ATTACHMENT D

MITIGATED NEGATIVE DECLARATION

APPENDIX E

GEOTECHNICAL REPORT

GEOTECHNICAL AND INFILTRATION EVALUATION

PROPOSED 9-LOT RESIDENTIAL DEVELOPMENT
APN 182-131-14
COX ROAD AND MULBERRY DRIVE
SAN MARCOS, SAN DIEGO COUNTY, CALIFORNIA

PREPARED FOR

MANNING HOMES
20151 SW BIRCH STREET, SUITE 150
NEWPORT BEACH, CALIFORNIA 92626

PREPARED BY

GEOTEK, INC.
1384 POINSETTIA AVENUE, SUITE A
VISTA, CALIFORNIA 92081

PROJECT NO. 3723-SD **SEPTEMBER 1, 2021**

GEOTEK

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September 1, 2021
Project No. 3723-SD

Manning Homes
20151 SW Birch Street, Suite 150
Newport Beach, California 92660

Attention: Mr. Craig Kozma

Subject: Geotechnical and Infiltration Evaluation
Proposed 9-Lot Residential Development
APN 182-131-14
Cox Road and Mulberry Drive
San Marcos, San Diego County, California

Dear Mr. Kozma:

GeoTek, Inc. (GeoTek) is pleased to provide the results of this geotechnical and infiltration evaluation for the proposed project located in San Marcos, San Diego County, California. This report presents the results of GeoTek's evaluation, discussion of findings, and provides geotechnical recommendations for foundation design and construction.

Based upon review and evaluation, site development appears feasible from a geotechnical viewpoint provided that the recommendations included in this report are incorporated into the design and construction phases of the project.

The opportunity to be of service is sincerely appreciated. If you should have any questions, please do not hesitate to contact GeoTek.

Respectfully
submitted,
GeoTek, Inc.

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1. PURPOSE AND SCOPE OF SERVICES

The purpose of this study was to evaluate the geotechnical engineering and geologic conditions at the project site, as outlined in GeoTek's proposal P-0601021-SD, dated June 18, 2021. Services provided for this study included the following:

- Research and review of available geologic data and general information pertinent to the site,
- Site exploration consisting of the excavation, logging, and sampling of seven (7) exploratory test borings extending to depths ranging from about 8 to 46.5 feet below grade,
- Excavation of two (2) percolation borings to a depth of about five (5) feet below grade and performing an infiltration test in each boring,
- Laboratory testing of soil samples collected during the field investigation,
- Review and evaluation of site seismicity, and
- Preparation of this geotechnical report which presents GeoTek's findings, conclusions, and recommendations for this site.

2. SITE DESCRIPTION AND PROPOSED DEVELOPMENT

2.1 SITE DESCRIPTION

The approximate 10-acre roughly rectangular-shaped project site is located adjacent to the southwest corner of Cox Road and Mulberry Drive, in the City of San Marcos, San Diego County, California (See Figure 1). Access to the site is available from Cox Road and Mulberry Drive, both paved improved streets, located adjacent to the northern and eastern boundaries of the site, respectively. The site is bordered to the south and west by existing single-family residences.

Topographically, the site slopes moderately downward to the south/southeast. Elevation of the northwestern portion of the the site is approximately 720 feet with approximately 25 feet of elevation differential across the site.

The site consisted of vacant land at the time of the field exploration with portions of the site being used for agriculture. A water well with associated improvements and farm equipment is located in the east-central edge of the site.

2.2 PROJECT DESCRIPTION

Based upon correspondence, GeoTek understands the property is to be developed with a minimum of nine (9) approximately 1-acre single-family residential lots and associated infrastructure improvements. Stormwater disposal is proposed to be by means of a stormwater management system in the southern edge of the site.

The proposed residential structures are anticipated to be of wood-frame construction, one- to two-stories in height, and incorporate conventional shallow foundations and concrete slab-on-grade floors. It is anticipated that sewage disposal will be by a public sewer. For the purposes of this report, it is assumed maximum column and wall loads will be about 50 kips and 2.5 kips per foot, respectively. Specific site development plans were not provided as of the date of this report. Once actual loads are known that information should be provided to GeoTek to determine if modifications to the recommendations presented in this report are warranted.

If site development differs from the assumptions made herein, the recommendations included in this report should be subject to further review and evaluation. Site development plans should be reviewed by GeoTek when they become available.

3. FIELD EXPLORATION AND LABORATORY TESTING

3.1 FIELD EXPLORATION

The field exploration for this report was conducted on August 12, 2021 and consisted of excavating seven (7) geotechnical exploratory test borings and two (2) percolation test borings with a hollow-stem drill rig to depths ranging from about 5 to 46.5 feet below grade. Borings B-1, B-2 and B-3 were terminated due to encountering refusal on the underlying bedrock. The approximate locations of the GeoTek excavations are shown on the Exploration Location Map

(Figure 2). A geologist from GeoTek logged the excavations and collected earth material samples for use in subsequent laboratory testing. The logs of the exploratory borings are included in Appendix A.

Bulk and relatively undisturbed soil samples were recovered at various intervals in the geotechnical borings with a California sampler. The California sampler is a 3-inch outside diameter, 2.5-inch inside diameter, split barrel sampler lined with brass rings. The sampler was 18 inches long. The sampler conformed to the requirements of ASTM D 3550. A 140-pound automatic trip hammer was utilized, dropping 30 inches for each blow. The relatively undisturbed samples, together with bulk samples of representative soil types, were returned to the laboratory for testing and evaluation. The California sampler test data are presented on the boring logs in Appendix A.

Percolation Testing

In addition to the geotechnical exploratory borings, two (2) percolation borings (P-1 and P-2) were excavated in the areas likely to be utilized for storm water management system to depths of about 5 feet. Instruction was given by the project civil engineer regarding potential storm water management system areas. Infiltration/percolation testing was conducted in these borings in general accordance with the requirements of the City of San Marcos.

The percolation tests consisted of drilling an eight-inch diameter test hole to the desired depth and installing approximately two inches of gravel in the bottom of the hole. A three-inch diameter perforated PVC pipe, wrapped in a filter sock, was placed in the excavations and the annular space was filled with gravel to prevent caving within the boring. Water was then placed in the borings to presoak the holes and percolation testing was performed the following the pre-soak period. Following presoaking, the percolation tests were performed which consisted of adding water to each test hole and measuring the water drop over a 30-minute period. The water drop was recorded for thirteen test intervals. Water was added to the test holes after each test interval.

The field percolations rates stabilized at a rate of 2 inches per hour (P-1) and 8 inches per hour (P-2). The field percolation rates were then converted to an infiltration rate using the Porchet Method. The results of the conversions indicate an infiltration rate of 0.08 to 0.36 inch per hour, indicating very low infiltration rates. Copies of the Porchet infiltration rate conversion calculations are presented in Appendix C. No factors of safety were applied to the rates provided. Over the lifetime of the infiltration areas, the infiltration rates may be affected by sediment build up and biological activities, as well as local variations in near surface soil conditions. A suitable factor of safety should be applied to the field rate in designing the infiltration system.

It should be noted that the infiltration rates provided above were performed in relatively undisturbed on-site soils. Infiltration rates will vary and are mostly dependent on the underlying consistency of the site soils and relative density. Infiltration rates may be impacted by weight of equipment travelling over the soils, placement of engineered fill and other various factors. GeoTek assumes no responsibility or liability for the ultimate design or performance of the storm water facility.

3.2 LABORATORY TESTING

Laboratory testing was performed on selected relatively undisturbed ring and bulk samples collected during the field exploration. The purpose of the laboratory testing was to confirm the field classification of the materials encountered and to evaluate their physical properties for use in the engineering design and analysis. Results of the laboratory testing program along with a brief description and relevant information regarding testing procedures are included on the exploratory borings logs (Appendix A) and included in Appendix B – Laboratory Test Results.

4. GEOLOGIC AND SOILS CONDITIONS

4.1 REGIONAL SETTING

The subject property is located in the Peninsular Ranges geomorphic province. The Peninsular Ranges province is one of the largest geomorphic units in western North America. Basically, it extends roughly 975 miles from the north and northeasterly adjacent the Transverse Ranges geomorphic province to the peninsula of Baja California. This province varies in width from about 30 to 100 miles. It is bounded on the west by the Pacific Ocean, on the south by the Gulf of California and on the east by the Colorado Desert Province.

The Peninsular Ranges are essentially a series of northwest-southeast oriented fault blocks. Several major fault zones are found in this province. The Elsinore Fault zone and the San Jacinto Fault zones trend northwest-southeast and are found in the near the middle of the province. The San Andreas Fault zone borders the northeasterly margin of the province. The closest known active fault is the Newport-Inglewood-Rose Canyon Fault Zone located approximately 14.4 miles west of the site. No faults are shown in the immediate site vicinity on the map reviewed for the area.

4.2 GENERAL SOIL CONDITIONS

A brief description of the earth materials encountered is presented in the following section. Based on the site reconnaissance, the exploratory excavations and review of published geologic maps, the area investigated is locally underlain alluvium over metasedimentary and metavolcanic bedrock.

4.2.1 Topsoil/Colluvium

Topsoil and/or colluvium was encountered in all the exploratory borings to depths ranging from approximately 0.5 to 2.5 feet below existing grade. The topsoil/colluvium encountered in the test borings generally consisted of clayey sand (SC soil types based upon the Unified Soil Classification System). This topsoil/colluvium appears to have been created in-part due to the past use of the property for agricultural purposes. Greater depths of topsoil/colluvium may be present within unexplored areas of the site.

4.2.2 Quaternary Alluvium (Qal)

Alluvium was encountered in all the borings beneath the topsoil/colluvium. These soils extended to depths ranging from approximately 0.5 to 19.5 feet below existing grade. As encountered in the borings, the alluvium consisted predominately of silty sands and clayey sands (SM and SC soil types).

Based on the laboratory test results, the near surface soils have a "low" (EI = 21-50) expansion potential (ASTM D 4829). However, based on observations made during the field exploration, it is GeoTek's opinion that some of the near surface soils are likely to have a "medium" (EI = 51-90) or possibly higher expansion potential. Based on the laboratory test results, the near surface soils have a "negligible" soluble sulfate content of less than 0.1 percent (ASTM D 4327). The test results are provided in Appendix B.

4.2.3 Mesozoic Metasedimentary-Metavolcanic Bedrock (Mzu)

Metasedimentary-metavolcanic bedrock was encountered at depth in all of the geotechnical borings. The bedrock is characterized to be generally massive, fine- to coarse-grained dark colored bedrock with variable degrees of weathering by depth. Where encountered, the bedrock was found to be highly weathered at the soil/bedrock contact but becomes less weathered with depth. Several of the geotechnical borings were terminated due to encountering hard bedrock. As encountered in the borings, the bedrock excavated as sand and silty sand (SP and SM soil types).

4.3 SURFACE WATER AND GROUNDWATER

4.3.1 Surface Water

If encountered during earthwork operations, surface water on this site is the result of precipitation or possibly some minor surface run-off from the surrounding areas. Overall site area drainage is to the south/southeast. Provisions for surface drainage will need to be accounted for by the project civil engineer.

4.3.2 Groundwater

Groundwater was not encountered within any of the test borings drilled at the site to the maximum depth drilled of 46.5 below the existing ground surface. Based on a review of information contained in the State Water Resources Control Board database (http://www.water.ca.gov/waterdatalibrary/) and the GeoTracker website, groundwater is estimated to be deeper than 50 feet below ground surface. Based on the results of the field exploration, review of site area geomorphology and geology, groundwater is not anticipated to adversely affect the proposed improvements.

4.4 FAULTING AND SEISMICITY

4.4.1 Faulting

The geologic structure of the entire southern California area is dominated mainly by northwest-trending faults associated with the San Andreas system. The site is in a seismically active region. No active or potentially active fault is known to exist at this site nor is the site situated within an *"Alquist-Priolo"* Earthquake Fault Zone or a Special Studies Zone (Bryant and Hart, 2007). No faults transecting the site were identified on the readily available geologic maps reviewed. The nearest known active fault is the Newport Inglewood-Rose Canyon fault located about 14.4 miles to the west of the site.

4.4.2 Seismic Design Parameters

The site is located at approximately 33.1734 degrees West Latitude and -117.1498 degrees North Longitude. Site spectral accelerations (S_a and S_1) for 0.2 and 1.0 second periods for a Class "C" site were determined from the SEAOC/OSHPD web interface that utilizes the USGS web services and retrieves the seismic design data and presents that information in a report format. These values are presented in the following table:

SITE SEISMIC PARAMETERS	
Mapped 0.2 sec Period Spectral Acceleration, S_S	0.921g
Mapped 1.0 sec Period Spectral Acceleration, S_1	0.338g
Site Coefficient for Site Class "C", F_a	1.2
Site Coefficient for Site Class "C", F_v	1.5
Maximum Considered Earthquake Spectral Response Acceleration for 0.2 Second, S_{MS}	1.105g
Maximum Considered Earthquake Spectral Response Acceleration for 1.0 Second, S_{M1}	0.506g
5% Damped Design Spectral Response Acceleration Parameter at 0.2 Second, S_{DS}	0.737g
5% Damped Design Spectral Response Acceleration Parameter at 1 second, S_{D1}	0.338g
Peak Ground Acceleration (PGA_M)	0.478g
Seismic Design Category	D

Final selection of the appropriate seismic design coefficients should be made by the project structural engineer based upon the local practices and ordinances, expected building response and desired level of conservatism.

4.5 LIQUEFACTION

Liquefaction describes a phenomenon in which cyclic stresses, produced by earthquake-induced ground motion, create excess pore pressures in relatively cohesionless and some low-plastic silt and clay soils. These soils may thereby acquire a high degree of mobility, which can lead to lateral movement, sliding, settlement of loose sediments, sand boils and other damaging deformations. This phenomenon occurs only below the water table, but, after liquefaction occurs, the liquefied soil/water matrix can propagate upward into overlying non-saturated soil as excess pore water dissipates.

The factors known to influence liquefaction potential include soil type and grain size, relative density, plasticity, groundwater level, confining pressures, and both intensity and duration of ground shaking. In general, materials that are susceptible to liquefaction are loose, saturated granular soils having low fines content under low confining pressures and some low plastic silts and clays.

Due to the lack of shallow groundwater at the project sites and presence of relatively shallow hard bedrock, the liquefaction potential for this project is considered low. Due to the dense to very dense nature of the subsurface soils and presence of relatively shallow bedrock, seismic induced ("dry sand") settlements are estimated to be minimal.

4.6 OTHER SEISMIC HAZARDS

Evidence of landslides or slope instabilities at the subject site was not observed during the investigation or geologically mapped in the general vicinity (Kennedy, M.P., Tan, S.S., Bovard, K.R., Alvarez, R.M., Watson, M.J., and Gutierrez, C.I., 2007).

The potential for secondary seismic hazards such as a seiche and tsunami is considered negligible due to site elevation and distance from an enclosed or open body of water.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 GENERAL

Development of the site appears feasible from a geotechnical engineering viewpoint. The following recommendations should be incorporated into the design and construction phases of development.

5.2 EARTHWORK CONSIDERATIONS

5.2.1 General

Earthwork and grading should be performed in accordance with the applicable grading ordinances of the County of San Diego, City of San Marcos and the 2019 California Building Code (CBC), and recommendations contained in this report. The Grading Guidelines included in Appendix D outline general procedures and do not anticipate all site-specific situations. In the event of conflict, the recommendations presented in the text of this report should supersede those contained in Appendix D.

5.2.2 Site Clearing

Initial site preparation should commence with removal of any debris, deleterious materials and vegetation within the limits of the planned improvements. As previously discussed, the site has been used for agricultural purposes and a water well is located in the east-central edge of the site. Any water well should be abandoned in accordance with San Diego County guidelines. Voids resulting from removing any materials should be replaced with engineered fill materials with expansion characteristics similar to the onsite materials.

5.2.3 Site Preparation

Due to the non-uniform nature and thickness of the near-surface topsoil/colluvium and alluvium, it is recommended that the soils be removed beneath the planned building footprint of the proposed structure to a depth of at least three (3) feet below existing grade, or one (1) foot beneath the base of the proposed foundations, whichever is greater. Removal bottoms should be relatively uniform in soil type which is not visibly porous and having an in-place density of at least 85 percent of the soil's maximum dry density as determined by ASTM D 1557 test procedures. A representative of this firm should observe and approve the bottom of all remedial excavations. The lateral extent of this recommended over-excavation should extend at least 5 feet beyond the building or foundation limits.

Following site clearing operations, over-excavation and lowering of site grades, where necessary, it is recommended that the exposed subgrade soils beneath all surface improvements be proof rolled with a heavy rubber-tired piece of construction equipment approved by and in the presence of the geotechnical engineering representative. The proof rolling equipment should possess a minimum weight of 15 tons and proof rolling should include at least 4 passes, two in each perpendicular direction. All soil that ruts or excessively deflects during proof rolling should be removed as recommended by the GeoTek representative. Following proof rolling and removal of any unsuitable bearing soil, the exposed subgrade should be scarified to a depth of about 12 inches, be moisture conditioned to slightly above the soil's optimum moisture content and then be compacted to at least 90 percent of the soil's maximum dry density as determined by ASTM D-1557 test procedures.

5.2.4 Engineered Fill

The on-site soils are generally considered suitable for reuse as engineered fill provided they are free from vegetation, debris, oversized materials (~6 inches) and other deleterious material. All areas should be brought to final subgrade elevations with fill materials that are placed and compacted in general accordance with minimum project standards. Engineered fill should be placed in 6-to-8-inch loose lifts, moisture conditioned to slightly above the optimum moisture content and compacted to a minimum relative compaction of 90 percent as determined by ASTM D-1557 test procedures.

If wet soils are encountered during remedial grading, methods for drying soils such as stockpiling or mixing with dry soils may be required to bring the soils to the required moisture content for placement as engineered fill. Placement of engineered fill should be observed and tested on a full-time basis by a GeoTek representative during grading activities.

5.2.5 Transition Lot Condition

Building pads graded with a cut/fill transition should be undercut to reduce the potential for differential settlement. The cut portion of the cut/fill transition should be undercut to a depth of at least 3 feet or one (1) foot below the deepest proposed footing, whichever is deeper, and be backfilled with a properly compacted engineered fill. The bottom of the undercut should be sloped at a minimum of 1 percent toward the adjacent street/parking lot area.

5.2.6 Oversized Rock Disposal

Oversized cobbles, bounders and rock fragments may be encountered during rough grading and utility trench operations, especially if the bedrock is encountered. On-site disposal of oversized materials is possible, provided the oversized materials are placed as recommended on Plate 4 within Appendix D. Alternatively, over-sized materials can be exported from the site.

5.2.7 Excavation Characteristics

Excavations in the on-site topsoil/colluvium and alluvium should be readily accomplished with heavy-duty earthmoving or excavating equipment in good operating condition. All excavations should be formed in accordance with current Cal-OSHA requirements.

Some excavation difficulties should be anticipated for any deep excavations into the on-site bedrock. Caving of loose material as a result of the bedrock excavation, known as "overbreak" of deep utility trench excavations into the bedrock should be anticipated. Dependent upon the depth of excavations, specialized equipment and/or techniques may be necessary.

5.2.8 Trench Excavations and Backfill

Temporary trench excavations within the on-site materials should be stable at a 1:1 inclination for short durations during construction and where cuts do not exceed 15 feet in height. Deeper temporary excavations should be reviewed by GeoTek prior to their planned excavation to determine if supplemental recommendations or analysis are warranted. It is anticipated that temporary cuts to a maximum height of 4 feet can be excavated vertically. Trench excavations should conform to Cal-OSHA regulations. The contractor should have a competent person, per OSHA requirements, on site during construction to observe conditions and to make the appropriate recommendations.

Utility trench backfill should be compacted to at least 90 percent relative compaction (as determined by ASTM D-1557 test procedures). Under-slab trenches should also be compacted to project specifications. Where applicable, based on jurisdictional requirements, the top 12 inches of backfill below subgrade for road pavements should be compacted to at least 95 percent relative compaction. On-site materials may not be suitable for use as bedding material but should be suitable as backfill provided particles larger than 6 inches are removed.

Compaction should be achieved with a mechanical compaction device. Ponding or jetting of trench backfill is not recommended. If backfill soils have dried out, they should be properly moisture conditioned prior to placement in trenches.

5.2.9 Shrinkage and Bulking

For planning purposes, a shrinkage loss of about 5 to 15 percent is anticipated for excavations within the topsoil/colluvium and alluvium at the site. A bulking factor of 10 percent should be considered for excavations extending into the underlying bedrock. Several factors will impact earthwork balancing on the site, including shrinkage, trench spoil from utilities and footing excavations, as well as the accuracy of topography. Shrinkage and bulking are primarily dependent upon the degree of compactive effort achieved during construction, depth of fill and underlying site conditions.

Due to the dense nature of underlying alluvium and presence of relatively shallow bedrock, subsidence is estimated to be to be less than 0.1 foot for the site.

Site balance areas should be available in order to adjust project grades, depending on actual field conditions at the conclusion of earthwork construction.

5.2.10 Grading Plan Review

Upon completion of the site grading plans, it is recommended that those plans be provided to GeoTek for review. Based on that review, some modifications to the recommendations provided in this report may be necessary.

5.3 DESIGN RECOMMENDATIONS

5.3.1 Foundation Design Criteria

Foundation design criteria for a conventional foundation system, in general conformance with the 2019 CBC, are presented below. The site soils are classified as having a “low” (21-50) to “medium” (51-90) expansion potential in accordance with ASTM D 4829. These are minimal recommendations and are not intended to supersede the design by the project structural engineer. The conventional foundation elements for the proposed structures should bear entirely in engineered fill soils. Foundations should be designed in accordance with the 2019 CBC requirements.

A summary of GeoTek's preliminary foundation design recommendations is presented in the table below:

Design Parameter	**"Low" Expansion Potential (21≤EI≤50)**	**"Medium" Expansion Potential (51<EI<90)**
Foundation Depth or Minimum Perimeter Beam Depth (inches below lowest adjacent grade)	12-One & Two Story	18-One & Two Story
Minimum Foundation Width (Inches)*	12-One Story 15-Two Story	15
Minimum Slab Thickness (actual)	4 inches (actual)	4 inches (actual)
Minimum Slab Reinforcing	6" x 6" – W2.9/W2.9 welded wire fabric placed in middle of slab or No. 3 bars at 18 inch centers.	No. 4 reinforcing bars at 18 inches on center each way placed in middle of slab
Minimum Footing Reinforcement	Two No. 4 Reinforcing Bars, two top and two bottom	Four No. 4 Reinforcing Bars, two top and two bottom
Effective Plasticity Index**	15	40
Presaturation of Subgrade Soil (Percent of Optimum)	Minimum 110% of the optimum moisture content to a depth of at least 18 inches prior to placing concrete	Minimum 120% of the optimum moisture content to a depth of at least 18 inches prior to placing concrete

*Code minimums per Table 1809.7 of the 2019 CBC.
**To be determined after rough grading, if necessary

It should be noted that the criteria provided are based on soil support characteristics only. The structural engineer should design the slab and foundation reinforcement based on actual loading conditions.

Presented below are post-tensioned foundation design parameters for the proposed structures at the site underlain by expansive soils. These parameters are in general conformance with guidelines presented in the *Design of Post-Tensioned Slabs-on-Ground*, Third Edition *with 2008 Supplement* (PTI, 2008). These recommendations are minimal recommendations and are not intended to supersede the design by the project structural engineer.

DESIGN PARAMTERS FOR POST-TENSIONED SLABS	
Foundation Design Parameter	Design Value
	"Medium" Expansion Potential (LL≤85; PI≤45; Passing #200 Sieve ≈ 85%; Clay fines ≈ 55%)
Edge Moisture Variation Distance, e_m -Edge Lift (swelling) -Center Lift (shrinkage)	 2.9 ft 5.3 ft
Soil Differential Movement, y_m -Edge Lift (swelling) -Center Lift (shrinkage)	 ≈1.49 in ≈-0.62 in
Exterior Perimeter Beam Embedment	One- and Two-Story – 18 inches*
Presaturation of Subgrade Soil (Percent of Optimum)	Minimum 120% to a depth of 18 inches

*Required depth of perimeter beam/stiffening rib per structural calculations may govern.
The following assumptions were used to generate e_m and y_m values: Thornthwaite Moisture Index = -20; constant suction value = 3.9pF; post-equilibrium case assumed with wet (swelling) cycle going from 3.9pF to 3.0pF and drying (shrinking) cycle going from 3.9pF to 4.5pF.

Post-tensioned slabs should be designed in accordance with the *2019 CBC* and PTI design methodology. The bottom of the perimeter edge beam/deepened footing should be designed to resist tension forces using either cable or conventional reinforcement, per the structural engineer.

The following criteria for design of foundations are preliminary and should be re-evaluated based on the results additional laboratory testing of samples obtained at/near finish pad grade.

5.3.1.1 An allowable bearing capacity of 2,000 pounds per square foot (psf) may be used for design of continuous and perimeter footings 12 inches deep and 12 inches wide, and pad footings 24 inches square and 12 inches deep. This allowable soil bearing capacity may be increased by 250 psf for each additional foot of footing depth and 250 psf for each additional foot of footing width to a maximum value of 3,000 psf. An increase of one-third may be applied when considering short-term live loads (e.g., seismic and wind loads).

5.3.1.2 Structural foundations should be designed in accordance with the 2019 CBC, and to withstand a total static settlement of 1 inch and maximum differential static settlement of one-half of the total settlement over a horizontal distance of 40 feet.

5.3.1.3 The passive earth pressure may be computed as an equivalent fluid having a density of 300 psf per foot of depth, to a maximum earth pressure of 3,000 psf for footings founded on engineered fill or competent native soil. A coefficient of friction between soil and concrete of 0.30 may be used with dead load forces. When combining passive pressure and frictional resistance, the passive pressure component should be reduced by one-third. The upper one foot of soil should be ignored in the passive pressure calculations unless the surface is covered with pavements.

5.3.1.4 A grade beam, a minimum of 15 inches wide and 18 inches deep, should be utilized across large entrances. The base of the grade beam should be at the same elevation as the bottom of the adjoining footings.

5.3.1.5 A moisture and vapor retarding system should be placed below slabs-on-grade where moisture migration through the slab is undesirable. Guidelines for these are provided in the 2019 California Green Building Standards Code (CALGreen) Section 4.505.2, the 2019 CBC Section 1907.1 and ACI 360R-10. The vapor retarder design and construction should also meet the requirements of ASTM E 1643. A portion of the vapor retarder design should be the implementation of a moisture vapor retardant membrane.

It should be realized that the effectiveness of the vapor retarding membrane can be adversely impacted as a result of construction related punctures (e.g., stake penetrations, tears, punctures from walking on the vapor retarder placed atop the underlying aggregate layer, etc.). These occurrences should be limited as much as possible during construction. Thicker membranes are generally more resistant to accidental puncture than thinner ones. Products specifically designed for use as moisture/vapor retarders may also be more puncture resistant. Although the CBC specifies a 6-mil vapor retarder membrane, it is GeoTek's opinion that a minimum 10 mil thick membrane with joints properly overlapped and sealed should be considered, unless otherwise specified by the slab design professional. The membrane should consist of Stego wrap or the equivalent.

Moisture and vapor retarding systems are intended to provide a certain level of resistance to vapor and moisture transmission through the concrete, but do not eliminate it. The acceptable level of moisture transmission through the slab is to a large extent based on the type of flooring used and environmental conditions. Ultimately, the vapor retarding system should be comprised of suitable elements to limited migration of water and reduce transmission of water vapor through the slab to acceptable levels. The selected elements should have suitable properties (i.e., thickness, composition, strength, and permeability) to achieve the desired performance level.

Moisture retarders can reduce, but not eliminate, moisture vapor rise from the underlying soils up through the slab. Moisture retarder systems should be designed and constructed in accordance with applicable American Concrete Institute, Portland Cement Association, Post-Tensioning Concrete Institute, ASTM and California Building Code requirements and guidelines.

GeoTek recommends that a qualified person, such as the flooring contractor, structural engineer, architect, and/or other experts specializing in moisture control within the building be consulted to evaluate the general and specific moisture and vapor transmission paths and associated potential impact on the proposed construction. That person (or persons) should provide recommendations relative to the slab moisture and vapor retarder systems and for migration of potential adverse impact of moisture vapor transmission on various components of the structures, as deemed appropriate.

In addition, the recommendations in this report and GeoTek's services in general are not intended to address mold prevention; since GeoTek, along with geotechnical consultants in general, do not practice in the area of mold prevention. If specific recommendations addressing potential mold issues are desired, then a professional mold prevention consultant should be contacted.

5.3.1.6 It is recommended that control joints be placed in two directions spaced approximately 24 to 36 times the thickness of the slab in inches. These joints are a widely accepted means to control cracks and should be reviewed by the project structural engineer.

5.3.2 Miscellaneous Foundation Recommendations

5.3.2.1 To reduce moisture penetration beneath the slab on grade areas, utility trench excavations should be backfilled with engineered fill, lean concrete or concrete slurry where they intercept the perimeter footing or thickened slab edge.

5.3.2.2 Soils from the footing excavations should not be placed in the slab-on-grade areas unless properly compacted and tested. The excavations should be free of loose/sloughed materials and be neatly trimmed at the time of concrete placement.

5.3.3 Foundation Setbacks

Minimum setbacks for all foundations should comply with the 2019 CBC, San Diego County or City of San Marcos requirements, whichever is more stringent. Improvements not conforming to these setbacks are subject to the increased likelihood of excessive lateral movements and/or differential settlements. If large enough, these movements can compromise the integrity of the improvements. The top outside edge of all footings should be set back a minimum of H/3 (where H is the slope height) from the face of any descending slope. The setback should be at least five feet and need not exceed 40 feet.

5.3.4 Soil Corrosivity

The soil resistivity at this site was tested in the laboratory on a sample collected during the field investigation. The results of the testing indicate that the on-site soils are considered "corrosive" (3,149 ohm-cm) (Roberge, 2000) to buried ferrous metal in accordance with current standards used by corrosion engineers. It is recommended that a corrosion engineer be consulted to provide recommendations for the protection of buried ferrous metal at this site.

5.3.5 Soil Sulfate Content

The sulfate content was determined in the laboratory on a sample collected during the field investigation. The results indicate that the water-soluble sulfate result is less than 0.1 percent by weight, which is considered "negligible" as per Table 4.2.1 of ACI 318. Based on the test results and Table 4.3.1 of ACI 318, no special recommendations for concrete are required for this project due to soil sulfate exposure.

5.4 RETAINING AND GARDEN WALL DESIGN AND CONSTRUCTION

5.4.1.1 General Design Criteria

Recommendations presented in this report apply to typical masonry or concrete vertical retaining walls to a maximum height of up to six (6) feet. Additional review and recommendations should be requested for higher walls. These are typical design criteria and are not intended to supersede the design by the structural engineer.

Retaining wall foundations should be embedded a minimum of 18 inches into engineered fill. Retaining wall foundations should be designed in accordance with Section 5.3 of this report. Structural needs may govern and should be evaluated by the project structural engineer.

All earth retention structure plans, as applicable, should be reviewed by this office prior to finalization.

Earthwork considerations, site clearing and remedial earthwork for all earth retention structures should meet the requirements of this report, unless specifically provided otherwise, or more stringent requirements or recommendations are made by the designer. The backfill material placement for all earth retention structures should meet the requirement of Section 5.2.4 in this report.

In general, cantilever earth retention structures, which are designed to yield at least 0.001H, where H is equal to the height of the earth retention structure, may be designed using the "active" condition. Rigid earth retention structures (including but not limited to rigid walls, and walls braced at top, such as typical basement walls) should be designed using the "at-rest" condition.

In addition to the design lateral forces due to retained earth, surcharges due to improvements, such as an adjacent building or traffic loading, should be considered in the design of the earth retention structures. Loads applied within a 1:1 (horizontal : vertical) projection from the surcharge on the stem of the earth retention structure should be considered in the design.

Final selection of the appropriate design parameters should be made by the designer of the earth retention structures.

5.4.1.2 Cantilevered Walls

The recommendations presented below are for cantilevered retaining walls up to six (6) feet high. Active earth pressure may be used for retaining wall design, provided the top of the wall is not restrained from minor deflections. An equivalent fluid pressure approach may be used to compute the horizontal pressure against the wall. Appropriate fluid unit weights are given below for specific slope gradients of the retained material. These do not include other superimposed loading conditions such as traffic, structures, seismic events, or adverse geologic conditions.

ACTIVE EARTH PRESSURES	
Surface Slope of Retained Materials (horizontal : vertical)	Equivalent Fluid Pressure (pcf) Select Backfill* and Native Soils
Level	40
2:1	65

*The design pressures assume the backfill material has an expansion index less than or equal to 20. Backfill zone includes area between back of the wall to a plane (1:1 horizontal : vertical) up from bottom of the wall foundation (on the backside of the wall) to the ground surface.

For walls with a retained height greater than 6 feet, an incremental seismic pressure should be included into the wall design. Where needed, it is recommended that an equivalent fluid pressure of 20 pcf be included into the wall design to account for seismic loading conditions. This pressure may be applied as a triangular distribution.

5.4.1.3 Retaining Wall Backfill and Drainage

The wall backfill should also include a minimum one (1) foot wide section of ¾- to 1-inch clean crushed rock (or an approved equivalent). The rock should be placed immediately adjacent to the back of the wall and extend up from a back drain to within approximately 24 inches of the finish grade. The upper 24 inches should consist of compacted on-site materials. The rock should be separated from the earth with filter fabric. The presence of other materials might necessitate revision to the parameters provided and modification of the wall designs. The backfill materials should be placed in lifts no greater than eight (8) inches in thickness and compacted to a minimum of 90% relative compaction as determined by ASTM D 1557 test procedures. Proper surface drainage needs to be provided and maintained.

As an alternative to the drain, rock and fabric, a pre-manufactured wall drainage product (example: Mira Drain 6000 or approved equivalent) may be used behind the retaining wall. The wall drainage product should extend from the base of the wall to within two (2) feet of the ground surface. The subdrain should be placed in direct contact with the wall drainage product.

Retaining walls should be provided with an adequate pipe and gravel back drain system to help prevent buildup of hydrostatic pressures. Backdrains should consist of a four (4)-inch diameter perforated collector pipe (Schedule 40, SDR 35, or approved equivalent) embedded in a minimum of one (1) cubic foot per linear foot of ¾ to 1-inch clean crushed rock or an approved equivalent, wrapped in filter fabric (Mirafi 140N or an approved equivalent). The drain system should be connected to a suitable outlet. Waterproofing of site walls should be performed where moisture migration through the walls is undesirable.

5.4.1.4 Restrained Retaining Walls

Retaining walls that will be restrained at the top that support level backfill or that have reentrant or male corners, should be designed for an equivalent at-rest fluid pressure of 65 pcf, plus any applicable surcharge loading. For areas of male or reentrant corners, the restrained wall design should extend a minimum distance of twice the height of the wall laterally from the corner, or a distance otherwise determined by the project structural engineer.

5.4.1.5 Other Design Considerations

- Wall design should consider the additional surcharge loads from superjacent slopes and/or footings, where appropriate.
- No backfill should be placed against concrete until minimum design strengths are evident by compression tests of cylinders.
- The retaining wall footing excavations, backcuts, and backfill materials should be approved by the project geotechnical engineer or their authorized representative.
- Positive separations should be provided in garden walls at horizontal distances not exceeding 20 feet.

5.5 PRELIMINARY PAVEMENT DESIGN RECOMMENDATIONS

Although planned final grades beneath the street improvements within the site are not yet known, the following preliminary pavement design recommendations are based on Traffic Indexes of 5.5 ("Private Street"). Preliminary pavement thickness design is based on the CalTrans Highway Design Manual (2018). An R-value of 20 has been assumed for the preliminary design of the project pavement sections. Once the traffic loading information becomes more defined, revision to the pavement design recommendations may be warranted. It is recommended that the final pavement design be based on R-value testing of the as-graded subgrade soils within the pavement areas.

Based on the assumptions noted above the following preliminary pavement recommendations are provided for the site:

PRELIMINARY MINIMUM PAVEMENT SECTION		
Traffic Index	Thickness of Asphalt Concrete (inches)	Thickness of Aggregate Base (inches)
5.5	3.0 4.0	10 8

Traffic Indices (TIs) used in the pavement design should provide a pavement life of approximately 20 years with a normal amount of flexible pavement maintenance. Irrigation adjacent to pavements, without a deep curb or other cutoff to separate landscaping from the paving may result in premature pavement failure. Traffic parameters used for design were selected based upon engineering judgment and not upon information furnished to us such as an equivalent wheel load analysis or a traffic study.

All base material and the upper 12 inches of subgrade should be compacted to at least 95 percent of the material's maximum dry density as determined by ASTM D 1557 test procedures. All materials and methods of construction should conform to the requirements of the City of San Marcos.

5.6 CONCRETE CONSTRUCTION

5.6.1 General

Concrete construction should follow the 2019 CBC and ACI guidelines regarding design, mix placement and curing of the concrete. If desired, GeoTek could provide quality control testing of the concrete during construction.

5.6.2 Concrete Mix Design

As discussed in Section 5.3.5, no special recommendations for concrete are required for this project due to soil sulfate exposure. Additional testing should be performed during grading so that specific recommendations can be formulated based on the as-graded conditions.

5.6.3 Concrete Flatwork

Exterior concrete flatwork is often one of the most visible aspects of site development. They are typically given the least level of quality control, being considered "non-structural" components. Cracking of these features is common due to various factors. While cracking usually does not affect the structural performance of the concrete, it is unsightly. It is recommended that the same standards of care be applied to these features as to the structure itself.

Flatwork should consist of a minimum four-inch (actual) thick concrete and the use of temperature and shrinkage control reinforcement is suggested. The project structural engineer should provide final design recommendations.

Subgrade soils, classified as having "low" or "medium" expansion potential, should be pre-moistened prior to placing concrete. The subgrade soils below exterior slabs, sidewalks, driveways, etc. at the subject site should be pre-saturated to a minimum of 110% or 130% of optimum moisture content to a depth of 18 inches for "low" or "medium" expansive soils, respectively.

5.6.4 Concrete Performance

Concrete cracks should be expected. These cracks can vary from sizes that are hairline to more than 1/8 inch in width. Most cracks in concrete while unsightly do not significantly impact long-term performance. While it is possible to take measures (proper concrete mix, placement, curing, control joints, etc.) to reduce the extent and size of cracks that occur, some cracking will occur despite the best efforts to minimize it. Concrete undergoes chemical processes that are dependent on a wide range of variables, which are difficult, at best, to control. Concrete, while seemingly a stable material, is subject to internal expansion and contraction due to external changes over time.

One of the simplest means to control cracking is to provide weakened control joints for cracking to occur along. These do not prevent cracks from developing; they simply provide a relief point for the stresses that develop. These joints are a widely accepted means to control cracks but are not always effective. Control joints are more effective the more closely spaced they are. GeoTek suggests that control joints be placed in two orthogonal directions and located a distance apart approximately equal to 24 to 36 times the slab thickness.

5.7 POST CONSTRUCTION CONSIDERATIONS

5.7.1 Landscape Maintenance and Planting

Water has been shown to weaken the inherent strength of soil, and slope stability is significantly reduced by overly wet conditions. Positive surface drainage away from graded slopes should be maintained and only the amount of irrigation necessary to sustain plant life should be provided for planted slopes. Controlling surface drainage and runoff and maintaining a suitable vegetation cover can minimize erosion. Plants selected for landscaping should be lightweight, deep-rooted types that require little water and are capable of surviving the prevailing climate.

Overwatering should be avoided. Care should be taken when adding soil amendments to avoid excessive watering. Leaching as a method of soil preparation prior to planting is not recommended. An abatement program to control ground-burrowing rodents should be implemented and maintained. This is critical as burrowing rodents can decreased the long-term performance of slopes.

It is common for planting to be placed adjacent to structures in planter or lawn areas. This will result in the introduction of water into the ground adjacent to the foundations. This type of landscaping should be avoided. Planters within 30 feet of the buildings should be above ground and underlain by a concrete slab. Waterproofing of the foundation and/or subdrains may be warranted and advisable. GeoTek could discuss these issues, if desired, when plans are made available.

5.7.2 Drainage

The need to maintain proper surface drainage and subsurface systems cannot be overly emphasized. Positive site drainage should be maintained at all times. Drainage should not flow uncontrolled down any descending slope. Water should be directed away from foundations and not allowed to pond or seep into the ground adjacent to the footings and floor-slabs. Pad drainage should be directed toward approved areas and not be blocked by other improvements.

Roof gutters should be installed that will direct the collected water at least 20 feet from the buildings.

It is the owner's responsibility to maintain and clean drainage devices on or contiguous to their lot. In order to be effective, maintenance should be conducted on a regular and routine schedule and necessary corrections made prior to each rainy season.

5.8 PLAN REVIEW AND CONSTRUCTION OBSERVATIONS

It is recommended that site grading, specifications, and foundation plans be reviewed by this office prior to construction to check for conformance with the recommendations of this report. It is also recommended that GeoTek representatives be present during site grading and foundation construction to observe and document for proper implementation of the geotechnical recommendations. The owner/developer should have GeoTek perform at least the following duties:

- Observe site clearing and grubbing operations for proper removal of all unsuitable materials.

- Observe and test bottom of removals prior to fill placement.
- Evaluate the suitability of on-site and import materials for fill placement and collect soil samples for laboratory testing where necessary.
- Observe the fill for uniformity during placement, including utility trench excavation backfill. Also, test the fill for density, relative compaction and moisture content.
- Observe and probe foundation excavations to confirm suitability of bearing materials with respect to density.

If requested, a construction observation and compaction report can be provided by GeoTek which can comply with the requirements of the governmental agencies having jurisdiction over the project. It is recommended that these agencies be notified prior to commencement of construction so that necessary grading permits can be obtained.

6. INTENT

It is the intent of this report to aid in the design and construction of the proposed development. Implementation of the advice presented in this report is intended to reduce risk associated with construction projects. The professional opinions and geotechnical advice contained in this report are not intended to imply total performance of the project or guarantee that unusual or variable conditions will not be discovered during or after construction.

The scope of GeoTek's evaluation is limited to the area explored that is shown on the Exploration Location Map (Figure 2). This evaluation does not and should in no way be construed to encompass any areas beyond the specific area of the proposed construction as indicated to GeoTek by the client. Further, no evaluation of any existing site improvements is included. The scope is based on GeoTek's understanding of the project and the client's needs, GeoTek's proposal (Proposal No. P-0601021-CR) dated June 18, 2021 and geotechnical engineering standards normally used on similar projects in this region.

7. LIMITATIONS

GeoTek's findings are based on site conditions observed and the stated sources. Thus, GeoTek's comments are professional opinions that are limited to the extent of the available data.

GeoTek has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering at this time and location and science professions currently practicing under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report.
Since GeoTek's recommendations are based on the site conditions observed and encountered at the stated times and laboratory testing. Thus, GeoTek's conclusions and recommendations are professional opinions that are limited to the extent of the available data. Observations during construction are important to allow for any change in recommendations found to be warranted. These opinions have been derived in accordance with current standards of practice and no warranty of any kind is expressed or implied. Standards of care/practice are subject to change with time.

8. SELECTED REFERENCES

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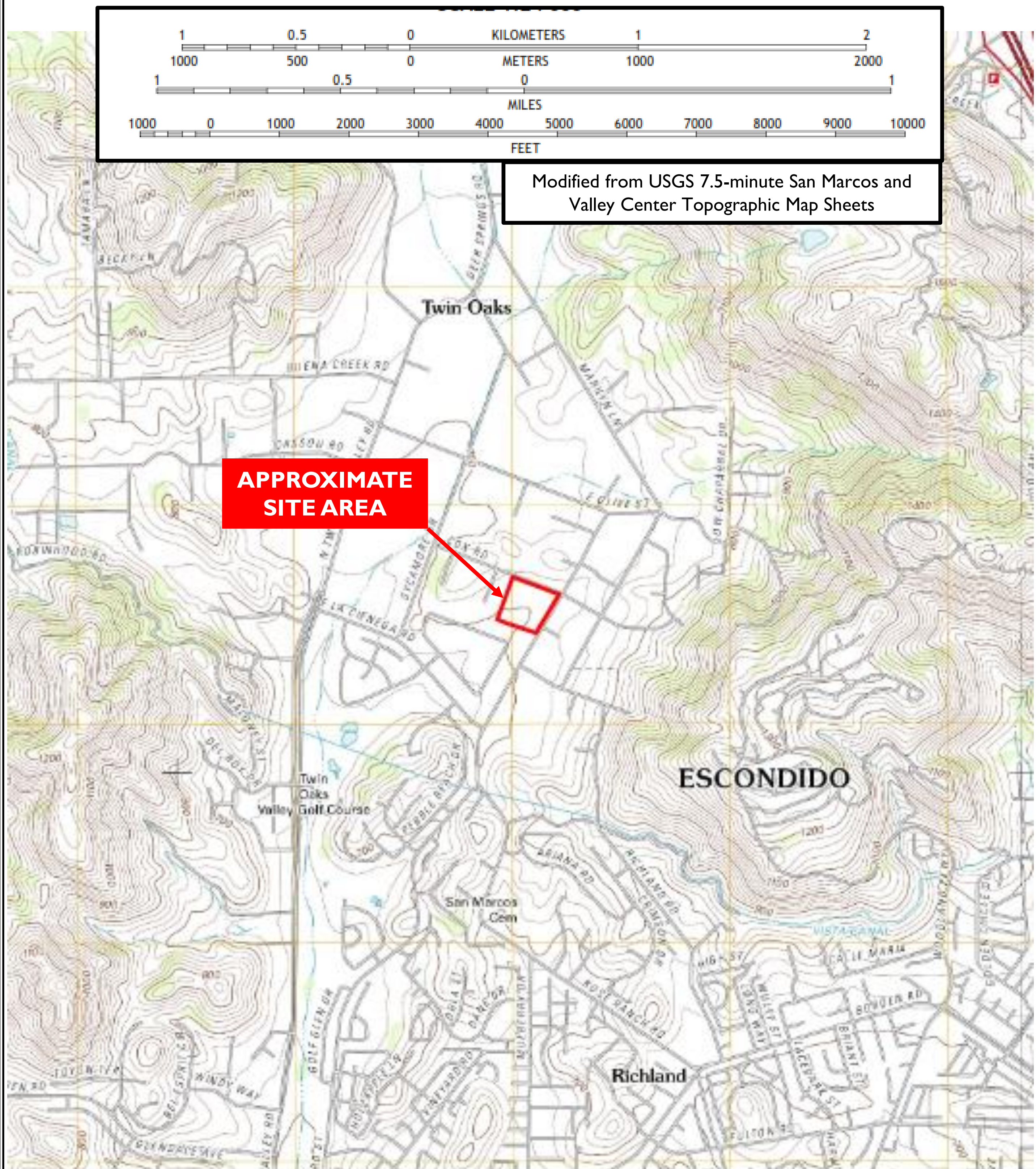

Manning Homes
APN 182-131-14
San Marcos, San Diego County, California

GeoTek Project No. 3723-SD

NORTH

Figure 1

Site Location Map

GEOTEK

Manning Homes APN 182-131-14 San Marcos, San Diego County, California GeoTek Project No. 3723-SD		NORTH	**Figure 2** **Exploration Location Map**	GEOTEK

APPENDIX A

LOGS OF EXPLORATORY BORINGS

Proposed 9-Lot Residential Development
Cox Road and Mulberry Drive
San Marcos, San Diego County, California
Project No. 3723-SD

GEOTEK

A - FIELD TESTING AND SAMPLING PROCEDURES

The Modified Split-Barrel Sampler (Ring)
The Ring sampler is driven into the ground at various depths in accordance with ASTM D 3550 test procedures. The sampler, with an external diameter of 3.0 inches, is lined with 1-inch long, thin brass rings with inside diameters of approximately 2.4 inches. The sampler is typically driven into the ground 12 or 18 inches with a 140-pound hammer free falling from a height of 30 inches. Blow counts are recorded for every 6 inches of penetration as indicated on the log of boring. The samples are removed from the sample barrel in the brass rings, sealed, and transported to the laboratory for testing.

Bulk Samples (Large)
These samples are normally large bags of earth materials over 20 pounds in weight collected from the field by means of hand digging or exploratory cuttings.

Bulk Samples (Small)
These are plastic bag samples which are normally airtight and contain less than 5 pounds in weight of earth materials collected from the field by means of hand digging or exploratory cuttings. These samples are primarily used for determining natural moisture content and classification indices.

B - BORING LOG LEGEND

The following abbreviations and symbols often appear in the classification and description of soil and rock on the log of borings:

SOILS

USCS	Unified Soil Classification System
f-c	Fine to coarse
f-m	Fine to medium

GEOLOGIC

B: Attitudes	Bedding: strike/dip
J: Attitudes	Joint: strike/dip
C: Contact line	
………..	Dashed line denotes USCS material change
———	Solid Line denotes unit / formational change
━━━	Thick solid line denotes end of boring

(Additional denotations and symbols are provided on the boring logs)

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	[illegible]	**DRILLER:**	[illegible]	**LOGGED BY:**	[illegible]
PROJECT NAME:	[illegible]	**DRILL METHOD:**	[illegible]	**OPERATOR:**	[illegible]
PROJECT NO.:	[illegible]	**HAMMER:**	[illegible]	**RIG TYPE:**	[illegible]
LOCATION:	[illegible]	**ELEVATION:**	[illegible]	**DATE:**	[illegible]

BORING NO.: B-1

MATERIAL DESCRIPTION AND COMMENTS

Depth	Sample				Description	Laboratory Testing		
			R[illegible]	[illegible]	**Topsoil/colluvium** [illegible] SAND [illegible]	[illegible]	[illegible]	
			R[illegible]	[illegible]M	**Quaternary Alluvium (Qal)** [illegible] SAND [illegible] Fin[illegible] SAND [illegible]	[illegible]	[illegible]	
[illegible]		[illegible]						
[illegible]		[illegible]	R[illegible]	[illegible]M	M[illegible] SAND [illegible]	[illegible]		
					[illegible] SAND [illegible]			
[illegible]		[illegible]						
[illegible]		[illegible]	[illegible]		**Mesozoic Metasedimentary-Metavolcanic Bedrock (Mzu)** E[illegible] SAND [illegible] A[illegible]	[illegible]		
[illegible]		[illegible]	[illegible]					
[illegible]		[illegible]	[illegible]	[illegible]M		[illegible]		

LEGEND

Sample type: [illegible]Rin[illegible] — [illegible]T — [illegible] — [illegible] — [illegible]N[illegible]R[illegible] — [illegible]

Lab testing: A[illegible] — EI [illegible] E[illegible] Ind[illegible] — [illegible]A [illegible] An[illegible] — R[illegible] — [illegible]R [illegible] — [illegible] — [illegible] — MD [illegible] M[illegible] D[illegible]

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	[illegible]	**DRILLER:**	[illegible]	**LOGGED BY:**	[illegible]
PROJECT NAME:	[illegible]	**DRILL METHOD:**	[illegible]	**OPERATOR:**	[illegible]
PROJECT NO.:	[illegible]	**HAMMER:**	[illegible]	**RIG TYPE:**	[illegible]
LOCATION:	[illegible]	**ELEVATION:**	[illegible]	**DATE:**	[illegible]

BORING NO.: B-1 Page 2

MATERIAL DESCRIPTION AND COMMENTS

[illegible]

[illegible]

HOLE TERMINATED AT 46.5 FEET

[illegible]

[illegible]

LEGEND	
Sample type:	[illegible]
Lab testing:	[illegible]

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	M□nnin□ □□□ □□	**DRILLER:**	□R Dri□in□	**LOGGED BY:**	M□□
PROJECT NAME:	□□□Rd □ M□□□rr□Dri□□	**DRILL METHOD:**	□" □□A □□□□" ID	**OPERATOR:**	[illegible]
PROJECT NO.:	□□□□□□D	**HAMMER:**	□□□□□□□in	**RIG TYPE:**	□ME□□□
LOCATION:	□□□ □□rin□ □□□□i□n M□□	**ELEVATION:**	[illegible]	**DATE:**	[illegible]

BORING NO.: B-2

Depth	Sample Type	Blows	N	USCS	MATERIAL DESCRIPTION AND COMMENTS	Water Content	Dry Density	Others
		□ □□ □□	R□	□□	**Topsoil/colluvium** □□□□□ □AND □□ □□nd□ □□□□r□d □r□□n□□ □i□□□ □di□□ d□n□□□□i□□□ □□□□i□	□□□	□□□□	
		□□	R□	□□	**Quaternary Alluvium (Qal)** T□□ □□□ □□□r □□□□□□ □AND□r□d □r□□n□□ □i□□□ □di□□ d□n□□			
		□□ □□□□		□M	□□□□□ □□□ □□□r □in□ □□ □ □di□□ □i□□ □AND□d□□ □□d□n□□	□□□	□□□□	
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		□□□□			**Mesozoic Metasedimentary-Metavolcanic Bedrock (Mzu)** □□r□d□n□□□□□□r □d□□n□□□ □n□□□□□ R□□□□□			
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LEGEND

Sample type: □Rin□ | □□□□T | □□□□ □□□□□ | □□□□r□□ □□□ | □N□ R□□□□□r□ | □□□ □□□r T□□□

Lab testing: A□ □A□□r□r□ □i□i□ | EI □ E□□□n□i□n Ind□□ | □A □ □i□□□ An□□□i□ | R□ □ R□□□□ T□□□ | □R □ □□□□□□R□i□i□i□□T□□□ | □□ □ □□□□r T□□□ | □□ □ □□n□□id□□n □□□ | MD □M□□i□□□ D□n□i□

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	M□nnin□ □□□ □□	**DRILLER:**	□R Dri□in□	**LOGGED BY:**	M□□
PROJECT NAME:	□□□Rd □ M□□□rr□Dri□□	**DRILL METHOD:**	□" □□A □□□□" ID	**OPERATOR:**	□□□□
PROJECT NO.:	□□□□□□D	**HAMMER:**	□□□□□□□□in	**RIG TYPE:**	□ME□□□
LOCATION:	□□□ □□rin□ □□□□i□□n M□□	**ELEVATION:**	□□□□	**DATE:**	□□□□□□□□

BORING NO.: B-3

D□□□□ □□□□	□AM□□E□: □□□□□ □□□□ T□□□	□□□□□ □□□□in	□□□□ □□□ N□□□r	□□□□ □□□□	MATERIAL DESCRIPTION AND COMMENTS	□□□□r □□□□□n□□□□□□	Dr□ D□n□i□□	□□□□r□
				□□	**Topsoil/colluvium** □□□□□□ □AND□r□d □r□□n□dr□□□□□□ □□ □ □di□□ d□n□□			M□□i□ □□ D□n□i□□ □ □□□□□ □□□ □ □i□ □□ M□i□□r□ □ □□□□
	Ring	□□	R□	□□	T□□ □□□ □□□r □□□□ □□i□	□□□□	□□□□□	R□□ □d□d Dir□□□□ □□□r □ □rr□□i□n T□□□□
		□□□□		□M	**Quaternary Alluvium (Qal)** □□□□□□ □" □□□ □□□r□□in□ □□ □□□r□□ □i□□ □AND □i□□ □r□□□□□d□□ □□d□n□□			
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	Ring	□□□□	R□		T□□ □□□ □□□r□□in□ □□ □□□r□□ □i□□ □AND □i□□ □r□□□□□	□□□	□□□□□	
			□□□□		**Mesozoic Metasedimentary-Metavolcanic Bedrock (Mzu)** □□□□□□ □□□ □□□r□E□□□□□□□□ □□ □□nd□□RA□E□□dr□□□□r□d□n□□			
□□	Bulk	□□□□	R□					
					R□□□□□□			
□□					**HOLE TERMINATED AT 14 FEET** N□ □r□□nd□□□□r □n□□□□□r□d □□□□□i□□d □i□□ □□i□□□□in□□ □nd □□n□□ni□□			
□□								
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□□								

LEGEND

Sample type□: □□Rin□ — □□□□□T — □□□□□ □□□□□□ — □□□□□r□□ □□□□ — □□N□R□□□□□r□ — □□□□ □□□r T□□□□

Lab testing: A□ □A□□r□□r□ □i□i□□ — EI □E□□□n□i□n Ind□□ — □A □□i□□□ An□□□□i□ — R□ □R□□□□□□T□□□ — □R □□□□□□□R□□i□i□i□□T□□□ — □□ □□□□□r T□□□ — □□ □□□n□□id□□i□n □□□□ — MD □M□□i□ □□ D□n□i□□

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	M[illegible]nnin[illegible]	**DRILLER:**	[illegible]R Dri[illegible]in[illegible]	**LOGGED BY:**	M[illegible]
PROJECT NAME:	[illegible]Rd [illegible] M[illegible]rr[illegible]Dri[illegible]	**DRILL METHOD:**	[illegible]" [illegible]A [illegible]" ID	**OPERATOR:**	[illegible]
PROJECT NO.:	[illegible]D	**HAMMER:**	[illegible]in	**RIG TYPE:**	[illegible]ME[illegible]
LOCATION:	[illegible] [illegible]rin[illegible] [illegible]i[illegible]n M[illegible]	**ELEVATION:**	[illegible]	**DATE:**	[illegible]

BORING NO.: B-4

D[illegible]	[illegible]AM[illegible]E[illegible] Sample Type	[illegible]in	N [illegible]	[illegible]	MATERIAL DESCRIPTION AND COMMENTS	[illegible]	Dr[illegible] D[illegible]n[illegible]	[illegible]
		[illegible]	R[illegible]	[illegible]	**Topsoil/colluvium** [illegible]AND[illegible]	[illegible]	[illegible]	M[illegible] D[illegible]n[illegible]; R[illegible] [illegible]d Dir[illegible]r; E[illegible]n[illegible]i[illegible]n Ind[illegible]
					Quaternary Alluvium (Qal)			
		[illegible]						
[illegible]		[illegible]	R[illegible]	[illegible]M	Fin[illegible] [illegible]AND[illegible]	[illegible]		
		[illegible]	R[illegible]	[illegible]M	Fin[illegible] [illegible]AND[illegible]			
[illegible]		[illegible]	R[illegible]	[illegible]M	Fin[illegible] [illegible]AND[illegible]	[illegible]	[illegible]	
[illegible]		[illegible]	R[illegible]	[illegible]M	Fin[illegible] [illegible]AND [illegible]	[illegible]	[illegible]	
					Mesozoic Metasedimentary-Metavolcanic Bedrock (Mzu) A[illegible]r [illegible]d[illegible]n[illegible]			
[illegible]		[illegible]	R[illegible]		E[illegible] [illegible]AND[illegible] d[illegible]n[illegible]			
					HOLE TERMINATED AT 20 FEET			
					N[illegible] [illegible]r[illegible]nd[illegible] [illegible]r [illegible]n[illegible]r[illegible]d			
					[illegible]i[illegible]d [illegible] [illegible]in[illegible] [illegible]nd [illegible]n[illegible]ni[illegible]			
[illegible]								
[illegible]								

LEGEND

Sample type[illegible]: [illegible]Rin[illegible] — [illegible]T — [illegible] — [illegible] — [illegible]N[illegible] R[illegible]r[illegible] — [illegible]r T[illegible]

Lab testing: A[illegible] A[illegible]r[illegible] — EI [illegible] E[illegible]n[illegible]i[illegible]n Ind[illegible] — [illegible]A [illegible] An[illegible] — R[illegible] R[illegible] T[illegible] — [illegible]R [illegible] R[illegible]T[illegible] — [illegible] T[illegible] — [illegible]n[illegible]id[illegible]n — MD [illegible]M[illegible] D[illegible]n[illegible]

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	M□nnin□ □□□ □□	**DRILLER:**	□R Dri□in□	**LOGGED BY:**	M□□
PROJECT NAME:	□□□Rd □ M□□□rr□Dri□□	**DRILL METHOD:**	□" □□A □□□" ID	**OPERATOR:**	□□□
PROJECT NO.:	□□□□□D	**HAMMER:**	□□□□□□□in	**RIG TYPE:**	□ME□□
LOCATION:	□□□ □□rin□ □□□□i□□n M□□	**ELEVATION:**	□□□□	**DATE:**	□□□□□□□

BORING NO.: B-5

D□□□□ □□□	□AM□□E□: □□□□ □□□ T□□□	□AM□□E□: □□□□□□□in	□AM□□E□: □□□□ □□□ N□ □□r	□□□□ □□□□	MATERIAL DESCRIPTION AND COMMENTS	□□□□r□□□r□T□□□in□: □ □□□r □□n□□n□□□□	□□□□r□□□r□T□□□in□: Dr□D□n□i□□ □□□□□	□□□□r□□□r□T□□□in□: □□□□r□
				□□	**Topsoil/colluvium** □□□□□□ □AND□r□d □r□□n□dr□□□□□□			
					Quaternary Alluvium (Qal)			
	Ring	□□ □□□□	R□	□M	Fin□ □□ □ □di□□ □i□□ □AND □i□□ □□□□r□d □r□□n□dr□□d□n□□□□i□□ □□□□i□i□□	□□□	□□□□□	
□	Ring	□□□□	R□	□M	Fin□ □□ □□□r□□ □AND□□□□□□ r□ddi□□ □r□□n□□□r□d□□ □□d□n□□□□□□ □ □ □di□□ □□ □□□r□□ □r□□□□	□□□	□□□□□	
					Mesozoic Metasedimentary-Metavolcanics (Mzu)			
	Ring	□□□□	R□		E□□□□□□□ □□ □□□r□□ □AND□□□□i□□d□r□ □r□□□d□□ □□□□r□d□n□□	□□□		
□□	Ring	□□□□	R□		M□di□□ □□ □□□r□□ □AND □i□□ □i□□□r□□ □r□□n□d□□ □□□□r□d□n□□			
□□	Ring	□□□□	R□		M□di□□ □□ □□□r□□ □ □□□□ □r□□i□ □AND□□r□□ □r□□n□d□□ □□□□r□d□n□□	□□□		
□□		□□□□			N□ r□□□□□r□			
					HOLE TERMINATED AT 20 FEET			
					N□ □r□□nd□□□□r □n□□□□□r□d			
					□□□□□i□□d □i□□ □□i□□□□in□□ □nd □□n□ni□□			
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LEGEND

Sample type□ □Rin□ — □□□□□T — □□□□ □□□□□□□ — □□□□□r□□ □□□ — □□N□R□□□□□r□ — □□□□ □□□r T□□□

Lab testing:

A□ □A□□□r□□r□ □i□i□□	EI □E□□□n□i□n Ind□□	□A □ □i□□□ An□□□□i□	R□ □ R□□□□□T□□□
□R □ □□□□□□□R□□i□i□i□□T□□□	□□ □ □□□□r T□□□	□□ □ □□n□□id□□in □□□□	MD □M□□i□ □□ D□n□i□□

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	[illegible]	**DRILLER:**	[illegible]	**LOGGED BY:**	[illegible]
PROJECT NAME:	[illegible]	**DRILL METHOD:**	[illegible]	**OPERATOR:**	[illegible]
PROJECT NO.:	[illegible]	**HAMMER:**	[illegible]	**RIG TYPE:**	[illegible]
LOCATION:	[illegible]	**ELEVATION:**	[illegible]	**DATE:**	[illegible]

BORING NO.: B-6

Depth	Sample Type	Blows	N	USCS	MATERIAL DESCRIPTION AND COMMENTS	Lab 1	Lab 2	Others
					Topsoil/colluvium			
		[illegible]	R[illegible]	[illegible]	[illegible] SAND [illegible]	[illegible]	[illegible]	
		[illegible]		[illegible]M	**Quaternary Alluvium (Qal)**			
					[illegible] Fin[illegible] SAND [illegible]			
		[illegible]	R[illegible]	[illegible]M	Fin[illegible] SAND [illegible]	[illegible]	[illegible]	
5		[illegible]	R[illegible]	[illegible]M	Fin[illegible] SAND [illegible]			
		[illegible]	R[illegible]	[illegible]M	T[illegible] Fin[illegible] SAND [illegible]	[illegible]	[illegible]	
					Mesozoic Metasedimentary-Metavolcanic Bedrock (Mzu)			
					[illegible] SAND [illegible]			
10		[illegible]	R[illegible]			[illegible]		
15		[illegible]	R[illegible]			[illegible]	[illegible]	
20		[illegible]	R[illegible]		[illegible] SAND [illegible]			
25					**HOLE TERMINATED AT 20 FEET**			
					N[illegible] [illegible]			
30								

LEGEND

Sample type: [illegible]Ring — [illegible]T — [illegible] — [illegible] — [illegible]N[illegible] R[illegible] — [illegible] T[illegible]

Lab testing: A[illegible] — EI [illegible] — [illegible]A [illegible] — R[illegible] — [illegible]R [illegible] — [illegible] — [illegible] — MD [illegible]

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	[illegible]	**DRILLER:**	[illegible]	**LOGGED BY:**	[illegible]
PROJECT NAME:	[illegible]	**DRILL METHOD:**	[illegible]	**OPERATOR:**	[illegible]
PROJECT NO.:	[illegible]	**HAMMER:**	[illegible]	**RIG TYPE:**	[illegible]
LOCATION:	[illegible]	**ELEVATION:**	[illegible]	**DATE:**	[illegible]

BORING NO.: B-7

Depth	Sample Type	Blows/6 in	N	USCS	MATERIAL DESCRIPTION AND COMMENTS	Water Content	Dry Density	Other
					Topsoil/colluvium [illegible]			
					Quaternary Alluvium (Qal)			
	Ring	[illegible]	R[illegible]	[illegible]M	Fin[illegible] AND [illegible]			
			[illegible]					
	Ring	[illegible]	R[illegible]	[illegible]M	Fin[illegible] AND [illegible]	[illegible]	[illegible]	
					Mesozoic Metasedimentary-Metavolcanic Bedrock (Mzu)			
	Ring	[illegible]	R[illegible]		E[illegible] AND [illegible]	[illegible]	[illegible]	
	Ring	[illegible]	R[illegible]			[illegible]		
	Ring	[illegible]	R[illegible]			[illegible]	[illegible]	
		[illegible]						

HOLE TERMINATED AT 20 FEET

N[illegible] [illegible]

LEGEND

Sample type: Ring; [illegible]T; [illegible]; [illegible]; No Recovery; Water Table

Lab testing: A[illegible]; EI = Expansion Index; [illegible]; R[illegible]; [illegible]; [illegible]; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	M nnin [illegible]	**DRILLER:**	R Dri in [illegible]	**LOGGED BY:**	M [illegible]
PROJECT NAME:	[illegible] Rd [illegible] M [illegible] rr Dri [illegible]	**DRILL METHOD:**	[illegible]" [illegible] A [illegible]" ID	**OPERATOR:**	[illegible]
PROJECT NO.:	[illegible] D	**HAMMER:**	[illegible] in	**RIG TYPE:**	ME [illegible]
LOCATION:	[illegible] rin [illegible] i n M [illegible]	**ELEVATION:**	[illegible]	**DATE:**	[illegible]

BORING NO.: P-1

Depth	Sample Type	Sample	Blows	USCS	MATERIAL DESCRIPTION AND COMMENTS	Lab Testing	Dry Density	Others
	X			[illegible]	**Topsoil/colluvium** [illegible] AND r d r n [illegible] i [illegible] di d n [illegible]			
			[illegible]	M	**Quaternary Alluvium (Qal)** Fin [illegible] di i AND [illegible] r n i di d n [illegible]			
5								
					HOLE TERMINATED AT 5 FEET			
					r [illegible] r r d i [illegible] in [illegible] d			
					Fi d i r r r [illegible] r i n			
					N r nd r n [illegible] r d			
10								
15								
20								
25								
30								

LEGEND

Sample type: Ring — T — [illegible] — [illegible] — N R [illegible] — [illegible] r T [illegible]

Lab testing:
A A r r i i [illegible] — EI E n i n Ind [illegible] — A i An i [illegible] — R R [illegible] T [illegible]
R [illegible] R i i i T [illegible] — [illegible] r T [illegible] — [illegible] n id i n [illegible] — MD M i D n i [illegible]

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	[illegible]	**DRILLER:**	[illegible]	**LOGGED BY:**	[illegible]
PROJECT NAME:	[illegible]	**DRILL METHOD:**	[illegible]	**OPERATOR:**	[illegible]
PROJECT NO.:	[illegible]	**HAMMER:**	[illegible]	**RIG TYPE:**	[illegible]
LOCATION:	[illegible]	**ELEVATION:**	[illegible]	**DATE:**	[illegible]

BORING NO.: P-2

Depth	Sample Type	[illegible]	[illegible]	[illegible]	MATERIAL DESCRIPTION AND COMMENTS	[illegible]	[illegible]	[illegible]
				[illegible]	**Topsoil/colluvium** [illegible]			
	X		[illegible]	[illegible]	**Quaternary Alluvium (Qal)** [illegible]			
[illegible]					**HOLE TERMINATED AT 5 FEET** [illegible]			

LEGEND

Sample type: [illegible]

Lab testing: [illegible]

APPENDIX B

RESULTS OF LABORATORY TESTING

Proposed 9-Lot Residential Development
Cox Road and Mulberry Drive
San Marcos, San Diego County, California
Project No. 3723-SD

GEOTEK

SUMMARY OF LABORATORY TESTING

Classification

Soils were classified visually in general accordance with the Unified Soil Classification System (ASTM Test Method D 2487). The soil classifications are shown on the logs of borings in Appendix A.

Direct Shear

Shear testing was performed in a direct shear machine of the strain-control type in general accordance with ASTM D 3080 test procedures. The rate of deformation was approximately 0.035 inch per minute. The sample was sheared under varying confining loads in order to determine the coulomb shear strength parameters, angle of internal friction and cohesion. The tests were performed on soil samples remolded to approximately 90 percent of maximum dry density as determined by ASTM D 1557 test procedures. The shear test results are presented in Appendix B.

Expansion Index

Expansion Index testing was performed on one soil sample. Testing was performed in general accordance with ASTM Test Method D 4829. The results of the testing are provided below.

Boring No.	Depth (ft.)	Description	Expansion Index	Classification
B-4	0-5	Clayey Sand	32	Low

In-Situ Moisture and Density

The natural water content of sampled soils was determined in general accordance with ASTM D 2216 test procedures on samples of the materials recovered from the subsurface exploration. In addition, in-place dry density of the sampled soils was determined in general accordance with ASTM D 2937 test procedures on relatively undisturbed samples to measure the unit weight of the subsurface soils. Results of these tests are shown on the boring logs at the appropriate sample depths in Appendix A.

Moisture-Density Relationship

Laboratory testing was performed on two samples collected during the subsurface exploration. The laboratory maximum dry density and optimum moisture content for the soil type was determined in general accordance with test method ASTM Test Procedure D 1557. The results of the testing are provided in Appendix B.

Sulfate Content, Resistivity and Chloride Content

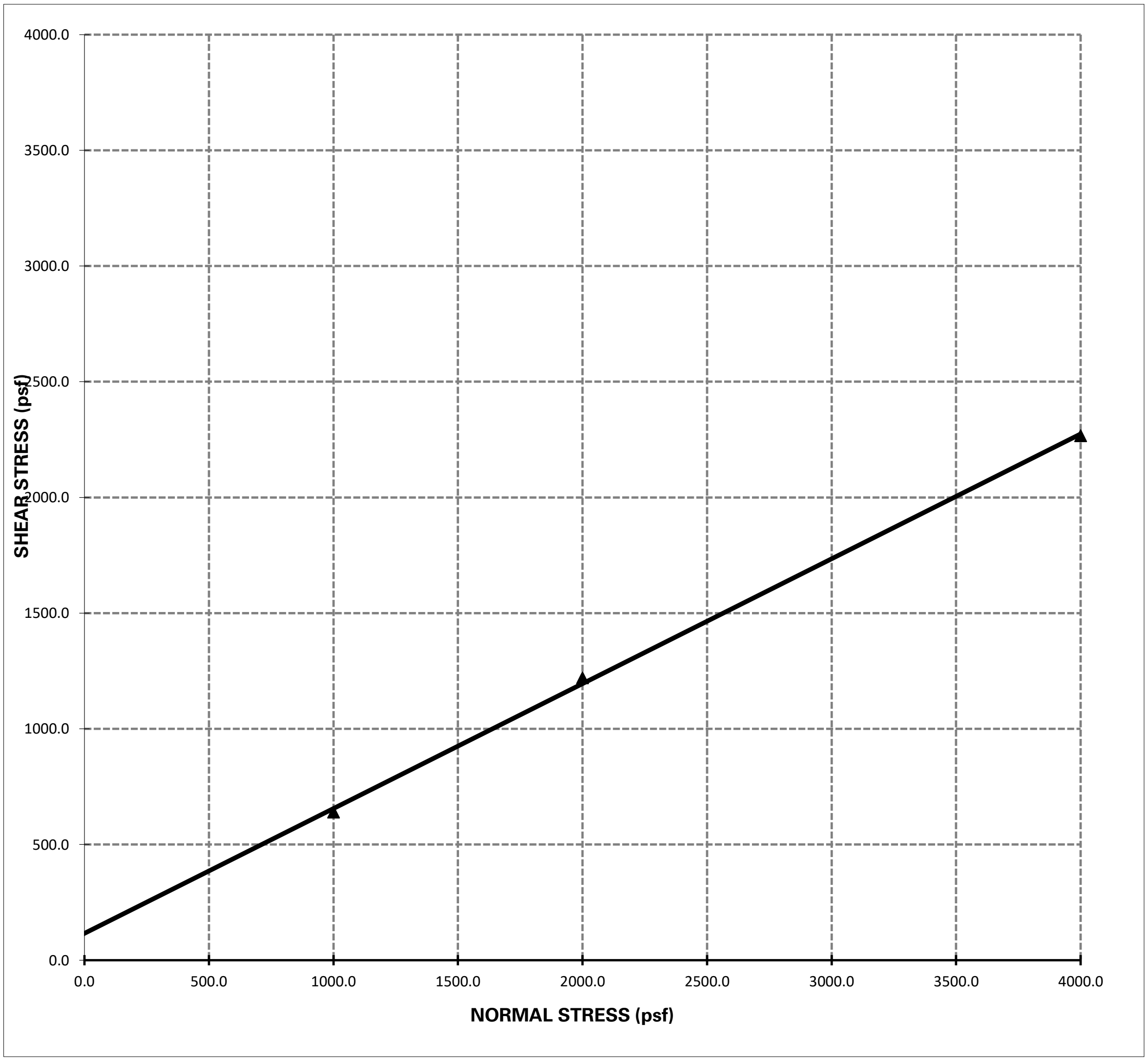
Testing to determine the water-soluble sulfate content was performed by others in general accordance with ASTM D4327 test procedures. Resistivity testing was completed by others in general accordance with ASTM G187 test procedures. Testing to determine the chloride content was performed by others in general accordance with ASTM D4327 test procedures. The results of the testing are provided below and in Appendix B.

Boring No.	Depth (ft.)	pH ASTM D4972	Chloride ASTM D4327 (mg/kg)	Sulfate ASTM D4327 (% by weight)	Resistivity ASTM G187 (ohm-cm)
B-3	0-5	9.4	6.9	0.0039	3,149

DIRECT SHEAR TEST

GEOTEK

Project Name:	Manning Homes	***Sample Location:***	B3 @ 0-5'
Project Number:	3723-CR	***Date Tested:***	8/26/2021



Shear Strength: **Φ = 28 °** **C = 116 psf**

Notes: 1 - The soil specimen used in the shear box was a ring sample remolded to approximately 90% relative compaction from a bulk sample collected during the field investigation.

2 - The above reflect direct shear strength at saturated conditions.

3 - The tests were run at a shear rate of 0.035 in/min.

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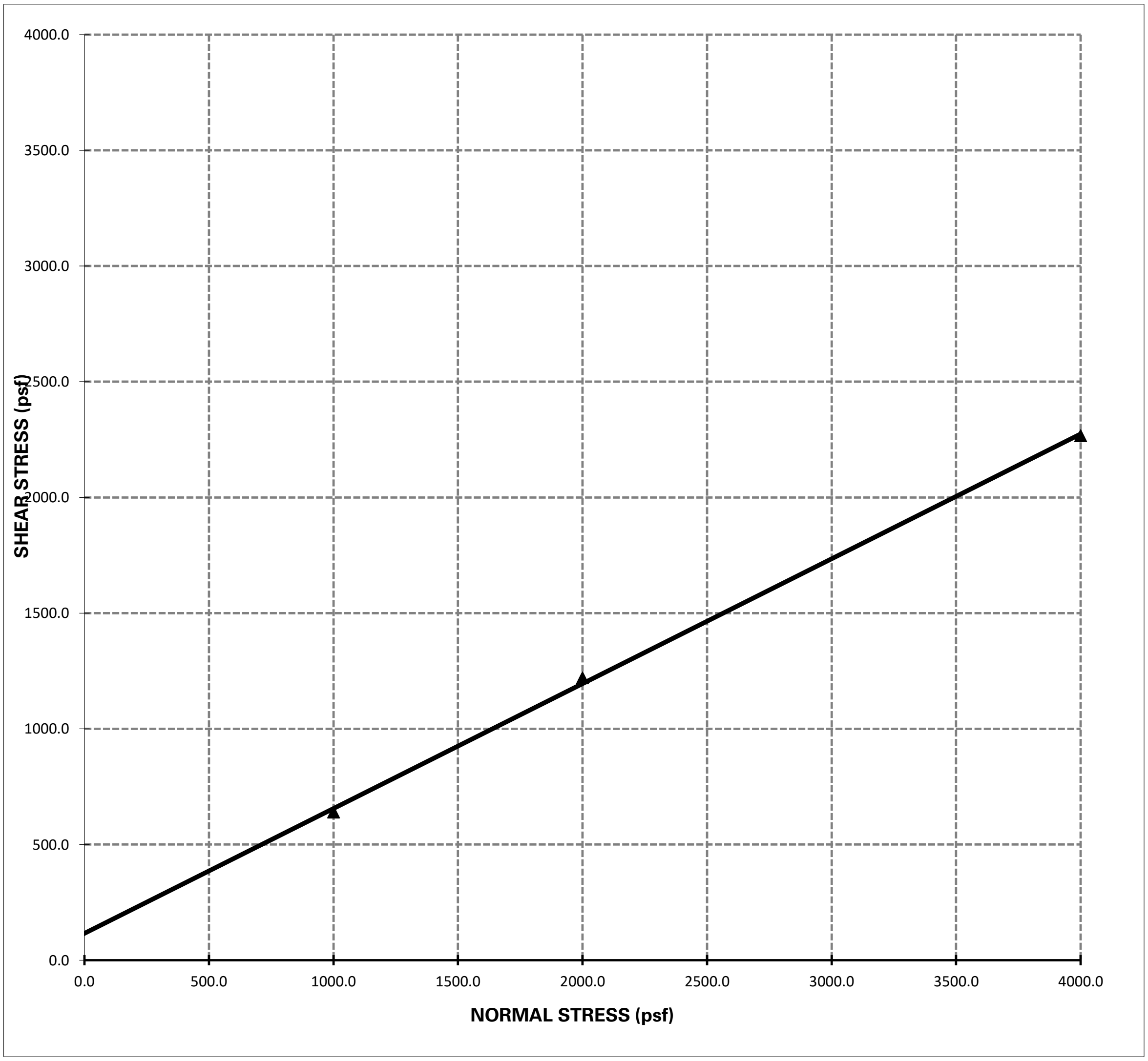
DIRECT SHEAR TEST

Project Name:	Manning Homes	***Sample Location:***	B3 @ 0-5'
Project Number:	3723-CR	***Date Tested:***	8/26/2021

PEAK VALUE



Shear Strength: **Φ = 28 °** **C = 116 psf**

Notes: 1 - The soil specimen used in the shear box was a ring sample remolded to approximately 90% relative compaction from a bulk sample collected during the field investigation.

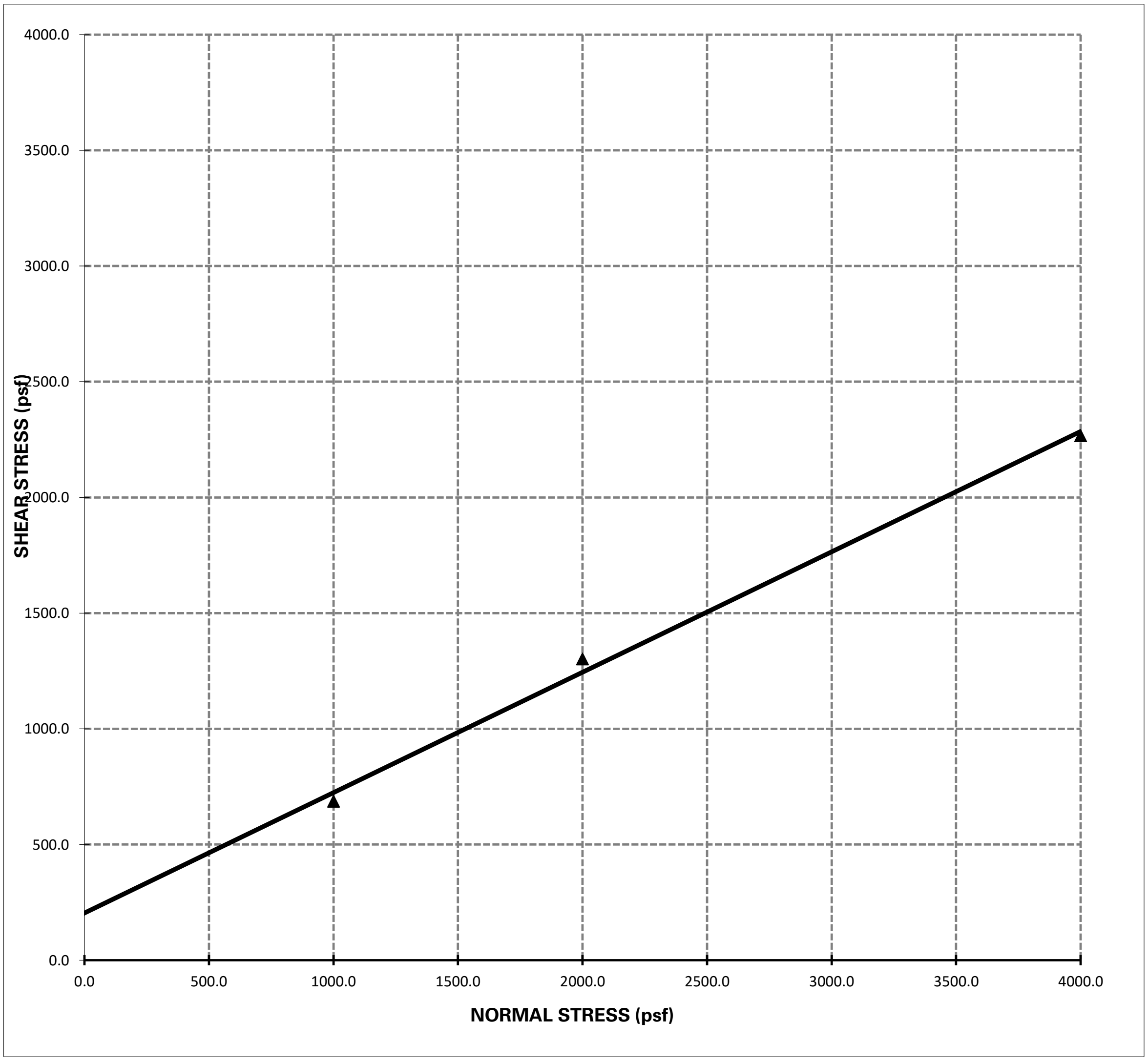
2 - The above reflect direct shear strength at saturated conditions.

3 - The tests were run at a shear rate of 0.035 in/min.

DIRECT SHEAR TEST

GEOTEK

Project Name: Manning Homes
Project Number: 3723-CR
Sample Location: B4 @ 0-5'
Date Tested: 8/26/2021



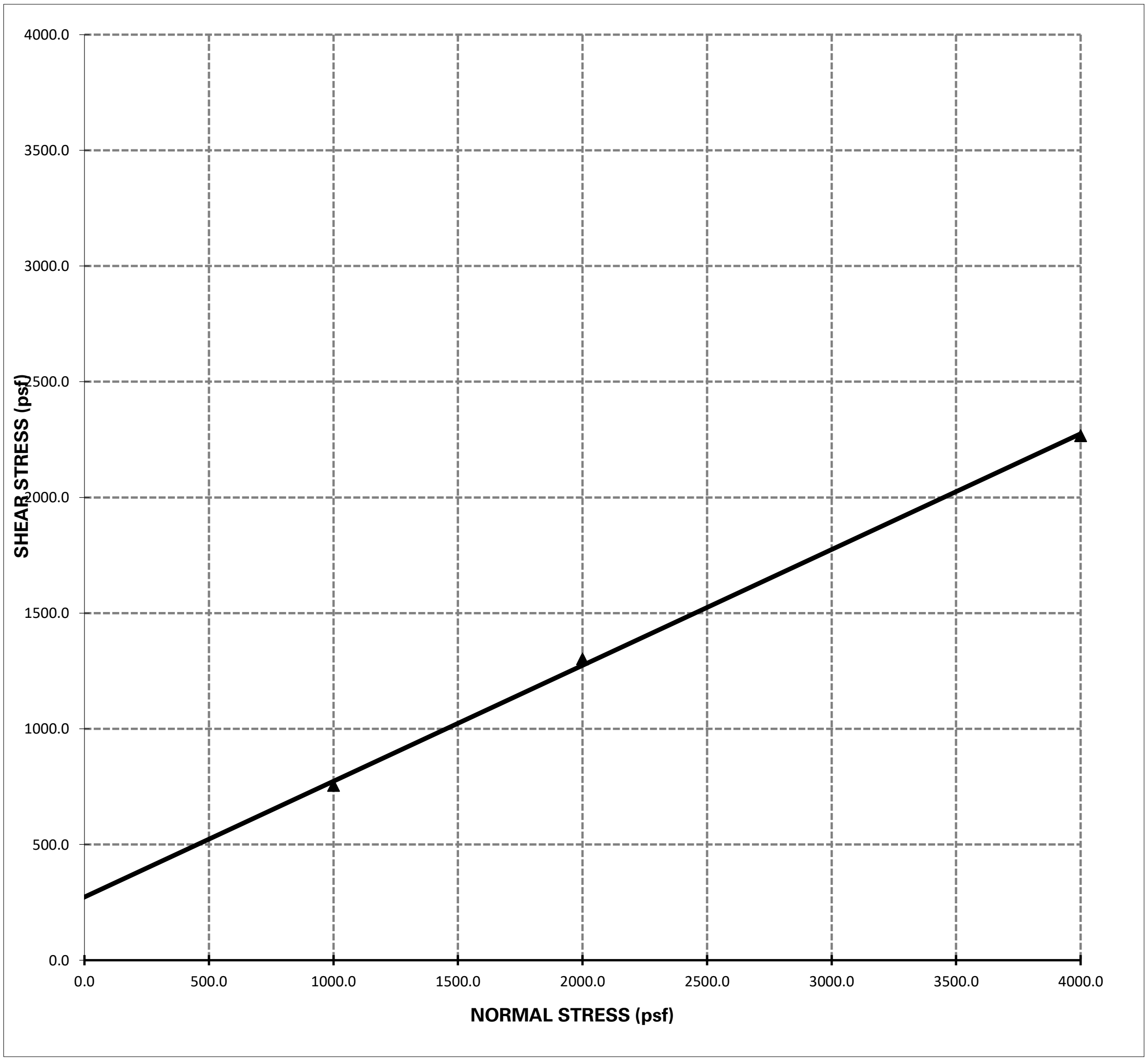
Shear Strength: **Φ = 27 °** **C = 204 psf**

Notes: 1 - The soil specimen used in the shear box was a ring sample remolded to approximately 90% relative compaction from a bulk sample collected during the field investigation.
2 - The above reflect direct shear strength at saturated conditions.
3 - The tests were run at a shear rate of 0.035 in/min.

DIRECT SHEAR TEST

Project Name: Manning Homes | ***Sample Location:*** B4 @ 0-5'
Project Number: 3723-CR | ***Date Tested:*** 8/26/2021

PEAK VALUE



Shear Strength: **Φ = 27 °** **C = 273 psf**

Notes: 1 - The soil specimen used in the shear box was a ring sample remolded to approximately 90% relative compaction from a bulk sample collected during the field investigation.
2 - The above reflect direct shear strength at saturated conditions.
3 - The tests were run at a shear rate of 0.035 in/min.

GEOTEK

EXPANSION INDEX TEST

(ASTM D4829)

Client:	M[illegible]nnin[illegible]	***Tested/ Checked By:***	E[illegible] N[illegible] [illegible]r[illegible]n[illegible]
Project Number:	[illegible]D	***Date Tested:***	[illegible]
Project Location:	[illegible] M[illegible]rr[illegible]	***Sample Source:***	[illegible]
		Sample Description:	

Rin[illegible] ______ Rin[illegible] Di[illegible] [illegible]" Rin[illegible] [illegible]"

DENSITY DETERMINATION

A	[illegible]i[illegible]d [illegible] rin[illegible] [illegible]	[illegible]
B	[illegible]i[illegible]rin[illegible] [illegible]	[illegible]
C	N[illegible]i[illegible]	**407.5**
D	[illegible]D[illegible]n[illegible]i[illegible]	**122.9**
E	Dr[illegible] D[illegible]n[illegible]i[illegible] D[illegible]F[illegible]	**112.4**

SATURATION DETERMINATION

F	M[illegible]i[illegible]r[illegible]n[illegible]n[illegible]	[illegible]
G	[illegible]i[illegible]r[illegible]i[illegible]d	**2.70**
H	[illegible]ni[illegible] [illegible]r [illegible]°C, (pcf)	**62.4**
I	[illegible]r[illegible]i[illegible]n	**50.4**

READINGS

DATE	TIME	READIN[illegible]	
[illegible]		[illegible]	Ini[illegible]i[illegible]
[illegible]		[illegible]	[illegible]in[illegible]Dr[illegible]
[illegible]		[illegible]	Fin[illegible]

FINAL MOISTURE

Fin[illegible] [illegible]r[illegible]	[illegible] M[illegible]i[illegible]r[illegible]
[illegible]	**19.1**

<u>EXPANSION INDEX =</u> **32**

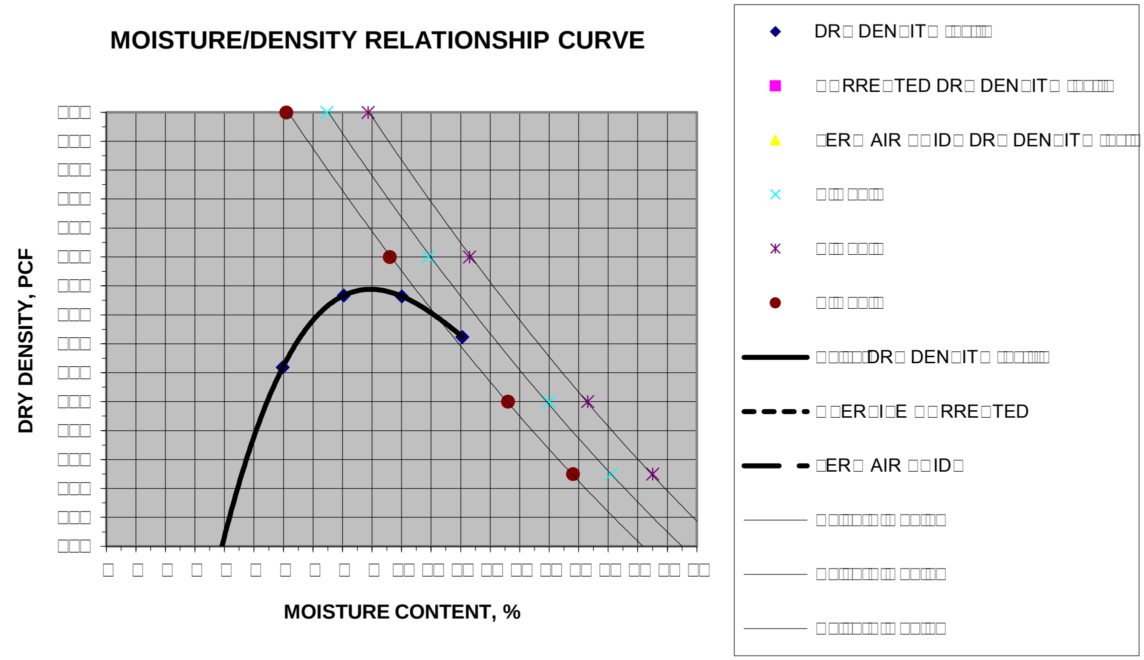
GEOTEK

MOISTURE/DENSITY RELATIONSHIP

Client:	M□nnin□ □□□ □□	**Job No.:**	□□□□□□R
Project:	□□□ □ M□□□rr□	**Lab No.:**	□□r□n□
Location:	□□□ □ M□□□rr□		
Material Type:	□r□□n □i□□ □□nd		
Material Supplier:	□		
Material Source:	□		
Sample Location:	□□ □ □□□□		
	□		
Sampled By:	M□	**Date Sampled:**	□□□□□□□□
Received By:	R□	**Date Received:**	□□□□□□□□
Tested By:	E□□AD	**Date Tested:**	□□□□□□□□
Reviewed By:	R□	**Date Reviewed:**	□□□□□□□□

Test Procedure: A□TM D□□□□ **Method:** A

Oversized Material (%): □□□ **Correction Required:** ☐ yes ☒ no



MOISTURE DENSITY RELATIONSHIP VALUES

Maximum Dry Density, pcf	□□□□	**@ Optimum Moisture, %**	□□
Corrected Maximum Dry Density, pcf		**@ Optimum Moisture, %**	

MATERIAL DESCRIPTION

Grain Size Distribution:

	□ □r□□□□r□□in□d □n N□□□□
	□ □□nd □□□□in□ N□□□□R□□in□d □n N□□□□□□
	□ □i□□nd □□□ □□□□in□ N□□□□□□

Atterberg Limits:

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Classification:

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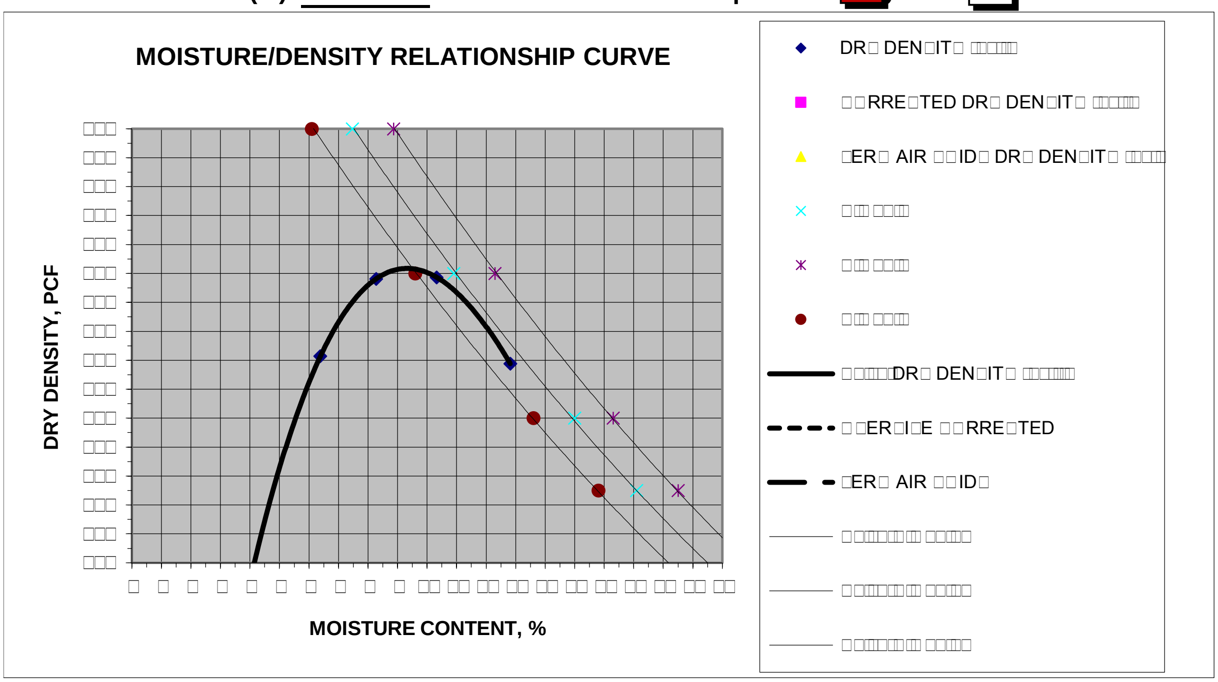
MOISTURE/DENSITY RELATIONSHIP

Client:	M□nnin□ □□□ □□	**Job No.:**	□□□□□□R
Project:	□□□ □ M□□□rr□	**Lab No.:**	□□r□n□
Location:	□□□ □ M□□□rr□		
Material Type:	□r□□n □i□□ □□nd		
Material Supplier:	□		
Material Source:	□		
Sample Location:	□□ □ □□□□		
	□		
Sampled By:	M□	**Date Sampled:**	□□□□□□□□□
Received By:	R□	**Date Received:**	□□□□□□□□□
Tested By:	E□□AD	**Date Tested:**	□□□□□□□□□
Reviewed By:	R□	**Date Reviewed:**	□□□□□□□□□

Test Procedure: A□TM D□□□□ **Method:** A

Oversized Material (%): □□□□ **Correction Required:** ■ yes □ no



MOISTURE DENSITY RELATIONSHIP VALUES

Maximum Dry Density, pcf	□□□□	**@ Optimum Moisture, %**	□□□
Corrected Maximum Dry Density, pcf		**@ Optimum Moisture, %**	

MATERIAL DESCRIPTION

Grain Size Distribution:

	□ □r□□□□r□□in□d □n N□□□□
	□ □□nd □□□□in□ N□□□□R□□in□d □n N□□□□□□
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Atterberg Limits:

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Classification:

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AA□□T□ □□i□ □□□□□i□□i□n□ ______

Results Only Soil Testing for Mulberry 9, San Marcos

August 31, 2021

Prepared for:

Kyle McHargue
GeoTek, Inc.
1548 North Maple Street
Corona, CA 92280
kmchargue@geotekusa.com

Project X Job#: S210827A
Client Job or PO#: 3723-SD Manning Homes

Respectfully Submitted,

Eduardo Hernandez, M.Sc., P.E.
Sr. Corrosion Consultant
NACE Corrosion Technologist #16592
Professional Engineer
California No. M37102
ehernandez@projectxcorrosion.com

REGISTERED PROFESSIONAL ENGINEER
EDUARDO HERNANDEZ
No. M37102
MECHANICAL
STATE OF CALIFORNIA

Soil Analysis Lab Results

Client: GeoTek, Inc.
Job Name: Mulberry 9, San Marcos
Client Job Number: 3723-SD Manning Homes
Project X Job Number: S210827A
August 31, 2021

	Method	ASTM D4327		ASTM D4327		ASTM G187		ASTM D4972	ASTM G200	ASTM D4658	ASTM D4327	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D6919	ASTM D4327	ASTM D4327
Bore# / Description	**Depth**	**Sulfates** SO_4^{2-}		**Chlorides** Cl^-		**Resistivity** As Rec'd | Minimum		**pH**	**Redox**	**Sulfide** S^{2-}	**Nitrate** NO_3^-	**Ammonium** NH_4^+	**Lithium** Li^+	**Sodium** Na^+	**Potassium** K^+	**Magnesium** Mg^{2+}	**Calcium** Ca^{2+}	**Fluoride** F_2^{--}	**Phosphate** PO_4^{3-}
	(ft)	(mg/kg)	(wt%)	(mg/kg)	(wt%)	(Ohm-cm)	(Ohm-cm)		(mV)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
3723-SD B-3	0-5	39.3	0.0039	6.9	0.0007	18,760	3,149	9.4	120	<0.01	47.7	13.9	ND	196.1	1.4	75.7	182.3	2.4	8.0

Cations and Anions, except Sulfide and Bicarbonate, tested with Ion Chromatography
mg/kg = milligrams per kilogram (parts per million) of dry soil weight
ND = 0 = Not Detected | NT = Not Tested | Unk = Unknown
Chemical Analysis performed on 1:3 Soil-To-Water extract
PPM = mg/kg (soil) = mg/L (Liquid)

Project X Corrosion Engineering
Corrosion Control - Soil, Water, and Metallurgy Lab

Lab Request Sheet Chain of Custody
Phone: (213) 928-7213 · Fax (951) 226-1720 · www.projectxcorrosion.com
Ship Samples To: 29990 Technology Dr, Suite 13, Murrieta, CA 92563

Project X Job Number S210827A Geotek 3723-SD Mulberry 9 1 Full

IMPORTANT: Please complete Project and Sample Identification Data as you would like it to appear in report & include this form with samples.

Company Name:	Geotek USA	**Contact Name:**	Kyle McHargue — **Phone No:** 951·206·5443
Mailing Address:	1548 N. Maple St. Corona,CA 92880	**Contact Email:**	kmchargue@geotekusa.com.
Accounting Contact:		**Invoice Email:**	
Client Project No:	3723-SD Manning Homes	**Project Name:**	Mulberry 9, San Marcos.
P.O. #:			

(Business Days) Turn Around Time: 3-5 Day Standard: X | 3 Day Guarantee (50% mark-up): | 24 Hr RUSH (100% mark-up):

Results By: ☐ Phone ☐ Fax ☒ Email

Date & Received by : 08/27/21 [signature]

Default Method

Special Instructions:

ANALYSIS REQUESTED (Please circle)

Methods: Caltrans CTM643 / AASHTO T2888 / ASTM G187 (Soil Resistivity); Caltrans CTM643 / AASHTO T 289 / ASTM G 51 (pH); Caltrans CTM417 / AASHTO T 290 / ASTM D4327 (Sulfate); Caltrans CTM422 / AASHTO T 291 / ASTM D4327 (Chloride); SM 2580B / ASTM G200 (Redox Potential); SM 4500-S2 (Sulfide); SM 4500-NH3 / ASTM D6919 (Ammonia); SM 4500-NO3 / ASTM D4327 (Nitrate); ASTM D4327 (Flouride); ASTM D4327 (Phosphate); ASTM D6919 (Lithium, Sodium, Potassium, Magnesium, Calcium); SM 2320B (BiCarbonate); ASTM D2216 (Moisture Content); SM 2320B (Total Alkalinity)

Geo Quad: Soil Resistivity, pH, Sulfate, Chloride
Full Corrosion Series
Reports: *Req. Min. 3 Samples, site map, and groundwater info

	SAMPLE ID - BORE #	DESCRIPTION	DEPTH (ft)	DATE COLLECTED	Soil Resistivity	pH	Sulfate	Chloride	Redox Potential	Sulfide	Ammonia	Nitrate	Flouride	Phosphate	Lithium	Sodium	Potassium	Magnesium	Calcium	BiCarbonate	Full Corrosion Series	Soil Corrosivity Evaluation Report	Water Corrosivity Mini Report	Moisture Content	Total Alkalinity	Thermal Resistivity	Metallurgical Analysis	Langelier Index	Puckorius Index	XRF Elemental Analysis	Water Hardness
216 1	3723-SD	B-3	0-5'																		X										
2																															
3																															
4																															
5																															
6																															
7																															
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9																															
10																															
11																															
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APPENDIX C

PORCHET CALCULATIONS

Proposed 9-Lot Residential Development
Cox Road and Mulberry Drive
San Marcos, San Diego County, California
Project No. 3723-SD

GEOTEK

Client: Manning Homes
Project: APN 182-131-14
Project No: 3723-SD
Date: 8/13/2021

Boring No. P-1

Infiltration Rate (Porchet Method)

Time Interval, Δt =	30
Final Depth to Water, D_F =	13
Test Hole Radius, r =	4
Initial Depth to Water, D_O =	12
Total Test Hole Depth, D_T =	59

Equation - $$I_t = \frac{\Delta H\,(60r)}{\Delta t\,(r+2H_{avg})}$$

$H_O = D_T - D_O$ =	47
$H_F = D_T - D_F$ =	46
$\Delta H = \Delta D = H_O - H_F$ =	1
$Havg = (H_O+H_F)/2$ =	46.5

I_t = 0.08 **Inches per Hour**

GEOTEK

Client: Manning Homes
Project: APN 182-131-14
Project No: 3723-SD
Date: 8/13/2021

Boring No. **P-1**

Infiltration Rate (Porchet Method)

Time Interval, Δt =	30
Final Depth to Water, D_F =	22
Test Hole Radius, r =	4
Initial Depth to Water, D_O =	18
Total Test Hole Depth, D_T =	63

Equation - $I_t = \dfrac{\Delta H\,(60r)}{\Delta t\,(r+2H_{avg})}$

$H_O = D_T - D_O$ =	45
$H_F = D_T - D_F$ =	41
$\Delta H = \Delta D = H_O - H_F$ =	4
Havg = $(H_O+H_F)/2$ =	43

I_t = 0.36 **Inches per Hour**

GEOTEK

APPENDIX D

GENERAL GRADING GUIDELINES

Proposed 9-Lot Residential Development

Cox Road and Mulberry Drive

San Marcos, San Diego County, California

Project No. 3723-SD

GEOTEK

GENERAL GRADING GUIDELINES

Guidelines presented herein are intended to address general construction procedures for earthwork construction. Specific situations and conditions often arise which cannot reasonably be discussed in general guidelines, when anticipated these are discussed in the text of the report. Often unanticipated conditions are encountered which may necessitate modification or changes to these guidelines. It is our hope that these will assist the contractor to more efficiently complete the project by providing a reasonable understanding of the procedures that would be expected during earthwork and the testing and observation used to evaluate those procedures.

General

Grading should be performed to at least the minimum requirements of governing agencies, Chapters 18 and 33 of the Uniform Building Code, CBC (2019) and the guidelines presented below.

Preconstruction Meeting

A preconstruction meeting should be held prior to site earthwork. Any questions the contractor has regarding our recommendations, general site conditions, apparent discrepancies between reported and actual conditions and/or differences in procedures the contractor intends to use should be brought up at that meeting. The contractor (including the main onsite representative) should review our report and these guidelines in advance of the meeting. Any comments the contractor may have regarding these guidelines should be brought up at that meeting.

Grading Observation and Testing

1. Observation of the fill placement should be provided by our representative during grading. Verbal communication during the course of each day will be used to inform the contractor of test results. The contractor should receive a copy of the "Daily Field Report" indicating results of field density tests that day. If our representative does not provide the contractor with these reports, our office should be notified.
2. Testing and observation procedures are, by their nature, specific to the work or area observed and location of the tests taken, variability may occur in other locations. The contractor is responsible for the uniformity of the grading operations; our observations and test results are intended to evaluate the contractor's overall level of efforts during grading. The contractor's personnel are the only individuals participating in all aspect of site work. Compaction testing and observation should not be considered as relieving the contractor's responsibility to properly compact the fill.
3. Cleanouts, processed ground to receive fill, key excavations, and subdrains should be observed by our representative prior to placing any fill. It will be the contractor's responsibility to notify our representative or office when such areas are ready for observation.

4. Density tests may be made on the surface material to receive fill, as considered warranted by this firm.
5. In general, density tests would be made at maximum intervals of two feet of fill height or every 1,000 cubic yards of fill placed. Criteria will vary depending on soil conditions and size of the fill. More frequent testing may be performed. In any case, an adequate number of field density tests should be made to evaluate the required compaction and moisture content is generally being obtained.
6. Laboratory testing to support field test procedures will be performed, as considered warranted, based on conditions encountered (e.g. change of material sources, types, etc.) Every effort will be made to process samples in the laboratory as quickly as possible and in progress construction projects are our first priority. However, laboratory workloads may cause in delays and some soils may require a **minimum of 48 to 72 hours to complete test procedures**. Whenever possible, our representative(s) should be informed in advance of operational changes that might result in different source areas for materials.
7. Procedures for testing of fill slopes are as follows:
   a) Density tests should be taken periodically during grading on the flat surface of the fill, three to five feet horizontally from the face of the slope.
   b) If a method other than over building and cutting back to the compacted core is to be employed, slope compaction testing during construction should include testing the outer six inches to three feet in the slope face to determine if the required compaction is being achieved.
8. Finish grade testing of slopes and pad surfaces should be performed after construction is complete.

Site Clearing

1. All vegetation, and other deleterious materials, should be removed from the site. If material is not immediately removed from the site it should be stockpiled in a designated area(s) well outside of all current work areas and delineated with flagging or other means. Site clearing should be performed in advance of any grading in a specific area.
2. Efforts should be made by the contractor to remove all organic or other deleterious material from the fill, as even the most diligent efforts may result in the incorporation of some materials. This is especially important when grading is occurring near the natural grade. All equipment operators should be aware of these efforts. Laborers may be required as root pickers.
3. Nonorganic debris or concrete may be placed in deeper fill areas provided the procedures used are observed and found acceptable by our representative.

Treatment of Existing Ground

1. Following site clearing, all surficial deposits of topsoil, alluvium, and/or weathered bedrock be removed unless otherwise specifically indicated in the text of this report.
2. In some cases, removal may be recommended to a specified depth (e.g. flat sites where partial alluvial removals may be sufficient). The contractor should not exceed these depths unless directed otherwise by our representative.
3. Groundwater existing in alluvial areas may make excavation difficult. Deeper removals than indicated in the text of the report may be necessary due to saturation during winter months.
4. Subsequent to removals, the natural ground should be processed to a depth of six inches, moistened to near optimum moisture conditions and compacted to fill standards.
5. Exploratory back hoe or dozer trenches still remaining after site removal should be excavated and filled with compacted fill if they can be located.

Fill Placement

1. Unless otherwise indicated, all site soil and bedrock may be reused for compacted fill; however, some special processing or handling may be required (see text of report).
2. Material used in the compacting process should be evenly spread, moisture conditioned, processed, and compacted in thin lifts six (6) to eight (8) inches in compacted thickness to obtain a uniformly dense layer. The fill should be placed and compacted on a nearly horizontal plane, unless otherwise found acceptable by our representative.
3. If the moisture content or relative density varies from that recommended by this firm, the contractor should rework the fill until it is in accordance with the following:
   a) Moisture content of the fill should be at or above optimum moisture. Moisture should be evenly distributed without wet and dry pockets. Pre-watering of cut or removal areas should be considered in addition to watering during fill placement, particularly in clay or dry surficial soils. The ability of the contractor to obtain the proper moisture content will control production rates.
   b) Each six-inch layer should be compacted to at least 90 percent of the maximum dry density in compliance with the testing method specified by the controlling governmental agency. In most cases, the testing method is ASTM Test Designation D 1557.
4. Rock fragments less than eight inches in diameter may be utilized in the fill, provided:
   a) They are not placed in concentrated pockets;
   b) There is a sufficient percentage of fine-grained material to surround the rocks;
   c) The distribution of the rocks is observed by, and acceptable to, our representative.
5. Rocks exceeding eight (8) inches in diameter should be taken off site, broken into smaller fragments, or placed in accordance with recommendations of this firm in areas designated

suitable for rock disposal. On projects where significant large quantities of oversized materials are anticipated, alternate guidelines for placement may be included. If significant oversize materials are encountered during construction, these guidelines should be requested.

6. In clay soil, dry or large chunks or blocks are common. If in excess of eight (8) inches minimum dimension, then they are considered as oversized. Sheepsfoot compactors or other suitable methods should be used to break up blocks. When dry, they should be moisture conditioned to provide a uniform condition with the surrounding fill.

Slope Construction

1. The contractor should obtain a minimum relative compaction of 90 percent out to the finished slope face of fill slopes. This may be achieved by either overbuilding the slope and cutting back to the compacted core, or by direct compaction of the slope face with suitable equipment.
2. Slopes trimmed to the compacted core should be overbuilt by at least three (3) feet with compaction efforts out to the edge of the false slope. Failure to properly compact the outer edge results in trimming not exposing the compacted core and additional compaction after trimming may be necessary.
3. If fill slopes are built "at grade" using direct compaction methods, then the slope construction should be performed so that a constant gradient is maintained throughout construction. Soil should not be "spilled" over the slope face nor should slopes be "pushed out" to obtain grades. Compaction equipment should compact each lift along the immediate top of slope. Slopes should be back rolled or otherwise compacted at approximately every 4 feet vertically as the slope is built.
4. Corners and bends in slopes should have special attention during construction as these are the most difficult areas to obtain proper compaction.
5. Cut slopes should be cut to the finished surface. Excessive undercutting and smoothing of the face with fill may necessitate stabilization.

UTILITY TRENCH CONSTRUCTION AND BACKFILL

Utility trench excavation and backfill is the contractors responsibility. The geotechnical consultant typically provides periodic observation and testing of these operations. While efforts are made to make sufficient observations and tests to verify that the contractors' methods and procedures are adequate to achieve proper compaction, it is typically impractical to observe all backfill procedures. As such, it is critical that the contractor use consistent backfill procedures.

Compaction methods vary for trench compaction and experience indicates many methods can be successful. However, procedures that "worked" on previous projects may or may not prove effective on a given site. The contractor(s) should outline the procedures proposed, so that we may discuss them **prior** to construction. We will offer comments based on our knowledge of site conditions and experience.

1. Utility trench backfill in slopes, structural areas, in streets and beneath flat work or hardscape should be brought to at least optimum moisture and compacted to at least 90 percent of the laboratory standard. Soil should be moisture conditioned prior to placing in the trench.
2. Flooding and jetting are not typically recommended or acceptable for native soils. Flooding or jetting may be used with select sand having a Sand Equivalent (SE) of 30 or higher. This is typically limited to the following uses:
   a) shallow (12 + inches) under slab interior trenches and,
   b) as bedding in pipe zone.

   The water should be allowed to dissipate prior to pouring slabs or completing trench compaction.
3. Care should be taken not to place soils at high moisture content within the upper three feet of the trench backfill in street areas, as overly wet soils may impact subgrade preparation. Moisture may be reduced to 2% below optimum moisture in areas to be paved within the upper three feet below sub grade.
4. Sand backfill should not be allowed in exterior trenches adjacent to and within an area extending below a 1:1 projection from the outside bottom edge of a footing, unless it is similar to the surrounding soil.
5. Trench compaction testing is generally at the discretion of the geotechnical consultant. Testing frequency will be based on trench depth and the contractors procedures. A probing rod would be used to assess the consistency of compaction between tested areas and untested areas. If zones are found that are considered less compact than other areas, this would be brought to the contractors attention.

JOB SAFETY

General

Personnel safety is a primary concern on all job sites. The following summaries are safety considerations for use by all our employees on multi-employer construction sites. On ground personnel are at highest risk of injury and possible fatality on grading construction projects. The company recognizes that construction activities will vary on each site and that job site safety is the contractor's responsibility. However, it is, imperative that all personnel be safety conscious to avoid accidents and potential injury.

In an effort to minimize risks associated with geotechnical testing and observation, the following precautions are to be implemented for the safety of our field personnel on grading and construction projects.

1. Safety Meetings: Our field personnel are directed to attend the contractor's regularly scheduled safety meetings.
2. Safety Vests: Safety vests are provided for and are to be worn by our personnel while on the job site.
3. Safety Flags: Safety flags are provided to our field technicians; one is to be affixed to the vehicle when on site, the other is to be placed atop the spoil pile on all test pits.

In the event that the contractor's representative observes any of our personnel not following the above, we request that it be brought to the attention of our office.

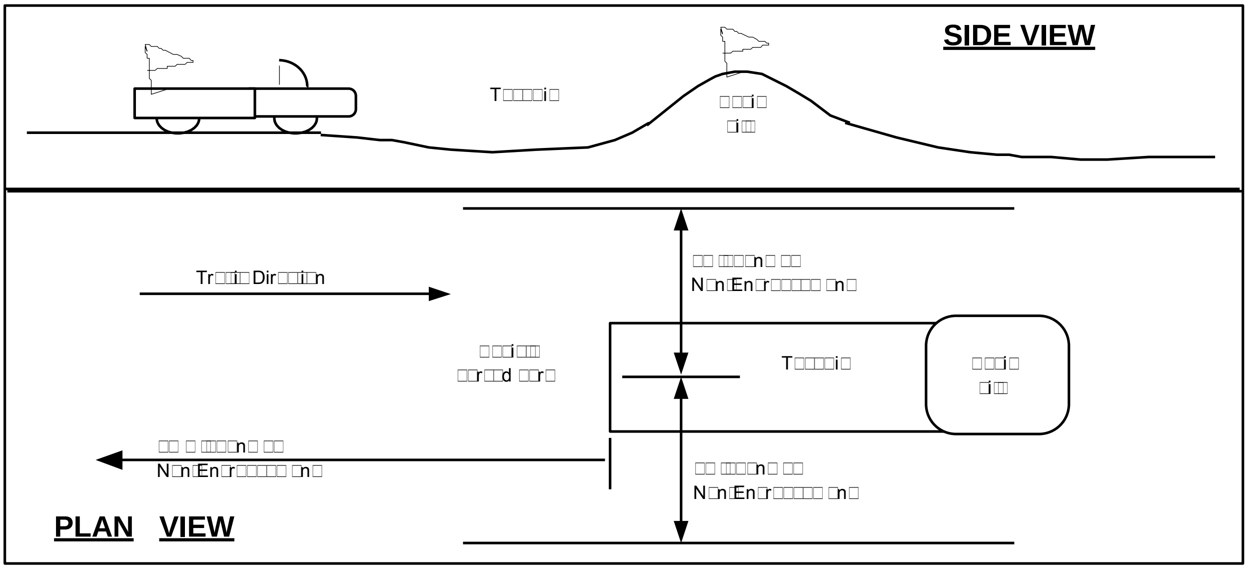
Test Pits Location, Orientation and Clearance

The technician is responsible for selecting test pit locations. The primary concern is the technician's safety. However, it is necessary to take sufficient tests at various locations to obtain a representative sampling of the fill. As such, efforts will be made to coordinate locations with the grading contractors authorized representatives (e.g. dump man, operator, supervisor, grade checker, etc.), and to select locations following or behind the established traffic pattern, preferably outside of current traffic. The contractors authorized representative should direct excavation of the pit and safety during the test period. Again, safety is the paramount concern.

Test pits should be excavated so that the spoil pile is placed away from oncoming traffic. The technician's vehicle is to be placed next to the test pit, opposite the spoil pile. This necessitates that the fill be maintained in a drivable condition. Alternatively, the contractor may opt to park a piece of equipment in front of test pits, particularly in small fill areas or those with limited access.

A zone of non-encroachment should be established for all test pits (see diagram below). No grading equipment should enter this zone during the test procedure. The zone should extend outward to the sides approximately 50 feet from the center of the test pit and 100 feet in the direction of traffic flow. This zone is established both for safety and to avoid excessive ground vibration, which typically decreases test results.

TEST PIT SAFETY PLAN



Slope Tests

When taking slope tests, the technician should park their vehicle directly above or below the test location on the slope. The contractor's representative should effectively keep all equipment at a safe operation distance (e.g. 50 feet) away from the slope during testing.

The technician is directed to withdraw from the active portion of the fill as soon as possible following testing. The technician's vehicle should be parked at the perimeter of the fill in a highly visible location.

Trench Safety

It is the contractor's responsibility to provide safe access into trenches where compaction testing is needed. Trenches for all utilities should be excavated in accordance with CAL-OSHA and any other applicable safety standards. Safe conditions will be required to enable compaction testing of the trench backfill.

All utility trench excavations in excess of 5 feet deep, which a person enters, are to be shored or laid back. Trench access should be provided in accordance with OSHA standards. Our personnel are directed not to enter any trench by being lowered or "riding down" on the equipment.

Our personnel are directed not to enter any excavation which;

1. is 5 feet or deeper unless shored or laid back,
2. exit points or ladders are not provided,
3. displays any evidence of instability, has any loose rock or other debris which could fall into the trench, or

4. displays any other evidence of any unsafe conditions regardless of depth.

If the contractor fails to provide safe access to trenches for compaction testing, our company policy requires that the soil technician withdraws and notifies their supervisor. The contractors representative will then be contacted in an effort to effect a solution. All backfill not tested due to safety concerns or other reasons is subject to reprocessing and/or removal.

Procedures

In the event that the technician's safety is jeopardized or compromised as a result of the contractor's failure to comply with any of the above, the technician is directed to inform both the developer's and contractor's representatives. If the condition is not rectified, the technician is required, by company policy, to immediately withdraw and notify their supervisor. The contractor's representative will then be contacted in an effort to effect a solution. No further testing will be performed until the situation is rectified. Any fill placed in the interim can be considered unacceptable and subject to reprocessing, recompaction or removal.

In the event that the soil technician does not comply with the above or other established safety guidelines, we request that the contractor bring this to technicians attention and notify our project manager or office. Effective communication and coordination between the contractors' representative and the field technician(s) is strongly encouraged in order to implement the above safety program and safety in general.

The safety procedures outlined above should be discussed at the contractor's safety meetings. This will serve to inform and remind equipment operators of these safety procedures particularly the zone of non-encroachment.

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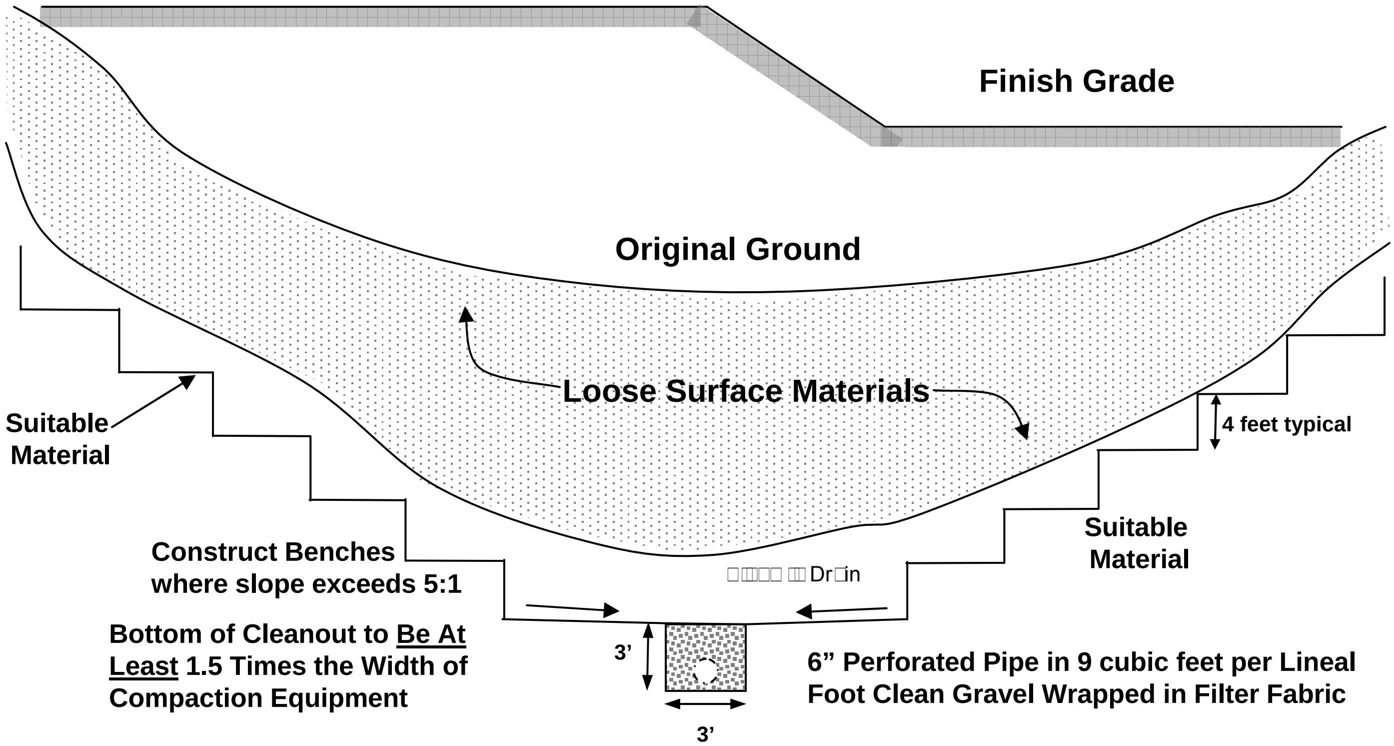
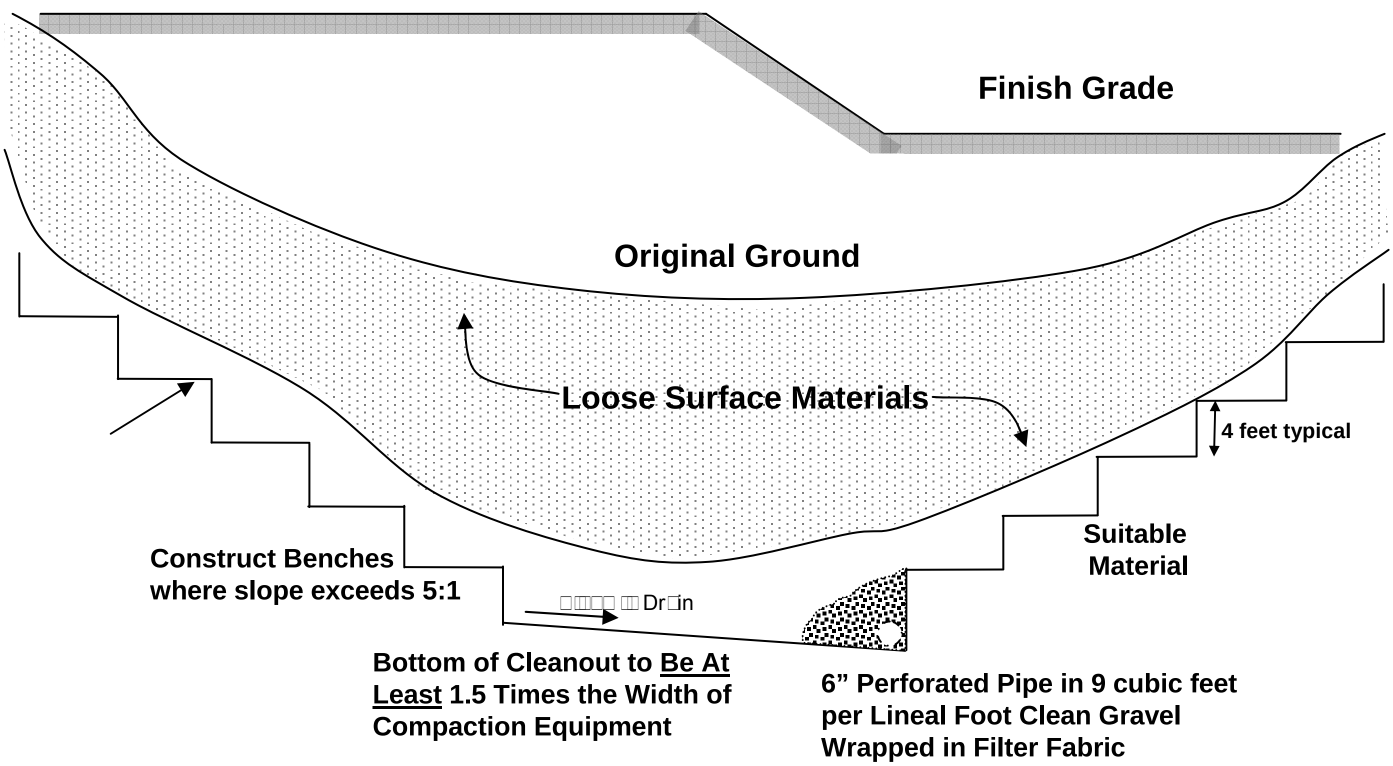
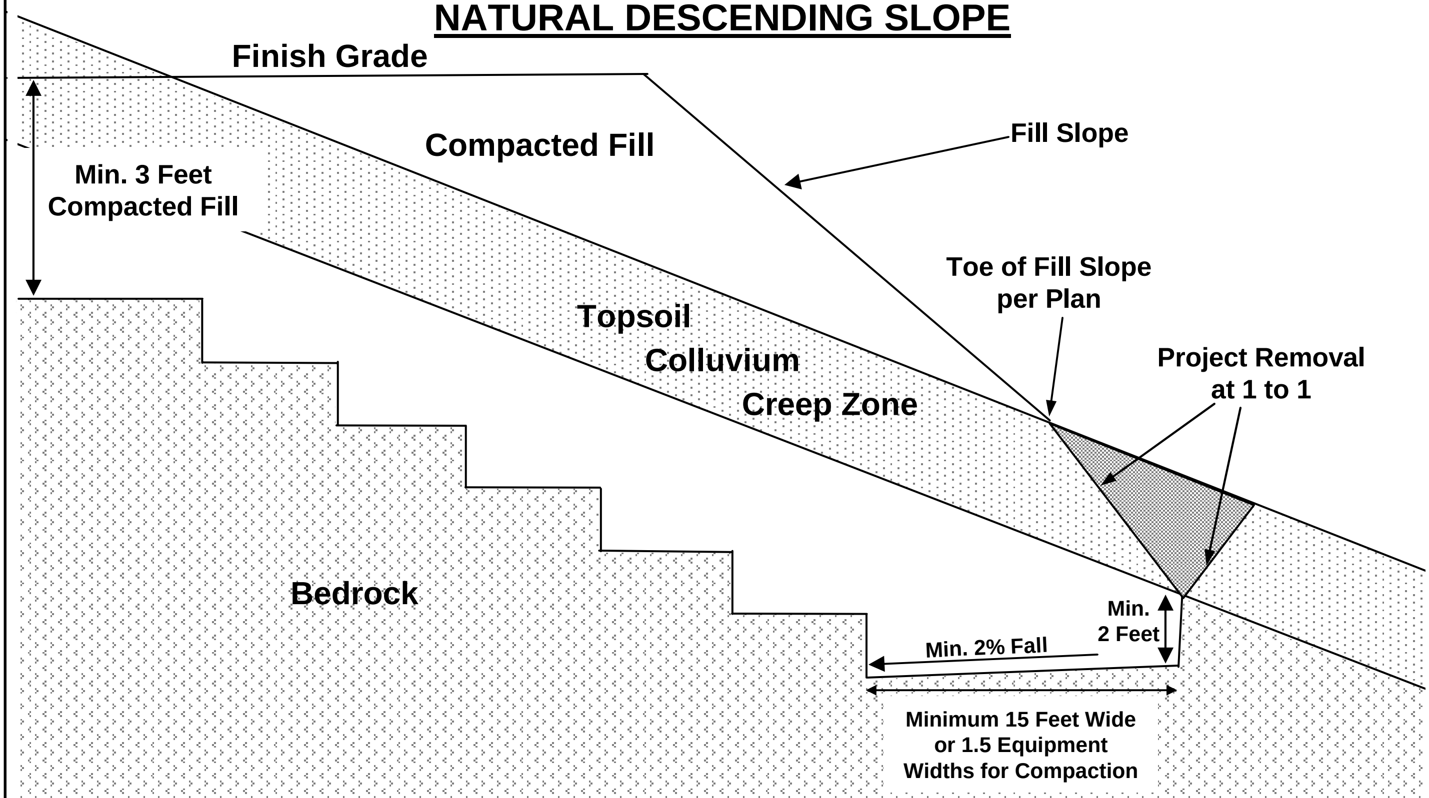
ALTERNATES



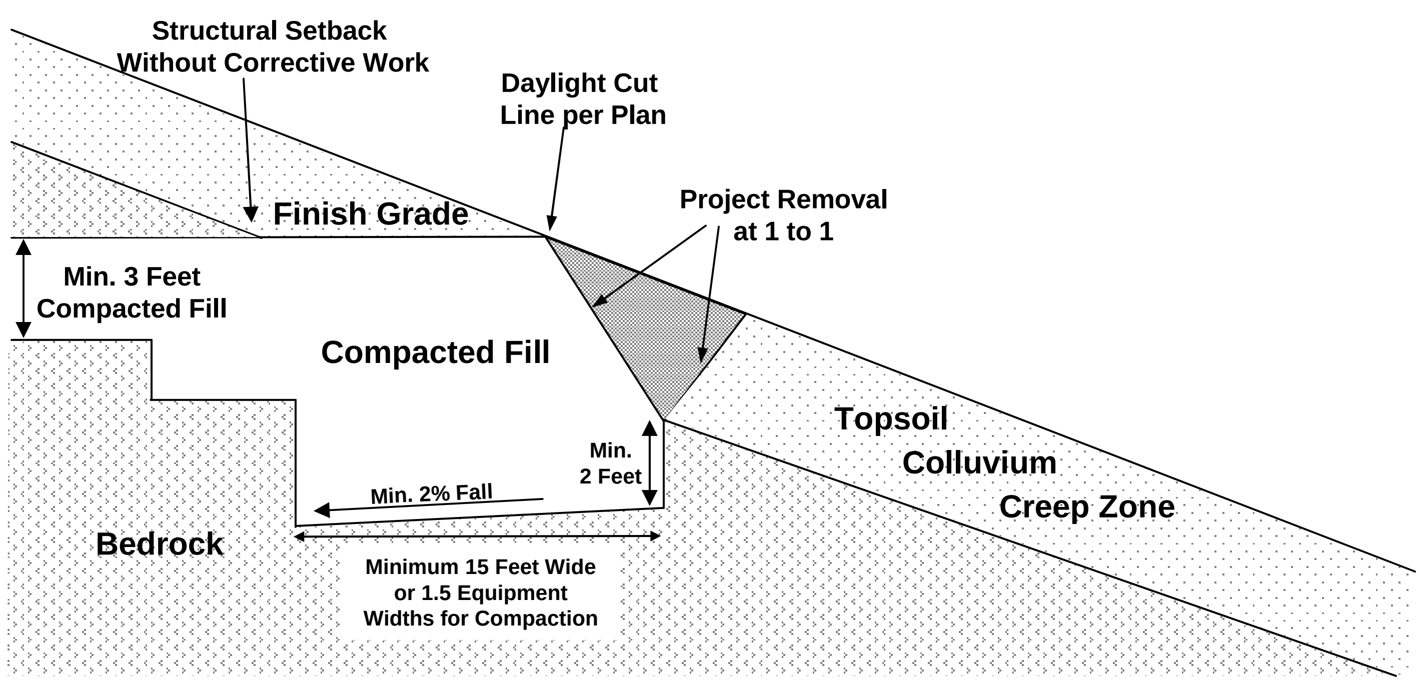


GEOTEK 1548 North Maple Street Corona, California 92880	TYPICAL CANYON CLEANOUT	STANDARD GRADING GUIDELINES PLATE G-1

TYPICAL FILL SLOPE OVER NATURAL DESCENDING SLOPE



DAYLIGHT CUT AREA OVER NATURAL DESCENDING SLOPE



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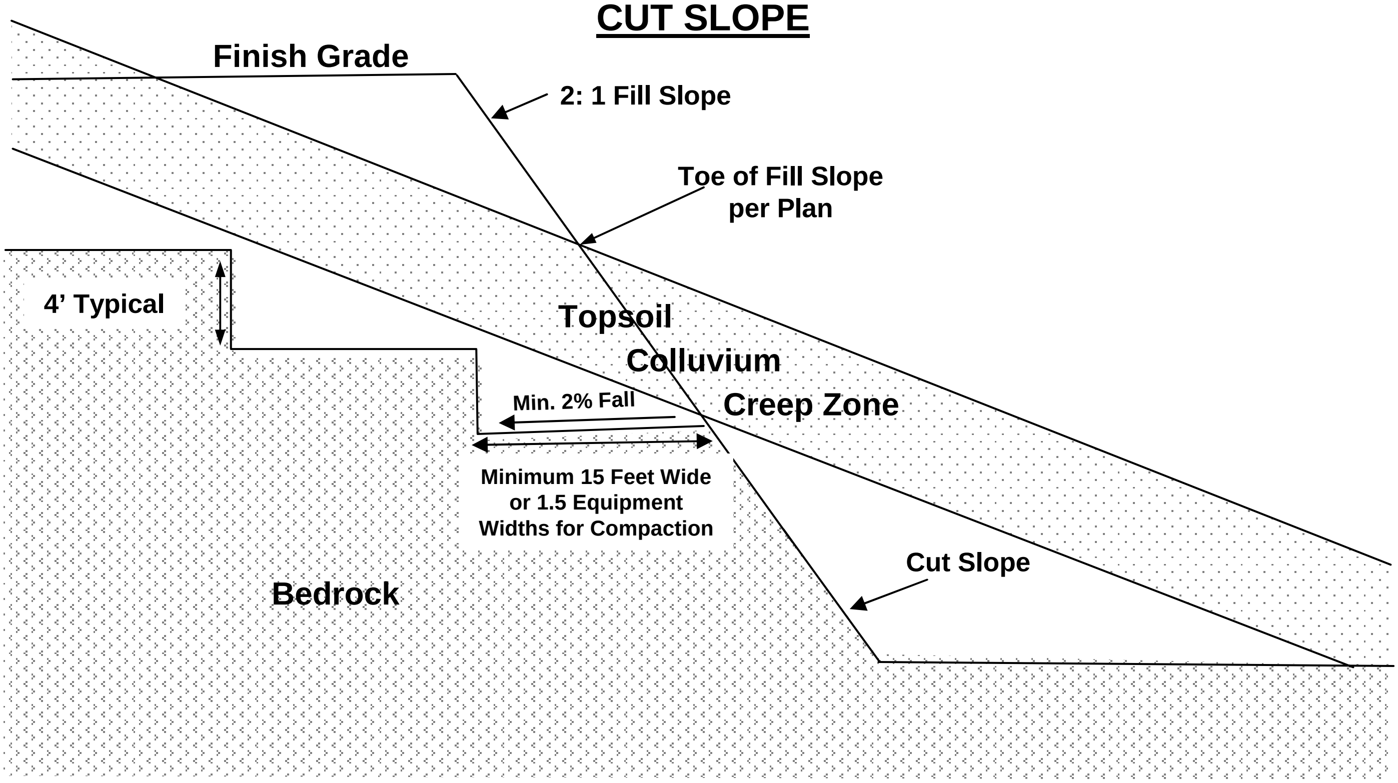
TREATMENT ABOVE NATURAL SLOPES

STANDARD GRADING GUIDELINES

PLATE G-2

TYPICAL FILL SLOPE OVER CUT SLOPE



TYPICAL FILL SLOPE

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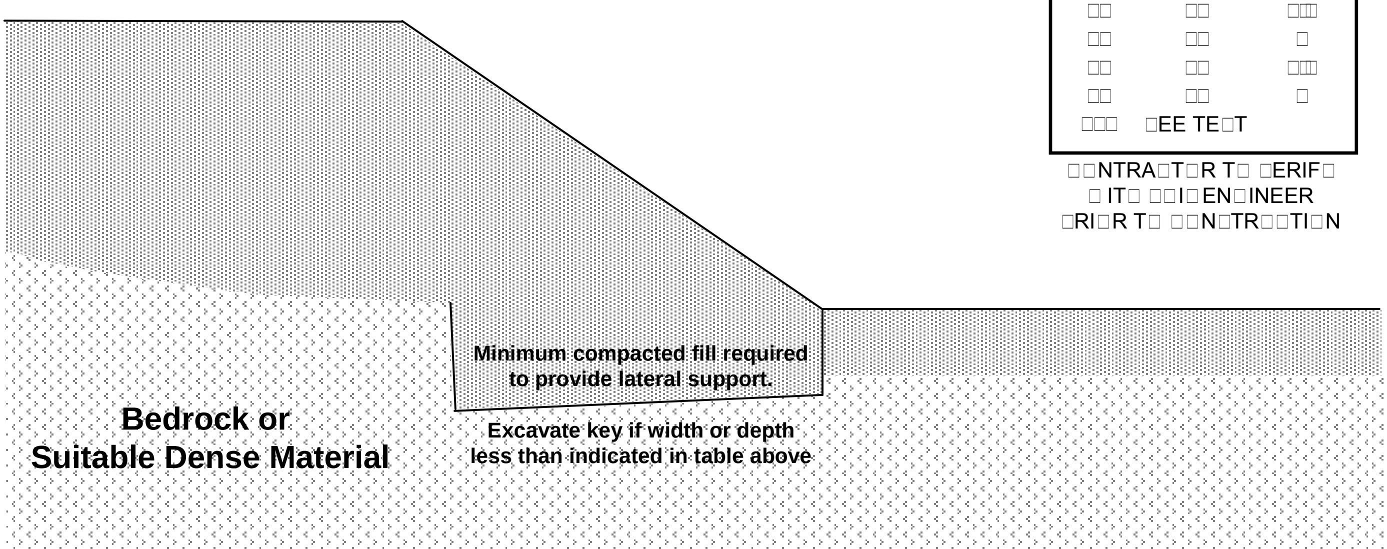

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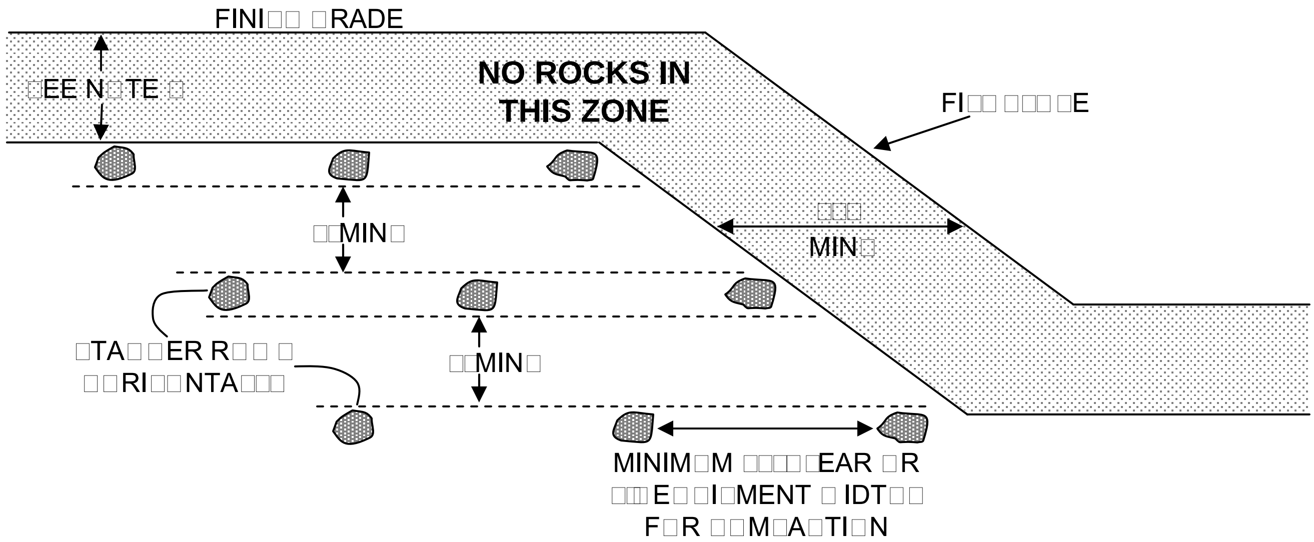
COMMON FILL SLOPE KEYS

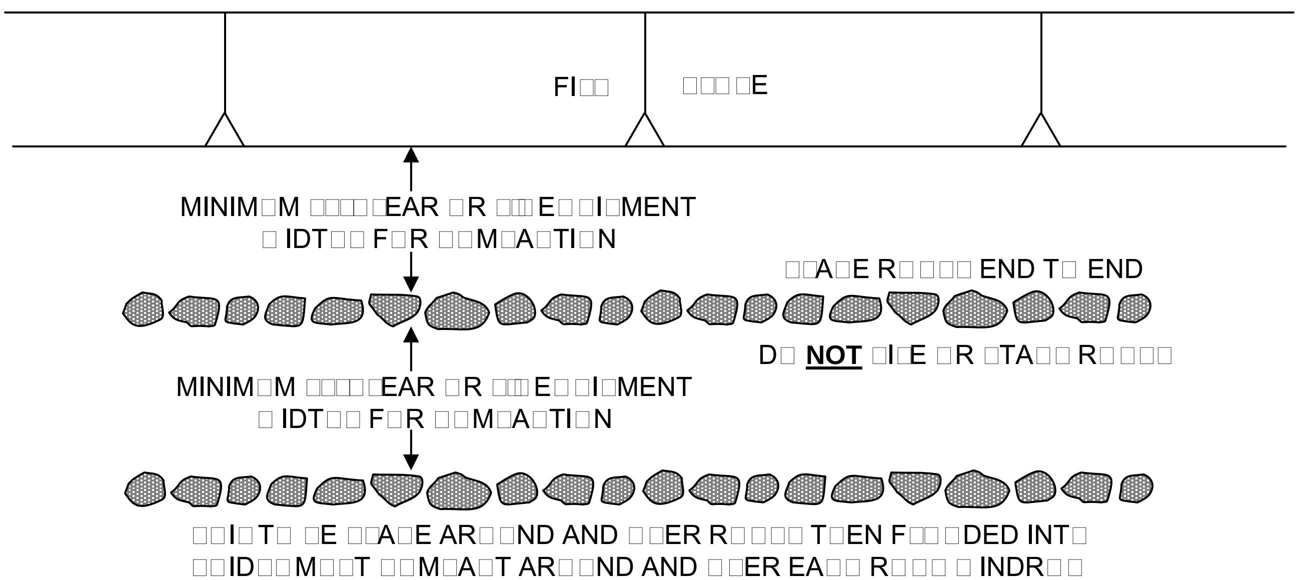
STANDARD GRADING GUIDELINES

PLATE G-3

CROSS SECTIONAL VIEW



PLAN VIEW



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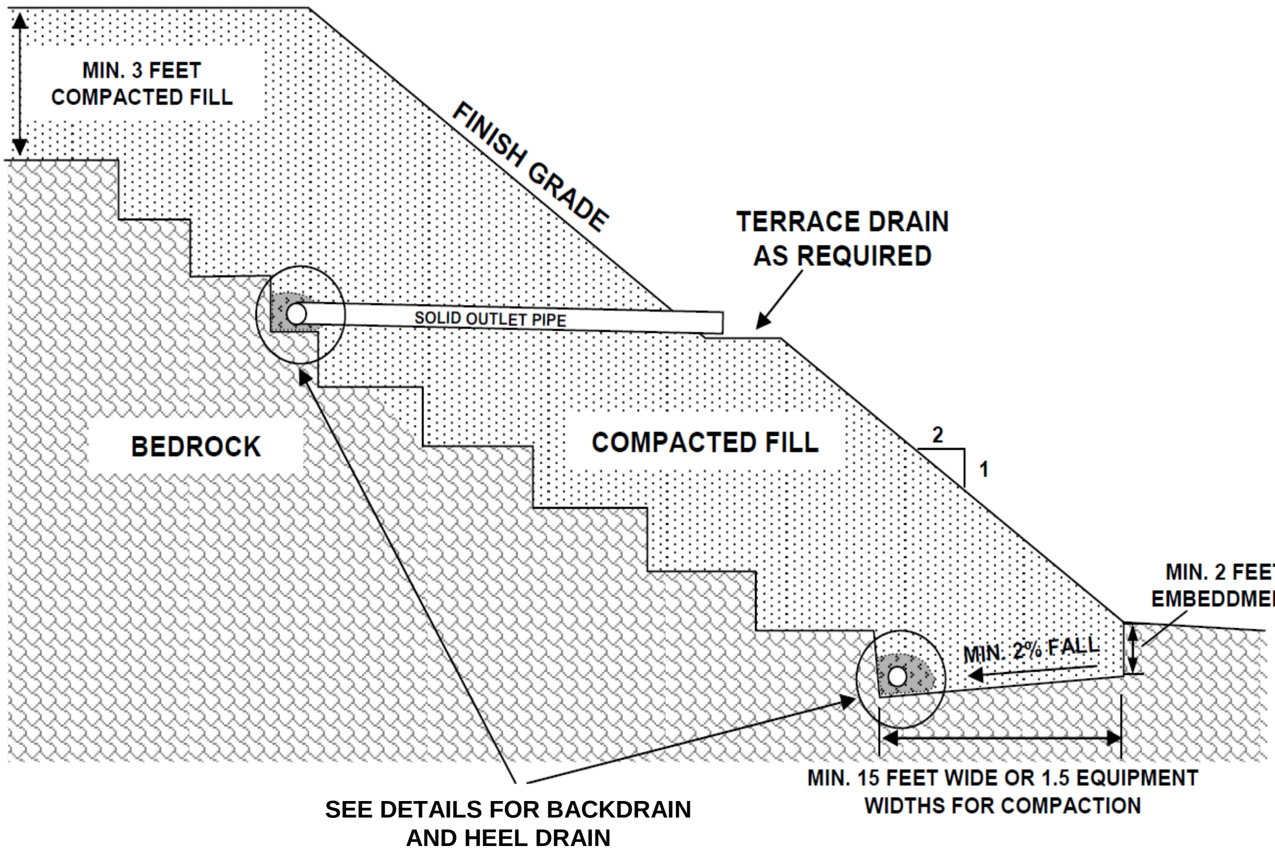
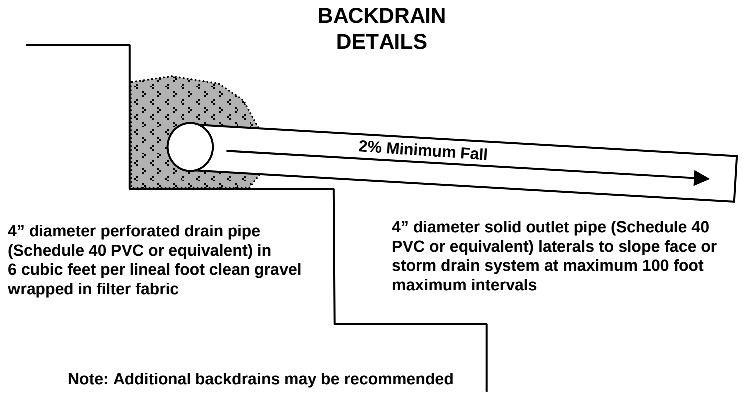
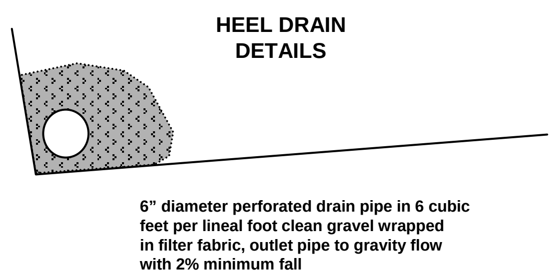
ROCK BURIAL DETAILS

STANDARD GRADING GUIDELINES

PLATE G-4







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TYPICAL BUTTRESS AND STABILIZATION FILL

STANDARD GRADING GUIDELINES

PLATE G-5