Appendix I

LGC GEO-ENVIRONMENTAL, INC.

UPDATED PRELIMINARY GEOTECHNICAL INVESTIGATION REPORT FOR THE PROPOSED 15.78-ACRE HOTEL AND EVENT CENTER DEVELOPMENT APN 392-280-007, LOCATED AT THE NORTHEAST CORNER OF LINNEL LANE AND MCELWAIN ROAD, CITY OF MURRIETA, RIVERSIDE COUNTY, CALIFORNIA.

Dated: April 8, 2019

Project No. G18-1687-10

Prepared For:

Murrieta Development II, LLC
Mr. Joseph Sapp
23656 Bellwood Court
Murrieta, CA. 92562

27570 Commerce Center Drive, Suite. 128, Temecula, California 92590
Phone: 951.297.2450 I Fax: 951.719.2998 I www.lgcgeoenv.com

LGC GEO-ENVIRONMENTAL, INC.
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS TESTING • SWPPP

April 8, 2019

Project No. G18-1687-10

Murrieta Development II, LLC
Mr. Joseph Sapp
23656 Bellwood Court
Murrieta, California 92562

Subject: Updated Preliminary Geotechnical Investigation Report for the Proposed 15.78-Acre Hotel and Event Center Development APN 392-280-007, Located at the Northeast Corner of Linnel Lane and McElwain Road, City of Murrieta, Riverside County, California.

LGC Geo-Environmental, Inc. (LGC) herewith submits our updated preliminary geotechnical investigation report for the proposed 15.78-acre hotel and event center development APN 392-280-007, located at the northeast corner of Linnel Lane and McElwain Road, City of Murrieta, Riverside County, California.

This report presents the results of our research of published geologic/geotechnical reports and maps, geologic mapping and 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 hotel and event center development.

Based on the results of our field exploration, geologic mapping, laboratory testing, geologic and geotechnical engineering evaluations, along with our review of published literature, preliminary geotechnical investigation report from T.H.E. Soils Co., Inc. (2006), and the referenced 50-Scale Site Plan, it is our opinion that the subject site is suitable for the proposed 15.78-acre hotel and event center 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 those become available, and revise the recommendations presented herein, if necessary.

LGC is pleased to have been retained 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 should you require additional information, please do not hesitate to contact us.

Respectfully submitted,

LGC GEO-ENVIRONMENTAL, INC.

REGISTERED GEOLOGIST
ROBERT L. GREGOREK II
No. 1257
CERTIFIED ENGINEERING GEOLOGIST
Exp. 8/31/19
STATE OF CALIFORNIA

Robert L. Gregorek II, CEG 1257
Certified Engineering Geologist

John P. Nielsen, PhD, GE 641
Geotechnical Engineer

REGISTERED PROFESSIONAL ENGINEER
JOHN P. NIELSEN
No. 641
EXP. 6/19
GEOTECHNICAL
STATE OF CALIFORNIA

AJR/RLG/JPN

Distribution: (4) Addressee

TABLE OF CONTENTS

LIST OF TABLES, APPENDICES AND ILLUSTRATIONS

Tables

Figures & Plates

Appendices

1.0 INTRODUCTION

1.1 Purpose and Scope of Services

This report presents the results of LGC Geo-Environmental, Inc.'s (LGC) preliminary geologic and geotechnical investigation for the proposed 15.78-acre hotel and event center development, located within the City of Murrieta, Riverside County, California. The purpose of this updated preliminary geotechnical report is to determine the nature of surface and subsurface soil conditions, evaluate the characteristics, and provide geotechnical recommendations with respect to grading, construction, foundation design, and other aspects relative to the proposed development of the site. The referenced 50-Scale Site Plan was utilized as the base map for our Geotechnical Map (Plate 1) for the site.

Our scope of services include:

- 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 consisted of seven (7) exploratory trenches for the purpose of determining existing subsurface geological conditions, labeled TR-1 through Tr-6, and IT-4, to depths of approximately 4.5 feet to 13 feet, utilizing a rubber tire backhoe.
- Laboratory testing of selected representative soil specimens for characterization of the engineering properties of onsite soil.
- Geotechnical engineering and geologic analyses of the data with respect to the proposed 15.78-acre hotel and event center development.
- Preparation of this report presenting our findings, conclusions, and preliminary geotechnical design recommendations for the proposed 15.78-acre hotel and event center development.

1.2 Proposed Construction and Grading

The referenced 50-Scale Site Plan indicates that the proposed 15.78-acre hotel and event center development will be comprised of a three-story, 120 key hotel, event center, roadways and parking lots, and landscape and hardscape areas. The western portion of the site will be only contour graded to drain at this time. Maximum cut areas are approximately 14 feet and maximum fill areas are approximately 12 feet. The slopes on site will be approximately 8 feet to 18 feet in the infiltration basin and approximately 9 feet on the western edge of site and 17 feet on the north side of the site. It is anticipated that the proposed structures will be constructed of wood and steel framing, with concrete footings and floor slabs constructed on-grade. For this type of construction, is characterized by relatively light to moderate loads imposed on the underlying soil.

1.3 Location and Site Description

The subject site is rectangular shaped and undulated and sloping generally to the south. The site is located West of McElwain Road, to the North of Linnel Lane and West of Interstate 215, in the City of Murrieta, Riverside County, California. The existing site elevations range from approximately 1,590 feet above mean sea level (msl) in the northwest and southwest corners of the site, to approximately 1,554 msl in the south eastern corner of the site. Existing drainage onsite is generally directed towards the south. On the East side of the property is south-southwest trending drainage ditch. There is an in-ground water well structure located in the northern central area where a single-family residence and equipment yard were once located. The lot contains trees, vegetation, annual weeds and granitic boulders. 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 northern part of the site once contained a residential structure, containers, and vehicles. Site doesn't appear to have been previously graded.

1.4 Aerial Imagery and Stereo Photograph Analysis

Google Earth Pro aerial imagery (from 1994 to 2018) was evaluated for the subject site and surrounding vicinity. The available information, as it pertains to the geologic and geotechnical issues of the proposed 15.78-acre hotel and event center development, has been included herein.

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 February 25, 2019, to document existing surface geological conditions - utilizing the referenced 50-Scale Site Plan for plotting geologic units. This information has been plotted on the enclosed Geotechnical Map (Plate 1).

2.2 Field Exploration

Subsurface exploration at the site was performed on February 25, 2019 and involved the excavation of seven (7) exploratory trenches (TR-1 thru TR-6 and PT-4) to depths ranging from approximately 4.5 feet to 13.0 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 Soils Classification System (USCS). At the conclusion of the subsurface exploration, the trenches were backfilled. Minor settlement of the backfill soil may occur over time. The approximate locations of the exploratory trenches are shown on the Geotechnical Map (Plate 1). Prior to subsurface work, an underground utilities clearance was obtained from Underground Service Alert of Southern California.

2.3 Laboratory Testing

During our subsurface exploration, representative soil samples were retained for laboratory testing. Laboratory testing was performed on selected representative samples of onsite soil materials and included in-situ density and water content, maximum density and optimum water content, expansion index, direct shear, R-Value, and chloride content. A brief description of the laboratory test criteria and test data are presented in Appendix C.

FIGURE 1
SITE LOCATION MAP

Project Name	MCELWAIN
Project No.	G18-1687-10
Geol./ Eng.	RLG/JPN
Scale	NOT TO SCALE
Date	APRIL 2019

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).

3.2 *Local Geology and Soil Conditions*

Based on our review of available geological and geotechnical literature, field mapping, and our subsurface exploration conducted at the site, it is our understanding that the site is primarily underlain by topsoil, alluvium, and granitic bedrock. The subsurface geological contacts are described in greater detail below and presented within the exploratory borings (Appendix B). The observed geologic unit is depicted on the Geotechnical and Infiltration Map (Plate 1).

- **Topsoil:** During our subsurface exploration, topsoil was encountered at the surface down to depths ranging from approximately 0.2 foot to 1.0 foot. This topsoil is generally comprised of silty sand and clayey sand, and is various shades of brown, red, olive, and gray; very fine to medium grained, with occasional coarse grains; damp to moist; loose to medium dense; roots and roothairs; pores; desiccated; and micaceous.

- **Alluvium (Qal):** Alluvium was encountered beneath the site during our subsurface exploration, was observed at depths of approximately 0.5 foot to 7.5 feet below the topsoil. The alluvium is generally comprised of silty sand and clayey sand and is characterized as being various shades of brown, red and gray; damp to moist; loose to medium dense; very fine to medium grained, with occasional coarse to very coarse grains, trace boulders and occasional cobbles; roots and roothairs; pores and pinhole pores; and micaceous.

- **Weathered Bedrock:** Weathered granitic bedrock was observed at a depth ranging from approximately 1.5 feet to 7.5 feet beneath the surface. The granitic bedrock is generally comprised of silty sand, clayey sand and well graded sand and is characterized as being various shades of yellow, gray, red, olive and orange; damp to moist; medium dense to very dense; very fine to very coarse grained, with some rock fragments; clayey matrix; oxidation staining; manganese staining; roothairs; micaceous; mottling; pinhole pores; and friable.

- **Granitic Bedrock (kvpg):** Granitic bedrock was observed at depths ranging from approximately 2.0 feet to 13.0 feet beneath the surface. The granitic bedrock is characterized as being various shades of yellow, gray, white, orange, and gray; dry to damp; hard to very hard; friable; some oxidation staining; micaceous, and moderately to very weathered.

3.3 *Groundwater*

Groundwater was not encountered within any of the exploratory trenches during the subsurface exploration, to the maximum depth explored of approximately 13 feet. Groundwater data, acquired from the California Department of Water Resources', "Water Data Library", reveals historical groundwater readings at a depth of approximately 28 feet below ground surface, from a well located approximately less than one mile away (well station 336070N1171745W001) at surface elevation of approximately 1,585 feet msl.

3.4 Caving

Caving was not encountered within the exploratory trenches of the subsurface investigation.

3.5 Surface Water

Based on our review of the referenced 50-Scale Site Plan, proposed on-site surface water flow is generally trending toward the south. 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 retaining walls, if any.

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.

The following table is comprised of a list of the significant faults located within 20 miles of the proposed project site. We have also included the Maximum Earthquake Magnitude predicted for each of these faults.

TABLE 1
Significant Faults in Proximity of the Project Site

ABBREVIATED FAULT NAME	APPROXIMATE DISTANCE (km)	MAXIMUM EARTHQUAKE MAGNITUDE (Mw)
Elsinore-Temecula	8.7	6.8
Elsinore-Glen Ivy	16.9	6.8
San Jacinto-San Jacinto Valley	27.7	6.9
San Jacinto-Anza	28.2	7.2
Elsinore-Julian	29.7	7.1

Source: EQFAULT for Windows Version 3.00b

3.7 Secondary Seismic Effects

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. Other secondary seismic effects include shallow ground rupture, lateral spreading, 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. An evaluation of these secondary seismic effects is included herein.

3.8 Liquefaction

Liquefaction is a seismic phenomenon in which loose, saturated, granular soil 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) soil; and 3) high-intensity ground motion. Studies indicate that saturated, loose to medium dense, near surface cohesionless soil exhibit the highest liquefaction potential, while dry, dense, cohesionless soil and cohesive soil exhibit low to negligible liquefaction potential.

The site is not located within a County of Riverside designated liquefaction hazard zone. Groundwater was not encountered below the surface to the depth explored of approximately 13 feet. The probability for liquefaction is considered nil because of the shallow depth to bedrock as well as recommended depths of overexcavation.

3.9 Subsidence

In consideration of the anticipated grading, recommended overexcavations, proposed structures and improvements, and subsurface material types and their conditions, unfavorable ground subsidence is not anticipated.

3.10 Landsliding

Landslides or surface failures were not observed at or directly adjacent to the site. As a result, the possibility of the site being affected by land sliding is not anticipated.

3.11 Shallow Ground Rupture

The potential for shallow ground rupture is considered remote at the subject site. Cracking because of shaking from nearby or distant seismic events is not considered a significant hazard, although it is a possibility at any site.

3.12 Lateral Spreading

Lateral spreading is the outward and downward movement of soil on descending slopes that occurs during a seismic event and is usually associated with liquefaction of underlying soil. This typically occurs adjacent to drainage channels as the affected soil moves laterally into the open channel area. The potential for lateral spreading is not considered a possibility, due to the dense nature of the weathered volcanics and moderately weathered volcanics.

3.13 Tsunamis and Seiches

Based on the elevation and location of the proposed hotel and event center development at the site with respect to sea level and its distance from large open bodies of water, the potential of seiches and/or tsunamis is considered to be nil.

4.0 CONCLUSIONS AND RECOMMENDATIONS

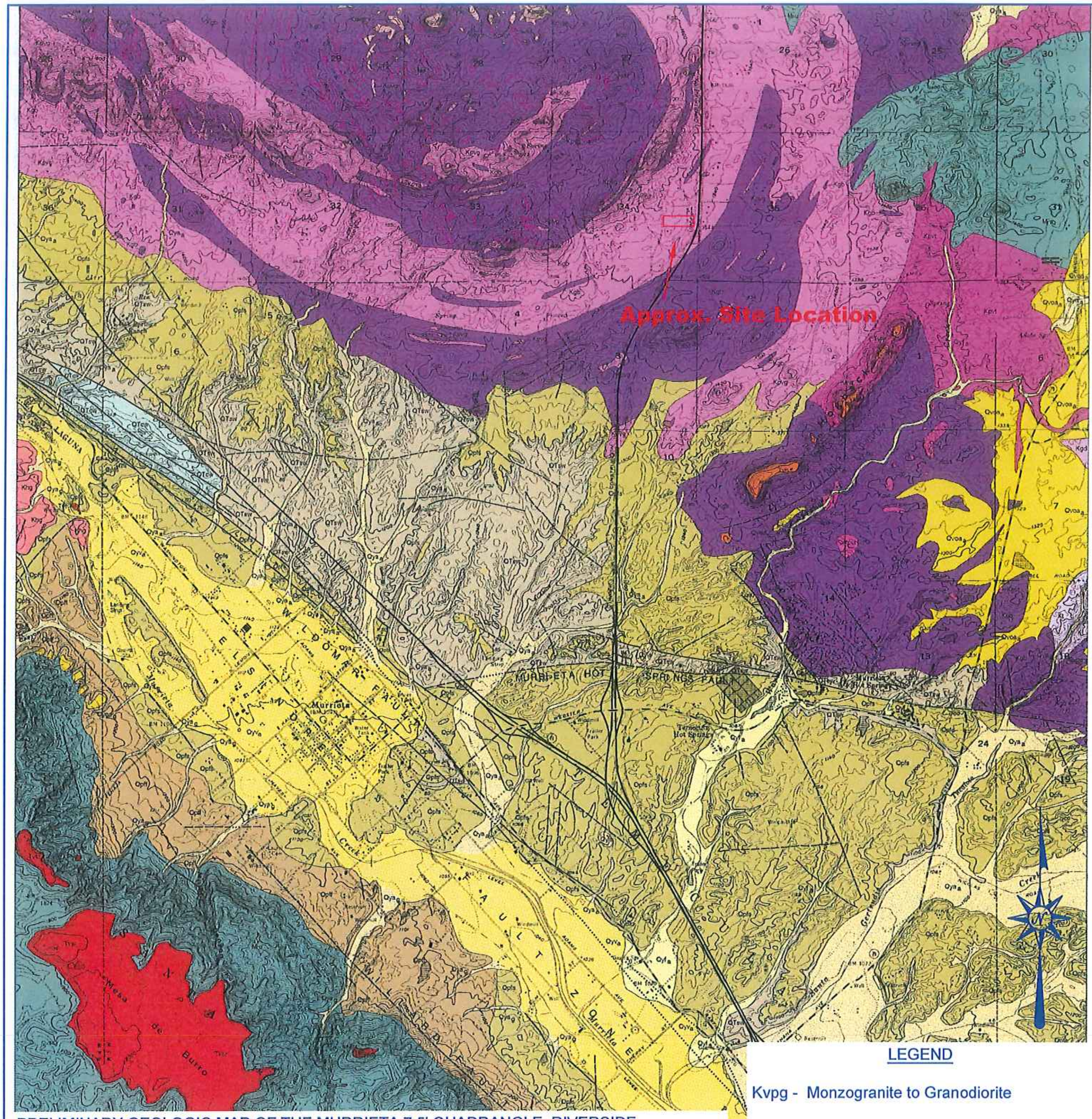
4.1 General

Based on the results of our geotechnical investigation, it is our opinion that the proposed 15.78-acre hotel and event center development as indicated on the referenced 50-Scale Site Plan, is feasible from a geotechnical and geologic standpoint provided that the following recommendations are incorporated into the design criteria and project specifications and implemented during construction. If foundation/structural plans for the proposed development change, a comprehensive plan review should be performed by LGC. Depending on the results, additional recommendations may be necessary to provide 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 obtained to prepare this report, published/unpublished literature, and geotechnical reports:

- Based on our subsurface exploration, the site is found to be underlain by alluvium, weathered bedrock and granitic bedrock.

- Groundwater is not considered a constraint for the proposed development.



PRELIMINARY GEOLOGIC MAP OF THE MURRIETA 7.5' QUADRANGLE, RIVERSIDE COUNTIES, CALIFORNIA, VERSION 1.0
By M.P. Kennedy1 and D.M. Morton2

Digital Database by Rachel M. Alvarez2 and Greg Morton3
1. United States Geological Survey, Riverside, California
2. U.S Geological Survery Department of Earth Sciences
3. Department of Earth Sciences, University of California

LEGEND

Kvpg - Monzogranite to Granodiorite

Geologic Contact

Fault Trace (Dotted where concealed, Dashed where inferred)

FIGURE 2
REGIONAL GEOLOGIC MAP

Project Name	MCELWAIN
Project No.	G18-1687-10
Geol./ Eng.	RLG/JPN
Scale	NOT TO SCALE
Date	APRIL 2019

- Active or potentially active faults are not known to exist on the site.
- There are not any known landslides impacting the site.
- Laboratory test results of the soil indicate a **VERY LOW** expansion potential; a negligible potential for soluble sulfate attack on normal concrete (per T.H.E. Soils Co., Inc, 2006 preliminary geotechnical investigation report); and negligible chloride effects on reinforcing steel.
- Laboratory test results (per T.H.E. Soils Co., Inc, 2006 preliminary geotechnical investigation report) of the soil encountered indicated a mild corrosion potential to buried metals.
- The site is underlain by approximately 1 foot to 12 feet of potentially compressible topsoil, alluvium and weathered bedrock 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 alluvial soil.
- Based on a geotechnical perspective, the existing onsite soils appear to be suitable material for use as fill, provided that those are relatively free from rocks (larger than 8 inches in maximum dimension), construction debris, and organic material. It is anticipated that the onsite soil 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 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 33.6060° N, 117.1740°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)]	1.82
Mapped Spectral Response Acceleration Parameter, S_1 (for 1.0 second) [Table 1613.5.3(2)]	0.72
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]	1.82

Adjusted Maximum Considered Earthquake (MCE) Spectral Response Acceleration Parameter S_{M1} (1-second period) [Eq. 16-38]	1.09
Design Spectral Response Acceleration Parameter, S_{DS} (short period) [Eq. 16-39]	1.21
Design Spectral Response Acceleration Parameter, S_{D1} (1-second period) [Eq. 16-40]	0.72
Mean Peak Ground Acceleration (PGA_m)	0.70

6.0 GEOTECHNICAL DESIGN PARAMETERS

6.1 Shrinkage/Bulking and Subsidence

Volumetric changes in earth quantities will occur when excavated onsite soil are replaced as properly compacted fill. Table 3 contains 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
Topsoil	15% to 20% (Shrinkage)
Alluvium	15% to 20% (Shrinkage)
Weathered Bedrock	5% to 10% (Shrinkage)
Granitic Bedrock	0% to 5% (Bulking)

Subsidence due to recompaction of exposed overexcavation bottom prior to fill replacement, and placement of additional fill, is estimated to be about 0.10 foot to 0.15 foot.

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. Thus, these estimates should be used with some caution because those 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 shallow fill portion 4 feet or more below pad grade or 2 feet below proposed footings, whichever is deeper 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 12 feet	5 feet (minimum)
Greater than 4 feet	One-third the maximum thickness of fill placed on the "fill" portion (15 feet maximum)

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

6.3 Excavation Characteristics

It is anticipated that the onsite soil and bedrock may be excavated with conventional heavy-duty construction equipment. However, based on current subsurface exploration and experience in the general area, difficult trenching may be encountered in the bedrock, in the areas of trenches TR-3 and TR-4 below depths of approximately 4.5 feet to 6.0 feet.

TABLE 4
Excavation Characteristics

GEOLOGIC UNIT	Easy* Ripping	Moderately** Difficult Ripping	Oversized Material (>6 inches)
Topsoil	X		
Alluvium	X		
Weathered Bedrock	X		X
Granitic Bedrock		X	X

6.4 Compressible/Collapsible Soil

The upper topsoil, alluvium and weathered bedrock are known to be susceptible to varying degrees of settlement and/or hydro-consolidation (collapse) when a load is applied, or the soil is saturated. Consequently, these materials should be overexcavated to underlying competent bedrock as determined in the field during site grading by LGC personal and replaced as engineered fill.

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 County of Riverside, and in accordance with the following recommendations prepared by LGC. Grading should also be performed in accordance with the applicable provisions of the attached "General Earthwork and Grading Specifications for Rough Grading" (Appendix D) prepared by LGC, 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, LGC, 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 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 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 1 foot to 12 feet of potentially compressible topsoil, allvuivum, and weathered bedrock and is considered unsuitable for support of proposed fills, structures, and/or improvements, and should be overexcavated to expose underlying competent bedrock. Within the proposed building pad and walls, overexcavations should also be at least 4 feet below proposed grade, as well as provide a minimum of 2 feet of compacted fill below the proposed footings. The overexcavation should also extend at least 5 feet outside the building footprint (or a 1:1 projection away from the footing to the approved removal bottom, whichever is greater). Actual depths of overexcavation should be evaluated upon review of final grading and foundation plans and on the basis of observations and testing during grading by the project geotechnical consultant. Groundwater is not anticipated to be encountered during site grading.

The estimated locations, extent and approximate depths for overexcavation of unsuitable materials are indicated on the enclosed Geotechnical 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.

Prior to placing engineered fill, exposed bottom surfaces in each overexcavated area should first be scarified to a depth of approximately 6 inches, water-conditioned or air-dried as necessary to achieve a uniform water 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).

Sidewalls for overexcavations greater than 5 feet in height should not be 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 along existing improvements adjacent to the site without endangering those from caving or sloughing.

7.5 Fill Suitability

Earth materials which will be excavated during grading are generally considered suitable for use as compacted fill provided 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 least a minimum height of 4 feet, excavated into competent alluvium.

7.8 *Fill Placement*

Fills should be placed in lifts not greater than 8 inches in uncompacted thickness, water-conditioned or air-dried as necessary to achieve a uniform water content of at least optimum water content and then compacted in-place to a relative compaction of 90 percent or more. Fills should be maintained in a relatively level condition. The laboratory maximum dry density and optimum water 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 County of Riverside and California State requirements.

8.0 SLOPE CONSTRUCTION

8.1 *Slope Stability*

If cut and fill slopes are proposed, slope ratios of approximately 2:1 (H:V) or flatter and should be grossly and surficially stable.

8.2 *Fill Slopes*

Following overexcavation of unsuitable soil, fill slopes should be initiated on a key excavated into competent soil 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/or cohesionless soil, which will likely require stabilization by overexcavation and replacement with compacted fill.

8.4 *Temporary Excavations*

Based on the physical properties of the onsite soil, temporary excavations exceeding 5 feet in height may 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 LGC 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 footings. 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. The civil engineer is responsible for designing drain control devices on the site.

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 soil should generally be suitable as trench backfill provided those 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 soil 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 buried 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, or inside, 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 considered feasible for support of the proposed structures. Tentative footing 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 16-inch or more wide continuous footings founded in compacted fill 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 not greater than 3,500 psf.

10.3 Settlement

Based on the general settlement characteristics of compacted fill, as well as the aforementioned overexcavation recommendations and anticipated loading, it is estimated that the total settlement of conventional footings will be approximately 0.50 inch. Differential settlement is expected to be 0.25-inch over 30 feet. It is anticipated that the majority of the static 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 300 psf per foot of depth, to a maximum value of 2,000 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 100 psf per foot of depth to a maximum value of 800 psf. In addition, a coefficient of friction of 0.30 times the dead-load forces may be used between concrete and the supporting soil to determine lateral sliding resistance. 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 those have been excavated into competent bearing soil. The foundation excavations should be observed prior to the placement of forms, reinforcement or concrete. The trenches should be trimmed neat, level and square. Loose, sloughed or water-softened soil must be removed prior to concrete placement.

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

10.8 Expansive Soil Considerations

The results of laboratory testing indicate that onsite soil exhibits an expansion potential of **VERY 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 are likely to exist at the completion of rough grading. Furthermore, it should be noted that additional slab thickness, footing sizes and/or reinforcement more stringent than those recommended in the following should be provided as recommended by the project architect or structural engineer.

10.9 *Footing/Floor Slabs – Very Low Expansion Potential*

The following are our recommendations where foundation soils exhibit **VERY LOW** expansion potential as classified in accordance with 2016 CBC. 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.

- ***Footings***
  - Exterior continuous footings should be founded into compacted engineered fill below the lowest adjacent final pad grade at minimum depths of 12 inches for one-story, 18 inches for two-story and 24-inches for three-story construction, respectfully. 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 12-inches or more for one-story, 15 inches for two-story, and 18-inches for three-story structures.
  - Continuous footings should be reinforced with a minimum of two (2) No. 4 bars, one near top and one near bottom for one and two-story structures, subject to concurrence of the structural engineer.
  - Both interior and exterior pad footings should be 24 inches or more square for all structures founded at a depth of 18 inches or more for one and two-story structures, below the lowest adjacent grade. Footings should be reinforced in accordance with the structural engineer's recommendation.

- ***Floor Slabs***
  - Concrete floor slabs for one and two-story structures should be 4 inches or more thick and for three-story structures should be 5 inches or more thick with reinforcing beam No. 3 bars spaced 24 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 100% of optimum water content to promote uniform curing of the concrete and reduce the development of shrinkage cracks. The water content should penetrate to a minimum depth of 18 inches.

10.10 *Nonstructural Concrete Flatwork*

Concrete flatwork (such as walkways, driveways, patios, bicycle trails, etc.) has a high potential for cracking because of 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 outlined in Table 5. These guidelines will reduce the potential for irregular cracking and promote cracking along construction joints but will <u>not</u> eliminate all cracking or lifting. Thickening the concrete and/or adding additional reinforcement will further reduce cosmetic distress.

TABLE 5
MINIMUM NONSTRUCTURAL CONCRETE FLATWORK FOR LOW EXPANSIVE SOIL

	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 24 inches on centers	No. 3 at 24 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 soil 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 minimum amount of chloride ions in the soil environment that are corrosive to steel, either in the form of reinforcement protected by concrete cover, or plain steel substructures such as steel pipes or piles, is 500 ppm per California Test 532 and ACI 318R-05, Table 4.4.1.

The corrosion potential of the onsite materials was evaluated for its effect on steel and concrete. The corrosion potential was evaluated using the results of laboratory tests performed on representative samples obtained during the subsurface exploration. Laboratory testing was performed to evaluate pH, resistivity, chloride content, and soluble sulfate content. Based on the laboratory testing performed, the onsite soil are classified as having a **negligible** sulfate exposure condition in accordance with ACI 318R-05, Table 4.3.1, and **negligible** chloride exposure condition in accordance with ACI 318R-05, Table 4.4.1. Based on laboratory testing of on-site soil, it is also our opinion that onsite soil should be considered to have a **mild** corrosion risk to buried metals due to the mild resistivity. Metal piping should be corrosion-protected or consideration should be given to using plastic piping instead of metal.

Despite the minimum recommendation above, LGC is not a corrosion-engineering firm. Therefore, we recommend that you consult with a competent corrosion engineer and conduct additional testing (if required) to evaluate the actual corrosion potential of the site and to provide recommendations to reduce the corrosion potential with respect to the proposed improvements. The recommendations of the corrosion engineer may supersede the above requirements.

These recommendations are based on representative samples of the near surface engineered fill soil. The initiation of grading at the site could blend various soil types and import soil may be used locally. These changes made to the foundation soil 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 within properly compacted fill within competent material should be designed and embedded in accordance with paragraphs 10.2 and 10.4 at least 12 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 import material (with an expansion index of **20** or less and phi angle of internal friction of at least **35** degrees), for level or sloping backfill are presented in Table 7. **Onsite fill soil with an expansion index of greater than 20 should not be used as backfill because of its expansive nature.** Onsite soil should be screened of rocks and other material over 3 inches in diameter.

TABLE 6

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	30	30	45	46
At-Rest	55	55	55	55
Passive	275	275	275	275
Seismic	N/A	150	N/A	150

Sliding resistance may be based upon a friction coefficient of 0.30 may be used at the concrete and soil interface. Wall footings should be designed in accordance with structural considerations.

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

Place the base of retaining wall footings constructed on level ground may be founded at a depth of 18 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 slope, 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 nor 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 soil 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. Outlet pipes should be sloped to drain to a day light or to a suitable outlet. It should be noted that that recommended drainage pipes do 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 may 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 soil 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 1/2 inch to 3/4 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 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. That 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 sock covered perforated pipe (described above) may be included at the bottom of the encased drainage or, 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 cut 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 be directed to drain away from trench slopes. 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 soil (with an expansion index of 20 or less) should be placed in 6 inch to 8 inch loose lifts, watered or air-dried as necessary to achieve near optimum water conditions and compacted to at least 90 percent relative density (based on ASTM Test Methods D2922 and D3017).

13.0 PLAN REVIEWS AND CONSTRUCTION SERVICES

This report was prepared for the exclusive use of **Mr. Joseph Sapp** to assist his project engineer and architect in the design of the proposed 15.78-acre hotel and event center development. It is recommended that LGC be engaged to review the rough grading plans, storm-drain/storm water mitigation plans, structural plans, foundation 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 analyses should be performed to address areas of concern. If LGC is not accorded the opportunity to review those documents, LGC cannot take responsibility for misinterpretation of these 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), LGC should be retained to review its original design recommendations and applicability to the revised construction. If conditions are encountered during construction that appears to be different than those indicated in this report, LGC 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 engineers and geologists practicing in this or similar localities. Other warranties, expressed or implied, are **not** made as to the conclusions and professional advice included in this report. The subsurface observations and information contained herein are believed representative of the entire project; 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 LGC project geotechnical engineer and engineering geologist and the design(s) adjusted as required or alternate design(s) recommended.

The findings of this report may be modified upon performing future geotechnical/geologic evaluations. Also, changes in the conditions of a property can and do occur with the passage of time, whether those are 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 that necessary steps are taken to confirm that the contractor and/or subcontractor properly implements the recommendations during construction 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 that 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 adopted 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 the result of 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.

APPENDIX A

REFERENCES

APPENDIX A

References

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.

California Department of Water Resources, Water Data Library, Groundwater Levels for Station 336070N1171745W001 http://wdl.water.ca.gov/waterdatalibrary/groundwater/hydrographs/brr_hydro.cfm?CFGRIDKEY=31712 accessed February 27, 2019.

California Division of Mines and Geology, 1996, "Probabilistic Seismic Hazard Assessment for the State of California", DMG Open File Report 96-08, USGS Open File Report 96-706.

California Division of Mines and Geology, 1997, "Guidelines for Evaluating and Mitigating Seismic Hazards in California" Special Publication 117.

EQFAULT, Seismic Hazard Analysis, (33.6060, -117.1740), accessed February 27, 2019.

Kennedy, M.P., and Morton, D.M., Preliminary Geologic Map of The Murrieta 7.5' Quadrangle Riverside County, California: A Digital Database, Version 1.0, USGS.

Mann, J.F., 1955, Geology of a Portion of the Elsinore Fault Zone, Division of Mines Special Report 43, dated October 1955.

Morton, D.M., Preliminary Digital Geologic Map of the Santa Ana 30'X60' Quadrangle, Southern California, Version 2.0, USGS California 2004.

OSHPD, U.S. Seismic Design Maps, Latitude: 33.6060°N, Longitude: -117.1740°W, Site Soil Classification "D", Risk Category I/II/III, accessed February 27, 2019.

Riverside County Open Data, http://data-countyofriverside.opendata.arcgis.com, Natural Hazards, Faults, accessed January 15, 2019

Riverside County Open Data, http://data-countyofriverside.opendata.arcgis.com, Natural Hazards, Fault Zones, accessed January 15, 2019

Summa Architecture, Site Plan – Sapphire, City of Murrieta, County of Riverside, California, Scale 1"=50', dated March 22, 2019

T.H.E Soils Co., Inc., "Preliminary Geotechnical Investigation, Proposed Retail/Professional/Medical Development "The Grove at Oak Creek" APN: 359-530-008, 35451 McElwain Road, City of Murrieta, Riverside County, California, Work Order No. 784501.00". Dated January 26, 2006.

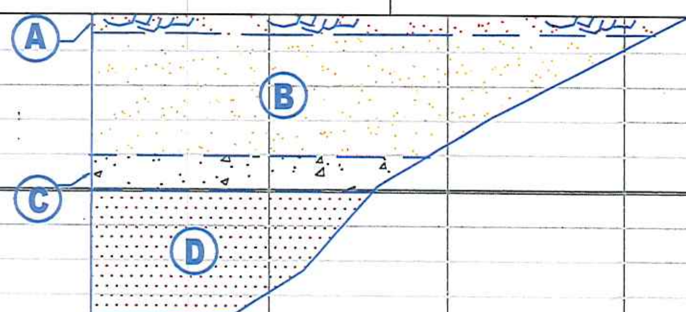
T.H.E. Soils Co., Inc., Geotechnical Map for Proposed Industrial/Professional/Medical Development "The Grove @ Oak Creek" Scale 1"=60' plate 1 of 1, dated January 2006.

APPENDIX B

LGC TRENCH LOGS

Project Name: MCELWAIN		Logged by: AJR/RGG		LOG OF TRENCH TR-1			
Project Number: G18-1687-10		Elevation: 1570'		Engineering Properties			
Equipment: BACKHOE		Location/Grid: SEE GEOTECHNICAL MAP					
Depth	Date: 2/25/2019	Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
0.0'-0.6'	A	TOPSOIL: Silty SAND; reddish brown to gray brown, damp, loose, very fine to medium grained with occasional coarse grains, pores, desiccated, roots and roothairs		SM	Bag-1 @ 0.0'-4.0'		
0.6'-4.0'	B	ALLUVIUM: Silty SAND; dark brown to red brown, moist, loose to medium dense, very fine to medium grained, pores, root hairs, upper 2 feet: electrical wire, trash, and plastic pieces	Afu	SM	Nuke @ 2.0' S-1 @ 2.0'-4.0'	11.8	92.2
4.0'-5.0'	C	WEATHERED BEDROCK: Silty SAND/Well Graded SAND; yellowish brown, damp, moderately hard to hard, very fine to coarse grained, rock fragments, oxidation staining, trace root hairs, severely weathered		SM/SW	Bag-2 @ 5.0'-6.0'		
5.0'-8.5'	D	GRANITIC BEDROCK: blackish gray to blackish yellow, damp, hard, oxidation staining, slight clayey matrix, friable, moderately weathered	Kpvg				

GRAPHICAL REPRESENTATION: EAST WALL | **SCALE: 1" = 5'** | **SURFACE SLOPE: LEVEL** | **TREND: N50E**



TOTAL DEPTH = 8.5 FEET
NO GROUNDWATER ENCOUNTERED

Project Name: MCELWAIN | Logged by: AJR/RGG | **LOG OF TRENCH TR-2**

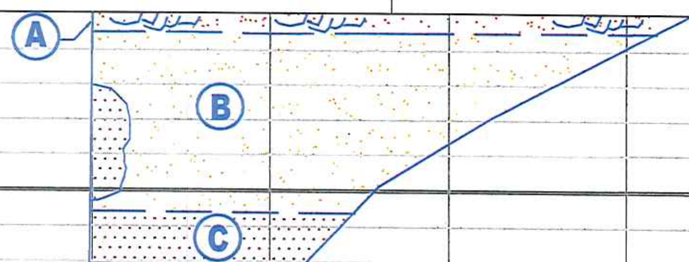
Project Number: G18-1687-10 | Elevation: 1564'

Equipment: BACKHOE | Location/Grid: SEE GEOTECHNICAL MAP

Engineering Properties

Depth	Date: 2/25/2019 Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
0.0'-0.4'	A TOPSOIL: Silty SAND; dark reddish brown, damp to moist, loose, very fine to medium grained, desiccated, roots and roothairs		SM	Nuke @ 0.0' S-2 @ 0.0'	10.6	98.6
0.4'-5.5'	B ALLUVIUM: Silty SAND; dark reddish brown, moist, loose to medium dense, very fine to fine grained, some coarse grains, pinhole pores, root hairs, trace granitic boulders, micaceous		SM	Bag-3 @ 0.0'-5.0'		
5.5'-7.0'	C GRANITIC BEDROCK: grayish white to dark orange, dry to damp, hard to very hard, some oxidation staining, slightly weathered			Bag-4 @ 5.5'-6.5' S-3 @ 6.5' Nuke @ 7.0'	2.5	107.8

GRAPHICAL REPRESENTATION: EAST WALL | SCALE: 1" = 5' | SURFACE SLOPE: LEVEL | TREND: N82E

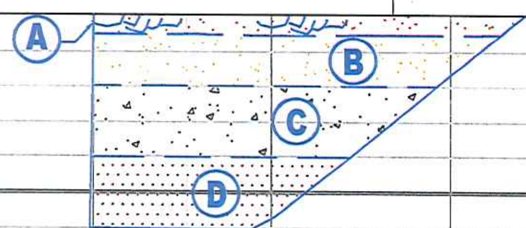


TOTAL DEPTH = 7.0 FEET
NO GROUNDWATER ENCOUNTERED

Project Name: MCELWAIN	Logged by: AJR/RGG	LOG OF TRENCH TR-3
Project Number: G18-1687-10	Elevation: 1563'	Engineering Properties
Equipment: BACKHOE	Location/Grid: SEE GEOTECHNICAL MAP	

Depth	Date: 2/25/2019 Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
0.0'-0.5'	A TOPSOIL: Silty SAND; dark reddish brown, moist, loose, very fine to fine grained, desiccated, pores, roots and roothairs		SM	Bag-6 @ 0.0'-3.0'		
0.5'-2.0'	B ALLUVIUM: Silty SAND; medium to dark brown, moist, loose to medium dense, fine to medium grained, micaceous		SM			
2.0'-4.0'	C GRANITIC BEDROCK: reddish orange brown, moist, moderately hard, very fine to coarse grained, clayey matrix, manganese staining, micaceous, very weathered	Kvpg		Nuke @ 2.0' S-4 @ 2.0' Bag-5 @ 4.0'-6.0'	10.9	127.8
4.0'-6.0'	D grayish white to dark orange brown, damp to moist, hard to very hard oxidation staining, slight clayey matrix, moderately weathered @ 6.0' becoming very hard					

GRAPHICAL REPRESENTATION: EAST WALL | **SCALE: 1" = 5'** | **SURFACE SLOPE: LEVEL** | **TREND: N45E**

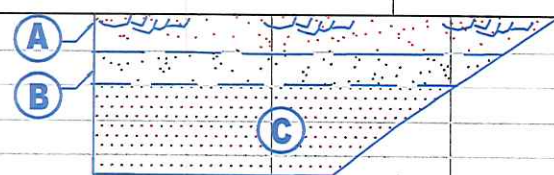


TOTAL DEPTH = 6.0 FEET
NO GROUNDWATER ENCOUNTERED

Project Name: MCELWAIN	Logged by: AJR/RGG	LOG OF TRENCH TR-4
Project Number: G18-1687-10	Elevation: 1560'	Engineering Properties
Equipment: BACKHOE	Location/Grid: SEE GEOTECHNICAL MAP	

Depth	Date: 2/25/2019 Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
0.0'-1.0'	A <u>TOPSOIL:</u> Clayey SAND; medium olive brown, damp to moist, medium dense, very fine to fine grained, occasional coarse grains, micaceous, roothairs, desiccated, pores and pinhole pores		SC	Nuke @ 0.0' S-6 @ 0.0' Bag-8 @ 0.0'	21.27	122.6
1.0'-2.0'	B <u>GRANITIC BEDROCK:</u> dark olive brown, moist to damp, moderately hard, very fine to coarse grained, oxidation staining, manganese staining, mottling, pores, rock fragments, micaceous	Kvpg		Nuke @ 2.0' S-5@2.0' Bag-7@2.0'-4.0'	8.28	134.6
2.0'-4.5'	C olive to gray brown, dry to damp, hard to very hard, trace of oxidation staining @4.5', becoming very dense, practical refusal					

GRAPHICAL REPRESENTATION: EAST WALL | SCALE: 1" = 5' | SURFACE SLOPE: LEVEL | TREND: N12W

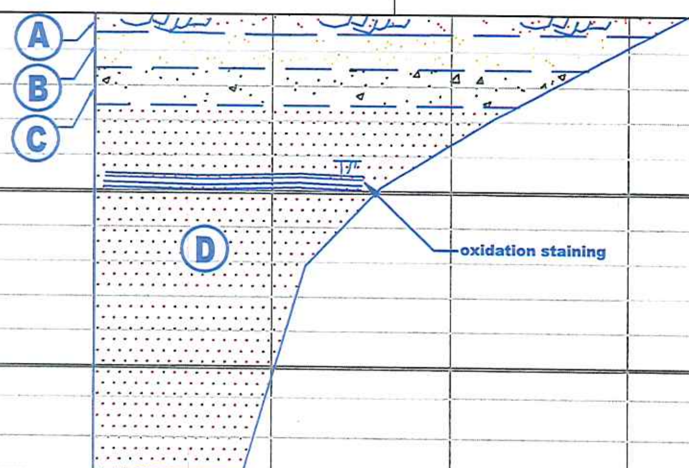


TOTAL DEPTH = 7.0 FEET
NO GROUNDWATER ENCOUNTERED

Project Name: MCELWAIN	Logged by: AJR/RGG	LOG OF TRENCH TR-5
Project Number: G18-1687-10	Elevation: 1572'	Engineering Properties
Equipment: BACKHOE	Location/Grid: SEE GEOTECHNICAL MAP	

Depth	Date: 2/25/2019 Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
0.0'-0.5'	A TOPSOIL: Silty SAND; dark reddish brown, damp to moist, loose to medium dense, very fine to fine grained, roots and roothairs, pores and pinhole pores, desiccated		SM			
0.5'-1.5'	B ALLUVIUM: Sandy CLAY; medium brown, moist to damp, medium dense, very fine-grained, micaceous		SC			
1.5'-2.5'	C WEATHERED BEDROCK: Clayey SAND; dark gray to gray reddish brown, moist to damp, hard to very hard, very fine to coarse grained, pinhole pores, mottling, oxidation staining, severely weathered		SC/SW			
2.5'-13.0'	D GRANITIC BEDROCK: light yellow orange to olive gray, damp, hard, fine to coarse grained, oxidation staining, manganese staining, friable, moderately weathered	Kpvg		Bag-9 @ 5.0'-10.0'		

GRAPHICAL REPRESENTATION: EAST WALL | SCALE: 1" = 5' | SURFACE SLOPE: LEVEL | TREND: N56E



TOTAL DEPTH = 13.0 FEET
NO GROUNDWATER ENCOUNTERED

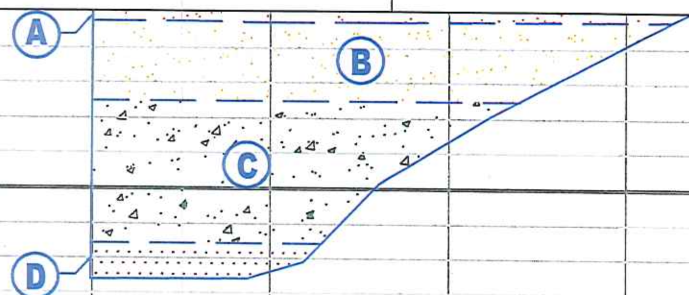
Project Name: MCELWAIN | **Logged by: AJR/RGG** | **LOG OF TRENCH TR-6**

Project Number: G18-1687-10 | **Elevation: 1582'** | **Engineering Properties**

Equipment: BACKHOE | **Location/Grid: SEE GEOTECHNICAL MAP**

Depth	Date: 2/25/2019 Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
0.0'-0.2'	A TOPSOIL: Clayey SAND; dark reddish brown, damp to moist, medium dense, very fine to finegrained, blocky, roots and roothairs, pores		SC	Nuke @ 0.0' S-8 @ 0.0' Bag-11 @ 0.0'		
0.2'-2.5'	B ALLUVIUM: Clayey SAND; gray brown, damp to moist, medium dense, very fine to finegrained, occasional coarse grains, occasional rock fragments, pores and pinhole pores		SC			
2.5'-6.5'	C GRANITIC BEDROCK: olive gray brown, damp, moderately hard to hard, very fine- to medium-grained, slight clayey matrix, trace granitic boulders, abundant manganese staining, abundant oxidation staining, moderately weathered	Kvpg		Bag-10 @ 2.5'-6.5'		
6.5'-7.5'	D Light yellow orange, damp, hard to very hard, fine-to coarse grained, friable, slightly weathered			Nuke @ 6.5' S-7 @ 6.5'	26.4/30.0	114.4

GRAPHICAL REPRESENTATION: EAST WALL | **SCALE: 1" = 5'** | **SURFACE SLOPE: LEVEL** | **TREND: N83E**

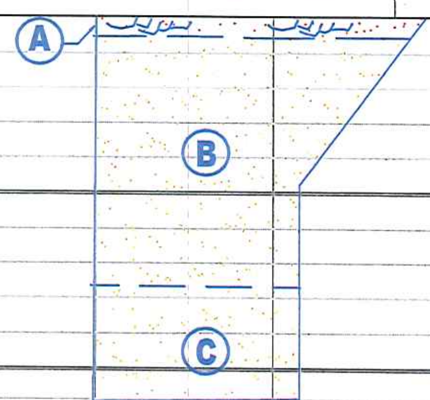


TOTAL DEPTH = 7.5 FEET
NO GROUNDWATER ENCOUNTERED

Project Name: MCELWAIN	Logged by: RGG	LOG OF TRENCH IT-4
Project Number: G18-1687-10	Elevation: 1557'	Engineering Properties
Equipment: BACKHOE	Location/Grid: SEE GEOTECHNICAL MAP	

Depth	Date: 2/25/2019 Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
0.0'-0.5'	A TOPSOIL: Silty SAND; medium brown, damp to moist, loose, very fine to fine grained, roothairs, desiccated, pores		SM			
0.5'-7.5'	B ALLUVIUM: Silty SAND, medium brown, moist, loose to medium dense, very fine to fine grained grained, occasional coarse grains, micaceous		SM			
7.5'-11.0'	WEATHERED BEDROCK: Silty SAND; light brown, damp, medium dense, very fine to fine grained, with some medium grains and coarse grains, occasional 6- to 8-inch cobbles @11.0' becoming very dense, practical refusal		SM			

GRAPHICAL REPRESENTATION: EAST WALL | SCALE: 1" = 5' | SURFACE SLOPE: LEVEL | TREND: N75E



TOTAL DEPTH =11.0 FEET
NO GROUNDWATER
ENCOUNTERED

APPENDIX B-1

TRENCH LOGS FROM T.H.E. SOILS CO., INC. (January 26, 2006)

LOGGED BY: JPF	METHOD OF EXCAVATION: CASE 580 SUPERM EXTENDA BACKHOE W/24" BUCKET ELEVATION: ± 1580	DATE OBSERVED: 11/23/05 LOCATION: SEE GEOTECHNICAL MAP

DEPTH (FEET)	CLASSIFICATION	BLOWS/FOOT	UNDISTURBED SAMPLE	BULK SAMPLE	MOISTURE CONTENT(%)	INPLACE DRY DENSITY (PCF)	TEST PIT NO. 1 DESCRIPTION	SOIL TEST
0–5				V–Λ			GRANITIC BEDROCK SILTY SAND (SM): TOP 1'FT IS WEATHERED, DRY, LOOSE COARSE GRAINED, YELLOW BROWN, COARSE GRAINED, FRIABLE, BECOMING DENSER WITH DEPTH	MAXIMUM DENSITY/OPTIMUM MOISTURE CONTENT (MAX), DIRECT SHEAR (DS), SIEVE ANALYSIS (SA), EXPANSION INDEX (EI), SAND EQUIVALENT (SE), CORROSIVITY SUITE (COR)
5								
10							TOTAL DEPTH = 5.0'	
15								
20								
25								
30								
35								
40								

JOB NO: 958501.00	LOG OF TEST PIT	FIGURE: T-1

LOGGED BY: JPF	METHOD OF EXCAVATION: CASE 580 SUPERM EXTENDA BACKHOE W/24" BUCKET ELEVATION: ± 1556	DATE OBSERVED: 11/23/05 LOCATION: SEE GEOTECHNICAL MAP

DEPTH (FEET)	CLASSIFICATION	BLOWS/FOOT	UNDISTURBED SAMPLE	BULK SAMPLE	MOISTURE CONTENT(%)	INPLACE DRY DENSITY (PCF)	TEST PIT NO. 2 DESCRIPTION	SOIL TEST
							UNDIFFERENTIATED ALLUVIUM/COLLUVIUM SILTY SAND (SM): DARK GRAY BROWN, FINE TO MEDIUM GRAINED, LOOSE, MOIST	
5							GRANITIC BEDROCK DARK GREENISH GRAY, FINE TO MEDIUM GRAINED, DENSE, FRIABLE, SLIGHTLY WEATHERED	
10							TOTAL DEPTH = 7.0' NO GROUNDWATER	
15								
20								
25								
30								
35								
40								

JOB NO: 958501.00	LOG OF TEST PIT	FIGURE: T-2

LOGGED BY: JPF	METHOD OF EXCAVATION: CASE 580 SUPERM EXTENDA BACKHOE W/24" BUCKET ELEVATION: ± 1576	DATE OBSERVED: 11/23/05 LOCATION: SEE GEOTECHNICAL MAP

DEPTH (FEET)	CLASSIFICATION	BLOWS/FOOT	UNDISTURBED SAMPLE	BULK SAMPLE	MOISTURE CONTENT(%)	INPLACE DRY DENSITY (PCF)	TEST PIT NO. 3 DESCRIPTION	SOIL TEST
0–5							GRANITIC BEDROCK REDDISH BROWN, FINE TO COARSE GRAINED, DRY, LOOSE, WEATHERED TO CLAYEY SILTY SAND COARSE GRAINED, YELLOW BROWN, FRIABLE IN TOP 1-FT, BECOMING EXTREMELY HARD AND DIFFICULT TO EXCAVATE	
5–40							TOTAL DEPTH = 5.0' NO GROUNDWATER	

JOB NO: 958501.00	LOG OF TEST PIT	FIGURE: T-3

LOGGED BY: JPF	METHOD OF EXCAVATION: CASE 580 SUPERM EXTENDA BACKHOE W/24" BUCKET ELEVATION: ± 1557	DATE OBSERVED: 11/23/05 LOCATION: SEE GEOTECHNICAL MAP

DEPTH (FEET)	CLASSIFICATION	BLOWS/FOOT	UNDISTURBED SAMPLE	BULK SAMPLE	MOISTURE CONTENT(%)	INPLACE DRY DENSITY (PCF)	TEST PIT NO. 4 DESCRIPTION	SOIL TEST
							OLDER ALLUVIUM SILTY SAND (SM): DARK YELLOW BROWN, FINE TO COARSE GRAINED, DRY, LOOSE, ABUNDANT PINPOINT PORES AND FINE ROOTS	
5							SILTY SAND (SM): DARK BROWN, FINE TO MEDIUM GRAINED, MINOR COARSE, MODERATELY GRADED, MEDIUM DENSE TO DENSE, BECOMING DENSER WITH DEPTH, SLIGHTLY MOIST	
10								
							TOTAL DEPTH = 10.0' NO GROUNDWATER	
15								
20								
25								
30								
35								
40								

JOB NO: 958501.00	LOG OF TEST PIT	FIGURE: T-4

LOGGED BY: JPF	METHOD OF EXCAVATION: CASE 580 SUPERM EXTENDA BACKHOE W/24" BUCKET ELEVATION: ± 1566	DATE OBSERVED: 11/23/05 LOCATION: SEE GEOTECHNICAL MAP

DEPTH (FEET)	CLASSIFICATION	BLOWS/FOOT	UNDISTURBED SAMPLE	BULK SAMPLE	MOISTURE CONTENT(%)	INPLACE DRY DENSITY (PCF)	TEST PIT NO. 5 DESCRIPTION	SOIL TEST
				V–Λ			OLDER ALLUVIUM SILTY SAND (SM): DARK YELLOW BROWN, FINE TO MEDIUM GRAINED, COARSE GRAINED, DRY AND LOOSE WITH NUMEROUS PINPOINT PORES IN TOP 3-FT	MAX, DS, SA, EI, SE, COR
5							SILTY SAND (SM): DARK BROWN, FINE GRAINED, MINOR MEDIUM AND COARSE, MODERATELY GRADED, MEDIUM DENSE, SLIGHTLY MOIST, BECOMING DENSER WITH DEPTH	
							GRANITIC BEDROCK ORANGISH BROWN, COARSE GRAINED, FRIABLE, DENSE, DIFFICULT EXCAVATION	
10								
							TOTAL DEPTH = 8.0' **NO GROUNDWATER**	
15								
20								
25								
30								
35								
40								

JOB NO: 958501.00	LOG OF TEST PIT	FIGURE: T-5

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 soil. Soil test specimens 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: Soil were classified according the Unified Soil Classification System (USCS) in accordance with ASTM Test Methods D2487 and D2488. This system relies on the Atterberg Limits and grain size distribution of a soil. The soil classifications (or group symbol) are shown on the laboratory test data and boring log.

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

SAMPLE LOCATION	SAMPLE DESCRIPTION (USCS)	MAXIMUM DRY DENSITY (% by weight)	OPTIMUM WATER CONTENT (%)
TR-2 @ 0'-5'	Silty SAND (SM)	132.3	8.3
TR-4 @ 2'-4'	Granitic Bedrock (Kpvg)	144.7	7.0

Chloride Content: Chloride content was tested with CTM 422. The results are presented in the table below:

SAMPLE LOCATION	SAMPLE DESCRIPTION	CHLORIDE CONTENT (ppm)
TR-2 @ 0'-5'	Silty SAND (SM)	21
TR-6 @ 2.5'-6.5'	Well-Graded SAND (SW)	53

Direct Shear: A direct shear test was performed on a selected remolded samples, (3 test specimens) which were soaked for a minimum of 24 hours under a surcharge equal to the applied normal force during testing. After transfer of the soil specimen into the shear box, and reloading, pore pressures set up in the sample because of the load transfer were allowed to dissipate for a period of approximately 1 hour prior to application of shearing force. The samples were tested under various normal loads, a motor-driven, strain-controlled, direct-shear testing apparatus at a strain rate of about 0.005 inch per minute (depending upon the soil/bedrock type). The test results are presented in the table present below:

SAMPLE LOCATION	SAMPLE DESCRIPTION	ANGLE OF INTERNAL FRICTION (degrees)	COHESION (pcf)
TR-2 @ 0'-5'	Silty SAND (SM)	35	90

Expansion Index Tests: Expansion Index of selected samples was evaluated in accordance with ASTM D4829. Specimens are molded under a given compactive energy to approximately the optimum water 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
TR-4 @ 0'	Clayey SAND (SC)	9	Very Low

APPENDIX C-1

LABORATORY TEST RESULTS FROM T.H.E. SOILS CO., INC.
(January 26, 2006)

TABLE I EXPANSION INDEX		
TEST LOCATION	EXPANSION INDEX	EXPANSION POTENTIAL
T-1 @ 0–4.5 ft	0	VERY LOW
T-5 @ 0–5 ft	0	VERY LOW

TABLE II MAXIMUM DENSITY/OPTIMUM MOISTURE RELATIONSHIP ASTM D 1557		
TEST LOCATION	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE (%)
T-1 @ 0–4.5 ft	128.9	8.4
T-5 @ 0–5 ft	131.2	7.4

TABLE III SAND EQUIVALENT ASTM D 2419		
TEST LOCATION	SAND EQUIVALENT	SOIL TYPE
T-1 @ 0–4.5 ft	78	Yellow Brown Granitic Bedrock
T-5 @ 0–5 ft	56	Dark Yellow Brown Silty Sand

TABLE IV SULFATE CONTENT	
TEST LOCATION	SULFATE CONTENT
T-1 @ 0–4.5 ft	Non Detected ppm
T-5 @ 0–5 ft	Non Detected ppm

Figure C-1

TABLE V CORROSIVITY SUITE				
TEST LOCATION	SATURATED RESISTIVITY	pH	REDOX POTENTIAL	SULFIDE
T-1 @ 0–4.5 ft	13,000	6.1	100	Negative
T-5 @ 0–5 ft	11,000	6.9	170	Negative

Figure C-1A

APPENDIX D

GENERAL EARTHWORK AND GRADING SPECIFICATIONS FOR ROUGH GRADING

APPENDIX D

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 water-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, water-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 water 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, trees, boulders 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 soil 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. Soil 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 soil 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 water content throughout.

4.2 ***Fill Water Conditioning:*** Fill soil shall be watered, dried back, blended, and/or mixed, as necessary to attain relatively uniform water content at or slightly over optimum. Maximum density and optimum soil water 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 water-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 water content and relative compaction of the fill soil 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 soil 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:***

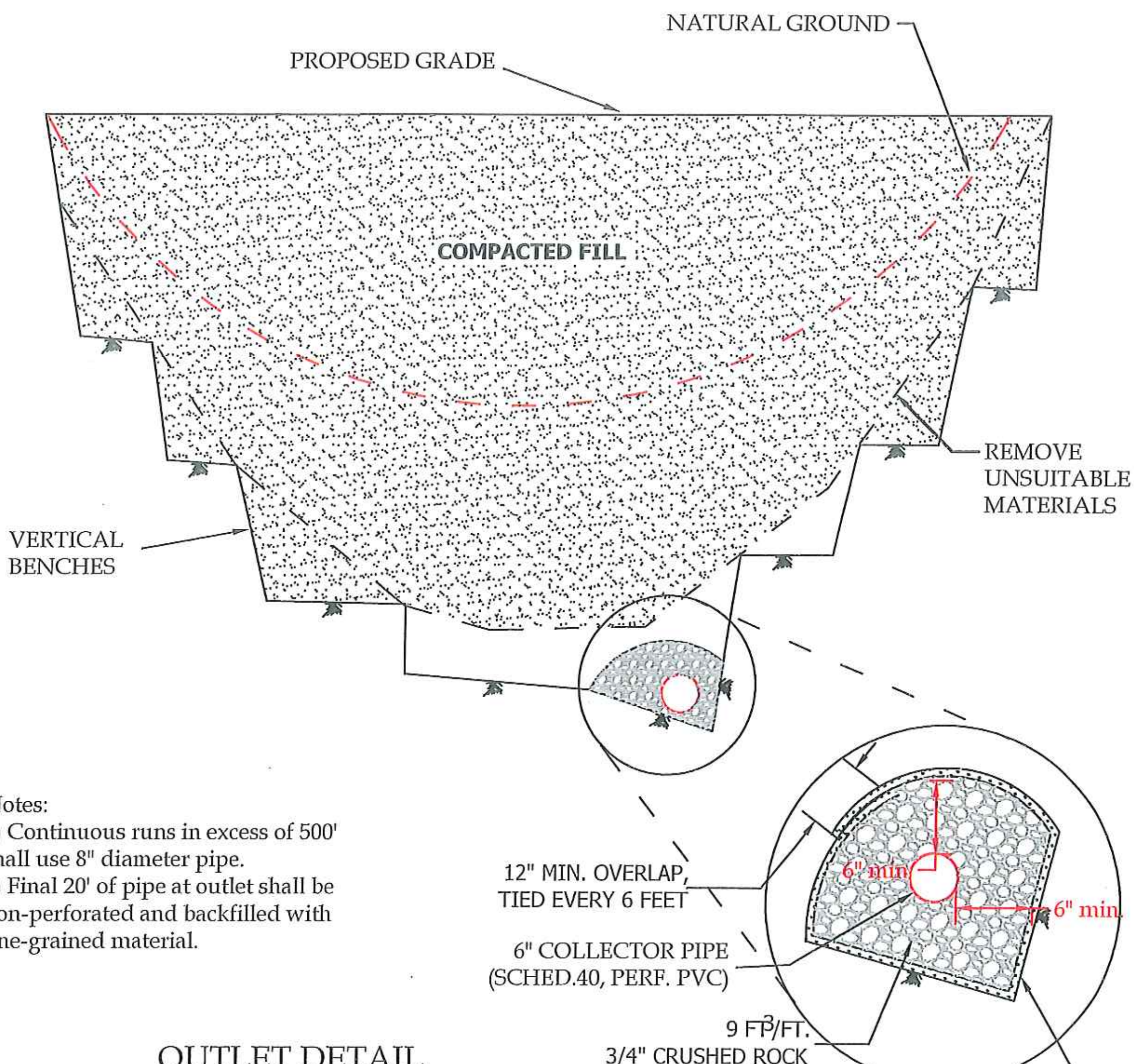
The Geotechnical Consultant shall document the approximate elevation and horizontal coordinates of each test location. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so that the Geotechnical Consultant can determine the test locations 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.

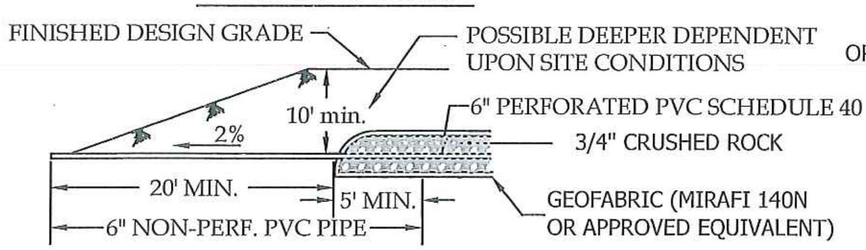
APPENDIX E

CONSTRUCTION DETAILS



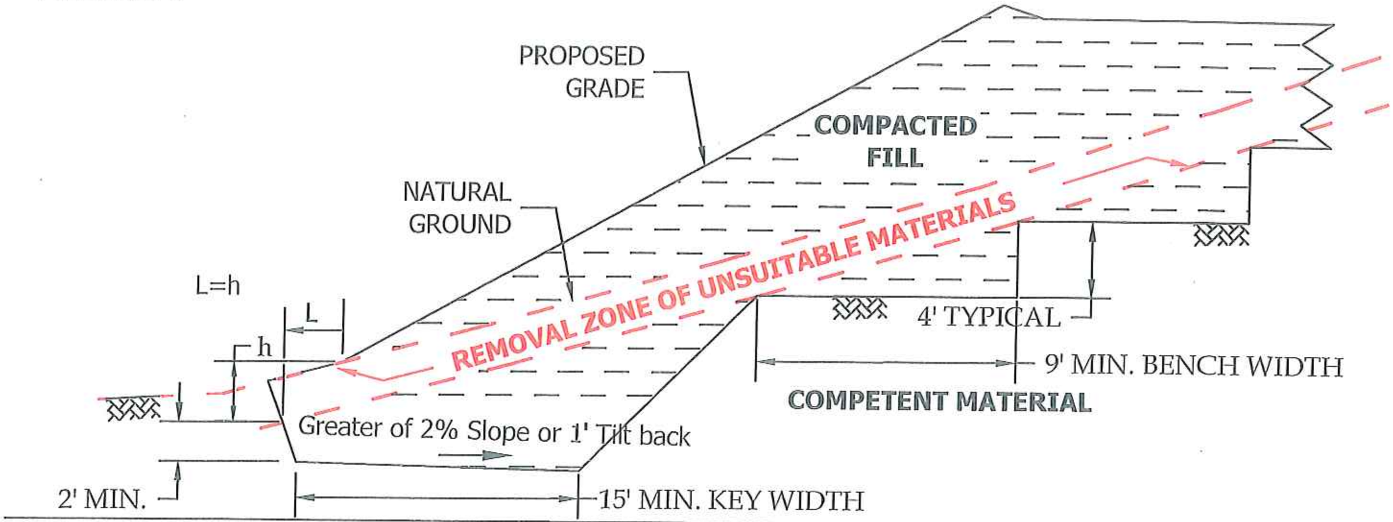
Notes:
1) Continuous runs in excess of 500' shall use 8" diameter pipe.
2) Final 20' of pipe at outlet shall be non-perforated and backfilled with fine-grained material.

OUTLET DETAIL

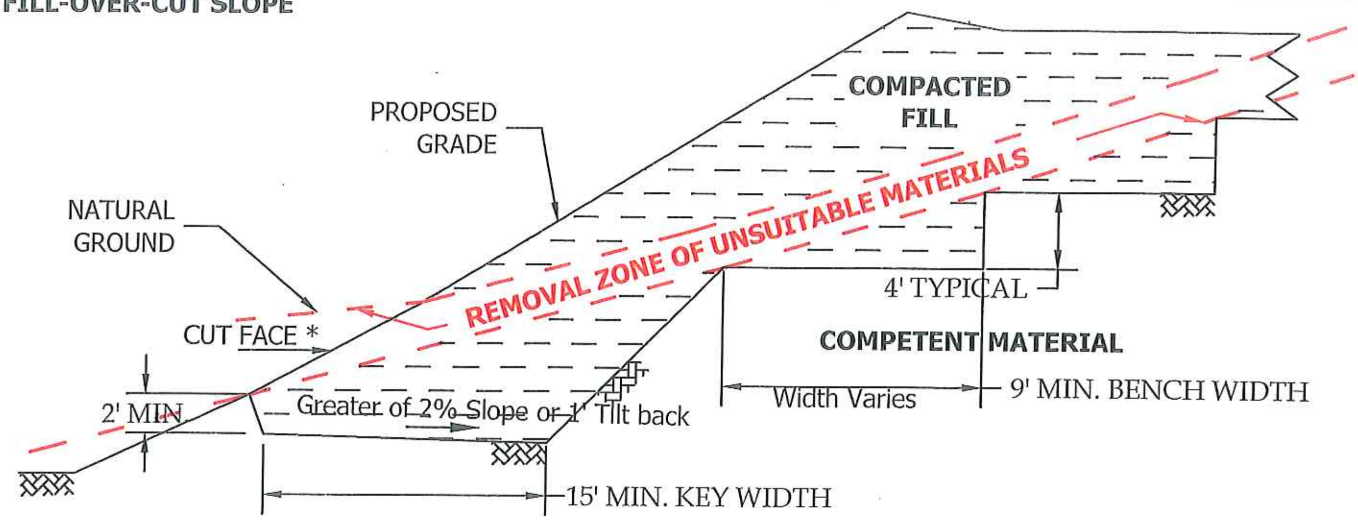


CANYON & STREET SUBDRAINS

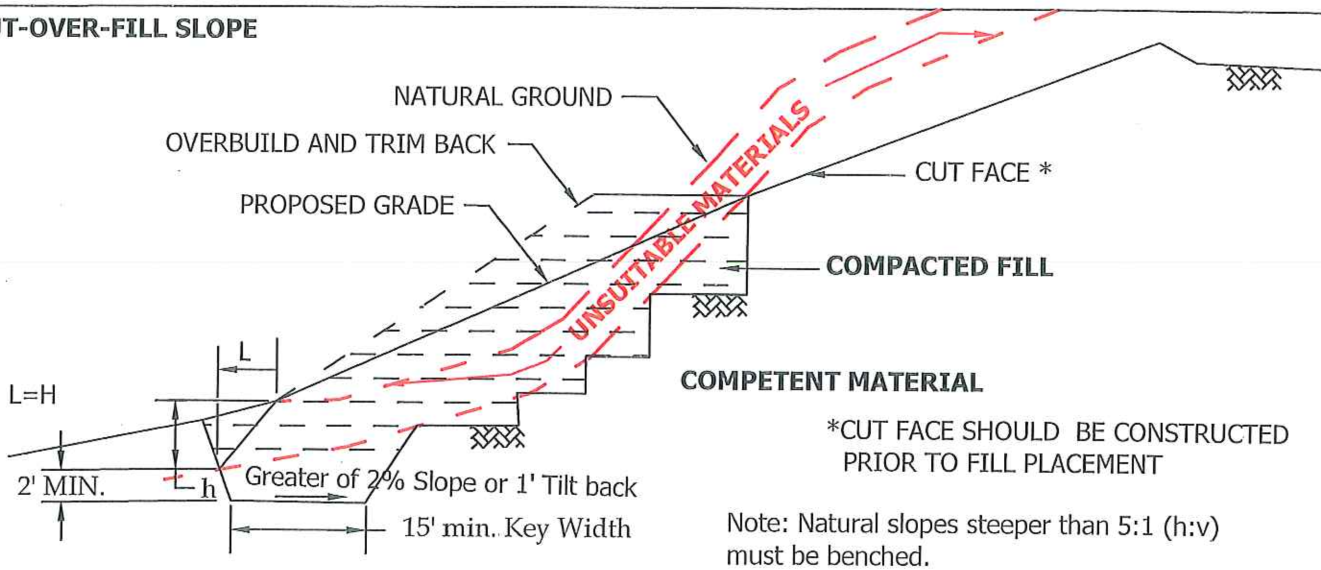
FILL SLOPE



FILL-OVER-CUT SLOPE



CUT-OVER-FILL SLOPE

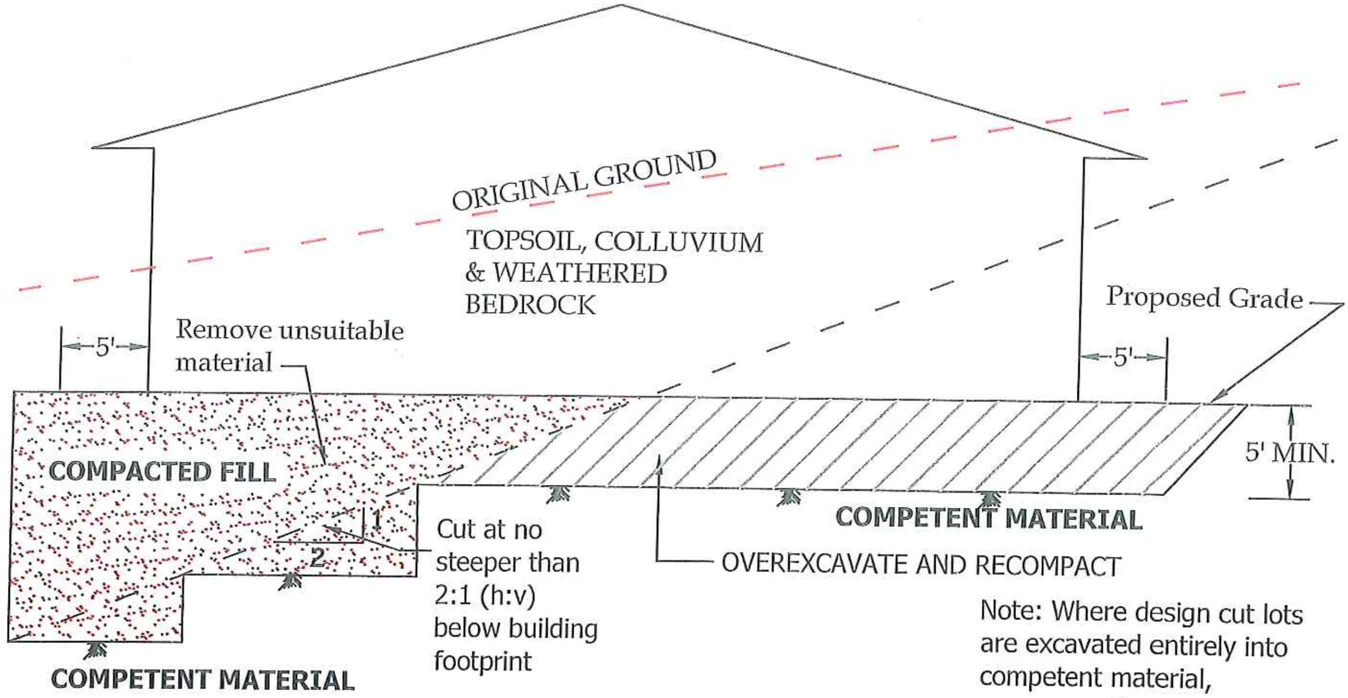


*CUT FACE SHOULD BE CONSTRUCTED PRIOR TO FILL PLACEMENT

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

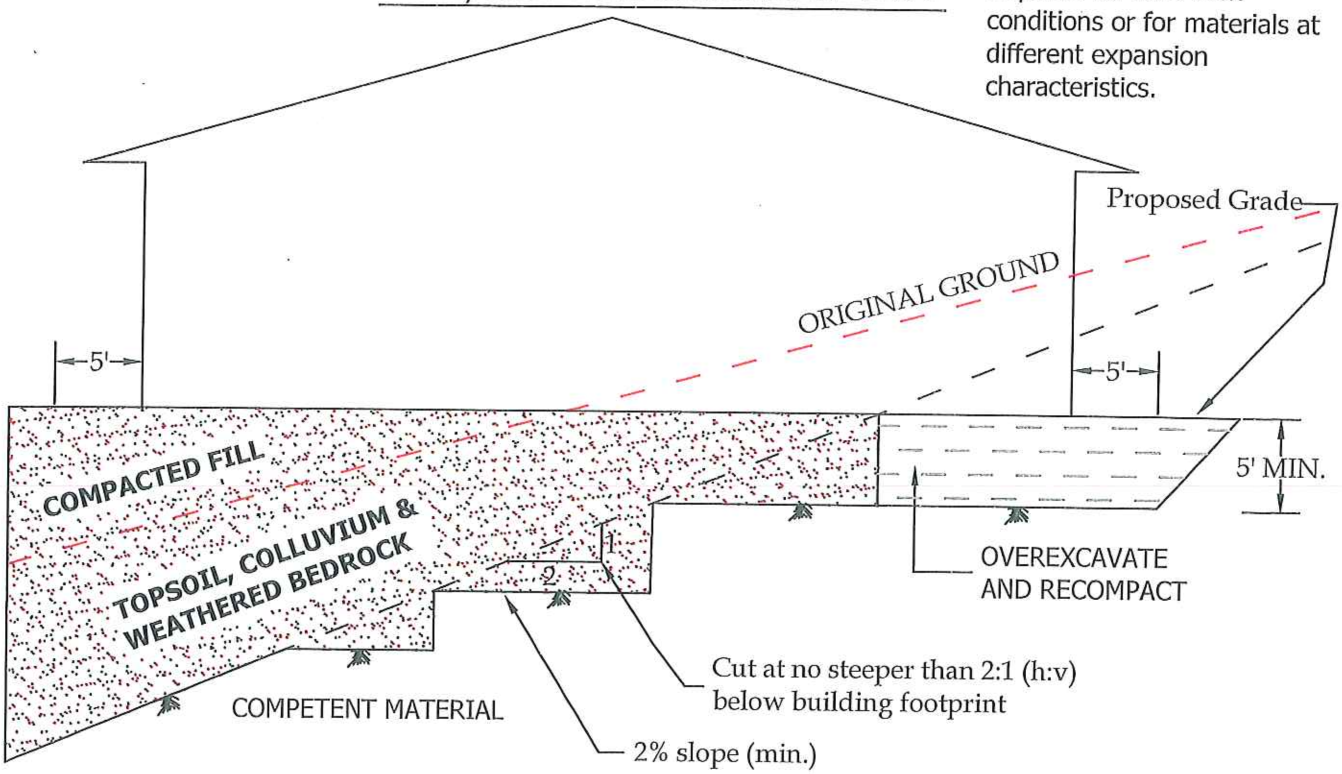
KEYING AND BENCHING

CUT LOT
(Exposing Unsuitable Soils/Bedrock @ Design Grade)

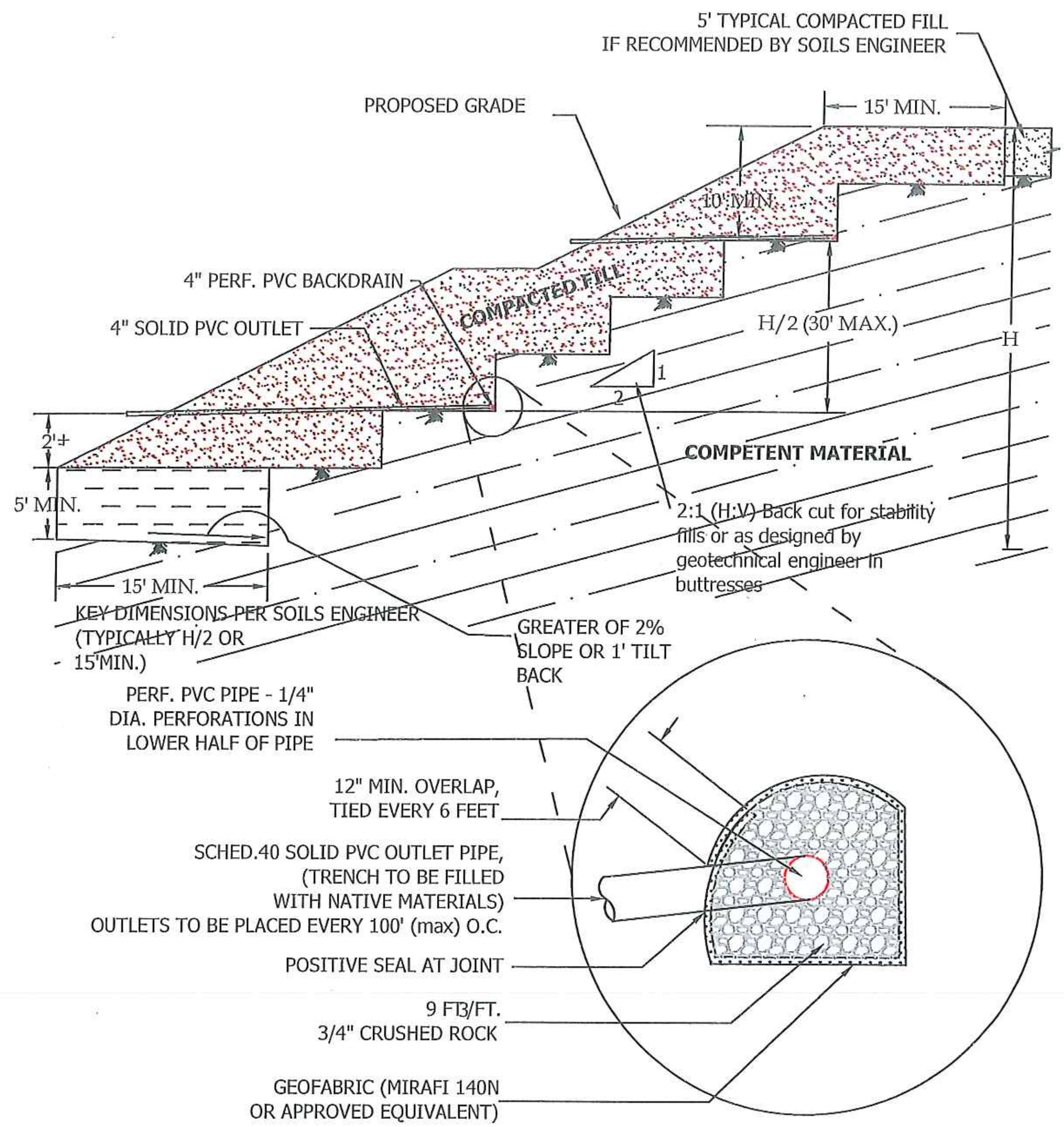


Note: Where design cut lots are excavated entirely into competent material, overexcavation may still be required for hard-rock conditions or for materials at different expansion characteristics.

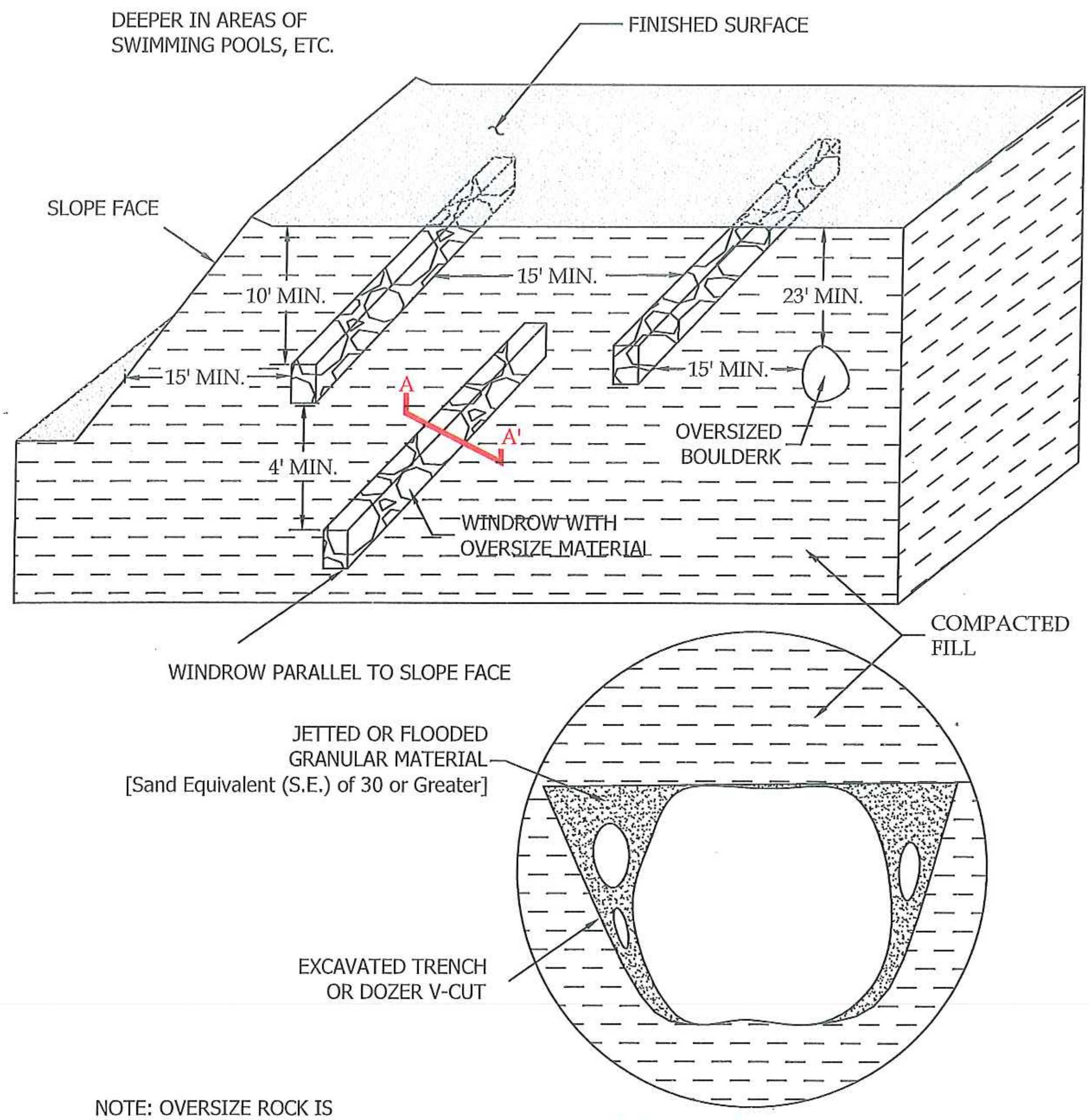
CUT/FILL TRANSITION LOT



TRANSITION LOT OVEREXCAVATION DETAIL



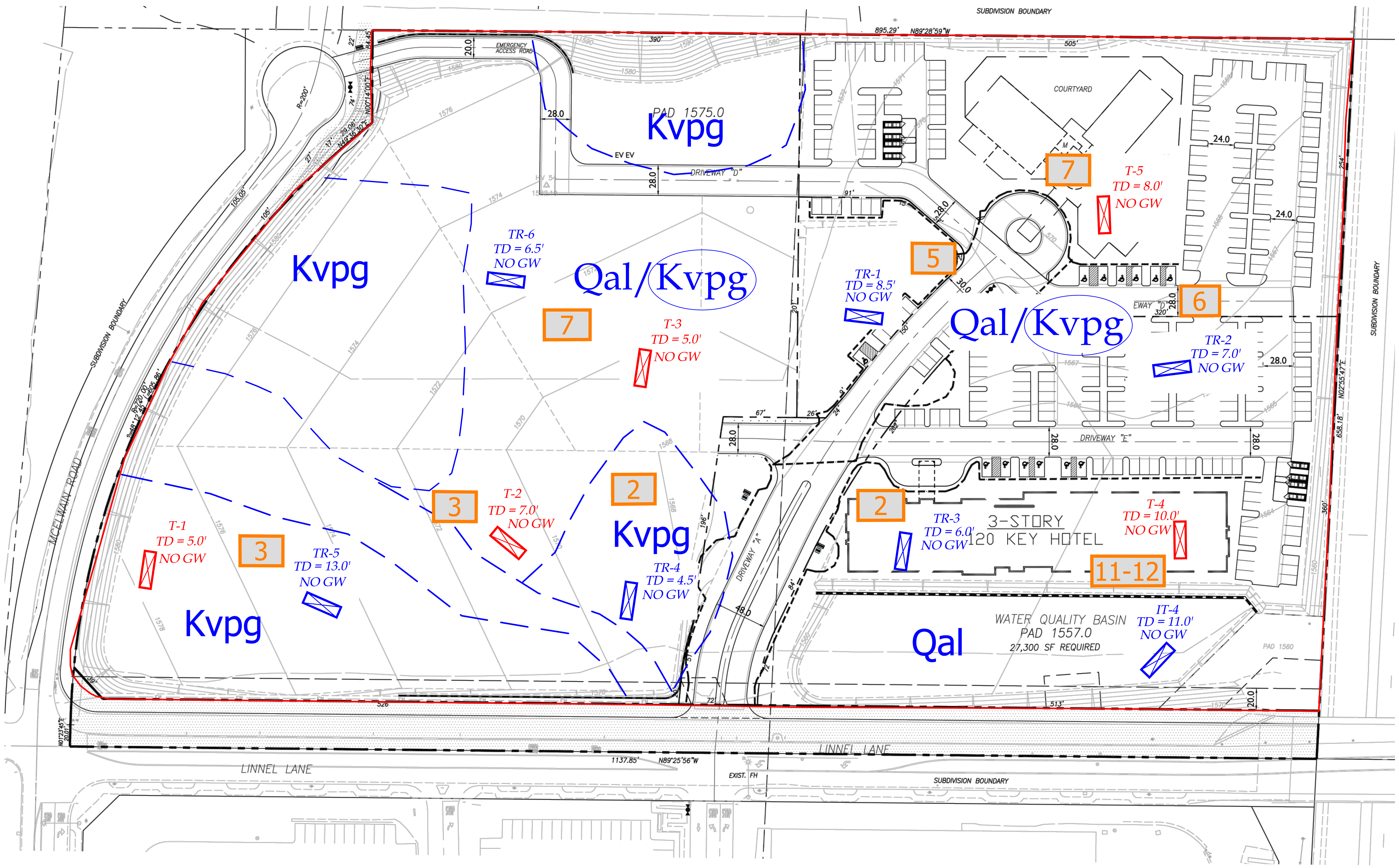
TYPICAL STABILIZATION FILL DETAIL



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

SECTION A-A'

OVERSIZE ROCK DISPOSAL



LEGEND
(Locations are Approximate)

Geologic Earth Units

Qal - Alluvium

Kvpg - Monzogranite to Granodiorite (circled where buried)

Symbols

- Limits of This Report

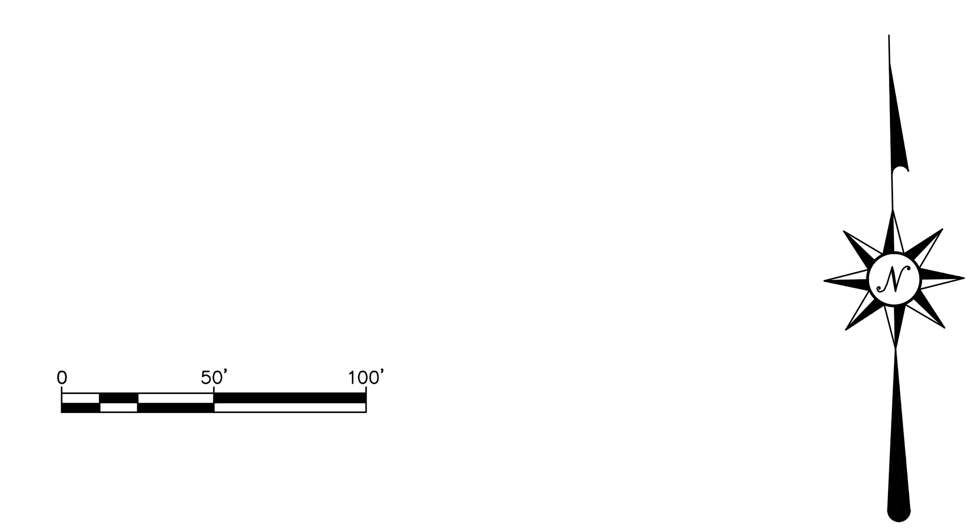
- Approximate Geologic Contact

TR-6 TD=6.5' NO GW - Exploratory Trench Location

IT-4 TD=11.0' NO GW - Percolation Exploratory Trench Location

T-5 TD=8.0' NO GW - Exploratory Trench Location (T.H.E. Soils Co., Inc., January 2006)

11-12 - Approximate Depths of Overexcavation Below Existing Grade (ft.) in proposed fill areas



LOGICAL GEOTECHNICAL CONSULTANTS
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS TESTING • SWPPP
27570 COMMERCE CENTER DR., #128, TEMECULA, CA 92590
PHONE: 951.297.2450 FAX: 951.719.2998
WWW.LGCGEOENV.COM

Robert L. Gregorek, II
Engineering Geologist

John P. Nielsen
Geotechnical Engineer

GEOTECHNICAL MAP

APN 392-280-007 Corner of Linnel Lane and McElwain Road
City of Murrieta, County of Riverside, State of California

Name:	McElwain
Project No.	G18-1687-10
Client:	Murrieta Development II, LLC
Scale:	1" = 50'
Date:	April 2019
Reference:	Summa Architecture, Sapphire Site Plan, Scale = 1"=50', dated March 22, 2019
Plate No.	1 OF 1