Appendix C: Geotechnical Report

Geofirm
801 Glenneyre St. • Suite F • Laguna Beach • CA 92651
(949) 494-2122 • FAX (949) 497-0270

June 7, 2018

Mr. Tom Norris
c/o Marshall Ininns Design Group
410 Broadway Street, Suite 210
Laguna Beach, California 92651

Project No: 72389-00
Report No: 18-8333

Subject: **Preliminary Geotechnical Investigation**
Proposed New Single-Family Residence
385 Nyes Place
Laguna Beach, California

INTRODUCTION

This report presents findings and conclusions of a preliminary geotechnical investigation undertaken to relate onsite and certain regional geotechnical conditions to the proposed new residence on the subject property. Analysis for this investigation is based upon conceptual drawings prepared by Marshall Ininns Design Group.

This report is considered preliminary until final foundation and grading plans are available, the formulation of which is partially dependent upon the findings presented herein.

Scope of Investigation

1. Review and analysis of pertinent reports, maps, aerial photographs, and published literature pertaining to the subject site and nearby areas, as well as grading, shoring, and foundation plans, in order to relate geotechnical conditions to existing and proposed construction.

2. Preparation of this geotechnical report, including map and cross-sections, to reflect the design recommendations.

Accompanying Illustrations and Appendices

Appendix E	-	Maintenance of Hillside Home Sites
Appendix F	-	Slope Stability Analyses
Plate 1	-	Geotechnical Plot Plan and Cross Sections A-A' and B-B'

Site Description

The irregularly shaped 0.2-acre property fronts 55± feet along the southeastern right-of-way of Nyes Place and extends southeasterly 120± feet to the rear property boundary. Topographically, the site ascends from Nyes Place 70± vertical feet from the southwestern corner at elevation 128 feet, up to a high-point of 198 feet located at the northeastern boundary corner, with an overall slope ratio of approximately 1.9:1 (horizontal:vertical). The adjacent lot to the north is developed with a single-family residence. The adjoining properties to the south and east are undeveloped, native terrain.

Previous Work

Geotechnical investigations were performed at the subject property in 1989 and 1994 by Peter E. Borella, Ph.D. Borella issued a geotechnical investigation report on March 17, 1994 for a proposed residence on the site. Borella performed a field investigation that included four test pits, which are presented in Appendix B. Borella concluded that bedrock instability is not anticipated, and that development of the site is feasible from a geotechnical perspective.

Geofirm assumed the role of project geotechnical engineer for the development of an adjacent residence at 405 Nyes Place, following the occurrence of a slope failure in a temporary excavation in 2012. Geofirm performed geologic analysis and slope stability analysis, and provided geotechnical recommendations in reports listed in Appendix A.

Proposed Development

Based on a review of the project plans prepared by Marshall Ininns Design Group, the overall project consists of a three-level, single-family residence that is terraced into the hillside. Proposed exterior improvements include construction of a swimming pool, decks, and patios. Floor level and grade changes of up to 30+ feet will be accommodated by retaining walls. The project largely involves cut and export grading, with fill placement limited to wall backfills.

GEOTECHNICAL CONDITIONS

Geologic Setting

This property is situated on the eastern side of "Nyes Canyon," located at the coastal margin of the San Joaquin Hills. Numerous canyons have been deeply and steeply incised into the San Joaquin Hills by natural erosional processes during this uplift. Erosional processes remain episodically active to the present day. Construction of Nyes Place included the placement of road fill locally in or near the canyon bottom.

Earth Materials

Based on review of our previous work in the vicinity of the site, and previous onsite subsurface exploration, the property is underlain by bedrock strata assigned on the basis of regional geologic mapping to the San Onofre Breccia (refer to Plate 1). The bedrock is overlain by a relatively thin mantle of Quaternary Slopewash across the majority of the site.

Bedrock of the San Onofre Breccia consists primarily of sandstones, conglomerates, and breccias. These units are moderately well cemented, hard to very hard, widely fractured, and massive to poorly bedded. The bedrock exposed in the test pits is breccia composed of fragments of schist and quartzite within a matrix of silt and clay. Bedding within the San Onofre Breccia strikes N60W to N65W, and dips 35 to 50 degrees to the southwest.

Based on the previous onsite test pits, our experience in the area, and the investigation and observations made during earthwork operations at the adjacent property at 405 Nyes Place, as described in documents listed in Appendix A, we anticipate the presence of fractures, joints, and shears at depth within the bedrock. Given that such rock discontinuities and other geologic structure can influence the design, temporary stability, and construction of the proposed retaining walls and other proposed site improvements, we have developed our geotechnical recommendations, by projecting the bedrock shears observed in the previous excavations at 405 Nyes Place to the subject property, as shown on the Cross-section A on Plate 1. A Geofirm geologist should observe all excavations during mass grading at the subject property, and provide additional recommendations as necessary.

Slopewash generally consists of variably brown, very weakly cemented silty clay and sandy clay with disaggregated fine gravel-sized clasts derived from bedrock. The maximum depth of slopewash observed in test pits at the site is approximately 3± feet. Greater thicknesses of slopewash may be present locally on the site.

Bedrock is considered suitable for the support of proposed improvements. Slopewash is considered unsuitable to support proposed improvements, unless recompacted as engineered fill. Slopewash should excavate with limited difficulty using standard earth-moving equipment in good repair. Excavations and caisson drilling in bedrock will likely be difficult, and may require the use of heavy equipment. Onsite materials derived from excavations should produce acceptable fill soil, provided oversized materials are removed prior to placement.

Groundwater

No groundwater was encountered in the test pits. Minor seepage was noted in lower portions of the slope at the adjacent site. Shallow groundwater perched upon the hard, cemented bedrock may develop on the subject site during periods of heavy precipitation. Groundwater is not anticipated to adversely affect the proposed retaining walls, provided that walls are properly waterproofed, and surface and subsurface drainage is controlled.

Surficial Runoff

In general, surface runoff currently flows downslope to the west onto Nyes Place. Typical development may modify and increase post-construction surficial discharge, which must be controlled, and conducted offsite by appropriate engineering design to preclude potentially damaging erosion or soil saturation.

Slope Stability

No evidence of former gross slope instability beneath the site and adjacent areas has been detected, based upon geologic reconnaissance and interpretation of aerial photographs. The potential for deep-seated gross instability beneath the site is considered low, due to the crudely bedded and cemented character of the underlying San Onofre Breccia.

Engineering stability analyses were performed to assess the gross stability of the lot. These analyses are based on the geologic structure under the site, as shown on Cross Section A-A', using SLIDE 7.0 computer program. The results indicate factor of safety over 1.5 for static condition and over 1.1 for pseudo-static conditions (Appendix F).

The possibility of shallow slumping of upslope surficial soils exists, but the potential impact is considered low due to the thin mantle of slopewash. However, minor nuisance debris flows are still possible, and a debris barrier should be incorporated into the proposed design as recommended herein. Surficial instability is not anticipated to adversely impact proposed improvements, provided new foundations are adequately setback from slope faces as recommended herein.

Seismic Considerations

Published Studies

One of the principals of seismic analyses and prediction is the premise that earthquakes are more likely to occur on geologically younger faults, and less likely to occur on older faults. For many years studies have described faults with Holocene movement (within the last 11,700 years) as "Active", and faults with documented Pleistocene movement (within the last 1.6 million years) and with undetermined Holocene movement as "Potentially Active". Informally, many studies have described faults documented to have no Holocene movement as "Inactive". Recent geologic and seismic publications are attempting to clarify the nomenclature describing faults to more accurately represent the potential affects from earthquakes.

Table 1. Definitions of Fault Activity in California

Activity		Category	Recency of Movement
Active		Historic	Within the last 200 years
		Holocene	Within the last 11,700 years
Potentially Active		Late Quaternary	Within the last 700,000 years
		Quaternary	Within the last 1.6 million years
		Pre-Quaternary	Before the last 1.6 million years

Reports by the California Division of Mines and Geology indicate faults with documented Holocene or Historic (within the last 200 years) movement should be considered Active. However, Potentially Active faults are more appropriately characterized in terms of the last period of documented movement. The Fault Activity Map of California (Jennings, C.W.; 2010) defines four categories for onshore Potentially Active faults. The categories are associated with the time of the last displacement evidenced on a given fault and are summarized in Table 1.

It is important to note that all Pre-Holocene faults are classified as Potentially Active, and provide no methodology to designate a given fault as "Inactive". 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.

Local and Regional Faults

The closest published active fault to the site is the offshore extension of the Newport-Inglewood Fault Zone, approximately 3.0 miles west, (Blake, T.F., 2000, CGS/2004). Other active faults in the vicinity include the San Joaquin Hills blind thrust fault, approximately 4.0 miles from the site, Palos Verdes Fault, approximately 17.8 miles to the northwest, the Coronado Bank Fault, approximately 20.1 miles to the south, and the San Andreas Fault, approximately 53.1 miles to the northeast.

The California Geological Survey updated the Fault Parameters and Earthquake Catalog for the probabilistic Seismic Hazards Maps in 2002. This update included the addition of the San Joaquin Hills blind thrust fault indicated above, theorized to exist from Newport Beach to Dana Point, and ramping up inland to the Irvine area, and essentially underlying the site. Earthquakes of Magnitude 6.6 are presently postulated for this structure. With the fault's location at approximately 4.0 miles distant, it is calculated as the most significant seismic source to affect the site.

Historic Ground Motion Analyses

Utilizing attenuation relationships (Bozorgnia, et al.; 1999, unconstrained/soft rock), one can estimate the ground motion history of the site. The study indicates the maximum site acceleration from 1800 to 2012 was approximately 0.14g and occurred during a magnitude 6.3 Long Beach Earthquake 13.5 miles from the site on March 11, 1933.

It is noted that the estimation of historic peak ground acceleration presented above is provided for the interest of the client and is required by local (City or County) review agencies. The value derived is not directly utilized in structural design of residential structures. Seismic parameters for use by the structural engineer, in accordance with the 2016 California Building, are presented in the recommendations portion of this report.

Site Classification for Seismic Design

For the purposes of determining seismic design parameters provided in the Recommendations portion of this report for use by the structural engineer, the upper 100 feet of material underlying the subject site has been classified in accordance with Section 1613.5.5 of the 2016 CBC. Given the results of our onsite review and review of conceptual plans, which indicates site improvements will be founded in soft bedrock, the site classifies as C.

Bedrock classification as specified above is based on the procedures outlined in Section 1613.5.5 of the 2016 CBC, which states that shear-wave velocities may be estimated by the Geotechnical Engineer or Engineering Geologist. As such, the bedrock of the San Onofre Breccia underlying the upper 100 feet of the site is estimated to have average shear wave velocities between 1,200 ft/sec and 2,500 ft/sec.

Secondary Seismic Hazards

Review of the Seismic Hazards Zones Map (CDMG, 1998) for the Laguna Beach Quadrangle, Figure 2, indicates this lot is located within a "zone of required investigation" for seismically-induced landsliding. The site is not located in a liquefaction hazard zone.

During construction of the lower portion of the slope at 405 Nyes Place, a wedge failure occurred in a temporary excavation in 2012. Review of the failure area by Geofirm indicates an unsupported thin wedge that was backed by a bedrock shear, oriented essentially sub-parallel to the cut face. In order to reduce the risk of such slope failures at the subject property, it is recommended that a Geofirm geologist observe all excavations on a full time basis, and provide additional recommendations as necessary.

Engineering stability analyses were performed to assess the gross stability of the subject lot. These analyses are based on the projected geologic structure under the site, as shown on Cross Section A-A' using SLIDE 7.0 computer program. The results indicate factors of safety over 1.5 for static condition and over 1.1 for pseudo-static conditions (Appendix F).

Other secondary seismic hazards can include deep rupture and shallow ground cracking. With the absence of active faulting onsite, 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.

CONCLUSIONS

1. Construction of the residence and exterior improvements is considered geotechnically feasible, providing the recommendations of this report are followed during final design, construction, and maintenance of the subject property.

2. The property is underlain near the surface and at depth by sandstone and breccias bedrock strata of the San Onofre Breccia. The bedrock is overlain by a thin mantle of slopewash.

3. The site is not anticipated to be affected by gross instability. Surficial instability in the form of rockfall and debris is locally possible, but may be mitigated with the use of slough barriers.

4. Given the presence of bedrock shears, and other adverse bedrock discontinuities in the vicinity of the site, it is recommended that a Geofirm geologist observe all excavations on a full time basis, and provide additional recommendations as necessary.

5. No active surface 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 strong seismic ground shaking (>0.05g) during its design life.

6. Surface discharge should be accommodated by appropriate civil engineering design.

7. Shallow groundwater has not been observed beneath the site. Groundwater is not anticipated to be a development constraint, provided appropriate subdrain design and construction.

8. The proposed retaining walls can be founded entirely in bedrock materials, utilizing conventional spread footings.

RECOMMENDATIONS

Site Preparation and Grading

1. Except as modified by the recommendations of this report, all site preparation and grading should be performed in accordance with Appendix C. Grading is anticipated to consist of cut and export of material, and backfill of proposed retaining walls. All fill compaction should be observed, tested and approved in writing by a representative of this firm. The recommended minimum density for recompacted materials is 90 percent of the maximum as determined by ASTM D 1557.

2. <u>Remedial Grading</u>

   Remedial grading may include minor removals of locally unsuitable near-surface soils pending field review by the geologist. Processing, over-excavation, and re-compaction should be observed, tested and approved in writing by a representative of this firm. The depth of removals is anticipated to be less than 3 feet; however, deeper removals may be necessary pending field-review by the geologist during grading.

3. <u>Removal of Existing Improvements</u>

   Existing vegetation, organic materials, and/or construction and demolition debris should be removed and disposed of offsite.

4. Compaction Standard

Onsite soil materials are anticipated to be suitable for re-use as compacted fill providing they are free of rubble and debris. Materials should be placed at approximately 120 percent of optimum moisture content and compacted under the observation and testing of the soil engineer to at least 90 percent of the maximum dry density, as evaluated by ASTM D 1557.

5. Temporary Construction Slopes

The grading of temporary construction slopes can create two potentially adverse conditions affecting the property and onsite personnel. These conditions include slope instability and safety. As the geotechnical consultant, we are limited to recommending temporary slope geometries considered stable such that any slope failures, should they occur, are not anticipated to adversely impact adjoining properties or structures. While our recommendations may often comply with safety guidelines concerning temporary slopes, our recommendations are not intended to create “safe” working conditions as defined by Cal/OSHA. The safety of onsite personnel is the responsibility of the general contractor as described below:

a. Protection of Property

In order to reduce the potential risk to adjoining properties/structures from slope failures, temporary construction slopes may be vertically excavated no higher than 5 feet with higher slopes laid back at 1:1 (horizontal:vertical) pending field review by the geologist during grading. Shoring should be constructed where space or grading limitations preclude temporary slope layback *or in locations where workers may be in close proximity to vertical cuts*.

b. Worker Safety

The safety of onsite personnel affected by the performance of temporary construction slopes is the responsibility of the general contractor who is recommended to implement the safety practices as defined in Section 1541, Subchapter 4, of Cal/OSHA T8 Regulations (2006).

The geometry of permissible temporary cuts varies based on soil type and may differ significantly from the geometry presented in Section A above. The earth materials exposed in temporary excavations should be evaluated and classified by the contractor during construction.

Foundation Design Parameters

Earth materials exposed at the proposed finish grades are anticipated to exhibit a low expansion potential. These conditions should be confirmed during grading. 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.

1. Conventional Foundations and Slabs-on-Grade

Conventional foundations and slabs-on-grade should be designed in accordance with the 2016 CBC. The minimum recommended slab thickness is 5 inches, with No. 4 bars at a spacing of 16 inches, placed in both directions. Slabs should be underlain by 4 inches of ½- to ¾-inch 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.

Conventional footings should be embedded into bedrock. Footings may be designed for an allowable bearing value of 5,000 pounds per square foot with a minimum width of 18 inches and a minimum embedment into competent bedrock of 18 inches. Actual footing depth and width should be governed by CBC requirements and the structural engineering design. The design value may be increased one-third for short duration wind or seismic loading. Settlement is anticipated to be less than 1/2 inch.

Lateral loads may be resisted by passive pressure forces and by friction acting on the bottom of footings. The allowable passive pressure forces may be computed using an equivalent fluid density of 400 pounds per cubic foot up to a maximum of 4000 pounds per square foot. A coefficient of friction of 0.45 may be used in computing the frictional resistance. Friction resistance and passive pressure may be combined without reduction.

2. Moisture Content of Slab Subgrade Soils

Pre-moistening of slab subgrade soils is recommended prior to construction of slabs.

3. Footing Reinforcement

Foundations should be reinforced in accordance with the requirements of the structural engineer. A minimum of two No. 5 bars should be placed at the top and bottom of continuous footings.

4. Slab Subdrains

Percolating irrigation and meteoric water may perch on top of less pervious layers at shallow depth beneath the site. Groundwater effects on the lower levels can be reduced by intercepting the groundwater with a subdrain constructed beneath the slab. The subdrain should be constructed in accordance with the detail presented on Figure 4.

The slab subdrain system should consist of 4-inch diameter perforated pipe graded to flow at one percent in the base of 12-inch deep trench around the perimeter of the slab, and spaced in a 10 feet grid pattern within the interior. The trench should be lined with non-woven filter fabric and backfilled with ½- or ¾-inch rock. The slab subdrain piping system should be outlet per the Civil Engineer.

As an alternative to the recommended slab subdrain system, the lower slab may be waterproofed. Slab waterproofing design and details should be provided by the project architect or waterproofing consultant.

5. Caissons

Minimum 24-inch diameter caissons with a minimum bedrock embedment of 10 feet may be designed for dead plus live load bearing value of 8000 pounds per square foot. A skin friction of 400 pounds per square foot may also be utilized for bedrock. Lateral resistance may be computed utilizing 500 pounds per square foot per foot of depth below a depth of 5 feet. An allowable coefficient of friction of 0.35 may be used in bedrock.

Structural Design of Retaining Walls

1. Lateral Loads

The required lateral load on a 30-foot-high retaining wall has been analyzed using the Slide computer program. The calculations model the presence of a bedrock shear that is shown on Cross-Section A. Shear strength parameters for the postulated bedrock shear was obtained from back-calculation of the stability of the excavation(s) at 405 Nyes Place. Calculations indicate that equivalent fluid pressures of 35 pcf and 60 pcf are required to achieve a factor of safety of 1.0 for static conditions, and seismic conditions, respectively.

Active pressure forces acting on the upper retaining wall(s) constructed into the 1.5:1 (horizontal:vertical) ascending hillside, and which support granular backfill and competent unsheared bedrock may be determined based on an equivalent fluid pressure of 60 pounds per cubic foot. Additionally, a minimum 3 feet high slough barrier should be added to the top of the wall or incorporated into the structure to help restrain possible debris flows or minor rock block failures. The slough barrier should be designed for impact loading of 125 pounds per cubic foot equivalent fluid pressure. Wall rotation on the order of 0.1 percent of the wall height should be anticipated and considered in design of the wall.

Seismic design of cantilever retaining walls may be based on the Mononobe-Okabe method, as updated by Atik and Sitar (2010), using an additional dynamic load of 25 pounds per cubic foot equivalent fluid pressure, acting at 1/3 H above the base of the wall. Final design requirements should be determined by the structural engineer.

Based upon review of the Building Seismic Safety Council Commentary, the governing requirement for seismic design is to limit deformations to tolerable levels. We therefore suggest a factor-of-safety of 1.1 be utilized for seismic design. Final design requirements should be determined by the structural engineer.

2. Retaining Wall Foundations

Bearing capacity and lateral resistance may be computed using the parameters presented in the foundation sections above.

3. Wall Excavations

Please refer to the Temporary Construction Slopes section above.

4. Subdrain

The drainage scheme depicted on Figure 3 and/or Figure 5, or a geotechnically approved alternative, should be used to reduce the potential for seepage forces behind retaining walls. Waterproofing of retaining walls is recommended and should be applied in accordance with the specifications of the architect or waterproofing consultant.

Swimming Pool

The swimming pool should be supported on in bedrock. Caissons may be required to penetrate through surficial materials. Active pressure forces acting on the un-surcharged pool shell may be computed based on an equivalent fluid pressure of 60 pounds per cubic foot. Structural surcharges from adjacent structures or improvements should also be considered in retaining wall design. Excavations should be reviewed by the Engineering Geologist.

Slope Setback

The bottom of foundations should be set back a minimum of 10 feet from the nearest slope face. Near or on-slope foundations supporting the residence and pool should be constructed on caissons as recommended herein.

Shoring

Shoring will likely be required. Shoring in areas where backslope is level may be designed using an equivalent fluid density of 40 pounds per cubic foot. Vibratory techniques for placement of piles or steel sheet lagging should not be utilized, as damage to adjoining property improvements may otherwise occur. It is the Contractor's responsibility to develop appropriate means and methods of construction to avoid damage to adjacent properties.

If temporary shoring elements are to be removed, the builder and homeowner must be aware that such removal could result in settlement and possible damage to improvements on the adjacent property. The adjacent property owners must be advised of the risks and the builder should provide arrangements to repair any possible damages.

The Contractor should also recognize the risk of leaving voids during removal of shoring elements. Lagging, plates and piles should, therefore, be removed slowly, and the voids created should be filled immediately. Consideration should be given to continuously injecting grout at the base of the piles and plates as they are being removed to fill the resultant voids.

Hardscape Design and Construction

Conventional spread footings in engineered fill should be designed for an allowable bearing value of 1,500 pounds per square foot with a minimum width of 15 inches and a minimum embedment of 18 inches below the lowest adjacent grade. Lateral loads may be resisted by passive pressure forces and friction acting on the bottom of the foundations. Passive pressure may be computed from an equivalent fluid density of 100 pounds per cubic foot, not to exceed 1,500 pounds per square foot for fill.

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. 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.

Flatwork elements should be a minimum 5 inches thick (actual) and reinforced with No. 4 bars 16 inches on center both ways.

Slabs-on-Grade

All conventional proposed slabs should be at least 5 inches thick (actual) and reinforced with No. 4 bars placed on chairs 16 inches on center in both directions. Slabs should be underlain by 4 inches of open graded gravel. In moisture sensitive areas, slabs should also be underlain by a 15-mil thick vapor retarder/barrier in accordance with the requirements of ASTM E:1745 and E:1643. Exposed slabs should be provided with weakened plane joints at maximum 10 feet intervals in order to control the location of cracks and reduce the possibility of developing randomly located unsightly, irregular cracks. All subgrade materials should be geotechnically approved prior to placing slab forms or steel.

Concrete

Previous laboratory test results indicate on-site soils have negligible soluble sulfate content. It is recommended that a concrete expert be retained to design an appropriate concrete mix to address soil soluble sulfate content and corrosivity as well as the structural requirements. In lieu of retaining a concrete expert, the 2016 California Building Code, Section 1904.3 be utilized, which refers to ACI 318, Table 4.3.1.

Utility Trench Backfill

Utility trench backfill should be placed in accordance with Appendix D, Utility Trench Backfill Guidelines. It is the responsibility of the owner and contractor to inform subcontractors of these requirements and to notify Geofirm when backfill placement is to begin.

Seismic Structural Design

Based on the geotechnical data and site parameters, the following is provided by the USGS (NEHRP, 2003) to satisfy the 2016 CBC design criteria:

Site and Seismic Design Criteria for 2016 CBC

Design Parameters	Recommended Values
Site Class	B
Site Longitude (degrees)	-117.761
Site Latitude (degrees)	33.522
Ss (g) C	1.600
S1 (g) C	0.590
SMs (g) C	1.600
SM1 (g) C	0.767
SDs (g) C	1.067
SD1 (g) C	0.511
Fa	1.0
Fv	1.3
Seismic Design Category	D

Finished Grade and Surface Drainage

All finished grades should assure that no water ponds onsite and that discharge is conducted offsite in a non-erosive manner as specified by the project civil engineer, in accordance with the 2016 California Building Code, Section 1804.3. A drainage swale designed to collect surface discharge from the slope face is recommended behind the rear wall, or slough barrier proposed along the base of the canyon side slope. Regular maintenance of the swale should be anticipated to remove soil, rocks and debris which will collect behind the wall during heavy rainstorms.

Foundation Plan Review

In order to help assure conformance with recommendations of this report, and as a condition of the use of this report, the undersigned should review final foundation plans and specifications prior to submission of such to the building official for issuance of permits. Such review is to be performed only for the limited purpose of checking for conformance with the design concept and the information provided herein. This review shall not include review 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. Geofirm's 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 Geofirm has reviewed the entire system of which the item is a component. Geofirm shall not be responsible for any deviation from the Construction Documents not brought to our attention in writing by the Contractor. Geofirm shall not be required to review partial submissions or those for which submissions of correlated items have not been received.

Observation and Testing

The 2016 California Building Code, Section 1704.7-9 requires geotechnical observation and testing during construction to verify proper removal of unsuitable materials, 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 installation, and pier/caisson drilling.

A Geofirm representative shall visit the site at intervals appropriate to the stage of construction, as notified by the Contractor, in order to observe the progress and quality of 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 Geofirm, as an experienced professional, to become generally familiar with the work in progress and to determine, in general, if the work is proceeding in accordance with the recommendations of this report.

Geofirm shall not supervise, direct, or have control over the Contractor's work nor have any responsibility for the construction means, methods, techniques, sequences, or procedures selected by the Contractor nor the Contractor's safety precautions or programs in connection with the work. These rights and responsibilities are solely those of the Contractor.

Geofirm shall not be responsible for any acts or omission of the Contractor, subcontractor, any entity performing any portion of the work, or any agents or employees of any of them. Geofirm does not guarantee the performance of the Contractor and shall not be responsible for the Contractor's failure to perform its work in accordance with the Contractor documents or any applicable law, codes, rules or regulations.

These 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. Typically, at least 24 hours' notice is required.

Jobsite Safety

Neither the professional activities of Geofirm, nor the presence of Geofirm's employees and subconsultants at a construction/project site, shall relieve the General Contractor of its obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending and coordination the work in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. Geofirm and its personnel have no authority to exercise any control over any construction contractor or its employees in connection with their work or any health or safety programs or procedures. The General Contractor shall be solely responsible for jobsite safety.

LIMITATIONS

This investigation has been conducted in accordance with generally accepted practice in the engineering geologic and soils engineering field. No further warranty is offered or implied. Conclusions and recommendations presented are based on subsurface conditions encountered and are not meant to imply a control of nature. As site geotechnical conditions may alter with time, the recommendations presented herein are considered valid for a time period of 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 in any form cannot be approved unless specific written verification of the applicability of the recommendations is obtained from this firm.

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

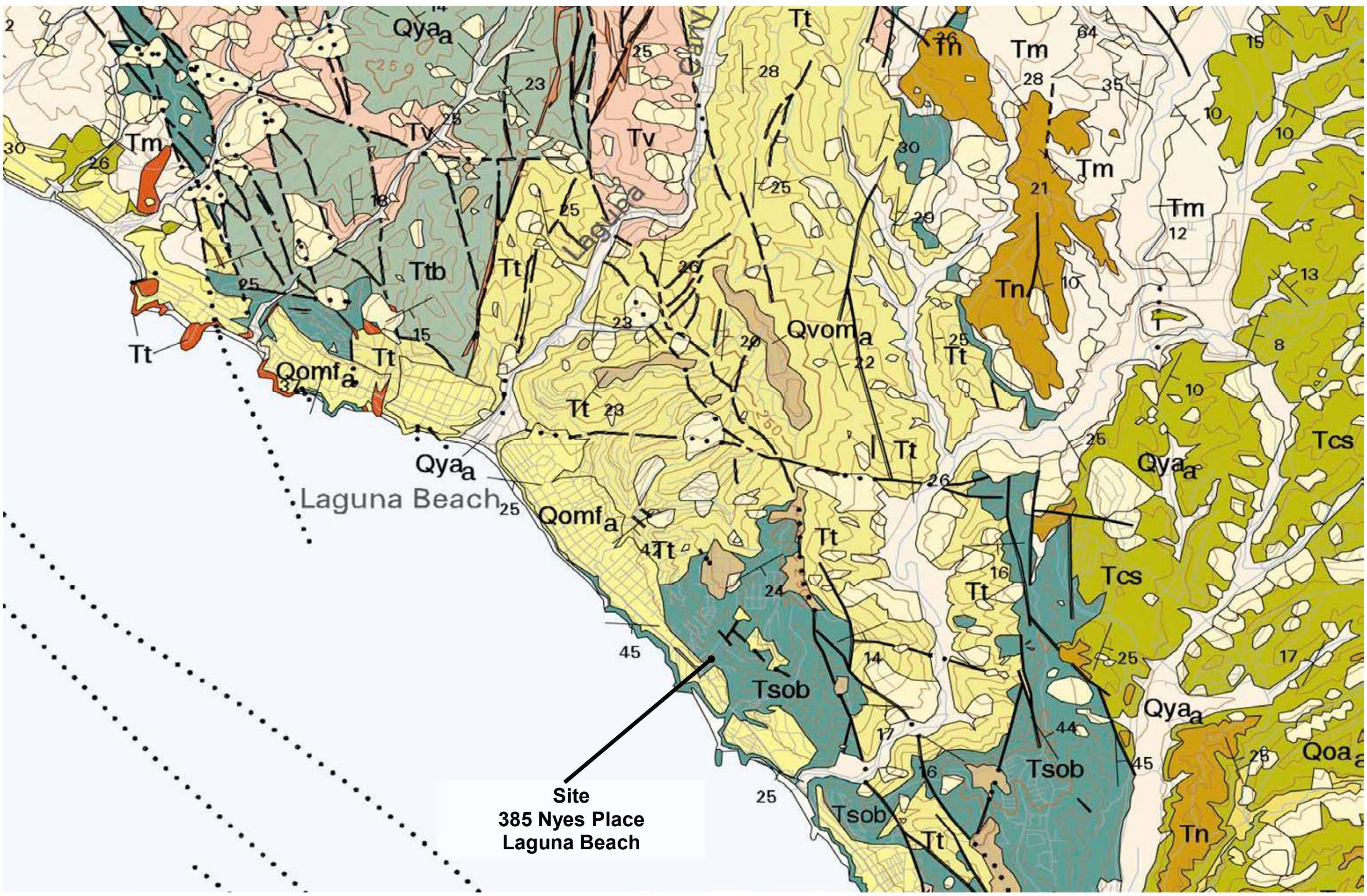
Respectfully submitted,

GEOFIRM

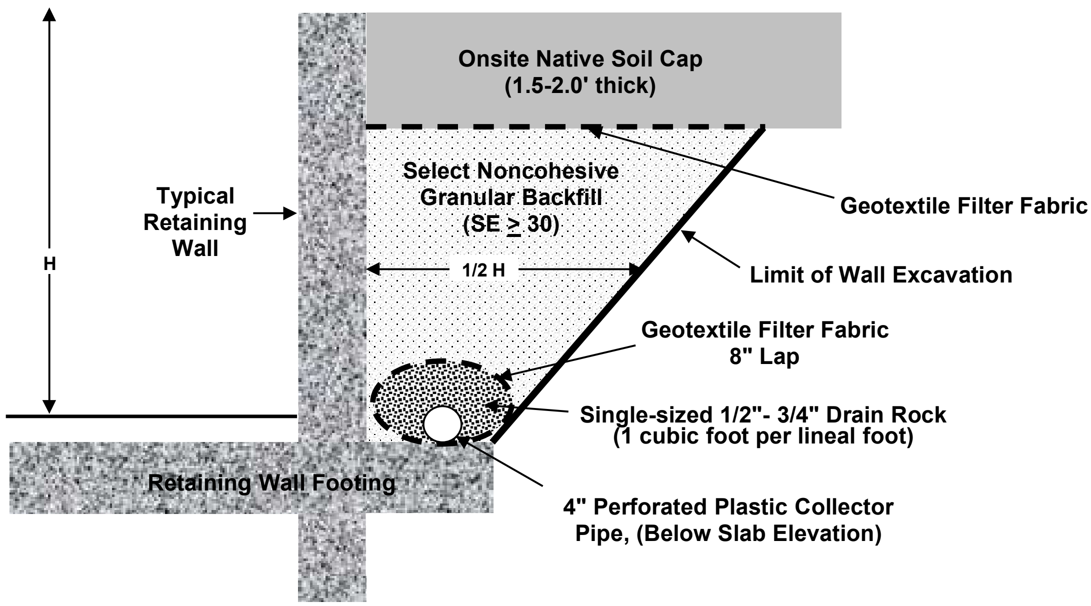
Bradley E. Dybel
Certified Engineering Geologist, C.E.G. 2044
Registration Expires 1-31-20

Registered Geotechnical Engineer, R.G.E. 2621
Registration Expires 12-31-19
Date Signed:

Distribution: Addressee (5)



Geofirm	USGS Geologic Location Map, Santa Ana 30' x 60' Quadrangle		
	JOB NO.: 72389-00	DATE: June 2018	FIGURE: 1

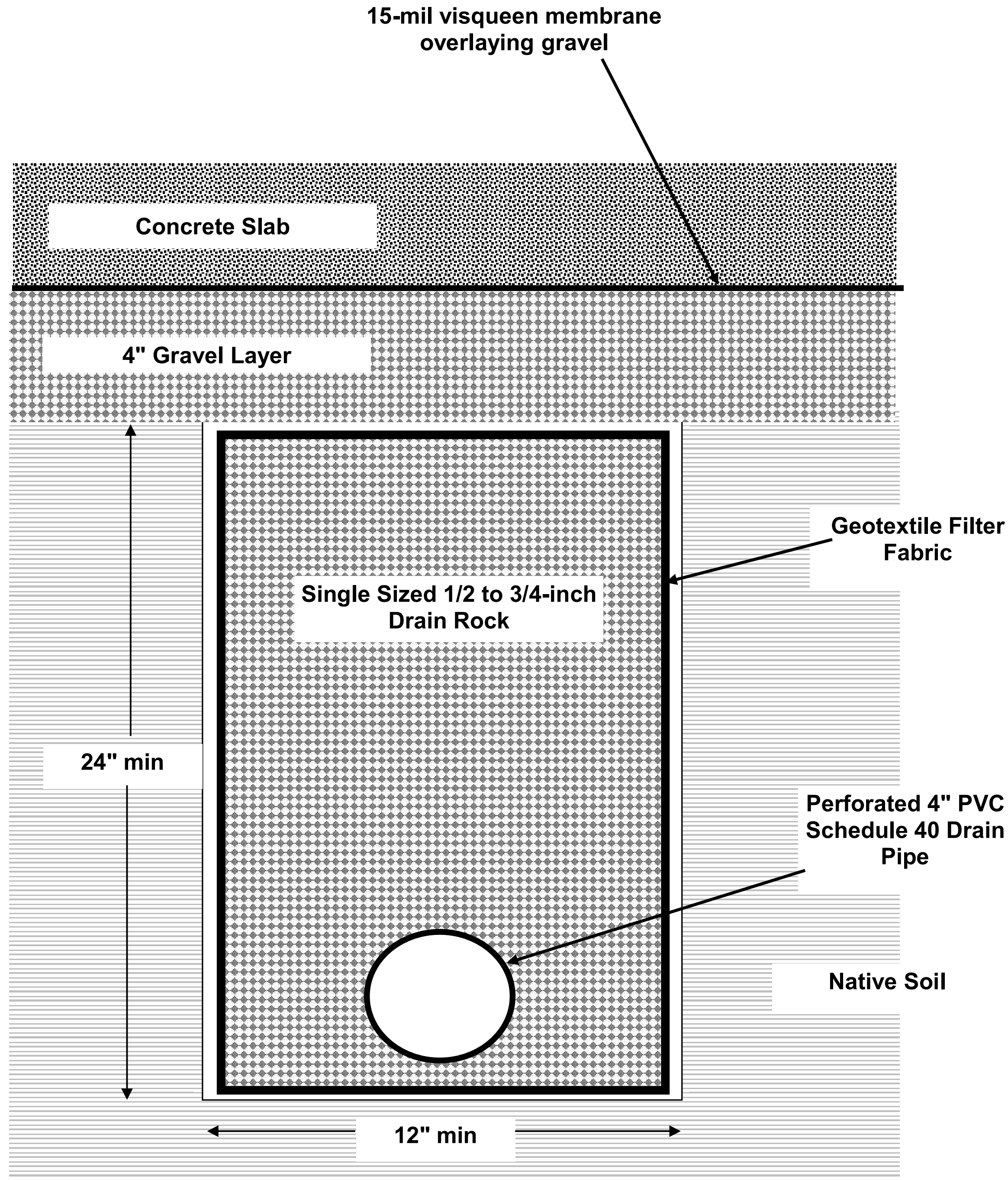


Notes: This system consists of a geotextile fabric-wrapped gravel envelope. Collection is with a 4-inch diameter perforated plastic pipe embedded in the gravel envelope and tied to a 4-inch diameter non-perforated plastic pipe which discharges at convenient locations. The outlet pipe should be placed such that the flow gradient is not less than 2.0 percent. The geotextile fabric-wrapped gravel envelope should be placed at a similar gradient

All drain pipes should be Schedule 40 PVC or ABS SDR-35. Perforations may be either bored 1/4-inch diameter holes or 3/16-inch slots placed on the bottom one-third of the pipe perimeter. If the pipe is to be bored, a minimum of 10 holes should be uniformly placed per foot of length. If slots are made, they should not exceed 2-1/2 inches in length and should not be closer than 2 inches. Total length of slots should not be less than 50 percent of the pipe length and should be uniformly spaced.

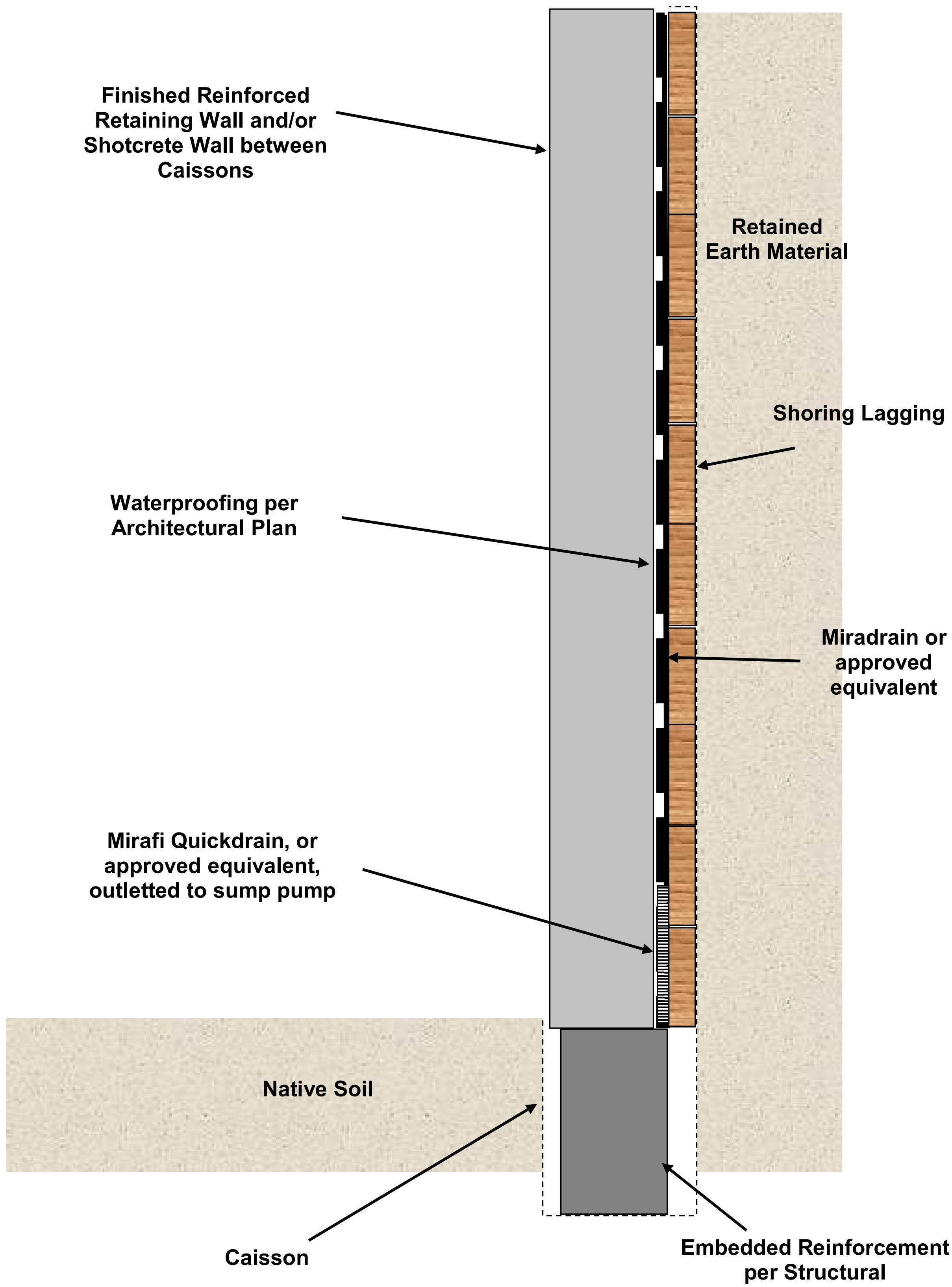
The fabric pore spaces should not exceed equivalent 30 mesh openings or be less than equivalent 100 mesh openings. The fabric should be placed such that a minimum lap of 8-inches exists at all splices.

Geofirm	Typical Retaining Wall Subdrain Detail		
	JOB NO.: 72389-00	DATE: June 2018	FIGURE: 3



Slab Subdrain Detail

Geofirm	JOB NO.: 72389-00	DATE: June 2018	FIGURE: 4



Geofirm

Conceptual Shoring/Retaining Wall Subdrain Detail

JOB NO.:	DATE:	FIGURE:
72389-00	June 2018	5

APPENDIX A

REFERENCES

APPENDIX A

REFERENCES

1. Al Atik, Linda, M. ASCE, and Sitar, Nicholas, M.ASCE, 2010, Seismic Earth Pressures on Cantilever Retaining Structures, ASCE Journal of Geotechnical and Geoenvironmental Engineering, dated October.

2. Blake, T.F., 2000a, "EQSEARCH, Version 3.0b, A Computer Program for the Estimation of Peak Horizontal Acceleration from California Historical Earthquake Catalogs."

3. Blake, T.F., 2000b, "EQFAULT, Version 3.0b, A Computer Program for the Deterministic Prediction of Peak Horizontal Acceleration from 3-D Fault Sources", User's Manual" (Windows 95/98 Version).

4. Bozorgnia, Y., Campbell, K.W., and Niazi, M. M., 1999, "Vertical Ground Motion: Characteristics, Relationship with Horizontal Component, and Building Code Implications", Proceedings of the SMIP99 Seminar on Utilization of Strong-Motion Data, pp. 23-49, dated September 15.

5. California Building Code, 2016 Edition.

6. California Division of Mines and Geology, 1976, "Geology and Engineering Geologic Aspects of Laguna Beach Quadrangle, Orange County, California," Special Report 127.

7. California Geological Survey, 2008, "Guidelines for Evaluating and Mitigating Seismic Hazards in California," Special Publication 117A.

8. California Division of Mines & Geology, 1998, "Seismic Hazards Zones Map, Laguna Beach Quadrangle."

9. Cao, T., Bryant, W.A., Rowshandel, B., Branum, D. and Wills, C.J., 2003, "The Revised 2002 California Probabilistic Seismic Hazard Maps, dated June.

10. Geofirm, 2013, "Preliminary Evaluation of Temporary Stability, Single Family Residence, 405 Nyes Place, Laguna Beach, California", Project No. 72061-00, Report No. 13-7363, dated September 27.

11. Geofirm, 2014, "Letter of Geotechnical Feasibility, Proposed New Single-Family Residence, 385 Nyes Place, Laguna Beach, California"; Project No. 72122-01, Report No. 14-7499, dated June 10.

12. Geofirm, 2014, "Geotechnical Design Recommendations for Upper Wall Construction, Single Family Residence, 405 Nyes Place, Laguna Beach, California", Project No. 72061-00, Report No. 14-7424, dated January 27.

13. Grant et al, 1999, “Late Quaternary Uplift and Earthquake Potential of the San Joaquin Hills, South Los Angeles Basin, California,” Geology, November 1999, V. 27, No. 11, P1031-1034.

14. Ian S. Kennedy, Inc., 2006, “Addendum Report on Review of Revised (Updated) Construction Plans and Existing Conditions with Additional and Revised Recommendations for Foundation Design, Proposed New Residence, Lot 11 of Tract 4888, 405 Nyes Place, Laguna Beach, California.” July 13.

15. Ian S. Kennedy, Inc., 2006, “Third Response to City of Laguna Beach Geotechnical Review Checklist for Bosra (sic) Residence, dated August 16, 2006, 405 Nyes Place, Laguna Beach, California.” August 21.

16. Ian S. Kennedy, Inc., 2006, “Letter on Temporary Cut Slope Stability for Proposed New Residence and Retaining Wall Systems, 405 Nyes Place, Laguna Beach, California.” September 20.

17. Ian S. Kennedy, 2008, “Sixth Response to City of Laguna Beach Geotechnical Review Checklist for Bosra (sic) Residence, dated January 2, 2008, 405 Nyes Place, Laguna Beach, California.” February 28.

18. Ian S. Kennedy, 2008, “Seventh Response to City of Laguna Beach Geotechnical Review Checklist for Bosra (sic) Residence (dated March 13, 2008), 405 Nyes Place, Laguna Beach, California.” March 19.

19. Ian S. Kennedy, 2012, “In-Progress on As-Graded Conditions, Proposed New Residence, 405 Nyes Place, Laguna Beach, California.” November 13.

20. Jennings, Charles W., et al, 2010, “Fault Activity Map of California and Adjacent Areas,” California Division of Mines and Geology, Geologic Data Map No. 6.

21. Peter E. Borella, Ph.D., 1994 “Geotechnical Investigation, 385 Nyes Place, Laguna Beach, California, 92651,” March 17.

22. Tan, Siang, S., and Edgington, William J., 1976, "Geology and Engineering Geology of the Laguna Beach Quadrangle, Orange County, California," California Division of Mines and Geology, Special Report 127.

APPENDIX B

PREVIOUS TEST PIT LOGS

PIT #1

Test Boring Log

Date APRIL 15, 1989
Location 385 Nyes Place
SEE FIGURE 1 For location
Elevation 190'
Logged by P.E.B.
Drilling method Hand Dug hole

Strike dip	Blows/ft	Sample Undis-turbed	Sample Bulk	Dry Density pcf	Graphic Log	Depth ft.	Soil type	Description and Remarks
								PIT DIMENSIONS 2'x2'x4.5' deep
						4' 8'		0-2ft slope wash/soil dry, silty clay to clayey silt with sand, yellow brown color, roots throughout, Schist and rock fragments of San Onofre Breccias, Secondary porosity from decay of organics present. (collapse if wet)
						12' 16' 20' 24' 28'		2-4½ ft. - weathered San Onofre Breccia/slopewash Reddish brown sandy silty clay, will large fragments of San Onofre Breccia. Sand, silt + clay in equal proportions. Stiff, hard, moist from 2½ ft down Earth materials are competent to support building structures Roots down to 3ft subsurface weather S.O.B at bottom of hole more apparent. MATERIALS Difficult to penetrate with pick and shovel
						32'		* No faults, fractures, ground water MASSIVE BEDDING - No Structural orientation

PIT #2

Test Boring Log

Date April 15, 1989 **Elevation** 176 ft **Logged by** P.E.B

Location 385 Nyes Place **Drilling method** HAND DUG Hole

SEE FIGURE 1 for LOCATION

Strike dip	Blows/ft	Sample: Undisturbed	Sample: Bulk	Dry Density pcf	Graphic Log	Depth ft.	Soil type	Description and Remarks
								Total depth 3.0 ft. Dimension 2x2x3
								0–18" – Soil/slopewash Light brown, dry silty clay w/sand. Large clasts of San Onofre Breccia Roots throughout
						4'		
						8'		18"–2' – TRANSITIONAL moist reddish brown, sandy silty clay to clayey silts with sand, roots
						12'		2'–3.0'+ – stiff, moist, reddish brown sandy silty clays to sandy clayey silts, Tight., Hard to penetrate with pick Large intraclasts of San Onofre Breccia – (WEATHERED SAN ONOFRE BRECCIA)
						16'		
						20'		
						24'		No fractures, faults groundwater
						28'		No bedding attitudes MASSIVE.
						32'		

Pit #3

Test Boring Log

Date April 15, 1989 **Logged by** PEB

Location 385 Nyes Place **Elevation** 164'

SEE FIGURE 1 FOR LOCATION

Drilling method HAND DUG HOLE

Strike dip	Blows/ft	Sample: Undisturbed	Sample: Bulk	Dry Density pcf	Graphic Log	Depth ft.	Soil type	Description and Remarks
								Total depth 2.5 ft. 2 x 3 x 2.5'
						0–1.5'		0–18" Loose soil, roots throughout, Dry silty clay to clayey silts with sands, yellow brown
						1.5–2.5'		18"–2.5' Weathered San Onofre Breccia (RESIDUAL SOIL) Large intraclasts of San Onofre Breccia, Schists, Quartzites moist, stiff. Difficult to pick
						4'		
						8'		
						12'		
						16'		No structures, faults fractures, ground water
								No structural attitudes
						20'		
						24'		* Upper 18", remove from 18" → bottom competent.
						28'		
						32'		

Pit #4

Test Boring Log

Date April 15, 1989 | Elevation 150' | Logged by PEB

Location 385 Nyes Place | Drilling method HAND DUG HOLE

SEE FIGURE 1 FOR LOCATION

Strike dip	Blows/ft	Sample Undis-turbed	Sample Bulk	Dry Density pcf	Graphic Log	Depth ft.	Soil type	Description and Remarks
								Total depth 3.5'
						4'		0 - 2.5' - Loose soil/slopewash, yellow brown, silty clay to clay silt with sands and fragments of San Onofre Breccia (schist, quartzite. etc) Roots throughout, Derived from S.O.B (To be removed) incompetent
						8'		
						12'		2.5 - 3.5' Weathered San Onofre Breccia Schist and Quartzite fragments, moist stiff to hard difficult to penetrate with pick, Reddish brown color. Sandy clay silts
						16'		
						20'		
						24'		No fracture, faults or ground water
						28'		No bedding attitudes (massive)
						32'		

APPENDIX C

STANDARD GRADING SPECIFICATIONS

APPENDIX C

STANDARD GRADING SPECIFICATIONS

GENERAL

These specifications present the usual and minimum requirements for grading operations observed by **Geofirm** or its designated representative. No deviation from these specifications 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 soils engineer signing the soils report. If unsatisfactory soil-related conditions exist, the soils 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 soils 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 soils 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 soils 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 diced 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 soils engineer.

MATERIALS

Materials for compacted fill shall consist of materials approved by the soils engineer. These 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 vegetable matter 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 soils 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 as soon as possible.

PLACING, SPREADING, AND COMPACTING FILL MATERIAL

The material used in the compacting process shall be evenly spread, watered, processed, and compacted in thin lifts not to exceed 6 inches in thickness to obtain a uniformly dense layer.

When the moisture content of the fill material is below that specified by the soils engineer, water shall be added by the contractor until the moisture content is near optimum as specified.

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 optimum as specified.

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 D: 1557-02 (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 soils engineer shall observe the placement of fill during the grading process and will file a written report upon completion of grading stating his observations as to compliance with these specifications.

One density test shall be required for each 2 vertical feet of fill placed, or one for each 1,000 cubic yards of fill, whichever requires the greater number of tests.

Any cleanouts and processed ground to receive fill must be observed by the soils engineer and/or engineering geologist prior to any fill placement. The contractor shall notify the geotechnical engineer when these areas are ready for observation.

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 terminated his observations of the completed grading, no further excavations and/or filling shall be performed without the approval of the soils engineer, if it is to be subject to the recommendations of this report.

APPENDIX D

UTILITY TRENCH BACKFILL GUIDELINES

APPENDIX D

UTILITY TRENCH BACKFILL GUIDELINES

The following guidelines pertinent to utility trench backfills have been adopted by the County of Orange, Environmental Management Agency Grading Section, effective March 31, 1986. The application of the guidelines is strictly enforced by the County reviewers and inspectors.

1. Each utility subcontractor (gas, electric, water, sewer, telephone, cable TV, irrigation, drainage, etc.) shall submit to the developer for dissemination to his consultants (civil engineer, geotechnical engineer, and utility contractor) a plot plan of all utility lines installed under his purview which identifies line type, material, size, depth, and approximate location.

2. The developer or his agent shall provide a composite plot plan of all utilities or a copy of all individual utility plot plans to his geotechnical engineer for use in evaluating whether all utility trench backfills are suitable for the intended use.

3. The geotechnical engineer shall provide the County with a report which includes a plot plan showing the location of all utility trenches which:

   A. Are located within the load influence zone of a structure (1:1 projection)

   B. Are located beneath any hardscape

   C. Are parallel and in close proximity to the top or toe of a slope and may adversely impact slope stability if improperly backfilled

   D. Are located on the face of a slope in a trench 18 or more inches in depth.

   Typically, trenches that are less than 18 inches in depth will not be within the load influence zone if located next to a structure, and will not have a significant effect on slope stability if constructed near the top or toe of a slope and need not be shown on the plot plan unless determined to be significant by the geotechnical engineer. This plot plan may be prepared by someone other than the soil engineer, but must meet his approval.

4. Backfill compaction test locations must be shown on the plot plan described in No. 3 above, and a table of test data provided in the geotechnical report.

5. The geotechnical report (utility trench backfill) must state that all utility trenches within the subject lots have been backfilled in a manner suitable for the intended use. This includes the backfill of all trenches shown on the plot plan described in No. 3 and the backfill of those trenches which did not need to be plotted on this plan.

APPENDIX E

MAINTENANCE OF HILLSIDE HOME SITES

APPENDIX E

MAINTENANCE OF HILLSIDE HOME SITES

Sites graded in hillsides require maintenance and repair of slopes and drainage. The City of Los Angeles, Department of Building and Safety has published a Homeowner's Guide (June 1974) containing "Recommendations for Maintenance of Graded Sites," which are pertinent to all graded sites:

> "It is incumbent upon the hillside property owner to maintain his property in a manner which will assure the continued stability of the property. The following are recommendations regarding slope and yard maintenance in graded hillside areas:

1. Maintain existing slope planting, provide new approved planting where indicated, and maintain irrigation systems in working order.
2. Maintain paved diverter terraces, interceptor terraces, downdrains, appurtenances such as inlets, and velocity reducer structures in a clean condition and in good repair.
3. Earth berms prevent water from flowing over slope. It is important that these berms be maintained.
4. Standing storm water on the pad area directly above the descending slopes, whether natural, cut or fill, is a major contributor toward slope failure. It is important that the pad drainage be maintained at a minimum of 2 percent to the street or other approved location to prevent this situation.
5. Side swales which direct water around the house should be maintained so that they will not become ineffective.
6. Catch basins, grates, and subsurface drainage piping should be kept free of silt and debris.
7. Roof gutters and downspouts should be inspected periodically to assure that they are not broken or clogged. All non-erosive drainage devices should be kept clean and in good repair.
8. Extensive landscaping or revision to the property may seriously alter the surface drainage pattern. When landscaping, homeowners should avoid disrupting flow patterns created when the property was original graded. It should be remembered that normal property drainage in hillside areas is from the rear yard to the street. Some properties drain to natural water courses.
9. Any problems such as erosion should be repaired immediately in order that more serious problems may be averted.
10. Rodent activity should be controlled to prevent water penetration and loosening of the soil.
11. Care should be exercised to prevent loose fill from being placed on a grading site, especially on slopes.

APPENDIX F

ENGINEERING STABILITY ANALYSES

APPENDIX F

ENGINEERING STABILITY ANALYSES

GENERAL

The "Slide 7.0", 2D slope stability program utilized the stability analyses. The computer program utilizes the limit equilibrium theory for the calculation of the minimum Factory of Safety (FS).

SHEAR STRENGTH PARAMETERS

The shear strength parameters utilized in our stability analyses are presented in Table F-1, below. These values were based on laboratory testing and local experience in similar soils, and engineering judgment, and are considered reasonable and representative of the on-site materials.

TABLE F-1

SUMMARY OF STRENGTH PARAMETERS

Material Type	Bulk Density γ_m (pcf)	Bulk Density γ_s (pcf)	Cohesion C (psf)	Friction Angle ϕ(deg)
San Onofre Formation Bedrock (Tso)	130	130	1500	35
San Onofre Formation Bedrock (Tso) Sheared	130	130	300	35

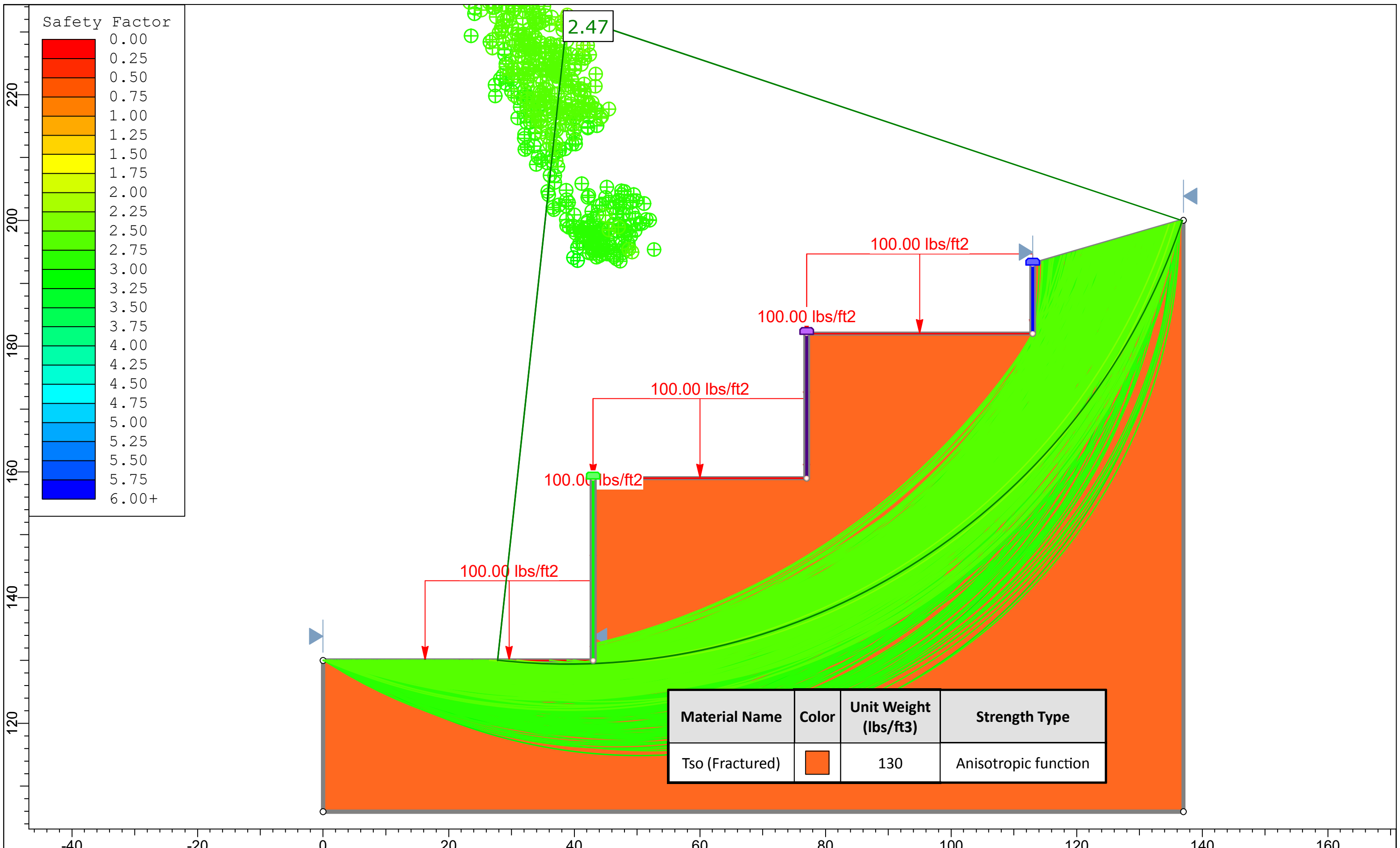
ANALYSES

Slope stability analyses were performed for the slope located within the property using Cross Section A-A'.

The Factor of Safety (FS) criteria adopted for verifying the adequacy of the stability of the slope for the final design are as follows:

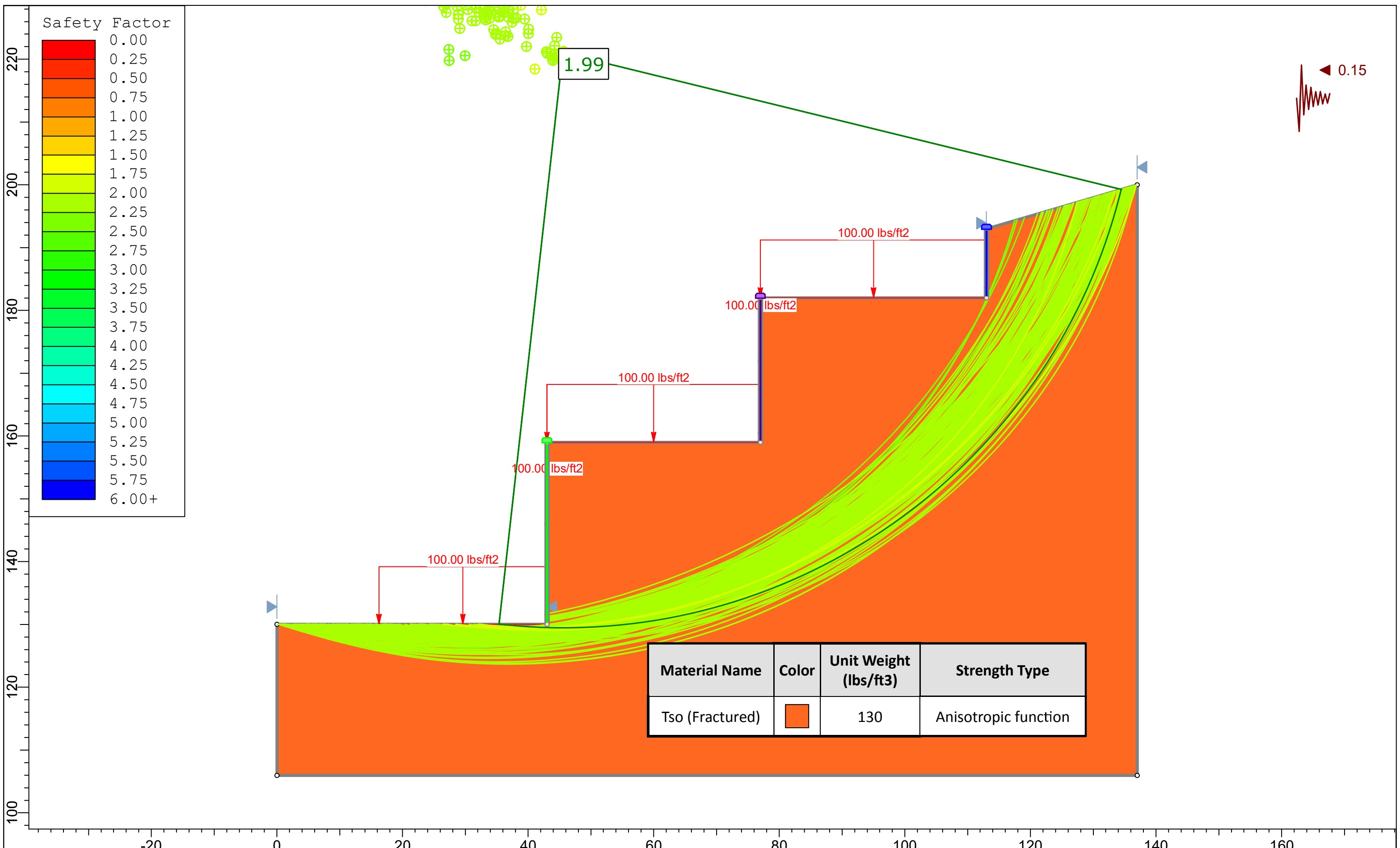
Static Conditions	–	FS≥1.5
Pseudostatic Conditions	–	FS≥1.1
Assumed Lateral Force (Seismic)	–	0.15g

The results of the analyses are presented in Figures F-1 and F-2.

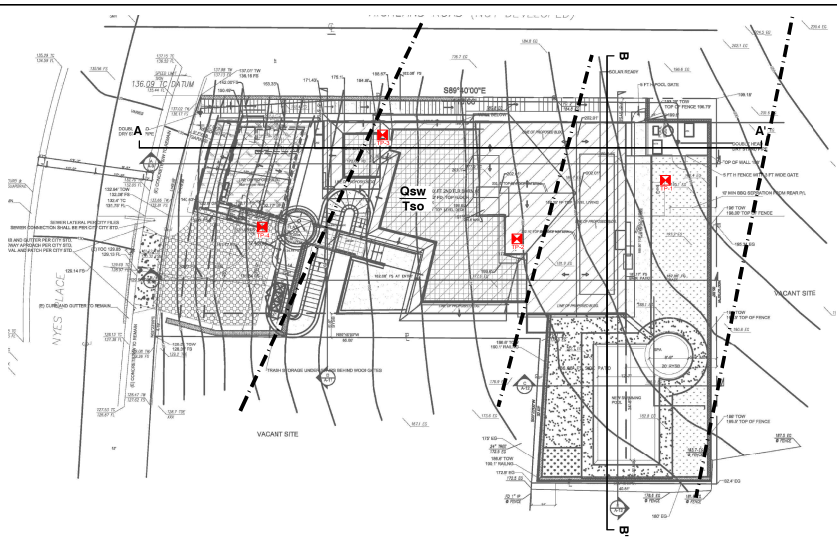


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type
Tso (Fractured)		130	Anisotropic function

Geofirm	*Project* Norris Residence 385 Nyes Place, Laguna Beach, CA		
	Analysis Description Cross Section A-A' - Global Static		
	Drawn By ZW	*Project Number* 72389-00	
SLIDEINTERPRET 8.010	*Date* 6/7/2018	*Figure #* F-1	

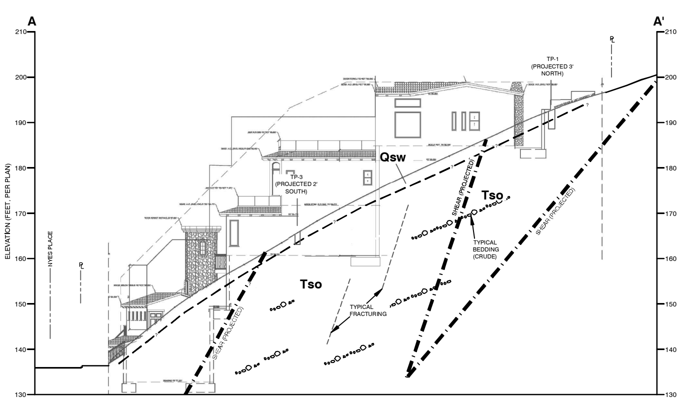


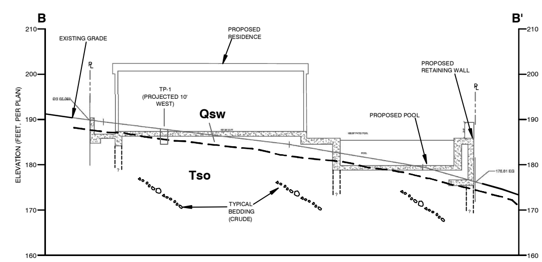
SLIDEINTERPRET 8.010	*Project*	Norris Residence 385 Nyes Place, Laguna Beach, CA	
	Analysis Description	Cross Section A-A' - Global Seismic	
	Drawn By	ZW	*Project Number* 72389-00
	Date	6/7/2018	*Figure #* F-2



EXPLANATION

Qsw	QUATERNARY SLOPEWASH
Tso	BEDROCK: SAN ONOFRE BRECCIA
TP-4	APPROXIMATE LOCATION OF TEST PIT BY PETER E. BORELLA, PHD
— · —	PROJECTED LOCATION OF SHEAR





GEOTECHNICAL PLOT PLAN AND SECTIONS A-A & B-B'
385 NYES PLACE
LAGUNA BEACH , CALIFORNIA

Geofirm

JOB NO.:	REPORT NO.:	DATE:	PLATE:
72389-00	18-8333	JUNE 2018	1