APPENDIX B
Preliminary Geotechnical Investigation

CHRISTIAN WHEELER
ENGINEERING

REPORT OF PRELIMINARY GEOTECHNICAL INVESTIGATION

PROPOSED SINGLE-FAMILY RESIDENCE
6110 CAMINO DE LA COSTA
LA JOLLA, CALIFORNIA

SUBMITTED TO

JMAN INVESTMENTS, LLC
3000 UPAS STREET
SAN DIEGO, CALIFORNIA 92104

SUBMITTED BY

CHRISTIAN WHEELER ENGINEERING
3980 HOME AVENUE
SAN DIEGO, CALIFORNIA 92105

CHRISTIAN WHEELER
ENGINEERING

July 15, 2022

JMAN Investments, LLC CWE 2220191.01
3000 Upas Street
San Diego, California 92104
Attention: Mr. Mathew Segal

Subject: Report of Preliminary Geotechnical Investigation
Proposed Single-Family Residence 6110 Camino de la Costa, La Jolla, California

Dear Mr. Segal:

In accordance with your request, and our proposal dated March 4, 2022, we have completed a preliminary geotechnical investigation for the subject property. We are presenting herewith a report of our findings and recommendations.

No geotechnical conditions were encountered that would preclude the construction of the subject project. The most significant geotechnical condition affecting the proposed construction is the presence of potentially compressible man-placed fill soils and native soils underlying the existing building pad. This condition will require that proposed foundations be deepened such that they bear entirely on Point Loma Formation deposits underlying the potentially compressible soils.

The coastal bluff top site is located in an area that is relatively free of geologic hazards that will have a significant effect on the proposed residence over its design life. The most likely geologic hazard that could affect the site is ground shaking due to seismic activity along one of the regional active faults. However, construction in accordance with the requirements of the 2019 edition of the California Building Code and the local governmental agencies should provide a level of life-safety suitable for the type of development proposed.

3980 Home Avenue ✦ San Diego, CA 92105 ✦ 619-550-1700 ✦ FAX 619-550-1701

If you have questions after reviewing this report, please do not hesitate to contact our office. This opportunity to be of professional service is sincerely appreciated.

Respectfully submitted,
CHRISTIAN WHEELER ENGINEERING

Daniel B. Adler, RCE #36037

David R. Russell, CEG #2215

DRR:DBA
cc: mrmatthewsegal@gmail.com

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REPORT OF PRELIMINARY GEOTECHNICAL INVESTIGATION

PROPOSED SINGLE-FAMILY RESIDENCE
6110 CAMINO DE LA COSTA
LA JOLLA, CALIFORNIA

INTRODUCTION AND PROJECT DESCRIPTION

This report presents the results of a preliminary geotechnical investigation performed for a proposed single-family residence to be constructed at 6110 Camino de la Costa, in the La Jolla area of the city of San Diego, California. The following Figure Number 1 presents a site vicinity map showing the location of the property.

We understand that the existing improvements on-site are to be razed and that a new one- to two-story residence with a basement, a swimming pool, decks, and other normally associated appurtenances are to be constructed at the site. We anticipate that the proposed residence will be of concrete/masonry and conventional, wood frame construction with an on-grade concrete floor slab. We also anticipate that the proposed residence and associated appurtenances will be supported by conventional shallow foundations. Grading to accommodate the proposed improvements is expected to be limited to cuts and fills of up to 15 feet and less than 2 feet from existing site grades, respectively.

To assist in the preparation of this report, we have been provided with a preliminary set of architectural plans prepared by Jonathan Segal/FAIA, dated June 15, 2022. A copy of the architectural site plan included in the set was used as the base for our Site Plan and Geotechnical Map. The Site Plan and Geotechnical Map as well as 3 geologic cross sections, which depict the spatial relationship of the earth materials underlying the site, the proposed site configuration, the edge of the coastal bluff, and the recommended bluff edge setback locations are included herein as Plate Numbers 1 through 3 of this report.

This report has been prepared for the exclusive use of JMAN Investments, LLC, and their design consultants for specific application to the project described herein. Should the project be changed in any way, the modified plans should be submitted to Christian Wheeler Engineering for review to determine their conformance with our recommendations and to determine if any additional subsurface investigation, laboratory testing and/or recommendations are warranted. Our professional services have been performed,

SITE VICINITY

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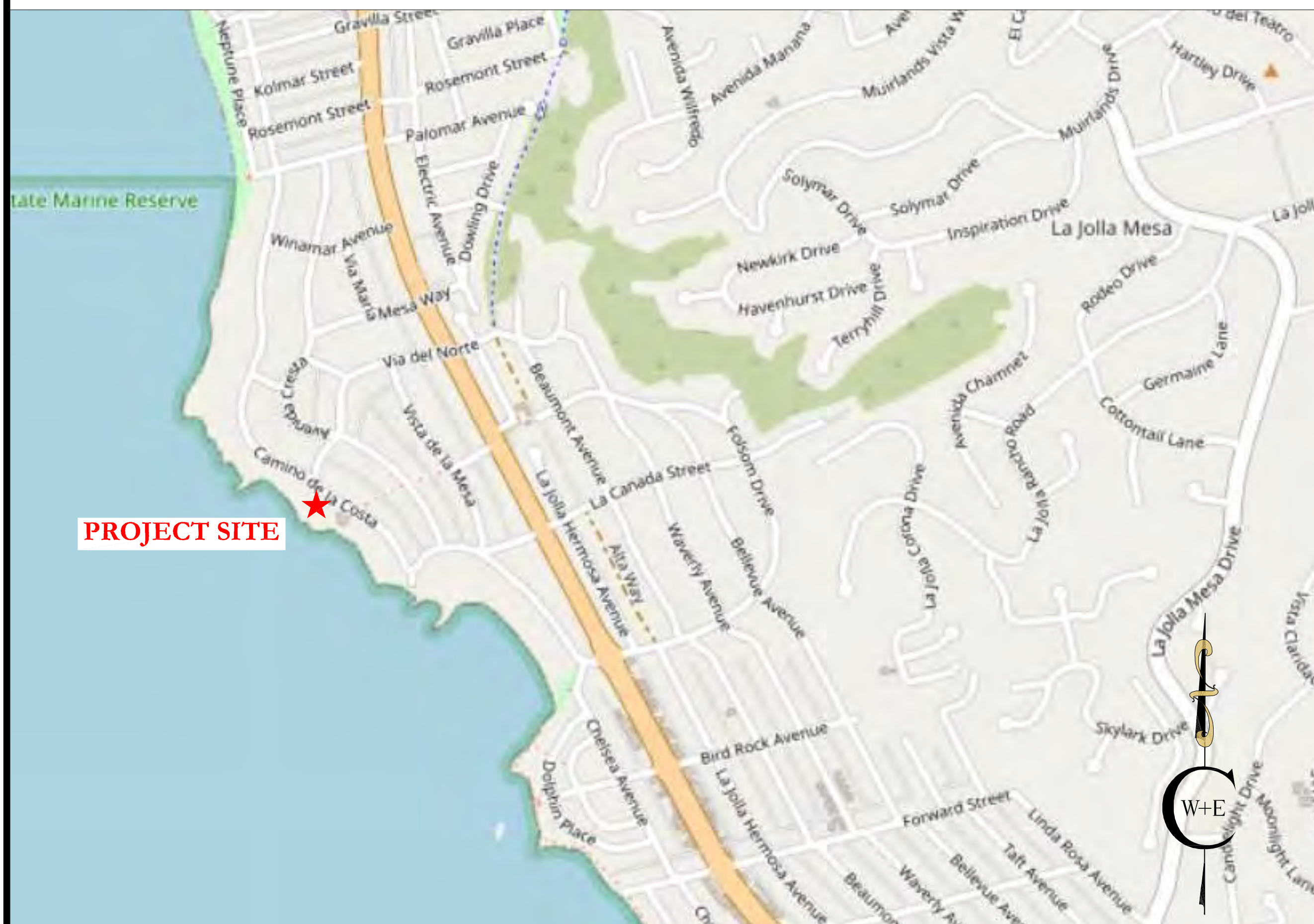


PROPOSED SINGLE-FAMILY RESIDENCE 6110 CAMINO DE LA COSTA LA JOLLA, CALIFORNIA		CHRISTIAN WHEELER ENGINEERING
DATE: JULY 2022	JOB NO.: 2220191.01	
BY: SD	FIGURE NO.: 1	

our findings obtained, and our recommendations prepared in accordance with generally accepted engineering principles and practices. This warranty is in lieu of all other warranties, express or implied.

SCOPE OF SERVICES

Our preliminary geotechnical investigation consisted of surface reconnaissance, subsurface exploration, obtaining representative soil samples, laboratory testing, analysis of the field and laboratory data, and review of relevant geologic literature. Our scope of service did not include assessment of hazardous substance contamination, recommendations to prevent floor slab moisture intrusion or the formation of mold within the structure, evaluation or design of storm water infiltration facilities, or any other services not specifically described in the scope of services presented below.

More specifically, the intent of our proposed investigation was to:

- Drill 9 small-diameter borings at the site to explore the subsurface conditions of the site and to obtain samples for laboratory testing.
- Backfill the boring holes using a grout or a grout/bentonite mix as required by the County of San Diego Department of Environmental Health.
- Excavate one hand-auger excavation within the rear of the property to explore the existing conditions of the near surface soils.
- Evaluate, by laboratory tests and our past experience with similar soil types, the engineering properties of the various soil strata that may influence the proposed construction, including bearing capacities, expansive characteristics and settlement potential.
- Describe the general geology at the site, including possible geologic hazards that could have an effect on the proposed construction, and provide the seismic design parameters as required by the current edition of the California Building Code.
- Identify the location of the edge of the coastal bluff in accordance with the City of San Diego Coastal Bluffs and Beaches Guidelines.
- Perform computer-assisted slope stability analyses of the proposed lot configuration in order to quantify the minimum global factors-of-safety of the proposed site development and, as necessary, to determine the approximate location of the 1.5 factor-of-safety line.
- Recommend a minimum setback, based on the geologic and geotechnical conditions, from the edge of the bluff for the proposed construction.
- Address potential construction difficulties that may be encountered due to soil conditions, groundwater or geologic hazards, and provide recommendations concerning these problems.

- Provide site preparation and grading recommendations for the anticipated work.
- Provide shored and unshored temporary cut slope recommendations.
- Provide foundation recommendations for the type of construction anticipated and develop soil engineering design criteria for the recommended foundation designs.
- Provide earth retaining wall design recommendations.
- Provide a preliminary geotechnical report that presents the results of our investigation which includes a plot plan showing the location of our subsurface explorations, excavation logs, laboratory test results, and our conclusions and recommendations for the proposed project.

FINDINGS

SITE DESCRIPTION

The subject site is a developed residential lot, identified as Assessor's Parcel Number 357-141-05, which is located adjacent to and southwest of Camino de la Costa in La Jolla, California. The site currently supports a one- to two-story, single-family residence with an attached garage, site retaining walls, and other normally associated improvements. Topographically, the central and northeastern portions of the site are characterized by a relatively level pad that supports the existing improvements and descends gently to the southwest. An unprotected coastal bluff characterizes the southwest portion of the lot.

Elevations across the site range from about 1 foot at the southwest corner of the property along the base of the coastal bluff to about 38 feet along the northeast perimeter of the site (San Diego Land Surveying & Engineering, 2022). Vegetation on-site consists of typical residential landscaping including lawns, shrubs and trees. Several small, cobble and mortar as well as masonry retaining walls exist within the rear of the property.

As is evident on the referenced aerial photographs from the State's California Coastal Records Project website, an erosion resistant headland characterizes the coastline along the southwest side of the site. This headland extends significantly further seaward at the subject lot than on the neighboring, residential lots.

GENERAL GEOLOGY AND SUBSURFACE CONDITIONS

GEOLOGIC SETTING AND SOIL DESCRIPTION: The subject site is located within the Coastal Physiographic Province of San Diego County. Based on our subsurface explorations, and analysis of readily available pertinent geologic literature, the site was found to be underlain by fill soils, Quaternary-age old paralic deposits, and Cretaceous-age sedimentary deposits of the Point Loma Formation.

ARTIFICIAL FILL (Qaf): Man-placed fill materials underlie the developed portions of the property and mantle the upper portions of the coastal bluff face (see Plate Nos. 1 through 3). As encountered in our subsurface explorations, the artificial fill typically consisted of light brown to dark brown, damp to moist, silty sand (SM) with lesser amounts of clayey sand (SC). The artificial fill was found to be generally loose in all the subsurface explorations. In general, the fill soils ranged in thickness from about 5 feet within the eastern portion of the lot to about 8½ feet along the southwest side of the existing residence (see B-6). Deeper fill soils may exist in areas of the site not investigated. From the west side of the existing structure, the artificial fill thins towards the central portion of the coastal bluff face. The fill soils were judged to possess a low expansion potential (EI between 21 and 50).

OLD PARALIC DEPOSITS (Qop): Quaternary-age old paralic deposits were encountered underlying the central and eastern portions of the site. The old paralic deposits make up the upper portions of the coastal bluff but are not present within the central and lower portions of the coastal bluff. Where encountered, the old paralic deposits were noted to consist of light brown, reddish-brown, and dark brown silty sands (SM) with lesser amounts of poorly-graded sands (SP) and slightly silty sands (SM-SP). The old paralic deposits were noted to be generally moist and medium dese to dense, in consistency. Within the central and eastern portions of the site the old paralic deposits were noted to extend to depths of about 8 feet to 13 feet from existing site grades. The old paralic deposits were judged to possess a low expansion potential (EI between 21 and 50).

POINT LOMA FORMATION (Kp): As observed along of the coastal bluff, and noted in our subsurface explorations, Cretaceous-age sedimentary deposits of the Point Loma Formation underlie the artificial fill and old paralic deposit within the central and eastern portions of the site, and crop out along the central and lower bluff face (see Plate Nos. 1-3). The materials of the Point Loma Formation were noted to generally consist of light brown to yellowish brown, silty sands (SM) with lesser amounts of slightly silty sands (SM-SP). These materials were noted to be moist and dense to very dense, in consistency. Although not noted in our borings, relatively thin lenses of yellowish-brown, hard, silty clay (CL) are commonly found within the Point Loma Formation in the general area of the subject site. The encountered materials of the Point Loma Formation underlying the site were judged to possess a low expansion potential (EI between 21 and 50).

GEOLOGIC STRUCTURE: The available exposures of the formational materials that crop out along the coastal bluff southwest of the site indicate that the Point Loma Formation dips to the northeast (into bluff) and northwest at inclinations ranging from approximately 5 to 10 degrees in the vicinity of the project site. Such bedding orientations are considered to be neutral to favorable with regards to the gross stability of the coastal bluff.

Several fractures and small, presumably inactive, faults were also observed in the formational outcrops along the coastal bluff southeast of the subject site. These fractures were noted to typically be very steep (often near-vertical) and strike predominantly in generally a northeasterly direction. The small faults exposed within the Cretaceous-age sedimentary deposits along the beach area to the southeast of the site generally dip steeply and do not bisect the overlying old paralic deposits. The shoreward projections of these small, presumably inactive faults, do not trend directly towards the subject site.

GROUNDWATER: No free groundwater or seepage conditions were encountered in our subsurface explorations. However, zones of seepage or localized perched groundwater are often encountered above the contact with the Point Loma Formation in the vicinity of the site. If encountered, such zones of seepage may affect the drilling of soldier piles or temporary excavations during construction. However, free groundwater or localized zones of seepage within the lower portions of the old paralic deposits (above the contact with the underlying Point Loma Formation) should not adversely affect the proposed construction after site construction is complete.

TECTONIC SETTING: Much of Southern California, including the San Diego County area, is characterized by a series of Quaternary-age fault zones that consist of several individual, en echelon faults that generally strike in a northerly to northwesterly direction. Some of these fault zones (and the individual faults within the zone) are classified as "active" according to the criteria of the California Division of Mines and Geology. Active fault zones are those that have shown conclusive evidence of faulting during the Holocene Epoch (the most recent 11,000 years). The Division of Mines and Geology used the term "potentially active" on Earthquake Fault Zone maps until 1988 to refer to all Quaternary-age (last 1.6 million years) faults for the purpose of evaluation for possible zonation in accordance with the Alquist-Priolo Earthquake Fault Zoning Act and identified all Quaternary-age faults as "potentially active" except for certain faults that were presumed to be inactive based on direct geologic evidence of inactivity during all of Holocene time or longer. Some faults considered to be "potentially active" would be considered to be "active" but lack specific criteria used by the State Geologist, such as *sufficiently active* and *well-defined*. Faults older than Quaternary-age are not specifically defined in Special Publication 42, Fault Rupture Hazard Zones in California, published by the California Division of Mines and Geology. However, it is generally accepted that faults showing no movement during the Quaternary period may be considered to be "inactive". The City of San Diego guidelines indicate that since the beginning of the Pleistocene Epoch marks the boundary between "potentially active" and "inactive" faults, unfaulted Pleistocene-age deposits are accepted as evidence that a fault may be considered to be "inactive".

A review of available geologic maps indicates that the nearest active fault zone is the Rose Canyon Fault Zone, located approximately 2¼ miles northeast of the site. Other active fault zones in the region that could possibly affect the site include the Coronado Bank, San Diego Trough, and San Clemente Fault Zones to the southwest; the Newport-Inglewood and Palos Verdes Fault Zones to the northwest, and the Elsinore, Earthquake Valley, San Jacinto, and San Andreas Fault Zones to the northeast. Additionally, several small, northeast and northwest trending, presumably inactive faults are present in the immediate vicinity of the site. As described in the Geologic Structure section of this report, the shoreward projections of these small, presumably inactive faults, do not trend directly towards the subject site.

In consideration of the fact that these small faults have, across the general vicinity of the subject site, been observed to bisect the Cretaceous-age Point Loma Formation and not to bisect the overlying Quaternary-age older paralic deposits, they are not considered to be active. In fact, these faults are considered to most likely be inactive. Since no deposits of the Pleistocene-age materials overlie these small faults, the possibility of these faults being potentially active cannot be ruled out. However, based on the information available to date, it is our opinion that no structural setbacks should be required from any such small, presumably inactive faults in the area of the site.

BLUFF EDGE: The edge of the bluff (for development purposes) is defined in the City of San Diego document titled "Coastal Bluffs and Beaches Guidelines." The "coastal bluff edge" is defined in the document as "the seaward-most termination of the top of a sensitive coastal bluff where the downward gradient of the land surface begins to increase more or less continuously until it reaches the general gradient of the coastal bluff face." Based on available information, the edge of the natural bluff at the site is at an approximate elevation of 25 feet to 27 feet, beneath a layer of man-placed fill soils that were previously placed above the bluff edge during the original site development approximately 100 years ago. The "edge of the bluff" is shown on the Site Plan and Geotechnical Map presented as Plate No. 1 of this report and on the geologic cross sections presented on Plate Nos. 2 and 3 of this report.

Delineation of the bluff edge at the subject site considered the geologic observations from the exploratory borings and hand auger explorations performed on-site as well as review of historic aerial photographs and topographic maps. By examining the totality of information provided by the subsurface exploration data, the geologic cross sections included as Plate Nos. 2 and 3 of this report, which are oriented roughly orthogonal to the coastal bluff edge, were created. Such cross sections demonstrate the spatial distribution of earth materials across the site and specifically along the portion of the bluff edge obscured by past retaining wall construction and fill placement. Consistent with the methodology presented in the City's Coastal Bluffs and Beaches Guidelines (Section III.A.4 and Diagram III-4 Modified Landform) the bluff edge at the site, along each of the geologic cross sections, is represented by the original geometry of the natural ground surface, projected to the present ground surface.

BLUFF EROSION: Coastal bluff recession is a process that is presently occurring in much of coastal San Diego County. Typically, coastal recession occurs through 3 modes that include: 1) undercutting of the base of the cliff by wave action and subsequent block falls of the overlying materials; 2) undercutting of the terrace deposits or other surficial material, initiated by water seepage conditions at the formational contact, and subsequent slumping of the overlying materials; and 3) deep-seated rotational-type failures.

The Cretaceous-age sediments of the Point Loma Formation that comprise the bluff face are "overconsolidated", stand well at steep inclinations, and have a relatively slow rate of erosion. However, the Quaternary-age old paralic deposits that comprise the upper bluff areas are only slightly consolidated and tend to erode back to a stable angle of repose of approximately 35 to 40 degrees when they become oversteepened, and can experience relatively rapid erosion during unfavorable conditions. Today, the inclination of the upper bluff face at the subject site is considered to be relatively gentle to moderate, as compared to other regional coastal bluffs. As noted above, an erosion resistant headland characterizes the coastline along the southwest side of the site. This headland extends significantly further seaward at the subject lot than on the neighboring, residential lots.

Historically, the mode of recession of the coastal bluff in the vicinity of the subject site appears to be manifested both as small to moderate block falls caused by erosion along the fractures and joints in the Point Loma Formation, and by subaerial erosion of surficial materials caused by severe storm conditions, drainage conditions, or the activities of man. The rate of erosion along the coastal bluff in the vicinity of the site has typically been variable with periods of very little recession alternating with episodes in which the lower bluff areas are rapidly eroded. Rapid erosion periods are typically associated with periods of high storm activities, and when substantial surficial erosion occurs as the result of increased natural and channeled drainage. The Shoreline Erosion Assessment and Atlas of the San Diego Region prepared by the California Department of Boating and Waterways and San Diego Association of Governments in 1994 indicates that the relative shoreline risk assessment in the area is "moderate" with an "inadequate setback." As presented on Plate No. 1 of this report, portions of the existing home at the site (plotted in orange) are currently seaward of the edge of bluff. Recommendations are contained herein to site the proposed single-family residence sufficiently inland from the edge of bluff so that the structure will be safe over its economic lifespan (assumed to be 75 years) without requiring shoreline protection.

Our review of available topographic maps and aerial photographs indicates that the edge of the bluff, as defined in the City's Coastal Bluffs and Beaches Guidelines, at the site has remained constant since the site was first developed in the early 1920s and the upper portions of the bluff were covered by artificial fill. This isn't to say that the bluff (including the lower bluff) has not experienced erosion since site development. Along this section of the La Jolla coastline, the elevation of the 10-foot contour along the lower bluff face has been measured to have migrated approximately 2 feet shoreward since 1953. Such erosion of the lower bluff face (not the top of bluff as defined for development purposes) equates to an approximate mean annual rate of lower bluff retreat of less than approximately 0.03 foot/year (<½ inch/year).

It should be understood that the mean annual rates of bluff top retreat represent average rates of bluff top/sea cliff retreat. As such, year to year variations in the rate of bluff recession should not only be anticipated but also expected. However, it is our professional opinion and judgment that even with the effects of projected sea level rise, the horizontal extent of bluff top retreat over the design life of the residence will be less than the minimum bluff top setback recommendation of 25 feet for the proposed project.

LANDSLIDE POTENTIAL AND BLUFF STABILITY

GENERAL: The Relative Landslide Susceptibility and Landslide Distribution Map of the La Jolla Quadrangle prepared by the California Division of Mines and Geology indicates that the central and eastern portions of the site are situated within Relative Landslide Susceptibility Area 2. Area 2 is considered to be "marginally susceptible" to slope failures. The southwest portion of the site, including the area of the coastal bluff face, is situated within Relative Landslide Susceptibility Area 4-1. Area 4 is considered to be a "most susceptible" to slope failures; Subarea 4-1 includes slopes considered to be generally outside of the limits of known landslides but contain "oversteepened high coastal bluffs which are subject to active sea-wave erosion" (Tan, 1995).

Based on our investigation, the site was found to be underlain at shallow depths by medium dense to dense, old paralic deposits above very dense, well-consolidated, sandstones of the Point Loma Formation. As part of our scope of services, we have performed quantitative slope stability analyses of the proposed site configuration.

STABILITY ANALYSIS: To analyze the stability of the site and proximal bluff areas, 3 cross-sections were drawn perpendicular to the bluff face. These cross-sections, labeled as A-A' through C-C' are presented on Plate Nos. 2 and 3 of this report. The results of the stability analyses are presented in Appendix E. As described above in the "Geologic Setting and Soil Description" section of this report, the site is underlain by Cretaceous-age materials of the Point Loma Formation that are overlain by Quaternary-age old paralic deposits.

Our slope (bluff) stability analyses have been performed incorporating circular-type modes of failure observed during historic bluff failures within the earth materials that underlie the site and bluff areas that display neutral to favorable (into-slope) bedding orientations. Given the neutral to favorable bedding orientation of the materials of Point Loma Formation, the modeling of block-type failure mechanisms was not considered necessary or performed during our bluff stability analyses. As presented herein, the minimum factors-of-safety that are considered stable are 1.5 for static slope (bluff) stability analyses and 1.1 for pseudo-static slope (bluff) stability analyses.

STRENGTH PARAMETERS: The strength parameters for the materials comprising the bluff were estimated based on the results of our direct shear testing and our experience with similar soil types in the vicinity of the site. Since the materials of the Point Loma Formation that underlie the site were observed to display neutral to into-slope bedding orientations, our stability analyses have been performed incorporating isotropic soil strength parameters for the Point Loma Formation.

The unit weights of the earth materials that underlie the subject site and adjacent areas utilized in our stability analyses were chosen based on the results of our previous laboratory testing and our experience with similar materials in the vicinity of the subject site. It is our professional opinion that the strength parameters and unit weights presented below and utilized in our stability analyses provide for conservative slope stability analyses.

Soil Type	Unit Weight, γ	Phi, ϕ	Cohesion, c
Artificial Fill (Qaf)	115 pcf	28 °	150 psf
Old Paralic Deposits (Qop)	120 pcf	32 °	250 psf
Point Loma Formation (Kp)	120 pcf	35 °	950 psf

METHOD OF ANALYSIS: The analyses of the gross stability of the coastal bluff to the west of the site were performed using Version 2 of the GSTABL7© computer program developed by Garry H. Gregory, PE. The program analyzes circular, block, specified, and randomly shaped failure surfaces using the Modified

Bishop, Janbu, or Spencer's Methods. The STEDwin© computer program, developed by Harald W. Van Aller, P. E., was used in conjunction with this program for data entry and graphics display.

The proposed topographies of the subject site and adjacent areas along geologic cross sections A-A' through C-C' were analyzed for circular-type failures originating within lower and mid portions of the bluff face and terminating at or landward of the edge of bluff. Each failure analysis was programmed to run at least 3,000 random failure surfaces. As described above, based on the neutral to into-slope bedding within the Point Loma Formation, stability analyses incorporating block-type failure mechanisms are not considered necessary and, as such, were not performed. The most critical failure surfaces from each analysis were accumulated and sorted by value of the factor-of-safety. After the specified number of failure surfaces were successfully generated and analyzed, the ten most critical surfaces were plotted so that the pattern may be studied. Additionally, pseudo-static stability analyses of the bluff were performed modeling each of the above-described stability analyses using kh coefficient equal to 0.15g and considering a factor-of-safety of 1.1 to be generally stable with regards to pseudo-static bluff stability.

RESULTS OF STABILITY ANALYSIS: The results of our stability analyses indicate that the lowest static factors-of-safety for the proposed configuration of the site are approximately 4.4, 4.6, and 4.9 along cross sections A-A', B-B', and C-C', respectively (See Appendix E).

Based on the results of our static bluff stability analyses, the existing coastal bluff at the site is considered to possess minimum factors-of-safety against static, gross failure in excess of 1.5, which is the minimum that is generally considered to be stable. As such, no delineations of where a minimum factor-of-safety of 1.5 or greater is demonstrated on the site are presented on the Site Plan and Geotechnical Map (see Plate No. 1) or geologic cross sections (see Plate Nos. 2 and 3) since all of the subject site demonstrates factors-of-safety of 1.5 or greater.

The results of our pseudo-static stability analyses indicate that the lowest pseudo-static factors-of-safety for the existing bluff along the west side of the site are approximately 3.0, 3.0, and 3.2 along cross sections A-A', B-B', and C-C', respectively.

Based on the results of our pseudo-static bluff stability analyses, the existing coastal bluff at the site is considered to possess minimum factors-of-safety against pseudo-static, gross failure in excess of the minimum that is generally considered to be stable of 1.1. As such, no delineations of where a minimum factor-of-safety of 1.1 or greater is demonstrated on the site are presented on the Site Plan and Geotechnical

Map (see Plate No. 1) or geologic cross sections (see Plate Nos. 2 and 3) since all of the site demonstrates factors-of-safety against pseudo-static failure that are 1.1 or greater.

RECOMMENDED BLUFF TOP SETBACK: Based on the results of our quantitative bluff stability analyses, the fact that our conservative estimation of future erosion of the edge of bluff to the west of the site is less than the City's minimum allowable setback, and the City of San Diego Municipal Code, which allows the 40-foot bluff top setback to be waived to 25 feet where the information in the geology report indicates that: "1) the site is stable enough to support the development with the proposed bluff edge setback; and 2) that the project can be designed so that it will neither be subject to nor contribute to significant geologic instability throughout the anticipated life span of the principal structures," it is our professional opinion and judgment that the required bluff top setback distance could be 25 feet.

RISING SEA LEVELS, TSUNAMI RUN-UP & ENSO EVENTS: Although Christian Wheeler Engineering does not practice oceanography or climatology, during our previous, recent studies of various bluff top sites within the La Jolla and Point Loma areas of San Diego we have worked with Richard J. Seymour, Ph.D., consultant of Oceanography, to evaluate the potential effects on local bluff stability of rising sea levels and to analyze the potential effects of past and projected El Niño events on local bluff stability.

For sites within both La Jolla and Point Loma, Dr. Seymour's papers, prepared using the latest scientific data, conclude that cliff recession at the properties studied can be expected to continue at the historically measured rates. This is because although the sea level is anticipated to rise over the design life of the proposed construction on the sites studied (and at the subject site), the anticipated magnitude of sea level rise and the fact that normal tidal fluctuations and previous, temporary rises in sea level associated with El Niño events are and have been of significantly greater magnitudes than the anticipated rise in sea level. As such, it is our professional opinion and judgment that the coastal bluff recession evaluation and stability analyses described herein adequately address the potential impacts of sea level rise over the design life of the proposed development.

It should also be noted that the lack of appreciable bluff edge retreat noted over the last few decades and our conservative prediction of the bluff edge retreat presented herein covered a time frame that included the significant El Niño events of 1982-83 and 1997-98. Similarly, although varying methods are employed to label or define El Niño events based on the Southern Oscillation Index (SOI) and/or sea surface temperatures (SSTs), no appreciable bluff edge retreat occurred at the site during other well documented El Niño events from 1976-78, 1987-8, 1991-93, 1994-95, and 2002-03. As such, it is our professional opinion and judgment that the evaluations and analyses described herein address the potential effects of both past and future El Niño events on bluff erosion and also on bluff stability.

GEOLOGIC HAZARDS

GENERAL: As part of our services, we have reviewed the City of San Diego Seismic Safety Study. This study is the result of a comprehensive investigation of the City that rates areas according to geological risk potential (nominal, low, moderate, and high) and identifies potential geotechnical hazards and/or describes geomorphic conditions.

According to the San Diego Seismic Safety Map No. 29, the northeastern portion of the site is located within Geologic Hazard Category 53. Hazard Category 53 is assigned to areas of level to sloping terrain with unfavorable geologic structure, where the potential risks are classified as “low to moderate.” The central and western portions of the site are mapped in Hazards Category 43, which is used to identify coastal bluffs that are “generally unstable”, with “unfavorable jointing” and “local high erosion.” The southeast portion of the site is also mapped within Geologic Hazard Category 12, which is a buffer zone around faults that are considered inactive, presumed inactive, potentially-active, or of unknown activity. A description of the presumed inactive faulting expressed on the nearby coastal bluffs is presented above in the tectonic setting section of this report.

SURFACE RUPTURE AND SOIL CRACKING: Based on the information available to us, it is our professional opinion that no active faults are present at the subject site proper so the site is not considered susceptible to surface rupture. The likelihood of soil cracking caused by shaking from distant sources should be considered to be nominal.

LIQUEFACTION: The materials at the site are relatively competent and are not anticipated to be subject to liquefaction due to such factors as soil density, grain-size distribution, and absence of shallow ground water.

EXPANSIVE SOILS: The majority of the surficial soils at the site are anticipated to possess a low to moderate expansive potential. However, the presence of detrimentally expansive soils (having an Expansion Index in excess of 50), if present, may be mitigated by proper foundation reinforcing and design.

FLOODING: The developed area of the site is located outside of the boundaries of both the 100-year and 500-year flood zones.

TSUNAMIS: Tsunamis are great sea waves produced by a submarine earthquake or volcanic eruption. Historically, the San Diego area has been free of tsunami-related hazards and tsunamis reaching San Diego have generally been well within the normal tidal range. It is thought that the wide continental margin off the coast acts to diffuse and reflect the wave energy of remotely generated tsunamis. The largest historical tsunami to reach San Diego's coast was 4.6 feet high, generated by the 1960 earthquake in Chile. A lack of knowledge about the offshore fault systems makes it difficult to assess the risk due to locally generated tsunamis.

Review of the referenced Tsunami Inundation Map of the La Jolla Quadrangle indicates that the portions of the site to be redeveloped are outside of both the projected tsunami inundation line and tsunami inundation area (CalEMA, 2009). The Multi-Jurisdictional Hazard Mitigation Plan of the County of San Diego (URS, 2004) does map the area of the subject site and adjacent coastal bluff areas as being within an area susceptible to the maximum projected run-up from a tsunami. However, based on the bathymetry of the offshore San Diego coastline, the fact that historical tsunamis reaching San Diego have generally been well within the normal tidal range, the inclination of the coastal bluff to the southwest of the site, and the elevation of the portions of the site to be redeveloped at or above 25 feet, it is our professional opinion and judgment that the tsunami hazard at the site is relatively low and no greater at the subject site than it is at other, proximal bluff edge sites throughout the Bird Rock and Windansea areas of La Jolla. Signage indicating evacuation routes in the event of tsunami warning has recently been put up along the La Jolla and San Diego coastline.

SEICHES: Seiches are periodic oscillations in large bodies of standing water such as lakes, harbors, bays, or reservoirs. The site is not considered susceptible to seiche hazards.

CONCLUSIONS

It is our professional opinion and judgment that no geotechnical conditions exist on the subject property that would preclude the construction of the proposed residence and associated improvements provided the recommendations presented herein are followed. The main geotechnical conditions affecting the subject project are the presence of potentially compressible fill soils and native soils underlying the area of the proposed construction and a cut/fill transition.

The existing potentially compressible fill materials and uppermost portions of the old paralic deposits are considered unsuitable, in their present condition for the support of settlement sensitive improvements. These materials extend to a maximum estimated combined depth of about 9 feet below existing grade. However, they may be deeper in areas of the site not investigated. In order to mitigate this condition, it is recommended that proposed foundations to support the proposed structure and swimming pool be deepened such that they bear entirely on the underlying competent Point Loma Formation deposits. Structural slabs are recommended for the proposed on-grade concrete floor slabs. In addition, special site preparation is recommended.

It is anticipated that the proposed development scheme, coupled with the recommended site preparation will result in cut/fill transitions and heterogenous soils underlying the proposed structure. Cut/fill transitions are not recommended due to the potential for differential settlement due to the different compression characteristics of compacted fill, old paralic deposits, and materials of the Point Loma Formation. The recommendations provided in the previous paragraph will also mitigate this condition.

The site is located in an area that is relatively free of geologic hazards that will have a significant effect on the proposed construction. The most likely geologic hazard that could affect the site is ground shaking due to seismic activity along one of the regional active faults. However, construction in accordance with the requirements of the most recent edition of the California Building Code and the local governmental agencies should provide a level of life-safety suitable for the type of development proposed.

RECOMMENDATIONS

GRADING AND EARTHWORK

GENERAL: All grading should conform to the guidelines presented in the current edition of the California Building Code, the minimum requirements of the City of San Diego, and the recommended Grading Specifications and Special Provisions attached hereto, except where specifically superseded in the text of this report.

PREGRADE MEETING: It is recommended that a pre-grade meeting including the grading contractor, the client, and a representative from Christian Wheeler Engineering be performed, to discuss the recommendations of this report and address any issues that may affect grading operations.

OBSERVATION OF GRADING: Continuous observation by the Geotechnical Consultant is essential during the grading operation to confirm conditions anticipated by our investigation, to allow adjustments in design criteria to reflect actual field conditions exposed, and to determine that the grading proceeds in general accordance with the recommendations contained herein.

CLEARING AND GRUBBING: Site preparation should begin with the removal of any existing vegetation and other deleterious materials in areas to receive proposed improvements or new fill soils.

SITE PREPARATION: It is recommended that all existing fill soils underlying the proposed structure, associated improvements, and new fills be removed and replaced as compacted fill. Based on our findings, it is anticipated that the existing fill soils generally extend to a maximum depth of about 8½ feet below existing grade (boring B-1). Deeper removals may be necessary in areas of the site not investigated or due to unforeseen conditions. In addition, old paralic deposits within 5 feet from existing grade should also be removed and replaced as compacted fill. Lateral removal limits should extend at least 5 feet from the perimeter of the structures, any settlement sensitive improvements, and new fills or equal to removal depth, whichever is more. No removals are recommended beyond property lines. All excavated areas should be approved by the geotechnical engineer or his representative prior to replacing any of the excavated soils. The excavated materials can be replaced as properly compacted fill in accordance with the recommendations presented in the "Compaction and Method of Filling" section of this report.

PROCESSING OF FILL AREAS: Prior to placing any new fill soils or constructing any new improvements in areas that have been cleaned out to receive fill, the exposed soils should be scarified to a depth of 12 inches, moisture conditioned, and compacted to at least 90 percent relative compaction. This recommendation applies to the area of the site outside the perimeter of the proposed structures.

COMPACTION AND METHOD OF FILLING: In general, all structural fill placed at the site should be compacted to a relative compaction of at least 90 percent of its maximum laboratory dry density as determined by ASTM Laboratory Test D1557. Fills should be placed at or slightly above optimum moisture content, in lifts 6 to 8 inches thick, with each lift compacted by mechanical means. Fills should consist of approved earth material, free of trash or debris, roots, vegetation, or other materials determined to be unsuitable by the Geotechnical Consultant. Fill material should be free of rocks or lumps of soil in excess of 3 inches in maximum dimension.

Utility trench backfill within 5 feet of the proposed structure and beneath all concrete flatwork or pavements should be compacted to a minimum of 90 percent of its maximum dry density.

SURFACE DRAINAGE: The drainage around the proposed improvements should be designed to collect and direct surface water away from proposed improvements and the top of slopes toward appropriate drainage facilities. Rain gutters with downspouts that discharge runoff away from the structure into controlled drainage devices are recommended.

The ground around the proposed improvements should be graded so that surface water flows rapidly away from the improvements without ponding. In general, we recommend that the ground adjacent to structure slope away at a gradient of at least 5 percent for a minimum distance of 10 feet. If the minimum distance of 10 feet cannot be achieved, an alternative method of drainage runoff away from the building at the termination of the 5 percent slope will need to be used. Swales and impervious surfaces that are located within 10 feet of the building should have a minimum slope of 2 percent. Pervious hardscape surfaces adjacent to structures should be similarly graded.

Drainage patterns provided at the time of construction should be maintained throughout the life of the proposed improvements. Site irrigation should be limited to the minimum necessary to sustain landscape growth. Over watering should be avoided. Should excessive irrigation, impaired drainage, or unusually high rainfall occur, zones of wet or saturated soil may develop.

TEMPORARY CUT SLOPES

The contractor is solely responsible for designing and constructing stable, temporary excavations and will need to shore, slope, or bench the sides of trench excavations as required to maintain the stability of the excavation sides. The contractor's "competent person", as defined in the OSHA Construction Standards for Excavations, 29 CFR, Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety process. We anticipate that the existing on-site soils will consist of Type C material; however, flatter temporary slopes may be necessary if cohesionless sands are encountered in temporary cuts. Our firm should be contacted to observe all temporary cut slopes during grading to ascertain that no unforeseen adverse conditions exist. No surcharge loads such as foundation loads, or soil or equipment stockpiles, vehicles, etc. should be allowed within a distance from the top of temporary slopes equal to half the slope height.

TEMPORARY SHORING

GENERAL: Shoring may be necessary for the proposed construction. It is anticipated that the shoring system will utilize soldier beams with wooden lagging. The following design parameters may be assumed to calculate earth pressures on shoring.

TABLE I: TEMPORARY SHORING

Soil Type	Compacted Fill/old paralic deposits	Point Loma Formation
Angle of friction	24°	36°
Apparent cohesion	400 pounds per square foot	950 pounds per square foot
Soil unit weight	130 pounds per cubic foot (pcf)	130 pounds per cubic foot (pcf)

Active pressures can be applied to shoring that is capable of rotating 0.002 radians. At-rest pressures should be applied to a shoring system that is unyielding and not able to rotate. These values do not include surcharge loads. Construction surcharge loads should be evaluated on a case-by-case basis. Vertical and lateral movements of the temporary shoring are expected to be small assuming an adequate lateral support system.

DRILLING CHARACTERISTICS: It is anticipated that drilling may be performed with conventional heavy-duty drilling equipment in good working order. However, it should be recognized that the Point Loma Formation was found to be dense to very dense condition. In addition, hard concretions should be anticipated.

FOUNDATIONS

GENERAL: Based on our findings and engineering judgment, the proposed structure and associated improvements may be supported by conventional shallow continuous and isolated spread footings extending into Point Loma Formation. Depending on the depth of these materials, conventional shallow foundations or cast-in-place concrete piers will be suitable. It is recommended that the proposed swimming pool be supported by cast-in-place piers. The following recommendations are considered the minimum based on the anticipated soil conditions, and are not intended to be lieu of structural considerations. All foundations should be designed by a qualified engineer.

SHALLOW FOUNDATIONS

DIMENSIONS: Spread footings supporting the proposed primary residential structure should be embedded at least 18 inches below lowest adjacent finish pad grade, and extend at least 12 inches into Point Loma Formation deposits, whichever is more. Spread footings supporting associated exterior improvements may be founded on newly compacted fill or competent old paralic deposits, and should be embedded at least 12 inches below lowest adjacent finish pad grade. Continuous and isolated footings should have a minimum width of 12 inches and 24 inches, respectively. Retaining wall footings should be at least 18 inches deep and 24 inches wide. Footings located adjacent to slopes should extend to a depth such that a minimum horizontal setback exists between the face of the slope and the bottom of the footing.

BEARING CAPACITY: Spread footings supporting the proposed structure founded in Point Loma Formation may be designed for an allowable soil bearing pressure of 4,000 pounds per square foot (psf). This value may be increased by 800 psf for each additional foot of embedment and 600 psf for each additional foot of width up to a maximum of 10,000 psf. Spread footings supporting light miscellaneous exterior improvements may be designed for an allowable soil bearing pressure of 2,000 pounds per square foot (psf). This value may be increased by 500 psf for each additional foot of embedment and 400 psf for each additional foot of width up to a maximum of 4,000 psf. These values may be increased by one-third for combinations of temporary loads such as those due to wind or seismic loads.

FOOTING REINFORCING: Reinforcement requirements for foundations should be provided by a structural designer. However, based on the expected soil conditions, we recommend that the minimum reinforcing for continuous footings consist of at least 2 No. 5 bars positioned near the bottom of the footing and 2 No. 5 bars positioned near the top of the footing. New footings located adjacent to existing footings should be dowelled as recommended by the structural engineer.

LATERAL LOAD RESISTANCE: Lateral loads against foundations may be resisted by friction between the bottom of the footing and the supporting soil, and by the passive pressure against the footing. The coefficient of friction between concrete and soil may be considered to be 0.3. The passive resistance may be considered to be equal to an equivalent fluid weight of 300 pounds per cubic foot. These values are based on the assumption that the footings are poured tight against undisturbed soil. If a combination of the passive pressure and friction is used, the friction value should be reduced by one-third.

SLURRY BACKFILL: Shallow foundation excavations exceeding minimum requirements may be backfilled with slurry provided this is approved by the project structural engineer. The void between the bottom of the proposed footing and underlying Point Loma Formation may be filled with a slurry mix (2 sack minimum) or some other type of controlled low strength material (CLSM) as recommended by the project's structural engineer.

CONCRETE CAST-IN-PLACE PIERS

MINIMUM PIER DIMENSIONS: Cast-in-place concrete pier foundations should have a minimum diameter of 24 inches. The piers should extend to a minimum depth of 10 feet below the existing grade and 5 feet into Point Loma Formation, whichever is more. At this depth, a bearing capacity of 10,000 pounds per square foot (psf) may be assumed for said piers. This bearing pressure may be increased by 900 psf for each additional foot of depth, and 700 psf for each additional foot of width, up to a maximum bearing pressure of 30,000 psf. This value may be increased by one-third when considering wind and/or seismic loads.

PIER REINFORCING: The reinforcing steel for the piers should be specified by the project structural designer. As a minimum, we recommend that the pier reinforcing extend the full depth of the pier excavation.

LATERAL BEARING CAPACITY: The allowable lateral bearing resistance to lateral loads for the portion of the piers embedded in newly compacted fill or old paralic deposits may be assumed to be 300 pounds per square foot per foot of depth up to a maximum of 3,000 pounds per square foot. The allowable lateral bearing resistance to lateral loads for the portion of the piers embedded in Point Loma Formation may be assumed to be 400 pounds per square foot per foot of depth up to a maximum of 4,000 pounds per square foot. These values may be assumed to act below the setback line and on an area equal to twice the pier diameter.

PIER EXCAVATION OBSERVATION AND CLEANING: The pier excavations should be observed by a member of our staff during drilling to determine that the minimum embedment recommend in this report is achieved. Prior to placing the steel reinforcing cages, all loose or disturbed soils at the bottom of the pier excavations should be removed. The cleanout of the pier excavations should be approved by the geotechnical engineer.

DRILLING CHARACTERISTICS: It is anticipated that the proposed piers may be drilled utilizing conventional heavy-duty drilling equipment in good working condition; however, the Point Loma Formation deposits are dense to very dense and hard concretions should be anticipated.

FOUNDATION EXCAVATION OBSERVATION: All footing excavations should be observed by Christian Wheeler Engineering prior to placing of forms and reinforcing steel to determine whether the foundation recommendations presented herein are followed and that the foundation soils are as anticipated in the preparation of this report. All footing excavations should be excavated neat, level, and square. All loose or unsuitable material should be removed prior to the placement of concrete.

SETTLEMENT CHARACTERISTICS: The anticipated total and differential settlement is expected to be less than about 1 inch and 1 inch over 40 feet, respectively, provided the recommendations presented in this report are followed. For swimming pool design, the anticipated total and differential footing settlement is expected to be less than about ¼ inch and ¼ inch in 40 feet, respectively. It should be recognized that minor cracks normally occur in concrete slabs and foundations due to concrete shrinkage during curing or redistribution of stresses, therefore some cracks should be anticipated. Such cracks are not necessarily an indication of excessive vertical movements.

EXPANSIVE CHARACTERISTICS: Provided the site preparation recommendations contained in this report are implemented, the prevailing foundation soils are assumed to have a low expansive potential (EI between 21 and 50). The recommendations within this report reflect these conditions.

FOUNDATION PLAN REVIEW: The final foundation plan and accompanying details and notes should be submitted to this office for review. The intent of our review will be to verify that the plans used for construction reflect the minimum dimensioning and reinforcing criteria presented in this section and that no additional criteria are required due to changes in the foundation type or layout. It is not our intent to review structural plans, notes, details, or calculations to verify that the design engineer has correctly applied the geotechnical design values. It is the responsibility of the design engineer to properly design/specify the foundations and other structural elements based on the requirements of the structure and considering the information presented in this report.

SOLUBLE SULFATES: The water-soluble sulfate content of selected soil samples from the site were determined in accordance with California Test Method 417. The results of these tests indicate that the soil samples had a soluble sulfate content of 0.036 percent and 0.096 percent. Soils with a soluble sulfate content of less than 0.1 percent are considered to have a negligible potential for causing adverse effects on concrete and structural steel materials of the proposed footings. Therefore, no special requirements are considered necessary for the concrete mix design.

It should be understood Christian Wheeler Engineering does not practice corrosion engineering. If a corrosivity analysis is considered necessary, we recommend that the client retain an engineering firm that specializes in this field to consult with them on this matter. The results of our corrosion testing should only be used as a guideline to determine if additional testing and analysis is necessary.

SEISMIC DESIGN FACTORS

The seismic design factors applicable to the subject site are provided below. The seismic design factors were determined in accordance with the 2019 California Building Code. The site coefficients and adjusted maximum considered earthquake spectral response acceleration parameters are presented in the following Table I.

TABLE II: SEISMIC DESIGN FACTORS

Site Coordinates: Latitude Longitude	32.820° -117.278°
Site Class	C
Site Coefficient F_a	1.2
Site Coefficient F_v	1.5
Spectral Response Acceleration at Short Periods S_s	1.278 g
Spectral Response Acceleration at 1 Second Period S_1	0.448 g
$S_{MS}=F_aS_s$	1.533 g
$S_{M1}=F_vS_1$	0.672 g
$S_{DS}=2/3*S_{MS}$	1.022 g
$S_{D1}=2/3*S_{M1}$	0.448 g

Probable ground shaking levels at the site could range from slight to moderate, depending on such factors as the magnitude of the seismic event and the distance to the epicenter. It is likely that the site will experience the effects of at least one moderate to large earthquake during the life of the proposed improvements.

ON-GRADE SLABS

GENERAL: It is our understanding that the floor system of the proposed structures will consist of a concrete slab-on-grade. The following recommendations are considered the minimum slab requirements based on the soil conditions and are not intended in lieu of structural considerations. These recommendations assume that the site preparation recommendations contained in this report are implemented.

INTERIOR FLOOR SLABS: The slab should be designed by the project structural engineer based on the findings of this report. A design coefficient of subgrade reaction, Kv1, of 150 pounds per cubic inch (pci) may be used for slab-on-grade design. However, the minimum slab thickness should be 5 inches (actual) and the slab should be reinforced with at least No. 4 bars spaced at 12 inches on center each way. Slab reinforcement should be supported on chairs such that the reinforcing bars are positioned at mid-height in the floor slab. The slab reinforcement should extend down into the perimeter footings at least 12 inches.

UNDER-SLAB VAPOR RETARDERS: Steps should be taken to minimize the transmission of moisture vapor from the subsoil through the interior slabs where it can potentially damage the interior floor coverings. Local industry standards typically include the placement of a vapor retarder, such as plastic, in a layer of coarse sand placed directly beneath the concrete slab. Two inches of sand are typically used above and below the plastic. The vapor retarder should be at least 15-mil Stegowrap® or similar material with sealed seams and should extend at least 12 inches down the sides of the interior and perimeter footings. The sand should have a sand equivalent of at least 30, and contain less than 10% passing the Number 100 sieve and less than 5% passing the Number 200 sieve. The membrane should be placed in accordance with the recommendation and consideration of ACI 302, "Guide for Concrete Floor and Slab Construction" and ASTM E1643, "Standards Practice for Installation of Water Vapor Retarder Used in Contact with Earth or Granular Fill Under Concrete Slabs." It is the flooring contractor's responsibility to place floor coverings in accordance with the flooring manufacturer specifications.

EXTERIOR CONCRETE FLATWORK: Exterior concrete slabs on grade should have a minimum thickness of 4 inches and be reinforced with at least No. 3 bars placed at 18 inches on center each way (ocew). Special consideration should be considered for slabs adjacent to swimming pools and spas due to potential chloride exposure. Driveway slabs should have a minimum thickness of 5 inches and be reinforced with at least No. 4 bars placed at 18 inches ocew. Driveway slabs abutting landscape areas should be provided with a thickened edge a least 12 inches deep and 6 inches wide. All slabs should be provided with weakened plane joints in accordance with the American Concrete Institute (ACI) guidelines. Special attention should be paid to the method of concrete curing to reduce the potential for excessive shrinkage cracking. It should be recognized that minor cracks occur normally in concrete slabs due to shrinkage. Some shrinkage cracks should be expected and are not necessarily an indication of excessive movement or structural distress.

EARTH RETAINING WALLS

FOUNDATIONS: Foundations for any proposed retaining walls should be constructed in accordance with the foundation recommendations presented previously in this report.

PASSIVE PRESSURE: The passive pressure for the anticipated foundation soils may be considered to be 300 pounds per square foot per foot of depth. The upper foot of embedment should be neglected when calculating passive pressures, unless the foundation abuts a hard surface such as a concrete slab. The passive pressure may be increased by one-third for seismic loading. The coefficient of friction for concrete to soil may be assumed to be 0.3 for the resistance to lateral movement. When combining frictional and passive resistance, the friction should be reduced by one-third.

ACTIVE PRESSURE: The active soil pressure for the design of "unrestrained" and "restrained" earth retaining structures with level backfill may be assumed to be equivalent to the pressure of a fluid weighing 40 and 60 pounds per cubic foot, respectively. These pressures do not consider any other surcharge. If any are anticipated, this office should be contacted for the necessary increase in soil pressure. These values are based on a drained backfill condition.

Seismic lateral earth pressures may be assumed to equal an inverted triangle starting at the bottom of the wall with the maximum pressure equal to 12.1H pounds per square foot (where H = wall height in feet) occurring at the top of the wall.

WATERPROOFING AND WALL DRAINAGE SYSTEMS: The need for waterproofing should be evaluated by others. If required, the project architect should provide (or coordinate) waterproofing details for the retaining walls. The design values presented above are based on a drained backfill condition and do not consider hydrostatic pressures. The retaining wall designer should provide a detail for a wall drainage system. Typical retaining wall drain system details are presented as Plate No. 4 of this report for informational purposes. Additionally, outlet points for the retaining wall drain system should be coordinated with the project civil engineer.

BACKFILL: Retaining wall backfill soils should be compacted to at least 90 percent relative compaction. Expansive or clayey soils should not be used for backfill material. The wall should not be backfilled until the masonry has reached an adequate strength. If gravel is used for backfill, it should be wrapped in filter fabric and capped with at least 24 inches of compacted fill.

LIMITATIONS

REVIEW, OBSERVATION AND TESTING

The recommendations presented in this report are contingent upon our review of final plans and specifications. Such plans and specifications should be made available to the geotechnical engineer and engineering geologist so that they may review and verify their compliance with this report and with the California Building Code.

It is recommended that Christian Wheeler Engineering be retained to provide continuous soil engineering services during the earthwork operations. This is to verify compliance with the design concepts, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to start of construction.

UNIFORMITY OF CONDITIONS

The recommendations and opinions expressed in this report reflect our best estimate of the project requirements based on an evaluation of the subsurface soil conditions encountered at the subsurface exploration locations and on the assumption that the soil conditions do not deviate appreciably from those encountered. It should be recognized that the performance of the foundations and/or cut and fill slopes may be influenced by undisclosed or unforeseen variations in the soil conditions that may occur in the intermediate and unexplored areas. Any unusual conditions not covered in this report that may be encountered during site development should be brought to the attention of the geotechnical engineer so that he may make modifications if necessary.

CHANGE IN SCOPE

This office should be advised of any changes in the project scope or proposed site grading so that we may determine if the recommendations contained herein are appropriate. This should be verified in writing or modified by a written addendum.

TIME LIMITATIONS

The findings of this report are valid as of this date. Changes in the condition of a property can, however, occur with the passage of time, whether they be due to natural processes or the work of man on this or adjacent properties. In addition, changes in the Standards-of-Practice and/or Government Codes may occur. Due to such changes, the findings of this report may be invalidated wholly or in part by changes beyond our control. Therefore, this report should not be relied upon after a period of two years without a review by us verifying the suitability of the conclusions and recommendations.

PROFESSIONAL STANDARD

In the performance of our professional services, we comply with that level of care and skill ordinarily exercised by members of our profession currently practicing under similar conditions and in the same locality. The client recognizes that subsurface conditions may vary from those encountered at the locations where our borings, surveys, and explorations are made, and that our data, interpretations, and recommendations be based solely on the information obtained by us. We will be responsible for those data, interpretations, and recommendations, but shall not be responsible for the interpretations by others of the information developed. Our services consist of professional consultation and observation only, and no warranty of any kind whatsoever, express or implied, is made or intended in connection with the work performed or to be performed by us, or by our proposal for consulting or other services, or by our furnishing of oral or written reports or findings.

CLIENT'S RESPONSIBILITY

It is the responsibility of the Client, or its representatives, to ensure that the information and recommendations contained herein are brought to the attention of the structural engineer and architect for the project and incorporated into the project's plans and specifications. It is further their responsibility to take the necessary measures to ensure that the contractor and his subcontractors carry out such recommendations during construction.

FIELD EXPLORATIONS

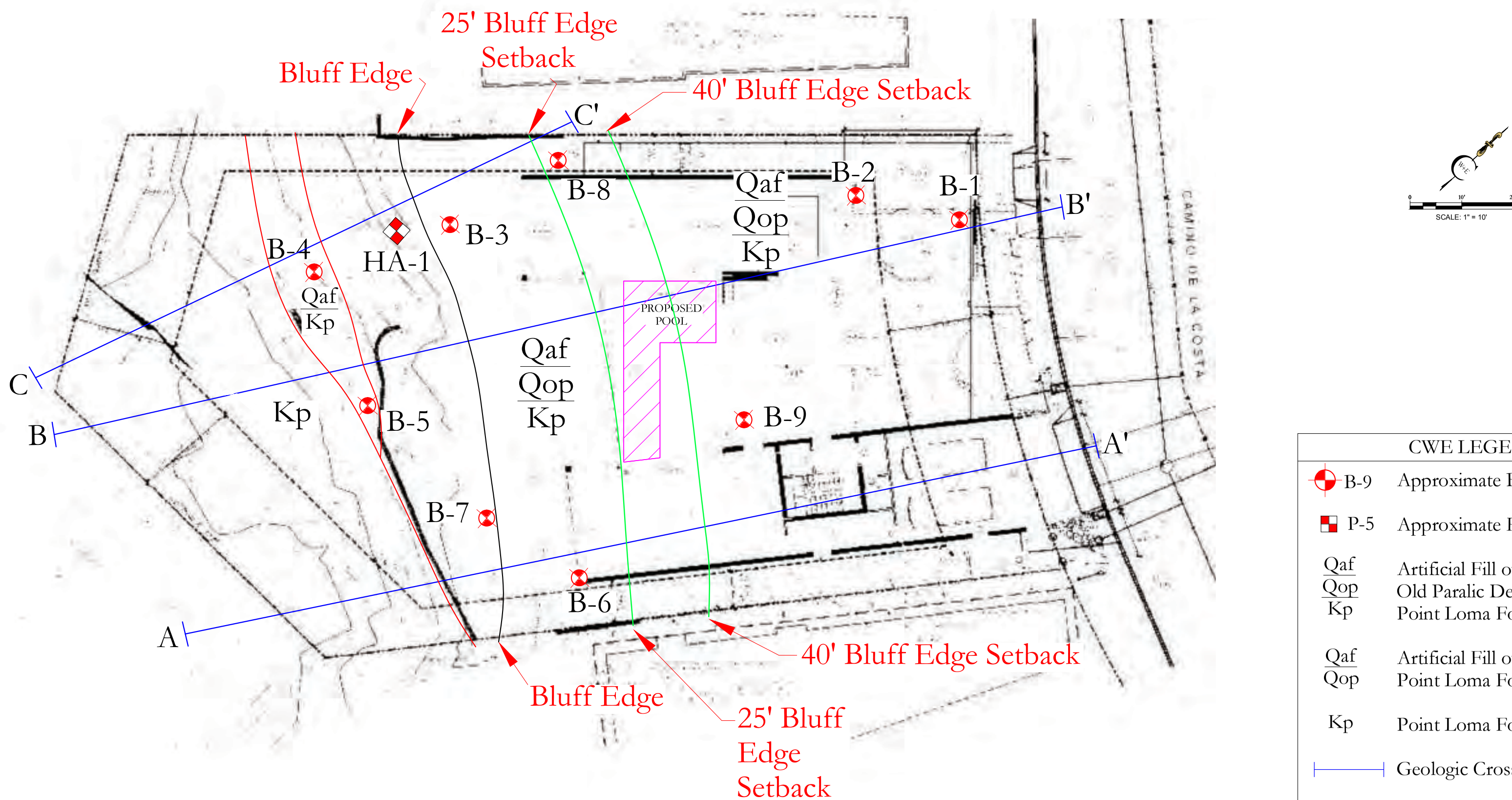
Nine subsurface explorations were made between April 6 and April 18, 2022 at the locations indicated on the Site Plan and Geotechnical Map included herewith as Plate No. 1. These explorations consisted of 2 borings drilled utilizing a truck mounted drill rig, 6 borings drilled with a limited access, tripod mounted drill rig, and 1 hand augur excavation. The fieldwork was conducted under the observation and direction of our engineering geology personnel.

The explorations were carefully logged when made. The subsurface exploration logs are presented on Appendix A. The soils are described in accordance with the Unified Soils Classification. In addition, a verbal textural description, the wet color, the apparent moisture, and the density or consistency is provided. The density of granular soils is given as very loose, loose, medium dense, dense or very dense. The consistency of silts or clays is given as either very soft, soft, medium stiff, stiff, very stiff, or hard.

Relatively undisturbed drive samples were collected using a modified California sampler. The sampler, with an external diameter of 3.0 inches, is lined with 1-inch long, thin, brass rings with inside diameters of approximately 2.4 inches. The sample barrel was driven into the ground with the weight of a 140-pound hammer falling 30 inches in general accordance with ASTM D 3550-84. The driving weight is permitted to fall freely. The number of blows per foot of driving, or as indicated, are presented on the boring logs as an index to the relative resistance of the sampled materials. The samples were removed from the sample barrel in the brass rings, and sealed. Relatively undisturbed chunk samples and bulk samples of the earth materials encountered were also collected. Samples were transported to our laboratory for testing.

LABORATORY TESTING

Laboratory tests were performed in accordance with the generally accepted American Society for Testing and Materials (ASTM) test methods or suggested procedures. A brief description of the tests performed and the subsequent results are presented in Appendix B.



CWE LEGEND

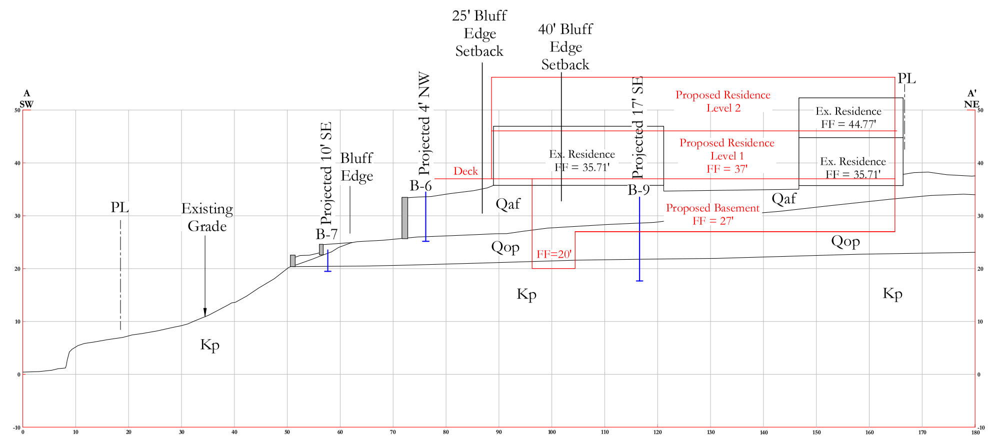
B-9	Approximate Boring Location
P-5	Approximate Hand Auger Location
Qaf / Qop / Kp	Artificial Fill over Old Paralic Deposits over Point Loma Formation
Qaf / Qop	Artificial Fill over Point Loma Formation
Kp	Point Loma Formation
	Geologic Cross Section
? ?	Geologic Contact (Queried where Inferred)

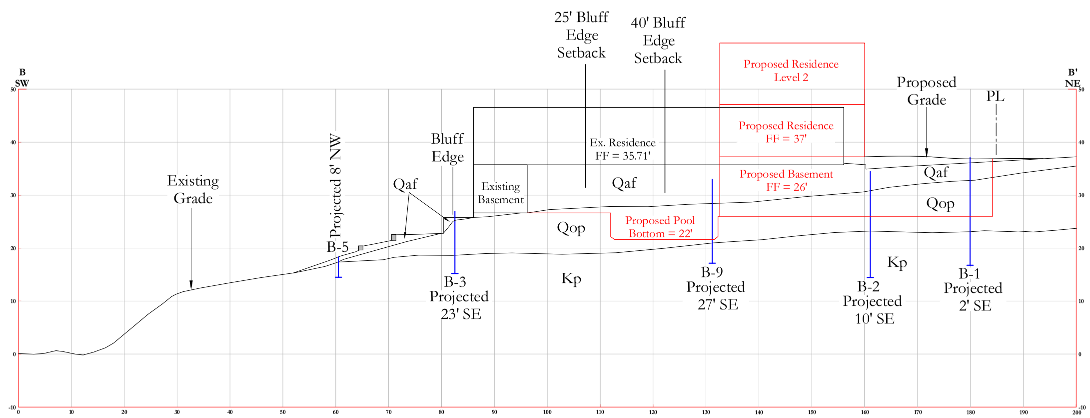
SITE PLAN AND GEOLOGIC MAP

PROPOSED SINGLE-FAMILY RESIDENCE
6110 CAMINO DE LA COSTA
LA JOLLA, CALIFORNIA

DATE:	JULY 2022	JOB NO.:	2220191.01
BY:	SD	PLATE NO.:	1

CHRISTIAN WHEELER ENGINEERING





SCALE: 1" = 10'

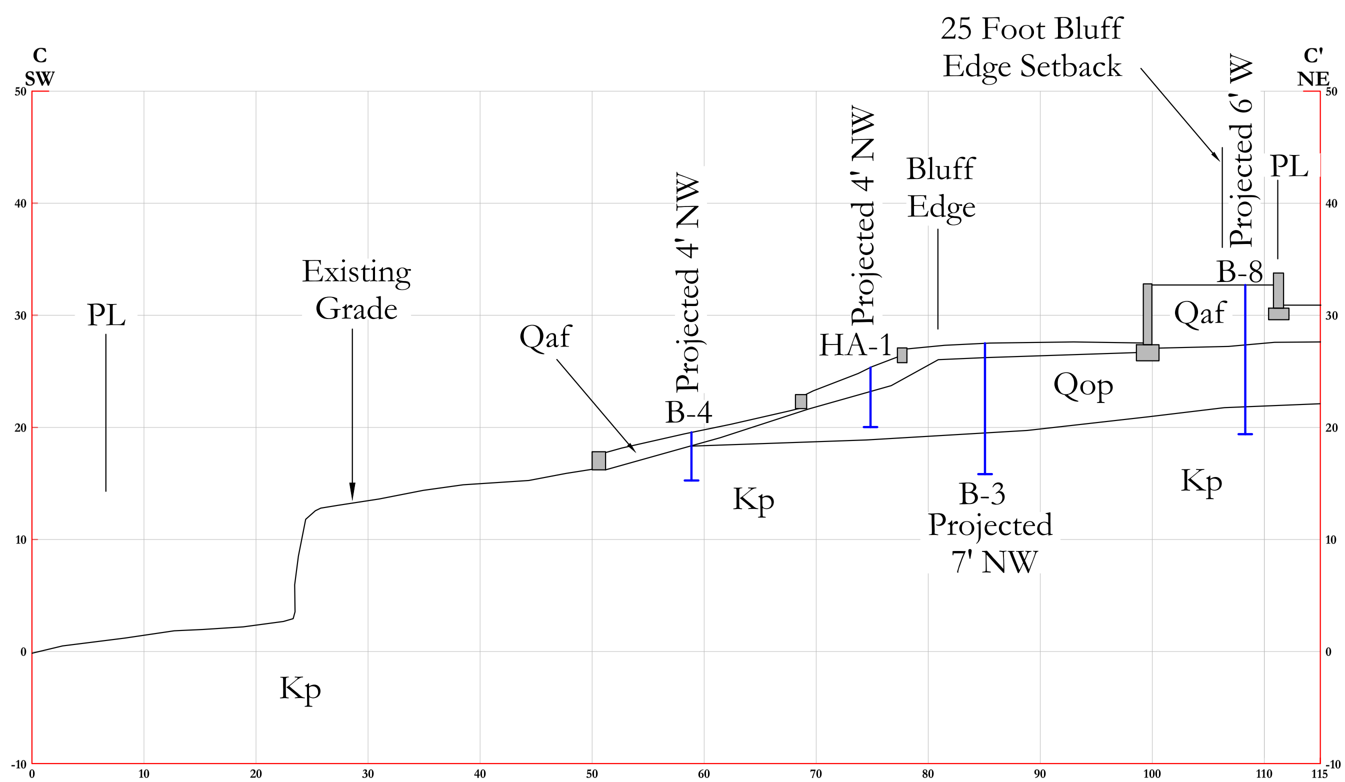
CWE LEGEND	
Qaf	Artificial Fill
Qop	Old Paralic Deposits
Kp	Point Loma Formation

GEOLOGIC CROSS SECTIONS
A-A' AND B-B'

PROPOSED SINGLE-FAMILY RESIDENCE
6110 CAMINO DE LA COSTA
LA JOLLA, CALIFORNIA

DATE:	JULY 2022	JOB NO.:	2220191.01
BY:	SD	PLATE NO.:	2

CHRISTIAN WHEELER
ENGINEERING

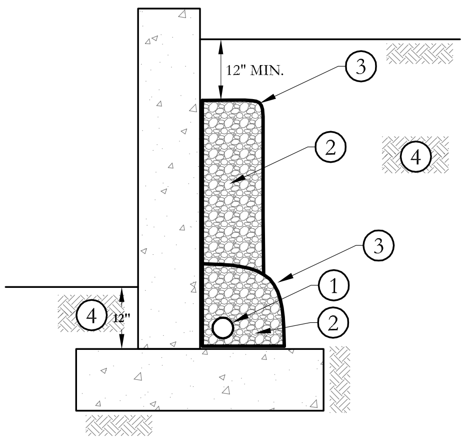


CWE LEGEND	
Qaf	Artificial Fill
Qop	Old Paralic Deposits
Kp	Point Loma Formation

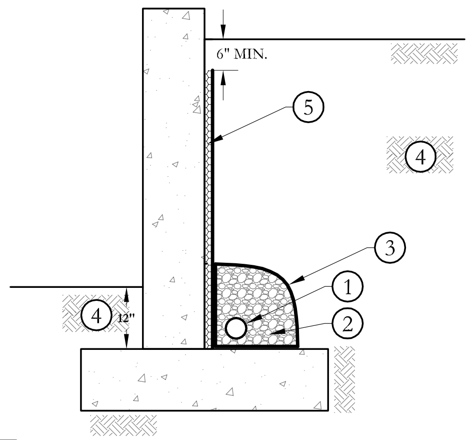
GEOLOGIC CROSS SECTION C-C'

PROPOSED SINGLE-FAMILY RESIDENCE 6110 CAMINO DE LA COSTA LA JOLLA, CALIFORNIA			
DATE:	JULY 2022	JOB NO.:	2220191.01
BY:	SD	PLATE NO.:	3

CHRISTIAN WHEELER
ENGINEERING



1 DETAIL



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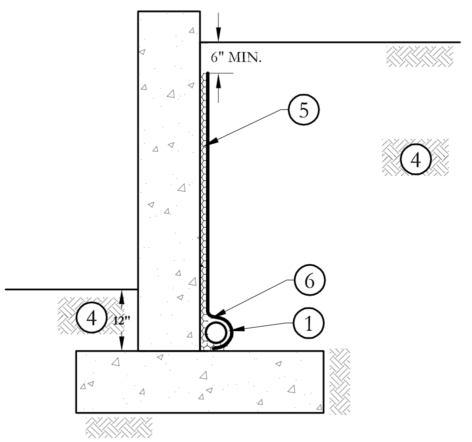

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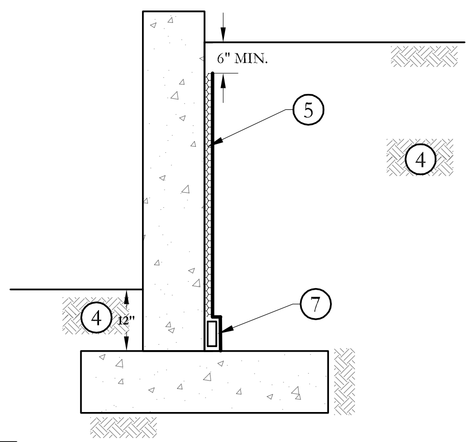

4 DETAIL

NOTES AND DETAILS

GENERAL NOTES:

1) THE NEED FOR WATERPROOFING SHOULD BE EVALUATED BY OTHERS.
2) WATERPROOFING TO BE DESIGNED BY OTHERS (CWE CAN PROVIDE A DESIGN IF REQUESTED).
3) EXTEND DRAIN TO SUITABLE DISCHARGE POINT PER CIVIL ENGINEER.
4) DO NOT CONNECT SURFACE DRAINS TO SUBDRAIN SYSTEM.

DETAILS:

(1) 4-INCH PERFORATED PVC PIPE ON TOP OF FOOTING, HOLES POSITIONED DOWNWARD (SDR 35, SCHEDULE 40, OR EQUIVALENT).

(2) ¾ INCH OPEN-GRADED CRUSHED AGGREGATE.

(3) GEOFABRIC WRAPPED COMPLETELY AROUND ROCK.

(4) PROPERLY COMPACTED BACKFILL SOIL.

(5) WALL DRAINAGE PANELS (MIRADRAIN OR EQUIVALENT) PLACED PER MANUFACTURER'S REC'S.

(6) UNDERLAY SUBDRAIN WITH AND CUT FABRIC BACK FROM DRAINAGE PANELS AND WRAP FABRIC AROUND PIPE.

(7) COLLECTION DRAIN (TOTAL DRAIN OR EQUIVALENT) LOCATED AT BASE OF WALL DRAINAGE PANEL PER MANUFACTURER'S RECOMMENDATIONS.

CANTILEVER RETAINING WALL DRAINAGE SYSTEMS	**PROPOSED SINGLE-FAMILY RESIDENCE** **6110 CAMINO DE LA COSTA** **LA JOLLA, CALIFORNIA**		CHRISTIAN WHEELER ENGINEERING
	DATE: JULY 2022	JOB NO.: 2220191.01	
	BY: MAH	PLATE NO.: 4	

Appendix A

Subsurface Explorations

LOG OF TEST BORING B-1

Date Logged:	4/6/22	Equipment:	IR A-300
Logged By:	JG	Auger Type:	6 inch Hollow Stem
Existing Elevation:	±36'	Drive Type:	140lbs/30 inches
Proposed Elevation:	N/A	Depth to Water:	Unknown

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0				3" concrete over 2" gravel.							
			SM	**Artificial Fill (Qaf):** Dark brown, moist, loose to medium dense, fine- to medium-grained, SILTY SAND with some gravel.							
5			SM	**Old Paralic Deposits (Qop):** Light reddish-brown, moist, medium dense, fine-grained, SILTY SAND, some roots, micaceous.							
					32	Cal		11.0	115.8		DS
10					45	Cal		5.7	114.1		SD
			SP-SM	Light grayish-brown, moist, dense, fine- to medium-grained, slightly SILTY SAND.							
			SM	**Point Loma Formation (Kp):** Light brown, moist, very dense, fine-grained, SILTY SAND, micaceous.							
15			SP	Light gray, moist, very dense, fine- to medium-grained, SAND, micaceous.							
					50/3.5"	Cal		14.2	114.5		SD
			SC	Yellowish-gray, moist, very dense, CLAYEY SAND.	50/3"	Cal		12.3	107.2		SD
20				Boring terminated at 19 feet. No groundwater or seepage encountered.							
25											
30											

Notes:

Symbol Legend

▽	Groundwater Level During Drilling
▼	Groundwater Level After Drilling
❞	Apparent Seepage
*	No Sample Recovery
**	Non-Representative Blow Count (rocks present)

PROPOSED SINGLE-FAMILY RESIDENCE
6110 CAMINO DE LA COSTA
LA JOLLA, CALIFORNIA

DATE:	JULY 2022	JOB NO.:	2220191.01
BY:	SD	APPENDIX:	A-1

CHRISTIAN WHEELER ENGINEERING

LOG OF TEST BORING B-2

Date Logged:	4/6/22	Equipment:	IR A-300
Logged By:	JG	Auger Type:	6 inch Hollow Stem
Existing Elevation:	±34.5'	Drive Type:	140lbs/30 inches
Proposed Elevation:	N/A	Depth to Water:	Unknown

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0				3" concrete over 2" gravel.							
			SM	**Artificial Fill (Qaf):** Dark brown, moist, loose, fine- to medium-grained, SILTY SAND with some roots.							
			SM	**Old Paralic Deposits (Qop):** Dark brown, moist, medium dense to dens, fine- to medium-grained, SILTY SAND, few small roots.							
5											
					51	Cal					
10			SP	Light brown to grayish-brown, moist, dense, fine- to medium-grained, SAND.							
					49	Cal		2.6	106.4		SD
			SM	**Point Loma Formation (Kp):** Light brown to grayish-brown, moist, dense to very dense, SILTY SAND.							
15			SP	Light gray, moist, very dense, fine- to medium grained, SAND, micaceous.	50/5"	Cal					
				Yellowish-gray, moist.	50/3"	Cal*					
				Boring terminated at 19 feet. No groundwater or seepage encountered.							
20											
25											
30											

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

PROPOSED SINGLE-FAMILY RESIDENCE
6110 CAMINO DE LA COSTA
LA JOLLA, CALIFORNIA

DATE:	JULY 2022	JOB NO.:	2220191.01
BY:	SD	APPENDIX:	A-2

CHRISTIAN WHEELER
ENGINEERING

LOG OF TEST BORING B-3

Date Logged:	4/18/22	Equipment:	Beaver
Logged By:	DRR	Auger Type:	6 inch Hollow Stem
Existing Elevation:	27½'	Drive Type:	140lbs/30 inches
Proposed Elevation:	N/A	Depth to Water:	Unknown

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			SM	**Artificial Fill (Qaf):** Medium brown, damp, loose, fine- to medium-grained, SILTY SAND.							
			SM	**Old Paralic Deposits (Qop):** Medium brown, damp, dense to very dense, fine- to medium-grained, SILTY SAND.	50/6"	Cal			5.5	113.6	SA MD SO4 CP
5					50/6"	SPT					
			SM	**Point Loma Formation (Kp):** Yellowish-brown, moist, very dense, fine- to medium-grained, SILTY SAND, micaceous.							
10					50/6"	Cal			10.3	101.3	SD
				Boring terminated at 11.5 feet. No groundwater or seepage encountered.							
15											
20											
25											
30											

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

PROPOSED SINGLE-FAMILY RESIDENCE
6110 CAMINO DE LA COSTA
LA JOLLA, CALIFORNIA

DATE:	JULY 2022	JOB NO.:	2220191.01
BY:	SD	APPENDIX:	A-3

CHRISTIAN WHEELER ENGINEERING

LOG OF TEST BORING B-4

Date Logged:	4/18/22	Equipment:	Beaver
Logged By:	ACC	Auger Type:	6 inch Hollow Stem
Existing Elevation:	20'	Drive Type:	140lbs/30 inches
Proposed Elevation:	N/A	Depth to Water:	Unknown

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			SM	**Artificial Fill (Qaf):** Medium brown, damp, loose, fine- to medium-grained, SILTY SAND, trace organics.							
			SM	**Point Loma Formation (Kp):** Yellowish-brown, damp, very dense, fine- to medium-grained, SILTY SAND, micaceous.	50/5"	Cal		12.0	111.0		DS
					50/6"	Cal		9.7	99.4		SD
5				Boring terminated at 4.5 feet. No groundwater or seepage encountered.							
10											
15											
20											
25											
30											

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- ❞ Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

PROPOSED SINGLE-FAMILY RESIDENCE
6110 CAMINO DE LA COSTA
LA JOLLA, CALIFORNIA

DATE:	JULY 2022	JOB NO.:	2220191.01
BY:	SD	APPENDIX:	A-4

CHRISTIAN WHEELER ENGINEERING

LOG OF TEST BORING B-5

Date Logged:	4/18/22	Equipment:	Beaver
Logged By:	ACC	Auger Type:	6 inch Hollow Stem
Existing Elevation:	19.5'	Drive Type:	140lbs/30 inches
Proposed Elevation:	N/A	Depth to Water:	Unknown

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			SM	**Artificial Fill (Qaf):** Medium brown, damp, loose, fine- to medium-grained, SILTY SAND, trace gravel and trace organics.							
			SM	**Point Loma Formation (Kp):** Yellowish-brown, damp, very dense, fine- to medium-grained, SILTY SAND, micaceous.	50/6"	Cal		11.6	119.7		DS SO4
5				Boring terminated at 4 feet. No groundwater or seepage encountered.							
10											
15											
20											
25											
30											

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

PROPOSED SINGLE-FAMILY RESIDENCE
6110 CAMINO DE LA COSTA
LA JOLLA, CALIFORNIA

DATE:	JULY 2022	JOB NO.:	2220191.01
BY:	SD	APPENDIX:	A-5

CHRISTIAN WHEELER ENGINEERING

LOG OF TEST BORING B-6

Date Logged:	4/18/22	Equipment:	Beaver
Logged By:	ACC	Auger Type:	6 inch Hollow Stem
Existing Elevation:	34'	Drive Type:	140lbs/30 inches
Proposed Elevation:	N/A	Depth to Water:	Unknown

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			SM	**Artificial Fill (Qaf):** Medium brown, damp, loose to medium dense, very fine- to medium-grained, SILTY SAND.							SA
					17	Cal					
5			SC	Dark brown, moist, medium dense, fine- to medium-grained, CLAYEY SAND.							
					28	Cal		6.9	119.1		SD
			SM	**Old Paralic Deposits (Qop):** Reddish-brown, damp, very dense, fine- to medium-grained, SILTY SAND.	50/5"	Cal		7.6	105.8		SD
10				Boring terminated at 9.5 feet. No groundwater or seepage encountered.							
15											
20											
25											
30											

Notes:

Symbol Legend

- Groundwater Level During Drilling
- Groundwater Level After Drilling
- Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

PROPOSED SINGLE-FAMILY RESIDENCE
6110 CAMINO DE LA COSTA
LA JOLLA, CALIFORNIA

DATE:	JULY 2022	JOB NO.:	2220191.01
BY:	SD	APPENDIX:	A-6

CHRISTIAN WHEELER ENGINEERING

LOG OF TEST BORING B-7

Date Logged:	4/18/22	Equipment:	Beaver
Logged By:	ACC	Auger Type:	6 inch Hollow Stem
Existing Elevation:	25'	Drive Type:	140lbs/30 inches
Proposed Elevation:	N/A	Depth to Water:	Unknown

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			SM	**Artificial Fill (Qaf):** Medium brown, damp, very loose, fine- to medium-grained, SILTY SAND.							
			SM	**Old Paralic Deposits (Qop):** Reddish-brown, damp, medium dense, fine- to medium-grained, SILTY SAND.	26	Cal					
			SM	**Point Loma Formation (Kp):** Yellowish-brown to grayish-brown, damp, very dense, fine- to medium-grained, SILTY SAND, micaceous.	50/6"	Cal		10.8	105.4		SD
5				Boring terminated at 4 feet. No groundwater or seepage encountered.							
10											
15											
20											
25											
30											

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

PROPOSED SINGLE-FAMILY RESIDENCE
6110 CAMINO DE LA COSTA
LA JOLLA, CALIFORNIA

DATE:	JULY 2022	JOB NO.:	2220191.01
BY:	SD	APPENDIX:	A-7

CHRISTIAN WHEELER ENGINEERING

LOG OF TEST BORING B-8

Date Logged:	4/18/22	Equipment:	Beaver
Logged By:	ACC	Auger Type:	6 inch Hollow Stem
Existing Elevation:	33'	Drive Type:	140lbs/30 inches
Proposed Elevation:	N/A	Depth to Water:	Unknown

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			SM	**Artificial Fill (Qaf):** Medium brown, damp, very loose, fine- to medium-grained, SILTY SAND, trace organics.							
				Reddish-brown, medium dense.	67**	Cal	X				SA MD
5			SM	**Old Paralic Deposits (Qop):** Grayish-brown to dark brown, damp, medium dense, fine- to medium-grained, SILTY SAND.	23	Cal	X	7.0	119.5		DS SA MD
				Reddish-brown, dense.	48	Cal		4.8	122.4		SD
10			SM	**Point Loma Formation (Kp):** Yellowish-brown, damp, very dense, fine- to medium-grained, SILTY SAND, micaceous.	50/3"	Cal					
				Boring terminated at 13 feet. No groundwater or seepage encountered.							
15											
20											
25											
30											

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

PROPOSED SINGLE-FAMILY RESIDENCE
6110 CAMINO DE LA COSTA
LA JOLLA, CALIFORNIA

DATE:	JULY 2022	JOB NO.:	2220191.01
BY:	SD	APPENDIX:	A-8

CHRISTIAN WHEELER ENGINEERING

LOG OF TEST BORING B-9

Sample Type and Laboratory Test Legend

Cal Modified California Sampler; SPT Standard Penetration Test; ST Shelby Tube; CK Chunk; DR Drive Ring

MD Max Density; SO4 Soluble Sulfates; SA Sieve Analysis; HA Hydrometer; SE Sand Equivalent; PI Plasticity Index; CP Collapse Potential; DS Direct Shear; Con Consolidation; EI Expansion Index; R-Val Resistance Value; Chl Soluble Chlorides; Res pH & Resistivity; SD Sample Density

Date Logged:	4/18/22	Equipment:	Beaver
Logged By:	ACC	Auger Type:	6 inch Hollow Stem
Existing Elevation:	34'	Drive Type:	140lbs/30 inches
Proposed Elevation:	N/A	Depth to Water:	Unknown

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			SM	**Artificial Fill (Qaf):** Medium brown, damp, loose, fine- to medium-grained, SILTY SAND.							
					17	Cal		13.3	94.8		SD
5			SM	**Old Paralic Deposits (Qop):** Dark brown, damp, dense, fine- to medium-grained, SILTY SAND.	36	Cal		8.3	120.7		CP
				Reddish-brown.	38	Cal					CP
10											
			SM	**Point Loma Formation (Kp):** Yellowish-brown, damp, very dense, fine- to medium-grained, SILTY SAND, micaceous.	50/2"	SPT*					
15					50/4"	Cal		13.2	107.5		SD
				Boring terminated at 16 feet. No groundwater or seepage encountered.							
20											
25											
30											

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

PROPOSED SINGLE-FAMILY RESIDENCE
6110 CAMINO DE LA COSTA
LA JOLLA, CALIFORNIA

DATE:	JULY 2022	JOB NO.:	2220191.01
BY:	SD	APPENDIX:	A-9

CHRISTIAN WHEELER ENGINEERING

LOG OF HAND AUGER HA-1

Date Logged:	4/18/22	Equipment:	Hand tools
Logged By:	ACC	Auger Type:	N/A
Existing Elevation:	26'	Drive Type:	N/A
Proposed Elevation:	N/A	Depth to Water:	Unknown

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			SM	**Artificial Fill (Qaf):** Dark brown, dry, loose, fine- to medium-grained, SILTY SAND with trace gravel.							
			SM	**Old Paralic Deposits (Qop):** Reddish-brown, damp, dense to very dense, fine- to medium-grained, SILTY SAND.							
5				Terminated at 5 feet. No groundwater or seepage encountered.							
10											
15											
20											
25											
30											

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

PROPOSED SINGLE-FAMILY RESIDENCE
6110 CAMINO DE LA COSTA
LA JOLLA, CALIFORNIA

DATE:	JULY 2022	JOB NO.:	2220191.01
BY:	SD	APPENDIX:	A-10

CHRISTIAN WHEELER ENGINEERING

Appendix B

Laboratory Test Results

Laboratory tests were performed in accordance with the generally accepted American Society for Testing and Materials (ASTM) test methods or suggested procedures. Brief descriptions of the tests performed are presented below:

a) **CLASSIFICATION:** Field classifications were verified in the laboratory by visual examination. The final soil classifications are in accordance with the Unified Soil Classification System and are presented on the exploration logs in Appendix A.

b) **MOISTURE-DENSITY: MOISTURE-DENSITY:** In-place moisture contents and dry densities were determined for selected soil samples in accordance with ATM D 1188 and 2937. The results are summarized in the boring logs presented in Appendix A.

c) **MAXIMUM DRY DENSITY AND OPTIUM MOISTURE CONTENT TEST:** The maximum dry density and optimum moisture content of selected soil samples were determined in the laboratory in accordance with ASTM D 1557, Method A.

d) **DIRECT SHEAR:** Direct shear tests were performed on selected samples of the on-site soils in accordance with ASTM D 3080.

e) **COLLAPSE POTENTIAL:** Collapse potential test were performed on selected undisturbed soil samples in accordance with ASTM D 5333.

f) **GRAIN SIZE DISTRIBUTION:** The grain size distribution of selected soil samples was determined in accordance with ASTM C136 and/or ASTM D422.

g) **SOLUBLE SULFATES:** The soluble sulfate content of selected soil samples was determined in accordance with California Test Method 417.

LABORATORY TEST RESULTS

PROPOSED SINGLE-FAMILY RESIDENCE

6110 CAMINO DE LA COSTA

LA JOLLA, CALIFORNIA

MAXIMUM DRY DENSITY AND OPTIMUM MOISTURE CONTENT (ASTM D1557)

Sample Location	**Boring B-8 @ 1'-4'**	**Boring B-8 @ 1'-5'**	**Boring B-8 @ 5'-8'**
Sample Description	Reddish-Brown, Silty Sand (SM)	Brown, Silty Sand (SM)	Dark Brown, Silty Sand (SM)
Maximum Density	119.3 pcf	115.2 pcf	129.8 pcf
Optimum Moisture	11.7 %	12.0 %	8.2 %

DIRECT SHEAR (ASTM D3080)

Sample Location	**Boring B-1 @ 6½'**	**Boring B-4 @ 2½'**	**Boring B-5 @ 2'**
Sample Type	Relatively Undisturbed	Relatively Undisturbed	Relatively Undisturbed
Friction Angle	34°	36°	35°
Cohesion	450 psf	950 psf	1,050 psf

GRAIN SIZE DISTRIBUTION (ASTM D422)

Sample Location	**Boring B-3 @ 1'-4'**	**Boring B-6 @ 1'-4'**	**Boring B-8 @ 1-5'**	**Boring B-8 @ 5'-8'**
Sieve Size	*Percent Passing*	*Percent Passing*	*Percent Passing*	*Percent Passing*
2"			100	
1½"			99	
1"			98	
¾"			98	
½"			97	
⅜"	100		97	
#4	99	100	97	100
#8	97	97	93	99
#16	94	93	88	98
#30	86	87	80	92
#50	65	72	60	69
#100	48	57	44	52
#200	38	43	30	41

SOLUBLE SULFATES (CALIFORNIA TEST 417)

Sample Location	**Boring B-3 @ 1'-4'**	**Boring B-5 @ 1'-4'**
Soluble Sulfate	0.096 % (SO_4)	0.036 % (SO_4)

COLLAPSE POTENTIAL (ASTM D 5333)

Sample Location	**Boring B-3 @ 5'**	**Boring B-9 @ 5½'**	**Boring B-9 @ 9½'**
Initial Moisture Content	5.5 %	8.3 %	7.3 %
Initial Density	113.6 pcf	120.7 pcf	127.3 pcf
Consolidation Before Water Added	1.8 %	2.0 %	1.2 %
Consolidation After Water Added	7.9 %	3.0 %	2.0 %
Final Moisture	13.4 %	13.8 %	10.2 %

Appendix C

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Appendix D

Recommended Grading Specifications – General Provisions

RECOMMENDED GRADING SPECIFICATIONS - GENERAL PROVISIONS

PROPOSED SINGLE-FAMILY RESIDENCE
6110 CAMINO DE LA COSTA
LA JOLLA, CALIFORNIA

GENERAL INTENT

The intent of these specifications is to establish procedures for clearing, compacting natural ground, preparing areas to be filled, and placing and compacting fill soils to the lines and grades shown on the accepted plans. The recommendations contained in the preliminary geotechnical investigation report and/or the attached Special Provisions are a part of the Recommended Grading Specifications and shall supersede the provisions contained hereinafter in the case of conflict. These specifications shall only be used in conjunction with the geotechnical report for which they are a part. No deviation from these specifications will be allowed, except where specified in the geotechnical report or in other written communication signed by the Geotechnical Engineer.

OBSERVATION AND TESTING

Christian Wheeler Engineering shall be retained as the Geotechnical Engineer to observe and test the earthwork in accordance with these specifications. It will be necessary that the Geotechnical Engineer or his representative provide adequate observation so that he may provide his opinion as to whether or not the work was accomplished as specified. It shall be the responsibility of the contractor to assist the Geotechnical Engineer and to keep him appraised of work schedules, changes and new information and data so that he may provide these opinions. In the event that any unusual conditions not covered by the special provisions or preliminary geotechnical report are encountered during the grading operations, the Geotechnical Engineer shall be contacted for further recommendations.

If, in the opinion of the Geotechnical Engineer, substandard conditions are encountered, such as questionable or unsuitable soil, unacceptable moisture content, inadequate compaction, adverse weather, etc., construction should be stopped until the conditions are remedied or corrected or he shall recommend rejection of this work.

Tests used to determine the degree of compaction should be performed in accordance with the following American Society for Testing and Materials test methods:

Maximum Density & Optimum Moisture Content - ASTM D1557
Density of Soil In-Place - ASTM D1556 or ASTM D6938

All densities shall be expressed in terms of Relative Compaction as determined by the foregoing ASTM testing procedures.

PREPARATION OF AREAS TO RECEIVE FILL

All vegetation, brush and debris derived from clearing operations shall be removed, and legally disposed of. All areas disturbed by site grading should be left in a neat and finished appearance, free from unsightly debris.

After clearing or benching the natural ground, the areas to be filled shall be scarified to a depth of 6 inches, brought to the proper moisture content, compacted and tested for the specified minimum degree of compaction. All loose soils in excess of 6 inches thick should be removed to firm natural ground which is defined as natural soil which possesses an in-situ density of at least 90 percent of its maximum dry density.

When the slope of the natural ground receiving fill exceeds 20 percent (5 horizontal units to 1 vertical unit), the original ground shall be stepped or benched. Benches shall be cut to a firm competent formational soil. The lower bench shall be at least 10 feet wide or 1-1/2 times the equipment width, whichever is greater, and shall be sloped back into the hillside at a gradient of not less than two (2) percent. All other benches should be at least 6 feet wide. The horizontal portion of each bench shall be compacted prior to receiving fill as specified herein for compacted natural ground. Ground slopes flatter than 20 percent shall be benched when considered necessary by the Geotechnical Engineer.

Any abandoned buried structures encountered during grading operations must be totally removed. All underground utilities to be abandoned beneath any proposed structure should be removed from within 10 feet of the structure and properly capped off. The resulting depressions from the above described procedure should be backfilled with acceptable soil that is compacted to the requirements of the Geotechnical Engineer. This includes, but is not limited to, septic tanks, fuel tanks, sewer lines or leach lines, storm drains and water lines. Any buried structures or utilities not to be abandoned should be brought to the attention of the Geotechnical Engineer so that he may determine if any special recommendation will be necessary.

All water wells which will be abandoned should be backfilled and capped in accordance to the requirements set forth by the Geotechnical Engineer. The top of the cap should be at least 4 feet below finish grade or 3 feet below the bottom of footing whichever is greater. The type of cap will depend on the diameter of the well and should be determined by the Geotechnical Engineer and/or a qualified Structural Engineer.

FILL MATERIAL

Materials to be placed in the fill shall be approved by the Geotechnical Engineer and shall be free of vegetable matter and other deleterious substances. Granular soil shall contain sufficient fine material to fill the voids. The definition and disposition of oversized rocks and expansive or detrimental soils are covered in the geotechnical report or Special Provisions. Expansive soils, soils of poor gradation, or soils with low strength characteristics may be thoroughly mixed with other soils to provide satisfactory fill material, but only with the explicit consent of the Geotechnical Engineer. Any import material shall be approved by the Geotechnical Engineer before being brought to the site.

PLACING AND COMPACTION OF FILL

Approved fill material shall be placed in areas prepared to receive fill in layers not to exceed 6 inches in compacted thickness. Each layer shall have a uniform moisture content in the range that will allow the compaction effort to be efficiently applied to achieve the specified degree of compaction. Each layer shall be uniformly compacted to the specified minimum degree of compaction with equipment of adequate size to economically compact the layer. Compaction equipment should either be specifically designed for soil compaction or of proven reliability. The minimum degree of compaction to be achieved is specified in either the Special Provisions or the recommendations contained in the preliminary geotechnical investigation report. When the structural fill material includes rocks, no rocks will be allowed to nest and all voids must be carefully filled with soil such that the minimum degree of compaction recommended in the Special Provisions is achieved. The maximum size and spacing of rock permitted in structural fills and in non-structural fills is discussed in the geotechnical report, when applicable.

Field observation and compaction tests to estimate the degree of compaction of the fill will be taken by the Geotechnical Engineer or his representative. The location and frequency of the tests shall be at the Geotechnical Engineer's discretion. When the compaction test indicates that a particular layer is at less than the required degree of compaction, the layer shall be reworked to the satisfaction of the Geotechnical Engineer and until the desired relative compaction has been obtained.

Fill slopes shall be compacted by means of sheepsfoot rollers or other suitable equipment. Compaction by sheepsfoot roller shall be at vertical intervals of not greater than four feet. In addition, fill slopes at a ratio of two horizontal to one vertical or flatter, should be trackrolled. Steeper fill slopes shall be over-built and cut-back to finish contours after the slope has been constructed. Slope compaction operations shall result in all fill material six or more inches inward from the finished face of the slope having a relative compaction of at least 90 percent of maximum dry density or the degree of compaction specified in the Special Provisions section of this specification. The compaction operation on the slopes shall be continued until the Geotechnical Engineer is of the opinion that the slopes will be surficially stable.

Density tests in the slopes will be made by the Geotechnical Engineer during construction of the slopes to determine if the required compaction is being achieved. Where failing tests occur or other field problems arise, the Contractor will be notified that day of such conditions by written communication from the Geotechnical Engineer or his representative in the form of a daily field report.

If the method of achieving the required slope compaction selected by the Contractor fails to produce the necessary results, the Contractor shall rework or rebuild such slopes until the required degree of compaction is obtained, at no cost to the Owner or Geotechnical Engineer.

CUT SLOPES

The Engineering Geologist shall inspect cut slopes excavated in rock or lithified formational material during the grading operations at intervals determined at his discretion. If any conditions not anticipated in the preliminary report such as perched water, seepage, lenticular or confined strata of a potentially adverse nature, unfavorably inclined bedding, joints or fault planes are encountered during grading, these conditions shall be analyzed by the Engineering Geologist and Geotechnical Engineer to determine if mitigating measures are necessary.

Unless otherwise specified in the geotechnical report, no cut slopes shall be excavated higher or steeper than that allowed by the ordinances of the controlling governmental agency.

ENGINEERING OBSERVATION

Field observation by the Geotechnical Engineer or his representative shall be made during the filling and compaction operations so that he can express his opinion regarding the conformance of the grading with acceptable standards of practice. Neither the presence of the Geotechnical Engineer or his representative or the observation and testing shall release the Grading Contractor from his duty to compact all fill material to the specified degree of compaction.

SEASON LIMITS

Fill shall not be placed during unfavorable weather conditions. When work is interrupted by heavy rain, filling operations shall not be resumed until the proper moisture content and density of the fill materials can be achieved. Damaged site conditions resulting from weather or acts of God shall be repaired before acceptance of work.

RECOMMENDED GRADING SPECIFICATIONS - SPECIAL PROVISIONS

RELATIVE COMPACTION: The minimum degree of compaction to be obtained in compacted natural ground, compacted fill, and compacted backfill shall be at least 90 percent. For street and parking lot subgrade, the upper six inches should be compacted to at least 95 percent relative compaction.

EXPANSIVE SOILS: Detrimentally expansive soil is defined as clayey soil which has an expansion index of 50 or greater when tested in accordance with the Uniform Building Code Standard 29-2.

OVERSIZED MATERIAL: Oversized fill material is generally defined herein as rocks or lumps of soil over 6 inches in diameter. Oversized materials should not be placed in fill unless recommendations of placement of such material are provided by the Geotechnical Engineer. At least 40 percent of the fill soils shall pass through a No. 4 U.S. Standard Sieve.

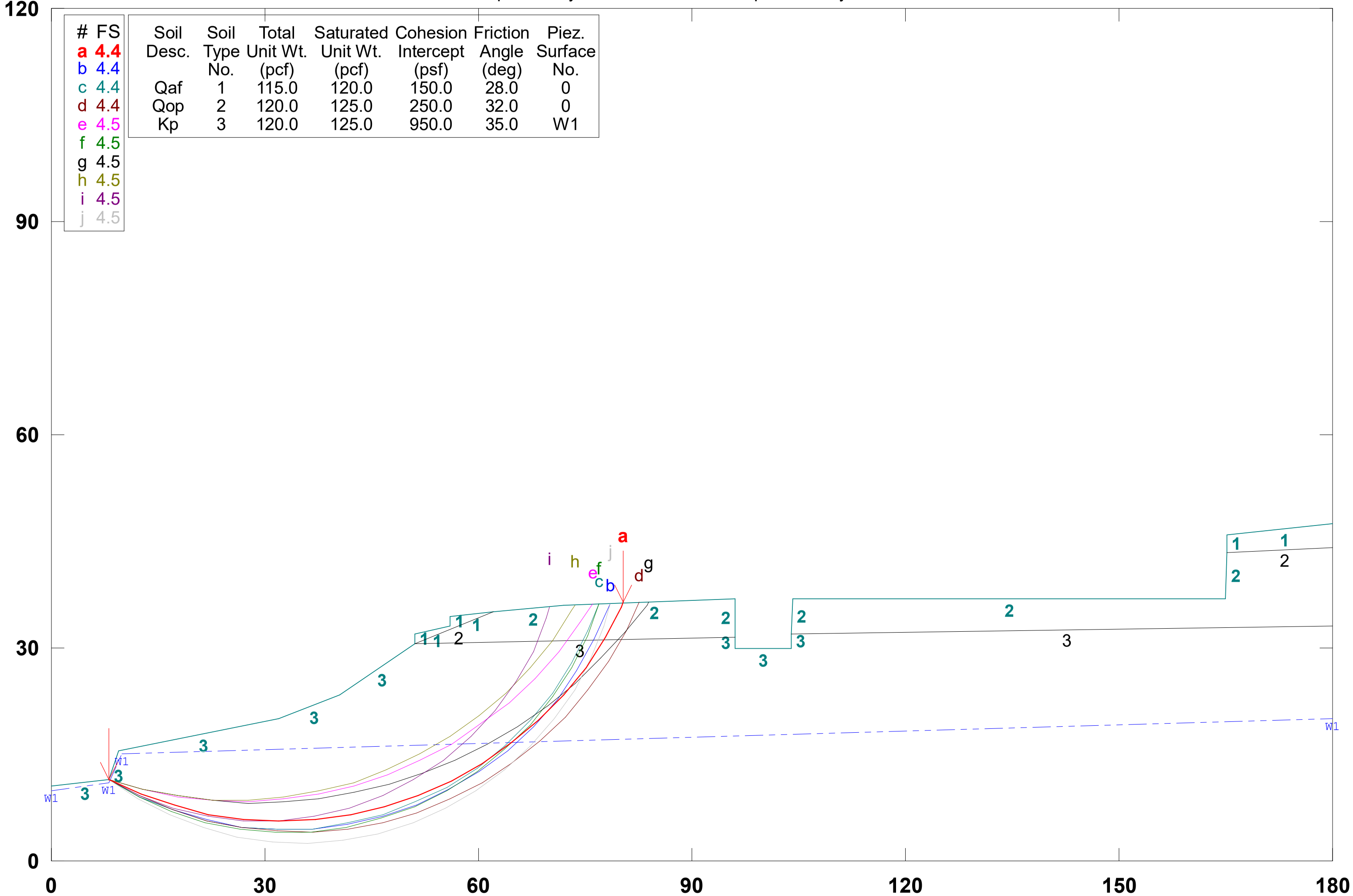
TRANSITION LOTS: Where transitions between cut and fill occur within the proposed building pad, the cut portion should be undercut a minimum of one foot below the base of the proposed footings and recompacted as structural backfill. In certain cases that would be addressed in the geotechnical report, special footing reinforcement or a combination of special footing reinforcement and undercutting may be required.

Appendix E

Results of Bluff Stability Analyses

Proposed SFR - 6110 Camino de La Costa A-A' Static

c:\users\drussell\desktop\sstability 2220191.01\a-a' static.pl2 Run By: DRR 7/14/2022 05:47PM



#	FS
a	4.4
b	4.4
c	4.4
d	4.4
e	4.5
f	4.5
g	4.5
h	4.5
i	4.5
j	4.5

Soil Desc.	Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Piez. Surface No.
Qaf	1	115.0	120.0	150.0	28.0	0
Qop	2	120.0	125.0	250.0	32.0	0
Kp	3	120.0	125.0	950.0	35.0	W1

GSTABL7 v.2 FSmin=4.4

Safety Factors Are Calculated By The Modified Bishop Method

***** GSTABL7 *****

** GSTABL7 by Garry H. Gregory, P.E. **
** Original Version 1.0, January 1996; Current Version 2.003, June 2002 **

****
SLOPE STABILITY ANALYSIS SYSTEM
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
****

Analysis Run Date: 7/14/2022
Time of Run: 05:47PM
Run By: DRR
Input Data Filename: C:\Users\drussell\Desktop\SStability 2220191.01\a-a' static.
in
Output Filename: C:\Users\drussell\Desktop\SStability 2220191.01\a-a' static.
OUT
Unit System: English
Plotted Output Filename: C:\Users\drussell\Desktop\SStabi 2220191.01\a-a' static.PLT

PROBLEM DESCRIPTION: Proposed SFR - 6110 Camino de La Costa
A-A' Static
BOUNDARY COORDINATES
20 Top Boundaries
24 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	10.50	8.00	11.50	3
2	8.00	11.50	9.50	15.50	3
3	9.50	15.50	32.00	20.00	3
4	32.00	20.00	40.50	23.50	3
5	40.50	23.50	51.00	30.50	3
6	51.00	30.50	51.10	32.00	1
7	51.10	32.00	56.00	33.00	1
8	56.00	33.00	56.10	34.50	1
9	56.10	34.50	62.00	35.00	1
10	62.00	35.00	72.00	36.00	2
11	72.00	36.00	96.00	37.00	2
12	96.00	37.00	96.05	31.50	2
13	96.05	31.50	96.10	30.00	3
14	96.10	30.00	104.00	30.00	3
15	104.00	30.00	104.05	32.00	3
16	104.05	32.00	104.10	37.00	2
17	104.10	37.00	165.00	37.00	2
18	165.00	37.00	165.10	43.50	2
19	165.10	43.50	165.20	46.00	1
20	165.20	46.00	180.00	47.50	1
21	165.10	43.50	180.00	44.00	2
22	51.00	30.50	62.00	35.00	2
23	104.05	32.00	180.00	33.00	3
24	51.00	30.50	96.05	31.50	3

Default Y-Origin = 0.00(ft)
Default X-Plus Value = 0.00(ft)
User Specified Y-Plus Value = 10.00(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	115.0	120.0	150.0	28.0	0.00	0.0	0
2	120.0	125.0	250.0	32.0	0.00	0.0	0
3	120.0	125.0	950.0	35.0	0.00	0.0	1

1 PIEZOMETRIC SURFACE(S) SPECIFIED
Unit Weight of Water = 62.40 (pcf)
Piezometric Surface No. 1 Specified by 4 Coordinate Points
Pore Pressure Inclination Factor = 0.50

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	10.00
2	8.00	11.00
3	10.00	15.00
4	180.00	20.00

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.
3000 Trial Surfaces Have Been Generated.
100 Surface(s) Initiate(s) From Each Of 30 Points Equally Spaced
Along The Ground Surface Between X = 8.00(ft)
and X = 38.00(ft)
Each Surface Terminates Between X = 60.00(ft)
and X = 150.00(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 Evaluated = 3000
Statistical Data On All Valid FS Values:
FS Max = 17.980   FS Min = 4.406   FS Ave = 7.299
Standard Deviation = 2.317   Coefficient of Variation = 31.74 %
Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	8.00	11.50
2	12.54	9.41
3	17.26	7.77
4	22.12	6.57
5	27.07	5.84
6	32.06	5.57
7	37.05	5.78
8	42.01	6.46
9	46.88	7.61
10	51.61	9.20
11	56.18	11.24
12	60.53	13.70
13	64.64	16.56
14	68.45	19.79
15	71.94	23.37
16	75.08	27.26
17	77.84	31.43
18	80.20	35.84
19	80.41	36.35

Circle Center At X = 32.34 ; Y = 58.54 ; and Radius = 52.96
Factor of Safety
*** 4.406 ***
Individual data on the 31 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	0.2	7.8	0.0	0.0	0.	0.	0.0	0.0	0.0
2	1.3	420.4	0.0	85.2	0.	0.	0.0	0.0	0.0
3	0.5	296.9	0.0	78.3	0.	0.	0.0	0.0	0.0
4	2.5	1852.0	0.0	879.9	0.	0.	0.0	0.0	0.0
5	4.7	4681.3	0.0	2044.1	0.	0.	0.0	0.0	0.0
6	4.9	6238.7	0.0	2531.5	0.	0.	0.0	0.0	0.0
7	4.9	7537.2	0.0	2877.1	0.	0.	0.0	0.0	0.0
8	4.9	8414.3	0.0	3041.1	0.	0.	0.0	0.0	0.0
9	0.1	104.5	0.0	36.9	0.	0.	0.0	0.0	0.0
10	5.0	9466.8	0.0	3132.1	0.	0.	0.0	0.0	0.0
11	3.4	7103.8	0.0	2131.7	0.	0.	0.0	0.0	0.0
12	1.5	3264.5	0.0	907.5	0.	0.	0.0	0.0	0.0
13	4.9	11370.7	0.0	2800.0	0.	0.	0.0	0.0	0.0
14	4.1	10468.4	0.0	2129.5	0.	0.	0.0	0.0	0.0
15	0.1	270.1	0.0	47.3	0.	0.	0.0	0.0	0.0

16	0.5	1427.5	0.0	239.9	0.	0.	0.0	0.0	0.0
17	4.4	11889.6	0.0	1829.4	0.	0.	0.0	0.0	0.0
18	0.1	272.8	0.0	35.3	0.	0.	0.0	0.0	0.0
19	0.1	223.7	0.0	27.9	0.	0.	0.0	0.0	0.0
20	4.4	11669.8	0.0	1232.6	0.	0.	0.0	0.0	0.0
21	1.5	3663.0	0.0	256.2	0.	0.	0.0	0.0	0.0
22	2.6	6177.9	0.0	186.1	0.	0.	0.0	0.0	0.0
23	0.1	135.5	0.0	0.1	0.	0.	0.0	0.0	0.0
24	3.8	7775.0	0.0	0.0	0.	0.	0.0	0.0	0.0
25	3.5	5969.1	0.0	0.0	0.	0.	0.0	0.0	0.0
26	0.1	85.3	0.0	0.0	0.	0.	0.0	0.0	0.0
27	3.1	3965.2	0.0	0.0	0.	0.	0.0	0.0	0.0
28	2.5	2132.0	0.0	0.0	0.	0.	0.0	0.0	0.0
29	0.2	133.5	0.0	0.0	0.	0.	0.0	0.0	0.0
30	2.4	750.8	0.0	0.0	0.	0.	0.0	0.0	0.0
31	0.2	6.4	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	8.00	11.50
2	12.39	9.11
3	17.01	7.19
4	21.80	5.76
5	26.71	4.83
6	31.69	4.42
7	36.69	4.52
8	41.65	5.15
9	46.52	6.28
10	51.25	7.91
11	55.78	10.03
12	60.07	12.60
13	64.06	15.61
14	67.73	19.01
15	71.02	22.77
16	73.90	26.86
17	76.35	31.22
18	78.32	35.81
19	78.47	36.27

Circle Center At X = 33.18 ; Y = 52.54 ; and Radius = 48.15

Factor of Safety

*** 4.436 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	8.00	11.50
2	12.38	9.09
3	16.99	7.15
4	21.78	5.73
5	26.70	4.82
6	31.68	4.44
7	36.68	4.60
8	41.63	5.29
9	46.48	6.50
10	51.18	8.23
11	55.66	10.45
12	59.87	13.14
13	63.78	16.26
14	67.33	19.78
15	70.49	23.65
16	73.21	27.85
17	75.47	32.31
18	76.94	36.21

Circle Center At X = 32.71 ; Y = 51.10 ; and Radius = 46.67

Factor of Safety

*** 4.443 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	8.00	11.50
2	12.40	9.13

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    3         17.02        7.20
    4         21.79        5.72
    5         26.69        4.71
    6         31.66        4.18
    7         36.66        4.13
    8         41.64        4.57
    9         46.56        5.48
   10         51.36        6.86
   11         56.01        8.70
   12         60.46       10.98
   13         64.67       13.68
   14         68.60       16.77
   15         72.21       20.22
   16         75.48       24.01
   17         78.36       28.10
   18         80.83       32.45
   19         82.62       36.44
Circle Center At X =    34.68 ; Y =    55.84 ; and Radius =    51.75
       Factor of Safety
      ***    4.449   ***
Failure Surface Specified By 17 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1          8.00       11.50
    2         12.80       10.09
    3         17.70        9.09
    4         22.66        8.53
    5         27.66        8.39
    6         32.65        8.69
    7         37.60        9.42
    8         42.46       10.58
    9         47.21       12.15
   10         51.80       14.13
   11         56.21       16.50
   12         60.39       19.24
   13         64.32       22.34
   14         67.96       25.76
   15         71.30       29.48
   16         74.30       33.48
   17         75.97       36.17
Circle Center At X =    26.70 ; Y =    66.08 ; and Radius =    57.69
       Factor of Safety
      ***    4.460   ***
Failure Surface Specified By 18 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1          8.00       11.50
    2         12.33        9.00
    3         16.90        6.98
    4         21.67        5.47
    5         26.57        4.49
    6         31.55        4.05
    7         36.55        4.16
    8         41.51        4.80
    9         46.37        5.98
   10         51.07        7.69
   11         55.56        9.89
   12         59.78       12.57
   13         63.69       15.69
   14         67.23       19.22
   15         70.37       23.11
   16         73.06       27.32
   17         75.28       31.80
   18         76.90       36.20
Circle Center At X =    33.10 ; Y =    49.92 ; and Radius =    45.89
       Factor of Safety
      ***    4.461   ***
Failure Surface Specified By 19 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
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    1          8.00       11.50
    2         12.81       10.13
    3         17.71        9.12
    4         22.67        8.48
    5         27.66        8.21
    6         32.66        8.30
    7         37.64        8.76
    8         42.57        9.59
    9         47.42       10.78
   10         52.18       12.33
   11         56.81       14.22
   12         61.28       16.45
   13         65.58       19.00
   14         69.68       21.87
   15         73.55       25.03
   16         77.18       28.46
   17         80.55       32.16
   18         83.64       36.09
   19         83.91       36.50
Circle Center At X =    28.89 ; Y =    75.86 ; and Radius =    67.66
       Factor of Safety
      ***    4.487   ***
Failure Surface Specified By 17 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1          8.00       11.50
    2         12.80       10.11
    3         17.71        9.16
    4         22.69        8.66
    5         27.69        8.60
    6         32.67        9.00
    7         37.60        9.84
    8         42.43       11.13
    9         47.13       12.84
   10         51.65       14.98
   11         55.96       17.51
   12         60.03       20.41
   13         63.82       23.68
   14         67.30       27.27
   15         70.44       31.16
   16         73.22       35.32
   17         73.62       36.07
Circle Center At X =    25.78 ; Y =    64.00 ; and Radius =    55.43
       Factor of Safety
      ***    4.495   ***
Failure Surface Specified By 17 Coordinate Points
  Point      X-Surf      Y-Surf
   No.        (ft)        (ft)
    1          8.00       11.50
    2         12.45        9.21
    3         17.13        7.47
    4         21.99        6.29
    5         26.96        5.69
    6         31.96        5.68
    7         36.92        6.27
    8         41.78        7.43
    9         46.48        9.16
   10         50.93       11.43
   11         55.09       14.21
   12         58.88       17.46
   13         62.27       21.14
   14         65.20       25.19
   15         67.63       29.56
   16         69.53       34.19
   17         69.98       35.80
Circle Center At X =    29.52 ; Y =    47.91 ; and Radius =    42.30
       Factor of Safety
      ***    4.525   ***
Failure Surface Specified By 19 Coordinate Points
  Point      X-Surf      Y-Surf
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