Attachment C.

Soil and Geologic Reconnaissance

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MATERIALS

SOIL AND GEOLOGIC RECONNAISSANCE

COTTONWOOD SAND MINING PIT
EL CAJON, CALIFORNIA

PREPARED FOR

HELIX
ENVIRONMENTAL PLANNING, INC.
LA MESA, CALIFORNIA

JANUARY 4, 2019
REVISED NOVEMBER 4, 2020
PROJECT NO. G2137-42-02

GEOCON
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GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS

Project No. G2137-42-02
January 4, 2019
Revised November 4, 2020

HELIX Environmental Planning, Inc.
7578 El Cajon Boulevard
La Mesa, California 92942

Attention: Ms. Andrea Bitterling

Subject: SOIL AND GEOLOGIC RECONNAISSANCE
COTTONWOOD SAND MINING PIT
EL CAJON, CALIFORNIA

Dear Ms. Bitterling:

In accordance with your request and our proposal (LG-17295), we have prepared this soil and geologic reconnaissance for the proposed Cottonwood Sand Mining Pit project in El Cajon, California. The accompanying report describes the site soil and geologic conditions, identifies potential geotechnical constraints; and geologic hazards pertinent to the subject property.

Should you have questions regarding this report, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON INCORPORATED

Garry W. Cannon
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RCE 56468

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GWC:RCM:dmc:arm

(e-mail) Addressee

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SOIL AND GEOLOGIC RECONNAISSANCE

1. PURPOSE AND SCOPE

This report presents the results of a soil and geologic reconnaissance for the proposed Cottonwood Sand Mining Pit project, in El Cajon, California. The purpose of this study is to provide preliminary soil and geologic information for the property and to identify known, if any, geologic hazards that may adversely impact the project.

A summary of reports, maps, and other documents used preparation of this report is presented in the *References* listing at the end of this report.

2. SITE AND PROJECT DESCRIPTION

The site consists of an approximately 280-acre, irregularly shaped parcel located in the Sweetwater River Valley along Willow Glen Drive approximately between Jamacha Boulevard and Hillsdale Road in El Cajon, California (see Vicinity Map, Figure 1). The site is currently utilized as a golf course. Site elevations vary from a high of approximately 380 feet above Mean Sea Level (MSL) at the eastern end, to a low of approximately 328 feet above MSL at the western end.

We understand that the property will be utilized to mine sand for concrete and asphalt. Based on the plans prepared by Change Consultants titled Cottonwood Sand Mining Project, dated October 28, 2020, bottom mine excavations ranging from 295 feet MSL at the west end to 330 feet MSL at the east end are planned. Excavations would average approximately 20 feet below existing ground surface across the property; some areas would be excavated to a depth up to approximately 40 feet below existing ground surface. After the completion of mining, the site will be reclaimed by filing in the mine pits with overburden, wash fines and topsoil. Permanent slopes at the completion of reclamation grading up to approximately 26 feet in height at an inclination of 3:1 (horizontal to vertical) are planned.. Upon completion of mining activities, the project site would be available for uses allowed by the existing land use designations and zoning classifications (Open Space, S80; Specific Planning Area, S88; and Holding Area, S90). Future development of the site is not included in the proposed project, with planned uses including open space and recreational trails.

3. SOIL AND GEOLOGIC CONDITIONS

Based on observations during our site reconnaissance and our review of Tan (2002a), Tan (2002b), and Geocon (2017) the site is underlain by Holocene-age alluvial deposits. The alluvial deposits are divided into channel deposits and flood plain deposits. The approximate limits of the geologic units, based on CSRL (2008), are shown on Figure 2 (Geologic Map). Granitic rock underlies the alluvium. Each of the units are discussed below. There are areas of undocumented fill. The undocumented fill was not mapped.

3.1 Undocumented Fill (not mapped)

Undocumented fill was encountered in previous borings at several locations on the property (Geocon, 2017). The fill was generally found within the upper 6 feet of the ground surface. At some locations, the fill was locally deeper. The fill was generally composed of loose to medium dense, silty to clayey sand (SC) and sandy clay (CL) with trace gravel.

3.2 Alluvium: Channel Deposits (Qalc)

Quaternary age alluvial channel deposits is present generally through the central portion of the project site. The alluvium generally consists of loose, fine- to course-grained sand with varying amounts of silt and gravel.

3.3 Alluvium: Flood Plain Deposits (Qalf)

Quaternary age alluvial flood plain deposits have been mapped flanking the north and south sides of the channel deposits. The flood plain deposits generally consists of soft to firm, micaceous, sandy clay, sandy silt, and silty sand.

3.4 Granitic Rock (Kgr)

Granitic rock was encountered below the alluvium in 4 borings performed during previous drilling (see Geocon, 2017). The granitic rock encountered was weathered and excavated as silty, fine to coarse sand.

4. GROUNDWATER

During our previous investigation (Geocon, 2017) groundwater was encountered within the western approximately three-fourths of the property between elevations of 316 feet MSL and 341 feet MSL. This corresponded to depths of approximately 5 feet to 18 feet below the ground surface. Because the property is situated in a drainage area, groundwater elevation is expected to fluctuate between dry and rainy periods from year to year.

5. GEOLOGIC STRUCTURE

Contacts between stratigraphic units described above are generally flat lying.

6. GEOLOGIC HAZARDS

6.1 Ground Rupture

The USGS (2016) shows that there are no mapped Quaternary faults crossing or trending toward the property. The site is not located within a currently established Alquist-Priolo Earthquake Fault Zone.

No active faults are known to exist at the site. The nearest active fault is the Rose Canyon Fault, which lies approximately 15 miles west of the site. The risk associated with ground rupture hazard is low.

6.2 Seismicity

We performed a deterministic seismic hazard analysis using Risk Engineering (2015). Six known active faults were located within a search radius of 50 miles from the property. We used the 2008 USGS fault database, which provides several models and combinations of fault data, to evaluate the fault information. Based on this database, the Newport-Inglewood/Rose Canyon Fault Zone, located approximately 15 miles west of the site, is the nearest known active fault and is the dominant source of potential ground motion. Earthquakes that might occur on the Newport-Inglewood/Rose Canyon Fault or other faults within the southern California and northern Baja California area are potential generators of significant ground motion at the site. The estimated maximum earthquake magnitude and peak ground acceleration for the Elsinore Fault are 7.5 and 0.0.23g, respectively. The table below lists the estimated maximum earthquake magnitude and peak ground acceleration for the most dominant faults in relation to the site. We calculated peak ground acceleration (PGA) using acceleration-attenuation relationships by: Boore and Atkinson (2008); Campbell and Bozorgnia (2008); and Chiou and Youngs (2008).

TABLE 6.2.1
DETERMINISTIC SPECTRA SITE PARAMETERS

Fault Name	Distance from Site (miles)	Maximum Earthquake Magnitude (Mw)	Peak Ground Acceleration		
			Boore-Atkinson 2008 (g)	Campbell-Bozorgnia 2008 (g)	Chiou-Youngs 2008 (g)
Newport-Inglewood/Rose Canyon	14.7	7.5	0.23	0.17	0.21
Rose Canyon	14.7	6.9	0.19	0.15	0.16
Coronado Bank	25.7	7.4	0.16	0.11	0.13
Palos Verdes/Coronado Bank	25.7	7.7	0.18	0.12	0.15
Elsinore	30.6	7.85	0.17	0.11	0.14

In the event of a major earthquake on the referenced faults or other significant faults in the southern California and northern Baja California area, the site could be subjected to moderate to severe ground shaking. The risk at this site is comparable to others in the general vicinity with respect to seismic shaking hazard.

We performed a probabilistic seismic hazard analysis for the site using Risk Engineering (2015). The computer program assumes that the occurrence rate of earthquakes on each mapped Quaternary fault is proportional to the fault slip rate. The program accounts for earthquake magnitude as a function of fault rupture length, and site acceleration estimates are made using the earthquake magnitude and distance from the site to the rupture zone. The program also accounts for uncertainty in each of following: (1) earthquake magnitude, (2) rupture length for a given magnitude, (3) location of the rupture zone, (4) maximum possible magnitude of a given earthquake, and (5) acceleration at the site from a given earthquake along each fault. By calculating the expected accelerations from considered earthquake sources, the program calculates the total average annual expected number of occurrences of site acceleration greater than a specified value. We used acceleration-attenuation relationships suggested by Boore-Atkinson (2008), Campbell-Bozorgnia (2008), and Chiou-Youngs (2008) in the analysis. Table 6.2.2 presents the site-specific probabilistic seismic hazard parameters including acceleration-attenuation relationships and the probability of exceedence.

TABLE 6.2.2
PROBABILISTIC SEISMIC HAZARD PARAMETERS

Probability of Exceedence	Peak Ground Acceleration		
	Boore-Atkinson, 2008 (g)	Campbell-Bozorgnia, 2008 (g)	Chiou-Youngs, 2008 (g)
2% in a 50 Year Period	0.41	0.35	0.40
5% in a 50 Year Period	0.31	0.26	0.29
10% in a 50 Year Period	0.24	0.21	0.21

While listing peak accelerations is useful for comparison of potential effects of fault activity in a region, other considerations are important in seismic design, including frequency and duration of motion and soil conditions underlying the site. Seismic design of the structures should be evaluated in accordance with the California Building Code (CBC) guidelines.

6.3 Liquefaction

Due to the loose subsurface soils and the near-surface groundwater, seismically induced soil liquefaction hazard could be high; however, given the nature of the proposed project as a sand mining pit, the associated risk is low.

6.4 Landslides

No evidence of landsliding was encountered at the site during the geotechnical investigation or in our review of historic, stereoscopic aerial photographs (USDA, 1953).

The risk associated with ground movement hazard due to landsliding is low.

6.5 Seiches and Tsunamis

The site is not located within a tsunami inundation zone as defined by California Geological Survey. Elevation at the site is approximately 350 feet MSL. There are no lakes or reservoirs are located near the site. The risk associated with inundation hazard due to tsunamis or seiches is low.

6.6 Flooding

The Federal Emergency Management Agency (FEMA 2012) locates the site within a Flood Zone AE area, indicating a high risk to inundation by 100-year and 500-year floods.

7. SLOPE STABILITY

A slope stability analysis was performed for the proposed permanent 3:1 (horizontal to vertical) slopes shown on the reclamation plan (Chang Consultants, 2020). We performed the analysis on the highest cut slope proposed for the project. The location of the analysis is shown on Figure 2. The analysis was performed using Geoslope (2018) distributed by Geo-Slope International. This program uses conventional slope stability equations and a two-dimensional limit-equilibrium method to calculate the factor of safety against deep-seated failure. For our analysis, Spencer's Method with a circular failure mechanism was used in the analysis. Spencer's Method satisfies both moment and force equilibrium.

Strength parameters used in the analysis were based on laboratory direct shear strength testing performed on samples taken during previous drilling (Geocon, 2017). Table 7.1 summarizes the shear strength test results. For our analysis we used the low bound curve, see Figure 3. We also utilized a groundwater elevation of 335 feet MSL based on information from the nearest borings to the slope stability section. We have also assumed fill will be replaced in the mined excavation in front of the slope toe during reclamation operations.

TABLE 7.1
SUMMARY OF LABORATORY DIRECT SHEAR TEST RESULTS
ASTM D 3080

Sample No.	Dry Density (pcf)	Moisture Content (%)		Unit Cohesion (psf)	Angle of Shear Resistance (degrees)
		Initial	Final		
B28-1	106.3	5.4	18.0	650	24
B28-4	94.1	28.7	30.4	520	24
B35-3	106.9	3.6	20.0	730	31

Graphical output of the stability analysis is shown on Figure 4. Based on our analysis, planned 3:1 cut slopes at the completion of reclamation grading have a static factor of safety greater than 1.5.

We also performed seismic slope stability analysis in accordance with *Recommended Procedures for Implementation of DMG Special Publication 117: Guidelines for Analyzing and Mitigating Landslide Hazards in California*, prepared by the Southern California Earthquake Center (SCEC), dated June 2002 and *Special Publication 117A, Guidelines for Evaluating and Mitigating Seismic Hazards in California (2008)*.

The seismic slope stability analysis was performed using a ground motion of 0.25g, corresponding to a 10 percent probability of exceedance in 50 years. A modal magnitude and modal distance of 7.7 and 48 kilometers, respectively, was used in the analysis.

Using the parameters discussed above, an equivalent site acceleration, k_{EQ}, of 0.175g was calculated to perform the screening analysis. Utilizing the calculated k_{EQ} as the horizontal seismic coefficient, the stability analyses indicates factor of safeties of 1.0 or greater. A slope is considered acceptable by the screening analysis if the calculated factor of safety is greater than 1.0 using k_{EQ}; therefore, the critical slopes pass the screening analysis for seismic slope stability. Printouts of the seismic slope stability analysis are provided on Figures 5 and 6.

Based on the results of the slope stability analyses, a minimum static and pseudo-static factor of safety of 1.5 and 1.0, respectively, was achieved and the proposed permanent reclaimed slopes are considered grossly stable.

All permanent slopes should be landscaped with drought-tolerant vegetation, having variable root depths and requiring minimal landscape irrigation. In addition, all slopes should be drained and properly maintained to reduce erosion.

We also performed an analysis for temporary mined slopes. Temporary slopes are expected to be less than 40 feet in height and constructed at a 2:1 inclination. We understand that if a temporary slope is inactive for more than a 10 to 15 day period, the slope will be flattened to 3:1 or shallower. Based on our analysis, temporary slopes at an 2:1 inclination have a static factor of safety greater than 1.5. Figure 7 shows the slope stability analysis for 2:1 slopes.

8. CONCLUSIONS AND RECOMMENDATIONS

8.1 Based on our review of published geologic maps, geotechnical reports for nearby developments, and our geologic reconnaissance, the study area is underlain by recent alluvium over weathered granitic rock.

8.2 No significant soil or geologic conditions were observed or are known to exist that would preclude the use of the site as a sand mining pit.

8.3 Proposed permanent 3:1 reclamation slopes have a factor of safety in excess of 1.5 for both static conditions and pseudo-static conditions.

8.4 The property is approximately 15 miles from the Rose Canyon Fault. It is our opinion active and potentially active faults do not extend across the site. Risks associated with seismic activity consist of the potential for strong seismic shaking and soil liquefaction.

8.5 The risk associated with ground rupture, tsunamis or seiches hazard is low.

8.6 Due to the loose subsurface soils and the near-surface groundwater, seismically induced soil liquefaction hazard is high; however, given the nature of the proposed project as a sand mining pit, the associated risk is low.

8.7 Shallow groundwater is present within the project boundaries.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

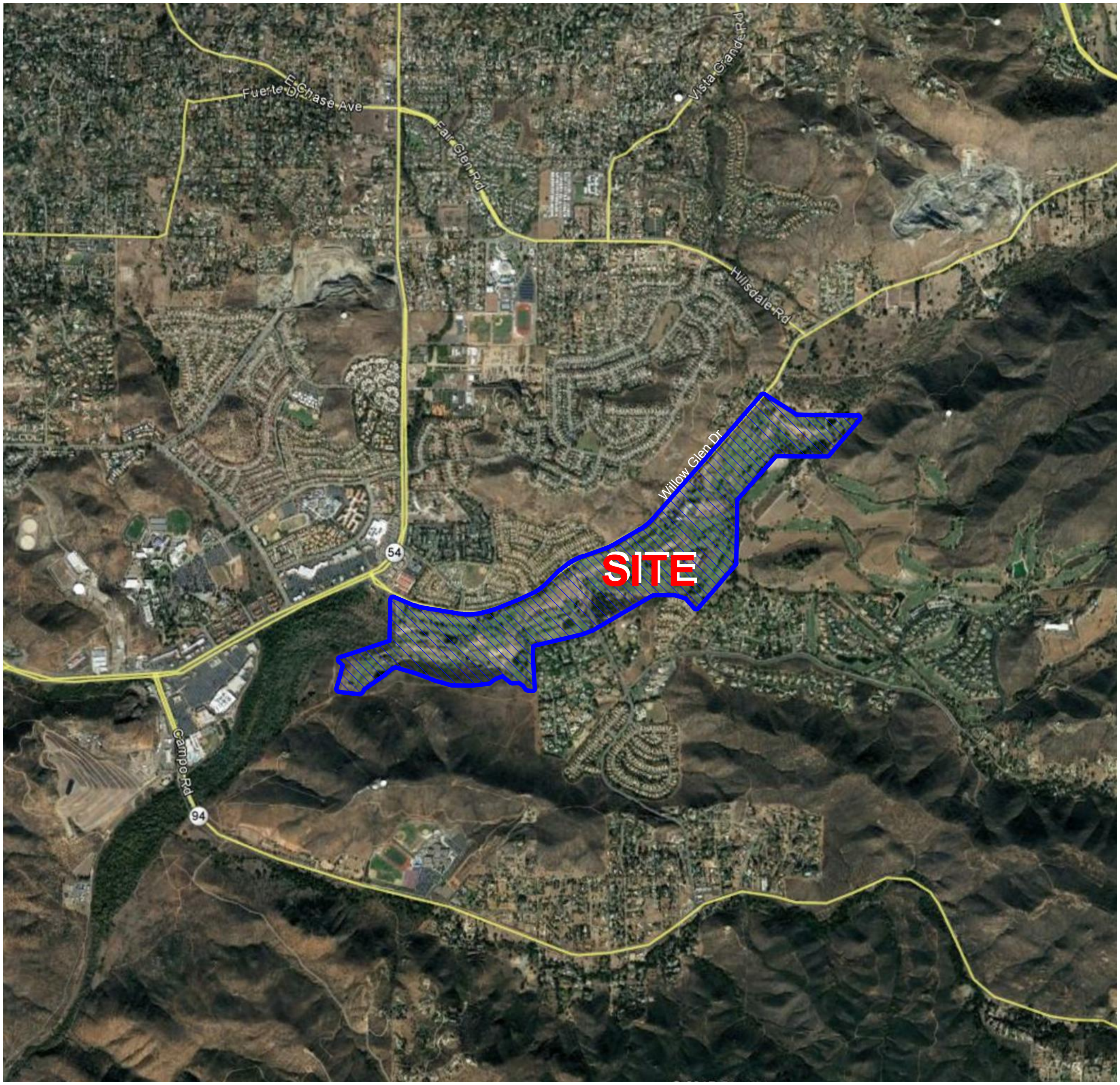
1. The conclusions and recommendations presented in this report are based on a review of available published information and performance of a site reconnaissance. In this regard, no subsurface investigation was conducted. As a consequence, the Client should recognize that this information is preliminary and our conclusions and recommendations could change significantly once a subsurface investigation is performed and the actual site conditions are identified.

2. The firm that performed the geotechnical investigation for the project should be retained to provide testing and observation services during construction to provide continuity of geotechnical interpretation and to check that the recommendations presented for geotechnical aspects of site development are incorporated during site grading, construction of improvements, and excavation of foundations. If another geotechnical firm is selected to perform the testing and observation services during construction operations, that firm should prepare a letter indicating their intent to assume the responsibilities of project geotechnical engineer of record. A copy of the letter should be provided to the regulatory agency for their records. In addition, that firm should provide revised recommendations concerning the geotechnical aspects of the proposed development, or a written acknowledgement of their concurrence with the recommendations presented in our report. They should also perform additional analyses deemed necessary to assume the role of Geotechnical Engineer of Record.

3. The recommendations of this report pertain only to the site investigated and are based upon the assumption that the soil conditions do not deviate from those disclosed in the investigation. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that anticipated herein, Geocon Incorporated should be notified so that supplemental recommendations can be given. The evaluation or identification of the potential presence of hazardous or corrosive materials was not part of the scope of services provided by Geocon Incorporated.

4. This report is issued with the understanding that it is the responsibility of the owner or his representative to ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project and incorporated into the plans, and the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

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



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NO SCALE

VICINITY MAP

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COTTONWOOD SAND MINING
EL CAJON, CALIFORNIA

GC / CW		DSK/GTYPD	DATE 11 - 04 - 2020	PROJECT NO. G2137 - 42 - 02	FIG. 1

GEOLOGIC MAP

COTTONWOOD SAND MINING
EL CAJON, CALIFORNIA

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SCALE 1" = 200'	DATE 11 - 04 - 2020
PROJECT NO. G2137 - 42 - 02	FIGURE 2A
SHEET 1 OF 2	

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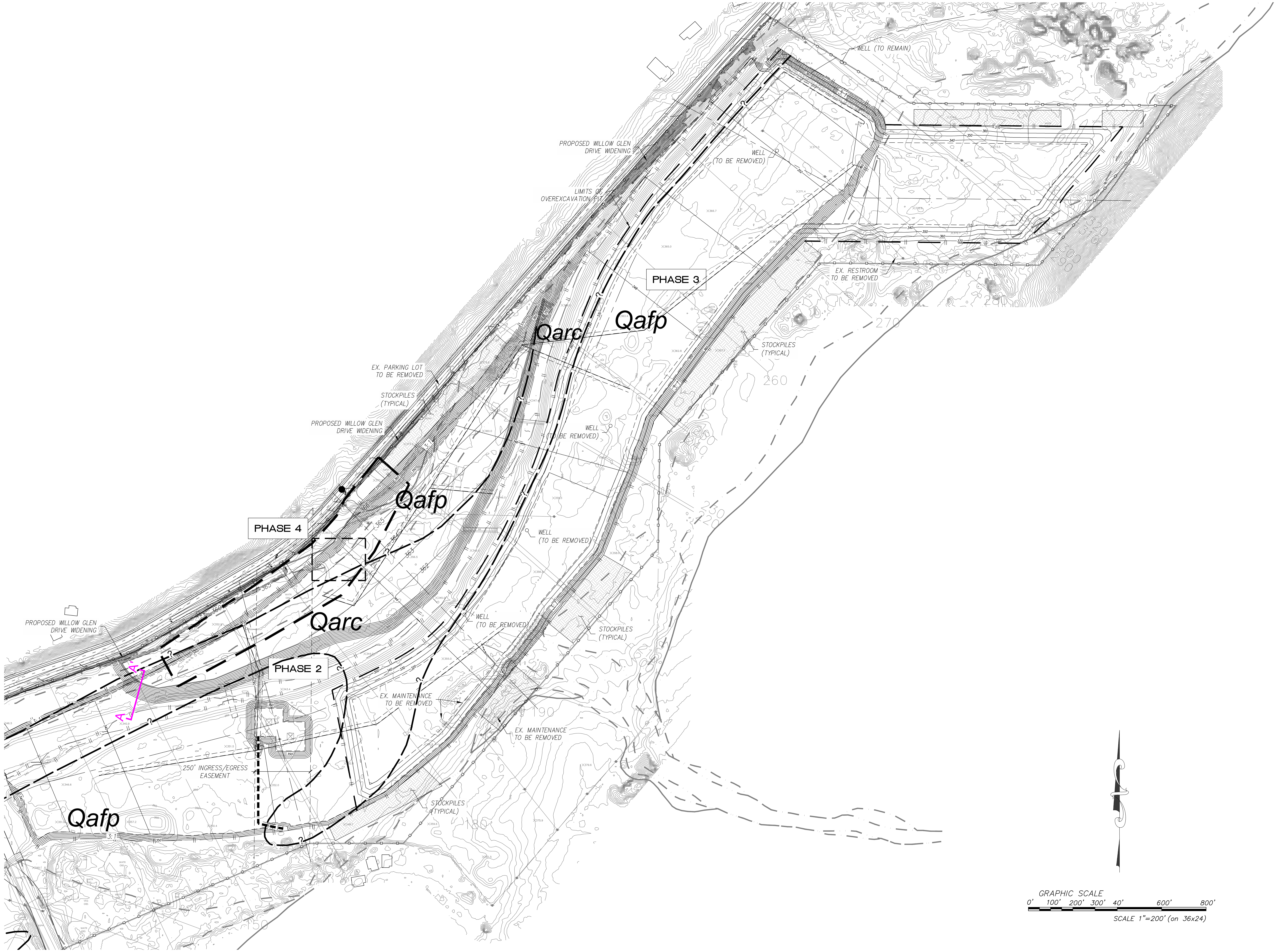

GEOLOGIC MAP

COTTONWOOD SAND MINING
EL CAJON, CALIFORNIA

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SCALE 1" = 200'	DATE 11 - 04 - 2020
PROJECT NO. G2137 - 42 - 02	FIGURE 2B
SHEET 2 OF 2	

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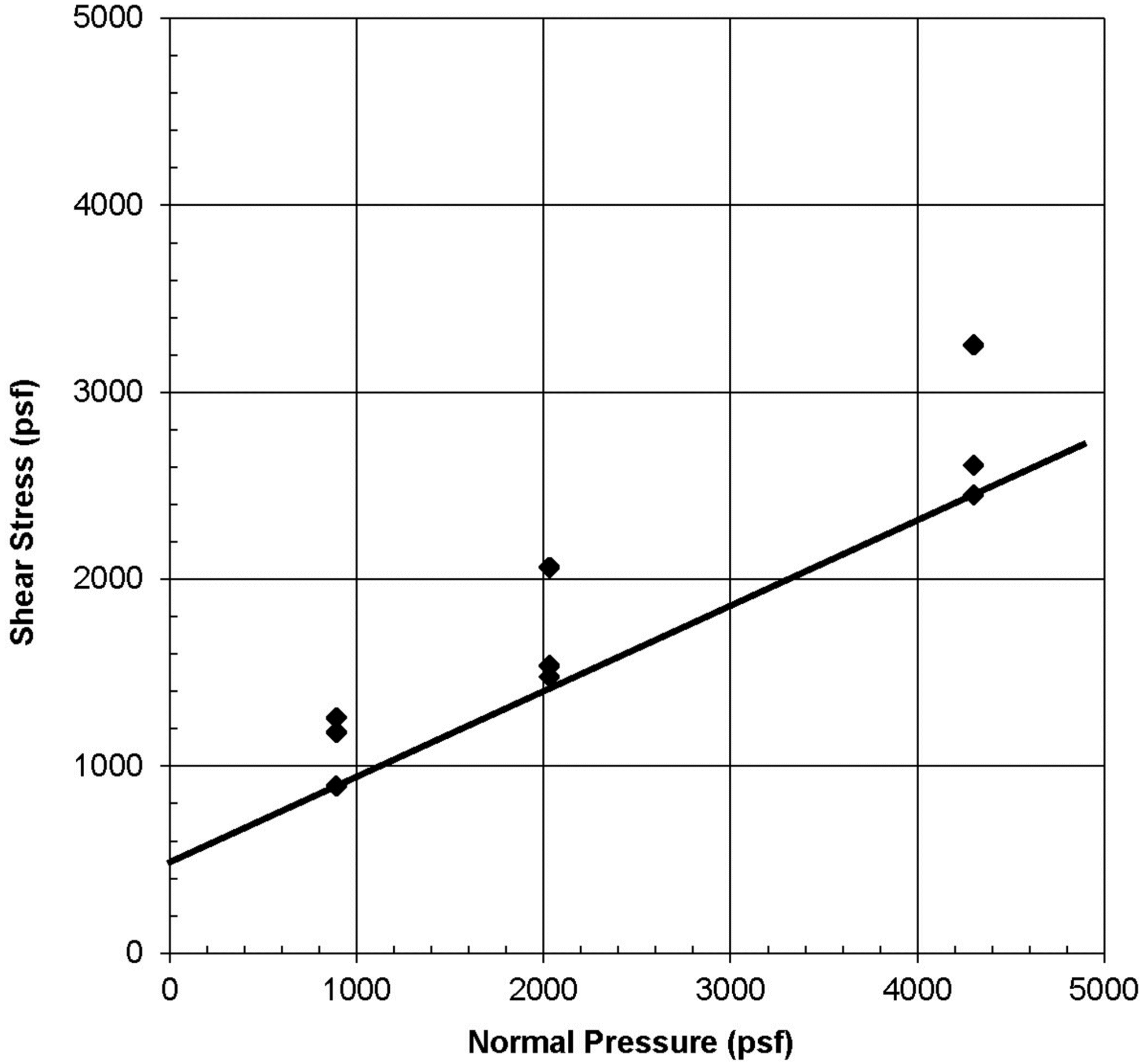

DIRECT SHEAR PLOT

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COTTONWOOD SAND MINING
EL CAJON, CALIFORNIA

GC / CW		DSK/GTYPD	DATE 11 - 04 - 2020	PROJECT NO. G2137 - 42 - 02	FIG. 3

MATERIAL PROPERTIES:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
(cyan)	Qal - Alluvium	110	490	25	1
(yellow)	Qudf - Undocumented Fill	100	100	20	1

Reclamation Conditions

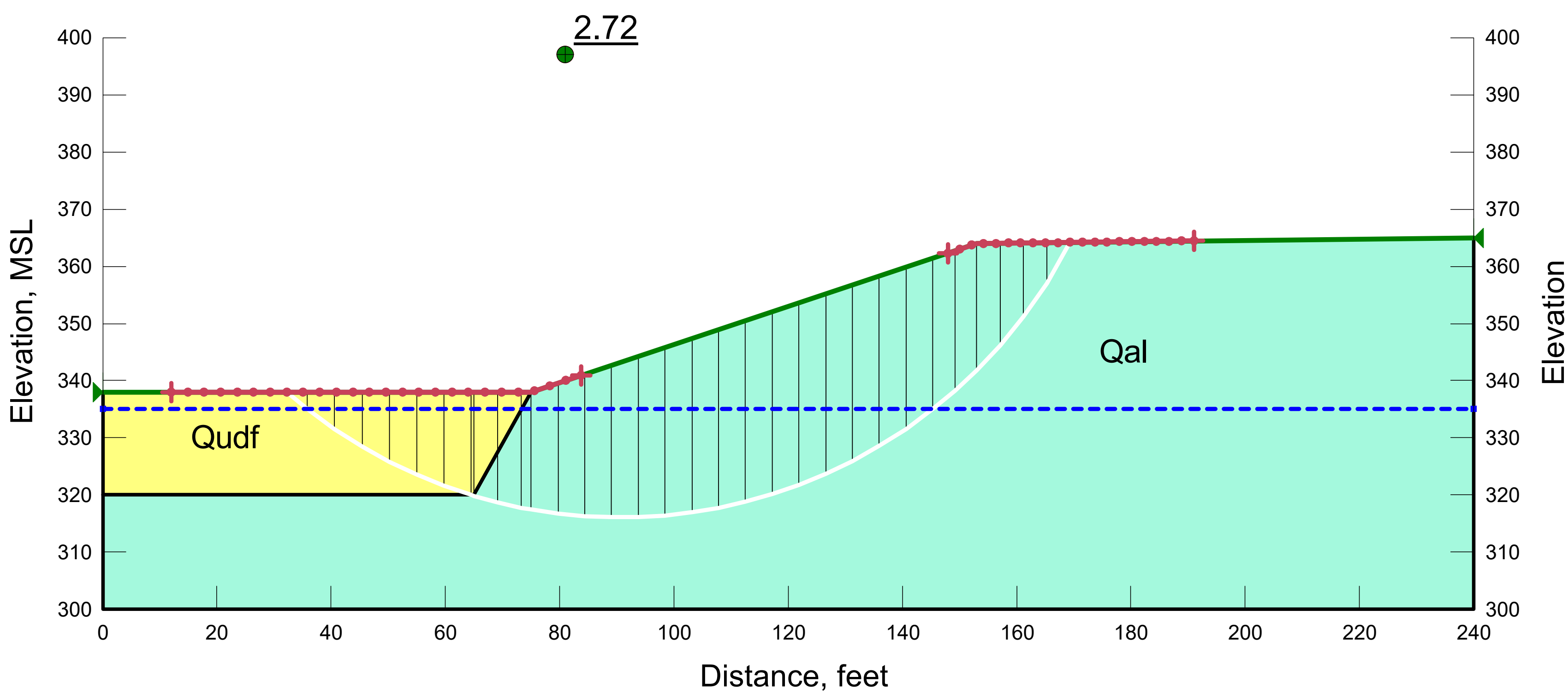

Figure 4

MATERIAL PROPERTIES:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Qal - Alluvium	110	490	25	1
	Qudf - Undocumented Fill	100	100	20	1

Reclamation Conditions

Seismic Analysis
keq = 0.175

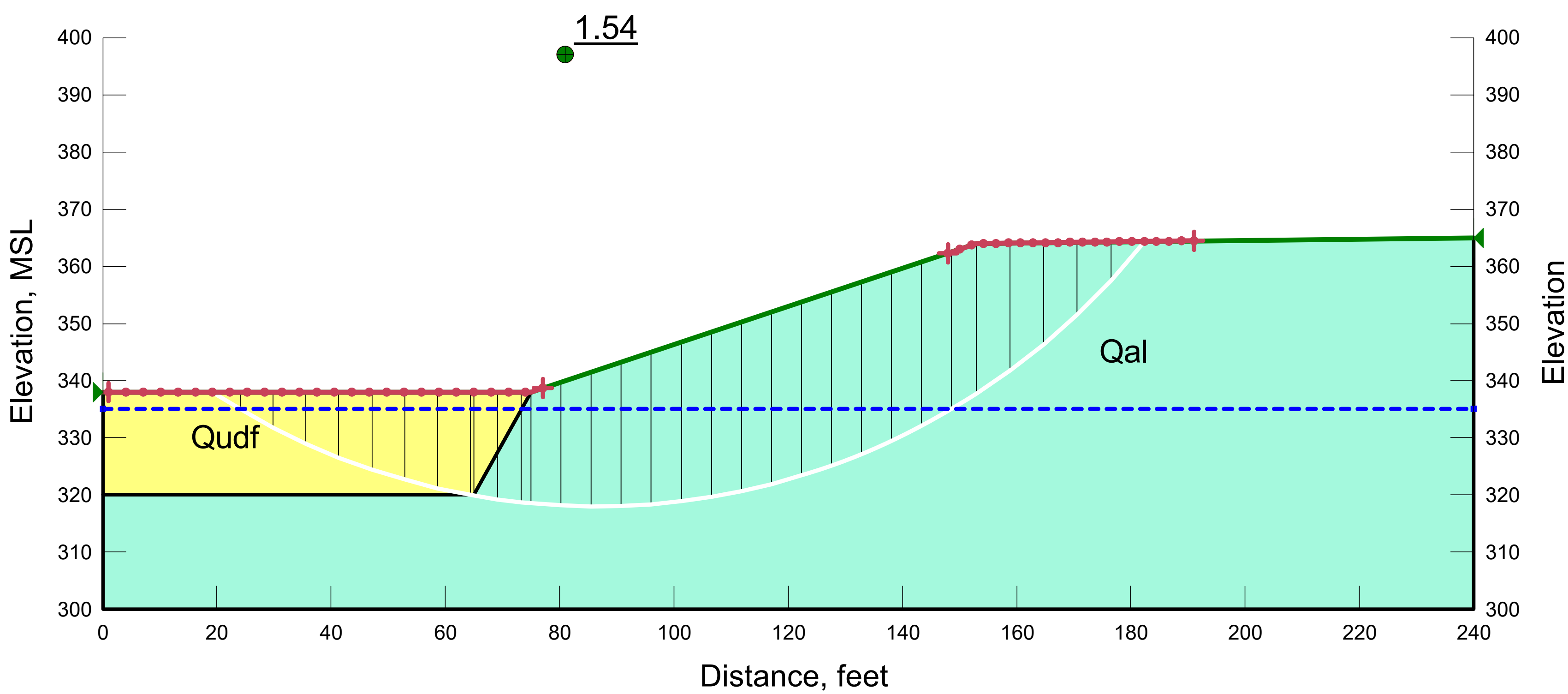

Figure 5

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Seismic Slope Stability Evaluation

Input Data in Shaded Areas

Project	Cottonwood	Computed By	RCM
Project Number	G2137-42-02		
Date	11/04/20		
Filename			

Peak Ground Acceleration (Firm Rock), MHA_r, g	0.25	10% in 50 years
Modal Magnitude, M	7.7	
Modal Distance, r, km	48.0	
Site Condition, S (0 for rock, 1 for soil)	1	
Yield Acceleration, k_y/g	NA	<-- Enter Value or NA for Screening Analysis
Shear Wave Velocity, V_s (ft/sec)	NA	<--
Max Vertical Distance, H (Feet)	NA	<--
Is Slide X-Area > 25,000ft^2 (Y/N)	N	<-- Use "N" for Buttress Fills
Correction for horizontal incoherence	1.0	
Duration, $D_{5\text{-}95}\|_{med}$, sec	31.197	
Coefficient, C_1	0.5190	
Coefficient, C_2	0.0837	
Coefficient, C_3	0.0019	
Standard Error, ε_T	0.437	
Mean Square Period, T_m, sec	0.715	

Initial Screening with MHEA = MHA = k_{max}g	
k_y/MHA	NA
f_{EQ}(u=5cm) = (NRF/3.477)*(1.87-log(u/((MHA_r/g)*NRF*$D_{5\text{-}95}$)))	0.6998
k_{EQ} = feq(MHA_r)/g	0.175
Factor of Safety in Slope Analysis Using k_{EQ}	1.54

Passes Initial Screening Analysis

Approximation of Seismic Demand	
Period of Sliding Mass, $T_s = 4H/V_s$, sec	NA
T_s/T_m	NA
MHEA/(MHA*NRF)	NA
NRF = 0.6225+0.9196EXP(-2.25*MHA_r/g)	1.15
MHEA/g	NA
k_y/MHEA = k_y/k_{max}	NA
Normalized Displacement, Normu	NA
Estimated Displacement, u (cm)	**NA**

FIGURE 6

MATERIAL PROPERTIES:

Color	Name	Unit Weight (pcf)	Cohesion' (psf)	Phi' (°)	Piezometric Line
	Qal - Alluvium	110	490	25	1
	Qudf - Undocumented Fill	100	100	20	1

Reclamation Conditions

Temporary Slopes

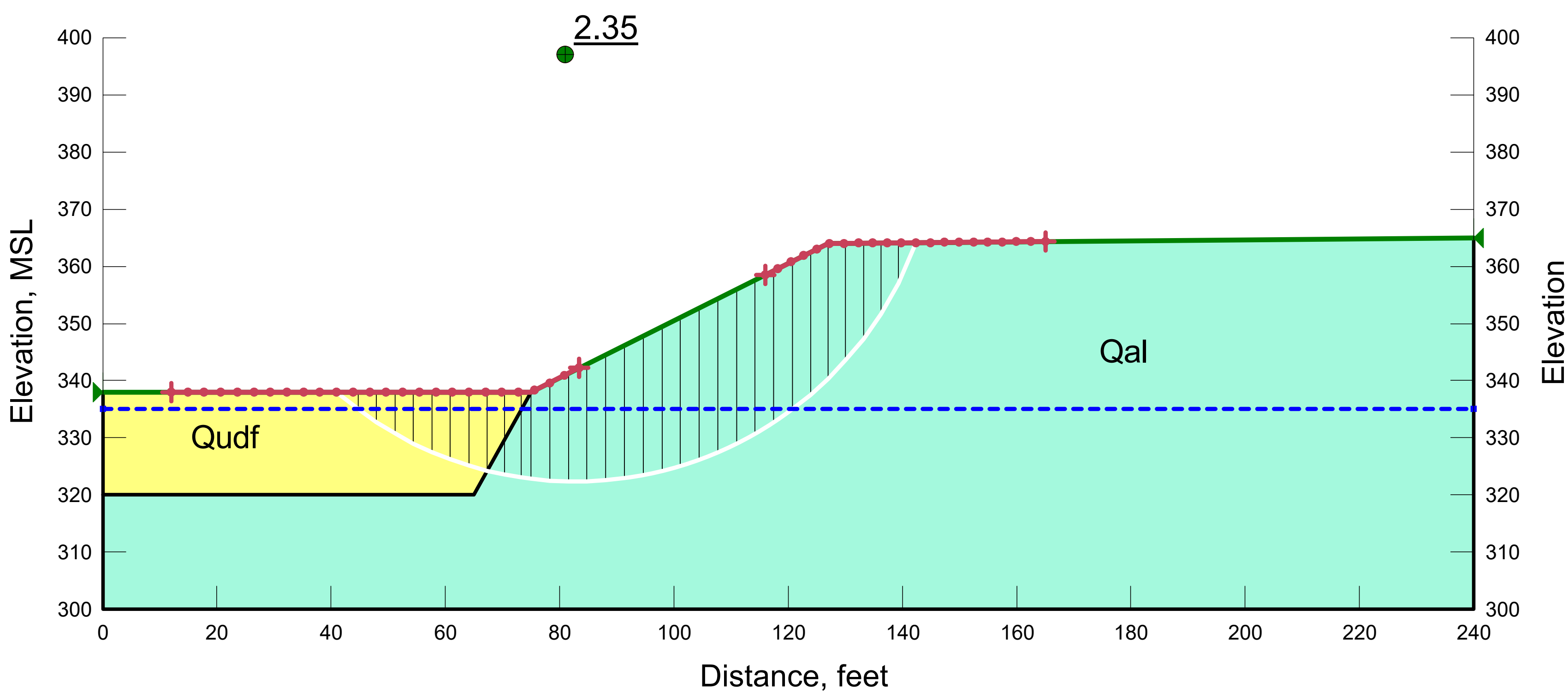

Figure 7

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