November 5, 2021
J.N.: 2908.00

Ms. Doris Nguyen
The Olson Company
3010 Old Ranch Parkway, Suite 100
Seal Beach, California 90740

Subject: Geotechnical Feasibility Report, Proposed Multi-Family Residential Development, Imperial Highway and Euclid Street, La Habra, California

Dear Ms. Nguyen,

As requested, we are providing this report addressing the geotechnical/geological hazards of the site, as they pertain to the feasibility of the proposed residential development. The purpose of this feasibility report is to address geotechnical and geologic issues that pertain to the CEQA process. As part of our evaluation, we performed exploration of the site on August 14, 2020, performed laboratory testing of samples obtained from our investigation, researched and reviewed previous geotechnical and geologic data for the general area, performed analyses, then prepared this report.

SITE DESCRIPTION

The site is comprised of two properties located at 251 and 351 West Imperial Highway within the city of La Habra, California. The site is situated on the north side of West Imperial Highway, west of the intersection with Euclid Avenue.

The site consists of rectangular shaped parcels (APN: 019-042-21 and 019-042-24) containing approximately 4.8 acres of land. The majority of the site is relatively flat with elevations ranging from EL. 255 to EL. 265 above mean sea level (based on Google Earth) descending to the southwest. The site then descends approximately 4 feet to West Imperial Highway where grades are approximately at EL 251 to EL 258.

The site includes four warehouse-type buildings. A partial two-story commercial building is situated on the southeastern corner of the site. A single-story building is situated on the southwestern corner of the site. This building was apparently used for a car dealership with an attached shed likely used as a maintenance area A semi-subterranean truck loading dock (approximately 5 feet deep) is also located at the central portion of the site. The asphalt pavement associated with the site was in moderate to poor condition due primarily to asphalt cracking. Concrete pavement was also observed surrounding a portion of the southern building and within the truck loading dock.

The site is bounded to the south by West Imperial Highway. The site is bounded to the west by two single-story commercial buildings and are developed along the property line. The site is bounded to the east by a single-story auto part retail building and is situated approximately 4 feet from the property line.

The site is bounded to the north by several single-family residences. The residences are situated approximately 13 to 27 feet above the subject property. The residences are separated from the site by an ascending slope which slopes up at gradients of approximately 2:1 (horizontal:vertical) to 1.7:1 (horizontal:vertical). The steeper gradients are generally located toward the west half of the site. The boundary of the subject site extends approximately 3 to 4 feet horizontally into the ascending slope.

SITE HISTORY

Based on our research of historical aerial photos from the NETROnline website, as early as 1952, the site was utilized for agricultural use. During this time, a drainage channel may have existed along the southeast portion of the site trending to the northeast. By 1963, the site was developed and several of the existing buildings were constructed. The adjacent residences to the north were also constructed by this time. Between 1965 and 1972, additions to the east, northwest, and west buildings were constructed. By 1980, the existing building to the northwest had been constructed. The site has remained relatively unchanged since 1980.

GEOLOGY

SETTING

Based on regional geologic maps, the site is underlain by both Quaternary alluvial deposits and sandstone bedrock as part of the La Habra Formation. The south half of the site is underlain by alluvial deposits, while the north half of the site (including the north ascending slope) is underlain by the La Habra Formation. The La Habra Formation (Qlh), is of Pleistocene age and consists of non-marine massive sandstone, siltstone, conglomerate and pebbly sandstone. The geologic map is included herein as Plate 2.

BEDDING STRUCTURE

The La Habra Formation is massive and lacks significant structural trends. The massive nature of the bedrock is favorable for the gross stability of the site and the adjacent north ascending slope.

GROUNDWATER

Groundwater was not encountered in our exploratory borings to the maximum depth of 51.5 feet below the existing ground surface. A review of the referenced Seismic Hazard Zone Report 009 indicates that historical high groundwater levels for the general site area is approximately 10 feet below the existing ground surface.

FAULTING

Geologic literature and field exploration do not indicate the presence of active faulting within the site. The site does not lie within an "Earthquake Fault Zone" as defined by the State of California in the Alquist-Priolo Earthquake Fault Zoning Act. Table 1 presents a summary of all the known seismically active faults within 10 miles of the site based on the 2008 National Seismic Hazards Maps.

TABLE 1
SUMMARY OF FAULTS

Name	Distance (miles)	Slip Rate (mm/yr.)	Preferred Dip (degrees)	Slip Sense	Rupture Top (km)	Fault Length (km)
Elsinore;W+GI+T+J+CM	2.6	n/a	84	strike slip	0	241
Elsinore;W	2.6	2.5	75	strike slip	0	46
Elsinore;W+GI	2.6	n/a	81	strike slip	0	83
Elsinore;W+GI+T	2.6	n/a	84	strike slip	0	124
Elsinore;W+GI+T+J	2.6	n/a	84	strike slip	0	199
Puente Hills (Coyote Hills)	3.09	0.7	26	thrust	2.8	17
Puente Hills (Santa Fe Springs)	4.15	0.7	29	thrust	2.8	11
San Jose	9.24	0.5	74	strike slip	0	20

FEASIBILITY OF PROPOSED DEVELOPMENT

From a geotechnical point of view, the proposed site development is considered feasible provided appropriate geotechnical recommendations are incorporated into the design and construction of the project. Key geotechnical issues of the proposed site development are discussed in the following section.

KEY GEOTECHNICAL ISSUES

GEOLOGIC HAZARDS

Ground Rupture

No known active faults are known to project through the site nor does the site lie within the boundaries of an “Earthquake Fault Zone” as defined by the State of California in the Alquist-Priolo Earthquake Fault Zoning Act. Therefore, the potential for ground rupture due to an earthquake beneath the site is considered low.

Ground Shaking

The site is situated in a seismically active area that has historically been affected by generally moderate to occasionally high levels of ground motion. The site lies in relatively close proximity to several seismically active faults; therefore, during the life of the proposed improvements, the property will probably experience similar moderate to occasionally high ground shaking from these fault zones, as well as some background shaking from other seismically active areas of the Southern California region. Design and construction in accordance with the current California Building Code (CBC) requirements is anticipated to address the issues related to potential ground shaking.

Landsliding

The site is relatively flat and is not located within an area identified by the California Geologic Survey (CGS) and La Habra General Plan as having potential for seismically-induced slope instability. Additionally, research of aerial photos do not indicate previous gross instability with the north ascending slope. Previous landslides are also not mapped on the site based on our review of the Seismic Hazard Zone Report for the La Habra Quadrangle, as published by the CGS (included herein as Plate 3). Therefore, geologic hazards associated with landsliding are not anticipated at the site.

Liquefaction

We have performed engineering analyses to evaluate the potential for liquefaction at the site if the design earthquake event were to occur. Our analyses followed the guidelines presented in the CGS Special Publication 117A (2008) and the procedures by Youd, et al. (2001). These analyses are based on field test data and laboratory test results from our previous investigation.

Our liquefaction analyses were based on the soil profile from boring B-1. High groundwater was assumed at a depth of 10 feet below the existing ground surface based on our earlier discussion about groundwater. Based on our analyses, the subsurface soils at the subject site are not prone to liquefaction during a strong ground motion event due to the predominantly fine-grained nature of the subsurface materials and the dense to very dense nature of the coarse-grained material below groundwater.

Seismic-induced settlement can occur both above and below the groundwater table during a strong seismic event. We have estimated the dry seismic settlement using the Tokimatsu and Seed (1987) Method. The analyses indicate a total dry seismic settlement of 0.27 inch. Martin and Lew (1999) recommend that the dry seismic settlement estimate be multiplied by two to account for multi-direction shaking. Therefore, the total estimated dry seismic settlement is estimated to be 0.54 inch.

Seismic-induced differential settlement is not expected to exceed one half the total settlement according to Martin and Lew (1999). The differential dry seismic settlement can be less than one half the total dry seismic settlement at sites with relatively uniform soil conditions and deep sediments. We estimate that differential dry seismic settlement of the proposed structure will not exceed 0.3 inch in 30 horizontal feet during the design.

Based on the State of California Special Publication 117A, hazards from liquefaction should be mitigated to the extent required to reduce seismic risk to “acceptable levels”. The acceptable level of risk means, “that level that provides reasonable protection of the public safety” [California Code of

Regulations Title 14, Section 3721 (a)]. Protection of public safety does not require that structures be resistant to cracking or general distress due to differential movements. As such, a greater allowance for differential movement during liquefaction events is acceptable compared to the design requirements for static conditions.

The use of well-reinforced foundations, such as post-tensioned slabs, grade beams with structural slabs, or mat foundations have been proven to adequately provide basal support for similar structures during seismic events comparable to the predicted site event.

SLOPE STABILITY

The existing slope north of the site has gradients of 1.7:1 (H:V) or flatter and is anticipated to be underlain by massive sandstone bedrock. As such, the north slope is anticipated to be grossly stable from a geologic perspective. Static and pseudo-static slope stability analyses were performed to evaluate stability along cross sections A-A' and B-B' shown on Plates 4 through 7. Shear strength parameters used in the slope stability analyses were obtained from the La Habra Quadrangle Seismic Hazard Zone Report which gathered numerous shear strength data of various geologic units. For the bedrock (La Habra Formation, Qlhc), a median phi value of 30 degrees and a median cohesion of 350 psf were utilized in the slope stability analyses. Cross sections A-A' and B-B' were used to perform engineering analyses and the interpreted subsurface profiles are provided in the engineering analyses shown in Plates 4 through 7. For the pseudo-static analysis, the seismic coefficient, "k" of 0.21g was calculated based on the recommendations presented in the CGS Special Publication 117A (2008). Based on results of our stability analyses, the slopes are shown to have a static factor of safety exceeding 1.5 and a pseudo-static factor of safety exceeding 1.1. These values meet the minimum requirements of the city of La Habra and County of Los Angeles. As such, the north slope is anticipated to be grossly stable under static and seismic conditions.

SOIL EXPANSION

Previous exploration indicates the near-surface soils within the site exhibit expansion characteristics that vary from Low to Medium expansion potential. Expansive soils can have detrimental effects on the performance of foundations, retaining walls, and flatwork. To mitigate these detrimental effects, foundations and other concrete work will need to be designed to mitigate expansive soils. Such design elements would typically include appropriate steel reinforcement, moisture preparation of the ground, and jointing details.

CORROSION POTENTIAL

Based on laboratory test results, site soils are Corrosive to Severely Corrosive to metals. Structures fabricated from metals will require appropriate corrosion protection if they will be in direct contact with site soils. Under such conditions, a corrosion specialist can provide specific recommendations.

LIMITATIONS

This report is based on the geotechnical data previously obtained during our due-diligence investigation. The materials encountered in our boring excavations and utilized in our laboratory testing for this investigation are believed representative of the project area, and the conclusions and recommendations contained in this report are presented on that basis. However, soil and bedrock materials can vary in characteristics between points of exploration, both laterally and vertically, and those variations could affect the conclusions and recommendations contained herein. As such, observations by a geotechnical consultant during the construction phase of the foundation are essential to confirming the basis of this report.

This report has been prepared consistent with that level of care being provided by other professionals providing similar services at the same locale and time period. The contents of this report are professional opinions and as such, are not to be considered a guaranty or warranty.

This report should be reviewed and updated after a period of one year or if the site ownership or project concept changes from that described herein.

This report has been prepared for the exclusive use of **The Olson Company.** to assist the project consultants in the design of the proposed development. This report has not been prepared for use by parties or projects other than those named or described herein. This report may not contain sufficient information for other parties or other purposes.

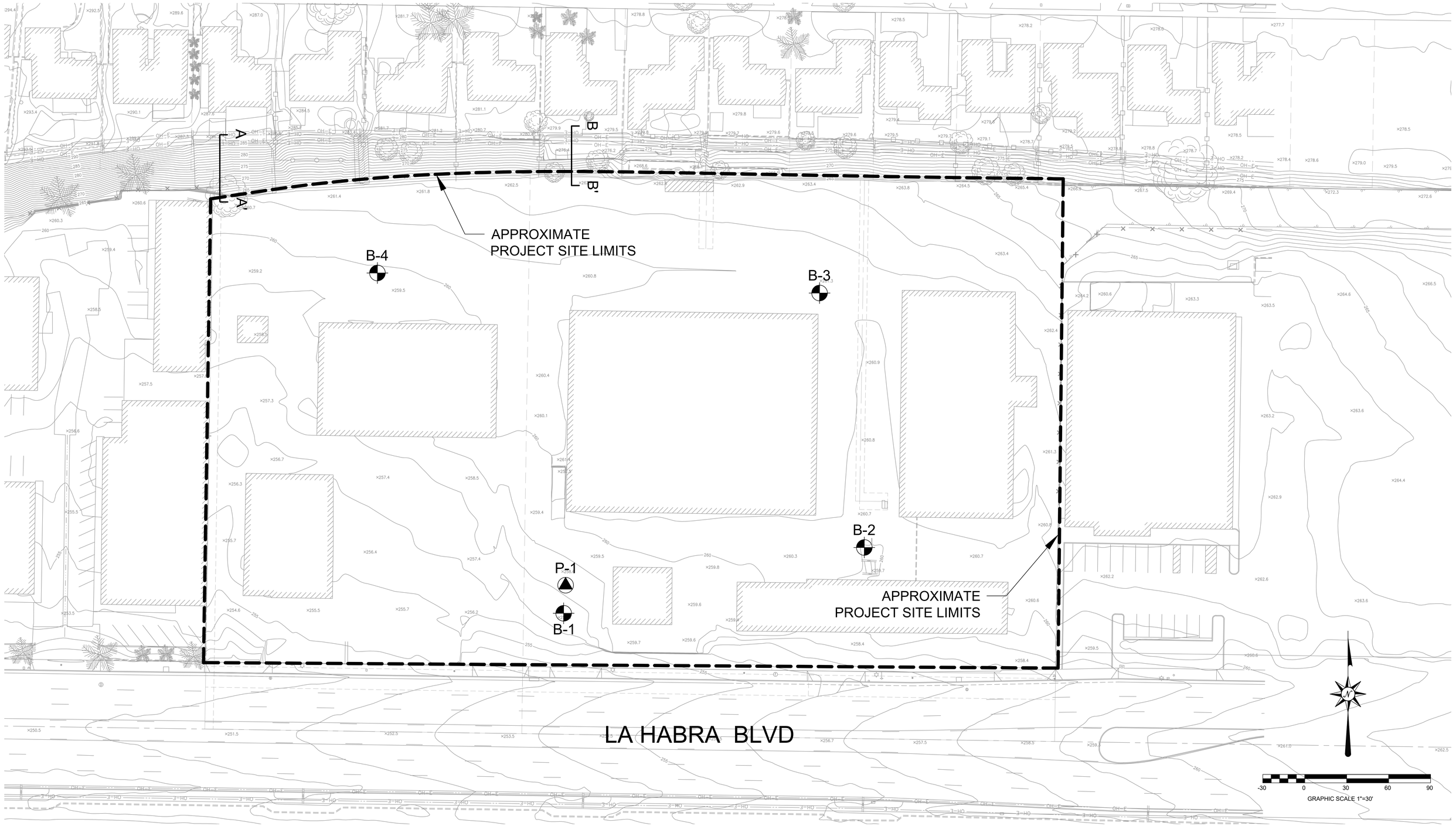
We appreciate this opportunity to be of service to you. If you should have any questions regarding the contents of this report, please do not hesitate to call.

Sincerely,

ALBUS & ASSOCIATES, INC

Paul Hyun Jin Kim
Associate Engineer
GE 3106

Enclosures: Plate 1- Geotechnical Map
Plate 2- Regional Geologic Map
Plate 3- CGS Slide Inventory Map
Plate 4- Slope Stability Section A-A' – Static Condition
Plate 5- Slope Stability Section A-A' – Pseudo-static Condition
Plate 6- Slope Stability Section B-B' – Static Condition
Plate 7- Slope Stability Section B-B' – Pseudo-static Condition



Base Map Provided by CVC Consulting, Inc.

EXPLANATION

(Locations Approximate)

- Exploratory Boring
- Exploratory Percolation Test Boring
- B B' - Geologic Cross-Section

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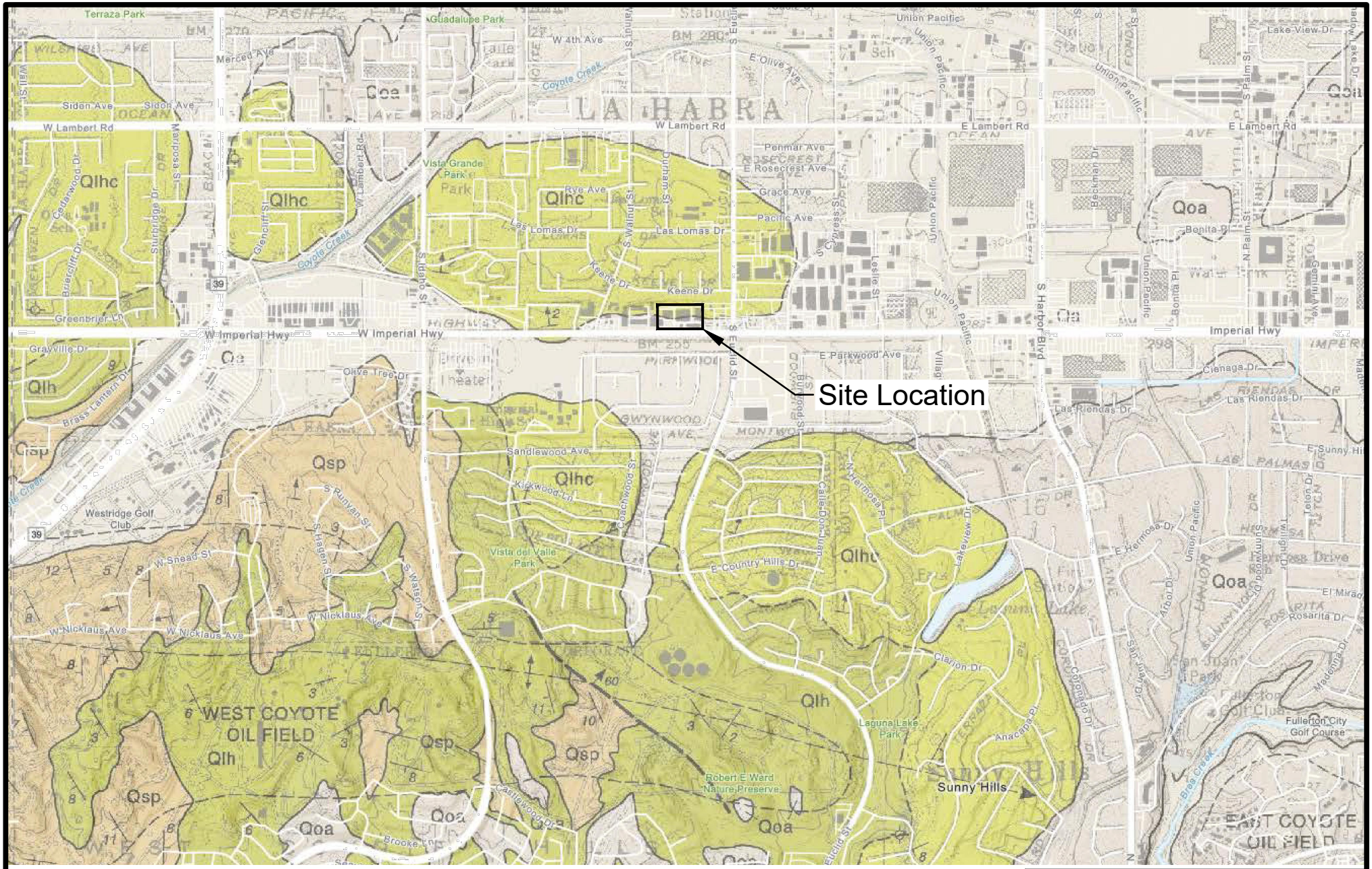
GEOTECHNICAL MAP

Job No.: 2908.00	Date: 11/05/21	Plate: 1



Base Map is part of: Geologic Map of the Whittier and La Habra Quadrangles, Dibblee Geology Center Map, DF-74, 2001

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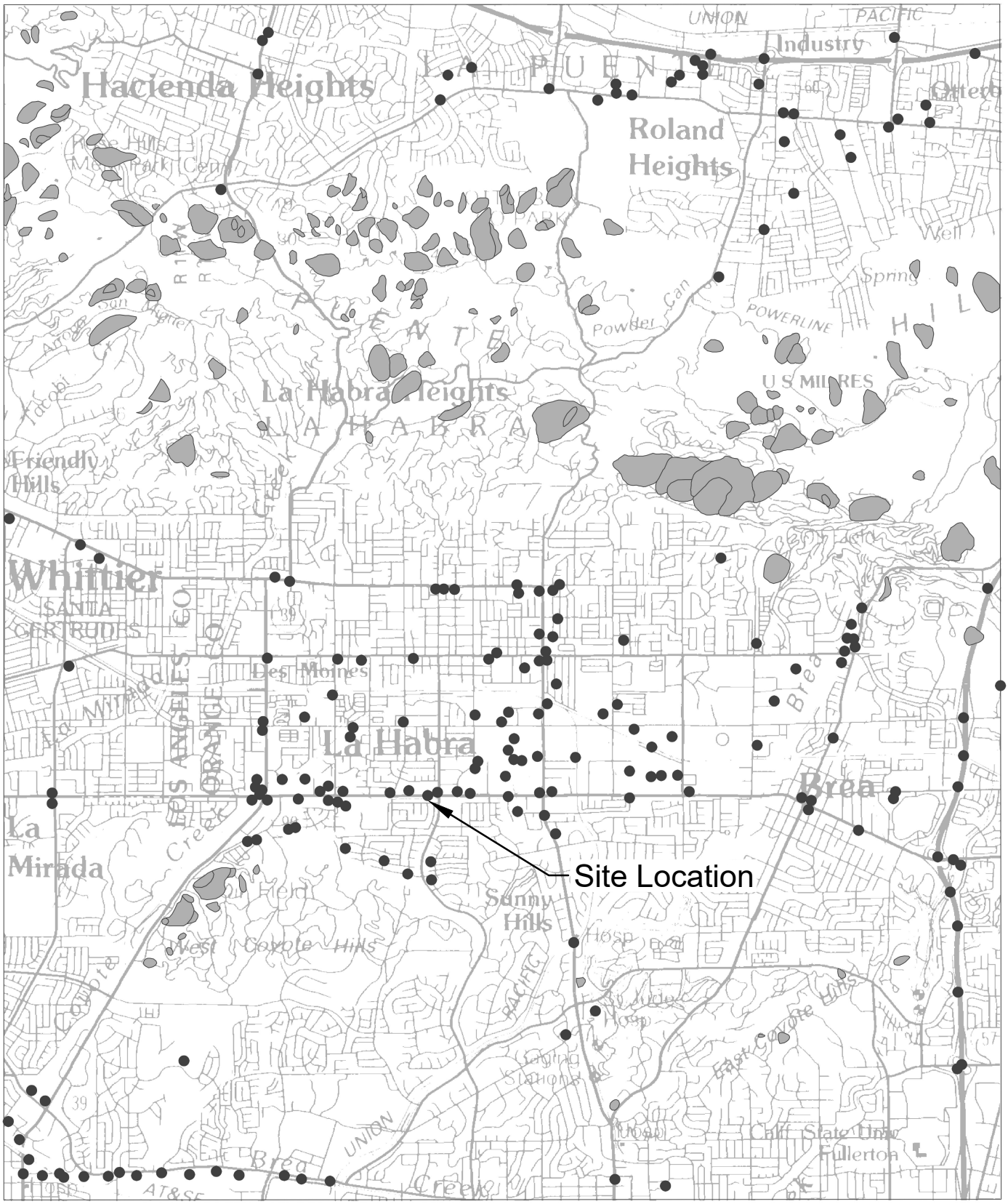
REGIONAL GEOLOGIC MAP

Job No.: 2908.00	Date: 11/05/21	Plate: 2



Base map enlarged from U.S.G.S. 30 x 60-minute series

● Shear test sample location

Landslide

Plate 2.1 Landslide inventory, shear test sample locations, and areas of significant grading, La Habra 7.5-minute quadrangle.

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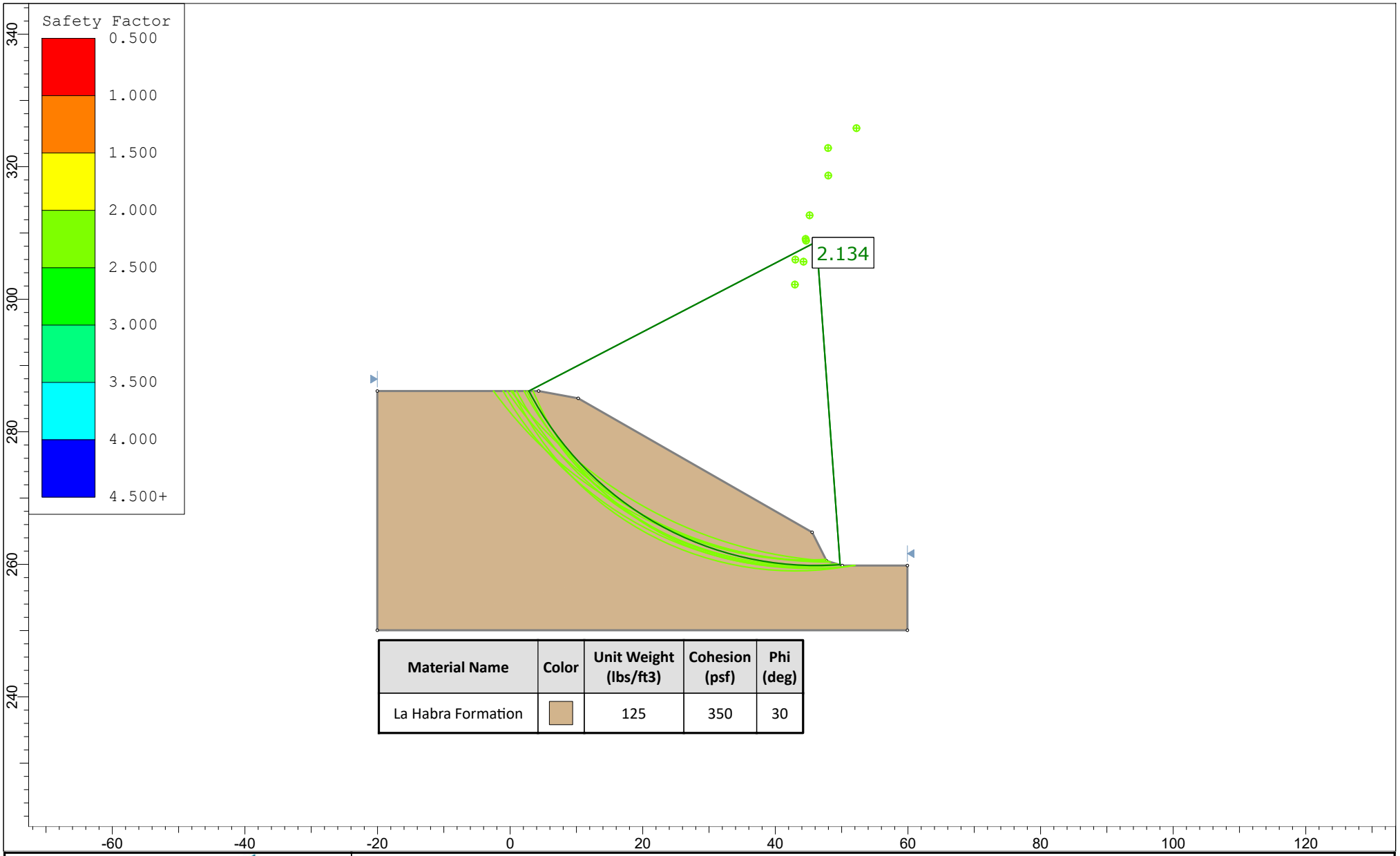
SLIDE INVENTORY MAP

Job No.: 2908.00	Date: 11/05/21	Plate: 3

Base Map is part of: CGS Seismic Hazard Zone Report for the La Habra Quadrangle, 1997, SHZ-09



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
La Habra Formation		125	350	30

SLIDEINTERPRET 7.038

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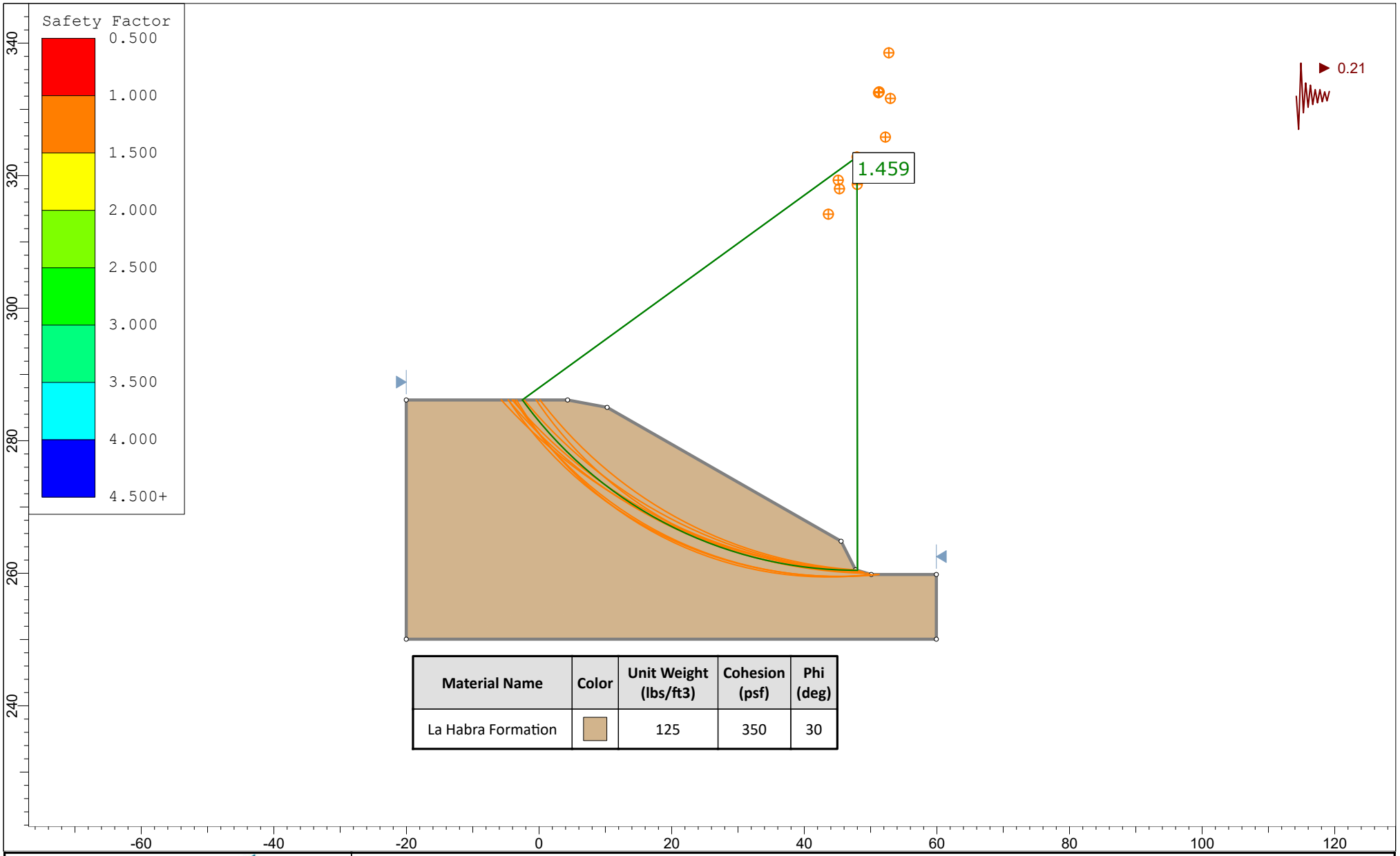
Project	2908.00 Cross Section A Proposed - Static
Analysis Description	Bishop
Drawn By	*Company*
Date	*File Name* 2908.00 Cross Section A - proposed - static.slim

PLATE 4

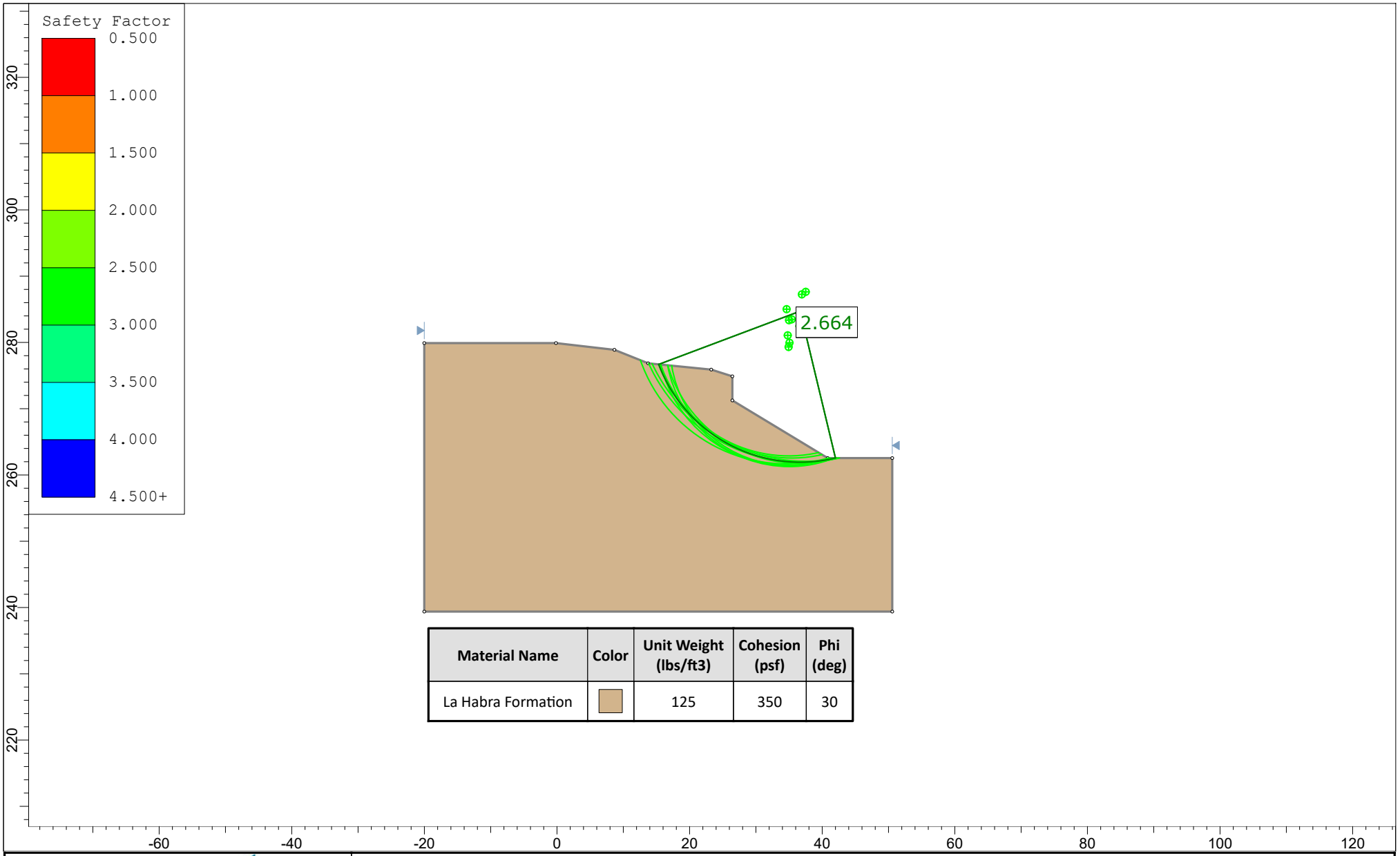


Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
La Habra Formation		125	350	30

SLIDEINTERPRET 7.038

Project	2908.00 Cross Section A Proposed - Static
Analysis Description	Bishop
Drawn By	Company
Date	File Name 2908.00 Cross Section A - proposed - seismic.slim

PLATE 5

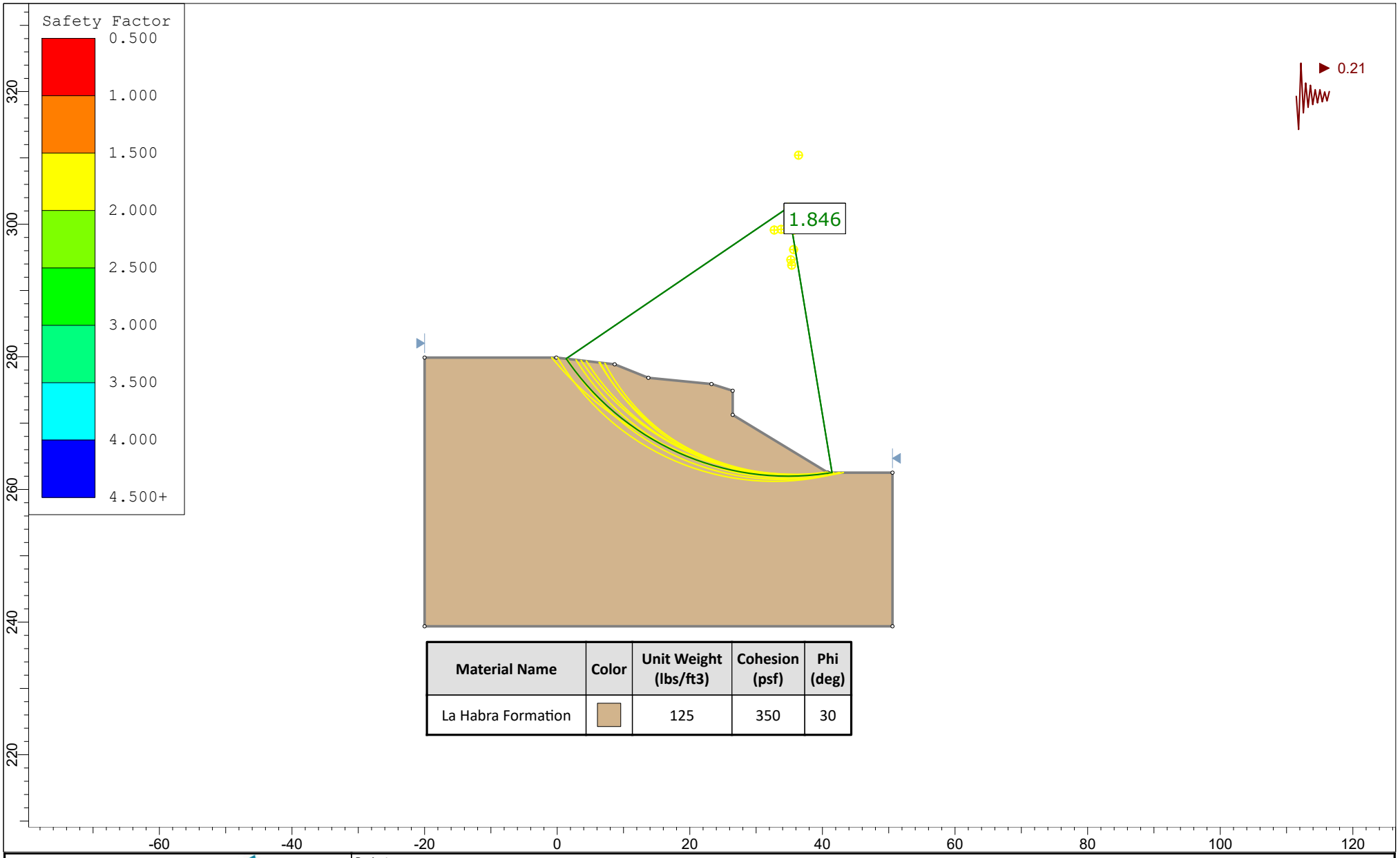


Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
La Habra Formation		125	350	30

SLIDEINTERPRET 7.038

Project	2908.00 Cross Section B Proposed - Static
Analysis Description	Bishop
Drawn By	*Company*
Date	*File Name* 2908.00 Cross Section B - proposed - static.slim

PLATE 6



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
La Habra Formation		125	350	30

SLIDEINTERPRET 7.038

Project	2908.00 Cross Section B Proposed - Static
Analysis Description	Bishop
Drawn By	*Company*
Date	*File Name* 2908.00 Cross Section B - proposed - seismic.slim

PLATE 7