The flood waters deposited debris to at least 10 feet above the creek bed flow line within the camp, including above the bridge levels within the facility. As a result, although the flood hazard is relatively low in most years, it appears that the hazard posed by storm-induced flooding is moderate to high after a fire event like the Woolsey Fire.

CONCLUSIONS AND RECOMMENDATIONS

Based on the information presented above, careful planning will be required to locate new structures outside hazardous areas of the facility, or to modify existing grades to mitigate the various hazards.

Grading to raise pad elevations above flood levels, above debris flow tracks, outside rock fall areas, or outside erosion zones will likely be a key component in planning the future layout of structures. Incorporation of retaining walls, debris deflection walls, or debris fences into grading plans could also be utilized for mitigation. It appears likely that these types of solutions can effectively mitigate the flooding, debris flow, rock fall, and erosion hazards throughout most of the facility. Coordination between the Engineering Geologist and Civil Engineer will be important for planning the rebuilt camp.

Reconstruction in the area of previous Cabin Nos. 20.N through 25.N and 31.N through 34.N could potentially be more problematic because of the landslide that ascends above these sites, and may or may not project below them. Detailed geologic investigation of this area will be required to determine subsurface geology.

Design-level geotechnical studies should be undertaken once preliminary plans become available. It is assumed that the new structures will be situated in areas of the facility where liquefaction analyses will be required.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

The analysis and recommendations submitted in this report are based in part upon the data obtained from the studies reported herein. Differences in the conclusions could result when subsurface investigation for design-level studies are conducted.

The scope of services did not include any environmental assessment or investigation for the presence or absence of wetlands, hazardous or toxic materials in the soil, surface water, groundwater or air, on, below, or around this site. Any statements in this report

Findings of this report are valid as of this date; however, changes in conditions of a property can occur with passage of time whether they be due to natural processes or works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur whether they result from legislation or broadening of knowledge. Accordingly, findings of this report may be invalidated wholly or partially by changes outside the control of Earth Systems. Therefore, this report is subject to review and should not be relied upon after a period of one year.

In the event that any changes in the nature, design, or location of the structures and other improvements are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing.

As the Geotechnical Engineers for this project, Earth Systems has striven to provide services in accordance with generally accepted geotechnical engineering practices in this community at this time. No warranty or guarantee is expressed or implied. This report was prepared for the exclusive use of the Client for the purposes stated in this document for the referenced project only. No third party may use or rely on this report without express written authorization from Earth Systems for such use or reliance.

It is recommended that Earth Systems perform design-level geologic and geotechnical studies for once plans are further developed.

AERIAL PHOTOGRAPHS INTERPRETED FOR THIS STUDY

Fairchild Aerial Surveys, Stereographic Pair, Index 9800, Frames 15-1548 and 1549, November 11, 1945.

Google Earth Historical Images: August 21, 1989; May 31, 1994; June 11, 2002; January 11, 2005, March 15, 2006; August 31, 2007; April 26, 2011; December 9, 2013; July 23, 2014; May 1, 2015; February 8, 2016; November 13, 2017; and August 12, 2018.

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C.D.M.G., 1975, Seismic Hazards Study of Ventura County, California, Open File Report 76-5-LA.

C.D.M.G., 1983, Landslides of the Central and Western Santa Monica Mountains, Los Angeles and Ventura Counties, California, Open File Report 83-16.

C.D.M.G., 2002a, Seismic Hazard Zone Report for the Triunfo Pass 7.5-Minute Quadrangle, Ventura County, California, Seismic Hazard Zone Report 059.

C.D.M.G., 2002b, State of California Seismic Hazard Zones, Triunfo Pass Quadrangle, Official Map, February 7, 2002.

California Emergency Management Agency, California Geological Survey, and University of Southern California, February 15, 2009, Tsunami Inundation Map for Emergency Planning, State of California, County of Ventura, Triunfo Pass Quadrangle.

C.G.S., 2008, Guidelines for Evaluating and Mitigating Seismic Hazards in California, Special Publication 117A.

Dibblee, Jr., Thomas W., and Helmut E. Ehrenspeck, 1990, Geologic Map of the Point Mugu and Triunfo Pass Quadrangles, Ventura and Los Angeles Counties, California, Dibblee Foundation Map No. DF-29.

Federal Emergency Management Agency (F.E.M.A.), 2020, FEMA Flood Map Service Center Website.

Sieh, Kerry E., 1978, Earthquake Intervals, San Andreas Fault, Palmdale, California, C.D.M.G., California Geology, June 1978.

Weber, F. Harold, Jr. and others, 1973, Geology and Mineral Resources of Southern Ventura County, California, C.D.M.G., Preliminary Report 14.

APPENDIX

Vicinity Map
Regional Geology Map
Seismic Hazard Zones Map
Historically Highest Groundwater Map
Geologic Map

*Taken from USGS Topo Map, Triunfo Pass Quadrangle, Los Angeles and Ventura Counties, California, 2018.

Approximate Scale: 1" = 2,000’

0 2,000’ 4,000’

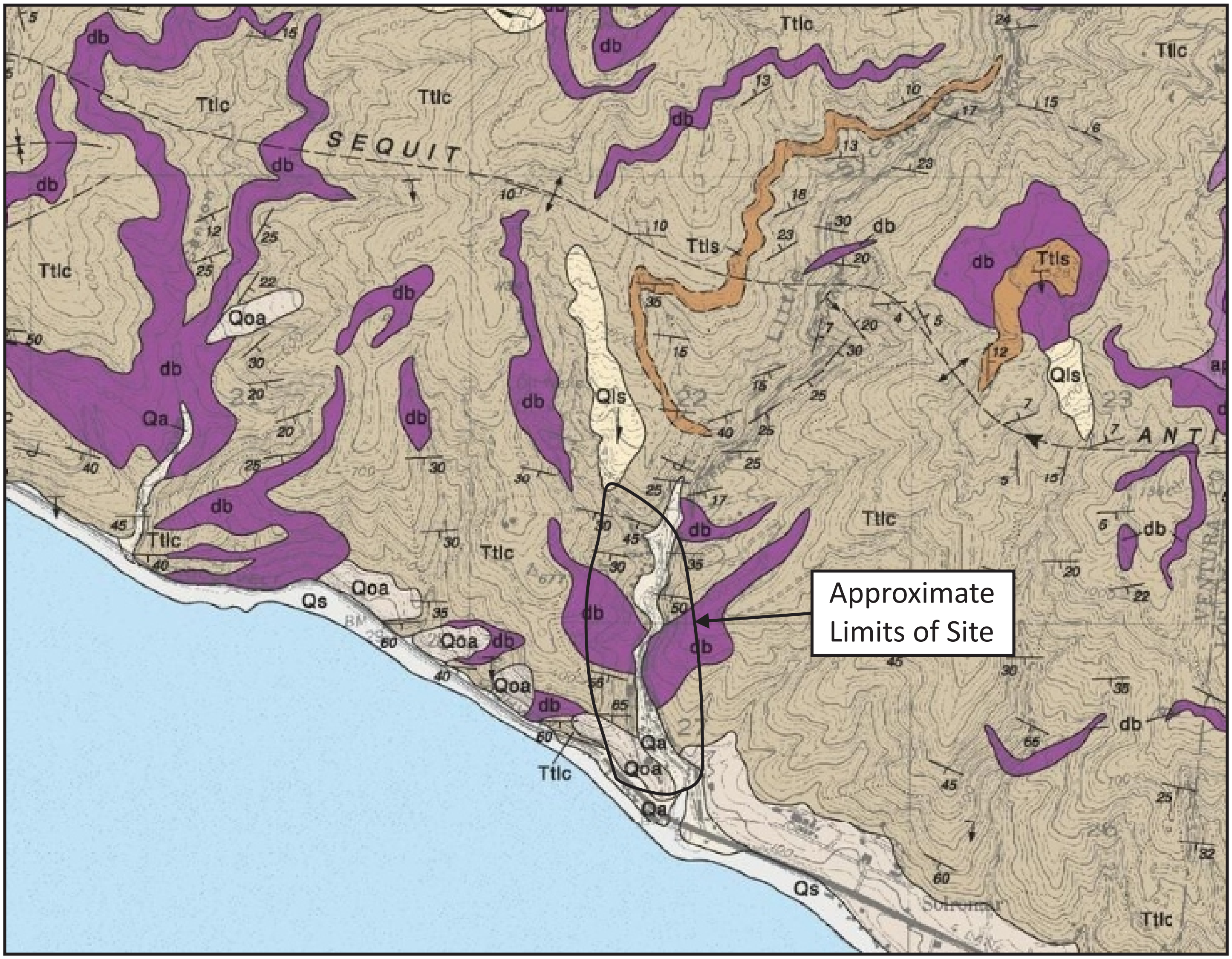
N

VICINITY MAP

Camp Hess Kramer
Ventura County, CA

Earth Systems

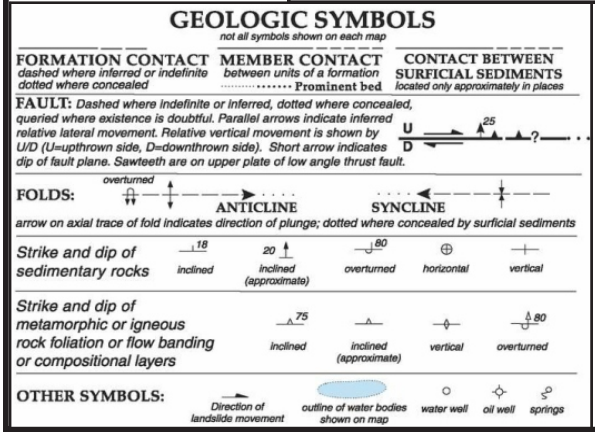
February 2020	301529-002



Approximate Limits of Site

*Taken from Dibblee, Jr., Geologic Map of The Triunfo Pass Quadrangle, Los Angeles and Ventura Counties, California, 1990, DF-29.

di ai bi api db	**db** *Diabase: dark gray to dark olive-brown, fine to coarse grained diabase or ophitic basalt; composed of lathy (elongated) plagioclase feldspar and ferromagnesian minerals, mostly augite and olivine; forms many lenticular sills and several basaltic feeder dikes (shown as bi) in lower Topanga Formation; in places complexly injected or sheared along margins; somewhat incoherent where weathered*
Ttlc Ttls Ttlcv Ttlsv	**Ttlc** *Dark to light gray, thin-bedded micaceous clay shale; includes a few thin strata of tan, hard, semi-siliceous shale and others of sandstone*
Qs Qg Qds Qf Qa Qc	**Qa** *Alluvium: gravel, sand and clay of flatlands*
Qoa	**Qoa** *Dissected, weakly indurated alluvial gravel, sand and silt*



GEOLOGIC SYMBOLS

not all symbols shown on each map

FORMATION CONTACT *dashed where inferred or indefinite dotted where concealed*

MEMBER CONTACT *between units of a formation*

CONTACT BETWEEN SURFICIAL SEDIMENTS *located only approximately in places*

FAULT: *Dashed where indefinite or inferred, dotted where concealed, queried where existence is doubtful. Parallel arrows indicate inferred relative lateral movement. Relative vertical movement is shown by U/D (U=upthrown side, D=downthrown side). Short arrow indicates dip of fault plane. Sawteeth are on upper plate of low angle thrust fault.*

FOLDS:

arrow on axial trace of fold indicates direction of plunge; dotted where concealed by surficial sediments

Strike and dip of sedimentary rocks

Strike and dip of metamorphic or igneous rock foliation or flow banding or compositional layers

OTHER SYMBOLS:

Approximate Scale: 1" = 2,000’

N

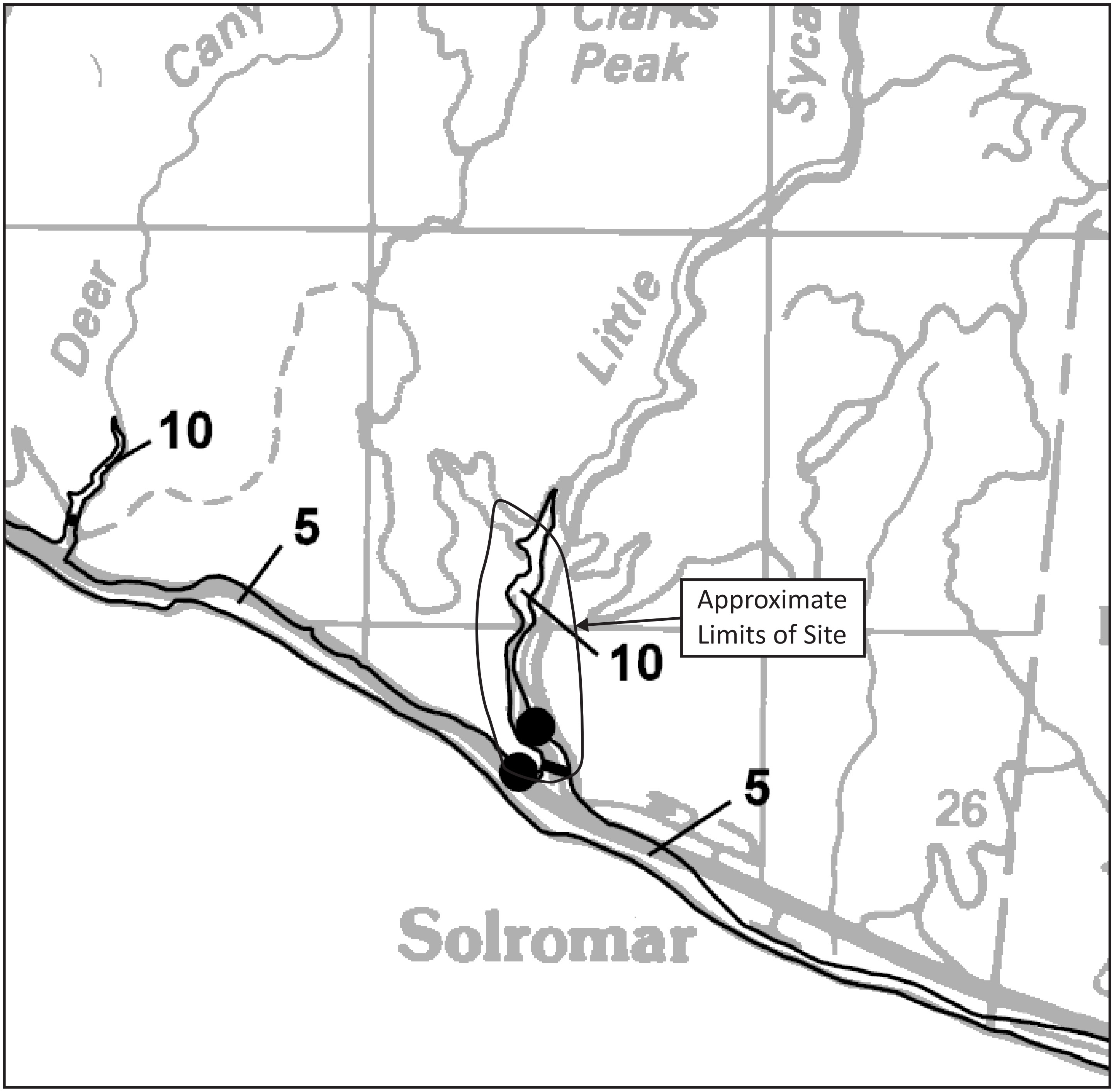
REGIONAL GEOLOGIC MAP

Camp Hess Kramer
Ventura County, California

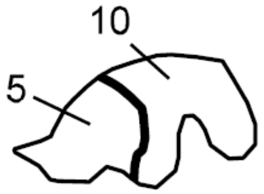
Earth Systems

February 2020

301529-002



*Taken from CGS, Seismic Hazard Zone Report For The Triunfo Pass 7.5-Minute Quadrangle, Los Angeles & Ventura Counties, California, 2002.



Alluviated valley and zones of estimated historically highest ground-water depth (in feet)
B = Pre-Quaternary bedrock

● Borehole Site

Approximate Scale: 1" = 2,000’

0 2,000’ 4,000’

N

HISTORICAL HIGH GROUNDWATER MAP

Camp Hess Kramer
Ventura County, CA

Earth Systems

February 2020

301529-002

Camp Hess Kramer (Lower Camp)		
Use	**Building Number**	**Footprint Area**
Parking w/ Tennis Courts above	0.N	N/A
Administration, program space; Executive staff residence	1.R	3,000
Program Space	2.R	3,600
Program Space	4.N	1,200
Overnight Accommodations	6.E	8,055
Program Space; Staff Housing	7.E	8,646
Dining Hall, administration	13.N	12,370
Program Space (Gildred Hall rebuild)	14.R	7,446
Restroom	16.E	420
Program Space (Baruh Hall rebuild)	18.R	6,400
Pool pump building	19.R	830
Outdoor dance stage	19A.R	937
Misc. Storage / Utility (various locations on site)		1,159
	Subtotal	**54,063**
Camp Hess Kramer (Middle Camp)		
Use	**Building Number**	**Footprint Area**
Staff Housing	8.N	2,550
Staff Housing	9.N	2,800
Staff Housing	10.N	1,800
Staff Housing	11.N	1,500
Cabin	20.N	1,125
Cabin	21.N	1,125
Cabin	22.N	1,125
Cabin	23.N	1,125
Cabin	24.N	1,125
Cabin	25.N	1,125
Cabin	26.N	1,125
Cabin	27.N	1,125
Cabin	28.N	1,125
Cabin	29.N	1,125
Cabin	30.N	1,125
Cabin	31.N	1,125
Cabin	32.N	1,125
Cabin	33.N	1,125
Cabin	34.N	1,125
Cabin	35.N	1,125
Cabin	35.R	530
Cabin	36.R	530
Cabin	37.R	560
Cabin	38.R	530
Cabin	39.R	530
Cabin	40.R	530
Storage / Utility		712
	Subtotal	**30,572**
TOTAL (LOWER & MIDDLE)		**84,635**

LEGEND:

- 🟥 BUILDING REMAINING (17,121 SF)
- 🟨 BUILDING REPAIRED/REBUILT ON PRE-FIRE FOOTPRINT (27,294 SF)
- 🟧 PROPOSED NEW BUILDING (40,220 SF)
- 🟩 PROPOSED REPAIRED/NEW OUTDOOR ACTIVITY AREA
- ⬚ PRE-FIRE BUILDING REMOVED FROM CREEK SETBACK
- ▪▪▪ (E) PLANNING POLYGON
- ▪▪▪ PROPOSED REALIGNMENT OF PLANNING POLYGON
- - - 100' CREEK SETBACK (16,890 SF)

af: Artificial Fill
Qdf: Debris Flows
Qal: Alluvium
Qlss: Surficial Landslides
Qls: Landslides
Qlsa: Ancient Landslides
Tci: Andesitic Intrusive of Conejo Volcanics
Tcb: Basalts of Conejo Volcanics
Tt: Topanga Formation
?: Queried where uncertain

GEOLOGIC MAP

11495 Pacific Coast Highway
Malibu, California

Earth Systems

February 2020 | 301529-002

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July 8, 2020

Project No.: 301529-003
Report No.: 20-7-8 (Revised)

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Project: Camp Hess Kramer Lower and Middle Camp Rebuilds
11495 Pacific Coast Highway
Malibu Area
Ventura County, California

Subject: Geotechnical Study Focused on Cabins Below Landslide

Reference: Earth Systems Pacific, February 25, 2020, Geotechnical Feasibility Report for Proposed Rebuilding of Lower and Middle Camps at Camp Hess Kramer, 11495 Pacific Coast Highway, Malibu Area, Ventura County, California.

Introduction

As authorized, Earth Systems performed geotechnical exploration, laboratory testing, and analyses to evaluate the potential hazard posed by landsliding to proposed Cabin Nos. 20N through 25N, and Cabin Nos. 31N through 34N. The landslide above these groups of cabins was identified during studies that resulted in the referenced Geotechnical Feasibility Report. Authorization to provide the geotechnical studies discussed in this letter was provided by Stantec Task Orders for Project No. 2064134600 dated March 11, 2020 and Project No. 2042586200 dated June 10, 2020.

Geotechnical Exploration

On March 24 and 25, 2020, two exploratory borings were drilled within the existing pad area of the key cabins and below the landslide. The borings were advanced with a 24-inch diameter bucket auger drilling rig. Samples were obtained from the boring and returned to the laboratory for testing. The number of blows required to drive core samples by the weight of the Kelly bar dropping about 18 inches were recorded. The borings were down-hole logged by a registered Professional Geologist to depths a few feet above the groundwater levels.

Boring BB-1 was drilled to a depth of 42 feet below the ground surface between proposed Cabin Nos. 23N and 24N. Materials encountered in the boring included 2 feet of surficial artificial fill over 26 feet of landslide debris followed by Topanga Formation bedrock to a depth of 42 feet. The landslide debris included angular rock fragments throughout the ground mass. Topanga Formation units at 28 feet appeared to be a claystone with slickensides that appeared to be

County of Ventura
Case No. PL21-0051
Attachment - Earth Systems
Geotechnical Feasibility Report dated
July 8, 2020

indicative of the landslide plane. Further evidence included groundwater encountered at the same depth, i.e. 28 feet.

Boring BB-2 was drilled to a depth of 32 feet near the location of Cabin No. 33N, which is approximately 80 feet southeast of Boring BB-1. The boring encountered 7.5 feet of artificial fill over alluvium that extended through the bottom of the boring. The alluvial sediments included larger clasts that were subrounded, which differentiated them from the clasts in the landslide debris that were more angular. The landslide plane was not encountered in Boring BB-2. Groundwater was encountered at a depth of 28 feet.

Laboratory Testing

Laboratory testing was performed on samples taken from the two exploratory borings. Samples were subjected to in-place moisture and density testing and direct shear testing, including determination of residual strength parameters of the slide plane material. Laboratory test results are presented in the Appendix of this report.

Geologic Interpretation

Based on the data gathered from field mapping activities in the first phase of work on the site, and the distribution of geologic units encountered in the borings, it appears likely that the landslide was caused by an ancient period of downcutting of Little Sycamore Creek that resulted in grades significantly below existing grades, and also resulted in an oversteepened natural slope with a height that was probably 25 feet greater than the current slope height. The slide plane encountered at a depth of 28 feet in BB-1 is interpreted to be the failure plane of an ancient slide that resulted from that ancient topography.

In more recent geologic time, Little Sycamore Creek has deposited tens of feet of alluvium that has since partially buttressed the ancient slide. The alluvial deposition simultaneously eroded and replaced some of the slide debris thus leading to the differences in stratigraphy encountered in the two borings.

A new headscarp appears to be forming in the steep slope above Cabin Nos. 20N through 25N, but significantly below the original headscarp. It is anticipated that this imminent slope failure will deposit debris at the toe of the current slope but will not cause significant further movement on the ancient slide plane. As such, this newer failure could potentially pose a hazard to structures built immediately adjacent to the toe of the slope unless the pads are raised above existing grades with some room allowed for debris to accumulate between the toe and the pad.

Remedial Solutions Analyzed for This Study

There are some potential options that could be incorporated to mitigate the potential hazards to proposed cabins. Through interaction with the design team, a revised configuration of cabin layouts has been generated to mitigate the potential hazards.

Preliminary stability analyses were performed based on the limited amount of available shear strength data, while also utilizing bedrock strength parameters included within the Seismic

Hazard Zone Report for the Triunfo Pass Quadrangle (CDMG, 2002), and assuming strength parameters for cement-treated fill. Modeling was based on the interpreted geologic conditions, pad grades determined by the design team, the assumption that a 10-foot wide gap would be provided between the toe of the natural slope, and a 10-foot rise to the pad grade from the gap at the toe of the slope.

Preliminary stability analyses indicated that the ancient slide plane could reactivate and generate failure planes through the proposed pads unless stabilization measures are installed near the toe of the slope, and additional weight is added over the buried slide plane by raising the pads upon which the cabins would be located to the grades currently proposed.

Stabilization measures when performing the analyses consisted of installing a section of cement-treated artificial fill up to and below the building pads to add strength to soils resisting failure surfaces. (Obviously, earthwork to install cement-treated fill would have costs that would exceed those for standard earthwork. Installation of the cement-treated fill would probably be required to be performed in sections so that the entire slide mass is not exposed at one time, which will also impact the cost per cubic yard of placing this fill.)

In addition to the strength enhancement produced by the cement-treated fill, the hazard posed by the more recent slide is anticipated to be mitigated by creating the 10-foot wide zone between the existing natural slope toe and the toe of the new fill slope up to the pad. Analyses were performed for both rotational and translational type failures, and static and pseudostatic conditions.

The analyses for Section A-A’ ran through Cabin Nos. 26 (nearest the slope) and 22 (to the east). The pad grade was assumed to be 160.0 feet for Cabin 26, and extended out to the back retaining wall of Cabin 22, whereupon the grade would go down to 150.0 feet. Grades would rise from the 10-foot wide gap at the toe of the natural slope to the pad via a 1:1 (horizontal to vertical) cement-treated fill slope. In addition, a 15-foot deep and 15-foot wide cement-treated fill would be placed below the 1:1 slope and an additional 5 feet away from the natural slope. The minimum factor of safety within the pad under static conditions was found to be 1.545, and the minimum factor of safety under pseudostatic conditions was found to be 1.241. These factors of safety are acceptable.

The analyses for Section B-B’ ran through Cabin No. 21. The pad grade was assumed to range from 154.0 feet at the west (slope) end to 150.0 feet at the back of the cabin retaining wall, whereupon the grade would go down to cabin floor grade of 140.0 feet. Grades would rise from the 10-foot wide gap at the toe of the natural slope to the west end of the pad via a 10-foot high 1:1 (horizontal to vertical) cement-treated fill slope. In addition, a 15-foot deep and 15-foot wide cement-treated fill would be placed below the 1:1 slope with an additional 5 feet eastward. The minimum factor of safety within the pad under static conditions was found to be 1.788, and the minimum factor of safety under pseudostatic conditions was found to be 1.329. These factors of safety are acceptable.

The analyses for Section C-C' ran through Cabin No. 20. The cabin floor is proposed at 140.0 feet, which is essentially equivalent to existing grades. To provide the 10-foot high protection against debris from ascending slope, a 10-foot high retaining wall would be constructed adjacent to the 10-foot wide gap, backfilled with 5 feet of compacted fill. A 10-foot wall on the other side of the backfill would comprise the back wall of Cabin 20. A 15-foot deep and 22-foot wide cement-treated fill would be placed below the retaining wall and the cabin pad. The minimum factor of safety within the pad under static conditions was found to be 3.253, and the minimum factor of safety under pseudostatic conditions was found to be 1.997. These factors of safety are acceptable.

Closure

It should be noted that the preliminary analyses discussed above were based on a very limited amount of geotechnical data and were only performed to provide an opinion with respect to the feasibility of developing this area of the Middle Camp. Additional data will need to be generated during design level geotechnical studies to further evaluate the conditions at the site.

More detailed analyses and recommendations can be prepared if the owners of the camp decide to move forward with development plans and with the authorization of a detailed Geotechnical Engineering Report for all proposed Lower and Middle Camp structures.

Please call if you have any questions, or if we can be of further service.

Respectfully submitted,

EARTH SYSTEMS PACIFIC

PATRICK V. BOALES
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Exp. 6-30-21

Patrick V Boales

Patrick V. Boales 7-8-20
Engineering Geologist

Anthony P. Mazzei
Geotechnical Engineer 7/8/20

Attach: Logs of Bucket Auger Borings
Laboratory Test Results
Stability Analysis Results

Copies: 2 - Izadpanah at Stantec (1 via US mail, 1 via email)
1 - Project File

Earth Systems

1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: BA-1	DRILLING DATE: March 24, 2020
PROJECT NAME: Camp Hess Kramer	DRILL RIG: Tri-Valley Drilling
PROJECT NUMBER: 301529-003	DRILLING METHOD: Bucket Auger
BORING LOCATION: Per Plan	LOGGED BY: A. Luna

Vertical Depth	Sample Type Bulk	SPT	Mod. Calif.	PENETRATION RESISTANCE (BLOWS/6")	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	DESCRIPTION OF UNITS
0					▨	SC			**ARTIFICIAL FILL:** Dark Brown Clayey fine to coarse Sand, bedrock fragments, mottled, some Silt, loose to medium dense, damp to moist
5			■	Push	▨	SC			**Qls:** Brown Clayey fine to coase Sand, bedrock fragments, some Silt, mottled, loose to medium dense
10			■	1	▥	SM	118.1	10.0	**Qls:** Brown Silty fine to coarse Sand, trace to little Clay, bedrock fragments, mottled, medium dense, damp to moist
15			■	1/1	▨	SC			**Qls:** Dark Yellow Brown Clayey fine to medium Sand, little coarse Sand, little bedrock fragments, medium dense, damp to moist
20			■	1/2	▨		113.0	10.1	
25			■	4/4	░	SW			**Qls:** Yellow Brown fine to coarse grained sandstone boulder, well cemented, slightly friable, dense to very dense, damp Groundwater at 28 Feet
	▼								
					▓				**SLIDE PLANE:** Gray Shale with well-developed slickensides, hard, wet
30			■	4/7	▓	Tt	138.7	6.5	**TOPANGA FORMATION:** Gray Shale, weathered, very dense, saturated
35			■	2/6	▓				

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

BORING NO: BA-1	DRILLING DATE: March 24, 2020
PROJECT NAME: Camp Hess Kramer	DRILL RIG: Tri-Valley Drilling
PROJECT NUMBER: 301529-003	DRILLING METHOD: Bucket Auger
BORING LOCATION: Per Plan	LOGGED BY: A. Luna

Vertical Depth	Sample Type			PENETRATION RESISTANCE (BLOWS/6")	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	DESCRIPTION OF UNITS
	Bulk	SPT	Mod. Calif.						
40			■	6/7	▨	Tt			**TOPANGA FORMATION:** Gray Shale, very dense, damp
									Total Depth: 42.0 feet **Groundwater Depth: 28.0 feet**
45									
50									
55									
60									
65									
70									
75									

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

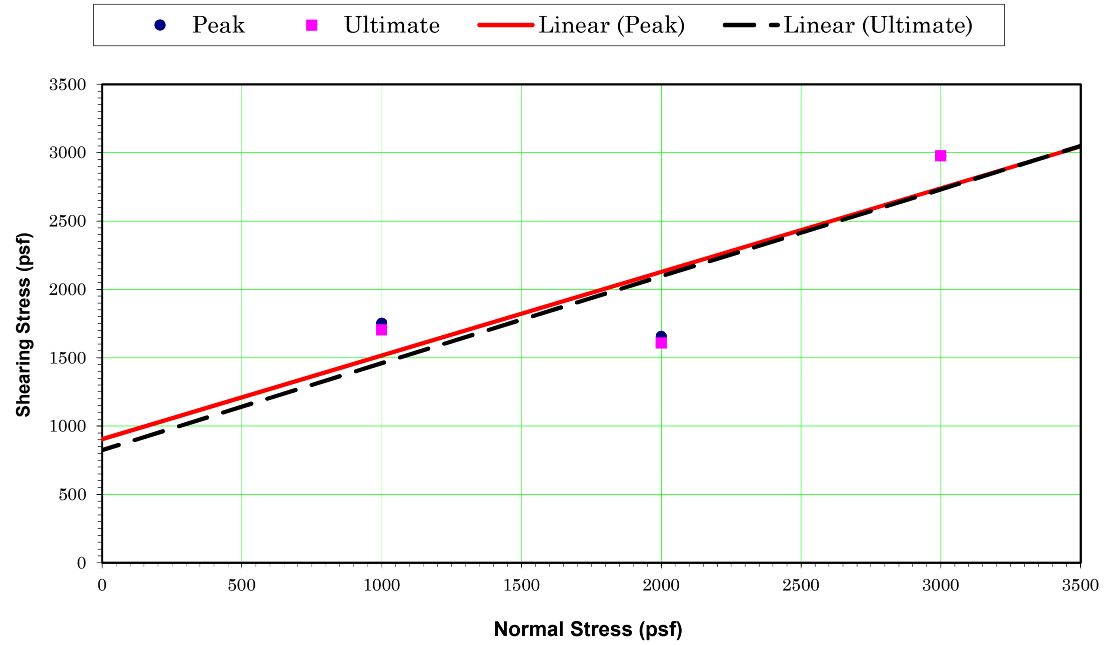
Earth Systems
1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

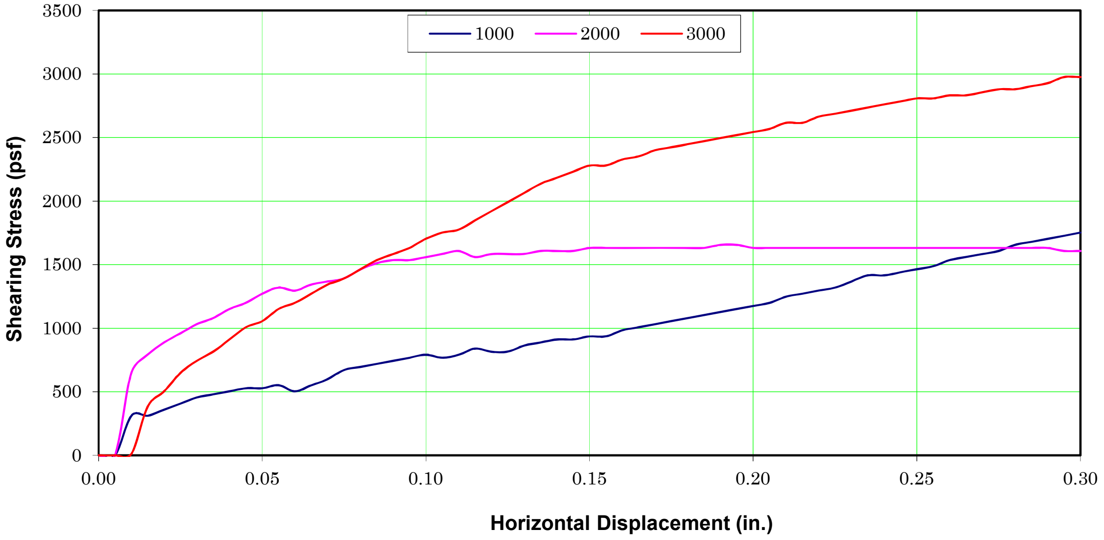
BORING NO: BA-2
PROJECT NAME: Camp Hess Kramer
PROJECT NUMBER: 301529-003
BORING LOCATION: Per Plan

DRILLING DATE: March 25, 2020
DRILL RIG: Tri-Valley Drilling
DRILLING METHOD: Bucket Auger
LOGGED BY: A. Luna

Vertical Depth	Sample Type			PENETRATION RESISTANCE (BLOWS/6"	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	**DESCRIPTION OF UNITS**
	Bulk	SPT	Mod. Calif.						
0									
5			■	Push		SM			**ARTIFICIAL FILL:** Dark Brown Silty fine to coarse Sand, trace Clay, mottled, occasional cobble and boulder, loose to medium dense, damp
10			■	Push		SC	106.5	11.8	**ALLUVIUM:** Dark Red Brown to Dark Brown fine Clayey Sand, some medium to coarse Sand, some Gravel, occasional cobble, medium stiff to stiff, damp to moist
15			■	Push		SC	116.2	13.5	
20			☒	4/4		GP			**ALLUVIUM:** Cobbles in a Clayey fine to coarse Sand matrix, some fine to coarse Gravel, very dense, wet
25									
	▼								Groundwater at 28 Feet
30			■	5/10					
35									**Total Depth: 32.0 feet** **Groundwater Depth: 28.0 feet**

Note: The stratification lines shown represent the approximate boundaries
between soil and/or rock types and the transitions may be gradual.





DIRECT SHEAR DATA*

Sample Location:	B A 1 @ 10'
Sample Description:	Silty Gravel
Dry Density (pcf):	118.1
Intial % Moisture:	10
Average Degree of Saturation:	100.0
Shear Rate (in/min):	0.005 in/min

Normal stress (psf)	1000	2000	3000
Peak stress (psf)	1752	1656	2976
Ultimate stress (psf)	1704	1608	2976

	Peak	Ultimate
ϕ Angle of Friction (degrees):	31	32
c Cohesive Strength (psf):	900	820

Test Type: Peak & Ultimate

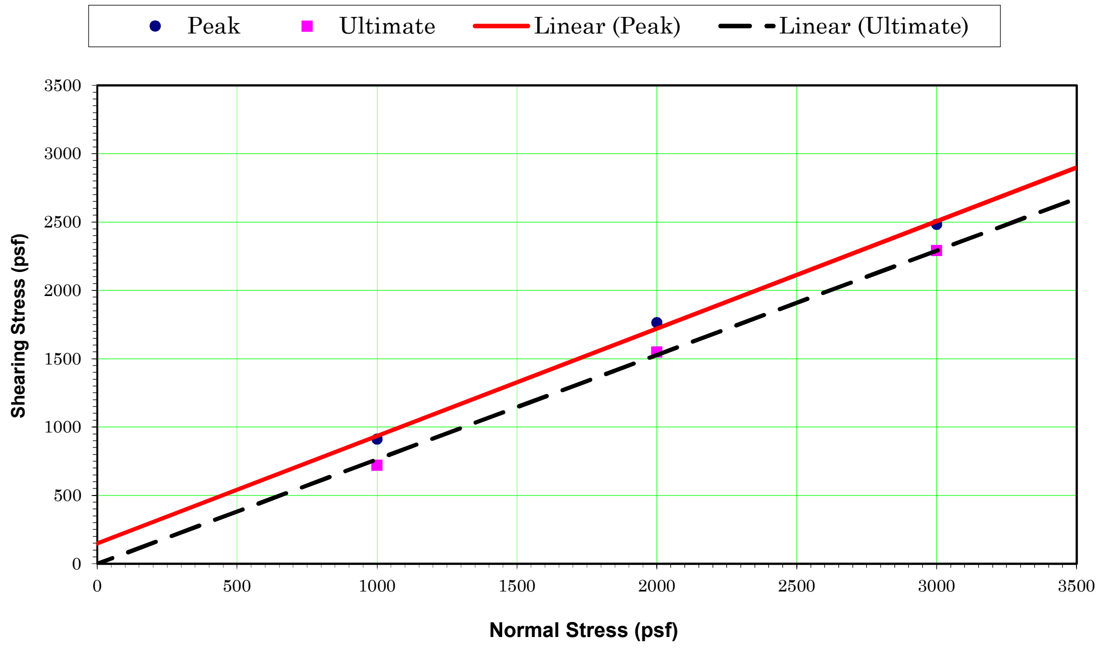
* Test Method: ASTM D-3080

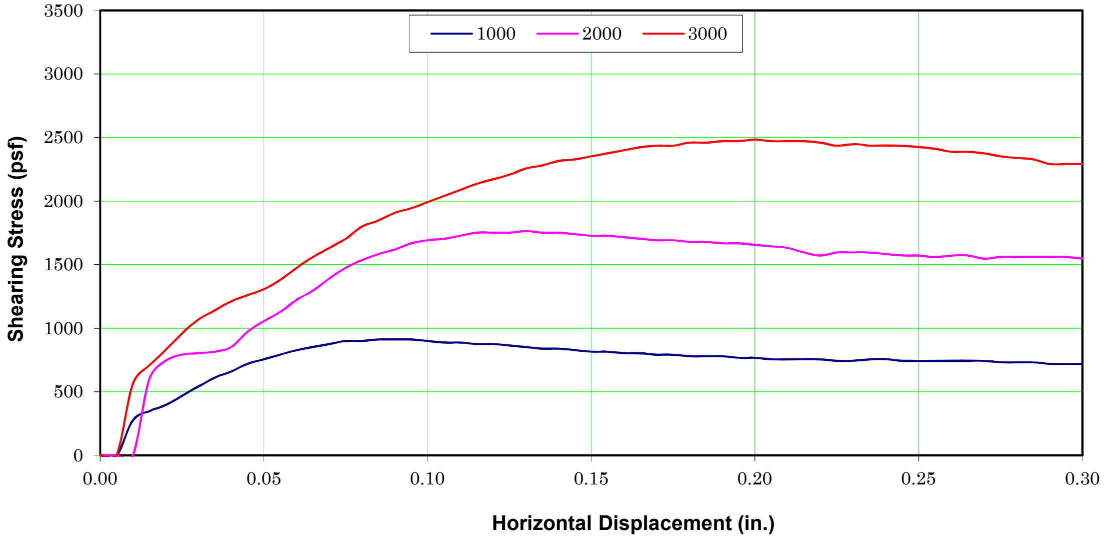
DIRECT SHEAR TEST

Camp Hess Kramer

Earth Systems

7/2/2020 301529-003





DIRECT SHEAR DATA*

Sample Location: B A 1 @ 20'
Sample Description: Silty Sand
Dry Density (pcf): 113.0
Intial % Moisture: 10.1
Average Degree of Saturation: 100.0
Shear Rate (in/min): 0.005 in/min

Normal stress (psf)	1000	2000	3000
Peak stress (psf)	912	1764	2484
Ultimate stress (psf)	720	1548	2292

	Peak	Ultimate
ϕ Angle of Friction (degrees):	38	38
c Cohesive Strength (psf):	140	0

Test Type: Peak & Ultimate

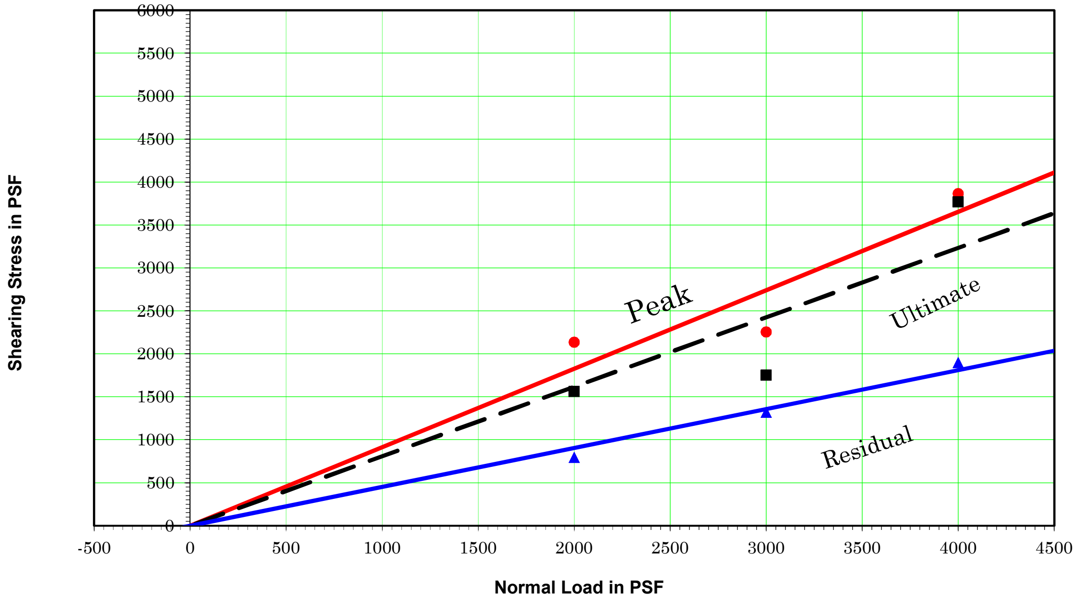
* Test Method: ASTM D-3080

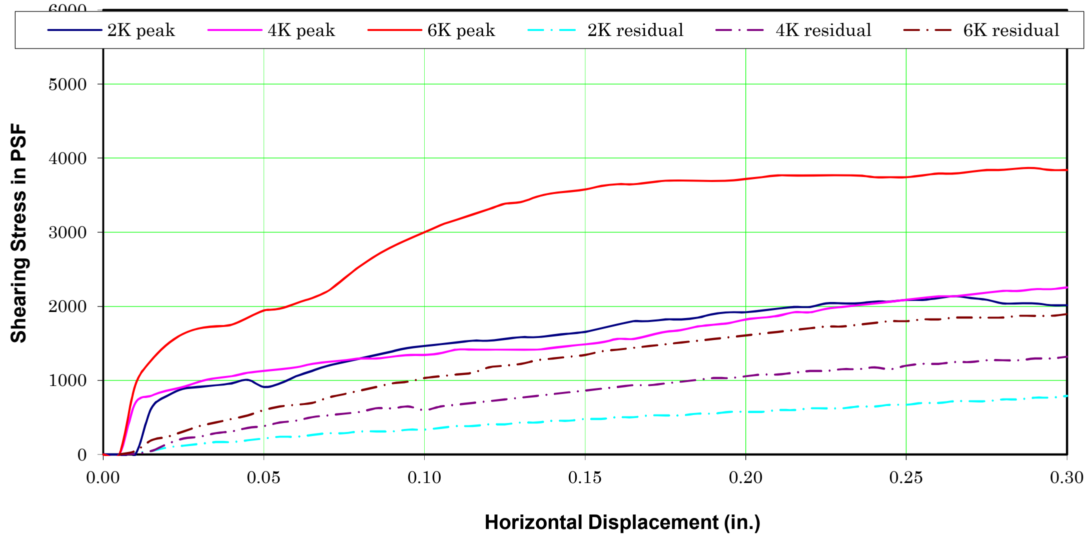
DIRECT SHEAR TEST

Camp Hess Kramer

Earth Systems

7/2/2020 301529-003





DIRECT SHEAR DATA*

Sample Location: B A 1 @ 30'
Sample Description: Siltstone
Dry Density (pcf): 138.7
Intial Moisture (%): 6.5
Moisture at Test (%): 12.6
Average Degree of Saturation: 100.0
Shear Rate (in/min): 0.005 in/min

Normal stress (psf)	2000	3000	4000
Peak stress (psf)	2136	2256	3864
Ultimate stress (psf)	1560	1752	3768
Residual stress (psf)	792	1320	1896

	Peak	Ultimate	Residual
ϕ Angle of Friction (degrees):	41	41	25
c Cohesive Strength (psf):	160	0	0

Test Type: Peak, Ultimate and Residual

*** Residual Shear Rate: 0.001 in/min.*

* Test Method: ASTM D-3080

Sample Resheared 5 cycles

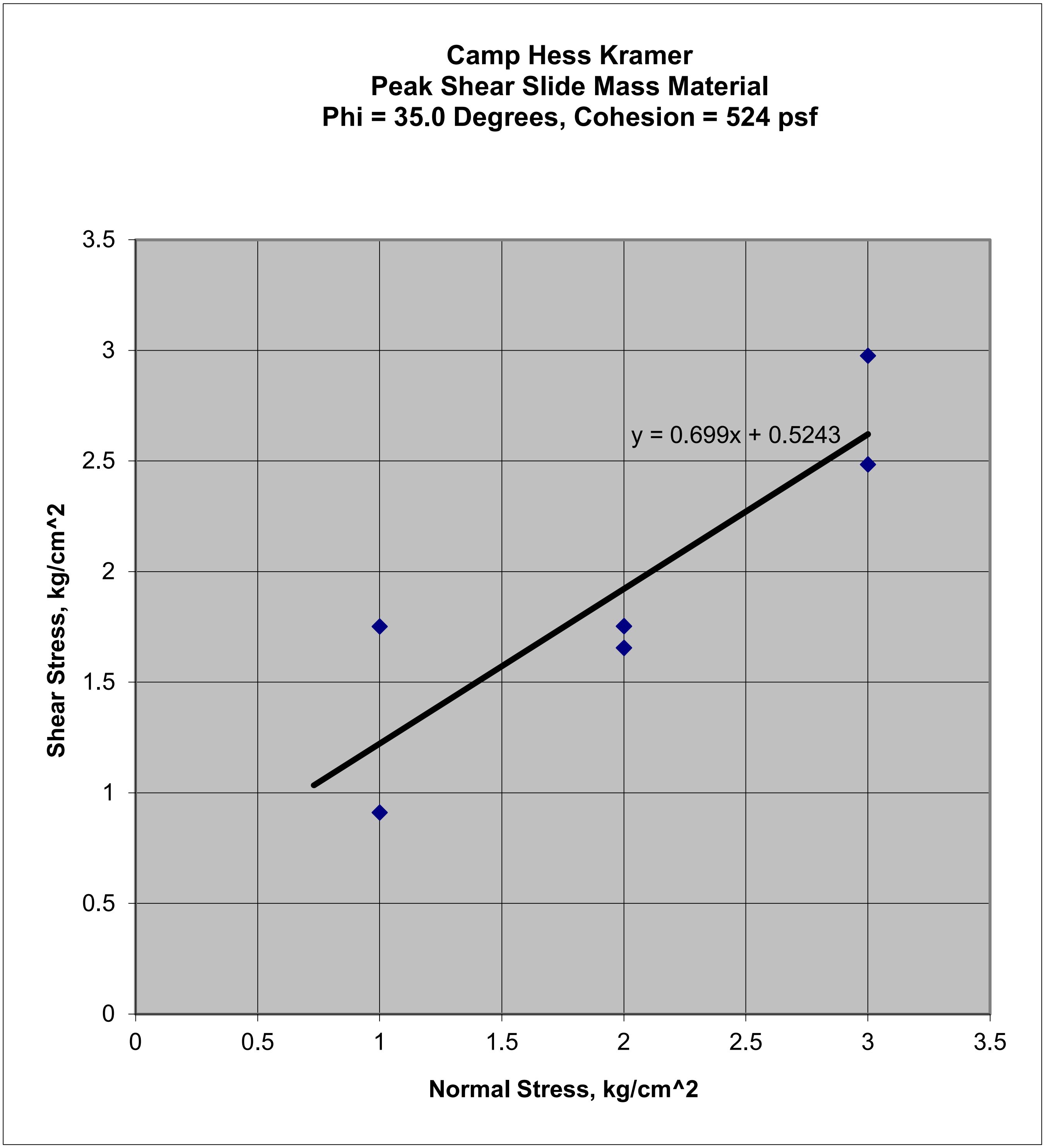
DIRECT SHEAR TEST

Camp Hess Kramer

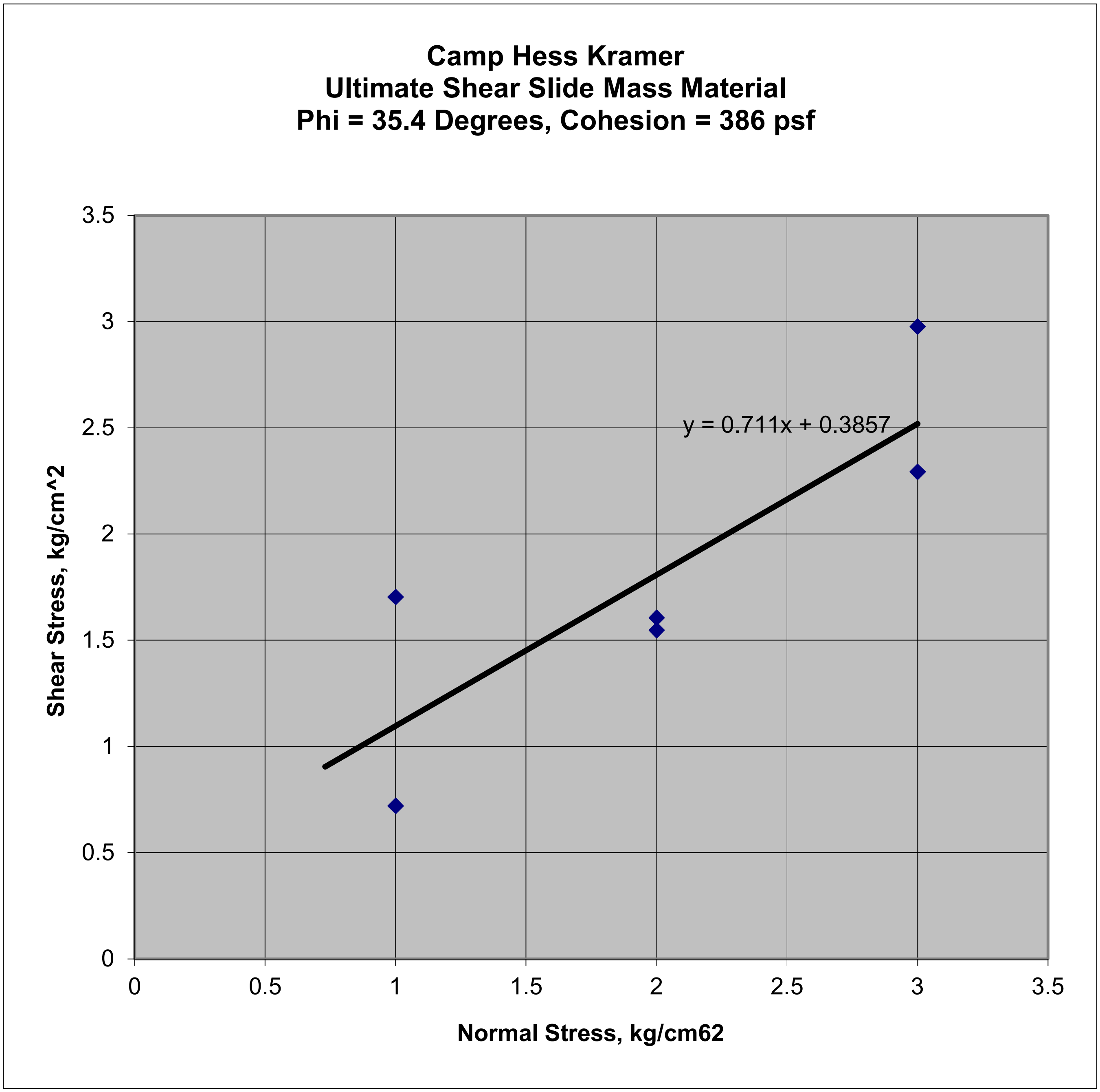
0

Earth Systems

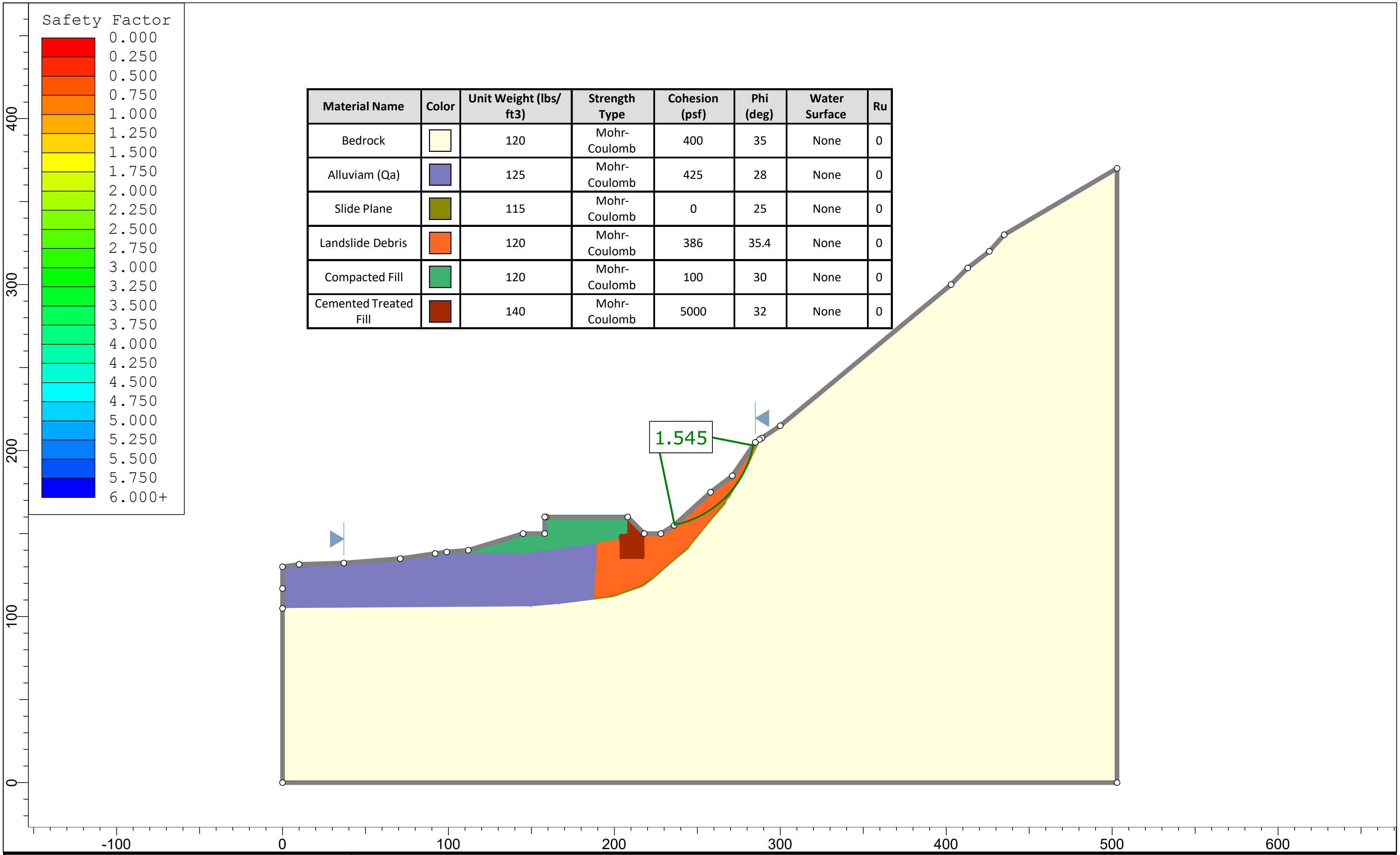
7/2/2020	301529-003



Camp Hess Kramer
Peak Shear Slide Mass Material
Phi = 35.0 Degrees, Cohesion = 524 psf



Camp Hess Kramer
Ultimate Shear Slide Mass Material
Phi = 35.4 Degrees, Cohesion = 386 psf



Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Bedrock	⬜	120	Mohr-Coulomb	400	35	None	0
Alluviam (Qa)	🟪	125	Mohr-Coulomb	425	28	None	0
Slide Plane	🟫	115	Mohr-Coulomb	0	25	None	0
Landslide Debris	🟧	120	Mohr-Coulomb	386	35.4	None	0
Compacted Fill	🟩	120	Mohr-Coulomb	100	30	None	0
Cemented Treated Fill	🟥	140	Mohr-Coulomb	5000	32	None	0

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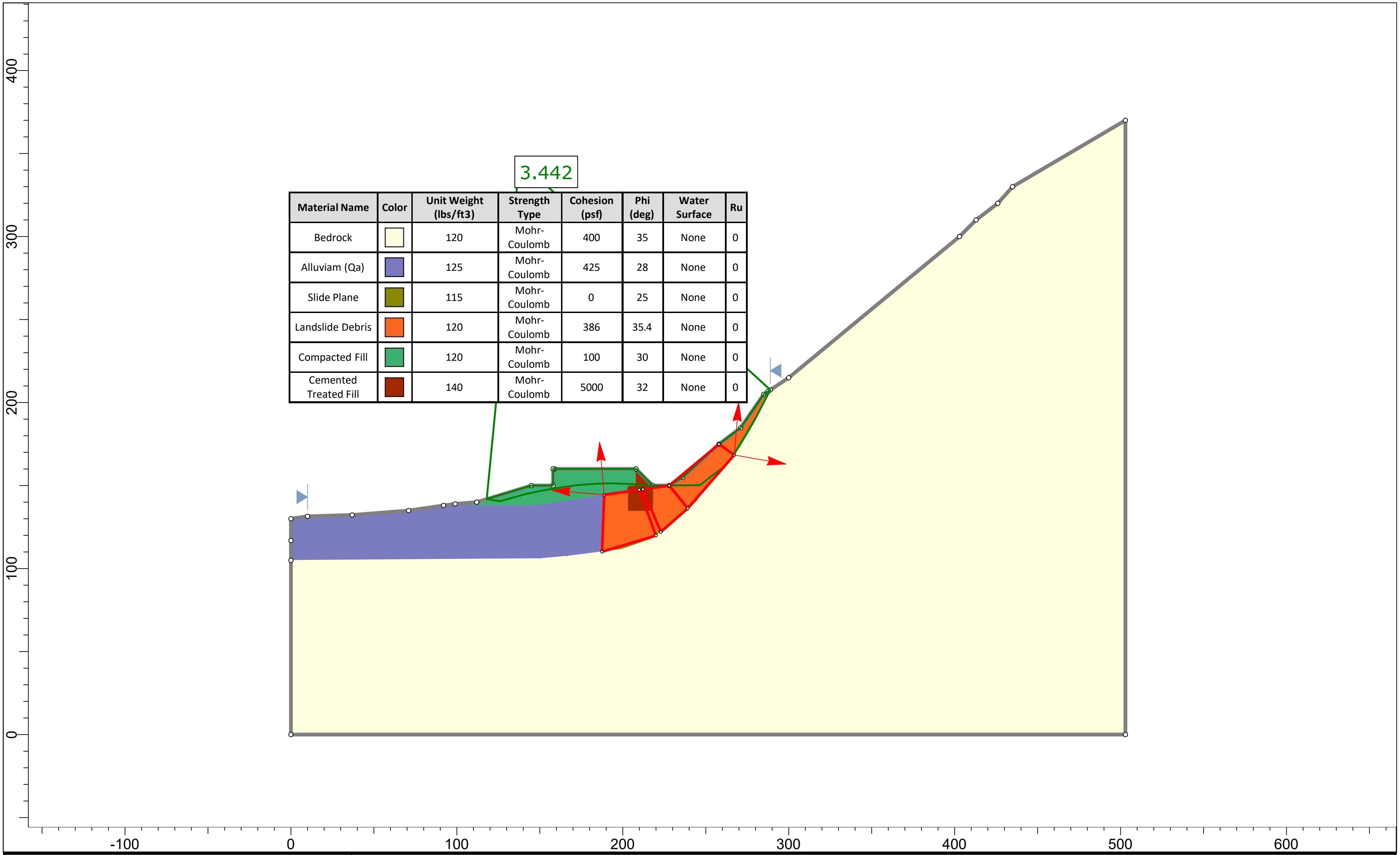
Project Section A-A' - Static, Circular.slmd

Analysis Description Group 1 - Master Scenario

Date 6/29/2020

Scale 1:960

Company Earth Systems Pacific



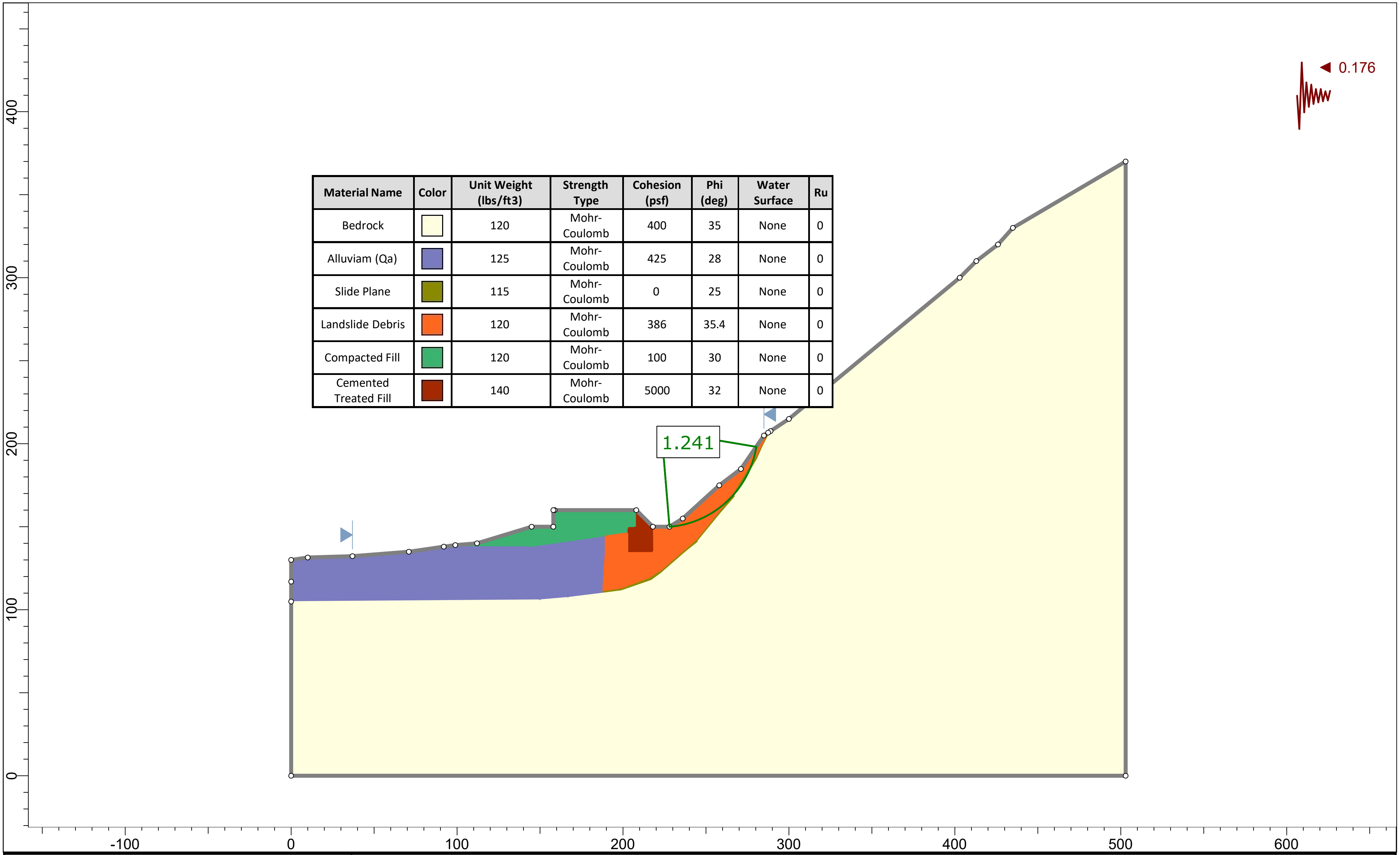
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Bedrock	🟨	120	Mohr-Coulomb	400	35	None	0
Alluviam (Qa)	🟪	125	Mohr-Coulomb	425	28	None	0
Slide Plane	🟫	115	Mohr-Coulomb	0	25	None	0
Landslide Debris	🟧	120	Mohr-Coulomb	386	35.4	None	0
Compacted Fill	🟩	120	Mohr-Coulomb	100	30	None	0
Cemented Treated Fill	🟥	140	Mohr-Coulomb	5000	32	None	0

Project
Section A-A' - Static, Planar.slmd

Analysis Description
Group 1 - Master Scenario

Date 6/29/2020
Scale 1:960
Company Earth Systems Pacific

SLIDEINTERPRET 9.007



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Bedrock	🟨	120	Mohr-Coulomb	400	35	None	0
Alluviam (Qa)	🟪	125	Mohr-Coulomb	425	28	None	0
Slide Plane	🟫	115	Mohr-Coulomb	0	25	None	0
Landslide Debris	🟧	120	Mohr-Coulomb	386	35.4	None	0
Compacted Fill	🟩	120	Mohr-Coulomb	100	30	None	0
Cemented Treated Fill	🟥	140	Mohr-Coulomb	5000	32	None	0

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SLIDEINTERPRET 9.007

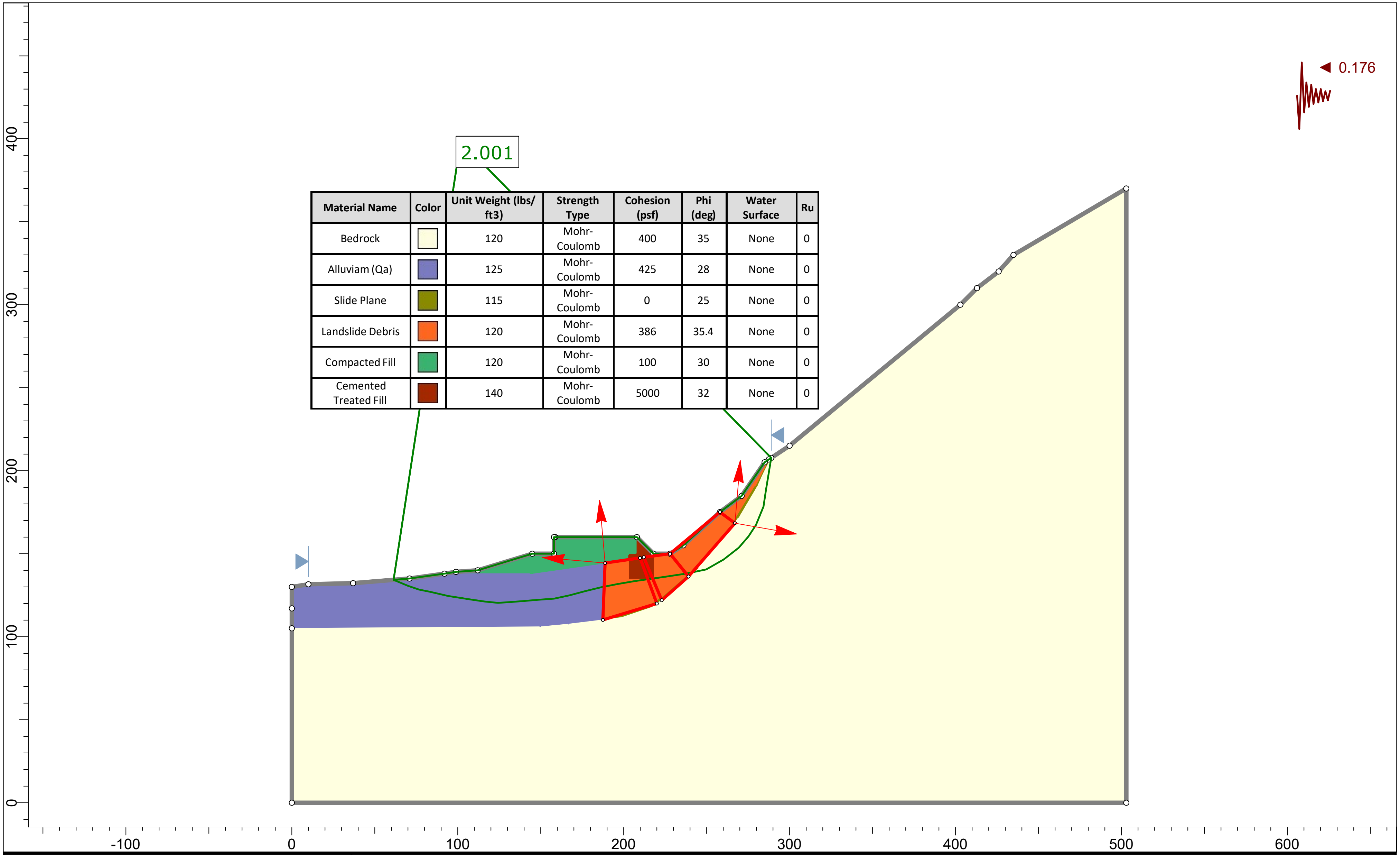
Project Section A-A' - Seismic, Circular.slmd

Analysis Description Group 1 - Master Scenario

Date 6/29/2020

Scale 1:960

Company Earth Systems Pacific



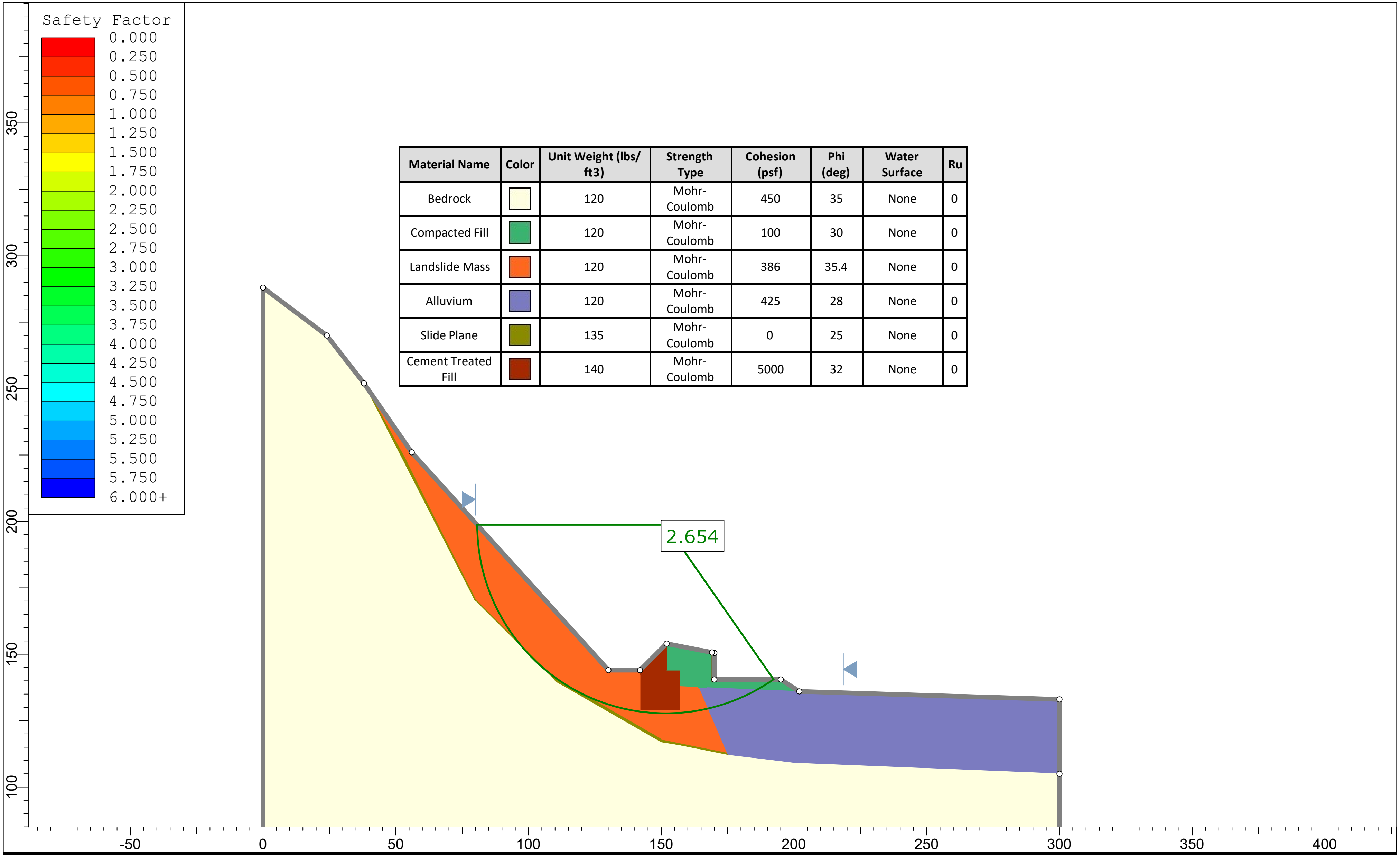
Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Bedrock	🟨	120	Mohr-Coulomb	400	35	None	0
Alluviam (Qa)	🟪	125	Mohr-Coulomb	425	28	None	0
Slide Plane	🟫	115	Mohr-Coulomb	0	25	None	0
Landslide Debris	🟧	120	Mohr-Coulomb	386	35.4	None	0
Compacted Fill	🟩	120	Mohr-Coulomb	100	30	None	0
Cemented Treated Fill	🟥	140	Mohr-Coulomb	5000	32	None	0

Project
Section A-A' - Seismic, Planar.slmd

Analysis Description
Group 1 - Master Scenario

Date 6/29/2020
Scale 1:960
Company Earth Systems Pacific

SLIDEINTERPRET 9.007



Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Bedrock	⬜	120	Mohr-Coulomb	450	35	None	0
Compacted Fill	🟩	120	Mohr-Coulomb	100	30	None	0
Landslide Mass	🟧	120	Mohr-Coulomb	386	35.4	None	0
Alluvium	🟪	120	Mohr-Coulomb	425	28	None	0
Slide Plane	🟫	135	Mohr-Coulomb	0	25	None	0
Cement Treated Fill	🟥	140	Mohr-Coulomb	5000	32	None	0

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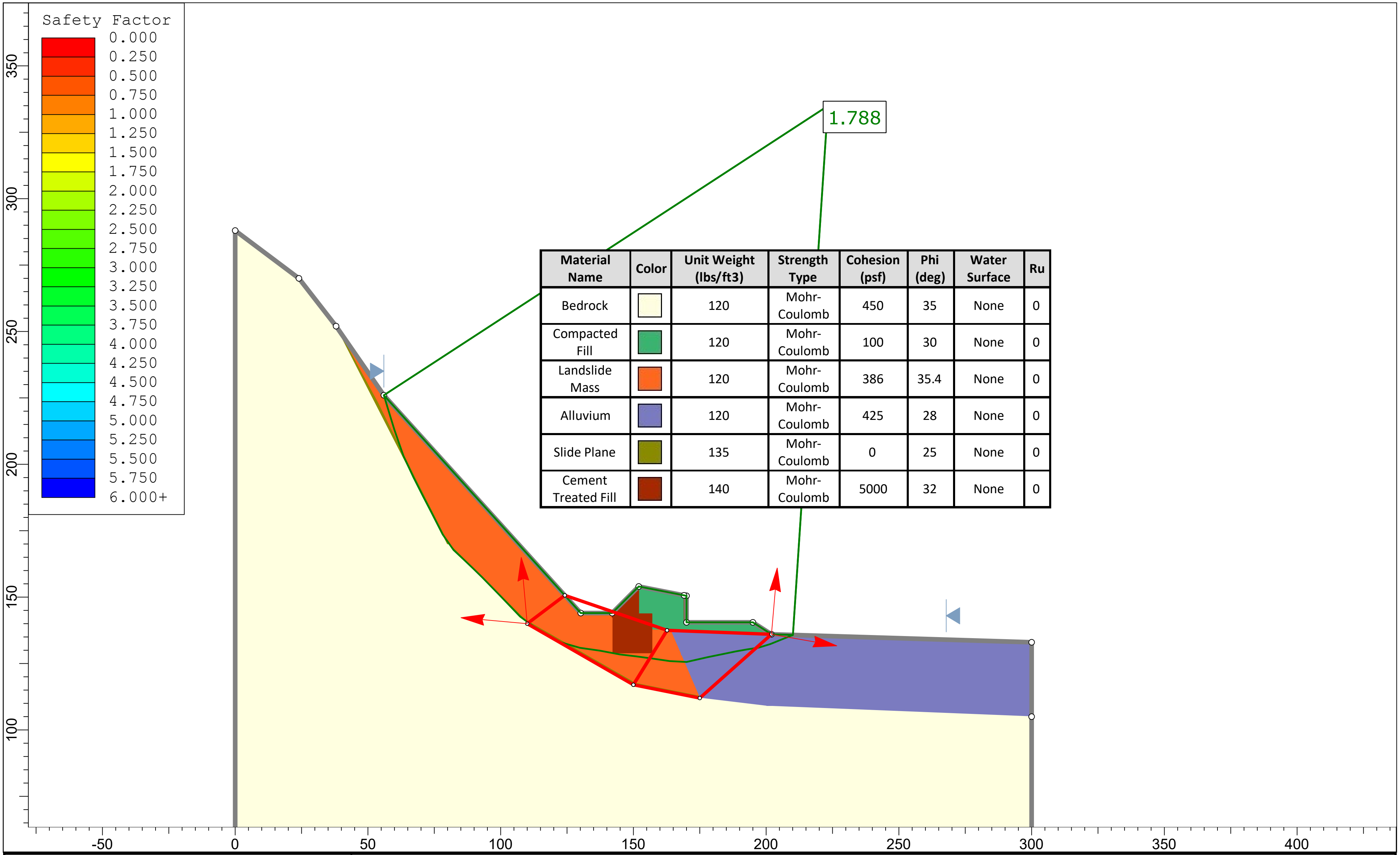
Project
Section B-B' - Static, Circular.slmd

Analysis Description
Group 1 - Master Scenario

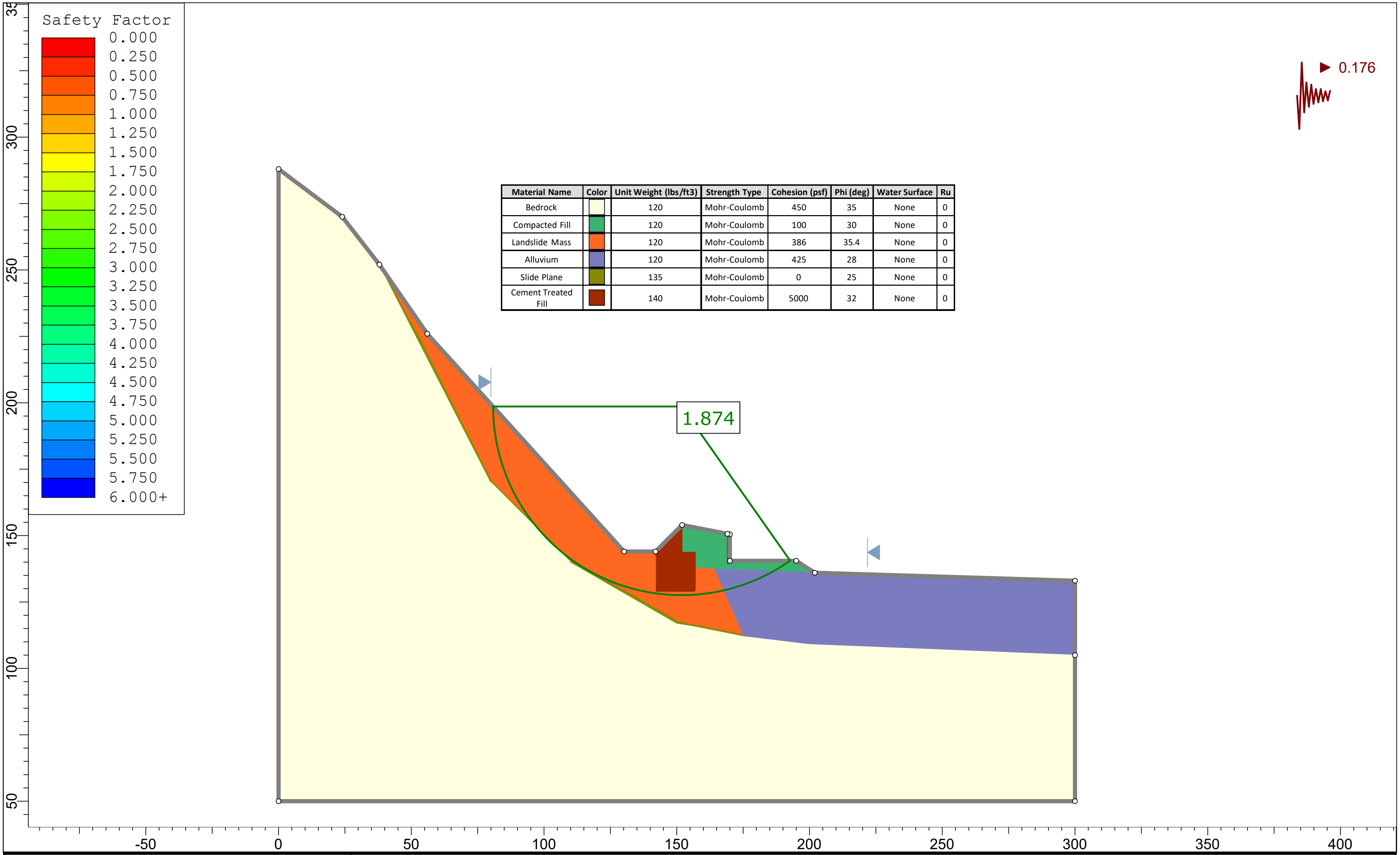
Date 7/1/2020
Scale 1:600
Company Earth Systems Pacific



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Bedrock	⬜	120	Mohr-Coulomb	450	35	None	0
Compacted Fill	🟩	120	Mohr-Coulomb	100	30	None	0
Landslide Mass	🟧	120	Mohr-Coulomb	386	35.4	None	0
Alluvium	🟪	120	Mohr-Coulomb	425	28	None	0
Slide Plane	🟫	135	Mohr-Coulomb	0	25	None	0
Cement Treated Fill	🟥	140	Mohr-Coulomb	5000	32	None	0

Project	Section B-B' - Static, Planar.slmd		
Analysis Description	Group 1 - Master Scenario		
Date 6/29/2020	*Scale* 1:600	*Company*	Earth Systems Pacific

SLIDEINTERPRET 9.007



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Bedrock	⬜	120	Mohr-Coulomb	450	35	None	0
Compacted Fill	🟩	120	Mohr-Coulomb	100	30	None	0
Landslide Mass	🟧	120	Mohr-Coulomb	386	35.4	None	0
Alluvium	🟪	120	Mohr-Coulomb	425	28	None	0
Slide Plane	🟫	135	Mohr-Coulomb	0	25	None	0
Cement Treated Fill	🟥	140	Mohr-Coulomb	5000	32	None	0

Project

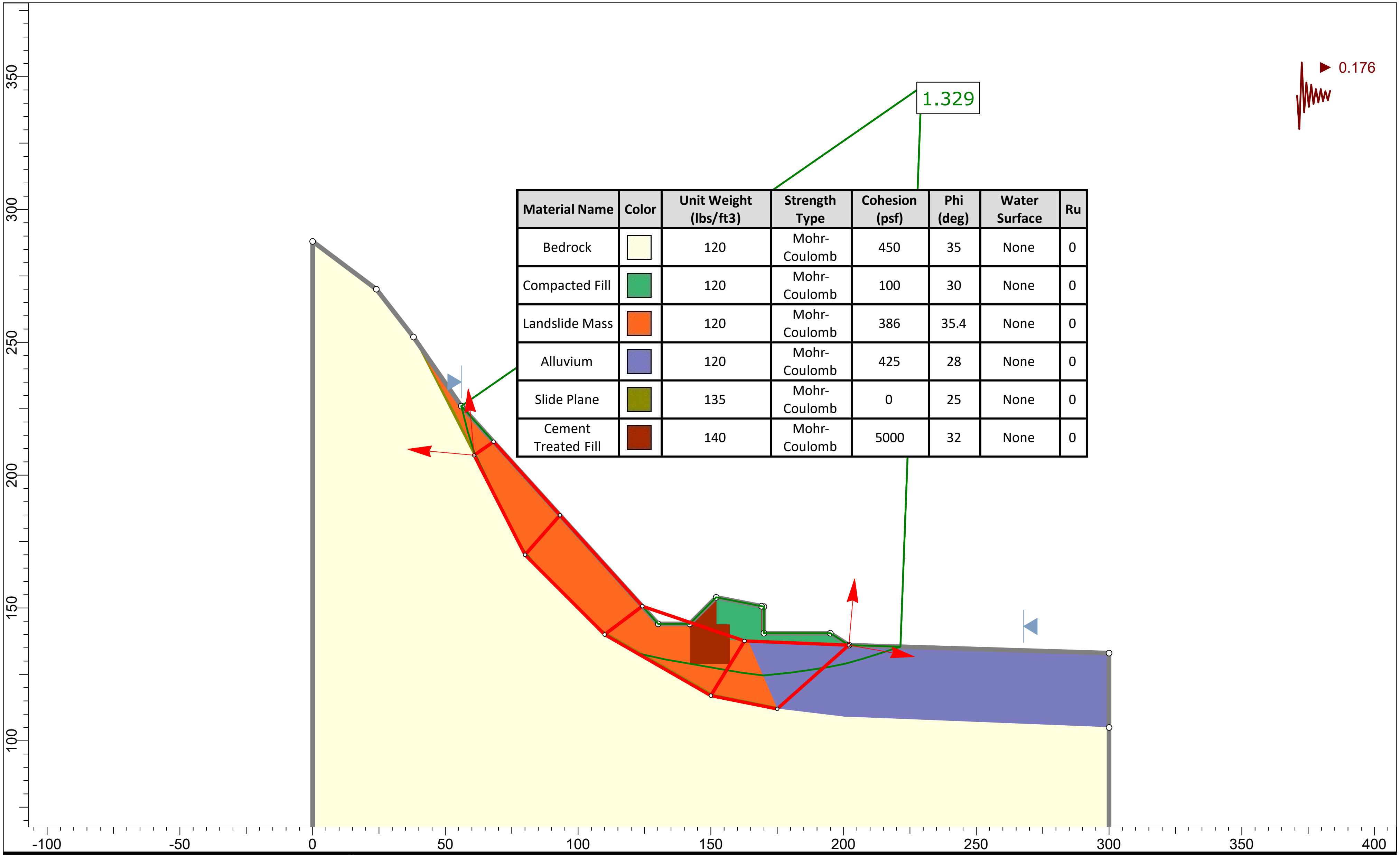
Section B-B' - Seismic, Circular.slmd

Analysis Description

Group 1 - Master Scenario

Date	*Scale*	*Company*
7/1/2020	1:600	Earth Systems Pacific

SLIDEINTERPRET 9.007



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Bedrock	🟨	120	Mohr-Coulomb	450	35	None	0
Compacted Fill	🟩	120	Mohr-Coulomb	100	30	None	0
Landslide Mass	🟧	120	Mohr-Coulomb	386	35.4	None	0
Alluvium	🟪	120	Mohr-Coulomb	425	28	None	0
Slide Plane	🟫	135	Mohr-Coulomb	0	25	None	0
Cement Treated Fill	🟥	140	Mohr-Coulomb	5000	32	None	0

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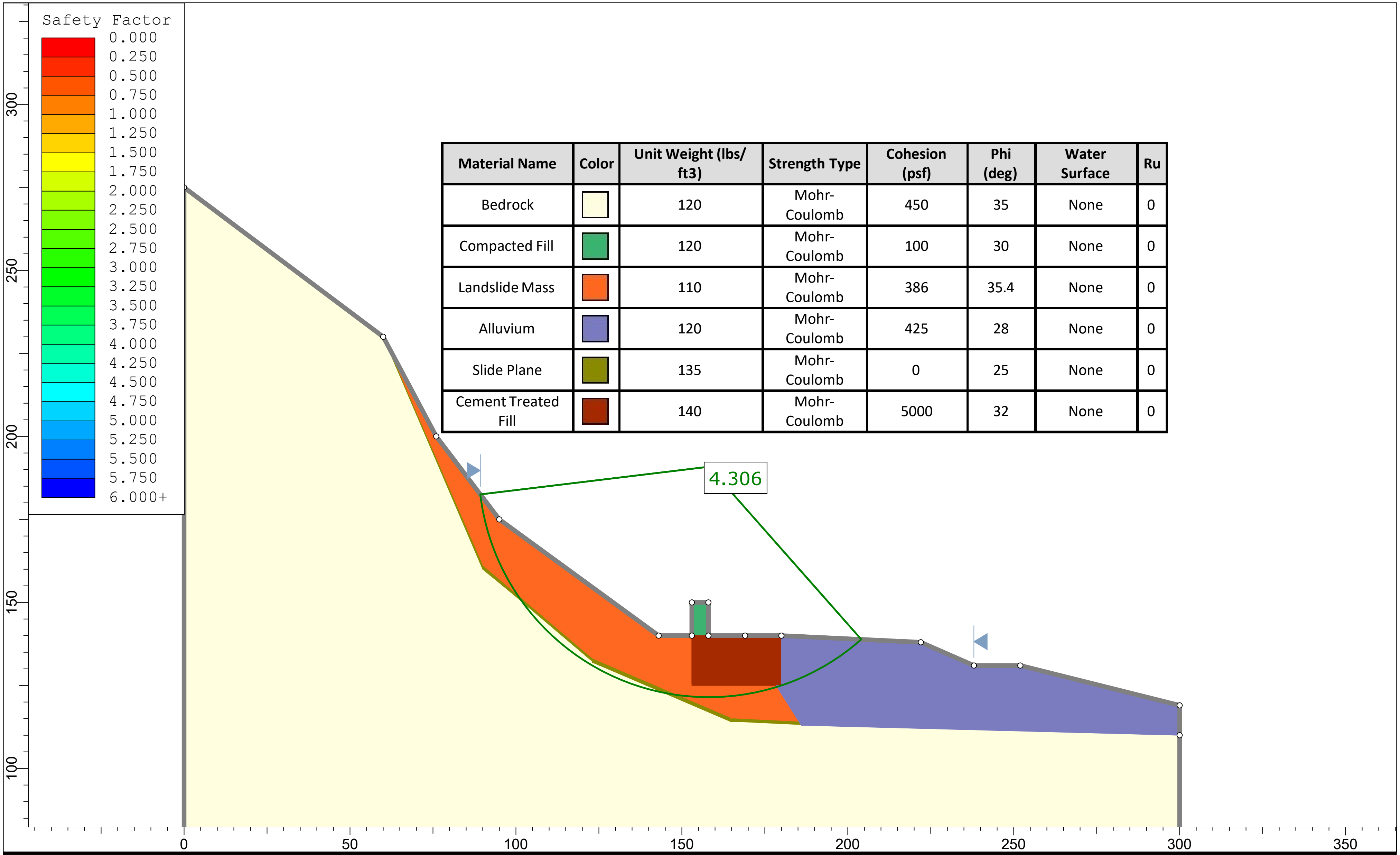
Project
Section B-B' - Seismic, Planar.slmd

Analysis Description
Group 1 - Master Scenario

Date 6/29/2020
Scale 1:600
Company Earth Systems Pacific



Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Bedrock	⬜	120	Mohr-Coulomb	450	35	None	0
Compacted Fill	🟩	120	Mohr-Coulomb	100	30	None	0
Landslide Mass	🟧	110	Mohr-Coulomb	386	35.4	None	0
Alluvium	🟪	120	Mohr-Coulomb	425	28	None	0
Slide Plane	🟫	135	Mohr-Coulomb	0	25	None	0
Cement Treated Fill	🟥	140	Mohr-Coulomb	5000	32	None	0

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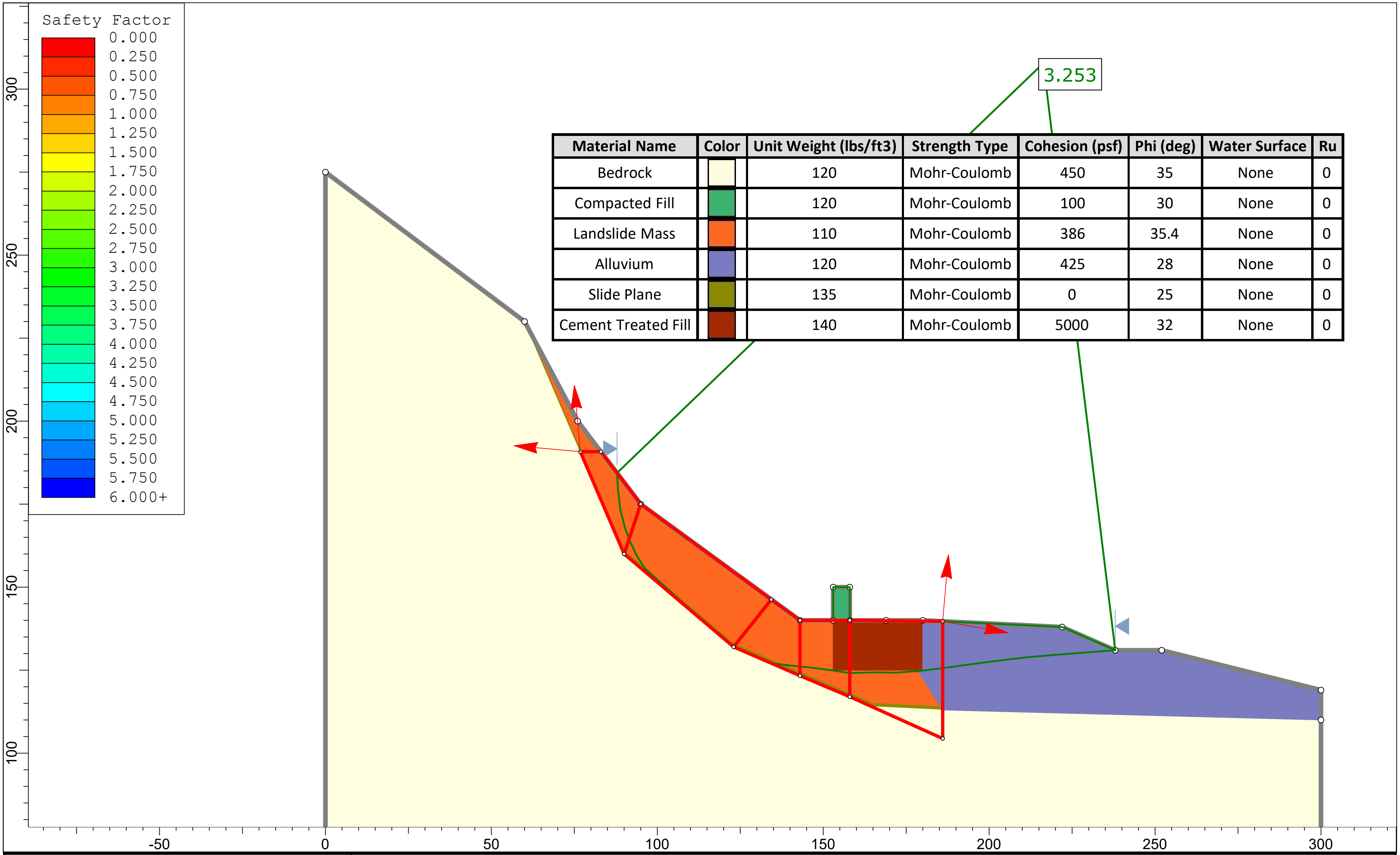
SLIDEINTERPRET 9.007

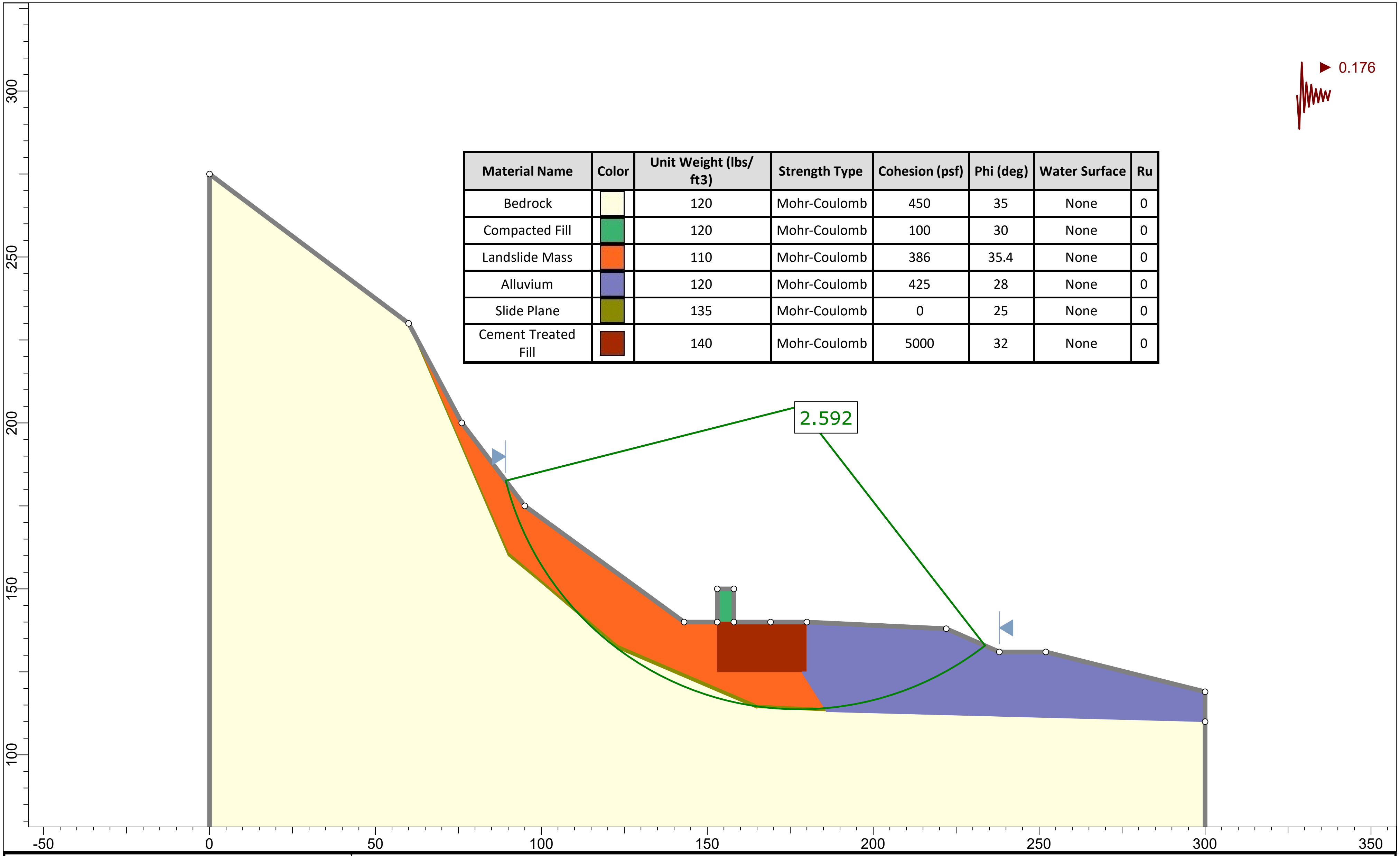
Project	Section C-C' - Static, Circular.slmd
Analysis Description	Group 1 - Master Scenario
Date	7/6/2020
Scale	1:480
Company	Earth Systems Pacific



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Bedrock	⬜	120	Mohr-Coulomb	450	35	None	0
Compacted Fill	🟩	120	Mohr-Coulomb	100	30	None	0
Landslide Mass	🟧	110	Mohr-Coulomb	386	35.4	None	0
Alluvium	🟪	120	Mohr-Coulomb	425	28	None	0
Slide Plane	🟫	135	Mohr-Coulomb	0	25	None	0
Cement Treated Fill	🟥	140	Mohr-Coulomb	5000	32	None	0

Project	Section C-C' - Static, Planar.slmd
Analysis Description	Group 1 - Master Scenario
Date	7/6/2020
Scale	1:480
Company	Earth Systems Pacific

SLIDEINTERPRET 9.007



Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Bedrock	🟨	120	Mohr-Coulomb	450	35	None	0
Compacted Fill	🟩	120	Mohr-Coulomb	100	30	None	0
Landslide Mass	🟧	110	Mohr-Coulomb	386	35.4	None	0
Alluvium	🟪	120	Mohr-Coulomb	425	28	None	0
Slide Plane	🟫	135	Mohr-Coulomb	0	25	None	0
Cement Treated Fill	🟥	140	Mohr-Coulomb	5000	32	None	0

Project

Section C-C' - Seismic, Circular.slmd

Analysis Description

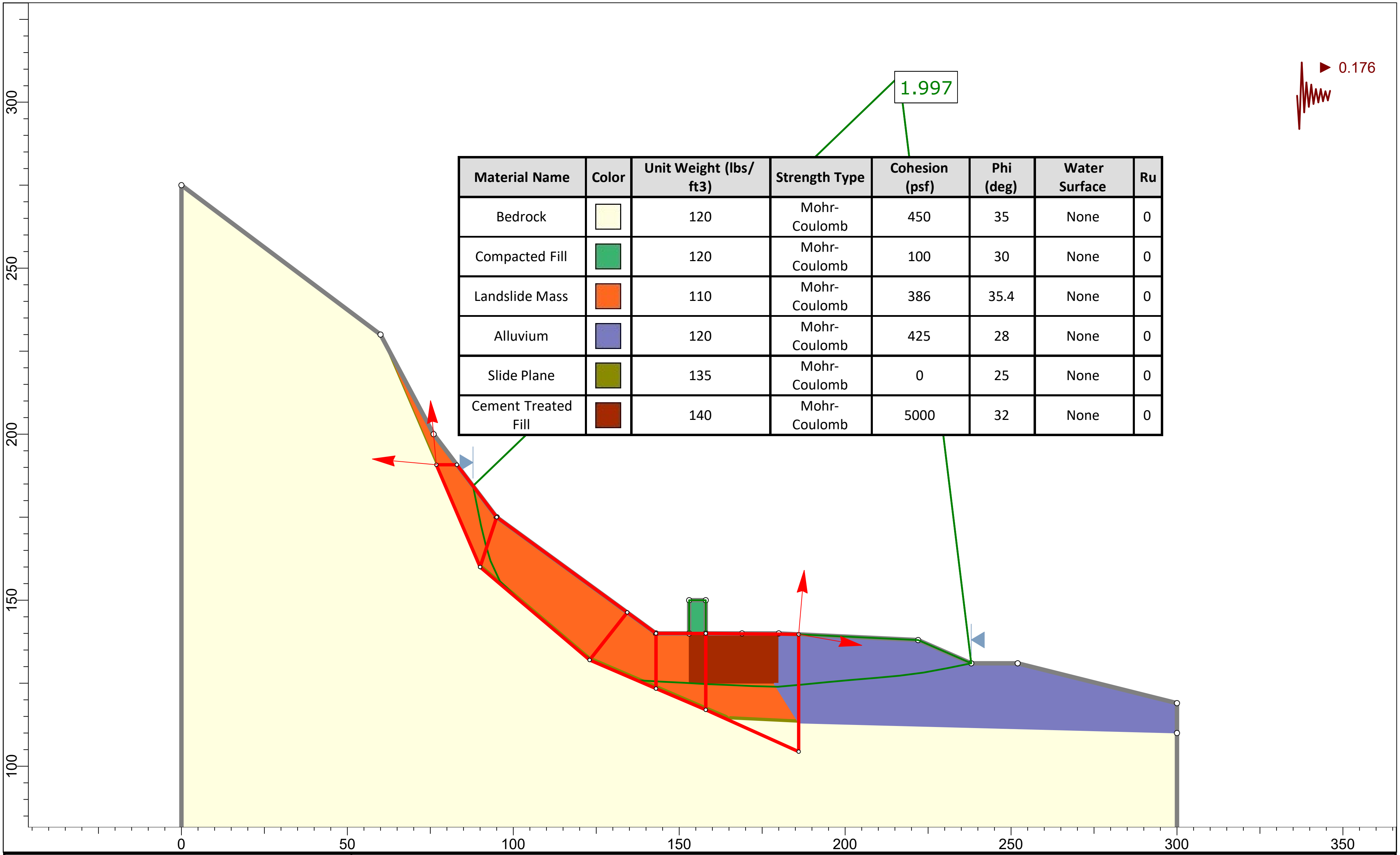
Group 1 - Master Scenario

Date 7/6/2020

Scale 1:480

Company Earth Systems Pacific

SLIDEINTERPRET 9.007



Material Name	Color	Unit Weight (lbs/ ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
Bedrock	🟨	120	Mohr-Coulomb	450	35	None	0
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Landslide Mass	🟧	110	Mohr-Coulomb	386	35.4	None	0
Alluvium	🟦	120	Mohr-Coulomb	425	28	None	0
Slide Plane	🟫	135	Mohr-Coulomb	0	25	None	0
Cement Treated Fill	🟥	140	Mohr-Coulomb	5000	32	None	0

rocscience

SLIDEINTERPRET 9.007

Project	Section C-C' - Seismic, Planar.slmd
Analysis Description	Group 1 - Master Scenario
Date	7/6/2020
Scale	1:480
Company	Earth Systems Pacific

County of Ventura
Case No. PL21-0051
Attachment - Earth Systems
Geotechnical Infiltration Testing Report
dated March 05, 2021

INFILTRATION TESTING REPORT

FOR PROPOSED REBUILDING OF
LOWER AND MIDDLE CAMPS AT
CAMP HESS KRAMER,
11495 PACIFIC COAST HIGHWAY,
MALIBU AREA,
VENTURA COUNTY, CALIFORNIA

PROJECT NO.: 301529-003
MARCH 5, 2021

PREPARED FOR
STANTEC

BY

EARTH SYSTEMS PACIFIC
1731-A WALTER STREET
VENTURA, CALIFORNIA 93003

Earth Systems
1731 Walter Street, Suite A | Ventura, CA 93003 | Ph: 805.642.6727 | www.earthsystems.com

March 5, 2021

Project No.: 301529-003
Report No.: 21-03-12

Attention: Hady Izadpanah
Stantec
111 E. Victoria Street
Santa Barbara, CA 93101-2018
hady.izadpanah@stantec.com

Project: Camp Hess Kramer Lower and Middle Camp Rebuilds
11495 Pacific Coast Highway
Malibu Area
Ventura County, California

As authorized, Earth Systems Pacific (Earth Systems) has prepared this Infiltration Testing Report that summarizes our evaluation of the feasibility for stormwater infiltration at Camp Hess Kramer located at 11495 Pacific Coast Highway in the Malibu area of Ventura County, California. The accompanying Infiltration Testing Report presents the results of our subsurface exploration and infiltration testing. This report completes the scope of services described within our Proposal No. VEN-20-12-008 dated December 10, 2020 and authorized by you on February 8, 2021. We have appreciated the opportunity to be of service to you on this project. Please call if you have any questions, or if we can be of further service.

Respectfully submitted,

3/5/21

EARTH SYSTEMS PACIFIC

Anthony Luna
NO. 9573

Reviewed and Approved

Patrick V Boales

Anthony Luna
Professional Geologist

Patrick V. Boales
Engineering Geologist
3-5-21

Anthony P. Mazzei
Geotechnical Engineer

ANTHONY P. MAZZEI
GE 2823
Exp. 6-30-21

3/5/21

Copies: 1 - Client (email)
1 - Project File

INTRODUCTION

Project Description

This report presents results of infiltration testing performed for proposed stormwater infiltration feasibility evaluation at Camp Hess Kramer at 11495 Pacific Coast Highway in the Malibu area of Ventura County, California. (see Vicinity Map in Appendix A).

Purpose and Scope of Work

The purpose of the geotechnical study was to analyze the soil conditions at the project site and to provide tested infiltration rates. The soil conditions include surface and subsurface soil types and the presence or absence of subsurface water. The scope of work included:

- Drilling and logging 14 borings to study soil and groundwater conditions.
- Performing infiltration testing in all of the boring locations.
- Analyzing the infiltration data obtained.
- Preparing this report.

Site Setting

Camp Hess Kramer occupies approximately 55.9 acres bounded by Pacific Coast Highway on the south, Yerba Buena Road on the east, Gindling Hilltop Camp to the north, and open space to the west. The Assessor Parcel Number of the property is 700-0-070-450. The lower camp and much of the middle camp are located in low lying areas within approximately 100 feet of Little Sycamore Creek and 15 feet above the tops of the creek banks. Exceptions in the lower camp include the existing administration building and the camp staff housing building, which are both further from the creek and at higher relative elevations. Exceptions in the middle camp are generally within the northern half, and are further from the creek than 100 feet and at relative elevations greater than 15 feet above the tops of the creek banks.

Most of the areas within the camp that supported structures were located near the toes of relatively steep ascending natural slopes. Slope heights are generally greater than 100 feet above the lower camp area and greater than 200 feet above the middle camp area. Gradients generally range above both camps from about 1:1 (horizontal to vertical) to 2.5:1.

Evaluation of the subsurface indicates that the project site is underlain mostly by native alluvial soils that generally consist of silty and gravelly sands. Artificial fill soils were also encountered at infiltration test locations IT-1, IT-2, and IT-5 through IT-8. These fill soils consist of clayey, silty, and gravelly sands. Groundwater was not encountered in any of our on-site borings to a maximum depth of about 14 feet below the existing ground surface. It should be noted that fluctuations in groundwater levels may occur because of variations in rainfall, regional climate, and other factors.

INFILTRATION TESTING

On February 22, 2021 twelve (IT-3 through IT-14) approximately 8-inch diameter infiltration borings and two 4 inch diameter hand auger borings (IT-1 and IT-2) were excavated to depths of about 3 and fourteen feet below the existing site grades to determine the soil profile and allow installation of plastic casing for infiltration testing (see Site Plan in Appendix A for infiltration boring locations).

After drilling was completed, 3-inch diameter slotted PVC casings were lowered into the boreholes. The annuli between the casings and boring walls were then filled with pea gravel. The falling-head borehole infiltration test procedure was used for infiltration testing. About 24 inches of water was added to the bottom of the holes to start the tests, and the drop in the water surface monitored by taking periodic measurements. Readings were taken at reasonable time intervals based on the infiltrating rate, and after each of these intervals, water was added to return the water level to its approximate original depth above the hole bottom. The tests were run until the infiltration rates were reasonably stable.

It should be noted that the rate the water surface drops in a borehole is a percolation rate, which is related to, but is not an infiltration rate. Percolation rate ignores the wetted soil surface area into which the water is infiltrating and does not account for the volume of water infiltrated. An infiltration rate considers both factors. Hence, percolation rates (in unit length per unit time) are an overestimation of infiltration rates (also in unit length per unit time). Earth Systems uses the Porchet equation to account for the wetted surface area and volume of water infiltrated to estimate an infiltration rate. Forms of the equation can be found in the Riverside County - Low Impact Development BMP Design Handbook (2001), the South Orange County Version, Technical Guidance Documents Appendices (2017), or in a paper by J.W. Van Hoorn, “Determining Hydraulic Conductivity with the Inversed Auger Hole and Infiltrometer Methods.” The Porchet equation in its most simple form is the volume of water infiltrated divided by the product of the change in time and the wetted surface area. By substitution, the equation can be shown to be equal to:

$$\text{Infiltration Rate (inches /hr.)} = \frac{\Delta H * r * 60}{\Delta t * (r + 2H_{avg})}$$

where: ΔH = Change in water level (inches)
Δt = Change in time (minutes)
r = Radius of test hole (inches)
H_{avg} = Average height of water in test hole (inches)

The above equation does not account for the gravel pack in the annulus between the borehole wall and the slotted pipe fitted in the test hole. Ignoring the gravel pack inflates the amount of water infiltrated and, hence, yields an unconservative infiltration rate. A method to account for the volume occupied by the gravel (and the slotted pipe) and adjust the infiltration rate accordingly is presented in Caltrans Test 750. Earth Systems makes this additional adjustment to our test data. The equation is:

$$\text{Correction Factor} = n * [\ 1 - (O/D)^2] + (I/D)^2$$

Where: n = Pea gravel porosity
O = Outside diameter of slotted pipe (inches)
D = Test hole diameter (inches)
I = Inside diameter of slotted pipe (inches)

Earth Systems has determined an average porosity for the pea gravel used in our testing. The other values are simple measurements.

Based on the infiltration testing results in Appendix B, the slowest measured test infiltration rates for the depths tested and boring locations are summarized in the following table:

Boring	Boring Depth (feet)	Infiltration Rate (inch/hour)
IT-1	2.9	0.21

IT-2	5.1	0.27
IT-3	3.0	1.67
IT-4	13.9	1.94
IT-5	3.0	0.05
IT-6	13.8	0.23
IT-7	3.0	1.13
IT-8	13.6	1.55
IT-9	3.1	0.31
IT-10	13.9	0.76
IT-11	3.1	18.09
IT-12	14.1	0.36
IT-13	3.2	1.13
IT-14	14.2	2.17

There are many factors that influence the infiltration rate. Clear water was used in our tests, whereas deleterious material will likely be contained in the storm water. Variations in soil conditions within the limits of the proposed infiltration system will likely affect infiltration characteristics. The designer who utilizes the infiltration results should consider these factors, as well as apply a factor-of-safety to the infiltration rate to account for future disposal bed siltation.

APPENDIX A

*Taken from USGS Topo Map, Triunfo Pass Quadrangle, California, 2018.

Approximate Scale: 1" = 2,000’

0 2,000’ 4,000’

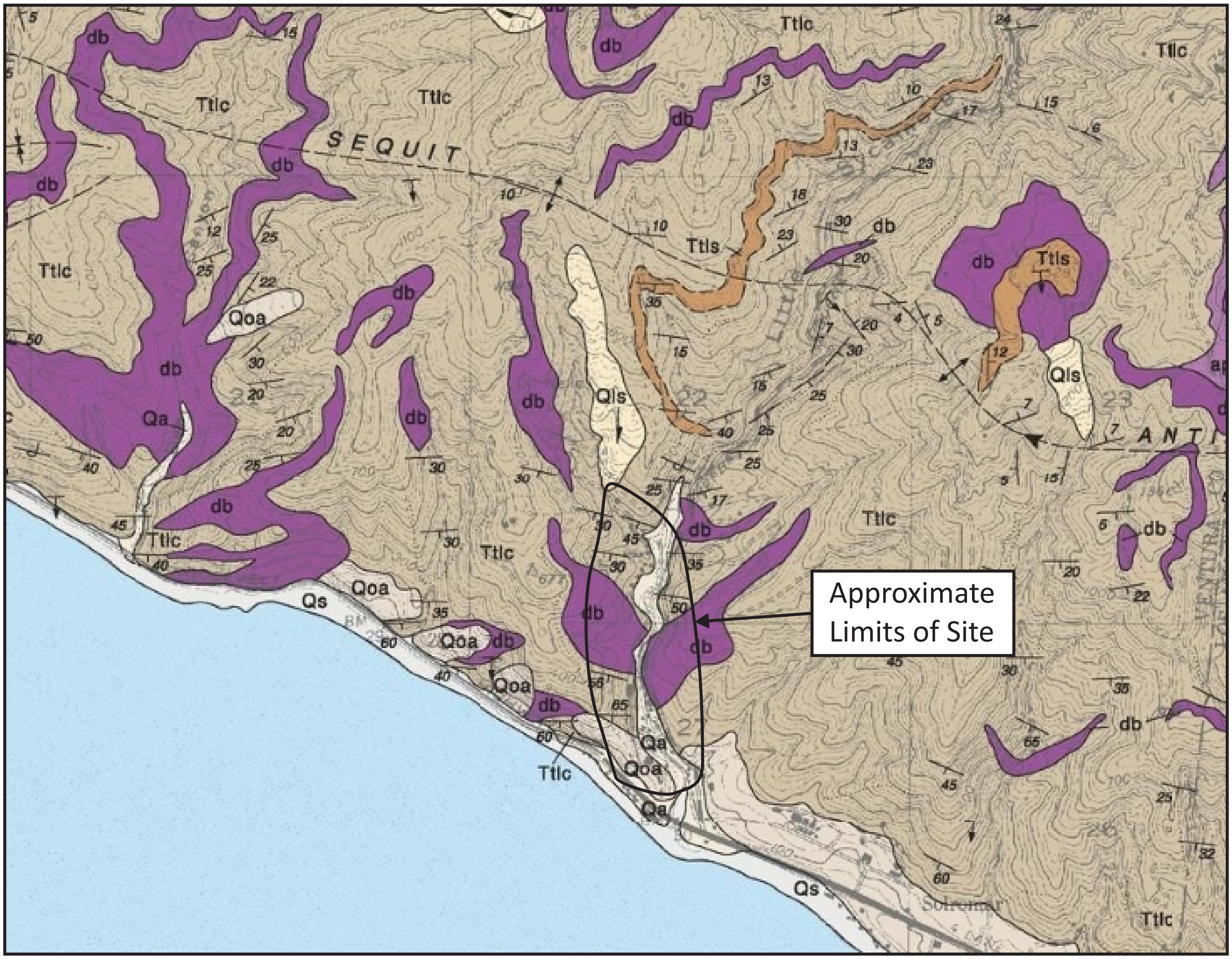
N

VICINITY MAP

Camp Hess Kramer
Ventura County, CA

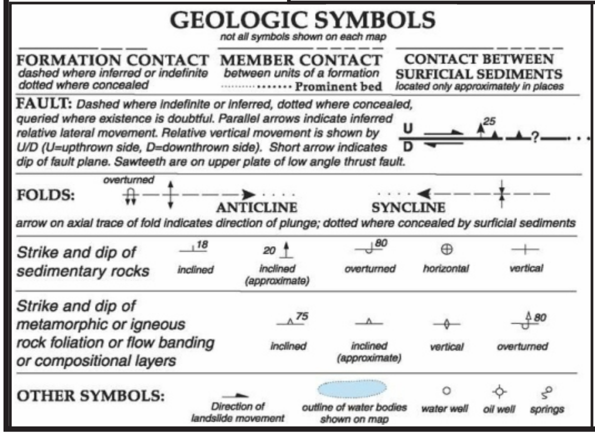
Earth Systems

March 2021 | 301529-003



*Taken from Dibblee, Jr., Geologic Map of The Triunfo Pass Quadrangle, Ventura County, California, 1990, DF-29.

di ai bi api db	**db** *Diabase: dark gray to dark olive-brown, fine to coarse grained diabase or ophitic basalt; composed of lathy (elongated) plagioclase feldspar and ferromagnesian minerals, mostly augite and olivine; forms many lenticular sills and several basaltic feeder dikes (shown as bi) in lower Topanga Formation; in places complexly injected or sheared along margins; somewhat incoherent where weathered*
Ttlc Ttls Ttlcv Ttlsv	**Ttlc** *Dark to light gray, thin-bedded micaceous clay shale; includes a few thin strata of tan, hard, semi-siliceous shale and others of sandstone*
Qs Qg Qds Qf Qa Qc	**Qa** *Alluvium: gravel, sand and clay of flatlands*
Qoa	**Qoa** *Dissected, weakly indurated alluvial gravel, sand and silt*



Approximate Scale: 1" = 2,000’

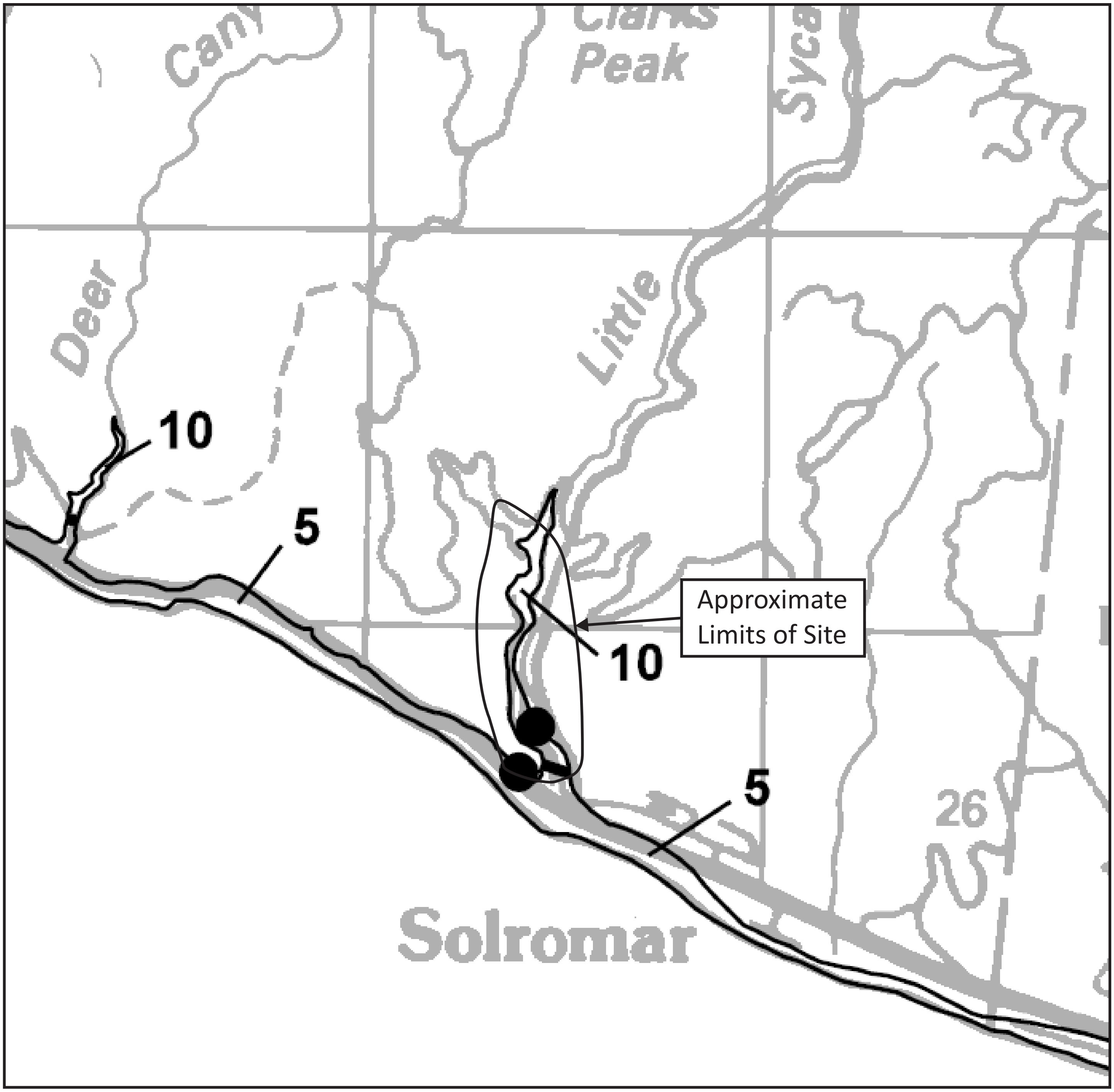
N

REGIONAL GEOLOGIC MAP

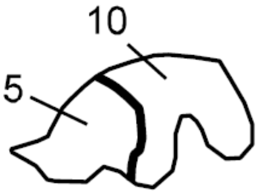
Camp Hess Kramer
Ventura County, California

Earth Systems

March 2021 | 301529-003



*Taken from CGS, Seismic Hazard Zone Report For The Triunfo Pass 7.5-Minute Quadrangle, Los Angeles & Ventura Counties, California, 2002.



Alluviated valley and zones of estimated historically highest ground-water depth (in feet)
B = Pre-Quaternary bedrock

● Borehole Site

Approximate Scale: 1" = 2,000’

0 2,000’ 4,000’

N

HISTORICAL HIGH GROUNDWATER MAP

Camp Hess Kramer
Ventura County, CA

Earth Systems

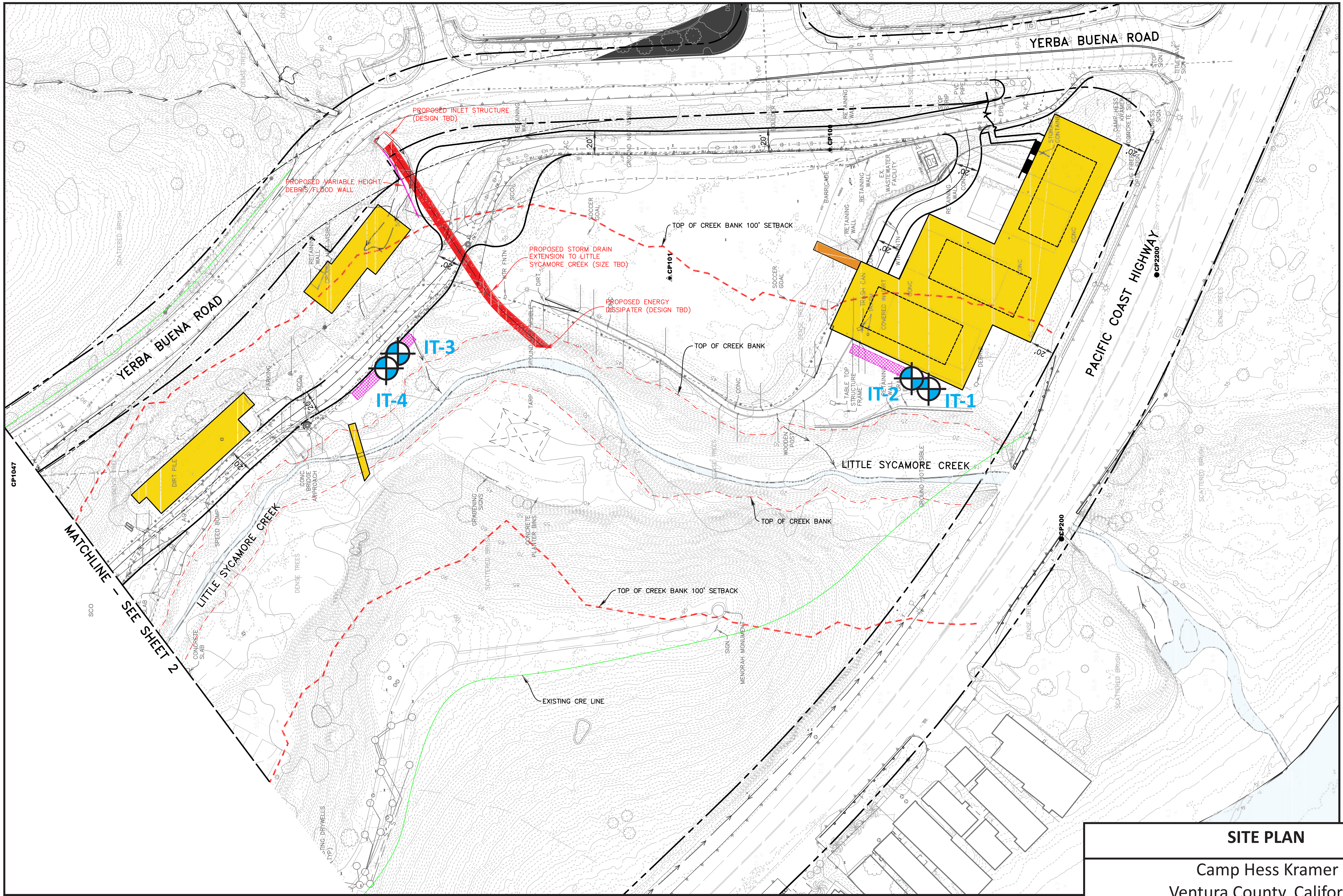
March 2021	301529-003

FIELD STUDY

A. Fourteen borings (IT-1 through IT-14) were drilled to depths of 3 and 14 feet below the existing ground surface to observe the soil profile and to perform infiltration testing. The borings were excavated on February 22, 2021, using hand tools and a CME-75 truck mounted drill rig. The approximate boring locations were determined in the field by pacing and sighting and are shown on the Site Plan in this Appendix.

B. On February 23 through February 25, 2021 infiltration testing was performed at each boring location.

C. The final boring logs represent interpretations of the field logs during the subsurface study. The final logs are included in this Appendix.



Approximate Scale: 1" = 80'

0 80' 160'

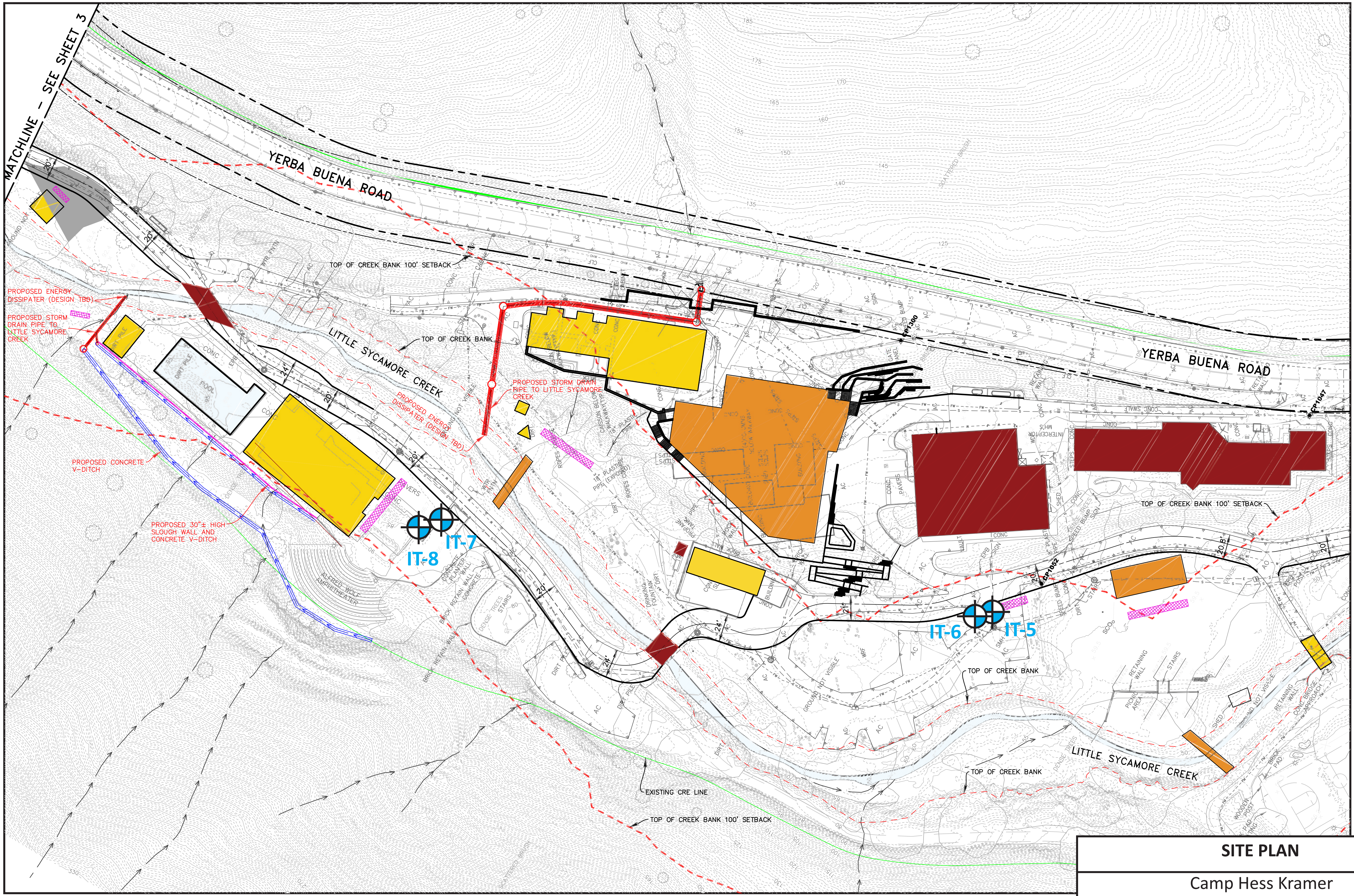
IT-1 ⊕ : Infiltration tests locations

SITE PLAN

Camp Hess Kramer
Ventura County, California

Earth Systems

March 2021	301529-003



Approximate Scale: 1" = 80'

0 80' 160'

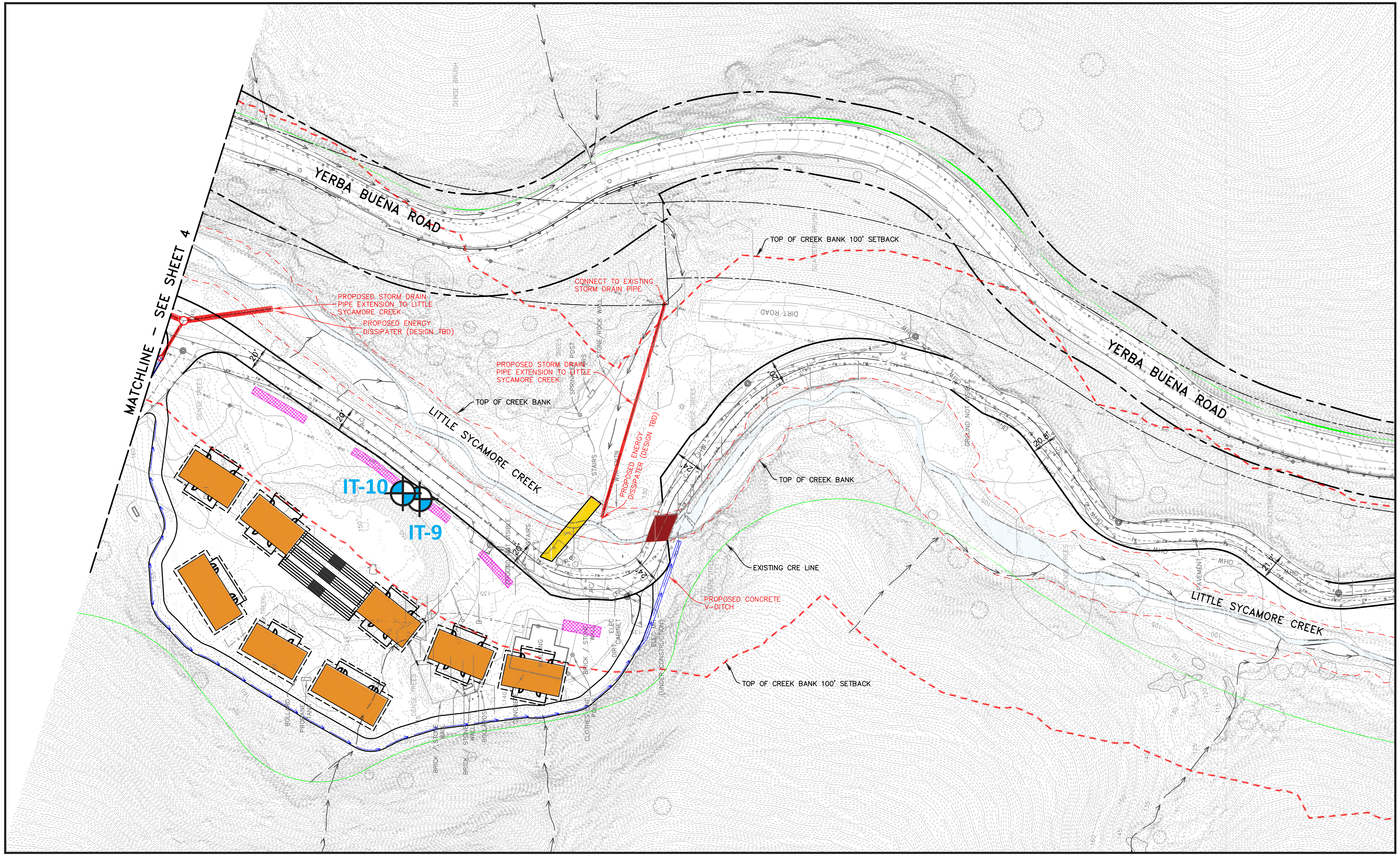
IT-5 ⊕ : Infiltration test locations

SITE PLAN

Camp Hess Kramer
Ventura County, California

Earth Systems

March 2021	301529-003



Approximate Scale: 1" = 80'

0 80' 160'

IT-9 ⊕ : Infiltration test locations

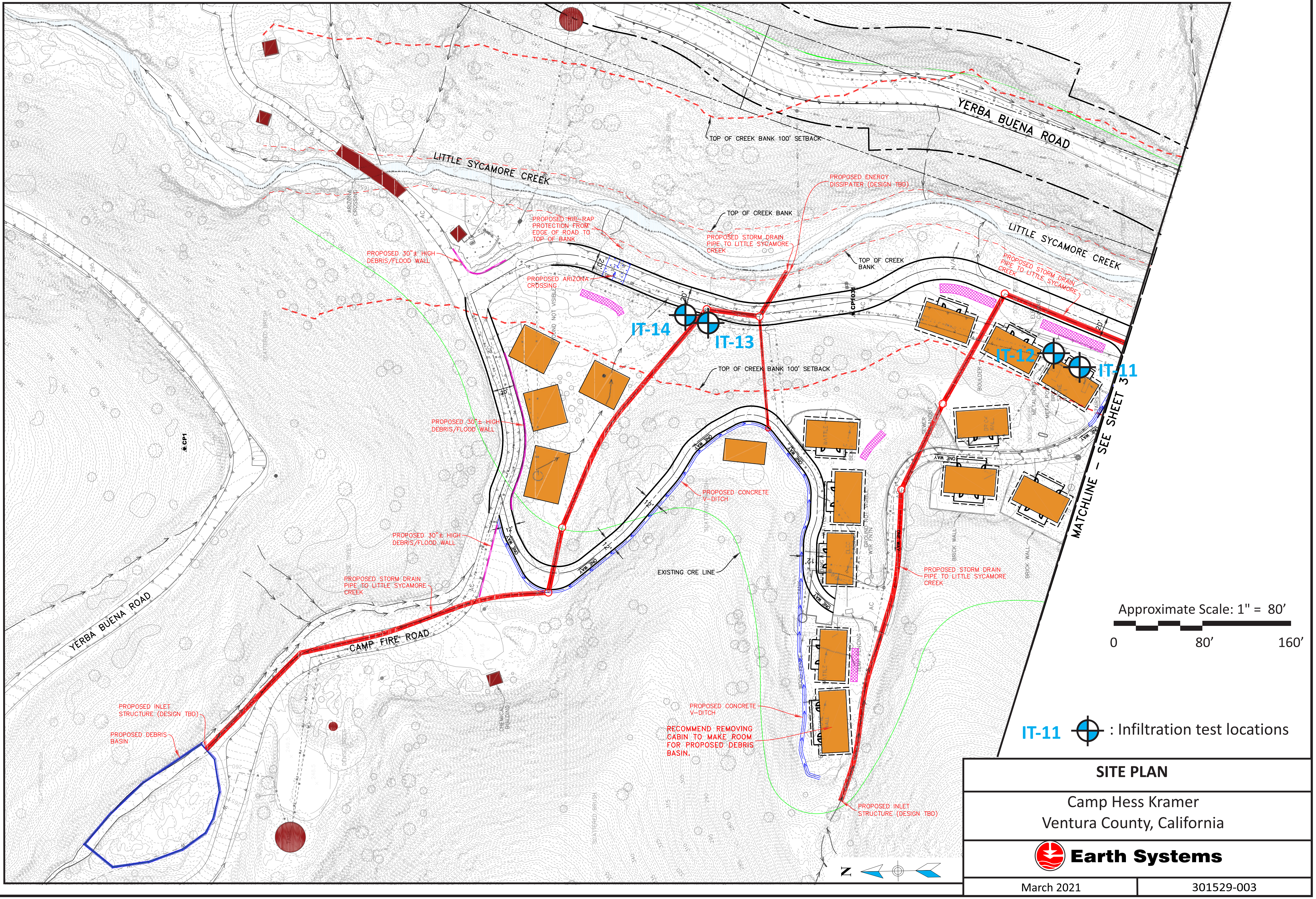
N

SITE PLAN

Camp Hess Kramer
Ventura County, California

Earth Systems

March 2021 | 301529-003



Approximate Scale: 1" = 80'

0 80' 160'

IT-11 ⌖ : Infiltration test locations

SITE PLAN

Camp Hess Kramer
Ventura County, California

Earth Systems

March 2021	301529-003

Earth Systems

1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: IT-1	DRILLING DATE: February 22, 2021
PROJECT NAME: Camp Hess Kramer Rebuild	DRILL RIG: CME-75
PROJECT NUMBER: 301529-003	DRILLING METHOD: Hollow-Stem Auger
BORING LOCATION: Per Plan	LOGGED BY: AL

Vertical Depth	Sample Type			PENETRATION RESISTANCE (BLOWS/6"	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	DESCRIPTION OF UNITS
	Bulk	SPT	Mod. Calif.						
0					▨	SC			**ALLUVIUM:** Dark Gray Brown Clayey fine to coarse Sand, little fine to coarse Gravel, medium dense, damp
					▥	SM			**ALLUVIUM:** Brown Silty fine to coarse Sand, little Clay, trace fine to coarse Gravel, medium dense to dense, damp
									Total Depth: 3.0 feet **No Groundwater Encountered**
5									
10									
15									
20									
25									
30									
35									

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

Earth Systems
1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: IT-2	DRILLING DATE: February 22, 2021
PROJECT NAME: Camp Hess Kramer Rebuild	DRILL RIG: CME-75
PROJECT NUMBER: 301529-003	DRILLING METHOD: Hollow-Stem Auger
BORING LOCATION: Per Plan	LOGGED BY: AL

Vertical Depth	Sample Type			PENETRATION RESISTANCE (BLOWS/6"	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	DESCRIPTION OF UNITS
	Bulk	SPT	Mod. Calif.						
0					▨	SC			**ARTIFICIAL FILL:** Dark Gray Brown Clayey fine to coarse Sand, little fine to coarse Gravel, glass fragments, medium dense, damp
5					▥	SM			**ALLUVIUM:** Brown Silty fine to coarse Sand, trace fine to coarse Gravel, medium dense to dense, damp
10 15 20 25 30 35									**Total Depth: 5.5 feet** **No Groundwater Encountered**

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

Earth Systems

1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: IT-3	DRILLING DATE: February 22, 2021
PROJECT NAME: Camp Hess Kramer Rebuild	DRILL RIG: CME-75
PROJECT NUMBER: 301529-003	DRILLING METHOD: Hollow-Stem Auger
BORING LOCATION: Per Plan	LOGGED BY: AL

Vertical Depth	Sample Type			PENETRATION RESISTANCE (BLOWS/6"	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	**DESCRIPTION OF UNITS**
	Bulk	SPT	Mod. Calif.						
0					▒	SM			**ALLUVIUM:** Brown Silty fine to coarse Sand, some fine to coarse Gravel, loose to medium dense, damp
									Total Depth: 3.0 feet **No Groundwater Encountered**
5									
10									
15									
20									
25									
30									
35									

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

Earth Systems

1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: IT-4
PROJECT NAME: Camp Hess Kramer Rebuild
PROJECT NUMBER: 301529-003
BORING LOCATION: Per Plan

DRILLING DATE: February 22, 2021
DRILL RIG: CME-75
DRILLING METHOD: Hollow-Stem Auger
LOGGED BY: AL

Vertical Depth	Sample Type Bulk	 SPT	 Mod. Calif.	PENETRATION RESISTANCE (BLOWS/6"	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	DESCRIPTION OF UNITS
0 5						SM			**ALLUVIUM:** Brown Silty fine to coarse Sand, some fine to coarse Gravel, loose to medium dense, damp
10						SW			**ALLUVIUM:** Brown to Gray Brown Gravelly fine to coarse Sand, some Silt, occasional Cobbles, medium dense to dense, dry to damp
						SM			**ALLUVIUM:** Brown Silty fine to coarse Sand, some fine to coarse Gravel, little Clay, dense, damp
15 20 25 30 35									**Total Depth: 14.0 feet** **No Groundwater Encountered**

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

Earth Systems

1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: IT-5	DRILLING DATE: February 22, 2021
PROJECT NAME: Camp Hess Kramer Rebuild	DRILL RIG: CME-75
PROJECT NUMBER: 301529-003	DRILLING METHOD: Hollow-Stem Auger
BORING LOCATION: Per Plan	LOGGED BY: AL

Vertical Depth	Sample Type			PENETRATION RESISTANCE (BLOWS/6"	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	DESCRIPTION OF UNITS
	Bulk	SPT	Mod. Calif.						
0					▩	GW			**ALLUVIUM:** Dark Brown fine to coarse Sandy Gravel, little to some Silt, medium dense to dense, damp
					▒	SM			**ALLUVIUM:** Light Brown Silty fine to coarse Sand, some fine to coarse Gravel, little Clay, medium dense, dry to damp
									Total Depth: 3.0 feet **No Groundwater Encountered**
5									
10									
15									
20									
25									
30									
35									

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

Earth Systems

1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: IT-6	DRILLING DATE: February 22, 2021
PROJECT NAME: Camp Hess Kramer Rebuild	DRILL RIG: CME-75
PROJECT NUMBER: 301529-003	DRILLING METHOD: Hollow-Stem Auger
BORING LOCATION: Per Plan	LOGGED BY: AL

Vertical Depth	Sample Type			PENETRATION RESISTANCE (BLOWS/6"	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	DESCRIPTION OF UNITS
	Bulk	SPT	Mod. Calif.						
0					▩	GW			**ARTIFICIAL FILL:** Dark Brown to Gray Brown fine to coarse Sandy Gravel, some Silt, little Clay, dense, dry to damp
5 10					░	SW			**ALLUVIUM:** Brown Gravelly fine to coarse Sand, some Silt, dense, dry to damp
					▥	SM			**ALLUVIUM:** Dark Brown Silty fine to coarse Sand, some fine Gravel, little Clay, medium dense, damp
15 20 25 30 35									**Total Depth: 14.0 feet** **No Groundwater Encountered**

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

Earth Systems

1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: IT-7	DRILLING DATE: February 22, 2021
PROJECT NAME: Camp Hess Kramer Rebuild	DRILL RIG: CME-75
PROJECT NUMBER: 301529-003	DRILLING METHOD: Hollow-Stem Auger
BORING LOCATION: Per Plan	LOGGED BY: AL

Vertical Depth	Sample Type			PENETRATION RESISTANCE (BLOWS/6")	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	DESCRIPTION OF UNITS
	Bulk	SPT	Mod. Calif.						
0					░	SM			**ARTIFICIAL FILL:** Brown Silty fine to coarse Sand, little fine to coarse Gravel, medium dense, damp
					░	SM			**ALLUVIUM:** Brown to Light Brown Silty fine to coarse Sand, little fine to coarse Gravel, medium dense to dense, dry to damp
5									**Total Depth: 3.0 feet** **No Groundwater Encountered**
10									
15									
20									
25									
30									
35									

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

Earth Systems
1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: IT-8	DRILLING DATE: February 22, 2021
PROJECT NAME: Camp Hess Kramer Rebuild	DRILL RIG: CME-75
PROJECT NUMBER: 301529-003	DRILLING METHOD: Hollow-Stem Auger
BORING LOCATION: Per Plan	LOGGED BY: AL

Vertical Depth	Sample Type Bulk	 SPT	 Mod. Calif.	PENETRATION RESISTANCE (BLOWS/6")	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	**DESCRIPTION OF UNITS**
0					░	SW			**ARTIFICIAL FILL:** Dark Brown Gravelly fine to coarse Sand, loose to medium dense, damp
5					▓	GW			**ALLUVIUM:** Brown to Light Brown fine to coarse Gravel, dense, dry to damp
10									
15									**Total Depth: 14.0 feet** **No Groundwater Encountered**
20									
25									
30									
35									

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

Earth Systems

1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: IT-9	DRILLING DATE: February 22, 2021
PROJECT NAME: Camp Hess Kramer Rebuild	DRILL RIG: CME-75
PROJECT NUMBER: 301529-003	DRILLING METHOD: Hollow-Stem Auger
BORING LOCATION: Per Plan	LOGGED BY: AL

Vertical Depth	Sample Type			PENETRATION RESISTANCE (BLOWS/6"	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	DESCRIPTION OF UNITS
	Bulk	SPT	Mod. Calif.						
0					▨	SM			**ALLUVIUM:** Brown Silty fine to coarse Sand, some fine to coarse Gravel, medium dense, dry to damp
									Total Depth: 3.0 feet **No Groundwater Encountered**
5									
10									
15									
20									
25									
30									
35									

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

Earth Systems
1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: IT-10
PROJECT NAME: Camp Hess Kramer Rebuild
PROJECT NUMBER: 301529-003
BORING LOCATION: Per Plan

DRILLING DATE: February 22, 2021
DRILL RIG: CME-75
DRILLING METHOD: Hollow-Stem Auger
LOGGED BY: AL

Vertical Depth	Sample Type			PENETRATION RESISTANCE (BLOWS/6"	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	DESCRIPTION OF UNITS
	Bulk	SPT	Mod. Calif.						
0					▒	SM			**ALLUVIUM:** Brown Silty fine to coarse Sand, some fine to coarse Gravel, dense, dry to damp
10					▒	SM			**ALLUVIUM:** Dark Brown Silty fine Sand, some medium to coarse Sand, trace fine Gravel, medium dense, damp
					▒	SM			**ALLUVIUM:** Brown Silty fine to coarse Sand, some fine to coarse Gravel, very dense, damp
15									**Total Depth: 14.0 feet** **No Groundwater Encountered**
20									
25									
30									
35									

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

Earth Systems

1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: IT-11	DRILLING DATE: February 22, 2021
PROJECT NAME: Camp Hess Kramer Rebuild	DRILL RIG: CME-75
PROJECT NUMBER: 301529-003	DRILLING METHOD: Hollow-Stem Auger
BORING LOCATION: Per Plan	LOGGED BY: AL

Vertical Depth	Sample Type Bulk	Sample Type SPT	Sample Type Mod. Calif.	PENETRATION RESISTANCE (BLOWS/6"	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	DESCRIPTION OF UNITS
0					▨	GW			**ALLUVIUM:** Brown fine to coarse Sandy Gravel, some Silt, dense, dry to damp
									Total Depth: 3.0 feet **No Groundwater Encountered**
5									
10									
15									
20									
25									
30									
35									

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

Earth Systems

1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: IT-12
PROJECT NAME: Camp Hess Kramer Rebuild
PROJECT NUMBER: 301529-003
BORING LOCATION: Per Plan

DRILLING DATE: February 22, 2021
DRILL RIG: CME-75
DRILLING METHOD: Hollow-Stem Auger
LOGGED BY: AL

Vertical Depth	Sample Type			PENETRATION RESISTANCE (BLOWS/6"	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	DESCRIPTION OF UNITS
	Bulk	SPT	Mod. Calif.						
0					▨	SM			**ALLUVIUM:** Dark Brown Silty fine to coarse Sand, some fine to coarse Gravel, loose to medium dense, damp
5					▩	GW			**ALLUVIUM:** Brown fine to coarse Sandy Gravel, some Silt, dense, dry to damp
10					▨	SM			**ALLUVIUM:** Dark Brown Silty fine to medium Sand, some coarse Sand, trace to little Clay, little fine to coarse Gravel, medium dense, dry to damp
15									**Total Depth: 14.0 feet** **No Groundwater Encountered**
20									
25									
30									
35									

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

Earth Systems

1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: IT-13
PROJECT NAME: Camp Hess Kramer Rebuild
PROJECT NUMBER: 301529-003
BORING LOCATION: Per Plan

DRILLING DATE: February 22, 2021
DRILL RIG: CME-75
DRILLING METHOD: Hollow-Stem Auger
LOGGED BY: AL

Vertical Depth	Sample Type			PENETRATION RESISTANCE (BLOWS/6")	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	DESCRIPTION OF UNITS
	Bulk	SPT	Mod. Calif.						
0					⁘	SW			**ALLUVIUM:** Brown to Dark Brown Gravelly fine to coarse Sand, some Silt, dense, dry to damp
									Total Depth: 3.0 feet **No Groundwater Encountered**
5									
10									
15									
20									
25									
30									
35									

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

Earth Systems
1731-A Walter Street, Ventura, California 93003
PHONE: (805) 642-6727 FAX: (805) 642-1325

BORING NO: IT-14
PROJECT NAME: Camp Hess Kramer Rebuild
PROJECT NUMBER: 301529-003
BORING LOCATION: Per Plan

DRILLING DATE: February 22, 2021
DRILL RIG: CME-75
DRILLING METHOD: Hollow-Stem Auger
LOGGED BY: AL

Vertical Depth	Sample Type Bulk	 SPT	 Mod. Calif.	PENETRATION RESISTANCE (BLOWS/6"	SYMBOL	USCS CLASS	UNIT DRY WT. (pcf)	MOISTURE CONTENT (%)	DESCRIPTION OF UNITS
0					▩	GW			**ALLUVIUM:** Brown fine to coarse Gravel, some Silt, dense, dry to damp
5									
10					░	SM			**ALLUVIUM:** Light Brown Silty fine to coarse Sand, some fine to coarse Gravel, medium dense to dense, dry to damp
15									**Total Depth: 14.0 feet** **No Groundwater Encountered**
20									
25									
30									
35									

Note: The stratification lines shown represent the approximate boundaries between soil and/or rock types and the transitions may be gradual.

BORING LOG SYMBOLS

■	Modified California Split Barrel Sampler
⧅	Modified California Split Barrel Sampler - No Recovery
◨	Standard Penetration Test (SPT) Sampler
◫	Standard Penetration Test (SPT) Sampler - No Recovery
▽	Perched Water Level
▼	Water Level First Encountered
▼	Water Level After Drilling
⊙	Pocket Penetrometer (tsf)
⊕	Vane Shear (ksf)

1. The location of borings were approximately determined by pacing and/or siting from visible features. Elevations of borings are approximately determined by interpolating between plan contours. The location and elevation of the borings should be considered.
2. The stratification lines represent the approximate boundary between soil types and the transition may be gradual.
3. Water level readings have been made in the drill holes at times and under conditions stated on the boring logs. This data has been reviewed and interpretations made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, tides, temperature, and other factors at the time measurements were made.

BORING LOG SYMBOLS

Earth Systems

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GRAPH SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO 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 (APPRECIABLE AMOUNT OF FINES)	▨	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
			▨	GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	CLEAN SAND (LITTLE OR NO FINES)	▨	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			▨	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNTOF FINES)	▨	SM	SILTY SANDS, SAND-SILT MIXTURES
			▨	SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50	▨	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			▨	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			▨	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50	▨	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
			▨	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			▨	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			▨	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENT

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

UNIFIED SOIL CLASSIFICATION SYSTEM

Earth Systems

APPENDIX B

Infiltration Test Results

INFILTRATION RATE BY THE BOREHOLE PERCOLATION TEST METHOD

This workbook calculates an adjusted infiltration rate from a borehole percolation test. The percolation rate is adjusted for sidewall area according to the Porchet method, and then re-adjusted for the effect of the gravel placed in annulus between the borehole wall and a pipe placed in the borehole by a method presented in Caltrans Test 750.

Project Name	Camp Hess Kramer Camp Rebuilds
Project Number	301529-003
Test Hole No.	IT-1
Tester	A. Luna
Pre-Soak Date	February 23, 2021
Test Date	February 24, 2021

Test Hole Radius, r (inches)	2
Total Depth of Test Hole, D_T (feet)	3.3
Inside Diameter of Pipe, I (inches)	3.00
Outside Diameter of Pipe, O (inches)	3.38
Pipe Stick-Up (feet)	0.4
Porosity of Gravel, n	0.41
Porosity Correction Factor, C	0.68
Factor of Safety (FOS), F	N/A

Interval No.	Delta Time, Δt (min.)	Initial Depth to Water from TOP, D_o (ft.)	Final Depth to Water from TOP, D_f (ft.)	Initial Water Height, H_o (in.)	Final Water Height, H_f (in.)	Change in Water Height, ΔH (in.)	Perc Rate, (in/hr)	Infiltration Rate (in./hr.)	Corrected Infiltration Rate (in/hr)
1	30.00	1.30	1.69	28.80	24.12	4.68	9.36	0.34	0.23
2	30.00	1.30	1.68	28.80	24.24	4.56	9.12	0.33	0.23
3	30.00	1.30	1.66	28.80	24.48	4.32	8.64	0.31	0.21
4	30.00	1.30	1.66	28.80	24.48	4.32	8.64	0.31	0.21
5	30.00	1.30	1.66	28.80	24.48	4.32	8.64	0.31	0.21
6	30.00	1.30	1.65	28.80	24.60	4.20	8.40	0.30	0.21
7	30.00	1.30	1.65	28.80	24.60	4.20	8.40	0.30	0.21
8	30.00	1.30	1.65	28.80	24.60	4.20	8.40	0.30	0.21
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INFILTRATION RATE BY THE BOREHOLE PERCOLATION TEST METHOD

This workbook calculates an adjusted infiltration rate from a borehole percolation test. The percolation rate is adjusted for sidewall area according to the Porchet method, and then re-adjusted for the effect of the gravel placed in annulus between the borehole wall and a pipe placed in the borehole by a method presented in Caltrans Test 750.

Project Name	Camp Hess Kramer Camp Rebuilds
Project Number	301529-003
Test Hole No.	IT-2
Tester	A. Luna
Pre-Soak Date	February 23, 2021
Test Date	February 24, 2021

Test Hole Radius, r (inches)	2
Total Depth of Test Hole, D_T (feet)	5.2
Inside Diameter of Pipe, I (inches)	3.00
Outside Diameter of Pipe, O (inches)	3.38
Pipe Stick-Up (feet)	0.1
Porosity of Gravel, n	0.41
Porosity Correction Factor, C	0.68
Factor of Safety (FOS), F	N/A

Interval No.	Delta Time, Δt (min.)	Initial Depth to Water from TOP, D_o (ft.)	Final Depth to Water from TOP, D_f (ft.)	Initial Water Height, H_o (in.)	Final Water Height, H_f (in.)	Change in Water Height, ΔH (in.)	Perc Rate, (in/hr)	Infiltration Rate (in./hr.)	Corrected Infiltration Rate (in/hr)
1	30.00	3.20	3.67	25.20	19.56	5.64	11.28	0.48	0.33
2	30.00	3.20	3.62	25.20	20.16	5.04	10.08	0.43	0.29
3	30.00	3.20	3.61	25.20	20.28	4.92	9.84	0.41	0.28
4	30.00	3.20	3.62	25.20	20.16	5.04	10.08	0.43	0.29
5	30.00	3.20	3.60	25.20	20.40	4.80	9.60	0.40	0.27
6	30.00	3.20	3.59	25.20	20.52	4.68	9.36	0.39	0.27
7	30.00	3.20	3.59	25.20	20.52	4.68	9.36	0.39	0.27
8	30.00	3.20	3.58	25.20	20.64	4.56	9.12	0.38	0.26
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INFILTRATION RATE BY THE BOREHOLE PERCOLATION TEST METHOD

This workbook calculates an adjusted infiltration rate from a borehole percolation test. The percolation rate is adjusted for sidewall area according to the Porchet method, and then re-adjusted for the effect of the gravel placed in annulus between the borehole wall and a pipe placed in the borehole by a method presented in Caltrans Test 750.

Project Name	Camp Hess Kramer Camp Rebuilds
Project Number	301529-003
Test Hole No.	IT-3
Tester	A. Luna
Pre-Soak Date	February 22, 2021
Test Date	February 23, 2021

Test Hole Radius, r (inches)	4
Total Depth of Test Hole, D_T (feet)	3.0
Inside Diameter of Pipe, I (inches)	3.00
Outside Diameter of Pipe, O (inches)	3.38
Pipe Stick-Up (feet)	0.0
Porosity of Gravel, n	0.41
Porosity Correction Factor, C	0.48
Factor of Safety (FOS), F	N/A

Interval No.	Delta Time, Δt (min.)	Initial Depth to Water from TOP, D_o (ft.)	Final Depth to Water from TOP, D_f (ft.)	Initial Water Height, H_o (in.)	Final Water Height, H_f (in.)	Change in Water Height, ΔH (in.)	Perc Rate, (in/hr)	Infiltration Rate (in./hr.)	Corrected Infiltration Rate (in/hr)
1	10.00	1.00	1.65	24.00	16.20	7.80	46.80	4.24	2.02
2	10.00	1.00	1.65	24.00	16.20	7.80	46.80	4.24	2.02
3	10.00	1.00	1.60	24.00	16.80	7.20	43.20	3.86	1.84
4	10.00	1.00	1.55	24.00	17.40	6.60	39.60	3.49	1.67
5	10.00	1.00	1.55	24.00	17.40	6.60	39.60	3.49	1.67
6	10.00	1.00	1.55	24.00	17.40	6.60	39.60	3.49	1.67
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INFILTRATION RATE BY THE BOREHOLE PERCOLATION TEST METHOD

This workbook calculates an adjusted infiltration rate from a borehole percolation test. The percolation rate is adjusted for sidewall area according to the Porchet method, and then re-adjusted for the effect of the gravel placed in annulus between the borehole wall and a pipe placed in the borehole by a method presented in Caltrans Test 750.

Project Name	Camp Hess Kramer Camp Rebuilds
Project Number	301529-003
Test Hole No.	IT-4
Tester	A. Luna
Pre-Soak Date	February 22, 2021
Test Date	February 23, 2021

Test Hole Radius, r (inches)	4
Total Depth of Test Hole, D_T (feet)	13.9
Inside Diameter of Pipe, I (inches)	3.00
Outside Diameter of Pipe, O (inches)	3.38
Pipe Stick-Up (feet)	0.0
Porosity of Gravel, n	0.41
Porosity Correction Factor, C	0.48
Factor of Safety (FOS), F	N/A

Interval No.	Delta Time, Δt (min.)	Initial Depth to Water from TOP, D_o (ft.)	Final Depth to Water from TOP, D_f (ft.)	Initial Water Height, H_o (in.)	Final Water Height, H_f (in.)	Change in Water Height, ΔH (in.)	Perc Rate, (in/hr)	Infiltration Rate (in./hr.)	Corrected Infiltration Rate (in/hr)
1	10.00	11.90	12.61	24.00	15.48	8.52	51.12	4.70	2.25
2	10.00	11.90	12.57	24.00	15.96	8.04	48.24	4.39	2.10
3	10.00	11.90	12.54	24.00	16.32	7.68	46.08	4.16	1.99
4	10.00	11.90	12.53	24.00	16.44	7.56	45.36	4.08	1.95
5	10.00	11.90	12.52	24.00	16.56	7.44	44.64	4.01	1.91
6	10.00	11.90	12.53	24.00	16.44	7.56	45.36	4.08	1.95
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INFILTRATION RATE BY THE BOREHOLE PERCOLATION TEST METHOD

This workbook calculates an adjusted infiltration rate from a borehole percolation test. The percolation rate is adjusted for sidewall area according to the Porchet method, and then re-adjusted for the effect of the gravel placed in annulus between the borehole wall and a pipe placed in the borehole by a method presented in Caltrans Test 750.

Project Name	Camp Hess Kramer Camp Rebuilds
Project Number	301529-003
Test Hole No.	IT-5
Tester	A. Luna
Pre-Soak Date	February 22, 2021
Test Date	February 23, 2021

Test Hole Radius, r (inches)	4
Total Depth of Test Hole, D_T (feet)	3.0
Inside Diameter of Pipe, I (inches)	3.00
Outside Diameter of Pipe, O (inches)	3.38
Pipe Stick-Up (feet)	0.0
Porosity of Gravel, n	0.41
Porosity Correction Factor, C	0.48
Factor of Safety (FOS), F	N/A

Interval No.	Delta Time, Δt (min.)	Initial Depth to Water from TOP, D_o (ft.)	Final Depth to Water from TOP, D_f (ft.)	Initial Water Height, H_o (in.)	Final Water Height, H_f (in.)	Change in Water Height, ΔH (in.)	Perc Rate, (in/hr)	Infiltration Rate (in./hr.)	Corrected Infiltration Rate (in/hr)
1	30.00	1.00	1.12	24.00	22.56	1.44	2.88	0.23	0.11
2	30.00	1.00	1.08	24.00	23.04	0.96	1.92	0.15	0.07
3	30.00	1.00	1.06	24.00	23.28	0.72	1.44	0.11	0.05
4	30.00	1.00	1.07	24.00	23.16	0.84	1.68	0.13	0.06
5	30.00	1.00	1.06	24.00	23.28	0.72	1.44	0.11	0.05
6	30.00	1.00	1.06	24.00	23.28	0.72	1.44	0.11	0.05
7	30.00	1.00	1.06	24.00	23.28	0.72	1.44	0.11	0.05
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INFILTRATION RATE BY THE BOREHOLE PERCOLATION TEST METHOD

This workbook calculates an adjusted infiltration rate from a borehole percolation test. The percolation rate is adjusted for sidewall area according to the Porchet method, and then re-adjusted for the effect of the gravel placed in annulus between the borehole wall and a pipe placed in the borehole by a method presented in Caltrans Test 750.

Project Name	Camp Hess Kramer Camp Rebuilds
Project Number	301529-003
Test Hole No.	IT-6
Tester	A. Luna
Pre-Soak Date	February 22, 2021
Test Date	February 23, 2021

Test Hole Radius, r (inches)	4
Total Depth of Test Hole, D_T (feet)	13.8
Inside Diameter of Pipe, I (inches)	3.00
Outside Diameter of Pipe, O (inches)	3.38
Pipe Stick-Up (feet)	0.0
Porosity of Gravel, n	0.41
Porosity Correction Factor, C	0.48
Factor of Safety (FOS), F	N/A

Interval No.	Delta Time, Δt (min.)	Initial Depth to Water from TOP, D_o (ft.)	Final Depth to Water from TOP, D_f (ft.)	Initial Water Height, H_o (in.)	Final Water Height, H_f (in.)	Change in Water Height, ΔH (in.)	Perc Rate, (in/hr)	Infiltration Rate (in./hr.)	Corrected Infiltration Rate (in/hr)
1	30.00	11.80	12.08	24.00	20.64	3.36	6.72	0.55	0.26
2	30.00	11.80	12.06	24.00	20.88	3.12	6.24	0.51	0.24
3	30.00	11.80	12.05	24.00	21.00	3.00	6.00	0.49	0.23
4	30.00	11.80	12.05	24.00	21.00	3.00	6.00	0.49	0.23
5	30.00	11.80	12.05	24.00	21.00	3.00	6.00	0.49	0.23
6	30.00	11.80	12.05	24.00	21.00	3.00	6.00	0.49	0.23
7	30.00	11.80	12.04	24.00	21.12	2.88	5.76	0.47	0.22
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INFILTRATION RATE BY THE BOREHOLE PERCOLATION TEST METHOD

This workbook calculates an adjusted infiltration rate from a borehole percolation test. The percolation rate is adjusted for sidewall area according to the Porchet method, and then re-adjusted for the effect of the gravel placed in annulus between the borehole wall and a pipe placed in the borehole by a method presented in Caltrans Test 750.

Project Name	Camp Hess Kramer Camp Rebuilds
Project Number	301529-003
Test Hole No.	IT-7
Tester	A. Luna
Pre-Soak Date	February 24, 2021
Test Date	February 25, 2021

Test Hole Radius, r (inches)	4
Total Depth of Test Hole, D_T (feet)	3.0
Inside Diameter of Pipe, I (inches)	3.00
Outside Diameter of Pipe, O (inches)	3.38
Pipe Stick-Up (feet)	0.0
Porosity of Gravel, n	0.41
Porosity Correction Factor, C	0.48
Factor of Safety (FOS), F	N/A

Interval No.	Delta Time, Δt (min.)	Initial Depth to Water from TOP, D_o (ft.)	Final Depth to Water from TOP, D_f (ft.)	Initial Water Height, H_o (in.)	Final Water Height, H_f (in.)	Change in Water Height, ΔH (in.)	Perc Rate, (in/hr)	Infiltration Rate (in./hr.)	Corrected Infiltration Rate (in/hr)
1	10.00	1.00	1.45	24.00	18.60	5.40	32.40	2.78	1.33
2	10.00	1.00	1.42	24.00	18.96	5.04	30.24	2.58	1.23
3	10.00	1.00	1.39	24.00	19.32	4.68	28.08	2.37	1.13
4	10.00	1.00	1.40	24.00	19.20	4.80	28.80	2.44	1.17
5	10.00	1.00	1.39	24.00	19.32	4.68	28.08	2.37	1.13
6	10.00	1.00	1.39	24.00	19.32	4.68	28.08	2.37	1.13
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INFILTRATION RATE BY THE BOREHOLE PERCOLATION TEST METHOD

This workbook calculates an adjusted infiltration rate from a borehole percolation test. The percolation rate is adjusted for sidewall area according to the Porchet method, and then re-adjusted for the effect of the gravel placed in annulus between the borehole wall and a pipe placed in the borehole by a method presented in Caltrans Test 750.

Project Name	Camp Hess Kramer Camp Rebuilds
Project Number	301529-003
Test Hole No.	IT-8
Tester	A. Luna
Pre-Soak Date	February 24, 2021
Test Date	February 25, 2021

Test Hole Radius, r (inches)	4
Total Depth of Test Hole, D_T (feet)	13.9
Inside Diameter of Pipe, I (inches)	3.00
Outside Diameter of Pipe, O (inches)	3.38
Pipe Stick-Up (feet)	0.3
Porosity of Gravel, n	0.41
Porosity Correction Factor, C	0.48
Factor of Safety (FOS), F	N/A

Interval No.	Delta Time, Δt (min.)	Initial Depth to Water from TOP, D_o (ft.)	Final Depth to Water from TOP, D_f (ft.)	Initial Water Height, H_o (in.)	Final Water Height, H_f (in.)	Change in Water Height, ΔH (in.)	Perc Rate, (in/hr)	Infiltration Rate (in./hr.)	Corrected Infiltration Rate (in/hr)
1	10.00	11.90	12.59	27.60	19.32	8.28	49.68	3.90	1.86
2	10.00	11.90	12.48	27.60	20.64	6.96	41.76	3.20	1.53
3	10.00	11.90	12.49	27.60	20.52	7.08	42.48	3.26	1.56
4	10.00	11.90	12.49	27.60	20.52	7.08	42.48	3.26	1.56
5	10.00	11.90	12.49	27.60	20.52	7.08	42.48	3.26	1.56
6	10.00	11.90	12.48	27.60	20.64	6.96	41.76	3.20	1.53
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INFILTRATION RATE BY THE BOREHOLE PERCOLATION TEST METHOD

This workbook calculates an adjusted infiltration rate from a borehole percolation test. The percolation rate is adjusted for sidewall area according to the Porchet method, and then re-adjusted for the effect of the gravel placed in annulus between the borehole wall and a pipe placed in the borehole by a method presented in Caltrans Test 750.

Project Name	Camp Hess Kramer Camp Rebuilds
Project Number	301529-003
Test Hole No.	IT-9
Tester	A. Luna
Pre-Soak Date	February 24, 2021
Test Date	February 25, 2021

Test Hole Radius, r (inches)	4
Total Depth of Test Hole, D_T (feet)	3.1
Inside Diameter of Pipe, I (inches)	3.00
Outside Diameter of Pipe, O (inches)	3.38
Pipe Stick-Up (feet)	0.0
Porosity of Gravel, n	0.41
Porosity Correction Factor, C	0.48
Factor of Safety (FOS), F	N/A

Interval No.	Delta Time, Δt (min.)	Initial Depth to Water from TOP, D_o (ft.)	Final Depth to Water from TOP, D_f (ft.)	Initial Water Height, H_o (in.)	Final Water Height, H_f (in.)	Change in Water Height, ΔH (in.)	Perc Rate, (in/hr)	Infiltration Rate (in./hr.)	Corrected Infiltration Rate (in/hr)
1	30.00	1.10	1.45	24.00	19.80	4.20	8.40	0.70	0.34
2	30.00	1.10	1.45	24.00	19.80	4.20	8.40	0.70	0.34
3	30.00	1.10	1.44	24.00	19.92	4.08	8.16	0.68	0.33
4	30.00	1.10	1.43	24.00	20.04	3.96	7.92	0.66	0.31
5	30.00	1.10	1.42	24.00	20.16	3.84	7.68	0.64	0.30
6	30.00	1.10	1.43	24.00	20.04	3.96	7.92	0.66	0.31
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INFILTRATION RATE BY THE BOREHOLE PERCOLATION TEST METHOD

This workbook calculates an adjusted infiltration rate from a borehole percolation test. The percolation rate is adjusted for sidewall area according to the Porchet method, and then re-adjusted for the effect of the gravel placed in annulus between the borehole wall and a pipe placed in the borehole by a method presented in Caltrans Test 750.

Project Name	Camp Hess Kramer Camp Rebuilds
Project Number	301529-003
Test Hole No.	IT-10
Tester	A. Luna
Pre-Soak Date	February 24, 2021
Test Date	February 25, 2021

Test Hole Radius, r (inches)	4
Total Depth of Test Hole, D_T (feet)	13.9
Inside Diameter of Pipe, I (inches)	3.00
Outside Diameter of Pipe, O (inches)	3.38
Pipe Stick-Up (feet)	0.0
Porosity of Gravel, n	0.41
Porosity Correction Factor, C	0.48
Factor of Safety (FOS), F	N/A

Interval No.	Delta Time, Δt (min.)	Initial Depth to Water from TOP, D_o (ft.)	Final Depth to Water from TOP, D_f (ft.)	Initial Water Height, H_o (in.)	Final Water Height, H_f (in.)	Change in Water Height, ΔH (in.)	Perc Rate, (in/hr)	Infiltration Rate (in./hr.)	Corrected Infiltration Rate (in/hr)
1	30.00	11.90	12.78	24.00	13.44	10.56	21.12	2.04	0.97
2	30.00	11.90	12.68	24.00	14.64	9.36	18.72	1.76	0.84
3	30.00	11.90	12.66	24.00	14.88	9.12	18.24	1.70	0.81
4	30.00	11.90	12.63	24.00	15.24	8.76	17.52	1.62	0.77
5	30.00	11.90	12.62	24.00	15.36	8.64	17.28	1.59	0.76
6	30.00	11.90	12.62	24.00	15.36	8.64	17.28	1.59	0.76
7	30.00	11.90	12.61	24.00	15.48	8.52	17.04	1.57	0.75
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INFILTRATION RATE BY THE BOREHOLE PERCOLATION TEST METHOD

This workbook calculates an adjusted infiltration rate from a borehole percolation test. The percolation rate is adjusted for sidewall area according to the Porchet method, and then re-adjusted for the effect of the gravel placed in annulus between the borehole wall and a pipe placed in the borehole by a method presented in Caltrans Test 750.

Project Name	Camp Hess Kramer Camp Rebuilds
Project Number	301529-003
Test Hole No.	IT-11
Tester	A. Luna
Pre-Soak Date	February 23, 2021
Test Date	February 24, 2021

Test Hole Radius, r (inches)	4
Total Depth of Test Hole, D_T (feet)	3.2
Inside Diameter of Pipe, I (inches)	3.00
Outside Diameter of Pipe, O (inches)	3.38
Pipe Stick-Up (feet)	0.1
Porosity of Gravel, n	0.41
Porosity Correction Factor, C	0.48
Factor of Safety (FOS), F	N/A

Interval No.	Delta Time, Δt (min.)	Initial Depth to Water from TOP, D_o (ft.)	Final Depth to Water from TOP, D_f (ft.)	Initial Water Height, H_o (in.)	Final Water Height, H_f (in.)	Change in Water Height, ΔH (in.)	Perc Rate, (in/hr)	Infiltration Rate (in./hr.)	Corrected Infiltration Rate (in/hr)
1	5.00	1.20	3.20	25.20	1.20	24.00	288.00	37.89	18.09
2	5.00	1.20	3.20	25.20	1.20	24.00	288.00	37.89	18.09
3	5.00	1.20	3.20	25.20	1.20	24.00	288.00	37.89	18.09
4	5.00	1.20	3.20	25.20	1.20	24.00	288.00	37.89	18.09
5	5.00	1.20	3.20	25.20	1.20	24.00	288.00	37.89	18.09
6	5.00	1.20	3.20	25.20	1.20	24.00	288.00	37.89	18.09
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INFILTRATION RATE BY THE BOREHOLE PERCOLATION TEST METHOD

This workbook calculates an adjusted infiltration rate from a borehole percolation test. The percolation rate is adjusted for sidewall area according to the Porchet method, and then re-adjusted for the effect of the gravel placed in annulus between the borehole wall and a pipe placed in the borehole by a method presented in Caltrans Test 750.

Project Name	Camp Hess Kramer Camp Rebuilds
Project Number	301529-003
Test Hole No.	IT-12
Tester	A. Luna
Pre-Soak Date	February 23, 2021
Test Date	February 24, 2021

Test Hole Radius, r (inches)	4
Total Depth of Test Hole, D_T (feet)	14.1
Inside Diameter of Pipe, I (inches)	3.00
Outside Diameter of Pipe, O (inches)	3.38
Pipe Stick-Up (feet)	0.0
Porosity of Gravel, n	0.41
Porosity Correction Factor, C	0.48
Factor of Safety (FOS), F	N/A

Interval No.	Delta Time, Δt (min.)	Initial Depth to Water from TOP, D_o (ft.)	Final Depth to Water from TOP, D_f (ft.)	Initial Water Height, H_o (in.)	Final Water Height, H_f (in.)	Change in Water Height, ΔH (in.)	Perc Rate, (in/hr)	Infiltration Rate (in./hr.)	Corrected Infiltration Rate (in/hr)
1	30.00	12.10	12.50	24.00	19.20	4.80	9.60	0.81	0.39
2	30.00	12.07	12.46	24.36	19.68	4.68	9.36	0.78	0.37
3	30.00	12.10	12.49	24.00	19.32	4.68	9.36	0.79	0.38
4	30.00	12.10	12.49	24.00	19.32	4.68	9.36	0.79	0.38
5	30.00	12.10	12.47	24.00	19.56	4.44	8.88	0.75	0.36
6	30.00	12.10	12.48	24.00	19.44	4.56	9.12	0.77	0.37
7	30.00	12.10	12.47	24.00	19.56	4.44	8.88	0.75	0.36
8	30.00	12.10	12.47	24.00	19.56	4.44	8.88	0.75	0.36
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INFILTRATION RATE BY THE BOREHOLE PERCOLATION TEST METHOD

This workbook calculates an adjusted infiltration rate from a borehole percolation test. The percolation rate is adjusted for sidewall area according to the Porchet method, and then re-adjusted for the effect of the gravel placed in annulus between the borehole wall and a pipe placed in the borehole by a method presented in Caltrans Test 750.

Project Name	Camp Hess Kramer Camp Rebuilds
Project Number	301529-003
Test Hole No.	IT-13
Tester	A. Luna
Pre-Soak Date	February 23, 2021
Test Date	February 24, 2021

Test Hole Radius, r (inches)	4
Total Depth of Test Hole, D_T (feet)	3.4
Inside Diameter of Pipe, I (inches)	3.00
Outside Diameter of Pipe, O (inches)	3.38
Pipe Stick-Up (feet)	0.2
Porosity of Gravel, n	0.41
Porosity Correction Factor, C	0.48
Factor of Safety (FOS), F	N/A

Interval No.	Delta Time, Δt (min.)	Initial Depth to Water from TOP, D_o (ft.)	Final Depth to Water from TOP, D_f (ft.)	Initial Water Height, H_o (in.)	Final Water Height, H_f (in.)	Change in Water Height, ΔH (in.)	Perc Rate, (in/hr)	Infiltration Rate (in./hr.)	Corrected Infiltration Rate (in/hr)
1	10.00	1.40	1.86	26.40	20.88	5.52	33.12	2.58	1.23
2	10.00	1.40	1.85	26.40	21.00	5.40	32.40	2.52	1.20
3	10.00	1.40	1.84	26.40	21.12	5.28	31.68	2.46	1.17
4	10.00	1.40	1.83	26.40	21.24	5.16	30.96	2.40	1.14
5	10.00	1.40	1.82	26.40	21.36	5.04	30.24	2.34	1.12
6	10.00	1.40	1.83	26.40	21.24	5.16	30.96	2.40	1.14
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INFILTRATION RATE BY THE BOREHOLE PERCOLATION TEST METHOD

This workbook calculates an adjusted infiltration rate from a borehole percolation test. The percolation rate is adjusted for sidewall area according to the Porchet method, and then re-adjusted for the effect of the gravel placed in annulus between the borehole wall and a pipe placed in the borehole by a method presented in Caltrans Test 750.

Project Name	Camp Hess Kramer Camp Rebuilds
Project Number	301529-003
Test Hole No.	IT-14
Tester	A. Luna
Pre-Soak Date	February 23, 2021
Test Date	February 24, 2021

Test Hole Radius, r (inches)	4
Total Depth of Test Hole, D_T (feet)	14.6
Inside Diameter of Pipe, I (inches)	3.00
Outside Diameter of Pipe, O (inches)	3.38
Pipe Stick-Up (feet)	0.4
Porosity of Gravel, n	0.41
Porosity Correction Factor, C	0.48
Factor of Safety (FOS), F	N/A

Interval No.	Delta Time, Δt (min.)	Initial Depth to Water from TOP, D_o (ft.)	Final Depth to Water from TOP, D_f (ft.)	Initial Water Height, H_o (in.)	Final Water Height, H_f (in.)	Change in Water Height, ΔH (in.)	Perc Rate, (in/hr)	Infiltration Rate (in./hr.)	Corrected Infiltration Rate (in/hr)
1	10.00	12.60	13.56	28.80	17.28	11.52	69.12	5.52	2.64
2	10.00	12.60	13.49	28.80	18.12	10.68	64.08	5.03	2.40
3	10.00	12.60	13.46	28.80	18.48	10.32	61.92	4.83	2.31
4	10.00	12.60	13.43	28.80	18.84	9.96	59.76	4.63	2.21
5	10.00	12.60	13.41	28.80	19.08	9.72	58.32	4.50	2.15
6	10.00	12.60	13.41	28.80	19.08	9.72	58.32	4.50	2.15
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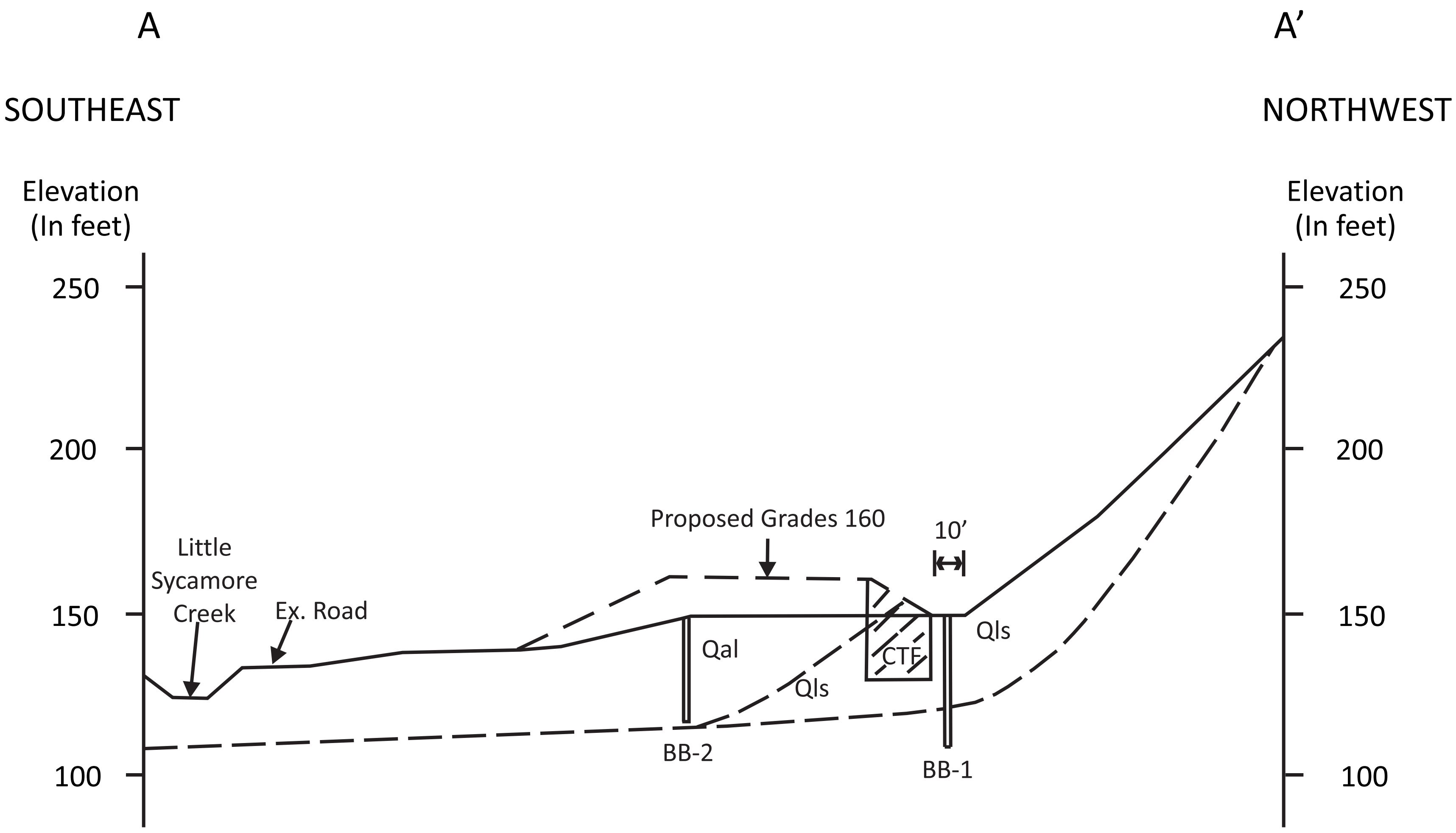
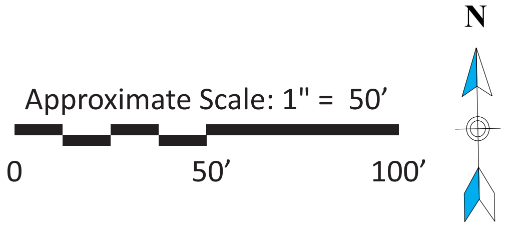


CTF = Cement-Treated Fill



GEOLOGIC CROSS-SECTION A-A’

Camp Hess Kramer
Ventura County, California

Earth Systems

April 2020	301529-003

Earth Systems
1731 Walter Street, Suite A | Ventura, CA 93003 | Ph: 805.642.6727 | www.earthsystems.com

December 8, 2020

Project No.: 301529-003
Report No.: 20-12-13

Attention: Hady Izadpanah
Stantec
111 E. Victoria Street
Santa Barbara, CA 93101-2018

Project: Camp Hess Kramer Lower and Middle Camp Rebuilds
11495 Pacific Coast Highway
Malibu Area
Ventura County, California
Subject: Rock Fall Protection for Indoor Basketball Court
Reference: Earth Systems Pacific, February 25, 2020, Geotechnical Feasibility Report for Proposed Rebuilding of Lower and Middle Camps at Camp Hess Kramer, 11495 Pacific Coast Highway, Malibu Area, Ventura County, California.

It is currently proposed to construct an indoor basketball court slightly south of the amphitheater in the Lower Camp of Camp Hess Kramer. The site would be close to the toe of a steep natural slope that is about 300 feet high and exposes outcrops of Topanga Formation bedrock. Although the slope appears to be stable, there is a possibility that loose rocks could become dislodged during a rain, wind, or earthquake event, and such rocks could pose a rock fall hazard to the structure unless proper mitigation is implanted.

Implementation could consist of incorporating structural enhancements to the wall(s) facing the slope or installing a specially designed rock fence between the toe of slope and the building. The structural enhancement would require designing the at-risk walls to withstand the impact of boulders rolling down the slope from heights of at least 100 feet.

The rock fence alternative is likely to be significantly less expensive and could be designed to catch the boulders between the slope and the structure. An example of a rock fall protection fence that prevented rock fall from impacting a roadway is attached. That fence was designed by Maccaferri. Earth Systems has collaborated within Maccaferri on other projects in the past. Methods for anchoring the rock fence and structural designs would be developed during design-level geotechnical studies.

Please call if you have any questions, or if we can be of further service.

Respectfully submitted,

EARTH SYSTEMS PACIFIC

PROFESSIONAL GEOLOGIST
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Patrick V Boales

Patrick V. Boales 12-8-20
Engineering Geologist

Anthony P. Mazzei
Geotechnical Engineer

12/8/20

Attach: Rockfall Protection Example

Copies:
2 - Izadpanah at Stantec (1 via US mail, 1 via email)
1 - Project File

5,000kJ ROCKFALL BARRIER (BESPOKE)

ARVIER (VALLE D’AOSTA) - ITA

ROCKFALL PROTECTION

Product: OM CTR 50/07/A (5000kJ MEL)

Problem

Regional Road SR n.25 (Valle d’Aosta) around chainage km 4.0 have a long history of rockfall problems. In 2010 and 2011 several blocks impacted the road, causing its closure.

In order to protect the road from the rock falls, the technical department of Servizio Sistemazioni Idrauliche e Dissesti di Versante della Regione Autonoma Valle d’Aosta performed a study of the rockfall characteristics. The study suggested a 2,000 kJ barrier with a minimum height of 5 m was necessary.

Solution

The biggest problem was the small distance between the road and the location of the barrier (less than 2.0-2.5 m) which meant no suitable barrier was available on the market for this project. A reduction of the maximum deflection of the rockfall barrier was needed.

Maccaferri were approached by the designers and suggested to increase the energy level of the barrier (up to 5,000 kJ) in order to reduce the deformation of the barrier [almost] to the SEL behavior; additionally to reinforce the chosen barrier by installing cross cables with energy dissipater devices, in order to further decrease the deflection of the fence during impact.

This special configuration of barrier was studied in great detail and subjected to rigorous performance assessments to confirm its ability to give the required low deformation even under the arduous impact and deformation conditions relevant to the site.

In compliance with these requirements a derivative of the OM CTR 50/07/A barrier (5,000 kJ MEL) was installed for 120 m along the roadside wall, with a height of 6m. To reduce the effect of the down-slope deformation a convex alignment was adopted and the designated system - composed of cables and energy dissipating devices - was installed in a X configuration on each span of the fence.

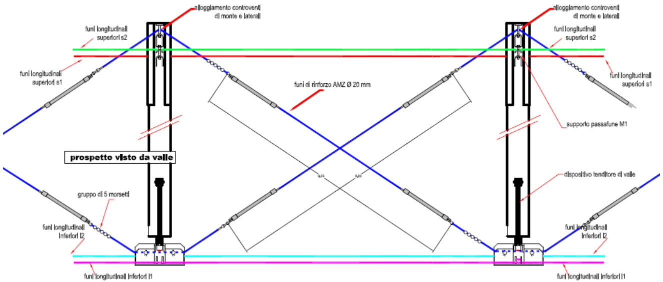
Due to the loose soil present on site barrier foundation design was another problem for the designers.

The up-slope and the lateral anchors were implemented using a double-spiroid cable 18 mm in diameter and 6 m long. They were installed in a 140 mm hole which was reinforced with a proprietary Maccaferri perforated sleeve system in order to avoid the collapse of the face of the hole during anchor insertion and grouting.

The post foundations were realized using 2 micropiles per base plate. Each with a diameter of 76.1 mm and a wall thickness of 10 mm. Their lengths were 5 m and they were installed into120 mm in diameter holes.

Detail of the base plate with two micropiles

Front view of the installed barrier



OM CTR 50/07/A reinforced with X cables and dissipators

Client:

REGIONE AUTONOMA VALLE D’AOSTA

Main contractor:

FD Costruzioni

Engineer:

Technical office of Regione Valle d’Aosta

Products used:

OM CTR 50/07/A

Date of construction:

Summer 2012