Appendix F1

Geotechnical Report

GEOTECHNICAL EVALUATION

Proposed "Sunrise" Residential Development
Assessor's Parcel Numbers (APNs): 228-312-18-05, -09 and -10
City of San Marcos, County of San Diego, California 92078

August 3, 2017

EEI Project Number IPF-72446.4.

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GEOTECHNICAL EVALUATION

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Subject Property Location:

Proposed "Sunrise" Residential Development
Assessor's Parcel Numbers (APNs) 228-312-05, -09 and -10
San Marcos, San Diego County, California

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Distribution: (1) Addressee via an electronic copy

1.0 INTRODUCTION

1.1 Purpose

The purpose of this Geotechnical Evaluation is to provide preliminary geotechnical information to Integral Communities ("Client") regarding the subject property in the City of San Marcos, San Diego County, California. The information gathered in this evaluation is intended to provide the Client with an understanding of the physical conditions of site-specific subsurface soils, groundwater, and the regional geologic setting which could affect the cost or design of the proposed development at the property (**Figure 1** -Site Vicinity Map, **Figure 2**-Aerial Site Map).

This Geotechnical Evaluation has been conducted in general accordance with accepted geotechnical engineering principles and in general conformance with the approved proposal and cost estimate for the project by EEI, dated June 7, 2017.

EEI conducted onsite field exploration on July 7, 2017 and July 8, 2017, that included drilling and sampling of ten hollow-stem auger geotechnical borings for the proposed development at the subject property. We conducted three percolation tests in conjunction with our field exploration. This Geotechnical Evaluation has been prepared for the sole use of Integral Communities. Other parties, without the express written consent of EEI and Integral Communities should not rely upon this Geotechnical Evaluation.

1.2 Project Description

Based on information provided by you and a site plan titled "Sunrise Conceptual Model" by Excel Engineering, not dated, we understand that development of the subject property will consist of new residential lots, paved roadways, retaining walls, stormwater basins and other associated improvements. No other information is known at this time.

No detailed grading plans were provided to EEI at the time of our preparation of this report; however, based on the referenced site conceptual plan by Excel Engineering grading is anticipated to include cuts on the order of approximately 25 feet and fills of up to 30 feet across the subject property (exclusive of remedial grading). No foundation plans were provided to EEI at the time of report preparation; however, foundation loads are assumed to be typical for the type of construction.

1.3 Scope of Services

The scope of our services included:

- A review of readily available data pertinent to the subject property, including published and unpublished geologic reports/maps, and soils data for the area (**References**).
- Conducting a geotechnical reconnaissance of the subject property and nearby vicinity.
- Coordination with Underground Service Alert (USA) to identify the presence of underground utilities for clearance of proposed boring locations.

- Drilling and logging of ten small diameter exploratory borings in readily accessible areas of the subject property to depths of approximately 8 feet to 21.5 feet below the ground surface (bgs), including conducting percolation testing at three of the boring locations. The approximate locations of each of our borings and percolation tests are presented on **Figure 3** (Field Exploration Plan).

- An evaluation of seismicity and geologic hazards including an evaluation of faulting and liquefaction potential.

- Completion of laboratory testing of representative earth materials encountered onsite to ascertain their pertinent soils engineering properties, including corrosion potential (**Appendix B**).

- The preparation of this report which presents our preliminary findings, conclusions, and recommendations.

2.0 BACKGROUND

2.1 Subject Property Description

Based on the information provided by Integral Communities ("Client") and a review of the GoogleEarth® online imagery, the overall subject property is located southwest of the intersection between Barham Drive and Meyers Avenue in the City of San Marcos, San Diego County, California. The subject property comprises roughly 19.3 acres and is identified by the Assessor's Parcel Numbers (APNs) is 228-312-05, -09, and -10. The property is currently undeveloped land. The property is bordered by a variety of single-family properties to the north and west, and by commercial development land to east and south.

The center of the subject property is approximately situated at 33.1294° north latitude and 117.1301° west longitude (GoogleEarth®, 2016).

2.2 Topography

The subject property is located within the 7.5 minute San Marcos, California Quadrangle at an elevation ranging from approximately 700 to 815 feet (GoogleEarth®, 2016). Based on the Conceptual Plan prepared by Excel Engineering, (2017) for the property, the ground surface at the property generally descends from the southwest to the northeast and ranges in elevation from approximately 700 to 815 feet (NAVD88).

3.0 FIELD EXPLORATION, SUBSURFACE CONDITIONS AND LABORATORY TESTING

3.1 Field Exploration

Field work for our Geotechnical Evaluation was conducted on July 7, 2017 and July 8, 2017. A total of ten hollow-stem auger borings were advanced at the subject property. Boring depths ranged from approximately 8 to 21.5 feet bgs and were logged under the supervision of a Registered Professional Engineer and Certified Engineering Geologist at EEI. Refusal on very dense decomposed granitic rock materials (tonalite) was encountered in exploratory borings B-4, B-5 and B-6. The approximate locations of the borings are shown on **Figure 3**.

A truck mounted hollow-stem auger (HSA) drill rig was used to advance the exploratory borings, designated B-1/P-1 through B-10. Blow count (N) values were determined utilizing a 140-pound hammer, falling 30-inches onto a Standard Penetration Test (SPT) split-spoon sampler and a Modified California split-tube sampler. The blows per 6-inch increment required to advance the 18-inch long SPT and 18-inch long Modified California split-tube samplers were measured at various depth intervals (varying between 2 to 10 feet), or at changes in lithology, recorded on the boring logs, and are presented in **Appendix A** (Soil Classification Chart and Boring Logs). Energy-corrected SPT N_{60} values are also presented on the borings logs.

Relatively "undisturbed" samples were collected in a 2.42-inch (inside diameter) California Modified split-tube sampler for visual examination and laboratory testing. The soils were classified in accordance with the Unified Soil Classification System (ASTM, 2015). Representative bulk samples were also collected for appropriate laboratory testing.

3.2 Laboratory Testing

Selected samples obtained from our borings were tested to evaluate pertinent soil classification and engineering properties and enable development of geotechnical conclusions and recommendations. The laboratory tests consisted of:

- Moisture Content and Dry Density
- Maximum Dry Density and Optimum Moisture Content
- Expansion Index
- Direct Shear
- Corrosivity
- R-Value

The results of the laboratory tests, and brief explanations of test procedures, are presented in **Appendix B**. It should be understood that the results provided in **Appendix B** are based upon pre-development conditions. Verification testing is recommended at the conclusion of grading on samples collected at or near finish grade.

4.0 GEOLOGIC SETTING AND SUBSURFACE CONDITIONS

4.1 Geologic Setting

Regionally, the subject property lies within the Peninsular Ranges Geomorphic Province of southern California. This province consists of a series of ranges separated by northwest trending valleys; sub parallel to branches of the San Andreas Fault (CGS, 2002). The Peninsular Ranges geomorphic province, one of the largest geomorphic units in western North America, extends from the Transverse Ranges geomorphic province and the Los Angeles Basin, south to Baja California. It is bound 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 (CGS, 2002). Major fault zones and subordinate fault zones found in the Peninsular Ranges Province typically trend in a northwest-southeast direction.

Regional geologic maps of the subject property and vicinity (published by the California Geological Survey) indicate the property is underlain by Cretaceous-age undivided tonalite materials (decomposed granitic rock, map symbol Kt). These tonalite materials are considered massive, and typically comprise coarse-grained, light-gray hornblende-biotite tonalite.

4.2 Subsurface Conditions

The subsurface materials encountered in our exploratory borings consisted of localized topsoil and middle Cretaceous-aged decomposed granitic rock materials (tonalite). A brief description of the subsurface conditions is provided in the following section. Detailed descriptions of the subsurface conditions are provided on the boring logs included in **Appendix A**.

Topsoil – As encountered in our exploratory borings B-1 through B-7, the observed topsoils were generally comprised of orange brown silty-sands with local clayey sands and sandy clay. These materials were observed to be typically dry to slightly moist at the time of our subsurface exploration.

Weathered Granitics (Tonalite) – As encountered in our exploratory borings, the decomposed granitic rock materials (tonalite) were observed to consist of light brown, orange- brown, gray, fine to coarse-grained highly weathered tonalite which excavated to mixed sands. The tonalite materials were observed to be typically slightly moist to moist, and dense to very dense. The tonalite materials were encountered at the surface in exploratory borings B-8, B-9, and B-10, and underlying the topsoil in the remaining borings. Refusal on the tonalite (decomposed granitic rock) was encountered in exploratory borings B-4, B-5 and B-6.

4.3 Groundwater

Static groundwater was not encountered in any of our exploratory borings to a depth of 21.5 feet bgs at the time of exploration. However, minor seepage was noted in boring B-4 at a depth of approximately 11.5 feet bgs. It should be noted that variations in groundwater may result from fluctuations in the ground surface topography, subsurface stratification, rainfall, irrigation, and other factors that may not have been evident at the time of our subsurface exploration.

5.0 GEOLOGIC HAZARDS

5.1 California Building Code Seismic Design Parameters

EEI utilized seismic design criteria provided in the CBC (2016) and ASCE 7-10. Final selection of the appropriate seismic design coefficients should be made by the structural consultant based on the local laws and ordinances, expected building response, and desired level of conservatism. The site coefficients and adjusted maximum considered earthquake spectral response accelerations in accordance with the 2016 California Building Code are presented in **Table 1**.

TABLE 1
2016 CBC Seismic Parameters and Peak Ground Acceleration

Parameter	Value
Site Coordinates	Latitude 33.1279° Longitude -117.1385°
Mapped Spectral Acceleration Value at Short Period: $\mathbf{S_s}$	1.016g
Mapped Spectral Acceleration Value at 1-Second Period: $\mathbf{S_1}$	0.396g
Site Classification	C
Short Period Site Coefficient: $\mathbf{F_a}$	1.000
1-Second Period Site Coefficient: $\mathbf{F_v}$	1.404
Design Spectral Response Acceleration at Short Periods: $\mathbf{S_{DS}}$	0.678g
Design Spectral Response Acceleration at 1-Second Period: $\mathbf{S_{D1}}$	0.371g
Peak Ground Acceleration adjusted for Site Class Effects: $\mathbf{PGA_M}$	0.388g

5.2 Faulting and Surface Rupture

The subject property is located within an area of California known to contain a number of active and potentially active faults. There are no known active faults crossing the property (Jennings and Bryant, 2010) and the property is not within a State of California Earthquake Fault Zone (Hart and Bryant, 1997; CDMG, 2000). The closest known active fault is the Rose Canyon Fault Zone, located offshore approximately 13.2 miles west of the property (USGS, 2008). Therefore, the potential for surface rupture at the property is considered low. Three of the closest faults along with their distance from the property and Maximum Magnitude are shown in **Table 2.**

Table 2
Nearby Active Faults

Fault	Distance in Miles (Kilometers)[1]	Maximum Magnitude[1]
Rose Canyon Fault	13.67 (22.0)	6.9
Newport Inglewood Connected Alt 1	13.67 (22.0)	7.5
Newport Inglewood Connected Alt 2	13.67 (22.0)	7.5

1. USGS Online Fault Search (2008)

5.3 Landslides and Slope Stability

The subject property and surrounding areas are slightly to moderately sloping. However, the property is underlain at shallow depths by hard/very dense granitic bedrock (tonalite) that is considered to be massive. As a result, we consider the potential for landslides or slope instabilities to occur at the property to be negligible.

5.4 Liquefaction and Dynamic Settlement

Liquefaction occurs when loose, saturated, generally fine sands and silts are subjected to strong ground shaking. The soils lose shear strength and become liquid; potentially resulting in large total and differential ground surface settlements as well as possible lateral spreading during an earthquake. Seismically induced settlement can occur in response to liquefaction of saturated loose granular soils, as well as the reorientation of soil particles during strong shaking of loose, unsaturated sands. Due to the lack of shallow groundwater and the relatively dense granitic bedrock (tonalite) material at the subject property the potential for liquefaction and dynamic settlement to occur is considered very low.

5.5 Tsunamis, Flooding and Seiches

The subject property is not located within a Tsunami Evacuation Area or FEMA Flood Zone; therefore, damage due to tsunamis and flooding is considered low.

EEI reviewed the Federal Emergency Management Agency (FEMA, 2012) Flood Insurance Rate Map (FIRM) panel 06073C0794G to determine if the subject property was located within an area designated as a Flood Hazard Zone. The property is within Zone X described as an area determined to be outside the 0.2 percent annual chance floodplain.

Seiches are periodic oscillations in large bodies of water such as lakes, harbors, bays, or reservoirs. The subject property is not located immediately adjacent to any lakes or confined bodies of water; therefore, the potential for a seiche to affect the site is considered low.

5.6 Expansive Soil

Laboratory test results indicate the near surface onsite soils have a very low expansion potential. The expansion potential of these materials is not considered to pose a hazard for the proposed development.

6.0 CONCLUSIONS

Based on our field exploration, laboratory testing and engineering and geologic analysis, it is our opinion that the subject property is suitable for the proposed residential development project from a geotechnical engineering and geologic viewpoint; however, there are existing geotechnical conditions associated with the property that will warrant mitigation and/or consideration during planning stages. If site plans and/or the proposed building locations are revised, additional field studies may be warranted to address proposed site-specific conditions. The main geotechnical conclusions for the project are presented in the following text.

- A total of ten exploratory HSA borings were advanced within the subject property during this evaluation. HSA boring depths ranged from 8 to 21.5 feet below ground surface. The property is underlain by topsoil and granitic bedrock (tonalite).

- The topsoil was observed to consist of orange-brown, loose to medium dense, mixed silty sands, and minor clayey sands and sandy clays.

- The granitic bedrock materials (tonalite) were observed to consist of light brown, orange-brown, gray, fine- to coarse-grained, highly weathered granitic rock (tonalite, decomposed granitics). The tonalite materials were encountered at the surface in exploratory borings B-8, B-9, and B-10 and underlying the topsoil in the remaining borings.

- Our preliminary study should not be relied upon as a detailed evaluation of rock hardness or the excavation/rippability characteristics of the onsite granitic (tonalite) materials. Supplemental studies could be warranted to further evaluate the rock hardness or the excavation/rippability characteristics of the underlying materials in areas of planned deeper cut excavations. It is anticipated that excavations within the onsite upper surficial soil materials and the upper 10 to 20 feet of the highly weathered portions of the granitic rock can be excavated with heavy duty conventional grading equipment; however, localized areas within the granitic (tonalite) materials could encounter relatively unweathered cores and difficult rippability or blasting conditions.

- In general, the ease of rock excavation or rippability depends on various factors such as rock type, rock hardness and density, the amount of weathering, and the existence and characteristics of discontinuities such as joint spacing, foliation, or fractures.

- Due to the relatively hard and dense character of the granitic bedrock encountered onsite, it is likely that oversized rock materials will be generated during grading operations. Native earth materials appear to be suitable for use as structural fill provided they are moisture conditioned (as needed), meet EEI's recommendations for size (**Section 7.4**), and are properly compacted. Dependent upon the grading plan, some of the oversized materials may be re-used in landscape areas.

- Groundwater was not encountered in any of our exploratory borings at the time of our subsurface exploration.

- The subject property is located within an area of southern California recognized as having a number of active and potentially-active faults located nearby. Our review indicates that there are no known active faults mapped as crossing the property and the property is not located within an Earthquake Fault Zone.

- Based on EEI's evaluation, earth materials underlying the subject property are not considered susceptible to liquefaction or significant amounts of seismic settlement.

- The onsite soils are predominantly silty sands and in general are anticipated to have a very low expansion potential (EI ≤ 20). It should be noted, however, that localized clayey soils could potentially be low to medium expansive (EI > 20 to 50), and should be further evaluated during future studies or during earthwork when the proposed building pads are near finish grade.

- Based on the preliminary site plan for the proposed residential development, grading is anticipated to include cuts up to 25 feet and fills of up to 30 feet across the subject property (exclusive of remedial grading).

- The upper portions of the topsoil are variable in density, and are considered potentially compressible. As such, they are considered unsuitable for the support of settlement-sensitive structures or additional fill in their current condition. Therefore, these materials should be removed and recompacted in those areas to receive additional fill, proposed buildings and other settlement-sensitive improvements. Based on the results of our subsurface exploration, we anticipate that these removals need to extend up to approximately three feet below existing site grades. Localized areas of deeper removals may be necessary depending on field conditions encountered.

- A conventional shallow foundation system in conjunction with a concrete slab-on-grade floor appears to be suitable for support of the proposed residential buildings.

7.0 RECOMMENDATIONS

The recommendations presented herein should be incorporated into the planning and design phases of development. Guidelines for site preparation, earthwork, and onsite improvements are provided in the following sections.

7.1 General

Grading should conform to the guidelines presented in the 2016 California Building Code (CBC, 2016), as well as the requirements of the City of San Marcos and the County of San Diego. Additionally, general Earthwork and Grading Guidelines are provided herein as **Appendix C**.

During earthwork construction, removals and reprocessing of soft or unsuitable fill and topsoil materials, as well as general grading procedures of the contractor should be observed and the fill placed should be selectively tested by representatives of the geotechnical engineer, EEI. If any unusual or unexpected conditions are exposed in the field, they should be reviewed by the geotechnical engineer and if warranted, modified and/or additional recommendations will be offered. Specific guidelines and comments pertinent to the planned development are provided herein.

The recommendations presented herein have been completed using the preliminary information provided to us regarding site development. EEI should be provided with grading and foundation plans once they are available so that we can determine if the recommendations provided in this report remain applicable.

7.2 Site Preparation and Grading

Debris and other deleterious material, such as organic soils, tree rootballs and/or environmentally impacted earth materials (if any) should be removed from the subject property prior to the start of grading. Any undocumented fill encountered should be removed and if suitable, can be reused as compacted fill.

Areas to receive fill should be properly scarified and/or benched in accordance with current industry standards of practice and guidelines specified in the CBC (2016) and the requirements of the local jurisdiction.

Abandoned trenches should be properly backfilled and tested. If unanticipated subsurface improvements (utility lines, septic systems, wells, utilities, etc.) are encountered during earthwork construction, the geotechnical engineer should be informed and appropriate remedial recommendations would then be provided.

7.3 Remedial Earthwork

The upper portions of the existing topsoil are variable in density, and are considered potentially compressible. As such, they are considered unsuitable for the support of settlement-sensitive structures or additional fill in their current condition. Therefore, where not already removed by the proposed site grading, topsoil or any undocumented fill encountered should be completely removed and recompacted within the limits of grading, in those areas to receive additional fill, proposed buildings and other settlement-sensitive improvements. Based on the results of our subsurface exploration, we recommend the following removals:

Fill Lots: It is recommended that where compacted fills are planned across a lot, the topsoils should be completely removed and recompacted to a depth of approximately three feet below existing site grades prior to the placement of the additional fill.

Cut-Fill Transition Lots: It is recommended that where cut-fill transitions (daylight) are planned across the lots, the entire cut portion of the pad or daylight pad should be over-excavated to a minimum depth of three feet below finish grade or 18-inches below the bottoms of the proposed footings (whichever is deeper) and replaced with compacted fill possessing a low expansion potential. Over-excavation of transition pads is recommended in order to reduce the potential for differential settlements between cut and fill transitions.

Cut Lots: In order to provide uniform bearing conditions and to help facilitate foundation construction for the proposed cut lots at the site, we recommend that consideration be given to over-excavation of the pad to a minimum depth of three feet below finish grade or 18-inches below the bottoms of the proposed footings (whichever is deeper) and replaced with compacted fill possessing a low expansion potential.

Streets: Where not removed by planned cut excavations potentially compressible soils in the street alignments should be completely removed and recompacted. Additionally, street alignments that are cut into the granitic rock (tonalite) could potentially pose excavation difficulties during utility and street installation. Consideration should be given to undercutting or over excavating the street/utility areas during the rough grading to minimize this condition and help facilitate utility installation. The undercut zone should extend at least one foot below the deepest utility.

The resulting excavation(s) for the removals should be observed by a representative of EEI to check that unsuitable materials have been sufficiently removed. It should be understood that based on the observations of our field representative, localized deeper removals may be recommended. <u>The required remedial grading for each residential lot should extend across the entirety of each lot within the proposed limits of grading, and not only limited to the proposed building pad footprints.</u>

The base of the removals should be scarified to a minimum depth of 6-inches, moisture conditioned as needed to achieve at least optimum moisture content and re-compacted to at least 90 percent of the maximum dry density (based on ASTM D1557).

The over-excavated areas should then be backfilled with onsite and/or imported soils that are placed and compacted as recommended herein until design finish grades are reached.

7.4 Fill Materials and Placement

Fill material should possess a low expansion potential (expansion index of less than 50 as determined by ASTM D4829) be free of organic matter (less than 3 percent organics by weight) and other deleterious material. Much of the onsite materials appear to be suitable for re-use as fill, provided they do not contain rocks greater than 6-inches in maximum dimension, organic debris and other deleterious materials.

Rock fragments exceeding 6-inches in one dimension should be segregated and exported from the subject property, placed in deeper fill areas at least 10 feet below finish grade in accordance with the oversize rock placement guidelines (**Appendix C**), or utilized for landscaping.

If imported soils will be needed to raise the existing grade to design elevations; the earthwork contractor should ensure that all proposed fill materials are approved by the Geotechnical Engineer prior to use. Representative soil samples should be made available for testing at least ten working days prior to hauling to the property to allow for laboratory tests.

7.5 Yielding Subgrade Conditions

The soils encountered at the subject property can exhibit "pumping" or yielding if they become saturated. This can often occur in response to periods of significant precipitation, such as during the winter rainy season. If this occurs and in order to help stabilize the yielding subgrade soils within the bottom of the removal areas, the contractor can consider the placement of stabilization fabric or geo-grid over the yielding areas, depending on the relative severity.

Mirafi 600X (or approved equivalent) stabilization fabric may be used for areas with low to moderate yielding conditions. Geo-grid such as Tensar TX-5 may be used for areas with moderate to severe yielding conditions. Uniform sized, ¾- to 2-inch crushed rock should be placed over the stabilization fabric or geo-grid. A 6- to 12-inch thick section of crushed rock will typically be necessary to stabilize yielding ground.

If significant voids are present in the crushed gravel, a filter fabric should be placed over the crushed gravel to prevent migration of fines into the gravel and subsequent settlement of the overlying fill. Fill soils, which should be placed and compacted in accordance with the recommendations presented herein, should then be placed over the fabric or geo-grid until design finish grades are reached. The crushed gravel and stabilization fabric or geo-grid should extend at least five feet laterally beyond the limits of the yielding areas. These operations should be performed under the observation and testing of a representative of EEI in order to evaluate the effectiveness of these measures and to provide additional recommendations for mitigation, as necessary.

7.6 Shrinkage and Bulking

Several factors will impact earthwork balancing on the site, including shrinkage, bulking, subsidence, trench spoils from utilities and footing excavations, and final pavement section thickness as well as the accuracy of topography.

Shrinkage, bulking and subsidence are primarily dependent upon the degree of compactive effort achieved during construction. For planning purposes, the shrinkage factor is estimated to be on the order of 10 to 15 percent for the topsoil to be utilized as fill. This shrinkage factor may vary with methods employed by the contractor. Subsidence is estimated to be on the order of 0.1 feet. Losses from site clearing and removal of existing site improvements may affect earthwork quantity calculation and should be considered. For preliminary planning purposes, bulking of granitic rock (tonalite) materials is estimated to be 5 to 10 percent. Losses from site clearing and removal of existing site improvements, as well as the generation of oversize material may affect earthwork quantity calculation and should be considered.

These estimates are intended as an aid for the project engineers in estimating earthwork quantities. It is recommended that the site development be planned to include an area that could be raised or lowered to accommodate final site balancing.

7.7 Site Excavation and Rippability

Our preliminary study should not be relied upon as a detailed evaluation of rock hardness or the excavation/rippability characteristics of the onsite granitic rock (tonalite) materials. Supplemental studies could be warranted to further evaluate the rock hardness or the excavation/rippability characteristics of the underlying materials in deeper cut areas and based on the final design cuts.

It is anticipated that excavations in the onsite materials can be generally excavated with standard heavy duty conventional grading equipment; however, localized areas within the granitic rock (tonalite) materials could consist of marginal to difficult rippability or blasting conditions. Heavy ripping with a single shank or a "rock breaker" should be anticipated for the relatively deep cuts at the subject property.

Areas planned for deeper cuts in the relatively less weathered tonalite bedrock or in areas where boulder outcrops exist may require localized blasting to achieve proposed grades. If blasting is required to remove the observed boulders/granitic outcrops, we recommend that a contractor specialized in controlled blasting or non-blasting methods be contacted to assess the site conditions and minimize the effect to adjacent properties.

7.8 Temporary Site Excavations

Temporary excavations within the onsite materials should be stable at 1H:1V inclinations for short durations during construction up to heights of 15 feet. Some sloughing of surface soils should be anticipated. Temporary excavations 4 feet deep or less can be made vertically.

The faces of temporary slopes should be inspected daily by the contractor's Competent Person before personnel are allowed to enter the excavation. Any zones of potential instability, sloughing or raveling should be brought to the attention of the Engineer and corrective action implemented before personnel begin working in the excavation.

Excavated soils should not be stockpiled behind temporary excavations within a distance equal to the depth of the excavation. EEI should be notified if other surcharge loads are anticipated so that lateral load criteria can be developed for the specific situation. If temporary slopes are to be maintained during the rainy season, berms are recommended along the tops of slopes to prevent runoff water from entering the excavation and eroding the slope faces.

7.9 Slopes

Permanent slopes should be constructed at an inclination of 2:1 H:V or flatter. Faces of fill slopes should be compacted either by rolling with a sheep-foot roller or other suitable equipment, or by overfilling and cutting back to design grade. All slopes are susceptible to surficial slope failure and erosion. Water should not be allowed to flow over the top of slopes. Additionally, slopes should be planted with vegetation that will reduce the potential for erosion.

8.0 FOUNDATION RECOMMENDATIONS

8.1 General

The conclusions and recommendations presented herein are based on the assumption that the planned development will consist of slab-on-grade residential structures. EEI should be provided with grading and foundation plans once they are available so that we can determine if the recommendations provided in this report remain applicable.

The foundation recommendations provided herein are based on the soil materials within 4 feet of building pad grade possessing a low expansion potential (EI < 50). The earthwork contractor should ensure that all proposed fill materials are approved by the Geotechnical Engineer prior to use. Recommendations by the project's design-structural engineer or architect may exceed the following <u>minimum</u> recommendations.

8.2 Preliminary Foundation Design

Provided the subject property is graded in accordance with the California Building Code (CBC, 2016) and the City of San Marcos grading ordinances, the proposed residential buildings can be supported on conventional continuous or isolated shallow spread footings bearing entirely on compacted fill materials placed in accordance with the recommendations provided in **Section 7**.

Footings should extend at least 18-inches below lowest adjacent finished grade. A minimum width of 15-inches is recommended for continuous footings and 24-inches for isolated or retaining wall footings. An allowable bearing capacity of 2,500 pounds per square-foot (psf) can be used for footings extending at least 18-inches below lowest adjacent finished grade. The bearing value can be increased by one-third when considering the total of all loads, including wind or seismic forces.

8.3 Lateral loads

Lateral loads will be resisted by friction between the bottoms of footings and passive pressure on the faces of footings and other structural elements below grade. An allowable coefficient of friction of 0.30 can be used. Passive pressure can be computed using an allowable lateral pressure of 250 psf per foot of depth below the ground surface for level ground conditions. Reductions for sloping ground should be made. The passive pressure can be increased by one-third when considering the total of all loads, including wind or seismic forces. The upper one-foot of soil should not be relied on for passive support unless the ground is covered with pavements or slabs.

8.4 Settlement

Settlement estimates for conventional foundations are as follows:

- Static Total Settlement: Less than 1-inch
- Static Differential Settlement: Less than ½ inch over a distance of 40 feet

8.5 Footing Setbacks

Footings adjacent to unlined drainage swales or underground utilities (if any) should be deepened to a minimum of 6-inches below the invert of the adjacent unlined swale or utilities. This distance is measured from the footing face at the bearing elevation. Footings for structures adjacent to retaining walls should be deepened so as to extend below a 1:1 projection from the heel of the wall. Alternatively, walls may be designed to accommodate structural loads from buildings or appurtenances.

Footings located adjacent to or within engineered slopes should be extended to a depth such that a minimum horizontal distance of 7 feet exists between the lower outside footing edge and the face of the slope. Reductions for sloping ground should be made.

8.6 Interior Slabs-on-Grade

The project structural engineer should design the interior concrete slabs-on-grade floor. As a minimum, we recommend that building slabs be at least 4-inches in thickness and reinforced with at least No. 3 bars spaced 18-inches on center, each way, and placed at slab mid-height. Subgrade materials should not be allowed to desiccate between grading and the construction of the concrete slabs. The floor slab subgrade should be thoroughly and uniformly moistened prior to placing concrete.

A moisture vapor retarder/barrier should be placed beneath slabs where moisture sensitive floor coverings will be installed. Typically, plastic is used as a vapor retardant. If plastic is used, a minimum 10-mil is recommended. The plastic should comply with ASTM E1745. Plastic installation should comply with ASTM E1643.

Current construction practice typically includes placement of a 2-inch thick sand cushion between the bottom of the concrete slab and the moisture vapor retarder/barrier. This cushion can provide some protection to the vapor retarder/barrier during construction, and may assist in reducing the potential for edge curling in the slab during curing. However, the sand layer also provides a source of moisture vapor to the underside of the slab that can increase the time required to reduce moisture vapor emissions to limits acceptable for the type of floor covering placed on top of the slab. The slab can be placed directly on the vapor retarder/barrier. The floor covering manufacturer should be contacted to determine the volume of moisture vapor allowable and any treatment needed to reduce moisture vapor emissions to acceptable limits for the particular type of floor covering installed. The project team should determine the appropriate treatment for the specific application.

8.7 Exterior Slabs-on-Grade (Hardscape)

The top 2 feet of soil below exterior concrete slabs-on-grade should have an expansion index of 50 or less. Exterior slabs should have a minimum thickness of 4-inches and be reinforced with at least No. 3 bars at 18-inches on center each way.

Slabs should be provided with weakened plane joints. Joints should be placed in accordance with the American Concrete Institute (ACI) guidelines. Proper control joints should be provided to reduce the potential for damage resulting from shrinkage. Subgrade materials should not be allowed to desiccate between grading and the construction of the concrete slabs. The floor slab subgrade should be thoroughly and uniformly moistened prior to placing concrete.

All dedicated exterior flatwork should conform to standards provided by the governing agency including section composition, supporting material thickness and any requirements for reinforcing steel. Concrete mix proportions and construction techniques, including the addition of water and improper curing, can adversely affect the finished quality of the concrete and result in cracking and spalling of the slab. We recommend that all placement and curing be performed in accordance with procedures outlined by the American Concrete Institute and/or Portland Cement Association. Special consideration should be given to concrete placed and cured during hot or cold weather conditions.

8.8 Mechanically Stabilized Earth (MSE) Walls

Based on information provided by you and the site plan we understand that development of the subject property will include walls up to heights of approximately 12 feet. Below are the geotechnical design parameters for MSE walls.

8.8.1 Foundations

The recommendations provided in the foundation section of this report are also applicable to conventional retaining walls.

8.8.2 Recommended Strength Parameters

Based on the geotechnical data and recommendations herein and our past experience with similar soils in the general vicinity of the subject property, we recommend that the following soils parameters be used for design of the proposed reinforced earth wall shown in **Table 3**.

TABLE 3 Recommended Geotechnical Parameters for Proposed MSE Walls				
Soil Parameters	Internal Friction Angle (Degrees)	Cohesion (psf)	Moist Unit Weight (pcf)	Soil Type
Reinforced Soil	30	0	125	Compacted select onsite or import materials with EI < 50 and 35% or less passing #200 sieve.
Retained Soil	28	200	125	In-place onsite materials or compacted onsite/imported granular materials.
Foundation Soil	30	200	125	Compacted onsite/imported granular materials.

8.8.3 Back Drainage

MSE walls should be provided with an adequate back drainage system in accordance with standard practice within Southern California and as required by the wall manufacturer/designer. Proper back drainage can reduce the potential for the accumulation of hydrostatic pressures behind the walls. The location of onsite storm water facilities (i.e., BMPs), if planned within the vicinity of the MSE walls, and the potential for increased hydrostatic pressures should be considered in design of the MSE walls.

8.9 Conventional Retaining Walls

8.9.1 Foundations

The recommendations provided in the foundation section of this report are also applicable to conventional retaining walls.

8.9.2 Lateral Earth Pressures

The active earth pressure for the design of unrestrained earth retaining structures with level backfills can be taken as equivalent to the pressure of a fluid weighing 40 pcf. The at-rest earth pressure for the design of restrained earth retaining structures (such as basement walls or re-entrant corners) with level backfills can be taken as equivalent to the pressure of a fluid weighing 60 pcf. The values mentioned herein assume a granular and drained backfill condition. If expansive soils are used to backfill the proposed walls, increased active and at-rest earth pressures will need to be utilized for retaining wall design, and can be provided upon request. An additional 20 pcf should be added to these values for walls with a 2:1 H:V sloping backfill. An increase in earth pressure equivalent to an additional 2 feet of retained soil can be used to account for surcharge loads from light traffic. The above values do not include a factor of safety. Appropriate factors of safety should be incorporated into the design. If any other surcharge loads are anticipated, EEI should be contacted for the necessary increase in soil pressure.

8.9.3 Retaining Wall Drainage

Retaining walls should be designed to resist hydrostatic pressures or be provided with a backdrain to reduce the accumulation of hydrostatic pressures. Backdrains may consist of a 2-foot wide zone of ¾-inch crushed rock. The backdrain should be separated from the adjacent soils using a non-woven filter fabric, such as Mirafi 140N or equivalent. Weep holes should be provided or a perforated pipe (Schedule 40 PVC) should be installed at the base of the backdrain and sloped to discharge to a suitable storm drain facility. As an alternative, a geocomposite drainage system such as Miradrain 6000 or equivalent placed behind the wall and connected to a suitable storm drain facility can be used. The project architect should provide waterproofing specifications and details.

8.9.4 Seismic Earth Pressures

If required, the seismic earth pressures can be taken as equivalent to the pressure of a fluid weighing 13 pounds per cubic foot (pcf) for flexible walls and 25 pcf for restrained walls. These values are for level backfill conditions and do not include a factor of safety. Appropriate factors of safety should be incorporated into the design. This pressure is in addition to the un-factored static pressures. The allowable passive pressure and bearing capacity can be increased by one-third in determining the stability of the wall.

8.9.5 Backfill

All backfill soils should be compacted to at least 90 percent relative compaction. Backfill soils should consist of granular, free-draining material having an expansion index of 50 or less determined in accordance with ASTM D4829. Expansive or clayey soil should not be used for backfill material. Additionally, fill within 3 feet from the back of the wall should not contain rocks greater than 3-inches in any dimension. The wall should not be backfilled until it has reached an adequate strength.

8.10 Corrosivity

One sample of the onsite soils was tested to provide a preliminary indication of the corrosion potential of the onsite soils. The test results are presented in **Appendix B**. A brief discussion of the corrosion test results is provided in the following section.

- The sample tested had a soluble sulfate concentration of 0.003 percent, which indicates the sample has a negligible sulfate corrosion potential relative to concrete.

  It should be noted that soluble sulfate in the irrigation water supply, and/or the use of fertilizer may cause the sulfate content in the surficial soils to increase with time. This may result in a higher sulfate exposure than that indicated by the test results reported herein. Studies have shown that the use of improved cements in the concrete, and a low water-cement ratio will improve the resistance of the concrete to sulfate exposure.

- The sample tested had a chloride concentration of 0.002 percent, which indicates the sample has a negligible chloride corrosion potential relative to metal.

- The sample tested had a minimum resistivity of 5,100 ohm-cm, which indicates the sample is extremely corrosive to ferrous metals.
- The sample tested had a pH of 6.7, which indicates the sample is slightly alkaline.

Additional testing should be performed after grading to evaluate the as-graded corrosion potential of the onsite soils. We are not corrosion engineers. A corrosion consultant should be retained to provide corrosion control recommendations if deemed necessary.

9.0 PAVEMENT DESIGN RECOMMENDATIONS

Deleterious material, excessively wet or dry pockets, concentrated zones of oversized rock fragments, and any other unsuitable yielding materials encountered during grading should be removed. Once compacted fill and/or native soils are brought to the proposed pavement subgrade elevations, the subgrade should be proof-rolled in order to check for a uniform firm and unyielding surface. Representatives of the project geotechnical engineer should observe all grading and fill placement.

The upper 12-inches of pavement subgrade soils should be scarified; moisture conditioned to at least optimum moisture content and compacted to at least 95 percent of the laboratory standard (ASTM D1557). If loose or yielding materials are encountered during subgrade preparation, evaluation should be performed by EEI.

Aggregate base materials should be properly prepared (i.e., processed and moisture conditioned) and compacted to at least 95 percent of the maximum dry density as determined by ASTM D1557. Aggregate base materials should conform to Caltrans specifications for Class 2 aggregate base.

All pavement section changes should be properly transitioned. Although not anticipated, if adverse conditions are encountered during the preparation of subgrade materials, special construction methods may need to be employed. A representative of the project geotechnical engineer should be present for the preparation of subgrade and aggregate base.

For design purposes we have assumed a Traffic Index (TI) of 5.0 for the residential drive/street alignment areas at the subject property. This assumed TI should be verified as necessary by the Civil Engineer or Traffic Engineer.

For preliminary design purposes, we have utilized a preliminary R-Value of 5. The modulus of subgrade reaction (K-Value) was estimated at 65 pounds per square inch per inch (psi/in) for an R-Value of 5 (Caltrans, 1974). Pavement design structural sections for asphaltic concrete were calculated using guidelines presented in the Caltrans Highway Design Manual. Rigid pavement sections were evaluated in general accordance with ACI 330R-08. Concrete pavement for cars and trucks were based on an average daily truck traffic value of 10.

TABLE 4
Preliminary Pavement Design Recommendations

Traffic Index (TI) / Intended Use	Pavement Surface	Aggregate Base Material (1)
5.5 – Drive Areas	4.0-inches Asphalt Concrete	8.0-inches
Concrete Pavement - Cars and Trucks	5.5-inches Portland Cement Concrete (2,3)	4.0-inches

(1) R-Value of 78 for Caltrans Class 2 aggregate base
(2) Reinforcement and control joints placed in accordance with the structural engineer's requirements
(3) Assumes Concrete Modulus of Rupture=600 psi (Compressive Strength=4,200 psi)

The recommended pavement sections provided in **Table 4** are intended as a minimum guideline. If thinner or highly variable pavement sections are constructed, increased maintenance and repair could be expected. If the actual ADT (average daily traffic), ADTT (average daily truck traffic), or traffic index (TI) increases beyond are assumed values, increased maintenance and repair could be required for the pavement section. Final pavement design should be verified by testing of soils exposed at subgrade after grading has been completed. Thinner pavement sections could result if R-Value testing indicates higher values.

10.0 DEVELOPMENT RECOMMENDATIONS

10.1 Landscape Maintenance and Planting

Water is known to decrease the physical strength of earth materials, significantly reducing stability by high moisture conditions. Surface drainage away from foundations and graded slopes should be maintained. Only the volume and frequency of irrigation necessary to sustain plant life should be applied.

Consideration should be given to selecting lightweight, deep rooted types of landscape vegetation which require low irrigation that are capable of surviving the local climate. From a soils engineering viewpoint, "leaching" of the onsite soils is not recommended for establishing landscaping. If landscape soils are processed for the addition of amendments, the processed soils should be re-compacted to at least 90 percent relative compaction (based on ASTM D1557).

10.2 Site Drainage

Positive site drainage should be maintained at all times. Drainage should not flow uncontrolled over slopes. Runoff should be channeled away from slopes and structures and not allowed to pond and/or seep uncontrolled into the ground. Pad drainage should be directed toward an acceptable outlet. Consideration should be given to eliminating open bottom planters directly adjacent to proposed structures for a minimum distance of 10 feet. As an alternative, closed-bottom type planters could be utilized, with a properly designed drain outlet placed in the bottom of the planter.

Final surface grades around structures should be designed to collect and direct surface water away from structures and toward appropriate drainage facilities. The ground around the structure should be graded so that surface water flows rapidly away from the structure without ponding. In general, we recommend that the ground adjacent to the structure slope away at a gradient of at least 2 percent. Densely vegetated areas where runoff can be impaired should have a minimum gradient of at least 5 percent within the first 5 feet from the structure. Roof gutters with downspouts that discharge directly into a closed drainage system are recommended on structures. Drainage patterns established at the time of fine grading should be maintained throughout the life of the proposed structures.

10.3 Site Runoff Considerations - Stormwater Disposal Systems

It is our understanding that the Client is considering that runoff generated from the facility to be disposed of in engineered subsurface features onsite. We performed percolation testing in order to provide an indication of the infiltration characteristics of the onsite materials. Our testing and findings are summarized in the following sections.

10.3.1 Percolation Testing

Following the drilling of exploratory borings B-1/P-1, B-2/P-2 and B-7/P-3, a 3-inch diameter perforated polyvinyl chloride (PVC) pipe was placed in the hole and gravel was placed around the pipe. The test holes were presoaked in general accordance with San Diego Region guidelines.

Percolation testing was performed until consistent results were obtained. The results were used to calculate the pre-adjusted percolation rate for the test hole. Upon conclusion of testing, the perforated pipe was removed from the test hole and the test hole was backfilled.

We note that a soil profile's percolation rate is not the same as its infiltration rate. Therefore, the measured/calculated field percolation rate was converted to an estimated infiltration rate utilizing a reduction factor determined using the Porchet method. Additionally, as indicated in the County of San Diego BMP guidelines (County of San Diego, 2016), a feasibility factor of safety of 2.0 is should be applied to the measured infiltration rates to account for remaining uncertainty and long-term deterioration that cannot be technically mitigated.

The following **Table 5** presents the measured percolation rate and corresponding infiltration rate calculated for the test hole.

TABLE 5
Summary of Percolation Testing

Location	Depth (ft.)	Pre-Adjusted Percolation Rate (in/hr)	Infiltration Rate* (in/hr)
B-1/P-1	~ 7-8	0.24	0.01
B-2/P-2	~ 8-9	0	0
B-7/P-3	~ 9-10	0	0

*Feasibility factor of safety of 2.0 is included

10.3.2 Summary of Findings

The County of San Diego BMP guidelines indicate that onsite storm-water disposal systems can be designed for "Full-Infiltration" for subsurface materials with corrected infiltration rates equal to or greater than 0.5-inches per hour, and for "Partial Infiltration" for corrected infiltration rates less than 0.5-inches per hour. However, based on the relatively low infiltration rates and the presence of shallow bedrock across the site, it is our preliminary conclusion that the onsite soils in the areas tested are <u>not suitable for direct infiltration of storm-water (No Infiltration)</u>.

We provide the following conclusions regarding the percolation test results:

- It is our opinion that the percolation characteristics at the tested depths are generally representative of the site conditions in the vicinity of the test holes. Percolation testing was performed within natural bedrock materials consisting of primarily of dense sandy soils.

- As discussed in the County of San Diego BMP guidelines for percolation testing, the bottom of the borings where the percolation tests are performed should be at approximately the same depth of the invert of the proposed infiltration facility. The project civil engineer should determine if the tests performed meet this requirement.

- As discussed in the County of San Diego BMP guidelines, a correction factor should be applied to the measured infiltration rates to account for soil assessment method, soil type, soil variability, depth to groundwater, level of pretreatment, redundancy, and compaction during construction. The project civil engineer should determine the appropriate design-level factor of safety for the proposed disposal system.

Design of the stormwater disposal system should be in accordance with the County of San Diego guidelines.

10.3.3 Structure Setback from Retention Devices

We recommend that storm-water disposal systems be situated at least three times their depth, or a minimum of 15 feet (whichever is greater), from the outside bottom edge of structural foundations.

Structural foundations include (but are not limited to) buildings, loading docks, retaining walls, and screen walls. The invert of storm-water infiltration should be outside a 1:1 (H:V) plane projected from the bottom of adjacent foundations.

Storm-water disposal systems should be checked and maintained on regular intervals. Storm-water devices including bio-swales that are located closer than 10 feet from any foundations/footings should be lined with an impermeable membrane to reduce the potential for saturation of foundation soils. Foundations may also need to be deepened.

10.4 Additional Site Improvements

Recommendations for additional grading can be provided upon request. If in the future, additional property improvements are planned for the subject property, recommendations concerning the design and construction of improvements would be provided upon request.

10.5 Utility Trench Backfill

Fill around the pipe should be placed in accordance with details shown on the drawings, and should be placed in layers not to exceed 8-inches loose (unless otherwise approved by the geotechnical engineer) and compacted to at least 90 percent of the maximum dry density as determined in accordance with ASTM D1557 (Modified Proctor). The geotechnical engineer should approve all backfill material.

Select material should be used when called for on the drawings, or when recommended by the geotechnical engineer. Care should be taken during backfill and compaction operations to maintain alignment and prevent damage to the joints. The backfill should be kept free from oversized material, chunks of highly plastic clay, or other unsuitable or deleterious material. Backfill soils should be non-expansive, non-corrosive, and compatible with native earth materials. Backfill materials and testing should be in accordance with the CBC (2016), and the requirements of the local governing jurisdiction.

Pipe backfill areas should be graded and maintained in such a condition that erosion or saturation will not damage the pipe bedding or backfill. Flooding trench backfill is not recommended. Heavy equipment should not be operated over any pipe until it has been properly backfilled with a minimum of 2 to 3 feet of cover. The utility trench should be systematically backfilled to allow maximum time for natural settlement. Backfill should not occur over porous, wet, or spongy subgrade surfaces. Should these conditions exist, the areas should be removed, replaced and recompacted.

11.0 PLAN REVIEW

Once detailed grading and foundation plans are available, they should be submitted to EEI for review and comment, to reduce the potential for discrepancies between plans and recommendations presented herein. If conditions found differ substantially from those stated; appropriate recommendations will be provided. Additional field studies may be warranted.

12.0 LIMITATIONS

This Geotechnical Evaluation has been conducted in accordance with generally accepted geotechnical engineering principles and practices. Findings provided herein have been derived in accordance with current standards of practice, and no warranty is expressed or implied.

Standards of practice are subject to change with time. This report has been prepared for the sole use of Integral Communities (Client), within a reasonable time from its authorization.

Subject property conditions, land use (both onsite and offsite), or other factors may change as a result of manmade influences, and additional work may be required with the passage of time. This Geotechnical Evaluation should not be relied upon by other parties without the express written consent of EEI and the Client; therefore, any use or reliance upon this Geotechnical Evaluation by a party other than the Client should be solely at the risk of such third party and without legal recourse against EEI, its employees, officers, or directors, regardless of whether the action in which recovery of damages is brought or based upon contract, tort, statue, or otherwise. The Client has the responsibility to see that all parties to the project, including the designer, contractor, subcontractor, and building official, etc. are aware of this report in its complete form. This report contains information that may be used in the preparation of contract specifications; however, the report is not designed as a specification document, and may not contain sufficient information for use without additional assessment. EEI assumes no responsibility or liability for work or testing performed by others. In addition, this report may be subject to review by the controlling authorities.

13.0 REFERENCES

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FIGURES

Map Source: USGS, San Marcos, California 7.5 Minute Quadrangle maps (USGS, 2012)

LEGEND

N

Approximate Scale: 1" = 24,000'

0 24,000 FT 48,000 FT

Note: All locations are approximate

SITE VICINITY MAP

INTEGRAL PARTNERS FUNDING, LLC
Cities of San Marcos and Escondido
County of San Diego, California 92078/92029
EEI Project IPF-72446.4
Created July 2017

EEI Engineering Solutions

FIGURE 1

Map Source: Google Earth®, Image Date: November 8, 2016

LEGEND

N

Scale: 1" = 365'

0 365 FT 730 FT

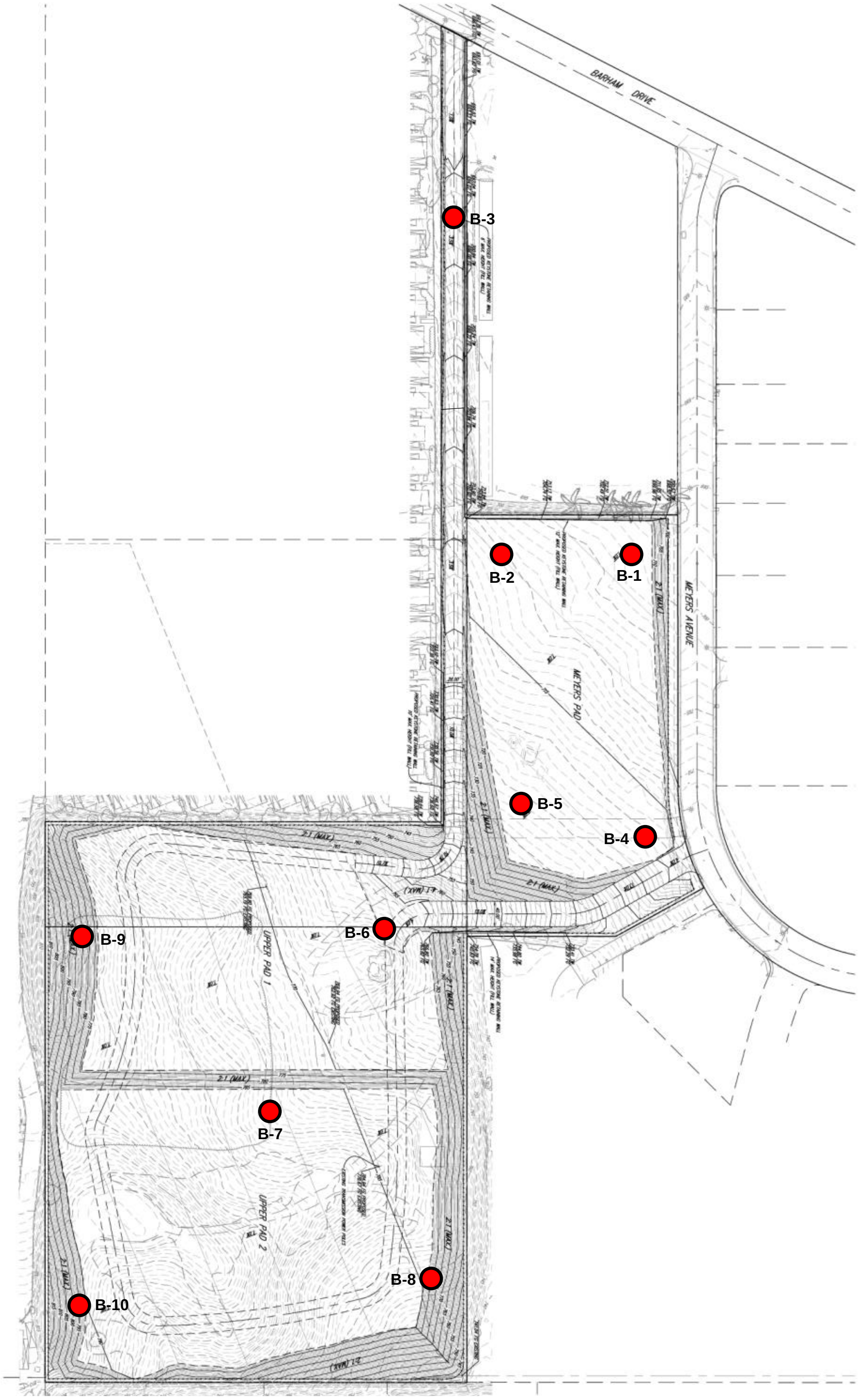
Note All Locations Are Approximate

AERIAL SITE MAP

INTEGRAL PARTNERS FUNDING, LLC
Cities of San Marcos and Escondido
County of San Diego, California 92078/92029
EEI Project IPF-72446.4
Created July 2017

EEI Engineering Solutions

FIGURE 2



Map Source: Excel Engineering; Sunrise Conceptual Model

LEGEND

B-10 *Approximate HSA Boring Location*

Scale: 1" = 365'

0 365 FT 730 FT

N

Note All Locations Are Approximate

FIELD EXPLORATION PLAN

INTEGRAL PARTNERS FUNDING, LLC

Cities of San Marcos and Escondido

County of San Diego, California 92078/92029

EEI Project IPF-72446.4

Created July 2017

EEI Engineering Solutions

FIGURE 3

APPENDIX A
SOIL CLASSIFICATION CHART AND BORING LOGS

UNIFIED SOIL CLASSIFICATION (ASTM D-2487-98)

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL- SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SEIVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL-SAND- CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS,GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION REATINED ON NO. 4 SEIVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY-SANDS, SAND – SILT MIXTURES
				SC	CLAYEY SANDS, SAND – CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS

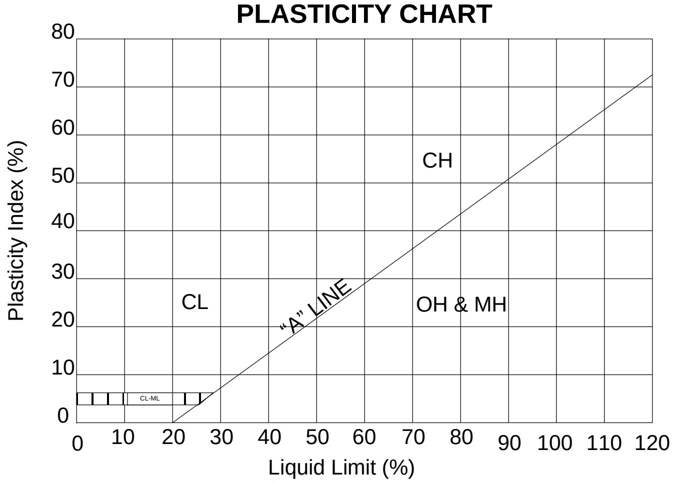
SAMPLER TYPES

- SPT
- Modified California (2.5" I.D.)
- Bulk
- Rock Core
- Shelby Tube
- Water Level

OTHER TESTS

ATT – Atterberg Limit (Plasticity Index)
CD – Consolidated Drained Triaxial
CON – Consolidation
COR – Corrosivity)
DS – Direct Shear
EI – Expansion Index
MAX – Maximum Density
RV – R-Value
SA – Sieve Analysis
-#200 - Percent Passing #200 Sieve
TV – Torvane Shear
UU – Unconsolidated Undrained Triaxial

PLASTICITY CHART



PENETRATION RESISTANCE
(Recorded As Blows/Foot)

SAND & GRAVEL		SILT & CLAY		
Relative Density	Blows/Foot* N_{60}	Consistency	Blows/Foot* N_{60}	Strength**(KSF)
Very Loose	0-4	Very Soft	0 - 2	0 – 0.5
Loose	4-10	Soft	2 - 4	0.5 – 1.0
Medium Dense	10-30	Medium Stiff	4 - 8	1.0 – 2.0
Dense	30-50	Stiff	8 - 15	2.0 – 4.0
Very Dense	Over 50	Very Stiff	15 - 30	4.0 – 8.0
		Hard	Over 30	Over 8.0

* Number of blows of 140LB hammer falling 30 inches to drive a 2 inch O.D. (1-3/8 inch I.D.) split barrel sampler the last 12 inches of an 18-inch drive (ASTM-1586 Standard Penetration Test)

** Undrained shear strength in kips/sq. ft. As determined by laboratory testing or approximated by the standard penetration test, pocket penetrometer, torvane, or visual observation

EEI Geotechnical & Environmental Solutions

LEGEND TO SOIL DESCRIPTIONS

APPENDIX A

BORING NUMBER B-1/P-1

EEI Engineering Solutions

CLIENT Integral Communities
PROJECT NAME Barham Drive/San Marcos, California
PROJECT NUMBER IPF-72446.4
PROJECT LOCATION Barham Drive/Meyers Avenue, San Marcos, CA
DATE STARTED 7/7/17 **COMPLETED** 7/7/17
GROUND ELEVATION **BORING DIAMETER** 8-inch
EQUIPMENT / RIG Truck-Mounted B-53
HAMMER EFFICIENCY (%) 68
METHOD 8" Hollow Stem Auger 140 lbs Auto Hammer
SPT CORRECTION 1.13 **CAL CORRECTION** 0.62
LOGGED BY WP **CHECKED BY**
GROUNDWATER DEPTH (ft) Not Encountered
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	USCS SYMBOL	SAMPLE TYPE	PENETRATION RESISTANCE (blows/6-inches)	SPT N60	POCKET PEN (tsf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (PI:LL)	FINES CONTENT (%)	OTHER TESTS
0–2.5		**TOPSOIL** SILTY SAND - orange-brown, fine to coarse grained; slightly moist, loose	SM	BULK								EI
2.5–5		@ 2.5' - **WEATHERED GRANITICS** SILTY SAND with trace CLAY - orange-brown, fine to medium grained, moist, medium dense	SM	MC	7 10 17	17		11	118			DS MAX
5		@ 5' - SILTY SAND - brown, fine to coarse grained, dry, very dense		MC	50 for 5"			3	126			
7.5–8				MC	50 for 4"			4	114			

Total depth: 8-feet
Percolation test performed
No groundwater encountered
Boring backfilled on 7/7/2017

BORING NUMBER B-2/P-2

EEI Engineering Solutions

CLIENT Integral Communities

PROJECT NAME Barham Drive/San Marcos, California

PROJECT NUMBER IPF-72446.4

PROJECT LOCATION Barham Drive/Meyers Avenue, San Marcos, CA

DATE STARTED 7/7/17 **COMPLETED** 7/7/17

GROUND ELEVATION **BORING DIAMETER** 8-inch

EQUIPMENT / RIG Truck-Mounted B-53

HAMMER EFFICIENCY (%) 68

METHOD 8" Hollow Stem Auger 140 lbs Auto Hammer

SPT CORRECTION 1.13 **CAL CORRECTION** 0.62

LOGGED BY WP **CHECKED BY**

GROUNDWATER DEPTH (ft) Not Encountered

NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	USCS SYMBOL	SAMPLE TYPE	PENETRATION RESISTANCE (blows/6-inches)	SPT N60	POCKET PEN (tsf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (PI:LL)	FINES CONTENT (%)	OTHER TESTS
0–2.5		**TOPSOIL** SILTY SAND - orange-brown, fine to coarse grained; slightly moist, loose	SM									
2.5–5		@ 2.5' -**WEATHERED GRANITICS** SILTY SAND - orange-brown, fine to coarse grained, moist, medium dense	SM	MC	20 27 35	39		11	125			
5–7.5		@ 5' - SILTY SAND - orange-brown, fine to coarse grained, moist, dense		MC	12 20 25	28		14	116			
7.5–10		@ 7.5' - becomes light brown		MC	16 27 47	46		10	120			
10–10.5		@ 10' - becomes very dense		MC	50 for 6"			6	97			

Total depth: 10.5-feet
Percolation test performed
No groundwater encountered
Boring backfilled on 7/7/2017

BORING NUMBER B-3

EEI Engineering Solutions

CLIENT Integral Communities
PROJECT NAME Barham Drive/San Marcos, California
PROJECT NUMBER IPF-72446.4
PROJECT LOCATION Barham Drive/Meyers Avenue, San Marcos, CA
DATE STARTED 7/7/17 **COMPLETED** 7/7/17
GROUND ELEVATION **BORING DIAMETER** 8-inch
EQUIPMENT / RIG Truck-Mounted B-53
HAMMER EFFICIENCY (%) 68
METHOD 8" Hollow Stem Auger 140 lbs Auto Hammer
SPT CORRECTION 1.13 **CAL CORRECTION** 0.62
LOGGED BY WP **CHECKED BY**
GROUNDWATER DEPTH (ft) Not Encountered
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	USCS SYMBOL	SAMPLE TYPE	PENETRATION RESISTANCE (blows/6-inches)	SPT N60	POCKET PEN (tsf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (PI:LL)	FINES CONTENT (%)	OTHER TESTS
0–2.5		**TOPSOIL** SILTY SAND with trace CLAY - brown, fine to coarse grained with trace organics; dry-slightly moist, loose	SM	BULK								
2.5		@ 2.5' - **WEATHERED GRANITICS** SILTY-SAND - orange-brown, fine to medium grained, slightly moist, medium dense	SM	MC	7 15 17	20		13	117			RV
5		@ 5' - SILTY-SAND - gray, fine to coarse grained, dry to slightly moist, very dense		MC	26 50 for 5"			4	117			
7.5		@ 7.5' - becomes light brown		MC	50 for 6"			6	101			
10		@ 10' - becomes very dense		MC	50 for 6"			4	101			

Total depth: 11.5-feet
No groundwater encountered
Boring backfilled on 7/7/2017

BORING NUMBER B-4

EEI Engineering Solutions

CLIENT Integral Communities
PROJECT NAME Barham Drive/San Marcos, California
PROJECT NUMBER IPF-72446.4
PROJECT LOCATION Barham Drive/Meyers Avenue, San Marcos, CA
DATE STARTED 7/7/17 **COMPLETED** 7/7/17
GROUND ELEVATION **BORING DIAMETER** 8-inch
EQUIPMENT / RIG Truck-Mounted B-53
HAMMER EFFICIENCY (%) 68
METHOD 8" Hollow Stem Auger 140 lbs Auto Hammer
SPT CORRECTION 1.13 **CAL CORRECTION** 0.62
LOGGED BY WP **CHECKED BY**
GROUNDWATER DEPTH (ft) Not Encountered
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	USCS SYMBOL	SAMPLE TYPE	PENETRATION RESISTANCE (blows/6-inches)	SPT N60	POCKET PEN (tsf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (PI:LL)	FINES CONTENT (%)	OTHER TESTS
0–2.5		**TOPSOIL** SILTY-SAND - orange-brown, fine to coarse grained, slightly moist, very dense	SM									
2.5		@ 2.5' - **WEATHERED GRANITICS** SILTY-SAND - orange-brown, fine to coarse grained, slightly moist, very dense	SM	MC	21 40 40	50		6	121			
5		@ 5' - SILTY SAND, CLAYEY SAND - orange, fine to medium grained, moist, medium dense		MC	5 15 30	28		13	121			
7.5		@ 7.5' - SILTY-SAND - orange-brown, fine to coarse grained, slightly moist, very dense		MC	50 for 6"			11	93			
10		@10' - becomes dry		MC	36 50 for 3"			9	112			
11.5		@ 11.5' -minor seapage										
12				SPT	50 for 1"			14				

Total depth: 12.5-feet Due to Refusal
No groundwater encountered
Boring backfilled on 7/7/2017

BORING NUMBER B-5

EEI Engineering Solutions

CLIENT Integral Communities
PROJECT NAME Barham Drive/San Marcos, California
PROJECT NUMBER IPF-72446.4
PROJECT LOCATION Barham Drive/Meyers Avenue, San Marcos, CA
DATE STARTED 7/7/17 **COMPLETED** 7/7/17
GROUND ELEVATION
BORING DIAMETER 8-inch
EQUIPMENT / RIG Truck-Mounted B-53
HAMMER EFFICIENCY (%) 68
METHOD 8" Hollow Stem Auger 140 lbs Auto Hammer
SPT CORRECTION 1.13 **CAL CORRECTION** 0.62
LOGGED BY WP **CHECKED BY**
GROUNDWATER DEPTH (ft) Not Encountered
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	USCS SYMBOL	SAMPLE TYPE	PENETRATION RESISTANCE (blows/6-inches)	SPT N60	POCKET PEN (tsf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (PI:LL)	FINES CONTENT (%)	OTHER TESTS
0–2.5		**TOPSOIL** SILTY-SAND -orange-brown, fine to coarse grained, slightly moist, loose	SM	BULK								COR
2.5–4		@ 2.5' - **WEATHERED GRANITICS** SILTY-SAND - orange-brown, fine to coarse grained, slightly moist, medium dense	SM	MC	5 7 10	11		7	99			DS MAX
5–6		@ 7' - SILTY-SAND - orange- brown, fine to coarse grained, moist, very dense		MC	18 50 for 5"			8	121			
7.5		@ 7.5 -becomes gray brown		MC	50 for 6"			7	110			
10				MC	34 50 for 6"			6	119			
15		@ 15 - trace GRAVELS		SPT	50 for 3"			2				
17				SPT	50 for 1"			2				

Total depth: 17.5-feet Due to Refusal
No groundwater encountered
Boring backfilled on 7/7/2017

BORING NUMBER B-6

EEI Engineering Solutions

CLIENT Integral Communities
PROJECT NAME Barham Drive/San Marcos, California
PROJECT NUMBER IPF-72446.4
PROJECT LOCATION Barham Drive/Meyers Avenue, San Marcos, CA
DATE STARTED 7/7/17 **COMPLETED** 7/7/17
GROUND ELEVATION **BORING DIAMETER** 8-inch
EQUIPMENT / RIG Truck-Mounted B-53
HAMMER EFFICIENCY (%) 68
METHOD 8" Hollow Stem Auger 140 lbs Auto Hammer
SPT CORRECTION 1.13 **CAL CORRECTION** 0.62
LOGGED BY WP **CHECKED BY**
GROUNDWATER DEPTH (ft) Not Encountered
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	USCS SYMBOL	SAMPLE TYPE	PENETRATION RESISTANCE (blows/6-inches)	SPT N60	POCKET PEN (tsf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (PI:LL)	FINES CONTENT (%)	OTHER TESTS
0–2.5		**TOPSOIL** SILTY-SAND - orange-brown, fine to coarse grained, slightly moist, loose	SM									
2.5–3.5		@ 2.5' - **WEATHERED GRANITICS** SILTY-SAND - orange-brown, fine to coarse grained, slightly moist, very dense	SM	MC	9 31 50 for 2	0		4	120			
5		@ 5' - becomes dry		MC	50 for 3			2	107			
7.5		@ 7.5 - becomes orange-brown		MC	18 50 for 4			3	110			
10		@ 10' - no recovery		MC	50 for 2							

Total depth: 10.5-feet Due to Refusal
No groundwater encountered
Boring backfilled on 7/7/2017

BORING NUMBER B-7/P-3

EEI Engineering Solutions

CLIENT Integral Communities

PROJECT NAME Barham Drive/San Marcos, California

PROJECT NUMBER IPF-72446.4

PROJECT LOCATION Barham Drive/Meyers Avenue, San Marcos, CA

DATE STARTED 7/7/17 **COMPLETED** 7/7/17

GROUND ELEVATION **BORING DIAMETER** 8-inch

EQUIPMENT / RIG Truck-Mounted B-53

HAMMER EFFICIENCY (%) 68

METHOD 8" Hollow Stem Auger 140 lbs Auto Hammer

SPT CORRECTION 1.13 **CAL CORRECTION** 0.62

LOGGED BY WP **CHECKED BY**

GROUNDWATER DEPTH (ft) Not Encountered

NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	USCS SYMBOL	SAMPLE TYPE	PENETRATION RESISTANCE (blows/6-inches)	SPT N60	POCKET PEN (tsf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (PI:LL)	FINES CONTENT (%)	OTHER TESTS
0–2.5		**TOPSOIL** SILTY-SAND - orange-brown, fine to coarse grained, moist, medium dense	SM									
2.5–5		@ 2.5' - **WEATHERED GRANITICS** SILTY-SAND - orange-brown, fine to coarse grained, moist, medium dense		MC	50 10 21	19		6	123			
5–9		@ 5' - SILTY-SAND - brown, fine to coarse grained, slightly moist, very dense	SM	MC	30 50 for 6			5	123			
				SPT	50 for 2			3				

Total depth: 9-feet
Percolation test performed
No groundwater encountered
Boring backfilled on 7/7/2017

BORING NUMBER B-8

EEI Engineering Solutions

CLIENT Integral Communities
PROJECT NAME Barham Drive/San Marcos, California
PROJECT NUMBER IPF-72446.4
PROJECT LOCATION Barham Drive/Meyers Avenue, San Marcos, CA
DATE STARTED 7/7/17 **COMPLETED** 7/7/17
GROUND ELEVATION
BORING DIAMETER 8-inch
EQUIPMENT / RIG Truck-Mounted B-53
HAMMER EFFICIENCY (%) 68
METHOD 8" Hollow Stem Auger 140 lbs Auto Hammer
SPT CORRECTION 1.13 **CAL CORRECTION** 0.62
LOGGED BY WP **CHECKED BY**
GROUNDWATER DEPTH (ft) Not Encountered
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	USCS SYMBOL	SAMPLE TYPE	PENETRATION RESISTANCE (blows/6-inches)	SPT N60	POCKET PEN (tsf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (PI:LL)	FINES CONTENT (%)	OTHER TESTS
0		**WEATHERED GRANITICS**										
1			SM	BULK								EI
2												
3		@ 2.5' - SILTY-SAND - orange-brown, fine to coarse grained, slightly moist, very dense		MC	17 40 50 for 3	0		4	126			
4												
5		@ 5' - becomes gray		MC	50 for 3			3	105			
6												
7												
8		@ 7.5' - no recovery		MC	50 for 3							
9			SM									
10		@ 10' - SILTY-SAND - gray, fine to coarse grained, slightly moist, very dense		MC	50 for 4			2	122			
11												
12												
13												
14												
15		@ 15' - no recovery		SPT	50 for 3							

Total depth: 15.5 feet
No groundwater encountered
Boring backfilled on 7/7/2017

BORING NUMBER B-9

EEI Engineering Solutions

CLIENT Integral Communities
PROJECT NAME Barham Drive/San Marcos, California
PROJECT NUMBER IPF-72446.4
PROJECT LOCATION Barham Drive/Meyers Avenue, San Marcos, CA
DATE STARTED 7/7/17 **COMPLETED** 7/7/17
GROUND ELEVATION **BORING DIAMETER** 8-inch
EQUIPMENT / RIG Truck-Mounted B-53
HAMMER EFFICIENCY (%) 68
METHOD 8" Hollow Stem Auger 140 lbs Auto Hammer
SPT CORRECTION 1.13 **CAL CORRECTION** 0.62
LOGGED BY WP **CHECKED BY**
GROUNDWATER DEPTH (ft) Not Encountered
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	USCS SYMBOL	SAMPLE TYPE	PENETRATION RESISTANCE (blows/6-inches)	SPT N60	POCKET PEN (tsf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (PI:LL)	FINES CONTENT (%)	OTHER TESTS
0		**WEATHERED GRANITICS**										
2.5		@ 2.5' - SILTY-SAND - light brown, fine to coarse grained, dry, very dense		MC	27 50 for 5			4	130			
5				MC	50 for 3			4	110			
7.5		@ 7.5' - becomes slightly moist		MC	50 for 3			3	106			
10		@ 10' - becomes brown-gray, becomes moist	SM	MC	50 for 4			3	95			
15				SPT	50 for 3			2				
20		@ 20' - no recovery		SPT	50 for 2							

Total depth: 21.5-feet
No groundwater encountered
Boring backfilled on 7/7/2017

BORING NUMBER B-10

CLIENT Integral Communities
PROJECT NAME Barham Drive/San Marcos, California
PROJECT NUMBER IPF-72446.4
PROJECT LOCATION Barham Drive/Meyers Avenue, San Marcos, CA
DATE STARTED 7/7/17 **COMPLETED** 7/7/17
GROUND ELEVATION **BORING DIAMETER** 8-inch
EQUIPMENT / RIG Truck-Mounted B-53
HAMMER EFFICIENCY (%) 68
METHOD 8" Hollow Stem Auger 140 lbs Auto Hammer
SPT CORRECTION 1.13 **CAL CORRECTION** 0.62
LOGGED BY WP **CHECKED BY**
GROUNDWATER DEPTH (ft) Not Encountered
NOTES

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	USCS SYMBOL	SAMPLE TYPE	PENETRATION RESISTANCE (blows/6-inches)	SPT N60	POCKET PEN (tsf)	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	ATTERBERG LIMITS (PI:LL)	FINES CONTENT (%)	OTHER TESTS
0		**WEATHERED GRANITICS** SILTY SAND - orange-brown, fine to coarse grained; slightly moist, loose	SM									
3		@ 2.5' - SILTY-SAND - orange-brown, fine to coarse grained, dry, very dense		MC	14 32 50 for 5	0		6	139			
5				MC	14 50 for 5			5	125			
8		@ 7.5' - becomes slightly moist		MC	31 50 for 3			6	98			
10		@ 10' - becomes brown-gray, becomes moist		MC	27 50 for 1			2	110			DS
15				SPT	18 50 for 4			5				
20				SPT	50 for 3			3				

Total depth: 21.5-feet
No groundwater encountered
Boring backfilled on 7/7/2017

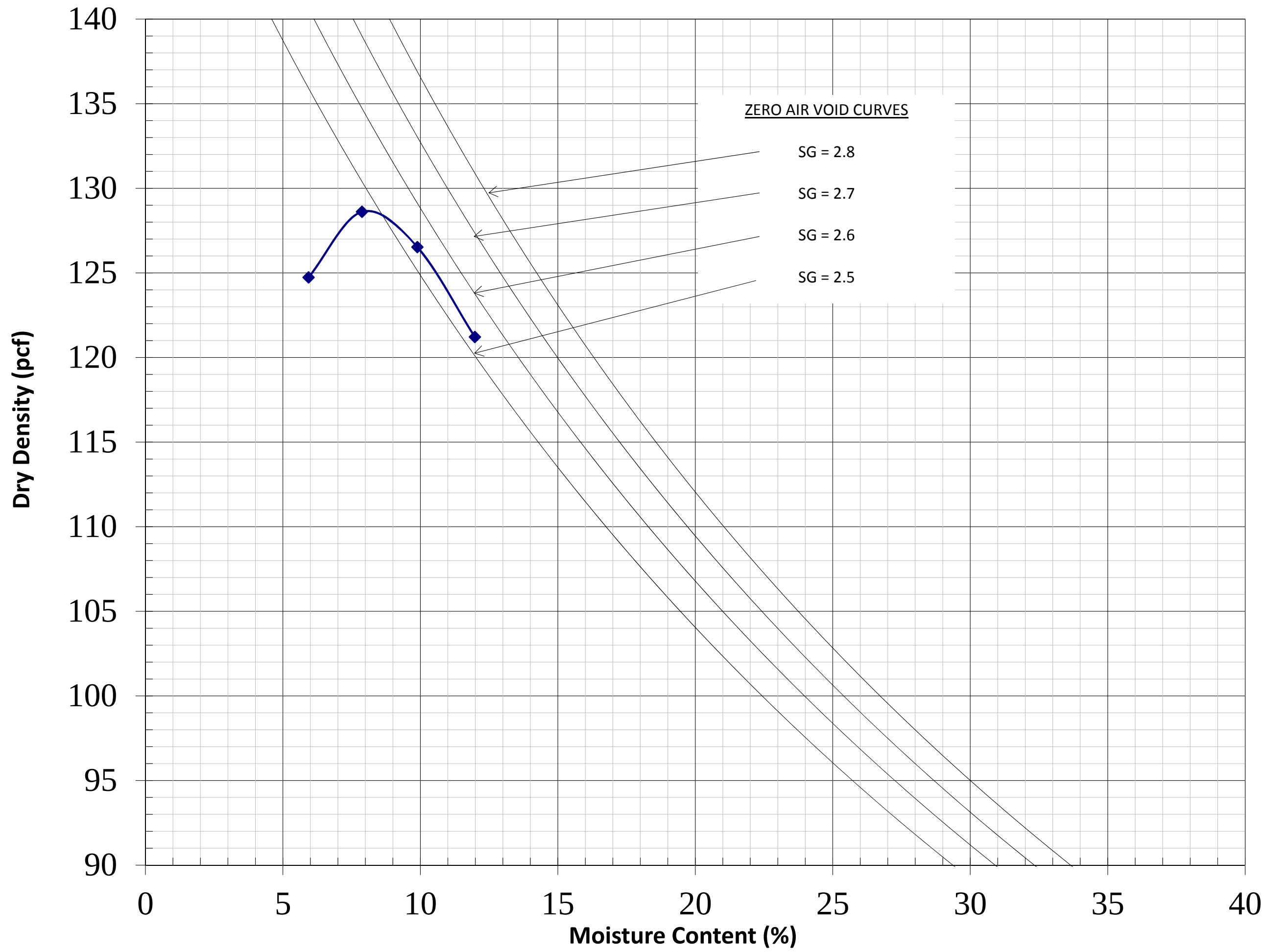
APPENDIX B
LABORATORY TEST DATA

Laboratory tests were performed to provide geotechnical parameters for engineering analyses. The following tests were performed:

- **CLASSIFICATION:** Field classifications were verified in the laboratory by visual examination. The final soil classifications are in accordance with the Unified Soil Classification System.
- **MOISTURE CONTENT and DRY DENSITY:** The in-situ moisture content and dry density of soils was determined for soil samples obtained from the borings, and were determined in general accordance with ASTM D2216 and ASTM 2937, respectively.
- **DIRECT SHEAR:** Direct shear testing was run in general accordance with ASTM D3080. Samples were tested with normal load increments of approximately 1,000, 1,700 and 3,000 psf.
- **MAXIMUM DRY DENSITY and OPTIMUM MOISTURE CONTENT:** The maximum dry density and optimum moisture content was determined in general accordance with ASTM D1557, Method A.
- **EXPANSION INDEX:** Expansion Index testing was run in general accordance with ASTM D4829.
- **R-VALUE:** R-Value testing was run by Geosoils, Inc of Carlsbad in general accordance with Caltrans Method 301.
- **CORROSIVITY**: Corrosion testing of representative soil samples included sulfate potential by California Test 417, chloride potential by California Test 422, and soil minimum resistivity and pH by California Test 643. The sample was tested at the Clarkson Laboratory and Supply, Inc. located in Chula Vista, California.

LABORATORY COMPACTION ASTM D 1557

Sample	1	2	3	4
Mold and Wet Soil (lbs.)	8.68	8.90	8.91	8.80
Small Mold (lbs.)	4.28	4.28	4.28	4.28
Wet Soil (lbs.)	4.40	4.62	4.63	4.52
Wet Density (pcf)	132.1	138.7	139.0	135.7
Tare and Wet Soil (gm.)	100.00	100.00	100.00	100.00
Tare and Dry Soil (gm.)	94.40	92.70	91.00	89.30
Moisture (%)	**5.9**	**7.9**	**9.9**	**12.0**
Dry Density (pcf)	**124.7**	**128.6**	**126.5**	**121.2**



Maximum Density 129.0 pcf @ 8.0 % Moisture

Client:	Integral Communities
Project Name:	Sunrise Development
Project Number:	IPF-72446.4
Date:	7/11/2017
Procedure:	D-1557-A
Boring/Sample No.:	B-1
Depth/Location:	0-5 ft.
Soil Description:	Orange-Brn. Silty Sand
Tested By:	B D

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Geotechnical & Environmental Solutions

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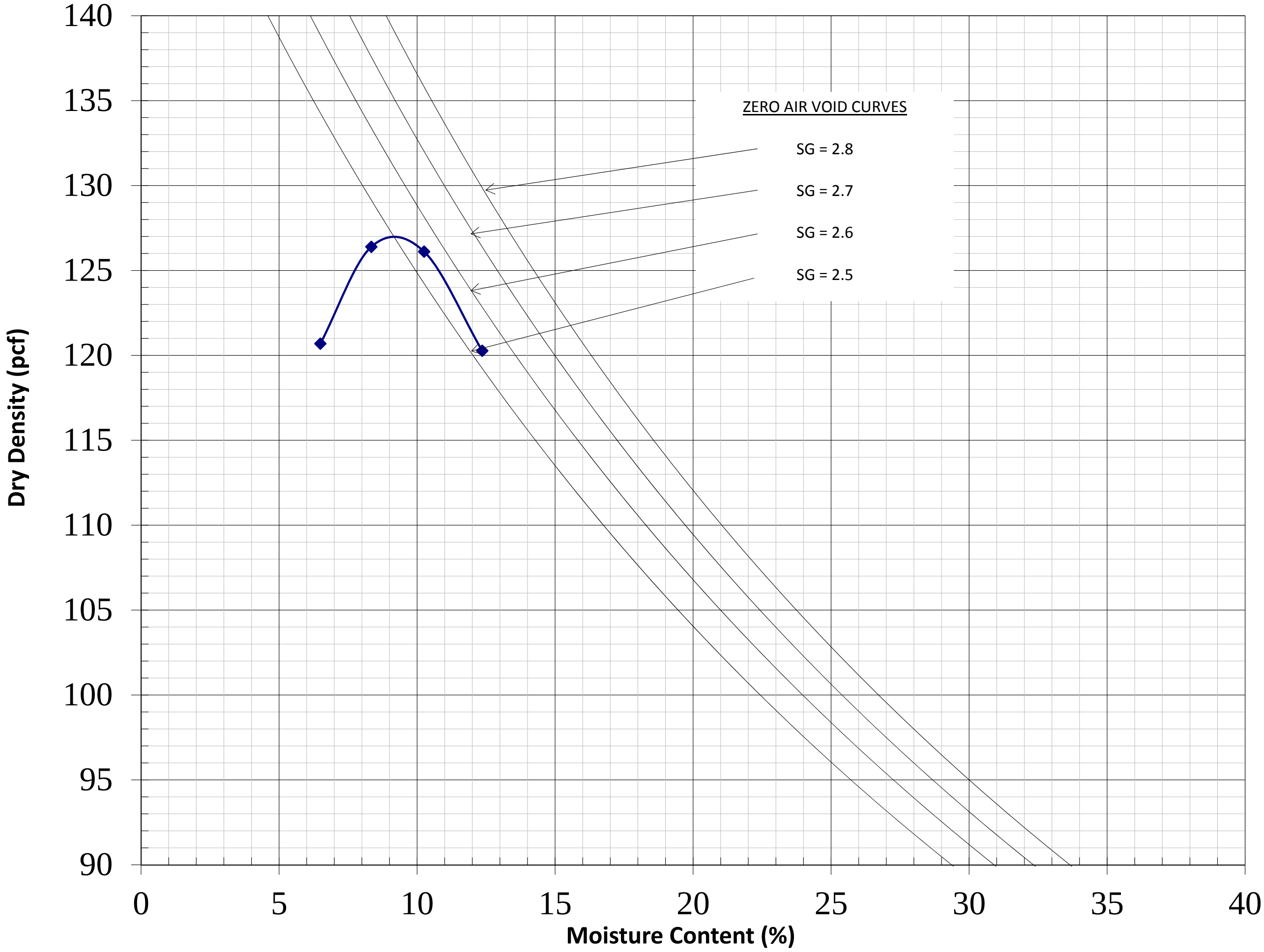
LABORATORY COMPACTION ASTM D 1557

Sample	1	2	3	4
Mold and Wet Soil (lbs.)	8.56	8.84	8.91	8.78
Small Mold (lbs.)	4.28	4.28	4.28	4.28
Wet Soil (lbs.)	4.28	4.56	4.63	4.50
Wet Density (pcf)	128.5	136.9	139.0	135.1
Tare and Wet Soil (gm.)	100.00	100.00	100.00	100.00
Tare and Dry Soil (gm.)	93.90	92.30	90.70	89.00
Moisture (%)	**6.5**	**8.3**	**10.3**	**12.4**
Dry Density (pcf)	**120.7**	**126.4**	**126.1**	**120.3**



Maximum Density 127.0 pcf @ 9.3 % Moisture

Client:	Integral Communities
Project Name:	Sunrise Development
Project Number:	IPF-72446.4
Date:	7/13/2017
Procedure:	D-1557-A
Boring/Sample No.:	B-5
Depth/Location:	0-5 ft.
Soil Description:	Orange-Brn.Silty Sand SM
Tested By:	B D

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EXPANSION INDEX TEST

ASTM METHOD D4829

B-1 @ 0-5 ft.

Moisture Content of Initial Sample		% Saturation of Re-molded Sample		Moisture Content of Final Sample	
Tare No. -	19	Wt. of Soil and Ring (g) -	602	Wt. of Soil and Ring (g) -	620
Wet Weight and Tare (g) -	164.1	Ring Weight (g) -	198.7	Ring Weight (g) -	198.7
Dry Weight and Tare (g) -	154.0	Wet Weight of Soil (g) -	403.3	Wet Weight of Soil (g) -	421.3
Tare Weight (g) -	50.4	Dry Weight of Soil (g) -	367.5	Dry Weight of Soil (g) -	367.5
Water Loss (g) -	10.1	Volume of Ring (ft^3) -	0.0073	Weight of Water (g) -	53.8
Dry Weight (g) -	103.6	Dry Density (pcf) -	111.0	Final Moisture (%)	14.6
Initial Moisture (%) -	9.7	Initital Saturation (%) -	50.8	Final Saturation (%) -	76.3

Expansion Test - UBC (144 PSF)				
	Date	Time	Reading	
Add Weight	7/11/17	8:05	0.000	
10 Minutes		8:15	0.000	Initial Reading
Add Water		10:08	0.003	
		1:15	0.005	
	7/12/17	6:14	0.008	Final Reading

EImeasured	=	8
EI_{50}	=	8

Expansion Index, EI_{50}	Potential Expansion
0-20	Very Low
21-50	Low
51-90	Medium
91-130	High
>130	Very High

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Client:	Integral Communities
Project Name:	Sunrise Development
Project No.:	IPF-72446.4
Date:	7/11/2017
Boring/Sample No.:	B-1
Depth/Location:	0-5 ft.
Soil Description:	Orange/Brn. Silty Sand SM
Tested By:	B D

EXPANSION INDEX TEST

ASTM METHOD D4829

B-8 @ 0-5 ft.

Moisture Content of Initial Sample		% Saturation of Re-molded Sample		Moisture Content of Final Sample	
Tare No. -	19	Wt. of Soil and Ring (g) -	599.9	Wt. of Soil and Ring (g) -	614
Wet Weight and Tare (g) -	150.4	Ring Weight (g) -	198.7	Ring Weight (g) -	198.7
Dry Weight and Tare (g) -	141.6	Wet Weight of Soil (g) -	401.2	Wet Weight of Soil (g) -	415.3
Tare Weight (g) -	50.4	Dry Weight of Soil (g) -	365.9	Dry Weight of Soil (g) -	365.9
Water Loss (g) -	8.8	Volume of Ring (ft^3) -	0.0073	Weight of Water (g) -	49.4
Dry Weight (g) -	91.2	Dry Density (pcf) -	110.5	Final Moisture (%)	13.5
Initial Moisture (%) -	9.6	Initital Saturation (%) -	49.7	Final Saturation (%) -	69.5

Expansion Test - UBC (144 PSF)				
	Date	Time	Reading	
Add Weight	7/12/17	9:31	0.000	
10 Minutes		9:41	0.000	Initial Reading
Add Water		11:04	0.002	
		1:30	0.002	
	7/13/17	5:55	0.003	Final Reading

EImeasured	=	3
EI_{50}	=	3

Expansion Index, EI_{50}	Potential Expansion
0-20	Very Low
21-50	Low
51-90	Medium
91-130	High
>130	Very High

EEI Geotechnical & Environmental Solutions

2195 Faraday Avenue, Suite K, Carlsbad, CA 92008

Client:	Integral Communities
Project Name:	Sunrise Development
Project No.:	IPF-72446.4
Date:	7/12/2017
Boring/Sample No.:	B-8
Depth/Location:	0-5 ft.
Soil Description:	Red-Brn. Silty Sand SM
Tested By:	B D

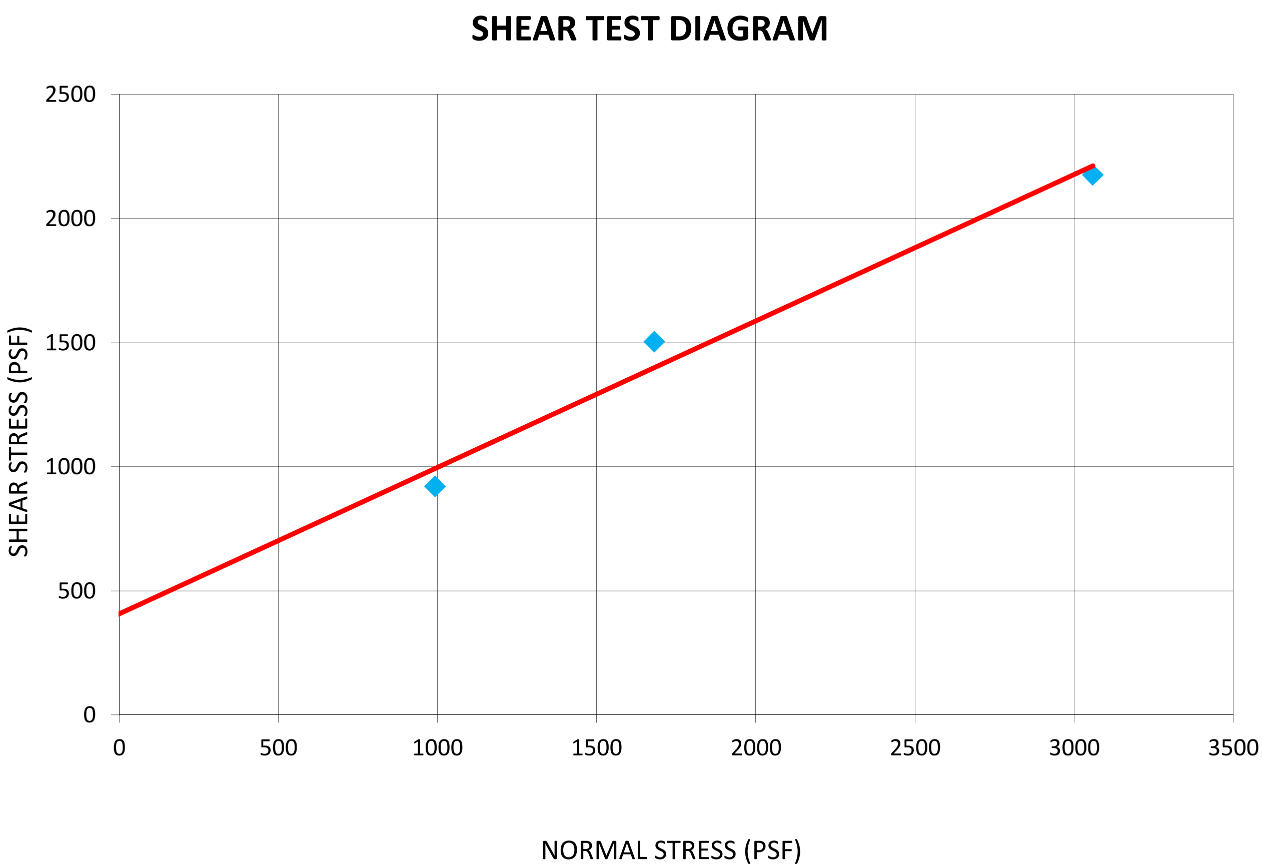
DIRECT SHEAR TEST (ASTM D3080)

B-1 @ 0-5 ft.

Sample Data	
Remolded:	90%
Remarks:	Sample inundated prior to testing
Soil Description:	Red-Brn. Silty Sand SM

Test Results		
Average Initial Moisture =	8.0	%
Average Dry Density =	116.0	pcf
Average Final Moisture =	15.7	%

Peak Strength	ϕ = 31 deg.	c = 407 psf



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Client:	Integral Communities
Project Name:	Sunrise Development
Project No.:	IPF-72446.4
Date:	7/13/17
Boring/Sample No:	B-1
Depth/Location:	0-5 ft.
Soil Description:	Red-Brn. Silty Sand SM
Tested by:	B D

DIRECT SHEAR TEST (ASTM D3080)

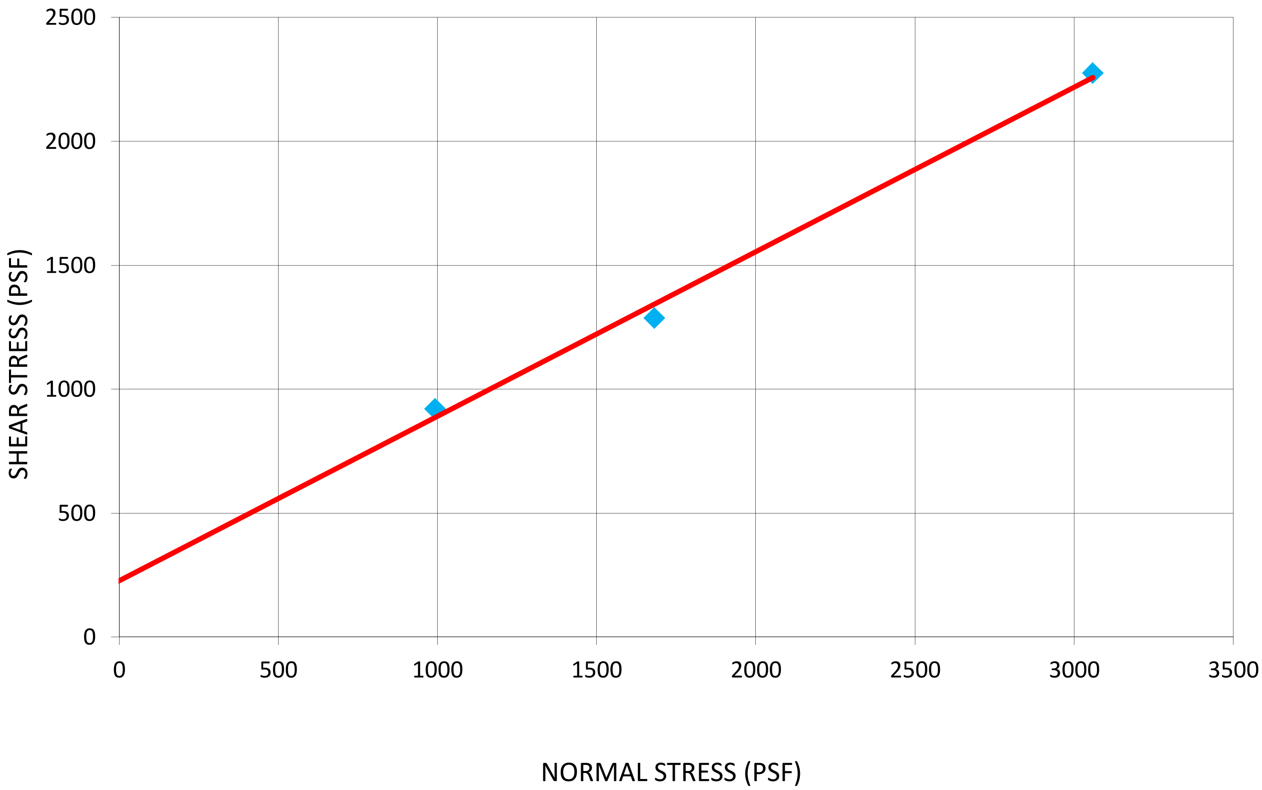
B-5 @ 0-5 ft.

Sample Data	
Remolded:	90%
Remarks:	Sample inundated prior to testing
Soil Description:	Red-Brn. Silty Sand SM

Test Results		
Average Initial Moisture =	9.3	%
Average Dry Density =	114.2	pcf
Average Final Moisture =	15.0	%

Peak Strength	ϕ = 34 deg.	c = 227 psf

SHEAR TEST DIAGRAM



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Client:	Integral Communities
Project Name:	Sunrise Development
Project No.:	IPF-72446.4
Date:	7/14/17
Boring/Sample No:	B-5
Depth/Location:	0-5 ft.
Soil Description:	Red-Brn. Silty Sand SM
Tested by:	B D

DIRECT SHEAR TEST (ASTM D3080)

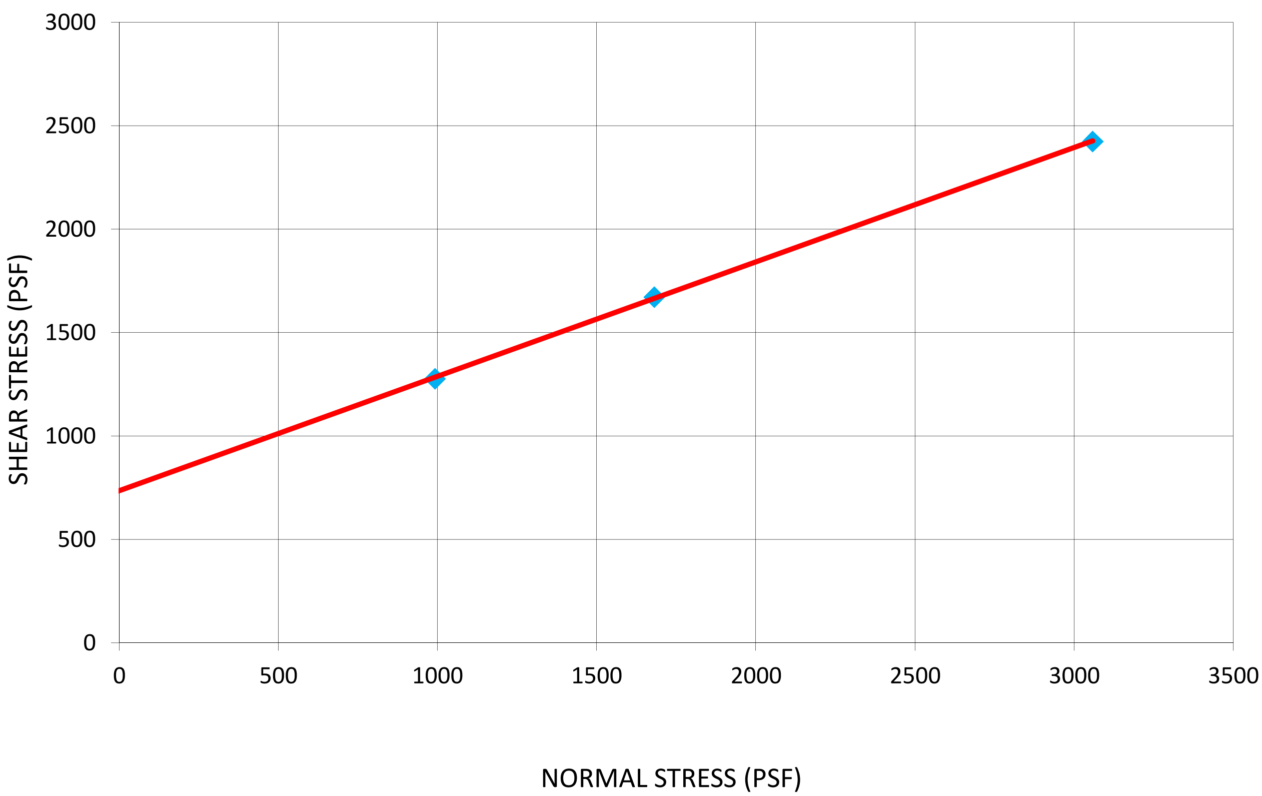
B-10 @ 10 ft.

Sample Data	
Remolded:	Natural
Remarks:	Sample inundated prior to testing
Soil Description:	Red-Brn. Silty Sand SM

Test Results		
Average Initial Moisture =	2.4	%
Average Dry Density =	115.1	pcf
Average Final Moisture =	11.8	%

Peak Strength	ϕ = 29 deg.	c = 734 psf

SHEAR TEST DIAGRAM



Geotechnical & Environmental Solutions

2195 Faraday Avenue, Suite K, Carlsbad, CA 92008

Client:	Integral Communities
Project Name:	Sunrise Development
Project No.:	IPF-72446.4
Date:	7/12/17
Boring/Sample No:	B-10
Depth/Location:	10 ft.
Soil Description:	Red-Brn. Silty Sand SM
Tested by:	B D

L A B O R A T O R Y   R E P O R T

Telephone (619) 425-1993   Fax 425-7917   Established 1928

C L A R K S O N   L A B O R A T O R Y   A N D   S U P P L Y   I N C.
350 Trousdale Dr. Chula Vista, Ca. 91910 www.clarksonlab.com
A N A L Y T I C A L   A N D   C O N S U L T I N G   C H E M I S T S

Date: July 18, 2017
Purchase Order Number: IPF-72446-4
Sales Order Number: 36551
Account Number: EEI

To:

EEI Environmental Equalizers Inc
2195 Faraday Avenue Suite K
Carlsbad, CA 92008
Attention: Jeff Blake

Laboratory Number: SO6454   Customers Phone: 760-431-3747

Sample Designation:

One soil sample received on 07/13/17 at 1:45pm,
taken from Sunrise Dev Project#IPF-72446-4
marked as B-5@0'-5'.

Analysis By California Test 643, 1999, Department of Transportation Division of Construction, Method for Estimating the Service Life of Steel Culverts.

pH 6.7

Water Added (ml)	Resistivity (ohm-cm)
10	12000
5	7400
5	5700
5	5200
5	5100
5	5300
5	5500

29 years to perforation for a 16 gauge metal culvert.
38 years to perforation for a 14 gauge metal culvert.
53 years to perforation for a 12 gauge metal culvert.
67 years to perforation for a 10 gauge metal culvert.
82 years to perforation for a 8 gauge metal culvert.

Water Soluble Sulfate Calif. Test 417 0.003%

Water Soluble Chloride Calif. Test 422 0.002%

Laura Torres

Laura Torres
LT/ilv

R - VALUE DATA SHEET

LaBelle Marvin

PROJECT No. 42613

DATE: 7/26/2017

BORING NO. B-3 @ 0'-5'

Integral Comm., Sunrise Dev.

P.N. IPF-72446.4

SAMPLE DESCRIPTION: Brown Slightly Sandy Clay

R-VALUE TESTING DATA | CA TEST 301			
Item	a	b	c
Mold Number	1		
Water added, grams	128		
Initial Test Water, %	19.1		
Compact Gage Pressure,psi	45		
Exudation Pressure, psi	493		
Height Sample, Inches	2.44		
Gross Weight Mold, grams	2967		
Tare Weight Mold, grams	1947		
Sample Wet Weight, grams	1020		
Expansion, Inches x 10exp-4	29		
Stability 2,000 lbs (160psi)	50 / 129		
Turns Displacement	3.40		
R-Value Uncorrected	15		
R-Value Corrected	15		
Dry Density, pcf	106.4		

DESIGN CALCULATION DATA

Traffic Index Assumed:	4.0		
G.E. by Stability	0.87		
G. E. by Expansion	0.97		

Equilibrium R-Value	**5 or less** by EXUDATION	Examined & Checked: 7 /26/ 17
REMARKS:	Gf = 1.25 Sample Exuded @ 493 psi.	REGISTERED PROFESSIONAL ENGINEER STEVEN R. MARVIN C 30659 CIVIL STATE OF CALIFORNIA Steven R. Marvin, RCE 30659

The data above is based upon processing and testing samples as received from the field. Test procedures in accordance with latest revisions to Department of Transportation, State of California, Materials & Research Test Method No. 301.

APPENDIX C
EARTHWORK AND GRADING GUIDELINES

EARTHWORK AND GRADING GUIDELINES

GENERAL

These guidelines present general procedures and recommendations for earthwork and grading as required on the approved grading plans, including preparation of areas to be filled, placement of fill and installation of subdrains and excavations. The recommendations contained in the geotechnical report are applicable to each specific project, are part of the earthwork and grading guidelines and would supersede the provisions contained hereafter in the case of conflict. Observations and/or testing performed by the consultant during the course of grading may result in revised recommendations which could supersede these guidelines or the recommendations contained in the geotechnical report. Figures A through O are provided at the back of this appendix, exhibiting generalized cross sections relating to these guidelines.

The contractor is responsible for the satisfactory completion of all earthworks in accordance with provisions of the project plans and specifications. The project soil engineer and engineering geologist (geotechnical consultant) or their representatives should provide observation and testing services, and geotechnical consultation throughout the duration of the project.

EARTHWORK OBSERVATIONS AND TESTING

Geotechnical Consultant

Prior to the commencement of grading, a qualified geotechnical consultant (a soil engineer and engineering geologist) should be employed for the purpose of observing earthwork procedures and testing the fills for conformance with the recommendations of the geotechnical report, the approved grading plans, and applicable grading codes and ordinances.

The geotechnical consultant should provide testing and observation so that determination may be made that the work is being completed as specified. It is the responsibility of the contractor to assist the consultant and keep them aware of work schedules and predicted changes, so that the consultant may schedule their personnel accordingly.

All removals, prepared ground to receive fill, key excavations, and subdrains should be observed and documented by the project engineering geologist and/or soil engineer prior to placing any fill. It is the contractor's responsibility to notify the engineering geologist and soil engineer when such areas are ready for observation.

Laboratory and Field Tests

Maximum dry density tests to determine the degree of compaction should be performed in accordance with American Standard Testing Materials test method ASTM designation D-1557-78. Random field compaction tests should be performed in accordance with test method ASTM designations D-1556-82, D-2937 or D-2922 & D-3017, at intervals of approximately two (2) feet of fill height per 10,000 sq. ft. or every one thousand cubic yards of fill placed. These criteria would vary depending on the soil conditions and the size of the project. The location and frequency of testing would be at the discretion of the geotechnical consultant

Contractor's Responsibility

All clearing, site preparation, and earthwork performed on the project should be conducted by the contractor, with observation by geotechnical consultants and staged approval by the appropriate governing agencies. It is the contractor's responsibility to prepare the ground surface to receive the fill to the satisfaction of the soil engineer, and to place, spread, moisture condition, mix and compact the fill in accordance with the recommendations of the soil engineer. The contractor should also remove all major deleterious material considered unsatisfactory by the soil engineer.

It is the sole responsibility of the contractor to provide adequate equipment and methods to accomplish the earthwork in accordance with applicable grading guidelines, codes or agency ordinances, and approved grading plans. Sufficient watering apparatus and compaction equipment should be provided by the contractor with due consideration for the fill material, rate of placement, and climatic conditions. If, in the opinion of the geotechnical consultant, unsatisfactory conditions such as questionable weather, excessive oversized rock, deleterious material or insufficient support equipment are resulting in a quality of work that is not acceptable, the consultant will inform the contractor, and the contractor is expected to rectify the conditions, and if necessary, stop work until conditions are satisfactory.

The contractor will properly grade all surfaces to maintain good drainage and prevent ponding of water. The contractor will take action to control surface water and to prevent erosion control measures that have been installed.

SITE PREPARATION

All vegetation including brush, trees, thick grasses, organic debris, and other deleterious material should be removed and disposed of offsite, and must be concluded prior to placing fill. Existing fill, soil, alluvium, colluvium, or rock materials determined by the soil engineer or engineering geologist as unsuitable for structural in-place support should be removed prior to fill placement. Depending upon the soil conditions, these materials may be reused as compacted fills. Any materials incorporated as part of the compacted fills should be approved by the soil engineer.

Any underground structures such as cesspools, cisterns, mining shafts, tunnels, septic tanks, wells, pipelines, or other structures not located prior to grading are to be removed or treated in a manner recommended by the soil engineer. Soft, dry, spongy, highly fractured, or otherwise unsuitable ground extending to such a depth that surface processing cannot adequately improve the condition should be over excavated down to firm ground and approved by the soil engineer before compaction and filling operations continue. Over excavated and processed soils which have been properly mixed and moisture-conditioned should be recompacted to the minimum relative compaction as specified in these guidelines.

Existing ground which is determined to be satisfactory for support of the fills should be scarified to a minimum depth of six (6) inches, or as directed by the soil engineer. After the scarified ground is brought to optimum moisture (or greater) and mixed, the materials should be compacted as specified herein. If the scarified zone is greater than 6 inches in depth, it may be necessary to remove the excess and place the material in lifts restricted to six (6) inches in compacted thickness.

Existing grind which is not satisfactory to support compacted fill should be over excavated as required in the geotechnical report or by the onsite soils engineer and/or engineering geologists. Scarification, discing, or other acceptable form of mixing should continue until the soils are broken down and free of large fragments or clods, until the working surface is reasonably uniform and free from ruts, hollows, hummocks, or other uneven features which would inhibit compaction as described above.

Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical) gradient, the ground should be benched. The lowest bench, which will act as a key, should be a minimum of 12 feet wide and should be at least two (2) feet deep into competent material, approved by the soil engineer and/or engineering geologist. In fill over cut slope conditions, the recommended minimum width of the lowest bench or key is at least 15 feet with the key excavated on competent material, as designated by the Geotechnical Consultant. As a general rule, unless superseded by the Soil Engineer, the minimum width of fill keys should be approximately equal to one-half (½) the height of the slope.

Standard benching is typically four feet (minimum) vertically, exposing competent material. Benching may be used to remove unsuitable materials, although it is understood that the vertical height of the bench may exceed four feet. Pre stripping may be considered for removal of unsuitable materials in excess of four feet in thickness.

All areas to receive fill, including processed areas, removal areas, and toe of fill benches should be observed and approved by the soil engineer and/or engineering geologist prior to placement of fill. Fills may then be properly placed and compacted until design grades are attained.

COMPACTED FILLS

Earth materials imported or excavated on the property may be utilized as fill provided that each soil type has been accepted by the soil engineer. These materials should be free of roots, tree branches, other organic matter or other deleterious materials. All unsuitable materials should be removed from the fill as directed by the soil engineer. Soils of poor gradation, undesirable expansion potential, or substandard strength characteristics may be designated unsuitable by the consultant and may require mixing with other earth materials to serve as a satisfactory fill material.

Fill materials generated from benching operations should be dispersed throughout the fill area. Benching operations should not result in the benched material being placed only within a single equipment width away from the fill/bedrock contact.

Oversized materials, defined as rock or other irreducible materials with a maximum size exceeding 12 inches in one dimension, should not be buried or placed in fills unless the location of materials and disposal methods are specifically approved by the soil engineer. Oversized material should be taken offsite or placed in accordance with recommendations of the soil engineer in areas designated as suitable for rock disposal. Oversized material should not be placed vertically within 10 feet of finish grade or horizontally within 20 feet of slope faces.

To facilitate trenching, rock should not be placed within the range of foundation excavations or future utilities unless specifically approved by the soil engineer and/or the representative developers.

If import fill material is required for grading, representative samples of the material should be analyzed in the laboratory by the soil engineer to determine its physical properties. If any material other than that previously analyzed is imported to the fill or encountered during grading, analysis of this material should be conducted by the soil engineer as soon as practical.

Fill material should be placed in areas prepared to receive fill in near-horizontal layers that should not exceed six (6) inches compacted in thickness. The soil engineer may approve thicker lifts if testing indicates the grading procedures are such that adequate compaction is being achieved. Each layer should be spread evenly and mixed to attain uniformity of material and moisture suitable for compaction.

Fill materials at moisture content less than optimum should be watered and mixed, and "wet" fill materials should be aerated by scarification, or should be mixed with drier material. Moisture conditioning and mixing of fill materials should continue until the fill materials have uniform moisture content at or above optimum moisture.

After each layer has been evenly spread, moisture-conditioned and mixed, it should be uniformly compacted to a minimum of 90 percent of maximum density as determined by ASTM test designation, D 1557-78, or as otherwise recommended by the soil engineer. Compaction equipment should be adequately sized and should be reliable to efficiently achieve the required degree of compaction.

Where tests indicate that the density of any layer of fill, or portion thereof, is below the required relative compaction or improper moisture content, the particular layer or portion will be reworked until the required density and/or moisture content has been attained. No additional fill will be placed in an area until the last placed lift of fill has been tested and found to meet the density and moisture requirements, and is approved by the soil engineer.

Compaction of slopes should be accomplished by over-building the outside edge a minimum of three (3) feet horizontally, and subsequently trimming back to the finish design slope configuration. Testing will be performed as the fill is horizontally placed to evaluate compaction as the fill core is being developed. Special efforts may be necessary to attain the specified compaction in the fill slope zone. Final slope shaping should be performed by trimming and removing loose materials with appropriate equipment. A final determination of fill slope compaction should be based on observation and/or testing of the finished slope face.

If an alternative to over-building and cutting back the compacted fill slope is selected, then additional efforts should be made to achieve the required compaction in the outer 10 feet of each lift of fill by undertaking the following:

- Equipment consisting of a heavy short-shanked sheepsfoot should be used to roll (horizontal) parallel to the slopes continuously as fill is placed. The sheepsfoot roller should also be used to roll perpendicular to the slopes, and extend out over the slope to provide adequate compaction to the face slope.

- Loose fill should not be spilled out over the face of the slope as each lift is compacted. Any loose fill spilled over a previously completed slope face should be trimmed off or be subject to re-rolling.

- Field compaction tests will be made in the outer two (2) to five (5) feet of the slope at two (2) to three (3) foot vertical intervals, subsequent to compaction operations.

- After completion of the slope, the slope face should be shaped with a small dozer and then re-rolled with a sheepsfoot to achieve compaction to near the slope face. Subsequent to testing to verify compaction, the slopes should be grid-rolled to achieve adequate compaction to the slope face. Final testing should be used to confirm compaction after grid rolling.

- Where testing indicates less than adequate compaction, the contractor will be responsible to process, moisture condition, mix and recompact the slope materials as necessary to achieve compaction. Additional testing should be performed to verify compaction.

- Erosion control and drainage devices should be designed by the project civil engineer in compliance with the ordinances of the controlling governmental agencies, and/or in accordance with the recommendations of the soil engineer or engineering geologist.

EXCAVATIONS

Excavations and cut slopes should be observed and mapped during grading by the engineering geologist. If directed by the engineering geologist, further excavations or over-excavation and refilling of cut areas should be performed. When fills over cut slopes are to be graded, the cut portion of the slope should be observed by the engineering geologist prior to placement of the overlying fill portion of the slope. The engineering geologist should observe all cut slopes and should be notified by the contractor when cut slopes are started.

If, during the course of grading, unanticipated adverse or potentially adverse geologic conditions are encountered, the engineering geologist and soil engineer should investigate, evaluate and make recommendations to mitigate (or limit) these conditions. The need for cut slope buttressing or stabilizing should be based on as-grading evaluations by the engineering geologist, whether anticipated previously or not.

Unless otherwise specified in soil and geological reports, no cut slopes should be excavated higher or steeper than that allowed by the ordinances of controlling governmental agencies. Additionally, short-term stability of temporary cut slopes is the contractor’s responsibility.

Erosion control and drainage devices should be designed by the project civil engineer and should be constructed in compliance with the ordinances of the controlling governmental agencies, and/or in accordance with the recommendations of the soil engineer or engineering geologist.

SUBDRAIN INSTALLATION

Subdrains should be installed in accordance with the approved embedment material, alignment and details indicated by the geotechnical consultant. Subdrain locations or construction materials should not be changed or modified without approval of the geotechnical consultant. The soil engineer and/or engineering geologist may recommend and direct changes in subdrain line, grade and drain material in the field, pending exposed conditions. The location of constructed subdrains should be recorded by the project civil engineer.

COMPLETION

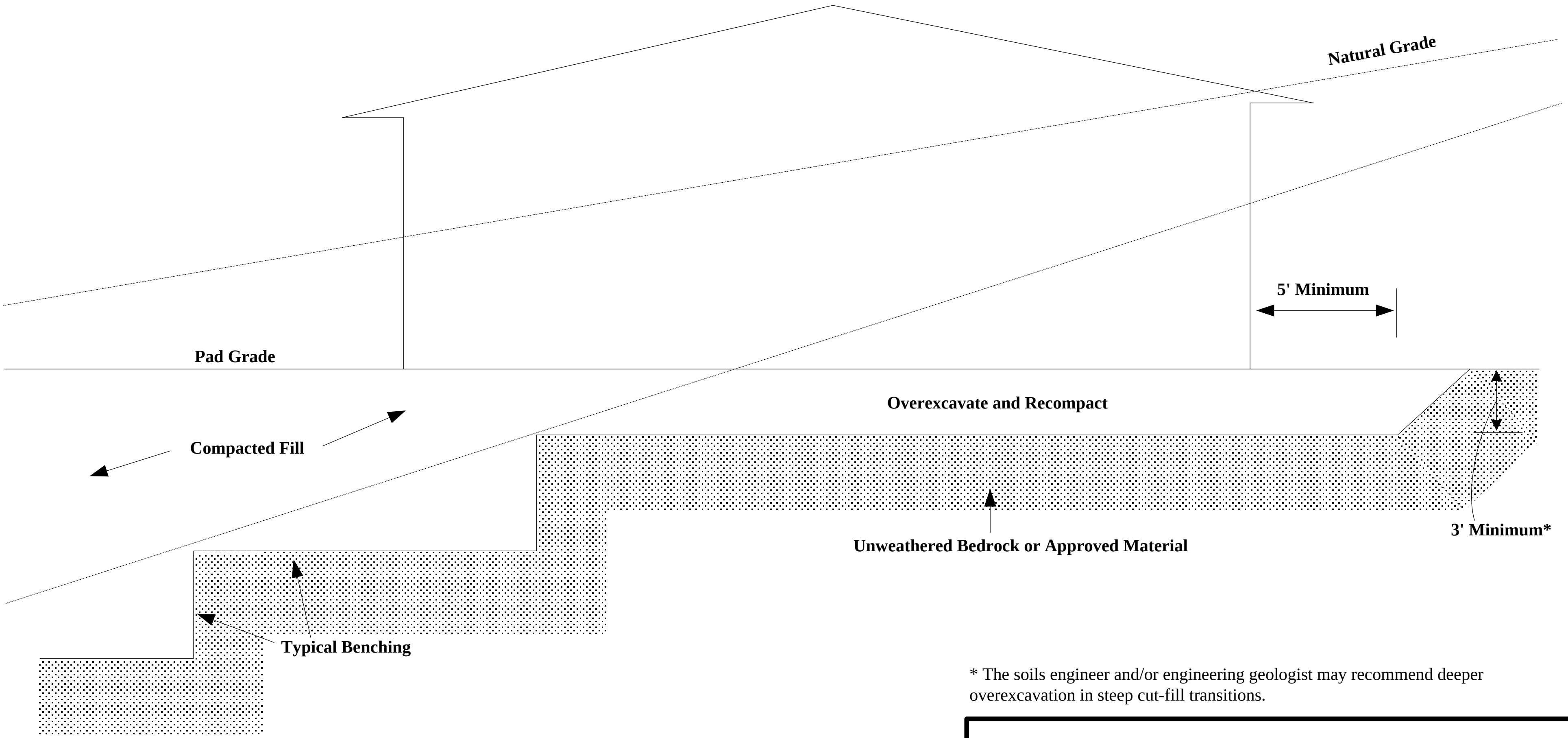
Consultation, observation and testing by the geotechnical consultant should be completed during grading operations in order to state an opinion that all cut and filled areas are graded in accordance with the approved project specifications.

After completion of grading and after the soil engineer and engineering geologist have finished their observations, final reports should be submitted subject to review by the controlling governmental agencies. No additional grading should be undertaken without prior notification of the soil engineer and/or engineering geologist.

All finished cut and fill slopes should be protected from erosion, including but not limited to planting in accordance with the plan design specifications and/or as recommended by a landscape architect. Such protection and/or planning should be undertaken as soon as possible after completion of grading.

ATTACHMENTS

TRANSITION LOT DETAIL
CUT LOT – MATERIAL TYPE TRANSITION



* The soils engineer and/or engineering geologist may recommend deeper overexcavation in steep cut-fill transitions.

Note: Figure not to scale

EARTHWORK AND GRADING GUIDELINES
TRANSITION LOT DETAIL
CUT LOT – MATERIAL TYPE TRANSITION

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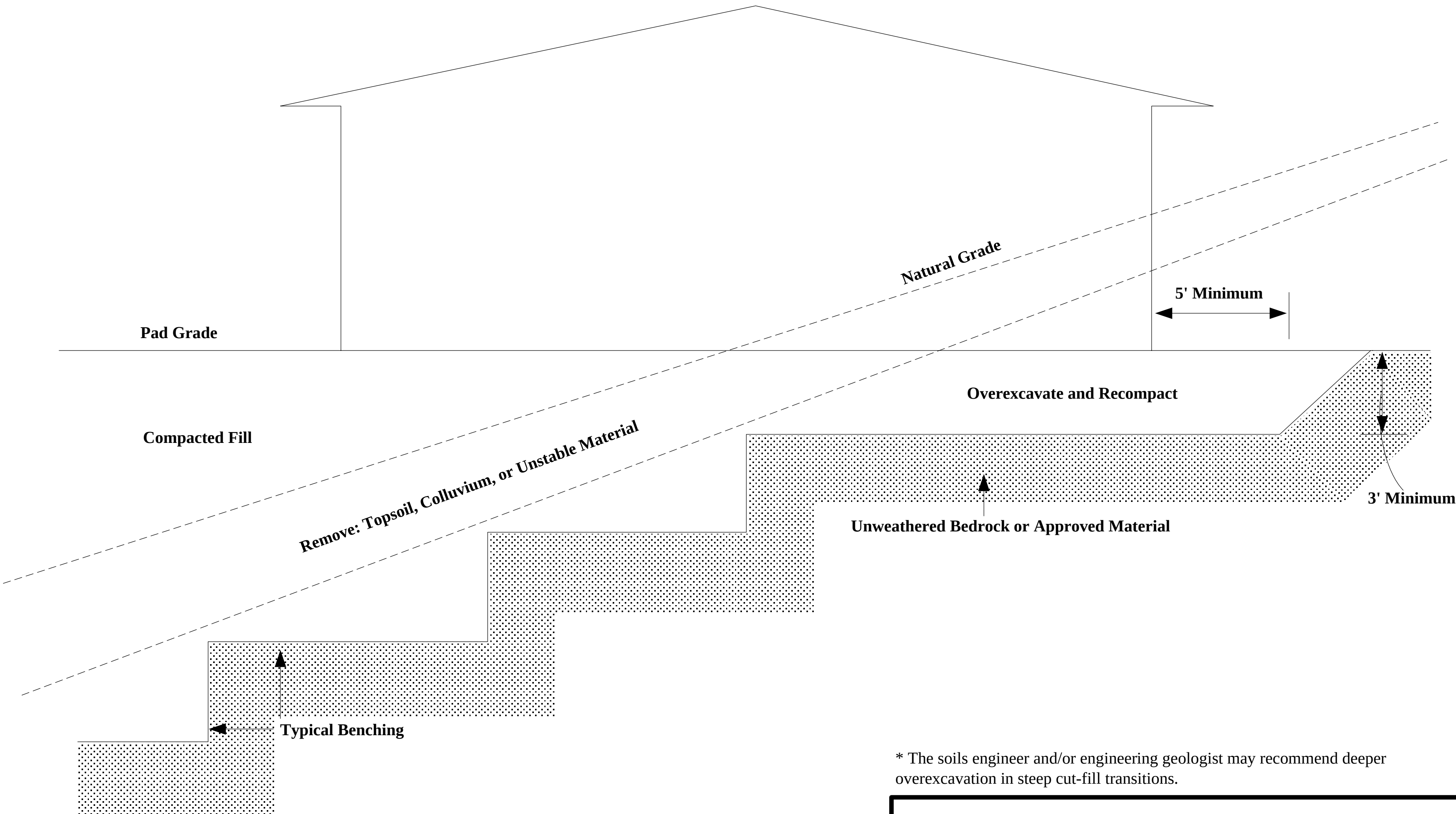
FIGURE A

TRANSITION LOT DETAIL
CUT – FILL – DAYLIGHT TRANSITION



* The soils engineer and/or engineering geologist may recommend deeper overexcavation in steep cut-fill transitions.

Note: Figure not to scale

EARTHWORK AND GRADING GUIDELINES
TRANSITION LOT DETAIL
CUT – FILL – DAYLIGHT TRANSITION

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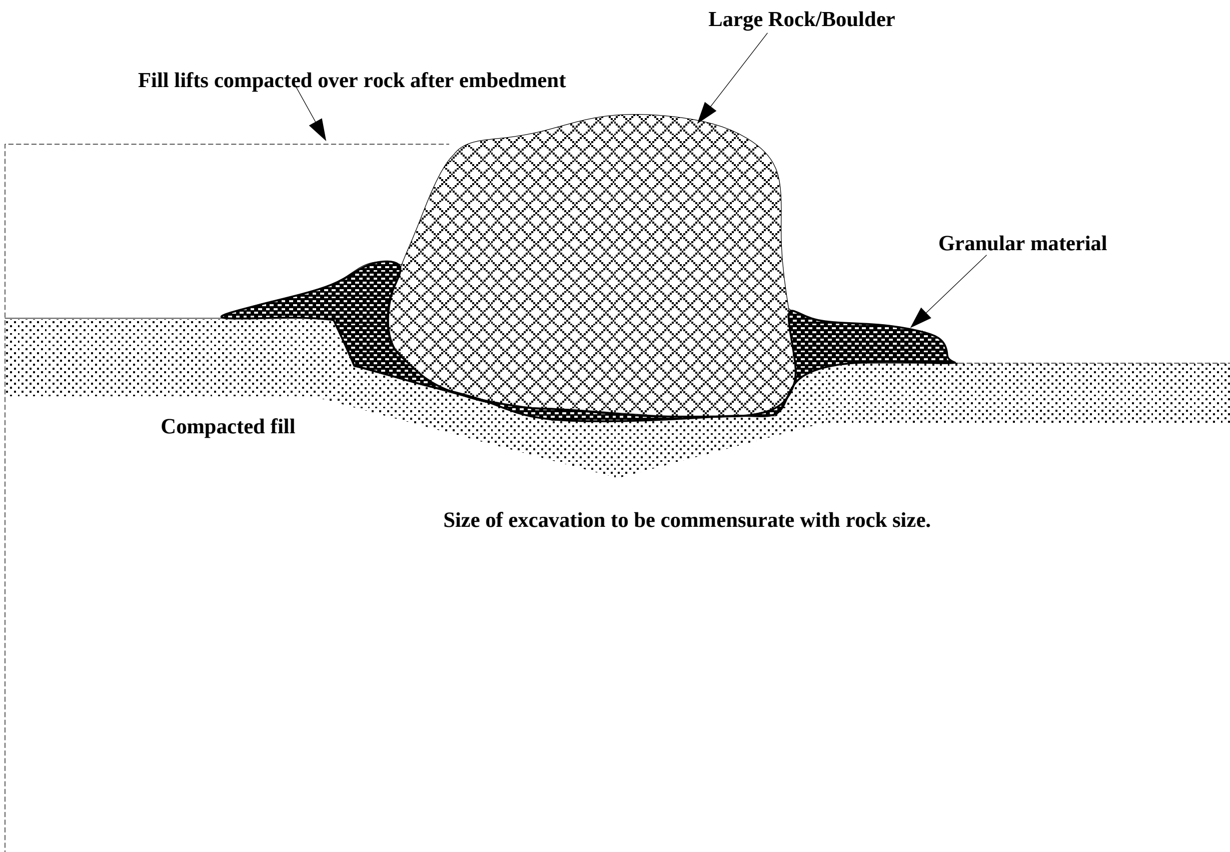
FIGURE B

ROCK DISPOSAL PITS



Note:
(1) Large rock is defined as having a diameter larger than 3 feet in maximum size.
(2) Pit shall be excavated into compacted fill to a depth equal to half of the rock size.
(3) Granular soil shall be pushed into the pit and then flooded around the rock using a sheepsfoot to help with compaction.
(4) A minimum of 3 feet of compacted fill should be laid over each pit.
(5) Pits shall have at least 15 feet of separation between one another, horizontally.
(6) Pits shall be placed at least 20 feet from any fill slope.
(7) Pits shall be used only in deep fill areas.

Note: Figure not to scale

EARTHWORK AND GRADING GUIDELINES
ROCK DISPOSAL PITS

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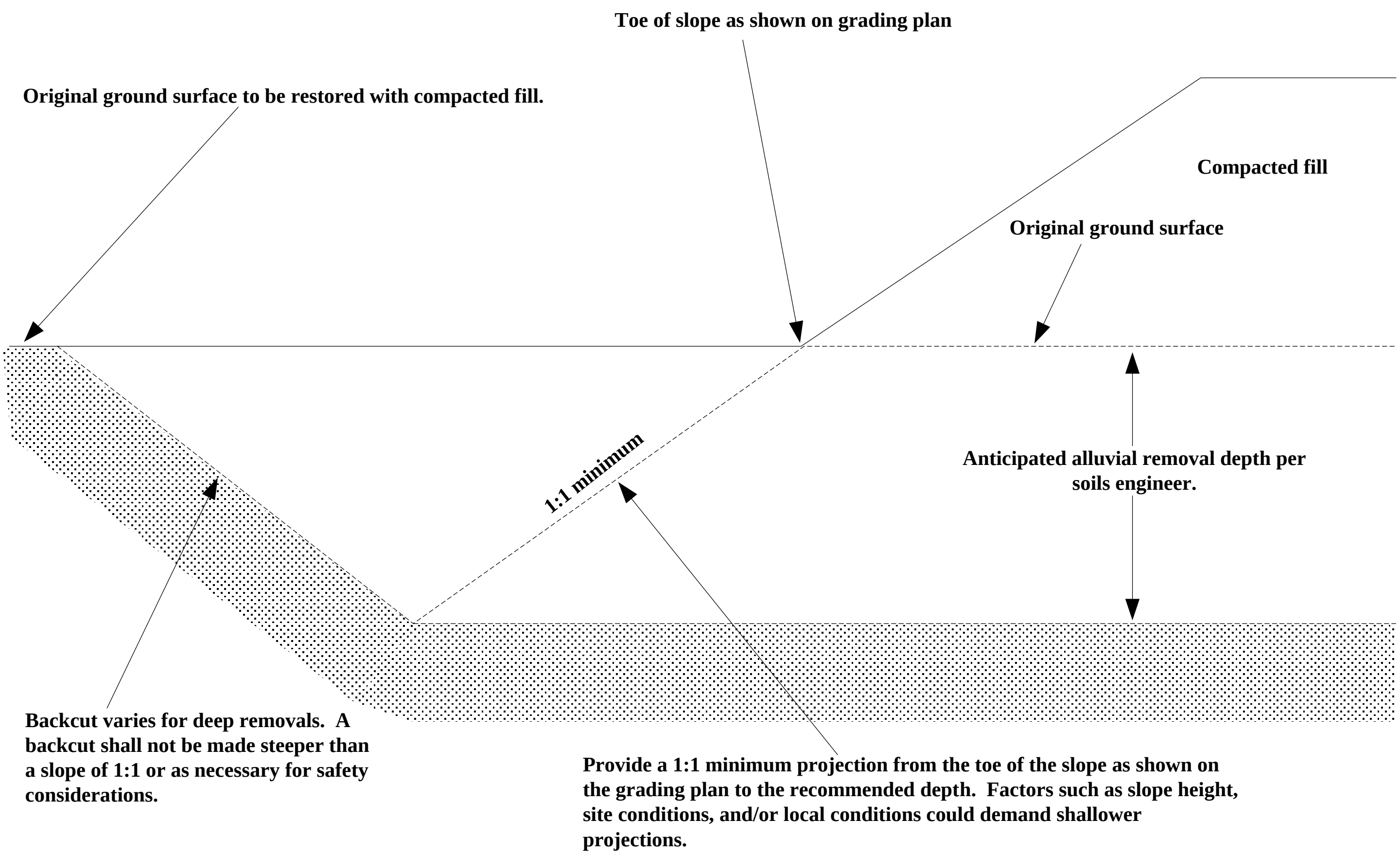
FIGURE C

DETAIL FOR FILL SLOPE TOEING OUT ON FLAT ALLUVIATED CANYON



Note: Figure not to scale

EARTHWORK AND GRADING GUIDELINES
DETAIL FOR FILL SLOPE TOEING OUT ON A FLAT ALLUVIATED CANYON

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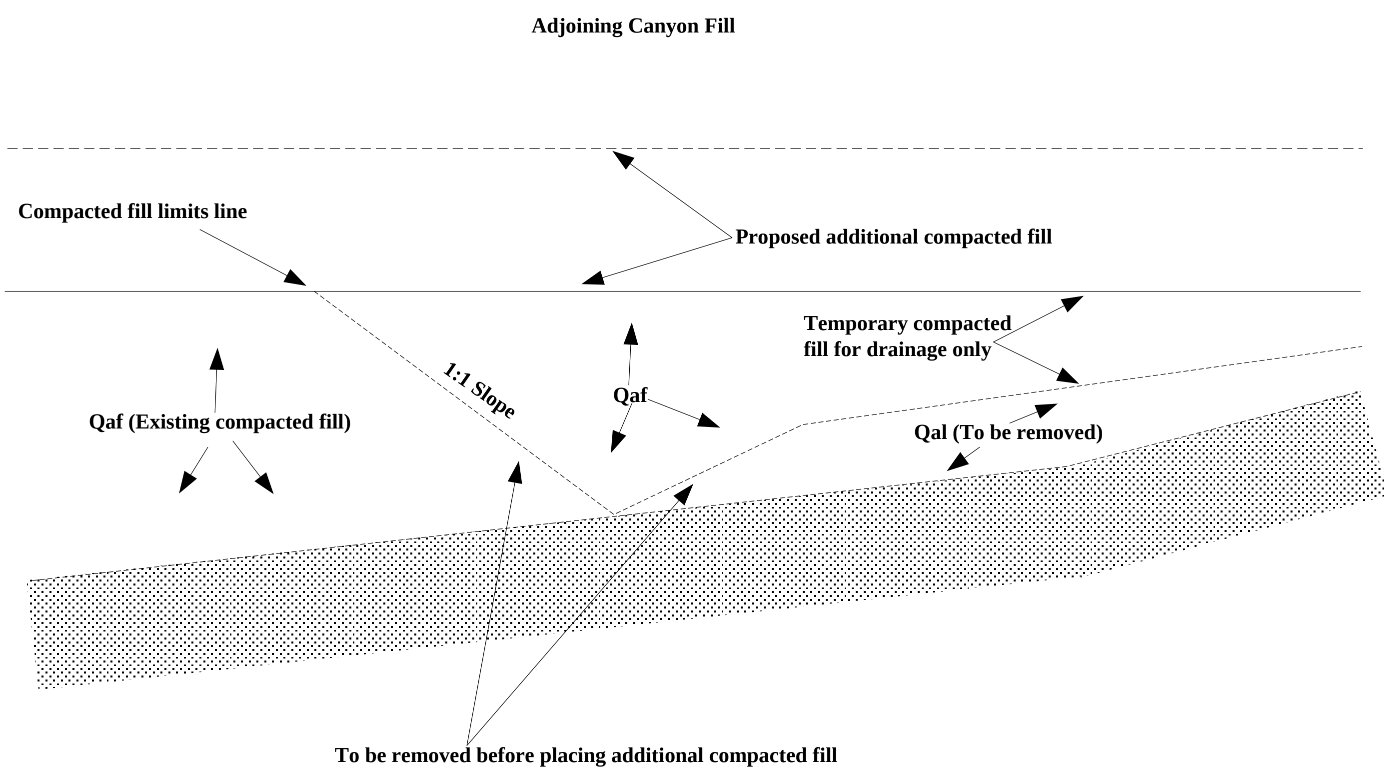
FIGURE D

REMOVAL ADJACENT TO EXISTING FILL



Legend

Qaf - **Artificial Fill**

Qal - **Alluvium**

Note: Figure not to scale

EARTHWORK AND GRADING GUIDELINES
REMOVAL ADJACENT TO EXISTING FILL

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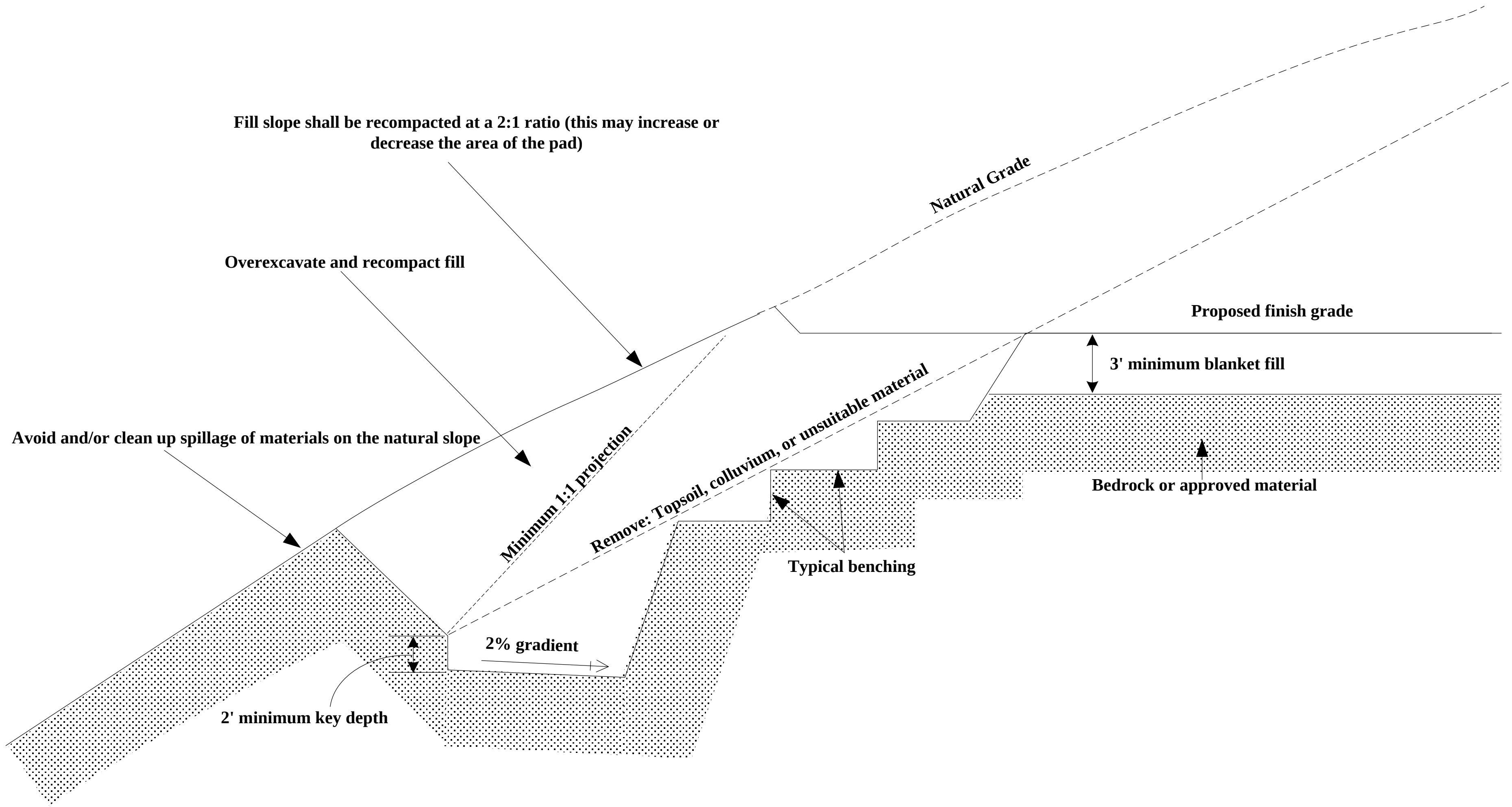
FIGURE E

DAYLIGHT CUT LOT DETAIL



Note: (1) Subdrain and key width requirements shall be determined based on exposed subsurface conditions and the thickness of overburden.

(2) Pad overexcavation and recompaction shall be completed if determined as necessary by the soils engineer and/or engineering geologist.

Note: Figure not to scale

EARTHWORK AND GRADING GUIDELINES
DAYLIGHT CUT LOT DETAIL

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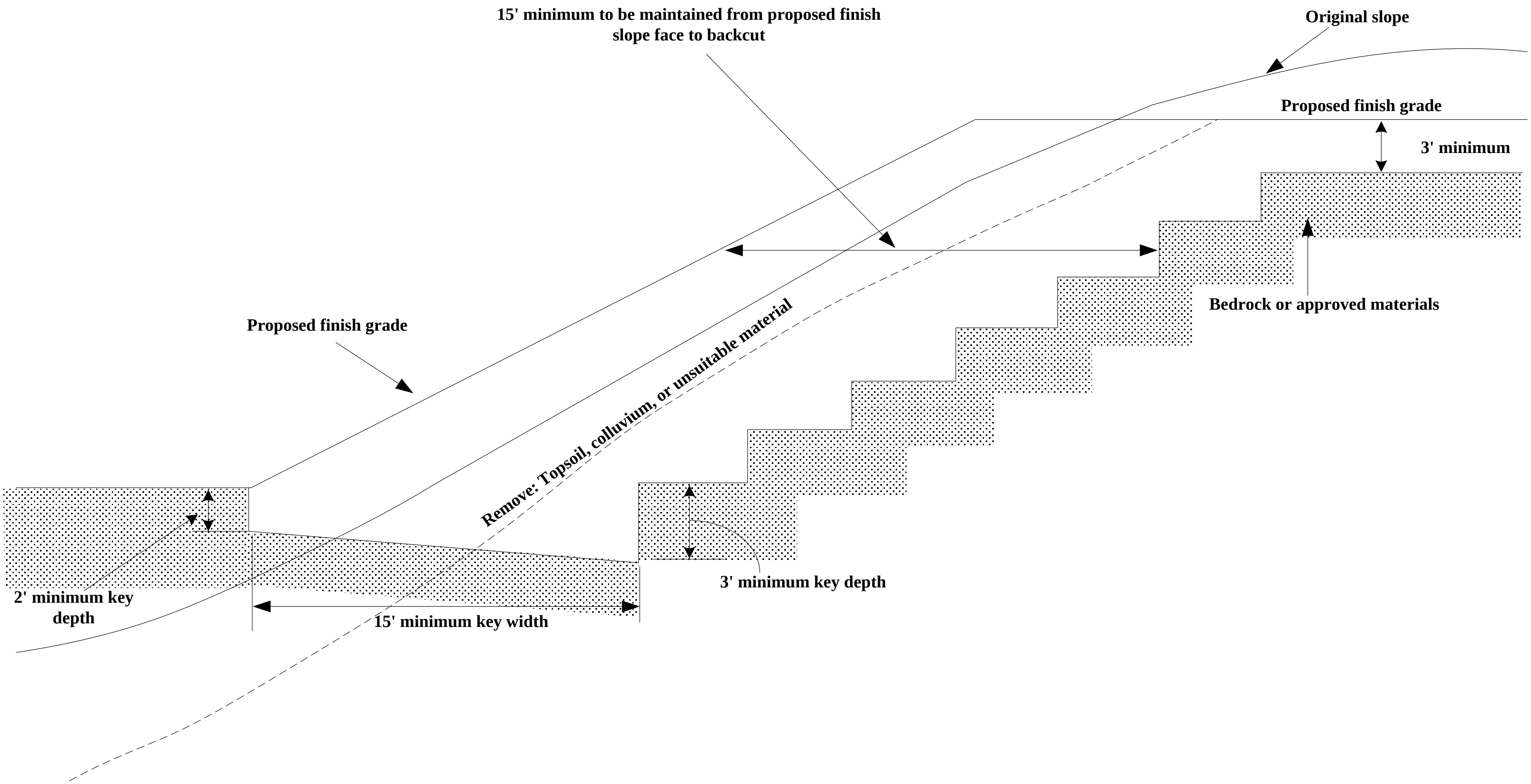
FIGURE F

SKIN FILL OF NATURAL GROUND



Note: (1) The need and disposition of drains will be determined by the soils engineer and/or engineering geologist based on site conditions.

(2) Pad overexcavation and recompaction shall be completed if determined as necessary by the soils engineer and/or engineering geologist.

Note: Figure not to scale

EARTHWORK AND GRADING GUIDELINES
SKIN FILL OF NATURAL GROUND

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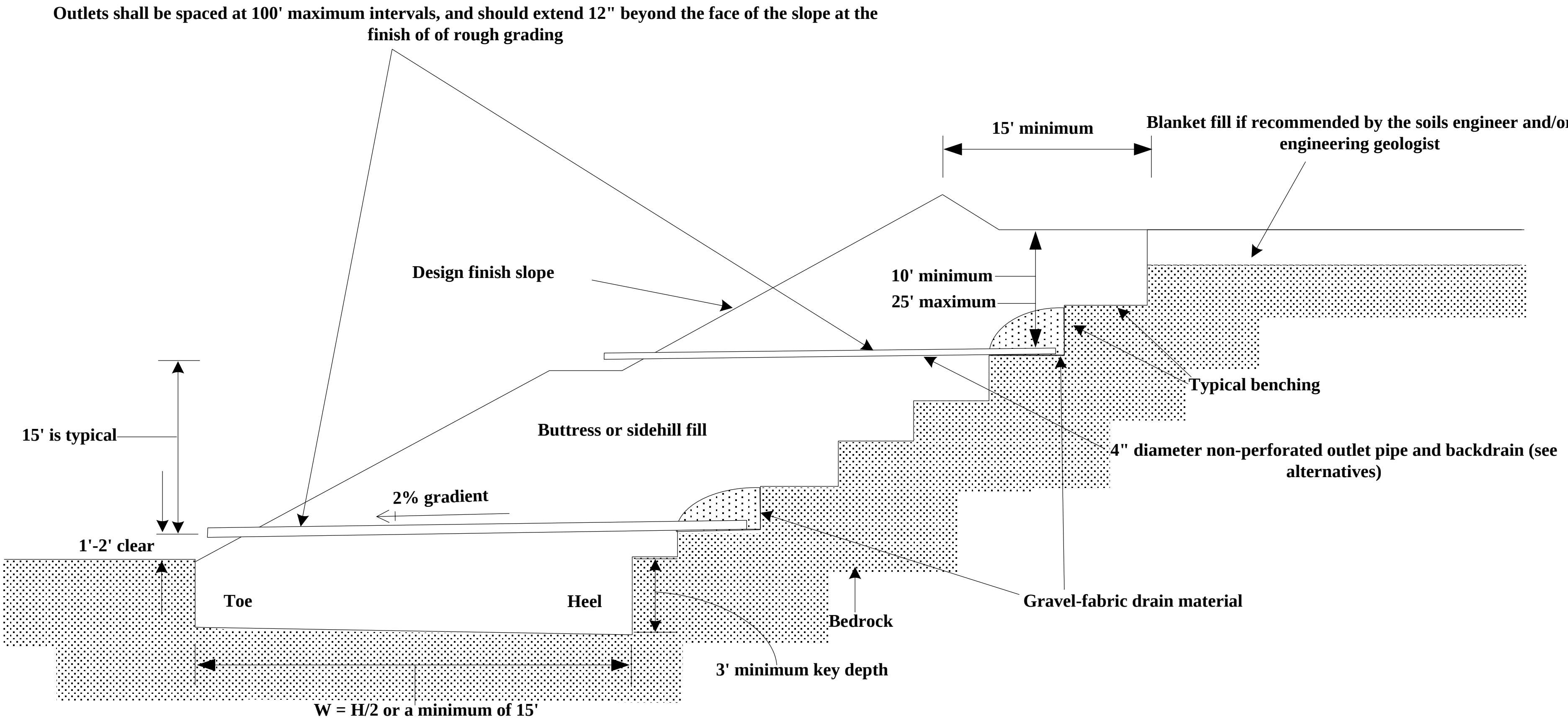
FIGURE G

TYPICAL STABILIZATION BUTTRESS FILL DESIGN



Note: Figure not to scale

EARTHWORK AND GRADING GUIDELINES
TYPICAL STABILIZATION BUTTRESS FILL DESIGN

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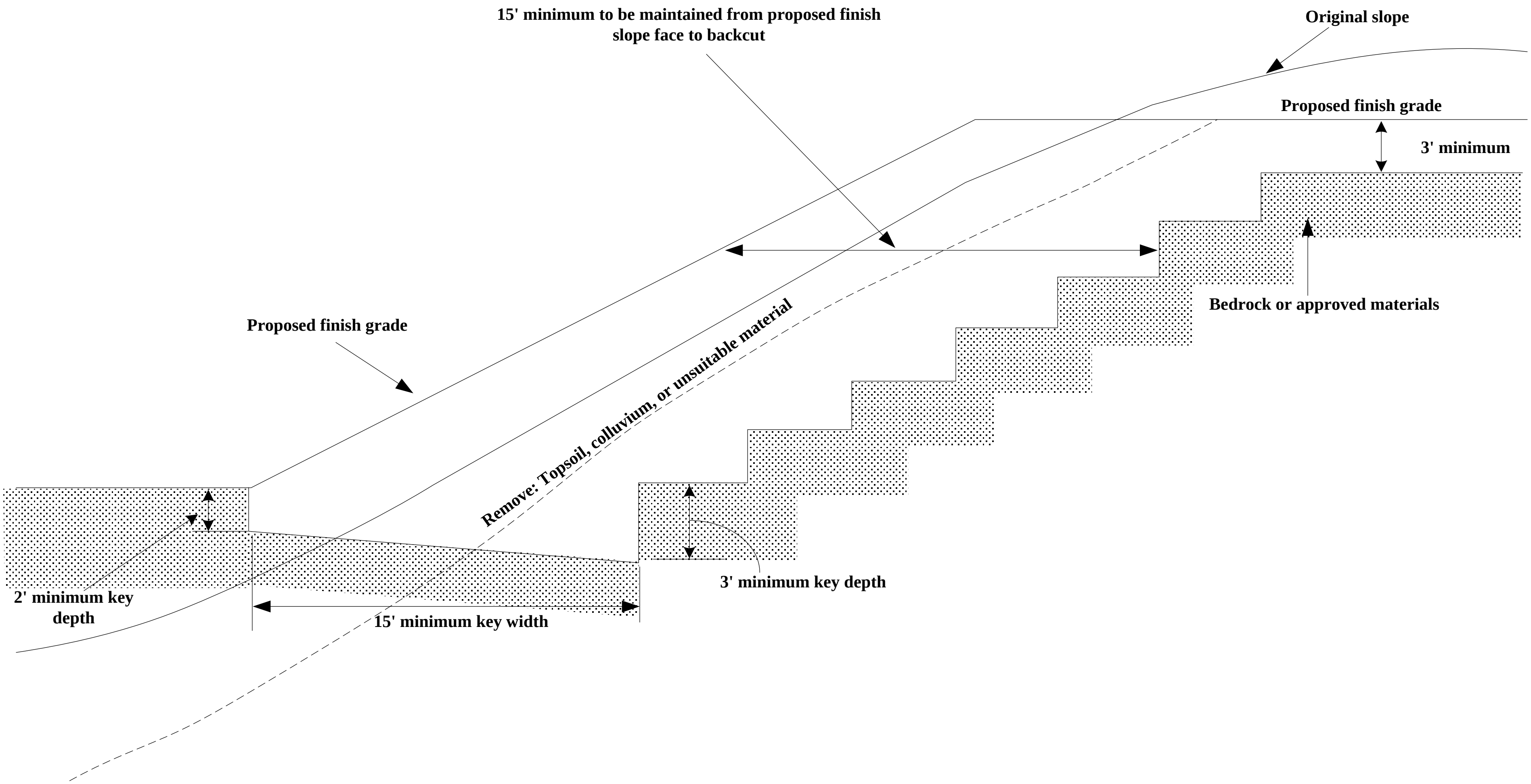
FIGURE H

SKIN FILL OF NATURAL GROUND



Note: (1) The need and disposition of drains will be determined by the soils engineer and/or engineering geologist based on site conditions.

(2) Pad overexcavation and recompaction shall be completed if determined as necessary by the soils engineer and/or engineering geologist.

Note: Figure not to scale

EARTHWORK AND GRADING GUIDELINES
SKIN FILL OF NATURAL GROUND

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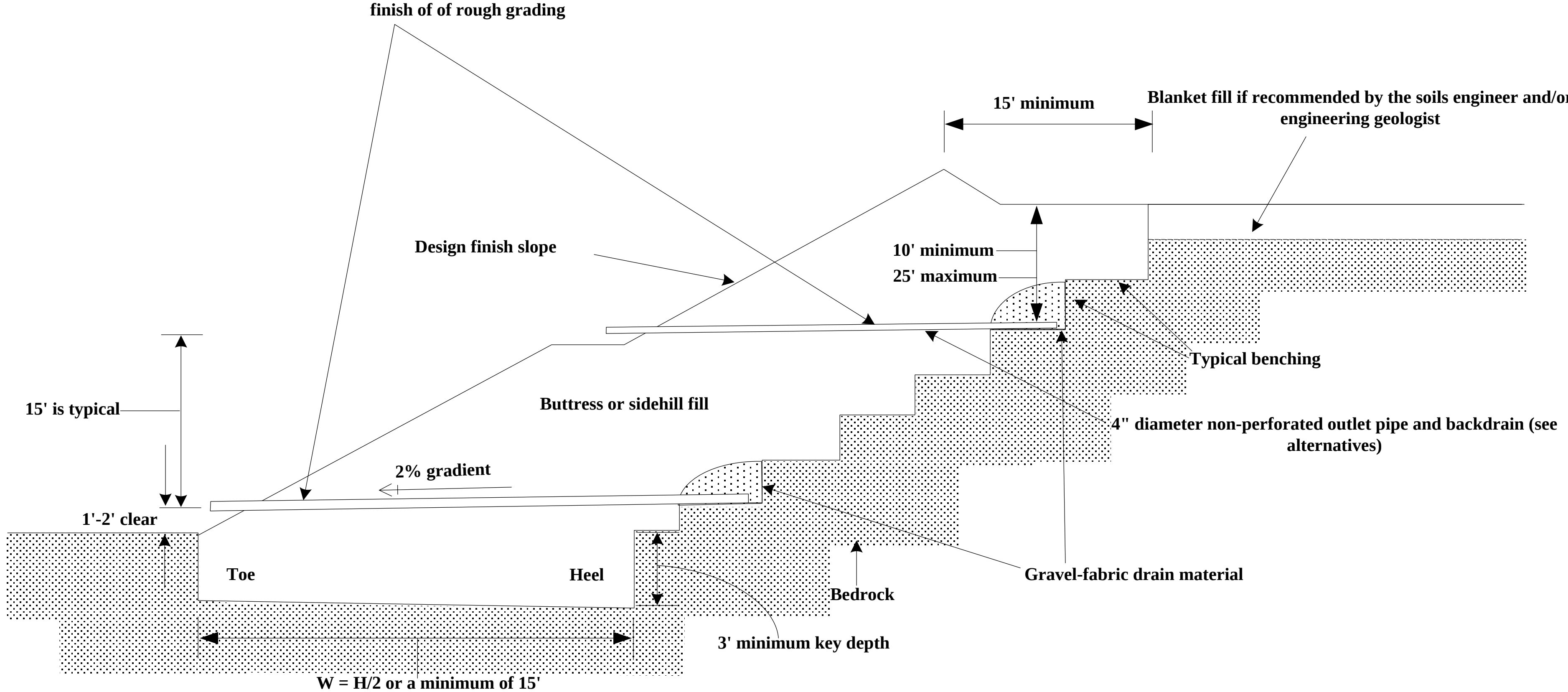
FIGURE G

TYPICAL STABILIZATION BUTTRESS FILL DESIGN



Note: Figure not to scale

EARTHWORK AND GRADING GUIDELINES
TYPICAL STABILIZATION BUTTRESS FILL DESIGN

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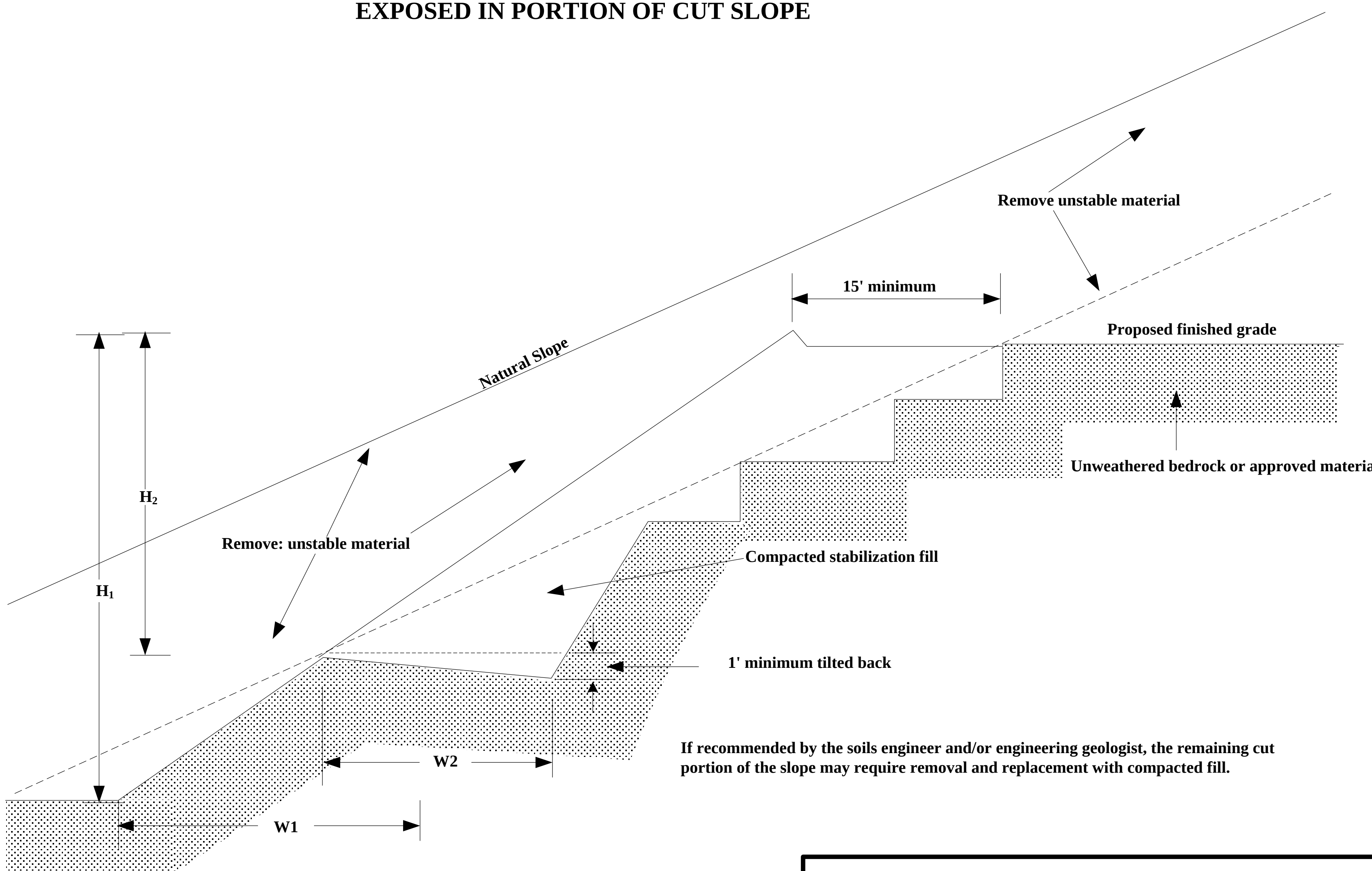
FIGURE H

STABILIZATION FILL FOR UNSTABLE MATERIAL EXPOSED IN PORTION OF CUT SLOPE



Note: (1) Subdrains are required only if specified by the soils engineer and/or engineering geologist.
(2) "W" shall be the equipment width (15') for slope heights less than 25 feet. For slopes greater than 25 feet "W" shall be determined by the project soils engineer and/or the engineering geologist. "W" shall never be less than H/2.

Note: Figure not to scale

EARTHWORK AND GRADING GUIDELINES
STABILIZATION FILL FOR UNSTABLE MATERIAL EXPOSED IN PORTION OF CUT SLOPE

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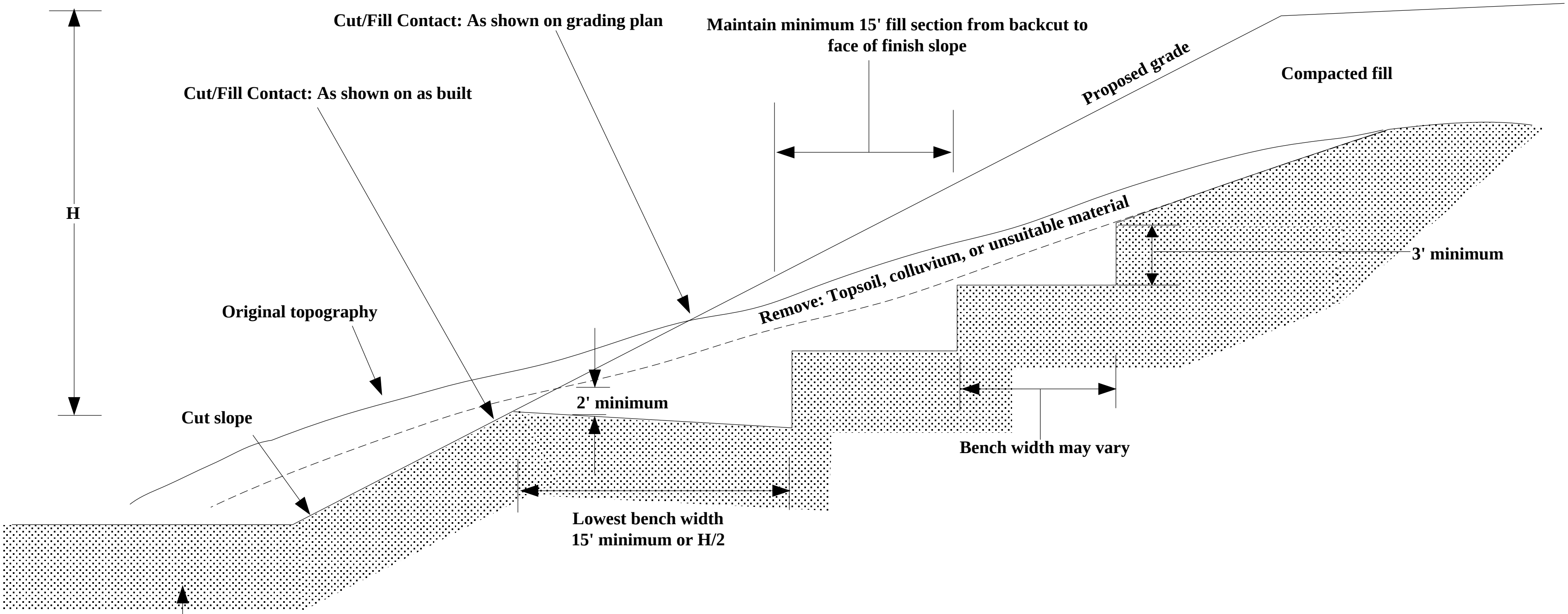
FIGURE I

FILL OVER CUT DETAIL



Note: The cut sectioin shall be excavated and evaluated by the soils engineer/engineering geologist prior to constructing the fill portion.

Note: Figure not to scale

EARTHWORK AND GRADING GUIDELINES
FILL OVER CUT DETAIL

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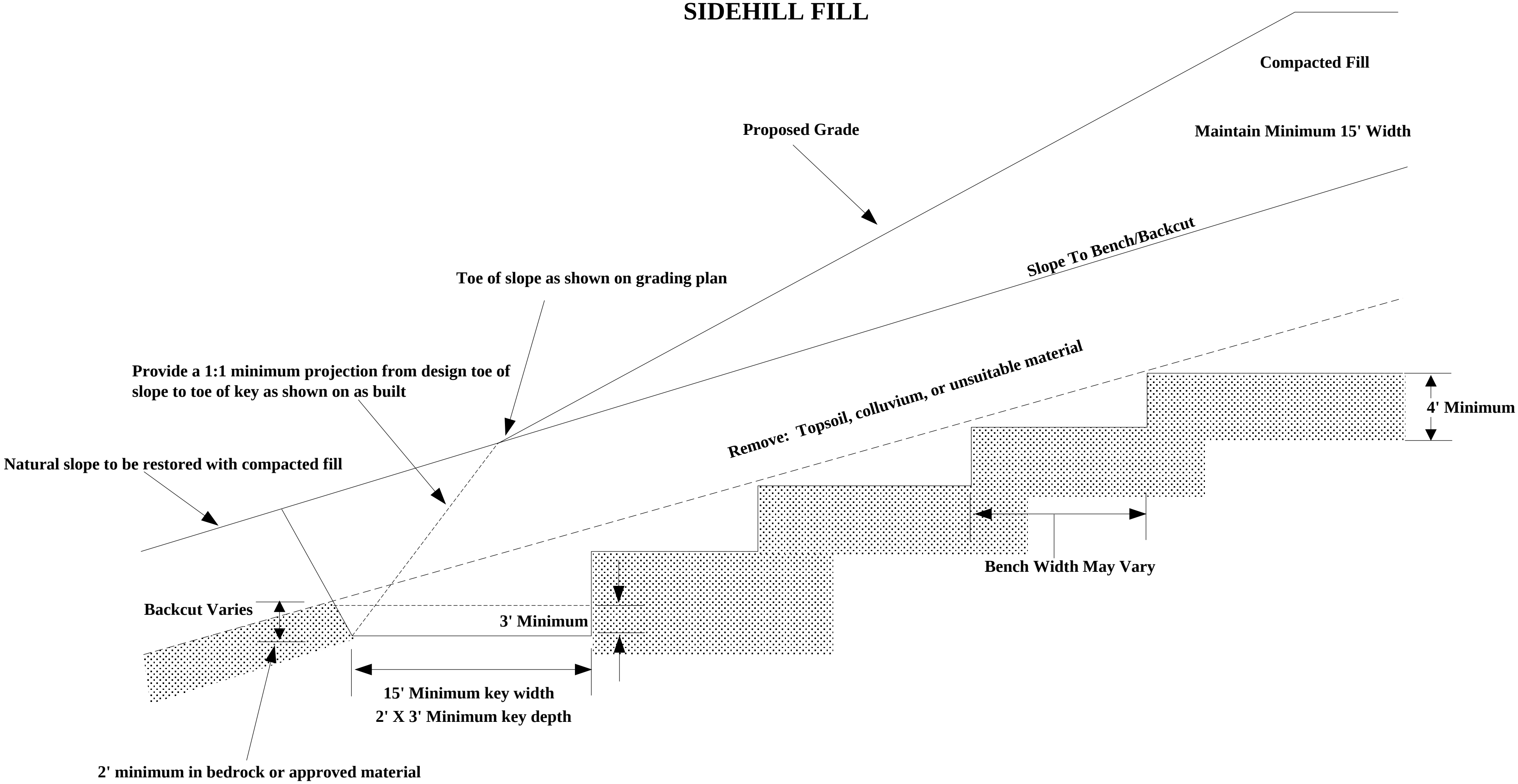
FIGURE J

FILL OVER NATURAL DETAIL
SIDEHILL FILL



Note: (1) Special recommendations shall be provided by the soils engineer/engineering geologist where the natural slope approaches or exceeds the design slope ratio.
(2) The need for and disposition of drains would be determined by the soils engineer/engineering geologist based upon exposed conditions.

Note: Figures not to scale

EARTHWORK AND GRADING GUIDELINES
FILL OVER NATURAL DETAIL
SIDEHILL FILL

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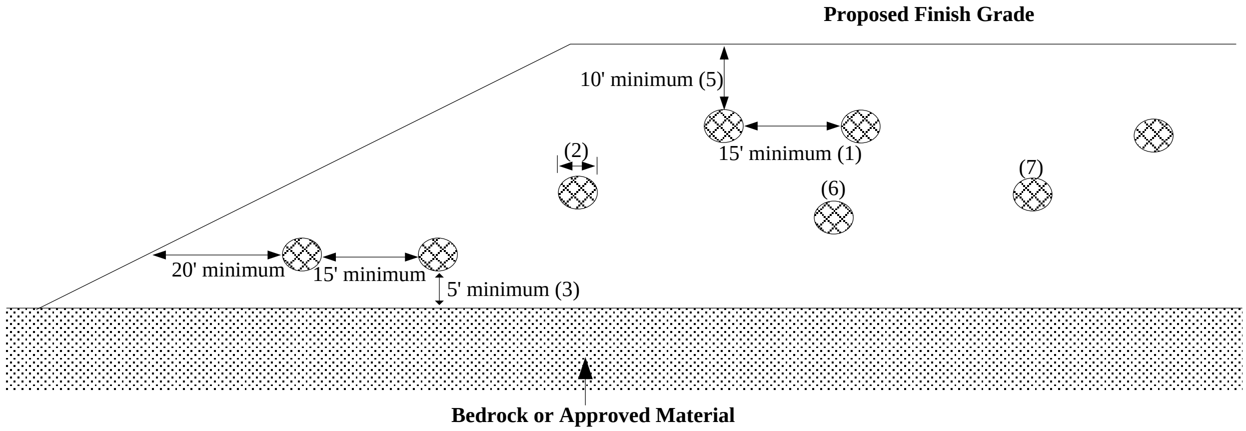
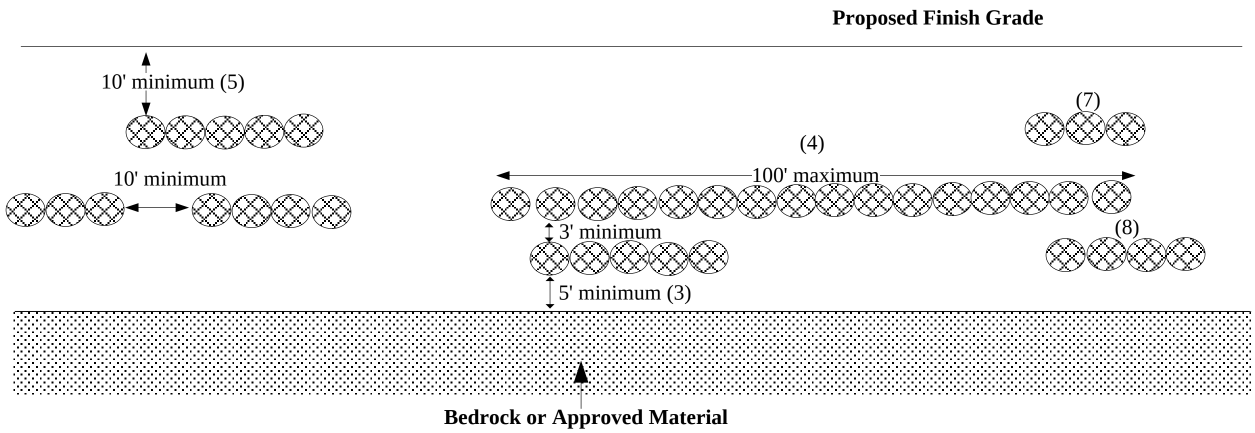
FIGURE K

OVERSIZE ROCK DISPOSAL

View Normal to Slope Face



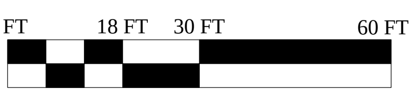
View Parallel to Slope Face



Note:

(1) One Equipment width or a minimum of 15 feet.
(2) Height and width may vary depending on rock size and type of equipment used. Length of windrow shall be no greater than 100 feet maximum.
(3) If approved by the soils engineer and/or engineering geologist.
(4) Orientation of windrows may vary but shall be as recommended by the soils engineer and/or engineering geologist. Unless recommended staggering of windrows is not necessary.
(5) Areas shall be cleared for utility trenches, foundations, and swimming pools.
(6) Voids in windrows shall be filled by flooding granular soil into place. Granular soil shall be any soil which has a unified soil classification system (Universal Building Code (UBC) 29-1). Designation of SM, SP, SW, GP, or GW.
(7) After fill between windrows is placed and compacted with the lift of fill covering windrow, windrow shall be proof rolled with a D-9 dozer or equivalent.
(8) Oversized rock is defined as larger than 12", and less than 4 feet in size.

Approximate Scale: 1" = 30'



Note: All distances are approximate

EARTHWORK AND GRADING GUIDELINES
OVERSIZE ROCK DISPOSAL

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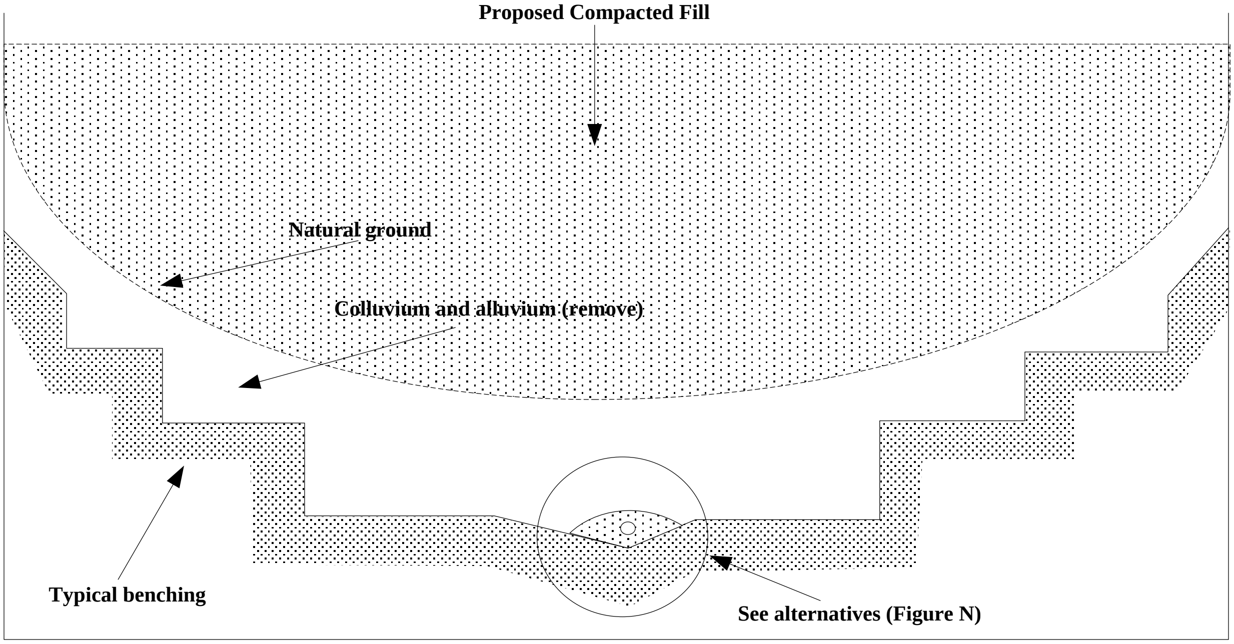
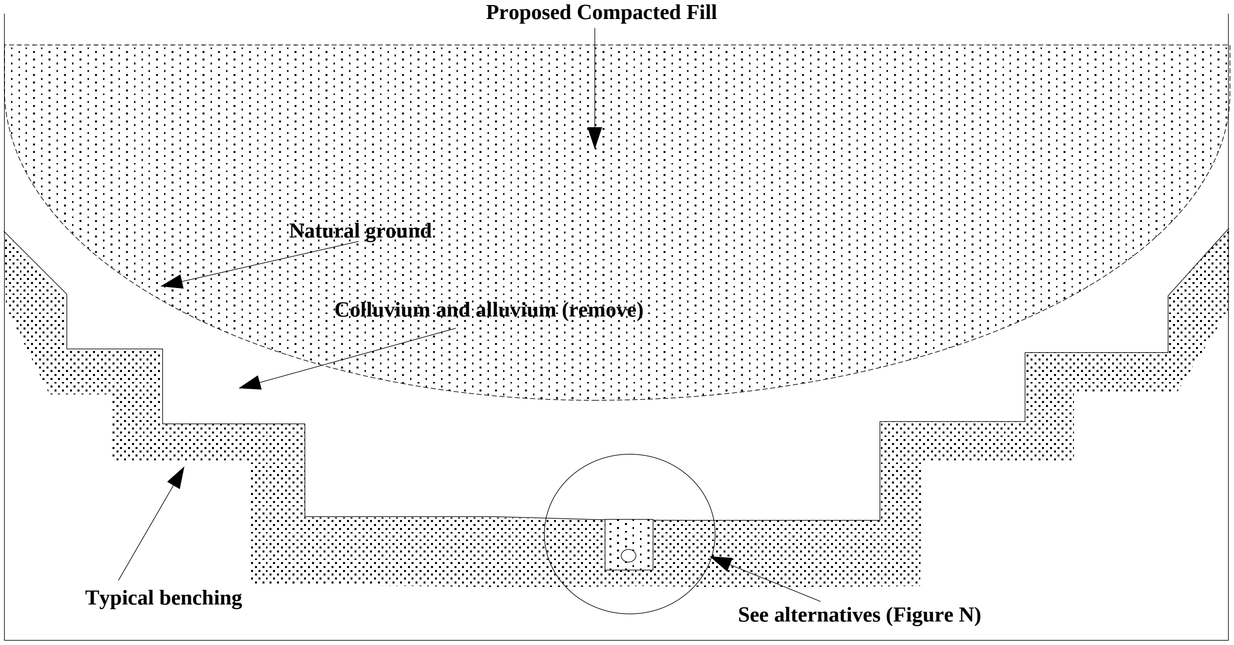
FIGURE L

CANYON SUBDRAIN DETAIL

Type A



Type B



Note: Alternatives, locations, and extent of subdrains should be determined by the soils engineer and/or engineering geologist during actual grading.

Note: Figures not to scale

EARTHWORK AND GRADING GUIDELINES
CANYON SUBDRAIN DETAIL

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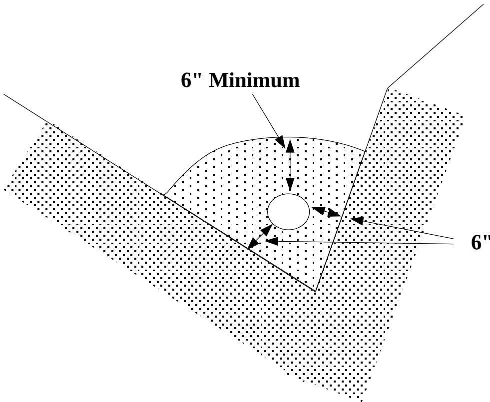
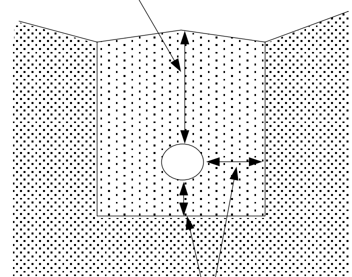
FIGURE M

CANYON SUBDRAIN ALTERNATE DETAILS

Alternate 1: Perforated Pipe and Filter Material



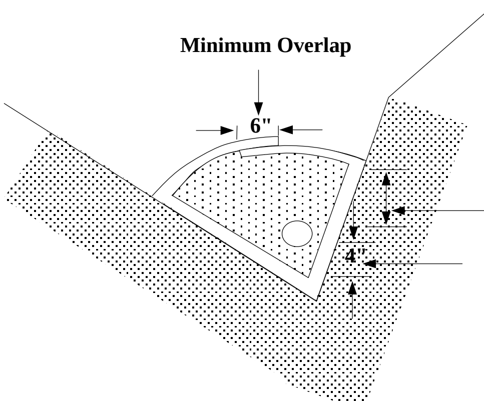
Filter material: Minimum volume of 9 $feet^3$/linear foot.
6" diameter ABS or PVC pipe or approved substitute with minimum 8 (¼" diameter) perforations per linear foot in bottom half of pipe.
ASTM D 2751, SDR 35 or ASTM D 1527, Schedule 40.
ASTM D 3034, SDR 35 or ASTM D 1785, Schedule 40.
For continuous run in excess of 500 feet use 8" diameter pipe.

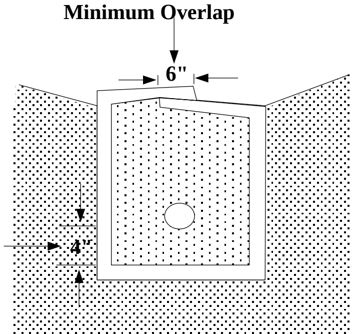


Filter Material

Sieve Size	Percent Passing
1"	100
¾"	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

Alternate 2: Perforated Pipe, Gravel and Filter Fabric





Gravel material 9 $feet^3$/linear foot.
Perforated pipe: see alternate 1.
Gravel: Clean ¾" rock or approved substitute.
Filter Fabric: Mirafi 140 or approved substitute.

Note: Figures not to scale

EARTHWORK AND GRADING GUIDELINES
CANYON SUBDRAIN ALTERNATE DETAILS

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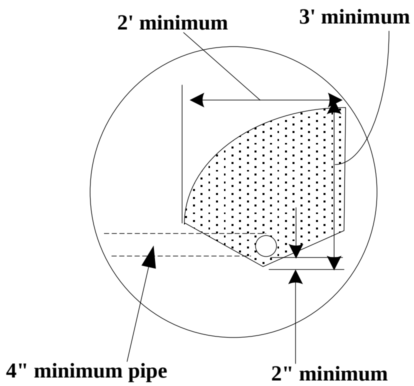
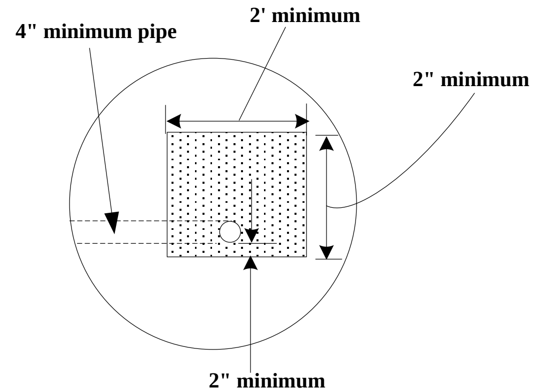
FIGURE N

TYPICAL STABILIZATION BUTTRESS SUBDRAIN DETAIL





Filter Material: Minimum of 5 ft^3/linear foot of pipe or 4 ft^3/linear foot of pipe when placed in square cut trench.

Alternative In Lieu Of Filter Material: Gravel may be encased in approved filter fabric. Filter fabric shall be mirafi 140 or equivalent. Filter fabric shall be lapped a minimum of 12" on all joints.

Minimum 4" Diameter Pipe: ABS-ASTM D-2751, SDR 35 or ASTM D-1527 schedule 40 PVC-ASTM D-3034, SDR 35 or ASTM D-1785 schedule 40 with a crushing strength of 1,000 pounds minimum, and a minimum of 8 uniformly spaced perforations per foot of pipe installed with perforations at bottom of pipe. Provide cap at upstream end of pipe. Slope at 2% to outlet pipe. Outlet pipe shall be connected to the subdrain pipe with tee or elbow.

Note: (1) Trench for outlet pipes shall be backfilled with onsite soil.
(2) Backdrains and lateral drains shall be located at the elevation of every bench drain. First drain shall be located at the elevation just above the lower lot grade. Additional drains may be required at the discretion of the soils engineer and/or engineering geologist.

Filter Material – Shall be of the following specification or an approved equivalent:

Filter Material

Sieve Size	Percent Passing
1"	100
¾"	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 - Shall be of the following specification or an approved equivalent:

Filter Material

Sieve Size	Percent Passing
1½"	100
No. 4	50
No. 200	8

Sand equivalent: Minimum of 50

Note: Figures not to scale

EARTHWORK AND GRADING GUIDELINES

TYPICAL STABILIZATION BUTTRESS SUBDRAIN DETAIL

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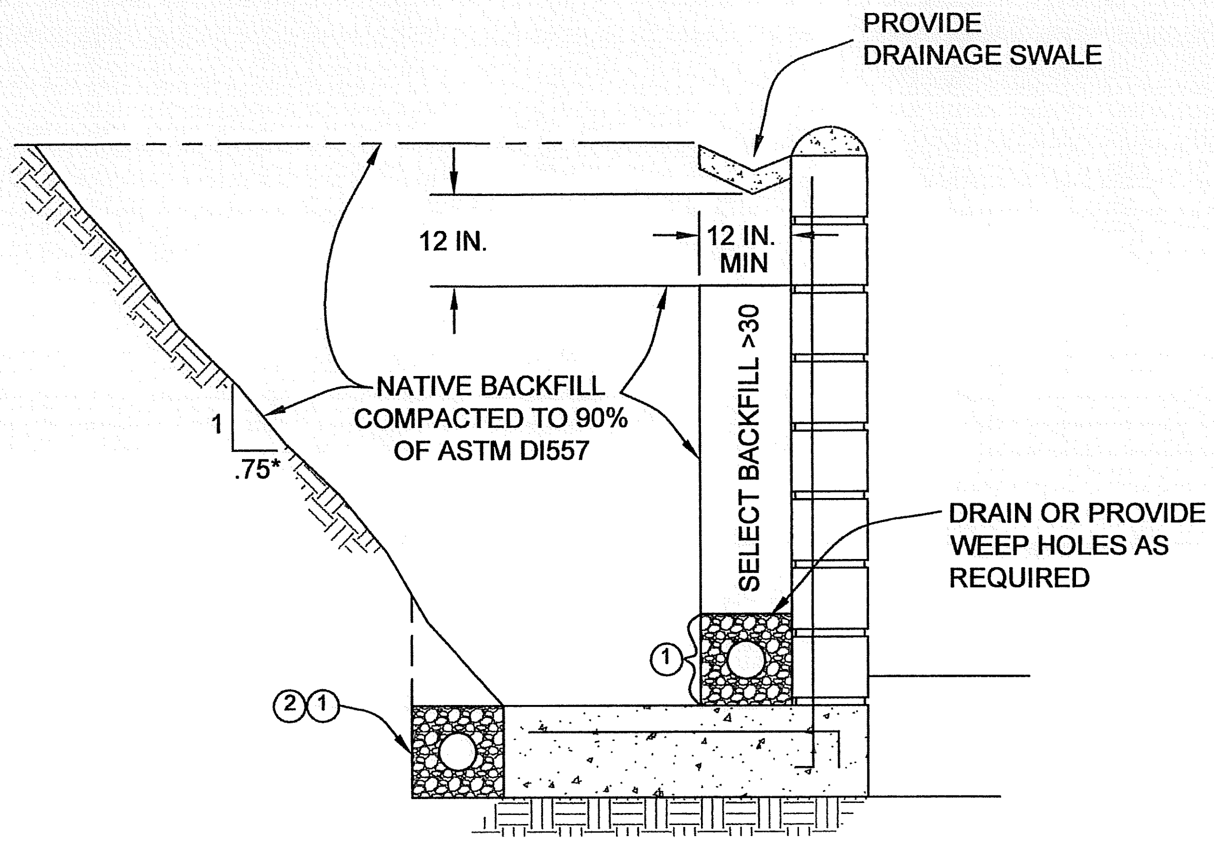
FIGURE O



* OR AS REQUIRED FOR SAFETY

NOTES

1. 4-INCH PERFORATED PVC SCHEDULE 40 OR APPROVED ALTERNATE. PLACE PERFORATION DOWN AND SURROUND WITH A MINIMUM OF 1 CUBIC FOOT PER LINEAL FOOT (1 FT. /FT.) OF 3/4 INCH ROCK OR APPROVED ALTERNATE AND WRAPPED IN FILTER FABRIC.

2. PLACE DRAIN AS SHOWN WHERE MOISTURE MIGRATION THROUGH THE WALL IS UNDESIRABLE.

NOTE: FIGURE NOT TO SCALE

EARTHWORK & GRADING GUIDELINES
TYPICAL RETAINING WALL BACKFILL

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FIGURE P