Environmental
Geotechnology
Laboratory, Inc.

November 23, 2021

Bowden Development
212 W. Foothill Boulevard
Monrovia, California 91016

Subject: **Report of Engineering Geologic and Geotechnical Engineering Investigation, Proposed Three (3) Single-Family Residences, Portion of Lot 3, Tract No. 3029, 347 Highland Place, Monrovia, California; EGL Project No.: 19-241-003EG**

Ladies and Gentlemen:

In accordance with your request, Environmental Geotechnology Laboratory, Inc. (EGL) is pleased to submit this Geotechnical Engineering Report for the subject site. Purpose of this report was to evaluate the subsurface conditions and provide recommendations for foundation designs and other relevant parameters of the proposed construction.

Based on the findings of EGL's field exploration, laboratory testing and engineering analysis, the proposed construction of the subject site for the intended use is considered feasible from the geotechnical engineering viewpoints, provided that specific recommendations set forth herein are followed.

This opportunity to be of service is sincerely appreciated. If you have any questions pertaining to this report, please call the undersigned.

Respectfully submitted,

Environmental Geotechnology Laboratory, Inc.

Ryan Jones, GE 2852
Project Engineer

Raymond Yang
Project Geologist

Dist: (4) Addressee
RJ/ry

REPORT OF ENGINEERING GEOLOGIC AND GEOTECHNICAL ENGINEERING INVESTIGATION

PROPOSED THREE (3) SINGLE-FAMILY RESIDENCES

AT

NORTHERLY PORTION OF LOT 3
TRACT NO. 3029
347 HIGHLAND PLACE
MONROVIA, CALIFORNIA

Prepared by
ENVIRONMENTAL GEOTECHNOLOGY LABORATORY, INC.
Project No.: 19-241-003EG
November 23, 2021

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1.0 INTRODUCTION

1.1 Purpose

This report presents a summary of our preliminary geotechnical engineering investigation for the proposed residential development located 347 Highland Place (Portion of Lot 3 of Tract No. 3029), in City of Monrovia, in the County of Los Angeles, California. Approximate regional location is shown on the attached Site (Location) Map, Figure 1. Purposes of this investigation were to evaluate the subsurface conditions at the area of proposed construction and to provide recommendations pertinent to grading, foundation design and other relevant parameters of the proposed development.

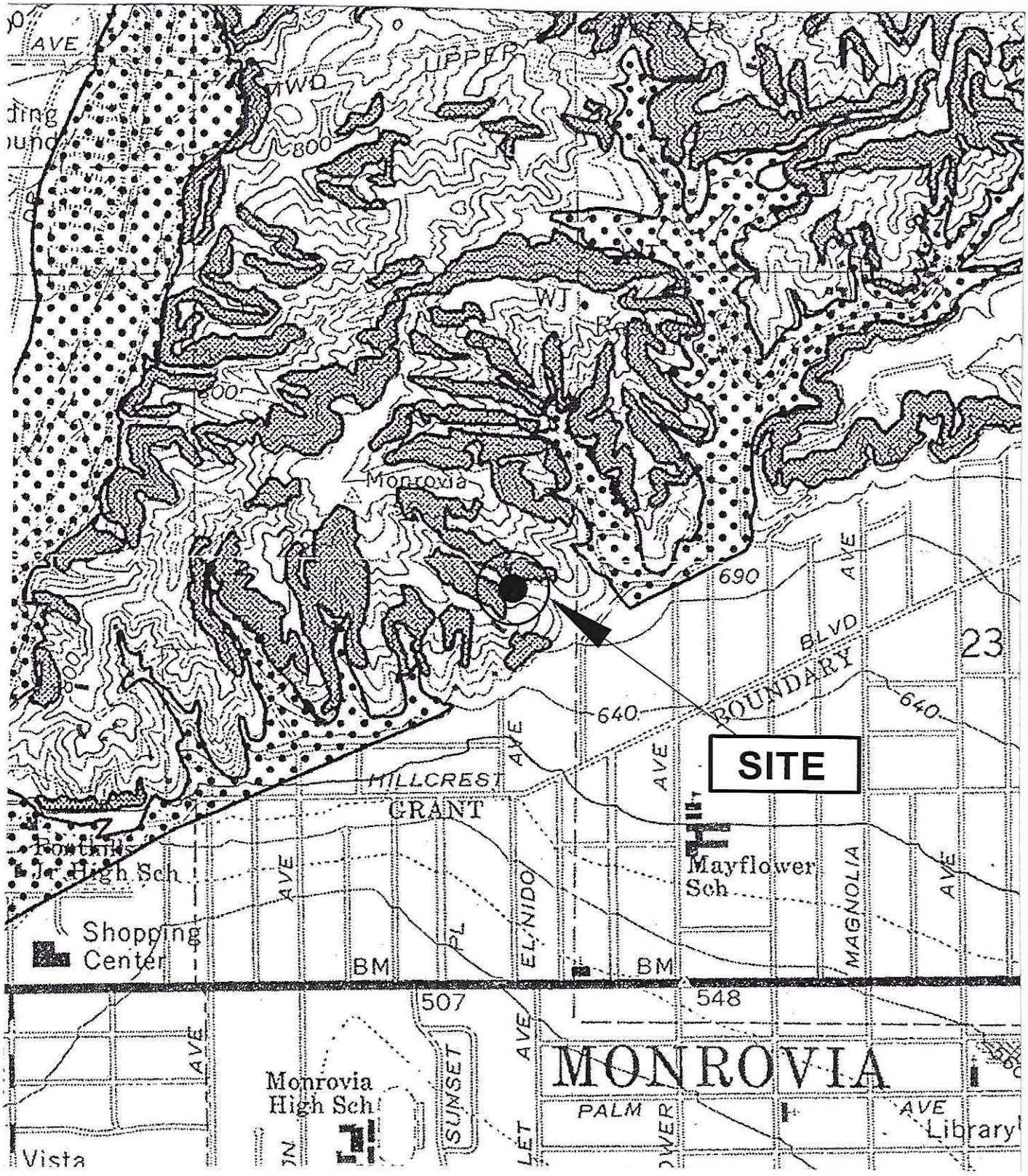
1.2 Scope of Services

Our scope of services included:

- Review available soil and geologic data of vicinity area.
- Subsurface exploration includes logging and sampling of four (4) excavated backhoe trenches. Trenches was extended to a maximum depth of 12 feet below the existing ground surface. Exploration logs are presented in Appendix A.
- Laboratory testing performed on representative earth materials samples to establish engineering characteristics. Field moisture and density are presented on the exploratory logs in Appendix A. Laboratory test results are presented in Appendix B.
- Engineering analyses of the geotechnical data obtained from EGL's background studies, field investigation and laboratory testing.
- Prepare this report presenting EGL's findings, conclusions and recommendations for proposed construction.

1.3 Site Conditions

Irregular shaped subject site occupied within a blind medium-width canyon flanked on both sides by steep ascending slopes. The canyon width narrowed northwesterly at its terminus. The said property is bounded southeasterly by Highland Place, bounded northerly by vacant property, bounded northwesterly by *Monrovia Wilderness Preserve,* bounded on all other sides by neighboring single-family residences in the City of Monrovia, California. Currently, a split one (1) and two (2)- story residence, a detached 1-story studio and a detached 1-story wood framed work shop located on elevated pads above the canyon bottom within the central portion of the subject site. Elevated main building pad is partially excavated into the northerly adjacent steep ascending slopes with short height retaining walls. Debris walls, two (2) to four (4) feet high,



Scale: 1" = 1,000'

Liquefaction
Areas where historic occurence of liquifaction, or local geological, geotechnical and groundwater conditions indicated a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693 (c) would be required.

Earthquake-Induced Landslides
Areas where previous occurence of landslide movement, or local topographic, geological, geotechnical and subsurface water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693 (c) would be required.

Base map adopted from CDMG, "Seismic Hazard Zones of Mt. Wilson Quadrangle, Los Angeles County, California."; Official Map, 1999. Scale 1"=2,000'

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SITE (LOCATION) MAP

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Figure 1

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surrounded the existing main building pad and access by brick pavers flanked by short height rubble concrete or rock curbs and walls. A private asphalt driveway co-shared with three (3) other southerly adjacent neighboring residences, including the subject property, via access from Highland Place. Exotic and native plants including medium- to large- diameter trees with established wide canopies occupied the surrounding ascending slopes and scattered within the property.

Topographically, the subject property is located within a narrow to moderately wide canyon bottom flanked northerly and southerly by moderately steep to steep ascending slopes. Based on the site topographic base, the elevation differences within the property between the northerly property corner and southerly ascending slope tops to the confined ravine bottom are approximately 53 to 337 feet and with the overall ascending slope ratios of approximately 1: 1 to 2.8:1 and locally steeper at 0.8:1 (Horizontal: Vertical). Detailed configuration of the site is shown on the Existing and Proposed Site (Geology) Plans, Figures 2a and 2b. Geologic Cross-Sections A-A', B-B' and C-C', Figure 2c, drawn through the entire site to the top and bottom of the subject property depict approximate subsurface geologic conditions and contacts within the existing and proposed residential development areas.

1.4 Proposed Construction

A limited topographic map base (*Merrell Johnson*, 2019) mosaic over the conceptual grading and drainage plan (*EGL Associates*, 2021 and architectural plan (*Pate Smeall Architect*, 2021) were reviewed and used as map base at the time of preparing this report. Based on the provided architectural plans the following are proposed:

- Existing 2-story residence, associated structures and selective trees are to be demolished and removed.
- Existing shared driveway is to be partially demolished and rebuilt at proposed grade. The other shared driveway is to protect in place and remain accessible for the southerly and easterly adjacent neighboring residences.
- The proposed development consists of three (3) single-family residential units, 2- to 3 stories high, with attached garages and shared private concrete driveways.
- Proposed retaining walls, approximately 2.3 to 10.7 feet tall, are to be constructed at the upslope side of the proposed residences.
- Proposed retaining walls, approximately one (1) to 8.8 feet tall, are be constructed at the upslope side of the proposed share driveway.

Proposed residential buildings are anticipated to be two- to three-stories wood frame structures with concrete slab-on-grade. Column loads are unknown at this time, but are expected to be

A' (See Index Map)

B'

C'

A

B

C

PREVIOUS NORTHERLY SPECIAL STUDIES ZONE BOUNDARY OF RAYMOND FAULT

CGS 2017 MODIFIED AP ZONE NORTHERLY BOUNDARY

FD 2" IP, OPEN, ON LINE

FD 2" IP OPEN

FD 2" IP W/ N&T, RE 1216

Neighboring Residence 437 Highland Place

Neighboring Residence 353 Highland Place

Neighboring Residence 401 Highland Place

Neighboring Residence 351 Highland Place

Neighboring Residence 343 Highland Place

Neighboring Residence 345 Highland Place

Neighboring Residence 349 Highland Place

Qal over wd

Qt over wd

Af and Qal over wd

wd

T-1

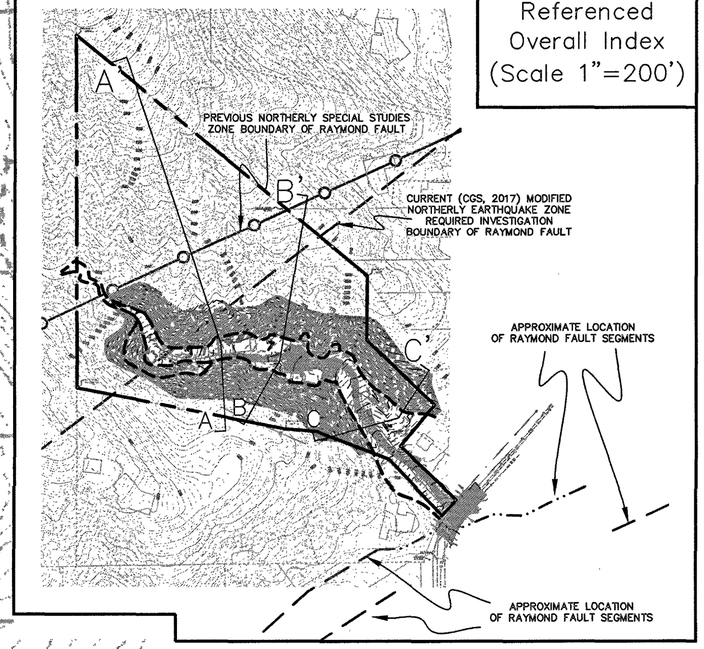
T-2

T-3

T-4

RAYMOND FAULT TRACE PER CGS MODIFIED FAULT ZONE MAP

Referenced Overall Index (Scale 1"=200')



LEGEND

Af	Artificial Fill
Qal	Natural Alluvial Deposits (Concealed)
Qt	Natural Alluvial Terrace Deposits
wd	Cretaceous Granitic Rocks
T-4	Location of Exploratory Excavated Backhoe Trenches (EGL, 2019)
C C'	Location of Geologic Cross Sections

Scale 1" = 40'

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Vicinity Site (Geology) Plan

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FIGURE 2a

Noted: Mosaic base map adopted and modified from current Site Topography at scale 1"=20' (Merrell Johnson, 2019) and adjacent offsite topography from Los Angeles County Regional Planning GIS Web Mapping Application (2020), http://rpgis.isd.lacounty.gov/Html5Viewer/index.html?viewer=GISNET_Public.GIS-NET_Public

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Proposed Site (Geology) Plan

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FIGURE 2b

LEGEND

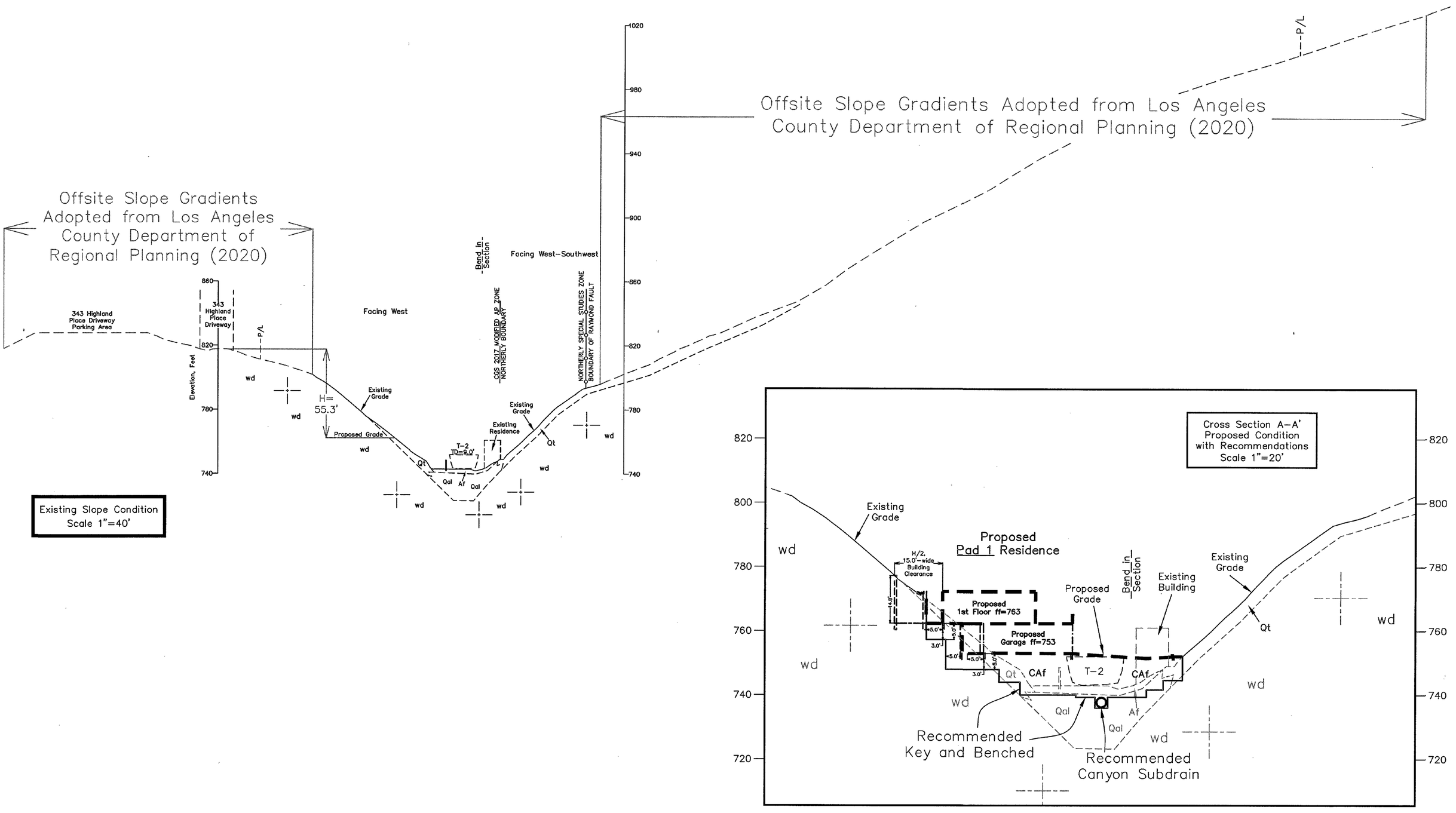
Af	Artificial Fill
Qal	Natural Alluvial Deposits (Concealed)
Qt	Natural Alluvial Terrace Deposits
wd	Cretaceous Granitic Rocks

Scale 1" = 20'

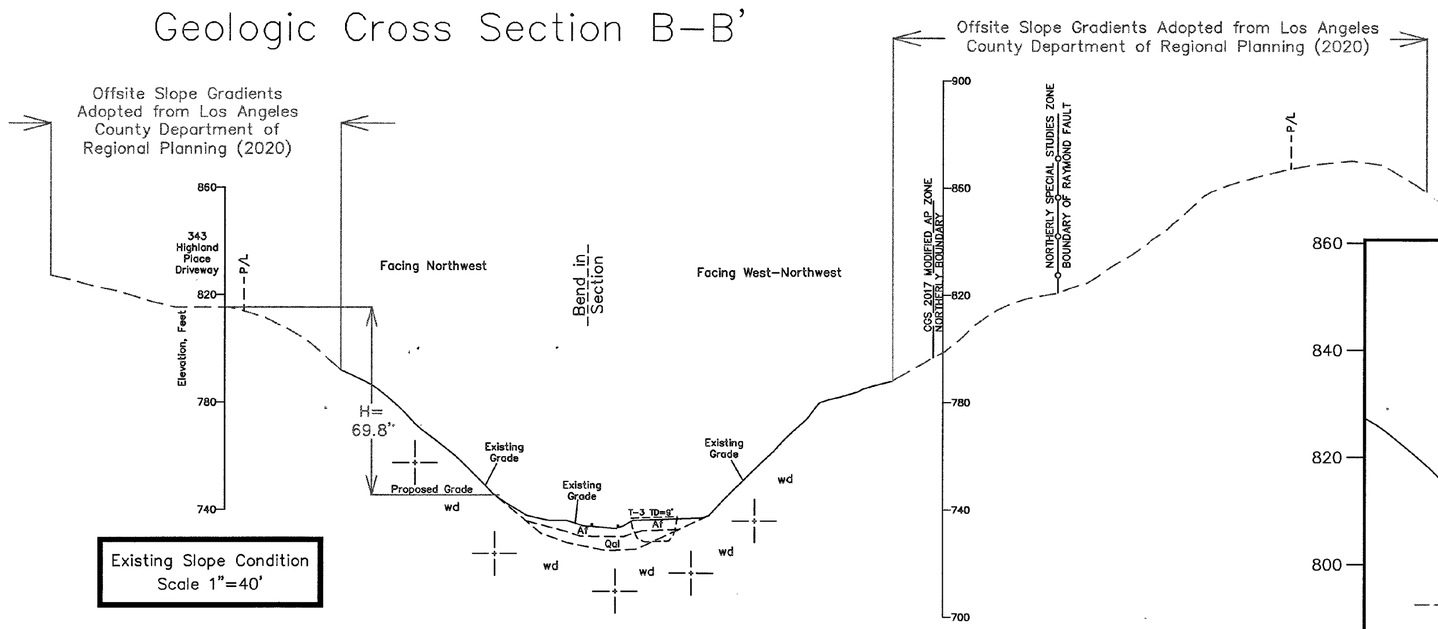
T-4 — Location of Exploratory Excavated Backhoe Trenches (EGL, 2019)

C — C' — Location of Geologic Cross Sections

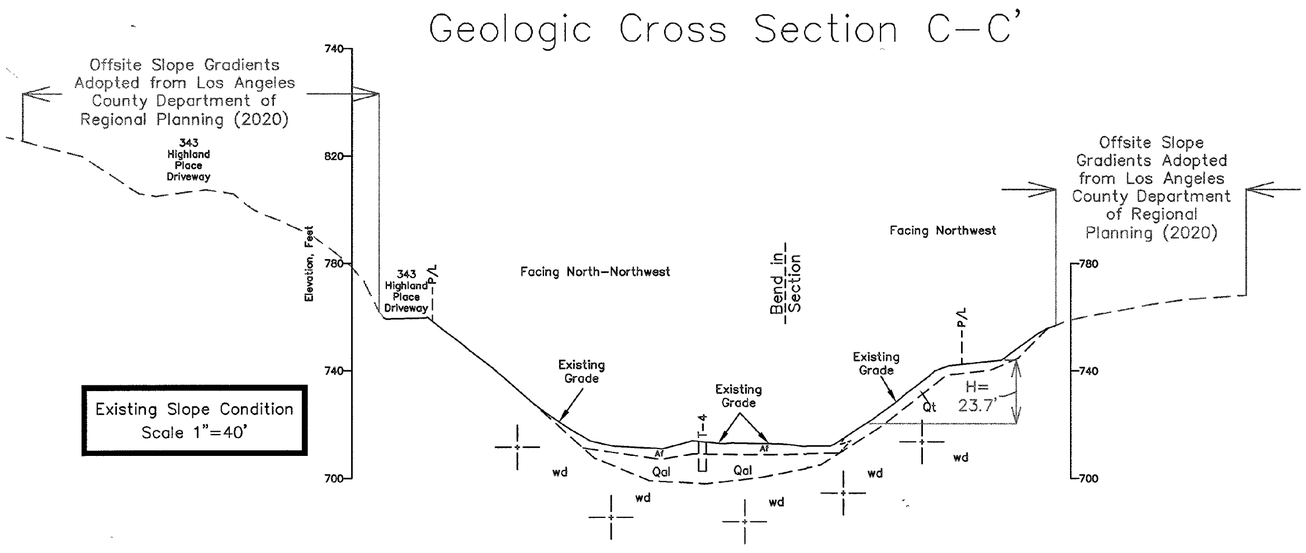
Geologic Cross Section A–A'



Geologic Cross Section B–B'



Geologic Cross Section C–C'



LEGEND

Af	Artificial Fill
Qal	Natural Alluvial Deposits (Concealed)
Qt	Natural Alluvial Terrace Deposits
wd	Cretaceous Granitic Rocks (Massive)

Geologic Cross Sections
A–A', B–B' and C–C'
Site: 347 Highland Place
Monrovia, California
Scale 1"=40'
Date: 11–18–2021

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Figure 2c

light to medium. Minor cut and fill grading operation, including footing excavations, are anticipated to achieve the desired grades.

2.0 FIELD EXPLORATION AND LABORATORY TESTING

2.1 Field Exploration

Subsurface conditions were explored on July 10, 2019 with the aid of a limited access rubber-tracked excavator equipped with three (3) feet wide bucket and hand labors equipped with hand tools. A total of four (4) excavated trenches were excavated to a maximum depth of 12.0 feet below existing ground surface at approximate locations shown on the enclosed Existing and Proposed Site (Geology) Plans, Figures 2a and 2b. Upon completion of excavations, all trenches were backfilled with onsite bedrock and soils cuttings that were removed from the excavations. Exploratory logs are presented in Plates A-1 to A-3.

EGL's field geologist supervised the excavation processes and conduct vicinity reconnaissance. EGL's field engineer logged and sampled all excavated trenches and visually classified the soils in accordance with the Unified Soil Classification System. Ring samples were taken at frequent intervals. Samples, taken by hand tools, were obtained by driving a split-tube sampler with successive blows of 32-pound hammer dropping from a height of 48 inches.

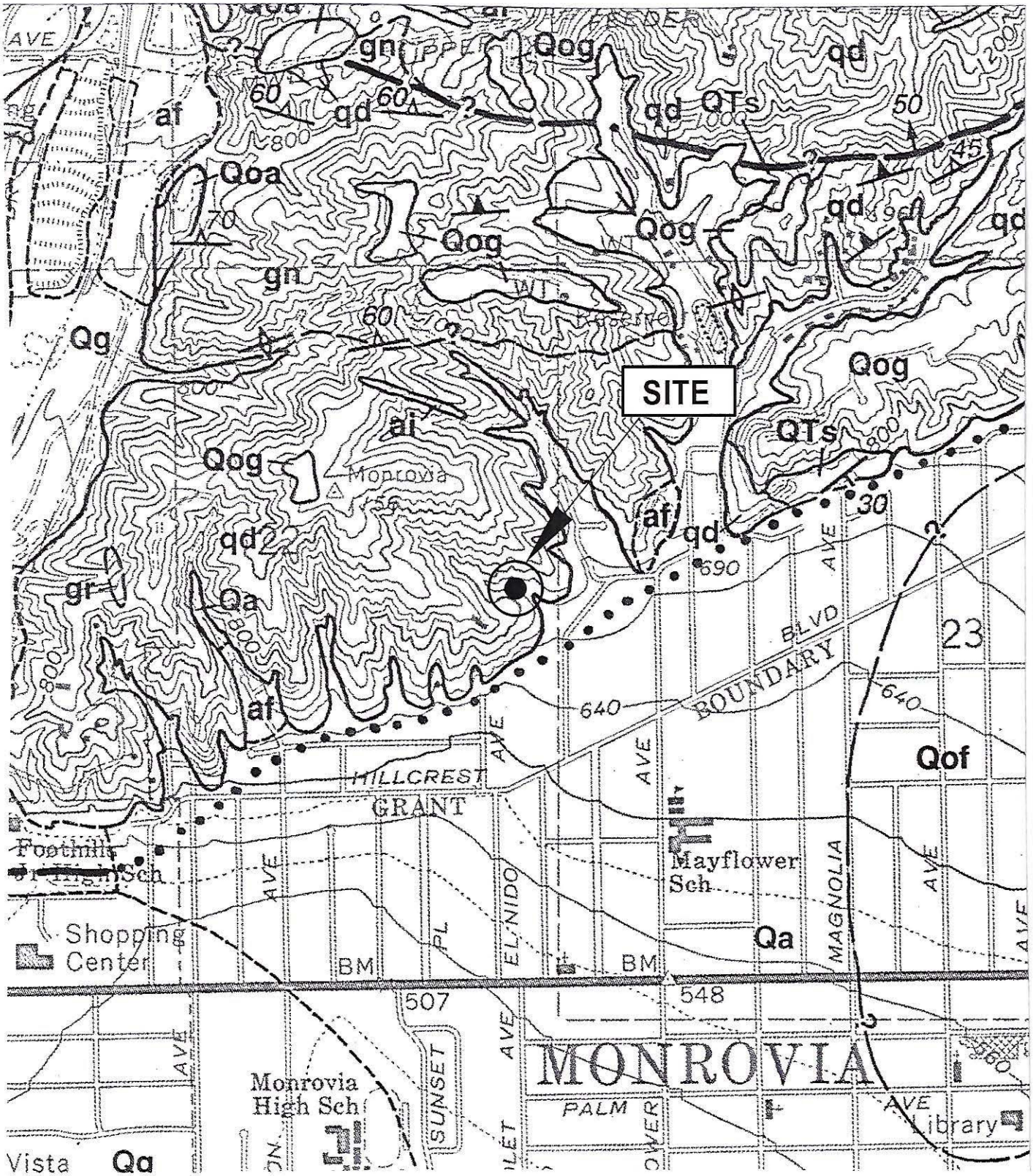
2.2 Laboratory Testing

Representative samples were tested for the following parameters: in-situ moisture content and density, direct shear strength, consolidation and corrosion potential. In-situ moisture and density test results are presented on the exploration logs in Appendix A. Results of EGL's laboratory testing along with a summary of the testing procedures are presented in Appendix B.

3.0 SUMMARY OF GEOLOGIC CONDITIONS

3.1 Regional Geology

Subject property is located within a dissected northwest southeast trending canyon within a faulted up lifted block bordering the Raymond fault in easterly San Gabriel Valley (CDMG, 1999b). Raymond fault trends nearly northeast southwest from Monrovia Ruby Debris Dam area that is located at westerly intersection with Sierra Madre fault zone and extends westerly toward lineament of Hollywood-Santa Monica fault zone. In eastern portion of San Gabriel Valley alluvial valley, Raymond fault zone consisted of transtensional and/or downthrown and locally up thrown structural blocks that resulted from left-step structural plate tension and resulted in shallow rip-apart basins (Crook et al, 1987; Yerkes, 1972; Yeats, 2004; Treiman, 1991; Figures 3 and 4).



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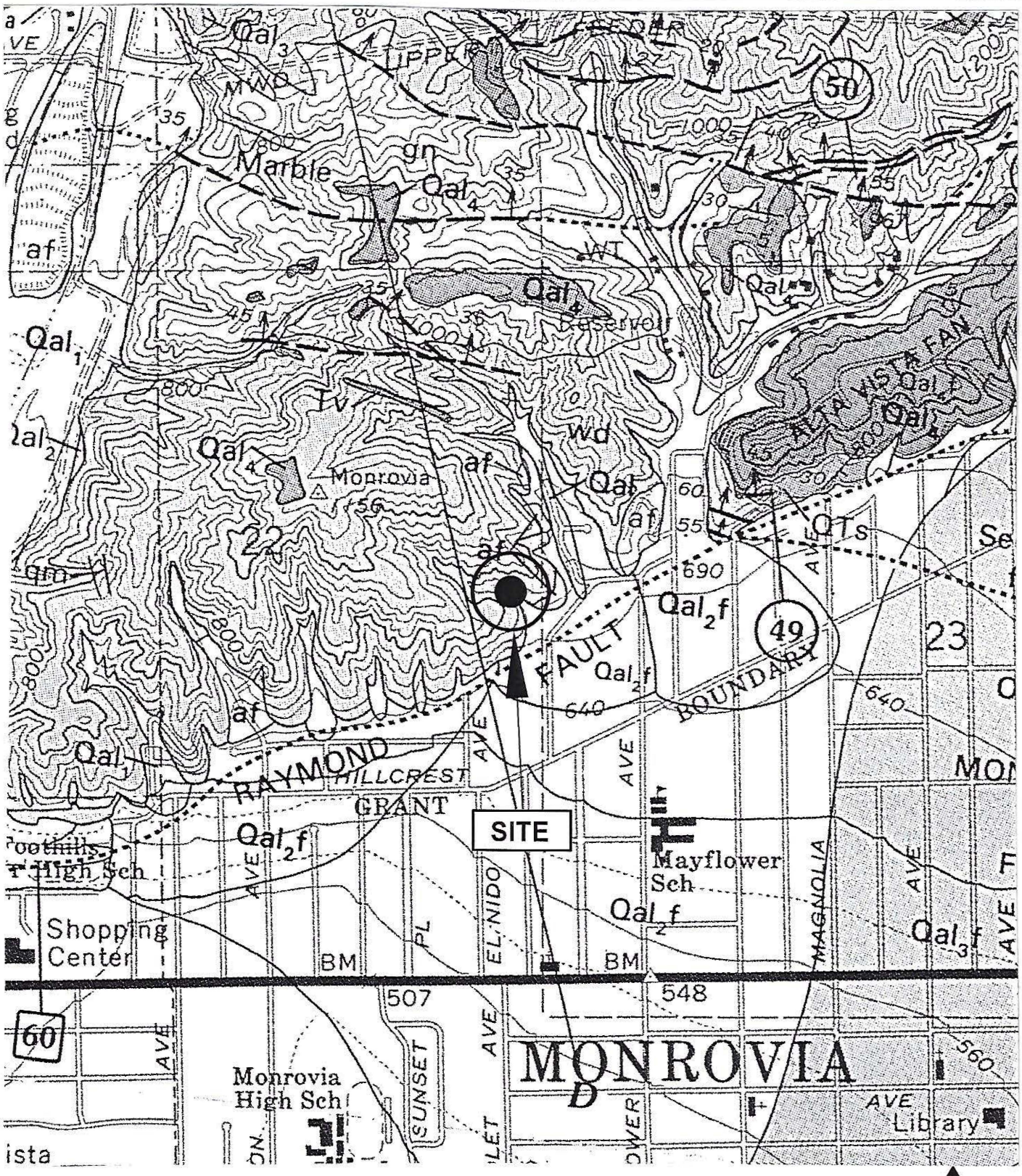

Qal_2f Holocene Alluvium Unit 2: grey to pale brown unconsolidated fine to coarse sand and gravel containing abundant cobbles and boulders, including stream terraces, recently abandoned flood plains, and alluvial fan with incipient soil. f-alluvial fan surface

Qal_4 Alluvium, Unit 4 (Pleistocene)-Red to reddish brown or yellow unconsolidated to well-consolidated fine to medium sand and gravels containing few to many cobble and boulders; all clasts are highly weathered and deposits have moderate to moderately high clay content and are commonly fractured or jointed; includes terraces and highly dissected and/or buried fan deposits with highly developed soils

wd Cretaceous Wilson Diorite of Miller (1934): grey hornblende-biotite-quartz diorite

FAULT-Showing dip. Dashed where approximately located; dotted where concealed; queried where inferred. Arrows show drirection of relative movement

(57) Locality of indirect evidence for Quaternary faulting

33 Locality of direct evidence for Quaternary faulting

U / D Trace of fault, Dashed where approximately located; U, upthrown side; D, downthrown side

Base map adopted from USGS "Geologic Map of the Raymond Fault Zone, the Arroyo Seco to Arcadia": Plate 2.2: Crook et al. 1987: Scale 1"=2,000'

Scale: 1" = 1,000'

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REGIONAL (GEOLOGY) MAP

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Figure 4

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Recent seismic events and reportedly surface ruptures (within the last 11,000 before present (b.p.)) did occur in Pasadena and presumably on Raymond fault trace in 1988. Well defined to subtle surficial features (abnormally vegetation growth, triangular facet slope face, offset drainage channels, branched flowing springs and subsurface groundwater barriers) were defined and determined to possibly occur during Pleistocene and Holocene time.

3.2 Seismic History

Raymond fault zones, 26-miles (42-km) long and 1,250 to 1,500 feet wide, has a significant left-lateral displacement that also shows minor high angle, 75°, reverse fault components (Crook et al, 1987). Raymond fault extends southwesterly from Monrovia Ruby Debris Dam area toward Arroyo Seco in a roughly northeast southwest direction. Based on field findings and geomorphological studies located within San Gabriel Basins along Raymond fault zone (Arcadia to San Marino), Weaver and Dolan (2000) indicated that consistently 400 meters and focal mechanism confirm major left-lateral strike slip on said fault system rather than right-stepping transpression (restraining bends) of pressure basement ridges.

Raymond fault system is considered active, fault traces that have past seismic events occurred in 1988 and within the last 11,000 years based on definition of California Geological Survey (formerly as California Division of Mines and Geology). However, Raymond Fault traces within San Marino and unincorporated southern East Pasadena have not been well documented due to dense residential development (Yeats, 2004; Dolan, 1997; Crook et al, 1987; and Treiman, 1991).

Fault zone of interest located within Mt. Wilson 7.5-minute quadrangle and particularly in the east Pasadena area branched into two splays, north and south branches. Projected fault traces are based on previous works performed by Crook et al, (USGS, 1987), CDMG staff, Los Angeles County officials and other private consulting companies utilizing aerial photographic and geomorphological interpretations. Fault trace interpretations include offset drainage channels, subsurface groundwater barriers (pre-1952) correlated with several water district companies' geologic interpretations and were reconfirmed and field checked later by CDMG geology staffs, Los Angeles County geotechnical officials and other college Thesis programs (see References). Subject property is located north and outside the projected crossings fault splay (see Figures 3 and 4, Regional Geologic Maps).

Based on recent fault trenching data, aerial photo interpretation and field geologic mapping of fault scarps, Southern California Earthquake Center (SCEC, 2006) estimated that at least eight (8) surface-rupturing events have occurred along entire fault in last 36,000 years. An estimated slip rate of 0.10 to 0.22 mm per year and with a plausible recurrence interval of 4,500 years is assigned for the entire fault length. Exact nature of fault slip is still a subject of debate. A probable seismic magnitude is estimated M_w=6.0 to 7.0 for the entire length of Raymond Hills fault.

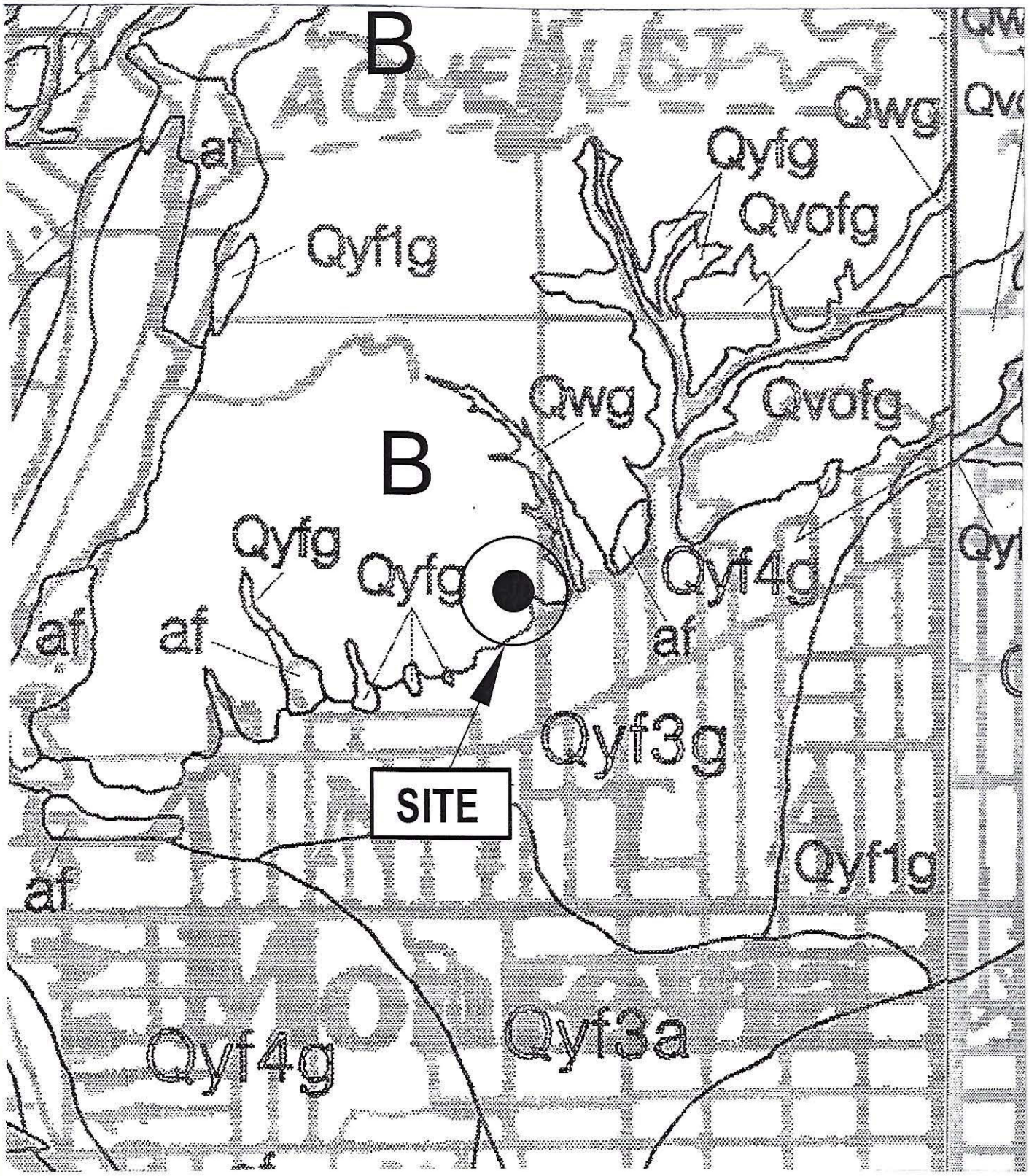
3.3 Site Geology

Field exploration on the subject property included four (4) excavated trenches and maximum 12-vertical feet. Earth materials encountered and observed surficially and within the trenches comprised undifferentiated artificial fill (Af), early Holocene aged Young Alluvial Fan Deposits (Qyf; Fig 5; CDMG, 1998), alluvial terrace deposits and Cretaceous granitic bedrock. Subsurface geologic conditions and approximation of geologic contacts are shown in trench logs, Plates A-1 to A-4, *Appendix A, Field Exploration*.

Artificial fill (Af) were encountered and observed in the elevated building and landscape areas above the existing canyon bottom and shared driveway. As encountered and observed the previously placed artificial fill, underneath the driveway, thickness is approximately two (2) to four (4) foot thick and consisted of silty sand with mixed in gravel- to small cobble sized granitic rock fragments, brown, dark brown and greyish brown in color, slightly moist, porous and moderately dense.

Onsite young alluvial deposits (Qal) composed of silty sand, pale brown to olive brown in color, slightly moist to moist, porous and moderately dense. Variable amount of gravel- and small cobble sized rock clasts are locally encountered and observed at lower depths within the excavated trenches. True thickness of alluvial deposits is unknown.

Remnant of alluvial terrace deposits (Qt) was encountered and/or observed in the elevated and higher elevation of the ascending slopes above the canyon bottom. As encountered the old alluvial deposits composed of clayey silty sand, light brown and brown in color, slightly moist, porous and dense. Caliche stringers are present within the alluvial terrace deposits. Thickness of alluvial terrace deposits is unknown.



Scale: 1" = 1,000'

Qyfg — Young Alluvial Fan Deposits, Undifferentiated, gravelly (g). Holocene to latest Pleistocene, gravels, sand and silt, loose to moderately dense

B — Bedrock material

Base map adopted from CDMG "Quaternary Geologic Map of the 7.5'-Mt. Wilson Quad., Los Angeles County, California"; CDMG OFR 98-021; 1998; Scale 1"=5,280'

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QUATERNARY REGIONAL (GEOLOGY) MAP

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Figure 5

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Weathered crystallined bedrock of Cretaceous Wilson Diorite (wd; equivalent to quartz diorite (qd) of Dibblee, 1998) were encountered underlain the existing alluvial fan deposits and exposed surficially at the surrounding ascending cut and natural slopes. Onsite granitic bedrock is massive in nature, mostly medium-grained to locally porphyritic, light grey in color, salt-and-pepper texture, jointed, dense, moderately hard and moderately tough. The appearance and hardness of the Wilson Diorite appeared differently than those exposed at depths as resulted from past tectonic deformation, localized intrusions and the degrees of weathering. Coloration is light greyish brown and reddish grey in color. Localized secondary granitic intrusive dike, inclusions, sills and veinlets are locally present and exposed surficially at outcrops. Development of foliation appeared absent or weak. Structurally, in proposed development area, it is considered geologically favorable as shown on cross sections due to the massive nature.

3.3 Geological Structures

Onsite dioritic structure is massive with little or no well-defined foliation or lineament. Jointing structure, block and/or conjugated, are locally present and appeared located in areas outside the proposed residential development. Presence of paleoshears are locally encountered and/or observed at the lower elevation outcrops and at surrounding denuded ascending slopes.

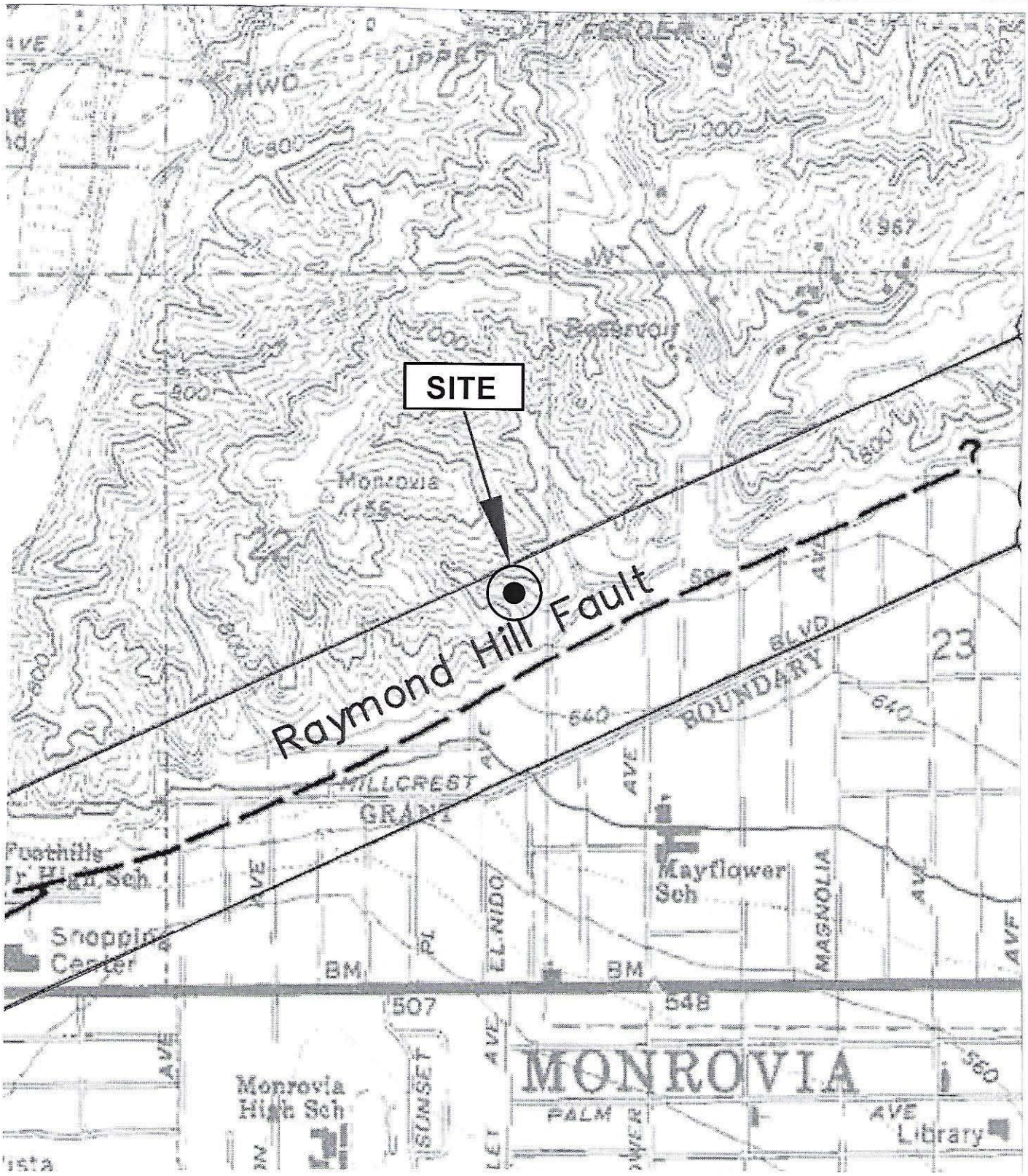
Dibblee (1998) and Crook et al. (USGS, 1987) reported that the site and vicinity located within a up thrown crystallined dioritic block flanked southeasterly by a north, 45° to 70°, plunging fault. Foliation measurement is absent for the site and vicinity. Both publications have similar geologic conditions and structures and are consistent with field geologic conditions and measurements.

3.4 Landslide and Instability

During EGL's field reconnaissance, evidence of previous slope instabilities were not encountered and/or observed at the surrounding ascending slopes. Subject property is located outside the earthquake induced liquefaction hazard zone but is within the earthquake induced landslide potential hazard zone and within the northerly Alquist-Priolo *Earthquake Zones of Required Investigation* of Raymond fault (formerly known as the *State of California Special Studies Zones*; see Figures 1 and 6).

3.5 Groundwater

Static ground water levels were not encountered during our subsurface investigation to the maximum explored depth of 12.0 feet below the existing ground surface. Based on the Mt.



Potentially Active Faults
Faults considered to have beed active during Holocene time and to have a relative high potential for surface rupture; solid line where accurately located, long dash where approximately ocated, short dash where inferred, dotted where concealed; query (?) indicates additional uncertainty. Evidence of historic offset indicated by year of earthquake-associated event or C fo displacementcaused by creep or possible creep.

Special Studies Zone Boundaries
These are delineated as staight-line segments that connect encircled turning points so as define special studies zones segments

Seaward projection of zone boundary

Base map adopted from CDMG "Alquist-Priolo Earthquake Fault Zone Map of Mt. Wilson 7.5' Quad, Los Angeles County, California", 1986, Scale 1"=2,000' and CGS "Fault Evaluation Report of El Monte and Mt. Wilson Quadrangles", 2017, FER 2016-0264, scale 1"=2000'

N

Scale: 1" = 1,000'

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REGIONAL FAULT ZONE MAP

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Figure 6

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Wilson Quadrangle historically high groundwater depth map, the historic groundwater is approximately ten (10) to forty (40) feet below ground surface at the subject site (Plate 1.2 High Ground Water Map; CDMG, 1998). No immediate groundwater wells are located in the subject site vicinity. The historic Los Angeles County Department of Public Works groundwater well data indicated historic wells area located at easterly nearby wells located near and south of Ruby Dam (Well Nos. 4203, 4213, 4213A and 4214E, 1930 to 1967) indicated the top of water level is approximately 7 to 25.3 feet below ground surface. Whereas the westerly nearby wells (Well Nos. 4174, 4174A, 4174F, 1952 to 1972) indicated the top of water level is approximately 3.2 to 109 feet below ground surface. Therefore, groundwater is not expected to be a significant constraint during the construction. However, groundwater may be a significant constraint if grading is completed during the rainy season when perched water is more likely to occur.

4.0 SLOPE STABILITY

4.1 General

Stability of the existing ascending slope, slope ratio of 2.8: 1 to 1: 1 (horizontal: vertical) and 53 to 337 feet high, has been considered and calculations are presented in Appendix C. Shear strength parameters were derived using in-place shear strengths of soil materials obtained from this and past investigations and evaluated in light of past experience in similar soil conditions. Based on EGL's field observation, the existing ascending slopes and proposed residential development are considered geologically stable but geotechnically unstable for the current conditions.

Simplified Bishop's method was used to analyze the entire slope for the critical area depicted in Geologic Cross Sections A-A', B-B' and C-C' extended to the top and bottom of the slopes of the existing and proposed slope conditions. Ascending slope geometry depicted in the northerly facing in southerly direction of Geologic Cross Section B is very similar to the Geologic Cross Section A and C in the northerly and southerly facings in southwesterly direction, respectively. EGL utilized residual and ultimate bedrock shear values for the deep-seated analyses. Seismic coefficient of 0.20 g (g: gravity) was used in the seismic condition. Conditions analyzed for slope stability analyses were performed for search ranges and forced at toe searches. Stability calculations and sections are presented on the plates following the report and the results of EGL's slope stability analyses of existing and proposed slope conditions are briefly described in the following sections.

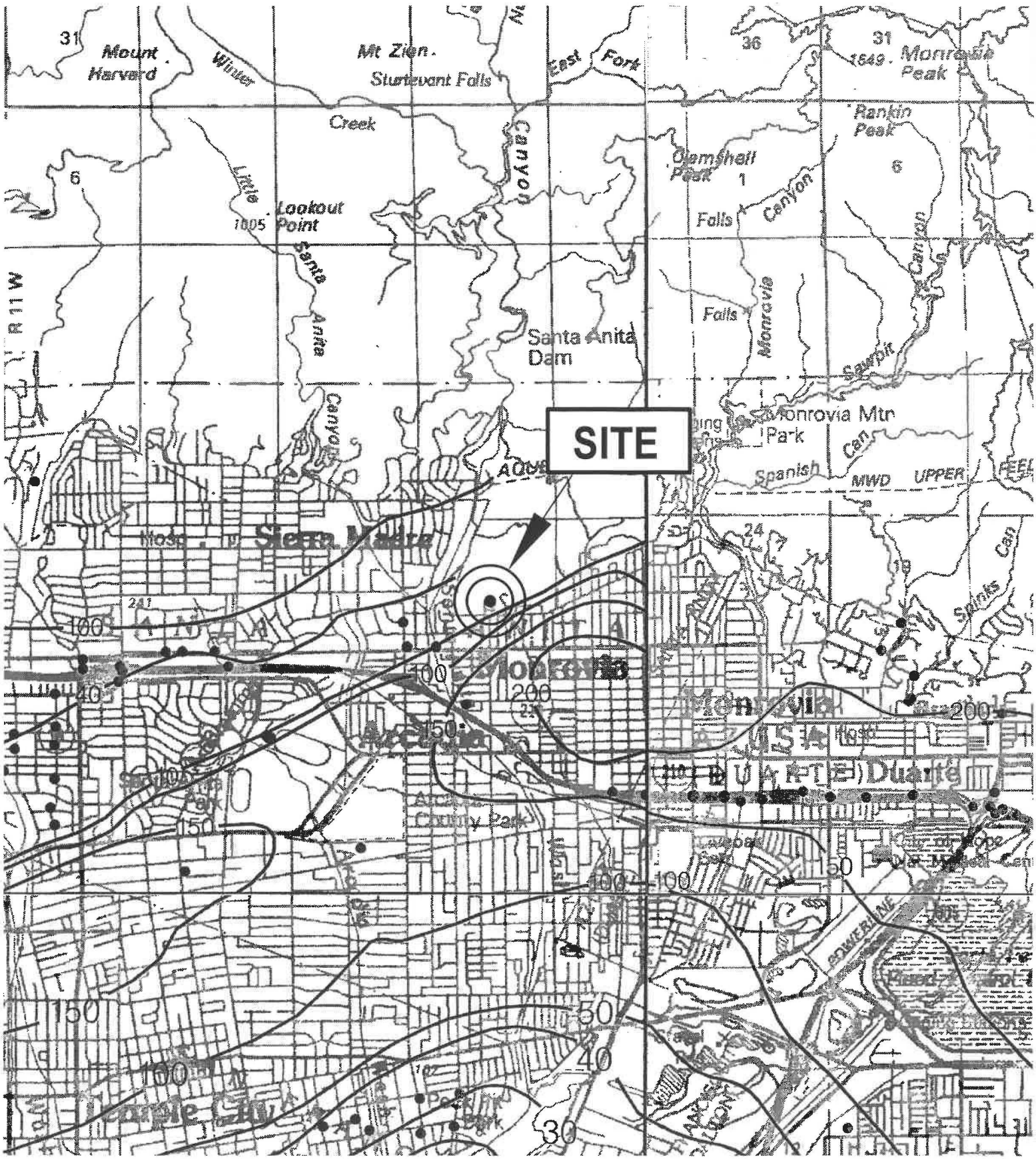


Plate 1.2 Historically Highest Ground Water Contour and Borehole Log Data Location
Mt. Wilson, Azusa, El Monte and Baldwin Park Quadrangles

● Borehole Site

— 30 — Depth to ground water in feet

ONE MILE

SCALE

Earth Materials	Unit Weight (pcf)	Friction Angle Static/Seismic (Degree)	Cohesion Static/Seismic (psf)
Undifferentiated Artificial Fill and Natural Alluvium Ultimate (Af- Qal; T-2 @ 6.0')	130.0	31	92
Bedrock, Residual (wd; T-3 @ 10.0')	140.0	48 / 52	0
Future Compacted Fill (CAf)	125	25	150

Based on EGL's field observation and slope stability analysis, the existing and proposed slopes are considered geologically stable but geotechnically unstable for the current conditions. No deep-seated failures were observed during EGL's field investigation. Results of slope stability analyses are described below and are presented in Slope Stability Analyses, Appendix C.

4.2 Existing Slope

Ascending slope has overall slope ratios of approximately 2.8: 1 to 1: 1 (horizontal: vertical), with maximum relief of 53 to 337 feet. Deep-seated failures were not encountered and/or observed during EGL's field investigation the existing slopes within the subject site. It is EGL's opinion that existing slopes within the subject site are considered unsatisfactory and possess inadequate factors of safety against instabilities.

Analyzed Section	Calculated Condition	Factors of Safety (Static / Seismic)
B - B' (West-Northwest facing in southwesterly direction)	Existing overall slope approximately 70 feet high	1.35 / 0.91
		1.32 / 0.89

Existing ascending slopes in Cross Section B-B', under static condition have factors of safety, FS=1.35 to FS=1.32, and under seismic condition, FS=0.91 to FS=0.89. Analyzed slope is statically greater than the minimum required of FS=1.50 but is seismically less than the minimum required, FS=1.10. Therefore, the existing slopes maybe considered unstable.

4.3 Temporary Slope Condition

Under similar analytical conditions as above, but without assigned wall loading. The temporary 12.5 feet high cut slope, for the recommended 15 feet wide building clearance, as depicted in Cross Section B-B' indicated the factors of safety, FS=0.88, is less than the minimum required FS=1.25. Therefore, the temporary cut slope conditions are unstable and require additional support and/or alternative excavation methods. Additional support for the temporary cut slope

condition using an assumed lateral load, 3.65 kips (kips, thousand pounds per foot), for the temporary shoring (see below and under 6.0 Recommendations Section)

Calculated Condition	Wall Lateral Load	Factors of Safety (Static / Seismic)
Overall temporary slope approximately 70 feet high with 13 feet high cut slope	N / A	0.88 / ----
	3.65	1.25 / ----

4.4 Proposed Permanent Condition

Under similar analytical conditions used as above, proposed ascending slope with building loads. Permanent Proposed Cross Section B condition under static condition have factors of safety, FS=1.52 to 1.50, and under seismic condition, FS=1.13 to 1.11. Additional support for the proposed permanent slope condition using an assumed lateral load, 12.5 and 8 kips (kips, thousand pounds per foot), for the static and seismic conditions, respectively. Both conditions are greater than the minimum required of FS=1.50 and FS=1.10. Therefore, proposed permanent slope conditions may be considered stable.

Pile spacing, feet	Pile Length, feet	Lateral Load, kips; Static / Seismic	Factors of Safety (Static / Seismic)
1	17	12.5 / 8	1.52 / 1.13
		12.5 / 8	1.50 / 1.11

4.5 Surficial Slope Stability

Existing alluvial terrace deposits and weathered bedrock materials located on the existing ascending slopes are subjected to sloughing under saturated conditions. Surficial slope stability of the existing ascending slopes at slope gradient of 1: 1 to 2:8 (H: V) possess factors of safety FS=0.41 and FS=1.14 and are less than the minimum required factor of safety for an assumed saturated depth of four (4) feet (see Figure 7). Surficial slope stability of the existing ascending slopes possesses less than the minimum required of FS=1.50. It is EGL's opinion that the surficial soils at the existing ascending slopes will not adversely affect the subject property or neighbor's property and should remain in the current condition due to the existing low to medium height brushes and medium- to large-large diameter trees with well-established wide canopies. Due to the low factors of safety against surficial instability, EGL recommends a minimum of one (1) foot high freeboard be provided on the ascending slope retaining walls.

All slopes will be subject to surficial erosion. Therefore, slopes should be protected from surface runoff by means of top-of-slope compacted earth berms or concrete interceptor drains.

SURFICIAL SLOPE STABILITY
INFINITE SLOPE W/ PARALLEL SEEPAGE

Existing Ascending Slope

$$F.S. = \frac{C + (\gamma t - \gamma w) \times H \times \cos^2\alpha \times \tan\phi}{\gamma t \times H \times \cos\alpha \times \sin\alpha}$$

Soil Properties and Slope Ratio:

1 : 1 Slope, Horizontal to Vertical
Direct Shear Test Results, from T-1 @ 0.0'

C =	6	psf
α =	45	degrees
ϕ =	38	degrees
H =	4	ft
γt =	123.8	pcf
γw =	62.4	pcf

$\cos\alpha$ =	0.707107
$\cos^2\alpha$ =	0.5
$\sin\alpha$ =	0.707107
$\tan\phi$ =	0.781286

F.S. = 0.41 (< 1.5)

Soil Properties and Slope Ratio:

2.8 : 1 Slope, Horizontal to Vertical
Direct Shear Test Results, from T-1 @ 0.0'

C =	6	psf
α =	19.43	degrees
ϕ =	38	degrees
H =	4	ft
γt =	123.8	pcf
γw =	62.4	pcf

$\cos\alpha$ =	0.943049
$\cos^2\alpha$ =	0.889341
$\sin\alpha$ =	0.332655
$\tan\phi$ =	0.781286

F.S. = 1.14 (< 1.5)

Therefore, existing 1 : 1 and 2.8 : 1 slopes located at the subject site do not have adequate factor of safety against surficial instability under saturated conditions to a depth of 4.0 feet for thick soil conditions.

EGL Project No.: 19-241-003EG
Site: 347 Highland Place, Monrovia, California

Figure 7

EGL, Inc., 11819 Goldring Road, Suite A, Arcadia, CA 91006; (626) 263-3588 (Office); (626) 263-3599 (Fax)

All slopes should be landscaped with suitable plants requiring minimal cultivation and irrigation water in order to thrive. Irrigation system should be installed and properly maintained. Over-watering and subsequent saturation of slope surface should be avoided.

5.0 CONCLUSIONS

Based on the results of our subsurface investigation and engineering analyses, it is our opinion that the proposed construction is feasible from an engineering geologic and geotechnical engineering standpoint, provided the recommendations contained herein are incorporated in the design and construction. The following is a summary of the geotechnical design and construction factors that may affect the development of the site:

5.1 Seismicity

EGL's studies of regional and local seismicity indicate that there are no known active faults crossing the property. However, Raymond fault (part of Puente Hill fault system) located approximately 200 to 500 feet southeast of subject site (Figures 3, 4 and 6). Since the subject property is located within the northern boundary of the Alquist-Priolo Special Study Zone (currently known as the *Earthquake Zones of Required Investigation*), the City of Monrovia may require a fault trench study for the caustic Raymond fault traces. The subject property is located in a seismically active region and is subject to seismically induced ground shaking from nearby and distant faults, which is a characteristic of all Southern California communities.

5.2 Seismic Induced Hazards

Based on our review of the seismic induced hazards zones of Mt. Wilson quadrangle (Figure 1, CDMG, 1999b) it is concluded that the site is located outside the mapped potential earthquake induced liquefaction but is located adjacent and within the mapped potential earthquake induced landslide areas. It is our opinion that a liquefaction study is not required for the subject site.

5.3 Excavatability

Excavation of the subsurface materials should be able to be accomplished with conventional earthwork equipment. However, existing granitic bedrock may be becomes harder and denser with depths and may require the use of hydraulic rock breaker and jackhammer.

5.4 Surficial Soil Removal and Recompaction

Based on our investigation, it is concluded that the existing surficial soils may not be suitable for structure support as they presently exist and will require remedial grading as discussed herein.

5.5 Groundwater

Groundwater, seeps, seepage or springs and/or static surface streams were not observed in the any of the excavated trenches or surficially during our subsurface investigation to the maximum explored depth of 12.0 feet below the existing ground surface. Groundwater is therefore not expected to be a significant constraint during the construction. However, groundwater may be a significant constraint if grading is completed during the rainy season when perched water is more likely to occur.

6.0 RECOMMENDATIONS

Based on the subsurface conditions exposed during field investigation and laboratory testing program, it is recommended that the following recommendations be incorporated in the design and construction phases of the project.

6.1 Grading

6.1.1 Site Preparation

Prior to initiating grading operations, any existing vegetation, trash, debris, over-sized materials (greater than 6 inches), and other deleterious materials within construction areas should be removed from the site.

6.1.2 Surficial Soil Removals

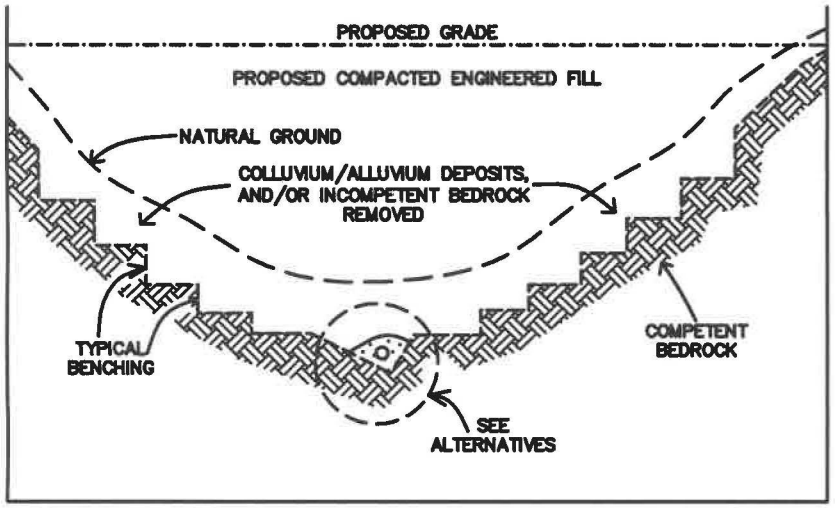
EGL recommends that the existing artificial fill soils and alluvial deposits should be removed to a depth of approximately five (5) feet below the existing ground surface or three (3) feet below the bottom of the proposed footings, whichever is deeper. The recommended removal should extend at least five (5) feet beyond proposed building exterior lines. Sandy import material (EI < 20) should be used for the top 12 inches of the building pad. Locally deeper removals may be necessary to expose competent natural ground.

Existing near surface soils within the proposed driveway areas should also be removed to competent natural soil or one (1) foot below proposed grade, whichever is deeper. Actual removal depths should be determined in the field as conditions are exposed. Visual inspection and/or testing may be used to define removal requirements.

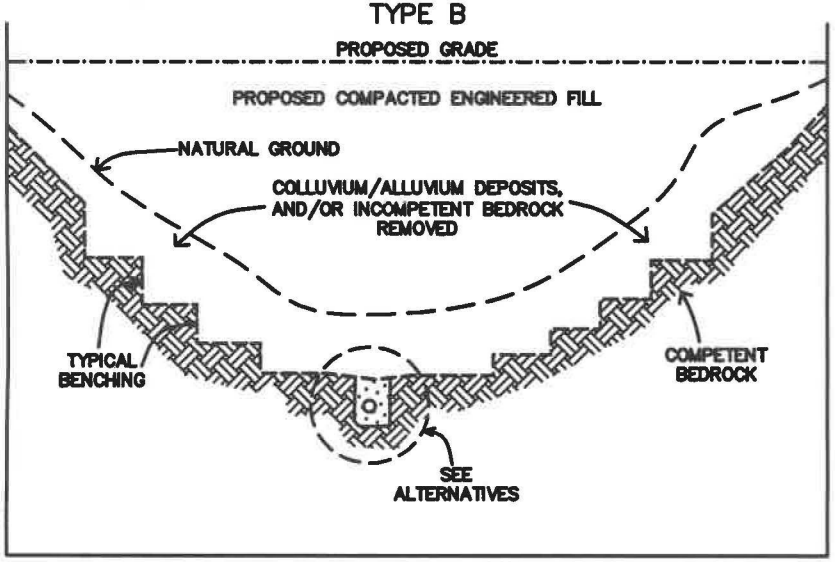
The proposed residential development is located within the canyon bottom EGL recommends a canyon subdrain be provided within the canyon and connected to the proposed storm drain system (see Figure 2c).

CANYON SUBDRAIN DETAIL

TYPE A



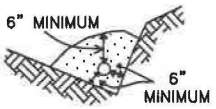
TYPE B



NOTED: ALTERNATIVES, LOCATION AND EXTEND OF SUBDRAINS SHOULD BE DETERMINED BY TH E SOILS ENGINEER AND/OR ENGINEERING GEOLOGIST DURING GRADING

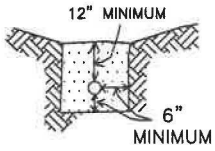
CANYON SUBDRAIN ALTERNATE DETAILS

ALTERNATE 1: PIPE AND FILTER MATERIAL



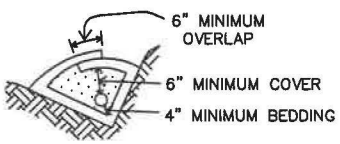
A–1

FILTER MATERIAL: Minimum of 9 Cubic Feet per Linear Foot
PIPE MATERIAL: 4"–diameter PVC Sewer Pipe or Approved Substitute with Minimum 8 (1/2"–∅) Perforation per linear feet in bottom half of pipe.
ASTM D2751, SDR 35 or ASTM D1527, SCHD. 40
ASTM D3034, SDR 35 OR ASTM D1785, SCHD. 40
for continuous run in excess of 500 feet use 6"–∅ pipe

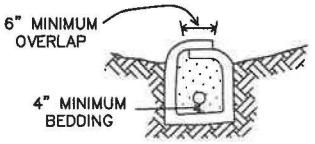


B–1

ALTERNATE 2: PERFORATED PIPE SURROUNDED WITH FILTER MATERIAL



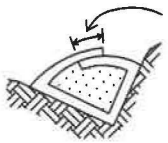
A–2



B–2

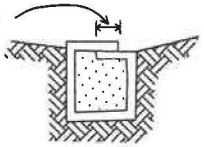
Filter Material: 9 Cubic Feet per Linear Foot
Perforated Pipe: Minimum 4"–Diameter

ALTERNATE 3: FILTER MATERIAL WRAPPEDM IN FABRIC



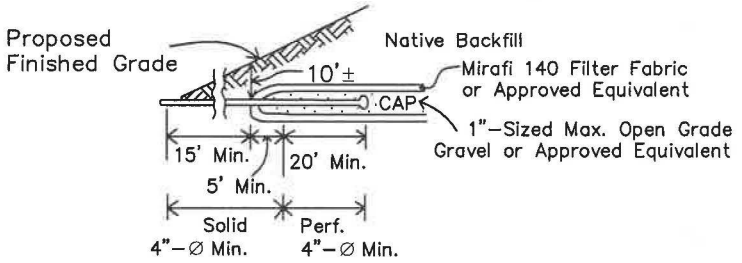
A–3

1"–Sized Gravel or Approved Equivalent 9 Cubic Feet per Linear Foot Wrapped in Filter Fabric of Mirafi 140 Filter Fabric or Approved Euivalent (Typical)



B–3

Detail of Canyon Subdrain Terminal For Alternates A–3 and B3



FILTER MATERIAL

SIEVE SIZE	PERCENT PASSING
1–Inch	100
3/4–Inch	90 – 100
3/8–Inch	40 – 100
No. 4	25 – 40
No. 8	18 – 33
No. 30	5 – 15
No. 50	0 – 7
No. 200	0 – 3

6.1.3 Treatment of Removal Bottoms

Competent natural alluvium exposed within approved areas for fill placement should be scarified minimum depth of 6 to 8-inches, conditioned to near optimum moisture content, then properly compacted in-place to minimum project standards.

6.1.4 Structural Backfill

Onsite fill, alluvial soils and granitic bedrock materials can be reused as compacted fill, provided they are free of oversized materials (greater than four (4)-inches), all organic materials, construction debris and trash. Soils imported from off-site sources should not be clayeyer than the onsite soils and should be approved by representatives of geotechnical engineer prior to transporting to the site. Sandy import material (EI < 20) should be used for the top 12 inches of the building pad. Fills should be placed in relatively thin lifts (6" to 8"-thick), brought to near optimum moisture content, then properly compacted to obtain minimum 90 percent relative compaction in accordance to ASTM D-1557-12.

6.1.5 Testing and Reporting

Fill soils should be tested at the time of fill placement to ascertain that the necessary moisture and compaction is achieved. Results of observation and testing services will be presented in the compaction report once site rough grading is completed.

6.2 Sloping Excavation

Based on materials encountered, it is EGL's opinion that sloped excavations located in area of the adjacent ascending slope retaining walls may be considered to the earth material and slope ratios tabulated below:

Earth Materials	Slope Ratio (Maximum)
Existing Fill and Alluvial Soils (Af-Qal) or Alluvial Terrace Deposits (Qt)	3' vertical with 1.5:1 layback
Existing Bedrock (wd)	5' vertical with 1:1 layback

Temporary excavations are anticipated to be temporary stable. Any existing adjacent structures should be protected during construction so no damage is done to the structure. Neither heavy equipment loading nor additional surcharge loading should be permitted at the top of the descending slope. A representative of this office should inspect the temporary excavation to make any necessary modification.

6.2.1 ABC Slot Cuts

In areas where there is insufficient space for sloped laybacks, EGL recommends ABC Slot Cut method be used up to a maximum excavation height of ten (10) feet.

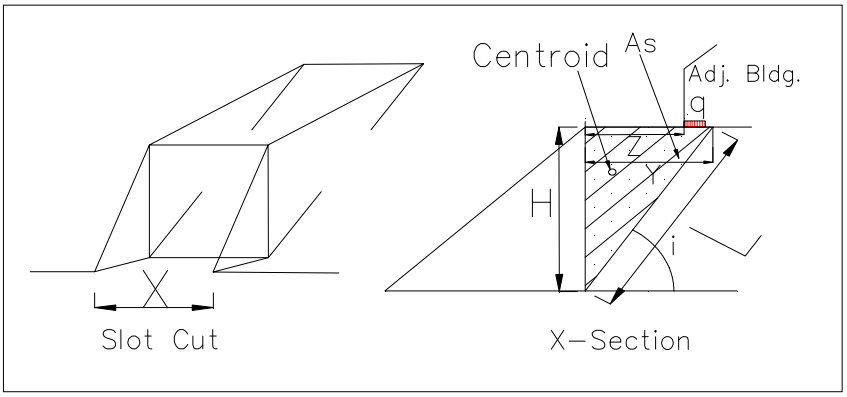
ABC Slot cuts should be used in the proposed excavations in the adjacent locations so existing southerly and easterly neighboring structures are safely to remain unaltered. It is recommended that ABC slot cut method be used during the grading and foundation excavations where the excavation is within a horizontal distance from the adjacent structures equal or less than the depth of the excavation. The following presents our ABC Slot cut recommendations:

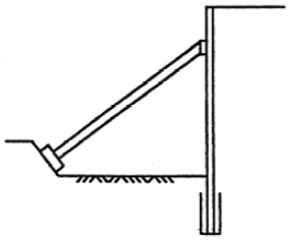
a. Excavate to over-excavation at side slopes no steeper than 1 to 1, horizontal to vertical,
b. For alternate slot cut method without bracing, slots should be no wider than ten (10) feet and for maximum ten (10) feet high cuts (see Calculations, Figure 8).
c. If caving or sloughing occurred, additional temporary shoring and/or bracing method may be used to support the vertical cuts. Excavate in alternate slots, no wider than eight (8) feet.
d. Once the excavations have been completed the bottom should be inspected and backfilled without delay.
e. In areas where slot cuts are needed during the retaining wall construction the footing excavation should be inspected prior to placing rebar. Wall sections should be constructed and backfilled prior to opening adjacent slots.
f. All excavations and shoring should be made under the observation of the geotechnical engineer or his representative.
g. Care must be taken to prevent additional surcharge loads above un-shored cuts a horizontal distance from the top of the cut equal to the depth of the excavation.
h. Provisions for drainage should be implemented to prevent saturation of unshored excavations.
i. It is recommended that geotechnical engineer representatives should inspect the excavations during construction, so that necessary modifications can be made.

In as much as the proposed excavations may remove lateral support from the adjacent easement a survey monitoring program or periodic inspection by project geotechnical consultant will be necessary to monitor potential movement in the excavation. In addition, the contractor should be solely responsible for safety during construction.

Slot Cut Calculation with Building Surcharge Load & Temporary Bracing

θ = Angle of influence (i) = 45 + ϕ/2 (Multiple provided)	30	45	50	62.5	75	degrees
H =Height of Slot Cut =	10	10	10	10	10	ft
L = Length of failure surface = H/sinθ =	20.0	14.1	13.1	11.3	10.4	ft
ϕ = Angle of internal friction =	35	35	35	35	35	degrees
C = Cohesion =	54	54	54	54	54	psf
γ = Unit weight of soil =	125	125	125	125	125	pcf
X = Width of slot cut =	10	10	10	10	10	ft
A = Area of failure = $H^2/(2*\tan\theta)$ =	86.6	50.0	42.0	26.0	13.4	ft
D = Depth of Centroid = H/3 =	3.3	3.3	3.3	3.3	3.3	ft
Z = Distance to Adjacent Building =	10.0	10.0	10.0	10.0	10.0	ft
q = Adjacent Building Load =	500.0	500.0	500.0	500.0	500.0	psf
Depth of the failure wedge, Y = H/tan(θ)	17.3	10.0	8.4	5.2	2.7	ft
Adjacent footing within the failure wedge? 1=Yes, 0=No	1	0	0	0	0	
Q = Surcharge on Failure Wedge =qx1/1000 =	0.5	0.0	0.0	0.0	0.0	kips/ft
W = Weight+Q = γ*(A/1000)+Q =	11.3	6.3	5.2	3.3	1.7	kips/ft
F_T = Tangent force = Wsinθ =	5.7	4.4	4.0	2.9	1.6	kips/ft
F_N = Normal force = Wcosθ =	9.8	4.4	3.4	1.5	0.4	kips/ft
R = Resistance force along failure plane = F_N*tanϕ + L(C/1000) =	7.9	3.9	3.1	1.7	0.9	kips/ft
Lateral Resistance from Bracing, R_L =	0.3	0.3	0.3	0.3	0.3	kips/ft
Forces along sides						
Area (A_S)=	86.6	50.0	42.0	26.0	13.4	ft^2
Average intergranular stress, τ = C + γ*Dtanϕ =	345.8	345.8	345.8	345.8	345.8	psf
Resistance force along sides of wedge = R_S = τ*2(A_S/1000) =	59.9	34.6	29.0	18.0	9.3	kips
F.S. = (R*X + R_S + R_L*X) / F_T*X =	2.51	1.72	1.56	1.30	1.29	





Bracing within Slot Cuts

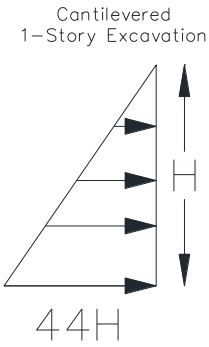
Site: 347 Highland Place, Monrovia, California
EGL Project No.: 19-241-003

Provide bracing within the slot cuts for additional support. Bracing should be designed by structural engineer and capable of supporting 0.3 kips/ft where the adjacent structure is approximately 10 feet away from the proposed excavation.

Figure 8

6.2.2 Shoring

The purpose of the shoring piles is to support the existing northerly and southerly upslope retaining wall and to protect construction personnel during the deep excavation process at the subject site. Based on the materials encountered at the subject site and the depth of the proposed excavation, it is our opinion that soldier piles with lagging may be used to support the southeasterly vertical cuts during construction of the proposed basement level. The contractor should be solely responsible for safety during construction. A survey monitoring program, or other type of instrumentation, may be necessary to monitor potential movement along the banks. Shoring should have a maximum deflection of ½-inch at the top to protect adjacent structures and streets. If necessary, bracing should be used to provide additional lateral support. Shoring, consisting of conventional soldier piles and braced with lagging, may be used for support of the planned excavations. Design parameters for the shoring system are presented in the following diagrams.



The project structural engineer should determine the spacing of the soldier piles. Lagging is required to span between soldier piles to support to lateral earth pressures or prevent soils sloughing. Lagging should be treated and left in place to provide lateral support for the new compacted fill.

Careful examination of the soil during the excavation and observation of on-site installation of the shoring system by a representative of this office is mandatory to verify the soil condition. All shoring and bracing should be in accordance with current requirements of Cal/OSHA and all other agencies having jurisdiction.

6.3 Shallow Foundation Design

6.3.1 Bearing Value

An allowable bearing value of 1,800 pounds per square foot (psf) may be used for design of continuous or pad footings with a minimum of 12 or 24 inches in width, respectively. All building

footings should be founded a minimum of 18 inches deep into new certified compacted fill. This bearing value may be increased by 200 psf for each additional foot of depth or width to a maximum value of 3000 psf. This value may be increased by one third (1/3) when considering short duration seismic or wind loads.

6.3.2 Settlement

Settlement of the footings placed as recommended and subject to no more than allowable loads is not expected to exceed 3/4 inch. Differential settlement between adjacent columns is not anticipated to exceed 1/2 inch for a span of 30 feet or less.

6.3.3 Lateral Pressures

Active earth pressure for static and seismic conditions from horizontal backfill may be computed as an equivalent fluid weighting of 30 pcf and 57 pcf, respectively. Where the slope of the backfill is 2:1, an equivalent fluid pressure of 50 pcf and 77 pcf may be used for static and seismic conditions, respectively. Active earth pressure for static conditions for 1.5:1 (H:V) backfill may be computed as an equivalent fluid weighting of 60 and 87 pcf may be used for static and seismic conditions, respectively. Only retaining walls greater than six (6) feet need to be designed for seismic loads. The above values assume free-draining conditions with a subdrain system installed behind the walls as recommended.

Due to the low factors of safety against surficial instability, EGL recommends the proposed rear yard ascending slope retaining wall be provided with minimum one (1) foot high freeboard above the H/2 building clearance from the proposed residence (see Section 4.5). The freeboard should be designed for an impact load using an equivalent fluid pressure of 125 pcf.

Passive earth pressure may be computed as an equivalent fluid pressure of 300 pcf, with a maximum earth pressure of 3000 psf. An allowable coefficient of friction between soil and concrete of 0.35 may be used with the dead load forces. When combining passive pressure and frictional resistance, the passive pressure component should be reduced by one third (1/3).

6.3.4 Foundation Construction

It is anticipated that the entire structure will be underlain by onsite alluvial soil and bedrock materials of very low to low expansion potentials. Following presented our recommendations for the foundation construction.

All footings should be founded at a minimum depth of 18 inches below the lowest adjacent ground surface and founded entirely into competent new certified compacted fill. All continuous footings should have at least two No. 4 reinforcing bar placed both at the top and at the bottom of the footings. A grade beam of at least 12 inches square, reinforced as recommended above for footings, should be utilized across the garage entrance. Base of the reinforced beam should be at the same elevation as the bottom of the adjoining footings. Isolated and/or continuous footings should be placed at a depth of at least 18 inches into underlying competent new certified compacted fill.

6.3.5 Concrete Slab

Concrete slabs should be a minimum of 4 inches thick and reinforced with No. 4 rebar spaced at 18-inches on center both ways. All slab reinforcement should be supported to ensure proper positioning during placement of concrete. Garage slabs should be poured separately from residence footings. A positive separation should be maintained with expansive joint material to permit relative movement. Concrete slabs in moisture sensitive areas should be underlain with a vapor barrier consist of a minimum of ten (10)-mil polyethylene (PE) membrane with all laps sealed. A minimum of two inches of sand should be placed over the membrane to aid in uniform curing of concrete.

6.4 Foundation Setback and Building Clearance

All proposed foundations should have a minimum H/3 or five (5) feet horizontal distance measure from the footing bottom to the adjacent descending slope face.

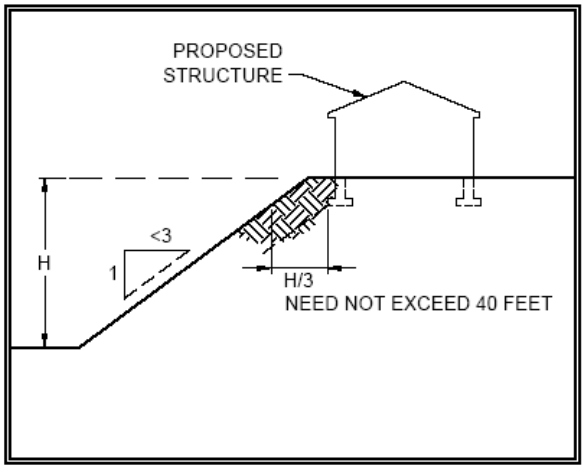


Figure 2 (Section 1808.7.2)

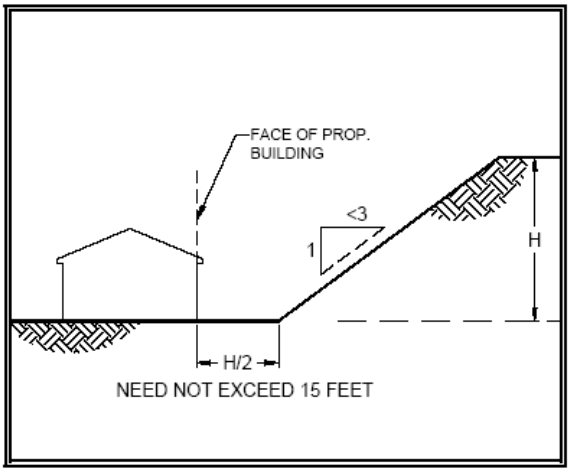


Figure 3 (Section 1808.7.1)

All residential building should provide with adequate horizontal building clearance, H/2 (H=ascending slope height), from the adjacent ascending slope. As depicted on the Geologic Cross Sections A-A', B-B' and C-C' the adjacent ascending slope heights are 24 to 60 feet high. The resulting H/2 horizontal building clearance distance behind the upslope portion of the residences should be minimum 12 (solely for Pad 3) and maximum 15 feet for the proposed Pad 1 and 2 upslope conditions.

6.5 Caisson Foundation

Due to relative high cut and limited working area adjacent to the proposed residence, EGL recommends that a deepened foundation system or caisson may be used for the proposed retaining walls. Wall footings should be founded entirely into underlying competent bedrock.

- An allowable end bearing value of 2,200 pounds per square foot may be used for the design of the proposed caissons founded a minimum of five (5) feet into underlying competent bedrock material (contacts see Figure 2c). This bearing value may be increased by 250 psf for each additional foot of depth to a maximum value of 4,000 psf.
- Passive earth pressure may be computed as an equivalent fluid pressure of 300 pcf, with a maximum earth pressure of 5,000 psf. An allowable coefficient of friction between soil and concrete of 0.35 may be used with the dead load forces. No passive pressure is allowed for the portion of the caisson that maintains less than five (5) horizontal feet between the face of the slopes and the edge of the caisson.
- An allowable skin friction of 400 psf may be used for the design of the friction piles within the competent bedrock.
- Recommended caissons should be founded at a minimum of five (5) feet into competent bedrock and maintain a minimum eight (8) horizontal feet setback to the face of the immediate descending slope.
- Point of fixity should be at two (2) feet below proposed grade.
- Caissons should be a minimum of 24-inches in diameter to facilitate cleanout and spaced at a minimum distance of three (3) times the diameter, center to center.
- Cast-in-place caissons may be used at the site. Weight of the concrete in the caisson may be neglected in considering the allowable caisson load, provided the bottoms of the caissons are cleared of any loose or disturbed soil prior to placement of concrete.
- Drilled holes should be filled with concrete as soon as possible after excavation. Care should be taken in setting reinforcing cages and all concrete should be poured through a tremie and/or other applicable technique.
- Mud cakes should be cleaned and removed from excavated caisson/pile surfaces walls prior to placement of reinforcing cages and pouring concrete.

Inspection of the operation by the project geotechnical engineer and geologists is mandatory to observe earth materials encountered and recommendations may be provided if drilling becomes difficult or the materials encountered is not suitable for caisson support. This office should review the caisson foundation plan.

6.6 Retaining Wall

Wall should be provided with subdrains to reduce the potential for the buildup of hydrostatic pressure. Backdrains could consist of free drainage materials (SE of 30 or greater) or CalTrans Class 2 permeable materials immediately behind the wall and extending to within 18 inches of the ground surface. A perforated pipe (schedule 40 PVC or schedule 35 SDR) should be installed at the base of the backdrain and sloped to discharge to a suitable collection facility or through weep holes. EGL recommends that weep hole size provided for retaining walls should be at least two- (2) inch in diameter, placed at maximum three (3) feet apart and should be located immediately above the adjacent grade (Figure 9). All exterior weep holes should be capped with slotted lids to deter rodent intrusion. Alternatively, commercially available drainage fabric could be used. Fabric manufacturer's recommendations should be followed in the installation of the drainage fabric backdrain.

6.7 Temporary Excavation and Backfill

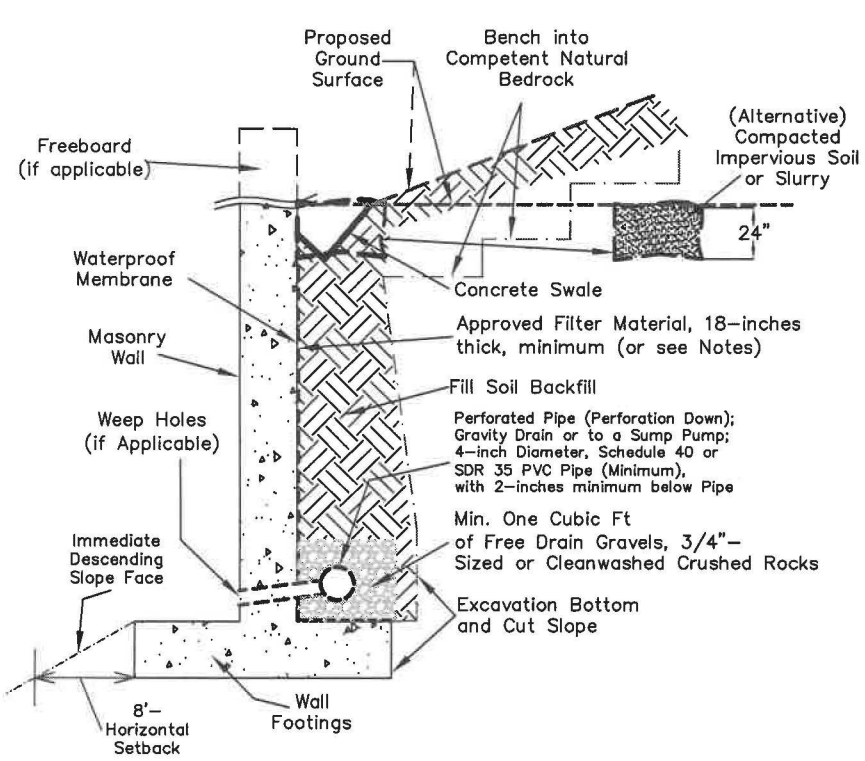
All trench excavations should conform to CAL-OSHA and local safety codes. All utilities trench backfill should be brought to near optimum moisture content and then compacted to obtain a minimum relative compaction of 90 percent of ASTM D-1557-12. All temporary excavations should be observed by a field engineer of this office so as to evaluate the suitability of the excavation to the exposed soil conditions.

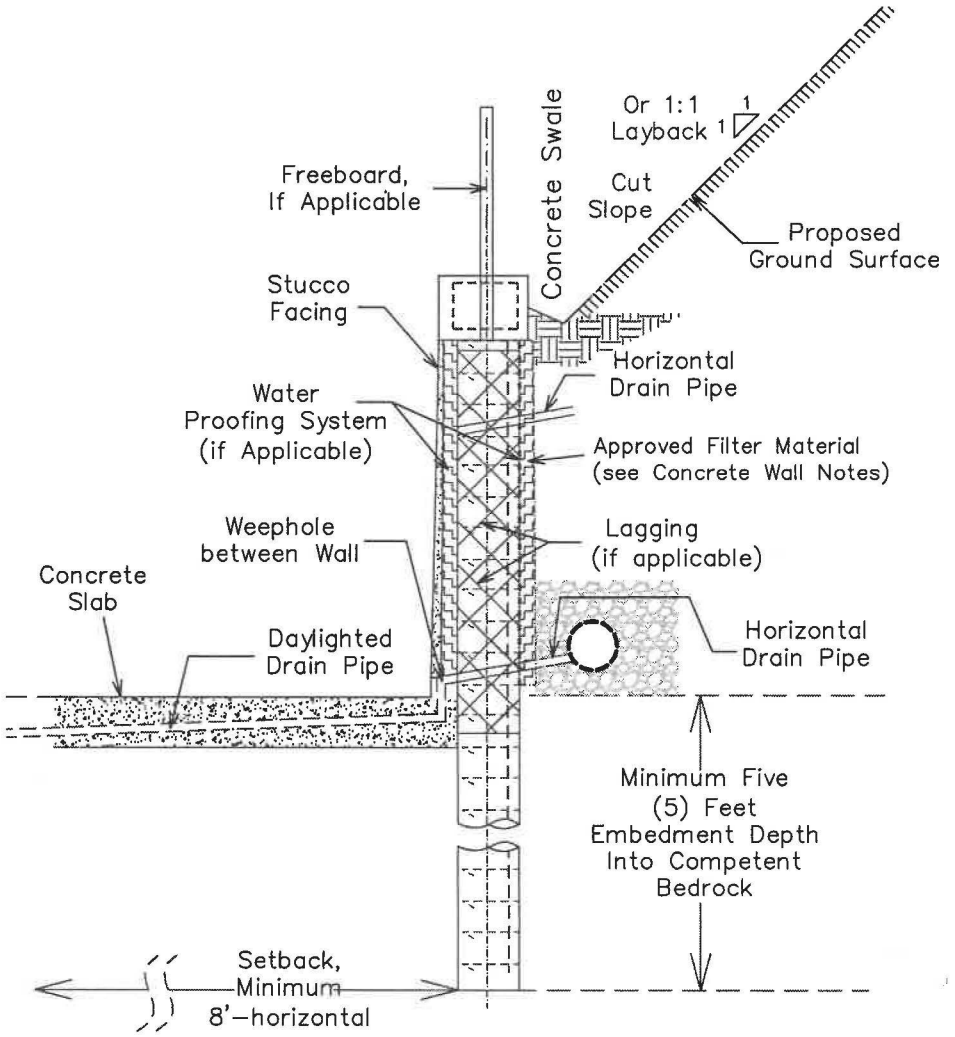
7.0 SEISMIC DESIGN

Based on EGL's seismicity studies that no known active faults crossing the property. However, subject site is located in Southern California, which is a tectonically active area. Based on the current code the following CBC 2019 (Chapter 16) & ASCE 7-16 (Chapter 20) seismic related values may be used:

Site Classification: (ASCE, Table 20.3-1)	D
Spectral Response Accelerations (g):	
(CBC, Figure 1613.3.1 (1) 0.2-Second, S_S	1.928
(CBC, Figure 1613.3.1 (2)) 1-Second, S_1	0.727
Site Coefficient:	
(CBC, Table 1613.3.3 (1)), F_a	1.0
(CBC, Table 1613.3.3 (2)), F_v	1.7

Based on the U.S. Seismic Design Maps (USGS, updated Dec., 2019), the proposed structures may be designed to accommodate up to a site modified horizontal acceleration of 0.923g with





Notes: 1) Approved filter material shall be free-draining materials (SE of 30 or greater) or CalTrans Class II permeable material.

Alternative 1: 3/4-inch crushed rock may be substituted for the approved filter material if an approved nonwoven geotextile filter fabric is used to encapsulate the /4-inch crushed rock (such as MIRAFI 140N or SUPAC 4NP).

Alternative 2: Mirafi-type G-Series Drainage Composite for approved filter material for use in inclined to vertical backfill space that is less than 12"-wide (Installation should follow manufacture's guidelines)

2) Pipe Perforations should not exceed a slot width of 1/2-inch for slotted pipe and 1-inch diameter for drilled pipe to migration of fines into drain pipe.

Typical Concrete Wall Backdrain Details

Not To Scale

Address: Northerly Lot 3 Portion, Tract 3029
347 Highland Place, Monrovia, California
Date: 11-19-2021 EGL Project No. 19-241-003EG

Environmental Geotechnology Laboratory, Inc.

Figure 9

2% probability of being exceeded in 50 years. However, Project Structural Engineer should be aware of the information provided to determine if any additional structural strengthening is warranted.

8.0 CORROSION POTENTIAL

Chemical laboratory tests were conducted on the existing onsite surficial and bedrock materials sampled during EGL's field investigation to aid in evaluation of soil corrosion potential and the attack on concrete by sulfate in the soils. Test results are presented in the Appendix B.

According to ACI 318-14 Table 19.3.1.1 (ACI, 2014), a sulfate content of 0.0013 percent by weight in soils is assigned to Class "S0" and the severity of exposure to sulfate for concrete placed in contact with the onsite soil is considered "Not Applicable". Based on the testing results and ACI 318-14 Table 19.3.2.1, it is concluded that there is no restriction on the type of cement ("No Type Restriction") to be used at the site; however, EGL recommends that Type II cement be used.

Based on the minimum resistivity test results, the subsurface soils are moderately corrosive to buried metal pipe. Any underground steel utilities should be blasted and given protective coating. Should additional protective measures be warranted, a corrosion specialist should be consulted.

9.0 INSPECTION

As a necessary requisite to the use of this report, the following inspection is recommended:

- Temporary excavations.
- Removal of surficial and unsuitable soils.
- Backfill placement and compaction.
- Foundation excavations.
- Utility trench backfill.

Engineering geologic, geotechnical engineer and its representative should be notified at least one (1) day in advance of the start of construction. A joint meeting between client, contractor, engineering geologist, geotechnical engineer and City's representative is highly recommended prior to the start of construction to discuss specific procedures and scheduling.

10.0 DRAINAGE

Proposed building pad should be properly drained toward the street away from the slope and structure via swales or area drains. Positive pad drainage shall be incorporated into the final

plans. In no cases should water be allowed to pond within the site, impound against structures, or flow in a concentrated and/or uncontrolled manner down the descending slope areas.

11.0 111 STATEMENT

Based on EGL's field investigation and the laboratory testing results, it is EGL's opinion that the grading and proposed structures will be safe against hazard from landslide, settlement, or slippage and the proposed construction will have no adverse affect on the geologically or geotechnical stability of the adjacent properties provided EGL's recommendations are followed.

12.0 REMARKS

Conclusions and recommendations contained herein are based on the findings and observations at the exploratory locations. However, soil materials may vary in characteristics between locations of the exploratory locations. If conditions are encountered during construction, which appear to be different from those disclosed by the exploratory work, this office should be notified to recommend the need for additional modifications.

This report has been prepared in accordance with generally accepted professional engineering principles and practice. No warranty is expressed or implied. This report is subject to review by controlling public agencies having jurisdiction.

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APPENDIX A

FIELD INVESTIGATION

Subsurface conditions were explored on July 10, 2019 with the aid of a limited access rubber-tracked excavator of *Best Bobcat Backhoe Services* and hand labors equipped with hand tools. A total of four (4) excavated trenches were excavated to a maximum depth of 12.0 feet below existing ground surface at approximate locations shown on the enclosed Existing and Proposed Site (Geology) Plans, Figures 2a and 2b. Upon completion of excavations, all trenches were backfilled with onsite bedrock and soils cuttings that were removed from the excavations. Exploratory logs are presented in Plates A-1 to A-3.

EGL's field geologist supervised the excavation operation and conduct vicinity reconnaissance. EGL's field engineer logged and sampled all excavated trenches and visually classified the soils in accordance with the Unified Soil Classification System. Ring samples were taken at frequent intervals. Samples, taken by hand tool, were obtained by driving a split-tube sampler with successive blows of 32-pound hammer dropping from a height of 48 inches.

Representative undisturbed samples of the subsurface soils were retained in a series of brass rings, each having an inside diameter of 2.42 inches and a height of 1.00 inch. All ring samples were transported to our laboratory. Bulk surface soil samples were also collected for additional classification and testing.

EGL

TRENCH LOG: TP-1

PROJECT LOCATION: 347 Highland Place, Monrovia, California (Northwesterly canyon area, 20 feet before the slot canyon)

PROJECT NO: 19-241-003

EXCAVATION SERVICE: Best Bobcat Excavation
DATE EXCAVATED: 07-10-2019
DATE LOGGED: 07-10-2019
EXCAVATION METHOD: Mini Excavator
SAMPLE METHOD: Split-Tube
ELEVATION: ~ 769.0'
LOGGED BY: CS / RY

S: Standard Penetration Test B: Bulk Sample R: Ring Sample

Depth (ft)	Sample: Bulk	Sample: Undisturbed	Blows Counts; ft	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	*Earth Material Descriptions*
0 - 1 - 2 -		R	10	SM	98.5	5.4	Quaternary Alluvial Fan Deposits (Qyfg, 0.0' - 4.0'): silty sand, fine- to coarse-grained, olive brown, slightly moist, porous, moderately dense; with gravel-sized rock clasts
3 -		R	10	SM	100.8	5.8	@ 3.0' silty sand, fine- to coarse-grained, olive brown, slightly moist, porous, moderately dense; with gravel-sized rock clasts
4 - 5 - 6 -		R	45		113.9	3.3	Bedrock, Cretaceous Wilson Diorite (wd, 4.0' - 5.5'): crystallined diorite, weathered, light greyish brown and reddish grey, slightly moist, massive, dense, moderately tough and moderately hard; medium-grained, locally jointed and sheared
7 - 8 -							Total Depth 5.5 feet; No Caving; No Groundwater Test pit backfilled and tamped Hammer Driving Weight = 32 lbs.; Hammer Driving Height = 48 inches

TRENCH LOG: TP-2

Location: Northerly landscape area, 46 feet northwest of existing debris wall, adjacent to house area)

SAMPLE METHOD: Split-Tube
ELEVATION: ~ 751.0'
LOGGED BY: CS / RY

Depth (ft)	Sample: Bulk	Sample: Undisturbed	Blows Counts; ft	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	*Earth Material Descriptions*
0 - 1 -		R	10	SM	101.0	2.7	Artificial Fill (Af, 0.0' - 2.0'): reworked alluvial deposits and crushed granitic rock fragments. Silty sandy matrix, fine- to coarse-grained, mottled brown and olive brown, dry to slightly moist, porous, rocky and moderately dense; commonly with gravel to small cobble sized rock clasts and 2" to 8"-sized angular rock fragments,
2 - 3 -		R	10	SM	126.1	5.2	Quaternary Alluvial Fan Deposits (Qyfg, 2.0' - 9.0'): @ 3.0' silty sand, fine- to coarse-grained, olive brown, slightly moist, porous, dense; with some roots and rootlets; gravel-sized rock clasts
4 - 5 - 6 -		R	10	SM	106.0	5.9	@ 6.0' silty sand, fine- to coarse-grained, light olive brown, slightly moist, porous, moderately dense; with gravel-sized rock clasts
7 - 8 - 9 - 10 -		R	12	SM	99.0	7.8	@ 10.0' silty sand, fine- to coarse-grained, light olive brown, slightly moist, porous, moderately dense; with gravel-sized rock clasts
11 - 12 -							Total Depth 10.0 feet; No Caving; No Groundwater Test pit backfilled and tamped Hammer Driving Weight = 32 lbs.; Hammer Driving Height = 48 inches

EGL

TRENCH LOG: TP-3

PROJECT LOCATION: 347 Highland Place, Monrovia, California (Norherly landscape area, east of house covered patio and west of existing power pole)

PROJECT NO: 19-241-003

EXCAVATION SERVICE:	Best Bobcat Excavation
DATE EXCAVATED:	07-10-2019
DATE LOGGED:	07-10-2019
EXCAVATION METHOD:	Mini Excavator
SAMPLE METHOD:	Split-Tube
ELEVATION:	~ 737.0'
LOGGED BY:	CS / RY

S: Standard Penetration Test B: Bulk Sample R: Ring Sample

Depth (ft)	Sample: Bulk	Sample: Undisturbed	Sample: Blows Counts; ft	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	*Earth Material Descriptions*
0 - 3		R	10	SM	85.2	6.0	Artificial Fill (Af, 0.0' - 4.0'): 3 feet above access road. Silty sandy matrix, fine- to coarse-grained, mottled olive brown, dry to slightly moist, porous, rocky and moderately dense; increasing in rock clasts and rock fragments with depths, gravel to small cobble sized rock clasts and 2" to 13"-sized angular rock fragments,
3 - 4		R	10	SM	100.9	6.0	
4 - 8							Quaternary Alluvial Fan Deposits (Qyfg, 4.0' - 11.0'):
6		R	10	SM	98.1	4.4	'@ 6.0' silty sand, fine- to coarse-grained, olive brown, slightly moist, porous, moderately dense; with gravel- to small cobble-sized rock clasts
8 - 10		R	45		125.8	1.8	Bedrock, Cretaceous Wilson Diorite (wd, 8.5' - 10.0'): exposed on test pit northside only; crystallined diorite, weathered, light to medium grey, slightly moist, massive, dense, moderately tough and moderately hard; aphanitic to medium-grained, locally jointed
11 - 23							Total Depth 11.0 feet; No Caving; No Groundwater Test pit backfilled and tamped Hammer Driving Weight = 32 lbs.; Hammer Driving Height = 48 inches

EGL

TRENCH LOG: T-4

PROJECT LOCATION: 347 Highland Place, Monrovia, California (Northeasterly landscape area, 10 feet northeast of access road)

PROJECT NO: 19-241-003

EXCAVATION SERVICE:	Best Bobcat Excavation
DATE EXCAVATED:	07-10-2019
DATE LOGGED:	07-10-2019
EXCAVATION METHOD:	Mini Excavator
SAMPLE METHOD:	Split-Tube
ELEVATION:	~ 710.0'
LOGGED BY:	CS / RY

S: Standard Penetration Test B: Bulk Sample R: Ring Sample

Depth (ft)	Sample: Bulk	Sample: Undisturbed	Blows Counts; ft	USCS Symbol	Dry Unit Wt. (pcf)	Moisture (%)	*Earth Material Descriptions*
0	B	R	35	SM	110.0	4.2	Artificial Fill (Af, 0.0' - 4.0'): 2 feet above access road. Silty sandy matrix, fine- to coarse-grained, mottled dark olive brown, dusty dry to slightly moist, porous, rocky and moderately dense; with mixed in gravel to small cobble sized rock clasts angular rock fragments; locally with mixed in brick and concrete fragments.
3		R	35	SM	112.1	6.1	
4							Quaternary Alluvial Fan Deposits (Qyfg, 4.0' - 12.0'):
6		R	35	SM	103.1	4.6	@ 6.0' silty sand, fine- to coarse-grained, olive brown, slightly moist, porous, moderately dense; with gravel-sized rock clasts
11		R	35	SM	106.9	6.9	@ 11.0' silty sand, fine- to coarse-grained, olive brown, slightly moist, porous, moderately dense; with gravel-sized rock clasts; locally with sandy silty layer, continuous uneven thicknes, 1" to 3"-thick
12							Total Depth 12.0 feet; No Caving; No Groundwater Test pit backfilled and tamped Hammer Driving Weight = 32 lbs.; Hammer Driving Height = 48 inches

APPENDIX B

LABORATORY TESTING

During the subsurface exploration, EGL personnel collected relatively undisturbed ring samples and bulk samples. Following tests were performed on selected soil samples:

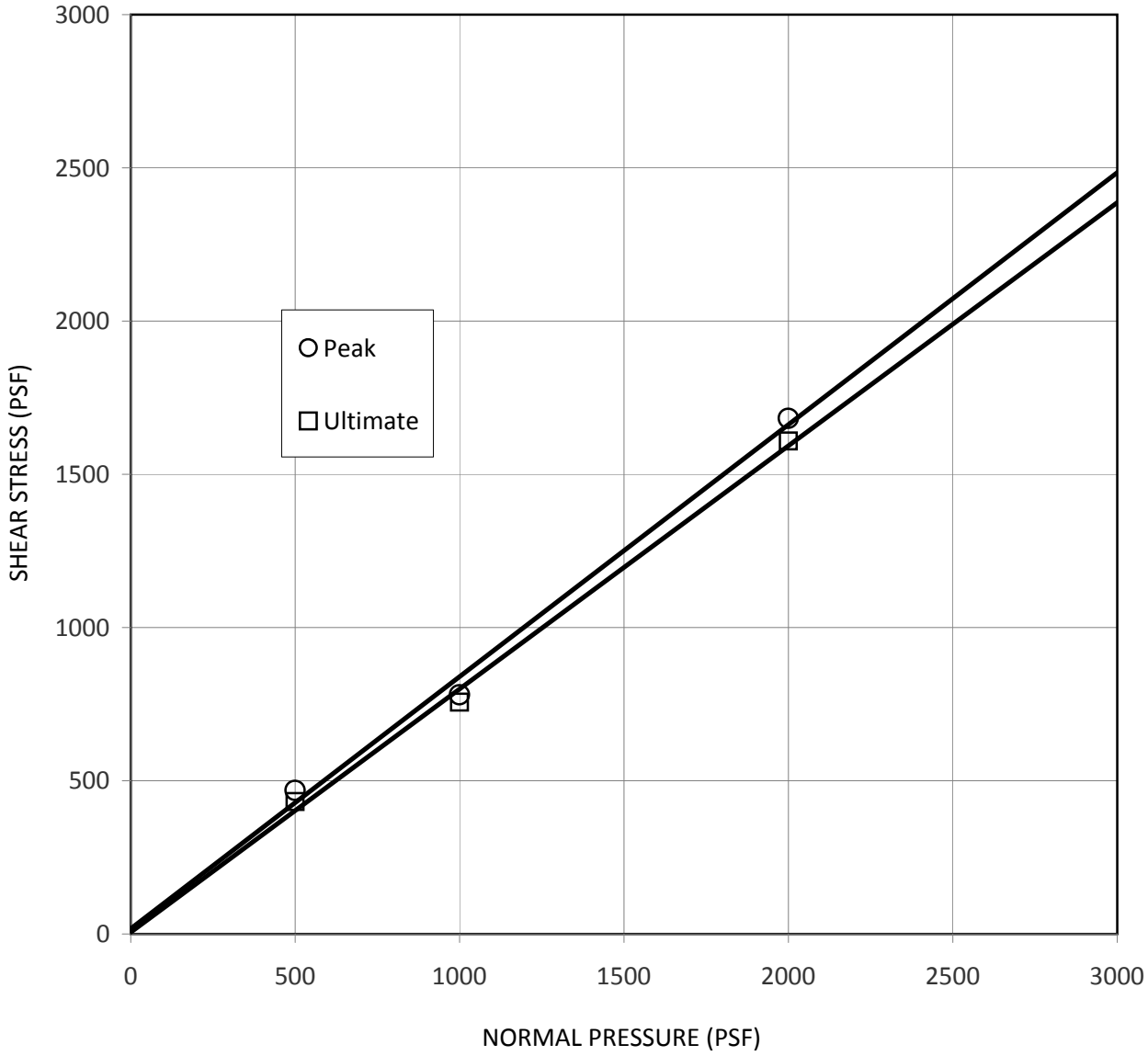
Moisture-Density
Moisture content and dry unit weight were determined for each relatively undisturbed soil sample obtained in the exploratory borings in accordance with ASTM D2937 standard and test results are shown on the exploratory logs in Appendix A.

Shear Tests
Shear tests were performed in a direct shear machine of strain-control type in accordance with ASTM D3080 standard. Rate of deformation was 0.025 inch per minute. Selected samples were sheared under varying confining loads in order to determine the Coulomb shear strength parameters: internal friction angle and cohesion. Shear test results are presented in the attached plates.

Consolidation Tests
Consolidation tests were performed on selected undisturbed soil samples in accordance with ASTM D2435 standard. Consolidation apparatus is designed for a one-inch high soil filled brass ring. Loads are applied in several increments in a geometric progression and the resulting deformations are recorded at selected time intervals. Porous stones are placed in contact with the top and bottom of each specimen to permit addition and release of pore fluid. Samples were inundated with water at a load of one kilo-pounds (kips) per square foot, and the test results are shown on the attached Figures.

Corrosion Potential
Chemical laboratory tests were conducted on the existing onsite near surface materials sampled during EGL's field investigation to aid in evaluation of soil corrosion potential and the attack on concrete by sulfate soils. These tests are performed in accordance with California Test Method 417, 422 and 532. Testing results are presented below:

Sample Location	pH	Chloride (ppm)	Sulfate (% by weight)	Min. Resistivity (ohm-cm)
Bulk T-4 @ 0' to 5'	7.28	115.4	0.0013	2,400



Test Pit No.:	Sample No.	Depth (ft)	Sample Type	Soil Type	Symbol	Cohesion (PSF)	Friction Angle
TP-1	1	0.0	Ring	SM	○	17	39
					□	6	38

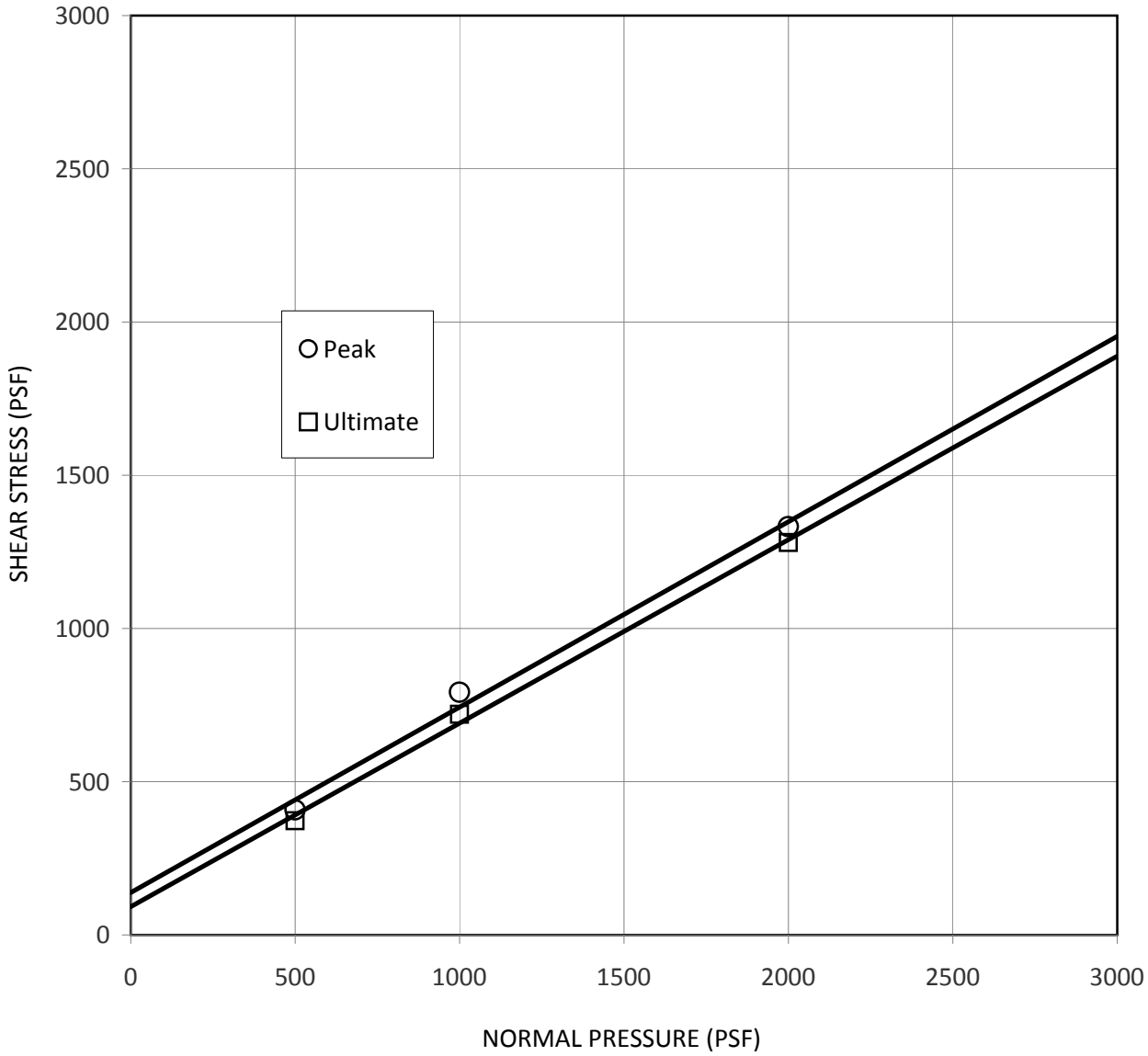
Normal Stress (psf)	Initial Moisture (%)	Final Moisture (%)	γ_d (pcf)	S (%)
500	5.4	22.0	101.5	100.0
1000	5.4	19.2	98.5	100.0
2000	5.4	20.6	98.1	100.0

ENVIRONMENTAL GEOTECHNOLOGY LABORATORY

EGL Proj. No.: 19-241-003
347 Highland Place
Monrovia, California

DIRECT SHEAR

11/19 (ASTM D3080) Figure



Test Pit No.:	Sample No.	Depth (ft)	Sample Type	Soil Type	Symbol	Cohesion (PSF)	Friction Angle
TP-2	3	6.0	Ring	SM	○	138	31
					□	92	31

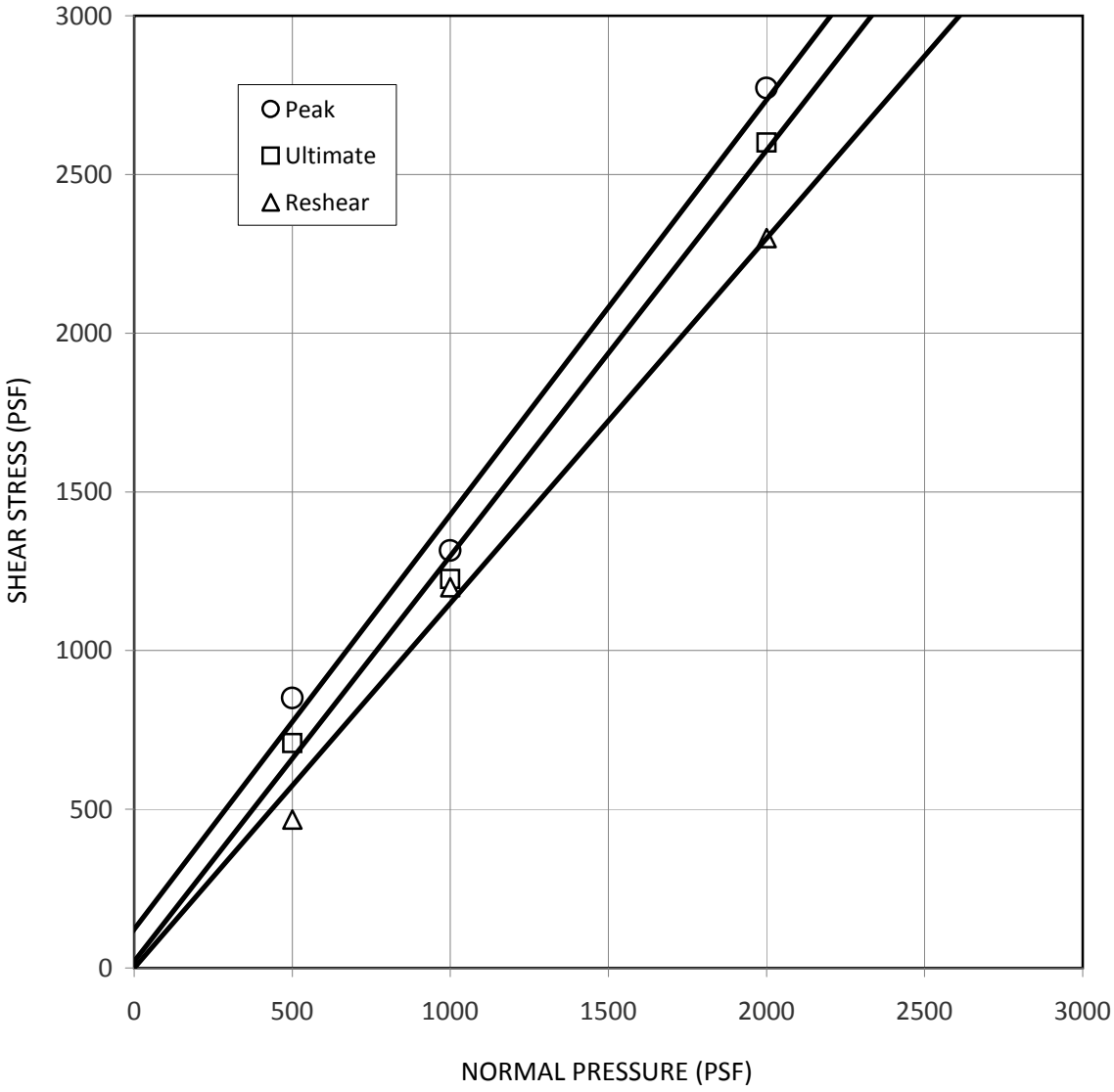
Normal Stress (psf)	Initial Moisture (%)	Final Moisture (%)	γ_d (pcf)	S (%)
500	5.9	19.1	108.8	100.0
1000	5.9	18.0	108.2	100.0
2000	5.9	18.0	107.4	100.0

ENVIRONMENTAL GEOTECHNOLOGY LABORATORY

EGL Proj. No.: 19-241-003
347 Highland Place
Monrovia, California

DIRECT SHEAR

11/19 (ASTM D3080) Figure



Test Pit No.	Sample No.	Depth (ft)	Sample Type	Soil Type	Symbol	Cohesion (PSF)	Friction Angle
TP-3	3	10.0	Ring	wd	○	122	53
					□	21	52
					△	0	48

Stress (psf)	Moisture (%)	Moisture (%)	γ_d (pcf)	S (%)
500	1.8	15.3	121.1	100.0
1000	1.8	15.3	121.1	100.0
2000	1.8	12.8	121.3	100.0

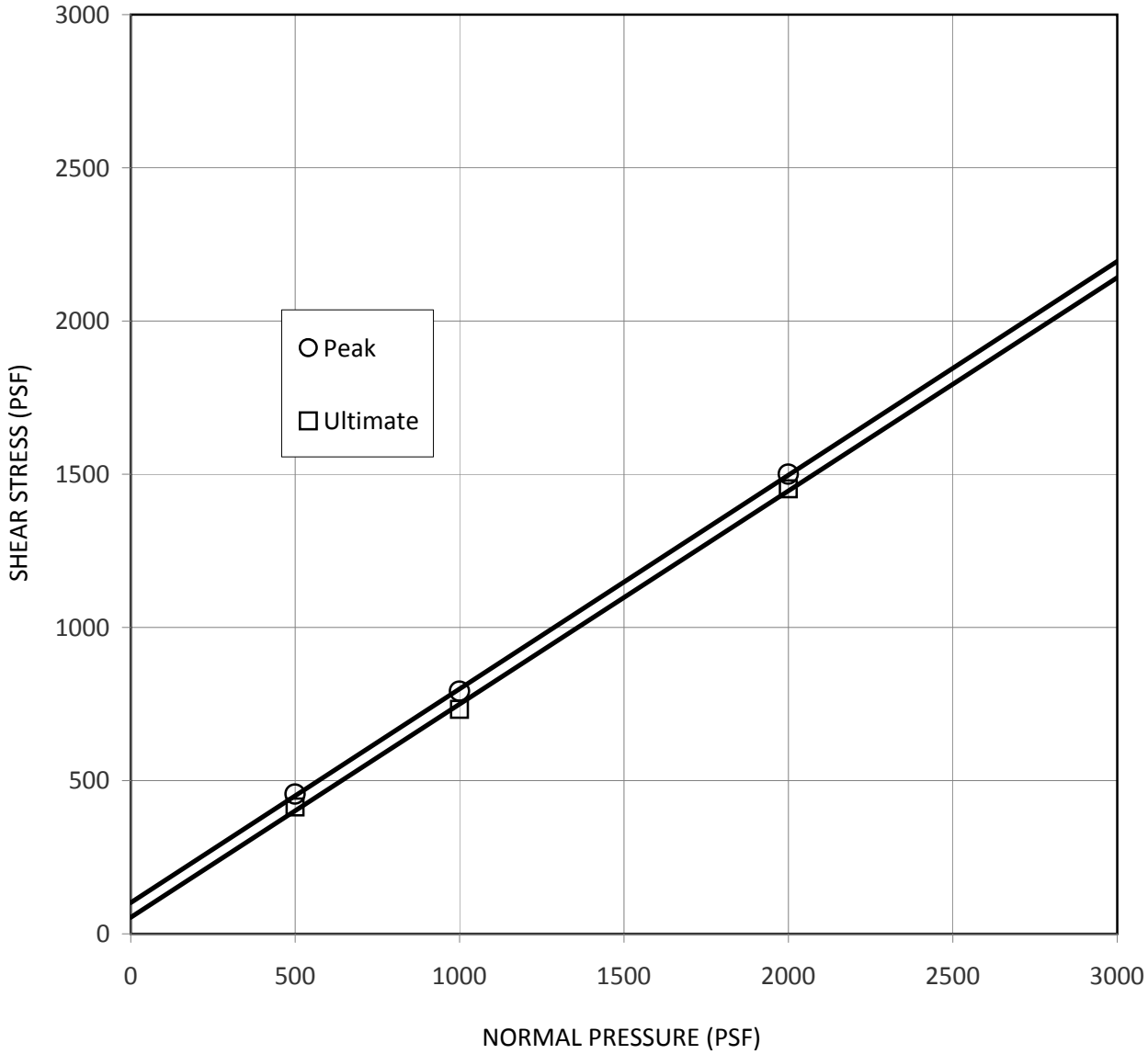
ENVIRONMENTAL GEOTECHNOLOGY LABORATORY

EGL Proj. No.: 19-241-003
347 Highland Place
Monrovia, California

DIRECT SHEAR

11/21 (ASTM D3080) Figure

11819 Goldring Road, Unit A, Arcadia, California 91006; Phone (626) 263-3588; Fax (626) 263-3599



Test Pit No.:	Sample No.	Depth (ft)	Sample Type	Soil Type	Symbol	Cohesion (PSF)	Friction Angle
TP-4	3	6.0	Ring	SM	○	102	35
					□	54	35

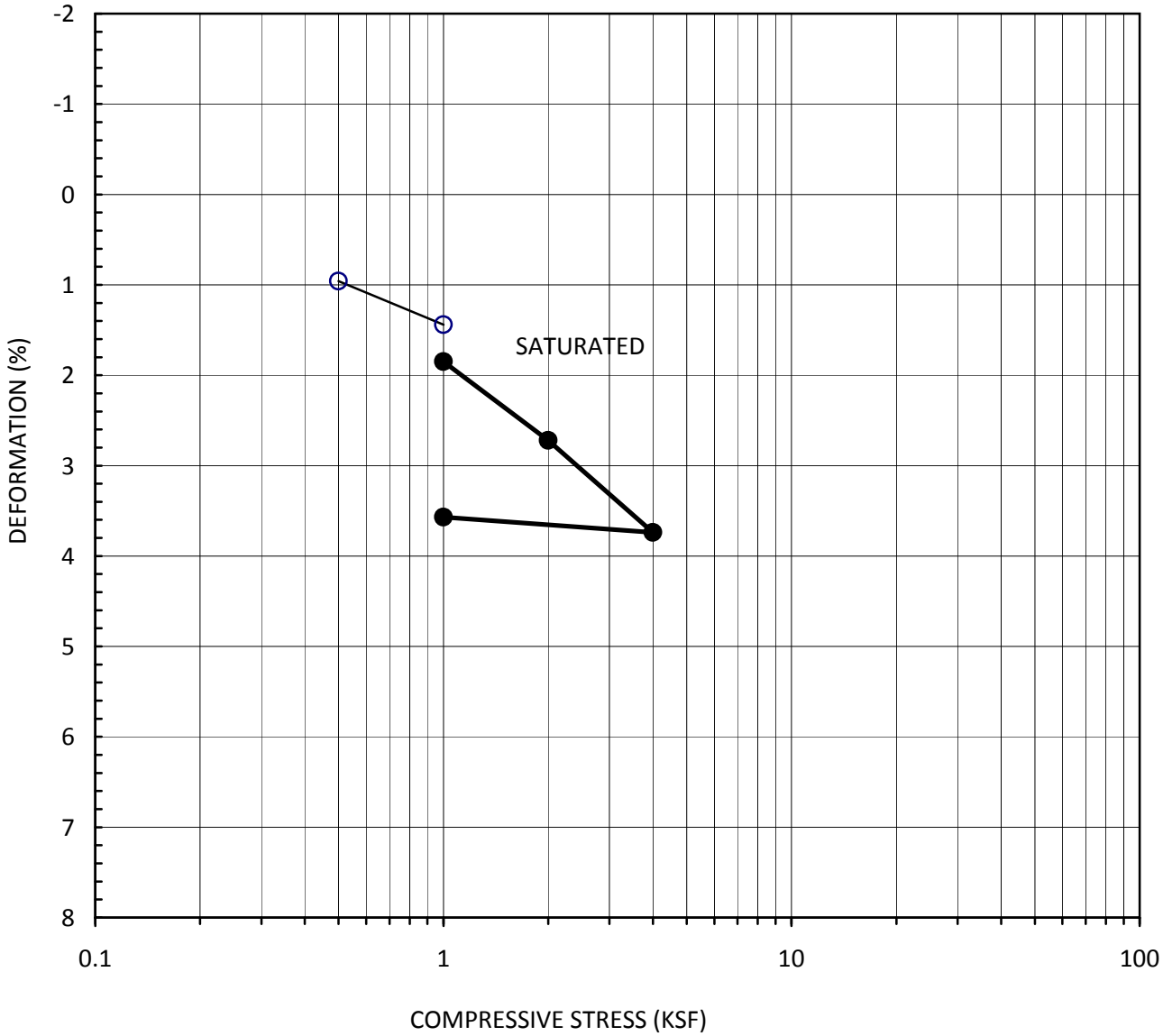
Normal Stress (psf)	Initial Moisture (%)	Final Moisture (%)	γ_d (pcf)	S (%)
500	4.6	18.9	105.4	91.5
1000	4.6	20.0	103.9	94.3
2000	4.6	18.3	103.4	93.0

ENVIRONMENTAL GEOTECHNOLOGY LABORATORY

EGL Proj. No.: 19-241-003
347 Highland Place
Monrovia, California

DIRECT SHEAR

11/19 (ASTM D3080) Figure



Symbol	Test Pit No.	Sample No.	Depth (Ft.)	Soil Type	Init. Moisture Content (%)	Init. Dry Density	Init. Void Ratio
○	TP-2	2	3.0	SM	5.2	101.8	0.655

ENVIRONMENTAL
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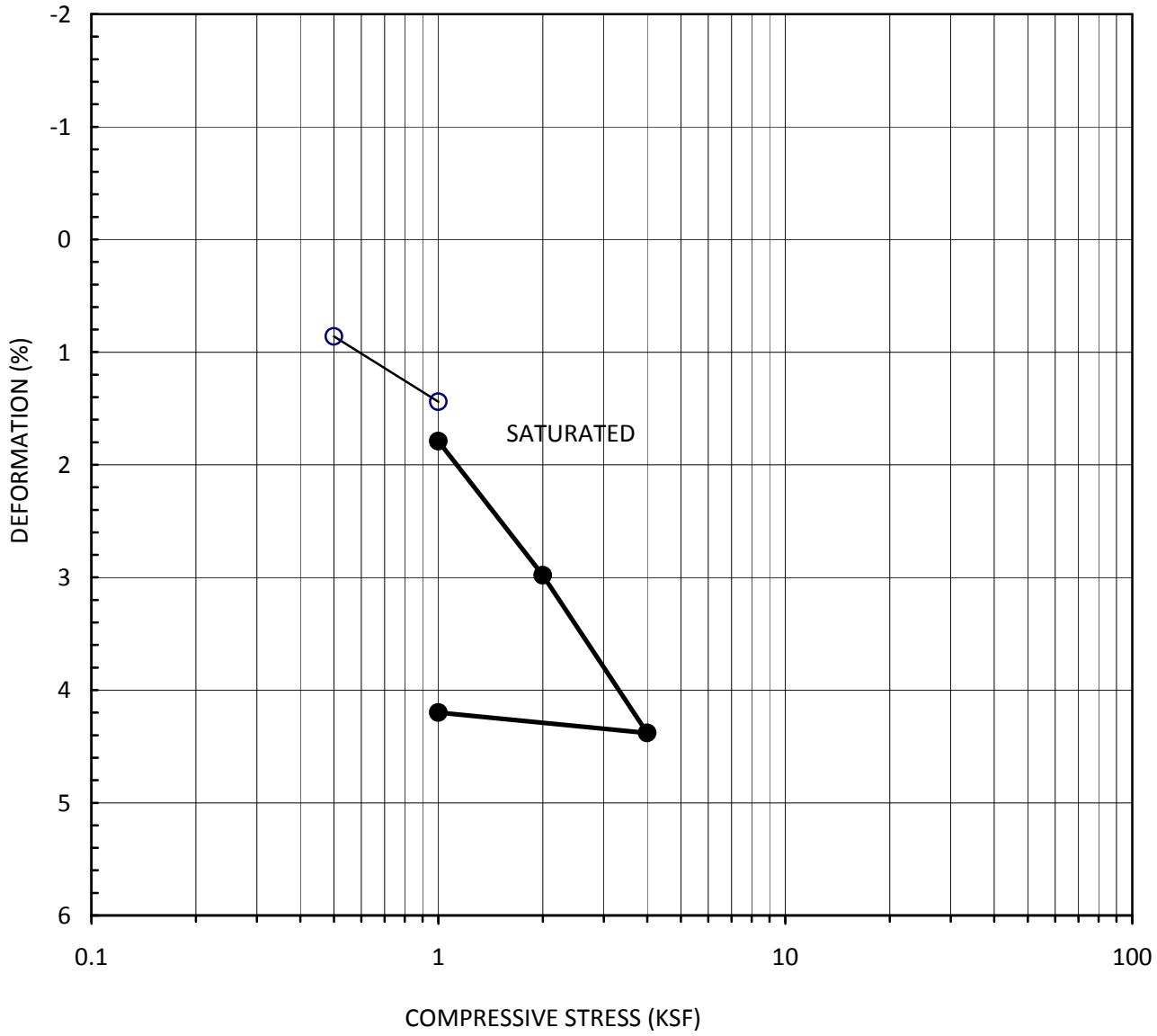
Monrovia, California

CONSOLIDATION

11/19 (ASTM D2435) Figure

11819 Goldring Road, Unit A, Arcadia, California 91006; Phone (626) 263-3588; Fax (626) 263-3599



Symbol	Test Pit No.	Sample No.	Depth (Ft.)	Soil Type	Init. Moisture Content (%)	Init. Dry Density	Init. Void Ratio
○	TP-2	4	10.0	SM	7.8	102.9	0.637

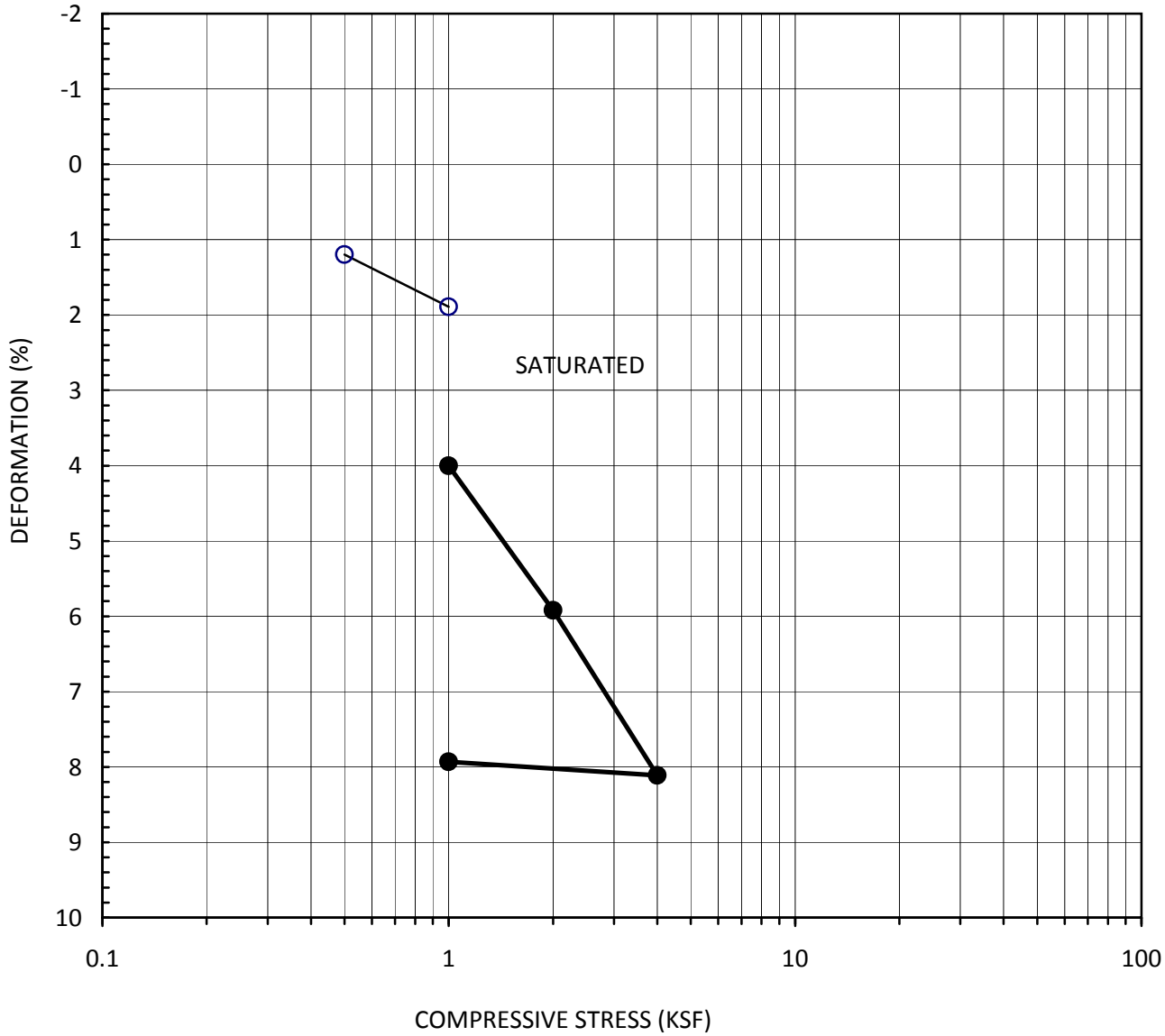
ENVIRONMENTAL
GEOTECHNOLOGY
LABORATORY

EGL Proj. No.: 19-241-003
347 Highland Place
Monrovia, California

CONSOLIDATION

11/19 (ASTM D2435) Figure

11819 Goldring Road, Unit A, Arcadia, California 91006; Phone (626) 263-3588; Fax (626) 263-3599



Symbol	Test Pit No.	Sample No.	Depth (Ft.)	Soil Type	Init. Moisture Content (%)	Init. Dry Density	Init. Void Ratio
○	TP-3	2	2.5	SM	6.0	102.7	0.641

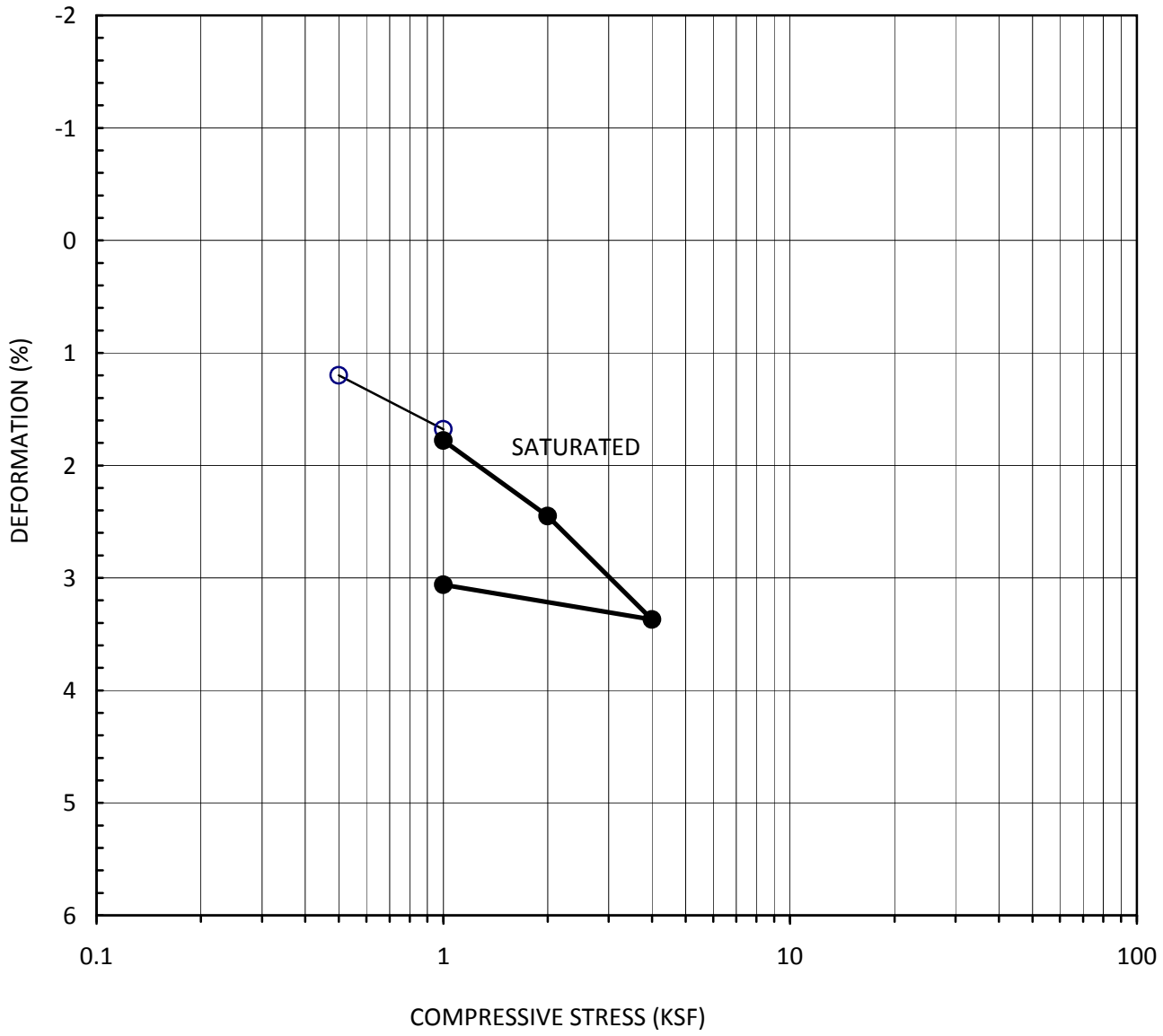
ENVIRONMENTAL
GEOTECHNOLOGY
LABORATORY

EGL Proj. No.: 19-241-003
347 Highland Place
Monrovia, California

CONSOLIDATION

11/19 (ASTM D2435) Figure

11819 Goldring Road, Unit A, Arcadia, California 91006; Phone (626) 263-3588; Fax (626) 263-3599



Symbol	Test Pit No.	Sample No.	Depth (Ft.)	Soil Type	Init. Moisture Content (%)	Init. Dry Density	Init. Void Ratio
○	TP-4	4	11.0	SM	6.9	107.2	0.571

ENVIRONMENTAL
GEOTECHNOLOGY
LABORATORY

EGL Proj. No.: 19-241-003
347 Highland Place
Monrovia, California

CONSOLIDATION

11/19 (ASTM D2435) Figure

11819 Goldring Road, Unit A, Arcadia, California 91006; Phone (626) 263-3588; Fax (626) 263-3599

APPENDIX C

SLOPE STABILITY ANALYSES

Simplified Bishop's method was used to analyze the overall and lower slope for the critical areas depicted in Geologic Cross Section B-B' (Figure 2c) extended to the top and bottom of the slopes of the existing and proposed slope conditions. Seismic coefficient value of 0.20g and was used in the seismic condition. Residual and ultimate shear values were used for the analyses. Conditions analyzed for slope stability analyses were performed for search ranges and forced at toe searches. Assumed lateral loads are applied to the proposed walls. Stability calculations and sections are presented on the plates following the report and the results of EGL's slope stability analyses of existing and proposed slope conditions are briefly described with corresponding geotechnical recommendations.

Earth Materials	Unit Weight (pcf)	Friction Angle Static/Seismic (Degree)	Cohesion Static/Seismic (psf)
Undifferentiated Artificial Fill and Natural Alluvium Ultimate (Af- Qal; T-2 @ 6.0')	130.0	31	92
Bedrock, Residual (wd; T-3 @ 10.0')	140.0	48 / 52	0
Future Compacted Fill (CAf)	125	25	150

EXISTING SLOPE CONDITIONS

Analyzed Section	Calculated Condition	Factors of Safety (Static / Seismic)
B - B' (West-Northwest facing in southwesterly direction)	Existing overall slope approximately 70 feet high	1.35 / 0.91
		1.32 / 0.89

TEMPORARY SLOPE CONDITIONS

Calculated Condition	Wall Lateral Load	Factors of Safety (Static / Seismic)
Overall temporary slope approximately 70 feet high with 13 feet high cut slope	N / A	0.88 / ----
	3.65	1.25 / ----

PROPOSED SLOPE CONDITIONS

Pile spacing, feet	Pile Length, feet	Lateral Load, kips; Static / Seismic	Factors of Safety (Static / Seismic)
1	17	12.5 / 8	1.52 / 1.13
		12.5 / 8	1.50 / 1.11

SURFICIAL SLOPE STABILITY

Calculated Conditions	Factor of Safety (Static/Seismic)	Conclusions and Preliminary Geotechnical Recommendation
Existing slope gradients 1:1 to 2.8: 1 (H: V) for 4.0 feet saturated soils condition	0.41 / -----	Unstable as Existed (see Fig. 7 and Subsection 4.5 for Recommendations)
	1.14 / -----	

Highland Cross Section B-B'; Overall Existing Slope Condition_Static

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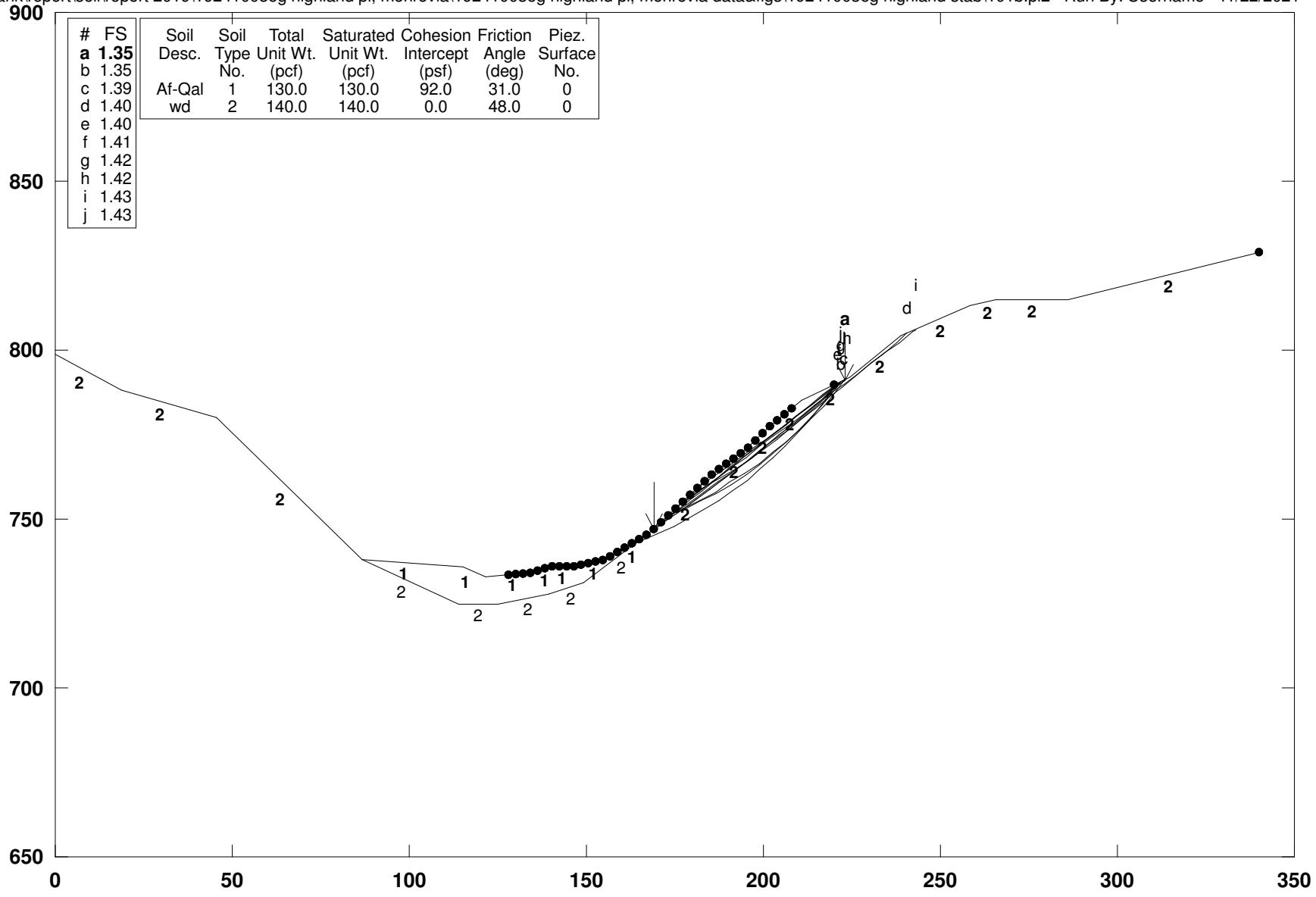

#	FS
a	**1.35**
b	1.35
c	1.39
d	1.40
e	1.40
f	1.41
g	1.42
h	1.42
i	1.43
j	1.43

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Af-Qal	1	130.0	130.0	92.0	31.0	0
wd	2	140.0	140.0	0.0	48.0	0

GSTABL7 v.2 FSmin=1.35

Safety Factors Are Calculated By The Modified Bishop Method

*** GSTABL7 ***
** GSTABL7 by Dr. Garry H. Gregory, Ph.D.,P.E.,D.GE **
** Original Version 1.0, January 1996; Current Ver. 2.005.3, Feb. 2013 **
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SLOPE STABILITY ANALYSIS SYSTEM
Modified Bishop or Simplified Janbu Method of Slices and Type Analysis
Including Pier/Pile Reinforcement, Nonlinear Undrained
Shear Strength, Curved Phi Envelope, Anisotropic Soil, Boundary
Loads, Pseudo-Static & Newmark Earthquake Applied Forces.

****

Analysis Run Date: 11/22/2021
Time of Run: 12:27PM
Input Data Filename: 101b.dat
Output Filename: 101b.OUT
Plotted Output Filename: 101b.PLT
Unit System: English

PROBLEM DESCRIPTION: Highland Cross Section B-B';
Overall Existing Slope Condition_Static

BOUNDARY COORDINATES
20 Top Boundaries
25 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	798.60	18.60	788.00	2
2	18.60	788.00	45.50	780.00	2
3	45.50	780.00	86.80	738.00	2
4	86.80	738.00	115.30	736.00	1
5	115.30	736.00	121.50	733.00	1
6	121.50	733.00	134.00	734.00	1
7	134.00	734.00	140.00	736.00	1
8	140.00	736.00	146.40	736.00	1
9	146.40	736.00	155.20	738.00	1
10	155.20	738.00	168.00	746.00	1
11	168.00	746.00	185.20	763.00	2
12	185.20	763.00	195.60	771.00	2
13	195.60	771.00	201.30	777.00	2
14	201.30	777.00	210.60	785.00	2
15	210.60	785.00	224.40	792.00	2
16	224.40	792.00	239.00	804.30	2
17	239.00	804.30	258.40	813.00	2
18	258.40	813.00	265.80	815.00	2
19	265.80	815.00	286.00	815.00	2
20	286.00	815.00	340.00	829.00	2
21	86.80	738.00	114.00	725.00	2
22	114.00	725.00	125.00	724.70	2
23	125.00	724.70	139.50	727.60	2
24	139.50	727.60	149.00	731.30	2
25	149.00	731.30	168.00	746.00	2

User Specified Y-Origin = 650.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
2 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	130.0	130.0	92.0	31.0	0.00	0.0	0
2	140.0	140.0	0.0	48.0	0.00	0.0	0

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

2000 Trial Surfaces Have Been Generated.

50 Surface(s) Initiate(s) From Each Of 40 Points Equally Spaced Along The Ground Surface Between X = 128.00(ft)
and X = 208.00(ft)

Each Surface Terminates Between X = 220.00(ft)
and X = 340.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 0.00(ft)

5.00(ft) Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Evaluated. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Total Number of Trial Surfaces Attempted = 2000
Number of Trial Surfaces With Valid FS = 2000

Statistical Data On All Valid FS Values:
FS Max = 6.847 FS Min = 1.348 FS Ave = 3.342
Standard Deviation = 1.188 Coefficient of Variation = 35.55 %

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	169.026	747.014
2	173.072	749.951
3	177.092	752.924
4	181.084	755.935
5	185.049	758.981
6	188.986	762.063
7	192.895	765.181
8	196.775	768.334
9	200.627	771.522
10	204.449	774.746
11	208.242	778.004
12	212.005	781.296
13	215.738	784.622
14	219.441	787.982
15	223.044	791.312

Circle Center At X = -152.001 ; Y = 1193.569 ; and Radius = 549.972

Factor of Safety *** 1.348 ***

Highland Cross Section B-B'; Overall Existing Slope Condition_Seismic

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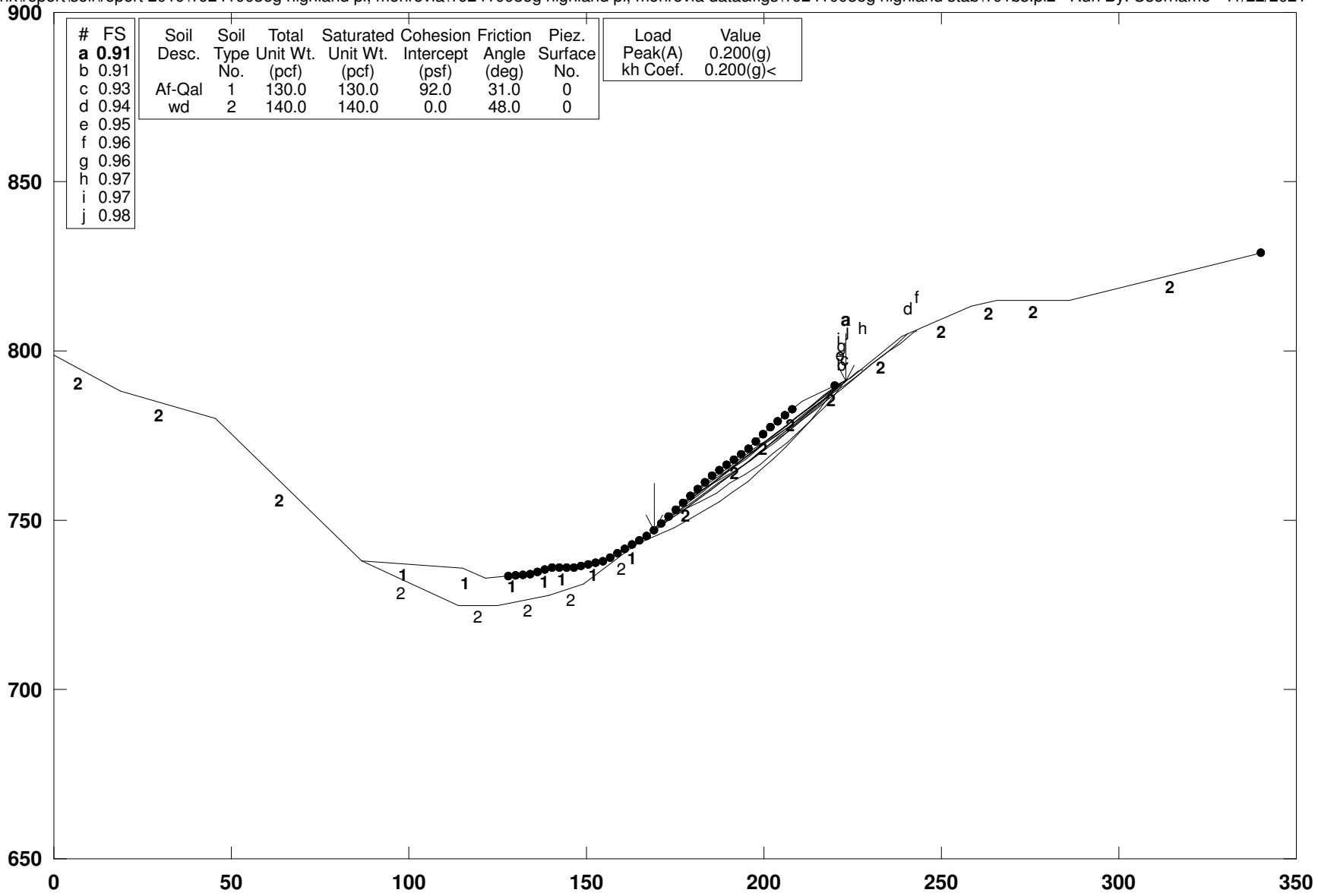

#	FS
a	**0.91**
b	0.91
c	0.93
d	0.94
e	0.95
f	0.96
g	0.96
h	0.97
i	0.97
j	0.98

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Af-Qal	1	130.0	130.0	92.0	31.0	0
wd	2	140.0	140.0	0.0	48.0	0

Load	Value
Peak(A)	0.200(g)
kh Coef.	0.200(g)<

GSTABL7 v.2 FSmin=0.91

Safety Factors Are Calculated By The Modified Bishop Method

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** Original Version 1.0, January 1996; Current Ver. 2.005.3, Feb. 2013 **
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SLOPE STABILITY ANALYSIS SYSTEM
Modified Bishop or Simplified Janbu Method of Slices and Type Analysis
Including Pier/Pile Reinforcement, Nonlinear Undrained
Shear Strength, Curved Phi Envelope, Anisotropic Soil, Boundary
Loads, Pseudo-Static & Newmark Earthquake Applied Forces.

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Analysis Run Date: 11/22/2021
Time of Run: 12:28PM
Input Data Filename: 101bs.dat
Output Filename: 101bs.OUT
Plotted Output Filename: 101bs.PLT
Unit System: English

PROBLEM DESCRIPTION: Highland Cross Section B-B';
Overall Existing Slope Condition_Seismic

BOUNDARY COORDINATES
20 Top Boundaries
25 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	798.60	18.60	788.00	2
2	18.60	788.00	45.50	780.00	2
3	45.50	780.00	86.80	738.00	2
4	86.80	738.00	115.30	736.00	1
5	115.30	736.00	121.50	733.00	1
6	121.50	733.00	134.00	734.00	1
7	134.00	734.00	140.00	736.00	1
8	140.00	736.00	146.40	736.00	1
9	146.40	736.00	155.20	738.00	1
10	155.20	738.00	168.00	746.00	1
11	168.00	746.00	185.20	763.00	2
12	185.20	763.00	195.60	771.00	2
13	195.60	771.00	201.30	777.00	2
14	201.30	777.00	210.60	785.00	2
15	210.60	785.00	224.40	792.00	2
16	224.40	792.00	239.00	804.30	2
17	239.00	804.30	258.40	813.00	2
18	258.40	813.00	265.80	815.00	2
19	265.80	815.00	286.00	815.00	2
20	286.00	815.00	340.00	829.00	2
21	86.80	738.00	114.00	725.00	2
22	114.00	725.00	125.00	724.70	2
23	125.00	724.70	139.50	727.60	2
24	139.50	727.60	149.00	731.30	2
25	149.00	731.30	168.00	746.00	2

User Specified Y-Origin = 650.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
2 Type(s) of Soil

Soil	Total	Saturated	Cohesion	Friction	Pore	Pressure	Piez.

Type No.	Unit Wt. (pcf)	Unit Wt. (pcf)	Intercept (psf)	Angle (deg)	Pressure Param.	Constant (psf)	Surface No.
1	130.0	130.0	92.0	31.0	0.00	0.0	0
2	140.0	140.0	0.0	48.0	0.00	0.0	0

Specified Peak Ground Acceleration Coefficient (A) = 0.200(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.200(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

2000 Trial Surfaces Have Been Generated.

50 Surface(s) Initiate(s) From Each Of 40 Points Equally Spaced Along The Ground Surface Between X = 128.00(ft)
and X = 208.00(ft)

Each Surface Terminates Between X = 220.00(ft)
and X = 340.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 0.00(ft)

5.00(ft) Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Evaluated. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Total Number of Trial Surfaces Attempted = 2000
Number of Trial Surfaces With Valid FS = 2000

Statistical Data On All Valid FS Values:
FS Max = 4.074 FS Min = 0.910 FS Ave = 2.256
Standard Deviation = 0.736 Coefficient of Variation = 32.65 %

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	169.026	747.014
2	173.072	749.951
3	177.092	752.924
4	181.084	755.935
5	185.049	758.981
6	188.986	762.063
7	192.895	765.181
8	196.775	768.334
9	200.627	771.522
10	204.449	774.746
11	208.242	778.004
12	212.005	781.296
13	215.738	784.622
14	219.441	787.982
15	223.044	791.312

Circle Center At X = -152.001 ; Y = 1193.569 ; and Radius = 549.972

Factor of Safety *** 0.910 ***

Highland Cross Section B-B'; Overall Existing Slope Condition_Static

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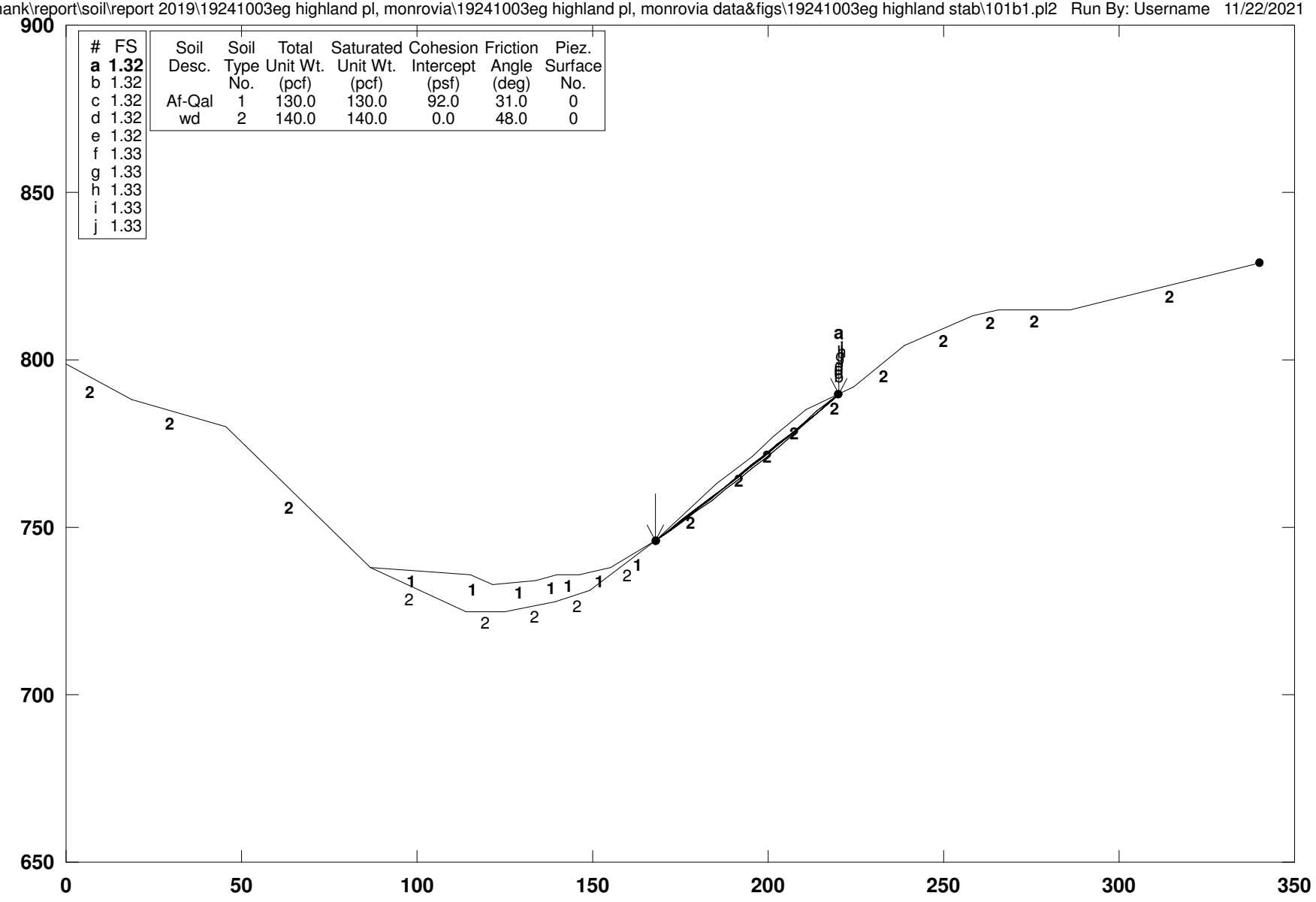

#	FS
a	**1.32**
b	1.32
c	1.32
d	1.32
e	1.32
f	1.33
g	1.33
h	1.33
i	1.33
j	1.33

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Af-Qal	1	130.0	130.0	92.0	31.0	0
wd	2	140.0	140.0	0.0	48.0	0

GSTABL7 v.2 FSmin=1.32

Safety Factors Are Calculated By The Modified Bishop Method

*** GSTABL7 ***
** GSTABL7 by Dr. Garry H. Gregory, Ph.D.,P.E.,D.GE **
** Original Version 1.0, January 1996; Current Ver. 2.005.3, Feb. 2013 **
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SLOPE STABILITY ANALYSIS SYSTEM
Modified Bishop or Simplified Janbu Method of Slices and Type Analysis
Including Pier/Pile Reinforcement, Nonlinear Undrained
Shear Strength, Curved Phi Envelope, Anisotropic Soil, Boundary
Loads, Pseudo-Static & Newmark Earthquake Applied Forces.

****

Analysis Run Date: 11/22/2021
Time of Run: 12:28PM
Input Data Filename: 101b1.dat
Output Filename: 101b1.OUT
Plotted Output Filename: 101b1.PLT
Unit System: English

PROBLEM DESCRIPTION: Highland Cross Section B-B';
Overall Existing Slope Condition_Static

BOUNDARY COORDINATES
20 Top Boundaries
25 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	798.60	18.60	788.00	2
2	18.60	788.00	45.50	780.00	2
3	45.50	780.00	86.80	738.00	2
4	86.80	738.00	115.30	736.00	1
5	115.30	736.00	121.50	733.00	1
6	121.50	733.00	134.00	734.00	1
7	134.00	734.00	140.00	736.00	1
8	140.00	736.00	146.40	736.00	1
9	146.40	736.00	155.20	738.00	1
10	155.20	738.00	168.00	746.00	1
11	168.00	746.00	185.20	763.00	2
12	185.20	763.00	195.60	771.00	2
13	195.60	771.00	201.30	777.00	2
14	201.30	777.00	210.60	785.00	2
15	210.60	785.00	224.40	792.00	2
16	224.40	792.00	239.00	804.30	2
17	239.00	804.30	258.40	813.00	2
18	258.40	813.00	265.80	815.00	2
19	265.80	815.00	286.00	815.00	2
20	286.00	815.00	340.00	829.00	2
21	86.80	738.00	114.00	725.00	2
22	114.00	725.00	125.00	724.70	2
23	125.00	724.70	139.50	727.60	2
24	139.50	727.60	149.00	731.30	2
25	149.00	731.30	168.00	746.00	2

User Specified Y-Origin = 650.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
2 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	130.0	130.0	92.0	31.0	0.00	0.0	0
2	140.0	140.0	0.0	48.0	0.00	0.0	0

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

2000 Trial Surfaces Have Been Generated.

2000 Surface(s) Initiate(s) From Each Of 1 Points Equally Spaced Along The Ground Surface Between X = 168.00(ft)
and X = 168.00(ft)

Each Surface Terminates Between X = 220.00(ft)
and X = 340.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 0.00(ft)

5.00(ft) Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Evaluated. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Total Number of Trial Surfaces Attempted = 2000
Number of Trial Surfaces With Valid FS = 2000

Statistical Data On All Valid FS Values:
FS Max = 4.694 FS Min = 1.315 FS Ave = 3.083
Standard Deviation = 1.081 Coefficient of Variation = 35.06 %

Failure Surface Specified By 15 Coordinate Points

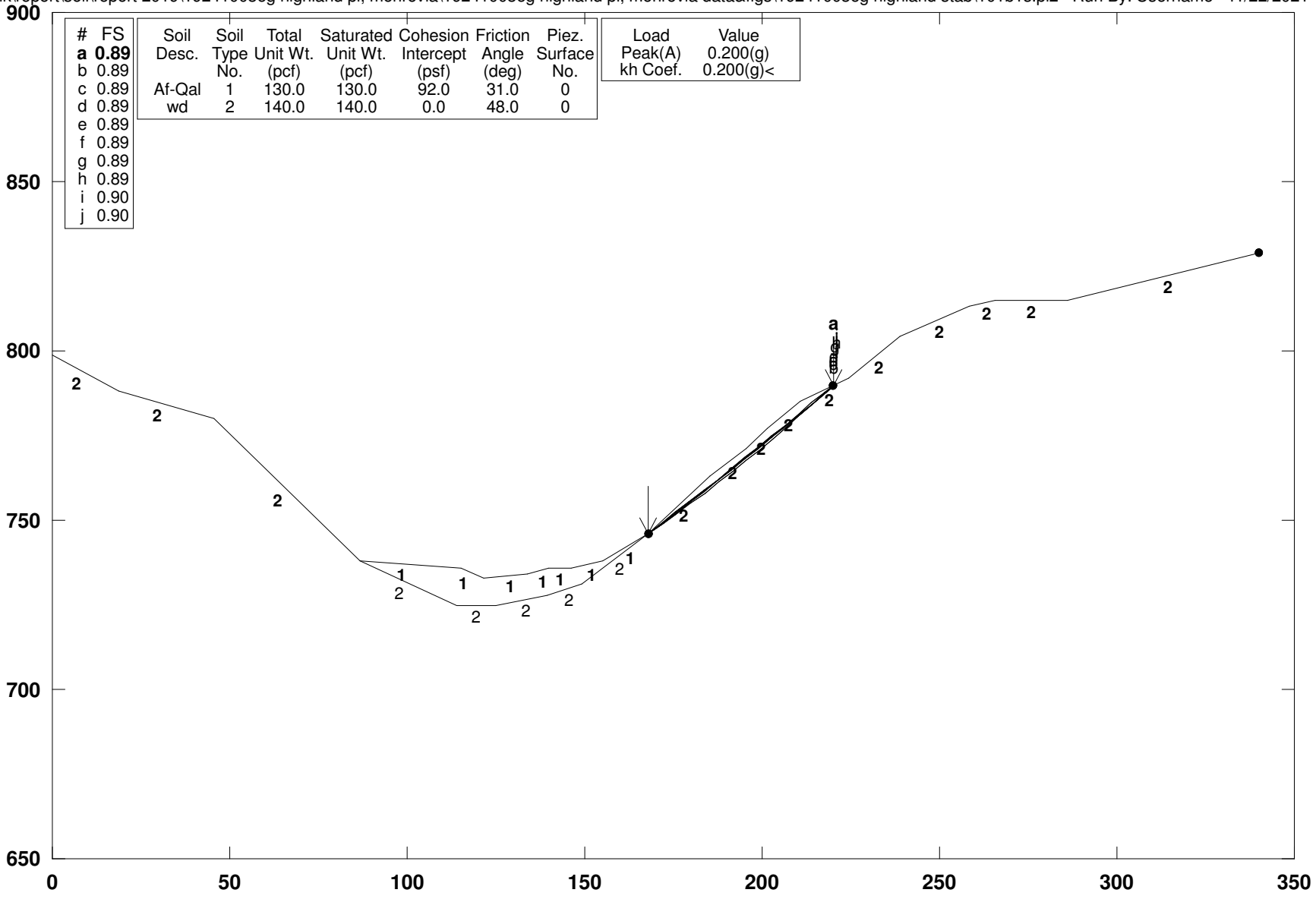
Point No.	X-Surf (ft)	Y-Surf (ft)
1	168.000	746.000
2	171.938	749.081
3	175.858	752.185
4	179.761	755.310
5	183.646	758.458
6	187.513	761.627
7	191.362	764.818
8	195.193	768.031
9	199.006	771.266
10	202.801	774.522
11	206.577	777.799
12	210.334	781.098
13	214.073	784.418
14	217.793	787.758
15	220.012	789.774

Circle Center At X = -375.544 ; Y = 1444.690 ; and Radius = 885.217

Factor of Safety *** 1.315 ***

Highland Cross Section B-B'; Overall Existing Slope Condition_Seismic

z:\hank\report\soil\report 2019\19241003eg highland pl, monrovia\19241003eg highland pl, monrovia data&figs\19241003eg highland stab\101b1s.pl2 Run By: Username 11/22/2021 12:29PM



#	FS
a	**0.89**
b	0.89
c	0.89
d	0.89
e	0.89
f	0.89
g	0.89
h	0.89
i	0.90
j	0.90

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Af-Qal	1	130.0	130.0	92.0	31.0	0
wd	2	140.0	140.0	0.0	48.0	0

Load	Value
Peak(A)	0.200(g)
kh Coef.	0.200(g)<

GSTABL7 v.2 FSmin=0.89

Safety Factors Are Calculated By The Modified Bishop Method

*** GSTABL7 ***
** GSTABL7 by Dr. Garry H. Gregory, Ph.D.,P.E.,D.GE **
** Original Version 1.0, January 1996; Current Ver. 2.005.3, Feb. 2013 **
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SLOPE STABILITY ANALYSIS SYSTEM
Modified Bishop or Simplified Janbu Method of Slices and Type Analysis
Including Pier/Pile Reinforcement, Nonlinear Undrained
Shear Strength, Curved Phi Envelope, Anisotropic Soil, Boundary
Loads, Pseudo-Static & Newmark Earthquake Applied Forces.

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Analysis Run Date: 11/22/2021
Time of Run: 12:29PM
Input Data Filename: 101b1s.dat
Output Filename: 101b1s.OUT
Plotted Output Filename: 101b1s.PLT
Unit System: English

PROBLEM DESCRIPTION: Highland Cross Section B-B';
Overall Existing Slope Condition_Seismic

BOUNDARY COORDINATES
20 Top Boundaries
25 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	798.60	18.60	788.00	2
2	18.60	788.00	45.50	780.00	2
3	45.50	780.00	86.80	738.00	2
4	86.80	738.00	115.30	736.00	1
5	115.30	736.00	121.50	733.00	1
6	121.50	733.00	134.00	734.00	1
7	134.00	734.00	140.00	736.00	1
8	140.00	736.00	146.40	736.00	1
9	146.40	736.00	155.20	738.00	1
10	155.20	738.00	168.00	746.00	1
11	168.00	746.00	185.20	763.00	2
12	185.20	763.00	195.60	771.00	2
13	195.60	771.00	201.30	777.00	2
14	201.30	777.00	210.60	785.00	2
15	210.60	785.00	224.40	792.00	2
16	224.40	792.00	239.00	804.30	2
17	239.00	804.30	258.40	813.00	2
18	258.40	813.00	265.80	815.00	2
19	265.80	815.00	286.00	815.00	2
20	286.00	815.00	340.00	829.00	2
21	86.80	738.00	114.00	725.00	2
22	114.00	725.00	125.00	724.70	2
23	125.00	724.70	139.50	727.60	2
24	139.50	727.60	149.00	731.30	2
25	149.00	731.30	168.00	746.00	2

User Specified Y-Origin = 650.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
2 Type(s) of Soil

Soil	Total	Saturated	Cohesion	Friction	Pore	Pressure	Piez.

Type No.	Unit Wt. (pcf)	Unit Wt. (pcf)	Intercept (psf)	Angle (deg)	Pressure Param.	Constant (psf)	Surface No.
1	130.0	130.0	92.0	31.0	0.00	0.0	0
2	140.0	140.0	0.0	48.0	0.00	0.0	0

Specified Peak Ground Acceleration Coefficient (A) = 0.200(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.200(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

2000 Trial Surfaces Have Been Generated.

2000 Surface(s) Initiate(s) From Each Of 1 Points Equally Spaced
Along The Ground Surface Between X = 168.00(ft)
and X = 168.00(ft)

Each Surface Terminates Between X = 220.00(ft)
and X = 340.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 0.00(ft)

5.00(ft) Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Total Number of Trial Surfaces Attempted = 2000
Number of Trial Surfaces With Valid FS = 2000

Statistical Data On All Valid FS Values:
FS Max = 3.166 FS Min = 0.886 FS Ave = 2.108
Standard Deviation = 0.729 Coefficient of Variation = 34.56 %

Failure Surface Specified By 15 Coordinate Points

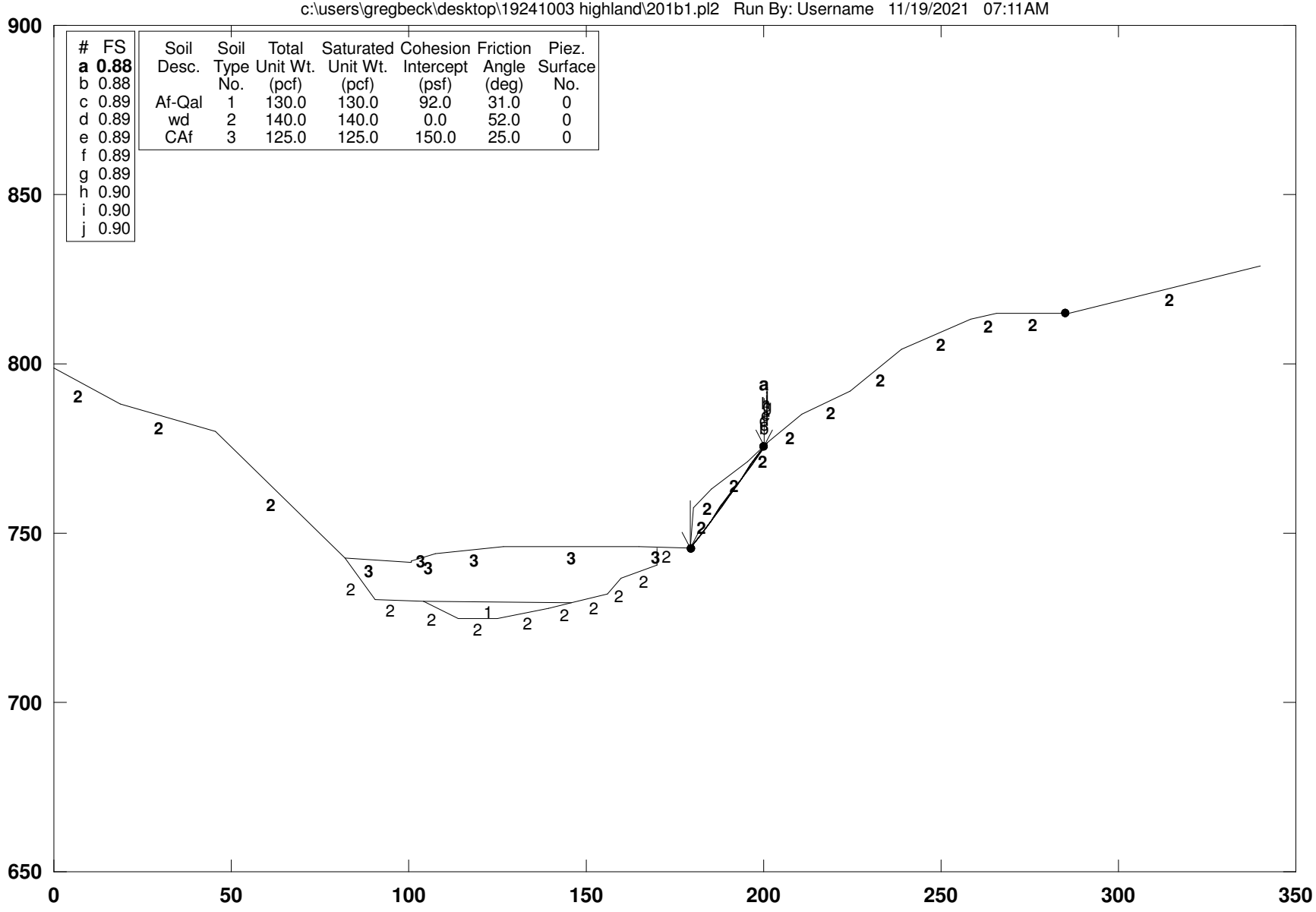
Point No.	X-Surf (ft)	Y-Surf (ft)
1	168.000	746.000
2	171.938	749.081
3	175.858	752.185
4	179.761	755.310
5	183.646	758.458
6	187.513	761.627
7	191.362	764.818
8	195.193	768.031
9	199.006	771.266
10	202.801	774.522
11	206.577	777.799
12	210.334	781.098
13	214.073	784.418
14	217.793	787.758
15	220.012	789.774

Circle Center At X = -375.544 ; Y = 1444.690 ; and Radius = 885.217

Factor of Safety *** 0.886 ***

Highland Cross Section B-B'; Temporary Slope Condition_Static

c:\users\gregbeck\desktop\19241003 highland\201b1.pl2 Run By: Username 11/19/2021 07:11AM



#	FS
a	**0.88**
b	0.88
c	0.89
d	0.89
e	0.89
f	0.89
g	0.89
h	0.90
i	0.90
j	0.90

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Af-Qal	1	130.0	130.0	92.0	31.0	0
wd	2	140.0	140.0	0.0	52.0	0
CAf	3	125.0	125.0	150.0	25.0	0

GSTABL7 v.2 FSmin=0.88

Safety Factors Are Calculated By The Modified Bishop Method

*** GSTABL7 ***
** GSTABL7 by Dr. Garry H. Gregory, Ph.D.,P.E.,D.GE **
** Original Version 1.0, January 1996; Current Ver. 2.005.3, Feb. 2013 **
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SLOPE STABILITY ANALYSIS SYSTEM
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Loads, Pseudo-Static & Newmark Earthquake Applied Forces.

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Analysis Run Date: 11/19/2021
Time of Run: 07:11AM
Input Data Filename: 201b1.dat
Output Filename: 201b1.OUT
Plotted Output Filename: 201b1.PLT
Unit System: English

PROBLEM DESCRIPTION: Highland Cross Section B-B';
Temporary Slope Condition_Static

BOUNDARY COORDINATES
20 Top Boundaries
31 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	798.60	18.60	788.00	2
2	18.60	788.00	45.50	780.00	2
3	45.50	780.00	82.00	742.50	2
4	82.00	742.50	100.80	741.50	3
5	100.80	741.50	100.90	742.00	3
6	100.90	742.00	107.50	744.00	3
7	107.50	744.00	126.50	746.00	3
8	126.50	746.00	165.00	746.00	3
9	165.00	746.00	179.50	745.50	3
10	179.50	745.50	180.00	757.50	2
11	180.00	757.50	185.20	763.00	2
12	185.20	763.00	195.60	771.00	2
13	195.60	771.00	201.30	777.00	2
14	201.30	777.00	210.60	785.00	2
15	210.60	785.00	224.40	792.00	2
16	224.40	792.00	239.00	804.30	2
17	239.00	804.30	258.40	813.00	2
18	258.40	813.00	265.80	815.00	2
19	265.80	815.00	286.00	815.00	2
20	286.00	815.00	340.00	829.00	2
21	82.00	742.50	90.60	730.40	2
22	90.60	730.40	104.20	729.80	2
23	104.20	729.80	145.60	729.50	1
24	145.60	729.50	156.00	732.20	2
25	156.00	732.20	160.00	736.50	2
26	160.00	736.50	170.00	740.50	2
27	170.00	740.50	170.01	745.50	2
28	104.20	729.80	114.00	725.00	2
29	114.00	725.00	125.00	724.70	2
30	125.00	724.70	139.50	727.60	2
31	139.50	727.60	145.60	729.50	2

User Specified Y-Origin = 650.00(ft)
Default X-Plus Value = 0.00(ft)

Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	130.0	130.0	92.0	31.0	0.00	0.0	0
2	140.0	140.0	0.0	52.0	0.00	0.0	0
3	125.0	125.0	150.0	25.0	0.00	0.0	0

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

2000 Trial Surfaces Have Been Generated.

2000 Surface(s) Initiate(s) From Each Of 1 Points Equally Spaced
Along The Ground Surface Between X = 179.50(ft)
and X = 179.50(ft)

Each Surface Terminates Between X = 200.00(ft)
and X = 285.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 0.00(ft)

5.00(ft) Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation.
The Angle Has Been Restricted Between The Angles Of 0.0 And 70.0 deg.

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Total Number of Trial Surfaces Attempted = 2000
Number of Trial Surfaces With Valid FS = 2000

Statistical Data On All Valid FS Values:
FS Max = 2.650 FS Min = 0.884 FS Ave = 1.908
Standard Deviation = 0.507 Coefficient of Variation = 26.57 %

Failure Surface Specified By 9 Coordinate Points

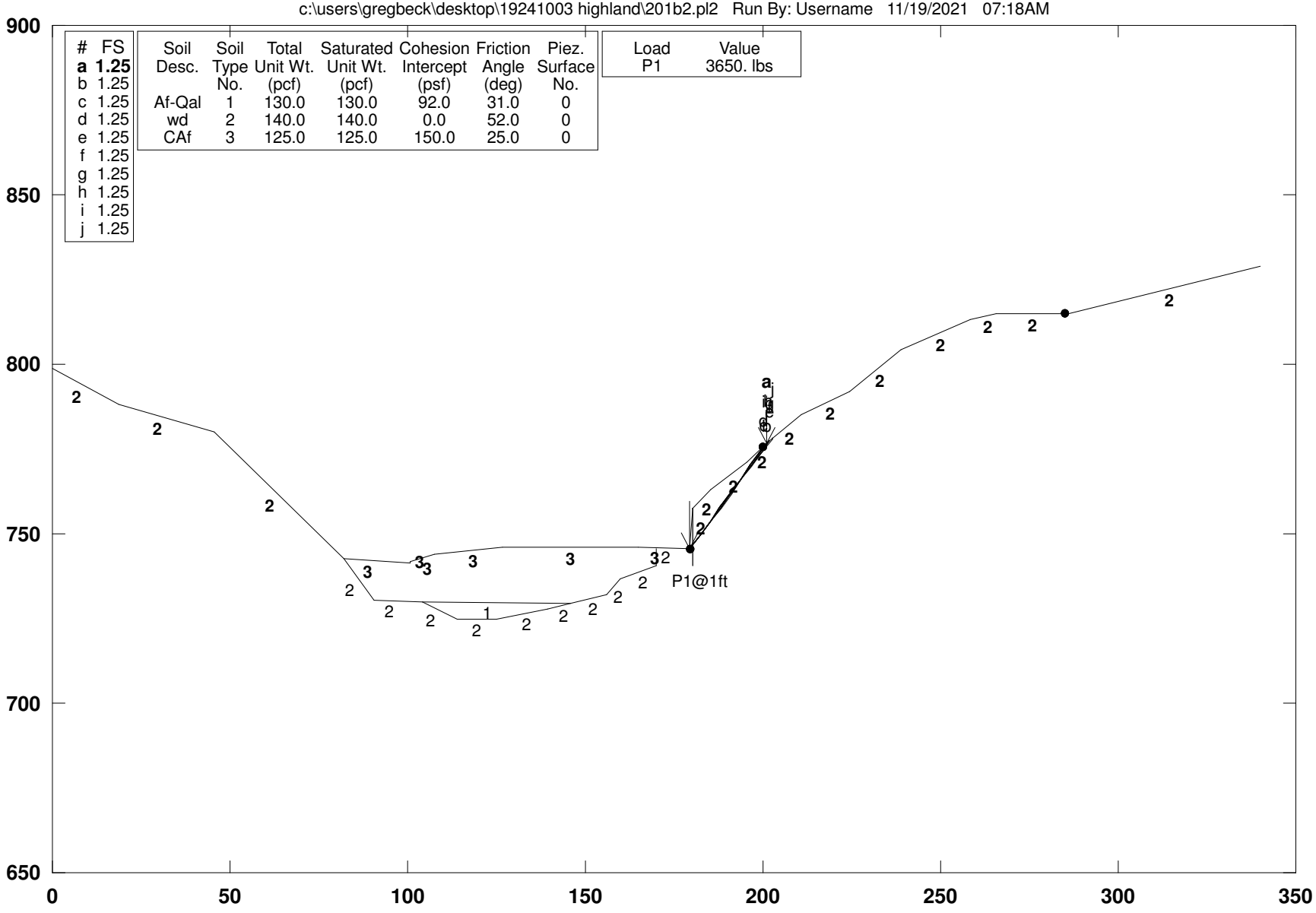
Point No.	X-Surf (ft)	Y-Surf (ft)
1	179.500	745.500
2	182.333	749.620
3	185.161	753.743
4	187.984	757.870
5	190.803	762.000
6	193.616	766.134
7	196.424	770.270
8	199.228	774.410
9	200.182	775.823

Circle Center At X = -3282.682 ; Y = 3129.202 ; and Radius = 4203.420

Factor of Safety *** 0.884 ***

Highland Cross Section B-B'; Temporary Slope Condition_Static

c:\users\gregbeck\desktop\19241003 highland\201b2.pl2 Run By: Username 11/19/2021 07:18AM



#	FS
a	**1.25**
b	1.25
c	1.25
d	1.25
e	1.25
f	1.25
g	1.25
h	1.25
i	1.25
j	1.25

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Af-Qal	1	130.0	130.0	92.0	31.0	0
wd	2	140.0	140.0	0.0	52.0	0
CAf	3	125.0	125.0	150.0	25.0	0

Load	Value
P1	3650. lbs

GSTABL7 v.2 FSmin=1.25

Safety Factors Are Calculated By The Modified Bishop Method

*** GSTABL7 ***
** GSTABL7 by Dr. Garry H. Gregory, Ph.D.,P.E.,D.GE **
** Original Version 1.0, January 1996; Current Ver. 2.005.3, Feb. 2013 **
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SLOPE STABILITY ANALYSIS SYSTEM
Modified Bishop or Simplified Janbu Method of Slices and Type Analysis
Including Pier/Pile Reinforcement, Nonlinear Undrained
Shear Strength, Curved Phi Envelope, Anisotropic Soil, Boundary
Loads, Pseudo-Static & Newmark Earthquake Applied Forces.

****

Analysis Run Date: 11/19/2021
Time of Run: 07:18AM
Input Data Filename: 201b2.dat
Plotted Output Filename: 201b2.PLT
Output Filename: 201b2.OUT

PROBLEM DESCRIPTION: Highland Cross Section B-B';
Temporary Slope Condition_Static

BOUNDARY COORDINATES
20 Top Boundaries
31 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	798.60	18.60	788.00	2
2	18.60	788.00	45.50	780.00	2
3	45.50	780.00	82.00	742.50	2
4	82.00	742.50	100.80	741.50	3
5	100.80	741.50	100.90	742.00	3
6	100.90	742.00	107.50	744.00	3
7	107.50	744.00	126.50	746.00	3
8	126.50	746.00	165.00	746.00	3
9	165.00	746.00	179.50	745.50	3
10	179.50	745.50	180.00	757.50	2
11	180.00	757.50	185.20	763.00	2
12	185.20	763.00	195.60	771.00	2
13	195.60	771.00	201.30	777.00	2
14	201.30	777.00	210.60	785.00	2
15	210.60	785.00	224.40	792.00	2
16	224.40	792.00	239.00	804.30	2
17	239.00	804.30	258.40	813.00	2
18	258.40	813.00	265.80	815.00	2
19	265.80	815.00	286.00	815.00	2
20	286.00	815.00	340.00	829.00	2
21	82.00	742.50	90.60	730.40	2
22	90.60	730.40	104.20	729.80	2
23	104.20	729.80	145.60	729.50	1
24	145.60	729.50	156.00	732.20	2
25	156.00	732.20	160.00	736.50	2
26	160.00	736.50	170.00	740.50	2
27	170.00	740.50	170.01	745.50	2
28	104.20	729.80	114.00	725.00	2
29	114.00	725.00	125.00	724.70	2
30	125.00	724.70	139.50	727.60	2

31	139.50	727.60	145.60	729.50	2

User Specified Y-Origin = 650.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	130.0	130.0	92.0	31.0	0.00	0.0	0
2	140.0	140.0	0.0	52.0	0.00	0.0	0
3	125.0	125.0	150.0	25.0	0.00	0.0	0

PIER/PILE LOAD(S)
1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	180.00	757.50	3650.0	1.0	90.00	17.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles
Assuming A Uniform Distribution Of Load Horizontally Between
Individual Piers/Piles.

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

2000 Trial Surfaces Have Been Generated.

2000 Surface(s) Initiate(s) From Each Of 1 Points Equally Spaced
Along The Ground Surface Between X = 179.50(ft)
and X = 179.50(ft)

Each Surface Terminates Between X = 200.00(ft)
and X = 285.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 0.00(ft)

5.00(ft) Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation.
The Angle Has Been Restricted Between The Angles Of 0.0 And 70.0 deg.

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Total Number of Trial Surfaces Attempted = 2000
Number of Trial Surfaces With Valid FS = 2000

Statistical Data On All Valid FS Values:
FS Max = 2.672 FS Min = 1.253 FS Ave = 1.996

Standard Deviation = 0.437 Coefficient of Variation = 21.89 %

Failure Surface Specified By 9 Coordinate Points

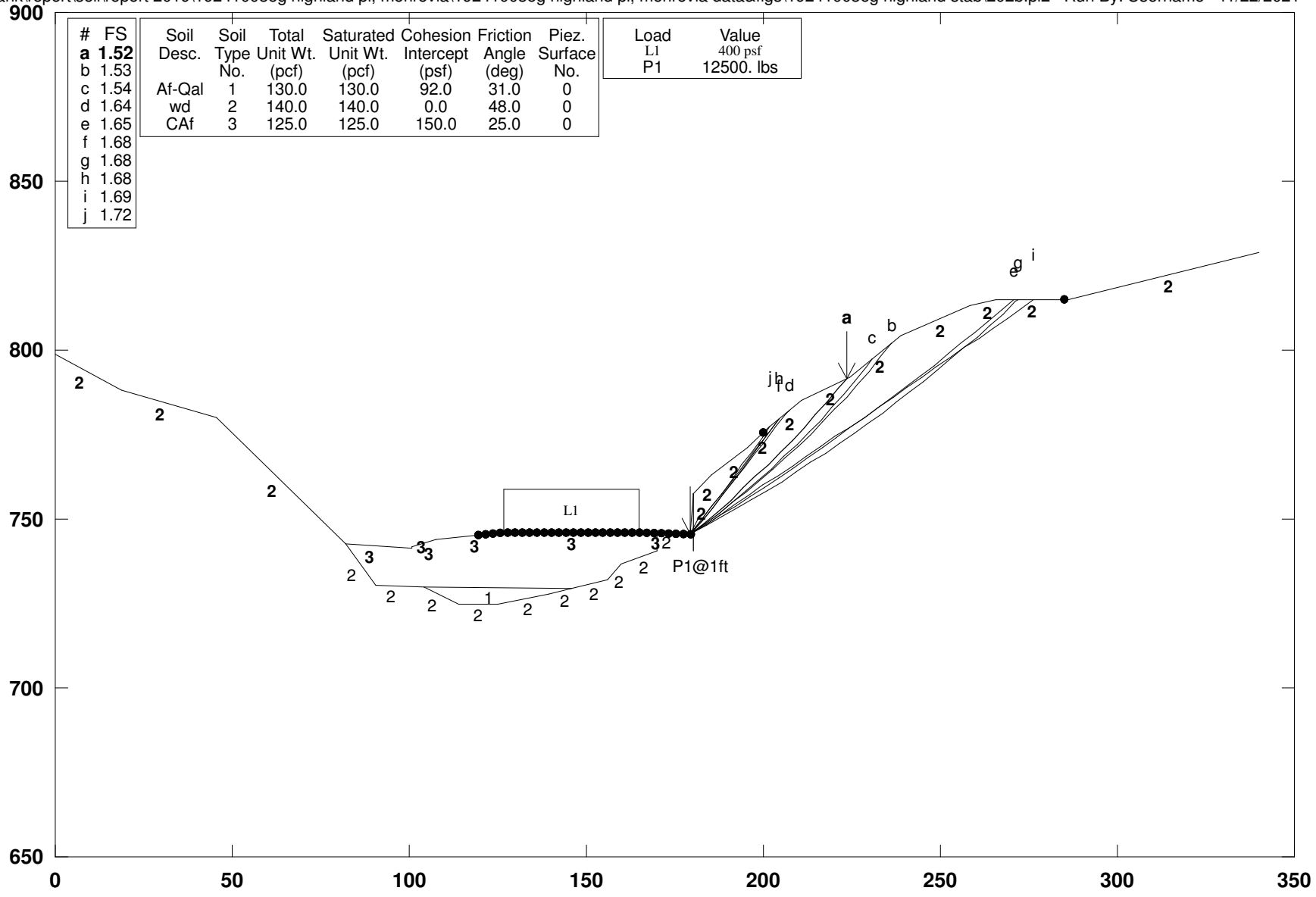
Point No.	X-Surf (ft)	Y-Surf (ft)
1	179.500	745.500
2	182.351	749.608
3	185.197	753.718
4	188.039	757.832
5	190.877	761.949
6	193.711	766.068
7	196.540	770.190
8	199.366	774.316
9	200.943	776.624

Circle Center At X = -3796.946 ; Y = 3508.125 ; and Radius = 4841.923

Factor of Safety *** 1.253 ***

Highland Cross Section B-B'; Proposed Slope Condition_Static

z:\hank\report\soil\report 2019\19241003eg highland pl, monrovia\19241003eg highland pl, monrovia data&figs\19241003eg highland stab\202b.pl2 Run By: Username 11/22/2021 12:30PM



#	FS
a	**1.52**
b	1.53
c	1.54
d	1.64
e	1.65
f	1.68
g	1.68
h	1.68
i	1.69
j	1.72

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Af-Qal	1	130.0	130.0	92.0	31.0	0
wd	2	140.0	140.0	0.0	48.0	0
CAf	3	125.0	125.0	150.0	25.0	0

Load	Value
L1	400 psf
P1	12500. lbs

GSTABL7 v.2 FSmin=1.52

Safety Factors Are Calculated By The Modified Bishop Method

*** GSTABL7 ***
** GSTABL7 by Dr. Garry H. Gregory, Ph.D.,P.E.,D.GE **
** Original Version 1.0, January 1996; Current Ver. 2.005.3, Feb. 2013 **
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Modified Bishop or Simplified Janbu Method of Slices and Type Analysis
Including Pier/Pile Reinforcement, Nonlinear Undrained
Shear Strength, Curved Phi Envelope, Anisotropic Soil, Boundary
Loads, Pseudo-Static & Newmark Earthquake Applied Forces.

****

Analysis Run Date: 11/22/2021
Time of Run: 12:30PM
Input Data Filename: 202b.dat
Output Filename: 202b.OUT
Plotted Output Filename: 202b.PLT
Unit System: English

PROBLEM DESCRIPTION: Highland Cross Section B-B';
Proposed Slope Condition_Static

BOUNDARY COORDINATES
20 Top Boundaries
31 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	798.60	18.60	788.00	2
2	18.60	788.00	45.50	780.00	2
3	45.50	780.00	82.00	742.50	2
4	82.00	742.50	100.80	741.50	3
5	100.80	741.50	100.90	742.00	3
6	100.90	742.00	107.50	744.00	3
7	107.50	744.00	126.50	746.00	3
8	126.50	746.00	165.00	746.00	3
9	165.00	746.00	179.50	745.50	3
10	179.50	745.50	180.00	757.50	2
11	180.00	757.50	185.20	763.00	2
12	185.20	763.00	195.60	771.00	2
13	195.60	771.00	201.30	777.00	2
14	201.30	777.00	210.60	785.00	2
15	210.60	785.00	224.40	792.00	2
16	224.40	792.00	239.00	804.30	2
17	239.00	804.30	258.40	813.00	2
18	258.40	813.00	265.80	815.00	2
19	265.80	815.00	286.00	815.00	2
20	286.00	815.00	340.00	829.00	2
21	82.00	742.50	90.60	730.40	2
22	90.60	730.40	104.20	729.80	2
23	104.20	729.80	145.60	729.50	1
24	145.60	729.50	156.00	732.20	2
25	156.00	732.20	160.00	736.50	2
26	160.00	736.50	170.00	740.50	2
27	170.00	740.50	170.01	745.50	2
28	104.20	729.80	114.00	725.00	2
29	114.00	725.00	125.00	724.70	2

30	125.00	724.70	139.50	727.60	2
31	139.50	727.60	145.60	729.50	2

User Specified Y-Origin = 650.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	130.0	130.0	92.0	31.0	0.00	0.0	0
2	140.0	140.0	0.0	48.0	0.00	0.0	0
3	125.0	125.0	150.0	25.0	0.00	0.0	0

BOUNDARY LOAD(S)
1 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	126.50	165.00	400.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed Force Acting On A Horizontally Projected Surface.

PIER/PILE LOAD(S)
1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	180.00	757.50	12500.0	1.0	90.00	17.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles Assuming A Uniform Distribution Of Load Horizontally Between Individual Piers/Piles.

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

1500 Trial Surfaces Have Been Generated.

50 Surface(s) Initiate(s) From Each Of 30 Points Equally Spaced Along The Ground Surface Between X = 119.50(ft)
and X = 179.50(ft)

Each Surface Terminates Between X = 200.00(ft)
and X = 285.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 0.00(ft)

5.00(ft) Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Evaluated. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Total Number of Trial Surfaces Attempted = 1500
Number of Trial Surfaces With Valid FS = 1500

Statistical Data On All Valid FS Values:
FS Max = 4.785 FS Min = 1.523 FS Ave = 2.702
Standard Deviation = 0.386 Coefficient of Variation = 14.30 %

Failure Surface Specified By 14 Coordinate Points

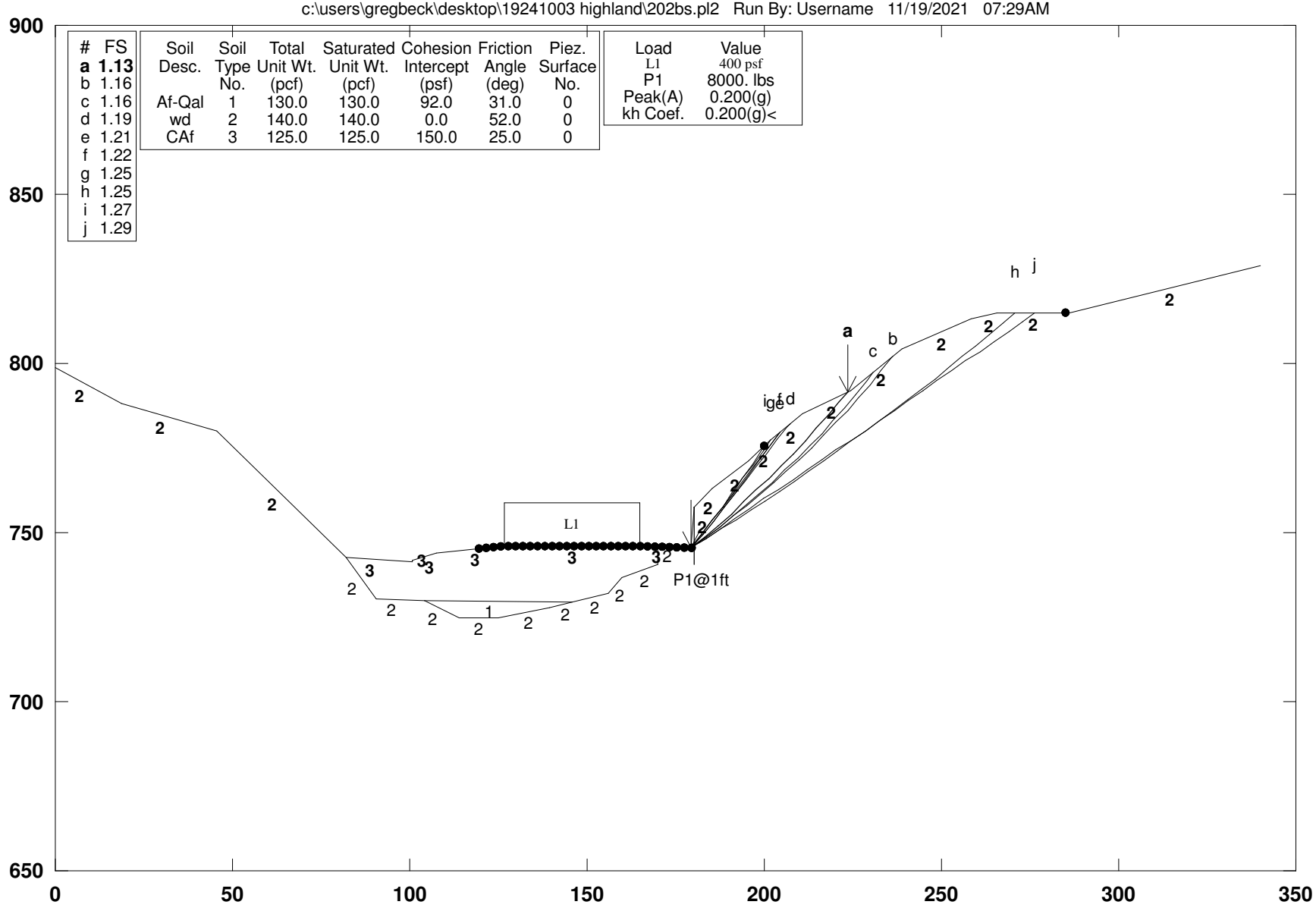
Point No.	X-Surf (ft)	Y-Surf (ft)
1	179.500	745.502
2	183.257	748.802
3	186.965	752.156
4	190.622	755.565
5	194.230	759.028
6	197.785	762.543
7	201.289	766.110
8	204.739	769.729
9	208.136	773.398
10	211.478	777.116
11	214.766	780.884
12	217.997	784.699
13	221.171	788.562
14	223.582	791.585

Circle Center At X = -41.907 ; Y = 1001.419 ; and Radius = 338.400

Factor of Safety *** 1.523 ***

Highland Cross Section B-B'; Proposed Slope Condition_Seismic

c:\users\gregbeck\desktop\19241003 highland\202bs.pl2 Run By: Username 11/19/2021 07:29AM



#	FS
a	**1.13**
b	1.16
c	1.16
d	1.19
e	1.21
f	1.22
g	1.25
h	1.25
i	1.27
j	1.29

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Af-Qal	1	130.0	130.0	92.0	31.0	0
wd	2	140.0	140.0	0.0	52.0	0
CAf	3	125.0	125.0	150.0	25.0	0

Load	Value
L1	400 psf
P1	8000. lbs
Peak(A)	0.200(g)
kh Coef.	0.200(g)<

GSTABL7 v.2 FSmin=1.13

Safety Factors Are Calculated By The Modified Bishop Method

*** GSTABL7 ***
** GSTABL7 by Dr. Garry H. Gregory, Ph.D.,P.E.,D.GE **
** Original Version 1.0, January 1996; Current Ver. 2.005.3, Feb. 2013 **
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SLOPE STABILITY ANALYSIS SYSTEM
Modified Bishop or Simplified Janbu Method of Slices and Type Analysis
Including Pier/Pile Reinforcement, Nonlinear Undrained
Shear Strength, Curved Phi Envelope, Anisotropic Soil, Boundary
Loads, Pseudo-Static & Newmark Earthquake Applied Forces.

****

Analysis Run Date: 11/19/2021
Time of Run: 07:29AM
Input Data Filename: 202bs.dat
Output Filename: 202bs.OUT
Plotted Output Filename: 202bs.PLT
Unit System: English

PROBLEM DESCRIPTION: Highland Cross Section B-B';
Proposed Slope Condition_Seismic

BOUNDARY COORDINATES
20 Top Boundaries
31 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	798.60	18.60	788.00	2
2	18.60	788.00	45.50	780.00	2
3	45.50	780.00	82.00	742.50	2
4	82.00	742.50	100.80	741.50	3
5	100.80	741.50	100.90	742.00	3
6	100.90	742.00	107.50	744.00	3
7	107.50	744.00	126.50	746.00	3
8	126.50	746.00	165.00	746.00	3
9	165.00	746.00	179.50	745.50	3
10	179.50	745.50	180.00	757.50	2
11	180.00	757.50	185.20	763.00	2
12	185.20	763.00	195.60	771.00	2
13	195.60	771.00	201.30	777.00	2
14	201.30	777.00	210.60	785.00	2
15	210.60	785.00	224.40	792.00	2
16	224.40	792.00	239.00	804.30	2
17	239.00	804.30	258.40	813.00	2
18	258.40	813.00	265.80	815.00	2
19	265.80	815.00	286.00	815.00	2
20	286.00	815.00	340.00	829.00	2
21	82.00	742.50	90.60	730.40	2
22	90.60	730.40	104.20	729.80	2
23	104.20	729.80	145.60	729.50	1
24	145.60	729.50	156.00	732.20	2
25	156.00	732.20	160.00	736.50	2
26	160.00	736.50	170.00	740.50	2
27	170.00	740.50	170.01	745.50	2
28	104.20	729.80	114.00	725.00	2
29	114.00	725.00	125.00	724.70	2

30	125.00	724.70	139.50	727.60	2
31	139.50	727.60	145.60	729.50	2

User Specified Y-Origin = 650.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	130.0	130.0	92.0	31.0	0.00	0.0	0
2	140.0	140.0	0.0	52.0	0.00	0.0	0
3	125.0	125.0	150.0	25.0	0.00	0.0	0

BOUNDARY LOAD(S)
1 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	126.50	165.00	400.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed
Force Acting On A Horizontally Projected Surface.

Specified Peak Ground Acceleration Coefficient (A) = 0.200(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.200(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)
1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	180.00	757.50	8000.0	1.0	90.00	17.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles
Assuming A Uniform Distribution Of Load Horizontally Between
Individual Piers/Piles.

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

1500 Trial Surfaces Have Been Generated.

50 Surface(s) Initiate(s) From Each Of 30 Points Equally Spaced
Along The Ground Surface Between X = 119.50(ft)
and X = 179.50(ft)

Each Surface Terminates Between X = 200.00(ft)
and X = 285.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 0.00(ft)

5.00(ft) Line Segments Define Each Trial Failure Surface.

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Total Number of Trial Surfaces Attempted = 1500
Number of Trial Surfaces With Valid FS = 1500

Statistical Data On All Valid FS Values:
FS Max = 2.953 FS Min = 1.134 FS Ave = 2.204
Standard Deviation = 0.323 Coefficient of Variation = 14.67 %

Failure Surface Specified By 14 Coordinate Points

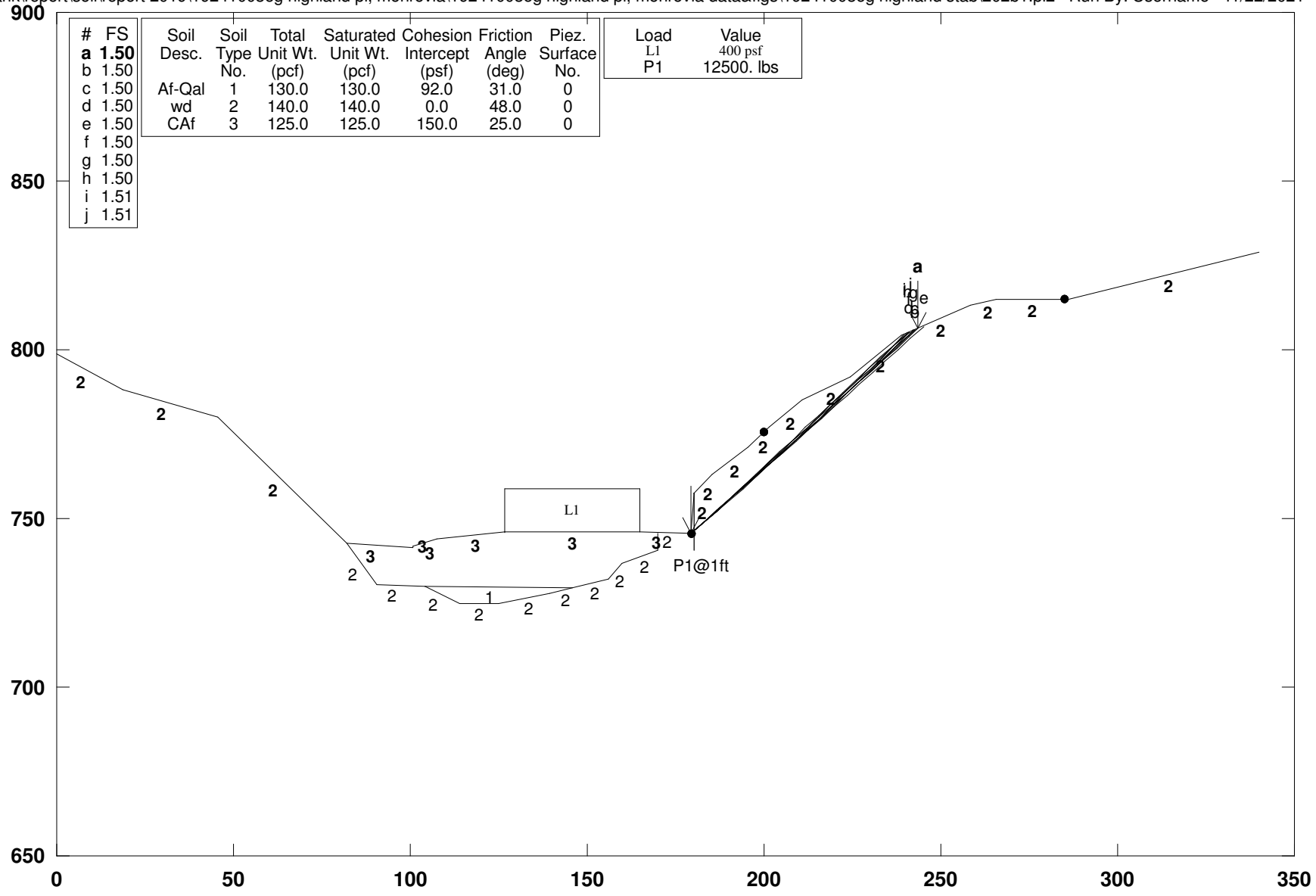
Point No.	X-Surf (ft)	Y-Surf (ft)
1	179.500	745.502
2	183.257	748.802
3	186.965	752.156
4	190.622	755.565
5	194.230	759.028
6	197.785	762.543
7	201.289	766.110
8	204.739	769.729
9	208.136	773.398
10	211.478	777.116
11	214.766	780.884
12	217.997	784.699
13	221.171	788.562
14	223.582	791.585

Circle Center At X = -41.907 ; Y = 1001.419 ; and Radius = 338.400

Factor of Safety *** 1.134 ***

Highland Cross Section B-B'; Proposed Slope Condition_Static

z:\hank\report\soil\report 2019\19241003eg highland pl, monrovia\19241003eg highland pl, monrovia data&figs\19241003eg highland stab\202b1.pl2 Run By: Username 11/22/2021 12:31PM



#	FS
a	**1.50**
b	1.50
c	1.50
d	1.50
e	1.50
f	1.50
g	1.50
h	1.50
i	1.51
j	1.51

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Af-Qal	1	130.0	130.0	92.0	31.0	0
wd	2	140.0	140.0	0.0	48.0	0
CAf	3	125.0	125.0	150.0	25.0	0

Load	Value
L1	400 psf
P1	12500. lbs

GSTABL7 v.2 FSmin=1.50

Safety Factors Are Calculated By The Modified Bishop Method

*** GSTABL7 ***
** GSTABL7 by Dr. Garry H. Gregory, Ph.D.,P.E.,D.GE **
** Original Version 1.0, January 1996; Current Ver. 2.005.3, Feb. 2013 **
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SLOPE STABILITY ANALYSIS SYSTEM
Modified Bishop or Simplified Janbu Method of Slices and Type Analysis
Including Pier/Pile Reinforcement, Nonlinear Undrained
Shear Strength, Curved Phi Envelope, Anisotropic Soil, Boundary
Loads, Pseudo-Static & Newmark Earthquake Applied Forces.

****

Analysis Run Date: 11/22/2021
Time of Run: 12:31PM
Input Data Filename: 202b1.dat
Output Filename: 202b1.OUT
Plotted Output Filename: 202b1.PLT
Unit System: English

PROBLEM DESCRIPTION: Highland Cross Section B-B';
Proposed Slope Condition_Static

BOUNDARY COORDINATES
20 Top Boundaries
31 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	798.60	18.60	788.00	2
2	18.60	788.00	45.50	780.00	2
3	45.50	780.00	82.00	742.50	2
4	82.00	742.50	100.80	741.50	3
5	100.80	741.50	100.90	742.00	3
6	100.90	742.00	107.50	744.00	3
7	107.50	744.00	126.50	746.00	3
8	126.50	746.00	165.00	746.00	3
9	165.00	746.00	179.50	745.50	3
10	179.50	745.50	180.00	757.50	2
11	180.00	757.50	185.20	763.00	2
12	185.20	763.00	195.60	771.00	2
13	195.60	771.00	201.30	777.00	2
14	201.30	777.00	210.60	785.00	2
15	210.60	785.00	224.40	792.00	2
16	224.40	792.00	239.00	804.30	2
17	239.00	804.30	258.40	813.00	2
18	258.40	813.00	265.80	815.00	2
19	265.80	815.00	286.00	815.00	2
20	286.00	815.00	340.00	829.00	2
21	82.00	742.50	90.60	730.40	2
22	90.60	730.40	104.20	729.80	2
23	104.20	729.80	145.60	729.50	1
24	145.60	729.50	156.00	732.20	2
25	156.00	732.20	160.00	736.50	2
26	160.00	736.50	170.00	740.50	2
27	170.00	740.50	170.01	745.50	2
28	104.20	729.80	114.00	725.00	2
29	114.00	725.00	125.00	724.70	2

30	125.00	724.70	139.50	727.60	2
31	139.50	727.60	145.60	729.50	2

User Specified Y-Origin = 650.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	130.0	130.0	92.0	31.0	0.00	0.0	0
2	140.0	140.0	0.0	48.0	0.00	0.0	0
3	125.0	125.0	150.0	25.0	0.00	0.0	0

BOUNDARY LOAD(S)
1 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	126.50	165.00	400.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed
Force Acting On A Horizontally Projected Surface.

PIER/PILE LOAD(S)
1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	180.00	757.50	12500.0	1.0	90.00	17.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles
Assuming A Uniform Distribution Of Load Horizontally Between
Individual Piers/Piles.

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

2000 Trial Surfaces Have Been Generated.

2000 Surface(s) Initiate(s) From Each Of 1 Points Equally Spaced
Along The Ground Surface Between X = 179.50(ft)
and X = 179.50(ft)

Each Surface Terminates Between X = 200.00(ft)
and X = 285.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 0.00(ft)

5.00(ft) Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation.
The Angle Has Been Restricted Between The Angles Of 0.0 And 70.0 deg.

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Total Number of Trial Surfaces Attempted = 2000
Number of Trial Surfaces With Valid FS = 2000

Statistical Data On All Valid FS Values:
FS Max = 2.376 FS Min = 1.502 FS Ave = 1.928
Standard Deviation = 0.258 Coefficient of Variation = 13.38 %

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	179.500	745.500
2	183.153	748.914
3	186.803	752.331
4	190.450	755.752
5	194.093	759.176
6	197.733	762.605
7	201.369	766.036
8	205.002	769.472
9	208.631	772.911
10	212.257	776.354
11	215.880	779.800
12	219.499	783.250
13	223.114	786.704
14	226.726	790.161
15	230.335	793.622
16	233.940	797.086
17	237.542	800.555
18	241.140	804.026
19	243.520	806.327

Circle Center At X = -3230.383 ; Y = 4398.536 ; and Radius = 4997.197

Factor of Safety *** 1.502 ***

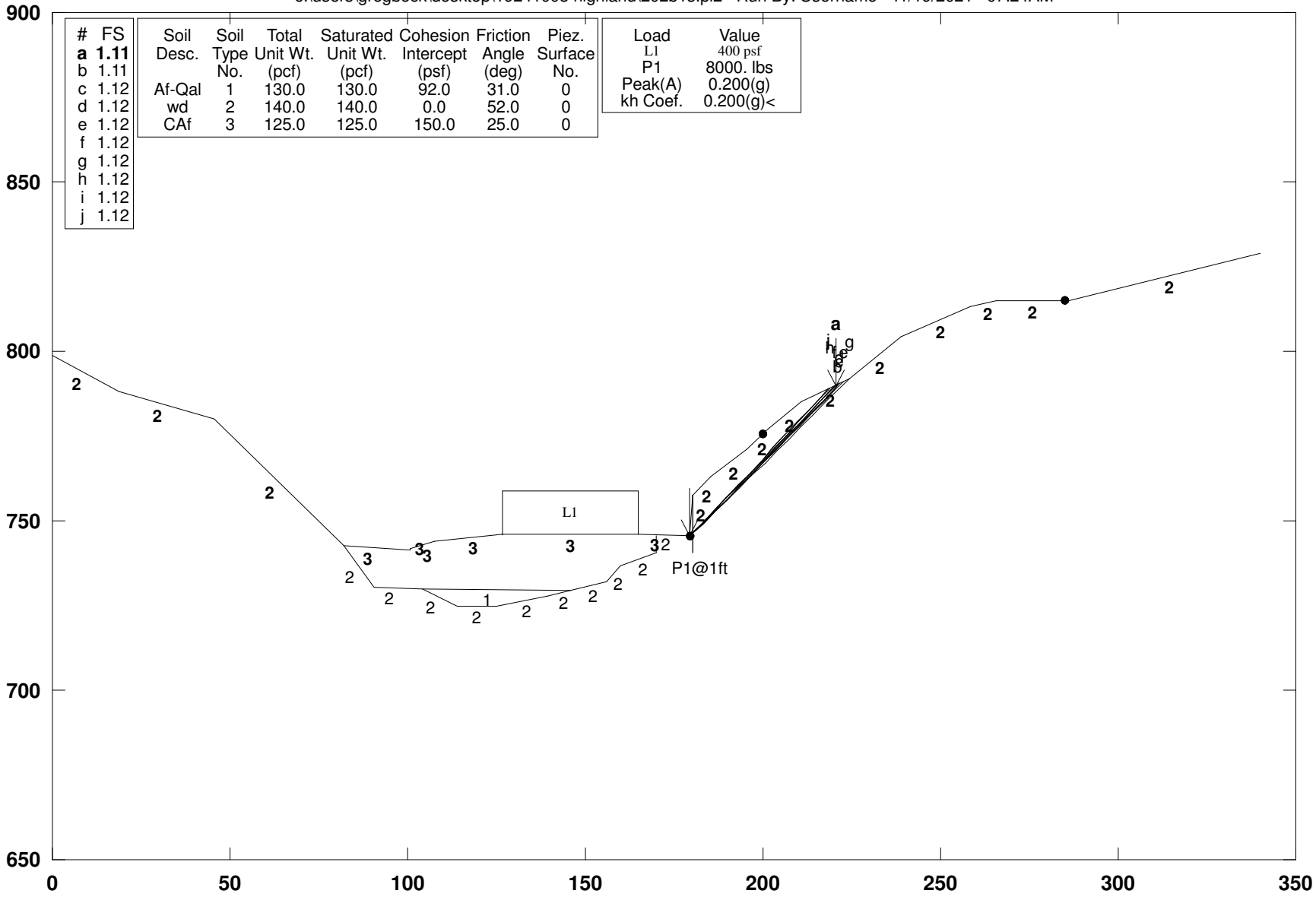
Highland Cross Section B-B'; Proposed Slope Condition_Seismic

c:\users\gregbeck\desktop\19241003 highland\202b1s.pl2 Run By: Username 11/19/2021 07:24AM

#	FS
a	**1.11**
b	1.11
c	1.12
d	1.12
e	1.12
f	1.12
g	1.12
h	1.12
i	1.12
j	1.12

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Af-Qal	1	130.0	130.0	92.0	31.0	0
wd	2	140.0	140.0	0.0	52.0	0
CAf	3	125.0	125.0	150.0	25.0	0

Load	Value
L1	400 psf
P1	8000. lbs
Peak(A)	0.200(g)
kh Coef.	0.200(g)<



GSTABL7 v.2 FSmin=1.11

Safety Factors Are Calculated By The Modified Bishop Method

*** GSTABL7 ***
** GSTABL7 by Dr. Garry H. Gregory, Ph.D.,P.E.,D.GE **
** Original Version 1.0, January 1996; Current Ver. 2.005.3, Feb. 2013 **
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SLOPE STABILITY ANALYSIS SYSTEM
Modified Bishop or Simplified Janbu Method of Slices and Type Analysis
Including Pier/Pile Reinforcement, Nonlinear Undrained
Shear Strength, Curved Phi Envelope, Anisotropic Soil, Boundary
Loads, Pseudo-Static & Newmark Earthquake Applied Forces.

****

Analysis Run Date: 11/19/2021
Time of Run: 07:24AM
Input Data Filename: 202b1s.dat
Output Filename: 202b1s.OUT
Plotted Output Filename: 202b1s.PLT
Unit System: English

PROBLEM DESCRIPTION: Highland Cross Section B-B';
Proposed Slope Condition_Seismic

BOUNDARY COORDINATES
20 Top Boundaries
31 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	798.60	18.60	788.00	2
2	18.60	788.00	45.50	780.00	2
3	45.50	780.00	82.00	742.50	2
4	82.00	742.50	100.80	741.50	3
5	100.80	741.50	100.90	742.00	3
6	100.90	742.00	107.50	744.00	3
7	107.50	744.00	126.50	746.00	3
8	126.50	746.00	165.00	746.00	3
9	165.00	746.00	179.50	745.50	3
10	179.50	745.50	180.00	757.50	2
11	180.00	757.50	185.20	763.00	2
12	185.20	763.00	195.60	771.00	2
13	195.60	771.00	201.30	777.00	2
14	201.30	777.00	210.60	785.00	2
15	210.60	785.00	224.40	792.00	2
16	224.40	792.00	239.00	804.30	2
17	239.00	804.30	258.40	813.00	2
18	258.40	813.00	265.80	815.00	2
19	265.80	815.00	286.00	815.00	2
20	286.00	815.00	340.00	829.00	2
21	82.00	742.50	90.60	730.40	2
22	90.60	730.40	104.20	729.80	2
23	104.20	729.80	145.60	729.50	1
24	145.60	729.50	156.00	732.20	2
25	156.00	732.20	160.00	736.50	2
26	160.00	736.50	170.00	740.50	2
27	170.00	740.50	170.01	745.50	2
28	104.20	729.80	114.00	725.00	2
29	114.00	725.00	125.00	724.70	2

30	125.00	724.70	139.50	727.60	2
31	139.50	727.60	145.60	729.50	2

User Specified Y-Origin = 650.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
3 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	130.0	130.0	92.0	31.0	0.00	0.0	0
2	140.0	140.0	0.0	52.0	0.00	0.0	0
3	125.0	125.0	150.0	25.0	0.00	0.0	0

BOUNDARY LOAD(S)
1 Load(s) Specified

Load No.	X-Left (ft)	X-Right (ft)	Intensity (psf)	Deflection (deg)
1	126.50	165.00	400.0	0.0

NOTE - Intensity Is Specified As A Uniformly Distributed
Force Acting On A Horizontally Projected Surface.

Specified Peak Ground Acceleration Coefficient (A) = 0.200(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.200(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000

PIER/PILE LOAD(S)
1 Pier/Pile Load(s) Specified

Pier/Pile No.	X-Pos (ft)	Y-Pos (ft)	Load (lbs)	Spacing (ft)	Inclination (deg)	Length (ft)
1	180.00	757.50	8000.0	1.0	90.00	17.0

NOTE - An Equivalent Line Load Is Calculated For Each Row Of Piers/Piles
Assuming A Uniform Distribution Of Load Horizontally Between
Individual Piers/Piles.

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

2000 Trial Surfaces Have Been Generated.

2000 Surface(s) Initiate(s) From Each Of 1 Points Equally Spaced
Along The Ground Surface Between X = 179.50(ft)
and X = 179.50(ft)

Each Surface Terminates Between X = 200.00(ft)
and X = 285.00(ft)

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 0.00(ft)

5.00(ft) Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation.
The Angle Has Been Restricted Between The Angles Of 0.0 And 70.0 deg.

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Evaluated. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Total Number of Trial Surfaces Attempted = 2000
Number of Trial Surfaces With Valid FS = 2000

Statistical Data On All Valid FS Values:
FS Max = 1.913 FS Min = 1.114 FS Ave = 1.528
Standard Deviation = 0.255 Coefficient of Variation = 16.69 %

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	179.500	745.500
2	182.909	749.158
3	186.314	752.819
4	189.715	756.485
5	193.111	760.154
6	196.504	763.827
7	199.892	767.504
8	203.276	771.185
9	206.655	774.870
10	210.031	778.558
11	213.402	782.251
12	216.769	785.947
13	220.132	789.647
14	220.448	789.995

Circle Center At X = -3019.869 ; Y = 3730.898 ; and Radius = 4375.907

Factor of Safety *** 1.114 ***