Appendix C
Geotechnical Report

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Project No: 72447-00
Report No: 20-8818

Subject: **Geotechnical Investigation for Residential Foundation Design and Right-of-Way Improvements**
2354 San Clemente Street
Laguna Beach, California

References: Geofirm, 2007, "Geotechnical Investigation for Residential Foundation Design, 2354 and 2360 San Clemente Street, Laguna Beach, California"; dated February 21, Project No. 71695-00, Report No. 07-5883.

Geofirm, 2008, "Response to City of Laguna Beach Geotechnical Report Review Sheet, dated May 16, 2008, 2360 San Clemente Street, Laguna Beach, California", dated June 27, Project No. 71695-01, Report No. 08-6303.

Geofirm, 2008, "Response to City of Laguna Beach Geotechnical Report Review Sheet, dated July 17, 2008, 2360 San Clemente Street, Laguna Beach, California", dated August 6, Project No. 71695-01, Report No. 08-6338.

INTRODUCTION

Purpose of Investigation

This report presents results and recommendations from an investigation undertaken to relate onsite and certain regional geotechnical conditions to the construction of a new three-story residence, including basement, at the subject site, as well as improvements to the San Clemente Street right-of-way (ROW) to accommodate a fire truck turnaround and loading of a Laguna Beach Fire Department fire apparatus. Analysis for this investigation is based upon conceptual plans provided by Geoff Sumich Design.

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

Scope of Investigation

The investigation included the following:

1. Review of geotechnical literature including certain regional and site-specific reports, including those previously produced by our office.
2. Review of surface observation of the property and reconnaissance of nearby areas.
3. Review of excavation and logging of two previous exploratory test pits in the proposed building area to obtain representative samples, undertake in situ testing and determine the geometrical distribution of subsurface earth materials.
4. Review of laboratory testing of previously collected representative samples to determine expansion index, Atterberg limits, maximum density and optimum moisture, soluble sulfate and corrosivity.
6. Geotechnical analysis of the subsurface conditions as related to proposed residential foundation design and construction.
7. Preparation of this report and illustrations.

Accompanying Illustrations and Appendices

Figure 1	-	USGS Geologic Location Map
Figure 2	-	CDMG Seismic Hazards Map
Figure 3	-	Typical Retaining Wall Subdrain Detail
Figure 4	-	Conceptual Shoring/Retaining Wall Subdrain Detail
Figure 5	-	Typical Slab Subdrain Detail
Figure 6	-	Geotechnical Plot Plan
Figure 7	-	Geotechnical Cross-Section A-A’
Figure 8	-	Geotechnical Cross-Section B-B’
Appendix A	-	References
Appendix B	-	Previous Test Pit Logs
Appendix C	-	Previous Laboratory Test Results
Appendix D	-	Standard Grading Specifications
Appendix E	-	Utility Trench Backfill Guidelines
Appendix F	-	Maintenance of Hillside Homes

Site Description

The combined triangular-shaped 0.3-acre lot fronts 160± feet on San Clemente Street to the southwest and extends 225± feet northerly to the rear property corner below Lomita Way. The property consists of two terraced pads excavated within a slope descending to the northwest adjacent to and below the end of the street. The property is flanked to the east by existing

residential properties. Existing improvements to the site are limited to two small single-story residences and an out-building. Grading of the lot and construction of the homes appears to have been performed in the early 1940's.

Proposed Development

The proposed construction consists of the removal of the existing structures and the development of a three-story single-family residence with terraced basement in the central portion of the combined lot. The proposed structure will be founded on retaining wall and conventional foundation systems. Proposed retaining walls are envisioned to be maximum of 15± feet high. Cut and fill earthwork is also proposed for the property. According to plans presented to our office by Toal Engineering, a total of 440 CY of export are planned in the area of the proposed residence. San Clemente Street right-of-way improvements are to require 250 CY of import material.

Improvements to the San Clemente Street right-of-way are to include the widening of the existing dead-end street to accommodate a cul-de-sac style Fire Department turn-around. Retaining walls are envisioned to support the improvements to a maximum height of 13± feet high.

GEOTECHNICAL CONDITIONS

Geologic Setting

The property is situated on the northwest flank of a ridgeline extending from the seaward margin of the San Joaquin Hills. The ridge and adjoining hillside have been uplifted over the past million years by tectonic forces acting on this region of southern California. Throughout this tectonic uplift, a succession of marine and nonmarine erosional events eroded the adjoining rock and carved out the local canyons, forming the site. Recently, local road building and property development further modified the area to its present configuration and morphology.

Earth Materials

The property is underlain at shallow depths by bedrock strata assigned on the basis of regional mapping to the San Onofre Formation of Miocene Age, Figure 1. Where exposed in the test pits, the bedrock consists of moderately to strongly cemented, light olive brown to yellow brown, fine to medium grained sandstone with thinly interbedded siltstone. The bedrock is mantled by residual soil (severely weathered bedrock) consisting of dark brown silt and clay, and by undocumented fill consisting of gravelly clay. The residual soil and fill are considered unsuitable for structural support in their present condition. These deposits can be reworked into suitable engineered fill materials.

The bedrock is suitable for foundation support. At the designed depths for excavation, hard rock should be anticipated in most cuts. Shoring should be anticipated where slope laybacks are not feasible.

Structures

Regional mapping of the Laguna Beach area indicates bedding typically strikes approximately east-west and dips at shallow to moderate angles south. Based on field observation bedrock strata in the vicinity of the site strikes northwesterly and dips gently to the southwest at 30 degrees from horizontal, obliquely into the topographic slope. This is a structural-topographic condition that generally promotes gross bedrock stability.

Slope Stability

No evidence of gross bedrock instability was observed during our field investigation or our literature-map review. Based upon good historical performance, a favorable topographic-structural relationship, and generally high strength bedrock materials, it is our opinion that the slope is grossly stable. However, the slope is considered surficially unstable.

Groundwater

No evidence of groundwater activity was noted during the field exploration. Perched water in the form of wet soils is anticipated to occur seasonally at the overburden-bedrock contact. However, groundwater is not anticipated to adversely affect the proposed construction providing proper subsurface and surface drainage is incorporated into design and construction.

Surficial Runoff

No evidence of uncontrolled, concentrated, erosive runoff onto or from the property was noted during our field reconnaissance. However, early residential construction typically did not provide adequate surface drainage controls. Proposed development will modify or may increase post-development surficial discharge, which should be addressed by the project Civil Engineer.

Seismic Considerations

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-southwest, (Blake, T.F., 2000, CGS/2004). Other active faults in the vicinity of the site include the San Joaquin Hills Fault approximately 3.9 miles from the site, the Palos Verdes Fault approximately 17.8 miles northwest, the Coronado Bank Fault, approximately 20.3 miles southwest, the Elsinore Fault, approximately 21.9 miles to

the east; and the San Andreas Fault, approximately 52.9 miles to the northeast.

The offshore portion of the Newport-Inglewood Fault zone is indicated in published reports as being a Potentially Active and Quaternary fault, (Jennings, C.W.; 1994). This interpretation is not universally shared, as this portion of the Newport-Inglewood Fault is included as a potential seismic source in the computer programs utilized to model ground motions for this study, (Blake, T.F.; 2000). With the fault's location approximately 3.0 miles to the west and given the present level of understanding of this offshore structure it is, in our opinion, appropriate to include this portion of the fault as a causative seismic feature.

The California Geological Survey updated the Fault Parameters and Earthquake Catalog for the probabilistic Seismic Hazards Maps, (CGS, 2004). This update included the addition of the "San Joaquin Hills" blind thrust fault, theorized to exist from Newport Beach to Dana Point, and ramping up inland to the Irvine area, and essentially underlying the site. Given that earthquakes of significant magnitude (M6.6) are presently postulated for this structure, it is calculated as the most significant seismic source to affect this site.

Ground Motion Analyses

Potential ground motions from earthquakes which could impact the sites were analyzed through probabilistic methods. The probabilistic method considers the regional seismic history and the slip rates of faults within a 100-mile radius of the subject site. Utilizing attenuation relationships (Bozorgnia, et al.; 1999, unconstrained/soft-rock), one can estimate the ground motion history of the site and attempt to predict the probability of future accelerations within a given period of time. The study indicates the maximum site acceleration from 1800 to 2004 was approximately 0.15g and occurred during a magnitude 6.3 Long Beach Earthquake 13.2 miles from the site on March 11, 1933. The closest earthquake greater than magnitude 5.0 to occur during that time period was a magnitude 5.2 earthquake aftershock from the Long Beach Earthquake, approximately 13.0 miles from the site. For the purposes of prediction and design, the peak acceleration with a 10 percent probability of exceedance in 50 years is determined to range from 0.34 to 0.40g. These values are consistent with published reports estimating this value for the subject location (Petersen, et. al., 1996-1999).

It is noted that the estimation of peak ground accelerations presented above is provided for the interest of the client and is required by local (City or County) review agencies. With the exception of use in liquefaction analysis, the values derived are not directly utilized in structural design of residential structures. Seismic parameters for use by the structural engineer in accordance with 2019 California Building Code for design of the proposed structure are presented in the recommendations portion of this report.

Secondary Seismic Hazards

Review of the Seismic Hazards Zones Map (CDMG, 1998) for the Laguna Beach Quadrangle, Figure 2, indicates the site is not located within a “zone of required investigation" for liquefaction or earthquake-induced landsliding.

Other secondary seismic hazards to the sites include deep rupture, shallow ground cracking, and settlement. 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. The potential for seismically induced settlement to occur is considered remote for bedrock sites.

CONCLUSIONS

1. The proposed construction 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. The proposed design should not adversely affect or be adversely affected by adjoining properties.
2. The property and right-of-way are underlain at shallow depth by competent sandstone bedrock strata of the San Onofre Formation. The bedrock is overlain by thin overburden of residual soils and fill. Based on observation, the bedrock is suitable in its present form for support of improvements. Residual/undocumented fill materials are not considered suitable in their present form to support new construction but may be removed to produce acceptable engineered fill. Fine-grained soils are not recommended for wall backfill.
3. The San Onofre bedrock materials have a low expansion potential and negligible sulfate concentration. Minimum resistivity results indicate a moderate potential for corrosion of buried metal. Hard rock excavation should be anticipated.
4. The slope is considered grossly stable but surficially unstable. Appropriate slope setbacks will be required as recommended herein.
5. Adverse groundwater conditions are not anticipated assuming appropriate drainage design.
6. Adverse surface discharge onto or off the site is not anticipated, provided proper engineering design is implemented.
7. The site is geotechnically unsuitable for the onsite discharge and/or infiltration of storm water due to the potential for adverse perching of groundwater on shallow impermeable bedrock.
8. The proposed residence is recommended to be supported on conventional foundations constructed in bedrock. Deepened foundations or caissons may be required to achieve

the recommended bedrock structural setbacks. Temporary shoring may be required to construct the basement level if temporary slopes are not feasible.

9. The proposed exterior hardscape elements and minor landscape walls may be constructed on bedrock or new engineered fill. Significant exterior landscape retaining walls are recommended to be supported on foundations constructed in bedrock.

RECOMMENDATIONS

Site Preparation and Grading

1. General

Grading should be performed in accordance with the Standard Grading Specifications in Appendix D. In general, grading is anticipated to include the excavation and export of existing soils and bedrock to create new design grades for the proposed improvements.

2. Remedial Grading

Remedial grading will include minor removals of locally unsuitable near-surface soils pending field review by the geologist in areas to receive fill or hardscape patios. Processing, over-excavation and re-compaction should be observed, tested and approved in writing by a representative of this firm. The depth of removal is anticipated to be approximately 3 feet; however, deeper removals may be necessary pending field-review by the geologist during grading, particularly in San Clemente Street.

Remedial grading beneath structural slabs is not required.

3. Removal of Existing Improvements

Any existing vegetation and/or construction/demolition and irrigation 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 if necessary, except for retaining wall backfill, providing oversized rock fragments (greater than 4-inches, greatest dimension) are excluded from the fills. Such 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

A. Protection of Property

In order to reduce the potential risk to adjoining properties from potential slope failures, temporary construction slopes exposing onsite earth materials may be excavated vertically to 5 feet, with higher slopes laid back at 1:1 (horizontal:vertical) pending field review by the geologist during grading.

Shoring should be anticipated where space or grading limitations preclude temporary slope layback or in locations where workers may be in close proximity to vertical cuts.

The maximum estimated height of proposed temporary slopes is uncertain at this time and is dependent on the foundation system chosen by the owner. Removal depths up to 10± feet or more are likely. Such cuts, where slope layback is feasible, may remain open for a period of 30 days pending field review by the geologist.

B. Worker Safety

As the safety of onsite personnel affected by the performance of temporary construction slopes is the responsibility of the general contractor, the contractor 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.

6. Temporary Shoring

Shoring may be required to construct the proposed garage depending on its final design and location relative to the existing residence. Temporary shoring may be designed using an equivalent fluid density of 35 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.

Monitoring

Complete documentation of the pre- and post-construction conditions of existing and adjacent improvements should be undertaken. In addition, monitoring of ground movement and construction vibrations should be made by the Geotechnical Consultant as an integral part of the construction.

Structural Design of Foundations

Earth materials to be exposed within foundation excavations are anticipated to exhibit a low expansion potential. It is anticipated that a conventional foundation system will be utilized and embedded into bedrock. We recommend that the foundations be designed in accordance with the 2019 California Building Code. Foundations and slabs should be designed for the intended use and loading by the Structural Engineer.

1. Conventional Foundations and Slabs-on-Grade

   Conventional spread footings founded in bedrock may be designed for an allowable bearing value of 4,000 pounds per square foot with a minimum width of 18 inches and a minimum embedment into bedrock of 18 inches below the lowest adjacent grade. The design value may be increased one-third for short duration wind or seismic loading. Settlement is anticipated to be less than approximately 3/4 -inch total and 1/2-inch differential over a distance of 20 feet.

   Lateral loads may be resisted by passive pressure forces and friction acting on the bottom of footings. The passive pressure forces may be computed using equivalent fluid densities of 400 pounds per cubic foot for bedrock, up to a maximum of 4,000 pounds per square foot. If caissons are utilized, the passive resistance may be applied over a tributary area of twice the caisson diameter. A coefficient of friction of 0.35 may be used in computing the frictional resistance in bedrock. These values may be combined. No lateral resistance may be utilized for existing loose fill and residual soil.

   Conventional foundations should be reinforced in conformance with the requirements of the structural engineer. From a geotechnical viewpoint, a minimum of two No. 5 bars

should be incorporated at the top and bottom of footings and grade beams in order to reduce the potential for cracking due to seismic shaking.

Slabs should be underlain by 4 inches of 1/2- and 3/4-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.

2. Moisture Content of Slab Subgrade Soils

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

3. 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 5. 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.

4. Structural Slab

Structural slabs should be designed by the structural engineer. Structural slabs should be designed to span between foundations with no soil support.

Caissons

Possible caissons utilized for foundation support or shoring should be at least twenty-four inches in diameter and embedded a minimum of 10 feet into competent bedrock. Caissons may be designed for a dead plus live load end bearing value of 8,000 pounds per square foot and skin friction of 400 pounds per square foot for bedrock. These values may be increased by one-third for wind and seismic forces. Lateral resistance may be computed utilizing 400 pounds per square foot per foot of depth for bedrock, acting on a tributary area of twice the caisson diameter.

Settlement is anticipated to be less than 1/4 inch. A minimum 24-inch diameter caisson is required in order to observe proper cleanout by the contractor and to allow visual observation and confirmation by the engineering geologist.

Structural Design of Retaining Walls

1. Lateral Loads

Active pressure forces acting on walls retaining level or 2:1 (horizontal:vertical) sloping backfill may be designed using an equivalent fluid pressures of 35 or 50 pounds per cubic foot, respectively, if backfilled with geotechnically approved, granular non-cohesive soils and free to rotate during backfilling (refer to Figure 3 for backcut and backfill geometry). Restrained walls should be designed for a 50 percent greater active pressure loading. Retaining wall design must consider topographic and structural surcharges.

It is our understanding that the San Clemente Street right-of-way needs to support the LBFD fire trucks. The assumed loads of LBFD fire apparatus include a total weight of 68,000 pounds. Apparatus weight is distributed as 46,000 pounds on tandem rear axles and 22,000 pounds on the front axle. Based on the assumed fire truck loads, we have calculated lateral earth pressure loads for use in the design of the fire truck turnaround retaining wall. The turnaround retaining wall should be designed for a uniform lateral pressure of 300 pounds per square foot.

The site is classified as being in Seismic Design Category D (Type II occupancy, SDs $\geq$ 0.5g, SD1 $\geq$ 0.2g). Seismic design of retaining walls over 6 feet in height may be based on the Mononobe-Okabe method, as updated by Atik and Sitar (2010), using an additional dynamic load of 17 pounds per cubic foot equivalent fluid pressure, respectively for active wall condition. These seismic wall loads may be assumed to act at 1/3 H above the base of the wall height, H. Final design requirements should be determined by the structural engineer.

2. Subdrains

The drainage scheme depicted on Figure 3 or 4, 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 architect's specifications or those of a waterproofing consultant.

3. Wall Excavations

Wall excavations should be cut in accordance the Temporary Construction Slopes section presented above.

Hardscape Design and Construction

Hardscape improvements may utilize conventional foundations embedded in compacted fill. Conventional spread footings founded in fill may be designed for an allowable bearing value of 2,000 pounds per square foot with a minimum embedment into the underlying soil of 18 inches below the lowest adjacent exterior grade. 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 150 pounds per cubic foot up to a maximum of 1,500 pounds per square foot. A coefficient of friction of 0.25 may be used in computing the frictional resistance in compacted fill. Friction resistance and passive pressure may be combined without reduction.

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; this is especially important if located upon retaining wall backfills.

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

Slope Setback

The bottom of all footings should be set back a minimum of 25 feet from the slope face, and a minimum of 10 feet from the bedrock face, whichever is greater. Actual embedment depths may exceed the minimum where structural design requirements supersede the slope setback requirement.

Concrete

Onsite derived soils have a 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 the structural requirements. In lieu of retaining a concrete expert, the 2019 California Building Code, Section 1904.1 should be utilized, which refers to ACI 318, Table 4.3.1.

Seismic Structural Design

Based on the geotechnical data and site parameters, the following is provided by the USGS (ASCE 7-16) to satisfy the 2019 CBC design criteria:

Seismic Design Criteria per 2019 CBC

Design Parameters	Recommended Values
Site Class	C
Site Longitude (degrees)	-117.7643
Site Latitude (degrees)	33.5265
Ss (g) B	1.327
S_1 (g) B	0.471
SMs (g) D	1.592
SM_1 (g) D	0.706
SDs (g) D	1.061
SD_1 (g) D	0.471
F_A	1.2
F_V	1.5
PGA (g)	0.582
Seismic Design Category	D

Pavement Design

General

Pavement areas for vehicle traffic may consist of concrete, asphalt concrete, or concrete pavers. Recommendations for each are given below. For design, we have used an assumed R-value of 20. In general, the site subgrade soils are expected to be mostly comprised of imported or onsite materials with a low expansion potential. A Traffic Index of 5 has been used for the design.

The upper 1-foot of subgrade soils directly supporting any structural section should be compacted to a minimum 90 percent of the maximum dry density at moisture contents at least above optimum moisture content (ASTM: D1557). This 1-foot layer of fill soils subgrade should be founded on competent engineered fill.

The untreated base material should consist of crushed aggregate base, crushed miscellaneous base, or processed miscellaneous base as defined in the Standard Specification for Public Works Construction. Base materials should be compacted to at least 95 percent relative compaction (ASTM: D1557) at or above optimum moisture content.

Concrete

We recommend the following concrete section:
Portland Cement Concrete Slab: 5-inches thick

Reinforcing: No. 3 rebar each way in middle third of section at 24-inch spacing
Minimum Concrete Modulus of Rupture: 550 psi

Asphalt Concrete (AC)

Typical or stamped asphalt concrete pavement sections at the site should be in accordance with those in the following table.

TABLE 1 – PAVEMENT SECTIONS

Area	Assumed Traffic Indices	R-Value (assumed)	AC/AB (Inches)	Full Depth AC/SG (Inches)
Drive/Parking Areas	5	20	4/5	6.5

Explanation: AC denotes Asphalt Concrete
AB denotes Base
SG denotes Competent Subgrade

Concrete Pavers

Typical concrete pavers for use in driveways and parking areas should be approximately 3-inches thick and underlain by 1 to 1.5-inches of clean sand. The pavers and sand should be supported on a minimum of 6-inches of untreated base material placed in two 3-inch thick lifts. All lifts should be placed at 95 percent relative compaction (ASTM: D1557). The base should be at or above optimum moisture content.

Concrete pavers for use in pedestrian traffic areas should be underlain with 1 to 1.5 inches of clean sand and 4-inches of base compacted to 95 percent relative compaction.

Finish Grading and Surface Drainage

Finished grades should be designed and constructed so that no water ponds in the vicinity of footings, or drains over the rear slope. Drainage design in accordance with the California Building Code, Section 1804.4, is recommended. Drainage should be conducted away from the house and rear slope in a non-erosive manner as specified by the project civil engineer or landscape architect. Proper interception and disposal of onsite surface discharge is presumed to be a matter of civil engineering or landscape architectural design.
The site is considered geotechnical unsuitable for the local onsite infiltration of storm water due to the impermeable character of the shallow bedrock and sloping conditions. The offsite discharge of storm water is recommended.

Utility Trench Backfill

Utility trench backfill should be placed in accordance with Appendix E, Utility Trench Backfill Guidelines. It is the owners and contractors responsibility to inform subcontractors of these requirements and to notify Geofirm when backfill placement is to begin. In addition, the owner or his representative should prepare a map on an ongoing basis which depicts the location of all underground utilities for inclusion in the as-built geotechnical report.

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 2019 California Building Code, Section 1705.6 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 geotechnical design assumptions. It is noted that the CBC requires continuous geologic observation during the drilling of deep foundation elements and observation and testing during placement of fill.

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 evaluate, 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.

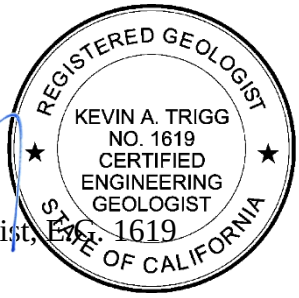
LIMITATIONS

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



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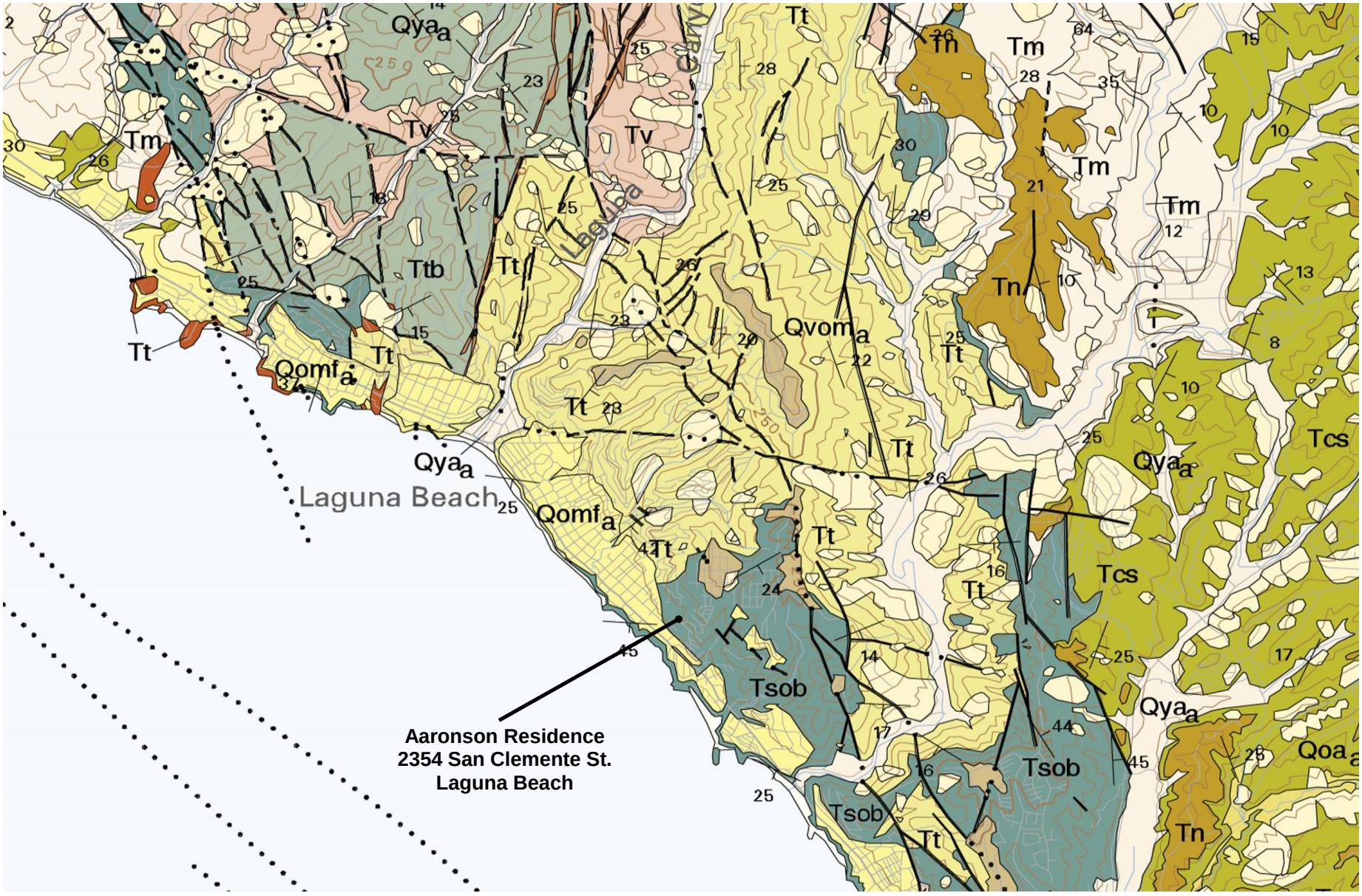
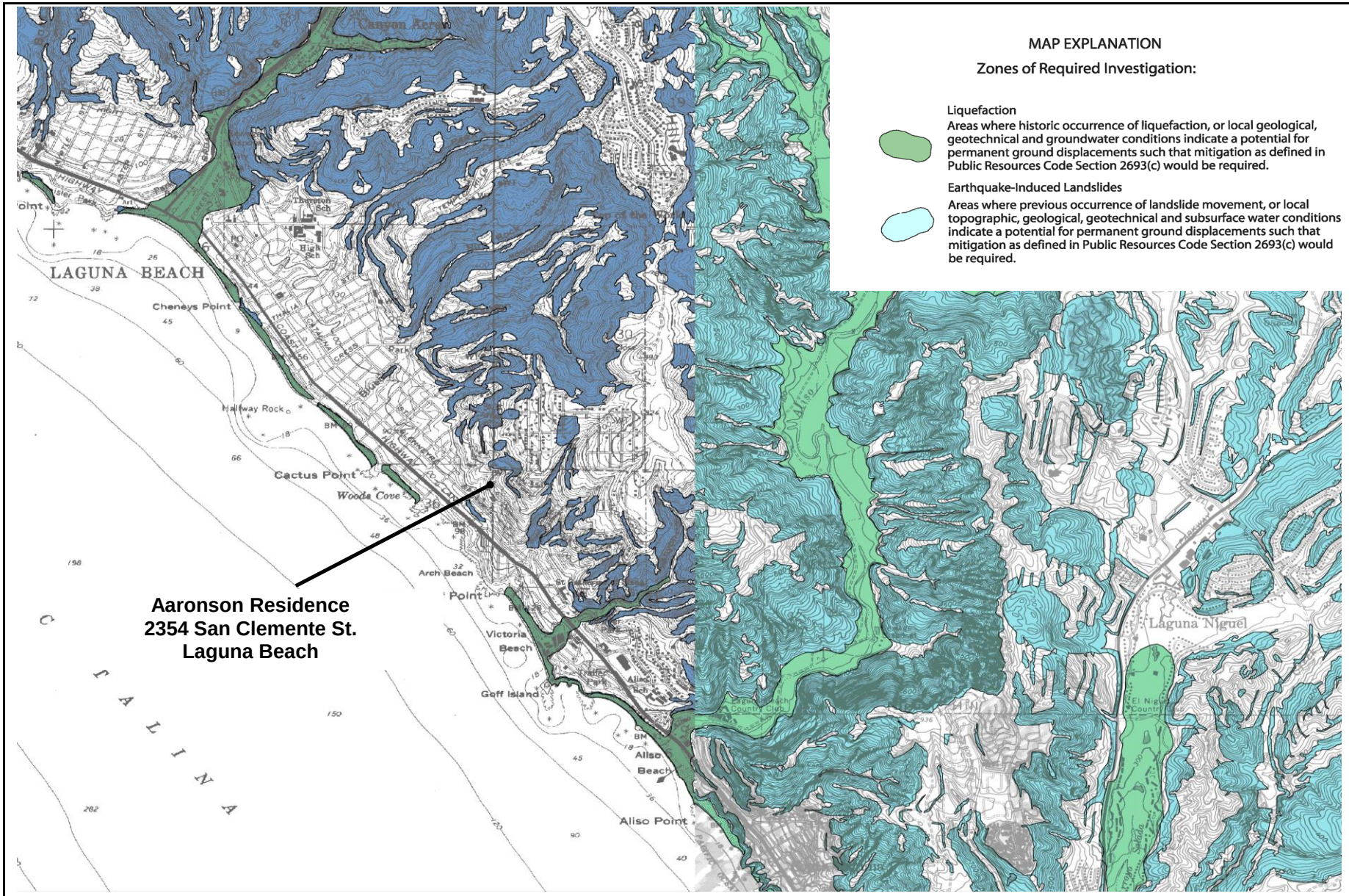
KAT/ZW:hsm

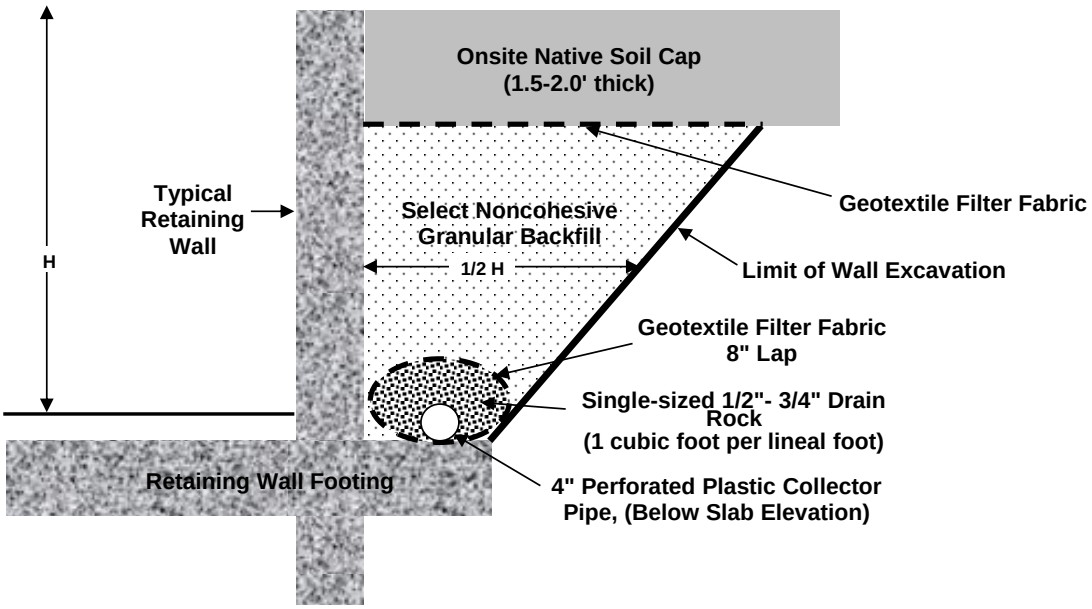
Distribution: (5) Addressee



GeoFirm	**USGS Geologic Location Map, Santa Ana 30' x 60' Quadrangle**		
	JOB NO.: **72447-00**	DATE: **December 2020**	FIGURE: **1**



Geofirm	**CDMG Seismic Hazards Map, San Juan Capistrano and Laguna Beach Quadrangle**		
	JOB NO.: **72447-00**	DATE: **December 2020**	FIGURE: **2**

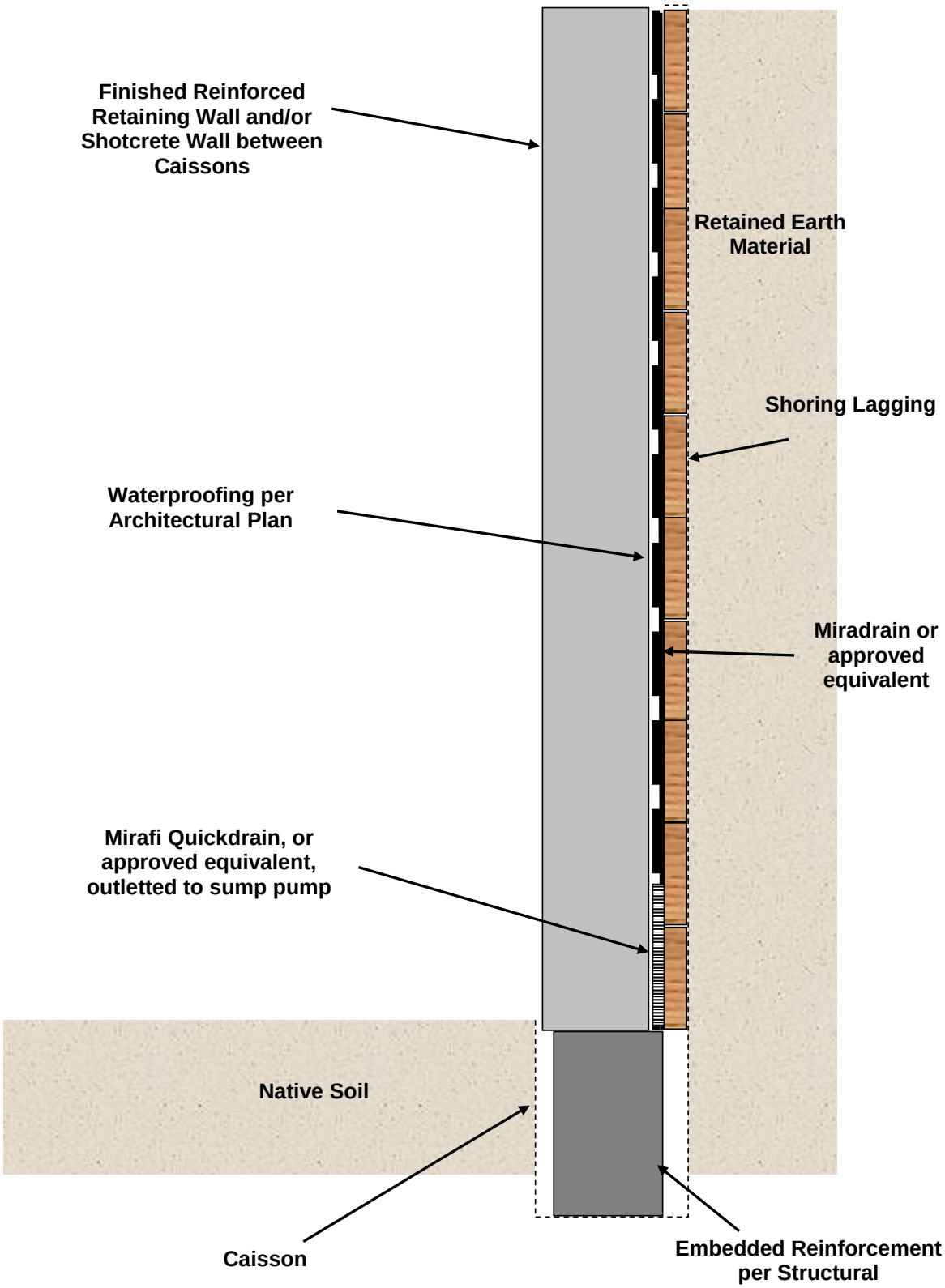


Notes: This system consists of a geotextile fabric-wrapped gravel envelope. Collection is with a 4-inch diameter perforated plastic pipe embedded in the gravel envelope and tied to a 4-inch diameter non-perforated plastic pipe which discharges at convenient locations. The outlet pipe should be placed 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

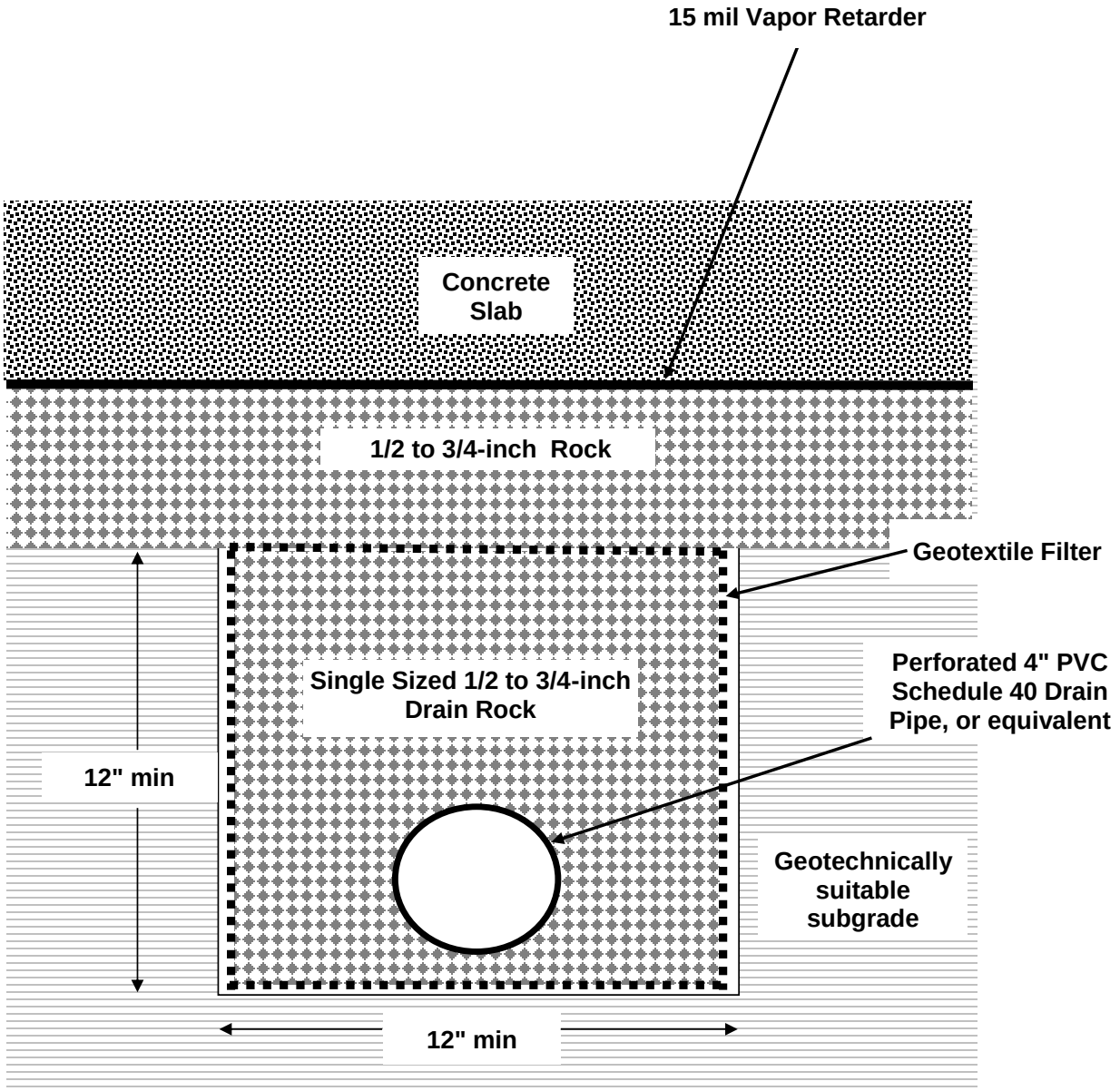
All drain pipes should be Schedule 40 PVC or ABS SDR-35. Perforations may be either bored 1/4-inch diameter holes or 3/16-inch slots placed on the bottom one-third of the pipe perimeter. If the pipe is to be bored, a minimum of 10 holes should be uniformly placed per foot of length. If slots are made, 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.

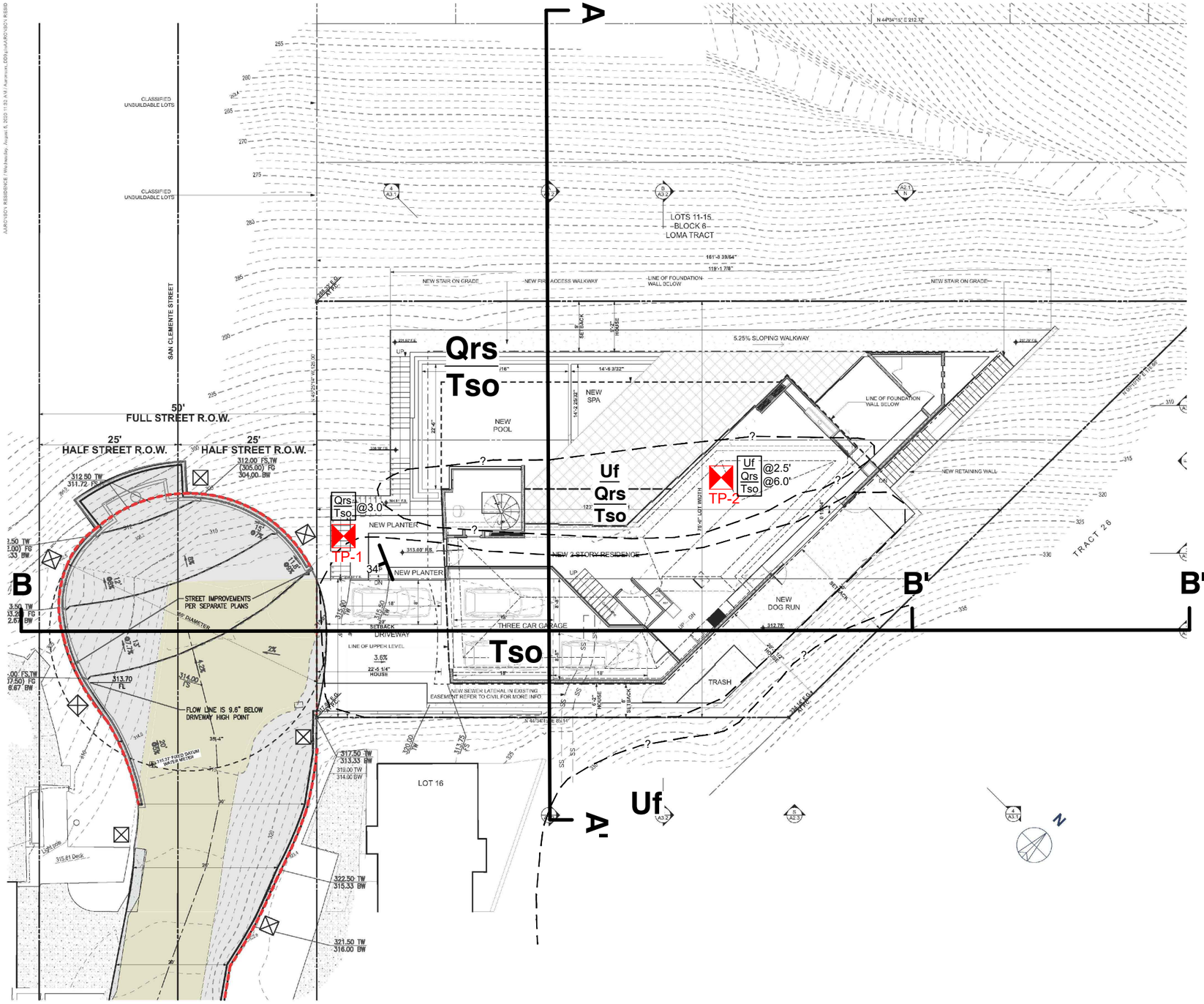
GeoFirm	**Typical Retaining Wall Subdrain Detail**		
	JOB NO.: **72447-00**	DATE: **December 2020**	FIGURE: **3**



GeoFirm	Conceptual Shoring/Retaining Wall Subdrain Detail		
	JOB NO.: 72447-00	DATE: December 2020	FIGURE: 4



GeoFirm	Typical Slab Subdrain Detail		
	JOB NO.: 72447-00	DATE: December 2020	FIGURE: 5



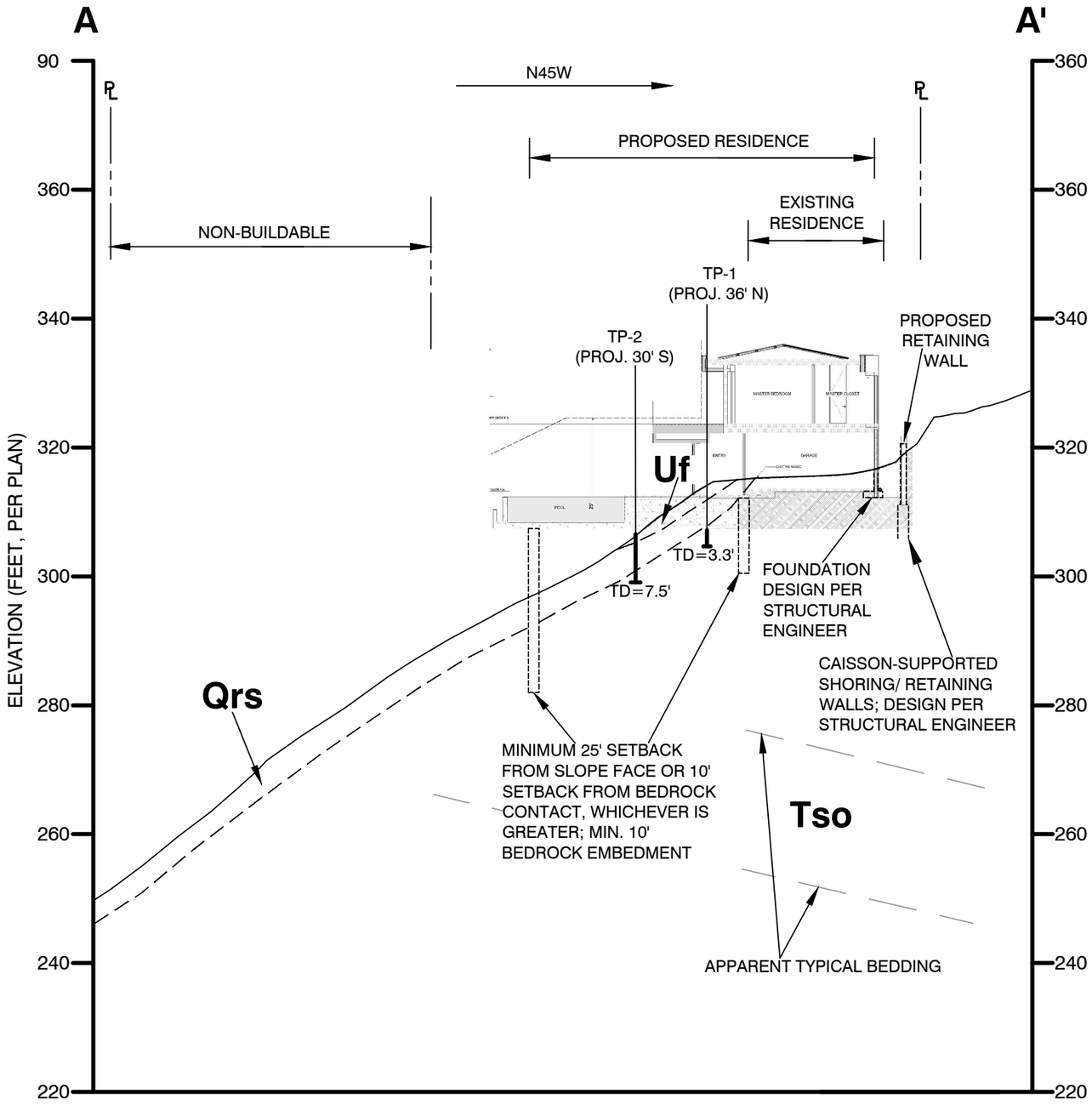
EXPLANATION

Uf	UNDOCUMENTED FILL
Qrs	RESIDUAL SOIL
Tso	BEDROCK: SAN ONOFRE FORMATION
	LITHOLOGIC CONTACT; QUERIED WHERE INFERRED
TP-2 (2007)	APPROXIMATE TEST PIT LOCATION
34	MEASURED STRIKE AND DIP OF BEDDING

GEOTECHNICAL PLOT PLAN
2354 SAN CLEMENTE STREET
LAGUNA BEACH, CALIFORNIA

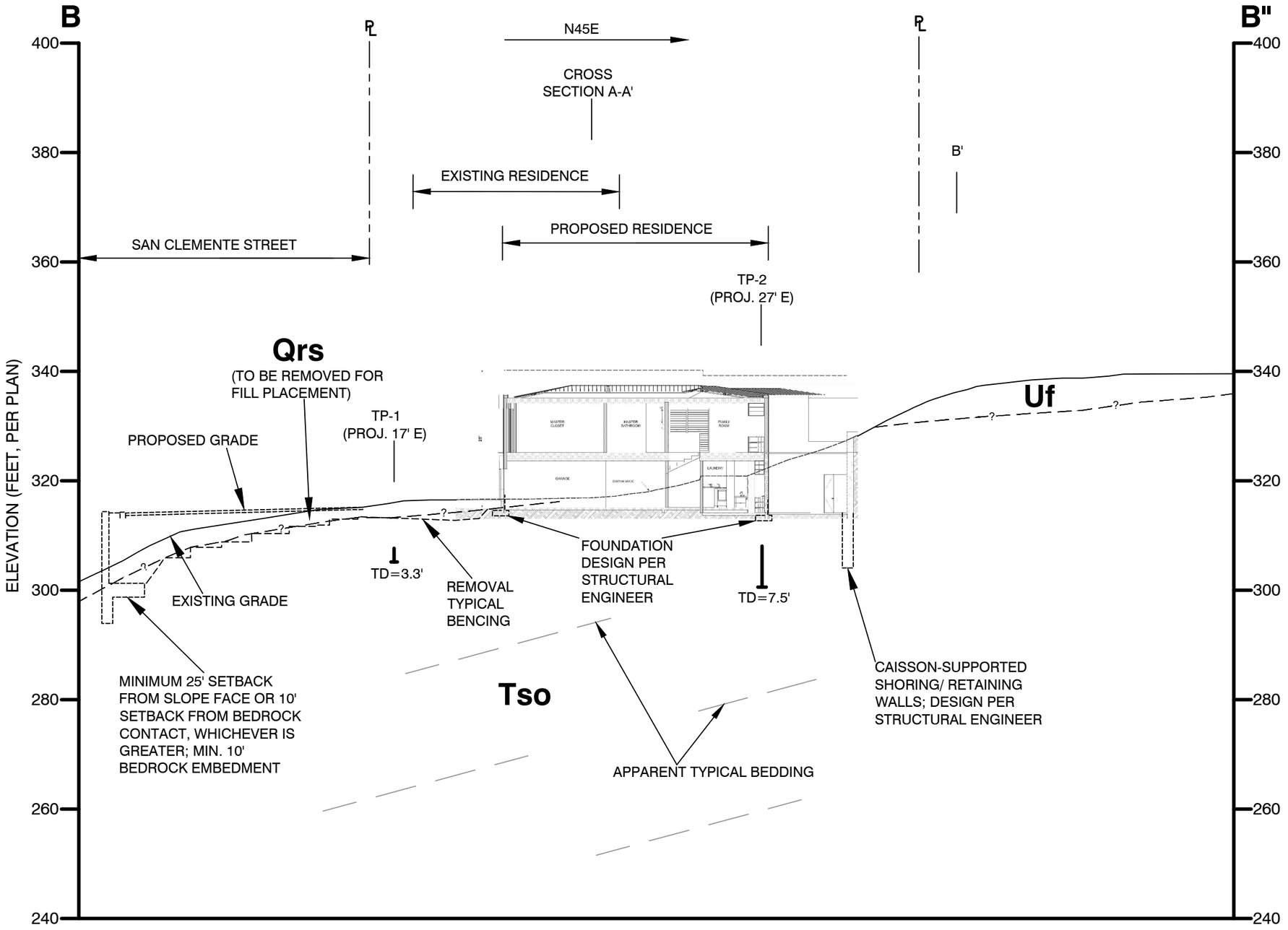
Geofirm

JOB NO.:	REPORT NO.:	DATE:	FIGURE:
72447-00A	20-8818	DECEMBER 2020	6



GEOTECHNICAL CROSS SECTION A-A'
2354 SAN CLEMENTE STREET
LAGUNA BEACH, CALIFORNIA

JOB NO.:	REPORT NO.:	DATE:	FIGURE:
72447-00A	20-8818	DECEMBER 2020	7



GEOTECHNICAL CROSS SECTION B-B"
2354 SAN CLEMENTE STREET
LAGUNA BEACH, CALIFORNIA

Geofirm

JOB NO.:	REPORT NO.:	DATE:	FIGURE:
72447-00A	20-8818	DECEMBER 2020	8

APPENDIX A

REFERENCES

APPENDIX A

REFERENCES

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APPENDIX B

PREVIOUS TEST PIT LOGS

Date(s) Logged: 1/22/2007
Logged By: ERH

LOCATION: 2354 San Clemente Dr.

Ground Elevation:

Method of Drilling: Manual
Drilling Company: Custom Landscape
Drop: N/A
Weight(s): N/A

Depth (feet)	Soil Classification	Blows/ft	Undisturbed Sample	Bulk Sample	Moisture Content (%)	In-place Dry Density (pcf)	**BORING NO.: TP-1** Description	Geologic Attitudes	Depth (feet)
0							Qrs - Residual Soil Upper ~13" consists of dry, crumbly and fractured sandy and gravelly CLAY, orangish brown to dark brown; abundant rootlets. Grades to sandy CLAY, damp.		0
1									1
2				▱					2
3							Tso - Bedrock - San Onofre Formation: Moderately to strongly cemented fine to medium SANDSTONE with thin SILTSTONE interbeds; light olive brown to yellowish brown.		3
4									4
5									5
6									6
7									7
8									8
9									9
10									10
11							Total Depth - 40"		11
12							Backfilled & compacted		12
13									13
14									14
15									15
16									16
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Project No.:

LOG OF BORING

Figure No.:

Stoney-Miller Consultants, Inc.

Date(s) Logged: 1/22/2007
Logged By: ERH

LOCATION: 2354 San Clemente Dr.

Ground Elevation:

Method of Drilling: Manual
Drilling Company: Custom Landscape
Drop: N/A
Weight(s): N/A

Depth (feet)	Soil Classification	Blows/ft	Undisturbed Sample	Bulk Sample	Moisture Content (%)	In-place Dry Density (pcf)	**BORING NO.: TP-2** Description	Geologic Attitudes	Depth (feet)
0							Uf - Undocumented Fill Dry, very weakly cemented gravelly CLAY derived from local residual soil.		0
1									1
2							Qrs - Residual Soil Dry to damp sandy and gravelly CLAY, abundant to scattered rootlets; orangish dark brown to dark brown.		2
3									3
4									4
5									5
6							Tso - Bedrock - San Onofre Formation: Moderately to strongly cemented fine to medium SANDSTONE, light olive brown to yellowish brown.		6
7									7
8									8
9									9
10									10
11							Total Depth = 90"		11
12							Backfilled and compacted		12
13									13
14									14
15									15
16									16
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Project No.: **LOG OF BORING** Figure No.:

APPENDIX C

PREVIOUS FIELD INVESTIGATION, SAMPLING AND LABORATORY TESTING

APPENDIX C

PREVIOUS FIELD INVESTIGATION, SAMPLING AND LABORATORY TESTING

I. Field Exploration Procedures

A. Field Exploration

Electrical spades and hand digging tools were utilized to expose subsurface soil of two test pits.

B. Sampling, Disaggregated Samples

Bulk samples of typical soil types were bagged and transported to the laboratory for classification and physical testing.

II. Laboratory Testing Procedures

A. Corrosivity Series

Soluble sulfates, pH and minimum resistivity were determined in accordance with California Test Method 417, ASTM D 4972-89, and California Test Method 643, respectively. The results are presented below:

Sample Designation	-	TP-1 @ 2-3’
pH	-	7.8
Soluble Sulfate per CA417	-	73 mg/kg
Minimum Resistivity per CA 643	-	3,600 ohm-cm (saturated)

B. Expansion Test

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

Sample Designation	-	TP-1 @ 2-3 ft
Expansion Index	-	14
Expansion Classification	-	Low

C. Atterberg Limits Determination

Atterberg Limits were determined in accordance with ASTM D 4318. The results are tabulated below:

Sample Location	Liquid Limit	Plastic Limit	Plasticity Index	Soil Classification
TP-1@ 2-3 ft	25	22	3	ML-CL

D. Maximum Density-Optimum Moisture

A maximum density-optimum moisture determination was performed in accordance with ASTM test method D1557-02. The results of the test are tabulated below:

Sample Designation	-	TP-1 @ 2-3’
Maximum Density	-	125 pcf
Optimum Moisture Content	-	11%

APPENDIX D

STANDARD GRADING SPECIFICATIONS

APPENDIX D

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: 1557-91 (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 E

UTILITY TRENCH BACKFILL GUIDELINES

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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 F

MAINTENANCE OF HILLSIDE LOTS

APPENDIX F

MAINTENANCE OF HILLSIDE LOTS

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."