Appendix F

Preliminary Geotechnical Interpretive Report

Earth Strata Geotechnical Services, Inc.
Geotechnical, Environmental and Materials Testing Consultants

September 3, 2019

Project No. 192805-10A

Empire Design Group, Inc.
24861 Washington Avenue
P.O. Box 944
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Subject: **Preliminary Geotechnical Interpretive Report, Proposed Commercial Development, Assessor's Parcel Number 389-030-012 through -018, Located at 28915 Lake Street, City of Lake Elsinore, Riverside County, California**

Earth Strata Geotechnical Services is pleased to present our updated preliminary geotechnical interpretive report for the proposed commercial development, Assessor's Parcel Number 389-030-012 through -018, located at 28915 Lake Street in the City of Lake Elsinore, Riverside County, California. This work was performed in accordance with the scope of work described in our proposal, dated August 9, 2019. The purpose of this study is to evaluate the nature, distribution, engineering properties, and geologic strata underlying the site with respect to the proposed development.

Earth Strata Geotechnical Services appreciates the opportunity to offer our consultation and advice on this project. In the event that you have any questions, please do not hesitate to contact the undersigned at your earliest convenience.

Respectfully submitted,

EARTH STRATA GEOTECHNICAL SERVICES

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INTRODUCTION

Earth Strata Geotechnical Services is pleased to present our updated preliminary geotechnical interpretive report for the proposed development. The purpose of this study was to evaluate the nature, distribution, engineering properties, and geologic strata underlying the site with respect to the proposed development, and then provide preliminary grading and foundation design recommendations based on the plans and previous geotechnical reports you provided. The general location of the subject property is indicated on the Vicinity Map, Figure 1. The plans you provided were used as the base map to show geologic conditions within the subject site, see Geotechnical Map, Plate 1.

SITE DESCRIPTION

The subject property is located at 28915 Lake Street in the City of Lake Elsinore, Riverside County, California. The approximate location of the site is shown on the Vicinity Map, Figure 1.

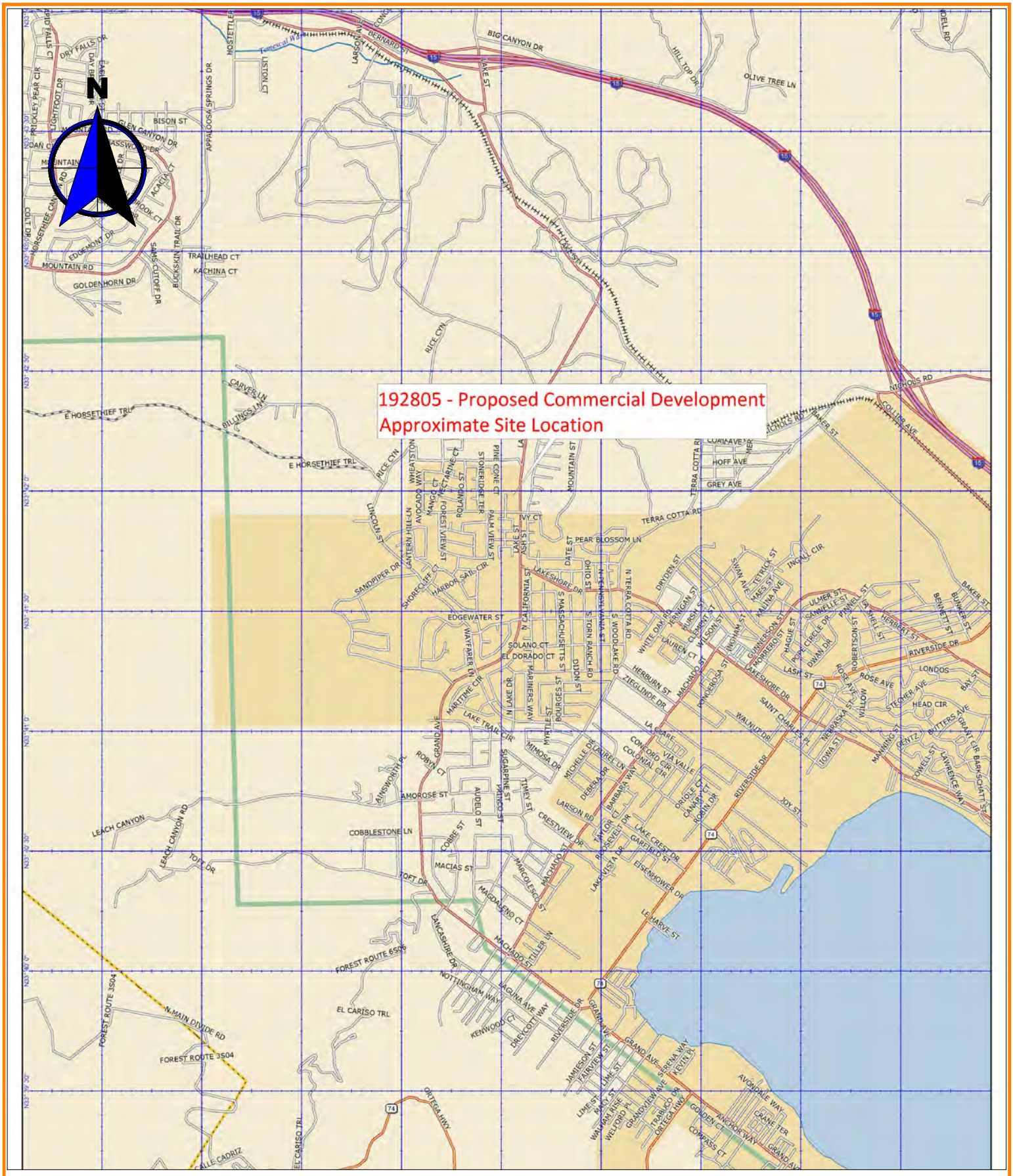
The subject property is comprised of approximately 4.15 acres of undeveloped land. The site has not been graded. Topographic relief at the subject property is relatively low with the terrain being generally sloping to flat. Elevations at the site range from approximately 1,480 to 1,520 feet above mean sea level (msl), for a difference of about 40± feet across the entire site. Drainage within the subject property generally flows to the east.

The site is currently bordered by residential development to the north, east, south, and west. Most of the vegetation on the site consists of moderate amounts of annual weeds/grasses, along with small to large trees scattered throughout the subject sites.

PROPOSED DEVELOPMENT AND GRADING

The proposed commercial development is expected to consist of concrete, wood or steel framed one- and/or two-story structures utilizing slab on grade construction with associated streets, landscape areas, and utilities. The current development plans include six (6) commercial buildings and one (1) gas station canopy positioned across seven (7) parcels.

The plans provided by you were utilized in our exploration and form the base for our Geotechnical Map.



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PROPOSED COMMERCIAL DEVELOPMENT		192805-10A
VICINITY MAP	SCALE 1:40,625	
	AUG 2019	FIGURE 1

FIELD EXPLORATION AND LABORATORY TESTING

Field Exploration

Previous subsurface exploration for the proposed commercial development was performed on November 16, 2007 by Leighton Consulting, Inc. A truck mounted hollow-stem-auger drill rig was utilized to drill seven (7) borings throughout the parcels to a maximum depth of 30 feet. In addition, subsurface exploration performed by Earth Strata Geotechnical Services within our subject sites was performed on August 23, 2019 for additional exploratory excavations. A truck mounted hollow-stem-auger drill rig was utilized to drill three (3) borings throughout the site to a maximum depth of 16.5 feet. An underground utilities clearance was obtained from Underground Service Alert of Southern California, prior to the subsurface exploration.

Earth materials encountered during exploration were classified and logged in general accordance with the Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) of ASTM D 2488. Upon completion of laboratory testing, exploratory logs and sample descriptions may have been reconciled to reflect laboratory test results with regard to ASTM D 2487.

Associated with the subsurface exploration was the collection of bulk (disturbed) samples and relatively undisturbed samples of earth materials for laboratory testing and analysis. The relatively undisturbed samples were obtained with a 3 inch outside diameter modified California split-spoon sampler lined with 1-inch-high brass rings. Samples obtained using a hollow stem auger drill rig, were mechanically driven with successive 30 inch drops of a 140-pound automatic trip safety hammer. The blow count per one-foot increment was recorded in the boring logs. The central portions of the driven samples were placed in sealed containers and transported to our laboratory for testing and analysis. The approximate exploratory locations are shown on Plate 1 and descriptive logs are presented in Appendix B.

Laboratory Testing

Atterberg Limits, maximum dry density/optimum moisture content, direct shear tests, expansion potential, R-value, collapse potential, pH, resistivity, sulfate content, chloride content, and in-situ density/moisture content were determined for selected undisturbed and bulk samples of earth materials, considered representative of those encountered. An evaluation of the test data is reflected throughout the Conclusions and Recommendations section of this report. A brief description of laboratory test criteria and summaries of test data are presented in Appendix C.

FINDINGS

Regional Geology

Regionally, the site is located in the Peninsular Ranges Geomorphic Province of California. The Peninsular Ranges are characterized by northwest trending steep mountain ranges separated by sediment filled elongated valleys. The dominant structural geologic features reflect the northwest trend of the province. Associated with and subparallel to the San Andreas Fault are the San Jacinto Fault, Newport-Inglewood, and the Whittier-Elsinore Fault. The Santa Ana Mountains abut the west side of the Elsinore Fault while the Perris Block forms the other side of the fault zone to the east. The Perris Block is bounded to the east by the San Jacinto Fault. The northern perimeter of the Los Angeles basin forms part of a northerly dipping

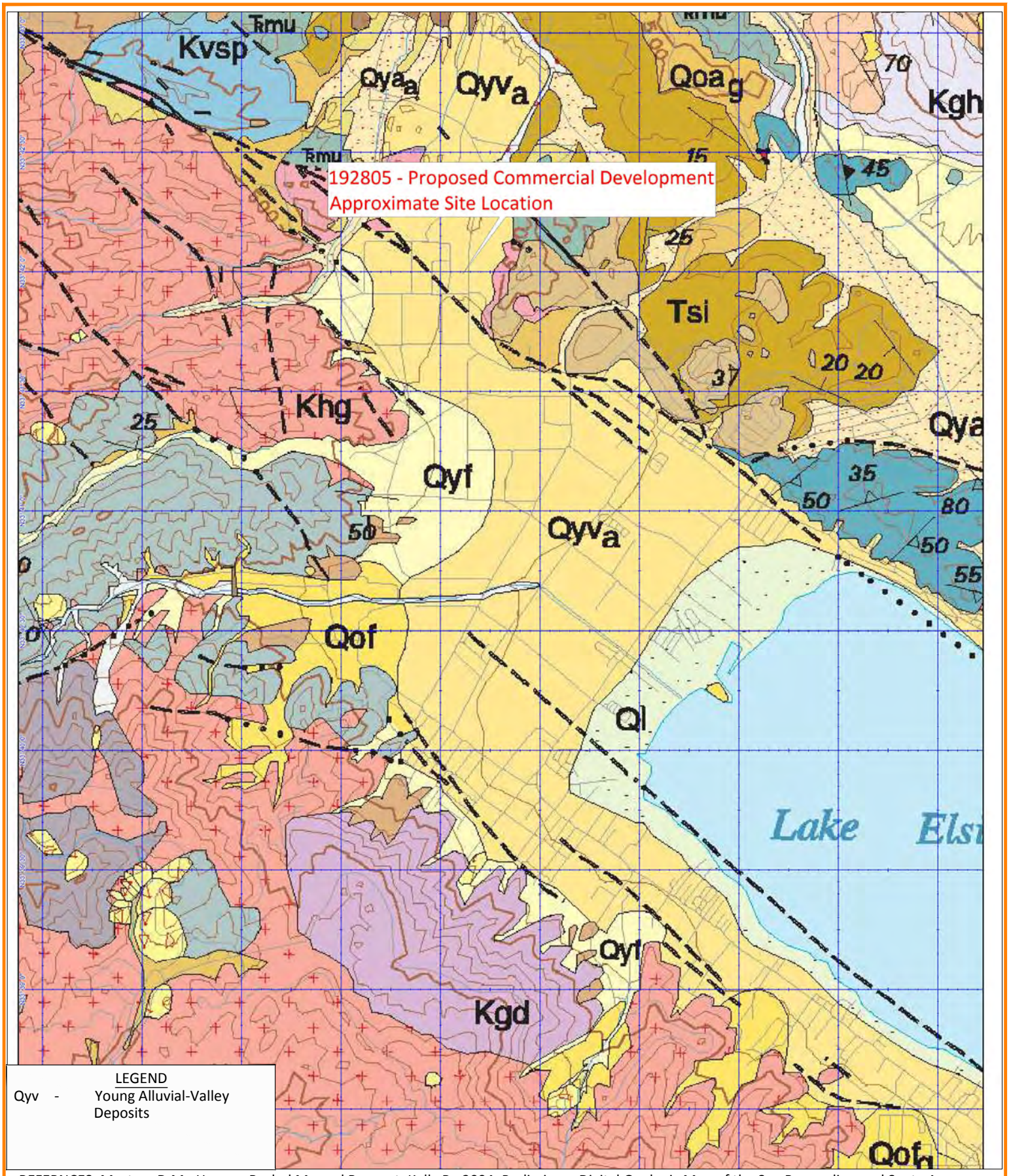
blind thrust fault at the boundary between the Peninsular Ranges Province and the Transverse Range Province.

The mountainous regions within the Peninsular Ranges Province are comprised of Pre-Cretaceous, metasedimentary, and metavolcanic rocks along with Cretaceous plutonic rocks of the Southern California Batholith. The low lying areas are primarily comprised of Tertiary and Quaternary non-marine alluvial sediments consisting of alluvial deposits, sandstones, claystones, siltstones, conglomerates, and occasional volcanic units. A map illustrating the regional geology is presented on the Regional Geologic Map, Figure 2.

Local Geology

The earth materials on the site are primarily comprised of Quaternary Young Alluvial Valley materials. A general description of the dominant earth materials observed on the site is provided below:

- Quaternary Young Alluvial Valley Deposits (map symbol Qyv): Quaternary Young Alluvial Valley deposits were encountered to the maximum depth explored of 16.5 feet. These alluvial deposits consist predominately of interlayered yellow brown to dark yellow brown, fine to coarse grained silty sand, and occasional sandy silt. These deposits were generally noted to be in a dry to slightly moist, dense to very dense state.



LEGEND

Qyv - Young Alluvial-Valley Deposits

REFERNCES: Morton, D.M., Hauser, Rachel M., and Ruppert, Kelly R., 2004, Preliminary Digital Geologic Map of the San Bernardino and Santa Ana 30' x 60' Quadrangle, Southern California, Version 2.0: U.S. Geological Survey Open-File Report 99-0172.

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PROPOSED COMMERCIAL DEVELOPMENT | 192805-10A

REGIONAL GEOLOGIC MAP | SCALE 1:40,625 | AUG 2019 | FIGURE 2

Faulting

The project is located in a seismically active region and as a result, significant ground shaking will likely impact the site within the design life of the proposed project. The geologic structure of the entire southern California area is dominated by northwest-trending faults associated with the San Andreas Fault system, which accommodates for most of the right lateral movement associated with the relative motion between the Pacific and North American tectonic plates. Known active faults within this system include the Newport-Inglewood, Whittier-Elsinore, San Jacinto and San Andreas Faults.

No active faults are known to project through the site and the site is not located within an Alquist-Priolo Earthquake Fault Zone, established by the State of California to restrict the construction of new habitable structures across identifiable traces of known active faults. Although no Alquist-Priolo Fault Zones are located within the subject sites, the County Fault Zone established for the Glen Ivy Fault Zone does trend northwest to southeast through the bottom half of the subject sites. See Figure 3, County Fault Zone and Geotechnical Map, Plate 1 for details.

Fault investigations with trenching and subsequent geotechnical mapping conducted by Leighton Consulting, Inc. found no evidence of faulting across a postulated fault scarp within the parcel south of mountain street, adjacent to the subject lots. No faults were able to be identified by previous fault zone studies (California Division of Mines and Geology 1979; Leighton 2002, 2003; Petra, 2004).

An active fault is defined by the State of California as having surface displacement within the past 11,000 years or during the Holocene geologic time period.

Based on our review of regional geologic maps and applicable computer programs (USGS 2008 Interactive Deaggregation, Caltrans ARS online, and USGS Earthquake Hazard Programs), the Elsinore Fault with an approximate source to site distance of 0.31 kilometers is the closest known active fault anticipated to produce the highest ground accelerations, with an anticipated maximum modal magnitude of 7.7. A list of faults as well as a list of significant historical seismic events within a 100km radius of the subject site are included in Appendix D.

Landslides

Landslide debris was not observed during our subsurface exploration and no ancient landslides are known to exist on the site. No landslides are known to exist, or have been mapped, in the vicinity of the site. Geologic mapping of the site conducted during our investigation, and review of aerial imagery of the site, reveal no geomorphic expressions indicative of landsliding. The materials encountered in the pad area were found to be very hard and no oversteepened slopes exist on the site or are proposed.

CONCLUSIONS AND RECOMMENDATIONS

General

From geotechnical and engineering geologic points of view, the subject property is considered suitable for the proposed development, provided the following conclusions and recommendations are incorporated into the plans and are implemented during construction.

Earthwork

Earthwork and Grading

The provisions of the 2016 California Building Code (CBC), including the General Earthwork and Grading Specifications in the last Appendix of this report, should be applied to all earthwork and grading operations, as well as in accordance with all applicable grading codes and requirements of the appropriate reviewing agency. Unless specifically revised or amended herein, grading operations should also be performed in accordance with applicable provisions of our General Earthwork and Grading Specifications within the last appendix of this report.

Clearing and Grubbing

Vegetation including trees, grasses, weeds, brush, shrubs, or any other debris should be stripped from the areas to be graded and properly disposed of offsite. In addition, laborers should be utilized to remove any roots, branches, or other deleterious materials during grading operations.

Earth Strata Geotechnical Services should be notified at the appropriate times to provide observation and testing services during Clearing and Grubbing operations. Any buried structures or unanticipated conditions should be brought to our immediate attention.

Excavation Characteristics

Based on the results of our exploration and experience with similar projects in similar settings, the near surface earth materials, will be readily excavated with conventional earth moving equipment. Excavation difficulty is a function of the degree of weathering and amount of fracturing within the bedrock. Bedrock generally becomes harder and more difficult to excavate with increasing depth.

Groundwater

Groundwater was not observed during our subsurface exploration. It should be noted that localized groundwater could be encountered during grading due to the limited number of exploratory locations or other factors.

Ground Preparation for Fill Areas

For each area to receive compacted fill, the removal of low density, compressible earth materials, such as topsoils, and upper alluvials, should continue until firm competent alluvium is encountered. Removal excavations are subject to verification by the project engineer, geologist or their representative. Prior to placing compacted fills, the exposed bottom in each removal area should be scarified to a depth of 6 inches or more, watered or air dried as necessary to achieve near optimum moisture conditions and then compacted to a minimum of 90 percent of the maximum dry density determined by ASTM D 1557.

The intent of remedial grading is to diminish the potential for hydro-consolidation, slope instability, and/or settlement. Remedial grading should extend beyond the perimeter of the proposed structures a horizontal distance equal to the depth of excavation or a minimum of 5 feet, whichever

is greater. For cursory purposes the anticipated removal depths are shown on the enclosed Geotechnical Map, Plate 1. In general, the anticipated removal depths should vary from 3 to 5 feet below existing grade.

Wet Removals

Wet alluvial materials will probably not be encountered within the low lying areas of the site. If removals of wet alluvial materials are required, special grading equipment and procedures can greatly reduce overall costs. Careful planning by an experienced grading contractor can reduce the need for special equipment, such as swamp cats, draglines, excavators, pumps, and top loading earthmovers. Possible solutions may include the placement of imported angular rock and/or geotextile ground reinforcement. More specific recommendations can be provided based on the actual conditions encountered. Drying or mixing of wet materials with dry materials will be needed to bring the wet materials to near optimum moisture prior to placing wet materials into compacted fills.

Oversize Rock

Oversize rock is not expected to be encountered during grading. Oversize rock that is encountered (i.e., rock exceeding a maximum dimension of 12 inches) should be disposed of offsite or stockpiled onsite and crushed for future use. The disposal of oversize rock is discussed in greater detail in General Earthwork and Grading Specifications within the last appendix of this report.

Compacted Fill Placement

Compacted fill materials should be placed in 6 to 8 inch maximum (uncompacted) lifts, watered or air dried as necessary to achieve uniform near optimum moisture content and then compacted to a minimum of 90 percent of the maximum dry density determined by ASTM D 1557.

Import Earth Materials

Should import earth materials be needed to achieve final design grades, all potential import materials should be free of deleterious/oversize materials, non-expansive, and approved by the project geotechnical consultant prior to delivery onsite.

Fill Slopes

When properly constructed, fill slopes up to 10 feet high with inclinations of 2:1 (h:v) or flatter are considered to be grossly stable. Keyways are required at the toe of all fill slopes higher than 5 feet and steeper than 5:1 (h:v). Keyways should be a minimum of 10 feet wide and 2 feet into competent earth materials, as measured on the downhill side. In order to establish keyway removals, backcuts should be cut no steeper than 1:1 or as recommended by the geotechnical engineer or engineering geologist. Compacted fill should be benched into competent earth materials.

Cut Slopes

When properly constructed, cut slopes into older alluvium up to 10 feet high with inclinations of 2:1 (h:v) or flatter are considered grossly stable. Cut slopes should be observed by the engineering geologist or his representative during grading, but are anticipated to be stable.

Stabilization Fills

Currently, stabilization fills will not be required for cut slopes in the alluvium. Our engineering geologist or his representative should be called to evaluate all slopes during grading. In the event that unfavorable geologic conditions are encountered, recommendations for stabilization fills or flatter slopes will be provided.

Fill Over Cut Slopes

The fill portion of fill over cut slopes should not be constructed until the cut portion of the slope has been cut to finish grade. The earth materials and geologic structure exposed along the cut slope should be evaluated with regard to suitability for compacted fills or foundations and for stability. If the cut materials are determined to be competent, then the construction of the keyway and subdrain system may commence or additional remedial recommendations will be provided.

Temporary Backcuts

It is the responsibility of the grading contractor to follow all Cal-OSHA requirements with regard to excavation safety. Where existing developments are upslope, adequate slope stability to protect those developments must be maintained. Temporary backcuts will be required to accomplish removals of unsuitable materials and possibly, to perform canyon removals, stabilization fills, and/or keyways. Backcuts should be excavated at a gradient of 1:1 (h:v) or flatter. Flatter backcuts may be required where geologic structure or earth materials are unfavorable. It is imperative that grading schedules minimize the exposure time of the unsupported excavations. All excavations should be stabilized within 30 days of initial excavation.

Cut/Fill Transitions

Cut/fill transitions should be eliminated from all building areas where the depth of fill placed within the "fill" portion exceeds proposed footing depths. This is to diminish distress to structures resulting from excessive differential settlement. The entire foundation of each structure should be founded on a uniform bearing material. This should be accomplished by overexcavating the "cut" portion and replacing the excavated materials as properly compacted fill. Refer to the following table for recommended depths of overexcavation.

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

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

Cut Areas

In cut areas, an area a minimum of 5 feet beyond the footprint of the proposed structures should overexcavated until; competent bottoms are achieved; to a minimum 3 feet below the proposed foundations; or per the Overexcavation Table above; (whichever is greater) and replaced with compacted fill. Final determination of areas that require overexcavation should be determined in the field by a representative of Earth Strata Geotechnical Services.

Shrinkage, Bulking and Subsidence

Volumetric changes in earth material quantities will occur when poorly consolidated earth materials are replaced with properly compacted fill. Estimates of the percent shrinkage/bulking factors for the various geologic units observed on the subject property are based on in-place densities and on the estimated average percent of relative compaction achieved during grading.

GEOLOGIC UNIT	SHRINKAGE (%)
Alluvium	5 to 10

Subsidence from scarification and recompaction of exposed bottom surfaces is expected to be negligible to approximately 0.01 foot.

The estimates of shrinkage/bulking and subsidence are intended as an aid for project engineers in determining earthwork quantities. Since many variables can affect the accuracy of these estimates, they should be used with caution and contingency plans should be in place for balancing the project.

Geotechnical Observations

Clearing operations, removal of unsuitable materials, and general grading procedures should be observed by the project geotechnical consultant or his representative. No compacted fill should be placed without observations by the geotechnical consultant or his representative to verify the adequacy of the removals.

The project geotechnical consultant or his representative should be present to observe grading operations and to check that minimum compaction requirements and proper lift thicknesses are being met, as well as to verify compliance with the other recommendations presented herein.

Post Grading Considerations

Slope Landscaping and Maintenance

Adequate slope and building pad drainage is essential for the long term performance of the subject site. The gross stability of graded slopes should not be adversely affected, provided all drainage provisions are properly constructed and maintained. Engineered slopes should be landscaped with deep rooted, drought tolerant maintenance free plant species, as recommended by the project landscape architect.

Site Drainage

Control of site drainage is important for the performance of the proposed project. Roof gutters are recommended for the proposed structures. Pad and roof drainage should be collected and transferred to driveways, adjacent streets, storm-drain facilities, or other locations approved by the building official in non-erosive drainage devices. Drainage should not be allowed to pond on the pad or against any foundation or retaining wall. Drainage should not be allowed to flow uncontrolled over any descending slope. Planters located within retaining wall backfill should be sealed to prevent moisture intrusion into the backfill. Planters located next to structures should be sealed to the depth of the footings. Drainage control devices require periodic cleaning, testing and maintenance to remain effective.

At a minimum, pad drainage should be designed at the minimum gradients required by the CBC. To divert water away from foundations, the ground surface adjacent to foundations should also be graded at the minimum gradients required per the CBC.

Utility Trenches

All utility trench backfill should be compacted at near optimum moisture to a minimum of 90 percent of the maximum dry density determined by ASTM D 1557. For utility trench backfill within pavement areas the upper 6 inches of subgrade materials should be compacted to 95 percent of the maximum dry density determined by ASTM D 1557. This includes within the street right-of-ways, utility easements, under footings, sidewalks, driveways and building floor slabs, as well as within or adjacent to any slopes. Backfill should be placed in approximately 6 to 8 inch maximum loose lifts and then mechanically compacted with a hydro-hammer, rolling with a sheepsfoot, pneumatic tampers, or similar equipment. The utility trenches should be tested by the project geotechnical engineer or their representative to verify minimum compaction requirements are obtained.

In order to minimize the penetration of moisture below building slabs, all utility trenches should be backfilled with compacted fill, lean concrete or concrete slurry where they undercut the perimeter foundation. Utility trenches that are proposed parallel to any building footings (interior and/or exterior trenches), should not be located within a 1:1 (h:v) plane projected downward from the outside bottom edge of the footing.

SEISMIC DESIGN CONSIDERATIONS

Ground Motions

Structures are required to be designed and constructed to resist the effects of seismic ground motions as provided in the 2016 California Building Code Section 1613. The design is dependent on the site class, occupancy category I, II, III, or IV, mapped spectral accelerations for short periods (S_s), and mapped spectral acceleration for a 1-second period (S_1).

In order for structural design to comply with the 2016 CBC, the USGS "US Seismic Design Maps" online tool was used to compile spectral accelerations for the subject property based on data and maps jointly compiled by the United States Geological Survey (USGS) and the California Geological Survey (CGS). The data found in the following table is based on the Maximum Considered Earthquake (MCE) with 5% damped ground motions having a 2% probability of being exceeded in 50 years (2,475 year return period).

The seismic design coefficients were determined by a combination of the site class, mapped spectral accelerations, and occupancy category. The following seismic design coefficients should be implemented during design of the proposed structures. Summaries of the Seismic Hazard Deaggregation graphs and test data are presented in Appendix D.

2016 CBC	FACTOR
Site Location	Latitude: 33.700119° (North) Longitude: -117.390624°(West)
Site Class	D
Mapped Spectral Accelerations for short periods, S_s	2.53 g
Mapped Spectral Accelerations for 1-Second Period, S_1	1.028 g
Maximum Considered Earthquake Spectral Response Acceleration for Short Periods, S_{ms}	2.53 g
Maximum Considered Earthquake Spectral Response Acceleration for 1-Second Period, S_{m1}	1.542 g
Design Spectral Response Acceleration for Short Periods, S_{DS}	1.687 g
Design Spectral Response Acceleration for 1-Second Period, S_{D1}	1.028 g
Seismic Design Category	E
Importance Factor Based on Occupancy Category	II

We performed the probabilistic seismic hazard assessment for the site in accordance with the 2016 CBC, Section 1803.5.11 and 1803.5.12. The probabilistic seismic hazard maps and data files were jointly prepared by the United States Geological Survey (USGS) and the California Geological Survey (CGS) and can be found at the CGS Probabilistic Seismic Hazards Mapping Ground Motion Page. Actual ground shaking intensities at the site may be substantially higher or lower based on complex variables such as the near source directivity effects, depth and consistency of earth materials, topography, geologic structure, direction of fault rupture, and seismic wave reflection, refraction, and attenuation rates. The mean peak ground acceleration was calculated to be 1.023 g.

Secondary Seismic Hazards

Secondary effects of seismic shaking considered as potential hazards include several types of ground failure as well as induced flooding. Different types of ground failure, which could occur as a consequence of severe ground shaking at the site, include landslides, ground lurching, shallow ground rupture, and liquefaction/lateral spreading. The probability of occurrence of each type of ground failure depends on the severity of the earthquake, distance from faults, topography, the state of subsurface earth materials, groundwater conditions, and other factors. Based on our experience, subsurface exploration, and laboratory testing, all of the above secondary effects of seismic activity are considered unlikely.

Seismically induced flooding is normally a consequence of a tsunami (seismic sea wave), a seiche (i.e., a wave-like oscillation of surface water in an enclosed basin that may be initiated by a strong earthquake) or failure of a major reservoir or retention system up gradient of the site. Since the site is at an elevation of more than 1,400 feet above mean sea level and is located more than 30 miles inland from the nearest coastline of the Pacific Ocean, the potential for seismically induced flooding due to a tsunami is considered nonexistent. Since no enclosed bodies of water lie adjacent to or up gradient of the site, the likelihood for induced flooding due to a dam failure or a seiche overcoming the dam's freeboard is considered nonexistent.

Liquefaction and Lateral Spreading

Liquefaction occurs as a result of a substantial loss of shear strength or shearing resistance in loose, saturated, cohesionless earth materials subjected to earthquake induced ground shaking. Potential impacts from liquefaction include loss of bearing capacity, liquefaction related settlement, lateral movements, and surface manifestation such as sand boils. Seismically induced settlement occurs when loose sandy soils become denser when subjected to shaking during an earthquake. The three factors determining whether a site is likely to be subject to liquefaction include seismic shaking, type and consistency of earth materials, and groundwater level. The proposed structures will be supported by compacted fill and competent alluvium. As such, the potential for earthquake induced liquefaction and lateral spreading beneath the proposed structures is considered very low to remote due to the recommended compacted fill, relatively low groundwater level, and the dense nature of the deeper onsite earth materials.

TENTATIVE FOUNDATION DESIGN RECOMMENDATIONS

General

Provided grading is performed in accordance with the recommendations of this report, shallow foundations are considered feasible for support of the proposed structures. Tentative foundation recommendations are provided herein and graphic presentations of relevant recommendations may also be included on the enclosed map.

Allowable Bearing Values

An allowable bearing value of 2,500 pounds per square foot (psf) is recommended for design of 24-inch square pad footings and 12-inch-wide continuous footings founded at a minimum depth of 12 inches below

the lowest adjacent final grade. This value may be increased by 20 percent for each additional 1-foot of width and/or depth to a maximum value of 3,000 psf. Recommended allowable bearing values include both dead and frequently applied live loads and may be increased by one third when designing for short duration wind or seismic forces.

Settlement

Based on the settlement characteristics of the earth materials that underlie the building sites and the anticipated loading, we estimate that the maximum total settlement of the footings will be less than approximately ¾ inch. Differential settlement is expected to be about ½ inch over a horizontal distance of approximately 20 feet, for an angular distortion ratio of 1:480. It is anticipated that the majority of the settlement will occur during construction or shortly after the initial application of loading.

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

Lateral Resistance

Passive earth pressure of 250 psf per foot of depth to a maximum value of 2,500 psf may be used to establish lateral bearing resistance for footings. For areas coved with hardscape, passive earth pressure may be taken from the surface. For areas without hardscape, the upper 12 inches of the soil profile must be neglected when calculating passive earth pressure. A coefficient of friction of 0.36 times the dead load forces may be used between concrete and the supporting earth materials to determine lateral sliding resistance. The above values may be increased by one-third when designing for short duration wind or seismic forces. When combining passive and friction for lateral resistance, the passive component should be reduced by one third. In no case shall the lateral sliding resistance exceed one-half the dead load for clay, sandy clay, sandy silty clay, silty clay, and clayey silt.

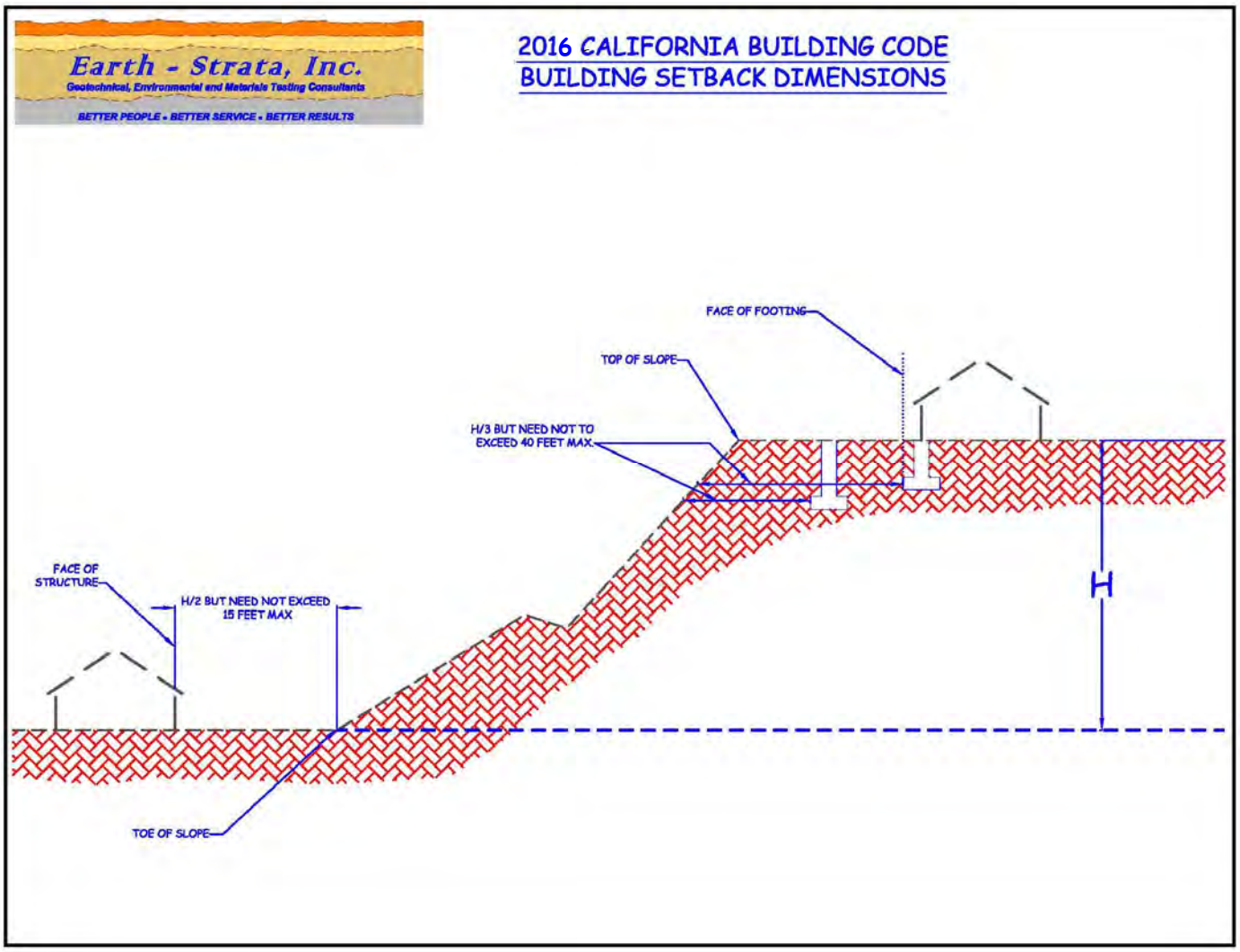
The above lateral resistance values are based on footings for an entire structure being placed directly against either compacted fill or competent alluvium.

Structural Setbacks and Building Clearance

Structural setbacks are required per the 2016 California Building Code (CBC). Additional structural setbacks are not required due to geologic or geotechnical conditions within the site. Improvements constructed in close proximity to natural or properly engineered and compacted slopes can, over time, be affected by natural processes including gravity forces, weathering, and long term secondary settlement. As a result, the CBC requires that buildings and structures be setback or footings deepened to resist the influence of these processes.

For structures that are planned near ascending and descending slopes, the footings should be embedded to satisfy the requirements presented in the CBC, Section 1808.7 as illustrated in the following Foundation Clearances from Slopes diagram.

FOUNDATION CLEARANCES FROM SLOPES



When determining the required clearance from ascending slopes with a retaining wall at the toe, the height of the slope shall be measured from the top of the wall to the top of the slope.

Foundation Observations

In accordance with the 2016 CBC and prior to the placement of forms, concrete, or steel, all foundation excavations should be observed by the geologist, engineer, or his representative to verify that they have been excavated into competent bearing materials. The excavations should be per the approved plans, moistened, cleaned of all loose materials, trimmed neat, level, and square. Any moisture softened earth materials should be removed prior to steel or concrete placement.

Earth materials from foundation excavations should not be placed in slab on grade areas unless the materials are tested for expansion potential and compacted to a minimum of 90 percent of the maximum dry density.

Expansive Soil Considerations

Preliminary laboratory test results indicate onsite earth materials exhibit an expansion potential of **LOW** as classified in accordance with 2016 CBC Section 1803.5.3 and ASTM D4829-03. Additional, testing for expansive soil conditions should be conducted upon completion of rough grading. The following recommendations should be considered the very minimum requirements, for the earth materials tested. It is common practice for the project architect or structural engineer to require additional slab thickness, footing sizes, and/or reinforcement.

Low Expansion Potential (Expansion Index of 21 to 50)

Our laboratory test results indicate that the earth materials onsite exhibit a **LOW** expansion potential as classified in accordance with 2016 CBC Section 1803.5.3 and ASTM D4829-03. Accordingly, the CBC specifies that slab on ground foundations (floor slabs) resting on earth materials with expansion indices greater than 20, require special design considerations in accordance with 2016 CBC Sections 1808.6.1 and 1808.6.2. The design procedures are based on the thickness and plasticity index of the various earth materials within the upper 15 feet of the proposed structure. For preliminary design purposes, we have assumed an effective plasticity index of 12.

Footings

- Exterior continuous footings may be founded at the minimum depths below the lowest adjacent final grade (i.e. 12-inch minimum depth for one-story, 18-inch minimum depth for two-story, and 24-inch minimum depth for three-story construction). Interior continuous footings for one-, two-, and three-story construction may be founded at a minimum depth of 12 inches below the lowest adjacent final grade. All continuous footings should have a minimum width of 12, 15, and 18 inches, for one-, two-, and three-story structures, respectively, and should be reinforced with a minimum of four (4) No. 4 bars, two (2) top and two (2) bottom.

- Exterior pad footings intended to support roof overhangs, such as second story decks, patio covers and similar construction should be a minimum of 24 inches square and founded at a minimum depth of 18 inches below the lowest adjacent final grade. The pad footings should be reinforced with a minimum of No. 4 bars spaced a maximum of 18 inches on center, each way, and should be placed near the bottom-third of the footings.

Building Floor Slabs

- The project architect or structural engineer should evaluate minimum floor slab thickness and reinforcement in accordance with 2016 CBC Section 1808.6.2 based on an assumed effective plasticity index of 12. Building floor slabs should be a minimum of 4 inches thick and reinforced with a minimum of No. 4 bars spaced a maximum of 18 inches on center, each way. All floor slab reinforcement should be supported on concrete chairs or bricks to ensure the desired placement at mid-depth.

- Interior floor slabs, within moisture sensitive areas, should be underlain by a minimum 10-mil thick moisture/vapor barrier to help reduce the upward migration of moisture from the underlying earth materials. The moisture/vapor barrier used should meet the performance

standards of an ASTM E 1745 Class A material, and be properly installed in accordance with ACI publication 318-05. It is the responsibility of the contractor to ensure that the moisture/vapor barriers are free of openings, rips, or punctures prior to placing concrete. As an option for additional moisture reduction, higher strength concrete, such as a minimum 28-day compressive strength of 5,000 pounds per square inch (psi) may be used. Ultimately, the design of the moisture/vapor barrier system and recommendations for concrete placement and curing are the purview of the foundation engineer, taking into consideration the project requirements provided by the architect and owner.

- Garage floor slabs should be a minimum of 5 inches thick and should be reinforced in a similar manner as living area floor slabs. Garage floor slabs should be placed separately from adjacent wall footings with a positive separation maintained with ⅜ inch minimum felt expansion joint materials and quartered with weakened plane joints. A 12-inch-wide turn down founded at the same depth as adjacent footings should be provided across garage entrances. The turn down should be reinforced with a minimum of two (2) No. 4 bars, one (1) top and one (1) bottom.

- The subgrade earth materials below all floor slabs should be pre-watered to achieve a moisture content that is at least equal or slightly greater than optimum moisture content, prior to placing concrete. This moisture content should penetrate a minimum depth of 12 inches into the subgrade earth materials. The pre-watering should be verified by Earth Strata Geotechnical Services during construction.

Post Tensioned Slab/Foundation Design Recommendations

In lieu of the proceeding foundation recommendations, post tensioned slabs may be used to support the proposed structures. We recommend that the foundation engineer design the foundation system using the Preliminary Post Tensioned Foundation Slab Design table below. These parameters have been provided in general accordance with Post Tensioned Design. Alternate designs addressing the effects of expansive earth materials are allowed per 2016 CBC Section 1808.6.2. When utilizing these parameters, the foundation engineer should design the foundation system in accordance with the allowable deflection criteria of applicable codes and per the requirements of the structural engineer/architect.

It should be noted that the post tensioned design methodology is partially based on the assumption that soil moisture changes around and underneath post tensioned slabs, are influenced only by climate conditions. Soil moisture change below slabs is the major factor in foundation damages relating to expansive soil. However, the design methodology has no consideration for presaturation, owner irrigation, or other non-climate related influences on the moisture content of subgrade earth materials. In recognition of these factors, we modified the geotechnical parameters determined from this methodology to account for reasonable irrigation practices and proper homeowner maintenance. Additionally, we recommend that prior to excavating footings, slab subgrades be presoaked to a depth of 12 inches and maintained at above optimum moisture until placing concrete. Furthermore, we recommend that the moisture content of the earth materials around the immediate perimeter and below the slab be presaturated to at least 1% above optimum moisture content just prior to placing concrete. The pre-watering should be verified and tested by Earth Strata Geotechnical Services during construction.

The following geotechnical parameters assume that areas adjacent to the foundations, which are planted and irrigated, will be designed with proper drainage to prevent water from ponding. Water ponding near

the foundation causes significant moisture change below the foundation. Our recommendations do not account for excessive irrigation and/or incorrect landscape design. Planters placed adjacent to the foundation, should be designed with an effective drainage system or liners, to prevent moisture infiltration below the foundation. Some lifting of the perimeter foundation beam should be expected even with properly constructed planters. Based on our experience monitoring sites with similar earth materials, elevated moisture contents below the foundation perimeter due to incorrect landscaping irrigation or maintenance, can result in uplift at the perimeter foundation relative to the central portion of the slab.

Future owners should be informed and educated of the importance in maintaining a consistent level of moisture within the earth materials around the structures. Future owners should also be informed of the potential negative consequences of either excessive watering, or allowing expansive earth materials to become too dry. Earth materials will shrink as they dry, followed by swelling during the rainy winter season, or when irrigation is resumed. This will cause distress to site improvements and structures.

Preliminary Post Tensioned Foundation Slab Design

PARAMETER	VALUE
Expansion Index	Low[1]
Percent Finer than 0.002 mm in the Fraction Passing the No. 200 Sieve	< 20 percent (assumed)
Type of Clay Mineral	Montmorillonite (assumed)
Thornthwaite Moisture Index	+20
Depth to Constant Soil Suction	7 feet
Constant Soil Suction	P.F. 3.6
Moisture Velocity	0.7 inches/month
Center Lift — Edge moisture variation distance, e_m Center lift, y_m	5.5 feet 2.0 inches
Edge Lift — Edge moisture variation distance, e_m Edge lift, y_m	3.0 feet 0.8 inches
Soluble Sulfate Content for Design of Concrete Mixtures in Contact with Earth Materials	Negligible
Modulus of Subgrade Reaction, k (assuming presaturation as indicated below)	200 pci
Minimum Perimeter Foundation Embedment	18
Perimeter Foundation Reinforcement	--
Under Slab Moisture/Vapor Barrier and Sand Layer	10-mil thick moisture/vapor barrier meeting the requirements of a ASTM E 1745 Class A material

1. Obtained by laboratory testing.
2. Recommendations for foundation reinforcement are ultimately the purview of the foundation/structural engineer based upon the geotechnical criteria presented in this report, and structural engineering considerations.

Corrosivity

Corrosion is defined by the National Association of Corrosion Engineers (NACE) as "a deterioration of a substance or its properties because of a reaction with its environment." From a geotechnical viewpoint, the "substances" are the reinforced concrete foundations or buried metallic elements (not surrounded by concrete) and the "environment" is the prevailing earth materials in contact with them. Many factors can contribute to corrosivity, including the presence of chlorides, sulfates, salts, organic materials, different oxygen levels, poor drainage, different soil types, and moisture content. It is not considered practical or realistic to test for all of the factors which may contribute to corrosivity.

The potential for concrete exposure to chlorides is based upon the recognized Caltrans reference standard "Bridge Design Specifications", under Subsection 8.22.1 of that document, Caltrans has determined that "Corrosive water or soil contains more than 500 parts per million (ppm) of chlorides". Based on limited preliminary laboratory testing, the onsite earth materials have chloride contents *less* than 500 ppm. As such, specific requirements resulting from elevated chloride contents are not required.

Specific guidelines for concrete mix design are provided in 2016 CBC Section 1904.1 and ACI 318, Section 4.3 Table 4.3.1 when the soluble sulfate content of earth materials exceeds 0.1 percent by weight. Based on limited preliminary laboratory testing, the onsite earth materials are classified in accordance with Table 4.3.1 as having a *negligible* sulfate exposure condition. Therefore, structural concrete in contact with onsite earth materials should utilize Type I or II.

Based on our laboratory testing of resistivity, the onsite earth materials in contact with buried steel should be considered *corrosive*. Additionally, pH values below 9.7 are recognized as being corrosive to most common metallic components including, copper, steel, iron, and aluminum. The pH values for the earth materials tested were *lower* than 9.7. Therefore, any steel or metallic materials that are exposed to the earth materials should be encased in concrete or other measures should be taken to provide corrosion protection.

If building slabs are to be post tensioned, the post tensioning cables should be encased in concrete and/or encapsulated in accordance with the Post Tensioning Institute Guide Specifications. Post tensioning cable end plate anchors and nuts also need to be protected if exposed. If the anchor plates and nuts are in a recess in the edge of the concrete slab, the recess should be filled in with a non-shrink, non-porous, moisture-insensitive epoxy grout so that the anchorage assembly and the end of the cable are completely encased and isolated from the soil. A standard non-shrink, non-metallic cementitious grout may be used only when the post tension anchoring assembly is polyethylene encapsulated similar to that offered by Hayes Industries, LTD or O'Strand, Inc.

The preliminary test results for corrosivity are based on limited samples, and the initiation of grading may blend various earth materials together. This blending or imported material could alter and increase the detrimental properties of the onsite earth materials. Accordingly, additional testing for chlorides and sulfates along with testing for pH and resistivity should be performed upon completion of grading. Laboratory test results are presented in Appendix C.

RETAINING WALLS

Active and At-Rest Earth Pressures

Foundations may be designed in accordance with the recommendations provided in the Tentative Foundation Design Recommendation section of this report. The following table provides the minimum recommended equivalent fluid pressures for design of retaining walls a maximum of 8 feet high. The active earth pressure should be used for design of unrestrained retaining walls, which are free to tilt slightly. The at-rest earth pressure should be used for design of retaining walls that are restrained at the top, such as basement walls, curved walls with no joints, or walls restrained at corners. For curved walls, active pressure may be used if tilting is acceptable and construction joints are provided at each angle point and at a minimum of 15 foot intervals along the curved segments.

MINIMUM STATIC EQUIVALENT FLUID PRESSURES (pcf)		
PRESSURE TYPE	BACKSLOPE CONDITION	
	LEVEL	2:1 (h:v)
Active Earth Pressure	40	63
At-Rest Earth Pressure	60	95

The retaining wall parameters provided do not account for hydrostatic pressure behind the retaining walls. Therefore, the subdrain system is a very important part of the design. All retaining walls should be designed to resist surcharge loads imposed by other nearby walls, structures, or vehicles should be added to the above earth pressures, if the additional loads are being applied within a 1.5:1 (h:v) plane projected up from the heel of the retaining wall footing. As a way of minimizing surcharge loads and the settlement potential of nearby buildings, the footings for the building can be deepened below the 1.5:1 (h:v)plane projected up from the heel of the retaining wall footing.

Upon request and under a separate scope of work, more detailed analyses can be performed to address equivalent fluid pressures with regard to stepped retaining walls, actual retaining wall heights, actual backfill inclinations, specific backfill materials, higher retaining walls requiring earthquake design motions, etc.

Subdrain System

We recommend a perforated pipe and gravel subdrain system be provided behind all proposed retaining walls to prevent the buildup of hydrostatic pressure behind the proposed retaining walls. The perforated pipe should consist of 4-inch minimum diameter Schedule 40 PVC or ABS SDR-35, placed with the perforations facing down. The pipe should be surrounded by 1 cubic foot per foot of ¾- or 1½ inch open graded gravel wrapped in filter fabric. The filter fabric should consist of Mirafi 140N or equivalent to prevent infiltration of fines and subsequent clogging of the subdrain system.

In lieu of a perforated pipe and gravel subdrain system, weep holes or open vertical masonry joints may be provided in the lowest row of block exposed to the air to prevent the buildup of hydrostatic pressure behind the proposed retaining walls. Weep holes should be a minimum of 3 inches in diameter and provided at intervals of at least every 6 feet along the wall. Open vertical masonry joints should be provided at a minimum of 32 inch intervals. A continuous gravel fill, a minimum of 1 cubic foot per foot, should be placed behind the weep holes or open masonry joints. The gravel should be wrapped in filter fabric consisting of Mirafi 140N or equivalent.

The retaining walls should be adequately coated on the backfilled side of the walls with a proven waterproofing compound by an experienced professional to inhibit infiltration of moisture through the walls.

Temporary Excavations

All excavations should be made in accordance with Cal-OSHA requirements. Earth Strata Geotechnical Services is not responsible for job site safety.

Retaining Wall Backfill

Retaining wall backfill materials should be approved by the geotechnical engineer or his representative prior to placement as compacted fill. Retaining wall backfill should be placed in lifts no greater than 6 to 8 inches, watered or air dried as necessary to achieve near optimum moisture contents. All retaining wall backfill should be compacted to a minimum of 90 percent of the maximum dry density as determined by ASTM D 1557. Retaining wall backfill should be capped with a paved surface drain.

CONCRETE FLATWORK

Thickness and Joint Spacing

Concrete sidewalks and patio type slabs should be at least 4 inches thick and provided with construction or expansion joints every 6 feet or less, to reduce the potential for excessive cracking. Concrete driveway slabs should be at least 5 inches thick and provided with construction or expansion joints every 10 feet or less.

Subgrade Preparation

In order to reduce the potential for unsightly cracking, subgrade earth materials underlying concrete flatwork should be compacted at near optimum moisture to a minimum of 90 percent of the maximum dry density determined by ASTM D 1557 and then moistened to optimum or slightly above optimum moisture content. This moisture should extend to a depth of 12 inches below subgrade and be maintained prior to placement of concrete. Pre-watering of the earth materials prior to placing concrete will promote uniform curing of the concrete and minimize the development of shrinkage cracks. The project geotechnical engineer or his representative should verify the density and moisture content of the earth materials and the depth of moisture penetration prior to placing concrete.

Cracking within concrete flatwork is often a result of factors such as the use of too high a water to cement ratio and/or inadequate steps taken to prevent moisture loss during the curing of the concrete. Concrete distress can be reduced by proper concrete mix design and proper placement and curing of the concrete. Minor cracking within concrete flatwork is normal and should be expected.

GRADING PLAN REVIEW AND CONSTRUCTION SERVICES

This report has been prepared for the exclusive use of **Empire Design Group** and their authorized representative. It likely does not contain sufficient information for other parties or other uses. Earth Strata Geotechnical Services should be engaged to review the final design plans and specifications prior to construction. This is to verify that the recommendations contained in this report have been properly incorporated into the project plans and specifications. Should Earth Strata Geotechnical Services not be accorded the opportunity to review the project plans and specifications, we are not responsibility for misinterpretation of our recommendations.

We recommend that Earth Strata Geotechnical Services be retained to provide geologic and geotechnical engineering services during grading and foundation excavation phases of the work. In order to allow for design changes in the event that the subsurface conditions differ from those anticipated prior to construction.

Earth Strata Geotechnical Services should review any changes in the project and modify and approve in writing the conclusions and recommendations of this report. This report and the drawings contained within are intended for design input purposes only and are not intended to act as construction drawings or specifications. In the event that conditions encountered during grading or construction operations appear to be different than those indicated in this report, this office should be notified immediately, as revisions may be required.

REPORT LIMITATIONS

Our services were performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable soils engineers and geologists, practicing at the time and location this report was prepared. No other warranty, expressed or implied, is made as to the conclusions and professional advice included in this report.

Earth materials vary in type, strength, and other geotechnical properties between points of observation and exploration. Groundwater and moisture conditions can also vary due to natural processes or the works of man on this or adjacent properties. As a result, we do not and cannot have complete knowledge of the subsurface conditions beneath the subject property. No practical study can completely eliminate uncertainty with regard to the anticipated geotechnical conditions in connection with a subject property. The conclusions and recommendations within this report are based upon the findings at the points of observation and are subject to confirmation by Earth Strata Geotechnical Services based on the conditions revealed during grading and construction.

This report was prepared with the understanding that it is the responsibility of the owner or their representative, to ensure that the conclusions and recommendations contained herein are brought to the attention of the other project consultants and are incorporated into the plans and specifications. The owners' contractor should properly implement the conclusions and recommendations during grading and construction, and notify the owner if they consider any of the recommendations presented herein to be unsafe or unsuitable.

APPENDIX A

REFERENCES

APPENDIX A

References

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APPENDIX B

EXPLORATORY LOGS

Geotechnical Boring Log B-2

Date: August 23, 2019	**Project Name: Lake Steet, Lake Elsinore** **Page: 1 of 1**
Project Number: 192805-10A	**Logged By: JF**
Drilling Company: Drilling It	**Type of Rig: B-61**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): See Map	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Quaternary Young Alluvial Valley Deposits (Qyv):**
					SC	Clayey SAND; dark brown, dry, medium dense, fine to coarse sand with
	35	2.5'	119.6	11.8		trace gravel
					SM	Silty SAND; dark yellowish brown, dense, fine to coarse sand with clay
5						
	83/11"	5'	123.2	2.1		Very dense below 5 feet
	83/10"	7.5'	112.9	8.3		Light olive yellow
10						Total Depth: 8.5 feet
						No Groundwater
15						
20						
25						
30						

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Geotechnical, Environmental and Materials Testing Consultants
www.ESGSINC.com (951) 397-8315

Geotechnical Boring Log B-3

Date: August 23, 2019	**Project Name: Lake Steet, Lake Elsinore** **Page: 1 of 1**
Project Number: 192805-10A	**Logged By: JF**
Drilling Company: Drilling It	**Type of Rig: B-61**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): See Map	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0						**Quaternary Young Alluvial Valley Deposits (Qyv):**
					SM	Silty SAND; light yellowish brown, dry, very dense, fine to coarse sand with
	44	2.5'	101.3	10.9		clay and trace gravel
5	90/11"	5'	103.1	15.6	ML	Sandy SILT; olive yellow, dry, very stiff, fine to medium sand
	REF/5"	7.5'	113.2	8.4		
10						Total Depth: 8.5 feet
						No Groundwater
15						
20						
25						
30						

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Geotechnical Boring Log B-1

Date: August 23, 2019	**Project Name: Lake Steet, Lake Elsinore** **Page: 1 of 1**
Project Number: 192805-10A	**Logged By: JF**
Drilling Company: Drilling It	**Type of Rig: B-61**
Drive Weight (lbs): 140	**Drop (in): 30** **Hole Diameter (in): 8**
Top of Hole Elevation (ft): See Map	**Hole Location: See Geotechnical Map**

Depth (ft)	Blow Count Per Foot	Sample Depth	Dry Density (pcf)	Moisture (%)	Classification Symbol	MATERIAL DESCRIPTION
0		0-5'				**Quaternary Young Alluvial Valley Deposits (Qyv):**
					SM	Silty SAND; yellowish brown, dry, medium dense, fine to coarse sand with clay
	63	2.5'	120.1	6.2		and trace gravel
						Very dense below 2 feet
5	49	5'	125.9	5.4		Olive yellow, dry to slightly moist, fine to medium sand below 5 feet
	74	7.5'	112.6	3.9		
10	43	10'	113.9	5.3		
15	45	15'	104.9	8.7		Strong brown, fine to coarse sand
						Total Depth: 16.5 feet
						No Groundwater
20						
25						
30						

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GEOTECHNICAL BORING LOG B-1

Date 11-16-07 **Sheet** 1 **of** 2

Project Marinita Devel Lake Street Prelim **Project No.** 602051-001

Drilling Co. Redman Drilling **Type of Rig** CME-75

Hole Diameter 8" inches **Drive Weight** 140lb **Drop** 30 inches

Elevation Top of Hole +/- feet **Location** See Boring Location Map

Elevation Feet	Depth Feet	Graphic Log (N S)	Notes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION (Logged By KXS; Sampled By)	Type of Tests
	0							SM	QUATERNARY YOUNGER ALLUVIUM (Qal)	
			B1-1 @ 0-5'						@0-5': Silty fine to medium grained SAND with coarse grained particles, brown, damp	EI
	5			R-2	20	114	4		@5': Silty fine to coarse grained SAND, brown, damp, medium dense	
								SM	QUATERNARY OLDER ALLUVIUM (Qalo)	
	10			R-3	50/4"				@10': Silty fine to coarse grained SAND, dark brown, damp, dense	DS
	15			R-4	76/11"				@15': Silty fine to coarse grained SAND, brown, moist, dense	
	20			R-5	67	117	15		@20': Silty fine to medium grained SAND with lean clay, dark brown, moist, dense	
	25			R-6	50/5"				@25': Silty fine to medium grained SAND, dark brown, moist, dense	
	30									

SAMPLE TYPES:

- S SPT
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- C CORE SAMPLE

TYPE OF TESTS:

- SU SULFATE
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDROCOLLAPSE
- HD HYDROMETER
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE
- CS CORROSION SUITE
- MC MOISTURE CONTENT
- SE SAND EQUIVALENT
- -200 200 WASH
- RDS REMOLDED DS
- LOI LOSS ON IGNITION

Leighton

GEOTECHNICAL BORING LOG B-1

Date 11-16-07 **Sheet** 2 **of** 2

Project Marinita Devel Lake Street Prelim **Project No.** 602051-001

Drilling Co. Redman Drilling **Type of Rig** CME-75

Hole Diameter 8" inches **Drive Weight** 140lb **Drop** 30 inches

Elevation Top of Hole +/- feet **Location** See Boring Location Map

Elevation Feet	Depth Feet	Graphic Log	Notes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
		N S							**Logged By** KXS **Sampled By**	
	30			R-7	50/1.5"				@30': Silty fine to medium grained SAND, brown, moist, very dense	
									Total Depth 30' 1.5" Grounwater Not Encountered Backfilled with Spoils on 11/16/2007	
	35									
	40									
	45									
	50									
	55									
	60									

SAMPLE TYPES:

- S SPT
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- C CORE SAMPLE

TYPE OF TESTS:

- SU SULFATE
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDROCOLLAPSE
- HD HYDROMETER
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE
- CS CORROSION SUITE
- MC MOISTURE CONTENT
- SE SAND EQUIVALENT
- -200 200 WASH
- RDS REMOLDED DS
- LOI LOSS ON IGNITION

Leighton

GEOTECHNICAL BORING LOG B-2

Date 11-16-07 **Sheet** 1 **of** 1

Project Marinita Devel Lake Street Prelim **Project No.** 602051-001

Drilling Co. Redman Drilling **Type of Rig** CME-75

Hole Diameter 8" inches **Drive Weight** 140lb **Drop** 30 inches

Elevation Top of Hole +/- feet **Location** See Boring Location Map

Logged By KXS

Sampled By

Elevation Feet	Depth Feet	Graphic Log	Notes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0	N S						SM	QUATERNARY OLDER ALLUVIUM (Qalo)	
			B2-1 @ 0-5'						@0-5': Silty fine to coarse grained SAND, brown, damp	SA
	5			R-2	50/3"	109	4		@5': Silty fine to medium grained SAND, light brown, damp, dense	
	10			R-3	50/5"	101	11		@10': Silty fine to medium grained SAND, dark brown, moist, dense	
	15			R-4	50/5"				@15': Silty fine to medium grained SAND, dark brown, moist, very dense	
	20								Total Depth 15' 6" Grounwater Not Encountered Backfilled with Spoils on 11/16/2007	
	25									
	30									

SAMPLE TYPES:

- S SPT
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- C CORE SAMPLE

TYPE OF TESTS:

- SU SULFATE
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDROCOLLAPSE
- HD HYDROMETER
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE
- CS CORROSION SUITE
- MC MOISTURE CONTENT
- SE SAND EQUIVALENT
- -200 200 WASH
- RDS REMOLDED DS
- LOI LOSS ON IGNITION

Leighton

GEOTECHNICAL BORING LOG B-3

Date 11-16-07 **Sheet** 1 **of** 1

Project Marinita Devel Lake Street Prelim **Project No.** 602051-001

Drilling Co. Redman Drilling **Type of Rig** CME-75

Hole Diameter 8" inches **Drive Weight** 140lb **Drop** 30 inches

Elevation Top of Hole +/- feet **Location** See Boring Location Map

Elevation Feet	Depth Feet	Graphic Log (N S)	Notes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION (Logged By KXS; Sampled By)	Type of Tests
	0							SM	QUATERNARY OLDER ALLUVIUM (Qalo)	
									@0-5': Silty fine to medium grained SAND, brown, damp	
	5			R-1	50/3"	108	4		@5': Silty fine to medium grained SAND, dark brown, damp, dense	
	10			R-2	50/3"				@10': Silty fine to coarse grained SAND, light brown, moist, dense	
									Total Depth 10' 9" Grounwater Not Encountered Backfilled with Spoils on 11/16/2007	
	15									
	20									
	25									
	30									

SAMPLE TYPES:

- S SPT
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- C CORE SAMPLE

TYPE OF TESTS:

- SU SULFATE
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDROCOLLAPSE
- HD HYDROMETER
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE
- CS CORROSION SUITE
- MC MOISTURE CONTENT
- SE SAND EQUIVALENT
- -200 200 WASH
- RDS REMOLDED DS
- LOI LOSS ON IGNITION

Leighton

GEOTECHNICAL BORING LOG B-4

Date 11-16-07 **Sheet** 1 **of** 1

Project Marinita Devel Lake Street Prelim **Project No.** 602051-001

Drilling Co. Redman Drilling **Type of Rig** CME-75

Hole Diameter 8" inches **Drive Weight** 140lb **Drop** 30 inches

Elevation Top of Hole +/- feet **Location** See Boring Location Map

Elevation Feet	Depth Feet	Graphic Log (N S)	Notes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0							SM	QUATERNARY YOUNGER ALLUVIUM (Qal)	
			B4-1 @ 0-5'						@0-5': Silty fine to coarse grained SAND, dark brown, damp	
	5			R-2	30	116	7	SM	QUATERNARY OLDER ALLUVIUM (Qalo) @5': Silty fine to coarse grained SAND, brown, moist, medium dense	
	10			R-3	69	121	6		@10': Silty fine to medium grained SAND with coarse grained particles, brown, moist, dense	
	15			R-4	61	117	6		@15': Silty fine to coarse grained SAND with silt, gray, moist, dense	
	20			R-5	50/2"				No Recovery	
									Total Depth 20' 2" Grounwater Not Encountered Backfilled with Spoils on 11/16/2007	
	25									
	30									

Logged By KXS

Sampled By

SAMPLE TYPES:

- S SPT
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- C CORE SAMPLE

TYPE OF TESTS:

- SU SULFATE
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDROCOLLAPSE
- HD HYDROMETER
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE
- CS CORROSION SUITE
- MC MOISTURE CONTENT
- SE SAND EQUIVALENT
- -200 200 WASH
- RDS REMOLDED DS
- LOI LOSS ON IGNITION

Leighton

GEOTECHNICAL BORING LOG B-5

Date 11-16-07 **Sheet** 1 **of** 1

Project Marinita Devel Lake Street Prelim **Project No.** 602051-001

Drilling Co. Redman Drilling **Type of Rig** CME-75

Hole Diameter 8" inches **Drive Weight** 140lb **Drop** 30 inches

Elevation Top of Hole +/- feet **Location** See Boring Location Map

Elevation Feet	Depth Feet	Graphic Log (N S)	Notes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION (Logged By KXS; Sampled By)	Type of Tests
	0							SM	QUATERNARY YOUNGER ALLUVIUM (Qal) @0-5': Silty fine to medium grained SAND with coarse grained particles, brown, damp	
	5			R-1	58	114	4	SM	QUATERNARY OLDER ALLUVIUM (Qalo) @5': Silty fine to medium grained SAND with coarse grained particles & gravel, gray, moist, medium dense	HCO
	10			R-2	35	106	6		@10': Silty fine to medium grained SAND with coarse grained particles, brown, moist, medium dense	HCO
	15			R-3	50/4"				@15': Silty fine to coarse grained SAND, brown, moist, dense	
	20			R-4	50/6"				@20': Silty fine to coarse grained SAND with gravel, dark brown, moist, dense	
	25								Total Depth 21' Grounwater Not Encountered Backfilled with Spoils on 11/16/2007	
	30									

SAMPLE TYPES:
- S SPT
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- C CORE SAMPLE

TYPE OF TESTS:
- SU SULFATE
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDROCOLLAPSE
- HD HYDROMETER
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE
- CS CORROSION SUITE
- MC MOISTURE CONTENT
- SE SAND EQUIVALENT
- -200 200 WASH
- RDS REMOLDED DS
- LOI LOSS ON IGNITION

Leighton

GEOTECHNICAL BORING LOG B-6

Date 11-16-07 **Sheet** 1 **of** 1

Project Marinita Devel Lake Street Prelim **Project No.** 602051-001

Drilling Co. Redman Drilling **Type of Rig** CME-75

Hole Diameter 8" inches **Drive Weight** 140lb **Drop** 30 inches

Elevation Top of Hole +/- feet **Location** See Boring Location Map

Elevation Feet	Depth Feet	Graphic Log (N S)	Notes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
									Logged By KXS **Sampled By**	
	0		B6-1 @ 0-5'					SM	QUATERNARY YOUNGER ALLUVIUM (Qal) @0-5': Silty fine SAND, reddish brown, moist	CS
	5			R-2	84/8"	117	8	SM	QUATERNARY OLDER ALLUVIUM (Qalo) @5': Silty fine SAND, reddish brown, moist, dense	
	10			R-3	50/3"				@10': Silty fine to coarse grained SAND with gravel, gray & brown, moist, very dense	
	15			R-4	50/4"				@15': Silty fine to coarse grained SAND with gravel, gray & brown, moist, very dense	
	20								Total Depth 15' 4" Grounwater Not Encountered Backfilled with Spoils on 11/16/2007	
	25									
	30									

SAMPLE TYPES:
- S SPT
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- C CORE SAMPLE

TYPE OF TESTS:
- SU SULFATE
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDROCOLLAPSE
- HD HYDROMETER
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE
- CS CORROSION SUITE
- MC MOISTURE CONTENT
- SE SAND EQUIVALENT
- -200 200 WASH
- RDS REMOLDED DS
- LOI LOSS ON IGNITION

Leighton

GEOTECHNICAL BORING LOG B-7

Date 11-16-07 **Sheet** 1 **of** 1

Project Marinita Devel Lake Street Prelim **Project No.** 602051-001

Drilling Co. Redman Drilling **Type of Rig** CME-75

Hole Diameter 8" inches **Drive Weight** 140lb **Drop** 30 inches

Elevation Top of Hole +/- feet **Location** See Boring Location Map

Elevation Feet	Depth Feet	Graphic Log (N / S)	Notes	Sample No.	Blows per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
									Logged By KXS **Sampled By**	
	0		B7-1 @ 2-5'					SM	QUATERNARY YOUNGER ALLUVIUM (Qal) @0-2': Silty fine SAND, reddish brown brown, moist @2-5': Silty fine to medium grained SAND with coarese grained particles, brown, moist	
	5			R-2	50/5"	113	3	SM	QUATERNARY OLDER ALLUVIUM (Qalo) @5': Silty fine to coarse grained SAND, brown, moist, dense	
	10			R-3	50/6"	93	7		@10': Silty fine to coarse grained SAND, brown, moist, dense (ring sample distrubed during sampling)	
	15			R-4	70				@15': Silty fine SAND, brown, moist, dense	
	20								Total Depth 16' 6" Grounwater Not Encountered Backfilled with Spoils on 11/16/2007	
	25									
	30									

SAMPLE TYPES:

- S SPT
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- C CORE SAMPLE

TYPE OF TESTS:

- SU SULFATE
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDROCOLLAPSE
- HD HYDROMETER
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE
- CS CORROSION SUITE
- MC MOISTURE CONTENT
- SE SAND EQUIVALENT
- -200 200 WASH
- RDS REMOLDED DS
- LOI LOSS ON IGNITION

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APPENDIX C

LABORATORY PROCEDURES AND TEST RESULTS

APPENDIX C

Laboratory Procedures and Test Results

Laboratory testing provided quantitative and qualitative data involving the relevant engineering properties of the representative earth materials selected for testing. The representative samples were tested in general accordance with American Society for Testing and Materials (ASTM) procedures and/or California Test Methods (CTM).

Soil Classification: Earth materials encountered during exploration were classified and logged in general accordance with the Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) of ASTM D 2488. Upon completion of laboratory testing, exploratory logs and sample descriptions were reconciled to reflect laboratory test results with regard to ASTM D 2487.

Moisture and Density Tests: For select samples moisture content was determined using the guidelines of ASTM D 2216 and dry density determinations were made using the guidelines of ASTM D 2937. These tests were performed on relatively undisturbed samples and the test results are presented on the exploratory logs.

Maximum Density Tests: The maximum dry density and optimum moisture content of representative samples were determined using the guidelines of ASTM D 1557. The test results are presented in the table below.

SAMPLE LOCATION	MATERIAL DESCRIPTION	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT (%)
Bulk 1@ 0 - 5 feet	Clayey SAND	127.0	10.5

Expansion Index: The expansion potential of representative samples was evaluated using the guidelines of ASTM D 4829. The test results are presented in the table below.

SAMPLE LOCATION	MATERIAL DESCRIPTION	EXPANSION INDEX	EXPANSION POTENTIAL
Bulk 1@ 0 - 5 feet	Clayey SAND	25	Low

Minimum Resistivity and pH Tests: Minimum resistivity and pH Tests of select samples were performed using the guidelines of CTM 643. The test results are presented in the table below.

SAMPLE LOCATION	MATERIAL DESCRIPTION	pH	MINIMUM RESISTIVITY (ohm-cm)
Bulk 1@ 0 - 5 feet	Clayey SAND	7.2	1,900

Soluble Sulfate: The soluble sulfate content of select samples was determined using the guidelines of CTM 417. The test results are presented in the table below.

SAMPLE LOCATION	MATERIAL DESCRIPTION	SULFATE CONTENT (% by weight)	SULFATE EXPOSURE
Bulk 1@ 0 - 5 feet	Clayey SAND	0.001	Negligible

Chloride Content: Chloride content of select samples was determined using the guidelines of CTM 422. The test results are presented in the table below.

SAMPLE LOCATION	MATERIAL DESCRIPTION	CHLORIDE CONTENT (ppm)
Bulk 1@ 0 - 5 feet	Clayey SAND	30

Previous Laboratory Testing by Leighton Consulting, Inc.

Previous laboratory testing was performed on selected representative subsurface soil samples by Leighton Consulting (2007) to evaluate the chemical and physical characteristics of the selected soils. A discussion of the laboratory test methods performed, and a summary of the laboratory test data is presented below.

Grain Size Distribution: Select samples were tested using the guidelines of ASTM D 1140. The test results are presented in the table below.

SAMPLE LOCATION	MATERIAL DESCRIPTION	% PASSING # 200 SIEVE
B-1 @ 0 - 5 feet	Clayey SAND	38

Atterberg Limits: The Atterberg limits of select samples were determined using the guidelines of ASTM D 4318 for engineering classification of fine materials. The test results are presented in the table below.

SAMPLE LOCATION	MATERIAL DESCRIPTION	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	ASTM SYMBOL
B-2 @ 0 - 5 feet	Clayey SAND	-	-	-	SC

Expansion Index: The expansion potential of representative samples was evaluated using the guidelines of ASTM D 4829. The test results are presented in the table below.

SAMPLE LOCATION	MATERIAL DESCRIPTION	EXPANSION INDEX	EXPANSION POTENTIAL
B-1 @ 0 - 5 feet	Silty SAND	5	Very Low

Direct Shear: Direct shear tests were performed on representative remolded and/or undisturbed samples using the guidelines of ASTM D 3080.

SAMPLE LOCATION	MATERIAL DESCRIPTION	*FRICTION ANGLE (degrees)	*APPARENT COHESION (psf)
B-1 @ 10 feet	Clayey SAND	35	680

Remolded to 90 percent of the maximum dry density.

R-Value: The R-value of representative samples was determined using the guidelines of CTM 301. The test results are presented in the table below.

SAMPLE LOCATION	MATERIAL DESCRIPTION	R-VALUE
B-1 @ 0 - 5 feet	Silty SAND	53

Minimum Resistivity and pH Tests: Minimum resistivity and pH Tests of select samples were performed using the guidelines of CTM 643. The test results are presented in the table below.

SAMPLE LOCATION	MATERIAL DESCRIPTION	pH	MINIMUM RESISTIVITY (ohm-cm)
B-1 @ 0 - 5 feet	Silty SAND	6.8	11,645

Soluble Sulfate: The soluble sulfate content of select samples was determined using the guidelines of CTM 417. The test results are presented in the table below.

SAMPLE LOCATION	MATERIAL DESCRIPTION	SULFATE CONTENT (% by weight)	SULFATE EXPOSURE
B-6 @ 0 – 5 feet	B-6 @ 0 – 5 feet	<0.015	Negligible

Chloride Content: Chloride content of select samples was determined using the guidelines of CTM 422. The test results are presented in the table below.

SAMPLE LOCATION	MATERIAL DESCRIPTION	CHLORIDE CONTENT (ppm)
B-6 @ 0 - 5 feet	Silty SAND	340

APPENDIX D

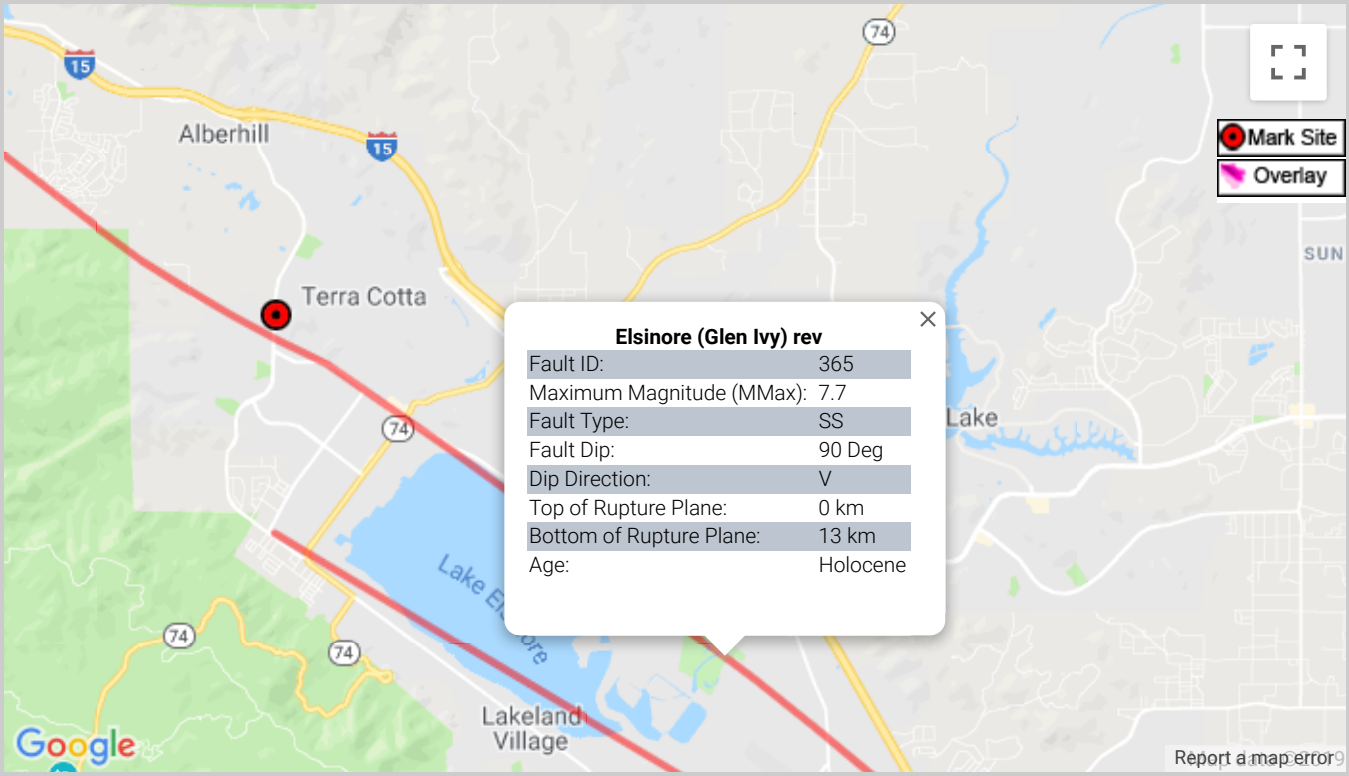
SEISMICITY

CALIFORNIA DEPARTMENT OF TRANSPORTATION

Caltrans ARS Online (v2.3.09)

This web-based tool calculates both deterministic and probabilistic acceleration response spectra for any location in California based on criteria provided in *Appendix B of Caltrans Seismic Design Criteria*. More...

SELECT SITE LOCATION

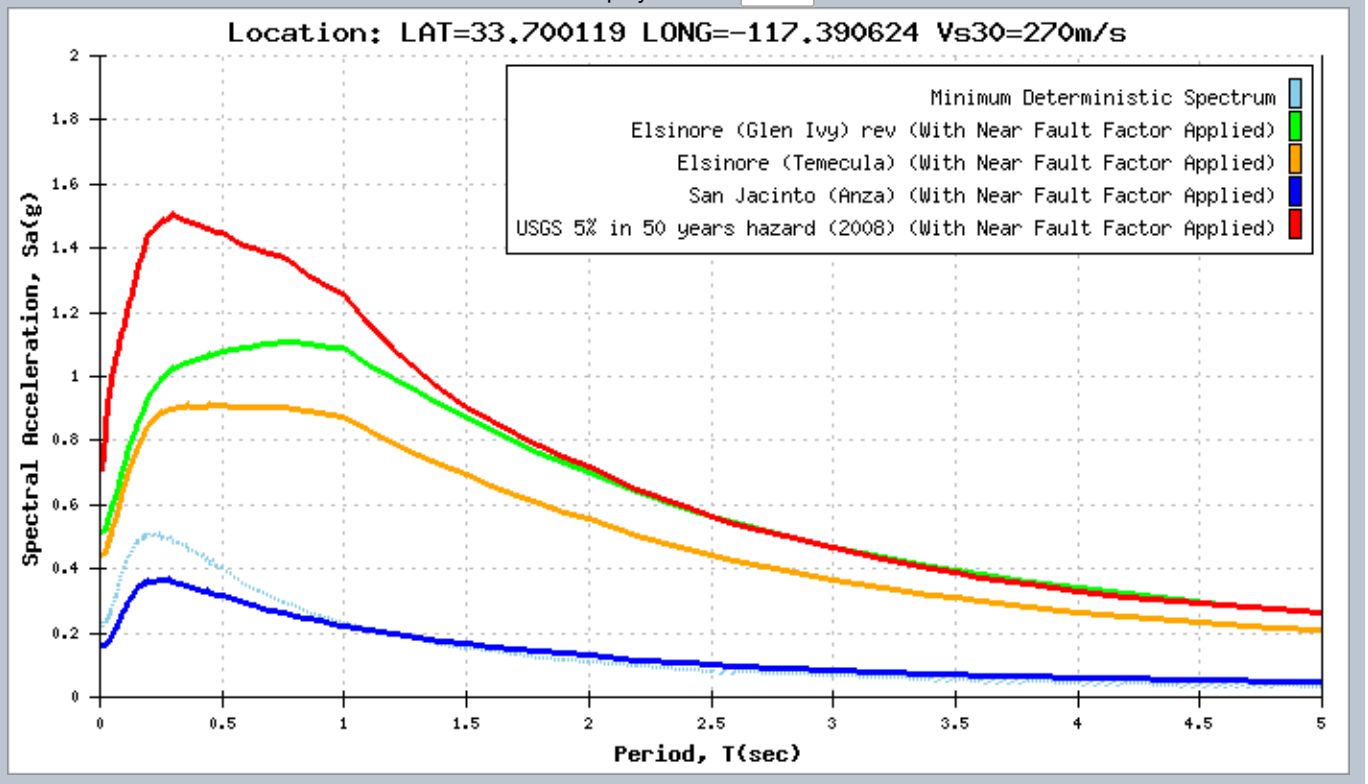


Elsinore (Glen Ivy) rev

Fault ID:	365
Maximum Magnitude (MMax):	7.7
Fault Type:	SS
Fault Dip:	90 Deg
Dip Direction:	V
Top of Rupture Plane:	0 km
Bottom of Rupture Plane:	13 km
Age:	Holocene

Latitude: 33.700119 **Longitude:** -117.390624 ***V*S30:** 270 m/s Calculate

CALCULATED SPECTRA Display Curves: 3



Tabular Data | Envelope Only | Hide Near Fault | Axis Scale | Show Basin

Apply Near Fault Adjustment To:
NOTE: Caltrans SDC requires application of a Near Fault Adjustment factor for sites less than 25 km (Rrup) from the causative fault.

☑ Deterministic Spectrum Using

0.31 Km Elsinore (Glen Ivy) rev
3.60 Km Elsinore (Temecula)
33.08 Km San Jacinto (Anza)

☑ Probabilistic Spectrum Using

0.31 Km (Recommend Performing Deaggregation To Verify)

◉ Show Spectrum with Adjustment Only
○ Show Spectrum with and without near fault Adjustment

OK

This application is being updated for digital accessibility and will continue to function while updates are in progress.

U.S. Geological Survey - Earthquake Hazards Program

2008 National Seismic Hazard Maps - Source Parameters

New Search

Distance in Kilometers	Name	State	Pref Slip Rate (mm/yr)	Dip (degrees)	Dip Dir	Slip Sense	Rupture Top (km)	Rupture Bottom (km)	Length (km)
0.34	Elsinore;GI+T+J	CA	n/a	86	NE	strike slip	0	17	153
0.34	Elsinore;W+GI+T	CA	n/a	84	NE	strike slip	0	14	124
0.34	Elsinore;W+GI	CA	n/a	81	NE	strike slip	0	14	83
0.34	Elsinore;GI+T	CA	5	90	V	strike slip	0	14	78
0.34	Elsinore;GI+T+J+CM	CA	n/a	86	NE	strike slip	0	16	195
0.34	Elsinore;W+GI+T+J+CM	CA	n/a	84	NE	strike slip	0	16	241
0.34	Elsinore;GI	CA	5	90	V	strike slip	0	13	37
0.34	Elsinore;W+GI+T+J	CA	n/a	84	NE	strike slip	0	16	199
3.59	Elsinore;T+J	CA	n/a	86	NE	strike slip	0	17	127
3.59	Elsinore;T+J+CM	CA	n/a	85	NE	strike slip	0	16	169
3.59	Elsinore;T	CA	5	90	V	strike slip	0	14	52
21.33	Chino, alt 2	CA	1	65	SW	strike slip	0	14	29
23.42	Elsinore;W	CA	2.5	75	NE	strike slip	0	14	46
25.54	Chino, alt 1	CA	1	50	SW	strike slip	0	9	24
28.74	San Joaquin Hills	CA	0.5	23	SW	thrust	2	13	27
33.56	San Jacinto;A+CC+B	CA	n/a	90	V	strike slip	0.1	15	152
33.56	San Jacinto;A+C	CA	n/a	90	V	strike slip	0	17	118
33.56	San Jacinto;A+CC+B+SM	CA	n/a	90	V	strike slip	0.1	15	178

33.56	San Jacinto;A	CA	9	90	V	strike slip	0	17	71
33.56	San Jacinto;A+CC	CA	n/a	90	V	strike slip	0	16	118
35.52	San Jacinto;SBV+SJV	CA	n/a	90	V	strike slip	0	16	88
35.52	San Jacinto;SJV+A+CC+B+SM	CA	n/a	90	V	strike slip	0.1	15	196
35.52	San Jacinto;SJV+A+CC+B	CA	n/a	90	V	strike slip	0.1	15	170
35.52	San Jacinto;SJV	CA	18	90	V	strike slip	0	16	43
35.52	San Jacinto;SJV+A+CC	CA	n/a	90	V	strike slip	0	16	136
35.52	San Jacinto;SJV+A+C	CA	n/a	90	V	strike slip	0	17	136
35.52	San Jacinto;SJV+A	CA	n/a	90	V	strike slip	0	17	89
35.52	San Jacinto;SBV+SJV+A+CC+B+SM	CA	n/a	90	V	strike slip	0.1	15	241
35.52	San Jacinto;SBV+SJV+A+CC+B	CA	n/a	90	V	strike slip	0.1	15	215
35.52	San Jacinto;SBV+SJV+A+CC	CA	n/a	90	V	strike slip	0	16	181
35.52	San Jacinto;SBV+SJV+A+C	CA	n/a	90	V	strike slip	0	17	181
35.52	San Jacinto;SBV+SJV+A	CA	n/a	90	V	strike slip	0	16	134
37.90	San Jacinto;SBV	CA	6	90	V	strike slip	0	16	45
42.59	Newport Inglewood Connected alt 1	CA	1.3	89		strike slip	0	11	208
42.59	Newport Inglewood Connected alt 2	CA	1.3	90	V	strike slip	0	11	208
42.59	Newport-Inglewood (Offshore)	CA	1.5	90	V	strike slip	0	10	66
49.36	Puente Hills (Coyote Hills)	CA	0.7	26	N	thrust	2.8	15	17
51.40	Newport-Inglewood, alt 1	CA	1	88		strike slip	0	15	65
51.91	S. San Andreas;CH+CC+BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	14	384
51.91	S. San Andreas;CH+CC+BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	86		strike slip	0.1	13	512

51.91	S. San Andreas;SSB+BG	CA	n/a	71		strike slip	0	13	101
51.91	S. San Andreas;NSB+SSB+BG+CO	CA	n/a	79		strike slip	0.2	12	206
51.91	S. San Andreas;CC+BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	14	322
51.91	S. San Andreas;CC+BB+NM+SM+NSB+SSB+BG	CA	n/a	85		strike slip	0	14	380
51.91	S. San Andreas;CC+BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	86		strike slip	0.1	13	449
51.91	S. San Andreas;CH+CC+BB+NM+SM+NSB+SSB+BG	CA	n/a	86		strike slip	0	14	442
51.91	S. San Andreas;NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	13	213
51.91	S. San Andreas;NM+SM+NSB+SSB+BG	CA	n/a	83		strike slip	0	14	271
51.91	S. San Andreas;NM+SM+NSB+SSB+BG+CO	CA	n/a	84		strike slip	0.1	13	340
51.91	S. San Andreas;NSB+SSB	CA	n/a	90	V	strike slip	0	13	79
51.91	S. San Andreas;NSB+SSB+BG	CA	n/a	75		strike slip	0	14	136
51.91	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0.1	13	421
51.91	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB+SSB+BG	CA	n/a	86		strike slip	0.1	13	479
51.91	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	86		strike slip	0.1	13	548
51.91	S. San Andreas;SM+NSB+SSB	CA	n/a	90	V	strike slip	0	13	176
51.91	S. San Andreas;SM+NSB+SSB+BG	CA	n/a	81		strike slip	0	13	234
51.91	S. San Andreas;SM+NSB+SSB+BG+CO	CA	n/a	83		strike slip	0.1	13	303
51.91	S. San Andreas;SSB	CA	16	90	V	strike slip	0	13	43
51.91	S. San Andreas;SSB+BG+CO	CA	n/a	77		strike slip	0.2	12	170
51.91	S. San Andreas;BB+NM+SM+NSB+SSB	CA	n/a	90	V	strike slip	0	14	263
51.91	S. San Andreas;BB+NM+SM+NSB+SSB+BG	CA	n/a	84		strike slip	0	14	321
51.91	S. San Andreas;BB+NM+SM+NSB+SSB+BG+CO	CA	n/a	85		strike slip	0.1	13	390

52.27	S. San Andreas;CC+BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0	14	279
52.27	S. San Andreas;PK+CH+CC+BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0.1	13	377
52.27	S. San Andreas;BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0	14	220
52.27	S. San Andreas;NM+SM+NSB	CA	n/a	90	V	strike slip	0	13	170
52.27	S. San Andreas;CH+CC+BB+NM+SM+NSB	CA	n/a	90	V	strike slip	0	14	341
52.27	S. San Andreas;SM+NSB	CA	n/a	90	V	strike slip	0	13	133
52.27	S. San Andreas;NSB	CA	22	90	V	strike slip	0	13	35
52.43	Cucamonga	CA	5	45	N	thrust	0	8	28
53.04	San Jose	CA	0.5	74	NW	strike slip	0	15	20
53.33	Elsinore;J	CA	3	84	NE	strike slip	0	19	75
53.33	Elsinore;J+CM	CA	3	84	NE	strike slip	0	17	118
57.01	Sierra Madre	CA	2	53	N	reverse	0	14	57
57.01	Sierra Madre Connected	CA	2	51		reverse	0	14	76
61.28	S. San Andreas;BG+CO	CA	n/a	72		strike slip	0.3	12	125
61.28	S. San Andreas;BG	CA	n/a	58		strike slip	0	13	56
63.55	Puente Hills (Santa Fe Springs)	CA	0.7	29	N	thrust	2.8	15	11
64.12	Rose Canyon	CA	1.5	90	V	strike slip	0	8	70
64.37	Cleghorn	CA	3	90	V	strike slip	0	16	25
66.59	Palos Verdes Connected	CA	3	90	V	strike slip	0	10	285
66.59	Palos Verdes	CA	3	90	V	strike slip	0	14	99
67.62	Coronado Bank	CA	3	90	V	strike slip	0	9	186
69.34	North Frontal (West)	CA	1	49	S	reverse	0	16	50
69.91	S. San Andreas;CH+CC+BB+NM+SM	CA	n/a	90	V	strike slip	0	14	306

69.91	S. San Andreas;CC+BB+NM+SM	CA	n/a	90	V	strike slip	0	14	243
69.91	S. San Andreas;BB+NM+SM	CA	n/a	90	V	strike slip	0	14	184
69.91	S. San Andreas;NM+SM	CA	n/a	90	V	strike slip	0	14	134
69.91	S. San Andreas;PK+CH+CC+BB+NM+SM	CA	n/a	90	V	strike slip	0.1	13	342
69.91	S. San Andreas;SM	CA	29	90	V	strike slip	0	13	98
73.25	Clamshell-Sawpit	CA	0.5	50	NW	reverse	0	14	16
73.37	Pinto Mtn	CA	2.5	90	V	strike slip	0	16	74
74.39	Puente Hills (LA)	CA	0.7	27	N	thrust	2.1	15	22
75.61	Raymond	CA	1.5	79	N	strike slip	0	16	22
77.36	Elysian Park (Upper)	CA	1.3	50	NE	reverse	3	15	20
82.68	San Jacinto;CC+B+SM	CA	n/a	90	V	strike slip	0.2	14	103
82.68	San Jacinto;CC+B	CA	n/a	90	V	strike slip	0.2	14	77
82.68	San Jacinto;CC	CA	4	90	V	strike slip	0	16	43
84.64	San Jacinto;C	CA	14	90	V	strike slip	0	17	47
85.30	Verdugo	CA	0.5	55	NE	reverse	0	15	29
87.30	Helendale-So Lockhart	CA	0.6	90	V	strike slip	0	13	114
89.21	North Frontal (East)	CA	0.5	41	S	thrust	0	16	27
90.57	Hollywood	CA	1	70	N	strike slip	0	17	17
94.35	Santa Monica Connected alt 2	CA	2.4	44		strike slip	0.8	11	93
94.39	Earthquake Valley	CA	2	90	V	strike slip	0	19	20
96.11	Burnt Mtn	CA	0.6	67	W	strike slip	0	16	21
99.76	Lenwood-Lockhart-Old Woman Springs	CA	0.9	90	V	strike slip	0	13	145

USGS

Search Results

1 of 1 earthquakes in map area.

Click for more information

6.5 **Gulf of Santa Catalina, California**
1800-11-22 21:30:00 (UTC) –

Didn't find what you were looking for?

- Check your Settings.
- Which earthquakes are included on the map and list?
- Felt something not shown – report it here.

Earthquakes updated

Hazards by Location

Search Information

Address: 28915 Lake St, Lake Elsinore, CA 92530, USA

Coordinates: 33.69979679999999, -117.391232

Elevation: ft

Timestamp: 2019-09-03T20:26:42.011Z

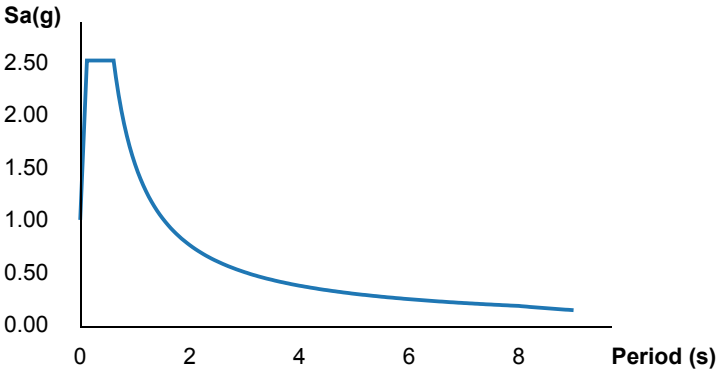
Hazard Type: Seismic

Reference Document: ASCE7-10

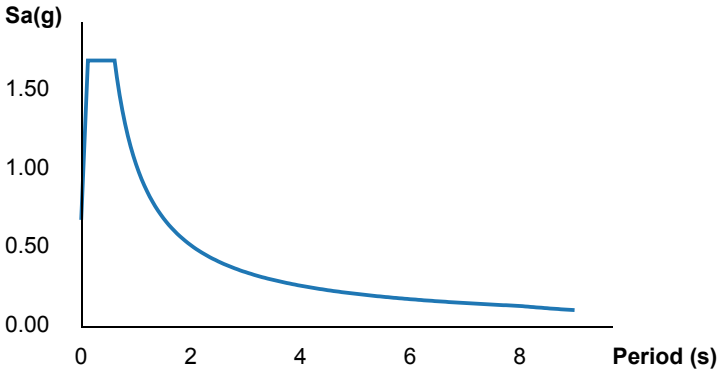
Risk Category: II

Site Class: D

MCER Horizontal Response Spectrum



Design Horizontal Response Spectrum



Basic Parameters

Name	Value	Description
S_S	2.53	MCE_R ground motion (period=0.2s)
S_1	1.028	MCE_R ground motion (period=1.0s)
S_{MS}	2.53	Site-modified spectral acceleration value
S_{M1}	1.542	Site-modified spectral acceleration value
S_{DS}	1.687	Numeric seismic design value at 0.2s SA
S_{D1}	1.028	Numeric seismic design value at 1.0s SA

Additional Information

Name	Value	Description
SDC	E	Seismic design category
F_a	1	Site amplification factor at 0.2s
F_v	1.5	Site amplification factor at 1.0s

CR_S	0.901	Coefficient of risk (0.2s)
CR_1	0.884	Coefficient of risk (1.0s)
PGA	1.023	MCE_G peak ground acceleration
F_{PGA}	1	Site amplification factor at PGA
PGA_M	1.023	Site modified peak ground acceleration
T_L	8	Long-period transition period (s)
SsRT	2.53	Probabilistic risk-targeted ground motion (0.2s)
SsUH	2.809	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	2.652	Factored deterministic acceleration value (0.2s)
S1RT	1.028	Probabilistic risk-targeted ground motion (1.0s)
S1UH	1.162	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	1.214	Factored deterministic acceleration value (1.0s)
PGAd	1.023	Factored deterministic acceleration value (PGA)

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Disclaimer

Hazard loads are provided by the U.S. Geological Survey Seismic Design Web Services.

APPENDIX E

GENERAL EARTHWORK AND GRADING SPECIFICATIONS

EARTH-STRATA

General Earthwork and Grading Specifications

General

Intent: These General Earthwork and Grading Specifications are intended to be the minimum requirements for the grading and earthwork shown on the approved grading plan(s) and/or indicated in the geotechnical report(s). These General Earthwork and Grading Specifications should be considered a part of the recommendations contained in the geotechnical report(s) and if they are in conflict with the geotechnical report(s), the specific recommendations in the geotechnical report shall supersede these more general specifications. Observations made during earthwork operations by the project Geotechnical Consultant may result in new or revised recommendations that may supersede these specifications and/or the recommendations in the geotechnical report(s).

The Geotechnical Consultant of Record: The Owner shall employ a qualified Geotechnical Consultant of Record (Geotechnical Consultant), prior to commencement of grading or construction. 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 or construction.

Prior to commencement of grading or construction, the Owner shall coordinate with the Geotechnical Consultant, and Earthwork Contractor (Contractor) to schedule sufficient personnel for the appropriate level of observation, mapping, and compaction testing.

During earthwork and grading operations, the Geotechnical Consultant shall observe, map, and document the subsurface conditions to confirm assumptions made during the geotechnical design phase of the project. Should the observed conditions differ significantly from the interpretive assumptions made during the design phase, the Geotechnical Consultant shall recommend appropriate changes to accommodate the observed conditions, and notify the reviewing agency where required.

The Geotechnical Consultant shall observe the moisture conditioning and processing of the excavations and fill materials. The Geotechnical Consultant should perform periodic relative density testing of fill materials to verify that the attained level of compaction is being accomplished as specified.

The Earthwork Contractor: The Earthwork Contractor (Contractor) shall be qualified, experienced, and knowledgeable in earthwork logistics, preparation and processing of earth materials to receive compacted fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall be provided with the approved grading plans and geotechnical report(s) for his review and acceptance of responsibilities, prior to commencement of grading. The Contractor shall be solely responsible for performing the grading in accordance with the approved grading plans and geotechnical report(s). Prior to commencement of grading, 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. The Contractor shall inform the Owner and the Geotechnical Consultant of work schedule changes and revisions to the work plan at least 24 hours in advance of such changes so that appropriate personnel will be available for observation and testing. No assumptions shall be made by the Contractor with regard to whether the Geotechnical Consultant is aware of all grading operations.

It is the sole responsibility of the Contractor to provide adequate equipment and methods to accomplish the earthwork operations 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). At the sole discretion of the Geotechnical Consultant, any unsatisfactory conditions, such as unsuitable earth materials, improper moisture conditioning, inadequate compaction, insufficient buttress keyway size, adverse weather conditions, etc., resulting in a quality of work less than required in the approved grading plans and geotechnical report(s), the Geotechnical Consultant shall reject the work and may recommend to the Owner that grading be stopped until conditions are corrected.

Preparation of Areas for Compacted Fill

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

The Geotechnical Consultant shall evaluate the extent of these removals on a site by site basis. Earth materials to be placed as compacted fill shall not contain more than 1 percent organic materials (by volume). No compacted fill lift shall contain more than 10 percent organic matter.

Should potentially hazardous materials be encountered, the Contractor shall stop work in the affected area, and a hazardous materials specialist shall immediately be consulted to evaluate the potentially hazardous materials, prior to continuing to work in that area.

It is our understanding that the State of California defines most refined petroleum products (gasoline, diesel fuel, motor oil, grease, coolant, etc.) as hazardous waste. As such, indiscriminate dumping or spillage of these fluids may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall be prohibited. The contractor is responsible for all hazardous waste related to his operations. The Geotechnical Consultant does not have expertise in this area. If hazardous waste is a concern, then the Owner should contract the services of a qualified environmental assessor.

Processing: Exposed earth materials that have been observed to be satisfactory for support of compacted fill by the Geotechnical Consultant shall be scarified to a minimum depth of 6 inches. Exposed earth materials that are not observed to be satisfactory shall be removed or alternative recommendations may be provided by the Geotechnical Consultant. Scarification shall continue until the exposed earth materials 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. The earth materials should be moistened or air dried to near optimum moisture content, prior to compaction.

Overexcavation: The Cut Lot Typical Detail and Cut/Fill Transition Lot Typical Detail, included herein provides a graphic illustration that depicts typical overexcavation recommendations made in the approved geotechnical report(s) and/or grading plan(s).

Keyways and Benching: Where fills are to be placed on slopes steeper than 5:1 (horizontal to vertical units), the ground shall be thoroughly benched as compacted fill is placed. Please see the three Keyway and Benching Typical Details with subtitles Cut Over Fill Slope, Fill Over Cut Slope, and Fill Slope for a graphic illustration. The lowest bench or smallest keyway shall be a minimum of 15 feet wide (or ½ the proposed slope height) and at least 2 feet into competent earth materials as advised by the Geotechnical Consultant. Typical benches shall be excavated a minimum height of 4 feet into competent earth materials or as recommended by the Geotechnical Consultant. Fill placed on slopes steeper than 5:1 should be thoroughly benched or otherwise excavated to provide a flat subgrade for the compacted fill.

Evaluation/Acceptance of Bottom Excavations: All areas to receive compacted fill (bottom excavations), including removal excavations, processed areas, keyways, and benching, shall be observed, mapped, general elevations recorded, and/or tested prior to being accepted by the Geotechnical Consultant as suitable to receive compacted fill. The Contractor shall obtain a written acceptance from the Geotechnical Consultant prior to placing compacted fill. A licensed surveyor shall provide the survey control for determining elevations of bottom excavations, processed areas, keyways, and

benching. The Geotechnical Consultant is not responsible for erroneously located, fills, subdrain systems, or excavations.

Fill Materials

General: Earth material to be used as compacted fill should to a large extent be free of organic matter and other deleterious substances as evaluated and accepted by the Geotechnical Consultant.

Oversize: Oversize material is rock that does not break down into smaller pieces and has a maximum diameter greater than 8 inches. Oversize rock shall not be included within compacted fill unless specific methods and guidelines acceptable to the Geotechnical Consultant are followed. For examples of methods and guidelines of oversize rock placement see the enclosed Oversize Rock Disposal Detail. The inclusion of oversize materials in the compacted fill shall only be acceptable if the oversize material is completely surrounded by compacted fill or thoroughly jetted granular materials. No oversize material shall be placed within 10 vertical feet of finish grade or within 2 feet of proposed utilities or underground improvements.

Import: Should imported earth materials be required, the proposed import materials shall meet the requirements of the Geotechnical Consultant. Well graded, very low expansion potential earth materials free of organic matter and other deleterious substances are usually sought after as import materials. However, it is generally in the Owners best interest that potential import earth materials are provided to the Geotechnical Consultant to determine their suitability for the intended purpose. At least 48 hours should be allotted for the appropriate laboratory testing to be performed, prior to starting the import operations.

Fill Placement and Compaction Procedures

Fill Layers: Fill materials shall be placed in areas prepared to receive fill in nearly horizontal layers not exceeding 8 inches in loose thickness. Thicker layers may be accepted by the Geotechnical Consultant, provided field density testing indicates that the grading procedures can adequately compact the thicker layers. Each layer of fill shall be spread evenly and thoroughly mixed to obtain uniformity within the earth materials and consistent moisture throughout the fill.

Moisture Conditioning of Fill: Earth materials to be placed as compacted fill shall be watered, dried, blended, and/or mixed, as needed to obtain relatively uniform moisture contents that are at or slightly above optimum. The maximum density and optimum moisture content tests should be performed in accordance with the American Society of Testing and Materials (ASTM test method D1557-00).

Compaction of Fill: After each layer has been moisture-conditioned, mixed, and evenly spread, it should be uniformly compacted to a minimum of 90 percent of maximum dry density as determined by ASTM test method D1557-00. Compaction equipment shall be adequately sized and be either specifically designed for compaction of earth materials or be proven to consistently achieve the required level of compaction.

Compaction of Fill Slopes: In addition to normal compaction procedures specified above, additional effort to obtain compaction on slopes is needed. This may be accomplished by backrolling of slopes with sheepsfoot rollers as the fill is being placed, by overbuilding the fill slopes, or by other methods producing results that are satisfactory to the Geotechnical Consultant. Upon completion of grading, relative compaction of the fill and the slope face shall be a minimum of 90 percent of maximum density per ASTM test method D1557-00.

Compaction Testing of Fill: Field tests for moisture content and relative density of the compacted fill earth materials shall be periodically performed by the Geotechnical Consultant. The location and frequency of tests shall be at the Geotechnical Consultant's discretion based on field observations. Compaction test locations will not necessarily be random. The test locations may or may not be selected to verify minimum compaction requirements in areas that are typically prone to inadequate compaction, such as close to slope faces and near benching.

Frequency of Compaction Testing: Compaction tests shall be taken at minimum intervals of every 2 vertical feet and/or per 1,000 cubic yards of compacted materials placed. Additionally, 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 for each 10 vertical feet of slope. The Contractor shall assure that fill placement is such that the testing schedule described herein can be accomplished by the Geotechnical Consultant. The Contractor shall stop or slow down the earthwork operations to a safe level so that these minimum standards can be obtained.

Compaction Test Locations: The approximate elevation and horizontal coordinates of each test location shall be documented by the Geotechnical Consultant. The Contractor shall coordinate with the Surveyor to assure that sufficient grade stakes are established. This will provide the Geotechnical Consultant with sufficient accuracy to determine the approximate test locations and elevations. The Geotechnical Consultant can not be responsible for staking erroneously located by the Surveyor or Contractor. A minimum of two grade stakes should be provided at a maximum horizontal distance of 100 feet and vertical difference of less than 5 feet.

Subdrain System Installation

Subdrain systems shall be installed in accordance with the approved geotechnical report(s), the approved grading plan, and the typical details provided herein. The Geotechnical Consultant may recommend additional subdrain systems and/or changes to the subdrain systems described herein, with regard to the extent, location, grade, or material depending on conditions encountered during grading or other factors. All subdrain systems shall be surveyed by a licensed land surveyor (except for retaining wall subdrain systems) to verify line and grade after installation and prior to burial. Adequate time should be allowed by the Contractor to complete these surveys.

Excavation

All excavations and over-excavations for remedial purposes shall be evaluated by the Geotechnical Consultant during grading operations. Remedial removal depths indicated on the geotechnical plans are estimates only. The actual removal depths and extent shall be determined by the Geotechnical Consultant based on the field evaluation of exposed conditions during grading operations. Where fill over cut slopes are planned, the cut portion of the slope shall be excavated, evaluated, and accepted by the Geotechnical Consultant prior to placement of the fill portion of the proposed slope, unless specifically addressed by the Geotechnical Consultant. Typical details for cut over fill slopes and fill over cut slopes are provided herein.

Trench Backfill

1) The Contractor shall follow all OHSA and Cal/OSHA requirements for trench excavation safety.

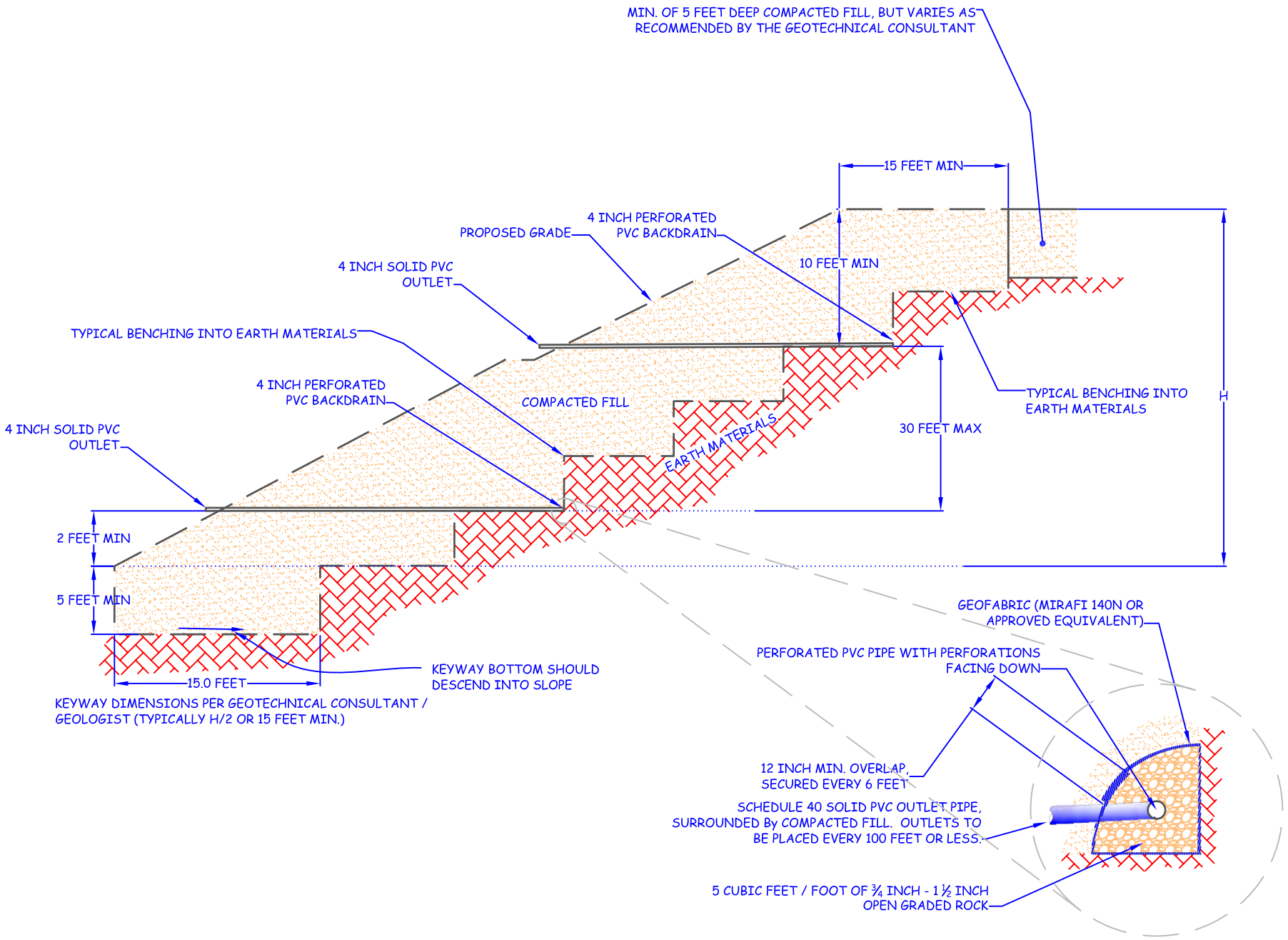
2) Bedding and backfill of utility trenches shall be done in accordance with the applicable provisions in the Standard Specifications of Public Works Construction. Bedding materials shall have a Sand Equivalency more than 30 (SE>30). The bedding shall be placed to 1 foot over the conduit and thoroughly jetting to provide densification. Backfill should be compacted to a minimum of 90 percent of maximum dry density, from 1 foot above the top of the conduit to the surface.

3) Jetting of the bedding materials around the conduits shall be observed by the Geotechnical Consultant.

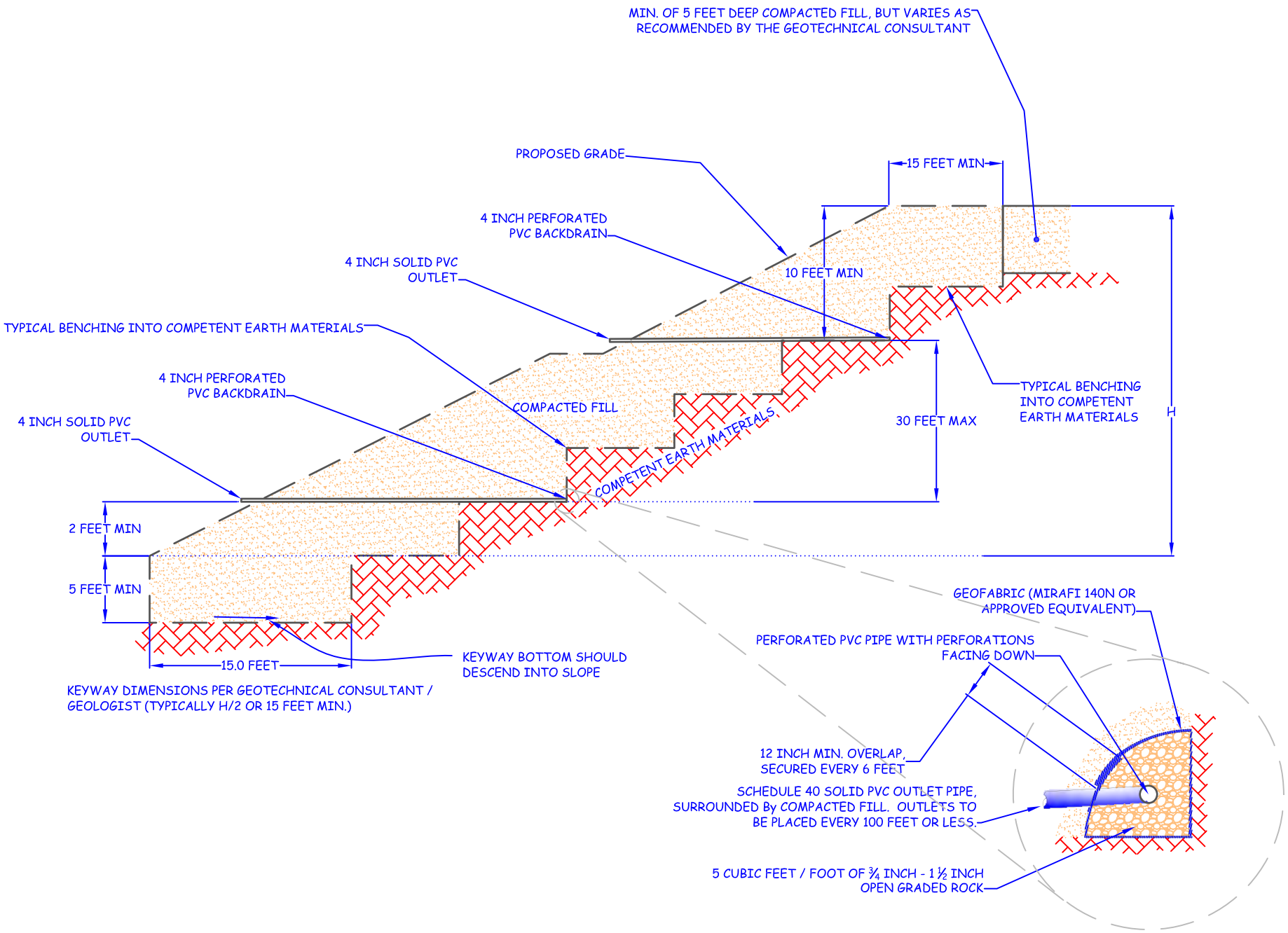
4) The Geotechnical Consultant shall test trench backfill for the minimum compaction requirements recommended herein. At least one test should be conducted for every 300 linear feet of trench and for each 2 vertical feet of backfill.

5) For trench backfill the lift thicknesses shall not exceed those allowed in the Standard Specifications of Public Works Construction, unless the Contractor can demonstrate to the Geotechnical Consultant that the fill lift can be compacted to the minimum relative compaction by his alternative equipment or method.

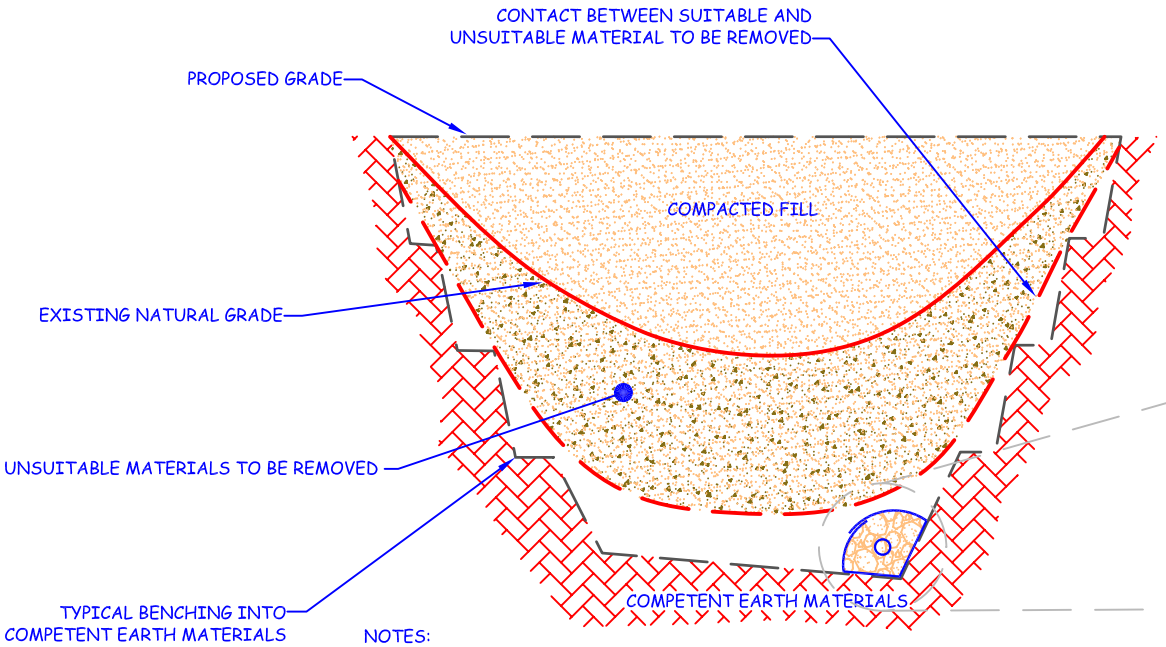
STABILIZATION FILL TYPICAL DETAIL

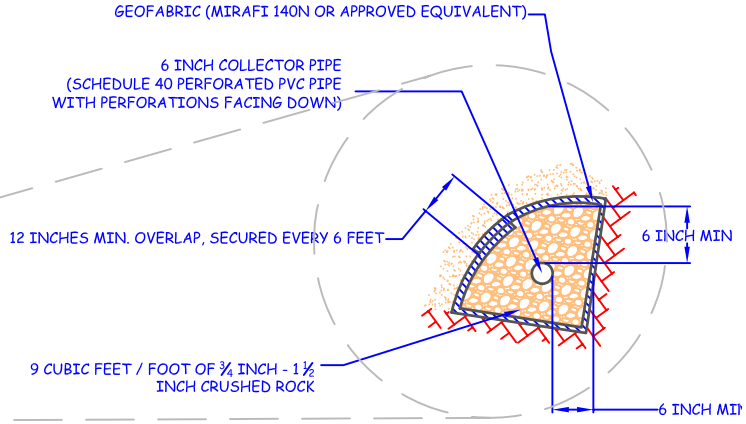


BUTTRESS TYPICAL DETAIL



CANYON SUBDRAIN SYSTEM TYPICAL DETAIL

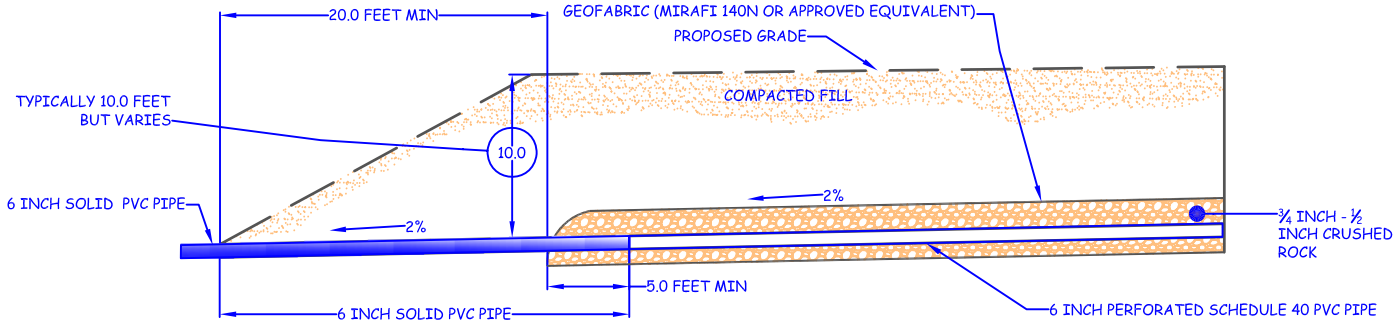




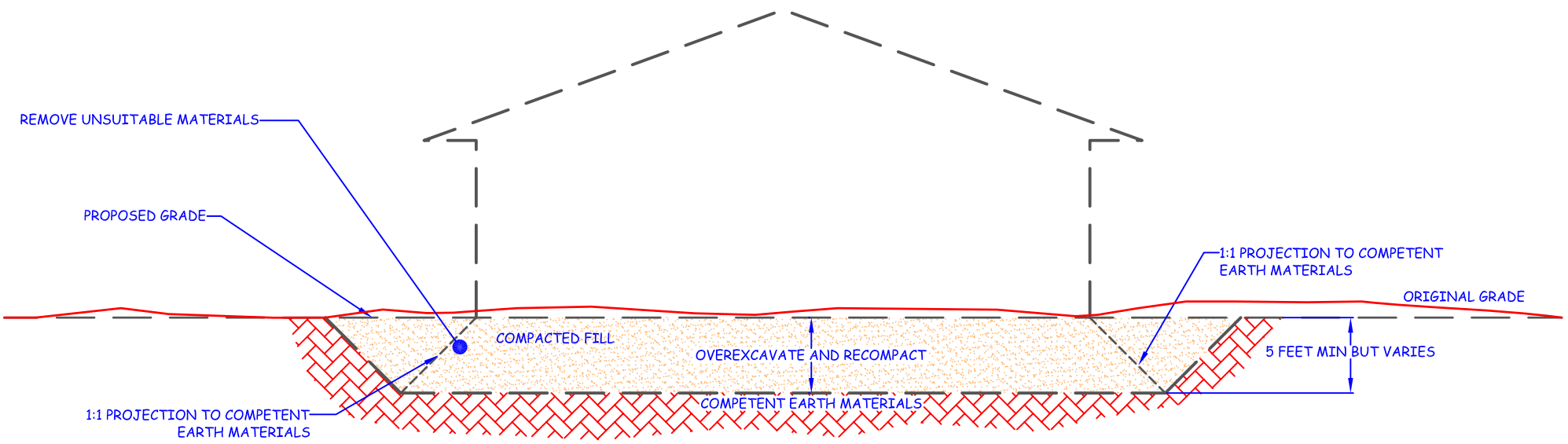
NOTES:
1 - CONTINUOUS RUNS IN EXCESS OF 500 FEET LONG WILL REQUIRE AN 8 INCH DIAMETER PIPE.

2 - FINAL 20 FEET OF PIPE AT OUTLET WILL BE SOLID AND BACKFILLED WITH COMPACTED FINE-GRAINED EARTH MATERIALS.

CANYON SUBDRAIN TYPICAL OUTLET



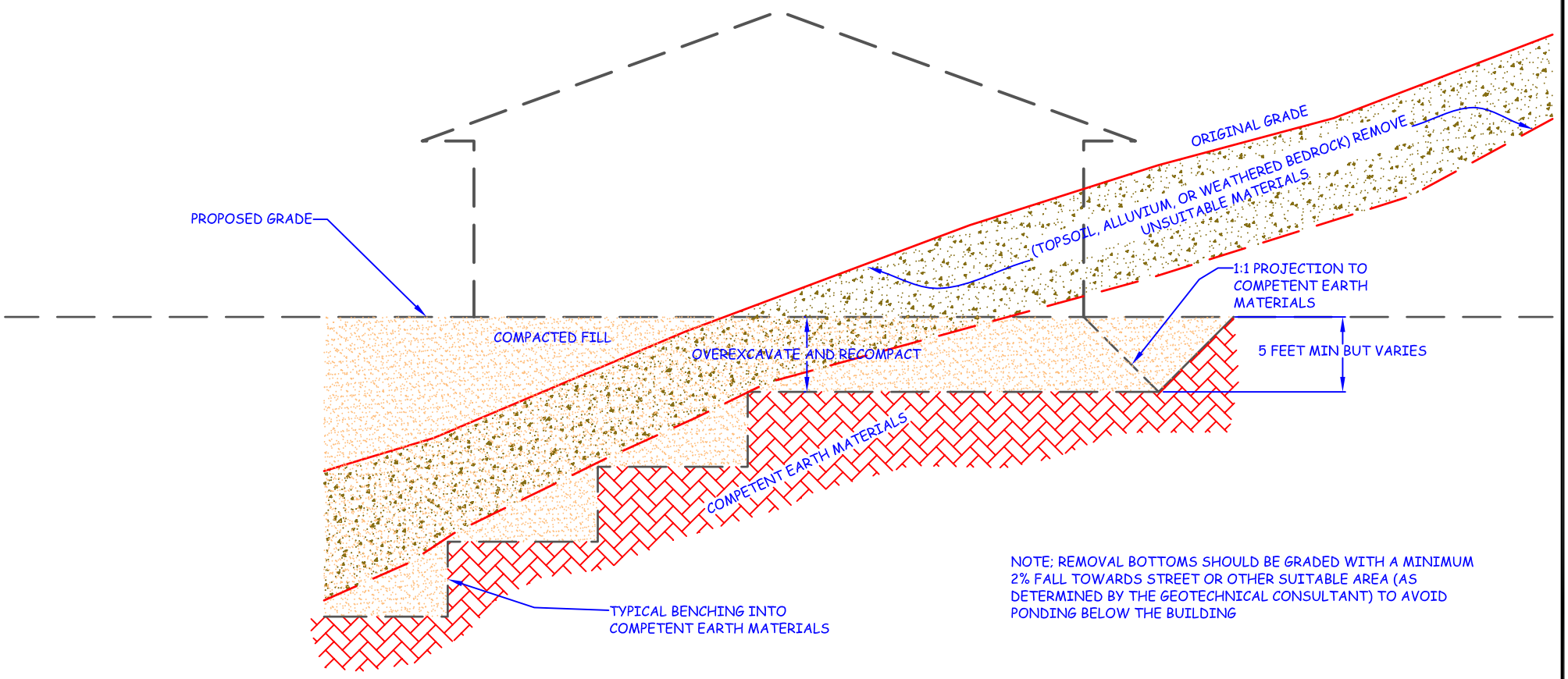
CUT LOT TYPICAL DETAIL



NOTE: REMOVAL BOTTOMS SHOULD BE GRADED WITH A MINIMUM 2% FALL TOWARDS STREET OR OTHER SUITABLE AREA (AS DETERMINED BY THE GEOTECHNICAL CONSULTANT) TO AVOID PONDING BELOW THE BUILDING

NOTE: WHERE DESIGN CUT LOTS ARE EXCAVATED ENTIRELY INTO COMPETENT EARTH MATERIALS, OVEREXCAVATION MAY STILL BY NEEDED FOR HARD-ROCK CONDITIONS OR MATERIALS WITH VARIABLE EXPANSION POTENTIALS

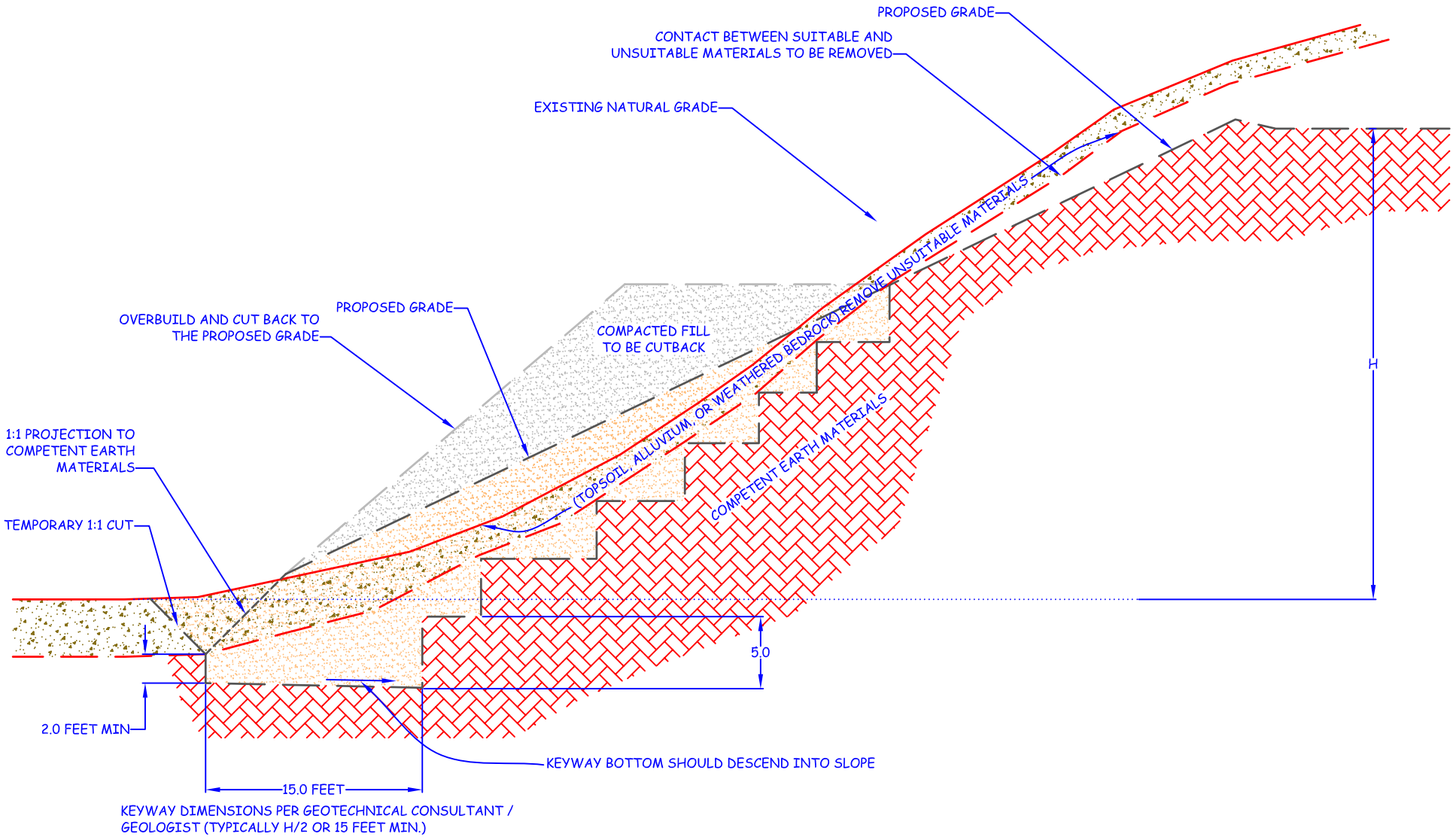
CUT / FILL TRANSITION LOT TYPICAL DETAIL



NOTE; REMOVAL BOTTOMS SHOULD BE GRADED WITH A MINIMUM 2% FALL TOWARDS STREET OR OTHER SUITABLE AREA (AS DETERMINED BY THE GEOTECHNICAL CONSULTANT) TO AVOID PONDING BELOW THE BUILDING

NOTE: WHERE DESIGN CUT LOTS ARE EXCAVATED ENTIRELY INTO COMPETENT EARTH MATERIALS, OVEREXCAVATION MAY STILL BY NEEDED FOR HARD-ROCK CONDITIONS OR MATERIALS WITH VARIABLE EXPANSION POTENTIALS

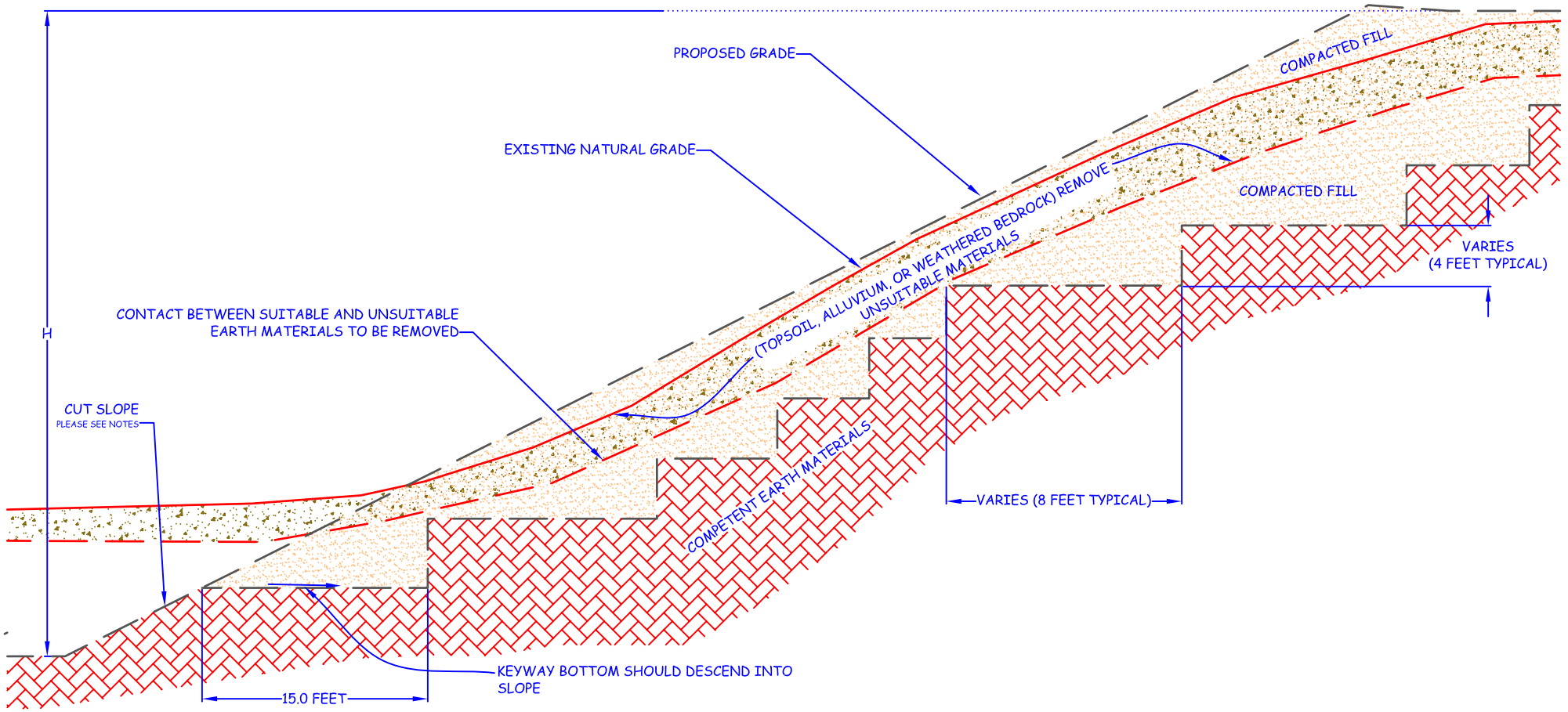
KEYWAY & BENCHING TYPICAL DETAILS
CUT OVER FILL SLOPE



NOTE:

NATURAL SLOPES STEEPER THAN 5:1 (H:V) MUST BE BENCHED INTO COMPETENT EARTH MATERIALS

KEYWAY & BENCHING TYPICAL DETAILS
FILL OVER CUT SLOPE



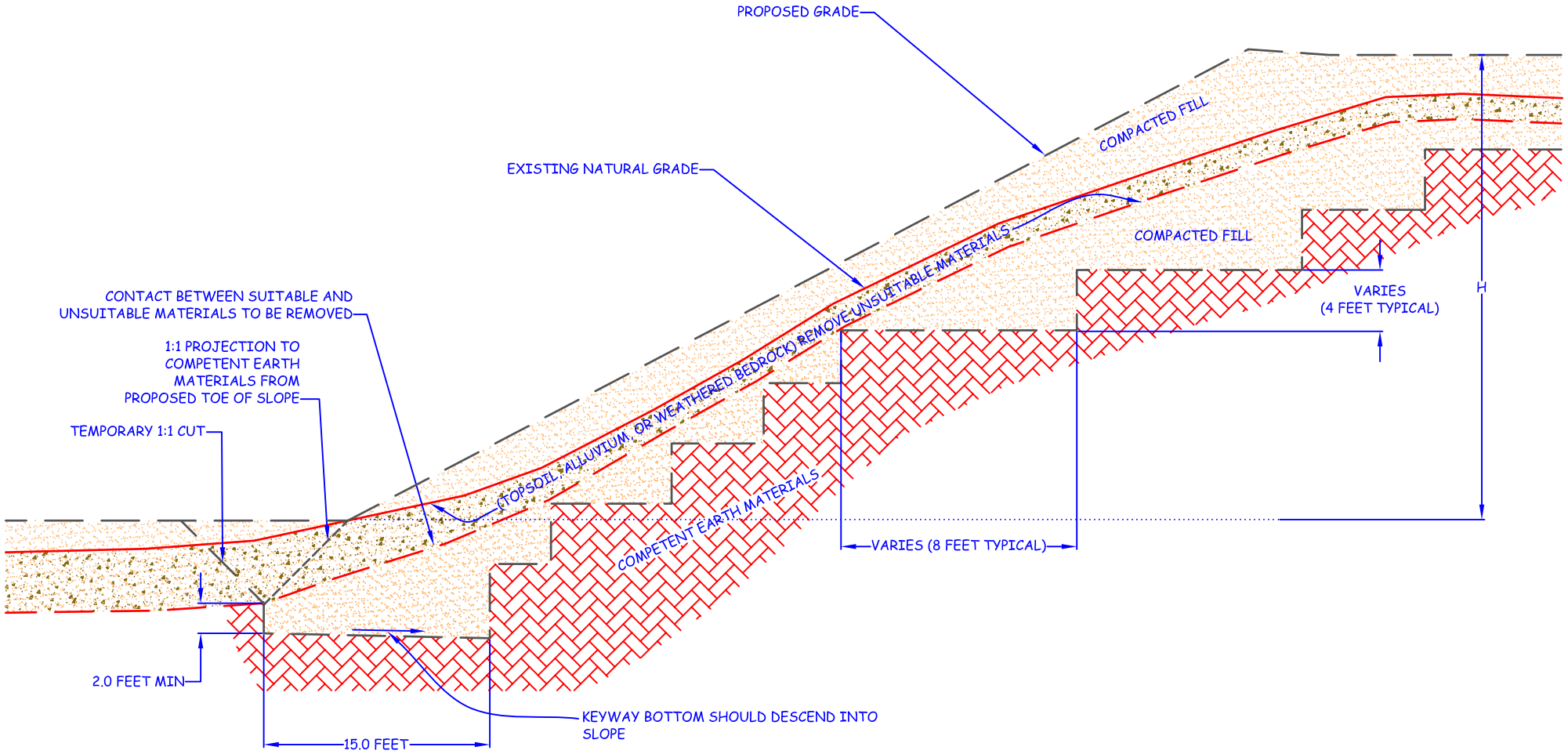
KEYWAY DIMENSIONS PER GEOTECHNICAL CONSULTANT / GEOLOGIST (TYPICALLY H/2 OR 15 FEET MIN.)

NOTES:

NATURAL SLOPES STEEPER THAN 5:1 (H:V) MUST BE BENCHED INTO COMPETENT EARTH MATERIALS

THE CUT SLOPE MUST BE CONSTRUCTED FIRST

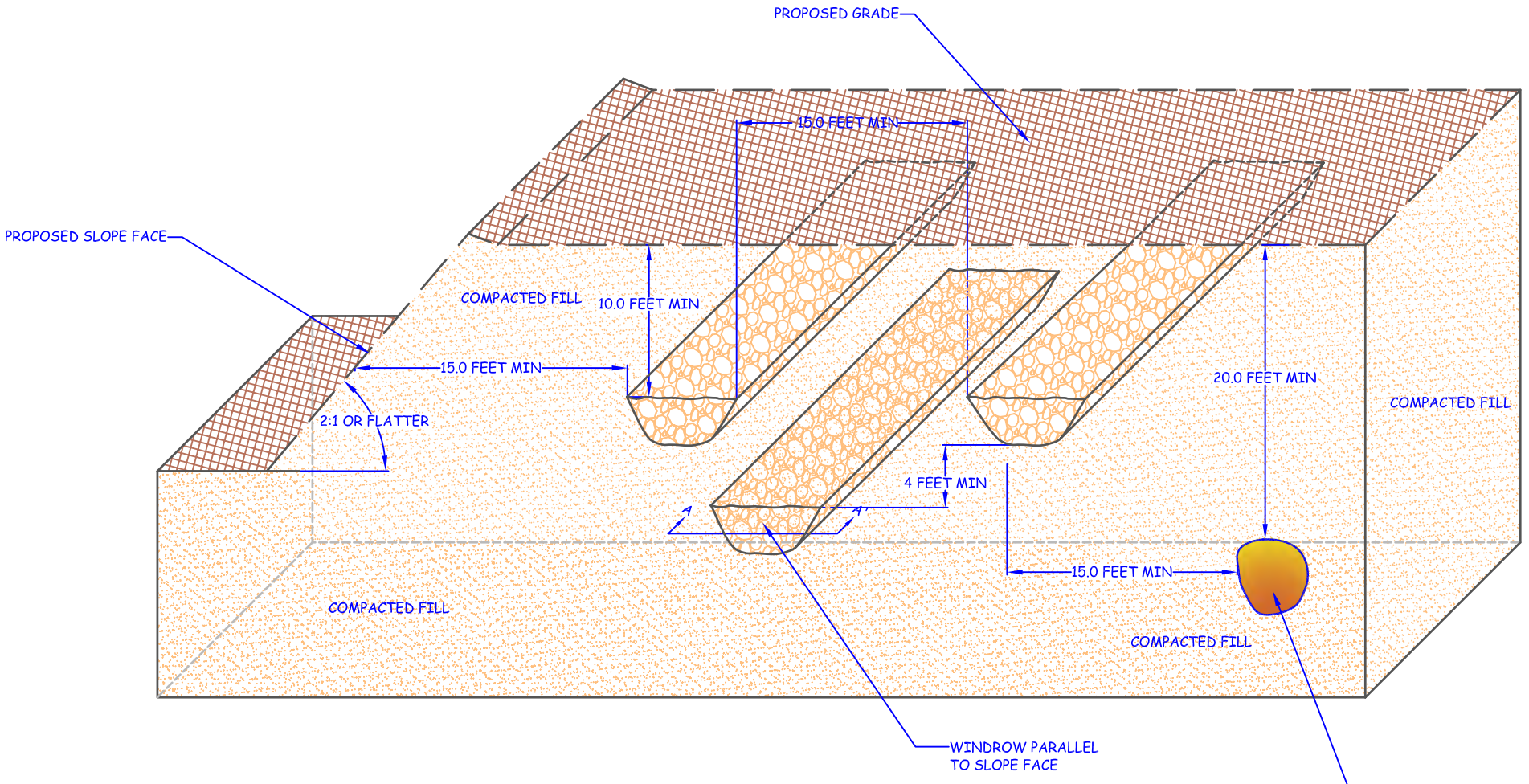
KEYWAY & BENCHING TYPICAL DETAILS
FILL SLOPE



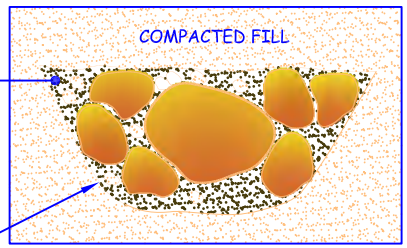
NOTES:

NATURAL SLOPES STEEPER THAN 5:1 (H:V) MUST BE BENCHED INTO COMPETENT EARTH MATERIALS

OVERSIZE ROCK TYPICAL DETAIL

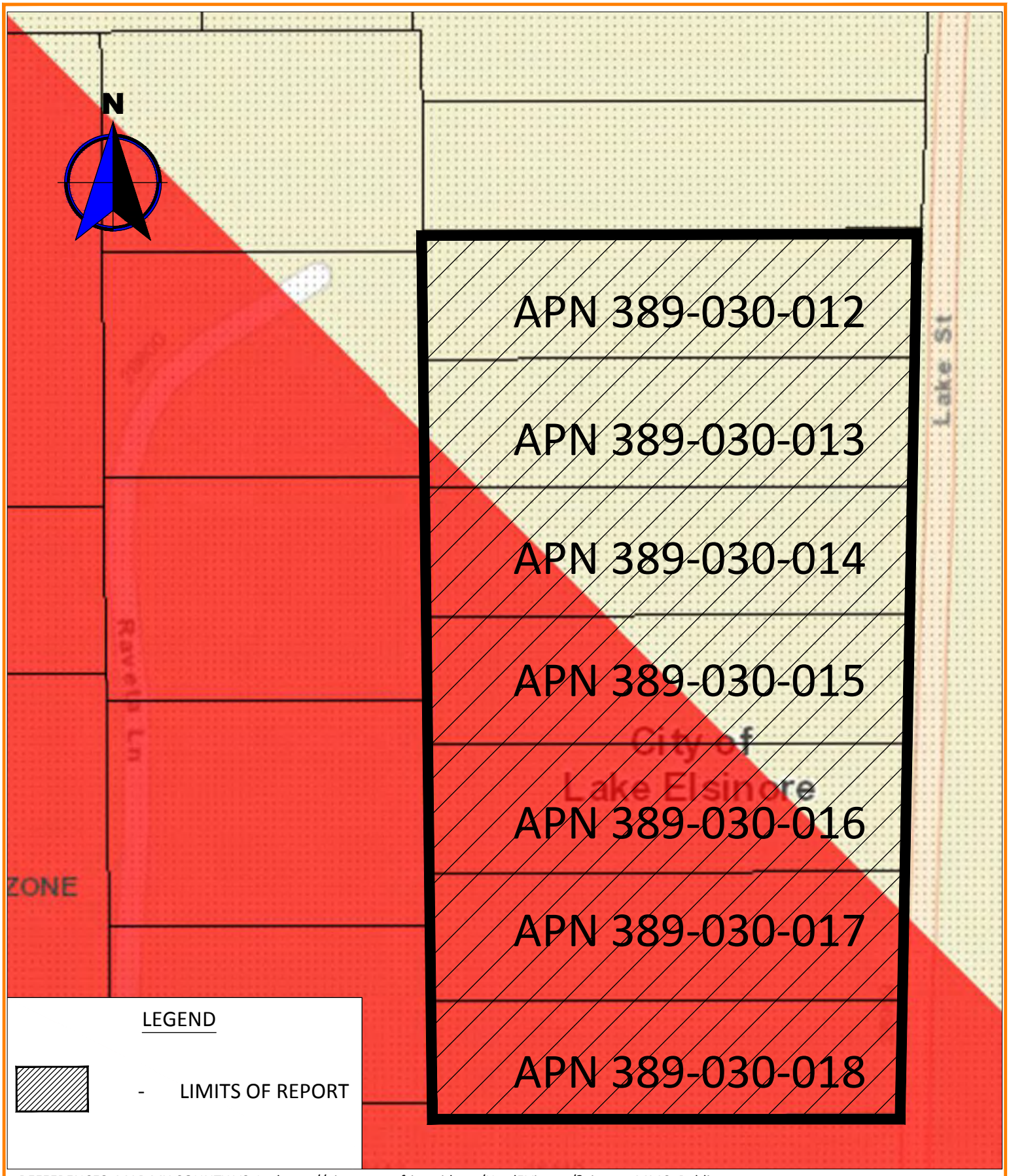


CROSS SECTION A-A'



NOTES:

OVERSIZE ROCK IS LARGER THAN
8 INCHES IN MAX DIAMETER



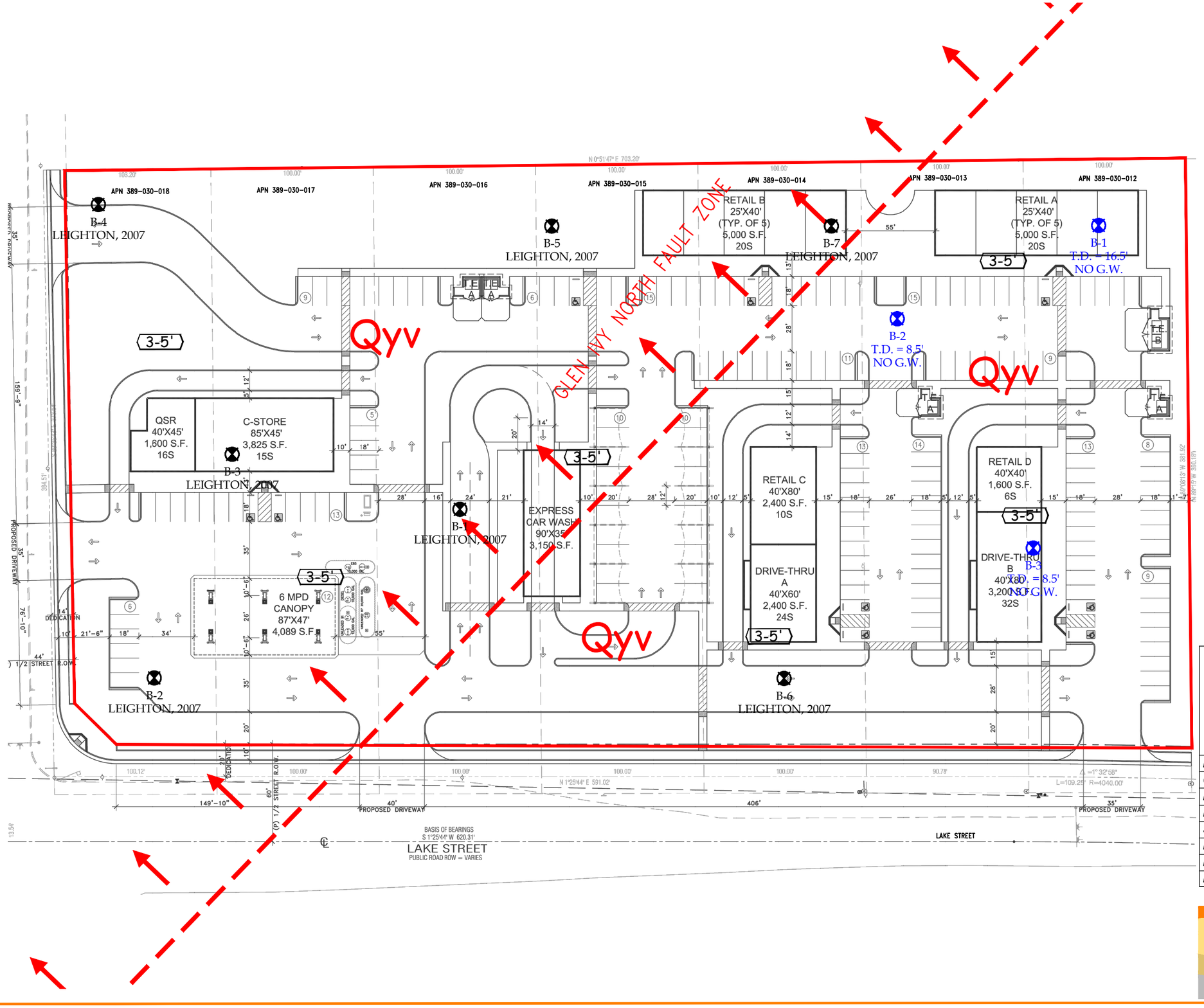
REFFERENCES: MAP MY COUNTY V8.1, https://gis.countyofriverside.us/Html5Viewer/?viewer=MMC_Public

Earth - Strata, Inc.
Geotechnical, Environmental and Materials Testing Consultants
BETTER PEOPLE • BETTER SERVICE • BETTER RESULTS

PROPOSED COMMERCIAL DEVELOPMENT | 192805-10A

COUNTY FAULT MAP | SCALE: 1" = 100'

AUG 2019 | FIGURE 3



LEGEND

Locations are Approximate

Geologic Units

Qyv - Quaternary Young Valley Deposits

Symbols

- Limits of Report
- Northeast Extent of County Fault Zone For Glen Ivy North Fault
- B-3 T.D. = 8.5' NO G.W. — Boring Location, Including Total Depth and Depth to Groundwater
- B-7 LEIGHTON, 2007 — Boring Location, By Leighton Consulting, Inc. May 2007
- 3-5' — Recommended Removal Depths

North

GEOTECHNICAL MAP

LOCATED AT 28915 LAKE STREET

CITY OF LAKE ELSINORE, RIVERSIDE COUNTY, CALIFORNIA

APN'S 389-030-012, -013, -014, -015, -016, 017 AND -018

PROJECT	***PROPOSED COMMERCIAL DEVELOPMENT***		
CLIENT	***EMPIRE DESIGN GROUP, INC.***		
PROJECT NO.	***192805-10A***		
DATE	***AUGUST 2019***		
SCALE	***1:60***		
DWG XREFS			
REVISION			
DRAWN BY	***JDG***	***PLATE***	***1 OF 1***

Earth Strata Geotechnical Services, Inc.

Geotechnical, Environmental and Materials Testing Consultants

www.ESGSINC.com (951) 397-8315

Earth Strata Geotechnical Services, Inc.
Geotechnical, Environmental and Materials Testing Consultants

February 14, 2020

Project No. 192805-70A

Mr. Greg Hann
EMPIRE DESIGN GROUP. INC.
24861 Washington Avenue
P.O. Box 944
Murrieta, CA 92562

Subject: **Response to the City of Lake Elsinore Review Comments Regarding Preliminary Geotechnical Interpretive Report for, Proposed Commercial Development, Assessor's Parcel Numbers 389-030-012 Through -018 City of Lake Elsinore, Riverside County, California**

Reference: *Preliminary Geotechnical Interpretive Report, Proposed Commercial Development, Assessor's Parcel Number 389-030-012 through -018, Located at 28915 Lake Street, City of Lake Elsinore, Riverside County, California*, dated September 3, 2019

Introduction

Earth Strata has prepared this response to the Review Comments letter for the above referenced project prepared by the City of Lake Elsinore dated December 26, 2019. The comment will be listed below followed by our response to each comment. The following changes and clarifications should be considered part of and attached to the report referenced above.

COMMENT NO. 9

9. "The Phase 1 ESA and City Records Show that parts of the project site fall within the county fault zone. The geotechnical report does not reference this."

Response – Acknowledged. According to Riverside County GIS reports, as show in Figure 3 of the referenced report, parcels 389-030-013 through -018 fall within a county fault zone.

COMMENT NO. 10

10. "Please provide copies of the past fault studies used for reference by the geotechnical report."

Response – The referenced reports were not provided. The references were taken from a previous report by Leighton Consulting Inc. The report by Leighton Consulting Inc., will be provided.

Leighton Consulting Inc., 2007, *Preliminary Geotechnical Investigation, Proposed Commercial Development, "Lake Street Marketplace", NWC Mountain Street and Lake Street, City of Lake Elsinore, California*, dated December 6

The opportunity to be of service is appreciated. Should you have any questions or require further clarification, please notify this office at your earliest convenience.

Respectfully submitted,

EARTH STRATA GEOTECHNICAL SERVICES, INC.

Stephen M. Poole, PE, GE
Principal Engineer

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Exp. 6/30/21
STATE OF CALIFORNIA

Hogan Rangel, GIT
Staff Geologist

SMP/AGW/hr

Attachment: County of Riverside Review Comments Letter (Rear of Text)

Distribution: (2) Addressee

Engineering Department:

TA-GROUP 9. The Phase I ESA and City records show that parts of the project site fall within the County Fault Zone. The geotechnical report does not reference this.

GEO EARTH STRATA 10. Please provide copies of the pat fault studies used for reference by the geotechnical report.

EDG 11. There are TIF/TUMF credits available for improvements to Lake Street. The credits cannot overlap.

CIVIL 12. How many lots will be on the final map?

Storm Water Management / Pollution Prevention / NPDES

CIVIL 13. Site discharges to Lake – treat & release.

LANDSCAPE 14. Incorporate self-retaining/self-treating features into onsite landscape.

CIVIL 15. Where are Retail Buildings A & B discharging to?

CIVIL 16. Identify how flows exiting by way of the driveways are treated.

CIVIL 17. Full trash capture for onsite and adjacent offsite CBs.

CIVIL 18. How is the canopy area treated?

CIVIL 19. WQMP – Prelim & Final are required.
- Prelim WQMP must be approved prior to scheduling for Planning Commission
- Final WQMP must be approved prior to ANY PERMIT issuance.

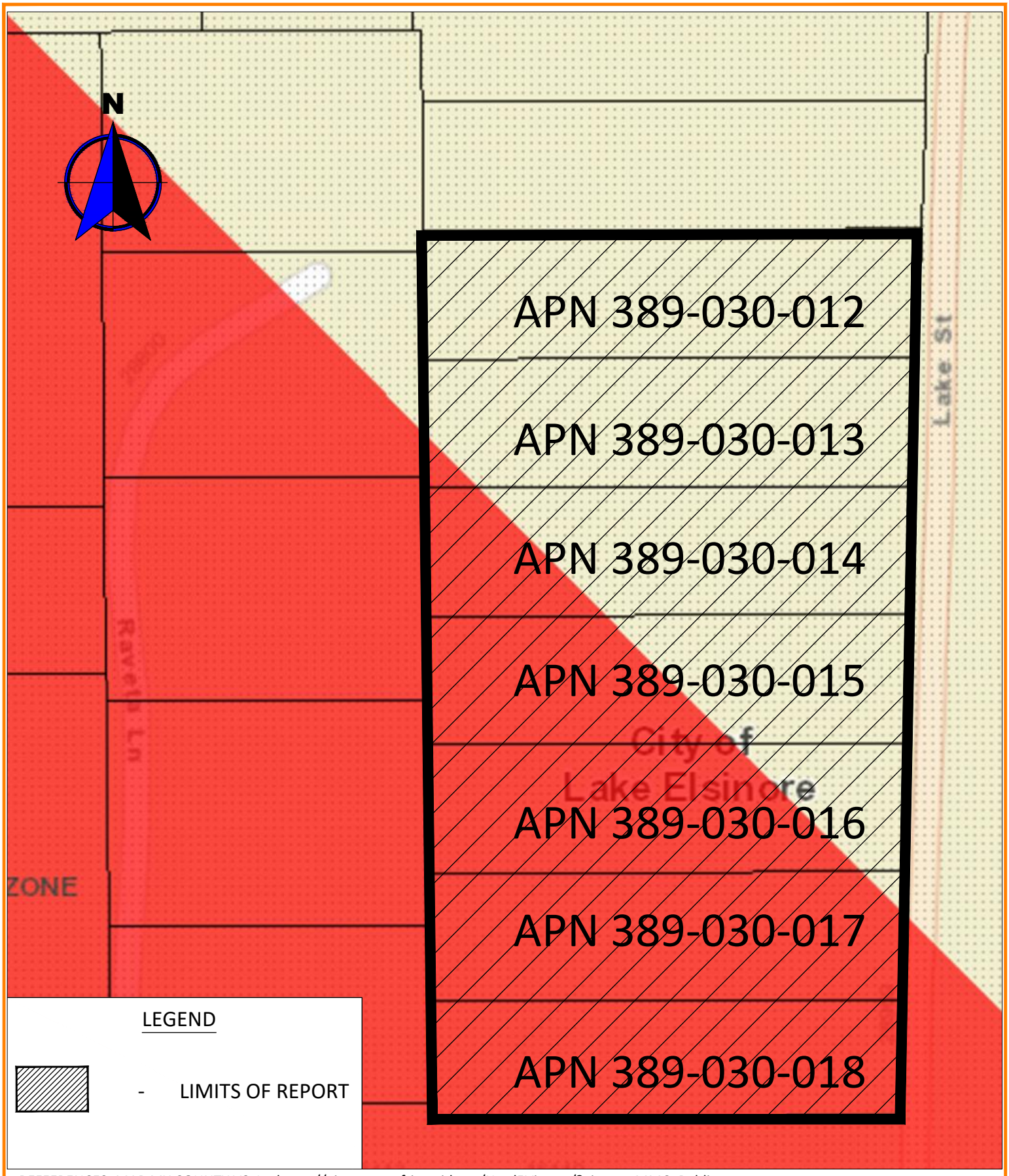
Fire Department:

EDG 20. Please see the attached comment letter dated December 5, 2019 from the Fire Department regarding this project.

Elsinore Valley Municipal Water District:

EDG 21. Please see the attached letter dated December 23, 2019 from the Water District regarding this project.

Please submit two (2) full size sets and eight (11X17) sets of the revised plans along with a digital copy (i.e. PDF format). If you have any questions or concerns regarding this letter, you may reach me by phone at (951) 674-3124, Ext. 913 or by e-mail at dabraham@lake-elsinore.org.



REFFERENCES: MAP MY COUNTY V8.1, https://gis.countyofriverside.us/Html5Viewer/?viewer=MMC_Public

Earth - Strata, Inc.
Geotechnical, Environmental and Materials Testing Consultants
BETTER PEOPLE • BETTER SERVICE • BETTER RESULTS

PROPOSED COMMERCIAL DEVELOPMENT | 192805-10A

COUNTY FAULT MAP | SCALE: 1" = 100'

AUG 2019 | FIGURE 3

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

May 11, 2009

Project No. 602051-001

Marinita Development Company
3835 Birch Street
Newport Beach, California 92660

Attention: Mr. David Garrison

Subject: Supplemental Geotechnical Report – Clarifications on Liquefaction at "Lake Street Marketplace", APN's 389-030-014 through -018, City of Lake Elsinore, California

Reference: Preliminary Geotechnical Investigation, Proposed Commercial Development "Lake Street Marketplace" NWC Mountain Street and Lake Street, City of Lake Elsinore, California, Project No. 602051-001, dated December 6, 2007.

In accordance with your request, we are providing this report to further describe the liquefaction potential at the subject site. As indicated in Section 2.5 of the referenced report, "the soils underlying the site have a very low potential for liquefaction due to their high relative density and lack of a shallow water table." The following is generally our basis for such a conclusion:

- The Older Alluvial Soils (Qalo), Late Pleistocene-aged alluvial soil is the major geologic unit underlying the site. This unit generally consists of moist, silty fine to coarse sand with an N-value (Standard Penetration Test) of at least 30 blows per foot within the depth explored. This relatively high N-value is indicative of dense to very dense soil that is not prone to liquefaction. This unit is expected to extend to a greater depth and be further underlain by very dense granitic bedrock.
- Groundwater was not encountered in any of the exploratory borings performed on this site to a maximum depth of 30 feet. Based on in-house data and historic records, groundwater is expected to exist at a depth greater than 50 feet. Based on our previous investigation performed by Leighton for the adjacent site (southwest corner of Grand Avenue and Mountain Street), groundwater was not encountered to a depth of 50.5 feet.
- The depth of our onsite borings were generally less than 30 feet due to encountering dense older alluvial materials and practical refusal to the 2.4-inch soil sampling apparatus (typically more than 50 blows / 6-inch of sample advancement). Due to this prevailing dense soil condition and our experience with the underlying geologic unit, we determined that these borings depths were sufficient to derive to the necessary geologic conclusions and design recommendations included in the report.

41715 Enterprise Circle N., Suite 103 ▪ Temecula, CA 92590-5661
951.296.0530 ▪ Fax 951.296.0534 ▪ www.leightonconsulting.com

Although the Safety Element of the Riverside County General Plan adopted in 2003 indicates that the project site is located within an area classified as having a "moderate" risk for liquefaction, the results of our site specific evaluation indicates that the risk of liquefaction on this site is very low. The relatively loose to medium dense Holocene-age alluvial soil (upper 7 feet) will be either removed by the proposed site grading or be subject to complete removal and recompaction as recommended in our referenced soils report.

The opportunity to be of continued service on this project is greatly appreciated. If you should have any questions, please do not hesitate to call the undersigned.

Respectfully submitted,
LEIGHTON CONSULTING, INC.

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Distribution: (2) Addressee, one via email
(1) Bob Edmonds via email

PRELIMINARY GEOTECHNICAL INVESTIGATION
PROPOSED COMMERCIAL DEVELOPMENT
"LAKE STREET MARKETPLACE"
NWC MOUNTAIN STREET AND LAKE STREET
CITY OF LAKE ELSINORE, CALIFORNIA

Prepared For:

MARINITA DEVELOPMENT COMPANY
3835 Birch Street
Newport Beach, CA 92660

Project No. 602051-001

December 6, 2007

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

December 6, 2007

Project No. 602051-001

Marinita Development Company
3835 Birch Street
Newport Beach, California, 92660

Attention: Mr. David Garrison

Subject: Preliminary Geotechnical Investigation for the Proposed Commercial Development, "Lake Street Marketplace", APNs 389-030-014 through -018, City of Lake Elsinore, California.

In accordance with your request and authorization, we are pleased to provide herewith our geotechnical investigation report for the subject site. This report summarizes our findings and provides preliminary recommendations for foundation design and construction. In our opinion, the subject site is considered suitable for the intended use provided the recommendations included in this report are implemented during design and construction phases of development.

The opportunity to be of service on this project is greatly appreciated. If you should have any questions, please do not hesitate to call our office.

Respectfully submitted,

LEIGHTON CONSULTING, INC.

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Leighton Consulting, Inc.
A LEIGHTON GROUP COMPANY

December 6, 2007

Project No. 602051-001

Marinita Development Company
3835 Birch Street
Newport Beach, California, 92660

Attention: Mr. David Garrison

Subject: Preliminary Geotechnical Investigation for the Proposed Commercial Development, "Lake Street Marketplace", APNs 389-030-014 through -018, City of Lake Elsinore, California.

In accordance with your request and authorization, we are pleased to provide herewith our geotechnical investigation report for the subject site. This report summarizes our findings and provides preliminary recommendations for foundation design and construction. In our opinion, the subject site is considered suitable for the intended use provided the recommendations included in this report are implemented during design and construction phases of development.

The opportunity to be of service on this project is greatly appreciated. If you should have any questions, please do not hesitate to call our office.

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Accompanying Figures, Tables, Plates and Appendices

Tables

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Appendices

1.0 INTRODUCTION

1.1 Purpose and Scope of Work

The purpose of our geotechnical investigation was to evaluate the overall geotechnical and geologic conditions on this site and provide recommendations for foundation design and construction. Our scope of work for this study included the following:

- Geologic site reconnaissance;
- Review of pertinent in-house maps and published documents regarding geological and geotechnical conditions at the proposed site;
- Drilling, sampling, and logging of seven (7) hollow-stem auger boreholes to evaluate subsurface soil conditions and collect samples for laboratory testing. One borehole was advanced to a depth of 30.0 feet;
- Laboratory testing of selected soil samples to determine in-situ moisture and density, soil classification (grain size distribution), compressibility, expansion potential, maximum dry density and optimum moisture content, subgrade Resistance Value (R-Value), corrosion potential and other pertinent engineering parameters of on site materials;
- Compilation of this geotechnical report which presents our findings, conclusions, and preliminary recommendations for foundation design and site development.

1.2 Site Description and Proposed Development

The subject site is an approximately 4-acre rectangular shaped parcel of land located at the northwest corner of the intersection of Lake Street and Mountain Street in the City of Lake Elsinore, California (Figure 1). Most of the site is currently vacant land except for a house situated in the northern portion of the property. Remnants of a previous building foundation and chimney were observed in the southeast portion of the property. Lake Street bounds the site to the east, Mountain Street to the south, and existing residential property to the west and north. Topographically, the site slopes moderately in a southwesterly direction with approximately 40 feet of relief.

Based on review of the provided preliminary site plan and the other information provided, we understand that the proposed development will include four one- to two-story retail/commercial buildings of conventional construction, parking areas and

associated site improvements. While grading plans were not available at the time of this investigation, your information indicates that cuts of up to 20 feet in height are anticipated, which may require the construction of retaining walls. Conventional cut and fill grading is anticipated to construct the graded pads and roadways.

1.3 Field Investigation

Prior to drilling, a preliminary field reconnaissance was made by a certified engineering geologist from our firm. During this site visit, the existing cut slope along Mountain Street in the southeastern portion of the site was examined for any evidence of potential faulting, shears, or any other geologic features. Based on this limited exposure, no evidence of faulting or any adverse geologic conditions were observed within this portion of the site.

Seven soil borings were excavated on November 16, 2007 utilizing a CME-75 drill rig. The boring depths ranged from approximately 10 to 30 feet below existing grade. The borings were logged and sampled by an engineer from our firm. The log of each boring is presented in Appendix B and the boring locations are indicated on the Boring Location Map (Figure 3).

1.4 Laboratory Testing

Laboratory testing was performed on selected representative subsurface soil samples to evaluate the chemical and physical characteristics of the selected soils. A discussion of the laboratory test methods performed and a summary of the laboratory test data is presented in Appendix C.

2.0 GEOTECHNICAL FINDINGS

2.1 Regional Geology

The site is located in the Peninsular Range Geomorphic Province of Southern California. More specifically, the property is located along the northeastern margin of a fault controlled, down dropped block (graben), known as the Elsinore Trough (Kennedy, 1977). This graben is believed to contain as much as 3000 feet of alluvium which has been accumulated since Miocene time (Mann,1955). In this area the Elsinore Trough is bounded on the northeast by the Glen Ivy North Fault (*Geologic Map*, Figure 2). The Glen Ivy North Fault, along with other local faults, form part of the Elsinore Fault Zone, which extends from the San Gabriel River Valley southeasterly to beyond the United States-Mexico border.

The Santa Ana Mountains lie along the western side of the Elsinore Fault Zone and the Perris Block is located along the eastern side of the fault zone. The mountain ranges are underlain by pre-Cretaceous meta-sedimentary and meta-volcanic rocks and Cretaceous plutonic rocks of the Southern California batholith. Tertiary sediments, volcanics and Quaternary sediments flank the mountain ranges. The Tertiary and Quaternary rocks are generally comprised of non-marine sediments consisting of sandstones, mudstones, conglomerates, and locally volcanic units.

2.2 Faulting and Seismicity

The City of Lake Elsinore, like the rest of Southern California, is in a seismically active region as a result of being located near the active margin between the North American and Pacific tectonic plates. The principal source of seismic activity is movement along the northwest-trending regional faults such as the San Andreas, San Jacinto and Elsinore fault zones. These fault systems produce approximately 55 millimeters of slip per year between the plates. The Elsinore fault zone is the closest fault to the site capable of producing a major quake. This fault zone is estimated to accommodate 10 to 15 percent of the plate boundary motion, and is estimated to have a slip rate of 5 millimeters per year (mm/yr.) (WGCEP, 1995).

By definition of the California Geologic Survey (CGS), an active fault is one which has had surface displacement within the Holocene Epoch (roughly the last 11,000 years). This definition of a fault with Holocene activity is used in delineating Earthquake Fault Zones as mandated by the Alquist-Priolo Geologic Hazard Zones Act of 1972 and as subsequently revised in 1994 (Hart, 1994) as the Alquist-Priolo Earthquake Fault Zoning

Act and Earthquake Fault Zones. The intent of the act is to require fault investigations on sites located within Earthquake Fault Zones to preclude new construction of certain inhabited structures across the trace of active faults.

The subject site is not located within any State of California Earthquake Fault Zones as created by the Alquist-Priolo Earthquake Fault Zoning Act. However, as depicted on Figure 2, a portion of the site is included within a fault hazard zone as indicated in the Safety Element portion of the Riverside County General Plan (2003). Our review of geologic literature for the area indicates that there have been previous investigations for the postulated fault associated with the County fault zone in the immediate vicinity of the subject site (CDMG, 1979; Leighton, 2002, 2003; Petra, 2004). None of these investigations were able to identify faulting at the site location in this zone. Specifically, trenching and subsequent geotechnical mapping conducted by Leighton Consulting, Inc. during grading to the immediate south of Mountain Street showed no evidence for faulting across the postulated fault scarp. It is our opinion that the postulated "fault" lineament is related to a buried stream channel margin and is not indicative of on-site faulting. Our interpretation of this feature is in agreement with the findings of the Supplement (#1) to Fault Evaluation FER-72 prepared by the California division of Mines and Geology (Dated January 30, 1979).

Based on the above, and review of pertinent geologic hazard maps, the nearest state zoned "active fault" included in both the county and State AP zones, is the Glen Ivy North Segment of the Elsinore Fault Zone, located approximately 0.38 mile (0.61 km) west of the site.

The following table presents geotechnical earthquake design parameters calculated in accordance with California Building Code (CBC), 2007, Chapter 16, Section 1613:

Table 1. 2007 CBC Seismic Design Coefficients

Design Parameters	Reference- CBC 2007	Design Value
Site Class	Table 1613.5.2	C
Mapped Spectral Acceleration at Short Period (S_S)	Figure 1613.5(3)	1.8 g
Mapped Spectral Acceleration at 1 Second (S_1)	Figure 1613.5(4)	0.7 g
Design Spectral Acceleration at Short Period (S_{DS})	Equation 16-39	1.2 g
Design Spectral Acceleration at 1 Second (S_{D1})	Equation 16-40	0.6 g

The design values were calculated utilizing a software program published by United States Geological Survey (USGS) Department which follows the procedures stated in American Society of Civil Engineers (ASCE) Publication ASCE 7-05 and CBC Chapter 16, Section 1613.

2.3 Site Specific Geotechnical Conditions

2.3.1 Earth Materials

Our field exploration, observations, and review of the pertinent literature (Appendix A) indicate that subsurface materials within the site include geologic units consisting of various alluvial deposits. These materials are considered suitable for re-use as compacted fill, if cleared of debris and organic matter. Detailed descriptions of the subsurface materials encountered during our field investigation are included in the boring logs (Appendix B). A general description of each geologic unit is given below:

2.3.2 Surficial Soils (not a mapped unit)

Thin deposits of topsoil and undocumented fill soils were observed locally within the site. These materials appeared to be derived from the other geologic units observed onsite. All topsoil and undocumented artificial fill should be excavated, but may be reused as compacted fill if cleared of debris and organic matter.

2.3.3 Alluvial Soils (Map Symbol - Qal)

Holocene-age alluvial soil ranging up to 7 feet in depth covers the majority of the site. This alluvium generally consists of brown, damp, loose to medium dense, fine to coarse, silty sand with a very low expansion potential (EI<21). Alluvial materials cleared of debris and organic materials are suitable for use as compacted fills.

2.3.4 Older Alluvial Soils (Map Symbol - Qalo)

Late Pleistocene-age alluvial soil is the major geologic unit underlying this site. These older valley deposits (alluvial fan deposits) generally consist of medium brown to dark brown, damp to moist, dense to very dense, silty fine to coarse sand. As observed in local road-cuts, a well developed argillic soil has resulted in pockets of dark red clay, well formed peds and clay films in the elevated portions of the older alluvium.

2.3.5 Groundwater and Surface Water

Groundwater was not encountered in the exploratory borings. No seepage or standing water was observed on the ground surface during the time of the investigation.

2.3.6 Landslides and Rockfalls

No evidence of on-site landsliding or rockfall was observed during our field investigation. Due to overall site topography, the potential for lansliding or rockfall in the future is considered very low.

2.3.7 Rippability

Based upon our field observations, and experience in the nearby area, LCI anticipates that the on-site near-surface soils will be excavatable using conventional heavy duty earthwork equipment.

2.4 Seismic Considerations

The principal seismic considerations for most structures in Southern California are surface rupturing of fault traces and damage caused by ground shaking or seismically induced ground settlement. Soil lurching refers to the rolling motion on the ground surface by the passage of seismic surface waves. Effects of this nature are likely to be most severe where the thickness of soft sediments varies appreciably under structures. The potential for lurching can be reduced if the potentially compressible soils present on the site are removed and properly compacted in accordance with the recommendations of this report.

Ground rupture is generally considered to most likely occur along pre-existing active faults. Although a splay of the Glen Ivy Fault has been postulated to traverse the site (Webber, 1977, Riverside Co., 2003), our investigation and previous investigations within this area did not identify any evidence of active faulting on the postulated fault trace. The potential for site ground rupture is considered low.

Ground rupture cannot be ruled out for nearby faults in the event of sympathetic movement associated with displacement along the Elsinore Fault Zone, San Andreas fault, or other regional faults. Ground rupture could potentially affect existing and future

facilities (such as gas, electrical, water mains and aqueducts) during a seismic event along the Elsinore Fault Zone.

2.5 Liquefaction

Liquefaction generally occurs when saturated fine sands and silts lose their physical strengths when subjected to earthquake shaking. Liquefaction potential is primarily affected by material gradation, relative density, and intensity and duration of ground motion. This effect may be manifested by excessive settlements and sand boils at the ground surface.

The soils underlying the site have a very low potential for liquefaction due to their high relative density and lack of a shallow water table. The relatively shallow loose alluvial deposists will be subject to removal and recompaction based on the remedial grading recommendations included in Section 4 of this report.

3.0 CONCLUSIONS AND PRELIMINARY RECOMMENDATIONS

3.1 Summary of Conclusions and Preliminary Recommendations

Based on the results of this study, the proposed development of the site appears feasible from a geotechnical viewpoint provided that the following recommendations are incorporated into the design and construction phases of development. Seismic Design Parameters

Seismically resistant structural design in accordance with local building ordinances should be followed during the design of all structures. Building Codes have been developed to minimize structural damage. However, some level of damage as the result of ground shaking generated by nearby earthquakes is considered likely in this area.

3.2 Earthwork

Earthwork should be performed in accordance with the following recommendations and the *Earthwork and Grading Guide Specifications* included in Appendix E of this report. In case of conflict, the following recommendations should supersede guide specifications in Appendix E. The contract between the developer and earthwork contractor should be worded such that it is the responsibility of the contractor to place fill properly and in accordance with the recommendations presented in this report, including the guide specifications in Appendix E, notwithstanding the required testing and observation of the geotechnical consultant.

3.2.1 Site Preparation and Remedial Grading

Prior to grading the proposed structural improvement areas (i.e. all-structural fill areas, pavement areas, building footprints, etc.), the site should be cleared of surface and subsurface structures or obstructions. Pending further field verification and evaluation, we recommend the following overexcavation / remedial grading:

Building Footprints: In order to reduce the potential for adverse long-term differential settlement, we recommend that the upper 5 to 7 feet of onsite soils be removed and recompacted in accordance with our recommendations included in Appendix E. After completion of the recommended removal and prior to fill placement, the exposed surface should be scarified to a minimum depth of 8-inches, moisture conditioned and recompacted to at least 90 percent of maximum

dry density, as determined in accordance with ASTM Test Method D1557-00. The lateral extent of overexcavation beyond the outside edge of all settlement-sensitive structures/ foundations should be equivalent to that vertically removed. Similarly, all compacted fill should extend laterally from the outside edge of all settlement-sensitive structures or foundations to a distance equal to the depth of filling. In areas where new foundations are located adjacent to exsiting foundations this remedial criteria should be subject to further review and evaluation. In cut areas where finish grades are below the recommended removal depth, the upper 12-inches of subgrade should be scarified and recompacted. Localized deeper removal may be warranted based on prevailing soils conditions encountered during grading.

Parking Areas: Where applicable, we recommend that the upper 3 feet of onsite soils for all exterior flatwork, hardscape, and paved areas be scarified and recompacted to at least 90 percent of maximum dry density prior to receiving aggregate base or concrete pavement. Deeper overexcavation may be required based on the exposed subsurface conditions during grading.

3.2.2 Suitability of Site Soils for Fills

Undocumented fill and alluvial soils should be considered suitable for re-use as compacted fills provided the recommendations contained herein are followed. If cobbles and boulders larger than 6-inches in largest dimension are encountered or produced during grading, these oversized cobbles and boulders should be disposed of in non-structural and non-pavement areas. As an alternative, oversized cobbles and boulders can be crushed in place to a size less-than 6-inches, and then placed in accordance with the recommendations presented in Appendix E. Fills containing appreciable percent of oversized rock (greater than 20%) with diameters greater-than 6-inches will require our reevaluation and recommendations for use or disposition.

3.2.3 Import Soils

Import soils and/or borrow sites should be evaluated by us prior to import. Import soils should be uncontaminated, granular in nature, free of organic material (loss on ignition less-than 2 percent), have very low expansion potential (with an Expansion Index less than 20) and have a low corrosion impact to the proposed improvements.

3.2.4 Utility Trenches

Utility trenches should be backfilled with compacted fill in accordance with Sections 306-1.2 and 306-1.3 of the *Standard Specifications for Public Works Construction,* ("Greenbook"), 2003 Edition. Fill material should be placed in lifts not exceeding 8 inches in uncompacted thickness and should be compacted to at least 90 percent relative compaction (ASTM D 1557-02$^{\varepsilon 1}$) by mechanical means only and 95 percent relative compaction within building footprints. The upper 6 inches of backfill in all pavement areas should be compacted to at least 95 percent relative compaction.

Where granular backfill is used in utility trenches adjacent to moisture sensitive subgrades and foundation soils, we recommend that a cut-off "plug" of impermeable material be placed in these trenches at the perimeter of buildings, and at pavement edges adjacent to irrigated landscaped areas. A "plug" can consist of a 5-foot long section of clayey soils with more than 35-percent passing the No. 200 sieve, or a Controlled Low Strength Material (CLSM) consisting of one sack of Portland-cement plus one sack of bentonite per cubic-yard of sand. CLSM should generally conform to Section 201-6 of the *Standard Specifications for Public Works Construction,* ("Greenbook"), 2003 Edition. Then CLSM plug is intended to reduce the likelihood of water migrating from landscaped areas along permeable trench backfill into the building and pavement subgrades, resulting in wetting of moisture sensitive subgrade earth materials under buildings and pavements.

Excavation of utility trenches should be performed in accordance with the project plans, specifications and the *California Construction Safety Orders* (2003 Edition or more current). The contractor must be responsible for providing a "competent person" as defined in Article 6 of the *California Construction Safety Orders.* Contractors should be advised that sandy soils (such as fills generated from the onsite alluvium) could make excavations particularly unsafe. All safety precautions should be properly implemented at all times. In addition, excavations at or near the toe of slopes and/or parallel to slopes may be highly unstable due to the increased driving force and load on the trench wall. Spoil piles from the excavation(s) and construction equipment should be kept away from the sides of the trenches. Leighton Consulting, Inc. does not consult in the area of safety engineering.

3.2.5 Shrinkage

The volume change of excavated onsite soils upon recompaction is expected to vary with materials, density, in-situ moisture content, location and compaction effort. The in-place and compacted densities of soil materials vary and accurate overall determination of shrinkage cannot be made. Therefore, we recommend site grading include, if possible, a balance area or ability to adjust grades slightly to accommodate some variation. Based on our limited geotechnical laboratory testing, we expect a recompaction shrinkage (when recompacted to 90-percent of ASTM D1557-02$^{\varepsilon 1}$) of 10- to 15-percent by volume within the upper 5 feet.

3.2.6 Drainage

All drainage should be directed away from structures and pavements by means of approved permanent/temporary drainage devices. Adequate storm drainage of any proposed pad should be provided to avoid wetting of foundation and pavement subgrade soils. Irrigation adjacent to buildings should be avoided wherever possible. As an option, sealed-bottom planter boxes and/or drought resistant vegetation should be used within 5-feet of buildings. Pavements should be separated from irrigated areas by deeply embedded concrete curbs extending below pavement base.

3.3 Foundation Design

Based on known conditions and anticipated structural loads, shallow spread or continuous wall footings bearing on properly compacted fill can be used to support the proposed buildings based the following design criteria:

3.3.1 Minimum Footing Dimensions and Embedment

Footings should be embedded at least 18-inches below lowest adjacent grades. Footing embedments are measured from lowest adjacent finished grade, considered as the top of interior slabs-on-grade or the finished exterior grade, excluding landscape, whichever is lower. Footings located adjacent to utility trenches or vaults should be embedded below an imaginary 1:1 (horizontal:vertical) plane projected upward and outward from the bottom edge of the trench or vault towards the footing. A minimum base width of 12 inches for continuous footings and a minimum bearing area of 3 square feet (1.75 ft by 1.75

ft) for pad foundations should be used. All footing excavations should be observed by geotechnical engineer before reinforcing steel is placed.

3.3.2 Allowable Vertical Bearing

Based on the above dimensions, an allowable vertical bearing capacity of 2,000 pounds-per-square-foot (psf) may be used for design of footings. This allowable bearing pressure may be increased by 500 psf for each additional foot of embedment and/or width, to a maximum vertical bearing value of 3,000 psf. These bearing values may be increased by one-third when considering short-term seismic or wind loads.

Conventional footings/slab may be enhanced by structurally tying the slabs-on-grade to the perimeter and interior footings as directed by the structural consultant for the project. The slab and footings may be placed (poured) monolithically to further integrate the structural system as a means of reducing the potential for structural damage due to dynamically induced settlement at this site. The need for tie beam/grade beam for these building foundations should be determined by the structural consultant for the project.

3.3.3 Lateral Loads

Lateral loads may be resisted by friction between the footings and the supporting subgrade. A maximum allowable frictional resistance of 0.35 may be used for design of concrete structures poured on properly compacted fill. In addition, lateral resistance may be provided by passive pressures acting against foundations poured neat against properly compacted granular fill. The passive earth pressure may be computed as an equivalent fluid having a density of 300 psf per foot of depth, to a maximum earth pressure of 3,000 pounds per square foot. When combining passive pressure and frictional resistance, the passive pressure component should be reduced by one-third.

3.3.4 Settlement Estimates

Based on known condition and the proposed remedial grading, total settlement due to applied foundation loads for buildings located on compacted fill soils (minimum 90 percent relative compaction) is expected to be less than one (1) inch with ½ inch differential settlement across a lateral distance of 40 feet or between similar structural elements of the building, whichever is a greater distortion. The

majority of the static settlement associated with the building loads (elastic compression) is anticipated to occur during construction as the load is applied.

3.4 Retaining Walls

Where applicable, basement walls or cantilever retaining walls (less than 20 feet in height) should be designed for lateral earth pressures as described in this section. The magnitude of these pressures depends on the amount that the wall can yield horizontally under load. If the wall can yield enough to mobilize full shear strength of backfill soils, then the wall can be designed for "active" pressure. If the wall cannot yield under the applied load, the shear strength of the soil cannot be mobilized and the earth pressure will be higher. Such walls should be designed for "at rest" conditions. If a structure moves toward the soils, the resulting resistance developed by the soil is the "passive" resistance. Retaining walls backfilled with non-expansive (Expansion Index less than 20), free draining soils should be designed using the following equivalent fluid pressures (Table 2):

Table 2. Retaining Wall Design Earth Pressures (Static, Drained Conditions)

Loading Conditions	Equivalent Fluid Density (pcf) For Level Backfill*	Equivalent Fluid Density (pcf) For 2H:1V Backfill*
Active*	35	50
At-Rest*	50	75
Passive**	300	300

*For non-expansive backfill, only.

** Maximum passive pressure not to exceed 3,000 psf at depth.

Total depth of retained earth for design of cantilever walls should be measured as the vertical distance below the ground surface measured at the wall face for stem design, or measured at the heel of the footing for overturning and sliding calculations. Should a sloping backfill be constructed above the wall or backfill be loaded by an adjacent surcharge load, the equivalent fluid weight values provided above should be re-evaluated on an individual case basis by Leighton Consulting, Inc.

In addition to the above lateral forces due to retained earth, surcharge due to above grade loads on the wall backfill, such as an adjacent structure, should be considered in design of the retaining wall. Vertical surcharge loads behind the retaining wall on or in the backfill within a 1:1 (horizontal:vertical) plane projection up and out from the retaining wall toe,

should be considered as lateral and vertical surcharge. Unrestrained (cantilever) retaining walls should be designed to resist one-third of these surcharge loads applied as a uniform horizontal pressure on the wall. Braced walls should also be designed to resist an additional uniform horizontal-pressure equivalent to one-half of uniform vertical surcharge-loads. Higher walls or non-standard wall designs should be reviewed by LCI prior to construction to check that the proper soil parameters have been incorporated into the wall design.

All basement walls should be provided with appropriate drainage. The outlet pipe should be sloped to drain to a suitable location. Typical wall drainage design is illustrated in Figure C-1, *Retaining Wall Backfill and Subdrain Detail*, for non-expansive backfill. Wall backfill should be compacted by mechanical methods to a minimum of 90 percent relative compaction (ASTM D1557-02$^{\varepsilon 1}$). Walls should not be backfilled until wall concrete attains the 28-day compressive strength and/or as determined by the Structural Engineer that the wall is structurally capable of supporting backfill. Lightweight compaction equipment should be used, unless other wise approved by the Structural Engineer.

3.5 Concrete Slabs-On-Grade

Slab-on-grade floors utilized with conventional foundations should be designed with a minimum thickness as indicated by the project structural engineer consistent with a modulus of subgrade reaction of 150 pounds-per-square-inch per inch (pci) and reinforced in accordance with the structural engineer's recommendations. A slip-sheet or equivalent should be used if crack-sensitive floor coverings (such as ceramic tiles, etc.) are to be placed directly on the concrete slab-on-grade. In addition, it has been a standard of care to install a moisture retarder underneath all slabs where moisture condensation is undesirable. Moisture vapor retarders may retard but not totally eliminate moisture vapor movement from the underlying soils up through the slabs. Moisture vapor transmission may be additionally reduced by use of concrete additives. LCI does not practice in the field of moisture vapor transmission evaluation/mitigation. Therefore, we recommend that a qualified person/firm be engaged/consulted with to evaluate the general and specific moisture vapor transmission paths and any impact on the proposed construction. This person/firm should provide recommendations for mitigation of potential adverse impact of moisture vapor transmission on various components of the structure as deemed appropriate.

3.6 Soil Corrosivity and Sulfate Content

3.6.1 Sulfate Content

Concrete in contact with earth materials should be designed in accordance with the California Building Code for a soil with negligible sulfate concentration. Additional geochemical testing should be conducted during grading to verify the sulfate content of the soils.

3.6.2 Soil Corrosivity

Based on past experience on this site, the onsite soil is considered corrosive to buried metal pipes. It is recommended that a corrosion engineer be consulted to provide recommendations for proper protection of buried metal pipes at this site.

3.7 Preliminary Pavement design

For planning and estimating purposes, we have made some assumptions based on the anticipated vehicle traffic usage. The appropriate pavement section will depend on the type of final subgrade soil, traffic load and planned pavement life. Since an evaluation of the actual finish subgrade soils cannot be made at this time, we have used an R-value of 53 based on our laboratory testing of a representative soil sample . The pavement sections are calculated based on Traffic Indexes (TI) as indicated in Table below:

Table 3. Asphalt Pavement Section Thickness

General Traffic Condition	Design Traffic Index (TI)	Asphalt Concrete (inches)	Aggregate Base* (inches)
Automobile	4.0	3.0	4.0
Parking Lanes	4.5	3.0	4.0
Truck Access &	6.0	3.5	6.0
Parking Areas	6.5	4.0	6.0

Appropriate Traffic Index (TI) data should be selected by the project civil engineer or traffic engineering consultant and appropriate R-value of the subgrade soils will need to be determined after completion of rough grading to finalize the pavement design. Final pavement sections should be in general accordance with local, county and industry standards. The Caltrans pavement section design calculations were based on a pavement

life of approximately 20 years with a normal amount of flexible pavement maintenance. Portland cement concrete should be used, rather than asphalt, in point and impact load areas such as loading docks and trash truck bin loading areas.

Subgrade soils in the upper 6 inches of the driveways and parking areas should be properly compacted to at least 95 percent relative compaction (ASTM D1557-02$^{\varepsilon 1}$) and should be moisture-conditioned to optimum or slightly above optimum, and kept in this condition until the pavement section is constructed. Minimum relative compaction requirements for aggregate base should be 95 percent of the maximum laboratory density as determined by ASTM D1557-02$^{\varepsilon 1}$.

Asphalt concrete and aggregate base should conform to *Caltrans Standard Specifications* (July 1995 Edition) Sections 39 and 26-1.02A, respectively. As an alternative, asphalt concrete can conform to Section 203-6 of the *Standard Specifications for Public Works Construction* (Green Book), 2003 Edition. Crushed aggregate base or crushed miscellaneous base can conform to Sections 200-2.2 and 200-2.4 of the *Standard Specifications for Public Works Construction* (Green Book), 2003 Edition, respectively. Pavement subgrades should be compacted to 90 percent and pavement base should be compacted to 95 percent of the ASTM D1557-02$^{\varepsilon 1}$ laboratory maximum density for these materials.

For preliminary planning purposes, fire lanes may be constructed of Portland Cement Concrete (PCC) with a minimum thickness of 5½-inches assuming light axle loads and an average daily truck traffic (ADTT) of less than 500. For medium/heavy axle loads and an ADT of 500 or more, a minimum PCC thickness of 7 inches should be used, such as for trash corrals and trash truck aprons, loading docks, etc. All PCC pavement should have a minimum 28-day concrete compressive strength of 3,250 psi and have appropriate joints and saw cuts in accordance with either Portland Cement Association (PCA) or American Concrete Institute (ACI) guidelines. PCC subgrade should be compacted to 95 percent relative compaction in the upper 6 inches.

The above PCC sections should be re-evaluated following the provision of the precise grading plans, which indicate the locations of concrete pavements. We recommend that the ADT be confirmed by the project civil designer or traffic consultant prior to completion of the project. For truck lanes and ramps, a 4-inch (minimum) layer of Class 2 aggregate base at 95 percent relative compaction should be considered beneath the PCC paving. This 4-inch layer of Class 2 aggregate may be used beneath other areas of PCC pavement to improve performance. The upper 6 inches of the underlying subgrade soils should also be compacted to at least 95 percent relative compaction (ASTM D1557-02$^{\varepsilon 1}$).

Additional details should be added to the plans indicating the pavement thickness transitions, pavement joint dowels, expansion joints and sawcut joints. Use of concrete cutoff or edge barriers should be considered at the perimeter of the common parking or driveway areas when they are adjacent to either open (unfinished) or landscaped areas

4.0 GEOTECHNICAL REVIEW

Geotechnical review of the project plans and specifications is of paramount importance in engineering practice. Poor performances of many foundation and earthwork projects have been attributed to inadequate construction review. We recommend that Leighton Consulting, Inc. be provided the opportunity to review the following items.

4.1 Plans and Specifications

We should review the project rough grading and foundation plans and specifications prior to release for bidding and construction. Such review is important to determine whether the geotechnical recommendations in this report have been effectively implemented in the project design. Additional field and laboratory testing may be warranted based on these reviews. Review findings should be reported in writing by the geotechnical consultant, or documented by stamp on the approved drawings.

4.2 Construction Review

Observation and testing should be performed by Leighton Consulting, Inc. representatives during construction. It is anticipated that the geologic conditions and materials exposed during construction will vary from that encountered in test borings. Reasonably continuous construction observation and review during site grading and foundation installation allows for evaluation of the actual soil conditions and the ability to provide appropriate revisions where required to meet the site conditions.

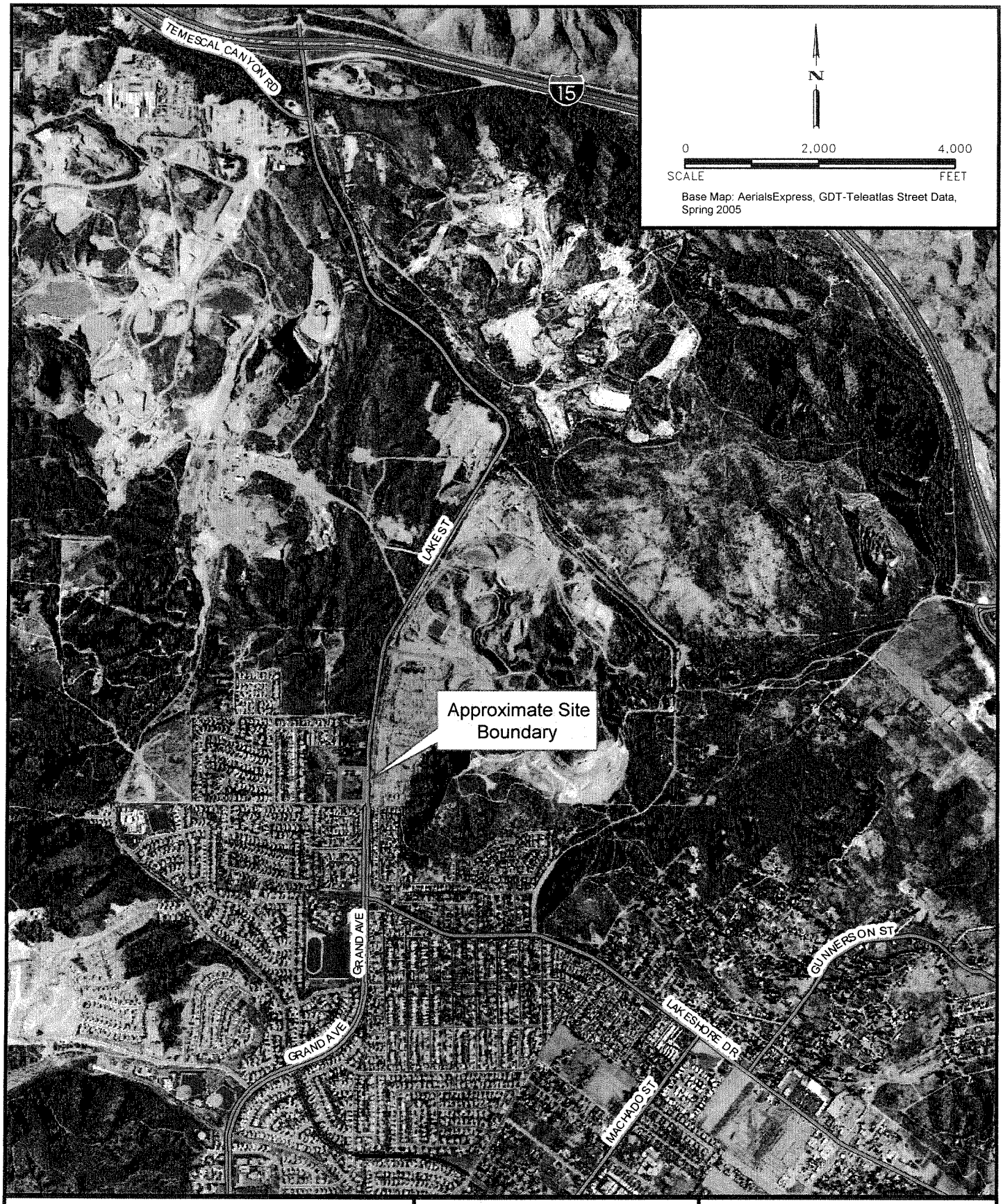
Site preparation, removal of unsuitable soils, approval of imported earth materials, fill placement, foundation installation and other geotechnically-related operations should be observed, tested, and documented by representatives of Leighton Consulting, Inc.

5.0 LIMITATIONS

This report was prepared solely for the use of Marinita Development Company and their consulting team, for the design of the proposed Lake Street Marketplace as described in this report, in accordance with generally accepted geotechnical engineering practices at this time in California. No warranty is expressed or implied.

This report was necessarily based in part upon data obtained from a limited number of observances, soil and/or samples, analyses, histories of occurrences, spaced past subsurface explorations and limited information on historical events and observations. Such information is necessarily incomplete. It is understood that additional subsurface geotechnical data may be necessary for the completion of the geotechnical evaluation of this property based on review of the project rough-grading plans. The nature of many sites is such that differing characteristics can be experienced within small distances and under various climatic conditions. Changes in subsurface conditions can, and do, occur over time.

This report is not authorized for use by, and is not to be relied upon by any party except, Marinita Development Company, its successors and assigns as owner of the property, with whom Leighton Consulting, Inc. has contracted for the work. Use of or reliance on this report by any other party is at that party's risk. Unauthorized use of or reliance on this report constitutes an agreement to defend and indemnify Leighton Consulting, Inc. from and against any liability which may arise as a result of such use or reliance, regardless of any fault, negligence, or strict liability of Leighton Consulting, Inc.



Preliminary Geotechnical Investigation
Lake Street Marketplace
City of Lake Elsinore, California

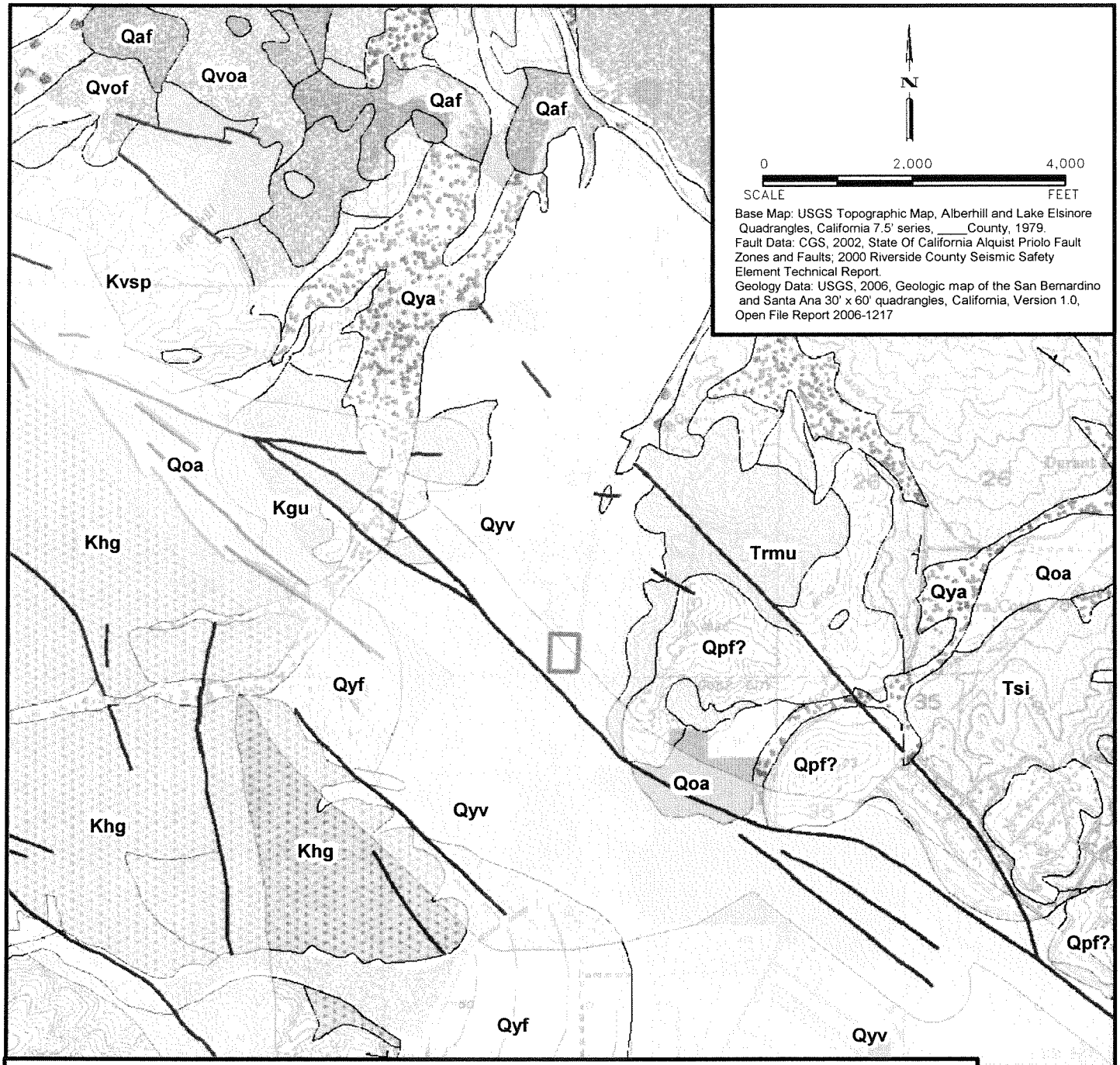
SITE LOCATION MAP

Project No.
602051-001

Date
December 2007

Figure 1

\\GIS\Administration\ArcGISTemplates\NEW_GDT_SiteLocationMap.mxd



Legend

- Approximate Site Boundary
- Alquist-Priolo Earthquake Faults
- Alquist-Priolo Earthquake Fault Zones
- Riverside County Earthquake Faults
- Riverside County Earthquake Fault Zones

Geologic Units

- Qyv, Young alluvial-valley deposits,
- Qpf, Pauba Formation, Fanglomerate member
- Khg, Heterogeneous granitic rocks,
- Kgu, Granite, undifferentiated,
- Trmu, Rocks of Menifee Valley, undifferentiated,

Note: Regional Geologic map does not reflect presence of Older Quaternary-age alluvium observed on site during this investigation.

Preliminary Geotechnical Investigation
Lake Street Marketplace
City of Lake Elsinore, California

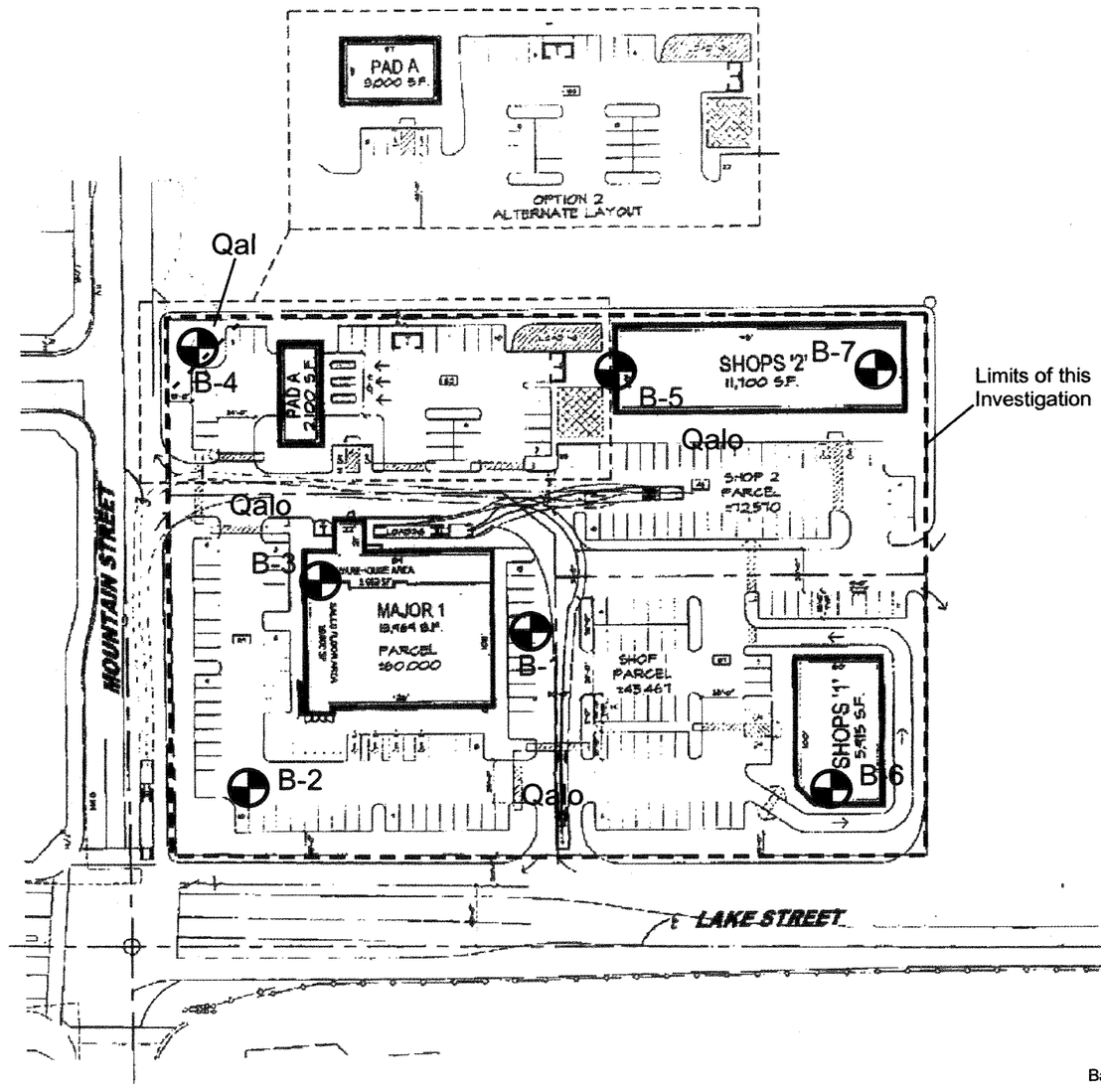
REGIONAL GEOLOGY AND FAULT MAP

Project No.
602051-001

Date
December 2007

Figure 2

\\GIS\project\602051_LakeStreetMarketplace\001\602051-001_RegionalGeologyMap.mxd



Summary

Land	±4.09 AC	±178,037SF
Building		33,684SF
Land-to-Bldg Ratio		4.2/1
Coverage		19%
Parking Required		203 stalls
Parking Provided		203 stalls
Parking Ratio		6/1000

Parking Required	
Retail @ 1/200 (13,969)	70 stalls
Rest. @ 1/45 Seating Area (2,800) & 1/200 Remaining (3,340) =62 + 17	79 stalls
Retail @ 1/250 (13,575)	54 stalls
Total	203 stalls

Summary (w/Alternate Layout)

Land	±4.09 AC	±178,037SF
Building		34,584SF
Land-to-Bldg Ratio		4.15/1
Coverage		19.43%
Parking Required		203 stalls
Parking Provided		203 stalls
Parking Ratio		6/1000

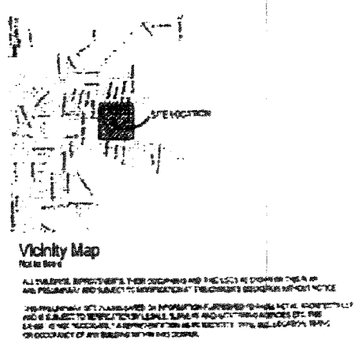
Parking Required	
Retail @ 1/200 (13,969)	70 stalls
Rest. @ 1/45 Seating Area (2,800) & 1/200 Remaining (2,600) =62 + 13	75 stalls
Retail @ 1/250 (14,475)	58 stalls
Total	203 stalls

NORTH

North

30

Scale
1 in ≈ 100 ft



Vicinity Map

Base Map Provided by: Nadel Retail Architects, Dated 5/4/07

LEGEND

Boring Location
B-7

Qal - Quaternary age younger alluvium

Qalo - Quaternary age older alluvium

See boring logs and report text for descriptions

Marinita Development Company/Lake St. Marketplace
NWC Mountain St. and Lake St.
Lake Elsinore, California

Boring Location Map

Project No.
602051-001

Date
December 2007

Figure 3

APPENDIX A

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APPENDIX B

FIELD EXPLORATION

On November 16, 2007, LCI conducted field investigation at the subject site. Approximate locations of these explorations are depicted on Figure 3, *Boring Location Map*. The primary purpose of these borings was to evaluate the physical characteristics of the site soils. These explorations allowed evaluation and measurement of the surficial soils, limited evaluation of the ability to excavate site earth materials and provided representative undisturbed and bulk samples for geotechnical laboratory testing.

The attached subsurface exploration logs and related information depict subsurface conditions only at the locations indicated and at the particular date designated on the logs. Subsurface conditions at other locations may differ from conditions occurring at these logged locations. The passage of time may result in altered subsurface conditions due to environmental changes. In addition, any stratification lines on the logs represent the approximate boundary between sampling intervals and soil types; and the transition may be gradual.

GEOTECHNICAL BORING LOG B-1

Date 11-16-07 **Sheet** 1 **of** 2

Project Marinita Devel Lake Street Prelim **Project No.** 602051-001

Drilling Co. Redman Drilling **Type of Rig** CME-75

Hole Diameter 8" inches **Drive Weight** 140lb **Drop** 30 inches

Elevation Top of Hole +/- feet **Location** See Boring Location Map

Elevation Feet	Depth Feet	Graphic Log (N S)	Notes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION (Logged By KXS; Sampled By)	Type of Tests
	0							SM	QUATERNARY YOUNGER ALLUVIUM (Qal)	
			B1-1 @ 0-5'						@0-5': Silty fine to medium grained SAND with coarse grained particles, brown, damp	EI
	5			R-2	20	114	4		@5': Silty fine to coarse grained SAND, brown, damp, medium dense	
								SM	QUATERNARY OLDER ALLUVIUM (Qalo)	
	10			R-3	50/4"				@10': Silty fine to coarse grained SAND, dark brown, damp, dense	DS
	15			R-4	76/11"				@15': Silty fine to coarse grained SAND, brown, moist, dense	
	20			R-5	67	117	15		@20': Silty fine to medium grained SAND with lean clay, dark brown, moist, dense	
	25			R-6	50/5"				@25': Silty fine to medium grained SAND, dark brown, moist, dense	
	30									

SAMPLE TYPES:

- S SPT
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- C CORE SAMPLE

TYPE OF TESTS:

- SU SULFATE
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDROCOLLAPSE
- HD HYDROMETER
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE
- CS CORROSION SUITE
- MC MOISTURE CONTENT
- SE SAND EQUIVALENT
- -200 200 WASH
- RDS REMOLDED DS
- LOI LOSS ON IGNITION

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GEOTECHNICAL BORING LOG B-1

Date 11-16-07 **Sheet** 2 **of** 2

Project Marinita Devel Lake Street Prelim **Project No.** 602051-001

Drilling Co. Redman Drilling **Type of Rig** CME-75

Hole Diameter 8" inches **Drive Weight** 140lb **Drop** 30 inches

Elevation Top of Hole +/- feet **Location** See Boring Location Map

Elevation Feet	Depth Feet	Graphic Log	Notes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	30	N S		R-7	50/1.5"				@30': Silty fine to medium grained SAND, brown, moist, very dense	
									Total Depth 30' 1.5" Grounwater Not Encountered Backfilled with Spoils on 11/16/2007	
	35									
	40									
	45									
	50									
	55									
	60									

Logged By KXS

Sampled By

SAMPLE TYPES:

- S SPT
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- C CORE SAMPLE

TYPE OF TESTS:

- SU SULFATE
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDROCOLLAPSE
- HD HYDROMETER
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE
- CS CORROSION SUITE
- MC MOISTURE CONTENT
- SE SAND EQUIVALENT
- -200 200 WASH
- RDS REMOLDED DS
- LOI LOSS ON IGNITION

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GEOTECHNICAL BORING LOG B-2

Date 11-16-07 **Sheet** 1 **of** 1

Project Marinita Devel Lake Street Prelim **Project No.** 602051-001

Drilling Co. Redman Drilling **Type of Rig** CME-75

Hole Diameter 8" inches **Drive Weight** 140lb **Drop** 30 inches

Elevation Top of Hole +/- feet **Location** See Boring Location Map

Logged By KXS

Sampled By

Elevation Feet	Depth Feet	Graphic Log	Notes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0	N S						SM	QUATERNARY OLDER ALLUVIUM (Qalo)	
			B2-1 @ 0-5'						@0-5': Silty fine to coarse grained SAND, brown, damp	SA
	5			R-2	50/3"	109	4		@5': Silty fine to medium grained SAND, light brown, damp, dense	
	10			R-3	50/5"	101	11		@10': Silty fine to medium grained SAND, dark brown, moist, dense	
	15			R-4	50/5"				@15': Silty fine to medium grained SAND, dark brown, moist, very dense	
									Total Depth 15' 6" Grounwater Not Encountered Backfilled with Spoils on 11/16/2007	
	20									
	25									
	30									

SAMPLE TYPES:

- S SPT
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- C CORE SAMPLE

TYPE OF TESTS:

- SU SULFATE
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDROCOLLAPSE
- HD HYDROMETER
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE
- CS CORROSION SUITE
- MC MOISTURE CONTENT
- SE SAND EQUIVALENT
- -200 200 WASH
- RDS REMOLDED DS
- LOI LOSS ON IGNITION

Leighton

GEOTECHNICAL BORING LOG B-3

Date 11-16-07 **Sheet** 1 **of** 1

Project Marinita Devel Lake Street Prelim **Project No.** 602051-001

Drilling Co. Redman Drilling **Type of Rig** CME-75

Hole Diameter 8" inches **Drive Weight** 140lb **Drop** 30 inches

Elevation Top of Hole +/- feet **Location** See Boring Location Map

Elevation Feet	Depth Feet	Graphic Log (N S)	Notes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION (Logged By KXS; Sampled By)	Type of Tests
	0							SM	QUATERNARY OLDER ALLUVIUM (Qalo)	
									@0-5': Silty fine to medium grained SAND, brown, damp	
	5			R-1	50/3"	108	4		@5': Silty fine to medium grained SAND, dark brown, damp, dense	
	10			R-2	50/3"				@10': Silty fine to coarse grained SAND, light brown, moist, dense	
									Total Depth 10' 9" Grounwater Not Encountered Backfilled with Spoils on 11/16/2007	
	15									
	20									
	25									
	30									

SAMPLE TYPES:

- S SPT
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- C CORE SAMPLE

TYPE OF TESTS:

- SU SULFATE
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDROCOLLAPSE
- HD HYDROMETER
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE
- CS CORROSION SUITE
- MC MOISTURE CONTENT
- SE SAND EQUIVALENT
- -200 200 WASH
- RDS REMOLDED DS
- LOI LOSS ON IGNITION

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GEOTECHNICAL BORING LOG B-4

Date 11-16-07 **Sheet** 1 **of** 1

Project Marinita Devel Lake Street Prelim **Project No.** 602051-001

Drilling Co. Redman Drilling **Type of Rig** CME-75

Hole Diameter 8" inches **Drive Weight** 140lb **Drop** 30 inches

Elevation Top of Hole +/- feet **Location** See Boring Location Map

Elevation Feet	Depth Feet	Graphic Log (N S)	Notes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION (Logged By KXS; Sampled By)	Type of Tests
	0		B4-1 @ 0-5'					SM	QUATERNARY YOUNGER ALLUVIUM (Qal) @0-5': Silty fine to coarse grained SAND, dark brown, damp	
	5			R-2	30	116	7	SM	QUATERNARY OLDER ALLUVIUM (Qalo) @5': Silty fine to coarse grained SAND, brown, moist, medium dense	
	10			R-3	69	121	6		@10': Silty fine to medium grained SAND with coarse grained particles, brown, moist, dense	
	15			R-4	61	117	6		@15': Silty fine to coarse grained SAND with silt, gray, moist, dense	
	20			R-5	50/2"				No Recovery Total Depth 20' 2" Grounwater Not Encountered Backfilled with Spoils on 11/16/2007	
	25									
	30									

SAMPLE TYPES:
- S SPT
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- C CORE SAMPLE

TYPE OF TESTS:
- SU SULFATE
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDROCOLLAPSE
- HD HYDROMETER
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE
- CS CORROSION SUITE
- MC MOISTURE CONTENT
- SE SAND EQUIVALENT
- -200 200 WASH
- RDS REMOLDED DS
- LOI LOSS ON IGNITION

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GEOTECHNICAL BORING LOG B-5

Date 11-16-07 **Sheet** 1 **of** 1

Project Marinita Devel Lake Street Prelim **Project No.** 602051-001

Drilling Co. Redman Drilling **Type of Rig** CME-75

Hole Diameter 8" inches **Drive Weight** 140lb **Drop** 30 inches

Elevation Top of Hole +/- feet **Location** See Boring Location Map

Elevation Feet	Depth Feet	Graphic Log (N S)	Notes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION (Logged By KXS; Sampled By)	Type of Tests
	0							SM	QUATERNARY YOUNGER ALLUVIUM (Qal) @0-5': Silty fine to medium grained SAND with coarse grained particles, brown, damp	
	5			R-1	58	114	4	SM	QUATERNARY OLDER ALLUVIUM (Qalo) @5': Silty fine to medium grained SAND with coarse grained particles & gravel, gray, moist, medium dense	HCO
	10			R-2	35	106	6		@10': Silty fine to medium grained SAND with coarse grained particles, brown, moist, medium dense	HCO
	15			R-3	50/4"				@15': Silty fine to coarse grained SAND, brown, moist, dense	
	20			R-4	50/6"				@20': Silty fine to coarse grained SAND with gravel, dark brown, moist, dense	
	25								Total Depth 21' Grounwater Not Encountered Backfilled with Spoils on 11/16/2007	
	30									

SAMPLE TYPES:
- S SPT
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- C CORE SAMPLE

TYPE OF TESTS:
- SU SULFATE
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDROCOLLAPSE
- HD HYDROMETER
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE
- CS CORROSION SUITE
- MC MOISTURE CONTENT
- SE SAND EQUIVALENT
- -200 200 WASH
- RDS REMOLDED DS
- LOI LOSS ON IGNITION

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GEOTECHNICAL BORING LOG B-6

Date 11-16-07 **Sheet** 1 **of** 1
Project Marinita Devel Lake Street Prelim **Project No.** 602051-001
Drilling Co. Redman Drilling **Type of Rig** CME-75
Hole Diameter 8" inches **Drive Weight** 140lb **Drop** 30 inches
Elevation Top of Hole +/- feet **Location** See Boring Location Map

Elevation Feet	Depth Feet	Graphic Log (N S)	Notes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION (Logged By KXS; Sampled By)	Type of Tests
	0		B6-1 @ 0-5'					SM	QUATERNARY YOUNGER ALLUVIUM (Qal) @0-5': Silty fine SAND, reddish brown, moist	CS
	5			R-2	84/8"	117	8	SM	QUATERNARY OLDER ALLUVIUM (Qalo) @5': Silty fine SAND, reddish brown, moist, dense	
	10			R-3	50/3"				@10': Silty fine to coarse grained SAND with gravel, gray & brown, moist, very dense	
	15			R-4	50/4"				@15': Silty fine to coarse grained SAND with gravel, gray & brown, moist, very dense	
	20								Total Depth 15' 4" Grounwater Not Encountered Backfilled with Spoils on 11/16/2007	
	25									
	30									

SAMPLE TYPES:
S SPT
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
G GRAB SAMPLE
C CORE SAMPLE

TYPE OF TESTS:
SU SULFATE
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
HCO HYDROCOLLAPSE
HD HYDROMETER
SA SIEVE ANALYSIS
AL ATTERBERG LIMITS
EI EXPANSION INDEX
RV R-VALUE
CS CORROSION SUITE
MC MOISTURE CONTENT
SE SAND EQUIVALENT
-200 200 WASH
RDS REMOLDED DS
LOI LOSS ON IGNITION

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GEOTECHNICAL BORING LOG B-7

Date 11-16-07 **Sheet** 1 **of** 1

Project Marinita Devel Lake Street Prelim **Project No.** 602051-001

Drilling Co. Redman Drilling **Type of Rig** CME-75

Hole Diameter 8" inches **Drive Weight** 140lb **Drop** 30 inches

Elevation Top of Hole +/- feet **Location** See Boring Location Map

Logged By KXS

Sampled By

Elevation Feet	Depth Feet	Graphic Log (N / S)	Notes	Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0		B7-1 @ 2-5'					SM	QUATERNARY YOUNGER ALLUVIUM (Qal) @0-2': Silty fine SAND, reddish brown brown, moist @2-5': Silty fine to medium grained SAND with coarese grained particles, brown, moist	
	5			R-2	50/5"	113	3	SM	QUATERNARY OLDER ALLUVIUM (Qalo) @5': Silty fine to coarse grained SAND, brown, moist, dense	
	10			R-3	50/6"	93	7		@10': Silty fine to coarse grained SAND, brown, moist, dense (ring sample distrubed during sampling)	
	15			R-4	70				@15': Silty fine SAND, brown, moist, dense	
	20								Total Depth 16' 6" Grounwater Not Encountered Backfilled with Spoils on 11/16/2007	
	25									
	30									

SAMPLE TYPES:

- S SPT
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- C CORE SAMPLE

TYPE OF TESTS:

- SU SULFATE
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDROCOLLAPSE
- HD HYDROMETER
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE
- CS CORROSION SUITE
- MC MOISTURE CONTENT
- SE SAND EQUIVALENT
- -200 200 WASH
- RDS REMOLDED DS
- LOI LOSS ON IGNITION

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APPENDIX C

Laboratory Testing Procedures and Test Results

Classification or Grain Size Tests: Typical materials were subjected to mechanical grain-size analysis by sieving from U.S. Standard brass screens (ASTM Test Method D2419). Hydrometer analyses were performed where appreciable quantities of fines were encountered and in accordance with ASTM Test Method D422. The data was evaluated in determining the classification of the materials. The grain-size distribution curves are presented in the test data and the Unified Soil Classification (USCS) is presented in both the test data and the boring logs.

Direct Shear Tests: Direct shear tests were performed, in general accordance with ASTM Test Method D3080, on selected disturbed samples. The samples were remolded to 90 percent relative compaction in accordance with ASTM 1557 and were soaked for a minimum of 24 hours under a surcharge equal to the applied normal force during testing. After transfer of the sample to the shear box, and reloading the sample, pore pressures set up in the sample due to the 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 less than 0.001 inches per minute (depending upon the soil type). The test results are presented in the test data.

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

Hydrocollapse Tests: Hydrocollapse tests were performed in accordance with ASTM Test Method D4546/D5333 on selected, relatively undisturbed ring samples. Samples were placed in a consolidometer and loads were applied in geometric progression. The percent hydrocollapse for each load cycle was recorded as the ratio of the amount of vertical compression to the original 1-inch height. The hydrocollapse test results are presented in the test data herein.

Moisture and Density Determination Tests: Moisture content and dry density determinations were performed in accordance with ASTM Test Method D2216 and D2937 on relatively undisturbed samples obtained from the test borings and/or trenches. The results of these tests are

presented in the boring and/or trench logs. Where applicable, only moisture content was determined from "undisturbed" or disturbed samples.

R-Value: The resistance (R-value) was determined by the California Materials Method No. 301 for subgrade soils. Three samples were prepared and exudation pressure and R-value determined on each one. The graphically determined R-value at exudation pressure of 300 psi is summarized in the test data.

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EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	MARINITA DEVEL LAKE STREET	Tested By:	JAP	Date:	11/28/07
Project No. :	602051-001	Checked By:	JMB	Date:	11/29/07
Boring No:	B-1	Depth (ft.)	0-5.0		
Sample No. :	B1-1	Location:			
Sample Description:	SM, BROWN SILTY SAND WITH TRACE GRAVEL.				

Dry Wt. of Soil + Cont. (gm.)	24725.0
Wt. of Container No. (gm.)	0.0
Dry Wt. of Soil (gm.)	24725.0
Weight Soil Retained on #4 Sieve	79.7
Percent Passing # 4	99.7

MOLDED SPECIMEN	Before Test	After Test
Specimen Diameter (in.)	4.01	4.01
Specimen Height (in.)	1.0000	1.0014
Wt. Comp. Soil + Mold (gm.)	633.5	652.4
Wt. of Mold (gm.)	188.6	188.6
Specific Gravity (Assumed)	2.70	2.70
Container No.	E-17	E-17
Wet Wt. of Soil + Cont. (gm.)	321.3	652.4
Dry Wt. of Soil + Cont. (gm.)	300.4	413.9
Wt. of Container (gm.)	21.3	188.6
Moisture Content (%)	7.5	12.1
Wet Density (pcf)	134.2	139.7
Dry Density (pcf)	124.8	124.7
Void Ratio	0.350	0.352
Total Porosity	0.259	0.261
Pore Volume (cc)	53.7	54.0
Degree of Saturation (%) [S meas]	**57.8**	**92.5**

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h.

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
11/28/07	14:18	1.0	0	0.5000
11/28/07	14:28	1.0	10	0.4998
	Add Distilled Water to the Specimen			
11/29/07	4:43	1.0	855	0.5014
11/29/07	5:43	1.0	915	0.5014

Expansion Index (EI meas) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	1.6
Expansion Index (EI)$_{50}$ = EI meas - (50 -S meas)x((65+EI meas) / (220-S meas))	**5**

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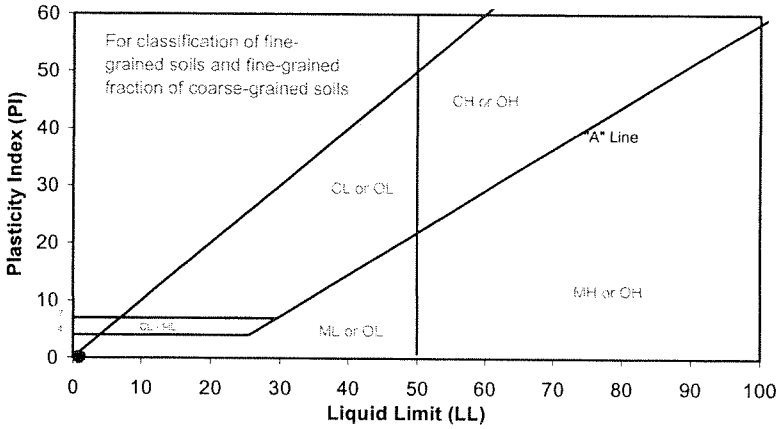
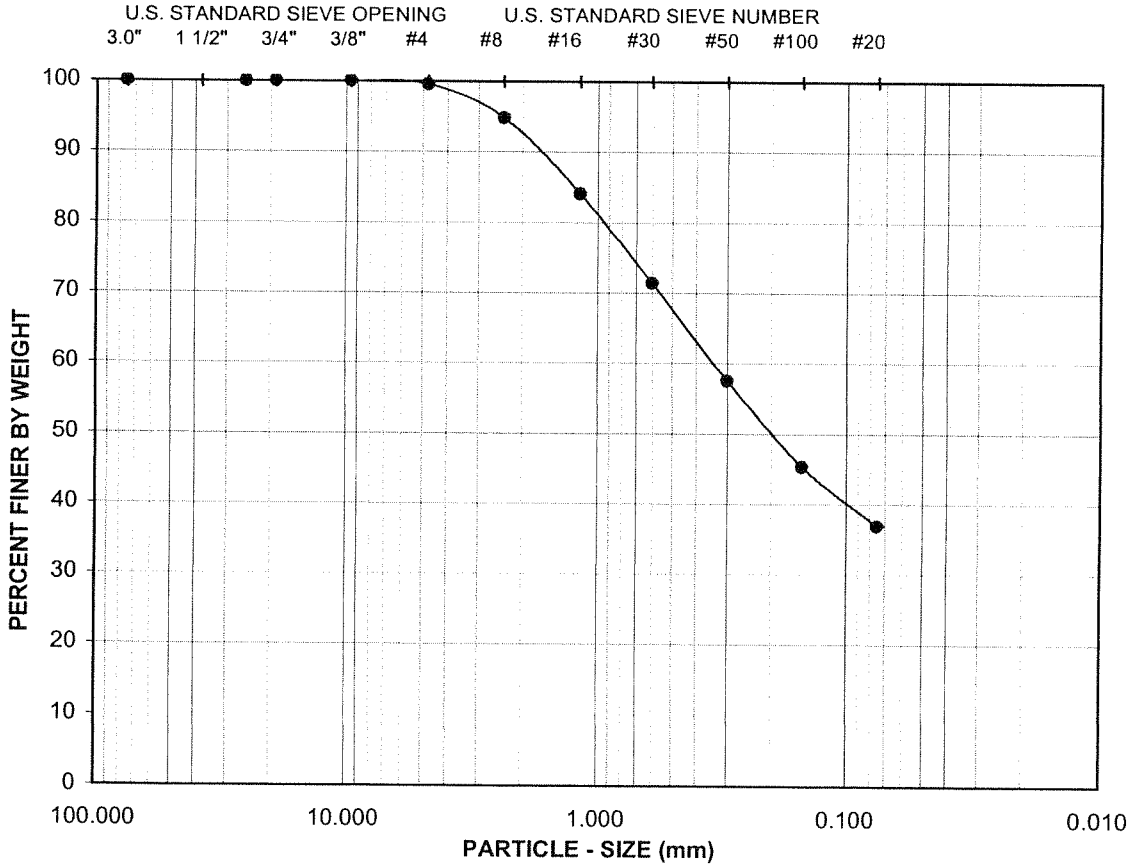


GRAVEL		SAND			FINES
COARSE	FINE	CRSE	MEDIUM	FINE	SILT / CLAY



Boring No.:	Sample No.:	Depth (ft.):	Soil Type	GR:SA:FI	LL,PL,PI
B-2	B2-1	0-5.0	(SC-SM)	0 : 63 : 37	** : ** : ** :

Visual Sample Description:
(SC-SM), BROWN SILTY, CLAYEY SAND WITH TRACE GRAVEL.

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Project No.: 602051-001

MARINITA DEVEL LAKE STREET

ATTERBERG LIMITS, PARTICLE - SIZE CURVE
ASTM D 4318, D 422

Rev. 08-04

Sieve,B-2,B2-1

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One-Dimensional Swell or Settlement Potential of Cohesive Soils

(ASTM D 4546)

Project Name: MARINITA DEVEL LAKE STREET
Project No.: 602051-001
Boring No.: B-5
Sample No.: R-1
Sample Description: SM, BROWN SILTY SAND.

Tested By: VRO Date: 11/28/07
Checked By: JMB Date: 11/29/07
Sample Type: IN SITU
Depth (ft.) 5.0

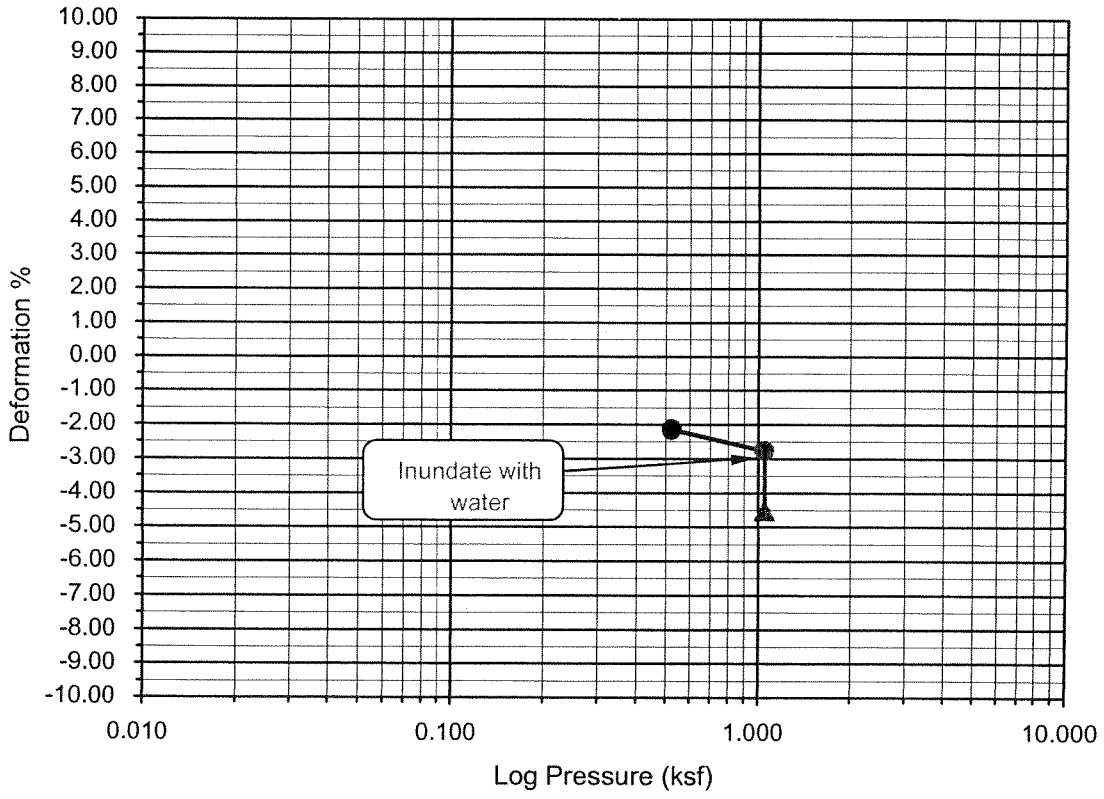
Initial Dry Density (pcf):	113.9
Initial Moisture (%):	4.2
Initial Length (in.):	1.0000
Initial Dial Reading:	0.0500
Diameter(in):	2.416

Final Dry Density (pcf):	119.3
Final Moisture (%) :	14.2
Initial Void ratio:	0.4795
Specific Gravity(assumed):	2.70
Initial Saturation (%)	23.4

Pressure (p) (ksf)	Final Reading (in)	Apparent Thickness (in)	Load Compliance (%)	Swell (+) Settlement (-) % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.525	0.0716	0.9784	0.00	-2.16	0.4476	-2.16
1.050	0.0778	0.9722	0.00	-2.78	0.4384	-2.78
H2O	0.0953	0.9547	0.00	-4.53	0.4125	-4.53

Percent Swell / Settlement After Inundation = -1.80

Deformation % - Log Pressure Curve



Rev. 08-04

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One-Dimensional Swell or Settlement Potential of Cohesive Soils

(ASTM D 4546)

Project Name:	MARINITA DEVEL LAKE STREET	Tested By:	VRO	Date:	11/28/07
Project No.:	602051-001	Checked By:	JMB	Date:	11/29/07
Boring No.:	B-5	Sample Type:	IN SITU		
Sample No.:	R-2	Depth (ft.)	10.0		
Sample Description:	SM, BROWN SILTY SAND.				

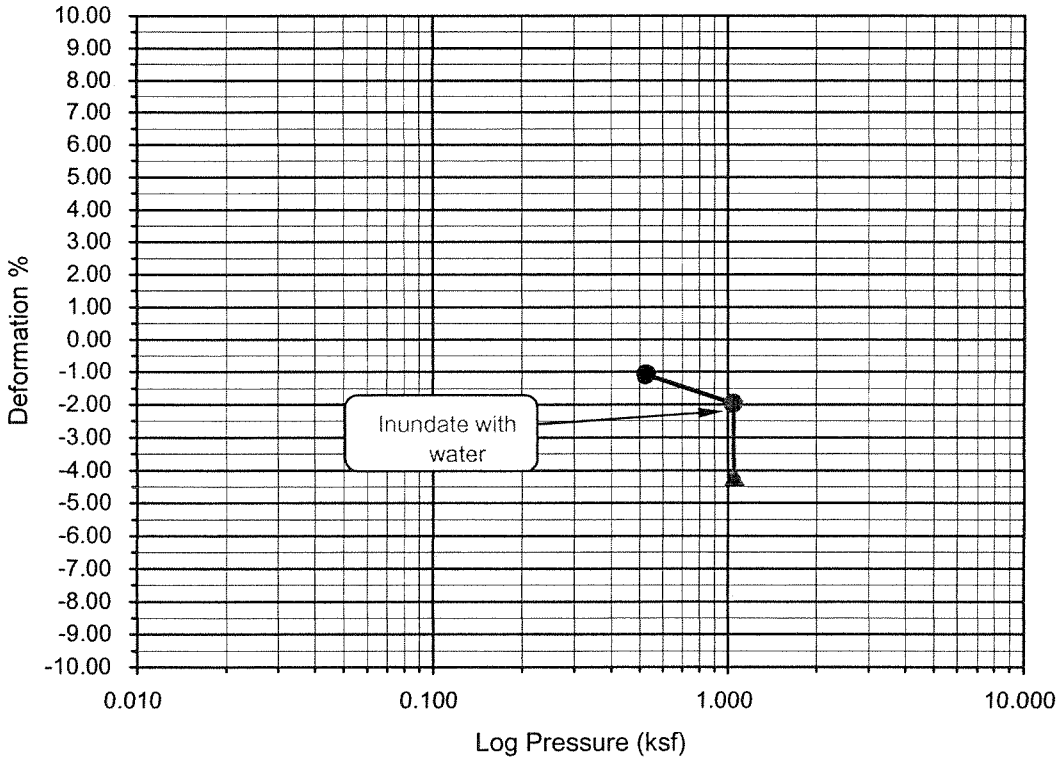
Initial Dry Density (pcf):	106.4
Initial Moisture (%):	6.1
Initial Length (in.):	1.0000
Initial Dial Reading:	0.0500
Diameter(in):	2.416

Final Dry Density (pcf):	111.0
Final Moisture (%) :	16.7
Initial Void ratio:	0.5847
Specific Gravity(assumed):	2.70
Initial Saturation (%)	28.1

Pressure (p) (ksf)	Final Reading (in)	Apparent Thickness (in)	Load Compliance (%)	Swell (+) Settlement (-) % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.526	0.0609	0.9891	0.00	-1.09	0.5674	-1.09
1.050	0.0698	0.9802	0.00	-1.98	0.5533	-1.98
H2O	0.0920	0.9580	0.00	-4.20	0.5181	-4.20

Percent Swell / Settlement After Inundation = -2.26

Deformation % - Log Pressure Curve



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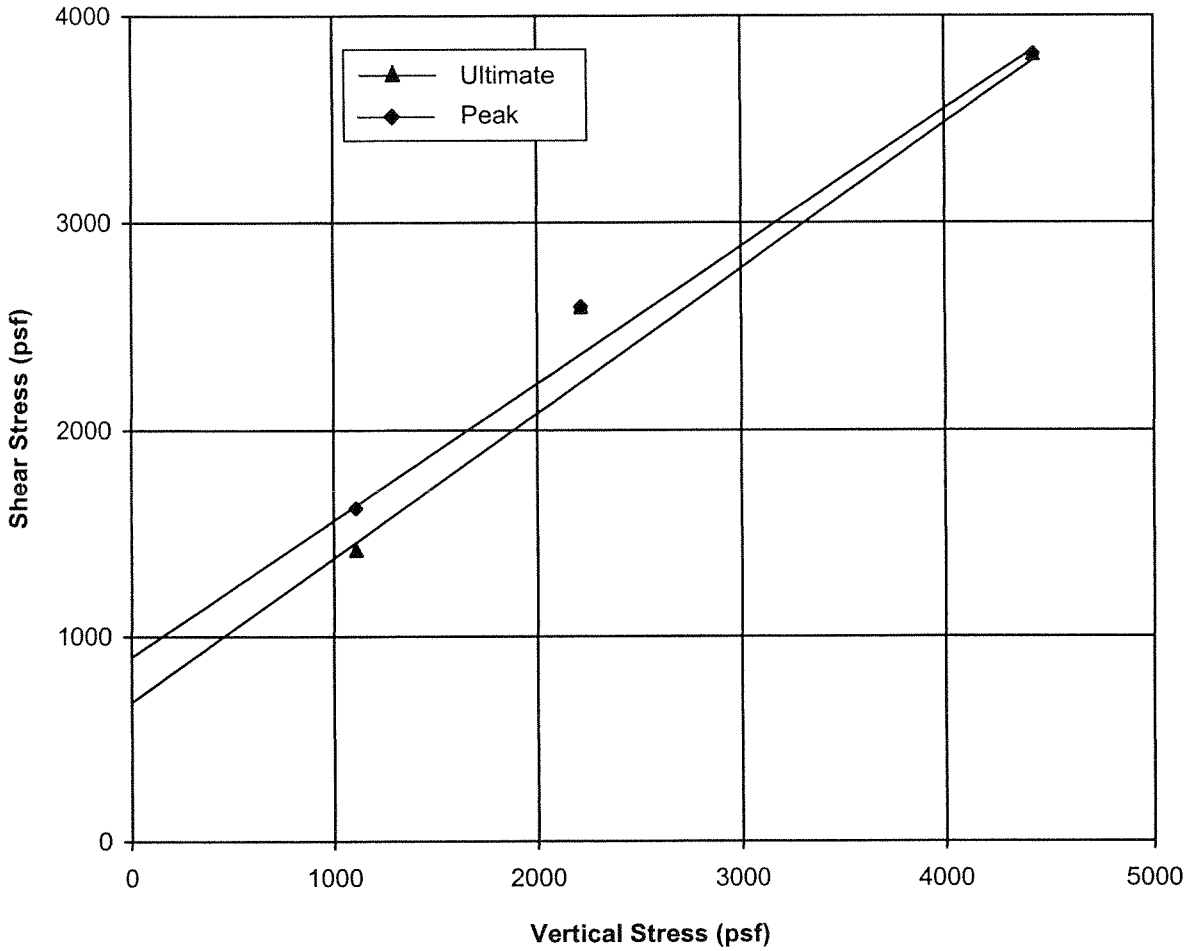

Boring Location	**B-1**
Sample Depth (feet)	**10**
Sample Description	**SC-SM, BROWN SILTY CLAYEY SAND**
Sample Method	**Remolded to 90 percent Compaction**
Initial Average Dry Density	**106.7** pcf

Average Strength Parameters

Friction Angle, ϕ'_{peak} (deg)	**33.5**
Cohesion, c'_{peak} (psf)	**900**
Friction Angle, ϕ'_{ult} (deg)	**35**
Cohesion, c'_{ult} (psf)	**680**

DIRECT SHEAR SUMMARY

Project No.	602051-001
Project Name	Marinita Devel Lake Street
Date	November 29, 2007

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SOIL RESISTIVITY TEST
DOT CA TEST 532 / 643

Project Name: MARINITA DEVEL LAKE STREET | Tested By : JAP | Date: 11/29/07

Project No. : 602051-001 | Data Input By: JAP | Date: 11/29/07

Boring No.: B-6 | Checked By: JMB | Date: 11/29/07

Sample No. : B6-1 | Depth (ft.) : 0-5.0

Visual Soil Identification: SM

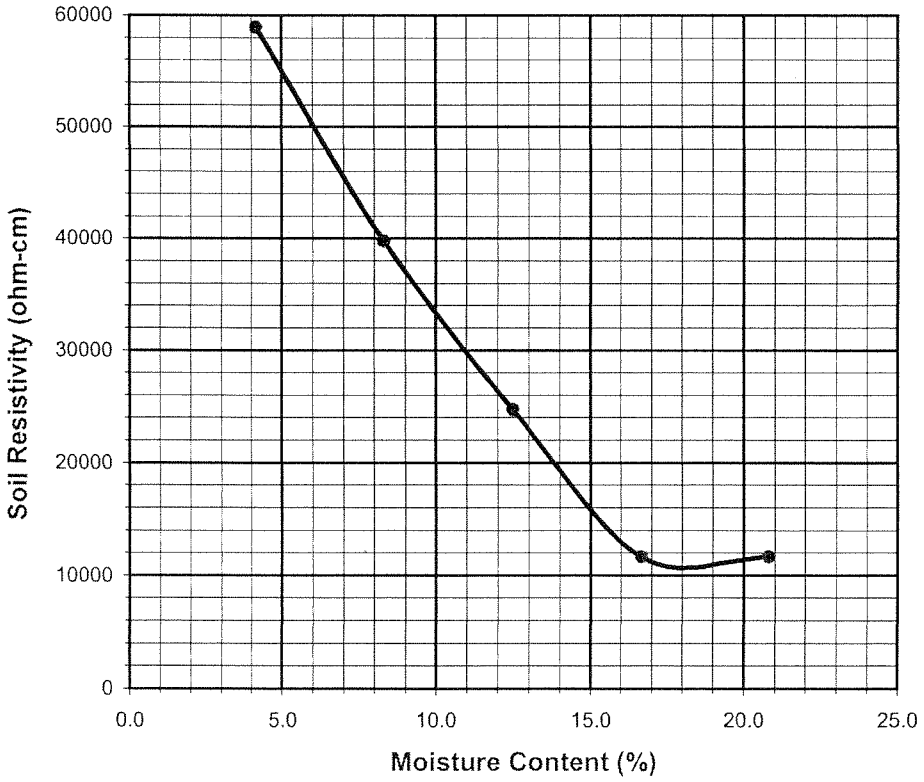
Initial Moisture Content (%)

Wet Wt. of Soil + Cont. (g)	1100.0
Dry Wt. of Soil + Cont. (g)	1100.0
Wt. of Container (g)	0.0
Moisture Content (%) (MCi)	0.00

Initial Soil Weight (gm)(Wt)	600.0
Box Constant:	6.85

MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100

Remolded Specimen	Moisture Adjustments				
Water Added (ml) (Wa)	25	50	75	100	125
Adj. Moisture Content (%) (MC)	4.17	8.33	12.50	16.67	20.83
Resistance Rdg. (ohm)	8600	5800	3600	1700	1700
Soil Resistivity (ohm-cm)	58910	39730	24660	11645	11645



Minimum Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content ppm / %	Chloride Content (ppm)	Soil pH
DOT CA Test 532 / 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 532/643
11645	**16.67**	**<150** <0.015	**340**	**6.84**

Rev. 11-04

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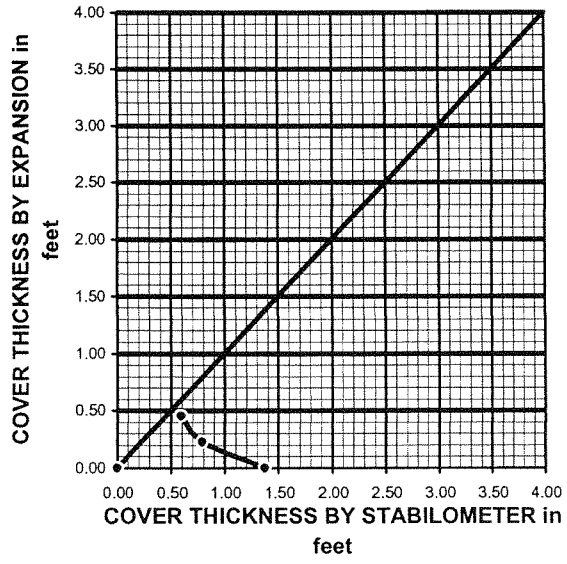
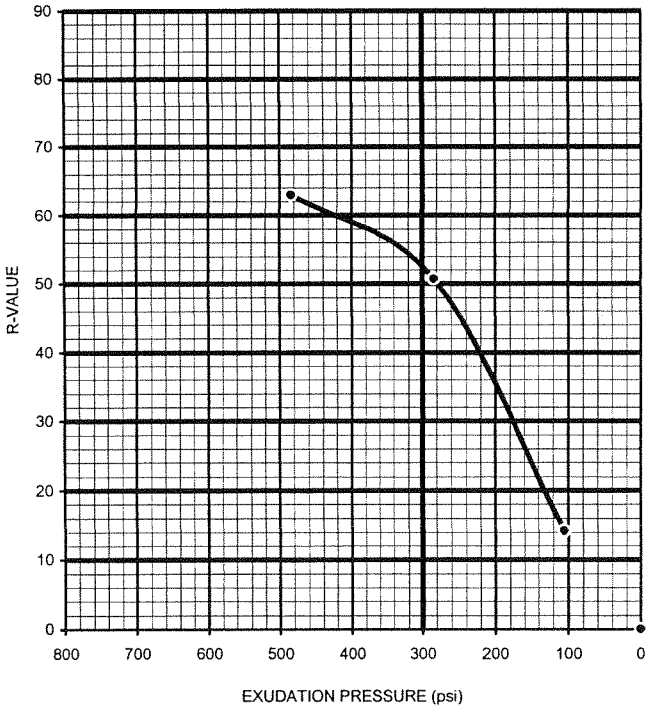
R-VALUE TEST RESULTS

Project Name:	MARINITA DEVEL LAKE STREET	Date:	11/29/07
Project Number:	602051-001	Technician:	JRH
Boring Number:	B-1	Depth (ft.):	0-5.0
Sample Number:	B1-1	Sample Location:	**
Sample Description:	SM, BROWN SILTY SAND WITH TRACE GRAVEL.		—

TEST SPECIMEN	A	B	C
MOISTURE AT COMPACTION %	8.4	9.4	10.4
HEIGHT OF SAMPLE, Inches	2.51	2.54	2.55
DRY DENSITY, pcf	126.8	124.6	125.7
COMPACTOR AIR PRESSURE, psi	250	200	100
EXUDATION PRESSURE, psi	484	283	105
EXPANSION, Inches x 10exp-4	12	6	0
STABILITY Ph 2,000 lbs (160 psi)	37	51	118
TURNS DISPLACEMENT	4.90	5.20	5.41
R-VALUE UNCORRECTED	63	51	14
R-VALUE CORRECTED	63	51	14

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	5.0	5.0	5.0
STABILOMETER THICKNESS, ft.	0.59	0.79	1.37
EXPANSION PRESSURE THICKNESS, ft.	0.45	0.23	0.00





R-VALUE BY EXPANSION:	N/A
R-VALUE BY EXUDATION:	53
EQUILIBRIUM R-VALUE:	53

Rev. 08-04

APPENDIX D

EARTHWORK AND GRADING SPECIFICATIONS

LEIGHTON CONSULTING, 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 the Geotechnical Consultant of Record (Geotechnical Consultant). The Geotechnical Consultants 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. Subsurface areas to be geotechnically observed, mapped, elevations recorded, and/or tested include natural ground after it has been cleared for receiving fill but before fill is placed, bottoms of all "remedial removal" areas, all key bottoms, and benches made on sloping ground to receive fill.

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

1.3 The Earthwork Contractor: The Earthwork Contractor (Contractor) shall be qualified, experienced, and knowledgeable in earthwork logistics, preparation and processing of ground to receive fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall review and accept the plans, geotechnical report(s), and these Specifications prior to commencement of grading. The Contractor shall be solely responsible for performing the grading in accordance with the 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 "spreads" 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 observations and tests can be planned and accomplished. The Contractor shall not assume that the Geotechnical Consultant is aware of all grading operations.

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

2.0 Preparation of Areas to be Filled

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

The Geotechnical Consultant shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 1 percent of organic materials (by volume). No fill lift shall contain more than 5 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.

2.2 Processing: Existing ground that has been declared satisfactory for support of fill by the Geotechnical Consultant shall be scarified to a minimum depth of 6 inches. Existing ground that is not satisfactory shall be overexcavated as specified in the following section. Scarification shall continue until soils are broken down and free of large clay lumps or clods 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. Please see the Standard Details for a graphic illustration. 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 shall also be benched or otherwise overexcavated to provide a flat subgrade for the fill.

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

3.0 Fill Material

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

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

3.3 Import: If importing of fill material is required for grading, proposed import material shall

meet the requirements of Section 3.1. 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. Import fill should be free of all deleterious material and hazardous waste. Testing for hazardous waste typically takes between 7 and 14 working days.

4.0 Fill Placement and Compaction

4.1 Fill Layers: Approved fill material shall be placed in areas prepared to receive fill (per Section 3.0) in near-horizontal layers not exceeding 8 inches in loose thickness. The Geotechnical Consultant may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.

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

4.3 Compaction of Fill: After each layer has been moisture-conditioned, mixed, and evenly spread, it shall be uniformly compacted to not less than 90 percent of maximum dry density (ASTM Test Method D1557-91). Compaction equipment shall be adequately sized and be either specifically designed for soil compaction or of proven reliability to efficiently achieve the specified level of compaction with uniformity.

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

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

4.6 Frequency of Compaction Testing: Tests shall be taken at intervals not exceeding 2 feet in vertical rise and/or 1,000 cubic yards of compacted fill soils embankment. In addition, as a guideline, at least one 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 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 the Standard Details. The Geotechnical Consultant may recommend additional subdrains 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.

6.0 Excavation

Excavations, as well as over-excavation for remedial purposes, shall be evaluated by the Geotechnical Consultant during grading. Remedial removal depths shown on geotechnical plans are estimates only. The actual extent of removal shall be determined by the Geotechnical Consultant based on the field evaluation of exposed conditions during grading. Where fill-over-cut slopes are to be graded, the cut portion of the slope shall be made, evaluated, and accepted by the Geotechnical Consultant prior to placement of materials for construction of the fill portion of the slope, unless otherwise recommended by the Geotechnical Consultant.

7.0 Trench Backfills

7.1 The Contractor shall follow all OHSA and Cal/OSHA requirements for safety of trench excavations.

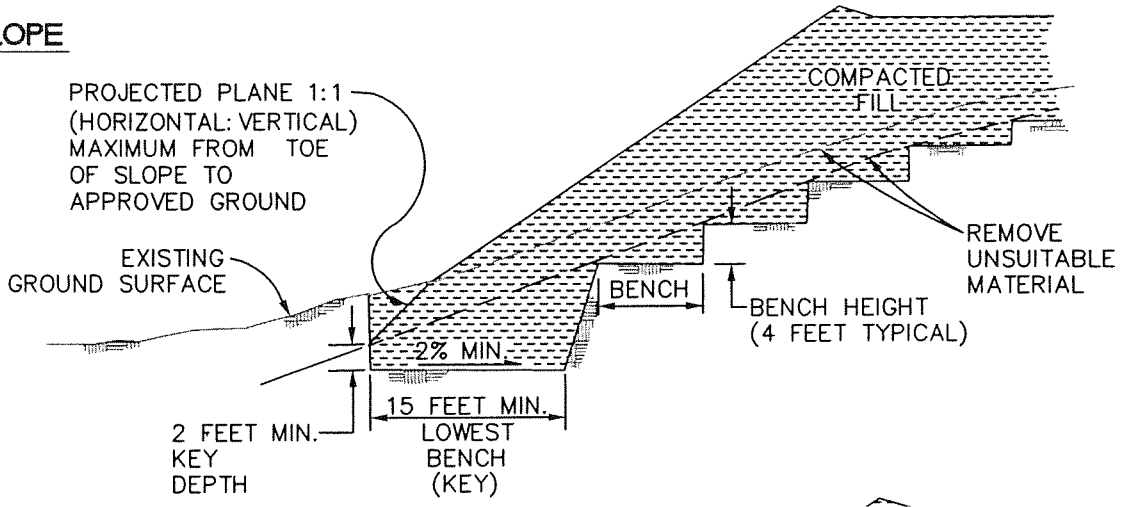
7.2 All bedding and backfill of utility trenches shall be done in accordance with the applicable provisions of Standard Specifications of Public Works Construction. Bedding material shall have a Sand Equivalent greater than 30 (SE>30). The bedding shall be placed to 1 foot over the top of the conduit and densified by jetting. Backfill shall be placed and densified to a minimum of 90 percent of maximum from 1 foot above the top of the conduit to the surface.

7.3 The jetting of the bedding around the conduits shall be observed by the Geotechnical Consultant.

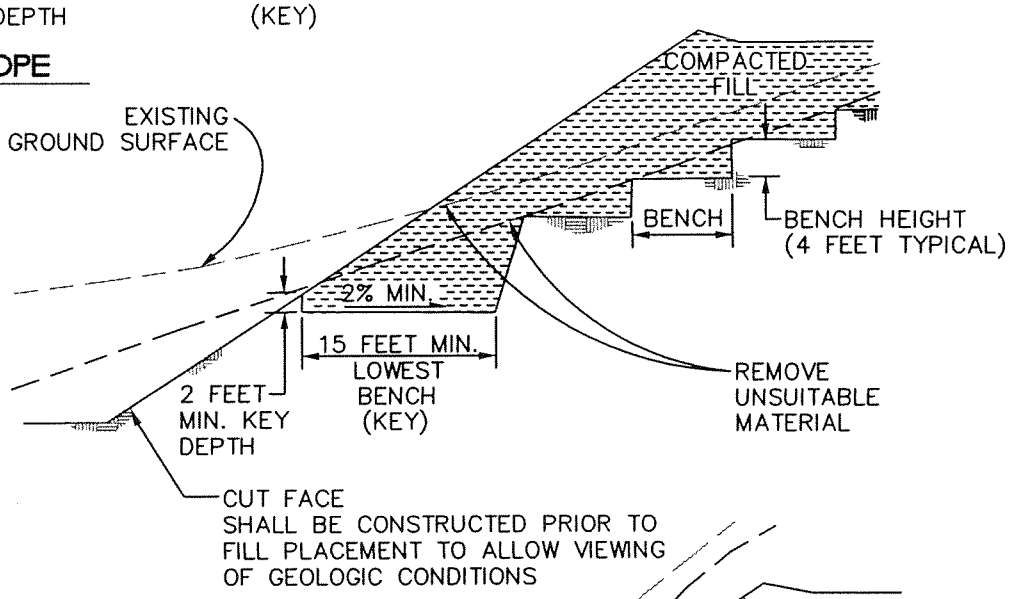
7.4 The Geotechnical Consultant shall test the trench backfill for relative compaction. At least one test should be made for every 300 feet of trench and 2 feet of fill.

7.5 Lift thickness of trench backfill shall not exceed those allowed in the Standard Specifications of Public Works Construction unless the Contractor can demonstrate to the Geotechnical Consultant that the fill lift can be compacted to the minimum relative compaction by his alternative equipment and method.

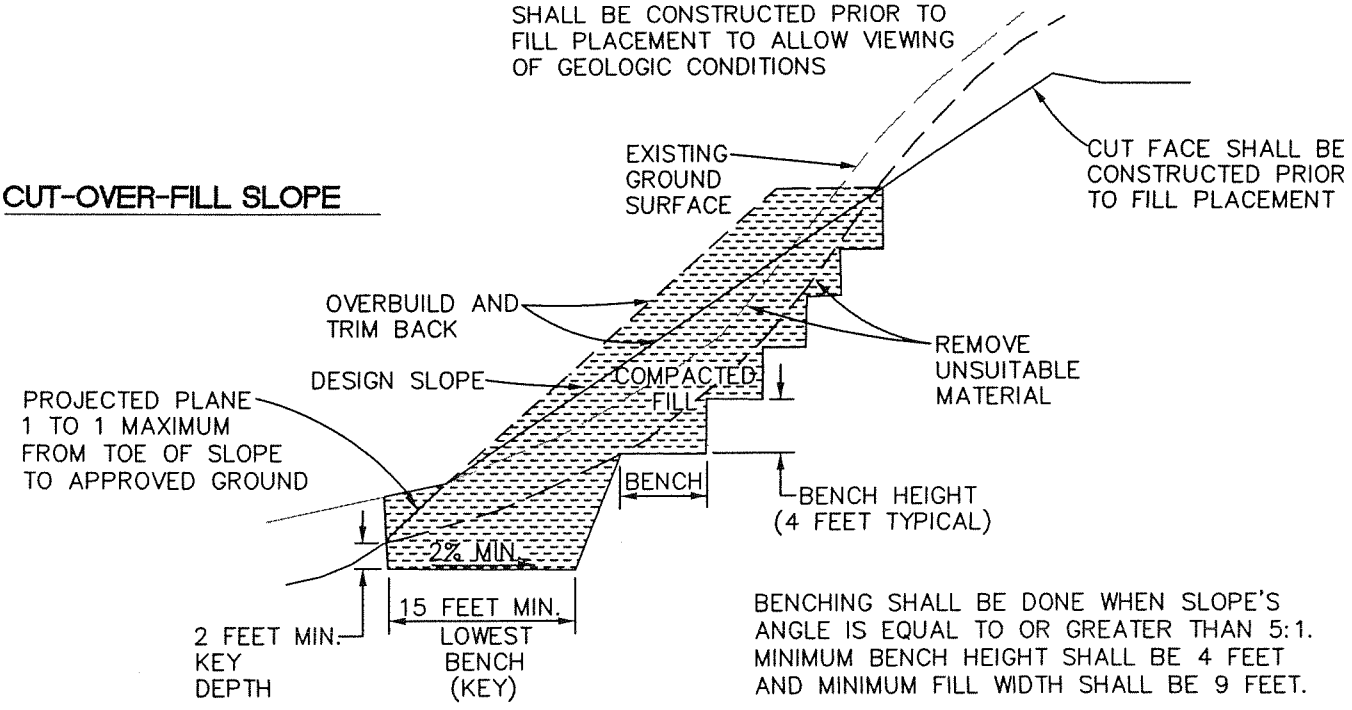
FILL SLOPE



FILL-OVER-CUT SLOPE

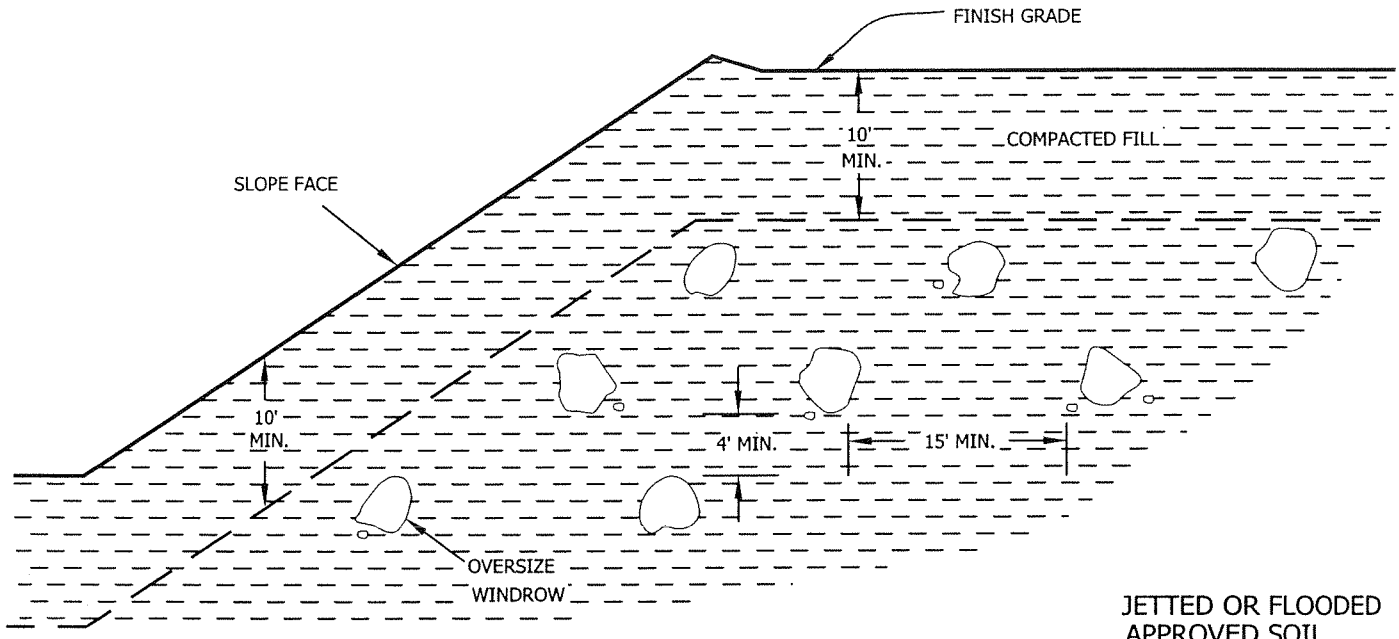


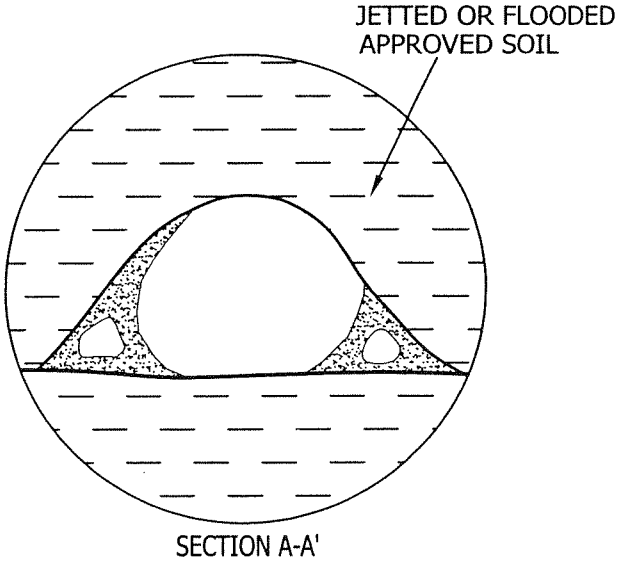
CUT-OVER-FILL SLOPE



BENCHING SHALL BE DONE WHEN SLOPE'S ANGLE IS EQUAL TO OR GREATER THAN 5:1. MINIMUM BENCH HEIGHT SHALL BE 4 FEET AND MINIMUM FILL WIDTH SHALL BE 9 FEET.

KEYING AND BENCHING	GENERAL EARTHWORK AND GRADING SPECIFICATIONS STANDARD DETAILS A	Leighton

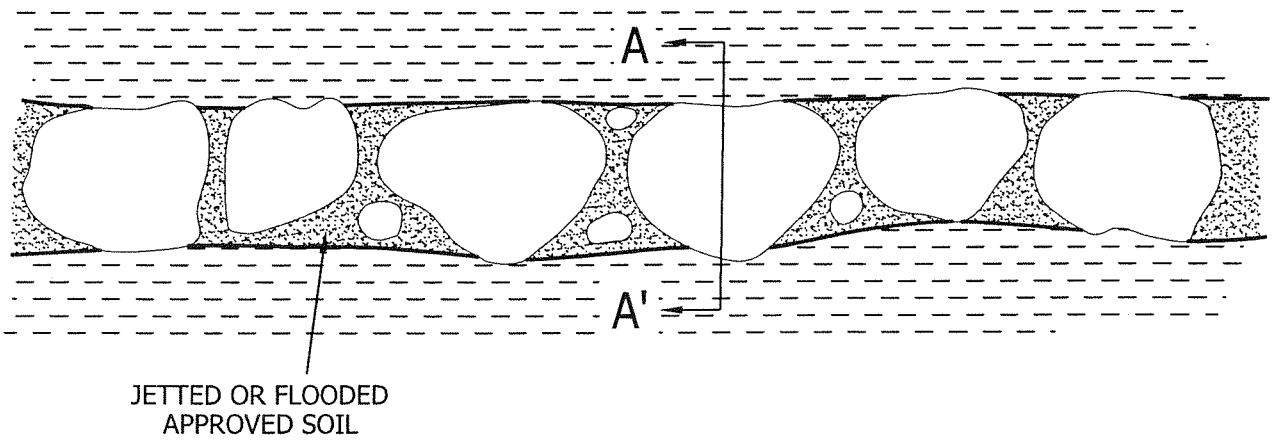




SECTION A-A'

- Oversize rock is larger than 8 inches in largest dimension.
- Backfill with approved soil jetted or flooded in place to fill all the voids.
- Do not bury rock within 10 feet of finish grade.
- Windrow of buried rock shall be parallel to the finished slope face.

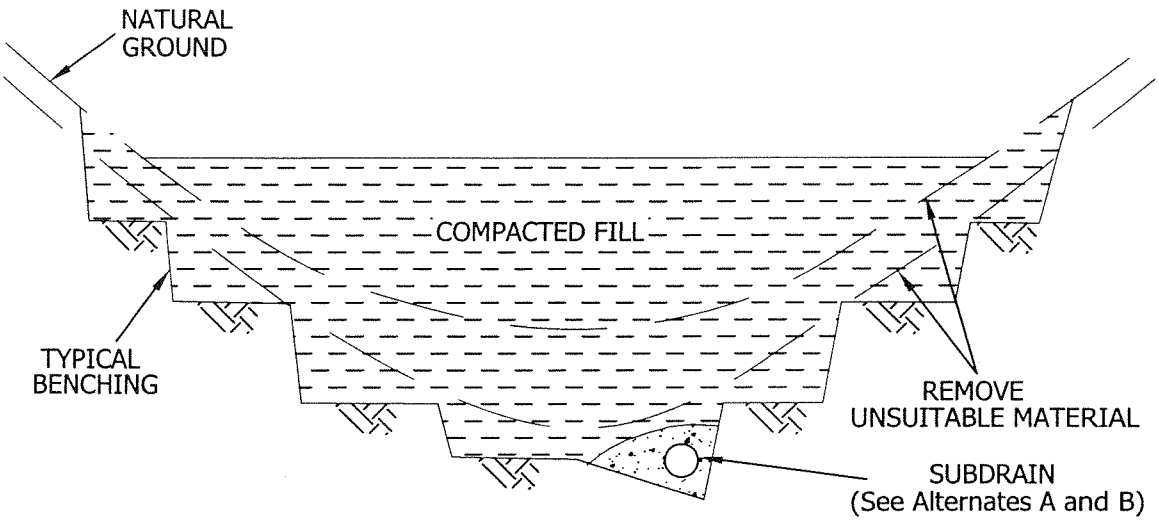
PROFILE ALONG WINDROW



OVERSIZE ROCK DISPOSAL

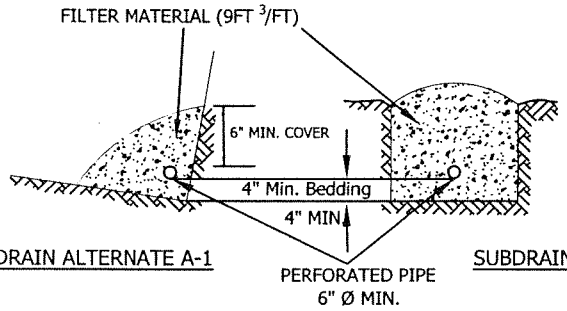
GENERAL EARTHWORK AND GRADING
SPECIFICATIONS
STANDARD DETAILS B

Leighton



SUBDRAIN ALTERNATE A

PERFORATED PIPE SURROUNDED WITH FILTER MATERIAL

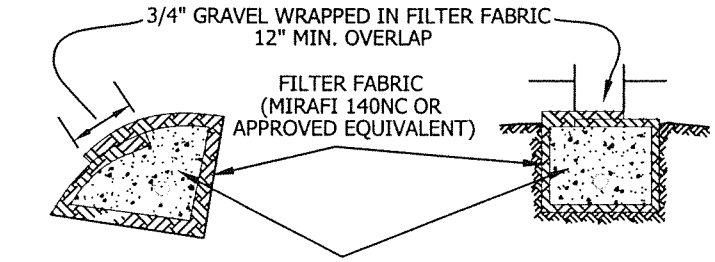


FILTER MATERIAL

FILTER MATERIAL SHALL BE CLASS 2 PERMEABLE MATERIAL PER STATE OF CALIFORNIA STANDARD SPECIFICATION, OR APPROVED ALTERNATE. CLASS 2 GRADING AS FOLLOWS:

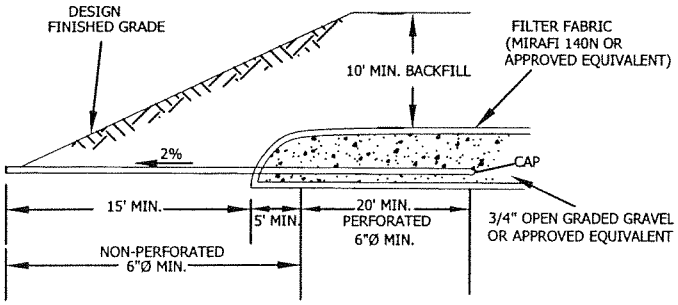
Sieve Size	Percent Passing
1"	100
3/4"	90-100
3/8"	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

SUBDRAIN ALTERNATE B

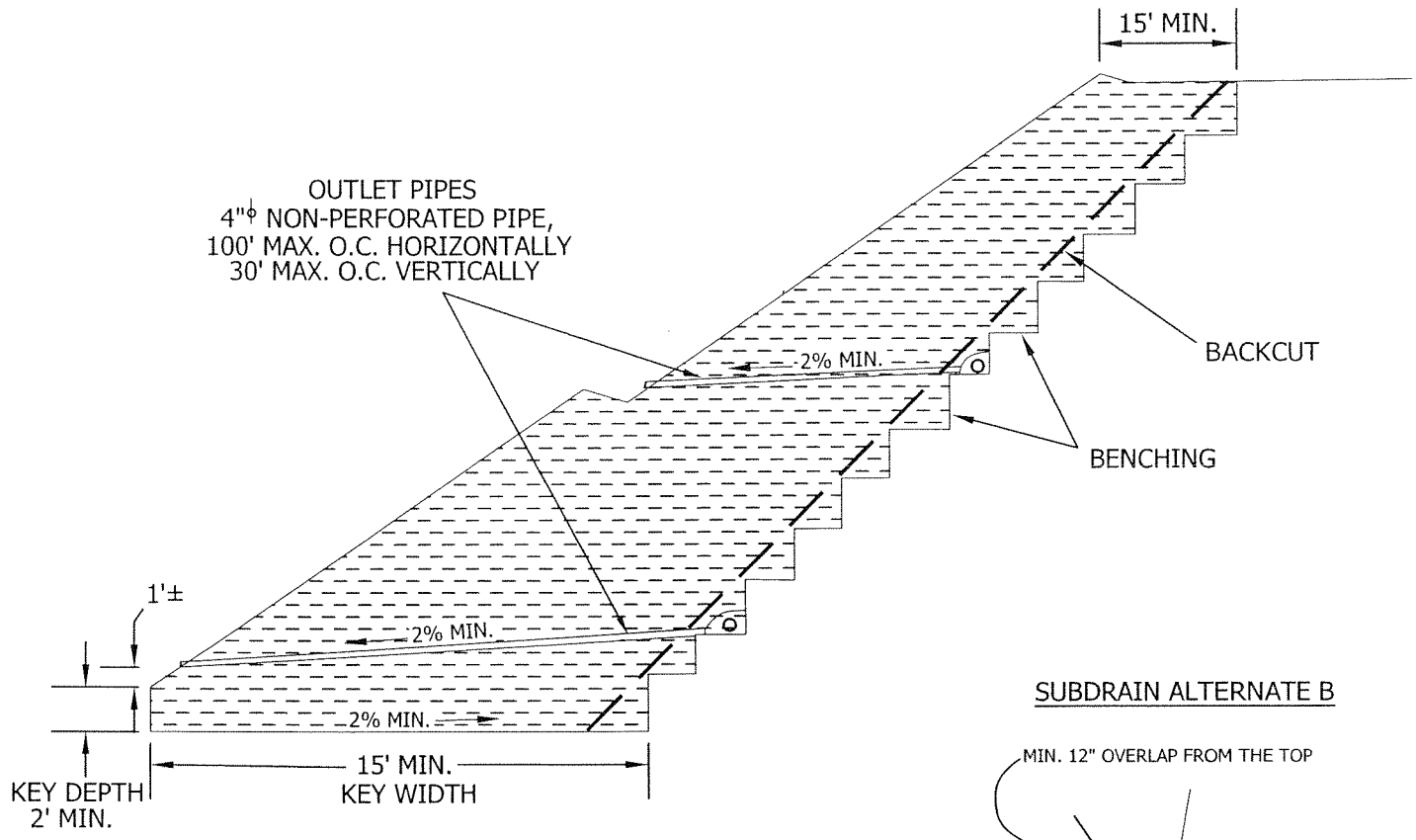


- PERFORATED PIPE IS OPTIONAL PER GOVERNING AGENCY'S REQUIREMENTS

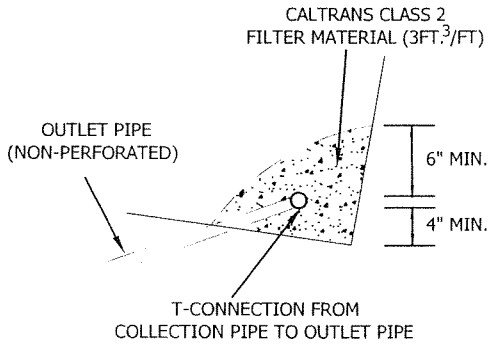
DETAIL OF CANYON SUBDRAIN TERMINAL



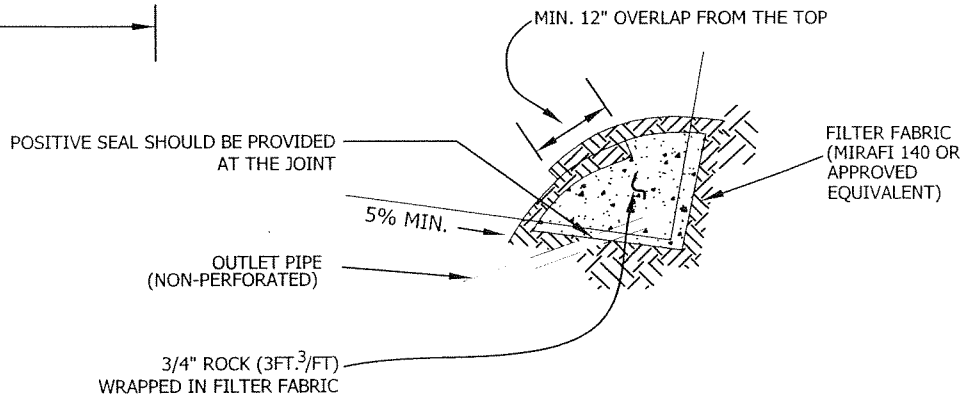
CANYON SUBDRAIN	GENERAL EARTHWORK AND GRADING SPECIFICATIONS STANDARD DETAILS C	Leighton



SUBDRAIN ALTERNATE A



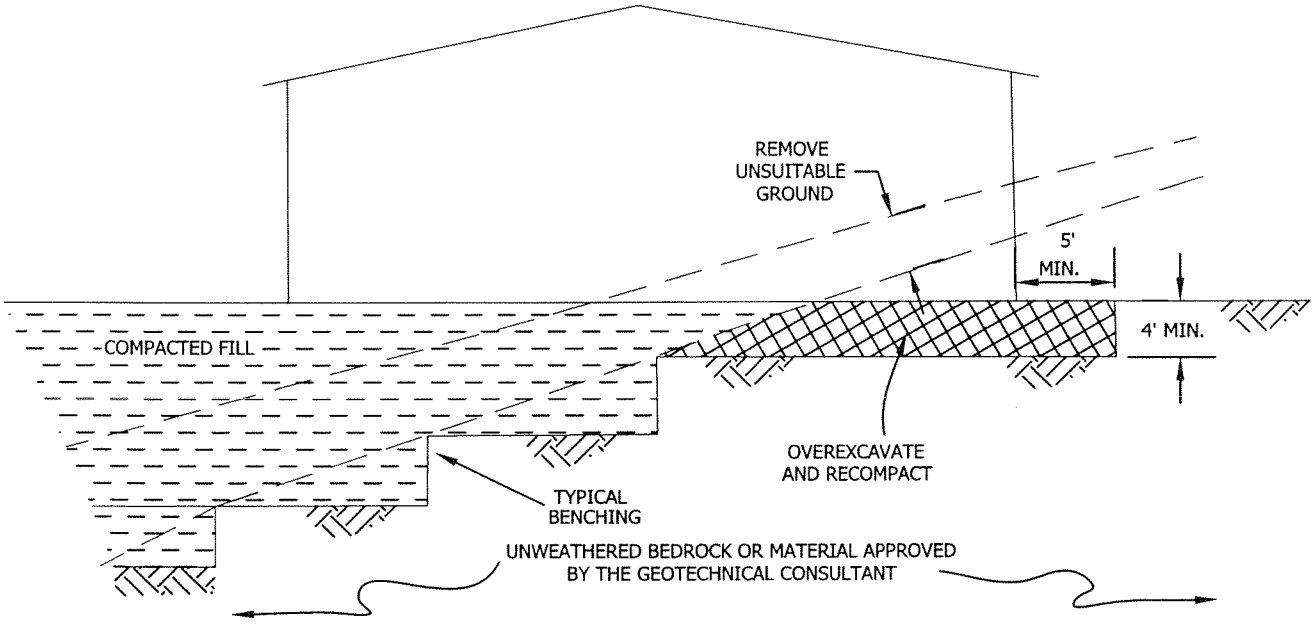
SUBDRAIN ALTERNATE B



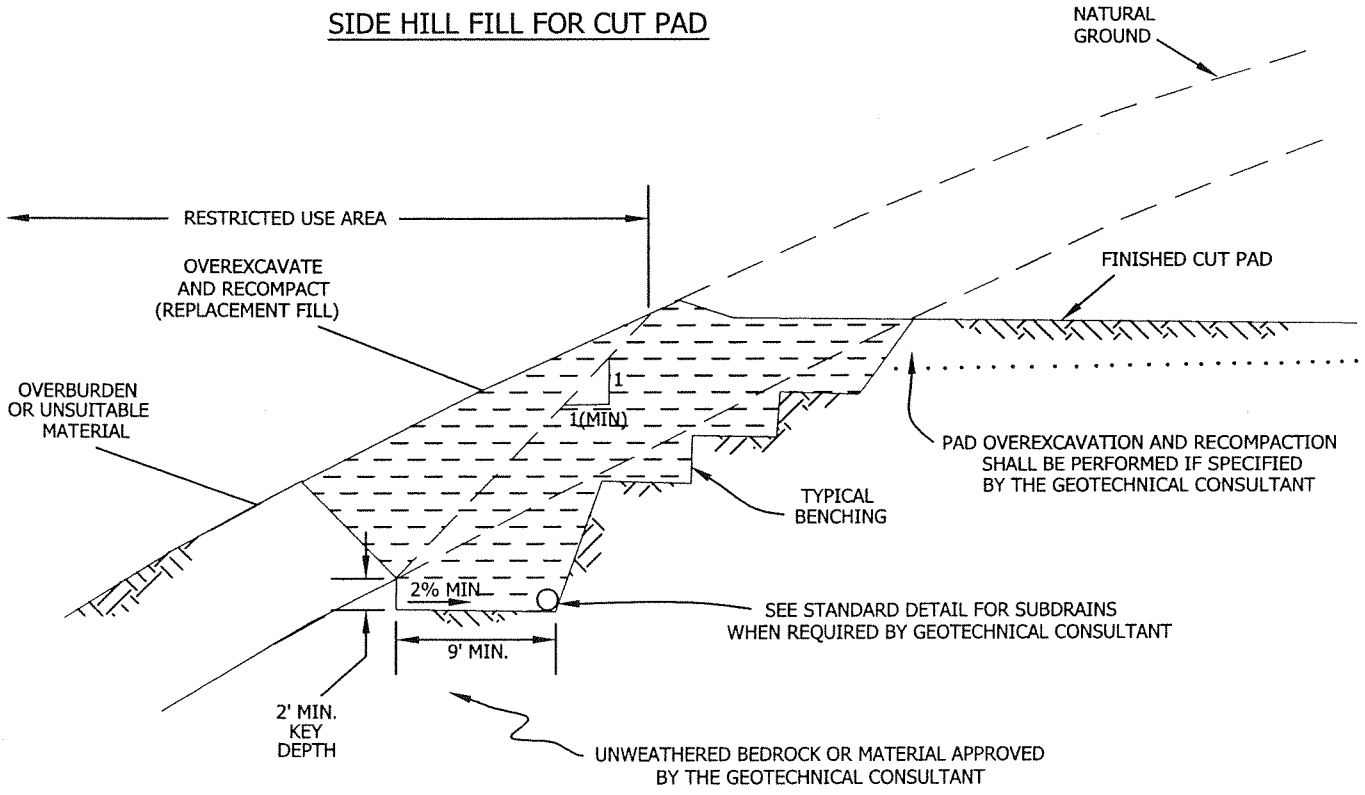
- SUBDRAIN INSTALLATION - Subdrain collector pipe shall be installed with perforations down or, unless otherwise designated by the geotechnical consultant. Outlet pipes shall be non-perforated pipe. The subdrain pipe shall have at least 8 perforations uniformly spaced per foot. Perforation shall be 1/4" to 1/2" if drilled holes are used. All subdrain pipes shall have a gradient at least 2% towards the outlet.
- SUBDRAIN PIPE - Subdrain pipe shall be ASTM D2751, ASTM D1527 (Schedule 40) or SDR 23.5 ABS pipe or ASTM D3034 (Schedule 40) or SDR 23.5 PVC pipe.
- All outlet pipe shall be placed in a trench and, after fill is placed above it, rodded to verify integrity.

BUTTRESS OR REPLACEMENT FILL SUBDRAINS	GENERAL EARTHWORK AND GRADING SPECIFICATIONS STANDARD DETAILS D	Leighton

CUT-FILL TRANSITION LOT OVEREXCAVATION



SIDE HILL FILL FOR CUT PAD



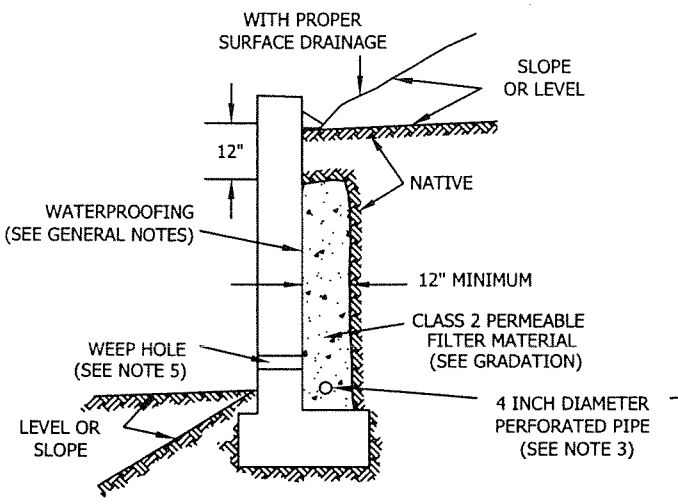
TRANSITION LOT FILLS AND SIDE HILL FILLS

GENERAL EARTHWORK AND GRADING
SPECIFICATIONS
STANDARD DETAILS E

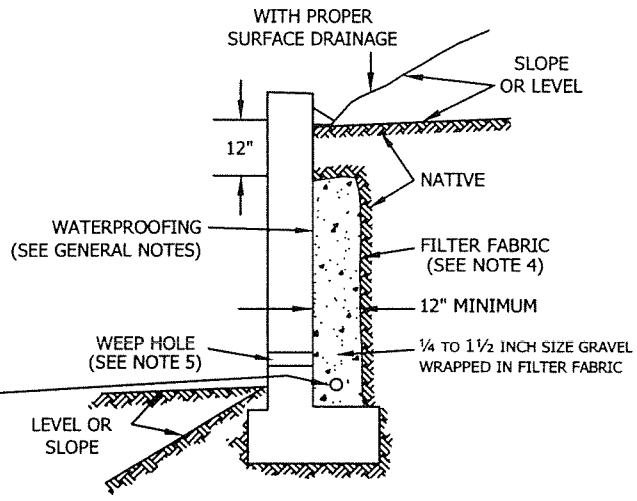
Leighton

SUBDRAIN OPTIONS AND BACKFILL WHEN NATIVE MATERIAL HAS EXPANSION INDEX OF ≤50

OPTION 1: PIPE SURROUNDED WITH CLASS 2 PERMEABLE MATERIAL



OPTION 2: GRAVEL WRAPPED IN FILTER FABRIC



Class 2 Filter Permeable Material Gradation
Per Caltrans Specifications

Sieve Size	Percent Passing
1"	100
3/4"	90-100
3/8"	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

GENERAL NOTES:

* Waterproofing should be provided where moisture nuisance problem through the wall is undesirable.
* Water proofing of the walls is not under purview of the geotechnical engineer
* All drains should have a gradient of 1 percent minimum
*Outlet portion of the subdrain should have a 4-inch diameter solid pipe discharged into a suitable disposal area designed by the project engineer. The subdrain pipe should be accessible for maintenance (rodding)
*Other subdrain backfill options are subject to the review by the geotechnical engineer and modification of design parameters.

Notes:
1) Sand should have a sand equivalent of 30 or greater and may be densified by water jetting.
2) 1 Cu. ft. per ft. of 1/4- to 1 1/2-inch size gravel wrapped in filter fabric
3) Pipe type should be ASTM D1527 Acrylonitrile Butadiene Styrene (ABS) SDR35 or ASTM D1785 Polyvinyl Chloride plastic (PVC), Schedule 40, Armco A2000 PVC, or approved equivalent. Pipe should be installed with perforations down. Perforations should be 3/8 inch in diameter placed at the ends of a 120-degree arc in two rows at 3-inch on center (staggered)
4) Filter fabric should be Mirafi 140NC or approved equivalent.
5) Weephole should be 3-inch minimum diameter and provided at 10-foot maximum intervals. If exposure is permitted, weepholes should be located 12 inches above finished grade. If exposure is not permitted such as for a wall adjacent to a sidewalk/curb, a pipe under the sidewalk to be discharged through the curb face or equivalent should be provided. For a basement-type wall, a proper subdrain outlet system should be provided.
6) Retaining wall plans should be reviewed and approved by the geotechnical engineer.
7) Walls over six feet in height are subject to a special review by the geotechnical engineer and modifications to the above requirements.

RETAINING WALL BACKFILL AND SUBDRAIN DETAIL FOR WALLS 6 FEET OR LESS IN HEIGHT

WHEN NATIVE MATERIAL HAS EXPANSION INDEX OF ≤50

Leighton

APPENDIX E

ASFE-IMPORTANT INFORMATION REGARDING YOUR GEOTECHNICAL REPORT

Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you —* should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you ASFE-member geotechnical engineer for more information.

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