

December 4, 2024

Huitt-Zollars, Inc.  
2603 Main Street, Suite 400  
Irvine, California 92614



**SOUTHERN  
CALIFORNIA  
GEOTECHNICAL**  
*A California Corporation*

Attention: Mr. Miguel Angel Hernandez, P.E., P.L.S., QSD/P  
Vice President

Project No.: **24G166-1**

Subject: **Limited Geotechnical Investigation**  
Western Way Widening & Improvements  
Western Way, between Harley Knox Boulevard and Van Buren Boulevard  
Perris, California

Mr. Hernandez:

In accordance with your request, this letter presents geotechnical design recommendations for the Western Way improvements. This report was prepared in accordance with our Proposal No. 24P184, dated April 17, 2024. The purpose of this limited geotechnical investigation is to provide construction and design considerations associated for the proposed street improvements as described below. In

#### Scope of Services

The scope of services included a visual site reconnaissance, subsurface exploration, field and laboratory testing, and geotechnical engineering analysis to provide recommendations for preparing the design of the proposed street improvements at the subject site. The proposed pavement thickness designs are based on the results of the laboratory testing and anticipated traffic volumes.

#### Site Description

The subject site is a road segment known as Western Way in Perris, California. The street segment extends from Harley Knox Boulevard at the southern end, to Van Buren Boulevard at the northern side. The general location of the current project site is illustrated on the Site Location Map, included as Plate 1 of this report.

Western way is intersected by Jet Avenue, Airport Way, and Nandina Avenue. The site is surrounded by numerous commercial developments, except for the northwest and southwest areas of the site, which contain an undeveloped lot and a pump station, respectively. Western Way is mostly paved with asphaltic concrete (AC) pavements, but contains occasional sections of Portland cement (PCC) pavements. The AC pavements appear to be in moderate to good condition overall, but contain some areas of linear cracks and localized alligator cracking. One to two severe potholes were also observed along a portion of Western Way. The PCC pavements throughout Western Way appear to be in good condition, with no discernible distress observed.

Detailed topographic information for the site was not available at the time of this report. Based on elevations obtained from Google Earth, and visual observations made at the time of the

subsurface investigation, the topography throughout Western Way is relatively flat, but slopes gently downward to the south at a gradient of less than 1± percent.

### **Proposed Development**

Based on the RFP prepared by the city of Perris, this project will consist of street widening and pavement reconstruction within the portion of Western Way extending between Harley Knox Boulevard and Van Buren Boulevard. The project will generally consist of removing portions of the existing asphaltic concrete (AC) pavements, and adjacent concrete flatwork, and replacing with a newly designed AC over AB section, or a PCC pavement section. Additional improvements associated with the street widening include areas of new concrete flatwork and new traffic signals. We understand the traffic signals will be supported on cast-in-drilled-hole (CIDH) pile foundations.

### **Subsurface Exploration**

The subsurface exploration for this project consisted of five (5) borings (identified as B-1 through B-5) advanced to depths of 8 to 25± feet below existing site grades. The borings were logged during drilling by a member of our staff.

The borings were advanced using manually operated hand tools to a depth of 5± feet below existing site grades by our drilling contractors. At depths greater than 5± feet, the borings were advanced with hollow-stem augers, by a conventional truck-mounted drilling rig. Representative bulk and relatively undisturbed soil samples were taken during drilling. Relatively undisturbed soil samples were taken with a split barrel "California Sampler" containing a series of one inch long, 2.416± inch diameter brass rings. The relatively undisturbed ring samples were placed in molded plastic sleeves that were then sealed and transported to our laboratory. Bulk samples were also collected from auger cuttings and placed into plastic bags to retain their original moisture content.

The approximate locations of the borings are indicated on the Boring Location Plan, included as Plate 2 in Appendix A of this report. The Boring Logs, which illustrate the conditions encountered at the boring locations, as well as the results of some of the laboratory testing, are included in Appendix B.

### **Geotechnical Conditions**

#### **Pavements**

Asphaltic concrete (AC) pavements were encountered at the ground surface at all of the boring locations, measuring 4 to 7± inches AC with 4 to 8± inches of underlying aggregate base (AB). A summary of the AC pavement thicknesses is presented below:

**EXISTING PAVEMENT THICKNESSES**

<b>Boring No.</b>	<b>Asphaltic Concrete Thickness (inches)</b>	<b>Aggregate Base Thickness (inches)</b>
B-1	7	5
B-2	4	4
B-3	4½	4
B-4	6	8
B-5	6½	8

## Artificial Fill

Artificial fill soils were encountered beneath the AC pavements at all of the boring locations, extending to depths of 4½ to 8½± feet below existing site grades. The artificial fill soils generally consist of dense clayey fine to medium sands, silty fine to coarse sands, loose silty sands with gravel, and loose well graded gravel with sands. Stiff to very stiff silty clays with occasional sands and very stiff fine sandy clays were also encountered in the artificial fill soils. Additionally, layers of stiff fine to medium sandy silts, fine sandy silts, and clayey silts were observed in the fill soils. The fill soils possess a disturbed appearance and some samples contain artificial debris, such as AC fragments, resulting in their classification as artificial fill.

## Younger Alluvium

Younger alluvial soils were encountered beneath the fill soils at Boring No. B-2, extending to a depth of 10± feet below existing site grades. The younger alluvial soils consist of medium dense silty fine to medium sands and very stiff fine sandy silts. Boring No. B-2 was terminated within the younger alluvium.

## Older Alluvium

Native older alluvial soils were encountered beneath the artificial fill at all of the borings, except for Boring Nos. B-2 and B-4, extending to the maximum explored depth of 25± feet below existing site grades. The older alluvial soils generally consist of dense to very dense fine to coarse sands, clayey fine to coarse sands, and silty fine to medium sands. Additionally, very stiff to hard fine to medium sandy silts were observed in the older alluvial strata. Very stiff silty clays and clayey silts were also encountered in the older alluvium.

## Groundwater

Free water was encountered during the drilling of Boring No. B-3 at a depth of 22± feet below existing site grades. A delayed groundwater measurement was attempted approximately 20-minutes after completion of Boring No. B-3. However, due to caving, groundwater measurement was not feasible. Free water was not encountered within any of the other boring locations. Therefore, the free water encountered during drilling at Boring No. B-3 is considered to have been a perched water condition.

Recent water level data was obtained from the California State Water Resources Control Board, GeoTracker, website, <http://geotracker.waterboards.ca.gov/>. Several monitoring wells are located 1,045± feet west of the central area of the subject site. Water level readings within these wells indicate a high groundwater level of 19± feet below the ground surface (August 2013).

## **Laboratory Testing**

### Classification

All recovered soil samples were classified using the Unified Soil Classification System (USCS), in accordance with ASTM D-2488. Field identifications were then supplemented with additional visual classifications and/or by laboratory testing. The USCS classifications are shown on the Boring Logs and are periodically referenced throughout this report.

### In-situ Density and Moisture Content

The density has been determined for selected relatively undisturbed ring samples. These densities were determined in general accordance with the method presented in ASTM D-2937. The results are recorded as dry unit weight in pounds per cubic foot. The moisture contents are determined in accordance with ASTM D-2216, and are expressed as a percentage of the dry weight. These test results are presented on the Boring Logs.

### Expansion Index

The expansion potential of the on-site soils was determined in general accordance with ASTM D-4829 as required by the California Building Code (CBC). The testing apparatus is designed to accept a 4-inch diameter, 1-in high, remolded sample. The sample is initially remolded to  $50 \pm 1$  percent saturation and then loaded with a surcharge equivalent to 144 pounds per square foot. The sample is then inundated with water, and allowed to swell against the surcharge. The resultant swell or consolidation is recorded after a 24-hour period. The result of the expansion index (EI) testing is as follows:

<u>Sample Identification</u>	<u>Expansion Index</u>	<u>Expansive Potential</u>
B-1 @ 1 to 5 feet	4	Very Low
B-3 @ 1 to 5 feet	0	Non-Expansive

### Maximum Dry Density and Optimum Moisture Content

Two (2) representative bulk samples were tested for their maximum dry densities and optimum moisture contents. The results have been obtained using the Modified Proctor procedure, per ASTM D-1557. These tests are generally used to compare the in-situ densities of undisturbed field samples, and for later compaction testing. Additional testing of other soil type or soil mixes may be necessary at a later date. The test results are plotted on Plates C-1 and C-2 with this report.

### Direct Shear

Direct shear testing was performed on two (2) selected soil samples to determine their shear strength parameters. The tests were performed in accordance with ASTM D-3080. The testing apparatus is designed to accept either natural or remolded samples in a one-inch high ring, approximately 2.416 inches in diameter. Three samples of the same soil are prepared by remolding them to  $90 \pm$  percent compaction and near optimum moisture. Each of the three samples are then loaded with different normal loads and the resulting shear strength is determined for that particular normal load. The shearing of the samples is performed at a rate slow enough to permit the dissipation of excess pore water pressure. Porous stones are in contact with the top and bottom of the sample to permit the addition or release of pore water. The results of the direct shear tests are presented on Plates C-3 and C-4 of this report.

### Corrosivity Testing

Three (3) representative bulk samples of the near-surface soils were submitted to a subcontracted corrosion engineering laboratory to determine if the near-surface soils possess corrosive characteristics with respect to common construction materials. The corrosivity testing included a

determination of the electrical resistivity, pH, and chloride concentrations of the soils, as well as other tests. The results of some of these tests are presented below.

<u>Sample Identification</u>	<u>Saturated Resistivity (ohm-cm)</u>	<u>pH</u>	<u>Chlorides (mg/kg)</u>	<u>Nitrates (mg/kg)</u>	<u>Sulfides (mg/kg)</u>	<u>Redox Potential (mV)</u>
B-1 @ 1 to 5 feet	1,072	6.6	103.1	524.9	<0.001	186
B-3 @ 1 to 5 feet	2,345	7.4	29.8	25.9	0.8	164
B-5 @ 1 to 5 feet	2,211	7.3	77.8	30.3	<0.001	172

### R-Value

R (resistance)-value testing was conducted on three (3) representative samples of the existing soils obtained from the proposed storm drain improvement areas. The R-value was determined in accordance with CA Test Method 301. This test provides a measure of the pavement support characteristics of the soils and is used in the pavement thickness design procedure. The results of the R-value testing are as follows:

<u>Sample Identification</u>	<u>R-Value</u>
B-1 @ 1 to 5 feet	62
B-3 @ 1 to 5 feet	10
B-5 @ 1 to 5 feet	50

## Geotechnical Design Considerations

### Backfill Materials

The excavated soils are suitable to be recompacted and used as structural backfill. Results of laboratory testing indicate these materials will possess maximum dry densities in the range of 130.5 lbs/ft<sup>3</sup> to 135.5 lbs/ft<sup>3</sup>. Therefore, removal and recompaction of these materials is expected to result in in-place moist densities in the range of 117 lbs/ft<sup>3</sup> to 125 lbs/ft<sup>3</sup>. These values assume the on-site soils will be moisture conditioned to 0 to 4± percent above the optimum moisture contents and recompacted to at least 90 to 92 percent of the ASTM D-1557 maximum dry-density.

The near surface soils are generally comprised of silty sands and clayey sands. These materials possess good pavement support characteristics. Some zones of silty clay and sandy clay exist at the near-surface, specifically encountered within the areas of Boring Nos. B-2, B-3, and B-4. These materials possess a greater expansive potential and less favorable pavement support characteristics. It is beneficial to the project to remove the upper zone of silty clay and sandy clay material, if encountered at the pavement subgrade surface, and replace with more favorable, very low expansive, material.

### Bedding and Shading

The existing soils recovered from the proposed street improvement areas possess appreciable silt and/or clay content. Therefore, It is expected that imported soils will be required for bedding and shading purposes.

## Expansion

Laboratory testing performed on representative samples of the near-surface soils indicates that these materials possess a non-expansive to very low expansion potential (EI = 0 and 4). Therefore, no design considerations related to expansive soils are considered warranted for this site. However, the boring logs identified zones of silty clays, sandy clays, and clayey silts near the ground surface. These materials are expected to possess a low expansion potential. These materials are recommended to be removed from the upper 12 inches of the proposed subgrades.

## Corrosion Potential

The results of laboratory testing indicate that the tested samples of the on-site soils possess saturated resistivities of 1,072 to 2,345 ohm-cm, and pH values of 6.6 to 7.4. The soils possess redox potentials ranging from 164 to 186 mV and sulfide concentrations of up to 0.8 parts per million. These test results have been evaluated in accordance with guidelines published by the Ductile Iron Pipe Research Association (DIPRA). The DIPRA guidelines consist of a point system by which characteristics of the soils are used to quantify the corrosivity characteristics of the site. Resistivity, pH, sulfide concentration, redox potential, and moisture content the five factors that enter into the evaluation procedure. **Based on these factors, the on-site soils are considered to be mildly corrosive to ferrous pipes. Therefore, corrosion protection is expected to be required for cast iron or ductile iron pipes.**

Based on American Concrete Institute (ACI) Publication 318 Building Code Requirements for Structural Concrete and Commentary, reinforced concrete that is exposed to external sources of chlorides requires corrosion protection for the steel reinforcement contained within the concrete. ACI 318 defines concrete exposed to moisture and an external source of chlorides as "severe" or exposure category C2. ACI 318 does not clearly define a specific chloride concentration at which contact with the adjacent soil will constitute a "C2" or severe exposure. However, the Caltrans Memo to Designers 10-5, Protection of Reinforcement Against Corrosion Due to Chlorides, Acids and Sulfates, dated June 2010, indicates that soils possessing chloride concentrations greater than 500 mg/kg are considered to be corrosive to reinforced concrete. The results of the laboratory testing indicate chloride concentrations of 77.8 to 103.1 mg/kg. Although the soils contain some chlorides, the soils are not considered to be corrosive with respect to reinforcing steel reinforced concrete, based on the Caltrans memo to designers. Based on the lack of an external source of chlorides, a chloride exposure category of C1 is considered appropriate for this site.

Nitrates present in soil can be corrosive to copper tubing at concentrations greater than 50 mg/kg. The tested samples possess nitrate concentrations of 30.3 to 524.9 mg/kg. **Based on these test results, the on-site soils are considered to be corrosive to copper pipe.**

**SCG does not practice in the area of corrosion engineering. Therefore, the client may wish to contact a corrosion engineer to provide a more thorough evaluation of the corrosion test results.**

## Site Grading Recommendations

The grading recommendations presented below are based on the subsurface conditions encountered at the boring locations and our understanding of the proposed development. We

recommend that all grading activities be completed in accordance with the Grading Guide Specifications included as an enclosure to this report, unless superseded by site-specific recommendations presented below.

### Site Stripping and Demolition

Demolition of the existing asphaltic concrete pavements and areas of Portland cement concrete may be required to facilitate the construction of the proposed improvements. Demolition should include any subsurface improvements that will not remain in place with the new development. Debris resultant from demolition should also be disposed of off-site. Alternatively, concrete and asphalt debris may be pulverized to a maximum 1-inch particle size, well-mixed with the sandy on-site soils, and placed as new compacted structural fill or it may be processed and made into crushed miscellaneous base (CMB).

### Treatment of Existing Soils: Pavement and Flatwork Areas

Subgrade preparation in the new pavement and flatwork areas should initially consist of removal of all soils disturbed during demolition operations. The geotechnical engineer should then evaluate the subgrade to identify any areas of unsuitable soils. **Any excavations that expose silty clay materials at the subgrade surface should be overexcavated to a depth of 12 inches below subgrade elevation.** The subgrade soils should then be scarified to a depth of 12± inches, moisture conditioned to 0 to 4 percent above optimum moisture content, and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density. Low areas may be raised to grade using very low expansive material.

### Fill Placement

- Fill soils should be placed in thin (6± inches), near-horizontal lifts, moisture conditioned to 0 to 4 percent above optimum moisture content, and compacted.
- On-site soils may be used for fill provided they are cleaned of any debris to the satisfaction of the geotechnical engineer.
- All grading and fill placement activities should be completed in accordance with the requirements of the 2022 California Building Code and the requirements of the City of Perris.
- All fill soils should be compacted to at least 90 percent of the ASTM D-1557 maximum dry density. Fill soils should be well mixed.
- Compaction tests should be performed periodically by the geotechnical engineer as random verification of compaction and moisture content. These tests are intended to aid the contractor. Since the tests are taken at discrete locations and depths, they may not be indicative of the entire fill and therefore should not relieve the contractor of his responsibility to meet the job specifications.

### Imported Structural Fill

All imported structural fill should consist of very low expansive ( $EI < 20$ ), well graded soils possessing at least 10 percent fines (that portion of the sample passing the No. 200 sieve). Additional specifications for structural fill are presented in the enclosed Grading Guide Specifications.

## Utility Trench Backfill

In general, all utility trench backfill soils should be compacted to at least 90 percent of the ASTM D-1557 maximum dry density. It is recommended that materials in excess of 3 inches in size not be used for utility trench backfill. Compacted trench backfill should conform to the requirements of the local grading code, and more restrictive requirements may be indicated by the City of Perris. All utility trench backfills should be witnessed by the geotechnical engineer. The trench backfill soils should be compaction tested where possible; probed and visually evaluated elsewhere.

## **Construction Considerations**

### Moisture Sensitive Subgrade Soils

Most of the near-surface soils possess appreciable silt and/or clay content and will become unstable if exposed to significant moisture infiltration or disturbance by construction traffic. In addition, based on their granular content, some of the on-site soils will be susceptible to erosion. Therefore, the site should be graded to prevent ponding of surface water and to prevent water from running into excavations.

### Excavation Considerations

The near-surface fill soils generally consist loose to medium dense silty sand, clayey sands, and sandy silts. Based on their granular composition, some caving of shallow excavations may occur. Where caving occurs within shallow excavations, flattened excavation slopes may be sufficient to provide excavation stability. On a preliminary basis, temporary excavation slopes should be made no steeper than 2h:1v. Deeper excavations may require some form of external stabilization such as shoring, trench shields, or bracing. Maintaining adequate moisture content within the near surface soils will improve excavation stability. All excavation activities on this site should be conducted in accordance with Cal-OSHA regulations.

### Groundwater

The static groundwater table is considered to have existed at depths greater than 25± feet at the time of the subsurface exploration. Therefore, groundwater is not expected to impact the proposed grading or excavations performed for utility construction.

## **Foundation Design and Construction**

We understand that foundations may be required for street lights or traffic light standards. It is recommended that these improvements be supported on cast-in-drilled-hole (CIDH) pile foundations. These foundations may be designed as follows:

- Maximum, net allowable soil bearing pressure: 2,500 lbs/ft<sup>2</sup>.
- Minimum pile diameter: 18 inches.
- Minimum pile embedment: 6 feet below adjacent exterior grade.
- All foundations should extend into competent native alluvium.

The allowable bearing pressure presented above may be increased by 1/3 when considering short duration wind or seismic loads. The actual design of the foundations should be determined by the structural engineer.

### CIDH Pile Construction

Minimum pile shaft diameters should be 18 inches to help eliminate arching of concrete and possible void formation within the piles. On-center pile spacing should be at least four (4) times the pile diameter at the bearing surface to eliminate an overlapping stress influence. At a minimum, a pile spacing equivalent to three (3) times the pile diameter could be utilized, with an associated 20 percent reduction in allowable capacities. Based on the conditions encountered at the boring locations, minor caving of the CIDH pile excavations may occur. If caving or groundwater intrusion does occur during drilling, casing or liners will be required.

Prior to the placement of concrete, a clean-out bucket should be used to ensure that excess materials in the bottom of the pile have been sufficiently removed and that the dimensions of the pile are correct. Concrete should be placed using a tremie pipe whenever the distance of fall is greater than five (5) feet. Concrete should be placed at about a 6-inch slump when long reinforcing steel is used. It is recommended that the pile construction be performed in accordance with American Concrete Institute documents (ACI 336, I-79 and ACI 336-3R-72, revised 1985). In the event that casing is required, a sufficient head of concrete (minimum of 5 feet) should be maintained in the casing as the casing is being removed to prevent the intrusion of caving soils in the pile.

It is recommended that the bearing materials at each CIDH pile location be evaluated by the geotechnical engineer prior to placing steel or concrete.

### Estimated Foundation Settlements

Post-construction total and differential settlements of shallow foundations designed and constructed in accordance with the previously presented recommendations are estimated to be less than 1.0 and 0.5 inches, respectively. Differential movements are expected to occur over a 30-foot span, thereby resulting in an angular distortion of less than 0.002 inches per inch.

### Lateral Load Resistance

Lateral load resistance will be developed by a combination of friction acting at the base of foundations and slabs and the passive earth pressure developed by footings below grade. The following friction and passive pressure may be used to resist lateral forces:

- Passive Earth Pressure: 300 lbs/ft<sup>3</sup>
- Friction Coefficient: 0.30

These are allowable values and include a factor of safety. When combining friction and passive resistance, the passive pressure component should be reduced by one-third. These values assume that footings will be poured directly against suitable native soils. Where the area around the CIDH piles is not covered by an impermeable surface, such as a slab or pavement, the upper 12 inches

of soil should be neglected when calculating the passive resistance. The maximum allowable passive pressure is 3,000 lbs/ft<sup>2</sup>.

### **Concrete Flatwork Design and Construction**

Subgrades which will support new exterior slabs-on-grade and sidewalks should be prepared in accordance with the recommendations contained in the **Grading Recommendations** section of this report. Based on these recommendations, the exterior flatwork will be supported on very low expansive fill soils scarified and moisture conditioned to a depth of 12 inches and recompactd at 90 percent of the ASTM D-1557 maximum dry density. Based on geotechnical considerations, exterior slabs-on-grade may be designed as follows:

- Minimum slab thickness: 4½ inches
- Minimum slab reinforcement: No. 3 bars at 18 inches on-center, in both directions.
- Moisture condition the flatwork subgrade soils to 0 to 4 percent of the optimum moisture content, to a depth of at least 12 inches.
- Proper concrete curing techniques should be utilized to reduce the potential for slab curling or the formation of excessive shrinkage cracks.
- Control joints should be provided at a maximum spacing of 8 feet on center in two directions for slabs and at 6 feet on center for sidewalks. Control joints are intended to direct cracking.
- Expansion or felt joints should be used at the interface of exterior slabs on grade and any fixed structures to permit relative movement.
- Where the flatwork is adjacent to a landscape planter or another area with exposed soil, it should incorporate a turned down edge. This turned down edge should be at least 8 inches in depth and 6 inches in width. The turned down edge should incorporate longitudinal steel reinforcement consisting of at least two (2) No. 4 bars (1 top, 1 bottom).

These recommendations are contingent upon additional expansion index testing being conducted at the completion of rough grading, to verify the actual expansion potential of the flatwork subgrade soils. Please note that due to the expansive nature of the on-site soils and the lightly-loaded nature of exterior concrete flatwork, some minor cracking and vertical movement should be expected in the concrete flatwork where underlain by expansive soils.

### **Pavement Design Recommendations**

Site preparation in the pavement area should be completed as previously recommended in the Site Grading Recommendations section of this report. The subsequent pavement recommendations assume proper drainage and construction monitoring, and are based on either PCA or CALTRANS design parameters for a twenty (20) year design period. However, these designs also assume a routine pavement maintenance program to obtain the anticipated 20-year pavement service life.

## Pavement Subgrades

It is anticipated that the new pavements will be primarily supported on a layer of compacted structural fill, consisting of scarified, thoroughly moisture conditioned and recompacted existing soils. The near-surface soils generally consist of silty sands, clayey sands, and sandy silts. These materials possess good to excellent pavement support characteristics. Based on the results of laboratory testing, the recommended pavement sections below were designed using an R-value of 40. Any fill material imported to the site should have support characteristics equal to or greater than that of the soils at the site. **As previously discussed, any silty clay, sandy clay or clayey silt material which is encountered at the pavement subgrade level should be removed to a depth of 12 inches below subgrade elevation.** The resulting excavations should be filled with very low expansive material.

## Asphaltic Concrete

Presented below are the recommended thicknesses for new flexible pavement structures consisting of asphaltic concrete over a granular base. The pavement designs are based on the traffic indices (TI's) indicated. The client and/or civil engineer should verify that these TI's are representative of the anticipated traffic volumes. If the client and/or civil engineer determine that the expected traffic volume will exceed the applicable traffic index, we should be contacted for supplementary recommendations. The design traffic indices equate to the following approximate daily traffic volumes over a 20-year design life, assuming six operational traffic days per week.

Traffic Index	No. of Heavy Trucks per Day
8.0	35
9.0	93
10.0	226
11.0	503

For the purpose of the traffic volumes indicated above, a truck is defined as a 5-axle tractor trailer unit with one 8-kip axle and two 32-kip tandem axles. All of the traffic indices allow for 1,000 automobiles per day.

ASPHALTIC CONCRETE PAVEMENTS (R=40)				
Materials	Thickness (inches)			
	Western Way			
	TI = 8.0	TI = 9.0	TI = 10.0	TI = 11.0
Asphaltic Concrete	5	5½	6½	7
Aggregate Base	8	10	11	13
Compacted Subgrade	12	12	12	12

The recommended pavement thicknesses listed above are the minimum sections per the Highway Design Manual. The city of Perris may hold additional minimum pavement standards which could govern the design.

The aggregate base course should be compacted to at least 95 percent of the ASTM D-1557 maximum dry density. The asphaltic concrete should be compacted to at least 95 percent of the batch plant-reported maximum density. The aggregate base course may consist of crushed aggregate base (CAB) or crushed miscellaneous base (CMB), which is a recycled gravel, asphalt and concrete material. The gradation, R-Value, Sand Equivalent, and Percentage Wear of the CAB or CMB should comply with appropriate specifications contained in the current edition of the "Greenbook" Standard Specifications for Public Works Construction.

Portland Cement Concrete

We understand the city may require some areas of the project to be paved with Portland Cement Concrete (PCC) pavements. The minimum recommended thicknesses for the Portland cement concrete pavement sections are as follows:

PORTLAND CEMENT CONCRETE PAVEMENTS (R=40)				
Materials	Thickness (inches)			
	Western Way			
	TI = 8.0	TI = 9.0	TI = 10.0	TI = 11.0
PCC	6.5	8	9	10
Compacted Subgrade (95% minimum compaction)	12	12	12	12

The concrete should have a 28-day compressive strength of at least 3,000 psi. The maximum joint spacing within all of the PCC pavements is recommended to be equal to or less than 30 times the pavement thickness.

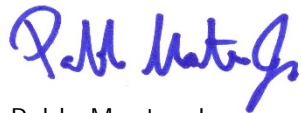
The recommended PCC sections are based on the PCA method, which does not require the use of aggregate beneath the PCC slab. However, we understand the city of Perris may require the use aggregate base beneath the PCC slab.

## Closure

We sincerely appreciate the opportunity to be of continued service on this project. If we may be of further assistance in any manner, please contact our office.

Respectfully Submitted,

## **SOUTHERN CALIFORNIA GEOTECHNICAL, INC.**



Pablo Montes Jr.  
Project Engineer

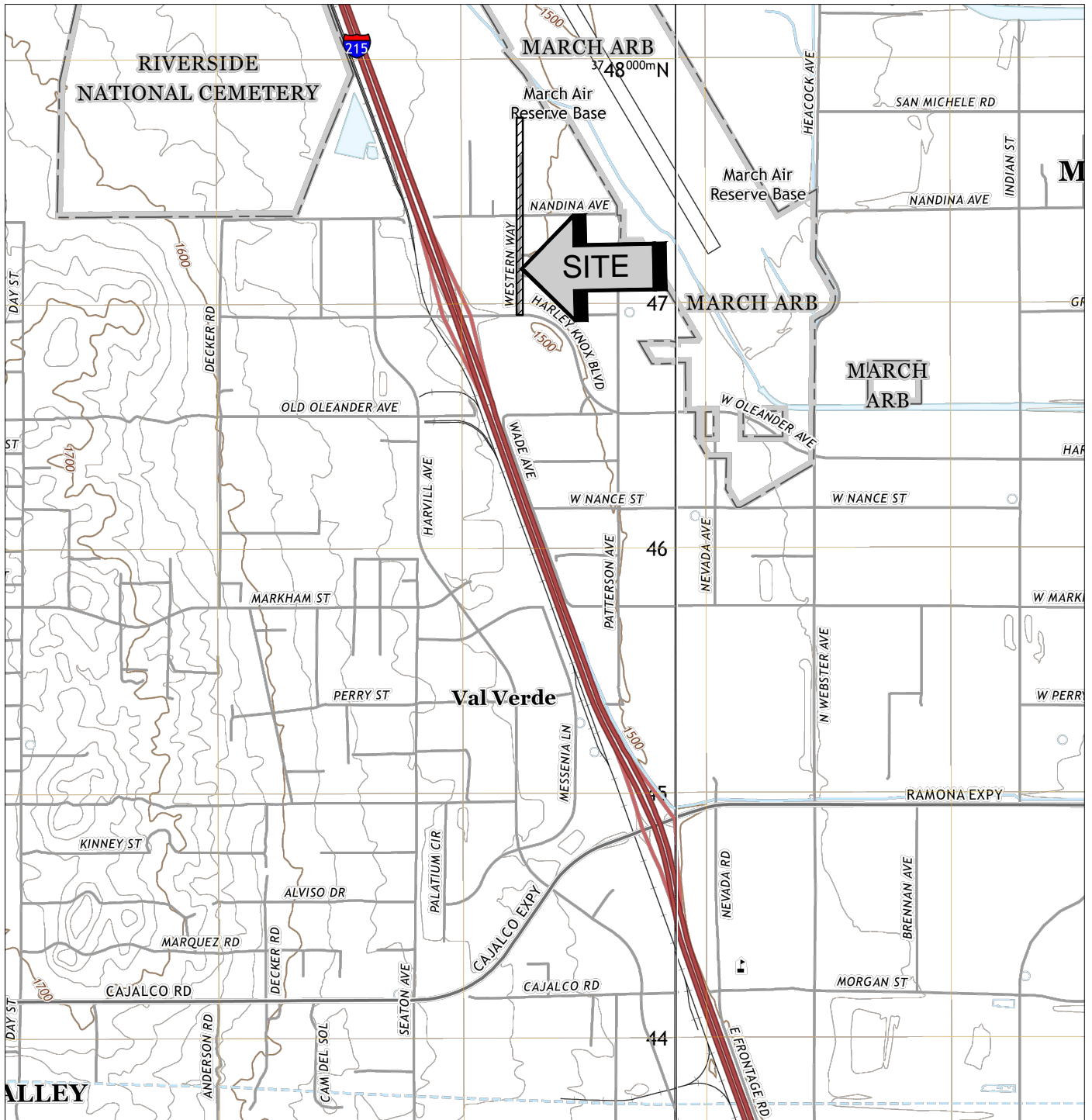


Gregory K. Mitchell, GE 2364  
Principal Engineer



Distribution: (1) Addressee

Enclosures: Plate 1 – Site Map  
Plate 2 – Boring Location Map  
Boring Logs and Legend (6 pages)  
Plates C-1 through C-4 – Results of Laboratory Testing  
Grading Guide Specifications



SOURCE: USGS TOPOGRAPHIC MAPS OF THE PERRIS AND STEELE PEAK QUADRANGLES, RIVERSIDE COUNTY, CALIFORNIA, 2021.




<b>SITE LOCATION PLAN</b>	
WESTERN WAY WIDENING & IMPROVEMENTS	
PERRIS, CALIFORNIA	
SCALE: 1" = 2000'	 <b>SOUTHERN CALIFORNIA GEOTECHNICAL</b>
DRAWN: RB	
CHKD: RGT	
SCG PROJECT 24G166-1	
<b>PLATE 1</b>	



NOTE: AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH.



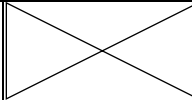



**GEOTECHNICAL LEGEND**

 APPROXIMATE BORING LOCATION

<b>BORING LOCATION PLAN</b>	
WESTERN WAY WIDENING & IMPROVEMENTS	
PERRIS, CALIFORNIA	
SCALE: 1" = 300'	 <b>SOUTHERN CALIFORNIA GEOTECHNICAL</b>
DRAWN: RB	
CHKD: RGT	
SCG PROJECT 24G166-1	
<b>PLATE 2</b>	

# BORING LOG LEGEND

SAMPLE TYPE	GRAPHICAL SYMBOL	SAMPLE DESCRIPTION
<b>GRAB</b>		SOIL SAMPLE TAKEN WITH NO SPECIALIZED EQUIPMENT, SUCH AS FROM A STOCKPILE OR THE GROUND SURFACE. (DISTURBED)
<b>CS</b>		CALIFORNIA SAMPLER: 2-1/2 INCH I.D. SPLIT BARREL SAMPLER, LINED WITH 1-INCH HIGH BRASS RINGS. DRIVEN WITH SPT HAMMER. (RELATIVELY UNDISTURBED)
<b>SPT</b>		STANDARD PEN`ETRATION TEST: SAMPLER IS A 1.4 INCH INSIDE DIAMETER SPLIT BARREL, DRIVEN 18 INCHES WITH THE SPT HAMMER. (DISTURBED)
<b>CORE</b>		ROCK CORE SAMPLE: TYPICALLY TAKEN WITH A DIAMOND-TIPPED CORE BARREL. TYPICALLY USED ONLY IN HIGHLY CONSOLIDATED BEDROCK.

## COLUMN DESCRIPTIONS

<b><u>DEPTH:</u></b>	Distance in feet below the ground surface.
<b><u>SAMPLE:</u></b>	Sample Type as depicted above.
<b><u>BLOW COUNT:</u></b>	Number of blows required to advance the sampler 12 inches using a 140 lb hammer with a 30-inch drop. 50/3" indicates penetration refusal (>50 blows) at 3 inches. WH indicates that the weight of the hammer was sufficient to push the sampler 6 inches or more.
<b><u>POCKET PEN.:</u></b>	Approximate shear strength of a cohesive soil sample as measured by pocket penetrometer.
<b><u>DRY DENSITY:</u></b>	Dry density of an undisturbed or relatively undisturbed sample in lbs/ft <sup>3</sup> .
<b><u>MOISTURE CONTENT:</u></b>	Moisture content of a soil sample, expressed as a percentage of the dry weight.
<b><u>LIQUID LIMIT:</u></b>	The moisture content above which a soil behaves as a liquid.
<b><u>PLASTIC LIMIT:</u></b>	The moisture content above which a soil behaves as a plastic.
<b><u>PASSING #200 SIEVE:</u></b>	The percentage of the sample finer than the #200 standard sieve.
<b><u>ORGANIC CONTENT:</u></b>	The ratio, expressed as a percentage, of the mass of organic matter in a given mass of soil to the mass of the dry soil solids.

JOB NO: 24G166-1

DRILLING DATE: 11/05/2024

ELEVATION: 1503 ft

PROJECT: Western Way Widening and Improvements

LOGGED BY: Ryan Bremer

WATER DEPTH: Dry 8 ft

LOCATION: Perris, CA, USA











CHECKED BY: Pablo Montes Jr.

READING TAKEN: 2024-11-05 08:00:00

DRILLING METHOD: Hollow Stem Auger

CHECKED DATE: 11/14/2024

CAVE DEPTH: 8 ft

Depth (ft)	FIELD RESULTS			GRAPHIC LOG	Material Description	LABORATORY RESULTS					COMMENTS	
	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)			MOISTURE CONTENT (%)	DRY DENSITY (PCF)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)		ORGANIC CONTENT (%)
					7± inches AC with 5± inches of underlying AB							
					FILL: CLAYEY SAND (SC), brown, fine to medium grained sand, little silt, trace fine sized gravel, trace coarse sand, dense- moist.	8						EI = 4 @ 1 to 2½ feet
					FILL: SANDY SILT (ML), brown, fine to medium grained sand, trace coarse sand, trace AC fragments, stiff- slightly moist.	8						
5		17, 50/5in			OLDER ALLUVIUM: SANDY SILT (ML), light brown, fine grained sand, trace medium to coarse sand, trace fine gravel, hard- moist.	11	115					
		28, 50/4in				11	123					
		12, 43			OLDER ALLUVIUM: SILTY SAND (SM), brown, fine to medium grained sand, trace fine sized gravel, little coarse sand, dense- moist.	9	124					
					<b>B-1 Terminated at 10ft</b>							
15												
20												
25												
30												

JOB NO: 24G166-1

DRILLING DATE: 11/05/2024

ELEVATION: 1502 ft

PROJECT: Western Way Widening and Improvements

LOGGED BY: Ryan Bremer

WATER DEPTH: Dry 8 ft

LOCATION: Perris, CA, USA










CHECKED BY: Pablo Montes Jr.

READING TAKEN: 2024-11-05 09:00:00

DRILLING METHOD: Hollow Stem Auger

CHECKED DATE: 11/14/2024

CAVE DEPTH: 8 ft

Depth (ft)	FIELD RESULTS			GRAPHIC LOG	Material Description	LABORATORY RESULTS					COMMENTS	
	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)			MOISTURE CONTENT (%)	DRY DENSITY (PCF)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)		ORGANIC CONTENT (%)
5					4± inches AC with 4± inches of underlying AB							
			2.5		FILL: SANDY LEAN CLAY (CL), red brown, fine grained sand, little silt, very stiff- moist.	10						
					FILL: SILTY SAND (SM), brown, fine to coarse grained sand, trace fine gravel, dense- slightly moist.	6						
		6, 8, 12	3.5		YOUNGER ALLUVIUM: SANDY SILT (ML), brown, fine grained sand, little clay, trace medium to coarse sand, medium stiff-moist.	10						
		5, 5, 7			YOUNGER ALLUVIUM: SILTY SAND (SM), brown, fine to medium grained sand, medium dense- slightly moist.	5						
15					<b>B-2 Terminated at 10ft</b>							
20												
25												
30												

JOB NO: 24G166-1

DRILLING DATE: 11/05/2024

ELEVATION: 1503 ft

PROJECT: Western Way Widening and Improvements

LOGGED BY: Ryan Bremer

WATER DEPTH: Dry 21 ft

LOCATION: Perris, CA, USA

CHECKED BY: Pablo Montes Jr.

READING TAKEN: 2024-11-05 12:00:00

DRILLING METHOD: Hollow Stem Auger

CHECKED DATE: 11/14/2024

CAVE DEPTH: 21 ft

Depth (ft)	FIELD RESULTS			GRAPHIC LOG	Material Description	LABORATORY RESULTS					COMMENTS	
	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)			MOISTURE CONTENT (%)	DRY DENSITY (PCF)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)		ORGANIC CONTENT (%)
					4 1/2 ± inches AC with 4 ± inches of underlying AB							
					FILL: SILTY SAND (SM), brown, fine grained sand, trace to little clay, medium dense- moist.	11						EI = 0 @ 1 to 2.5 feet
					FILL: SANDY SILT (ML), brown, with fine grained sand, stiff to very stiff moist.	12						
5		11, 27	3.0		OLDER ALLUVIUM: SANDY SILT (ML), light brown, fine grained sand, trace to few clay, trace medium to coarse sand, very stiff- moist.	14	112					
		10, 21	3.5			12	112					
10		9, 18	4.5		OLDER ALLUVIUM: SILTY CLAY (CL-ML), brown, trace to little fine grained sand, very stiff- moist.	13	119					
		8, 13, 24			OLDER ALLUVIUM: WELL-GRADED SAND (SW), light brown, fine to coarse grained sand, trace silt, trace fine sized gravel, dense- slightly moist to wet .	8						
15												
20		10, 22, 26				13						
		14, 23, 44			OLDER ALLUVIUM: SILTY SAND (SM), brown, fine to medium grained sand, trace clay, very dense- wet.	15						@ 22 feet groundwater encountered during drilling
30					<b>B-3 Terminated at 25ft</b>							

JOB NO: 24G166-1

DRILLING DATE: 11/05/2024

ELEVATION: 1504 ft

PROJECT: Western Way Widening and Improvements

LOGGED BY: Ryan Bremer

WATER DEPTH: Dry 7 ft

LOCATION: Perris, CA, USA




CHECKED BY: Pablo Montes Jr.

READING TAKEN: 2024-11-05 11:00:00

DRILLING METHOD: Hollow Stem Auger

CHECKED DATE: 11/14/2024

CAVE DEPTH: 7 ft

Depth (ft)	FIELD RESULTS			GRAPHIC LOG	Material Description	LABORATORY RESULTS					COMMENTS	
	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)			MOISTURE CONTENT (%)	DRY DENSITY (PCF)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)		ORGANIC CONTENT (%)
5	Hand		1.5		6± inches AC with 8± inches of underlying AB							
					FILL: CLAYEY SILT (ML), brown, little fine grained sand, stiff- moist.	10						
	Hand				FILL: SANDY SILT (ML), brown, fine grained sand, trace to little clay, trace medium to coarse sand, stiff- moist.	12						
	X	3, 3, 2			FILL: SILTY SAND WITH GRAVEL (SM), gray brown, with fine sized gravel, fine to coarse grained sand, loose- slightly moist.	8						
10					FILL: WELL-GRADED GRAVEL WITH SAND (GW), gray, with fine to coarse grained sand, fine grained gravel, loose- slightly moist.	4						
					<b>B-4 refusal at 8ft</b>							
15												
20												
25												
30												

JOB NO: 24G166-1

DRILLING DATE: 11/05/2024

ELEVATION: 1506 ft

PROJECT: Western Way Widening and Improvements

LOGGED BY: Ryan Bremer

WATER DEPTH: Dry 22 ft

LOCATION: Perris, CA, USA

















CHECKED BY: Pablo Montes Jr.

READING TAKEN: 2024-11-05 13:00:00

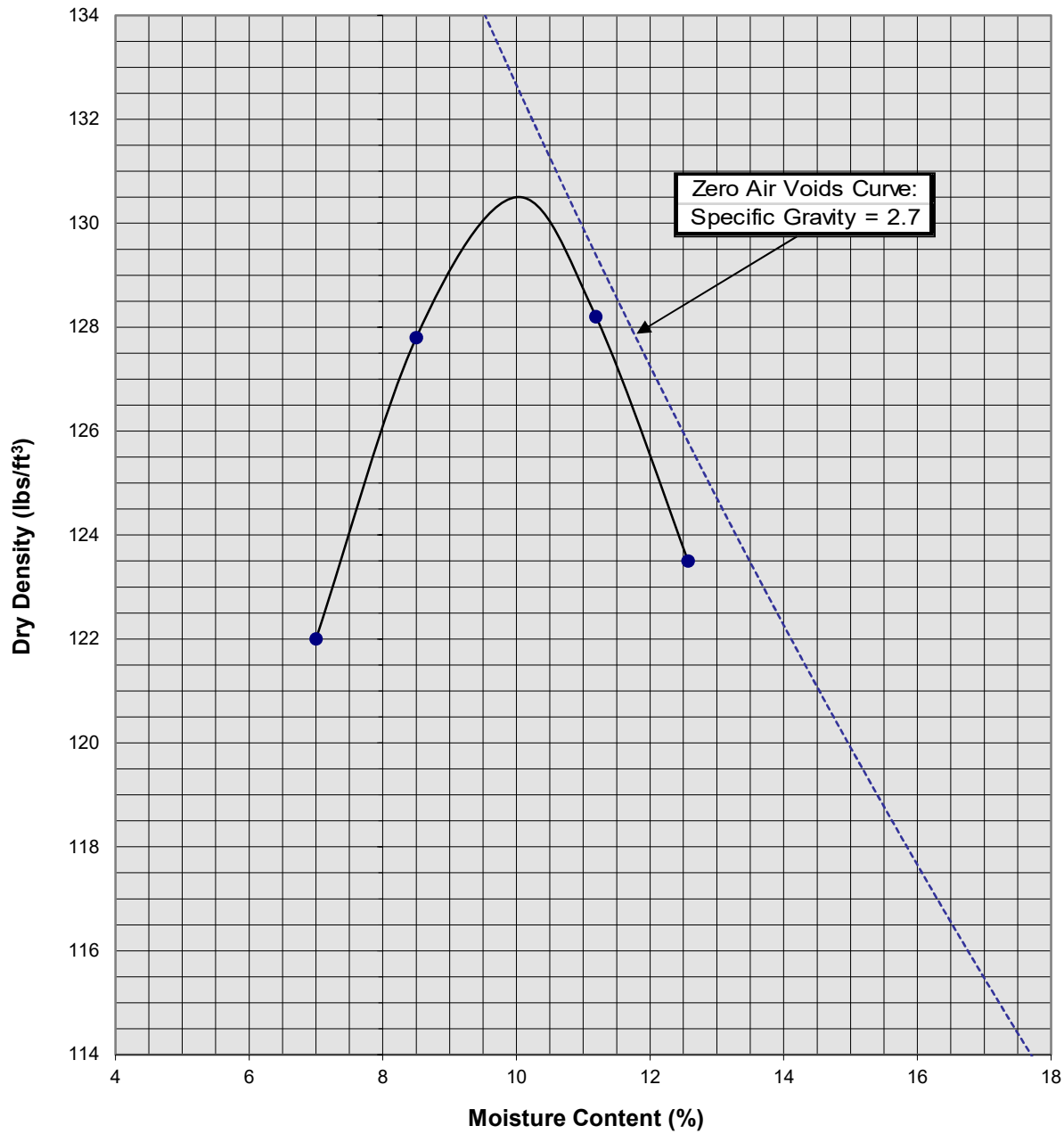
DRILLING METHOD: Hollow Stem Auger

CHECKED DATE: 11/14/2024

CAVE DEPTH: 22 ft

Depth (ft)	FIELD RESULTS			GRAPHIC LOG	Material Description	LABORATORY RESULTS					COMMENTS	
	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)			MOISTURE CONTENT (%)	DRY DENSITY (PCF)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)		ORGANIC CONTENT (%)
					6½± inches AC with 8± inches of underlying AB							
					FILL: CLAYEY SAND (SC), brown, fine grained sand, trace to little medium to coarse sand, medium dense- slightly moist.	8						
						8						
5		7, 13			FILL: SILTY SAND (SM), brown, fine to medium grained sand, trace clay medium dense- slightly moist.	7	119					
		12, 24	4.5+		FILL: SILTY CLAY (CL-ML), brown, little to some fine to medium grained sand, trace coarse sand, very stiff- slightly moist.	5	129					
10		13, 27			OLDER ALLUVIUM: SANDY SILT (ML), brown, fine to medium grained sand, very stiff- slightly moist.	8	117					
		13, 18, 21			OLDER ALLUVIUM: SANDY SILT (ML), brown, fine grained sand, trace medium sand, hard- moist.	11						
		8, 8, 9	3.5		OLDER ALLUVIUM: CLAYEY SILT (ML), gray brown, trace to few fine grained sand, very stiff- very moist.	24						
		12, 22, 32	2.5		OLDER ALLUVIUM: CLAYEY SAND (SC), brown, fine to coarse grained sand, little silt, very dense- moist.	12						
					<b>B-5 Terminated at 25ft</b>							
30												

### Moisture/Density Relationship ASTM D-1557



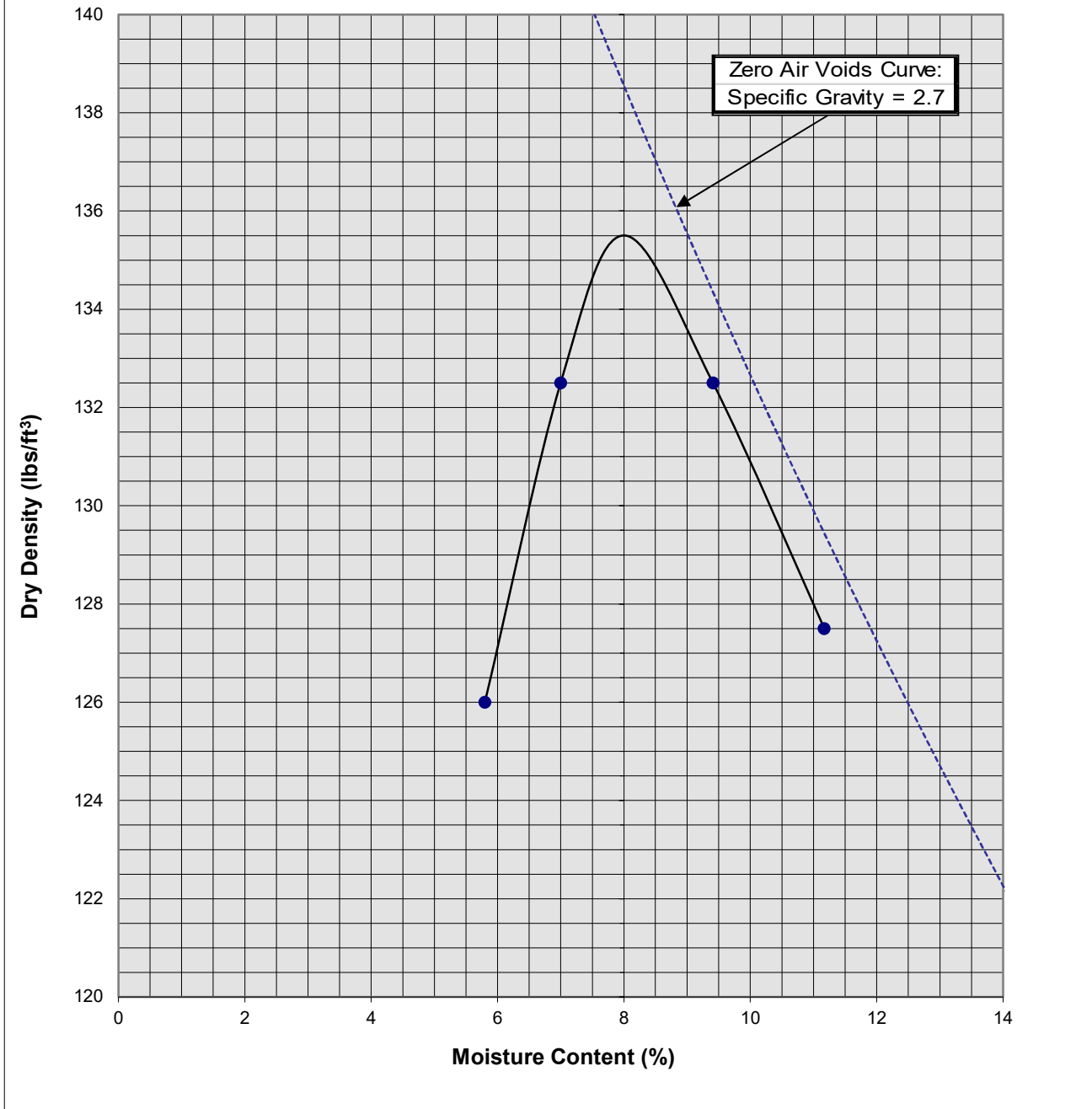
Soil ID Number	B-3 @ 1 to 5'
Optimum Moisture (%)	10
Maximum Dry Density (pcf)	130.5
Soil Classification	Silty Sand (SM), Brown fine grained, trace to little non-plastic Clay

Western Way Widening and Improvements  
 Perris, California  
 Project No. 24G166-1  
**PLATE C-1**



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*A California Corporation*

### Moisture/Density Relationship ASTM D-1557



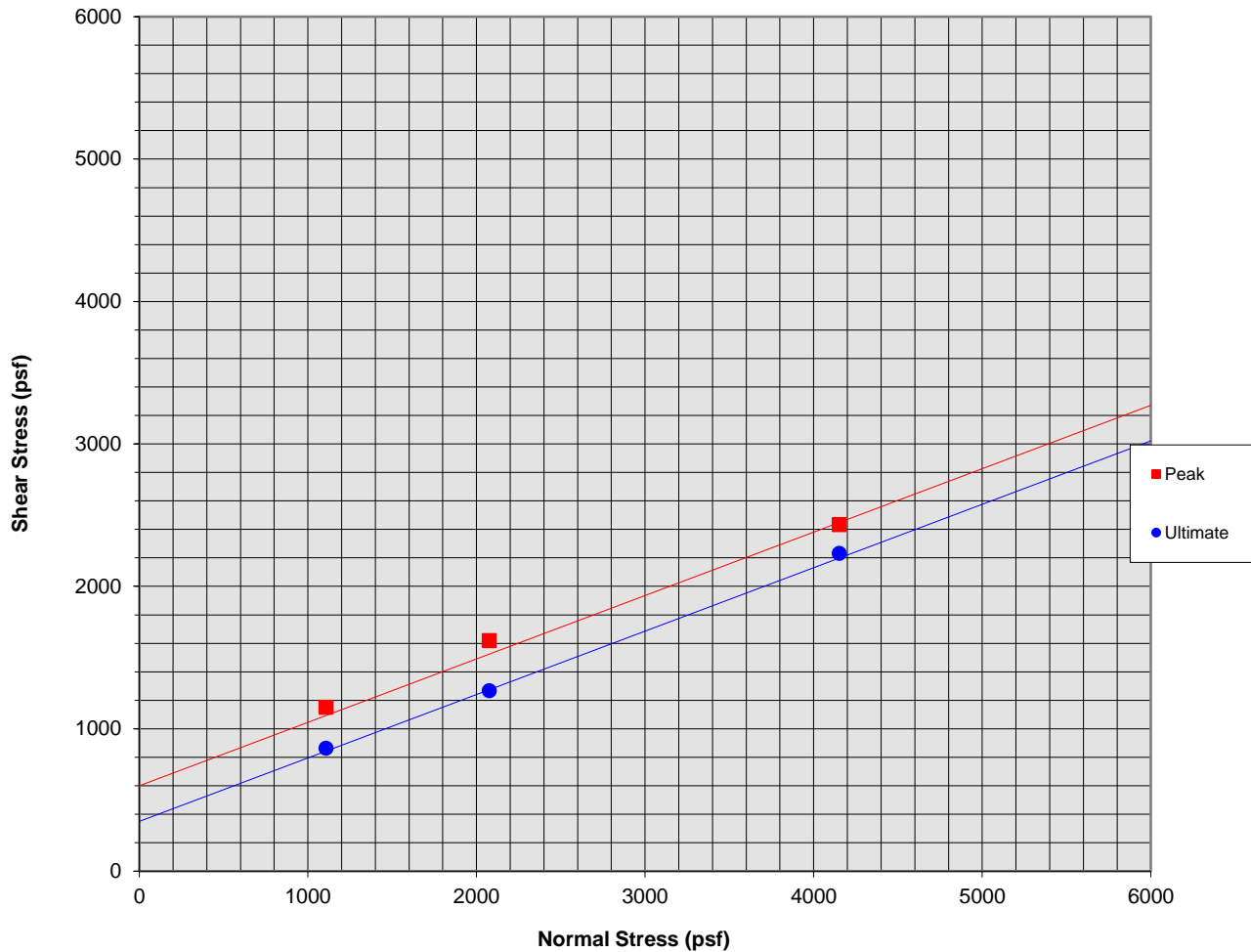
Soil ID Number	B-5 @ 1 to 5'
Optimum Moisture (%)	8
Maximum Dry Density (pcf)	135.5
Soil Classification	Clayey Sand (SC), Brown, fine grained Sand, trace to little medium to coarse Sand

Western Way Widening and Improvements  
 Perris, California  
 Project No. 24G166-1  
**PLATE C-2**



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*A California Corporation*

### Direct Shear Test Results (Undisturbed)



Sample Description: B-3 @ 9 to 10 feet

Classification: OLDER ALLUVIUM: Silty Clay (CL-ML), Brown, trace to little fine grained Sand

#### Sample Data

Initial Moisture Content	13.0
Final Moisture Content	20.0
Initial Dry Density	119.0
Final Dry Density	--
Specimen Diameter (in)	2.4
Specimen Thickness (in)	1.0

#### Test Results

	Peak	Ultimate
$\phi$ (°)	24.0	24.0
C (psf)	600	350

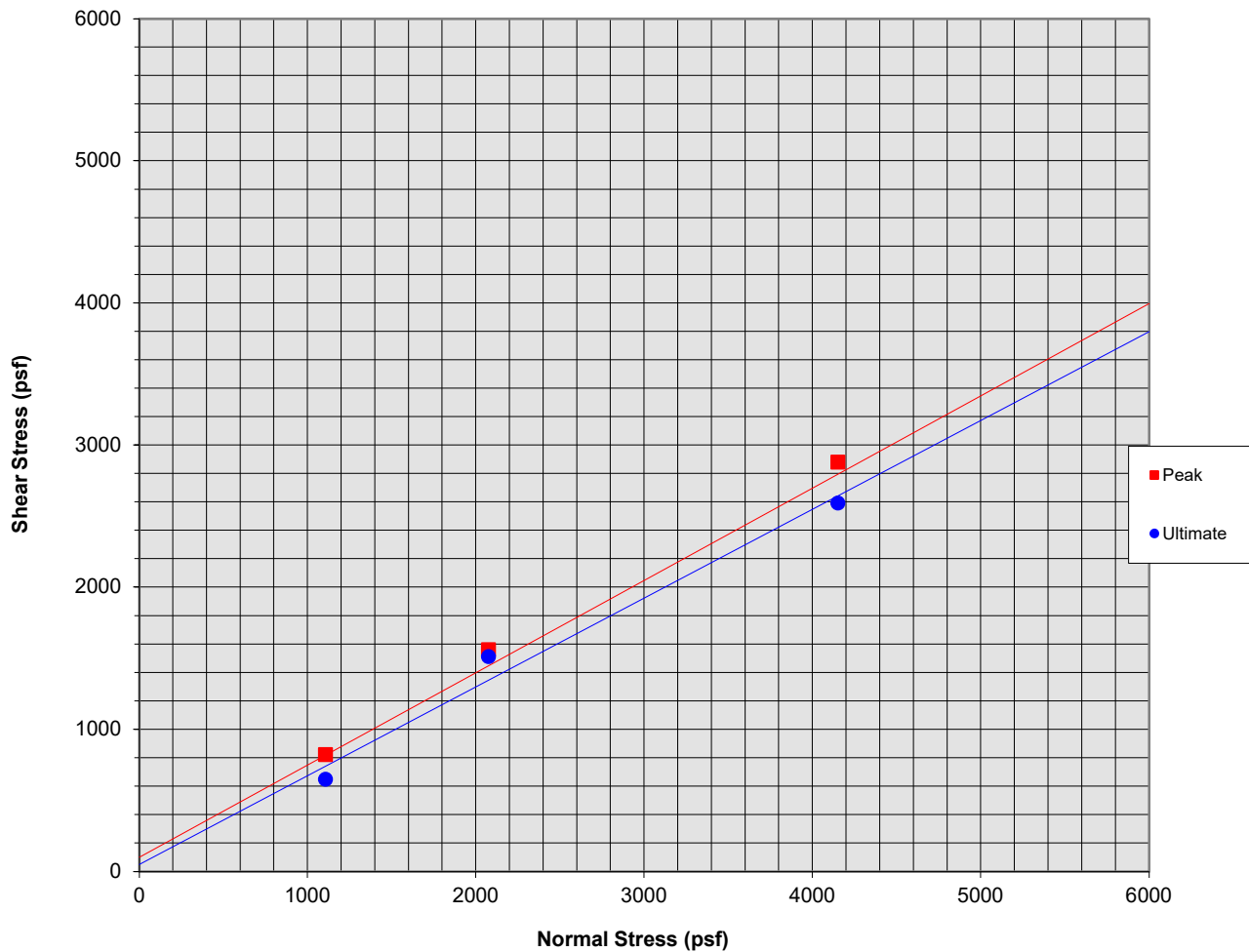
Western Way Widening and Improvements  
Perris, California  
Project No. 24G166

**PLATE C- 3**



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CALIFORNIA  
GEOTECHNICAL**  
A California Corporation

### Direct Shear Test Results (Undisturbed)



Sample Description: B-5 @ 5 to 6 feet

Classification: Sandy Silt (SM), Brown, fine to medium grained Sand, trace Clay

Sample Data

Test Results

Initial Moisture Content	7.0
Final Moisture Content	16.0
Initial Dry Density	119.0
Final Dry Density	--
Specimen Diameter (in)	2.4
Specimen Thickness (in)	1.0

	Peak	Ultimate
$\phi$ (°)	33.0	32.0
C (psf)	100	50

Western Way Widening and Improvements  
Perris, California  
Project No. 24G166

**PLATE C- 4**



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CALIFORNIA  
GEOTECHNICAL**  
A California Corporation

## **GRADING GUIDE SPECIFICATIONS**

These grading guide specifications are intended to provide typical procedures for grading operations. They are intended to supplement the recommendations contained in the geotechnical investigation report for this project. Should the recommendations in the geotechnical investigation report conflict with the grading guide specifications, the more site specific recommendations in the geotechnical investigation report will govern.

### General

- The Earthwork Contractor is responsible for the satisfactory completion of all earthwork in accordance with the plans and geotechnical reports, and in accordance with city, county, and applicable building codes.
- The Geotechnical Engineer is the representative of the Owner/Builder for the purpose of implementing the report recommendations and guidelines. These duties are not intended to relieve the Earthwork Contractor of any responsibility to perform in a workman-like manner, nor is the Geotechnical Engineer to direct the grading equipment or personnel employed by the Contractor.
- The Earthwork Contractor is required to notify the Geotechnical Engineer of the anticipated work and schedule so that testing and inspections can be provided. If necessary, work may be stopped and redone if personnel have not been scheduled in advance.
- The Earthwork Contractor is required to have suitable and sufficient equipment on the job-site to process, moisture condition, mix and compact the amount of fill being placed to the approved compaction. In addition, suitable support equipment should be available to conform with recommendations and guidelines in this report.
- Canyon cleanouts, overexcavation areas, processed ground to receive fill, key excavations, subdrains and benches should be observed by the Geotechnical Engineer prior to placement of any fill. It is the Earthwork Contractor's responsibility to notify the Geotechnical Engineer of areas that are ready for inspection.
- Excavation, filling, and subgrade preparation should be performed in a manner and sequence that will provide drainage at all times and proper control of erosion. Precipitation, springs, and seepage water encountered shall be pumped or drained to provide a suitable working surface. The Geotechnical Engineer must be informed of springs or water seepage encountered during grading or foundation construction for possible revision to the recommended construction procedures and/or installation of subdrains.

### Site Preparation

- The Earthwork Contractor is responsible for all clearing, grubbing, stripping and site preparation for the project in accordance with the recommendations of the Geotechnical Engineer.
- If any materials or areas are encountered by the Earthwork Contractor which are suspected of having toxic or environmentally sensitive contamination, the Geotechnical Engineer and Owner/Builder should be notified immediately.

- Major vegetation should be stripped and disposed of off-site. This includes trees, brush, heavy grasses and any materials considered unsuitable by the Geotechnical Engineer.
- Underground structures such as basements, cesspools or septic disposal systems, mining shafts, tunnels, wells and pipelines should be removed under the inspection of the Geotechnical Engineer and recommendations provided by the Geotechnical Engineer and/or city, county or state agencies. If such structures are known or found, the Geotechnical Engineer should be notified as soon as possible so that recommendations can be formulated.
- Any topsoil, slopewash, colluvium, alluvium and rock materials which are considered unsuitable by the Geotechnical Engineer should be removed prior to fill placement.
- Remaining voids created during site clearing caused by removal of trees, foundations basements, irrigation facilities, etc., should be excavated and filled with compacted fill.
- Subsequent to clearing and removals, areas to receive fill should be scarified to a depth of 10 to 12 inches, moisture conditioned and compacted
- The moisture condition of the processed ground should be at or slightly above the optimum moisture content as determined by the Geotechnical Engineer. Depending upon field conditions, this may require air drying or watering together with mixing and/or discing.

#### Compacted Fills

- Soil materials imported to or excavated on the property may be utilized in the fill, provided each material has been determined to be suitable in the opinion of the Geotechnical Engineer. Unless otherwise approved by the Geotechnical Engineer, all fill materials shall be free of deleterious, organic, or frozen matter, shall contain no chemicals that may result in the material being classified as "contaminated," and shall be very low to non-expansive with a maximum expansion index (EI) of 20. The top 12 inches of the compacted fill should have a maximum particle size of 3 inches, and all underlying compacted fill material a maximum 6-inch particle size, except as noted below.
- All soils should be evaluated and tested by the Geotechnical Engineer. Materials with high expansion potential, low strength, poor gradation or containing organic materials may require removal from the site or selective placement and/or mixing to the satisfaction of the Geotechnical Engineer.
- Rock fragments or rocks less than 6 inches in their largest dimensions, or as otherwise determined by the Geotechnical Engineer, may be used in compacted fill, provided the distribution and placement is satisfactory in the opinion of the Geotechnical Engineer.
- Rock fragments or rocks greater than 12 inches should be taken off-site or placed in accordance with recommendations and in areas designated as suitable by the Geotechnical Engineer. These materials should be placed in accordance with Plate D-8 of these Grading Guide Specifications and in accordance with the following recommendations:
  - Rocks 12 inches or more in diameter should be placed in rows at least 15 feet apart, 15 feet from the edge of the fill, and 10 feet or more below subgrade. Spaces should be left between each rock fragment to provide for placement and compaction of soil around the fragments.
  - Fill materials consisting of soil meeting the minimum moisture content requirements and free of oversize material should be placed between and over the rows of rock or

concrete. Ample water and compactive effort should be applied to the fill materials as they are placed in order that all of the voids between each of the fragments are filled and compacted to the specified density.

- Subsequent rows of rocks should be placed such that they are not directly above a row placed in the previous lift of fill. A minimum 5-foot offset between rows is recommended.
- To facilitate future trenching, oversized material should not be placed within the range of foundation excavations, future utilities or other underground construction unless specifically approved by the soil engineer and the developer/owner representative.
- Fill materials approved by the Geotechnical Engineer should be placed in areas previously prepared to receive fill and in evenly placed, near horizontal layers at about 6 to 8 inches in loose thickness, or as otherwise determined by the Geotechnical Engineer for the project.
- Each layer should be moisture conditioned to optimum moisture content, or slightly above, as directed by the Geotechnical Engineer. After proper mixing and/or drying, to evenly distribute the moisture, the layers should be compacted to at least 90 percent of the maximum dry density in compliance with ASTM D-1557-78 unless otherwise indicated.
- Density and moisture content testing should be performed by the Geotechnical Engineer at random intervals and locations as determined by the Geotechnical Engineer. These tests are intended as an aid to the Earthwork Contractor, so he can evaluate his workmanship, equipment effectiveness and site conditions. The Earthwork Contractor is responsible for compaction as required by the Geotechnical Report(s) and governmental agencies.
- Fill areas unused for a period of time may require moisture conditioning, processing and recompaction prior to the start of additional filling. The Earthwork Contractor should notify the Geotechnical Engineer of his intent so that an evaluation can be made.
- Fill placed on ground sloping at a 5-to-1 inclination (horizontal-to-vertical) or steeper should be benched into bedrock or other suitable materials, as directed by the Geotechnical Engineer. Typical details of benching are illustrated on Plates D-2, D-4, and D-5.
- Cut/fill transition lots should have the cut portion overexcavated to a depth of at least 3 feet and rebuilt with fill (see Plate D-1), as determined by the Geotechnical Engineer.
- All cut lots should be inspected by the Geotechnical Engineer for fracturing and other bedrock conditions. If necessary, the pads should be overexcavated to a depth of 3 feet and rebuilt with a uniform, more cohesive soil type to impede moisture penetration.
- Cut portions of pad areas above buttresses or stabilizations should be overexcavated to a depth of 3 feet and rebuilt with uniform, more cohesive compacted fill to impede moisture penetration.
- Non-structural fill adjacent to structural fill should typically be placed in unison to provide lateral support. Backfill along walls must be placed and compacted with care to ensure that excessive unbalanced lateral pressures do not develop. The type of fill material placed adjacent to below grade walls must be properly tested and approved by the Geotechnical Engineer with consideration of the lateral earth pressure used in the design.

### Foundations

- The foundation influence zone is defined as extending one foot horizontally from the outside edge of a footing, and proceeding downward at a 1/2 horizontal to 1 vertical (0.5:1) inclination.
- Where overexcavation beneath a footing subgrade is necessary, it should be conducted so as to encompass the entire foundation influence zone, as described above.
- Compacted fill adjacent to exterior footings should extend at least 12 inches above foundation bearing grade. Compacted fill within the interior of structures should extend to the floor subgrade elevation.

### Fill Slopes

- The placement and compaction of fill described above applies to all fill slopes. Slope compaction should be accomplished by overfilling the slope, adequately compacting the fill in even layers, including the overfilled zone and cutting the slope back to expose the compacted core
- Slope compaction may also be achieved by backrolling the slope adequately every 2 to 4 vertical feet during the filling process as well as requiring the earth moving and compaction equipment to work close to the top of the slope. Upon completion of slope construction, the slope face should be compacted with a sheepsfoot connected to a sideboom and then grid rolled. This method of slope compaction should only be used if approved by the Geotechnical Engineer.
- Sandy soils lacking in adequate cohesion may be unstable for a finished slope condition and therefore should not be placed within 15 horizontal feet of the slope face.
- All fill slopes should be keyed into bedrock or other suitable material. Fill keys should be at least 15 feet wide and inclined at 2 percent into the slope. For slopes higher than 30 feet, the fill key width should be equal to one-half the height of the slope (see Plate D-5).
- All fill keys should be cleared of loose slough material prior to geotechnical inspection and should be approved by the Geotechnical Engineer and governmental agencies prior to filling.
- The cut portion of fill over cut slopes should be made first and inspected by the Geotechnical Engineer for possible stabilization requirements. The fill portion should be adequately keyed through all surficial soils and into bedrock or suitable material. Soils should be removed from the transition zone between the cut and fill portions (see Plate D-2).

### Cut Slopes

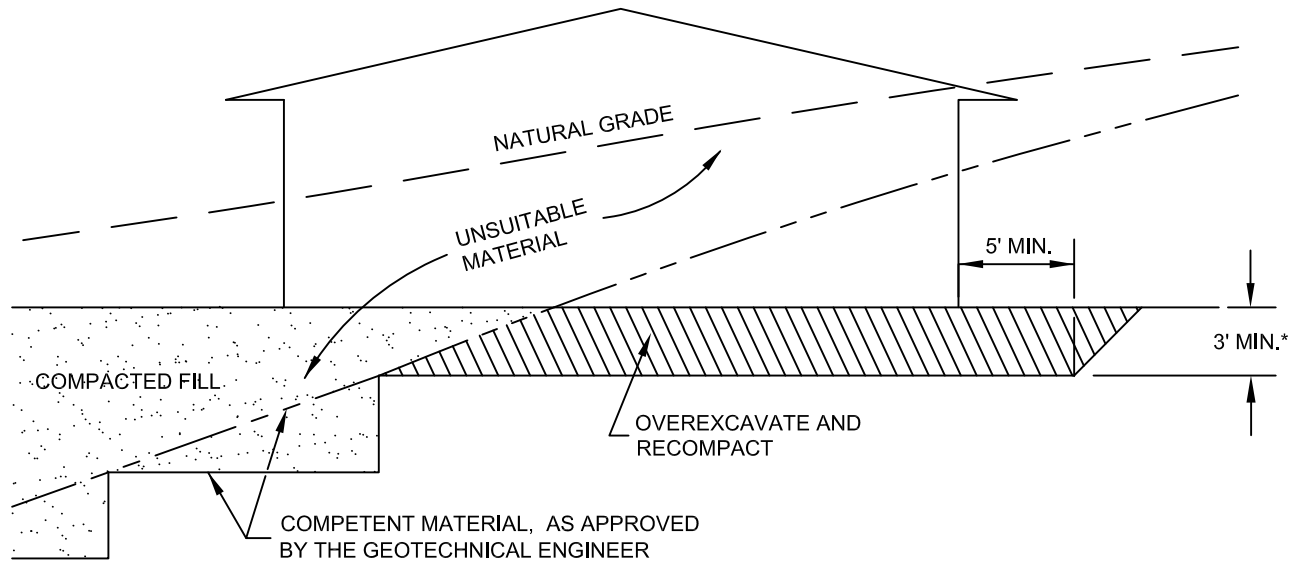
- All cut slopes should be inspected by the Geotechnical Engineer to determine the need for stabilization. The Earthwork Contractor should notify the Geotechnical Engineer when slope cutting is in progress at intervals of 10 vertical feet. Failure to notify may result in a delay in recommendations.
- Cut slopes exposing loose, cohesionless sands should be reported to the Geotechnical Engineer for possible stabilization recommendations.

- All stabilization excavations should be cleared of loose slough material prior to geotechnical inspection. Stakes should be provided by the Civil Engineer to verify the location and dimensions of the key. A typical stabilization fill detail is shown on Plate D-5.
- Stabilization key excavations should be provided with subdrains. Typical subdrain details are shown on Plates D-6.

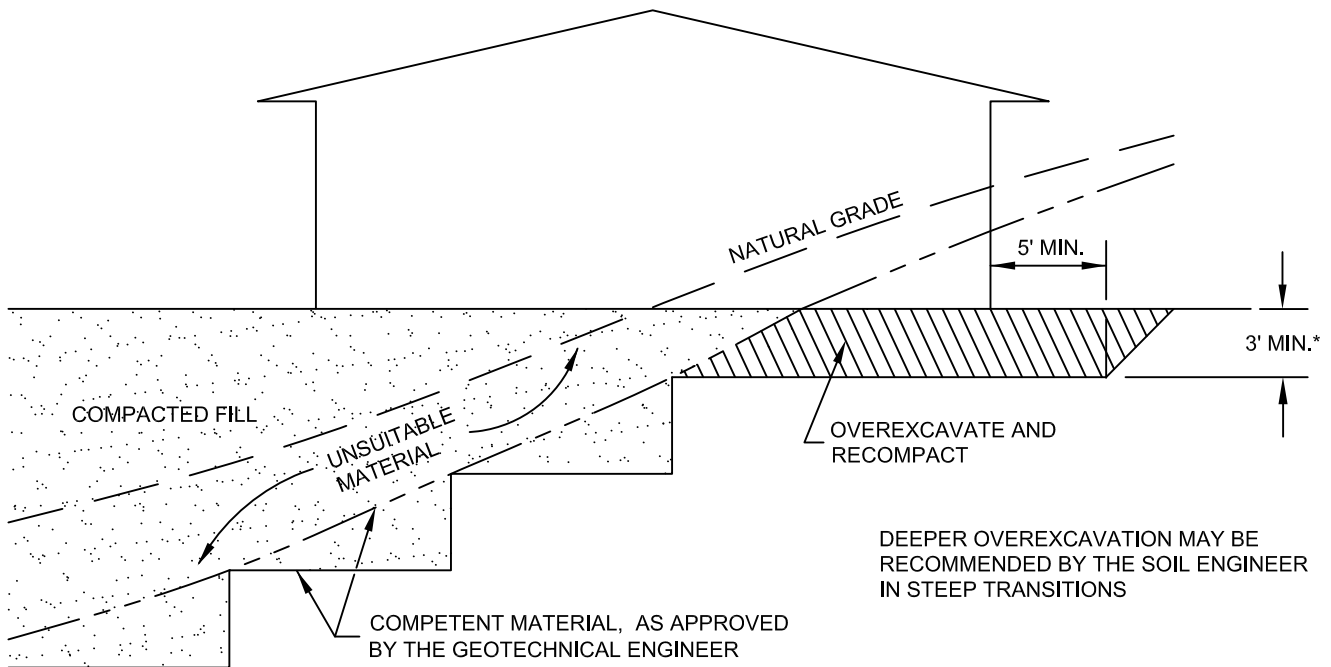
#### Subdrains

- Subdrains may be required in canyons and swales where fill placement is proposed. Typical subdrain details for canyons are shown on Plate D-3. Subdrains should be installed after approval of removals and before filling, as determined by the Soils Engineer.
- Plastic pipe may be used for subdrains provided it is Schedule 40 or SDR 35 or equivalent. Pipe should be protected against breakage, typically by placement in a square-cut (backhoe) trench or as recommended by the manufacturer.
- Filter material for subdrains should conform to CALTRANS Specification 68-1.025 or as approved by the Geotechnical Engineer for the specific site conditions. Clean  $\frac{3}{4}$ -inch crushed rock may be used provided it is wrapped in an acceptable filter cloth and approved by the Geotechnical Engineer. Pipe diameters should be 6 inches for runs up to 500 feet and 8 inches for the downstream continuations of longer runs. Four-inch diameter pipe may be used in buttress and stabilization fills.

CUT LOT

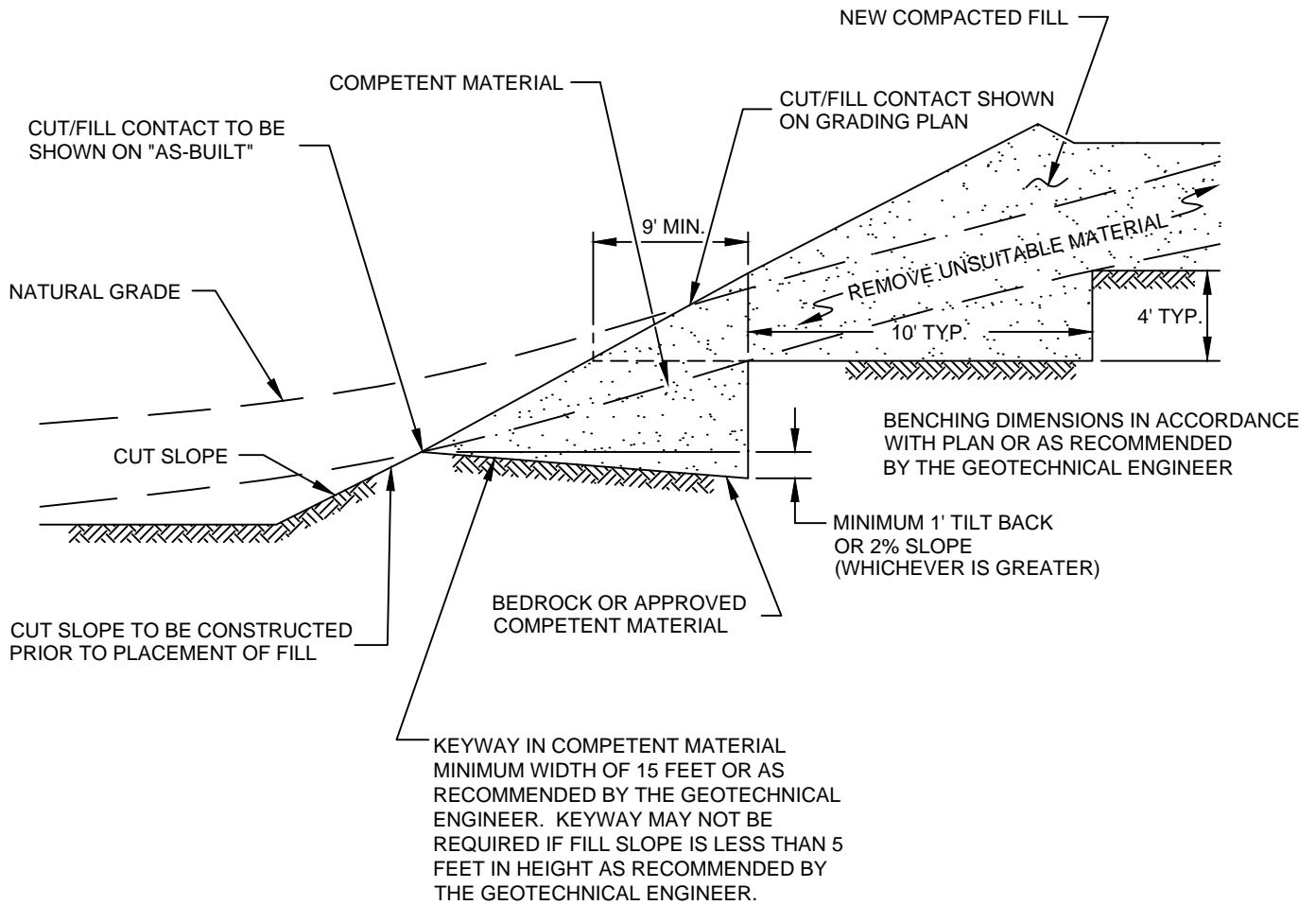


CUT/FILL LOT (TRANSITION)

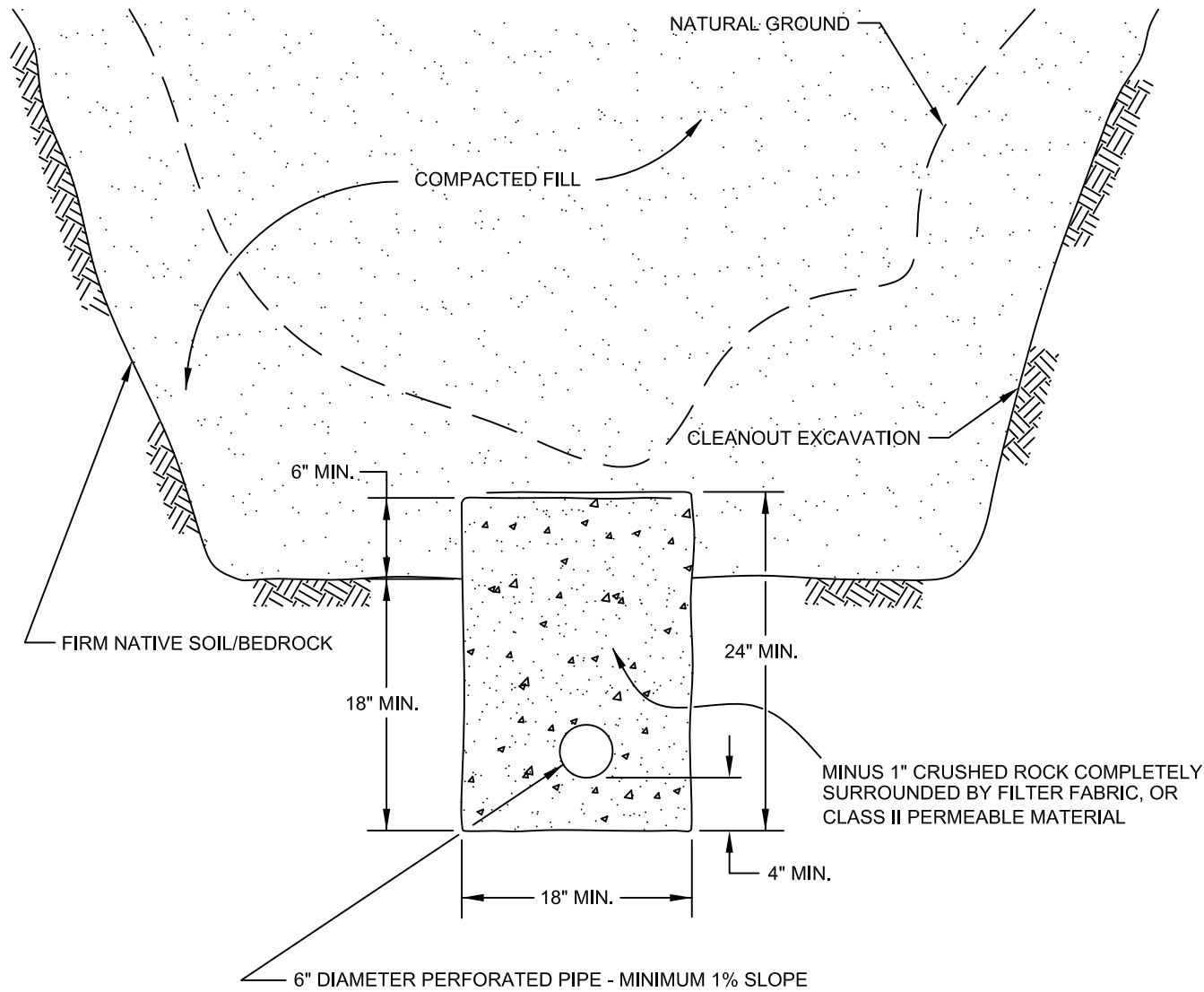


\*SEE TEXT OF REPORT FOR SPECIFIC RECOMMENDATION.  
ACTUAL DEPTH OF OVEREXCAVATION MAY BE GREATER.

<b>TRANSITION LOT DETAIL</b>	
GRADING GUIDE SPECIFICATIONS	
NOT TO SCALE	 <b>SOUTHERN CALIFORNIA GEOTECHNICAL</b>
DRAWN: JAS CHKD: GKM	
<b>PLATE D-1</b>	




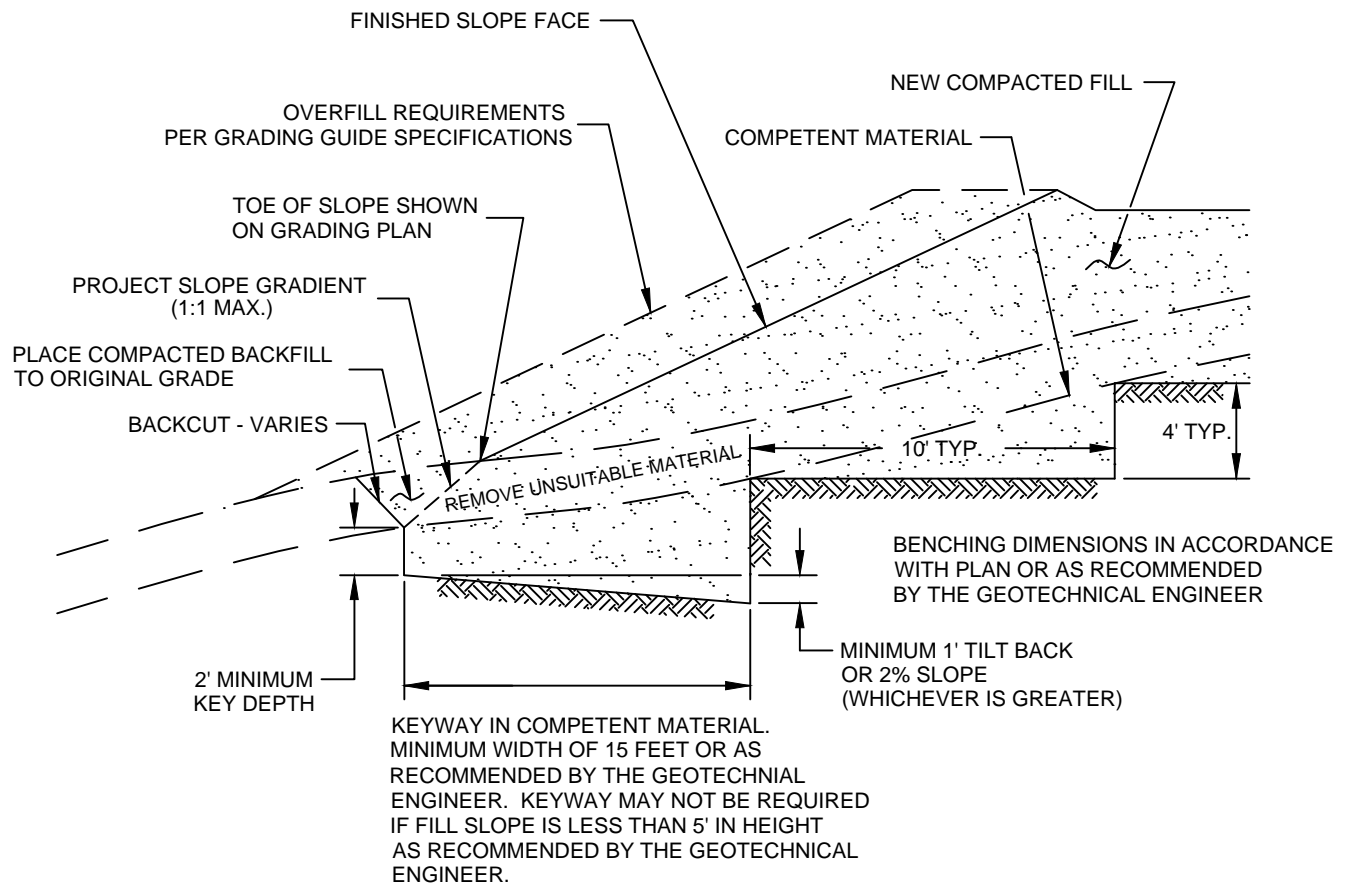
<b>FILL ABOVE CUT SLOPE DETAIL</b>	
<b>GRADING GUIDE SPECIFICATIONS</b>	
NOT TO SCALE	 <b>SOUTHERN CALIFORNIA GEOTECHNICAL</b>
DRAWN: JAS CHKD: GKM	
<b>PLATE D-2</b>	




PIPE MATERIAL	DEPTH OF FILL OVER SUBDRAIN
ADS (CORRUGATED POLETHYLENE)	8
TRANSITE UNDERDRAIN	20
PVC OR ABS: SDR 35	35
SDR 21	100

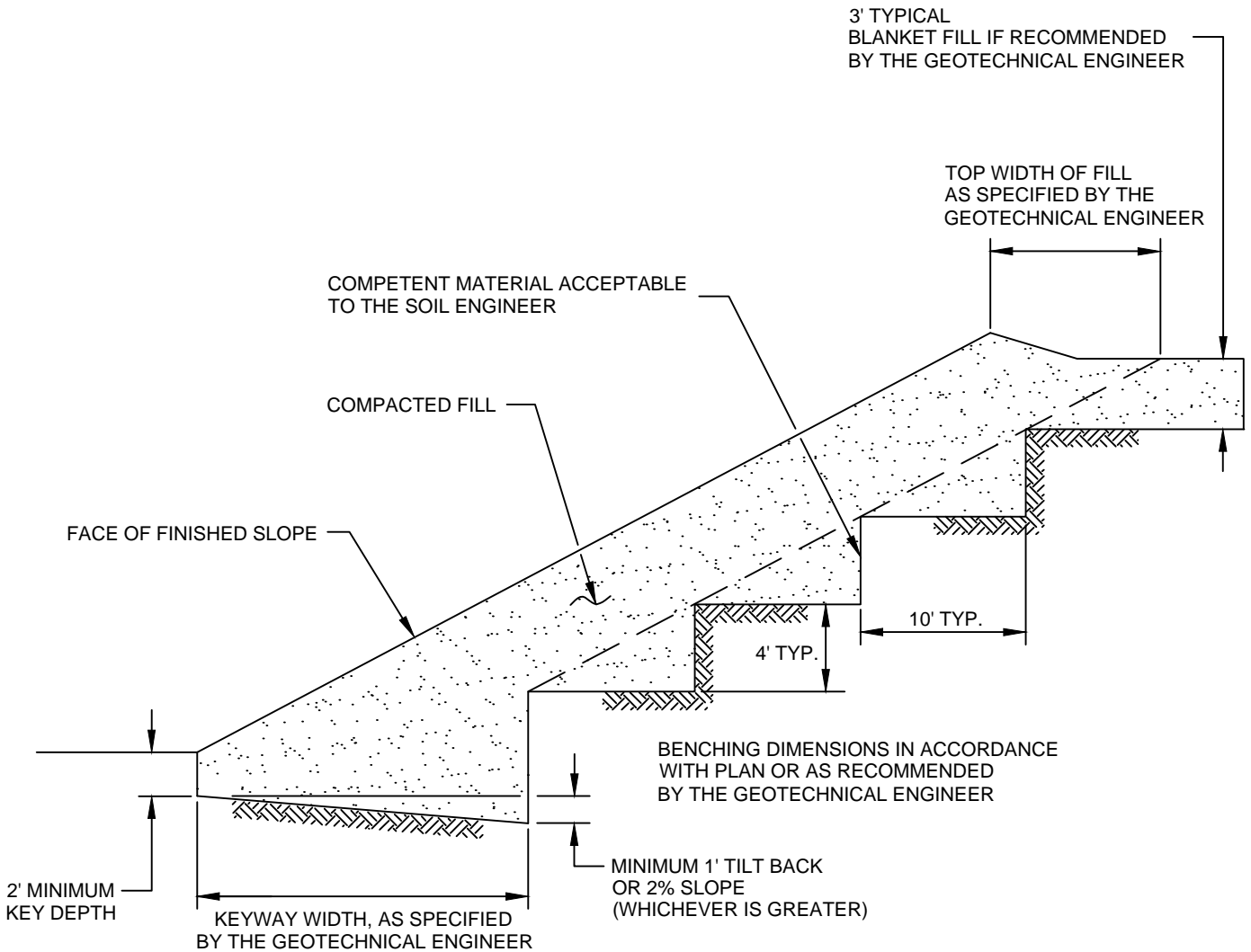
**SCHEMATIC ONLY  
NOT TO SCALE**

<b>CANYON SUBDRAIN DETAIL</b>	
<b>GRADING GUIDE SPECIFICATIONS</b>	
NOT TO SCALE	 <b>SOUTHERN CALIFORNIA GEOTECHNICAL</b>
DRAWN: JAS CHKD: GKM	
<b>PLATE D-3</b>	

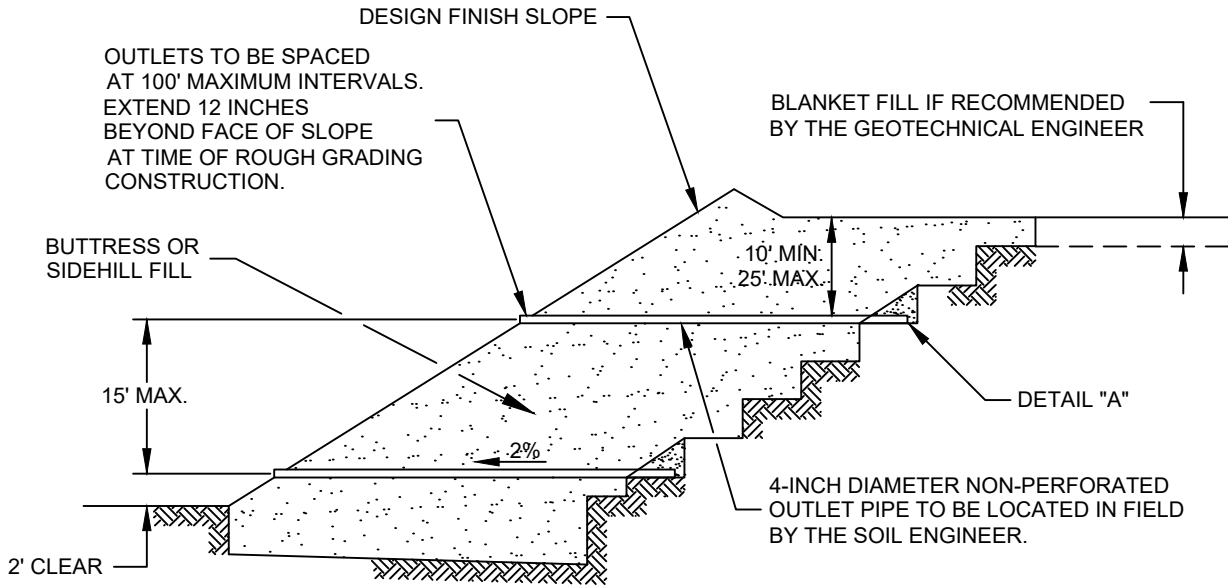


NOTE:  
 BENCHING SHALL BE REQUIRED  
 WHEN NATURAL SLOPES ARE  
 EQUAL TO OR STEEPER THAN 5:1  
 OR WHEN RECOMMENDED BY  
 THE GEOTECHNICAL ENGINEER.

<b>FILL ABOVE NATURAL SLOPE DETAIL</b>	
GRADING GUIDE SPECIFICATIONS	
NOT TO SCALE	 <b>SOUTHERN CALIFORNIA GEOTECHNICAL</b>
DRAWN: JAS CHKD: GKM	
<b>PLATE D-4</b>	



<b>STABILIZATION FILL DETAIL</b>	
GRADING GUIDE SPECIFICATIONS	
NOT TO SCALE	 <b>SOUTHERN CALIFORNIA GEOTECHNICAL</b>
DRAWN: JAS CHKD: GKM	
<b>PLATE D-5</b>	



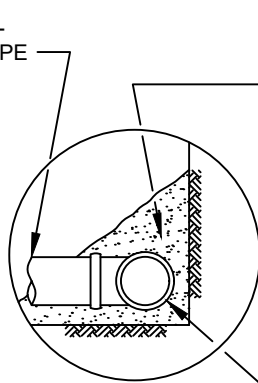
"FILTER MATERIAL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT: (CONFORMS TO EMA STD. PLAN 323)

SIEVE SIZE	PERCENTAGE PASSING
1"	100
3/4"	90-100
3/8"	40-100
NO. 4	25-40
NO. 8	18-33
NO. 30	5-15
NO. 50	0-7
NO. 200	0-3

"GRAVEL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT:

SIEVE SIZE	MAXIMUM PERCENTAGE PASSING
1 1/2"	100
NO. 4	50
NO. 200	8
SAND EQUIVALENT = MINIMUM OF 50	

OUTLET PIPE TO BE CONNECTED TO SUBDRAIN PIPE WITH TEE OR ELBOW



DETAIL "A"

FILTER MATERIAL - MINIMUM OF FIVE CUBIC FEET PER FOOT OF PIPE. SEE ABOVE FOR FILTER MATERIAL SPECIFICATION.


ALTERNATIVE: IN LIEU OF FILTER MATERIAL FIVE CUBIC FEET OF GRAVEL PER FOOT OF PIPE MAY BE ENCASED IN FILTER FABRIC. SEE ABOVE FOR GRAVEL SPECIFICATION.

FILTER FABRIC SHALL BE MIRAFI 140 OR EQUIVALENT. FILTER FABRIC SHALL BE LAPPED A MINIMUM OF 12 INCHES ON ALL JOINTS.

MINIMUM 4-INCH DIAMETER PVC SCH 40 OR ABS CLASS SDR 35 WITH A CRUSHING STRENGTH OF AT LEAST 1,000 POUNDS, WITH A MINIMUM OF 8 UNIFORMLY SPACED PERFORATIONS PER FOOT OF PIPE INSTALLED WITH PERFORATIONS ON BOTTOM OF PIPE. PROVIDE CAP AT UPSTREAM END OF PIPE. SLOPE AT 2 PERCENT TO OUTLET PIPE.

NOTES:

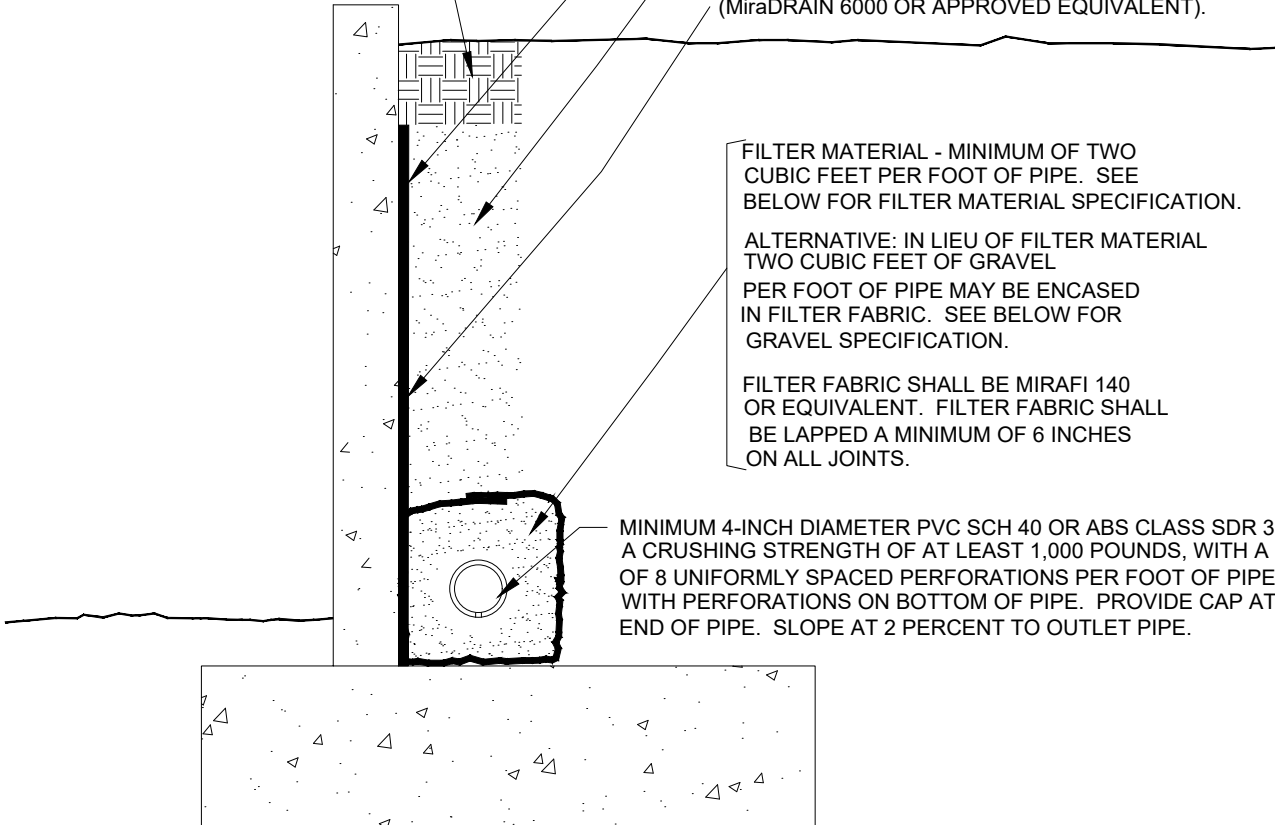
- TRENCH FOR OUTLET PIPES TO BE BACKFILLED WITH ON-SITE SOIL.

SLOPE FILL SUBDRAINS	
GRADING GUIDE SPECIFICATIONS	
NOT TO SCALE	 <b>SOUTHERN CALIFORNIA GEOTECHNICAL</b>
DRAWN: JAS CHKD: GKM	
PLATE D-6	

MINIMUM ONE FOOT THICK LAYER OF LOW PERMEABILITY SOIL IF NOT COVERED WITH AN IMPERMEABLE SURFACE

WATERPROOFING AT FACE OF WALL IN ACCORDANCE WITH ARCHITECTURAL AND/OR STRUCTURAL DETAILS

MINIMUM ONE FOOT WIDE LAYER OF FREE DRAINING MATERIAL (LESS THAN 5% PASSING THE #200 SIEVE) OR PROPERLY INSTALLED PREFABRICATED DRAINAGE COMPOSITE (MiraDRAIN 6000 OR APPROVED EQUIVALENT).



FILTER MATERIAL - MINIMUM OF TWO CUBIC FEET PER FOOT OF PIPE. SEE BELOW FOR FILTER MATERIAL SPECIFICATION.

ALTERNATIVE: IN LIEU OF FILTER MATERIAL TWO CUBIC FEET OF GRAVEL PER FOOT OF PIPE MAY BE ENCASED IN FILTER FABRIC. SEE BELOW FOR GRAVEL SPECIFICATION.

FILTER FABRIC SHALL BE MIRAFI 140 OR EQUIVALENT. FILTER FABRIC SHALL BE LAPPED A MINIMUM OF 6 INCHES ON ALL JOINTS.


MINIMUM 4-INCH DIAMETER PVC SCH 40 OR ABS CLASS SDR 35 WITH A CRUSHING STRENGTH OF AT LEAST 1,000 POUNDS, WITH A MINIMUM OF 8 UNIFORMLY SPACED PERFORATIONS PER FOOT OF PIPE INSTALLED WITH PERFORATIONS ON BOTTOM OF PIPE. PROVIDE CAP AT UPSTREAM END OF PIPE. SLOPE AT 2 PERCENT TO OUTLET PIPE.

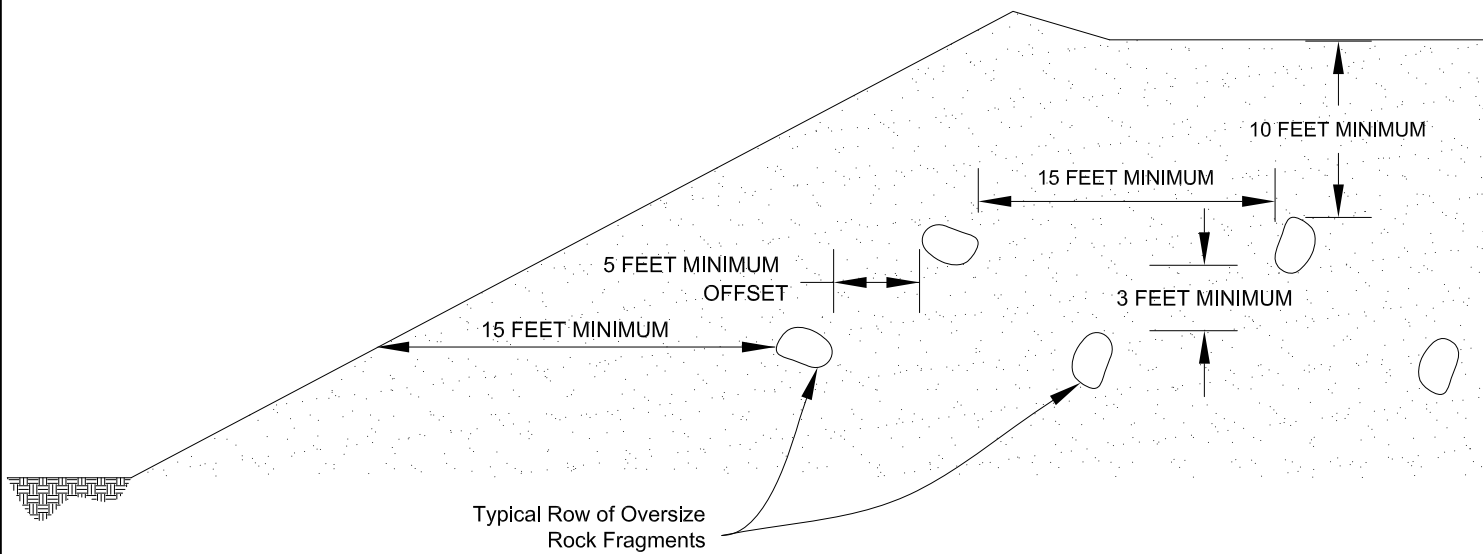
"FILTER MATERIAL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT: (CONFORMS TO EMA STD. PLAN 323)

SIEVE SIZE	PERCENTAGE PASSING
1"	100
3/4"	90-100
3/8"	40-100
NO. 4	25-40
NO. 8	18-33
NO. 30	5-15
NO. 50	0-7
NO. 200	0-3

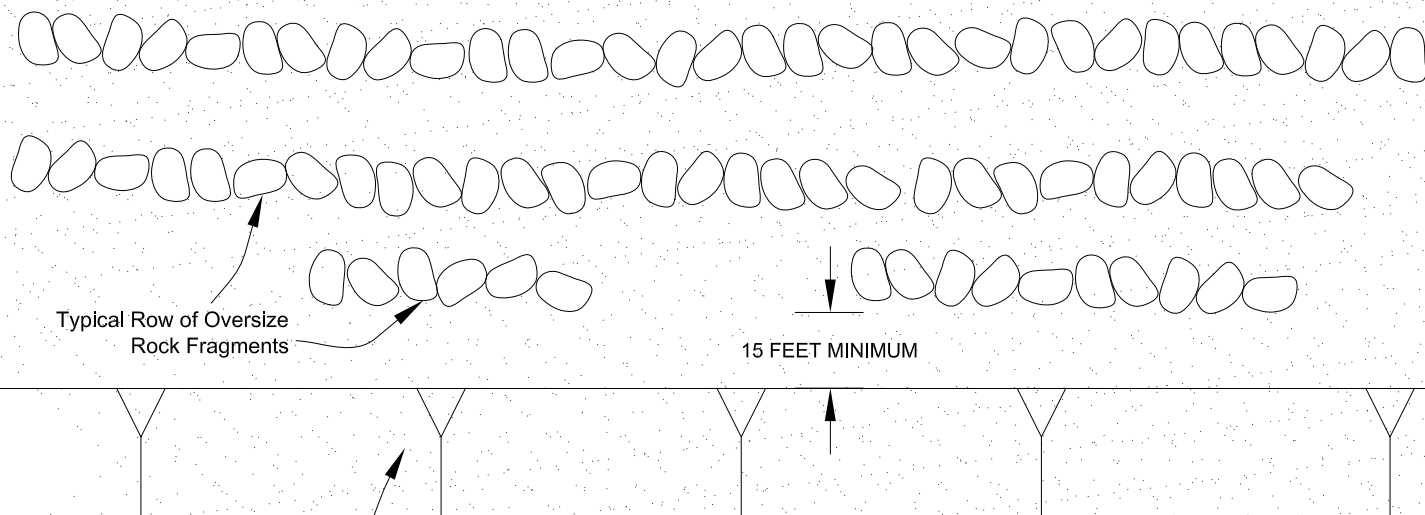
"GRAVEL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT:

SIEVE SIZE	MAXIMUM PERCENTAGE PASSING
1 1/2"	100
NO. 4	50
NO. 200	8
SAND EQUIVALENT = MINIMUM OF 50	

RETAINING WALL BACKDRAINS	
GRADING GUIDE SPECIFICATIONS	
NOT TO SCALE	 <b>SOUTHERN CALIFORNIA GEOTECHNICAL</b>
DRAWN: JAS CHKD: GKM	
PLATE D-7	



**Section View**



**Plan View**

**PLACEMENT OF OVERSIZED MATERIAL  
GRADING GUIDE SPECIFICATIONS**

NOT TO SCALE

DRAWN: PM  
CHKD: GKM

PLATE D-8



**SOUTHERN  
CALIFORNIA  
GEOTECHNICAL**