Appendix C: Geotechnical Report

October 8, 2021

Joud Construction
1485 Pomona Road, Suite G
Corona, California 92882

File No: 8560-00
Report No: R1-8560

Attention: Yousef Audi

Subject: **Geotechnical Investigation**
Proposed Custom Home Construction
820 Gainsborough Drive
Laguna Beach, California

APN: 644-291-08

INTRODUCTION

This report presents the results of our geotechnical investigation for 820 Gainsborough in the City of Laguna Beach, California, which was performed to determine various site and regional geotechnical conditions pertinent to the residential construction currently proposed for the subject property. Analyses for this investigation are based upon our understanding of the proposed project and preliminary plans prepared by Leigh Snow Architects. We understand the project will include a multi-level, single-family residence with an attached garage near street level. The purpose of our review and investigation was to evaluate the subsurface conditions, determine the compatibility of the proposed development with respect to the geotechnical features of the site, and provide geotechnical recommendations and design parameters for conceptual planning. Specific information and recommendations for site development are provided herein.

The conclusions and recommendations of this report are considered preliminary due to the absence of specific foundation and grading plans, the formulation of which are partially dependent upon recommendations presented herein.

Project Authorization

The work performed was per your authorization based on our Proposal No. P1-8560, dated April 10, 2021.

Scope of Investigation

The investigation included the following:

1. Review of collected geologic, geotechnical engineering and seismological reports and maps pertinent to the subject site. A reference list is included in Appendix A.

2. Subsurface exploration consisting of one test pit, and surface investigation including slope mapping and observation of road cuts. The location of the test pit is shown on the Geotechnical Plot Plan, Figure 1.

3. Logging and sampling of the exploratory excavation, including collection of soil samples for laboratory testing. The test pit log is included in Appendix B.

4. Laboratory testing of soil samples representative of subsurface conditions. The results are presented in Appendix C.

5. Geotechnical engineering and geologic analyses of collected data, including preparation of Geotechnical Cross Section A-A' and B-B'. The geotechnical cross sections are included as Figures 2 and 3.

6. Preparation of this report containing our geotechnical recommendations for the design and construction in accordance with the current 2019 California Building Code (CBC) and for use by your design professionals and contractors.

Site Description

The property is located at 820 Gainsborough Drive as shown on the attached Location Map, Figure 4. The site is a vacant, previously undeveloped lot on a natural slope area with little or no flat terrain. The site is bordered on the east by a developed residential lot (812 Gainsborough Drive), to the south by an ascending natural slope below a developed residential lot (2396 Crestview), to the west by a similar vacant lot and on the north by Gainsborough Drive.

The Topographic Map prepared by LDDC, Land Development Design Company, LLC, (Reference 1) was used as a base map for our Geotechnical Plot Plan, Figure 1. The lot has an approximate trapezoidal shape consisting of approximately 5,200 square feet. The LDDC map indicates that site elevations vary from 375 feet the northwest property corner fronting Gainsborough Drive to 434 feet along the southwest property boundary (elevation datum basis not noted), with an overall slope gradient of approximately 1.6:1 (horizontal: vertical), with local variations as steep as 1:1 and as flat as 2.9:1. Slope vegetation generally consists of trees, shrubs, and brush. Drainage consists primarily of sheet flow along the gradient of the natural terrain.

Site History

A review of historic aerial photos accessible through the County of Orange indicate that the road cuts were performed prior to 1931. The Del Mar landslide of February 17, 1980 occurred on several lots east of this property. The landslide remediation included extensive grading to restore the hillside. No previous grading is known to have been done at 820 Gainsborough Drive and the lot is outside of any identified landslide features.

Proposed Development

The plans provided for our review consist of preliminary Concept Perspective, and floor plans for the proposed house and property improvements. Development will include construction of a three-level, single family residence that is centrally located on the lot beginning at the lower end along Gainsborough. Grading and earthwork is expected to consist of excavation and export. Fill placement will likely be limited to wall and utility backfills and minor fills for pad grading. Construction is expected to include conventional or pile supported retaining walls and foundations with slab on grade floors. Some deepened foundations may be required for slope setbacks and retaining walls. Shoring is anticipated along property lines and for steep cuts.

Structural loads were not provided. We anticipate wood-frame and light steel construction that is typical of the area and relatively light construction loads; however, retaining wall loads could be significant. We assume that maximum column loads will be less than 70 kips and wall loads of 2 kip/foot. Slab-on-grade and raised deck construction was noted in the surrounding area. Our office should be notified when the structural design loads for foundation elements are available to check these preliminary assumptions.

Other improvements are expected to include concrete hardscape, utility connections, drainage improvements, and landscaping.

GEOTECHNICAL CONDITIONS

Geologic Setting

The property lies within the Peninsular Ranges geomorphic province of southern California. The lot is situated on steep terrain within the San Joaquin Hills. Bedrock of the San Onofre and Topanga formations are regionally mapped and were observed onsite. The bedrock formations are locally observable along hillside road cuts and within hillside exposures and outcrops. Regional geology is presented in the attached Figure 6.

Earth Materials

The site exposes bedrock strata of the Topanga Formation of middle Miocene age at the surface along Gainsborough Drive. The bedrock in the local vicinity is generally light olive gray, thickly bedded siltstone and interbedded sandstone. The bedrock is firm but locally fractured.

Based on mapping, San Onofre Formation of Middle Miocene age is anticipated to overly the Topanga formation at higher site elevations. The San Onofre formation consists of conglomeratic sandstone and breccia. The sandstone and breccia are massive and characterized by abrupt vertical and lateral transitions from silty to sandy matrix. This formation is moderately cemented, well-indurated and contains clasts that range from small pebbles to boulders in excess of four feet.

Minor amounts of slopewash and colluvium (not mapped) should be expected onsite. These materials may mantle the bedrock locally with thicknesses typically ranging from zero to 5 feet.

Laboratory test results indicate that fill derived from sandstone bedrock has a low expansion potential. Materials derived from the siltstone may exhibit medium to high expansion potential.

Idealized profiles of the geology expected onsite are depicted on Figures 2 and 3, Geotechnical Cross-Sections A-A' and B-B'.

Bedrock should be anticipated at relatively shallow depth for both conventional foundations and deepened components of shoring or caissons, if needed. Bedrock may be difficult to excavate. Excavating and drilling into the bedrock will, therefore, require appropriate equipment. Casing of boreholes should be anticipated if low cohesion pockets and/or perched groundwater is encountered.

Most materials derived on-site will recompact to produce acceptable structural backfill. Organic materials, debris and other unsuitable materials that may be present as part of the demolition and clearing should be hauled away and not used in recompacted fill or backfill.

Geologic Hazard

The property is listed by the State of California as a seismic hazard zone on the Laguna Beach Quadrangle Official Map, April 15, 1998. The site is also shown in a landslide hazard zone on City of Laguna Beach GIS maps (Figure 5). This places the site in a category of required investigation for potential landslide conditions, including earthquake-induced landslides. An initial screening investigation is therefore required as part of this investigation to evaluate the severity of the potential landslide hazards. The slope is primarily a natural slope. Bedrock, colluvium and slopewash materials were observed in the natural slope areas. The general interpretation of the distribution of earth materials is depicted in the cross sections, Figures 2 and 3. Although the site is located in a landslide hazard zone, there are no known landslides on the property.

Other geologic hazards at the site are primarily from shaking due to movement of nearby or distant faults during earthquake events. The site is a sloping hillside lot with shallow colluvium and slopewash materials over bedrock. There is no adverse geologic structure or active faulting near the site indicative of geologic hazards that would affect the site as further detailed below. No groundwater seepage was observed on the slope. Our review and findings indicate that the slope will possess adequate factors of safety with regard to deep-seated and surficial failure mechanisms.

Structure

The underlying bedrock is exposed at the site. In addition, the bedrock structure on the adjoining lots to the east was described and documented during the grading for the landslide remediation in 1981. In general, the bedrock strata in the vicinity strikes approximately east-west and dips between 25 and 75 degrees from the horizontal to the south. The bedrock is sheared and faulted locally and obliquely transects the bedding. These conditions are generally favorable from a stability standpoint. Bedding can be characterized as dipping obliquely into slope.

The State of California has mapped several geologic faults trending northwest-southeast in the vicinity of the site. The faults are within the underlying bedrock. The faults are considered inactive at this time; however, sympathetic movement may occur during significant shaking on one of the nearby active fault traces.

Slope Stability

The lot is located on a north-facing natural slope that ascends above Gainsborough Drive. The slope is part of a larger hillside terrain that continues below Gainsborough Drive to a canyon bottom and uphill beyond the property limits. The slope ascends approximately 125 feet above Gainsborough Drive to the developed property at 2396 Crestview Drive, which is terraced into the larger hillside. The slope exposes Topanga and San Onofre formation bedrock that is generally massive or with bedding that dips into slope. The site is located in a designated landslide hazard zone area as shown on the City of Laguna Beach GIS hazard map and on the State of California seismic hazard maps.

Two cross sections were prepared to depict the soil profile and underlying geology. Cross section A-A’ and B-B’ are idealized profiles through the site and are included as Figures 2 and 3.

No evidence of deep-seated gross instability was noted at the site during our site reconnaissance or as part of our literature and map review. As indicated previously, a landslide occurred in 1980 on several lots east of the site, in a west-facing slope below Del Mar Avenue. The landslide failure was remediated in 1981. The landslide limits were clearly identified as part of the remediation and it was determined that the subject site is outside of the landslide failure area.

Engineering and slope stability analyses were performed to assess the gross and surficial stability of the existing slope at the site. Analyses indicate gross factors of safety in excess of 1.5 for static conditions. A pseudo-static screening procedure, as recommended by SCEC, was performed for the 5 cm slope deformation threshold and indicated a factor of safety in excess of 1.0, passing the screen procedure. Please note that the 5 cm slope deformation threshold is an index value associated with little displacement. This should be distinguished from the traditional approach where a horizontal seismic coefficient (Kh) of 0.15g is applied to the slide mass and is calibrated against a 100 cm threshold. Please note that current City of Laguna Beach, Community Development, Building Division Guidelines for Geotechnical Reports and Bluff Edge Determinations allow use of a Kh = 0.15, with resulting Factor of Safety of 1.2 or greater. The guidance document also allows other methodology as determined by the geotechnical engineer. In consideration of the steep natural hillside and nearby remediated landslide, we determined that the screening procedure is an appropriate approach.

The lower slope areas will be largely excavated and replaced with retaining walls with the upper slope areas left in their existing natural state. The natural slope may be subject to weathering, surface erosion, minor rock falls and falling of uphill debris. These are conditions that exist now and will remain after the planned construction. Slope setbacks and potential soil creep should also be considered in the design.

Slope Creep

Potential distress due to creep forces may be minimized with appropriate design which considers that most of the downslope movement of creep-prone materials at this site will occur in the upper surficial soils above the bedrock. It is, therefore, recommended that the proposed structural improvements at the site obtain bearing below the compressible surficial materials, which are the primary potential creep prone materials. Additionally, deformations caused by movement cannot be entirely precluded, and it is the intent of the recommendations herein to minimize their perception.

Groundwater

Groundwater or seepage was not observed at the site as part of this investigation.

Although no evidence of shallow groundwater was observed during our field investigation, subdrains and waterproofing should be included in retaining wall design and construction as a precaution against the development of hydrostatic wall loading and possible wall seepage.

Water Infiltration

On-site water infiltration is not recommended due to shallow bedrock and to minimize water intrusion behind proposed subterranean walls. Surface and subsurface drainage should be directed toward approved outlets that carry collected water away from foundations.

Surficial Run-off

Uncontrolled, concentrated or erosive runoff was not observed onto or off the property. The surface drainage of the ascending natural slope is controlled at the intermediate bench formed by Crestview Drive. Planned construction will modify existing drainage and should be considered in the development of grading plans.

Proposed development should incorporate engineering and landscape drainage designed to transmit surface and subsurface flow to the storm drain systems via non-erosive pathways. Care should be taken to not allow water to pond or infiltrate soil adjacent to foundation elements and slopes.

Faulting/Seismic Considerations

The major concern relating to geologic faults is ground shaking that affects many properties over a wide area. Direct hazards from faulting are essentially due to surface rupture along fault lines that could occur during an earthquake. Therefore, geologists have mapped fault locations and established criteria for determining the risks of potential surface rupture based on the likelihood of renewed movement on faults that could be located under a site.

Based on criteria established by the California Division of Mines and Geology (CDMG), now referred to as the California Geological Survey, faults are generally categorized as active, potentially active or inactive (Jennings, 1994). The basic principle of faulting concern is that existing faults could move again, and that faults which have moved more recently are the most likely faults to move again and affect us. As such, faults have been divided into categories based on their age of last movement. Although the likelihood of an earthquake or movement to occur on a given fault significantly decreases with inactivity over geologic time, the potential for such events to occur on any fault cannot be eliminated within the current level of understanding.

By definition, faults with no evidence of surface displacement within the last 1.6 million years are considered inactive and generally pose no concern for earthquakes due renewed movement. Potentially active faults are those with the surface displacement within the last 1.6 million years. Further refinement of potentially active faults is sometimes described based on the age of the last known movement such as late Quaternary (last 700,000 years) implying a greater potential for renewed movement. In fact, most potentially active faults have little likelihood of moving within the time frame of construction life, but the degree of understanding of fault age and activity is sometimes not well understood due to absence of geologic data or surface information, so geologists have acknowledged this doubt by using the term "potentially active." A few faults that were once thought to be potentially active, have later been found to be active based on new findings and mapping. Active faults are those with a surface displacement within the last 11,000 years and, therefore, most likely to move again. The State of California has, additionally, mapped known areas of active faulting as designated Alquist-Priolo "Special Studies Zones," which requires special investigations for fault rupture to limit construction over active faults.

A potential seismic source near the site is the San Joaquin Hills Blind Thrust Fault (SJHBT), which is approximately 2 to 8 kilometers beneath the site at its closest point, based on the reported fault structure. The SJHBT is a postulated fault that is suspected to be responsible for uplift of the San Joaquin Hills. This fault is a blind thrust fault that does not intercept the ground surface and, therefore, presents no known potential for ground rupture at the property.

The closest active fault to the site is the off-shore extension of the Newport Inglewood Fault Zone (north branch) located approximately 5 kilometers west-southwest of the site. As such, the potential for surface rupture at the site is very low, but the site will experience shaking, during earthquake events on nearby or distant faults. Site improvements should take into consideration the seismic design parameters outlined below.

The site is not located near an active fault, or within a special studies zone for earthquake fault rupture. The potential for surface rupture at the site is therefore considered to be low.

Site Classification for Seismic Design

Seismic design parameters are provided in a later section of this report and in Appendix E for use by the Structural Engineer. The soil underlying the subject site has been classified in accordance with Chapter 21 of ASCE 7, per Section 1613 of the 2019 CBC.

The results of our on-site field investigation, as well as nearby investigations by us and others, indicate that the site is underlain at shallow depth by Class C bedrock. We, therefore, recommend using a characterization of this property as a Class C, Very Dense Soil and Soft Rock, Site Classification.

Secondary Seismic Hazards

Review of the Seismic Hazards Zones Map (CDMG, 1998) for the Laguna Beach Quadrangle, 1998 indicates that the site is not located within a zone of required investigation for earthquake-induced liquefaction. This finding is in keeping with the results of our study.

Review of the Seismic Hazards Zones Map (CDMG, 1998) for the Laguna Beach Quadrangle, 1998 indicates that the slope at the site is located within a zone of required investigation for earthquake-induced landslides. The instability conditions at the subject site are expected to be surficial in nature. In addition, the planned improvements will be provided with foundation elements that meet slope setback requirements. Beyond/above the proposed residence, we anticipate that the existing slope will largely remain as-is, without modification to the existing slope conditions.

Other secondary seismic hazards to the site include deep rupture, shallow ground cracking, lurching with lateral movement and settlement. With the absence of active faulting on-site, the potential for deep fault rupture is not present. The potential for shallow ground cracking to occur during an earthquake is a possibility at any site, but does not pose a significant hazard to site development. The potential for seismically-induced lurching and settlement to occur is considered remote for the site. The potential for tsunami inundation at the site elevation is nil at the planned foundation levels.

CONCLUSIONS

1. Proposed development is considered feasible and safe from a geotechnical viewpoint provided the recommendations of this report are followed during design, construction, and maintenance of the subject property. Proposed development should not adversely affect, or be adversely affected by, adjacent properties or the ascending on-site terrain, providing appropriate engineering design, construction methods and care are utilized during construction.

2. The primary geotechnical considerations at the property will include the need for shoring, excavation for partial subterranean level construction, excavation to remove unsuitable soil materials, distribution of footing loads, drainage, subdrainage, slope setbacks and property line constraints.

3. There are no geotechnical constraints that would preclude planned construction if designed and constructed appropriately and in consideration of the property line and slope conditions.

4. The property is underlain at shallow depth by sedimentary bedrock assigned to the Topanga and San Onofre formations.

5. Undisturbed bedrock is expected to be suitable for support of compacted fill and new structures.

6. Bedrock and bedrock derived fill is expected to have a low to medium expansion potential.

7. Retaining wall plans will require further review by this office and should be forwarded to us for review, as they are prepared, in order to provide specific load information for proposed walls.

8. No active faults are known to transect the site and therefore the site is not expected to be adversely affected by surface rupturing. It will, however, be affected by ground

motions from earthquakes during the design life of the residence. The potential for seismically-induced liquefaction affecting the residence is considered to be nil. The potential for seismically-induced landslide activity affecting the residence is considered to be remote as no active landslides have been identified as part of this or previous studies for the area of this site.

9. The slope at the site appears to have performed favorably with regard to gross and surficial stability. Erosion due to weathering of the exposed slope materials is possible. Slope conditions are not expected to impact proposed new structures provided that appropriate construction and maintenance considerations are maintained. Toe of slope setbacks and protection should be incorporated into the design.

10. The planned improvements are not anticipated to adversely affect the on-site or offsite slopes provided that proper setbacks are implemented, appropriate surface drainage is provided, subdrains are installed for subsurface structural elements and that the slope is properly maintained.

11. Erosion due to weathering of the exposed uphill slope materials and shallow surficial failures are possible. Future surficial instability is possible but should not adversely affect planned improvements provided that the recommendations herein are implemented.

12. Seepage and/or perched groundwater was not encountered at the site. Although not anticipated based on initial findings, appropriate measures should be implemented to divert nuisance water away from the work areas if present during construction.

13. Although groundwater was not encountered within our exploratory excavations, suitable drainage elements need to be installed at retaining walls to mitigate possible transient seepage.

14. Adverse surface discharge onto or off the site is not anticipated provided proper civil engineering design and post-construction site grading are implemented.

15. The proposed residence should be supported by retaining walls and a thickened/mat slab foundation system. Caisson or deepened foundation support of structures constructed in slope setback areas will be required. Shoring will require the use of soldier piles and lagging.

RECOMMENDATIONS

Site Preparation and Earthwork

1. General

Site grading should be performed in accordance with the requirements of City of Laguna Beach, the recommendations of this report, and the Standard Grading Guidelines of

Appendix D. All excavations should be supervised and approved in writing by a representative of this firm.

2. Demolition and Clearing

Deleterious materials, including those from the demolition, vegetation, organic matter and trash, should be removed and disposed of off-site. Roots and root balls for cut trees should be completely removed within improvement areas. Subsurface elements of demolished structures should be completely removed, including any trench or wall backfills, basements, foundations, septic tanks, cisterns, abandoned utility lines, etc. within new foundation and slab areas.

3. Subgrade Preparation

The existing surficial colluvium and slopewash materials are not reliable for support of structures and surrounding improvements. Most of these materials will be removed by planned excavations for the structure, which will extend into the hillside. Temporary shoring should be installed as necessary to accomplish the removals while protecting adjacent properties, providing uphill support and for excavation safety considerations. Any remaining surficial soil materials on the pad areas of the lot should be removed to competent bedrock.

Cut/fill transitions in pad areas may be present as a result of localized removals and retaining wall backfills. The extent of compacted fill soils necessary to achieve pad grades is anticipated to be minor and have a shallow and narrow thickness. Additionally, a mat slab foundation is recommended for structure support. As such, overexcavation to eliminate cut/fill transitions is not anticipated to be necessary.

Subsurface materials are depicted on the Geotechnical Plot Plan, Figure 1, and in Cross Sections A-A′ and B-B′ on Figures 2 and 3. The cross sections were prepared without benefit of a grading plan and are idealized profiles through the site. Actual removals will need to be verified and adjusted as necessary during the design phase and in the field during excavation as conditions are exposed.

Removals below planned pad grades should be followed by 6-inches of scarification and re-compaction. Excavations that require filling should be replaced with compacted engineered fill.

Removals below significant hardscape improvements such as driveways, patios, and sidewalks should be sufficient to remove any existing unsuitable soil. Removal depths of 12-inches are expected to be adequate in exterior yard areas; however, deeper removals are possible in localized areas. Boundary conditions for removals under exterior improvements may be better addressed subsequent to demolition and clearing when excavation equipment can expose the site materials for evaluation and when improvement limits are identified on the plan.

Actual removals will need to be verified and adjusted as necessary in the field during grading as conditions are exposed. The depths of overexcavation should be reviewed by the Geotechnical Engineer or Geologist during the actual construction. Any surface or subsurface obstructions, or questionable material encountered during grading, should be brought immediately to the attention of the Geotechnical Engineer for recommendations.

4. Fill Soils

The on-site soils are anticipated to be suitable for use as compacted fill for site grading. Fill soils should be free of debris, organic matter, cobbles and concrete fragments greater than 6-inches in diameter. Soils imported to the site for use as fill below foundation and slab areas should be predominantly granular, non-expansive, non-plastic and approved by the Geotechnical Engineer prior to importing. Geofabric, such as Mirafi 140N or similar, should be placed to separate gravel backfill from soil to prevent significant piping of soil into the void spaces of the gravel.

All materials should be placed at near optimum moisture content and compacted under the observation and testing of the Soil Engineer. The recommended minimum density for compacted material is 90 percent of the maximum density as determined by ASTM: D1557.

5. Shrinkage and Bulking

Removed materials as part of excavation will largely be exported off-site. Shrinkage losses for removal and replacement of surficial materials are expected to be negligible; however some bulking of excavated bedrock materials is likely. Subsidence is also expected to be minimal. These are preliminary estimates and may vary depending on the uniformity, or non-uniformity, of the on-site materials and field conditions at the time of grading. These estimates are opinions based on experience with similar projects and the test results from the on-site samples collected.

6. Expansive Soils

Evaluation of the graded building pads should be made during construction to verify the expansion potential of the exposed subgrade materials. On-site bedrock disaggregated and placed as fill is expected to become silty sand with a low expansion potential.

7. Compaction Standard

The on-site soils are anticipated to be suitable for use as compacted fill. Fill materials should be placed at near optimum moisture content and compacted under the observation and testing of the Soil Engineer. The recommended minimum density for compacted material is 90 percent of the maximum density as determined by ASTM D1557.

8. Temporary Construction Slopes

Temporary slopes exposing on-site materials should be cut in accordance with Cal/OSHA Regulations. It is anticipated that the exposed on-site earth materials may be classified as sandstone (rock), and temporary vertical cuts to a maximum height of 10 feet are allowed and anticipated to possess adequate stability. Fractured or loosened bedrock materials may require shoring. Higher cuts, and exposed surficial soil materials, should be laid back at 1:1 (horizontal: vertical). The material exposed in temporary excavations should be evaluated by the Contractor and Geotechnical Consultant during excavation and construction.

Lateral support of adjacent public and private property improvements should be maintained during excavation and construction. Excavations should be reviewed by the Geologist as these materials are exposed. Retaining wall design and construction should consider potential property line constraints. Shoring should be anticipated along the property margins and where high retaining walls are planned.

The safety and stability of temporary construction slopes and cuts is deferred to the General Contractor, who should implement the safety practices as defined in Section 1541, Subchapter 4, of Cal/OSHA T8 Regulations (2006). The Geotechnical Consultant makes no warranties as to the stability of temporary cuts. Soil conditions may vary locally and the contractor(s) should be prepared to remedy local instability if necessary. Contract documents should be written in a manner that places the Contractor in the position of responsibility for the stability of all temporary excavations. Stability of excavations is also time dependent. Unsupported cuts should not be allowed to dry out and should not be left open for extended time periods.

9. Adjacent Property Assessments and Monitoring

The proposed excavations into bedrock will cause vibrations and sound pressure (noise) that may be potentially disturbing to occupants of neighboring properties. If appropriate equipment and experienced operators and contractors perform the excavations, it is unlikely that such vibrations will be sufficient to promote structural damage in the vicinity.

The following measures may be considered in order to reduce the potential risks of damage, and perceived damage, to adjoining improvements:

- Visual inspections and walk-throughs of each of the adjacent properties should be arranged in order to document pre-existing conditions and damages.
- Measurements of all existing damages observed, including crack lengths, widths and precise locations should be made.
- Photographs should be taken to accompany written notes that refer to damages or even lack of damages. Video may also be considered; however, videos that attempt to show these types of damages are often lacking in detail.

- Floor level surveys of nearby structures may be considered especially if pre-existing damage is evident.
- Vibrations from construction equipment may be monitored with portable seismographs during excavation into bedrock materials. Vibration monitoring is, therefore, highly recommended during demolition and installation of shoring.
- Surveys to monitor lateral and vertical position of adjacent improvements and shoring elements is recommended.
- It is recommended that the Project Geologist be on-site during excavation in order to evaluate conditions as the project advances.

Construction activities, particularly excavation equipment, produce vibrations that can be felt by occupants of adjoining properties. People will often be annoyed by the noise and vibration caused by construction activities, which prompts them to personally perform detailed inspections of their property for damage. Pre-existing damage, that previously went unnoticed, can be unfairly attributed to current construction activities, particularly when pre-construction property inspections are not performed. At that point it may be difficult to determine what caused the damage, especially damages such as wall separations, cracks in drywall, stucco and masonry. Other common problems that may be scrutinized can include uneven doors, sticking windows, tile cracks, leaning patio posts, fences, gates, etc. Implementation of measures such as those listed above can help avoid conflicts by monitoring construction activities that may be problematic as well as provide valuable data to defend against unwarranted claims.

Foundation Design - Design of Footings

General

It is anticipated that foundation elements for the residence will bear in competent bedrock and will utilize a combination of retaining wall and mat slab foundation system. Caissons and/or deepened footings should be anticipated for structures within slope setback zones.

The near surface materials and disaggregated bedrock are expected to exhibit a low expansion potential. When removed, mixed and replaced as compacted fill the materials are expected to be in the low expansion range; however, this will depend on the distribution of these materials on the site. The following recommendations are based on the geotechnical data available and are subject to revision based on conditions actually encountered in the field.

Foundations and slabs should be designed for the intended use and loading by the Structural Engineer. Our recommendations are considered to be generally consistent with the standards of practice. They are based on both analytical methods and empirical methods derived from experience with similar geotechnical conditions. These recommendations are considered the minimum necessary for the likely soil conditions and are not intended to supersede the design of the Structural Engineer or criteria of governing agencies.

a. Bearing Capacity for Mat Slab Foundations and Conventional Retaining Walls

The allowable net contact pressure or bearing capacity for a mat slab system and/or retaining wall footings founded in competent bedrock should not exceed 3,000 pounds per square foot. This value may be increased by one-third for short-term wind or seismic loading. For mat slab construction, a modulus of subgrade reaction of 250 kcf (kips per cubic foot) may be assumed. Actual footing depths and widths should be governed by CBC requirements and the structural engineering design. A minimum footing depth of 24-inches is recommended.

b. Caissons

Caissons for shoring and permanent wall design, if needed, are anticipated to extend into undisturbed bedrock. Caissons used for foundation support should be designed for a minimum of 10 feet of embedment into undisturbed bedrock. Caissons may be designed for a dead plus live load end bearing value of 8,000 pounds per square foot. A skin friction value of 500 pounds per square foot may also be utilized below the upper 2 feet. Lateral resistance may be calculated utilizing 400 pounds per cubic foot equivalent fluid pressure, acting on a tributary area of twice the caisson diameter, with a maximum lateral value of 8,000 pounds per square foot.

Caisson design in the creep zone should recognize that soil creep movement will remove downslope support. Caissons adjacent to the rear slope should be designed to resist an additional lateral pressure loading of 1000 pounds per cubic foot equivalent fluid pressure to the base of the creep zone. This creep pressure should be assumed to act on a tributary area equal to the diameter of the caissons. Passive resistance may be taken only below the potential creep zone. The creep zone may be assumed to include the upper 5 feet of the caisson embedment. Note that the creep pressure is only applicable in areas with an unconfined downslope component. Since most of the lower slope will be removed and replaced with retaining structures, this loading would generally be limited to exterior improvements or appendages to the main structure that are slope supported.

c. Settlement

Settlement for a mat slab type foundation and slab system combined with retaining wall footings is anticipated to be less than ¾-inch total and ¼-inch differential between adjacent similarly loaded columns or between shear walls (approximately 30 feet), provided that bedrock support is provided. These estimates should be confirmed when structural engineering plans are prepared and foundation load conditions are determined.

d. Lateral Resistance

Lateral loads may be resisted by passive pressure forces developed in front of foundation elements and by friction acting at the base of the slab/foundations. Allowable lateral resistance for footings should not exceed 400 pounds per square foot per foot of depth equivalent fluid pressure. Resistance to sliding can be calculated using a coefficient of friction of 0.35. These values may be used in combination per CBC 2019 Section 1806.3.1.

e. Footing Reinforcement

Two No. 5 bars should be placed at the top and two at the bottom of continuous footings in order to resist potential movement due to various factors such as subsurface imperfections and seismic shaking.

f. Building Setbacks from Top of Slope

A minimum horizontal, top of slope setback for foundations of H/3, per the CBC 2019 requirements should be maintained as a code minimum. The setback will therefore vary with position on the lot. Additionally, the bottom of all foundation elements, including exterior improvements, should be set back a minimum horizontal distance of 10 feet from the slope face.

g. Building Setbacks from Bottom of Slope

A minimum horizontal, toe of slope setback for living area foundations of 15 feet per the CBC 2019 requirements should be maintained as a code minimum. Special design may be required if shorter setbacks are desirable along the bottom of the ascending natural slope at the site. Our office should be notified to provide recommendations as appropriate.

Slab-On-Grade Construction

Mat slabs should be designed in accordance with the CBC 2019. The on-site soils are expected to exhibit a low expansion potential based on our site investigation. Mat slabs should be at least 12-inches thick (actual). Slabs should consist of properly reinforced concrete materials. Reinforcement should be in accordance with the structural engineering design; however, unreinforced concrete slabs are not recommended. Therefore, as a minimum, reinforcement should consist of No. 4 bars placed at 12-inches on center in both directions at the top and bottom of the slab.

Slabs should be underlain by 4 inches of open graded gravel. Slab underlayment is deferred to the project architect; however, in accordance with the American Concrete Institute, we suggest that slabs be underlain by a 15-mil thick vapor retarder/barrier (Stego Wrap or equivalent) placed over the gravel in accordance with the requirements of ASTM E:1745 and E:1643. A layer of geofabric, such as Mirafi 140N, is recommended between the gravel and the plastic vapor retarder. Slab subgrade soils should be well-moistened prior to placement of the vapor retarder. All subgrade materials should be geotechnically approved prior to placing the gravel for the slab underlayment.

Basement/subterranean area slabs should be appropriately waterproofed.

Subdrainage should be provided below slab elevations along the exterior at the base of all subterranean walls. Subdrains should flow via gravity drains to an approved outlet with precautions to prevent backup of water into the perforated portions of the systems. The drain and preventive measures should be shown on the grading plans.

Flatwork/hardscape elements should be a minimum 4-inches thick (actual) and reinforced with No. 3 bars 18-inches on center both ways. Subgrade soils should be well moistened prior to placement of concrete.

Seismic Design

Based on the geotechnical data and site parameters, the following table is provided based on ASCE/SEI 7-16 using the ASCE Hazard Tool to satisfy the 2019 CBC design criteria. A site-specific Ground-Motion Hazard Analysis (GMHA) was not performed for the site.

Site and Seismic Design Criteria
For 2019 CBC

Design Parameters	**Recommended Values**
Site Class	C (Very Dense Soil and Soft Rock)
Site Longitude (degrees)	117.764598 W
Site Latitude (degrees)	33.530392 N
Ss (g)	1.321
S1 (g)	0.469
SMs (g)	1.586
SM1 (g)	0.703
SDs (g)	1.057
SD1 (g)	0.469
Fa	1.2
Fv	1.5
Seismic Design Category	D

A Site-Specific Ground Motion Hazard Analysis (GMHA) may be beneficial for this project as part of the structural design. A Site-Specific GMHA can be performed at an additional cost if requested.
Supporting documentation is also included in a previous section of this report, Site Classification for Seismic Design, and in Appendix E.

Shoring

Excavations for anticipated retaining walls at the site may necessitate the use of shoring to protect adjacent property. Selection of an appropriate shoring system should consider the potential effects of vibrations, deflections and lateral support of adjoining properties. We anticipate that soldier pile and lagging systems will be used for shoring, if needed.

Design lateral loading values for a cantilevered temporary shoring system should be based upon an equivalent fluid pressures provided below for earth retaining structures. Recommended lateral passive resistance for soldier piles founded in bedrock is 400 pounds per cubic foot, acting on a tributary area of twice the pile diameter. The passive pressure should not exceed 6,000 psf. Passive resistance may start at 2 feet below the lowest excavation level along the below grade segment of pile (24-inch diameter). Piles may use an allowable bearing value of 8,000 pounds per square foot and an allowable skin friction of 500 psf.

We anticipate that shoring will be within bedrock material. It is the contractor's responsibility to develop appropriate means and methods of construction to avoid damage to adjacent properties. Proper installation of shoring is the responsibility of the contractor. The adjacent property owners should be notified and advised of the risks and the owner and builder should provide arrangements to repair possible damages.

Existing soil conditions behind shoring elements may result in collapse and caving of soils during removal of shoring. Permanent shoring is therefore recommended unless the contractor can demonstrate a safe system for removal of shoring elements.

All soldier pile installations should be observed by the geotechnical consultant to verify that the intent of the recommendations herein are implemented. After the soldier piles have been placed and backfilled, site excavations may begin. Sufficient curing time for concrete and grout should be allowed before excavating. Care should be taken to make sure that the lagging drops into place as the excavations advance. Gaps in the lagging or behind the lagging are undesirable and could cause undermining of adjacent soils and should be immediately filled with grout or slurry. Maximum lagging cuts of 5 feet are recommended for this site.

Subdrains should be installed between shoring and permanent retaining walls. If space limitations do not allow the placement of conventional gravel and pipe drains between the shoring and retaining wall, the use of geotextile drain mats such as Mirafi Miradrain or similar system may be considered; however, our office should be notified to provide appropriate recommendations and review of planned alternate drainage systems.

Prior to drilling and installing the shoring system, the shoring plans and calculations should be forwarded to the project geotechnical consultant for review to confirm that the shoring has been designed in accordance with the recommendations herein.

Lateral Earth and Bearing Pressures for Earth Retaining Structures

Design lateral loading values for cantilevered retaining walls should be based upon the following:

Foundations

Bearing Capacity- Ret Walls	= 3,000 psf (24-inch embedment into undisturbed bedrock)
Bearing Capacity – Temp Shoring	= 8,000 psf (10-feet embedment into undisturbed bedrock)

Lateral Earth Pressures – Retaining Walls and Shoring

Active Earth Pressure	= 45 psf/ft (level backfill/ on-site soil)
Active Earth Pressure	= 60 psf/ft (2:1 sloping backfill)
Active Earth Pressure	= 80 psf/ft (1.5:1 sloping backfill)
Active Earth Pressure	= 100 psf/ft (1:1 sloping backfill)
Restrained Condition	= 65 psf/ft at-rest loading (level b/fill)
Passive Earth Pressure	= 400 psf/ft (level soil/bedrock in front of footing)
Friction	= 0.35

Other topographic and structural surcharges should be addressed by the Structural Engineer, as appropriate. Stacked walls should include applied surcharges from the uphill walls as appropriate.

Design of Retaining Walls

1. Earthquake Loads on Retaining Walls

We anticipate that permanent retaining walls will be utilized such that a residence can be constructed into the slope. The structural engineer should determine which retaining walls at the site within their purview that will be subject to design lateral loads due to earthquake events. Section 1803.5.12 of the 2019 CBC states that the geotechnical investigation shall include the determination of dynamic seismic lateral earth pressures on foundation walls and retaining walls supporting more than 6 feet (1.83 m) of backfill height due to design earthquake ground motions.

Retaining walls supporting onsite bedrock in a level backfill condition may be considered using an additional dynamic load (ΔP_{aE}) of 21 pounds per cubic foot equivalent fluid pressure.

This force is presumed to act at 0.33H above the base of the wall (Al Atik and Sitar, ASCE 2010). This value is preliminary and we recommend that each wall be evaluated individually as plans are prepared. Note that the load diagrams and lateral pressures may vary based on wall height, orientation and backfill conditions. We therefore recommend that structural design not proceed until each wall is addressed by the geotechnical engineer based on the planned retaining wall configurations.

2. Foundation Bearing Values for Walls

Footings for retaining walls may be designed in accordance with the recommendations provided above and should be embedded in undisturbed bedrock at a minimum depth of 24-inches below the lowest adjacent grade.

3. Wall Backfill

The on-site soils are generally suitable for use as retaining wall backfill. Imported backfill, if used, should consist of select, non-expansive sand or gravel. Gravel may consist of pea gravel or crushed rock. Where space for compaction equipment is adequate, on-site or imported granular, non-expansive sand materials may be compacted into place in thin lifts per the compaction requirements provided herein. Imported pea gravel or crushed rock should be placed in lifts and tamped or vibrated into place. The lift thickness for gravel is dependent on the type of material and method of compaction. Gravel lifts of 18- to 24-inches or less are recommended. The Geotechnical Engineer should observe the backfill placement of soil or gravel behind each wall. Approval of wall backdrains should be obtained prior to backfill. Gravel wall backfill material should be separated from on-site soil materials, along back cuts and at interfaces with other materials with a suitable filter fabric such as Mirafi 140N and capped with on-site soil or concrete.

Fill and backfill soils should be free of debris, organic matter, cobbles and rock fragments greater than 6-inches in diameter. Fill materials should be placed in 6- to 8-inch maximum lifts at above optimum moisture content and compacted under the observation and testing of the Soil Engineer. The recommended minimum density for compacted material is 90 percent of the maximum dry density as determined by ASTM D1557. Field density tests should be performed at intervals of 2 vertical feet or less within the backfill zone and in accordance with agency requirements at the time of grading.

4. Subdrains

An approved exterior foundation subdrain system should be used to achieve control of seepage forces behind retaining walls. The details of such subdrain systems are deferred to the Wall Designer, Builder or Waterproofing Consultant. The subdrain is not a substitute for waterproofing. Water in subdrain systems should be collected and delivered to suitable disposal locations or facilities. Additional recommendations may be provided when plans are available.

Retaining walls should be provided with an approved drain at the base of the backfill. Subdrains should consist of a 4-inch diameter perforated pipe (Schedule 40 or similar) surrounded by at least 3 cubic foot per foot of 3/4-inch gravel wrapped in geofabric (Mirafi 140N or similar). Perforations should be placed down and filter fabric should be lapped at least 12-inches at seams. Weep holes or open head joints may be included for low-height garden walls with a height of less than 30-inches as an alternative to a pipe subdrain; however, the geofabric wrapped gravel burrito at the base of the wall is recommended to reduce clogging of the weep openings.

5. Dampproofing and Waterproofing

Waterproofing should be installed in accordance with the architectural specifications or those of a waterproofing consultant. Protection at the basement level should be wrapped up along the lower portions of the walls. A Miradrain type system is recommended for the height of the basement/subterranean wall backfills. Waterproof systems and materials should be installed in accordance with manufacturer's recommendations, based on geologic conditions. The wall waterproofing should tie into the underslab waterproofing so that there are no permeable seams in the building envelope. The criteria in Section 1805 of the 2016 CBC should be followed as a minimum.

Hardscape Design and Construction

Hardscape improvements may utilize conventional foundations in compacted fill and undisturbed bedrock. Such improvements should be designed in accordance with the foundation recommendations presented above and should consider the expansion potential of the on-site soils. Cracking and offsets at joints are possible; however, occurrence may be minimized by appropriate drainage and the use of thickened edge beams to limit moisture transfer below slabs.

Concrete flatwork should be divided into as nearly square panels as possible. Joints should be provided at maximum 6 feet intervals to give articulation to the concrete panels (shorter spacing is recommended if needed to square the panels).

Landscaping and planters adjacent to concrete flatwork should be designed in such a manner as to direct drainage away from concrete areas to approved outlets. Planters located adjacent to principal foundation elements should be sealed and drained; this is also important if they are near retaining wall backfills.

Flatwork elements should be a minimum 4-inches thick (actual) and reinforced with No. 3 bars at 18-inches on center both ways. Subgrade soils should be geotechnically approved prior to placement of concrete. Maintaining the graded moisture content and preventing desiccation of the subgrade soils through periodic watering of the exposed soils is recommended.

Concrete Construction Components in Contact with Soil

Fill soils derived from bedrock have a low soluble sulfate content based on the results of our laboratory testing, which indicated less than 0.10 percent soluble sulfate. Ordinary Type II cement is, therefore, anticipated to be suitable for concrete in contact with the subgrade soils. A minimum design strength of 4,500 psi and water to cement ratio of 0.5 maximum is recommended for added flooring moisture considerations, but is not required for sulfate considerations. It is recommended that a Concrete Expert be retained to design an appropriate concrete mix to address the structural requirements. In lieu of retaining a Concrete Expert, it is recommended that the 2019 CBC, Section 1904 and 1905, be utilized, which refers to ACI 318. The sulfate testing is presented in the attached Appendix C, Laboratory Test Results. Additional testing should be done during grading to confirm preliminary test results.

Metal Construction Components in Contact with Soil

Corrosivity testing was performed on a bedrock derived fill sample near the surface. Test results indicate a moderate potential for corrosion (1,320 ohm-cm when saturated). Metal rebar encased in concrete, iron pipes, copper pipes, elevator shafts, air conditioner units, etc., that are in contact with soil or water that permeates the soil should be protected from corrosion that may result from salts contained in the soil. Recommendations to mitigate damage due to corrosive soils, if needed, should be provided by a qualified Corrosion Specialist. Additional testing should be done during grading to confirm preliminary test results.

Foundation Excavations

All excavations should be observed by the Geotechnical Engineer prior to placement of forms, reinforcement, and concrete for verification of conformance with the intention of these recommendations. All excavations should be trimmed neat, level, and square. All loose or sloughed material should be removed prior to the placement of concrete. Materials from footing excavations should not be spread in house slab-on-grade areas unless compacted and tested.

Surface and Subsurface Drainage

1. Finished Grade and Surface Drainage

   Finished grades should be designed and constructed so that no water ponds in the vicinity of footings, subterranean walls or slopes. Drainage design in accordance with the 2019 CBC, Section 1804.4, is recommended or per local City requirements. Roof gutters should be provided and outflow directed away from structures in a non-erosive manner as specified by the project Civil Engineer or Landscape Architect. Surface and subsurface water should be directed away from slope areas toward approved outlets. Proper interception and disposal of on-site surface discharge is presumed to be a matter of civil engineering or landscape architectural design.

2. Drainage and Drainage Devices

The performance of the planned foundation and improvements is dependent upon maintaining adequate surface drainage both during and after construction. The ground surface around foundations and improvements should be graded so that surface water will not collect and pond. The impact of heavy irrigation can artificially create perched water conditions. This may result in seepage or shallow groundwater conditions where previously none existed.

Attention to surface drainage and controlled irrigation will significantly reduce the potential for future problems related to water infiltration. Irrigation should be well controlled and minimized. Seasonal adjustments should be made to prevent excessive watering.

Sources of uncontrolled water, such as leaky water pipes or drains, should be repaired if identified.

The Owner should be aware of the potential problems that could develop when drainage is altered through construction of retaining walls, paved walkways, utility installations or other various improvements. Ponded water, incorrect drainage, leaky irrigation systems, overwatering or other conditions that could lead to unwanted groundwater infiltration must be avoided.

Area drains should be installed in all planter and landscape areas. Planter surfaces should be sloped away from building areas in accordance with Code requirements. Roof drainage should be tight-lined into the area drain system or carried to outlets away from building foundations. Planters should not be allowed adjacent to foundations unless they are lined with a bottom barrier installed with a minimum 5 percent gradient away from foundations.

Irrigation water should be controlled for the landscape areas in a way that maintains uniform moisture conditions around and below the building slab and footings. Changes in exterior moisture will promote heave and desiccation in the soil supporting foundations and must, therefore, be avoided. Installation of concrete patios and walkways adjacent to the building is recommended due to the potentially expansive on-site soil conditions.

3. Infiltration

It is recommended that surface water be collected and directed to a suitable off-site outlet rather than allowed to infiltrate into the soil. It is important to not purposely introduce site water into the gravel zones along retaining walls or into slope areas. Cleaner sand zones within subsurface soils may create pockets for collection of perched water that can back up along retaining walls or travel distances to outlet at lower elevation on slopes. This may result in unwanted water infiltration around structures, nuisance water and potential instability.

Utility Trench Backfill

Utility trench backfill should be placed in accordance with Appendix D, Standard Grading Guidelines. It is the Owner's and Contractor's responsibility to inform Subcontractors of these requirements and to notify R McCarthy Consulting, Inc. when backfill placement is to begin. It has been our experience that trench backfill requirements are rigorously enforced by local agencies.

The on-site soils are anticipated to be generally suitable for use as trench backfill. The use of imported backfill is sometimes more efficient when on-site soil materials are at high moisture contents. Fill materials should be placed at near optimum moisture content and compacted under the observation and testing of the Soil Engineer. The minimum dry density required for compacted backfill material is 90 percent of the maximum dry density as determined by ASTM D1557.

Foundation and Grading Plan Review

The undersigned should review final foundation and grading plans and specifications prior to their submission to the building official for issuance of permits. The review is to be performed only for the limited purpose of checking for conformance with design concepts and the information provided herein. Review shall not include evaluation of the accuracy or completeness of details, such as quantities, dimensions, weights or gauges, fabrication processes, construction means or methods, coordination of the work with other trades or construction safety precautions, all of which are the sole responsibility of the Contractor. The R McCarthy Consulting, Inc. (RMC) review shall be conducted with reasonable promptness while allowing sufficient time in our judgment to permit adequate review. Review of a specific item shall not indicate that RMC has reviewed the entire system of which the item is a component. RMC shall not be responsible for any deviation from the Contract Documents not brought to our attention in writing by the Contractor. RMC shall not be required to review partial submissions or those for which submissions of correlated items have not been received.

Pre-Grade Meeting

A pre-job conference should be held with a representative of the Owner, Contractor, Architect, Civil Engineer, Geotechnical Engineer, and Building Official prior to commencement of construction to clarify any questions relating to the intent of these recommendations or additional recommendations.

Observation and Testing

Geotechnical observation and testing during construction is required to verify proper removal of unsuitable materials, check that foundation excavations are clean and founded in competent material, to test for proper moisture content and proper degree of compaction of fill, to test and observe placement of wall and trench backfill materials, and to confirm design assumptions. It is noted that the CBC requires continuous verification and testing during placement of fill, pile driving, and pier/caisson drilling.

An RMC representative shall observe the site at intervals appropriate to the phase of construction, as notified by the Contractor, in order to observe the work completed by the Contractor. Such visits and observation are not intended to be an exhaustive check or a detailed inspection of the Contractor's work but rather are to allow RMC as an experienced professional, to become generally familiar with the work in progress and to determine, in general, if the grading and construction is in accordance with the recommendations of this report.

RMC shall not supervise, direct, or control the Contractor's work. RMC shall have no responsibility for the construction means, methods, techniques, sequences, or procedures selected by the Contractor, the Contractor's safety precautions or programs in connection with the work. These rights and responsibilities are solely those of the Contractor.

RMC shall not be responsible for any acts or omission of any entity performing any portion of the work, including the Contractor, Subcontractor, or any agents or employees of any of them. RMC does not guarantee the performance of any other parties on the project site, including the Contractor, and shall not be responsible for the Contractor's failure to perform its work in accordance with the Contract Documents or any applicable law, codes, rules or regulations.

Construction-phase observations are beyond the scope of this investigation and budget and are conducted on a time and material basis. The responsibility for timely notification of the start of construction and ongoing geotechnically-involved phases of construction is that of the Owner and his Contractor. We request at least 48 hours' notice when such services are required.

<u>List of Guidelines</u>

The Geotechnical Consultant should be notified to observe and test the following activities during grading and construction:

- To observe proper removal of unsuitable materials;
- to observe the bottom of removals for all excavations for building pad grading, trenching, exterior site improvements, etc.;
- to observe side cut excavations for shoring, retaining walls, trenches, etc.;
- to test for proper moisture content and proper degree of compaction of fill;
- to check that foundation excavations are clean and founded in competent material;
- prior to and after pre-soaking of the slab subgrade soils, if necessary;
- to check the slab subgrade materials prior to placing the gravel/sand, vapor barrier and concrete;
- to check retaining wall subdrain installation when the pipe is exposed and before it is covered by the gravel and fabric; and again after the gravel and fabric have been placed/wrapped;
- to test and observe placement of wall backfill materials;
- to test and observe placement of trench backfill materials;
- to test and observe patio and sidewalk subgrade materials;
- to observe any other fills or backfills that may be constructed at the site.

It is noted that this list should be used as a guideline. Additional observations and testing may be required per local agency and code requirements at the time of the actual construction. The 2019 CBC requires continuous verification and testing during placement of fill materials and during pile/caisson drilling.

LIMITATIONS

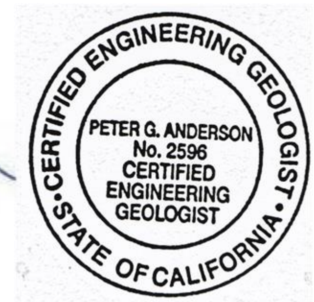
This investigation has been conducted in accordance with, and limited to, generally accepted practice in the engineering geologic and soils engineering field, and in accordance with services provided by geotechnical consultants practicing in the same or similar locality under the same or similar circumstances. No further warranty, expressed or implied, is made as to the conclusions and professional advice included in this report. Conclusions and recommendations presented are based on subsurface conditions encountered and are not meant to imply that we have control over the natural site conditions. The samples taken and used for testing, the observations made and the field testing performed are believed representative of the general project area; however, soil and geologic conditions can vary significantly between tested or observed locations.

The recommendations provided herein are subject to outside review and revision by the various governmental agencies, including the City of Laguna Beach. The agencies, at their discretion, may add requirements to planned construction that vary from the information provided herein. Additionally, requirements of the agencies and their interpretations of relevant codes may change over time and with each individual permit application.

Site geotechnical conditions may change with time due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur as a result of the broadening of knowledge, new legislation, or agency requirements. The recommendations presented herein are, therefore, arbitrarily set as valid for one year from the report date. The recommendations are also specific to the current proposed development. Changes in proposed land use or development may require supplemental investigation or recommendations. Also, independent use of this report without appropriate geotechnical consultation is not approved or recommended.

Thank you for this opportunity to be of service. If you have any questions, please contact this office.

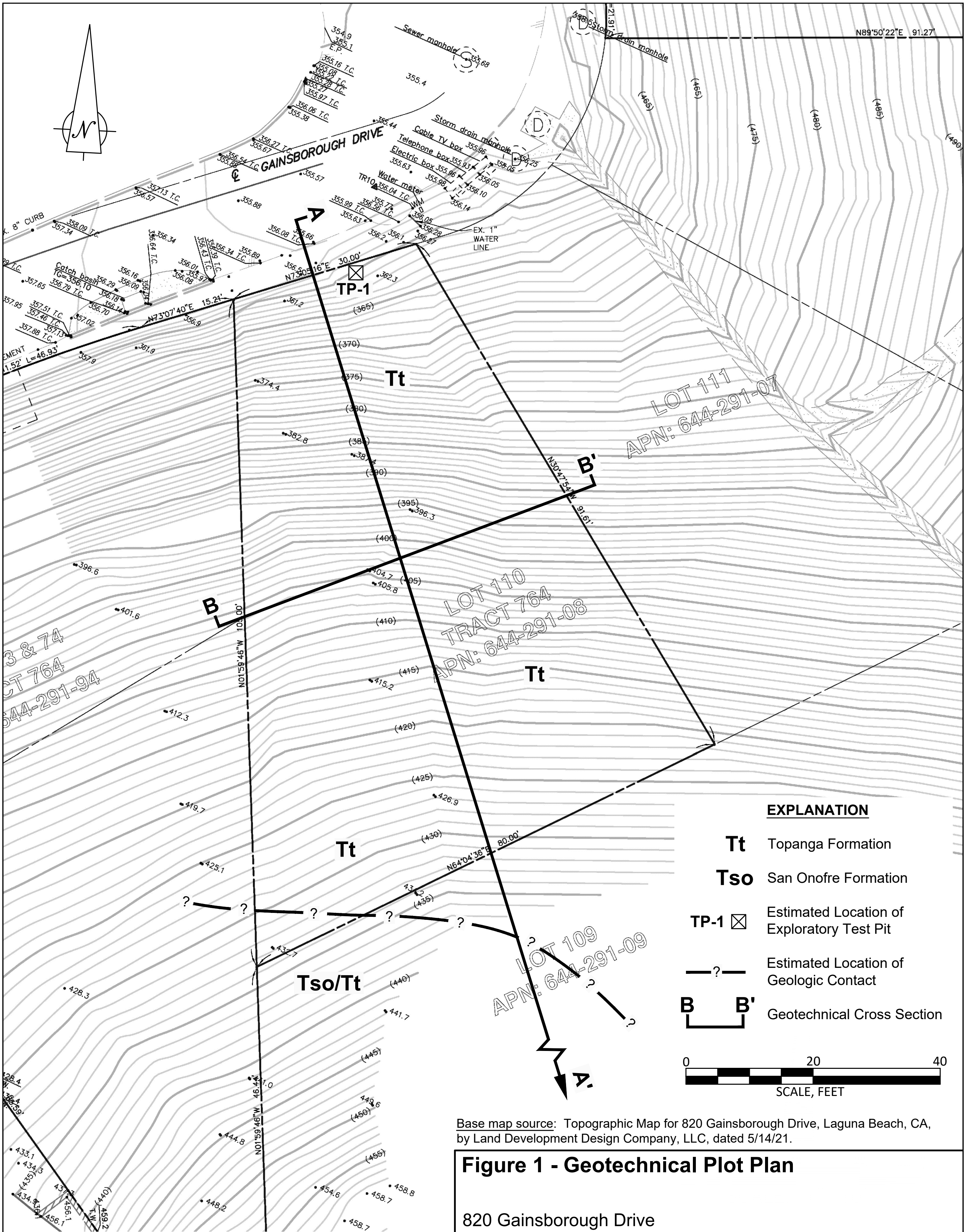
Respectfully submitted,
R MCCARTHY CONSULTING, INC.



Robert J. McCarthy
Principal Engineer, G.E. 2490
Registration Expires 3-31-22
Date Signed: 10/09/2021

Peter G. Anderson
Engineering Geologist CEG No. 2596
Registration Expires: 9-30-23
Date Signed: 10/09/2021

Accompanying Illustrations and Appendices

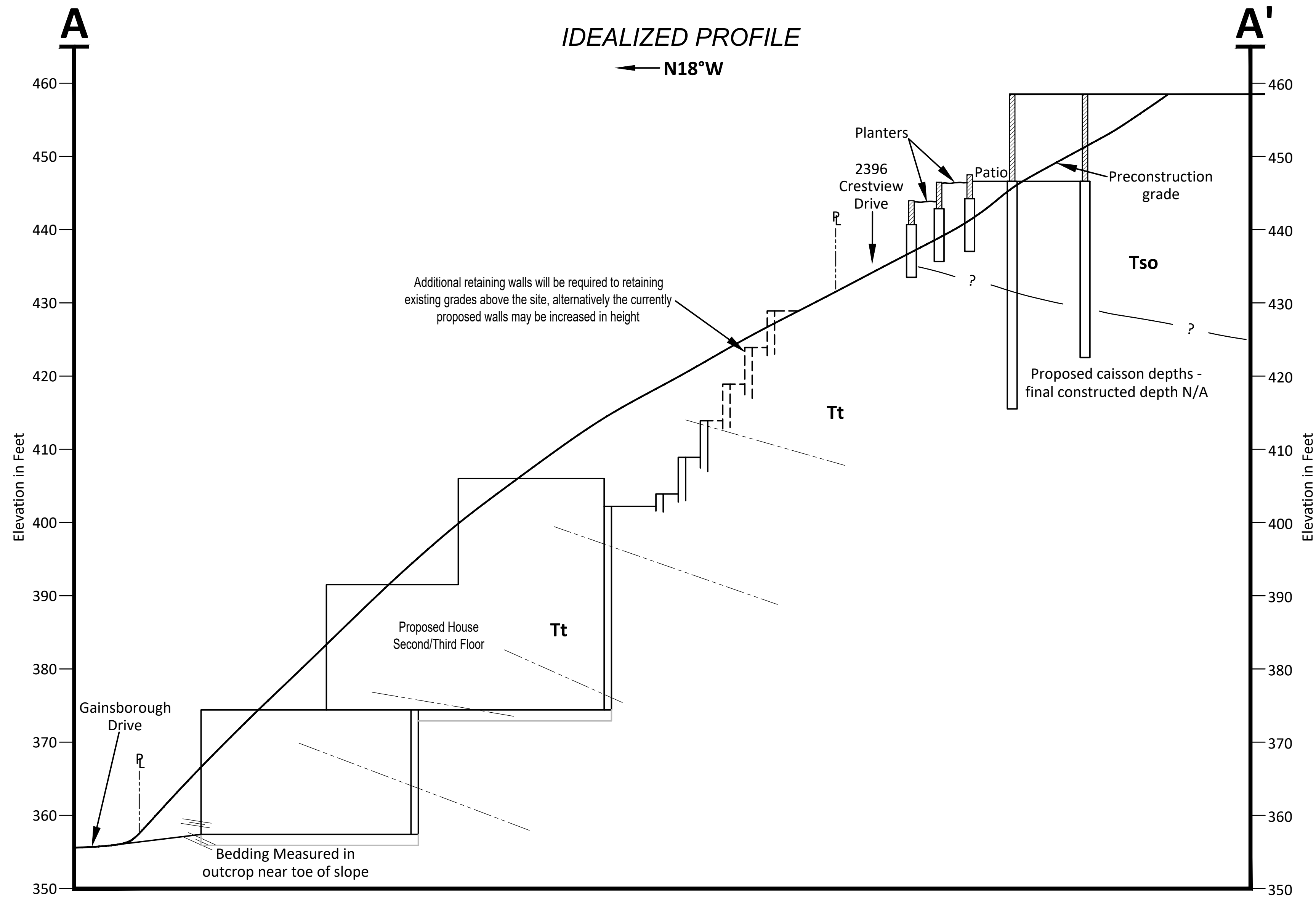


Base map source: Topographic Map for 820 Gainsborough Drive, Laguna Beach, CA, by Land Development Design Company, LLC, dated 5/14/21.

Figure 1 - Geotechnical Plot Plan

820 Gainsborough Drive
Laguna Beach, CA
File: 8560-00 October 2021

R McCARTHY CONSULTING, INC



0 20 40

Horizontal and Vertical Scale (feet)

Notes:

1. All elevations estimated; figure is idealized.
2. Actual profiles may vary significantly; based on topographic and geologic interpretation.
3. Configuration of construction at 2396 Crestview Drive from Borella Geology, 9/21/08.

EXPLANATION

Tt Topanga Formation

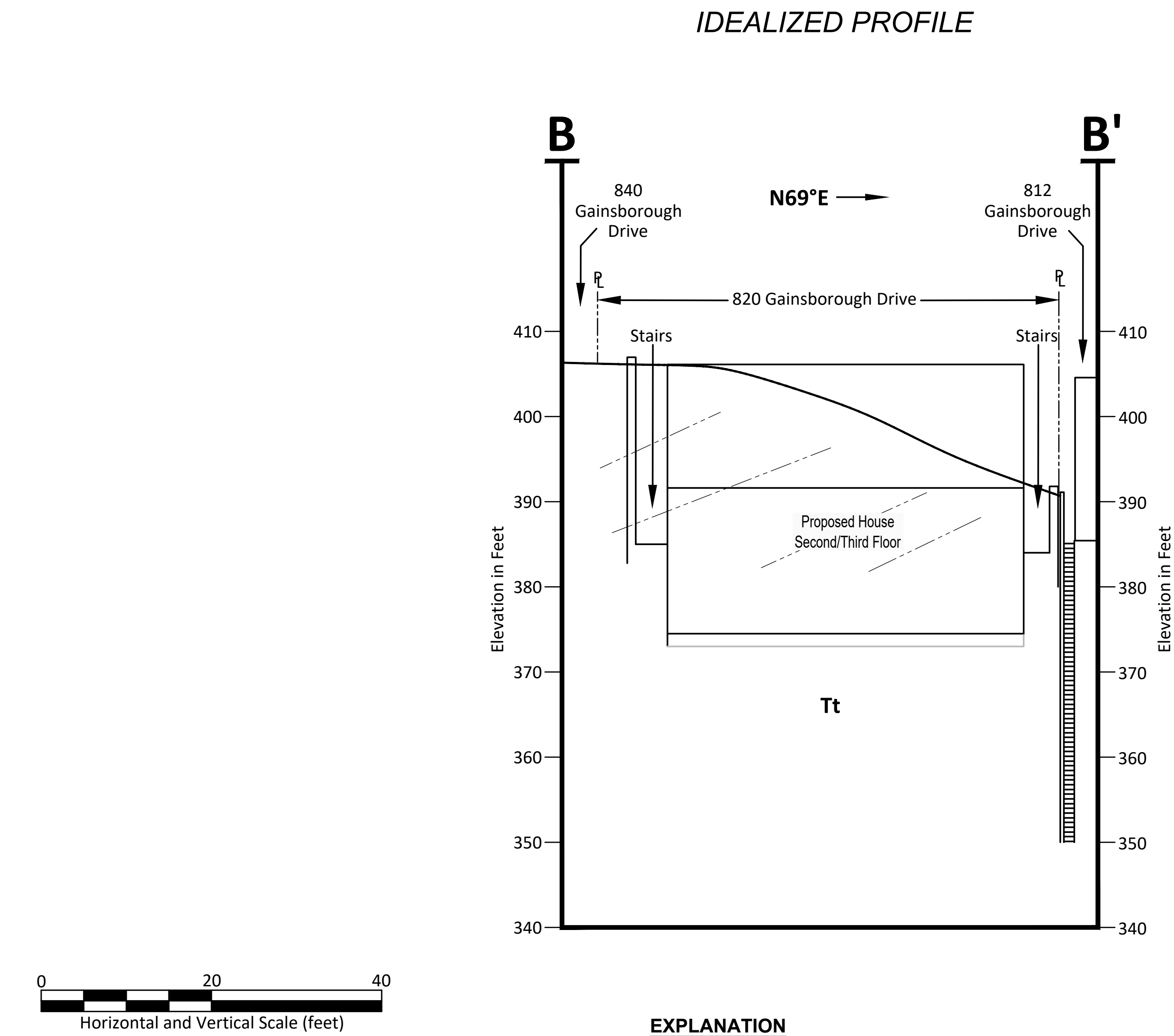
Tso San Onofre Formation

— —?— Estimated Location of Geologic Contact

Figure 2 - Geotechnical Cross Section A-A'

820 Gainsborough Drive
Laguna Beach, CA
File: 8560-00 October 2021

R McCarthy Consulting, Inc



EXPLANATION

Tt Topanga Formation

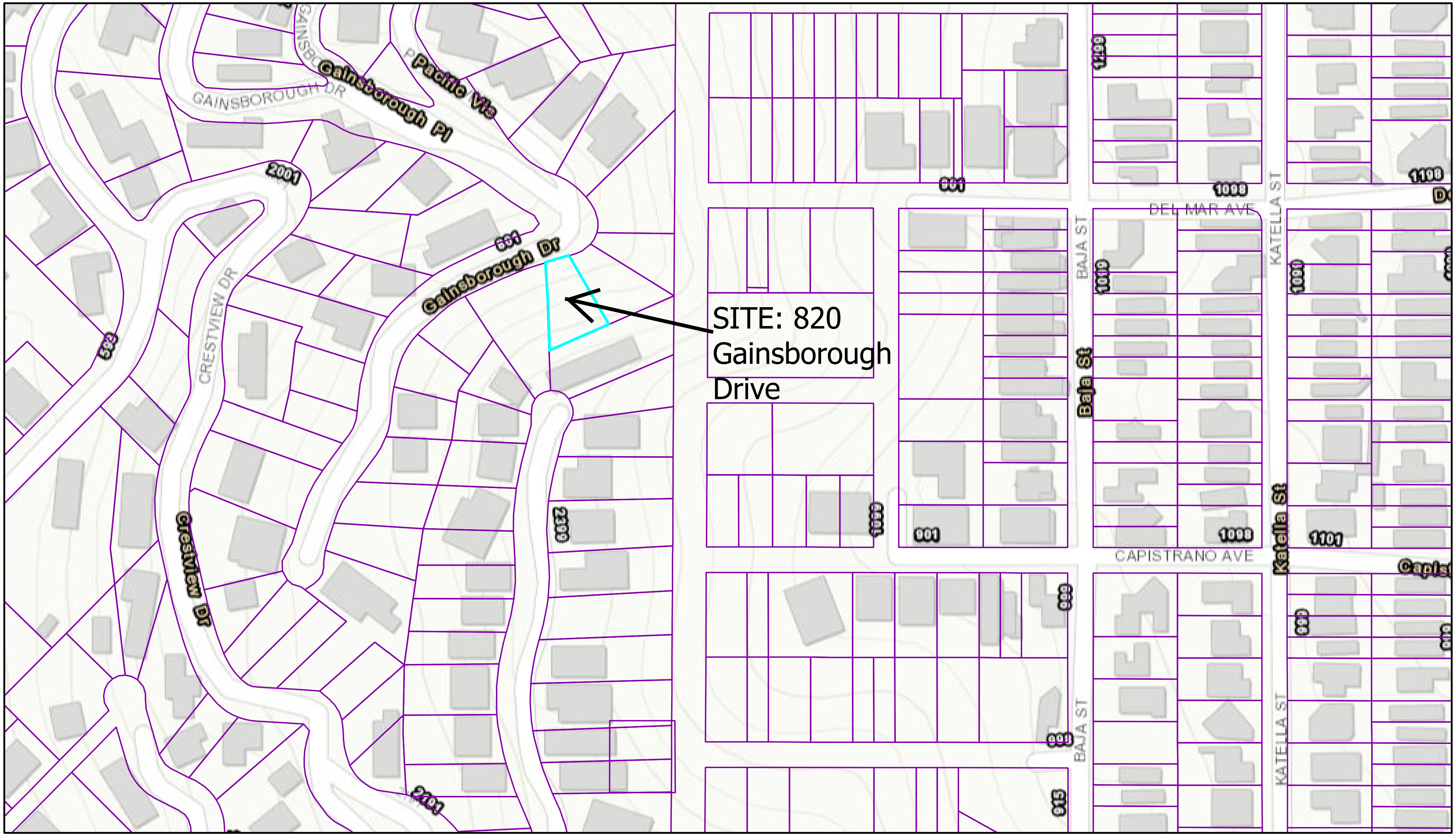
Notes:

1. All elevations estimated; figure is idealized.
2. Actual profiles may vary significantly; based on topographic and geologic interpretation.
3. Configuration of construction at 2396 Crestview Drive from Borella Geology, 9/21/08.

Figure 3 - Geotechnical Cross Section B-B'

820 Gainsborough Drive
Laguna Beach, CA
File: 8560-00 October 2021

R McCarthy Consulting, Inc



The City of Laguna Beach does not guarantee the accuracy, adequacy, completeness, or usefulness of any information displayed in this application.

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0 0.01 0.03 0.06 mi

0 0.03 0.05 0.1 km

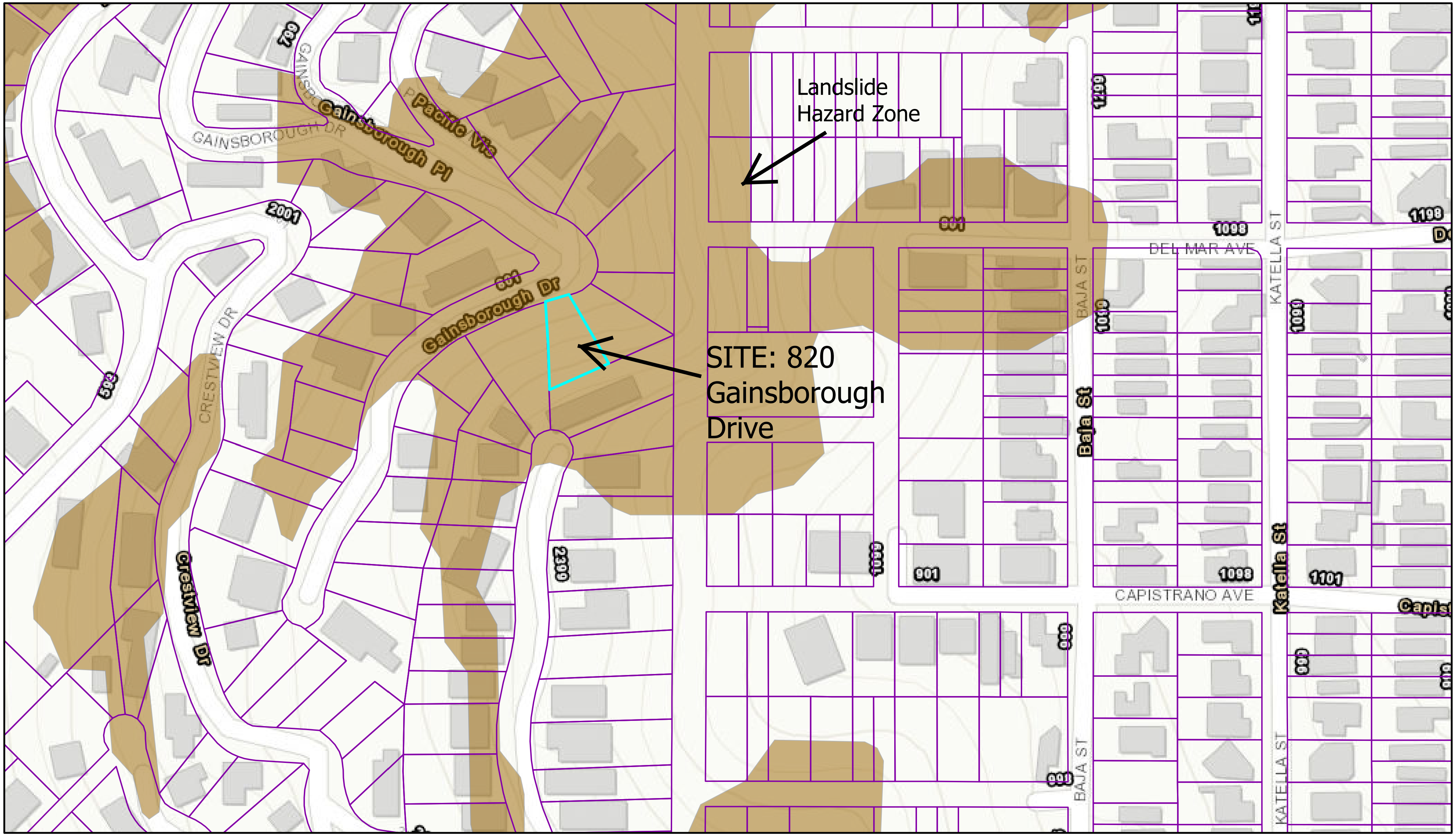
R McCARTHY CONSULTING, INC

FILE NO: 8560-00

OCTOBER 2021

FIGURE 4 - LOCATION MAP

City of Laguna Beach Parcel Information



City of Laguna Beach

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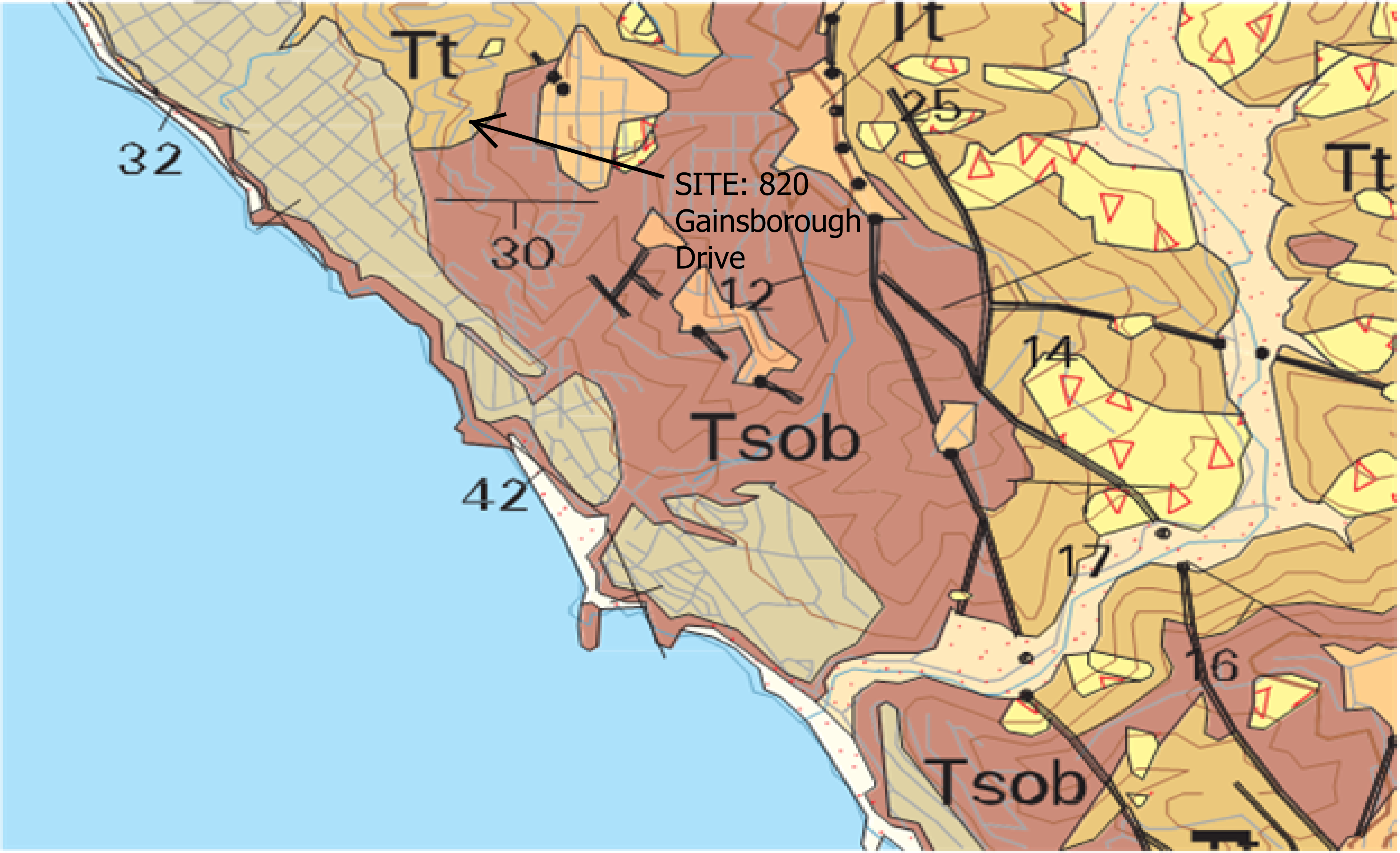
R McCARTHY CONSULTING, INC

FILE NO: 8560-00

OCTOBER 2021

FIGURE 5 - GEOLOGIC HAZARDS MAP



GEOLOGIC MAP OF THE SAN BERNARDINO AND SANTA ANA 30' X 60' QUADRANGLES, CALIFORNIA
U. S. Geological Survey, Open File Report 2006-1217
Compiled by Douglas M. Morton and Fred K. Miller, 2006

R MCCARTHY CONSULTING, INC FILE NO: 8560-00 OCTOBER 2021 FIGURE 6 - REGIONAL GEOLOGY MAP

APPENDIX A

REFERENCES

APPENDIX A
REFERENCES

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(820 Gainsborough Drive, Laguna Beach)

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APPENDIX B

FIELD EXPLORATION

APPENDIX B
FIELD EXPLORATION PROGRAM

(820 Gainsborough)

Subsurface conditions were explored by excavating test pit TP-1 near Gainsborough Road at the subject site on April 20, 2021 and April 21, 2021. TP-1 was excavated into the sandstone bedrock with manual equipment including shovels, picks, chisels, etc. Geologic reconnaissance and visual mapping of the slope was also performed. The approximate location of the test pit is shown on the Geotechnical Plot Plan, Figure 1. The Excavation Log is included as Figure B-2. A Key to Logs is included as Figure B-1. Excavation of the test pit was observed by our field geologist who logged the soils and obtained samples for identification and laboratory testing.

Exploratory excavations were located in the field by pacing from known landmarks. Their locations as shown are, therefore, within the accuracy of such measurements. The elevations on the test pit log was determined by interpolation between contours on the Topographic Map prepared LDDC, Land Development Design Company, LLC, Reference 1.

Representative bulk samples were collected from the test pit excavation and sealed in plastic bags. The exposed rock at the surface limited sampling. An undisturbed, carved block sample of the bedrock was obtained and returned to the laboratory for testing along with disaggregated bulk samples.

Summary

The soils were classified based on field observations and laboratory tests. The classification is in accordance with ASTM D2487 (the Unified Soil Classification System). Collected samples were transported to the laboratory for testing. No groundwater was encountered in the test pit or observed as part of our field investigation.

UNIFIED SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			GROUP SYMBOLS	SYMBOL	TYPICAL NAMES
COARSE-GRAINED SOILS: more than 50% retained on No. 200 sieve (based on the material passing the 3-inch [75mm] sieve)	GRAVELS: 50% or more of coarse fraction retained on No. 4 sieve	CLEAN GRAVELS	GW		Well graded gravels and gravel-sand mixtures, little or no fines
			GP		Poorly graded gravels and gravel-sand mixtures, little or no fines
		GRAVEL WITH FINES	GM		Silty gravels, gravel-sand-silt mixtures
			GC		Clayey gravels, gravel-sand-clay mixtures
	SANDS: more than 50% of coarse fraction passes No. 4 sieve	CLEAN SANDS	SW		Well graded sands and gravelly sand, little or no fines
			SP		Poorly graded sands and gravelly sands, little or no fines
		SANDS WITH FINES	SM		Silty sands, sand-silt mixtures
			SC		Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS: 50% or more passes No. 200 sieve*	SILTS AND CLAYS: Liquid Limit 50% or less		ML		Inorganic silts, very fine sands, rock flour, silty or clayey fine sands
			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL		Organic silts and organic silty clays of low plasticity
	SILTS AND CLAYS: Liquid Limit greater than 50%		MH		Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic clays
			CH		Inorganic clays of high plasticity, fat clays
			OH		Organic clays of medium to high plasticity
HIGHLY ORGANIC SOILS			PT		Peat, muck, and other highly organic soils

KEY TO LOGS

NOTATION	SAMPLER TYPE
C	Core barrel
CA	California split-barrel sampler with 2.5-inch outside diameter and a 1.93-inch inside diameter
D&M	Dames & Moore piston sampler using 2.5-inch outside diameter, thin-walled tube
O	Osterberg piston sampler using 3.0-inch outside diameter, thin-walled Shelby tube
PTB	Pitcher tube sampler using 3.0-inch outside diameter, thin-walled Shelby tube
S&H	Sprague & Henwood split-barrel sampler with a 3.0-inch outside diameter and a 2.43-inch inside diameter
SPT	Standard Penetration Test (SPT) split-barrel sampler with a 2.0-inch outside diameter and a 1.5-inch inside diameter
ST	Shelby Tube (3.0-inch outside diameter, thin-walled tube) advanced with hydraulic pressure
NR	No Recovery

SYMBOL

- Modified California Sampler (3" O.D.)
- Modified California Sampler, no recovery
- Standard Penetration Test, ASTM D 1586
- Standard Penetration Test, no recovery
- Thin-walled tube sample using Pitcher barrel
- Thin-walled tube sample, pushed or used Osterberg sampler
- Disaggregated (bulk) sample
- Water level

Figure B-1:
Unified Soil Classification Chart / Key To Logs

R McCarthy Consulting, Inc

TRENCH NO: T-1	PROJECT NO.: 8560-00	PROJECT NAME: 820 Gainsborough Drive
LOCATION: Road cut at SE side of Gainsborough Drive		
DATE: 4-21-21	EQUIPMENT: Bedrock Outcrop - Road Cut	
ELEVATION: 360' +/-	LOGGED BY: PA	

DESCRIPTION	ENGINEERING PROPERTIES					
	GEOLOGIC UNIT	CLASSIFICATION U.S.C.S.	BULK SAMPLE	UNDISTURBED SAMPLE	MOISTURE %	DENSITY (PCF)
Topanga Formation **Talus Deposits at toe of slope** @0-30': Pale brown medium to coarse-grained SANDSTONE with localized fine-grained SANDSTONE/SILTSTONE layers, damp, medium dense to dense, locally fractured/sheared, moderately weathered. - Road cut transitions to natural slope with slopewash over bedrock and extends to the southeast Bedding 1 N77°W 11°S 2 N80°W 26°S 3 N72°W 32°S						
T.D. 30'						

SCALE: 1" = 10' TOPOGRAPHY: ORIENTATION: N63°E

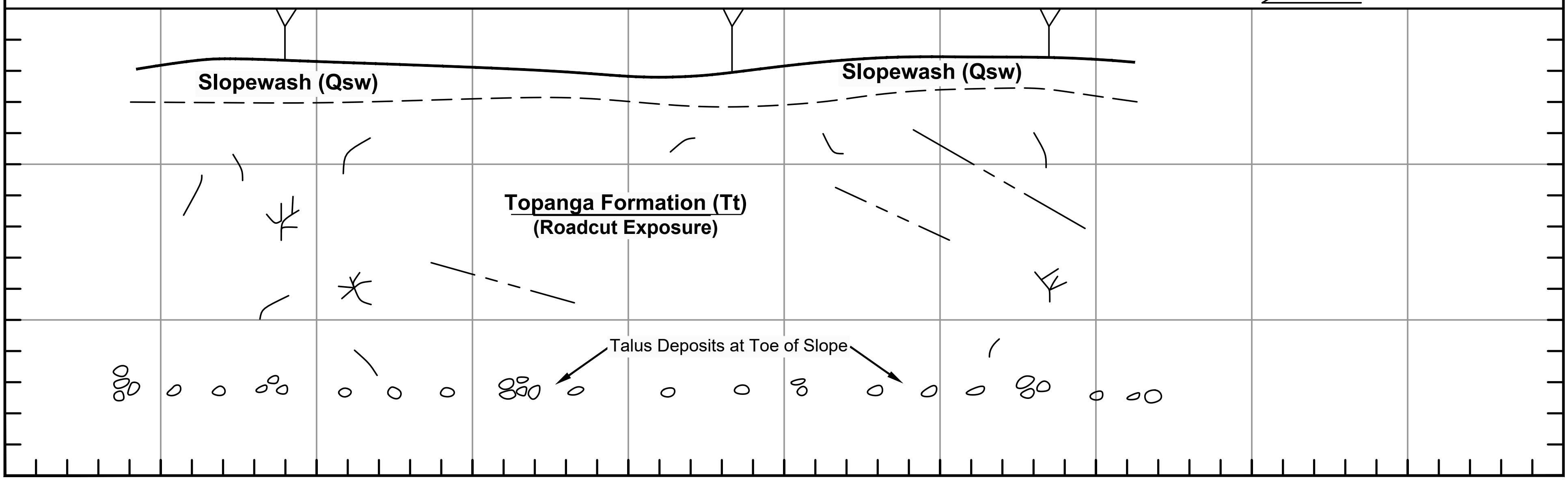


Figure B-2

R McCarthy Consulting, Inc

APPENDIX C

LABORATORY TESTING

APPENDIX C
LABORATORY TESTING

(820 Gainsborough)

The subject site exposes bedrock at the surface and sampling was limited to bulk samples picked out of the rock, including an undisturbed carved block sample of bedrock from the TP-1 location taken to the laboratory for shear testing.

Soils were classified visually and per the results of laboratory testing according to ASTM D2487, the Unified Soil Classification System (USCS). The results of the soil classifications are shown on the Test Pit Log in Appendix B.

This laboratory test program is supplemented by laboratory testing performed R McCarthy Consulting, Inc (RMC) on samples obtained from 796 Gainsborough Drive concurrently with this investigation. Also attached are laboratory test results reported by Geofirm for the adjoining lots to the east of 820 Gainsborough.

Direct Shear – Relatively Undisturbed

Direct shear tests were performed on selected relatively undisturbed samples obtained from the carved block bedrock sample, which were saturated under a surcharge equal to the applied normal force during testing. The apparatus used is in conformance with the requirements outlined in ASTM D3080. The test specimens, approximately 2.5-inches in diameter and 1-inch in height, were subjected to simple shear along a plane at mid-height after allowing time for pore pressure dissipation prior to application of shearing force. The samples were tested under various normal loads, a different specimen being used for each normal load. The samples were sheared at a constant rate of strain of 0.005-inches per minute. Shearing of the specimens was continued until the shear stress became essentially constant or until a deformation of approximately 10 percent of the original diameter was reached. The peak and ultimate shear stress values were plotted versus applied normal stress, and a best-fit straight line through the plotted points was determined to arrive at the cohesion and the angle of internal friction parameters of the soil samples. The direct shear test results are presented in Figure C-3.

Sulfate Test

Sulfate test results indicated low soluble sulfates as shown in Table C-1 below:

TABLE C-1
Results of Sulfate Tests
ASTM D4327

Test Location	Soil Classification	Soluble Sulfates (mg/kg) ASTM D4327	Sulfate Exposure
796/820 Gainsborough	SM	53	Low

APPENDIX C
LABORATORY TESTING

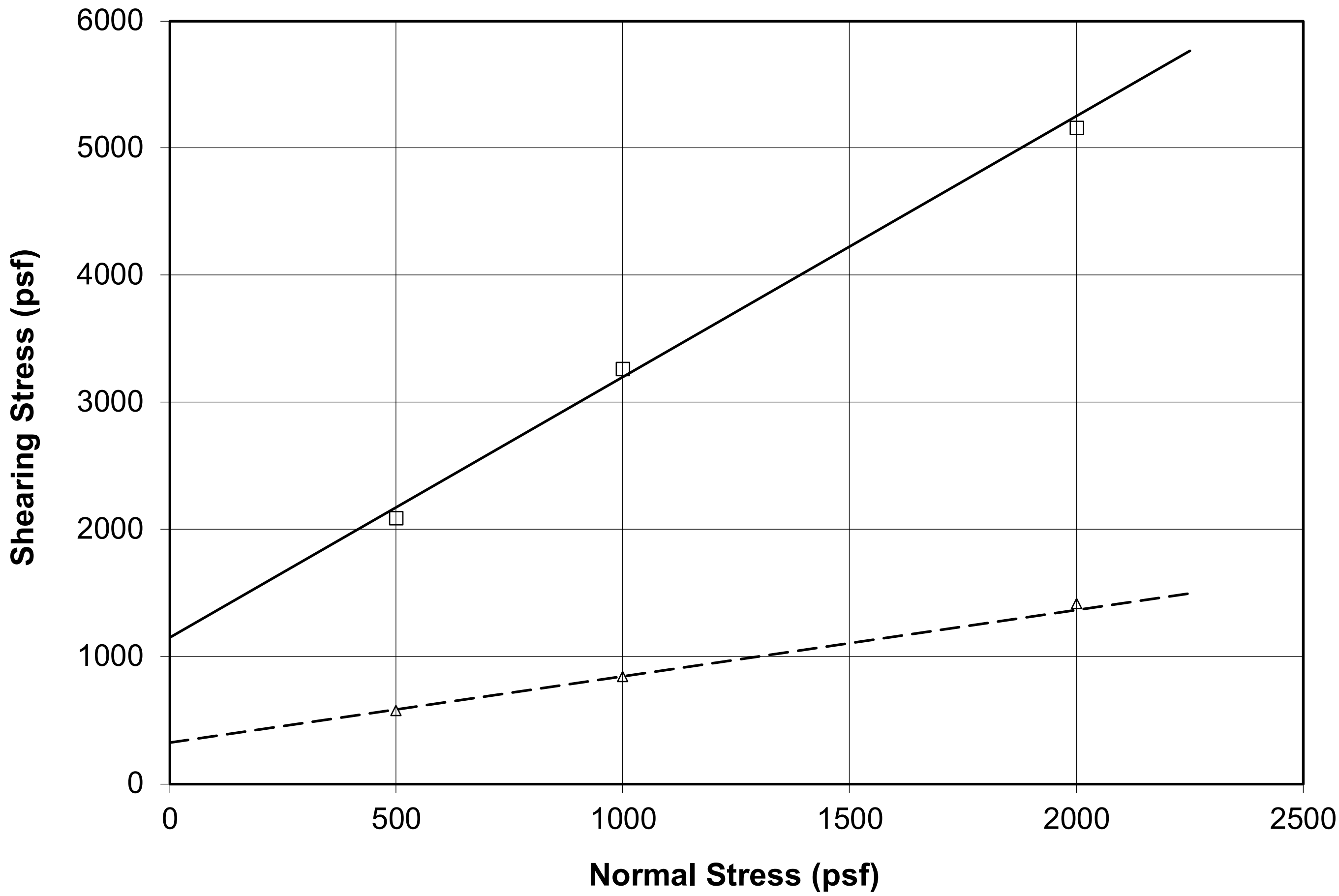
(820 Gainsborough)

Chemical Testing

A series of chemical test results are presented in Table C-2 below:

TABLE C-2
Results of Sulfate Tests

Test Location	Soil Classification	pH	Soluble Sulfates (mg/kg) ASTM D4327	Soluble Chlorides (mg/kg) ASTM D4327	Min. Resistivity (ohm-cm) ASTM G187
796/820 Gainsborough	SM	7.8	53	123	1,320



Sample Identification	TP-1 (Carved Block bedrock sample)

Rate of Shear	0.005	in/min	Sample Type	In-situ

Characteristics		Shear Strength			
Dry Density (pcf)	121.3	Angle of Friction - degrees (Ultimate)	28	Angle of Friction - degrees (Peak)	64.0
Moisture Content (%)	14.2	Cohesion - psf (Ultimate)	350	Cohesion - psf (Peak)	1150

R McCARTHY CONSULTING, INC

DIRECT SHEAR TEST

File No.:	8560-00	Date:	August - 2021	Figure No.:	C-1

TRANSMITTAL LETTER

DATE: May 12, 2021

ATTENTION: **Rob McCarthy**

TO: R McCarthy Consulting, Inc.
23 Corporate Plaza, Suite 150
Newport Beach, CA 92660

SUBJECT: Laboratory Test Data
8560/8561-00 - Gainsborough
Your #8560/8561-00, HDR Lab #21-0386LAB

COMMENTS: Enclosed are the results for the subject project.

James T. Keegan, MD
Corrosion and Lab Services Section Manager

431 West Baseline Road · Claremont, CA 91711
Phone: 909.962.5485 · Fax: 909.626.3316

Table 1 - Laboratory Tests on Soil Samples

R McCarthy Consulting, Inc.
8560/8561-00 - Gainsborough
Your #8560/8561-00, HDR Lab #21-0386LAB
12-May-21

Sample ID			
			HA-1 @ 0-5'
Resistivity		**Units**	
as-received		ohm-cm	13,600
saturated		ohm-cm	1,320
pH			7.8
Electrical Conductivity		mS/cm	0.24
Chemical Analyses			
Cations			
calcium	Ca^{2+}	mg/kg	27
magnesium	Mg^{2+}	mg/kg	23
sodium	Na^{1+}	mg/kg	265
potassium	K^{1+}	mg/kg	6.7
ammonium	NH_4^{1+}	mg/kg	0.7
Anions			
carbonate	CO_3^{2-}	mg/kg	71
bicarbonate	HCO_3^{1-}	mg/kg	140
fluoride	F^{1-}	mg/kg	6.1
chloride	Cl^{1-}	mg/kg	123
sulfate	SO_4^{2-}	mg/kg	53
nitrate	NO_3^{1-}	mg/kg	7.2
phosphate	PO_4^{3-}	mg/kg	ND
Other Tests			
sulfide	S^{2-}	qual	na
Redox		mV	na

Resistivity per ASTM G187, pH per ASTM G51, Cations per ASTM D6919, Anions per ASTM D4327, and Alkalinity per APHA 2320-B.

Electrical conductivity in millisiemens/cm and chemical analyses were made on a 1:5 soil-to-water extract.

mg/kg = milligrams per kilogram (parts per million) of dry soil.

Redox = oxidation-reduction potential in millivolts

ND = not detected

na = not analyzed

LABORATORY TESTING

796 Gainsborough Drive

RMC (October 2021)

APPENDIX C
LABORATORY TESTING

(796 Gainsborough)

The laboratory testing program was designed to fit the specific needs of this project and was limited to testing the soil samples collected during the on-site exploration. The test program was performed by our laboratory and supplemented with testing performed by HDR, Inc..

Soils were classified visually and per the results of laboratory testing according to ASTM D2487, the Unified Soil Classification System (USCS). The field moisture content and dry densities of the soils encountered were determined by performing laboratory tests on the collected samples. The results of the moisture tests, density determinations and soil classifications are shown on the Boring Logs in Appendix B.

Maximum Density

The maximum dry density and optimum moisture content relationships were determined for representative samples of the on-site soil. The laboratory standard used was ASTM D1557. The test results are presented below in Table C-1 and on Figure C-1.

TABLE C-1
RESULTS OF MAXIMUM DRY DENSITY AND OPTIMUM MOISTURE CONTENT
ASTM D1557

Test Location	Soil Classification	Soil Description	Maximum Dry Density pcf	Optimum Moisture Content %
HA-1 @ 0-5'	SM	Brown Silty SAND	126.5	9.5

Expansion Index Test

Expansion index tests were performed in accordance with ASTM D4829. The results are summarized in Table C-2 below.

TABLE C-2
RESULTS OF EXPANSION INDEX
ASTM D4829

Test Location	Soil Classification	Expansion Index	Expansion Potential	Moisture Content %	Saturation %
HA-1 @ 0-5'	SM	29	Low	7.9 Initial 17.4 Final	51 Initial 100 Final

APPENDIX C
LABORATORY TESTING

(796 Gainsborough)

Gradation

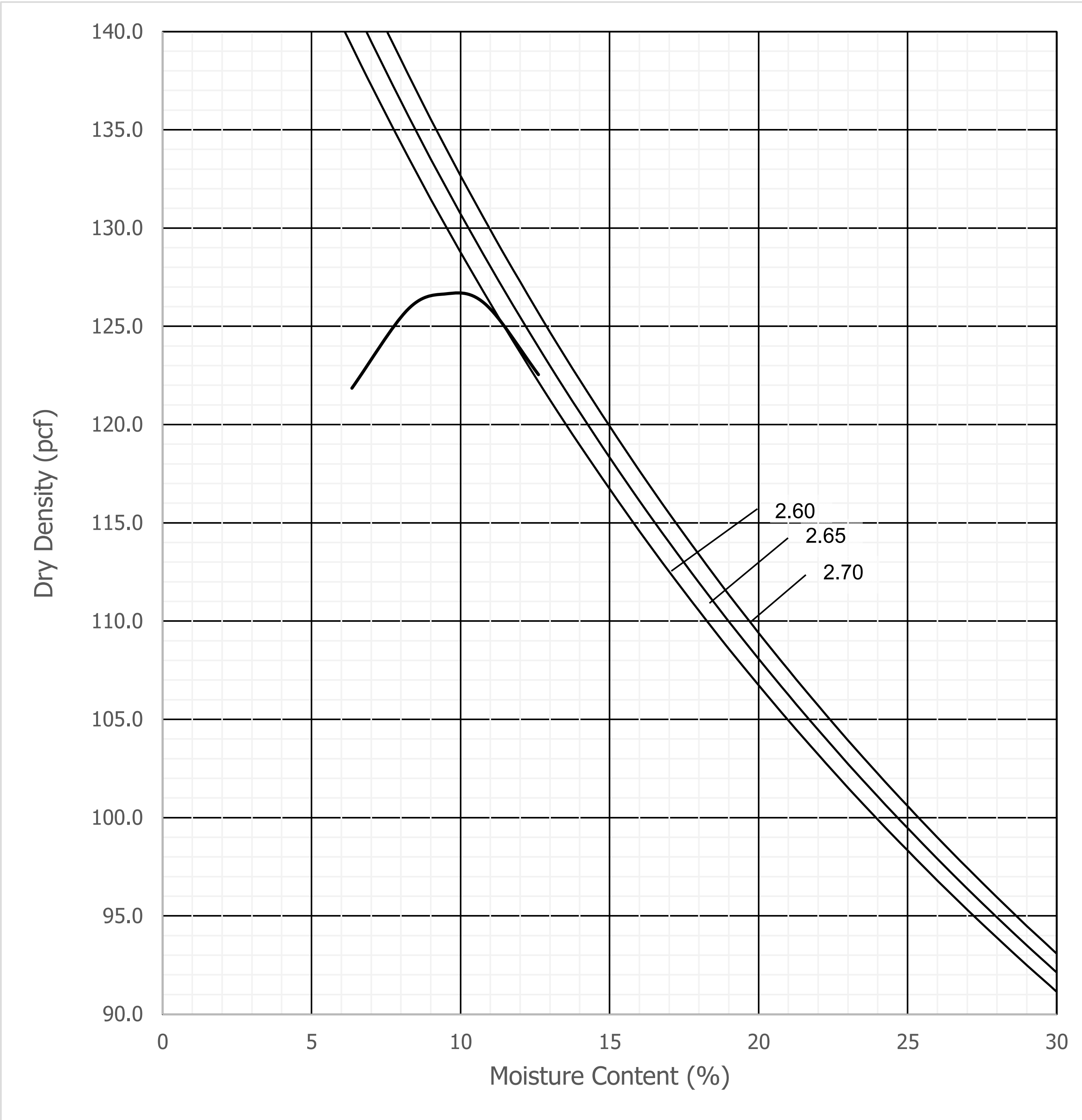
Particle size analysis consisting of mechanical sieve analysis were performed on representative samples of the on-site soils in accordance with ASTM D 1140 and C-136. The test results are presented on Figures C-2. The percentage of particles passing the No. 200 (75μm) sieve are tabulated in Table C-3 below:

TABLE C-3
Grain Size – Fines Content

Location	Classification	% Fines (Passing #200)	Figure No.
HA-1 @ 0-5′	SM	31.5	C-2

Direct Shear – Relatively Undisturbed

Direct shear tests were performed on selected relatively undisturbed samples which were saturated under a surcharge equal to the applied normal force during testing. The apparatus used is in conformance with the requirements outlined in ASTM D3080. The test specimens, approximately 2.5-inches in diameter and 1-inch in height, were subjected to simple shear along a plane at mid-height after allowing time for pore pressure dissipation prior to application of shearing force. The samples were tested under various normal loads, a different specimen being used for each normal load. The samples were sheared at a constant rate of strain of 0.005-inches per minute. Shearing of the specimens was continued until the shear stress became essentially constant or until a deformation of approximately 10 percent of the original diameter was reached. The peak and ultimate shear stress values were plotted versus applied normal stress, and a best-fit straight line through the plotted points was determined to arrive at the cohesion and the angle of internal friction parameters of the soil samples. The direct shear test results are presented in Figure C-3.

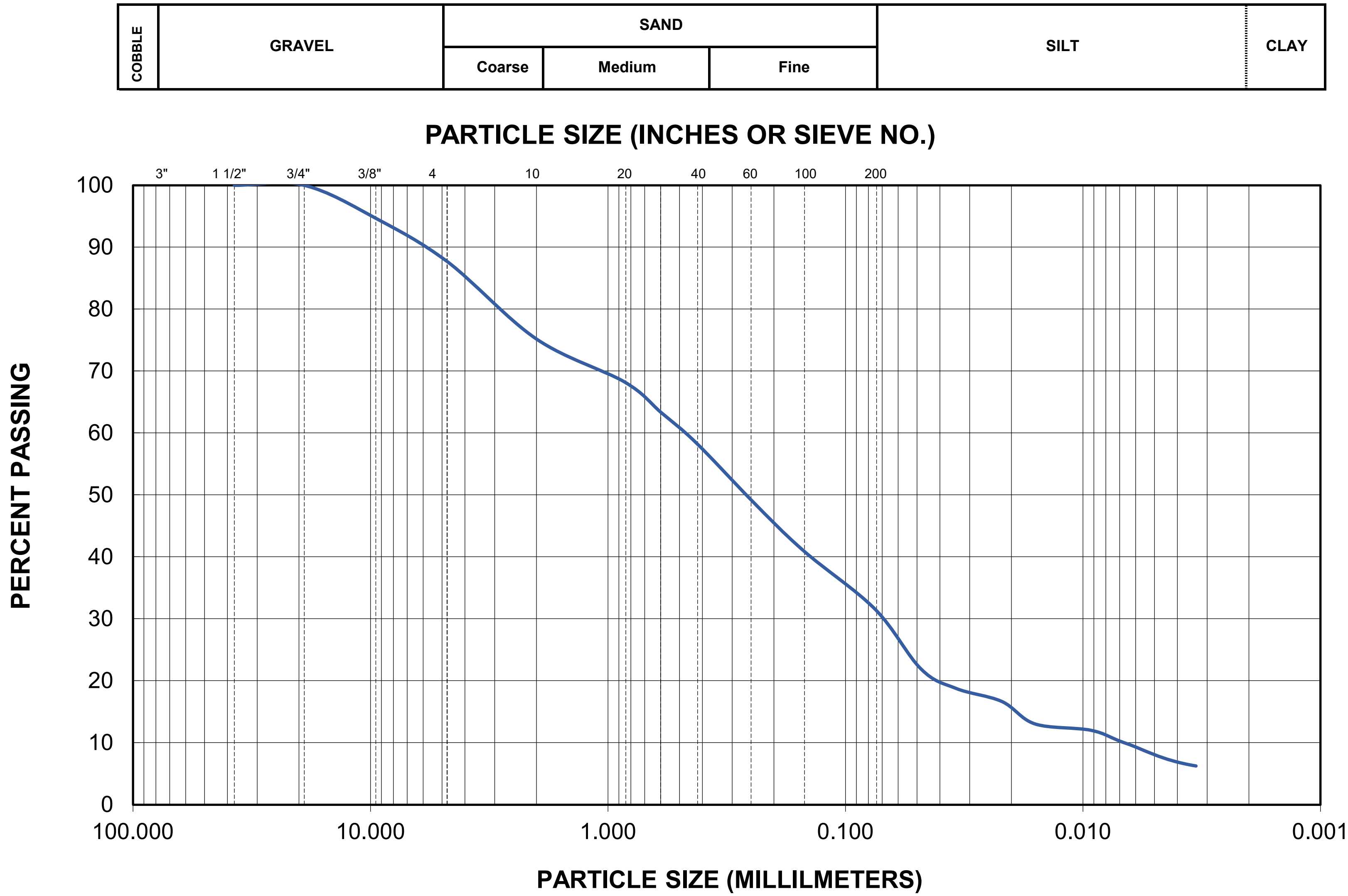


Sample Identification	HA-1 @ 0-5'
Sample Description	Brown Silty Sand
Maximum Dry Density (pcf)	126.5
Optimum Moisture Content (%)	9.5

R McCarthy Consulting, Inc

MAXIMUM DENSITY & OPTIMUM MOISTURE CONTENT DETERMINATION

File No.:	8561-00	Date:	August - 2021	Figure:	C-1

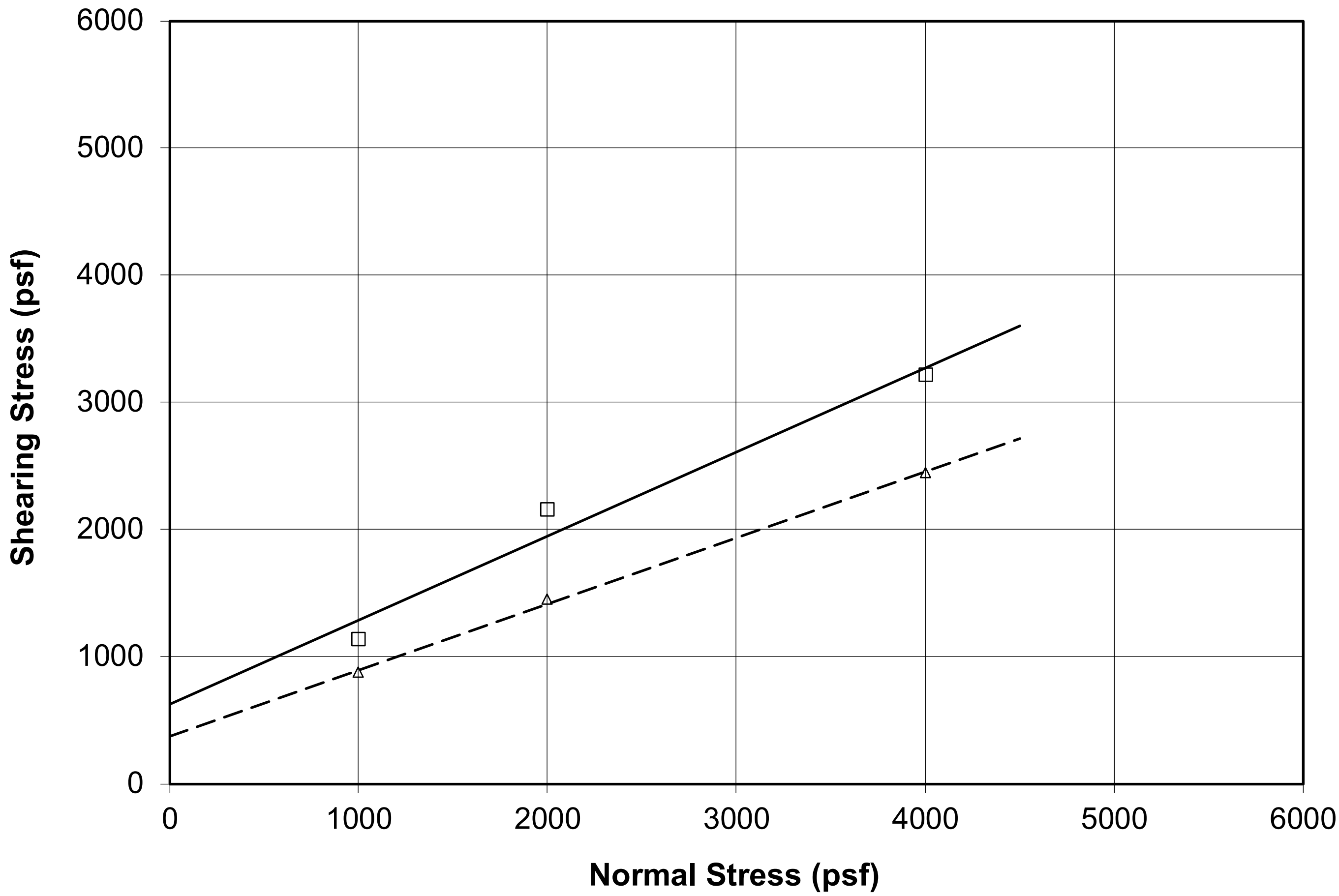


SAMPLE IDENTIFICATION		SOIL DESCRIPTION	C_U	C_C	PASSING NO. 200 (%)	USCS
LOCATION	DEPTH (FT)					
HA-1	0-5'	Brown Silty SAND	73.1	1.6	31.5	SM

R McCARTHY CONSULTING, INC

PARTICLE SIZE ANALYSIS COMPARISON

File No.:	8561-00	Date:	August 2021	Figure No.:	C-2



Sample Identification	HA-3 @ 7.5'

Rate of Shear	0.005	in/min	Sample Type	In-situ

Characteristics		Shear Strength			
Dry Density (pcf)	111.6	Angle of Friction - degrees (Ultimate)	27.5	Angle of Friction - degrees (Peak)	33.5
Moisture Content (%)	16.9	Cohesion - psf (Ultimate)	375	Cohesion - psf (Peak)	625

R McCARTHY CONSULTING, INC	DIRECT SHEAR TEST					
	File No.:	8561-00	Date:	August - 2021	Figure No.:	C-3

LABORATORY TESTING

Results from
Geotechnical Investigation
at
806/812 Gainsborough Drive

Geofirm (January 2007)
Reference 17

APPENDIX C

FIELD EXPLORATION AND LABORATORY TESTING

I. Field Exploration Procedures

A. Field Exploration

A test Pit excavation was manually excavated with a pick and shovel. The excavation exposed sandy silt fill soils to a depth of one foot below grade. Borings were excavated with a portable tripod mounted 6-inch diameter solid stem auger rig.

B. Sampling

A bulk sample of the excavated soil was bagged and transported to the laboratory for classification and physical testing.

II. Laboratory Testing Procedures

A. Expansion Test

An expansion index test was performed in accordance with UBC Standard No. 29-2. The results of the test are tabulated below:

Sample Designation	-	Test Pit 1 @0-1'
Expansion Index	-	24
Expansion Classification	-	Low

B. Corrosivity Series

Soluble sulfates, pH and minimum resistivity were determined in accordance with California Test Method 417, ASTM D 4972, California Test Method 643, respectively. The results of the test are presented below:

Soluble Sulfate	-	300
pH	-	8.25
Minimum Resistivity	-	3900 ohm-cm

C. Direct Shear Tests

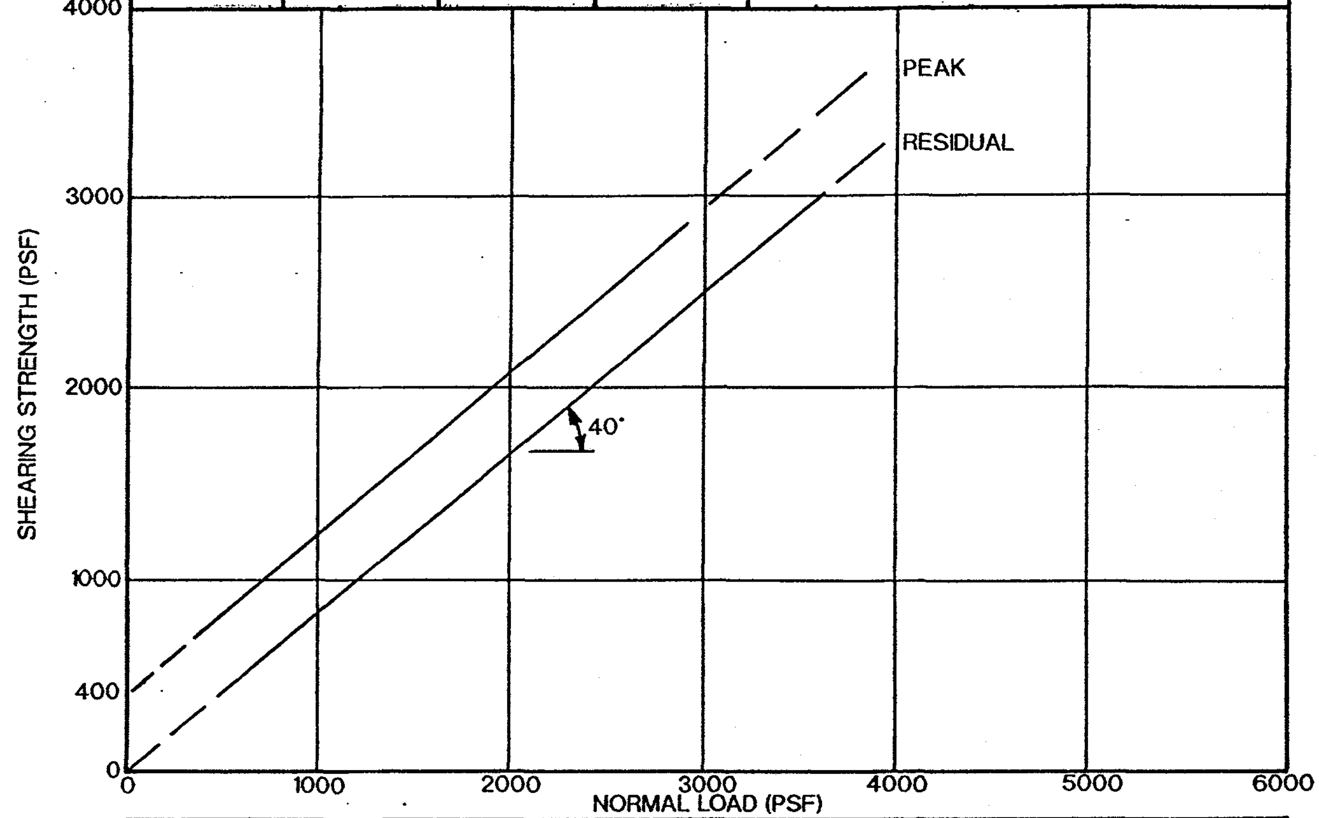
Direct shear tests were performed in general accordance with ASTM: D 3080 on specimens of soil inundated before and during testing. The direct shear machine employed was a conventional single shear, strain controlled device. The shear strength parameters were obtained by fitting a straight line through three points of residual shearing strength versus total normal stress. The total normal stress range used was 1000 to 4000 pounds per square foot. Results from these tests are summarized and presented on Figure C-1.

Boring No.	Depth (Feet)	Result	Angle of Internal Friction	Cohesion (psf)
B-1	10-11 ½’	Residual	40°	0
B	10-11 ½’	Peak	40°	400

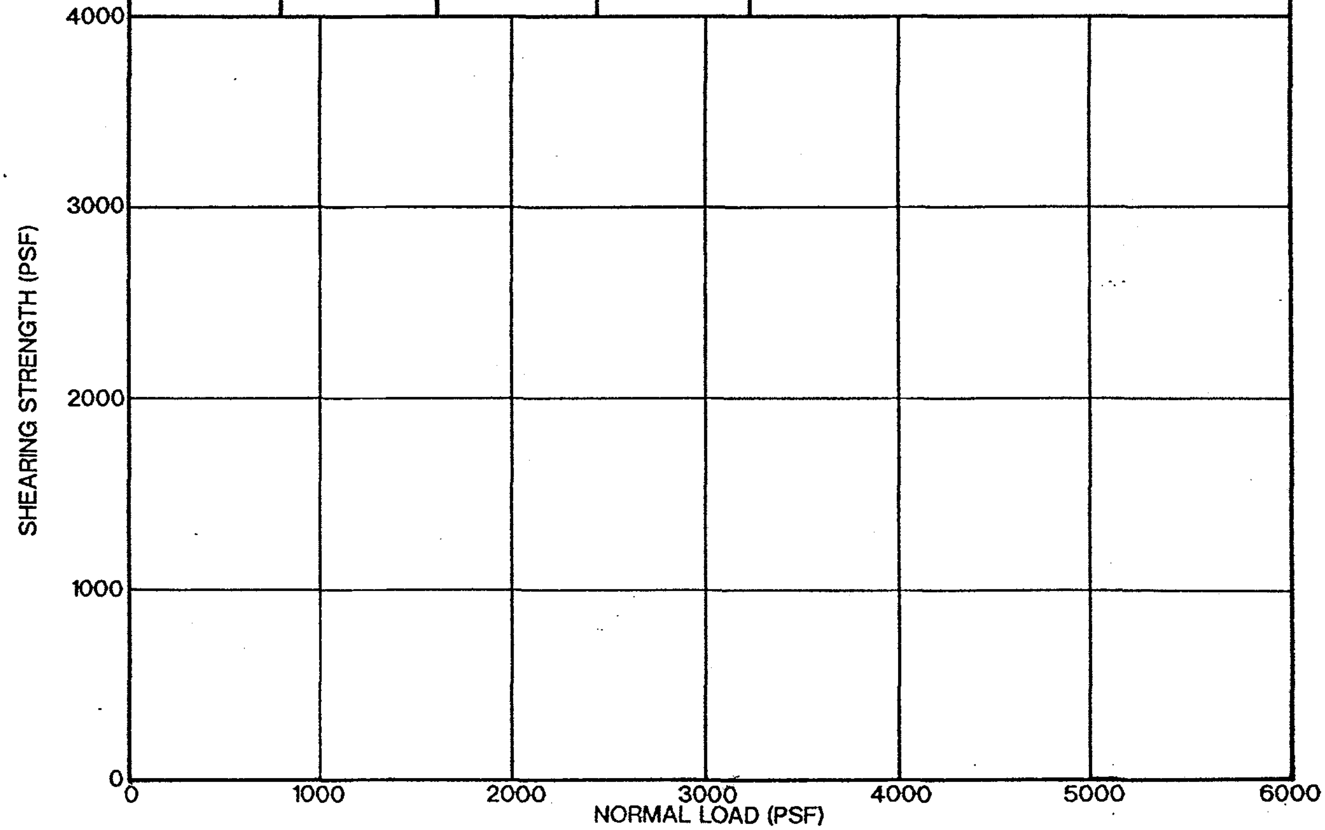
D. Particle Size Analysis

The quantitative distribution of particle sizes in soil was determined by sieve and hydrometer testing in accordance with ASTM Test Designation D 422. Classification of the fine-grained soil fraction was determined by Atterberg limits in accordance with ASTM D 4318. The results are presented on the attached Figures C-2 and C-3

BORING NO.	DEPTH (FEET)	COHESION (PSF)	ANGLE OF FRICTION (°)	SAMPLE DESCRIPTION
B-1	10-11.5	0/400	40	FILL (SILTY SAND TO SANDY SILT)



BORING NO.	DEPTH (FEET)	COHESION (PSF)	ANGLE OF FRICTION (°)	SAMPLE DESCRIPTION

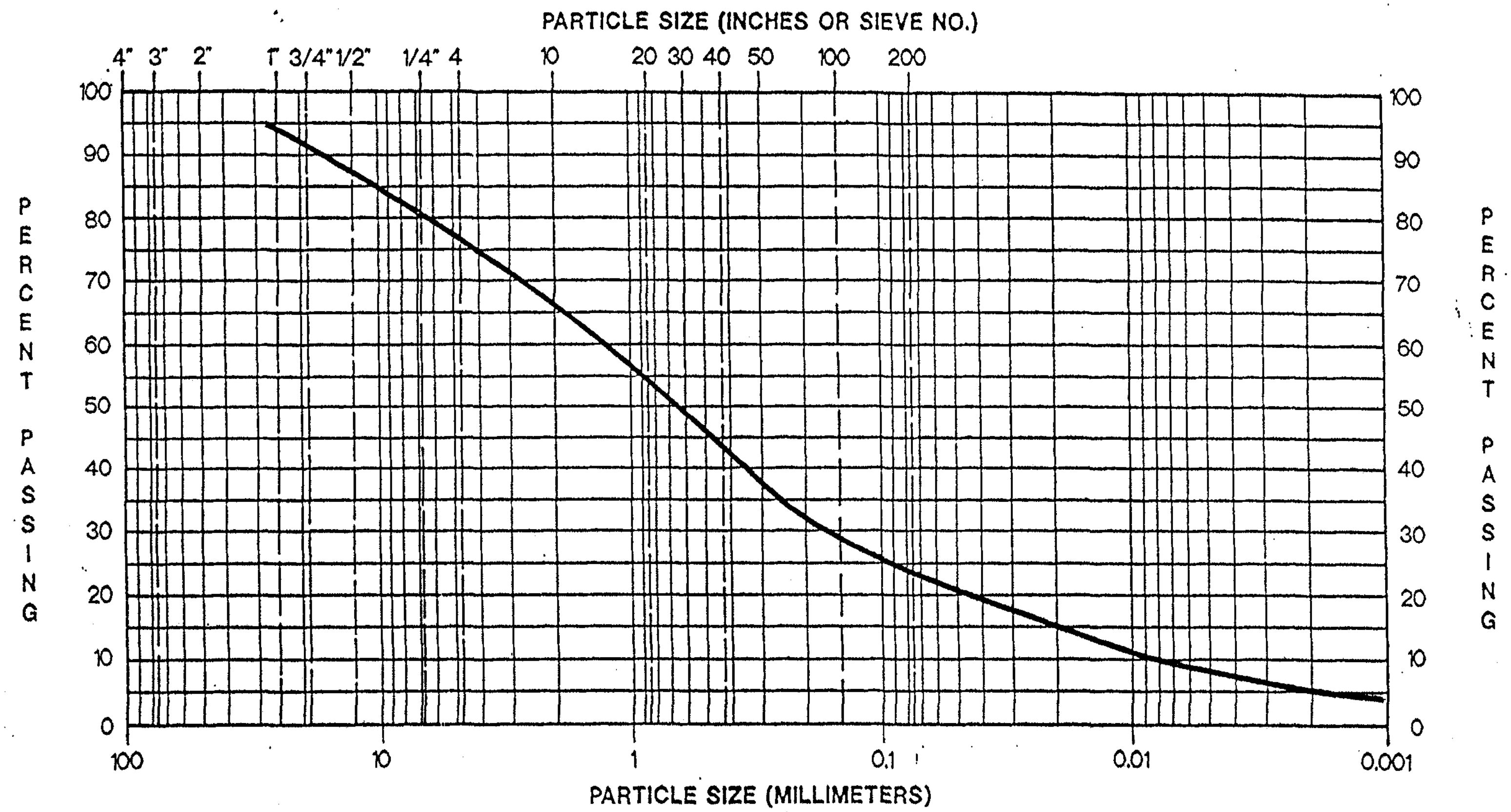


SMC

SHEARING STRENGTH TEST

JOB NO.: 71701-00 | DATE: JANUARY 2007 | FIGURE: C-1

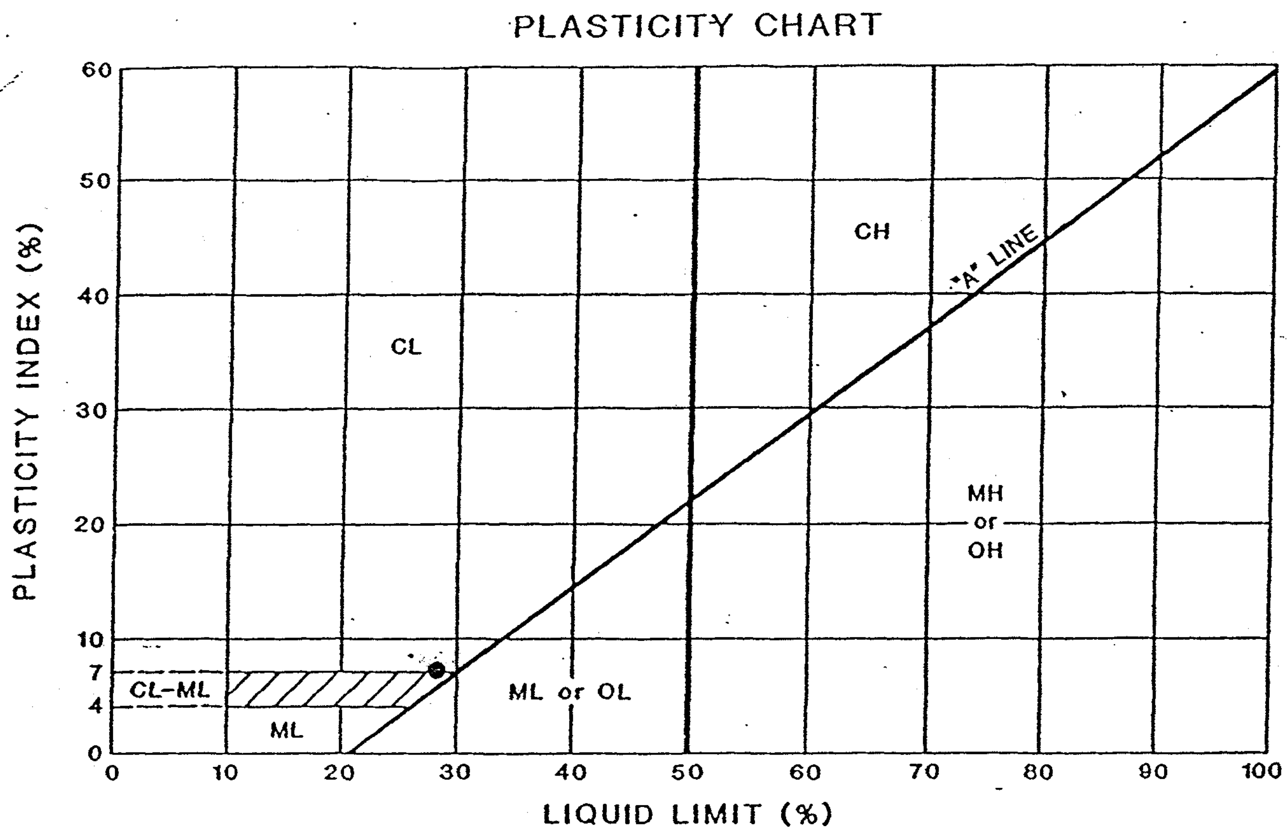
COBBLES	GRAVEL	SAND			SILT	CLAY
		COARSE	MEDIUM	FINE		



SAMPLE IDENTIFICATION	GRAPH SYMBOL	SOIL DESCRIPTION :
TP-1 at 0'-1'	——	Silty, clayey SAND with gravel (SC-SM)

PARTICLE SIZE ANALYSIS

JOB NO.: 71701-00	DATE: JANUARY 2007	FIGURE NO.: C-2



SYMBOL	BORING NO.	SAMPLE DEPTH (FEET)	NATURAL WATER CONTENT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	PASSING NO. 200 SIEVE (%)	LIQUIDITY INDEX (%)	UNIFIED SOIL CLASSIFICATION SYMBOL
●	B-1		–	28	7	–	–	CL-ML

ATTERBERG LIMITS

JOB NO.: 71701-00 | DATE: JANUARY 2007 | FIGURE: C-3

APPENDIX D

STANDARD GRADING GUIDELINES

APPENDIX D
STANDARD GRADING GUIDELINES

(820 Gainsborough Drive, Laguna Beach)

GENERAL

These Guidelines present the usual and minimum requirements for grading operations observed by R McCarthy Consulting, Inc., (RMC), or its designated representative. No deviation from these guidelines will be allowed, except where specifically superseded in the geotechnical report signed by a registered geotechnical engineer.

The placement, spreading, mixing, watering, and compaction of the fills in strict accordance with these guidelines shall be the sole responsibility of the Contractor. The construction, excavation, and placement of fill shall be under the direct observation of the Geotechnical Engineer or any person or persons employed by the licensed Geotechnical Engineer signing the soils report. If unsatisfactory soil-related conditions exist, the Geotechnical Engineer shall have the authority to reject the compacted fill ground and, if necessary, excavation equipment will be shut down to permit completion of compaction. Conformance with these specifications will be discussed in the final report issued by the Geotechnical Engineer.

SITE PREPARATION

All brush, vegetation and other deleterious material such as rubbish shall be collected, piled and removed from the site prior to placing fill, leaving the site clear and free from objectionable material.

Soil, alluvium, or rock materials determined by the Geotechnical Engineer as being unsuitable for placement in compacted fills shall be removed from the site. Any material incorporated as part of a compacted fill must be approved by the Geotechnical Engineer.

The surface shall then be plowed or scarified to a minimum depth of 6-inches until the surface is free from uneven features that would tend to prevent uniform compaction by the equipment used. After the area to receive fill has been cleared and scarified, it shall be disced or bladed by the contractor until it is uniform and free from large clods, brought to the proper moisture content and compacted to minimum requirements. If the scarified zone is greater than 12-inches in depth, the excess shall be removed and placed in lifts restricted to 6-inches.

Any underground structures such as cesspools, cisterns, mining shafts, tunnels, septic tanks, wells, pipe lines or others not located prior to grading are to be removed or treated in a manner prescribed by the Geotechnical Engineer.

MATERIALS

Materials for compacted fill shall consist of materials previously approved by the Geotechnical Engineer. Fill materials may be excavated from the cut area or imported from other approved sources, and soils from one or more sources may be blended. Fill soils shall be free from organic (vegetation) materials and other unsuitable substances. Normally, the material shall contain no rocks or hard lumps greater than 6-inches in size and shall contain at least 50 percent of material smaller than 1/4-inch in size. Materials greater than 4-inches in size shall be placed so that they are completely surrounded by compacted fines; no nesting of rocks shall be permitted. No material of a perishable, spongy, or otherwise of an unsuitable nature shall be used in the fill soils.

Representative samples of materials to be utilized, as compacted fill shall be analyzed in the laboratory by the Geotechnical Engineer to determine their physical properties. If any material other than that previously tested is encountered during grading, the appropriate analysis of this material shall be conducted by the Geotechnical Engineer in a timely manner.

PLACING, SPREADING, AND COMPACTING FILL MATERIAL

Soil materials shall be uniformly and evenly processed, spread, watered, and compacted in thin lifts not to exceed 6-inches in thickness. Achievement of a uniformly dense and uniformly moisture conditioned compacted soil layer should be the objective of the equipment operators performing the work for the Owner and Contractor.

When the moisture content of the fill material is below that specified by the Geotechnical Engineer, water shall be added by the Contractor until the moisture content is near optimum as specified. Moisture levels should generally be at optimum moisture content or greater.

When the moisture content of the fill material is above that specified by the Geotechnical Engineer, the fill material shall be aerated by the Contractor by blading, mixing, or other satisfactory methods until the moisture content is near the specified level.

After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted to 90 percent of the maximum laboratory density in compliance with ASTM D1557 (five layers). Compaction shall be accomplished by sheepsfoot rollers, vibratory rollers, multiple-wheel pneumatic-tired rollers, or other types of acceptable compacting equipment. Equipment shall be of such design that it will be able to compact the fill to the specified density. Compaction shall be continuous over the entire area and the equipment shall make sufficient passes to obtain the desired density uniformly.

A minimum relative compaction of 90 percent out to the finished slope face of all fill slopes will be required. Compacting of the slopes shall be accomplished by backrolling the slopes in increments of 2 to 5 feet in elevation gain or by overbuilding and cutting back to the compacted inner core, or by any other procedure, which produces the required compaction.

GRADING OBSERVATIONS

The Geotechnical Engineer shall observe the fill placement during the course of the grading process and will prepare a written report upon completion of grading. The compaction report shall make a statement as to compliance with these guidelines.

As a minimum, one density test shall be required for each 2 vertical feet of fill placed, or 1 for each 1,000 cubic yards of fill, whichever requires the greater number of tests; however, testing should not be limited based on these guidelines and more testing is generally preferable.

Processed ground to receive fill, including removal areas such as canyon or swale cleanouts, must be observed by the Geotechnical Engineer and/or Engineering Geologist prior to fill placement. The Contractor shall notify the Geotechnical Engineer when these areas are ready for observation.

UTILITY LINE BACKFILL

Utility line backfill beneath and adjacent to structures; beneath pavements; adjacent and parallel to the toe of a slope; and in sloping surfaces steeper than ten horizontal to one vertical (10:1), shall be compacted and tested in accordance with the criteria given in the text of this report. Alternately, relatively self-compacting material may be used. The material specification and method of placement shall be recommended and observed by the Soil Engineer, and approved by the Geotechnical Engineer and Building Official before use and prior to backfilling.

Utility line backfill in areas other than those stated above are generally subject to similar compaction standards and will require approval by the Soil Engineer.

The final utility line backfill report from the Project Soil Engineer shall include an approval statement that the backfill is suitable for the intended use.

PROTECTION OF WORK

During the grading process and prior to the complete construction of permanent drainage controls, it shall be the responsibility of the Contractor to provide good drainage and prevent ponding of water and damage to adjoining properties or to finished work on the site.

After the Geotechnical Engineer has finished observations of the completed grading, no further excavations and/or filling shall be performed without the approval of the Geotechnical Engineer.

APPENDIX E

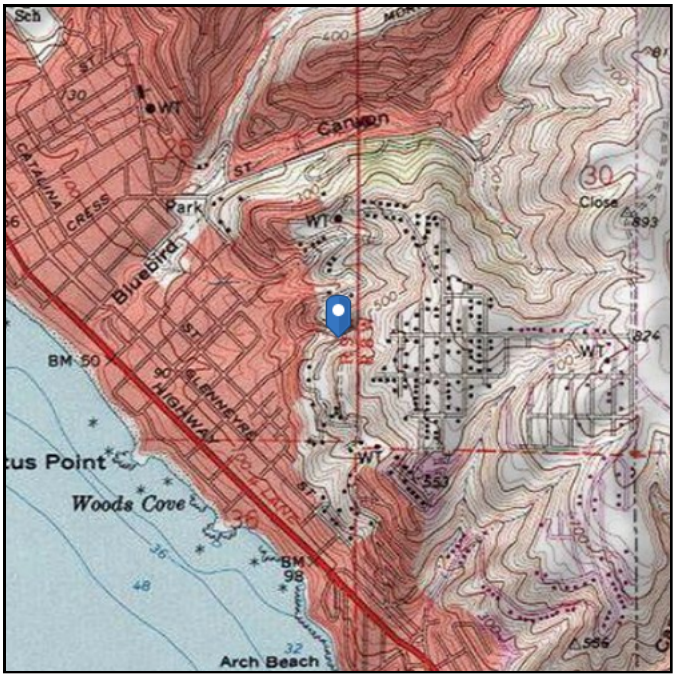
SEISMICITY DATA

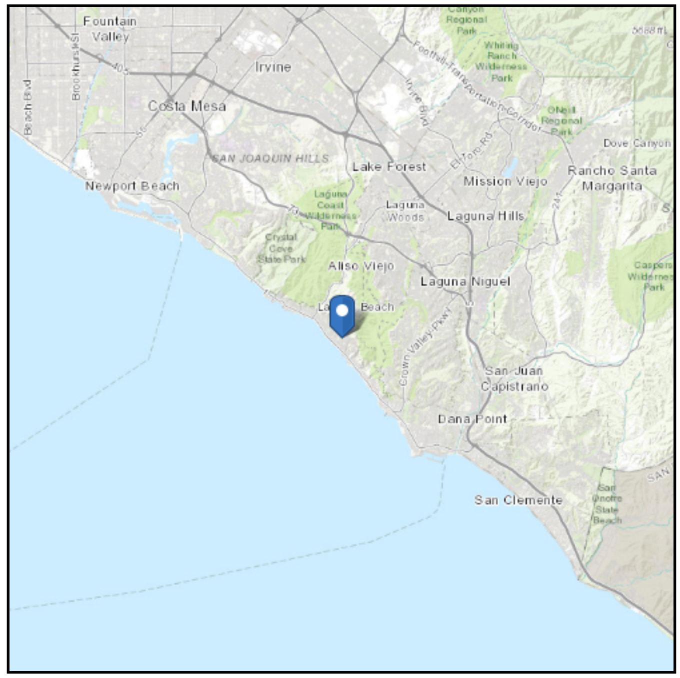
ASCE 7 Hazards Report

Address:
820 Gainsborough Dr
Laguna Beach, California
92651

Standard: ASCE/SEI 7-16
Risk Category: II
Soil Class: C - Very Dense Soil and Soft Rock

Elevation: 335.31 ft (NAVD 88)
Latitude: 33.530392
Longitude: -117.764598





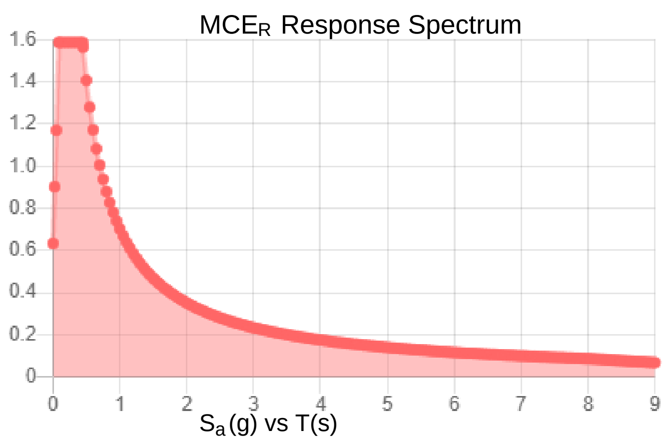
Seismic

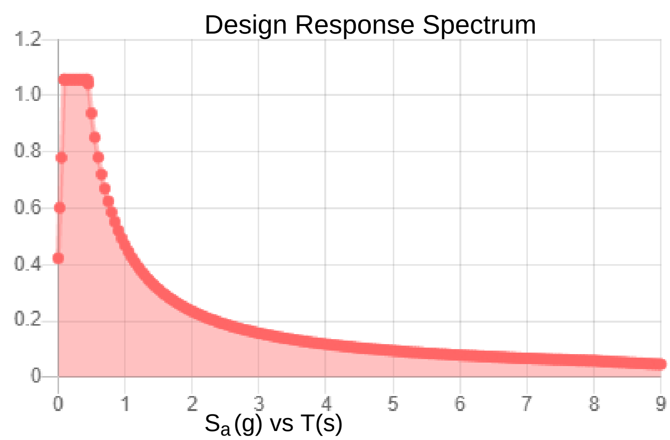
Site Soil Class: C - Very Dense Soil and Soft Rock

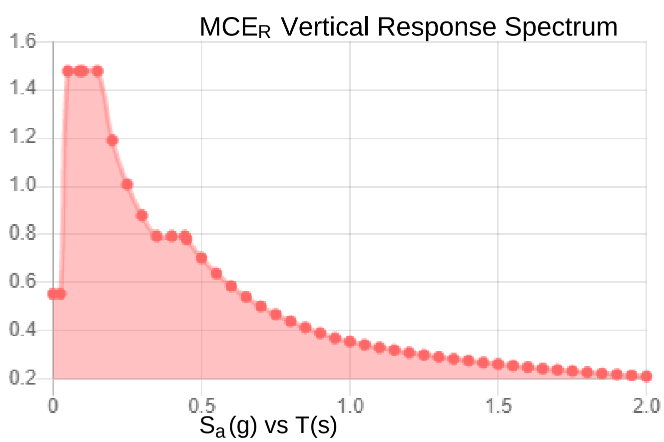
Results:

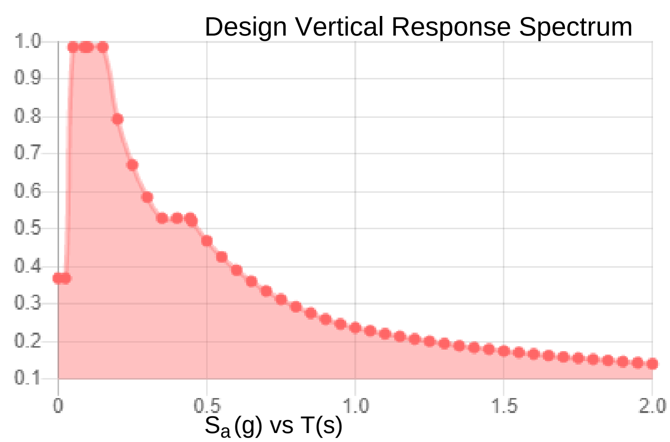
S_S :	1.321	S_{D1} :	0.469
S_1 :	0.469	T_L :	8
F_a :	1.2	PGA :	0.579
F_v :	1.5	PGA_M :	0.695
S_{MS} :	1.586	F_{PGA} :	1.2
S_{M1} :	0.703	I_e :	1
S_{DS} :	1.057	C_v :	1.164

Seismic Design Category D









Data Accessed: Fri Oct 08 2021

Date Source: USGS Seismic Design Maps based on ASCE/SEI 7-16 and ASCE/SEI 7-16 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-16 Ch. 21 are available from USGS.

The ASCE 7 Hazard Tool is provided for your convenience, for informational purposes only, and is provided “as is” and without warranties of any kind. The location data included herein has been obtained from information developed, produced, and maintained by third party providers; or has been extrapolated from maps incorporated in the ASCE 7 standard. While ASCE has made every effort to use data obtained from reliable sources or methodologies, ASCE does not make any representations or warranties as to the accuracy, completeness, reliability, currency, or quality of any data provided herein. Any third-party links provided by this Tool should not be construed as an endorsement, affiliation, relationship, or sponsorship of such third-party content by or from ASCE.

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APPENDIX F

HILLSIDE MAINTENANCE

APPENDIX G

SUGGESTED GUIDELINES FOR MAINTENANCE OF HILLSIDE PROPERTY

(820 Gainsborough Drive, Laguna Beach)

Slopes and Slope Drainage Devices

Maintenance of slopes and drainage devices is important to their long term performance. The following is a list of suggested procedures provided as a guide for slope maintenance.

1. Drainage Devices Associated with Hillsides

- Graded berms, swales, area drains, and slopes are designed to carry surface water from pad areas and should not be blocked or destroyed. Water should not be allowed to pond in pad areas, or overtop and flow onto graded or natural slopes.
- Sources of uncontrolled water, such as leaky water pipes or drains, should be repaired if identified.
- Devices constructed to drain and protect slopes, including brow ditches, berms, terrace drains and down drains should be maintained regularly, and in particular, should not be allowed to clog such that water can flow unchecked over slope faces.
- Subdrain outlets should be maintained to prevent burial or other blockage.

2. Slopes

- Slopes in the southern California area should be planted with appropriate drought-resistant vegetation as recommended by a landscape architect.
- Rodent activity should be controlled on the slope and within yard areas along the top of the slope as burrowing may introduce paths for transfer of water into the subsurface soils and out to the slope face.

Lot and Building Pad Drainage

1. Roof drains should collect water into a tight-lined drainage system of area drains. When area drain systems are not feasible, roof drain water should be diverted by swales and sloping ground to approved outlet areas. Where planters or unimproved ground are located next to building foundations or slab-on-grade construction, roof drain outlets should be extended at least 3 feet away from the structure. Outlets and infiltration of roof water next to structures is not acceptable and should be eliminated by drainage devices.
2. Area drain inlet grates should be properly installed and maintained. The inlets need to be properly located at lower grade collection points around yard areas. The grate should be installed low enough to quickly transfer collecting water into the area drain pipe system. It should also be installed high enough to not be easily buried, silted over or choked out by vegetation.
3. Drainage inlet grates should be regularly inspected and cleaned/replaced as necessary to allow free flow of water into the drain system while effectively blocking larger detritus from entering risers and flow pipes.
4. Area drain pipes should be periodically checked for blockage and cleaned as necessary.

5. Landscape grades should be maintained or improved to allow efficient drainage to approved surface water outlets and into the storm drain system. Modifications to designed or existing drainage grades should be made as necessary when ponds of excess water, standing water, low flows, etc. are noticed. An experienced landscape contractor or landscape architect should be consulted if necessary to provide recommendations for drainage improvements.
6. As yard improvements are made to existing residential properties, it is common for unlicensed landscape contractors, laborers or the homeowner to alter the flow patterns that were designed for site drainage. Such actions however can be harmful to the property. Adverse infiltration and surface flows may cause damage to foundations, slabs, concrete hardscape, slopes, neighboring properties, etc. and result in large repair costs or litigation.

Water Use

1. Irrigation of on-site vegetation should be properly controlled. Excessive watering should be avoided not only to save water, but also to protect property.
2. Water leaks should be repaired quickly when identified.
3. Broken sprinkler heads, broken pipes, leaks at joints, or other breaches should be immediately repaired when identified.