LGC GEO-ENVIRONMENTAL, INC.

UPDATED PRELIMINARY GEOTECHNICAL INVESTIGATION AND INFILTRATION TESTING FOR THE PROPOSED COMMERCIAL DEVELOPMENT, "SKY CANYON RETAIL CENTER", LOCATED AT APNS: 920-120-034 AND 920-120-035, IN THE CITY OF TEMECULA, RIVERSIDE COUNTY, CALIFORNIA.

Dated: December 28, 2017
Project No. G17-1567-10

Prepared For:

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GEOTECHNICAL • ENVIRONMENTAL • MATERIALS TESTING • SWPPP

December 28, 2017 Project No. G17-1567-10

AVA, Property Investment, LLC
144407 Alondra Boulevard
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Subject: ***Updated Preliminary Geotechnical Investigation and Infiltration Testing Report for the Proposed Commercial Development, "Sky Canyon Retail Center", Located between Winchester Road and Sky Canyon Drive; APNs: 920-120-034 and 920-120-035, in the City of Temecula, Riverside County, California***

LGC Geo-Environmental, Inc. (LGC) is pleased to submit herewith our updated preliminary geotechnical investigation and infiltration testing report for the proposed commercial development, "Sky Canyon Retail Center", located in the city of Temecula, Riverside County, California.

This report presents the results of previous and current research of published geologic/geotechnical reports and maps, geologic mapping and current review of aerial imagery, field exploration and laboratory testing; in addition to our geotechnical and geologic judgment, opinions, conclusions and preliminary recommendations associated with the proposed commercial development and associated infiltration devices.

Based on the results of our field exploration, geologic mapping, preliminary infiltration testing, laboratory testing, geologic and geotechnical engineering evaluations, along with our review of published literature and the referenced 40-scale plot plan, it is our opinion that the subject site is suitable for the proposed commercial development, provided that the recommendations presented herein are utilized during the design, grading, and construction. LGC should review any grading plans, as well as any foundation/structural plans when they become available, and revise the recommendations presented herein, if necessary.

It has been a pleasure to be of service to you during the design stages of this project. If you have any questions regarding the contents of this report or require additional information, please do not hesitate to contact us.

Respectfully submitted,

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1.0 INTRODUCTION

1.1 Purpose and Scope of Services

This report presents the updated results of LGC Geo-Environmental, Inc.'s (LGC) preliminary geologic and geotechnical investigation, in addition to preliminary infiltration testing results for onsite storm water infiltration devices, for the proposed commercial development, "Sky Canyon Retail Center", located between Winchester Road and Sky Canyon Drive APNs: 920-120-034 and 920-120-035, in the city of Temecula, Riverside County, California. The purposes of this updated preliminary geologic/geotechnical investigation and preliminary infiltration testing report for proposed onsite storm water infiltration devices are to determine the nature of surface and subsurface soil conditions; and evaluate their characteristics and provide geotechnical recommendations with respect to grading, construction, foundation design, onsite storm water infiltration, and other aspects relative to the proposed development of the site. The referenced 40-scale plot plan was utilized as the base map for our Geotechnical and Infiltration Map (Plate 1) for the site.

Our scope of services includes:

- Review of previous preliminary geotechnical and geologic reports for the site, as well as readily available published geologic maps, recent aerial imagery, and pertinent documents regarding the anticipated geologic and geotechnical conditions at the site (Appendix A).
- Geologic observations and mapping of the existing surface conditions at the site.
- Field exploration consisting of six (6) exploratory trenches for the purposes of infiltration testing, to depths of approximately 5.5 feet to 10.5 feet, utilizing a rubber-tired backhoe.
- Preliminary infiltration tests, utilizing a standard percolation methodology, within all six (6) of the exploratory trenches.
- Laboratory testing of selected representative samples of soils for characterization of the engineering properties of onsite soils.
- Geotechnical engineering and geologic analysis of the data with respect to the proposed commercial development.
- Analysis of data to address potential geologic/geotechnical issues associated with the proposed development, regarding geologic hazards.
- Preparation of this report presenting previous and current findings, updated conclusions, and updated preliminary geotechnical design recommendations for the proposed commercial development, as well as provide preliminary infiltration rates and recommendations for proposed storm water infiltration devices.

1.2 Proposed Construction and Grading

The referenced 40-scale plot plan indicates that the proposed commercial development will be comprised of multiple commercial structures, associated roadways, parking areas, and hardscape areas. It is anticipated that the proposed commercial structures will be constructed of wood and steel framing, with concrete footings and floor slabs constructed on-grade. For this type of construction, relatively light to moderate loads will likely be imposed on the underlying soils.

According to the referenced 40-scale plot plan, proposed maximum cut and fill depths both appear to be approximately 7 feet or less; however, the proposed cut area of the infiltration basin on the westerly section of the property appears to be approximately 9 feet in depth. Proposed maximum cut and fill slope heights appear to be approximately 6 feet or less, at slope ratios of 2:1 horizontal to vertical (h:v) or flatter.

1.3 ***Location and Site Description***

The subject site is irregular in shape and is located on the easterly corner of the intersection of Willows Avenue and between Winchester Road (State Route Highway 79) and Sky Canyon Drive, in the city of Temecula, Riverside County, California. The existing site elevation varies, and generally ranges from approximately 1,111 feet above mean sea level (msl) in the north, to approximately 1,098 msl in the south, with differences of 12± feet throughout the entire site. Local drainage is generally directed to the south. The general location and configuration of the site is shown on the Site Location Map (Figure 1).

A site reconnaissance and aerial imagery shows the site to be covered with a light to moderate growth of grass, shrubs, and trees. Additionally, the site has been utilized for end-dump fills and debris; which are located across the site.

1.4 ***Research of Previous Geological and Geotechnical Data***

This firm researched and reviewed previous geotechnical reporting for the site, including the most recent report prepared by LGC Inland, Inc. (2008), and associated response to comments; in addition to available published geologic data (Appendix A). Pertinent information was incorporated into the conclusions and recommendations presented in our report.

1.5 ***Aerial Imagery Analysis***

Google Earth Pro aerial imagery, from 1996 to 2016, was evaluated for the subject site and surrounding vicinity. The available information, as it pertains to the geologic and geotechnical issues of the proposed development, has been included herein.

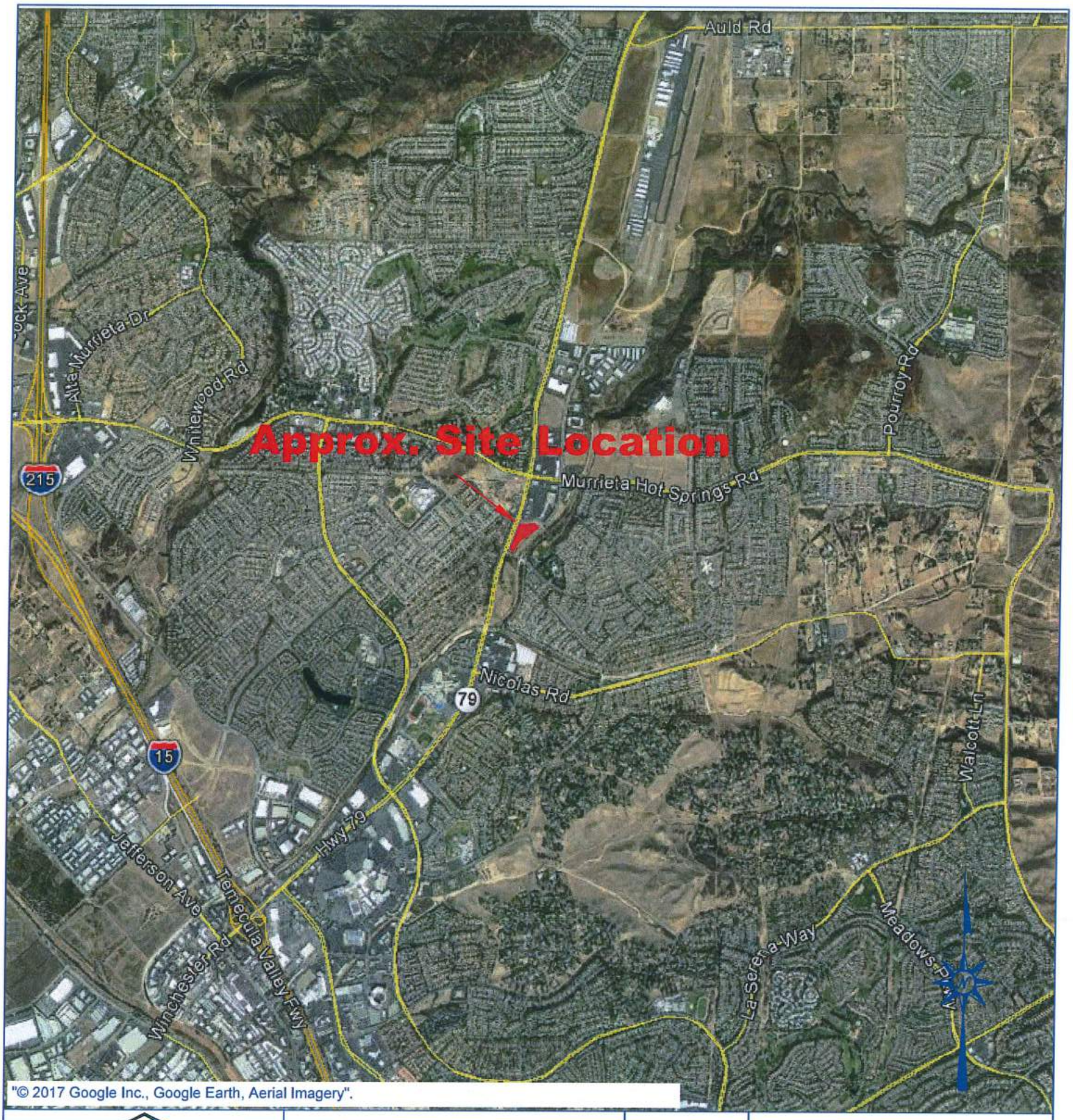


FIGURE 1
SITE LOCATION MAP

Project Name	Sky Canyon Retail Center
Project No.	G17-1567-10
Geol./ Eng.	RLG/LDC
Scale	NOT TO SCALE
Date	DECEMBER 2017

2.0 FIELD EXPLORATION

2.1 Surface Reconnaissance

Surface reconnaissance of the site and accessible surrounding areas was accomplished by a geologist from this firm on November 20, 2017, to document existing surface geological conditions - utilizing the referenced 40-scale plot plan for plotting geologic units. This information has been plotted on the enclosed Geotechnical and Infiltration Map (Plate 1).

2.2 Field Exploration

Current subsurface exploration on the subject site was performed on December 4, 2017, and involved the excavation of six (6) exploratory trenches (TR-1 thru TR-6) for the purposes of infiltration testing, within locations of proposed infiltration devices, to depths ranging from approximately 5.5 feet to 10.5 feet utilizing a rubber-tire backhoe. Earth materials encountered within the exploratory trenches were classified and logged by a geologist from this firm in accordance with the visual-manual procedures of the Unified Soil Classification System (USCS). At the conclusion of the subsurface exploration, all trenches were backfilled with existing trench spoils with minor compactive effort. Minor settlement of the backfill soils may occur over time. The approximate locations of the exploratory trenches are shown on the Geotechnical and Infiltration Map (Plate 1). Prior to subsurface work, an underground utilities clearance was obtained from Underground Service Alert of Southern California.

Previous subsurface exploration was performed by LGC Inland on February 16, 2005 and April 22, 2008, and consisted of nine (9) hollow-stem auger borings (B-1 through B-9) extending to depths ranging from approximately 21.0 to 51.5 feet below existing ground surface. The approximate locations of the borings are shown on the Geotechnical and Infiltration Map (Plate 1).

2.3 Laboratory Testing

During the previous subsurface explorations, performed by LGC Inland (2008), representative bulk and relatively undisturbed samples were retained for laboratory testing. Laboratory testing was performed on representative soil samples and included moisture and density tests, maximum dry density and optimum moisture content, R-value, corrosion, and expansion. A discussion of the tests performed and a summary of the results are presented in Appendix C. The moisture and density test results are presented on the boring logs in Appendix B.

2.4 Infiltration Testing

Shallow infiltration tests, labeled IT-1 thru IT-7, were performed on December 4, 2017, and December 5, 2017, within all of the exploratory trenches (TR-1 through TR-6), at depths ranging from 5.5 feet to 10.5 feet. The tests were performed as per the referenced Riverside County Low Impact Development Manual (Appendix A). Infiltration test holes which are 8-inch in diameter and 20-inch deep test holes were excavated in all trenches, at the approximate depth of the proposed infiltration device bottom. Approximately two inches of ¾-inch gravel was placed at the bottom of the test hole to prevent scouring of the excavated test hole, and 20 inches of clean water (5 times the radius of the test hole) was filled within each of the test holes. The drop in water level, in inches, was measured and recorded at 30 minute intervals over a period of at least 6 hours, or 10 minute intervals over a period of at least 1 hour (if sandy-soil criteria was achieved). The field percolation rates, which have vertical and sidewall infiltration, were reduced utilizing a reduction factor per the Porchet Method standard in order to determine the vertical design infiltration rate.

- Infiltration test IT-1 (test performed in Trench TR-1), pertinent to the infiltration device located on the southwesterly section of the property, yielded a reduction factor of 5.89 and a design infiltration rate of 0.30.
- Infiltration tests IT-2 and IT-3 (both tests performed in Trench TR-2), pertinent to the infiltration device located on the westerly section of the property, yielded a reduction factor of 5.98 and a design infiltration rate of 0.04.

- For infiltration test IT-4 (test performed in Trench TR-3), pertinent to the infiltration device located on the northwesterly section of the property, yielded a reduction factor of 3.50 and a design infiltration rate of 34.29.
- For infiltration test IT-5 (test performed in Trench TR-4), pertinent to the infiltration device located on the northeasterly section of the property, yielded a reduction factor of 3.50 and a design infiltration rate of 34.29.
- For infiltration test IT-6 (test performed in Trench TR-5), pertinent to the infiltration device located on the southeasterly section of the property, yielded a reduction factor of 3.50 and a design infiltration rate of 34.29.
- For infiltration test IT-7 (test performed in Trench TR-6), pertinent to the infiltration device located on the easterly section of the property, yielded a reduction factor of 3.50 and a design infiltration rate of 34.29.

The results of the percolation method infiltration tests are presented in Table 1 below. The infiltration test data sheets are presented in Appendix D.

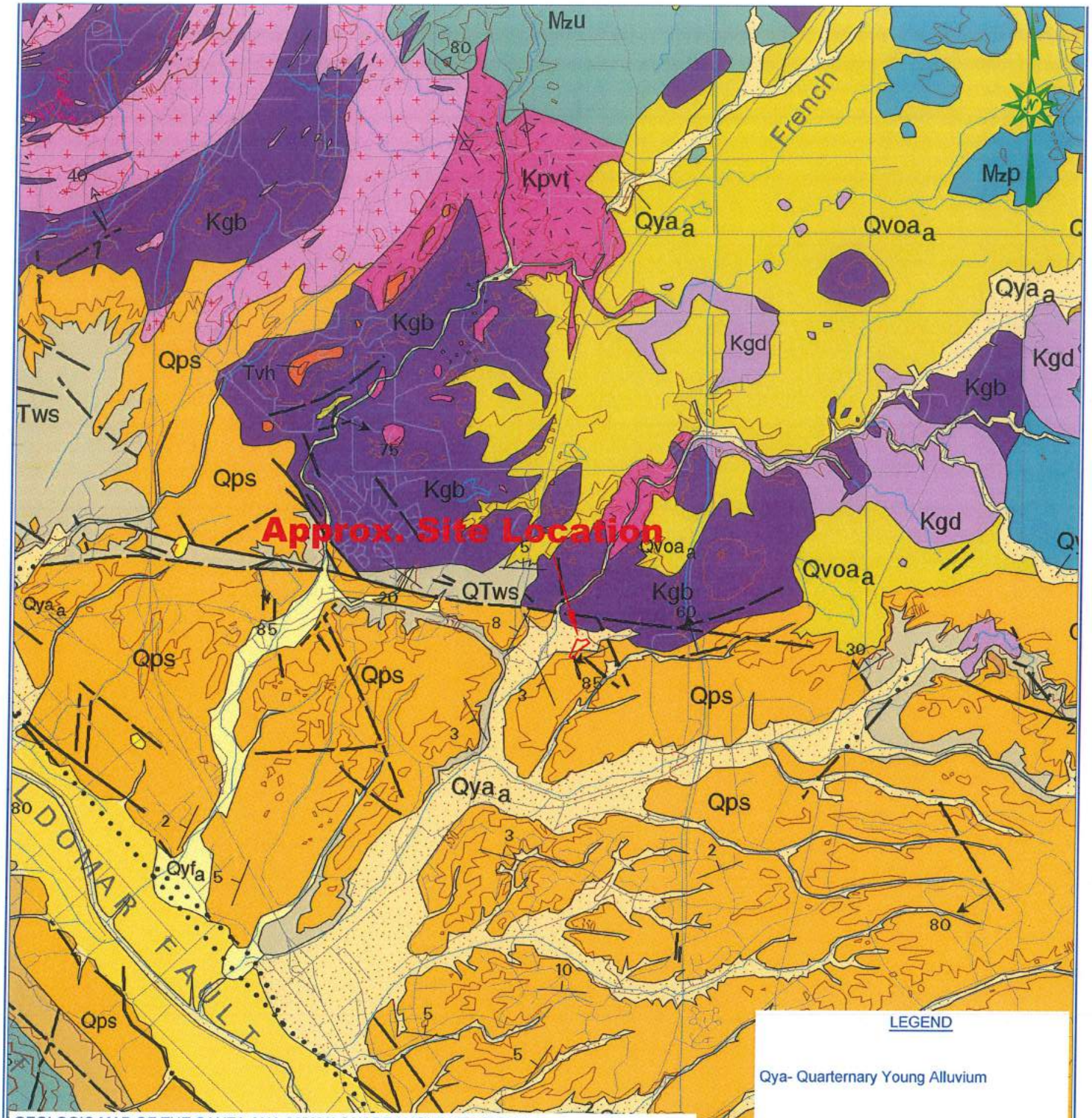
TABLE 1
Infiltration Design Rates

TEST NO.	DRAINAGE DEVICE LOCATION	TEST DEPTH (feet)	INFILTRATION RATES		SOIL DESCRIPTION (USCS)
			FIELD PERCOLATION RATE (inches/hour)	DESIGN INFILTRATION RATE (inches/hour)	
IT-1	TR-1	5.5	1.75	0.30	Silty SAND (SM)
IT-2	TR-2	10.5	0.25	0.04	Silty SAND (SM)
IT-3	TR-2	10.5	0.25	0.04	Silty SAND (SM)
IT-4	TR-3	9.0	0.5	34.29	Silty SAND (SM)
IT-5	TR-4	9.5	0.5	34.29	Silty SAND (SM)
IT-6	TR-5	7.0	0.5	34.29	Silty SAND (SM)
IT-7	TR-6	6.0	0.5	34.29	Silty SAND (SM)

3.0 FINDINGS

3.1 Regional Geologic Setting

Regionally, the site is located in the Peninsular Ranges Geomorphic Province of California. The Peninsular Ranges are characterized by steep, elongated valleys that trend west to northwest. The northwest-trending topography is controlled by the Elsinore fault zone, which extends from the San Gabriel River Valley southeasterly to the United States/Mexico border. The Santa Ana Mountains lie along the western side of the Elsinore fault zone, while the Perris Block is located along the eastern side of the fault zone. The mountainous regions are underlain by Pre-Cretaceous, metasedimentary and metavolcanic rocks and Cretaceous plutonic rocks of the Southern California Batholith. Tertiary and Quaternary rocks are generally comprised of non-marine sediments consisting of sandstone, mudstones, conglomerates, and occasional volcanic units. A map of the regional geology is presented on the Regional Geologic Map (Figure 2).



GEOLOGIC MAP OF THE SANTA ANA 30'X60' QUADRANGLE VERSION 1.0
Compiled By D.M. Morton1

Digital Database by Rachel M. Hauser1 and Kelly R. Ruppert1
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FIGURE 2
REGIONAL GEOLOGIC MAP

Project Name	Sky Canyon Retail Center
Project No.	G17 1567-10
Geol./ Eng.	RG/LC
Scale	NOT TO SCALE
Date	DECEMBER 2017

3.2 Local Geology and Soil Conditions

Based on our review of available geological and geotechnical literature, previous reporting, current and previous field mapping, and current and previous subsurface exploration conducted at the site, it is our understanding that the site is primarily underlain by undocumented artificial fill material and Quaternary young axial channel deposits. The subsurface geological contacts within previous and current explorations are described in greater detail below, and presented within the exploratory trench and boring logs (Appendix B). The observed geologic unit is depicted on the Geotechnical and Infiltration Map (Plate 1).

- Artificial Fill, Undocumented (Afu): Undocumented artificial fill material was encountered throughout the site during the previous and current subsurface explorations, to depths ranging from approximately 1.0 foot to 13.0 feet. This material appears to have been imported to the site, as the site appears to have been utilized as an end-dump in the past. This material is generally inconsistent, poorly consolidated fill material, placed as dump piles throughout the site. This material was generally comprised of silty sand and clayey sand, and is characterized as having/being various shades and hues of brown, and light yellow; dry to damp, and locally moist; loose to medium dense, locally dense; very fine to coarse grained; gravel; locally containing cobbles; blocky; roots and root hairs; locally micaceous; locally containing clay lenses; locally laminated; and containing debris.

- Quaternary Young Axial Channel Deposits (Qya): During the previous and current subsurface exploration, Quaternary aged young axial channel deposits were encountered in all trenches and borings, below the undocumented artificial fill, to depths ranging from approximately 5.5 foot to 51.5 feet. This soil was generally comprised of poorly graded sand, silty sand, and clayey sand; is characterized as having/being olive grey, and various shades and hues of brown; very fine to coarse-grained; damp to wet; medium dense to dense; locally desiccated, micaceous; gravel; blocky; root hairs; locally containing traces of gravel; and locally weathered.

3.3 Groundwater

Groundwater was not encountered within any of the exploratory trenches of the current subsurface exploration, to the depth explored of approximately 10.5 feet. However, based on the previous subsurface exploration, performed by LGC Inland (2008), groundwater was encountered within the exploratory borings at a depth range of approximately 26 feet to 28 feet. Additionally, previous reporting discusses a review of the Seismic Hazard Zone Report for the Murrieta 7.5-Minute Quadrangle (CGS, 2007) indicating historic groundwater levels potentially at a depth range of approximately 20 feet to 30 feet.

3.4 Caving

Caving was not encountered within the exploratory trenches of the current subsurface investigation; however, localized caving may occur within loosely compacted sections of undocumented artificial fill material, or low-density young axial channel soils.

3.5 Surface Water

Based on our review of the referenced 40-scale plot plan, proposed on-site surface water flow is generally trending to the south-southwest. A proposed stormwater infiltration device is located on the westerly section of property. Surface water runoff relative to project design is the purview of the project civil engineer and should be designed to be directed away from the proposed structures and walls.

3.6 Faulting

The geologic structure of the Southern California area is dominated mainly by northwest-trending faults associated with the San Andreas system. Faults such as the Newport-Inglewood, Whittier, Elsinore, San Jacinto and San Andreas, are major faults in this system and are known to be active and may produce moderate to strong ground shaking during an earthquake. In addition, the San Andreas, Elsinore and San Jacinto faults are known to have ruptured the ground surface in historic times.

Based on our review of published and unpublished geologic maps and literature pertaining to the site and regional geology, the closest active faults within 20 miles of the site are the Elsinore-Temecula Fault (approximately 3.7 miles away); the Elsinore-Glen Ivy (approximately 13.8 miles away); the Elsinore-Julian Fault (approximately 13.9 miles away); the San Jacinto – San Jacinto Valley (approximately 18.8 miles away); and San Jacinto – Anza. These faults are capable of producing large magnitude earthquakes.

No faults (active, potentially active, or inactive) are known to project through the site, based on review of geologic literature and geologic mapping. The site does not lie within an Alquist-Priolo Earthquake Fault Hazard Zone as defined by the State of California in the Alquist-Priolo Earthquake Fault Hazard Zoning Act. The possibility of damage due to ground rupture is considered negligible, since active faults are not known to cross the site.

3.7 Seismicity

Secondary effects of seismic shaking resulting from large earthquakes on the major faults in the southern California region, which may affect the site, include soil liquefaction and dynamic settlement. Liquefaction is a seismic phenomenon in which loose, saturated, granular soils behave similarly to a fluid when subject to high-intensity ground shaking. Liquefaction occurs when three general conditions exist: 1) shallow groundwater; 2) low density non-cohesive (granular) soils; and 3) high-intensity ground motion. Studies indicate that saturated, loose to medium dense, near surface cohesionless soils exhibit the highest liquefaction potential, while dry, dense, cohesionless soils and cohesive soils exhibit low to negligible liquefaction potential.

A Liquefaction analysis was performed during the previous investigation by LGC Inland (2008), on Boring B-6, considering the historic high ground water of 20 feet below the existing surface and a Peak Ground Acceleration (PGA) of 0.40g. The professional software, Liquefy2 (interim Version 1.5), developed by Thomas F. Blake, was utilized. Based on the liquefaction analysis, the soil layer between approximately 22 and 35 feet has a potential for liquefaction. Due to the liquefaction of this layer, potential for liquefaction-induced settlement, sand boils, and ground fissures, which are discussed in the following sections, should be considered. An analysis of Liquefaction is attached in Appendix E.

Other secondary seismic effects include shallow ground rupture, and seiches and tsunamis. In general, these secondary effects of seismic shaking are a possibility throughout the Southern California region and are dependent on the distance between the site and causative fault and the onsite geology. A risk assessment of these secondary effects is provided in the following sections.

3.7.1 Liquefaction Induced Settlement

Based on previous reporting, liquefaction-induced settlements may occur at the site. The estimation of potential liquefaction or induced settlements is divided into two separate causative mechanisms: the dynamic settlement of dry coarse-grained soil above the groundwater table and seismic settlement below the groundwater from liquefaction.

Dynamic settlement of dry sands can occur as the sand particles tend to settle and densify as a result of a seismic event. A dry sand settlement of approximately 0.8 inches was estimated. Based on the results of the liquefaction analysis (based on the SPT data), a liquefaction-induced saturated settlement of approximately 2.3 inches was estimated. These settlement estimations are based on the procedures proposed by Tokimatsu and Seed (1987), and the calculations are attached in Appendix E.

The calculations estimated the total liquefaction-induced settlement of approximately 3.1 inches. Differential settlements due to lateral heterogeneities in the soil profile would likely be only a fraction of the total, it was concluded that the differential settlements would be buffered by the remedial removals and/or structural mitigation such as stiffened foundation system. Based on the publication, *Recommended Procedures for Implementation of DMG Special Publication 117, Guidelines for Analyzing and Mitigating Liquefaction in California,* it can be concluded that the differential settlement at level ground sites with natural soils is expected to be small even if total settlements are large. However, for design purposes differential settlement is typically assumed to be approximately one-half

of the total settlement. Based on the above, the estimated differential settlement that should be considered in site development is approximately 1.5 inches.

3.7.2 Sand Boils and Ground Fissures

The possible effect of liquefaction on level ground includes surface manifestations such as seismic settlement (discussed above), sand boils, and ground fissures (although liquefaction may occur with no evidence of surface manifestation).

During a seismic event, seismically induced excess pore pressures are commonly dissipated by the upward flow of pore water, which produces upward acting forces on soil particles. If the hydraulic gradient reaches a critical value, the vertical effective stress will drop to zero and the soil will be in a quick "liquefied" condition. In these cases the water velocity during a seismic event may be sufficient to carry soil particles to the surface causing sand boils and/or ground fissures.

Based upon the design chart prepared by Ishihara (Ishihara, 1985), a peak ground acceleration of 0.40g, and the anticipated additional fill thickness of approximately 6 to 9 feet at the liquefaction potential area, the site is considered not susceptible to sand boils and ground fissures.

3.7.3 Lateral Spread

Lateral spread involves the lateral displacement of large surface blocks of soil due to liquefaction of subsurface layers. Lateral spread generally develops on gentle slopes that move toward a free face such as a stream or channel. The site is located close to the Tucalota Creek. However, due to the absence of shallow liquefiable soils, the potential for lateral spread is not considered to be significant.

3.7.4 Shallow Ground Rupture

Ground rupture due to active faulting is not likely to occur on site due to the absence of known active fault traces within the immediate site vicinity. Cracking due to shaking from distant seismic events is not considered a significant hazard, although it is a possibility at any site.

3.7.5 Tsunamis and Seiches

Based on the elevation of the proposed development at the site with respect to sea level and its distance from large open bodies of water, the potential of seiche and/or tsunami is not considered to be significant.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 General

Based on the results of current and previous geotechnical investigations, it is our opinion that the proposed commercial development, as indicated on the referenced 40-scale plot plan, is feasible from a geotechnical and geologic standpoint provided that the following recommendations are incorporated into the design criteria and project specifications. When foundation/structural plans for the proposed development are available, a comprehensive plan review should be performed by LGC. Depending on the results, additional recommendations may be necessary for geotechnical design parameters for both earthwork and foundations. Grading should be conducted in accordance with local and state codes, including the 2016 edition of the California Building Code (CBC), the recommendations within this report, and future geotechnical reports. It is also our opinion that the proposed grading and construction will not adversely impact the geologic stability of adjoining properties.

The following is a summary of the primary geotechnical factors, as determined from our geotechnical evaluation of the data, published/unpublished literature, and geotechnical reports:

- Based on the current and previous subsurface explorations, the site is found to be primarily underlain by undocumented artificial fill material and Quaternary young axial channel deposits.

- The existing undocumented artificial fill soils on the subject site are not suitable to support the proposed structures

- Groundwater was encountered in the borings of the previous investigation by LGC Inland (2008). Groundwater was encountered at depths of approximately 26.5 feet and 28.0 feet below existing ground surface; perched groundwater conditions may occur during seasonal fluctuations.

- Based on the conclusions of the previous subsurface exploration and liquefaction analysis, a layer between approximately 22 to 35 feet has a potential for liquefaction.

- For design purposes, a liquefaction-induced settlement of approximately 3.1-inch with a differential settlement of approximately 1.5-inch should be considered.

- Active or potentially active faults are not known to exist on the site.

- There are no known landslides impacting the site.

- Previous laboratory test results of the onsite soils indicate a very low to low expansion potential and negligible potential for soluble sulfate attack on normal concrete.

- Previous laboratory test results indicate that on-site soils are moderately corrosive to buried metals.

- The site is underlain by approximately 12 feet to 15 feet of potentially compressible undocumented artificial fill material and young axial channel deposits, which may be prone to potential intolerable post-grading settlement and/or hydroconsolidation, under the surcharge of the future proposed structural loads and/or fill loads. These materials should be overexcavated to underlying competent young axial channel deposits.

- From a geotechnical perspective, the existing onsite soils appear to be suitable material for use as fill, provided that they are relatively free from rocks (larger than 8 inches in maximum dimension), construction debris, and organic material. It is anticipated that the onsite soils may be excavated with conventional heavy-duty construction equipment.

5.0 SEISMIC-DESIGN CONSIDERATIONS

5.1 Ground Motions

The site will probably experience ground shaking from moderate to large size earthquakes during the life of the proposed development. Furthermore, it should be recognized that the Southern California region is an area of high seismic risk, and that it is not considered feasible to make structures totally resistant to seismic-related hazards.

Structures within the site should be designed and constructed to resist the effects of seismic ground motions as provided in the 2016 CBC Sections 1613 and 1616 and 2010 ASCE 7. The method of design is dependent on the seismic zoning, site characterizations, occupancy category, building configuration, type of structural system, and building height.

The following seismic design parameters, presented in Table 2, were developed based on the CBC 2016 and should be used for the proposed structures. A site coordinate of 33.5444° N, 117.1422° W was used to derive the seismic parameters presented below:

TABLE 2
Seismic Design Soil Parameters

SEISMIC DESIGN SOIL PARAMETERS (2016 CBC Section 1613 and 2010 ASCE 7)	
Site Class Definition (ASCE 7; Chapter 20) [Table 20.3-1]	D
Mapped Spectral Response Acceleration Parameter S_S (for 0.2 second) [Table 1613.5.3(1)]	1.89
Mapped Spectral Response Acceleration Parameter, S_1 (for 1.0 second) [Table 1613.5.3(2)]	0.76
Site Coefficient F_a (short period) [Table 1613.3.3(1)]	1.00
Site Coefficient F_v (1-second period) [Table 1613.3.3(2)]	1.50
Adjusted Maximum Considered Earthquake (MCE) Spectral Response Acceleration Parameter S_{MS} (short period) [Eq. 16-37]	1.89
Adjusted Maximum Considered Earthquake (MCE) Spectral Response Acceleration Parameter S_{M1} (1-second period) [Eq. 16-38]	1.13
Design Spectral Response Acceleration Parameter, S_{DS} (short period) [Eq. 16-39]	1.26
Design Spectral Response Acceleration Parameter, S_{D1} (1-second period) [Eq. 16-40]	0.76
Mean Peak Ground Acceleration (PGA_m)	0.75

6.0 GEOTECHNICAL DESIGN PARAMETERS

6.1 Shrinkage/Bulking and Subsidence

Volumetric changes in earth quantities will occur when excavated onsite soils are replaced as properly compacted fill. Following is an estimate of the shrinkage and bulking factors for the various geologic units present onsite. These estimates are based on in-place densities of the various materials and on the estimated average degree of relative compaction that will be achieved during grading.

TABLE 3
Estimated Shrinkage/Bulking

GEOLOGIC UNIT	***SHRINKAGE/BULKING***
Artificial fill, Undocumented	15% to 20%
Quaternary Young Axial Channel Deposits	6% to 8%

Subsidence due to recompaction of exposed overexcavation bottom prior to fill placement, and placement of proposed fills, is estimated to be about 0.05 foot to 0.1 feet.

The above estimates of shrinkage and subsidence are intended as an aid for project engineers in determining earthwork quantities. These are preliminary rough estimates which may vary with depth of removal, stripping losses, field conditions at the time of grading, etc. However, these estimates should be used with some caution since they are not absolute values. Contingencies should be made for balancing earthwork quantities based on actual shrinkage and subsidence that occurs during the grading operations.

6.2 Cut/Fill Transition and Fill Differentials

To mitigate distress to structures related to the potential adverse effects of excessive differential settlement, cut/fill transitions should be eliminated from all building areas where the depth of fill placed within the "fill" portion exceeds proposed footing depths. The entire structure should be founded on a uniform bearing material.

This should be accomplished by overexcavating the "cut" portion and replacing the excavated materials as properly compacted fill. Recommended depths of overexcavation are provided in the following table:

Cut/Fill Transition

DEPTH OF FILL ("fill" portion)	***DEPTH OF OVEREXCAVATION ("cut" portion)***
Up to 5 feet	Equal Depth
5 to 10 feet	5 feet
Greater than 10 feet	One-half the maximum thickness of fill placed on the "fill" portion (20 feet maximum)

Overexcavation of the "cut" portion should extend beyond the perimeter building lines a horizontal distance equal to the depth of overexcavation or to a minimum distance of 5 feet, whichever is greater.

6.2 Excavation Characteristics

It is anticipated that the onsite soils may be excavated with conventional heavy-duty construction equipment based on LGC's subsurface exploration and experience with these materials in the area.

6.3 Compressible/Collapsible Soils

The results of previous laboratory testing indicate that the upper 12.0 feet to 15.0 feet of surficial soil/material is susceptible to varying degrees of intolerable settlement and/or hydro-consolidation (collapse) when a load is applied or the soil is saturated. Consequently, this material should be overexcavated to underlying competent young axial channel deposits, and replaced as engineered fill.

6.4 Preliminary Infiltration Design Rates

Shallow infiltration testing for the proposed stormwater infiltration devices indicated design rates of approximately 0.30 inches/hour (IT-1), 0.04 inches/hour (IT-2 and IT-3), 34.29 inches/hour (IT-4), 34.29 inches/hour (IT-5), 34.29 inches/hour (IT-6), and 34.29 inches/hour (IT-7), at approximate proposed infiltration device bottoms, as presented in Table 1, in Section 2.4. Furthermore, based on current and previous exploratory investigations, including historic data, groundwater should not be present within the current allowable limit (of within 10 feet of the bottom of testing and/or drainage devices) set forth by the County of Riverside.

7.0 SITE EARTHWORK

7.1 General Earthwork and Grading Specifications

Earthwork and grading should be performed in accordance with applicable requirements of the grading code of the City of Temecula, and in accordance with the following recommendations prepared by this firm. Grading should also be performed in accordance with the applicable provisions of the attached "General Earthwork and Grading Specifications for Rough Grading" (Appendix E) prepared by this firm, unless specifically revised or amended herein. In case of conflict, the following recommendations shall supersede those included in Appendix E.

7.2 Geotechnical Observations and Testing

Prior to the start of grading, a meeting should be held at the site with the owner, developer, grading contractor, civil engineer and geotechnical consultant to discuss the work schedule and geotechnical aspects of the grading. Rough grading, which includes clearing, overexcavation, scarification/processing and fill placement, should be accomplished under the full-time observation and testing of the geotechnical consultant. Fills should not be placed without prior approval from the geotechnical consultant.

A representative of the project geotechnical consultant should also be present onsite during grading operations to document proper placement and compaction of fills, as well as to document excavations and compliance with the other recommendations presented herein.

7.3 Clearing and Grubbing

Weeds, grasses, and trees in areas to be graded should be stripped and hauled offsite. Trees to be removed should be grubbed so that their stumps and major-root systems are also removed and the organic materials hauled offsite. During site grading, laborers should clear from fills roots, tree branches and other deleterious materials missed during clearing and grubbing operations.

The project geotechnical consultant or a qualified representative should be notified at the appropriate times to provide observation and testing services during clearing and grubbing operations to observe and document compliance with the above recommendations. In addition, buried structures, and any unusual or adverse soil conditions encountered that are not described or anticipated herein, should be brought to the immediate attention of the geotechnical consultant.

7.4 Overexcavation and Ground Preparation

The site is underlain by approximately 5 feet to 15 feet of potentially compressible undocumented artificial fill material and upper young axial channel deposits. Therefore, surficial soil/material considered unsuitable for support of proposed fills, structures, and/or improvements, and should be overexcavated to expose underlying competent young axial channel deposits. The overexcavation should also be at least 3 feet below the proposed footings for buildings or walls. In pavement areas, all undocumented artificial fill material and generally the upper 3 feet to 5 feet of native young axial channel soils should be overexcavated and recompacted. Groundwater is not anticipated to be encountered during site grading. Actual depths of overexcavation should be evaluated upon review of final grading and foundation plans on the basis of observations and testing during grading by the project geotechnical consultant.

Prior to placing engineered fill, exposed bottom surfaces in each overexcavated area should first be scarified to a depth of approximately 6 inches, watered or air-dried as necessary to achieve a uniform moisture content of optimum or higher, and then compacted in place to a relative compaction of 90 percent or more (based on American Society for Testing and Materials [ASTM] Test Method D1557).

The estimated locations, extent and approximate depths for overexcavation of unsuitable materials are indicated on the enclosed Geotechnical and Infiltration Map (Plate 1). The geotechnical consultant should be provided with appropriate survey staking during grading to document that depths and/or locations of recommended overexcavation are adequate.

Sidewalls for overexcavations greater than 5 feet in height should be no steeper than 1:1 (h:v) and should be periodically slope-boarded during their excavation to remove loose surficial debris and facilitate mapping. Flatter excavations may be necessary for stability.

The grading contractor will need to consider appropriate measures necessary to excavate adjacent existing improvements adjacent to the site without endangering them due to caving or sloughing.

7.5 Fill Suitability

Soil materials excavated during grading are generally considered suitable for use as compacted fill provided that they do not contain significant amounts of trash, vegetation, construction debris and oversize material.

7.6 Oversized Material

Oversized material that may be encountered during grading, greater than 8 inches, should be reduced in size or removed from the site.

7.7 Benching

Where compacted fills are to be placed on natural slope surfaces inclining at 5:1 (h:v) or greater, the ground should be excavated to create a series of level benches, which are at a minimum height of 4 feet, excavated into competent soils.

7.8 Fill Placement

Fills should be placed in lifts no greater than 8 inches in uncompacted thickness, watered or air-dried as necessary to achieve a uniform moisture content of at least optimum moisture content and then compacted in place to relative compaction of 90 percent or more. Fills should be maintained in a relatively level condition. The laboratory maximum dry density and optimum moisture content for each change in soil type should be determined in accordance with ASTM Test Method D1557.

7.9 Inclement Weather

Inclement weather may cause rapid erosion during mass grading and/or construction. Proper erosion and drainage control measures should be taken during periods of inclement weather in accordance with City of Temecula and California State requirements.

8.0 SLOPE CONSTRUCTION

8.1 Slope Stability

Based on the referenced 40-scale plot plan, both cut and fill slopes are proposed at slope ratios of 2:1 (H:V) or flatter and should be grossly and surficially stable.

8.2 Fill Slopes

Following overexcavation of unsuitable soils, a 10-foot wide fill key excavated into competent soil/material should be provided at the toes of fill and fill over cut slopes. The bottom of the fill keys should be tilted at 2 percent back into the slope.

8.3 Cut Slopes

Proposed cut slopes may expose low-density, dry and desiccated soils, which will likely require stabilization by overexcavation and replacement with compacted fill.

8.4 Temporary Excavations

Based on the physical properties of the onsite soils, temporary excavations exceeding 5 feet in height should be cut back at a ratio of 1:1 (h:v) or flatter, for the duration of the overexcavation and recompaction of unsuitable soil material. Temporary slopes excavated at the above slope configurations are expected to remain stable during grading operations. However, the temporary excavations should be observed by a representative of the project geotechnical consultant for any evidence of potential instability. Depending on the results of these observations, revised slope configurations may be necessary.

Other factors which should be considered with respect to the stability of the temporary slopes include construction traffic and storage of materials on or near the tops of the slopes; construction scheduling; presence of nearby walls or structures on adjacent properties; drainage; and weather conditions at the time of construction. Applicable requirements of the California Construction and General Industry Safety Orders; the Occupational Safety and Health Act of 1970; and the Construction Safety Act should also be followed.

9.0 POST-GRADING CONSIDERATIONS

9.1 Control of Surface Water and Drainage Control

Positive-drainage devices, such as sloping sidewalks, graded-swales and/or area drains, should be provided to collect and direct water away from the structure and slopes. Neither rain nor excess irrigation water should be allowed to collect or pond against building foundations. Roof gutters and downspouts should be provided on the sides of structures. Drainage should be directed to adjacent driveways, adjacent streets or storm-drain faculties. The ground surface adjacent to the structures should be sloped at a gradient of at least 5 percent for a distance of at least 10 feet, and further maintained by a swale or drainage path at a gradient of at least 2 percent. Where necessary, drainage paths may be shortened by use of area drains and collector pipes.

Planters with open bottoms adjacent to buildings should be avoided. Planters should not be designed adjacent to buildings unless provisions for drainage, such as catch basins, liners, and/or area drains, are made. Over watering must be avoided.

9.2 Utility Trenches

Utility-trench backfill within roadways, utility easements, under walls, sidewalks, driveways, floor slabs and any other structures or improvements should be compacted. The onsite soils should generally be suitable as trench backfill provided they are screened of rocks and other material over 3 inches in diameter and organic matter. Trench backfill should be compacted in uniform lifts (generally not exceeding 6 inches to 8 inches in uncompacted thickness) by mechanical means to at least 90 percent relative density (per ASTM Test Method D1557).

Where onsite soils are utilized as backfill, mechanical compaction should be used. Density testing, along with probing, should be performed by the project geotechnical consultant or his representative, to document proper compaction.

If trenches are shallow and the use of conventional equipment may result in damage to the utilities; clean sand, having sand equivalent (SE) of 30 or greater, should be used to bed and shade the utilities. Sand backfill should be densified. The densification may be accomplished by jetting or flooding and then tamping to ensure adequate compaction. A representative from LGC should observe, probe, and test the backfill to verify compliance with the project specifications.

Utility-trench sidewalls deeper than 5 feet should be laid back at a ratio of 1:1 (h:v) or flatter or braced. A trench box may be used in lieu of shoring. If shoring is anticipated, LGC should be contacted to provide design parameters.

To avoid point-loads and subsequent distress to clay, cement or plastic pipe, imported sand bedding should be placed 1 foot or more above pipe in areas where excavated trench materials contain significant cobbles. Sand-bedding materials should be compacted and tested prior to placement of backfill.

Where utility trenches are proposed parallel to building footings (interior and/or exterior trenches), the bottom of the trench should not be located within a 1:1 (h:v) plane projected downward from the outside bottom edge of the adjacent footing.

10.0 PRELIMINARY FOUNDATION DESIGN RECOMMENDATIONS

10.1 General

Provided that site grading is performed in accordance with the recommendations of this report, conventional shallow foundations are still considered feasible for support of the proposed commercial structures. Tentative foundation recommendations are provided herein. However, these recommendations may require modification depending on as-graded conditions within the building pad areas upon completion of grading.

10.2 Allowable-Bearing Values

An allowable-bearing value of 2,500 pounds per square foot (psf) may be used for 24-inch square pad footings and 12-inch or more wide continuous footings founded in compacted fill or competent native soil/material at a depth of 18 inches or more below the lowest adjacent final grade. This value may be increased by 20 percent for each additional foot of width and depth, to a value no greater than 3,500 psf. The recommended allowable-bearing value includes both dead and live loads and may be increased by one-third for short-duration wind and seismic forces.

10.3 Settlement

Based on the general settlement characteristics of the soil types that underlie the building sites and the anticipated loading, it has been estimated that the maximum total settlement of conventional footings will be less than approximately 1.00 inch. Differential settlement is expected to be about 0.50 inches over a horizontal distance of approximately 30 feet. It is anticipated that the majority of the settlement will occur during construction or shortly thereafter as building loads are applied.

The above settlement estimates are based on the assumption that the grading will be performed in accordance with the grading recommendations presented in this report and that the project geotechnical consultant will observe or test the soil conditions in the footing excavations.

10.4 Lateral Resistance

A passive earth pressure of 250 psf per foot of depth to a maximum value of 3,000 psf may be used to determine lateral-bearing resistance for footings. The passive earth pressure incorporates a minimum factor of safety of 1.5. Where structures are planned in or near descending slopes, the passive earth pressure should be reduced to 150 psf per foot of depth to a maximum value of 1,500 psf. In addition, a coefficient of friction of 0.35 times the dead-load forces may be used between concrete and the supporting soils to determine lateral sliding resistance. The above values may be increased by one-third when designing for short-duration wind or seismic forces. When combining passive and friction for lateral resistance, the passive component should be reduced by one third.

The above values are based on footings placed directly against engineered compacted fill. In the case where footing sides are formed, backfill placed against the footings should be compacted to 90 percent or more of maximum dry density as determined by ASTM D1557.

10.5 Footing Setbacks from Descending Slopes

Where structures are proposed near the tops of descending graded or natural slopes, the footing setbacks from the slope face should conform to the 2016 CBC, Figure 1808.7.1. The required setback is H/3 (one-third the slope height) measured along a horizontal line projected from the lower outside face of the footing to the slope face. The footing setbacks should be 5 feet where the slope height is 15 feet or less and up to a maximum of 40 feet where the slope height exceeds 15 feet.

10.6 Building Clearances from Ascending Slopes

Building setbacks from ascending graded or natural slopes should conform with the 2016 CBC, Figure 1808.7.1, which requires a building clearance of H/2 (one-half the slope height) varying from 5 to 15 feet. The building clearance is measured along a horizontal line projected from the toe of the slope to the face of the building. A retaining wall may be constructed at the base of the slope to achieve the required building clearance.

10.7 Footing Observations

Footing excavations should be observed by LGC to document that they have been excavated into competent bearing soils. The foundation excavations should be observed prior to the placement of forms, reinforcement or concrete. The excavations should be trimmed neat, level and square. Loose, sloughed or moisture-softened soil should be removed prior to concrete placement.

Excavated materials from footing excavations should not be placed in slab-on-ground areas unless the soils are compacted to 90 percent or more of maximum dry density as determined by ASTM D1557.

10.8 Expansive Soil Considerations

The results of current and previous laboratory tests indicate that onsite soil materials exhibit an expansion potential of **VERY LOW** to **LOW** in accordance with 2016 CBC, Chapter 18. However, expansive soil conditions should be evaluated for the subject building pad during and at the completion of rough grading to observe and document the anticipated conditions. The design and construction details presented herein are intended to provide recommendations for the levels of expansion potential which may be evident at the completion of rough grading. Furthermore, it should be noted that additional slab thickness, footing sizes and/or reinforcement more stringent than the recommendations that follow should be provided as recommended by the project architect or structural engineer.

10.9 Footing/Floor Slabs – VERY LOW to LOW Expansion Potential

The following are our recommendations where the foundation soils exhibit a **VERY LOW** to **LOW** expansion potential as classified in accordance with the 2016 CBC, which specifies that slab-on-ground foundations resting on soils with an expansion index greater than 20 require special design considerations. For this condition, it is recommended that footings and floors be constructed and reinforced in accordance with the following criteria. However, additional slab thickness, footing sizes, and/or reinforcement may be required by the project architect or structural engineer. We recommend using an assumed plasticity index (P.I.) of **16.**

- ***Footings***
  - Exterior continuous footings should be founded into compacted engineered fill below the lowest adjacent final grade at minimum depths of 18 inches deep for one-story and two-story construction. Interior continuous footings may be founded at a depth of 12-inches or greater for one-story and two-story structures, into compacted engineered fill below the lowest adjacent final grade. Continuous footings should have a minimum width of 15-inches or more for one-story and two-story structures.
  - Continuous footings should be reinforced with a minimum of four (4) No. 4 bars, two near top and two near bottom, subject to concurrence of the structural engineer.
  - Interior isolated pad footings should be 18 inches or more square and founded at a depth of 18-inches or more for one-story and two-story structures, below the lowest adjacent grade. Footings should be reinforced in accordance with the structural engineer's recommendation.
  - Exterior pad footings should be 18 inches or more square and founded at a depth of 18 inches or more below the lowest adjacent grade. Footings should be reinforced in accordance with the structural engineer's recommendations.
- ***Floor Slabs***
  - Concrete floor slabs should be 5 inches or more thick and reinforced with No. 3 bars spaced 18 inches or less on-centers, both ways. Slab reinforcement should be supported on concrete chairs or bricks so that the desired placement is near mid-depth.
  - Concrete floors should be underlain with a moisture-vapor retarder consisting of 15-mil thick vapor barrier. Laps within the membrane should be sealed and overlapped 12 inches. Two inches or more of clean sand should be placed above and below the membrane to promote uniform curing of the concrete. These recommendations must be confirmed (and/or modified) by the foundation engineer with our concurrence, based upon the performance expectations of the foundation. It is the responsibility of the contractor to ensure that the moisture/vapor barrier systems are placed in accordance with the project plans and specifications, and that the moisture/vapor retarder materials are free of tears and punctures prior to concrete placement. Additional moisture reduction and/or

prevention measures may be needed, depending on the performance requirements of future interior floor coverings.

- Prior to placing concrete, subgrade soils should be thoroughly moistened to approximately 110% of optimum moisture content to promote uniform curing of the concrete and reduce the development of shrinkage cracks. The moisture content should penetrate to a minimum depth of 18 inches.

10.10 Nonstructural Concrete Flatwork

Concrete flatwork (such as walkways, bicycle trails, etc.) has a high potential for cracking due to changes in soil volume related to soil-moisture fluctuations. To reduce the potential for excessive cracking and lifting, concrete should be designed in accordance with the minimum guidelines for **VERY LOW to LOW** expansive soils, outlined in Table 4. These guidelines will reduce the potential for irregular cracking and promote cracking along construction joints, but will not eliminate all cracking or lifting. Thickening the concrete and/or adding additional reinforcement will further reduce cosmetic distress.

TABLE 4
Nonstructural Concrete Flatwork for Very Low Expansive Soils

	Private Sidewalks	***Private Drives***	***Patios/Entryways***	***City Sidewalk Curb and Gutters***
Minimum Thickness (in.)	4 (nominal)	4(full)	4 (full)	City/Agency Standard
Presaturation	Presoak to 12 inches	Presoak to 12 inches	Presoak to 12 inches	City/Agency Standard
Reinforcement	—	No. 3 at 18 inches on centers	No. 3 at 18 inches on centers	City/Agency Standard
Thickened Edge	—	8" x 8"	8" X 8"	City/Agency Standard
Crack Control	Saw cut or deep open tool joint to a minimum of 1/3 the concrete thickness	Saw cut or deep open tool joint to a minimum of 1/3 the concrete thickness	Saw cut or deep open tool joint to a minimum of 1/3 the concrete thickness	City/Agency Standard
Maximum Joint Spacing	5 feet	10 feet or quarter cut whichever is closer	6 feet	City/Agency Standard

11.0 SOIL CORROSIVITY

11.1 Corrosivity to Concrete and Metal

The National Association of Corrosion Engineers (NACE) defines corrosion as "a deterioration of a substance or its properties because of a reaction with its environment". From a geotechnical viewpoint, the "environment" is the prevailing foundation soils and the "substances" are the reinforced concrete foundations or various buried metallic elements such as rebar, piles, pipes, etc., which are in direct contact with or within close vicinity of the foundation soil.

In general, soil environments that are detrimental to concrete have high concentrations of soluble sulfates. ACI 318R-05, Table 4.3.1 provides specific guidelines for the concrete mix design based on different amount of soluble sulfate content.

The corrosion potential of the onsite materials was previously evaluated for its effect on concrete. The corrosion potential was evaluated using the results of laboratory tests performed on representative samples

obtained during previous investigations. Laboratory testing was performed to evaluate soluble sulfate content only. Based on previous laboratory testing performed, the onsite soils are classified as having a **negligible** sulfate exposure condition in accordance with ACI 318R-05, Table 4.3.1.

These recommendations are based on the previous samples of the near surface engineered fill soils. The initiation of re-grading at the site could blend various soil types and import soils may be used locally. These changes made to the foundation soils could alter sulfate-content levels. Accordingly, it is recommended that additional testing may be performed at the completion of grading.

12.0 RETAINING WALLS

12.1 Lateral Earth Pressures and Retaining Wall Design Parameters

Conventional foundations for retaining walls completely within properly compacted fill should be embedded at least 18 inches below lowest adjacent grade. At this depth, an allowable bearing capacity of 2,500 psf may be assumed for retaining walls founded in competent compacted fill.

The following lateral earth pressures are recommended for retaining walls that may be proposed. The recommended lateral pressures for approved on-site soils or import material (with an expansion index of 20 or less and phi angle of internal friction of at least 32 degrees), for level or sloping backfill are presented in Table 5. **Onsite fill soil with an expansion index of greater than 20 should not be used as backfill due to the expansive nature.** Onsite soil should be screened of rocks and other material over 3 inches in diameter.

TABLE 5
Lateral Earth Pressures

CONDITIONS	*EQUIVALENT FLUID WEIGHT (pcf)*			
	Level Backfill (up to 6 feet)	*Level Backfill-Dynamic (>6 feet to 10 feet)*	*2:1 Backfill Ascending (up to 6 feet)*	*2:1 Backfill Ascending-Dynamic (>6 feet to 10 feet)*
Active	40	65	65	85
At-Rest	65	90	90	115
Passive	250	250	120	120

For sliding resistance, the friction coefficient of 0.35 may be used at the concrete and soil interface. Wall footings should be designed in accordance with structural considerations. The passive resistance value may be increased by one-third when considering loads of short duration such as wind or seismic loads.

Restrained structural walls should be designed for at rest conditions. The magnitude of those pressures depends on the amount of deformation that the wall can yield under load. If the wall can yield enough to mobilize the full shear strength of the soil, it can be designed for "active" pressure. If the wall cannot yield under the applied load, the shear strength of the retained soil cannot be mobilized and the earth pressure will be higher. Such walls should be designed for "at-rest" conditions.

The equivalent fluid pressure values assume free-draining conditions and a soil expansion index of 20 or less. If conditions other than those assumed above are anticipated, revised equivalent fluid pressure values should be provided on an individual-case basis by the geotechnical engineer.

Surcharge loading effects from the adjacent structures should be evaluated by the geotechnical and structural engineers.

12.2 Footing Embedments

The base of retaining wall footings constructed on level ground may be founded at a depth of 12 inches or more below the lowest adjacent final grade. Where retaining walls are proposed on or within 15 feet from the top of an adjacent descending fill slopes, the footings should be deepened such that a horizontal clearance of

H/3 or more (one-third the slope height) is maintained between the outside bottom edges of the footings and the face of the slope but not to exceed 15 feet or be less than 5 feet. The above recommended footing setbacks are preliminary and may be revised based on site specific soil conditions. Footing or pier excavations should be observed by the project geotechnical representative to document that the footing trenches have been excavated into competent bearing soils and to the embedments recommended above. These observations should be performed prior to placing forms or reinforcing steel.

12.3 Drainage

All retaining wall structures should be provided with appropriate drainage and appropriately waterproofed. The outlet pipe should be sloped to drain to a suitable outlet. It should be noted that that recommended subdrains does not provide protection against seepage through the face of the wall and/or efflorescence. If such seepage or efflorescence is undesirable, retaining walls should be waterproofed to reduce this potential.

Weep holes or open vertical masonry joints should be provided in retaining walls 3 feet or less in height to reduce the likelihood of entrapment of water in the backfill. Weep holes, if used, should be 3 inches or more in diameter and provided at intervals of 6 feet or less along the wall. Open vertical masonry joints, if used, should be provided at 32-inch or less intervals. A continuous gravel fill, 12 inches by 12 inches, should be placed behind the weep holes or open masonry joints. The gravel should be wrapped in filter fabric to reduce infiltration of fines and subsequent clogging of the gravel. Filter fabric may consist of Mirafi 140N or equivalent.

In lieu of weep holes or open joints, for retaining walls less than 3 feet, a perforated pipe and gravel subdrain may be used. Perforated pipe should consist of 4-inch or more diameter PVC Schedule 40 or ABS SDR-35, with the perforations laid down. The pipe should be embedded in 1.5 cubic feet per foot of 0.75 or 1.5-inch open graded gravel wrapped in filter fabric. Filter fabric may consist of Mirafi 140N equivalent.

Retaining walls greater than 3 feet high should be provided with a continuous backdrain for the full height of the wall. This drain could consist of geosynthetic drainage composite, such as Miradrain 6000 or equivalent, or a permeable drain material, placed against the entire backside of the wall. If a permeable drain material is used, the backdrain should be 1 or more feet thick. Caltrans Class II permeable material or open graded gravel or crushed stone (described above) may be used as permeable drain material. If gravel or crushed stone is used, it should have less than 5 percent material passing the No. 200 sieve. The drain should be separated from the backfill with a geofabric. The upper 1 foot of the backdrain should be covered with compacted fill. A drainage pipe consisting of 4-inch diameter perforated pipe (described above) surrounded by 1 cubic foot per foot of gravel or crushed rock wrapped in a filter fabric should be provided along the back of the wall. The pipe should be placed with perforations down, sloped at 2 percent or more and discharge to an appropriate outlet through a solid pipe. The pipe should outlet away from structures and slopes. The outside portions of retaining walls supporting backfill should be coated with an approved waterproofing compound to inhibit infiltration of moisture through the walls.

12.4 Temporary Excavations

Retaining walls, if any are proposed, should be constructed and backfilled as soon as possible after backcut excavations are constructed. Prolonged exposure of backcut slopes may result in some localized slope instability. To facilitate retaining wall construction, the lower 5 feet of temporary slopes may be cut vertical and the upper portions exceeding a height of 5 feet should be cut back at a gradient of 1:1 (h:v) or flatter for the duration of construction. However, temporary slopes should be observed by the project geotechnical consultant for evidence of potential instability. Depending on the results of these observations, flatter slopes may be necessary. The potential effects of various parameters such as weather, heavy equipment travel, storage near the tops of the temporary excavations and construction scheduling should also be considered in the stability of temporary slopes. Water should not be permitted to drain away from the slope. Surcharges, due to equipment, spoil piles, etc., should not be allowed within 10 feet of the top of the slope.

All excavations should be made in accordance with Cal/OSHA. Excavation safety is the sole responsibility of the contractor.

12.5 Retaining Wall Backfill

Any retaining wall backfill soils (with an expansion index of 20 or less) should be placed in 6 to 8 inch loose lifts, watered or air-dried as necessary to achieve near optimum moisture conditions and compacted to at least 90 percent relative density (based on ASTM Test Methods D2922 and D3017).

13.0 PAVEMENT RECOMMENDATIONS

Previous laboratory testing by LGC Inland (2008), indicates an R-value of 30. Based on an R-value of 30, and assumed Traffic Indices (TI's) of 5.0, 5.5, 6.5, and 7.0, previous reporting recommends the following minimum pavement sections (Table 6). These recommendations should be confirmed by additional testing at the completion of grading. Final pavement sections should be confirmed by the project civil engineer based upon the project Traffic Index and the City of Temecula minimum requirements.

TABLE 6
Recommended Minimum Pavement Sections

	Auto Parking Area	Access Road/Local Street	Enhanced Local Street	Collector
Assumed Traffic Index	5.0	5.5	6.5	7.0
Design R-Value	30	30	30	30
AC Thickness	3.0 inches	3.0 inches	3.5 inches	4.0 inches
AB Thickness	6.0 inches	8.0 inches	10.0 inches	10.0 inches

Notes: AC – Asphaltic Concrete
AB – Aggregate Base

The aggregate base material should conform to the specifications for Class 2 Aggregate Base (Caltrans) or Crushed Aggregate Base (Standard Specifications for Public Works Construction). The base material should be compacted to achieve a minimum relative compaction of 95 percent. The subgrade should achieve a minimum relative compaction of 95 percent through the upper 12 inches. Base and subgrade materials should be moisture-conditioned to a relatively uniform moisture content at or slightly over optimum. The R-value should be obtained during the concluding stages of grading, and the final pavement section will then be designed accordingly. TI's for the streets within the subject project site should be obtained from the City, County or calculated by a traffic engineer. The above recommendations are considered applicable if complete removals of the compressible materials are performed in the pavement areas.

13.0 PLAN REVIEWS AND CONSTRUCTION SERVICES

This report has been prepared for the exclusive use of AVA, Property Investment, LLC to assist the project engineer and architect in the design of the proposed development. It is recommended that LGC be engaged to review the rough grading plans, finalized detention device locations, structural plans and the final design drawings and specifications prior to construction. This is to document that the recommendations contained in this report have been properly interpreted are incorporated into the project specifications. LGC's review of the rough grading plan may indicate that additional subsurface exploration, laboratory testing and analysis should be performed to address areas of concern. If LGC is not accorded the opportunity to review these documents, we can take no responsibility for misinterpretation of our recommendations.

We recommend that LGC be retained to provide geotechnical engineering services during both the rough grading and construction phases of the work. This is to document compliance with the design, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to start of construction.

If the project plans change significantly (e.g., building loads or type of structures), we should be retained to review our original design recommendations and their applicability to the revised construction. If conditions are encountered during construction that appears to be different than those indicated in this report, this office should be notified immediately. Design and construction revisions may be required.

14.0 LIMITATIONS

Our services were performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable engineers and geologists practicing in this or similar localities. No other warranty, expressed or implied, is made as to the conclusions and professional advice included in this report. The current subsurface observations, the observations made in the field, samples taken and submitted for laboratory testing and the in-situ field testing performed as well as information contained in the previous referenced geotechnical reports are believed representative of the entire project, based on review of the referenced previous geotechnical reports; however, soil and geologic conditions revealed by excavation may be different than our preliminary findings. If this occurs, the changed conditions must be evaluated by the project geotechnical engineer and engineering geologist and design(s) adjusted as required or alternate design(s) recommended.

The findings of this report may be modified upon performing future geotechnical/geologic evaluations. However, changes in the conditions of a property can and do occur with the passage of time, whether they be due to natural processes or the works of man on this or adjacent properties.

This report is issued with the understanding that it is the responsibility of the owner, or of his/her representative, to ensure that the information and recommendations contained herein are brought to the attention of the architect and/or project engineer and incorporated into the plans, and the necessary steps are taken to see that the contractor and/or subcontractor properly implements the recommendations in the field. The contractor and/or subcontractor should notify the owner if they consider any of the recommendations presented herein to be unsafe.

The conclusions and opinions contained in this report are based on the results of the described geotechnical evaluations and represent our professional judgment. The findings, conclusions and recommendations contained in this report are to be considered tentative only and subject to confirmation by LGC during the construction process. Without this confirmation, this report is to be considered incomplete and LGC will not assume any responsibility for its use.

The conclusions and opinions contained in this report are valid up to a period of 2 years from the date of this report or changes within the California Building Code, whichever occurs first. Changes in the conditions of a property can and do occur with the passage of time, whether those be because of natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate codes or standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside LGC's control. Therefore, if any of the above mentioned situations occur, an update of this report must be completed.

This report has not been prepared for use by parties or projects other than those named or designed above. It may not contain sufficient information for other parties or other purposes.

The opportunity to be of service is appreciated. Should you have any questions regarding the content of this report, or should you require additional information, please do not hesitate to contact this office at your earliest convenience.

APPENDIX A

REFERENCES

APPENDIX A

REFERENCES

Technical Reports

LGC Inland, Inc., 2005, Preliminary Geotechnical Investigation for the Proposed Winchester Commercial Center, Northeast Corner of Winchester Road and Willow Springs Avenue in the City of Temecula, Riverside County, California, dated April 7 (Project No. I05759-10).

_____, 2005, Response to the County of Riverside Review Comments Regarding County Geologic Report 1525 (Geologic) Preliminary Geotechnical Investigation for the Proposed Winchester Commercial Center, Northeast Corner of Winchester Road and Willow Springs Avenue in the City of Temecula, Riverside County, California, dated October 27 (Project No. I05759-10).

_____, Inc., 2008, Updated Preliminary Geotechnical Investigation for the Proposed Winchester Commercial Center, Northeast Corner of Winchester Road and Willow Springs Avenue, County of Riverside, California, dated May 16 (Project No. I05759-10).

Publications and Plans

Blake, T.F., 1998, Maps of Known Active Fault Near-Source Zones in California and Adjacent Portions of Nevada, Prepared by California Division of Mines and Geology.

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Jennings, Charles W., 1994, Fault Activity Map of California and Adjacent areas, Map No. 6, California Division of Mines and Geology.

Morton, Douglas M., and Cox, Brett, 1988, Geologic Map of the Riverside East 7.5' Quadrangle, Riverside County, California, U.S. Geological Survey.

Proactive Engineering Consultants West, Inc., 2017, Plot Plan No. 37398, County of Riverside, California, Sheet 1 of 1, Scale: 1"=40', dated September 7.

Ziony, J.L., and Jones, L.M., 1989, Map Showing Late Quaternary Faults and 1978-84 Seismicity of the Los Angeles Region, California: U.S.G.S. Miscellaneous Field Studies, Map MF-1964.

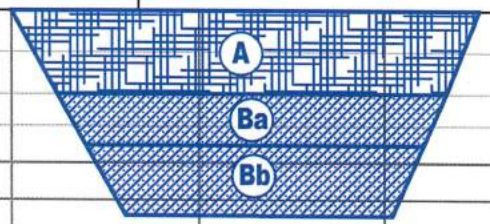
APPENDIX B

TRENCH AND BORING LOGS
(LGC Inland, Inc., 2008)

Project Name: Sky Canyon	Logged by: KRM	Date: 12/4/17	LOG OF TRENCH: TR-1
Project Number: G17-1567-10	Elevation: 1092.5'		Engineering Properties
Equipment: Backhoe	Location/Grid: SEE PLATE 1		

Depth	Description	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
0.0'-2.0'	ARTIFICIAL FILL UNDOCUMENTED: A Silty SAND; light grey brown, dry, loose to medium dense, very fine to medium grained with some coarse grains, blocky texture, root hairs, slightly laminated.	Afu	SM			
2.0'-3.5'	YOUNG AXIAL CHANNEL DEPOSITS: Ba Silty SAND; light brown, dry to damp, medium dense, very fine to coarse grained, slightly porous, some root hairs, slightly desiccated, weathered.	Qya	SM			
3.5'-5.5'	Bb dark yellow brown, damp, dense, very fine to medium grained with some coarse grains.					

GRAPHICAL REPRESENTATION: NORTH WALL	SCALE: 1" = 5'	SURFACE SLOPE: LEVEL	TREND: N85E

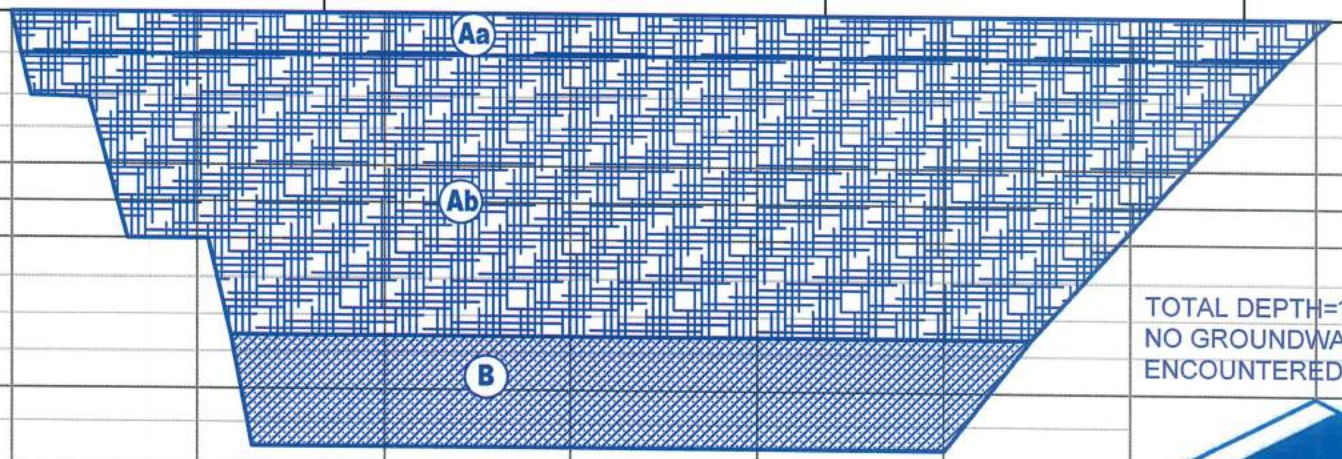


TOTAL DEPTH= 5.5 FEET
NO GROUNDWATER ENCOUNTERED

Project Name: Sky Canyon	Logged by: KRM	Date: 12/4/17	LOG OF TRENCH: TR-2
Project Number: G17-1567-10	Elevation: 1108.0'		Engineering Properties
Equipment: Backhoe	Location/Grid: SEE PLATE 1		

Depth	Description	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
0.0'-1.0'	ARTIFICIAL FILL UNDOCUMENTED: Aa Silty SAND; light grey brown to dark brown, dry, loose to medium dense, very fine to coarse grained, blocky texture, root hairs, debris.	Afu	SM			
1.0'-7.5'	Ab Silty SAND; light yellow, red brown, dry to damp, medium dense, very fine with some coarse grains, root hairs, debris.					
7.5'-10.5'	B YOUNG AXIAL CHANNEL DEPOSITS: Silty SAND; dark yellowish olive brown, dense, damp, very fine to medium grained with some coarse grains, micaceous.	Qya	SM			

GRAPHICAL REPRESENTATION: NORTH WALL | **SCALE: 1" = 5'** | **SURFACE SLOPE: LEVEL** | **TREND: N80E**

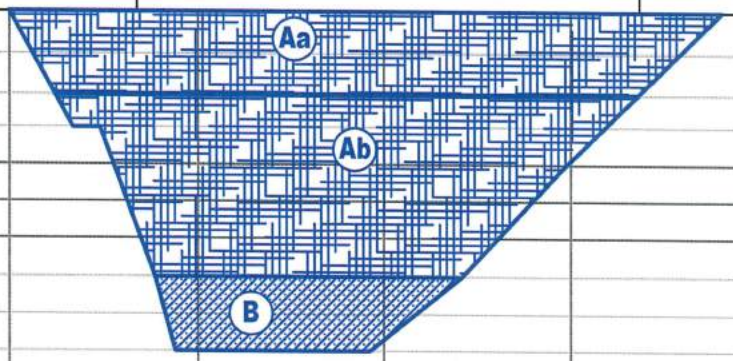


TOTAL DEPTH=10.5 FEET
NO GROUNDWATER ENCOUNTERED

Project Name: Sky Canyon	Logged by: KRM	Date: 12/4/17	LOG OF TRENCH: TR-3
Project Number: G17-1567-10	Elevation: 1106.0'		Engineering Properties
Equipment: Backhoe	Location/Grid: SEE PLATE 1		

Depth	Description	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
0.0'-2.0'	ARTIFICIAL FILL UNDOCUMENTED: Aa Silty SAND; light grey brown, dry, loose to medium dense, very fine to coarse grained with some coarse gravel, root hairs, debris.	Afu	SM			
2.0'-7.0'	Ab Silty SAND: light yellow, red brown, damp, medium dense, very fine to medium grained with some coarse grains, root hairs, debris, clay lenses.					
7.0'-9.0'	B YOUNG AXIAL CHANNEL DEPOSITS: Silty SAND; reddish brown, dense, very fine to medium grained, damp to moist, weathered, micaceous.	Qya	SM			

GRAPHICAL REPRESENTATION: NORTH WALL | **SCALE: 1" = 5'** | **SURFACE SLOPE: LEVEL** | **TREND: N85W**

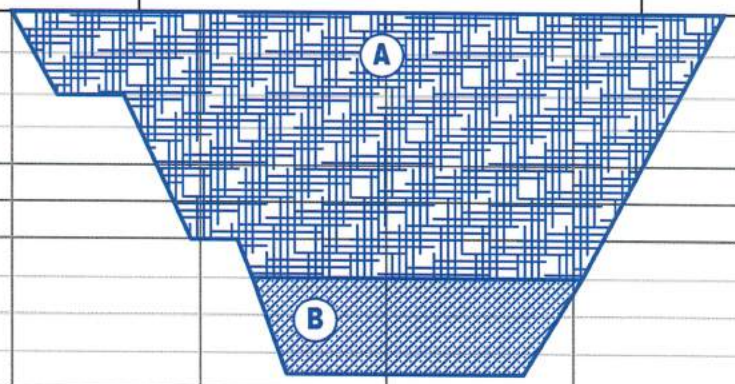


TOTAL DEPTH= 9.0 FEET
NO GROUNDWATER ENCOUNTERED

Project Name: Sky Canyon	Logged by: KRM	Date: 12/4/17	LOG OF TRENCH: TR-4
Project Number: G17-1567-10	Elevation: 1107.0'		Engineering Properties
Equipment: Backhoe	Location/Grid: SEE PLATE 1		

Depth	Description	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
0.0'-7.0'	A ARTIFICIAL FILL UNDOCUMENTED: Silty SAND; tan brown to dark grey brown, dry, loose to medium dense, very fine to coarse grained, cobbles, gravel, roots, debris.	Afu	SM			
7.0'-9.5'	B YOUNG AXIAL CHANNEL DEPOSITS: Poorly Graded SAND; dark olive brown, dense, fine to medium grained with trace coarse grains, damp to moist, micaceous.	Qya	SP			

GRAPHICAL REPRESENTATION: NORTH WALL | **SCALE: 1" = 5'** | **SURFACE SLOPE: LEVEL** | **TREND: N40W**

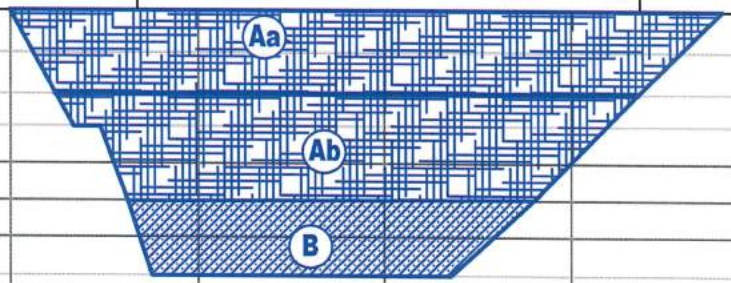


TOTAL DEPTH= 9.5 FEET
NO GROUNDWATER ENCOUNTERED

Project Name: Sky Canyon	Logged by: KRM	Date: 12/4/17	LOG OF TRENCH: TR-5
Project Number: G17-1567-10	Elevation: 1100.0'		Engineering Properties
Equipment: Backhoe	Location/Grid: SEE PLATE 1		

Depth	Description	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
0.0'-2.0'	ARTIFICIAL FILL UNDOCUMENTED: Aa Silty SAND; light grey brown, dry, loose to medium dense, very fine to coarse grained, gravel, blocky, debris.	Afu	SM			
2.0'-5.0'	Ab Silty SAND; light yellow brown, damp, medium dense, very fine to coarse grained roots.					
5.0'-7.0'	YOUNG AXIAL CHANNEL DEPOSITS: B Poorly Graded SAND; dark olive brown, dense, fine to medium grained with trace coarse gravels, damp to moist, micaceous.	Qya	SP			

GRAPHICAL REPRESENTATION: NORTH WALL	SCALE: 1" = 5'	SURFACE SLOPE: LEVEL	TREND: N85W

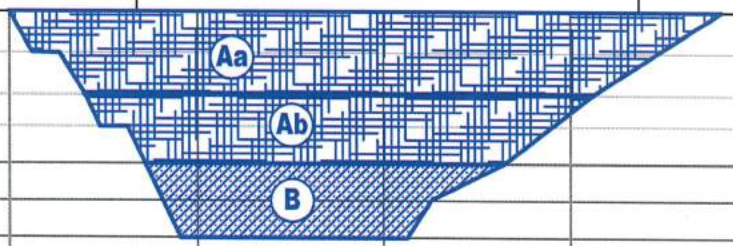


TOTAL DEPTH= 7.0 FEET
NO GROUNDWATER ENCOUNTERED

Project Name: Sky Canyon	Logged by: KRM	Date: 12/4/17	LOG OF TRENCH: TR-6
Project Number: G17-1567-10	Elevation: 1090.0'		Engineering Properties
Equipment: Backhoe	Location/Grid: SEE PLATE 1		

Depth	Description	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
0.0'-2.0'	ARTIFICIAL FILL UNDOCUMENTED: Aa Silty SAND; light grey to brown, dry, loose to medium dense, very fine to coarse grained, blocky, debris.	Afu	SM			
2.0'-4.0'	Ab Silty SAND; light yellow brown, damp to moist, medium dense to dense, very fine to coarse grained,trace gravel, micaceous.					
4.0'-6.0'	YOUNG AXIAL CHANNEL DEPOSITS: B Poorly Graded SAND; dark olive brown, damp to moist, dense, fine to medium grained, trace coarse gravels, micaceous.	Qya	SP			

GRAPHICAL REPRESENTATION: NORTH WALL	SCALE: 1" = 5'	SURFACE SLOPE: LEVEL	TREND: N65W



TOTAL DEPTH= 6.0 FEET
NO GROUNDWATER ENCOUNTERED

Geotechnical Boring Log B-1

Date: 2/16/05		Project Name: Transcan Dev.-Winchester Commercial Center	Page 1 of 2
Project Number: I05759-10		Logged By: AW	
Drilling Company: 2R		Type of Rig: CME-55	
Drive Weight (lbs): 140		Drop (in): 30	Hole Dia (in): 8
Top of Hole Elevation (ft):		Hole Location: See Geotechnical Map	

Depth (ft)	Blow Count / 6"	Sample No.	Dry Density (pcf)	Moisture (%)	Geologic / USCS Symbol	DESCRIPTION	Type of Test
0					Qya	***Artificial Fill, Undocumented:***	
		Bag 1			SC	Clayey SAND; brown, dry, medium dense, fine to coarse sand.	Max
		0-5'					
	7						El
	9						
	9	R-1	111.6	6.1			
5					SM	Silty SAND; olive grey, slightly moist, dense, fine to coarse sand.	
	9						
	16	R-2	114.6	4.0			
	25						
					Qya	***Young Axial Channel Deposits:***	
	8						
	11						
	14	R-3	108.2	2.6	SP-SM	SAND; yellow brown, slightly moist, medium dense, fine to coarse sand.	
10							
	9						
	12	R-4	109.5	2.2			
	14						
					SP	SAND; grey, dry, medium dense, fine to coarse sand.	
15							
	5						
	7	S-1		2.6			
	9						
20							
	9						
	11	R-5	105.3	2.6			
	15						
					SM	Silty SAND; olive grey, moist, loose, fine to medium sand.	
25							
	3						
	4	S-2		18.9			
	6						
					SP	SAND; grey, dry, dense, fine to coarse sand.	

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Geotechnical Boring Log B-1

Date: 2/16/05		**Project Name: Transcan Dev.-Winchester Commercial Center**	**Page 2 of 2**
Project Number: I05759-10		**Logged By: AW**	
Drilling Company: 2R		**Type of Rig: CME-55**	
Drive Weight (lbs): 140		**Drop (in): 30**	**Hole Dia (in): 8**
Top of Hole Elevation (ft):		**Hole Location: See Geotechnical Map**	

Depth (ft)	Blow Count / 6"	Sample No.	Dry Density (pcf)	Moisture (%)	Geologic / USCS Symbol	DESCRIPTION	Type of Test
30	8 18 24	R-6	97.5	3.0	SP	SAND; grey, dry, dense, fine to coarse sand.	
					ML	SILT; dark grey, moist, medium stiff.	-200 Wash
35	1 2 5	S-3		43.2			
					SM	Silty SAND; grey, moist, medium dense, fine to medium sand.	
40	8 14 20	R-7	102.2	21.8	¥		
					SW	SAND; grey, wet, medium dense, fine to coarse sand.	
45	8 12 12	S-4		12.2			
					ML/CL	Clayey SILT; olive brown, moist, hard.	
50	12 26 50 for 4"	R-8	108.4	19.8			
						Total Depth = 51' 4" **Groundwater @ 43 feet**	
55							
60							

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Geotechnical Boring Log B-2

Date: 2/16/05	Project Name: Transcan Dev.-Winchester Commercial Center Page 1 of 2
Project Number: I05759-10	Logged By: AW
Drilling Company: 2R	Type of Rig: CME-55
Drive Weight (lbs): 140	Drop (in): 30 Hole Dia (in): 8
Top of Hole Elevation (ft):	Hole Location: See Geotechnical Map

Depth (ft)	Blow Count / 6"	Sample No.	Dry Density (pcf)	Moisture (%)	Geologic / USCS Symbol	DESCRIPTION	Type of Test
0		Bag 1 0-5'			Afu CL	***Artifical Fill, Undocumented:*** Sandy CLAY; olive brown, moist, stiff, fine to coarse sand.	Max El
5							
10	9 19 50 for 5"	R-1	123.3	4.3			
		Bag 2 15-20'			Qya SW	***Young Axial Channel Deposits:*** SAND; yellow brown, dry, medium dense, fine to coarse sand.	
15	5 7 8	R-2	106.4	1.6			
					SM	Silty SAND; dark grey, moist, medium dense, interfingered with SILT; grey, moist, stiff.	
20	4 5 11	R-3	94.7	25.8		Passing #200 = 45%	
					SP-SM	SAND; grey, slightly moist, medium dense, fine to medium sand, with silt.	
25	5 6 12	R-4	100.8	5.6			
					SM	Silty SAND; olive grey, slightly moist, medium dense, fine to medium sand.	
30							

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Geotechnical Boring Log B-2

Date: 2/16/05		Project Name: Transcan Dev.-Winchester Commercial Center	Page 2 of 2
Project Number: I05759-10		Logged By: AW	
Drilling Company: 2R		Type of Rig: CME-55	
Drive Weight (lbs): 140		Drop (in): 30	Hole Dia (in): 8
Top of Hole Elevation (ft):		Hole Location: See Geotechnical Map	

Depth (ft)	Blow Count / 6"	Sample No.	Dry Density (pcf)	Moisture (%)	Geologic / USCS Symbol	DESCRIPTION	Type of Test
30	4 12 16	R-5	106.7	7.7	SM	Silty SAND; olive grey, slightly moist, medium dense, fine to medium sand.	
					SP	SAND; yellow brown, moist, very dense, fine to coarse sand.	
35	15 29 36	R-6	114.5	9.2			
						Total Depth = 36½ feet	
						No Groundwater	
40							
45							
50							
55							
60							

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Geotechnical Boring Log B-3

Date: 2/16/05	Project Name: Transcan Dev.-Winchester Commercial Center Page 1 of 2
Project Number: I05759-10	Logged By: AW
Drilling Company: 2R	Type of Rig: CME-55
Drive Weight (lbs): 140	Drop (in): 30 Hole Dia (in): 8
Top of Hole Elevation (ft):	Hole Location: See Geotechnical Map

Depth (ft)	Blow Count / 6"	Sample No.	Dry Density (pcf)	Moisture (%)	Geologic / USCS Symbol	DESCRIPTION	Type of Test
0					Afu CL	**Artifical Fill, Undocumented:** Sandy CLAY, dark olive brown, moist, stiff, fine to coarse sand.	
5							
10	17 24 37	R-1	125.2	9.2		dry, hard, porosity, fine rootlets.	
15	5 7 11	R-2	100.2	9.9	Qya SM	***Young Axial Channel Deposits:*** Silty SAND; medium brown, slightly moist, medium dense, fine to coarse sand, interfingered with CLAY; medium brown, moist, stiff, porosity, fine rootlets.	
20	6 11 13	R-3	103.3	2.1	SP	SAND; yellow brown, dry, medium dense, fine to coarse sand.	
25	8 11 18	R-4	110.8	2.5		grey, slightly moist.	
					ML	Sandy SILT, dark olive grey/ brown, wet, stiff, porosity.	

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Geotechnical Boring Log B-3

Date: 2/16/05	Project Name: Transcan Dev.-Winchester Commercial Center Page 2 of 2
Project Number: I05759-10	Logged By: AW
Drilling Company: 2R	Type of Rig: CME-55
Drive Weight (lbs): 140	Drop (in): 30 Hole Dia (in): 8
Top of Hole Elevation (ft):	Hole Location: See Geotechnical Map

Depth (ft)	Blow Count / 6"	Sample No.	Dry Density (pcf)	Moisture (%)	Geologic / USCS Symbol	DESCRIPTION	Type of Test
30	8 12 17	R-5	99.2	21.3	ML ¥	Sandy SILT; olive grey, moist, very stiff, porosity.	
					ML	SILT; dark olive grey/ brown, wet, stiff, porosity.	
35	3 3 7	R-6	92.9	30.4			
						Total Depth = 36½ feet	
						Groundwater @ 34 feet	
40							
45							
50							
55							
60							

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Geotechnical Boring Log B-4

Date: 2/16/05	Project Name: Transcan Dev.-Winchester Commercial Center Page 1 of 1
Project Number: I05759-10	Logged By: AW
Drilling Company: 2R	Type of Rig: CME-55
Drive Weight (lbs): 140	Drop (in): 30 Hole Dia (in): 8
Top of Hole Elevation (ft):	Hole Location: See Geotechnical Map

Depth (ft)	Blow Count / 6"	Sample No.	Dry Density (pcf)	Moisture (%)	Geologic / USCS Symbol	DESCRIPTION	Type of Test
0					Afu CL	***Artifical Fill, Undocumented:*** Sandy CLAY; dark olive grey, dry, very stiff, fine to coarse sand.	
5							
10	20 34 50 for 5"	R-1	123.0	10.6			
15	10 24 40	R-2	119.8	9.3	Qya ML/CL	***Young Axial Channel Deposits:*** Clayey SILT; olive brown, moist, very stiff, with thin sand lenes.	
					SC	Clayey SAND; dark grey, moist, very dense, fine to coarse sand.	
20	50 for 5"	R-3	128.3	8.2			
25						**Total Depth = 21 feet** **Refusal @ 21 feet** **No Groundwater**	
30							

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Geotechnical Boring Log B-5

Date: 2/16/05	Project Name: Transcan Dev.-Winchester Commercial Center Page 1 of 2
Project Number: I05759-10	Logged By: AW
Drilling Company: 2R	Type of Rig: CME-55
Drive Weight (lbs): 140	Drop (in): 30 Hole Dia (in): 8
Top of Hole Elevation (ft):	Hole Location: See Geotechnical Map

Depth (ft)	Blow Count / 6"	Sample No.	Dry Density (pcf)	Moisture (%)	Geologic / USCS Symbol	DESCRIPTION	Type of Test
0					Afu SM	***Artifical Fill, Undocumented:*** Silty SAND; dark olive brown, slightly moist, dense, fine to coarse sand, clayey layers.	
5		Bag 1 5-10'					R-value Sulfate
10	11 17 40	R-1	129.3	8.5			
15	15 23 27	R-2	117.0	3.7	Qya SM	***Young Axial Channel Deposits:*** Silty SAND; dark yellow brown, slightly moist, dense, fine to coarse sand.	
20	21 30 30	R-3	110.1	2.5	SW	SAND; yellow brown, slightly moist, very dense, fine to coarse sand, fine to medium gravel.	
25	12 14 24	R-4	113.6	14.2	SM ¥	Silty SAND; yellow brown, wet, dense, fine to coarse sand, fine to coarse gravel.	
					SW	SAND; grey, wet, dense, fine to coarse sand, fine to coarse gravel.	

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Geotechnical Boring Log B-5

Date: 2/16/05	Project Name: Transcan Dev.-Winchester Commercial Center Page 2 of 2
Project Number: I05759-10	Logged By: AW
Drilling Company: 2R	Type of Rig: CME-55
Drive Weight (lbs): 140	Drop (in): 30 Hole Dia (in): 8
Top of Hole Elevation (ft):	Hole Location: See Geotechnical Map

Depth (ft)	Blow Count / 6"	Sample No.	Dry Density (pcf)	Moisture (%)	Geologic / USCS Symbol	DESCRIPTION	Type of Test
30	5 19 20	R-5	112.7	14.9	SW	SAND; grey, wet, dense, fine to coarse sand, fine to coarse gravel.	
35						**Total Depth = 35 feet** **Groundwater @ 24 feet**	
40							
45							
50							
55							
60							

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Geotechnical Boring Log B-6

Date: 4/22/08	**Project Name:** Winchester Commercial Center	Page 1 of 2
Project Number: I05759-10	**Logged By:** JAM	
Drilling Company: Cal-Pac	**Type of Rig:** B-61	
Drive Weight (lbs.): 140	**Drop (in.):** 30 **Hole Dia. (in.):** 8	
Top of Hole Elevation (ft): 1100	**Hole Location:** See Geotechnical Map	

Elevation (MSL) and Depth (ft.)	Blow Count / 6"	Sample No.	Soil Graphic	Geologic / Group Symbol	DESCRIPTION	In-Situ Moist.(%)	Dry Density (pcf)	Standard Penetration Test SPT Depth	SPT N	CURVE (10 30 50)	Type of Test
1100 / 0				SC	**Artificial Fill, Undocumented:** Clayey Sand; medium brown, moist, loose to medium dense, fine-coarse grained, some fine gravel						
	13 19 33	R-1		Qya	**Quaternary Young Axial Channel Deposits:** Poorly graded SAND; tan to yellow brown, moist, dense, fine to coarse grained	8.7	127.1	2.5-4.0	35		
1095 / 5	13 16 18	R-2 Bag1 5-10			Gravel up to 2" diameter Passing #200 = 3%	3.2	112.1	5.0-6.5	23		200-wash
	5 4 5	R-3		SM	Silty SAND; yellow brown, moist, medium dense, fine to coarse grained	8.8	105	7.5-9.0	6		
1090 / 10	2 2 3	S-1		SP	Poorly graded SAND; light grey to olive brown, moist, medium dense, fine to medium grained	4.5		10.0-11.5	5		
	8 10 15	R-4			white to light grey Passing #200 = 6%	4.5	102.7	12.0-13.5	17		200-wash
1085 / 15	3 4 5	S-2			wet, medium dense	12.3		15.0-16.5	9		
1080 / 20	5 10 11	R-5			fine to very coarse grained Passing #200 = 3%	▽ 14.1	120.8	20.0-21.5	15		200-wash
1075 / 25	3 4 9	S-3			interbedded silty sand Passing #200 = 13%	20.9		25.0-26.5	13		200-wash
1070 / 30											

Sample Legend

- SPT
- Ring Sample (CA modified)

Geotechnical Consulting

LGC INLAND

Geotechnical Boring Log B-6

Date: 4/22/08	**Project Name:** Winchester Commercial Center	Page 2 of 2
Project Number: I05759-10	**Logged By:** JAM	
Drilling Company: Cal-Pac	**Type of Rig:** B-61	
Drive Weight (lbs.): 140	**Drop (in.):** 30 **Hole Dia. (in.):** 8	
Top of Hole Elevation (ft): 1100	**Hole Location:** See Geotechnical Map	

Elevation (MSL) and Depth (ft.)	Blow Count / 6"	Sample No.	Soil Graphic	Geologic / Group Symbol	DESCRIPTION	In-Situ Moist.(%)	Dry Density (pcf)	Standard Penetration Test SPT Depth	SPT N	CURVE 10 30 50	Type of Test
1070 30	8 12 12	R-6		SP	Poorly graded SAND; light grey to white, wet, medium dense, medium to coarse grained	12.3	121.6	30.0-31.5	16		
1065 35	7 12 16	S-4			dark grey Passing #200 = 8%	19.5		35.0-36.5	28		200-wash
1060 40	16 23 38	R-7			SAND; dense, fine to very coarse grained, interbedded clays	13.1	136.4	40.0-41.5	41		
1055 45	19 19 20	S-5				16.4		45.0-46.5	39		
1050 50	14 17 17	R-8		CL	Sandy CLAY; grey, wet, stiff	39.2	82.4	50.0-51.5	23		
					Total Depth: 51.5' Groundwater at 20.25'						
1045 55											
1040 60											

Sample Legend

- SPT
- Ring Sample (CA modified)

Geotechnical Consulting

LGC INLAND

Geotechnical Boring Log B-7

Date: 4/22/08	**Project Name:** Winchester Commercial Center	Page 1 of 2
Project Number: I05759-10	**Logged By:** JAM	
Drilling Company: Cal-Pac	**Type of Rig:** B-61	
Drive Weight (lbs.): 140	**Drop (in.):** 30 **Hole Dia. (in.):** 8	
Top of Hole Elevation (ft): 1110	**Hole Location:** See Geotechnical Map	

Elevation (MSL) and Depth (ft.)	Blow Count / 6"	Sample No.	Soil Graphic	Geologic / Group Symbol	DESCRIPTION	In-Situ Moist.(%)	Dry Density (pcf)	Standard Penetration Test SPT Depth	SPT N	SPT CURVE 10 30 50	Type of Test
1110 — 0		Bag 1 0-5'		Afu SM	**Artificial Fill, Undocumented:** Silty SAND; medium yellow brown, moist, medium dense, fine to coarse grained abundent rootlets, fine to coarse gravel up to 1.5" diameter						
	6 8 8	R-1				8.6	111.6	2.5-4.0	11		
1105 — 5	9 4 4	R-2			medium olive brown	6.8	112.1	5.0-6.5	5		
	6 12 17	R-3				11.2	122.5	7.5-9.0	19		
1100 — 10	7 9 10	R-4		Qya SM	**Quaternary Young Axial Channel Deposits:** Silty SAND; dark olive brown, moist, medium dense, fine to coarse grained few pinhole porosity	8.4	112.6	10.0-11.5	13		
	6 7 8	S-1				8.0		12.5-14.0	15		
1095 — 15	6 7 9	R-5			yellow brown, slightly moist, medium dense, fine to coarse grained, friable	2.5	111.7	15.0-16.5	11		
	4 5 6	S-2				6.9		17.5-19.0	11		
1090 — 20	5 7 10	R-6		SP	Poorly Graded SAND; white, slightly moist, medium dense, extremely friable, fine to coarse grained (disturbed)	1.9	103.9	20.0-21.5	11		
1085 — 25	6 10 9	R-7				3.2	109.7	25.0-26.5	13		
1080 — 30											

Sample Legend

- SPT
- Ring Sample (CA modified)

Geotechnical Consulting

LGC INLAND

Geotechnical Boring Log B-7

Date: 4/22/08	**Project Name:** Winchester Commercial Center	Page 2 of 2
Project Number: I05759-10	**Logged By:** JAM	
Drilling Company: Cal-Pac	**Type of Rig:** B-61	
Drive Weight (lbs.): 140	**Drop (in.):** 30 **Hole Dia. (in.):** 8	
Top of Hole Elevation (ft): 1110	**Hole Location:** See Geotechnical Map	

Elevation (MSL) and Depth (ft.)	Blow Count / 6"	Sample No.	Soil Graphic	Geologic / Group Symbol	DESCRIPTION	In-Situ Moist.(%)	Dry Density (pcf)	Standard Penetration Test SPT Depth	SPT N	CURVE 10 30 50	Type of Test
1080 30	6 8 9	R-8		SM	Silty SAND; olive, wet, soft to medium stiff	13.9	114.6	30.0-31.5	11		
1075 35	2 2 4	S-3			olive to grey brown, soft	30.1	94.2	35.0-36.5	6		
					Total Depth: 36.5' Groundwater at 32.75'						
1070 40											
1065 45											
1060 50											
1055 55											
1050 60											

Sample Legend

- SPT
- Ring Sample (CA modified)

Geotechnical Consulting

LGC INLAND

Geotechnical Boring Log B-8

Date: 4/22/08	**Project Name:** Winchester Commercial Center	Page 1 of 2
Project Number: I05759-10	**Logged By:** JAM	
Drilling Company: Cal-Pac	**Type of Rig:** B-61	
Drive Weight (lbs.): 140	**Drop (in.):** 30 **Hole Dia. (in.):** 8	
Top of Hole Elevation (ft): 1107	**Hole Location:** See Geotechnical Map	

Elevation (MSL) and Depth (ft.)	Blow Count / 6"	Sample No.	Soil Graphic	Geologic / Group Symbol	DESCRIPTION	In-Situ Moist.(%)	Dry Density (pcf)	Standard Penetration Test SPT Depth	SPT N	CURVE 10 30 50	Type of Test
0				Afu SM	**Artificial Fill, Undocumented:** Silty SAND; orange brown, moist, loose, fine to coarse grained, rootlets						
1105	3 5 5	R-1			mixture of dumped materials	17.2	102.9	2.5-4.0	7		
5	5 6 6	R-2			yellow brown, moist, medium dense, fine to coarse grained	6.5	111.8	5.0-6.5	8		
1100	5 6 9	R-3				7.5	111.0	7.5-9.0	10		
10	4 5 7	S-1		Qya SM	**Quaternary Young Alluvial Wash Deposits:** Silty SAND with trace CLAYS; yellow brown, moist, medium dense, fine to medium grained	11.7		10.0-11.5	12		
1095											
15	6 7 7	S-2				7.9		15.0-16.5	14		
1090	5 6 9	R-4		SP	Poorly Graded SAND; white to light grey, moist, medium dense, fine to medium grained	2.6	102.0	17.5-19.0	10		
20	2 4 4	S-3		SM	Silty SAND; olive brown, moist, medium dense, fine to medium grained	16.0		20.0-21.5	8		
1085											
25	5 7 7	R-5		SP	Poorly graded SAND; white, moist, medium dense, medium to coarse grained (disturbed)	3.2	98.4	25.0-26.5	9		
1080											
30											

Sample Legend

- SPT
- Ring Sample (CA modified)

Geotechnical Consulting

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Geotechnical Boring Log B-8

Date: 4/22/08	**Project Name:** Winchester Commercial Center
Project Number: I05759-10	**Logged By:** JAM
Drilling Company: Cal-Pac	**Type of Rig:** B-61
Drive Weight (lbs.): 140	**Drop (in.):** 30 **Hole Dia. (in.):** 8
Top of Hole Elevation (ft): 1107	**Hole Location:** See Geotechnical Map

Elevation (MSL) and Depth (ft.)	Blow Count / 6"	Sample No.	Soil Graphic	Geologic / Group Symbol	DESCRIPTION	In-Situ Moist.(%)	Dry Density (pcf)	Standard Penetration Test SPT Depth	SPT N	CURVE 10 30 50	Type of Test
30	6 7 8	S-4						30.0-31.5	15		
1075					Total Depth: 31.5' No Groundwater						
35											
1070											
40											
1065											
45											
1060											
50											
1055											
55											
1050											
60											

Sample Legend

- SPT
- Ring Sample (CA modified)

Geotechnical Consulting

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Geotechnical Boring Log B-9

Date: 4/22/08	**Project Name:** Winchester Commercial Center	Page 1 of 2
Project Number: I05759-10	**Logged By:** JAM	
Drilling Company: Cal-Pac	**Type of Rig:** B-61	
Drive Weight (lbs.): 140	**Drop (in.):** 30 **Hole Dia. (in.):** 8	
Top of Hole Elevation (ft): 1098	**Hole Location:** See Geotechnical Map	

Elevation (MSL) and Depth (ft.)	Blow Count / 6"	Sample No.	Soil Graphic	Geologic / Group Symbol	DESCRIPTION	In-Situ Moist.(%)	Dry Density (pcf)	Standard Penetration Test SPT Depth	SPT N	CURVE 10 30 50	Type of Test
0				Afu SC	**Artificial Fill, Undocumented:** Clayey SAND; orange brown, moist, loose, fine to coarse grained rootlets						
1095	4 5 6	R-1				10.4	115.3	2.5-4.0	7		
5	4 10 10	R-2		Qya SM	**Quaternary Young Alluvial Wash Deposits:** Silty SAND; medium yellow brown, moist, medium dense, fine to coarse grained	6.9	114.5	5.0-6.5	13		
1090	5 8 23	R-3		SP	Poorly graded SAND; orange brown, moist, medium dense (rock in sample), fine to coarse grained, sub angular	2.1	113.6	7.5-9.0	21		
10	5 6 8	R-4			light brown	2.0	105.5	10.0-11.5	9		
1085	6 8 11	R-5		SP-SM	Silty SAND to poorly graded SAND; olive brown, moist, medium dense, fine to coarse sand	5.8	111.1	12.5-14.0	13		
15	3 4 3	S-1		SP	Poorly Graded SAND; with interbedded, Sandy SILT, olive brown, medium dense	10.7		15.0-16.5	7		
1080	5 8 14	R-6		SM	Silty SAND; olive brown, moist, medium dense, fine to coarse grained	5.6	114.4	17.5-19.0	15		
20	5 6 7	S-2		SP	Poorly graded SAND; white, moist, medium dense, fine to coarse grained fine gravel	5.3		20.0-21.5	12		
1075						▽					
25	5 10 15	R-7			Gray, wet, medium dense	15.2	113.4	25.0-26.5	17		
1070											
30											

Sample Legend

- SPT
- Ring Sample (CA modified)

Geotechnical Consulting

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Geotechnical Boring Log B-9

Date: 4/22/08	**Project Name:** Winchester Commercial Center	Page 2 of 2
Project Number: I05759-10	**Logged By:** JAM	
Drilling Company: Cal-Pac	**Type of Rig:** B-61	
Drive Weight (lbs.): 140	**Drop (in.):** 30 **Hole Dia. (in.):** 8	
Top of Hole Elevation (ft): 1098	**Hole Location:** See Geotechnical Map	

Elevation (MSL) and Depth (ft.)	Blow Count / 6"	Sample No.	Soil Graphic	Geologic / Group Symbol	DESCRIPTION	In-Situ Moist.(%)	Dry Density (pcf)	Standard Penetration Test SPT Depth	SPT N	CURVE 10 30 50	Type of Test
30	10 17 29	R-8				19.1	110.0	30.0-31.5	30.82		
					Total Depth: 31.5' Groundwater at 24'						
1065 35											
1060 40											
1055 45											
1050 50											
1045 55											
1040 60											

Sample Legend

- SPT
- Ring Sample (CA modified)

Geotechnical Consulting

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APPENDIX C

LABORATORY TESTING PROCEDURES AND TEST RESULTS

APPENDIX C

Laboratory Testing Procedures and Test Results

The laboratory testing program was directed towards providing quantitative data relating to the relevant engineering properties of the soils. Samples considered representative of site conditions were tested in general accordance with American Society for Testing and Materials (ASTM) procedure and/or California Test Methods (CTM), where applicable. The following summary is a brief outline of the test type and a table summarizing the test results.

Soil Classification: Representative samples were classified with ASTM D2487. The soil classifications (or group symbol) are shown on the laboratory test data and/or exploratory logs. Soil classifications are supplemented with Visual-Manual Soils Descriptions and Identification with ASTM D2488.

Moisture and Density Determination Tests: Moisture content (ASTM D2216) and dry density determinations (ASTM D2937) were performed on relatively undisturbed samples obtained from the boring(s) and/or trenche(s). The results of these tests are presented in the boring and/or trench logs. Where applicable, only moisture content was determined from undisturbed or disturbed samples.

Maximum Density Tests: The maximum dry density and optimum moisture content of typical materials were determined in accordance with ASTM D1557. The results of these tests are presented in the table below:

SAMPLE LOCATION	SAMPLE DESCRIPTION	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT (%)
B-1 @ 0'-5'	Clayey SAND (SC)	134.5	7.5
B-2 @ 0'-5'	Sandy CLAY (CL)	127.5	10.0

Expansion Index: The expansion potential of selected samples was evaluated by the Expansion Index Test ASTM D4829. Specimens are molded under a given compactive energy to approximately the optimum moisture content and approximately 50 percent saturation or approximately 90 percent relative compaction. The prepared 1-inch thick by 4-inch diameter specimens are loaded to an equivalent 144 psf surcharge and are inundated with tap water until volumetric equilibrium is reached. The results of these tests are presented in the table below:

SAMPLE LOCATION	SAMPLE DESCRIPTION	EXPANSION INDEX	EXPANSION POTENTIAL
B-1 @ 0'-5'	Clayey SAND (SC)	12	VERY LOW
B-2 @ 0'-5'	Sandy CLAY (CL)	25	LOW

R-Value: The resistance R-value was determined by the ASTM D2844 soils test: The sample(s) were prepared, and the exudation pressure and R-value were determined. These/This result(s) were used for asphaltic concrete pavement design purposes.

SAMPLE LOCATION	SAMPLE DESCRIPTION	R-VALUE
B-5 @ 5'-10'	Silty SAND (SM)	30

Soluble Sulfate: The soluble sulfate content of selected samples were determined with CTM 417. The test results are presented in the table below:

SAMPLE LOCATION	SAMPLE DESCRIPTION	SULFATE CONTENT (% by weight)*	SULFATE EXPOSURE*
B-5 @ 5'-10'	Silty SAND (SM)	0	Negligible

APPENDIX D

INFILTRATION TEST DATA SHEETS

Project:	SKY CANYON	Job No.:	G17-1567-10		
Test Hole No.:	IT-1 (TRENCH TR-1)	Date Excavated:	12/4/2017		
Depth of Test Hole:	20"	Soil Classification:	SM		
Check for Sandy Soil Criteria By:		Date of Perc Test:	12/5/2017	Diameter:	8 inches

SANDY SOIL CRITERIA TEST

TIME	Time Interval (Minutes)	Total Elasped Time (min.)	Initial Water Level (Inches)	Final Water Level (Inches)	Change In Water Level (Inches)

PRESOAK PERIOD

	Date	Time	Interval	Amount of Water Used
Start	12/4/17	4:00 PM	17 HRS	5 GALLONS
Stop	12/5/17	9:00 AM		

Time	Time Interval (min.)	Total Elasped Time (min.)	Initial Water Level (inches)	Final Water Level (inches)	Change In Water Level (Inches)	Field Percolation Rate (minutes/inch)
9:07	30	30	20	18	2	15.0
9:37						
9:38	30	61	20	18 3/4	1 1/4	24.0
10:08						
10:09	30	92	20	18 3/4	1 1/4	24.0
10:39						
10:40	30	123	20	18 7/8	1 1/8	26.7
11:10						
11:11	30	154	20	18 7/8	1 1/8	26.7
11:41						
11:42	30	185	20	19 1/8	7/8	34.3
12:12						
12:13	30	216	20	19 1/8	7/8	34.3
12:43						
12:44	30	247	20	19 1/8	7/8	34.3
1:14						
1:15	30	278	20	19 1/8	7/8	34.3
1:45						
					Reduction Factor:	5.89
					Design Infiltration Rate (in/hr):	0.30

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Project:	SKY CANYON	Job No.:	G17-1567-10		
Test Hole No.:	IT-2 (TRENCH TR-2)	Date Excavated:	12/4/2017		
Depth of Test Hole:	20"	Soil Classification:	SM		
Check for Sandy Soil Criteria By:		Date of Perc Test:	12/5/2017	Diameter:	8 inches

SANDY SOIL CRITERIA TEST

TIME	Time Interval (Minutes)	Total Elasped Time (min.)	Initial Water Level (Inches)	Final Water Level (Inches)	Change In Water Level (Inches)

PRESOAK PERIOD

	Date	Time	Interval	Amount of Water Used
Start	12/4/17	4:00 PM	17 HRS	4.5 GALLONS
Stop	12/5/17	9:00 AM		

Time	Time Interval (min.)	Total Elasped Time (min.)	Initial Water Level (inches)	Final Water Level (inches)	Change In Water Level (Inches)	Field Percolation Rate (minutes/inch)
9:00	30	30	20	19 1/2	1/2	60.0
9:30						
9:31	30	61	20	19 3/4	1/4	120.0
10:01						
10:02	30	92	20	19 3/4	1/4	120.0
10:32						
10:33	30	123	20	19 3/4	1/4	120.0
11:03						
11:04	30	154	20	19 7/8	1/8	240.0
11:34						
11:35	30	185	20	19 7/8	1/8	240.0
12:05						
12:06	30	216	20	19 7/8	1/8	240.0
12:36						
12:37	30	247	20	19 7/8	1/8	240.0
1:07						
1:08	30	278	20	19 7/8	1/8	240.0
1:38						

Reduction Factor:	5.98
Design Infiltration Rate (in/hr):	0.04

LGC GEO-ENVIRONMENTAL, INC.

Project:	SKY CANYON	Job No.:	G17-1567-10
Test Hole No.:	IT-3 (TRENCH TR-2)	Date Excavated:	12/4/2017
Depth of Test Hole:	20"	Soil Classification:	SM
Check for Sandy Soil Criteria By:		Date of Perc Test:	12/5/2017

Diameter: 8 inches

SANDY SOIL CRITERIA TEST

TIME	Time Interval (Minutes)	Total Elasped Time (min.)	Initial Water Level (Inches)	Final Water Level (Inches)	Change In Water Level (Inches)

PRESOAK PERIOD

	Date	Time	Interval	Amount of Water Used
Start	12/4/17	4:00 PM	17 HRS	4.5 GALLONS
Stop	12/5/17	9:00 AM		

Time	Time Interval (min.)	Total Elasped Time (min.)	Initial Water Level (inches)	Final Water Level (inches)	Change In Water Level (Inches)	Field Percolation Rate (minutes/inch)
9:01	30	30	20	19 3/4	1/4	120.0
9:31						
9:32	30	61	20	19 3/4	1/4	120.0
10:02						
10:03	30	92	20	19 7/8	1/8	240.0
10:33						
10:34	30	123	20	19 7/8	1/8	240.0
11:04						
11:05	30	154	20	19 7/8	1/8	240.0
11:35						
11:36	30	185	20	19 7/8	1/8	240.0
12:06						
12:07	30	216	20	19 7/8	1/8	240.0
12:37						
12:38	30	247	20	19 7/8	1/8	240.0
1:08						
1:09	30	278	20	19 7/8	1/8	240.0
1:39						

Reduction Factor:	5.98
Design Infiltration Rate (in/hr):	0.04

LGC GEO-ENVIRONMENTAL, INC.

Project:	SKY CANYON	Job No.:	G17-1567-10
Test Hole No.:	IT-4 (TRENCH TR-3)	Date Excavated:	12/4/2017
Depth of Test Hole:	20"	Soil Classification:	SM
Check for Sandy Soil Criteria By:	KM	Date of Perc Test:	12/4/2017

Diameter: 8 inches

SANDY SOIL CRITERIA TEST

TIME	Time Interval (Minutes)	Total Elasped Time (min.)	Initial Water Level (Inches)	Final Water Level (Inches)	Change In Water Level (Inches)
10:14 10:39	25 mins	25 mins	20.0	0.0	20.0
10:40 11:05	25 mins	51 mins	20.0	0.0	20.0

PRESOAK PERIOD

	Date	Time	Interval	Amount of Water Used
Start				
Stop				

Time	Time Interval (min.)	Total Elasped Time (min.)	Initial Water Level (inches)	Final Water Level (inches)	Change In Water Level (Inches)	Field Percolation Rate (minutes/inch)
11:08 11:18	10	10	20	0	20	0.5
11:19 11:29	10	21	20	0	20	0.5
11:30 11:40	10	32	20	0	20	0.5
11:41 11:51	10	43	20	0	20	0.5
11:52 12:02	10	54	20	0	20	0.5
12:03 12:13	10	65	20	0	20	0.5

Reduction Factor:	3.50
Design Infiltration Rate (in/hr):	34.29

LGC GEO-ENVIRONMENTAL, INC.

Project:	SKY CANYON		Job No.:	G17-1567-10	
Test Hole No.:	IT-5 (TRENCH TR-4)		Date Excavated:	12/4/2017	
Depth of Test Hole:	20"		Soil Classification:	SM	
Check for Sandy Soil Criteria By:	KM		Date of Perc Test:	12/4/2017	Diameter: 8 inches

SANDY SOIL CRITERIA TEST

TIME	Time Interval (Minutes)	Total Elasped Time (min.)	Initial Water Level (Inches)	Final Water Level (Inches)	Change In Water Level (Inches)
12:35	25 mins	25 mins	20.0	0.0	20.0
1:00					
1:01	25 mins	51 mins	20.0	0.0	20.0
1:26					

PRESOAK PERIOD

	Date	Time	Interval	Amount of Water Used
Start				
Stop				

Time	Time Interval (min.)	Total Elasped Time (min.)	Initial Water Level (inches)	Final Water Level (inches)	Change In Water Level (Inches)	Field Percolation Rate (minutes/inch)
1:30	10	10	20	0	20	0.5
1:40						
1:41	10	21	20	0	20	0.5
1:51						
1:52	10	32	20	0	20	0.5
2:02						
2:03	10	43	20	0	20	0.5
2:13						
2:14	10	54	20	0	20	0.5
2:24						
2:26	10	65	20	0	20	0.5
2:36						
					Reduction Factor:	3.50
					Design Infiltration Rate (in/hr):	34.29

LGC GEO-ENVIRONMENTAL, INC.

Project:	SKY CANYON	Job No.:	G17-1567-10	
Test Hole No.:	IT-6 (TRENCH TR-5)	Date Excavated:	12/4/2017	
Depth of Test Hole:	20"	Soil Classification:	SM	
Check for Sandy Soil Criteria By:	AR	Date of Perc Test:	12/4/2017	Diameter: 8 inches

SANDY SOIL CRITERIA TEST

TIME	Time Interval (Minutes)	Total Elasped Time (min.)	Initial Water Level (Inches)	Final Water Level (Inches)	Change In Water Level (Inches)
12:51 1:16	25 mins	25 mins	20.0	0.0	20.0
1:17 1:42	25 mins	51 mins	20.0	0.0	20.0

PRESOAK PERIOD

	Date	Time	Interval	Amount of Water Used
Start				
Stop				

Time	Time Interval (min.)	Total Elasped Time (min.)	Initial Water Level (inches)	Final Water Level (inches)	Change In Water Level (Inches)	Field Percolation Rate (minutes/inch)
1:47 1:57	10	10	20	0	20	0.5
1:58 2:08	10	21	20	0	20	0.5
2:09 2:19	10	32	20	0	20	0.5
2:20 2:30	10	43	20	0	20	0.5
2:31 2:41	10	54	20	0	20	0.5
2:42 2:52	10	65	20	0	20	0.5

Reduction Factor:	3.50
Design Infiltration Rate (in/hr):	34.29

LGC GEO-ENVIRONMENTAL, INC.

Project:	SKY CANYON	Job No.:	G17-1567-10
Test Hole No.:	IT-7 (TRENCH TR-6)	Date Excavated:	12/4/2017
Depth of Test Hole:	20"	Soil Classification:	SM
Check for Sandy Soil Criteria By:	AR	Date of Perc Test:	12/4/2017 Diameter: 8 inches

SANDY SOIL CRITERIA TEST

TIME	Time Interval (Minutes)	Total Elasped Time (min.)	Initial Water Level (Inches)	Final Water Level (Inches)	Change In Water Level (Inches)
2:05 2:30	25 mins	25 mins	20.0	0.0	20.0
2:31 2:56	25 mins	51 mins	20.0	0.0	20.0

PRESOAK PERIOD

	Date	Time	Interval	Amount of Water Used
Start				
Stop				

Time	Time Interval (min.)	Total Elasped Time (min.)	Initial Water Level (inches)	Final Water Level (inches)	Change In Water Level (Inches)	Field Percolation Rate (minutes/inch)
3:00 3:10	10	10	20	0	20	0.5
3:11 3:21	10	21	20	0	20	0.5
3:22 3:32	10	32	20	0	20	0.5
3:33 3:43	10	43	20	0	20	0.5
3:44 3:54	10	54	20	0	20	0.5
3:55 4:05	10	65	20	0	20	0.5

Reduction Factor:	3.50
Design Infiltration Rate (in/hr):	34.29

LGC GEO-ENVIRONMENTAL, INC.

APPENDIX E

LIQUEFACTION ANALYSIS

```
*****************************
*                           *
*      L I Q U E F Y 2      *
*                           *
*       Version 1.50        *
*                           *
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EMPIRICAL PREDICTION OF
EARTHQUAKE-INDUCED LIQUEFACTION POTENTIAL

JOB NUMBER: I05759 DATE: 05-06-2008

JOB NAME: Transcan

SOIL-PROFILE NAME: tran.LDW

BORING GROUNDWATER DEPTH: 20.80 ft

CALCULATION GROUNDWATER DEPTH: 20.00 ft

DESIGN EARTHQUAKE MAGNITUDE: 6.80 Mw

SITE PEAK GROUND ACCELERATION: 0.400 g

BOREHOLE DIAMETER CORRECTION FACTOR: 1.00

SAMPLER SIZE CORRECTION FACTOR: 1.15

N60 HAMMER CORRECTION FACTOR: 1.30

MAGNITUDE SCALING FACTOR METHOD: Idriss (1997, in press)

Magnitude Scaling Factor: 1.285

rd-CORRECTION METHOD: Seed (1985)

FIELD SPT N-VALUES ARE CORRECTED FOR THE LENGTH OF THE DRIVE RODS.

Rod Stick-Up Above Ground: 3.0 ft

CN NORMALIZATION FACTOR: 1.044 tsf

MINIMUM CN VALUE: 0.6

NCEER [1997] Method — LIQUEFACTION ANALYSIS SUMMARY — PAGE 1

File Name: tran.OUT

SOIL NO.	CALC. DEPTH (ft)	TOTAL STRESS (tsf)	EFF. STRESS (tsf)	FIELD N (B/ft)	FC DELTA N1_60	C N	CORR. (N1)60 (B/ft)	LIQUE. RESIST RATIO	r d	INDUC. STRESS RATIO	LIQUE. SAFETY FACTOR
1	0.25	0.016	0.016	30	~	*	*	*	*	*	**
1	0.75	0.047	0.047	30	~	*	*	*	*	*	**
1	1.25	0.078	0.078	30	~	*	*	*	*	*	**
1	1.75	0.109	0.109	30	~	*	*	*	*	*	**
1	2.25	0.141	0.141	30	~	*	*	*	*	*	**
1	2.75	0.172	0.172	30	~	*	*	*	*	*	**
1	3.25	0.203	0.203	30	~	*	*	*	*	*	**
1	3.75	0.234	0.234	30	~	*	*	*	*	*	**
1	4.25	0.266	0.266	30	~	*	*	*	*	*	**
1	4.75	0.297	0.297	30	~	*	*	*	*	*	**
2	5.25	0.328	0.328	6	~	*	*	*	*	*	**
2	5.75	0.359	0.359	6	~	*	*	*	*	*	**
2	6.25	0.391	0.391	6	~	*	*	*	*	*	**
2	6.75	0.422	0.422	6	~	*	*	*	*	*	**
2	7.25	0.453	0.453	6	~	*	*	*	*	*	**
2	7.75	0.484	0.484	6	~	*	*	*	*	*	**
2	8.25	0.516	0.516	6	~	*	*	*	*	*	**
2	8.75	0.547	0.547	6	~	*	*	*	*	*	**
2	9.25	0.578	0.578	6	~	*	*	*	*	*	**
2	9.75	0.609	0.609	6	~	*	*	*	*	*	**
3	10.25	0.641	0.641	5	~	*	*	*	*	*	**
3	10.75	0.672	0.672	5	~	*	*	*	*	*	**
3	11.25	0.703	0.703	5	~	*	*	*	*	*	**
3	11.75	0.734	0.734	5	~	*	*	*	*	*	**
3	12.25	0.766	0.766	5	~	*	*	*	*	*	**
3	12.75	0.797	0.797	5	~	*	*	*	*	*	**
3	13.25	0.828	0.828	5	~	*	*	*	*	*	**
3	13.75	0.859	0.859	5	~	*	*	*	*	*	**
3	14.25	0.891	0.891	5	~	*	*	*	*	*	**
3	14.75	0.922	0.922	5	~	*	*	*	*	*	**
4	15.25	0.953	0.953	9	0.02	*	*	*	*	*	**
4	15.75	0.984	0.984	9	0.02	*	*	*	*	*	**
4	16.25	1.016	1.016	9	0.02	*	*	*	*	*	**
4	16.75	1.047	1.047	9	0.02	*	*	*	*	*	**
4	17.25	1.078	1.078	9	0.02	*	*	*	*	*	**
4	17.75	1.109	1.109	9	0.02	*	*	*	*	*	**
4	18.25	1.141	1.141	9	0.02	*	*	*	*	*	**
4	18.75	1.172	1.172	9	0.02	*	*	*	*	*	**
4	19.25	1.203	1.203	9	0.02	*	*	*	*	*	**
4	19.75	1.234	1.234	9	0.02	*	*	*	*	*	**
5	20.25	1.266	1.258	14	2.54	0.897	20.2	0.213	0.956	0.250	1.09
5	20.75	1.297	1.273	14	2.54	0.897	20.2	0.213	0.955	0.253	1.08
5	21.25	1.328	1.289	14	2.54	0.897	20.2	0.213	0.954	0.255	1.07

File Name: tran.OUT

SOIL NO.	CALC. DEPTH (ft)	TOTAL STRESS (tsf)	EFF. STRESS (tsf)	FIELD N (B/ft)	FC DELTA N1_60	C N	CORR. (N1)60 (B/ft)	LIQUE. RESIST RATIO	r d	INDUC. STRESS RATIO	LIQUE. SAFETY FACTOR
5	21.75	1.359	1.305	14	2.54	0.897	20.2	0.213	0.952	0.258	1.06
5	22.25	1.391	1.320	14	2.54	0.897	20.2	0.213	0.951	0.260	1.05
5	22.75	1.422	1.336	14	2.54	0.897	20.2	0.213	0.949	0.263	1.04
5	23.25	1.453	1.352	14	2.54	0.897	20.2	0.213	0.948	0.265	1.03
5	23.75	1.484	1.367	14	2.54	0.897	20.2	0.213	0.946	0.267	1.02
5	24.25	1.516	1.383	14	2.54	0.897	20.2	0.213	0.945	0.269	1.02
5	24.75	1.547	1.399	14	2.54	0.897	20.2	0.213	0.943	0.271	1.01
6	25.25	1.578	1.414	13	2.49	0.848	18.8	0.194	0.941	0.273	0.91
6	25.75	1.609	1.430	13	2.49	0.848	18.8	0.194	0.939	0.275	0.90
6	26.25	1.641	1.446	13	2.49	0.848	18.8	0.194	0.938	0.277	0.90
6	26.75	1.672	1.461	13	2.49	0.848	18.8	0.194	0.936	0.278	0.89
6	27.25	1.703	1.477	13	2.49	0.848	18.8	0.194	0.934	0.280	0.89
6	27.75	1.734	1.493	13	2.49	0.848	18.8	0.194	0.931	0.281	0.88
6	28.25	1.766	1.508	13	2.49	0.848	18.8	0.194	0.929	0.283	0.88
6	28.75	1.797	1.524	13	2.49	0.848	18.8	0.194	0.927	0.284	0.88
6	29.25	1.828	1.540	13	2.49	0.848	18.8	0.194	0.925	0.285	0.87
6	29.75	1.859	1.555	13	2.49	0.848	18.8	0.194	0.922	0.287	0.87
7	30.25	1.891	1.571	16	1.72	0.805	21.0	0.214	0.920	0.288	0.95
7	30.75	1.922	1.586	16	1.72	0.805	21.0	0.214	0.917	0.289	0.95
7	31.25	1.953	1.602	16	1.72	0.805	21.0	0.214	0.914	0.290	0.95
7	31.75	1.984	1.618	16	1.72	0.805	21.0	0.214	0.912	0.291	0.94
7	32.25	2.016	1.633	16	1.72	0.805	21.0	0.214	0.909	0.292	0.94
7	32.75	2.047	1.649	16	1.72	0.805	21.0	0.214	0.906	0.292	0.94
7	33.25	2.078	1.665	16	1.72	0.805	21.0	0.214	0.903	0.293	0.94
7	33.75	2.109	1.680	16	1.72	0.805	21.0	0.214	0.899	0.294	0.93
7	34.25	2.141	1.696	16	1.72	0.805	21.0	0.214	0.896	0.294	0.93
7	34.75	2.172	1.712	16	1.72	0.805	21.0	0.214	0.893	0.295	0.93
8	35.25	2.203	1.727	28	9.67	0.769	41.9	Infin	0.889	0.295	NonLiq
8	35.75	2.234	1.743	28	9.67	0.769	41.9	Infin	0.886	0.295	NonLiq
8	36.25	2.266	1.759	28	9.67	0.769	41.9	Infin	0.882	0.295	NonLiq
8	36.75	2.297	1.774	28	9.67	0.769	41.9	Infin	0.878	0.296	NonLiq
8	37.25	2.328	1.790	28	9.67	0.769	41.9	Infin	0.874	0.296	NonLiq
8	37.75	2.359	1.806	28	9.67	0.769	41.9	Infin	0.871	0.296	NonLiq
8	38.25	2.391	1.821	28	9.67	0.769	41.9	Infin	0.866	0.296	NonLiq
8	38.75	2.422	1.837	28	9.67	0.769	41.9	Infin	0.862	0.296	NonLiq
8	39.25	2.453	1.853	28	9.67	0.769	41.9	Infin	0.858	0.295	NonLiq
8	39.75	2.484	1.868	28	9.67	0.769	41.9	Infin	0.854	0.295	NonLiq
9	40.25	2.516	1.884	40	11.51	0.737	55.6	Infin	0.849	0.295	NonLiq
9	40.75	2.547	1.899	40	11.51	0.737	55.6	Infin	0.845	0.295	NonLiq
9	41.25	2.578	1.915	40	11.51	0.737	55.6	Infin	0.840	0.294	NonLiq
9	41.75	2.609	1.931	40	11.51	0.737	55.6	Infin	0.836	0.294	NonLiq
9	42.25	2.641	1.946	40	11.51	0.737	55.6	Infin	0.831	0.293	NonLiq
9	42.75	2.672	1.962	40	11.51	0.737	55.6	Infin	0.826	0.293	NonLiq

9 | 43.25| 2.703| 1.978| 40 |11.51|0.737| 55.6 |Infin |0.822| 0.292|NonLiq

NCEER [1997] Method — LIQUEFACTION ANALYSIS SUMMARY —

File Name: tran.OUT

SOIL NO.	CALC. DEPTH (ft)	TOTAL STRESS (tsf)	EFF. STRESS (tsf)	FIELD N (B/ft)	FC DELTA N1_60	C N	CORR. (N1)60 (B/ft)	LIQUE. RESIST RATIO	r d	INDUC. STRESS RATIO	LIQUE. SAFETY FACTOR
9	43.75	2.734	1.993	40	11.51	0.737	55.6	Infin	0.817	0.291	NonLiq
9	44.25	2.766	2.009	40	11.51	0.737	55.6	Infin	0.812	0.291	NonLiq
9	44.75	2.797	2.025	40	11.51	0.737	55.6	Infin	0.807	0.290	NonLiq
10	45.25	2.828	2.040	39	11.08	0.709	52.4	Infin	0.802	0.289	NonLiq
10	45.75	2.859	2.056	39	11.08	0.709	52.4	Infin	0.797	0.288	NonLiq
10	46.25	2.891	2.072	39	11.08	0.709	52.4	Infin	0.792	0.287	NonLiq
10	46.75	2.922	2.087	39	11.08	0.709	52.4	Infin	0.787	0.286	NonLiq
10	47.25	2.953	2.103	39	11.08	0.709	52.4	Infin	0.782	0.285	NonLiq
10	47.75	2.984	2.119	39	11.08	0.709	52.4	Infin	0.776	0.284	NonLiq
10	48.25	3.016	2.134	39	11.08	0.709	52.4	Infin	0.771	0.283	NonLiq
10	48.75	3.047	2.150	39	11.08	0.709	52.4	Infin	0.766	0.282	NonLiq
10	49.25	3.078	2.166	39	11.08	0.709	52.4	Infin	0.761	0.281	NonLiq
10	49.75	3.109	2.181	39	11.08	0.709	52.4	Infin	0.756	0.280	NonLiq
10	50.25	3.141	2.197	39	11.08	0.709	52.4	Infin	0.751	0.279	NonLiq
10	50.75	3.172	2.212	39	11.08	0.709	52.4	Infin	0.746	0.278	NonLiq
10	51.25	3.203	2.228	39	11.08	0.709	52.4	Infin	0.741	0.277	NonLiq

Seismic Densification and Dynamic Settlement Calculation for Dry Sands

I05759

Magnitude of earthquake :	6.80	Mw	Hammer Energy Ratio (E_m) 1.30
a_{max} :	0.40	g	Hole Diameter Factor (C_B) 1.00
			Sampling Meth Factor (C_s) 1.15

May 6, 2008

Layer Number	Depth to Top of Layer	Depth to Bot. of Layer	Layer Thickness	Depth to Center of Layer	Raw N values	Total Dry Density	σ eff at Center of the Layer	Rod Length Factor : C_R	N_{60}	$(N1)_{60}$	Fine Content	$(N1)_{60,cs}$	$\sigma_m' = \sigma_{eff}(1+2k_0)/3$	$G_{max} = 20(\sigma m')^{0.5}((N_1)_{60cs})^{1/3}$	$r_d = (1-(0.1*\text{depth})/30)$	$\gamma_{eff}\, G_{eff}/G_{max} = 0.65*amax*seff*rd/Gmax$	Shear Strain : γ_{eff}	Vol. Strain: ε_c	Vol. Strain Corrected for M $2*0.075*M^{1.285}$	Settlement = 12* (Vol strain)*(Layer thickness)
	(ft)	(ft)	(ft)	(ft)		(pcf)	(psf)						(psf)	(ksf)						(in)
1	0	5	5	2.5	30.0	120.0	300	0.75	34	87	3	87	200	1234	0.99	6.3E-05	1.1E-04	1.8E-05	1.6E-05	0.00
2	5	10	5	7.5	6.0	120.0	900	0.75	7	10	6	10	600	1051	0.98	2.2E-04	7.8E-04	1.8E-03	1.6E-03	0.19
3	10	14	4	12.0	5.0	120.0	1440	0.75	6	7	6	7	960	1159	0.96	3.1E-04	1.2E-03	4.4E-03	3.9E-03	0.37
4	14	20	6	17.0	9.0	120.0	2040	0.85	11	11	3	11	1360	1643	0.94	3.0E-04	8.7E-04	1.8E-03	1.6E-03	0.23
			20																Total Settlement (inches)	0.8

Note:

(N1)60 was calculated by the method suggested in DMG Special Publication SP117

Settlement Analysis, **Tokimatsu and Seed 1987**, ASCE, Evaluation of Settlements in Dry Sands Due to Eathquake Shaking, Journal of the Goetechnical Engineering Division, ASCE, Vol 113, No. 8, Agust 1987

Liquefaction-induced Settlement in Saturated Sand
Transcan - B 6

Layer No.	Thickness (ft)	Cyclic Stress Ratio, CSR (ave)	Corrected (N1/60)	Strain (%)	Settlement (in)
1(22'-25')	3	0.80	20	1.60	0.6
2(25'-30')	5	0.69	19	1.50	0.9
4(30'-35')	5	0.73	21	1.40	0.8
			Total Settlement (in)		2.3

Reference: **Tokimatsu and Seed 1987**, ASCE, Evaluation of Settlements in Sands Due to Eathquake Shaking, Journal of the Goetechnical Engineering Division, ASCE, Vol 113, No. 8, Agust 1987

APPENDIX F

GENERAL EARTHWORK AND GRADING SPECIFICATIONS FOR ROUGH GRADING

APPENDIX F

LGC Geo-Environmental, Inc.

General Earthwork and Grading Specifications for Rough Grading

1.0 General

1.1 Intent: These General Earthwork and Grading Specifications are for the grading and earthwork shown on the approved grading plan(s) and/or indicated in the geotechnical report(s). These Specifications are a part of the recommendations contained in the geotechnical report(s). In case of conflict, the specific recommendations in the geotechnical report shall supersede these more general Specifications. Observations of the earthwork by the project Geotechnical Consultant during the course of grading may result in new or revised recommendations that could supersede these specifications or the recommendations in the geotechnical report(s).

1.2 The Geotechnical Consultant of Record: Prior to commencement of work, the owner shall employ a qualified Geotechnical Consultant of Record (Geotechnical Consultant). The Geotechnical Consultant shall be responsible for reviewing the approved geotechnical report(s) and accepting the adequacy of the preliminary geotechnical findings, conclusions, and recommendations prior to the commencement of the grading.

Prior to commencement of grading, the Geotechnical Consultant shall review the "work plan" prepared by the Earthwork Contractor (Contractor) and schedule sufficient personnel to perform the appropriate level of observation, mapping, and compaction testing.

During the grading and earthwork operations, the Geotechnical Consultant shall observe, map, and document the subsurface exposures to verify the geotechnical design assumptions. If the observed conditions are found to be significantly different than the interpreted assumptions during the design phase, the Geotechnical Consultant shall inform the owner, recommend appropriate changes in design to accommodate the observed conditions, and notify the review agency where required.

The Geotechnical Consultant shall observe the moisture-conditioning and processing of the subgrade and fill materials and perform relative compaction testing of fill to confirm that the attained level of compaction is being accomplished as specified. The Geotechnical Consultant shall provide the test results to the owner and the Contractor on a routine and frequent basis.

1.3 The Earthwork Contractor: The Earthwork Contractor (Contractor) shall be qualified, experienced, and knowledgeable in earthwork logistics, preparation and processing of ground to receive fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall review and accept the plans, geotechnical report(s), and these Specifications prior to commencement of grading. The Contractor shall be solely responsible for performing the grading in accordance with the project plans and specifications. The Contractor shall prepare and submit to the owner and the Geotechnical Consultant a work plan that indicates the sequence of earthwork grading, the number of "equipment" of work and the estimated quantities of daily earthwork contemplated for the site prior to commencement of grading.

The Contractor shall inform the owner and the Geotechnical Consultant of changes in work schedules and updates to the work plan at least 24 hours in advance of such changes so that

appropriate personnel will be available for observation and testing. The Contractor shall not assume that the Geotechnical Consultant is aware of all grading operations.

The Contractor shall have the sole responsibility to provide adequate equipment and methods to accomplish the earthwork in accordance with the applicable grading codes and agency ordinances, these Specifications, and the recommendations in the approved geotechnical report(s) and grading plan(s). If, in the opinion of the Geotechnical Consultant, unsatisfactory conditions, such as unsuitable soil, improper moisture condition, inadequate compaction, insufficient buttress key size, adverse weather, etc., are resulting in a quality of work less than required in these specifications, the Geotechnical Consultant shall reject the work and may recommend to the owner that construction be stopped until the conditions are rectified. It is the contractor's sole responsibility to provide proper fill compaction.

2.0 ***Preparation of Areas to be Filled***

2.1 ***Clearing and Grubbing:*** Vegetation, such as brush, grass, roots, and other deleterious material shall be sufficiently removed and properly disposed of in a method acceptable to the owner, governing agencies, and the Geotechnical Consultant.

The Geotechnical Consultant shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 1 percent of organic materials (by volume). No fill lift shall contain more than 10 percent of organic matter. Nesting of the organic materials shall not be allowed.

If potentially hazardous materials are encountered, the Contractor shall stop work in the affected area, and a hazardous material specialist shall be informed immediately for proper evaluation and handling of these materials prior to continuing to work in that area.

As presently defined by the State of California, most refined petroleum products (gasoline, diesel fuel, motor oil, grease, coolant, etc.) have chemical constituents that are considered to be hazardous waste. As such, the indiscriminate dumping or spillage of these fluids onto the ground may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall not be allowed. The contractor is responsible for all hazardous waste relating to his work. The Geotechnical Consultant does not have expertise in this area. If hazardous waste is a concern, then the Client should acquire the services of a qualified environmental assessor.

2.2 ***Processing:*** Existing ground that has been declared satisfactory for support of fill by the Geotechnical Consultant shall be scarified to a minimum depth of 6 inches. Existing ground that is not satisfactory shall be overexcavated as specified in the following section. Scarification shall continue until soils are broken down and free of oversize material and the working surface is reasonably uniform, flat, and free of uneven features that would inhibit uniform compaction.

2.3 ***Overexcavation:*** In addition to removals and overexcavations recommended in the approved geotechnical report(s) and the grading plan, soft, loose, dry, saturated, spongy, organic-rich, highly fractured or otherwise unsuitable ground shall be overexcavated to competent ground as evaluated by the Geotechnical Consultant during grading.

2.4 ***Benching:*** Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical units), the ground shall be stepped or benched. The lowest bench or key shall be a minimum of 15 feet wide and at least 2 feet deep, into competent material as evaluated by the Geotechnical Consultant. Other benches shall be excavated a minimum height of 4 feet into competent material or as otherwise recommended by the Geotechnical Consultant. Fill placed on ground sloping flatter than 5:1 (h:v) shall also be benched or otherwise overexcavated to provide a flat subgrade for the fill.

2.5 ***Evaluation/Acceptance of Fill Areas:*** All areas to receive fill, including removal and processed areas, key bottoms, and benches, shall be observed, mapped, elevations recorded, and/or tested prior to being accepted by the Geotechnical Consultant as suitable to receive fill. The Contractor shall obtain a written acceptance from the Geotechnical Consultant prior to fill placement. A licensed surveyor shall provide the survey control for determining elevations of processed areas, keys, and benches.

3.0 Fill Material

3.1 ***General:*** Material to be used as fill shall be essentially free of organic matter and other deleterious substances evaluated and accepted by the Geotechnical Consultant prior to placement. Soils of poor quality, such as those with unacceptable gradation, high expansion potential, or low strength shall be placed in areas acceptable to the Geotechnical Consultant or mixed with other soils to achieve satisfactory fill material.

3.2 ***Oversize:*** Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 8 inches, shall not be buried or placed in fill unless location, materials, and placement methods are specifically accepted by the Geotechnical Consultant. Placement operations shall be such that nesting of oversized material does not occur and such that oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 vertical feet of finish grade or within 2 feet of future utilities or underground construction.

3.3 ***Import:*** If importing of fill material is required for grading, proposed import material shall meet all the requirements of this section. The potential import source shall be given to the Geotechnical Consultant at least 48 hours (2 working days) before importing begins so that its suitability can be determined and appropriate tests performed.

4.0 Fill Placement and Compaction

4.1 ***Fill Layers:*** Approved fill material shall be placed in areas prepared to receive fill in near-horizontal layers not exceeding 8 inches in loose thickness. The Geotechnical Consultant may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.

4.2 ***Fill Moisture Conditioning:*** Fill soils shall be watered, dried back, blended, and/or mixed, as necessary to attain relatively uniform moisture content at or slightly over optimum. Maximum density and optimum soil moisture content tests shall be performed in accordance with the American Society for Testing and Materials (ASTM Test Method D1557-91).

4.3 ***Compaction of Fill:*** After each layer has been moisture-conditioned, mixed, and evenly spread, it shall be uniformly compacted to not less than 90 percent of maximum dry density

(ASTM Test Method D1557-91). Compaction equipment shall be adequately sized and be either specifically designed for soil compaction or of proven reliability to efficiently achieve the specified level of compaction with uniformity.

4.4 ***Compaction of Fill Slopes:*** In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by backrolling of slopes with sheepsfoot rollers at increments of 3 to 4 feet in fill elevation, or by other methods producing satisfactory results acceptable to the Geotechnical Consultant. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent of maximum density per ASTM Test Method D1557-91.

4.5 ***Compaction Testing:*** Field tests for moisture content and relative compaction of the fill soils shall be performed by the Geotechnical Consultant. Location and frequency of tests shall be at the Consultant's discretion based on field conditions encountered. Compaction test locations will not necessarily be selected on a random basis. Test locations shall be selected to verify adequacy of compaction levels in areas that are judged to be prone to inadequate compaction (such as close to slope faces and at the fill/bedrock benches).

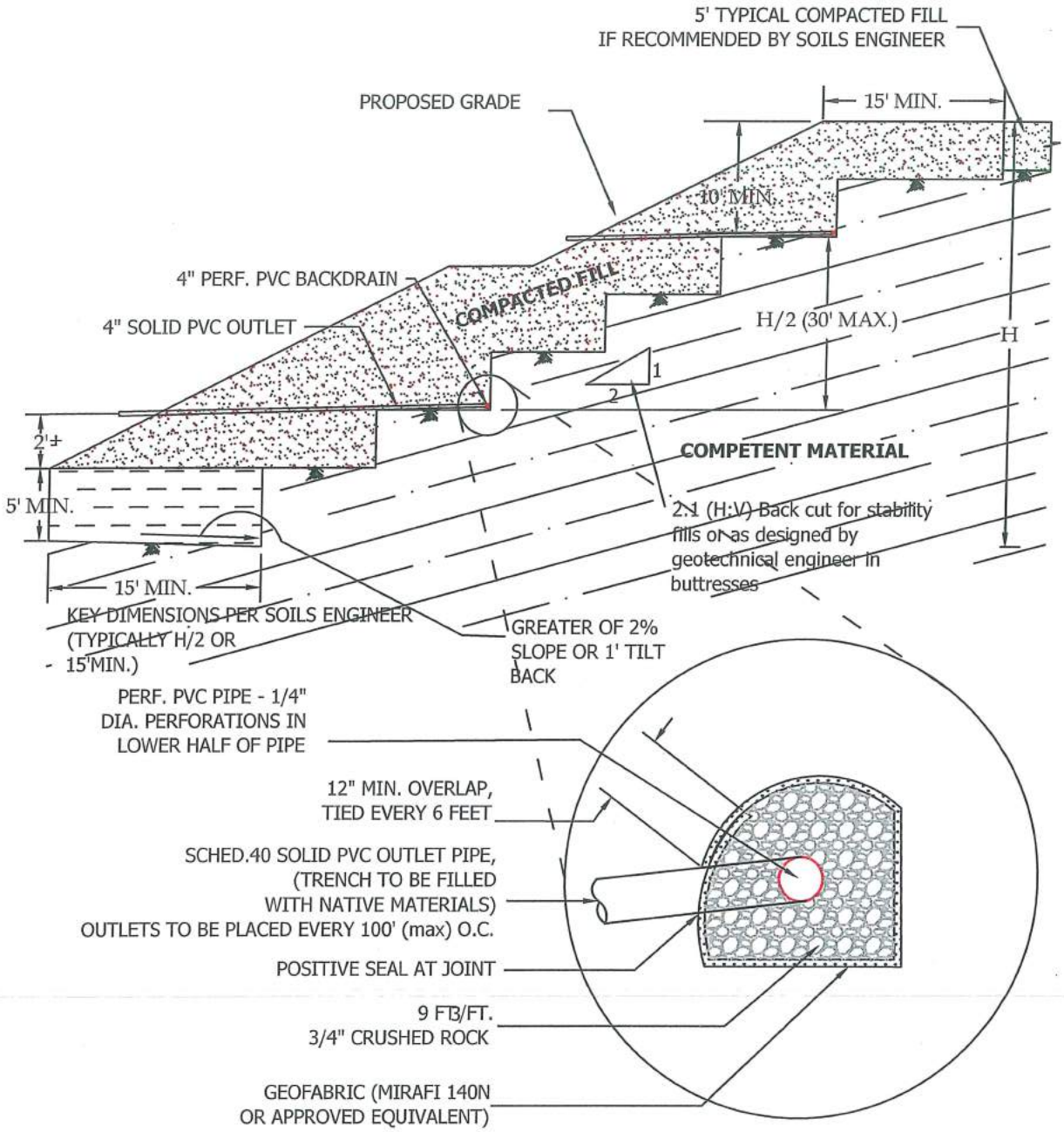
4.6 ***Frequency of Compaction Testing:*** Tests shall be taken at intervals not exceeding 2 feet in vertical rise and/or 1,000 cubic yards of compacted fill soils embankment. In addition, as a guideline, at least one (1) test shall be taken on slope faces for each 5,000 square feet of slope face and/or each 10 feet of vertical height of slope. The Contractor shall assure that fill construction is such that the testing schedule can be accomplished by the Geotechnical Consultant. The Contractor shall stop or slow down the earthwork construction if these minimum standards are not met.

4.7 ***Compaction Test Locations:***

The Geotechnical Consultant shall document the approximate elevation and horizontal coordinates of each test location. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so that the Geotechnical Consultant can determine the test locations with sufficient accuracy. At a minimum, two (2) grade stakes within a horizontal distance of 100 feet and vertically less than 5 feet apart from potential test locations shall be provided.

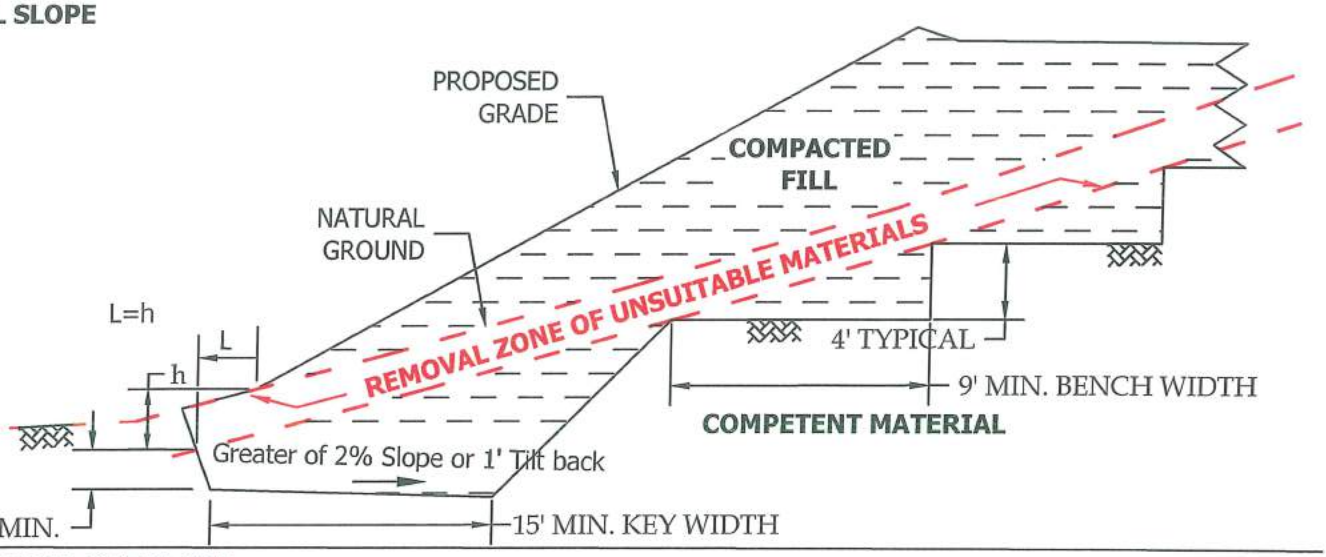
5.0 Subdrain Installation

Subdrain systems shall be installed in accordance with the approved geotechnical report(s), the grading plan, and City requirements and standards. The Geotechnical Consultant may recommend additional subdrain and/or changes in subdrain extent, location, grade, or material depending on conditions encountered during grading. All subdrains shall be surveyed by a land surveyor/civil engineer for line and grade after installation and prior to burial. Sufficient time should be allowed by the Contractor for these surveys.

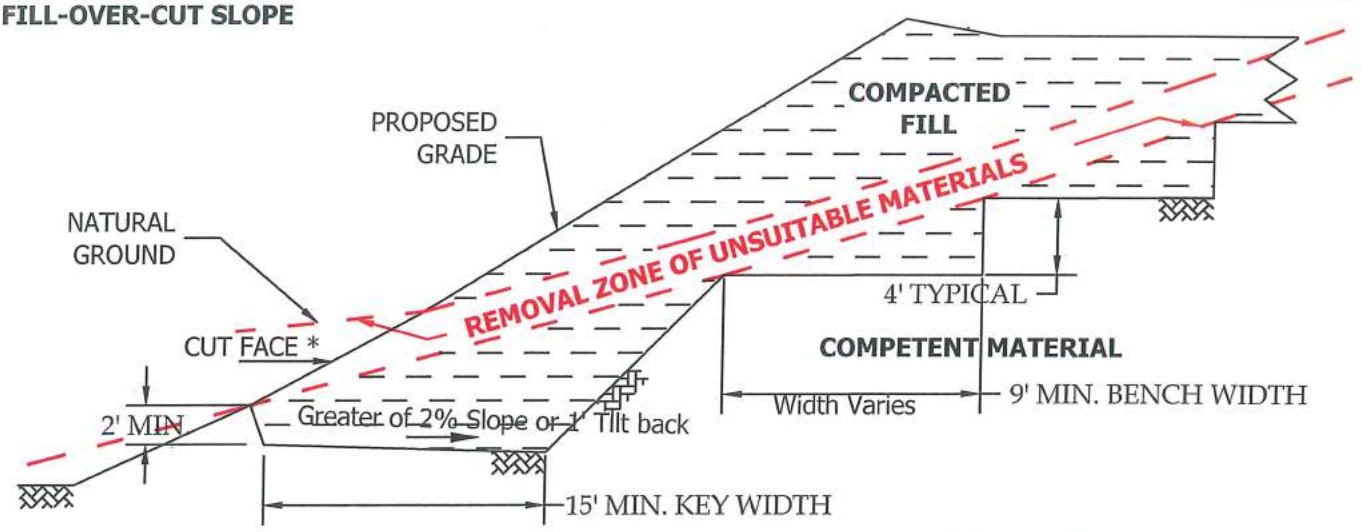


TYPICAL BUTTRESS/ STABILIZATION FILL DETAIL

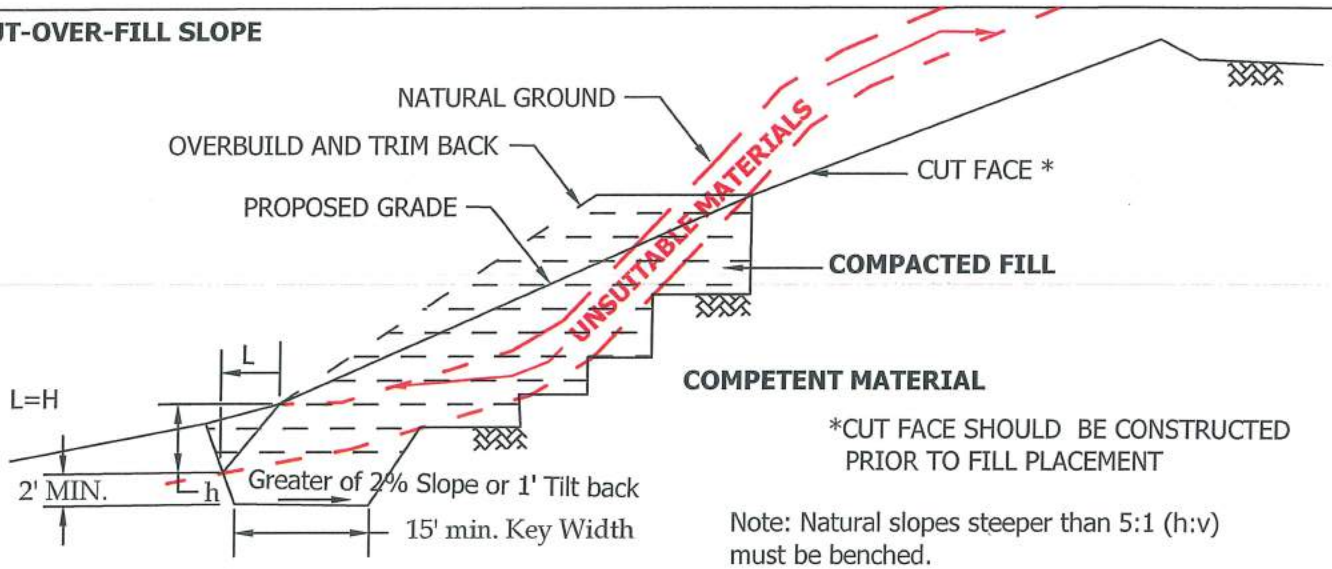
FILL SLOPE



FILL-OVER-CUT SLOPE



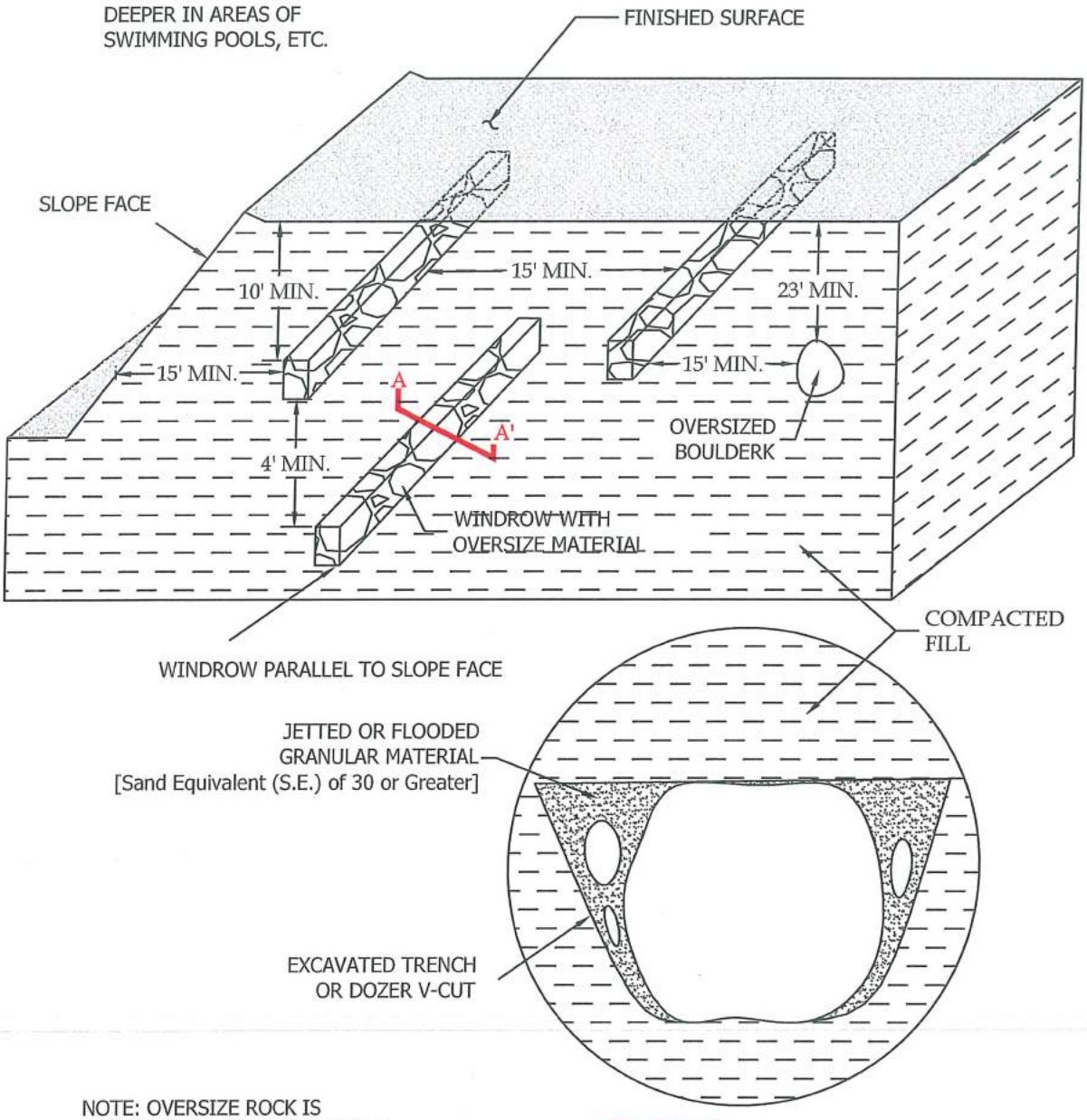
CUT-OVER-FILL SLOPE



*CUT FACE SHOULD BE CONSTRUCTED PRIOR TO FILL PLACEMENT

Note: Natural slopes steeper than 5:1 (h:v) must be benched.

KEYING AND BENCHING



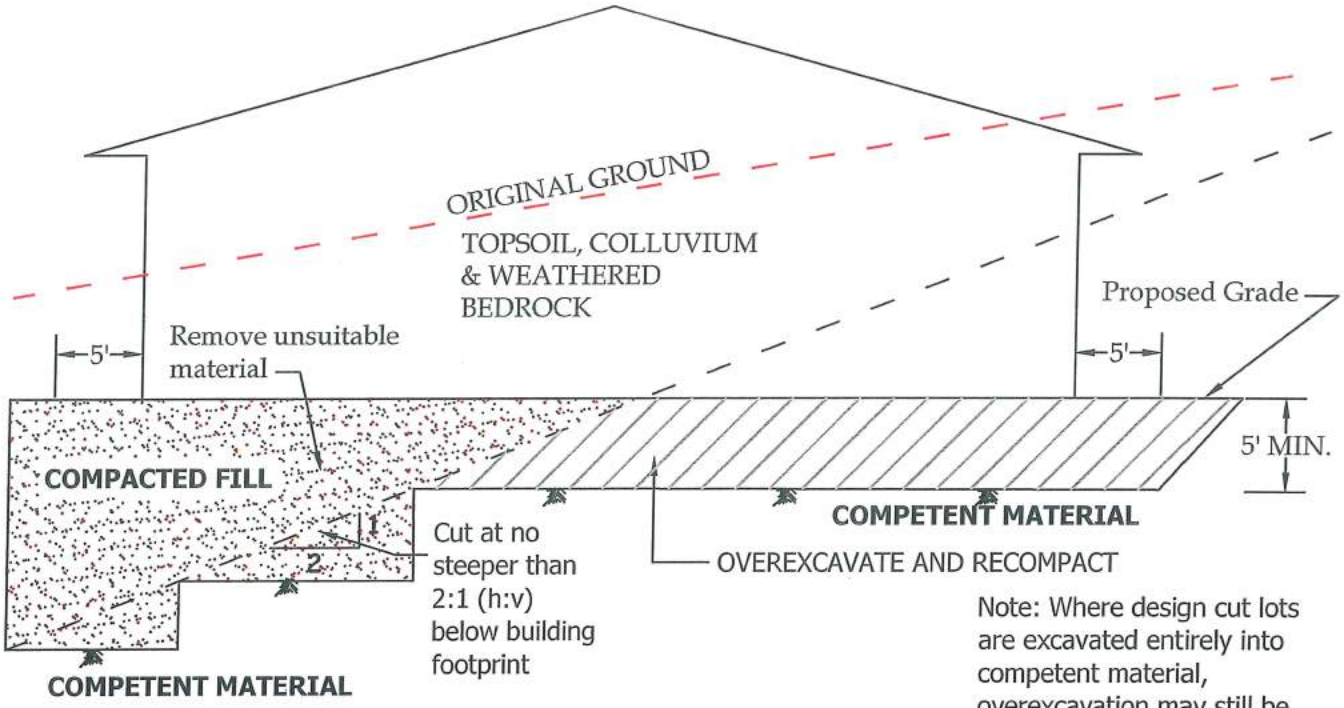
NOTE: OVERSIZE ROCK IS
LARGER THAN 12" IN DIMENSION.

SECTION A-A'

OVERSIZE ROCK DISPOSAL

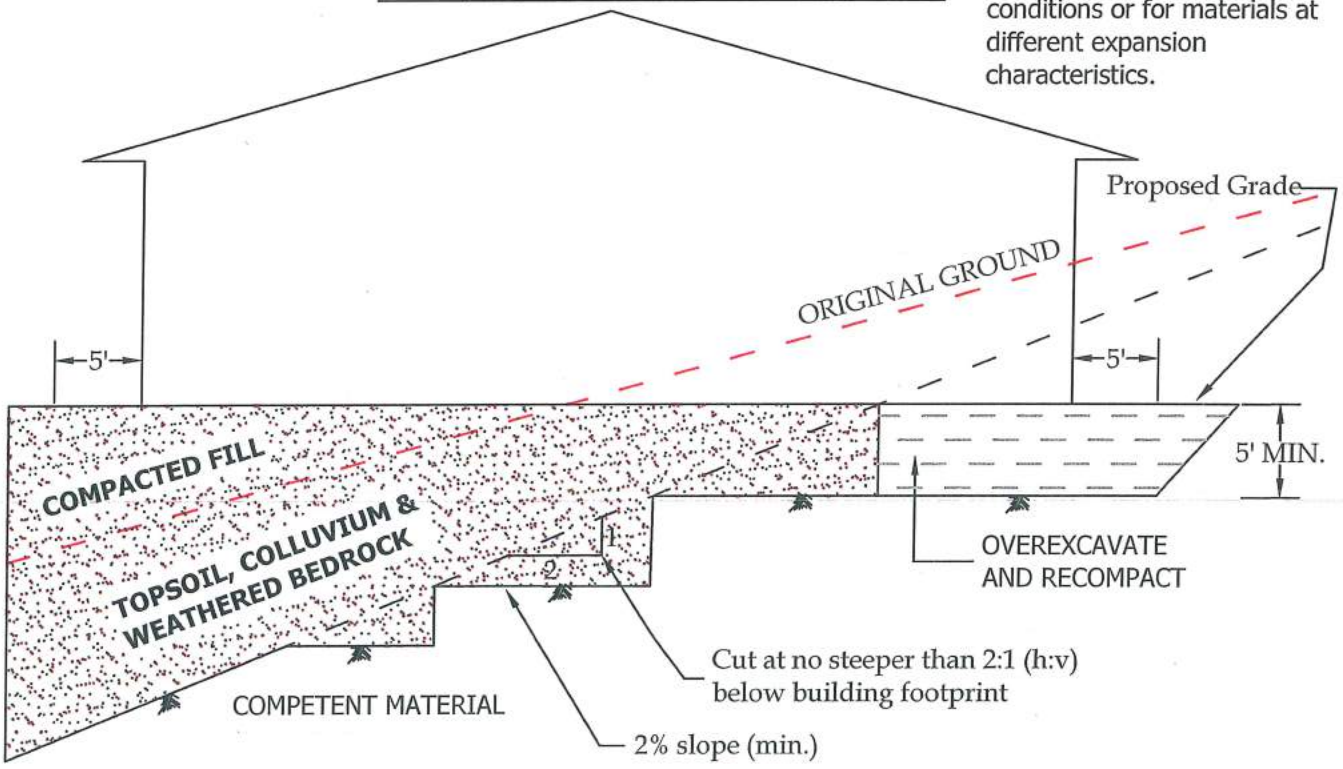
CUT LOT

(Exposing Unsuitable Soils/Bedrock @ Design Grade)



Note: Where design cut lots are excavated entirely into competent material, overexcavation may still be required for hard-rock conditions or for materials at different expansion characteristics.

CUT/FILL TRANSITION LOT



TRANSITION LOT OVEREXCAVATION DETAIL