GEOTECHNICAL EVALUATION
PROPOSED 18.925-ACRE RESIDENTIAL DEVELOPMENT
LOCATED NORTHEAST OF LURIN AVENUE AND **WOOD** ROAD
WOODCREST AREA, RIVERSIDE COUNTY CALIFORNIA

Prepared for

COASTAL COMMERCIAL PROPERTIES

1020 Second Street Suite C
Encinitas, California 92024

Project No. 12994.001

June 24, 2022

Leighton and Associates, Inc.
A LEIGHTON GROUP COMPANY

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Coastal Commercial Properties
1020 Second Street Suite C
Encinitas, California 92024

Attention: Mr. Brett Crowder

Subject: Geotechnical Evaluation
Proposed 18.925-acre Residential Development
Located Northeast of Lurin Avenue and Wood Road
Woodcrest Area, Riverside County, California

In accordance with your request, we are pleased to present this revised geotechnical/soils evaluation report for the subject project. This report presents our findings, conclusions and recommendations pertaining to the geotechnical aspects of the proposed development. It is our opinion that the overall site appears suitable for the intended use provided our recommendations included herein are properly incorporated during design and construction phases of development.

If you have any questions regarding this report, please do not hesitate to contact the undersigned. We appreciate this opportunity to be of service on this project.

Respectfully submitted,

LEIGHTON AND ASSOCIATES, INC.

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1.0 INTRODUCTION

1.1 Purpose and Scope

This geotechnical evaluation report is for a the Proposed 18.925-acre Residential Development located Northeast of Lurin Avenue and Wood Road in Riverside County, California (see Figure 1). Our scope of services for this geotechnical review included the following:

- Review of available site-specific and other provided reports, including various publications listed in the references at the end of this report.
- A review of the provided site plan.
- Site reconnaissance and visual observations of surface conditions to evaluate any potential localized settlement or other surface distresses.
- Excavation of five (5) geotechnical borings and two (2) percolation-infiltration tests to explore the subsurface soil conditions within the site. Approximate locations of these explorations are depicted on Figure 3. During the field exploration, representative samples were collected for laboratory testing. The logs of borings and percolation tests are included in Appendix A.
- Laboratory testing was performed on representative samples and results are included in Appendix B.
- Geotechnical engineering analyses performed or as directed by a California registered Geotechnical Engineer (GE). A California Certified Engineering Geologist (CEG) performed engineering geology review of site geologic hazards.
- Preparation of this update report, which presents the results of our geotechnical exploration and preliminary recommendation for site development.

This report is not intended to be used as an environmental assessment (Phase I or other), and foundation and/or a rough grading plan review.

1.2 Site Location and Description

The project consists of three contiguous lots forming a “T” shape parcel on the northeast corner of Wood Road and Lurin Avenue, in the Woodcrest Area of Riverside County, California (*see Figure 1, Site Location Map*). The lots have Assessor Parcel Numbers (APNs) 266-13-0016, -0023, and -0024. Based on our review of the information provided, the approximately 18.925-acre site is undeveloped and vacant land, although the eastern lot is partially occupied with small structures. The overall site is relatively flat to slightly rolling terrain and slopes gently toward the west. During our field exploration, we observed scattered small soil stockpiles in overhead electric lines along south and west boundaries. Seasonal weeds and scattered trees were also noted throughout the site.

1.3 Proposed Development

Based on the provided Conceptual Site Plan (Urban Arena, 2020), we understand that the property will be developed to into 96 residential lots, with associated site improvements including open space recreation centers and water detention basin. The residential lots are expected to host typical one- or two-story single-family residential homes consisting of wood-frame structures with conventional slab-on-grade foundations. The foundation loads are not expected to exceed 2,500 pounds per lineal foot (plf) for continuous footings. Grading plans were not available at the time of this report; however, planned grading is anticipated to require maximum cuts and fills on the order of ±15 feet.

2.0 FIELD EXPLORATION AND LABORATORY TESTING

2.1 Field Exploration

Our field exploration consisted of the excavation of five (5) borings and two (2) percolation/infiltration tests within accessible areas of the site. During excavation, bulk samples and relatively “undisturbed” Ring samples were collected from the exploration borings for further laboratory testing and evaluation. Approximate locations of the borings and percolation/infiltration tests are depicted on the *Boring Location Plan* (Figure 3). Sampling was conducted by a staff engineer from our firm. After logging and sampling, the excavations were loosely backfilled with spoils generated during excavation. Additionally, the property was traversed by an engineer from our firm to look for indications of surface distress, ground settlement (ground cracking) or other possible ground surface deficiencies.

The exploration logs included within Appendix A and related information depicts 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 borings 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 soil types and the transition may be gradual.

2.2 Laboratory Testing

Laboratory tests were performed on representative bulk samples to provide a basis for development of remedial earthwork and geotechnical design parameters. Selected samples were tested to determine the following parameters: maximum dry density and optimum moisture, expansion index, soluble sulfate content, gradation and collapse potential. The results of our laboratory testing are presented in Appendix B.

3.0 GEOTECHNICAL AND GEOLOGIC FINDINGS

3.1 Regional Geology

The site is located within a prominent natural geomorphic province in southwestern California known as the Peninsular Ranges. It is characterized by steep, elongated ranges and valleys that trend northwestward. More specifically, the site is situated within the Perris Block, an eroded mass of Cretaceous and older crystalline rock.

The Perris Block, approximately 20 miles by 50 miles in extent, is bounded by the San Jacinto Fault Zone to the northeast, the Elsinore Fault Zone to the southwest, the Cucamonga Fault Zone to the northwest, and the Temecula Basin to the southeast. The southeast boundary of the Perris block is poorly defined. The Perris Block has had a complex tectonic history, apparently undergoing relative vertical land movements of several thousand feet in response to movement on the Elsinore and San Jacinto Fault Zones. Thin sedimentary and volcanic materials locally mantle the crystalline bedrock. Alluvial and colluvial deposits fill the lower valley areas.

3.2 Site Specific Geology

Based on the results of our field exploration and review of the referenced geotechnical/ geologic reports, the site is underlain by granitic bedrock (*see Figure 2, Regional Geology Map*). The site is covered by a relatively thin layer of surficial soils/alluvium. These conditions are discussed further below and described in details on the logs of geotechnical borings included in Appendix A.

<u>Surficial Alluvium/Overburden Soils</u>

Alluvial soils were locally observed within the upper 2 to 4 feet within our exploratory borings. As encountered, these soils appear to vary in color, moisture content, density and composition. This unit is typically composed of brown to reddish brown, moist, medium dense to dense, silty sand (SM) and lessor silty/clayey sand (SM/SC). Isolated pockets of thicker alluvial soils should be anticipated. This alluvium appears to be generally dense and is expected to generally possess a low expansion potential (EI<51).

<u>Granitic bedrock</u>

The Cretaceous-aged granitic bedrock was encountered at shallow depths underlying the surficial soils/alluvium. As observed during the field exploration, the condition of the near-surface bedrock varies from that of completely disintegrated rock that has become a dense soil-like deposit to that of highly to moderately weathered rock. Where encountered, the bedrock is generally massive and can be expected to range from readily rippable to marginally-rippable depending on the degree of weathering, depth and excavation equipment. The less weathered granitic rock is anticipated to generate sand, gravel, cobble, and possibly oversize boulders. The weathered bedrock produced fine to coarse sand with silt and gravel-size rock fragments. It should be anticipated that deep cuts may generate boulders or core stones (greater than 12 inches) that will require special placement described later in Section 4 of this report.

3.3 Landslide/Debris Flow and Rock Fall

No evidence of on-site landslides/debris flow or rock fall was observed during our field investigation and review of referenced reports. Thick deposits of surficial soils typically associated with landsliding or debris flows are not present. Due to the lack of nearby rock outcrop and the gentle natural slope of adjacent hillside areas, the debris flow and rock fall hazard is considered very low.

3.4 Rippability

Based on the results of our geotechnical borings, previous experience in this area and nearby grading, highly weathered/rippable bedrock should be anticipated within the upper 20 to 30 feet below ground surface. However, hard bedrock or core stones may be locally encountered. If these conditions are encountered, it may be desirable to over-excavate at least 2 feet below the bottom of proposed deep utility trenches (>20 feet, if any) or 3 to 4 feet below pad grade in deep cut areas (>20 feet, if any). to facilitate future trenching operations, where applicable.

3.5 Groundwater and Surface Water

Groundwater was locally encountered in the weathered granitic bedrock at depths of 18 to 20 feet below existing grades at time of our field exploration. Groundwater can be encountered within the Tonalite bedrock associated with a joint/fracture system. If encountered during grading and/or utility installation, it would likely be associated with localized seepages along these joints and fractures. Mitigation of possible seepage within building pads or cut-slope areas can be provided on an individual basis after evaluation by the geotechnical consultant during grading operations. Surface water was not observed onsite during our field reconnaissance.

3.6 Faulting

No indications of faulting or fault related fissuring or fracturing is known to exist or observed onsite. This site is not located within a currently designated Alquist-Priolo Earthquake Fault Zone or County of Riverside Fault Zone.

3.7 Ground Shaking

Strong ground shaking can be expected at the site during moderate to severe earthquakes in this general region. This is common to virtually all of Southern California. Intensity of ground shaking at a given location depends primarily upon earthquake magnitude, site distance from the source, and site response (soil type) characteristics. The site-specific seismic coefficients provided in this section are based on an interactive tools/programs currently available on USGS website and OSHPD seismic maps. Based on ASCE 7-16 and our site-specific ground motion analysis for site Class C, the seismic coefficients for this site are as listed in Table 1 below:

Table 1. CBC Site-Specific Seismic Coefficients

CBC Categorization/Coefficient		Value (g)
Site Longitude (decimal degrees)	-117.32971	
Site Latitude (decimal degrees)	33.87752	
Site Class Definition	**D**	
Mapped Spectral Response Acceleration at 0.2s Period, S_s		**1.50**
Mapped Spectral Response Acceleration at 1s Period, S_1		**0.56**
Short Period Site Coefficient at 0.2s Period, F_a		**1.2**
Long Period Site Coefficient at 1s Period, F_v		**1.44**
Adjusted Spectral Response Acceleration at 0.2s Period, S_{MS}		**1.80**
Adjusted Spectral Response Acceleration at 1s Period, S_{M1}		**0.81**
Design Spectral Response Acceleration at 0.2s Period, S_{DS}		***1.20***
Design Spectral Response Acceleration at 1s Period, S_{D1}		***0.54***

* g- Gravity acceleration

3.8 Dynamic Settlement (Liquefaction and Dry Settlement)

Assuming that the loose, near-surface soils will be removed and recompacted in accordance with the recommendations of Section 4.0 of this report in the areas of development, the potential for liquefaction or dynamic settlement due to the design earthquake event to affect structures at this site is considered very low.

3.9 Expansive Soils

Limited laboratory testing indicated that near surface soils generally possess a very low to low expansion potential.

3.10 Slope Stability

It is anticipated that slopes constructed within the site are to be less than 15 feet in height. If constructed at 2:1 gradient using onsite soils, these slopes should be grossly stable under short- and long-term conditions (including seismic loading).

3.11 Percolation/Infiltration Testing

Percolation tests and associated deeper test borings were performed in the vicinity of the proposed open basin along the western boundary area of the site (see Figure 3). Testing was performed in general accordance with the procedures of the Riverside County Flood Control and Water Conservation District (RCFC&WCD) Design Handbook (RCFC, 2011). The percolation tests (P-1 and P-2) were performed to depths of approximately 5 feet BGS. Adjacent deeper boring indicates weathered granitic bedrock is from approximately 3.5 feet (B-1) to 4.0 feet (B-2) below ground surface. The results of the percolation testing are presented below. A factor of safety has not been applied to these rates.

Table 2. Summary of Percolation/Infiltration Test Results

Test Hole #	Location	Depth BGS (ft)	Percolation Rate (min/in)	Infiltration Rate (in/hr)	Soil Description
P-1	See Fig 3	5	48	0.07	Dense Clayey Sand/Alluvium
P-2	See Fig 3	5	6.6	0.55	Weathered granitic bedrock

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 General

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.

4.2 Earthwork

Earthwork should be performed in accordance with the following recommendations and the *Earthwork and Grading Specifications* Appendix C. The recommendations contained in Appendix C, are general grading specifications provided for typical grading projects and some of the recommendations may not be strictly applicable to this project. The specific recommendations contained in the text of this report supersede the general recommendations in Appendix C. The contract between the developer and earthwork contractor should be worded such that it is the responsibility of the contractor to place the fill properly in accordance with the recommendations of this report, the specifications in Appendix C, applicable City Grading Ordinances, notwithstanding the testing and observation of the geotechnical consultant.

4.2.1 Site Preparation and Remedial Grading

Prior to any grading, the proposed structural improvement areas (i.e. all-structural fill areas, pavement areas, buildings, etc.) should be cleared of surface debris and vegetation, obstructions, undocumented fill soils and erosion control materials. Heavy vegetation, roots, sand bags, straw waddles and debris should be disposed of offsite. Voids created by removal of buried/unsuitable materials should be backfilled with properly compacted soil in general accordance with the recommendations of this report.

The near surface soils (including undocumented artificial fill/stockpiles, and top 2 to 4 feet of alluvium) are considered potentially compressible in their present state and may settle under the surcharge of fills or foundation loading. As such, these materials should be removed in all settlement-sensitive areas including building pads, pavement, and slopes. The depth of removal should extend into underlying dense granitic bedrock. Acceptability of all removal bottoms should be reviewed by an engineering geologist or geotechnical engineer and documented in the as-graded geotechnical report. The removal limit should be established by a 1:1 (horizontal:vertical) projection from the edge of fill soils supporting structural fill or settlement-sensitive structures downward and outward to competent material identified by the geotechnical consultant.

In order to mitigate the impact of underlying cut/fill transition conditions, we recommend overexcavation of the cut portion of transition lots. Overexcavation should extend to a minimum depth of 3 feet or one-third of the maximum fill thickness on the lot, whichever is deeper (or not to exceed 3:1 differential fill ratio in 30 feet). This overexcavation does not include scarification or preprocessing prior to placement of fill. Overexcavation can encompass the entire lot or extend laterally beyond the building limits a horizontal distance equal to the depth of overexcavation or to a minimum distance of 5 feet whichever is greater. Overexcavation bottoms should be sloped as needed to prevent the accumulation of subsurface water. For planning purposes, we also recommend to over-excavate at least 2 feet below the bottom of proposed utility trenches or 3 to 5 feet below pad grade to facilitate future trenching operations, where applicable.

4.2.2 Suitability of Site Soils for Fills

The onsite soils are generally suitable for re-use as compacted fill, provided they are free of debris and organic matter. Fills placed within 10 feet of finish pad grades or slope faces should contain no rocks over 12 inches in maximum dimension. In addition, encountered clayey soils layers (EI>51) should be placed at depth greater than 5 feet below finished grades where feasible. All structural fill should be compacted throughout to 90 percent of the ASTM D 1557 laboratory maximum density, at or slightly above optimum moisture.

Fill soils should be placed at a minimum of 90 percent relative compaction (based on ASTM D1557) and near or above optimum moisture content. Placement and compaction of fill should be performed in accordance with local grading ordinances under the observation and testing of the geotechnical consultant. The optimum lift thickness to produce a uniformly compacted fill will depend on the type and size of compaction equipment used. In general, fill should be placed in uniform lifts not exceeding 8 inches in thickness.

Fill slope keyways will be necessary at the toe of all fill slopes and at fill-over-cut contacts. Keyway schematics, including dimensions and subdrain recommendations are provided in Appendix C. All keyways should be excavated into dense bedrock or dense older alluvium as determined by the geotechnical engineer.

Fills placed on slopes steeper than 5:1 (horizontal:vertical) should be benched into dense soils (see Appendix C for benching detail). Benching should be of sufficient depth to remove all loose material. A minimum bench height of 2 feet into approved material should be maintained at all times. A grading contractor with experience in the handling and placement of oversize rock should be selected for this project.

4.2.3 Shrinkage

The volume change of excavated onsite soils upon recompaction is expected to vary with materials, density, insitu moisture content, and location and compaction effort. The in-place and compacted densities of soil materials vary and accurate overall determination of shrinkage and bulking 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 review, we expect recompaction shrinkage (when recompacted to an average 93 percent of ASTM D1557) of 5- to 15-percent by volume for alluvial soils and 10 to 20 percent for any surficial topsoil/undocumented fill. The underlying bedrock formations can experience 5 to 10 percent bulk for excavations deeper than 5 to 10 feet. Deeper excavations or if blasting is required, up to 20 percent bulk may occur.

4.2.4 Import Soils

Import soils and/or borrow sites, if needed, 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 low expansion potential (with an Expansion Index less than 51) and have a low corrosion impact to the proposed improvements.

4.2.5 Utility Trenches

Utility trenches should be backfilled with compacted fill in accordance with the *Standard Specifications for Public Works Construction,* ("Greenbook"), 2018 Edition. Fill material above the pipe zone 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) by mechanical means only. Site soils may generally be suitable as trench backfill provided these soils are screened of rocks over 1½ inches in diameter and organic matter. The upper 6 inches of backfill in all pavement areas should be compacted to at least 95 percent relative compaction.

Excavation of utility trenches should be performed in accordance with the project plans, specifications and the *"Greenbook"*. The contractor should 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 if all safety precautions are not properly implemented. 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 does not consult in the area of safety engineering.

4.2.6 Drainage

All drainage should be directed away from structures a minimum of 1% by means of approved permanent/temporary drainage devices. Adequate storm drainage of any proposed pad should be provided to avoid wetting of foundation soils. Irrigation adjacent to buildings should be avoided when possible. As an option, sealed-bottom planter boxes and/or drought resistant vegetation should be used within 5-feet of buildings.

4.2.7 Slope Construction

Compacted fill or cut slopes up to 25 feet in height at 2:1 (horizontal:vertical) are considered grossly stable for static and pseudostatic conditions. Higher or steeper slopes should be subject to further review and evaluation. Any new 2:1 slopes using the onsite soils compacted to minimum 90 percent should also be stable under short and long term conditions. The outer portion of new fill slopes should be either overbuilt by 2 feet (minimum) and trimmed back to the finished slope configuration or compacted in vertical increments of 5 feet (maximum) by a weighted sheepsfoot roller as the fill is placed. The slope face should then be track-walked by dozers of appropriate weight to achieve the final slope configuration and compaction to the slope face.

New fill slopes should be provided a toe of slope keyways as depicted in Appendix C. Any new fill slopes placed along existing fill slope, the minimum new fill width should be 8 feet. If fill is placed against existing cut slope (exposing older alluvium), the minimum fill width should be 15 feet per Appendix C. All cut slopes should be observed and mapped by a Leighton geologist to confirm the exposed conditions are stable and no minor fill width is left in place. In this case, when cutting an existing fill slope back into the fill core, a minimum remaining fill width of 15 feet is recommended. Any existing cut or fill slopes to remain in the current condition should be minimally scarified to remove minor erosion rills or vermin burrow, moisture conditioned thoroughly and compacted by track walking large dozer to achieve a compacted slope face.

Slope faces are inherently subject to erosion, particularly if exposed to rainfall and irrigation. Landscaping and slope maintenance should be conducted as soon as possible in order to increase long-term surficial stability. Berms should be provided at the top of fill slopes. Drainage should be directed such that surface runoff on the slope face is minimized

4.3 Foundation Design

4.3.1 Bearing and Lateral Pressures

Based on our analysis, the proposed single-family residential structures may be founded on conventional or post-tensioned/stiffened slab-on-grade system based on prevailing finish pad soils conditions after grading. As indicated previously in this report, the compacted fill possesses very low to medium expansion potential. As such, we recommend that the structural consultant and/or foundation engineer presents foundation design categories (i.e. conventional or stiffened slab-on-grade design) based on actual expansion potential of subgrade soils of each pad at completion of grading. Foundation footings may be designed with the following geotechnical design parameters:

- Allowable Bearing Capacity: 2,000 psf at a minimum depth of embedment of 12 inches (minimum width of 12 inches). This bearing capacity may be increased by ⅓ for short-term loading conditions (e.g., wind, seismic).
- Sliding Coefficient: 0.35
- Total Settlement: 0.5-inch
- Differential Settlement: ½ inch in 40 feet

The conventional and/or post-tensioned slabs should be designed in accordance with the 2016 CBC and guidelines included of the Post-Tensioning Institute (PTI), 3rd Edition.

4.3.2 Vapor Retarder

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. However, we recommend that the slab subgrade soils be properly moisture conditioned prior to placement of the vapor barrier system and foundation concrete. The extent of moisture conditioning or depth of presoaking, if required, should be determined during grading based on expansion potential testing of near finish grade soils.

4.4 Retaining Walls

Retaining wall earth pressures are a function of the amount of wall yielding 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 soils should be designed using the following equivalent fluid pressures:

Table 3. Retaining Wall Design Earth Pressures (Static, Drained)

Loading Conditions	Equivalent Fluid Density (pcf)	
	Level Backfill	2:1 Backfill
Active	36	50
At-Rest	55	85
Passive*	300	150 (2:1, sloping down)

* This assumes level condition in front of the wall will remain for the duration of the project, not to exceed 3,500 psf at depth. If sloping down (2:1) grades exist in front of walls, then they should be designed using passive values reduced to ½ of level backfill passive resistance values.

Unrestrained (yielding) cantilever walls should be designed for the active equivalent-fluid weight value provided above for very low to low expansive soils that are free draining. In the design of walls restrained from movement at the top (non-yielding) such as basement or elevator pit/utility vaults, the at-rest equivalent fluid weight value should be used. 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 other than a 2:1 (horizontal:vertical) be constructed above the wall (or a backfill is loaded by an adjacent surcharge load), the equivalent fluid weight values provided above should be re-evaluated on an individual case basis by us. Non-standard wall designs should also be reviewed by us prior to construction to check that the proper soil parameters have been incorporated into the wall design.

All retaining walls should be provided with appropriate drainage. The outlet pipe should be sloped to drain to a suitable outlet. Typical wall drainage design is illustrated in Appendix C, *Retaining Wall Backfill and Subdrain Detail*. Wall backfill should be non-expansive (EI $\leq$ 21) sands compacted by mechanical methods to a minimum of 90 percent relative compaction (ASTM D 1557). Clayey site soils should not be used as wall backfill. 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 otherwise approved by the Structural Engineer.

4.5 Foundation Setback from Slopes

We recommend a minimum horizontal setback distance from the face of slopes for all structural footings (retaining and decorative walls, flatwork, building footings, pools, etc.). This distance is measured from the outside bottom edge of the footing horizontally to the slope face (or the face of a retaining wall) and should be a minimum of H/2, where H is the slope height (in feet).

Table 4. Footing Setbacks

Slope Height	Recommended Footing Setback
<5 feet	5 feet minimum
5 to 15 feet	7 feet minimum
>15 feet	H/2, where H is the slope height, not to exceed 10 feet to 2:1 slope face

The soils within the structural setback area generally possess poor lateral stability and improvements (such as retaining walls, pools, sidewalks, fences, pavements, decorative flatwork, etc.) constructed within this setback area will be subject to lateral movement and/or differential settlement. Potential distress to such improvements may be mitigated by providing a deepened footing or a pier and grade-beam foundation system to support the improvement. The deepened footing should meet the setback described above. Modifications of slope inclinations near foundations may increase the setback and should be reviewed by the design team prior to completion of design or implementation.

4.6 Sulfate Attack

The results of limited laboratory testing indicated negligible exposure to concrete per ACI 318. Further testing should be performed during site grading to confirm soluble-sulfate content of near finish subgrade soils. Additional testing for general corrosion potential to ferrous materials should also be performed during grading.

4.7 Concrete Flatwork

Sidewalk/Flatwork should conform to applicable City and County standards. A representative of Leighton should verify subgrade soil expansion, moisture conditions and compaction prior to formwork and reinforcement placement. If subgrade soils possess expansion index greater than 21, we recommend a minimum 8-inch deepened edge be constructed for all flatwork to reduce moisture variation in subgrade soils along concrete edges adjacent to open (unfinished) or irrigated landscape areas.

Concrete flatwork should be constructed of uniformly cured, low-slump concrete and should contain sufficient control/contraction joints. Additional provisions such as ascending/descending slope conditions, perched (irrigation) water, special surcharge loading conditions, potential expansive soil pressure and differential settlement/heave should be incorporated into the design of exterior improvements. Additional exterior slab details are suggested in the American Concrete Institute (ACI) guidelines. Homeowners (HOA) should be advised of their maintenance responsibilities as well as geotechnical issues that could affect performance of site improvements.

4.8 Preliminary Pavement Design

The preliminary pavement design provided below is based on the locally accepted Caltrans Highway Design Manual and an assumed preliminary R-value of 40. For planning and estimating purposes, the pavement sections are calculated based on assumed Traffic Indexes (TI).

Table 5. Asphalt Pavement Sections

General Traffic Condition*	Traffic Index (TI)**	Asphalt Concrete (inches)	Aggregate Base* (inches)
Private Street	5.0	3.0	4.0
General Local Street	5.5	3.0	5.0
Collector/Enhanced Local	7.0	4.0	7.0

*Per City minimum or as calculated

Actual R-value of the subgrade soils will need to be verified after completion of site grading to finalize the pavement design. Pavement design and minimum sections should conform to applicable City standards, where applicable.

For rigid pavement design, we recommend that a minimum of 6 inches of PCC pavement be used, in high impact load areas or if to be subjected to truck traffic. The PCC pavement should be placed on a minimum 4-inch aggregate base. The PCC pavement may be placed directly on a compacted subgrade with an R-Value of 40 or higher. The PCC pavement should have a minimum of 28-day compressive strength of 3,250 psi. Aggregate base should conform to the Standard Specifications for Public Works Construction (Green Book), 2018 Edition. Placement of concrete materials should follow applicable ACI and County standards.

The upper 6 inches of the subgrade soils should be moisture-conditioned to near optimum moisture content, compacted to at least 95 percent relative compaction (ASTM D1557) 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. If applicable, aggregate base should conform to the “Standard Specifications for Public Works Construction” (Greenbook) current edition or Caltrans Class 2 aggregate base and applicable City standards

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If pavement areas are adjacent to watered landscape areas, some deterioration of the subgrade load bearing capacity may result. Moisture control measures such as deepened curbs or other moisture barrier materials may be used to prevent the subgrade soils from becoming saturated. The use of concrete cutoff or edge barriers should be considered when pavement is planned adjacent to either open (unfinished) or irrigated landscaped areas.

5.0 GEOTECHNICAL CONSTRUCTION SERVICES

Geotechnical review 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 be provided the opportunity to review the grading plan and foundation plan(s) prior to bid.

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 during construction. Geotechnical conclusions and preliminary recommendations should be reviewed and verified by Leighton during construction, and revised accordingly if geotechnical conditions encountered vary from our findings and interpretations. Geotechnical observation and testing should be provided:

- After completion of site clearing,
- During preparation and overexcavation of surface soils as described herein,
- During compaction of all fill materials,
- Testing of slab subgrade moisture content, prior to placement of vapor retarder,
- After excavation of all footings, and prior to placement of concrete,
- During utility trench backfilling and compaction, and
- When any unusual conditions are encountered.

Additional geotechnical exploration and analysis may be required based on final development plans, for reasons such as significant changes in proposed structure locations/footprints. We should review grading (civil) and foundation (structural) plans, and comment further on geotechnical aspects of this project.

6.0 LIMITATIONS

This report was necessarily based in part upon data obtained from a limited number of observances, site visits, soil samples, tests, analyses, histories of occurrences, spaced subsurface explorations and limited information on historical events and observations. Such information is necessarily incomplete. 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 investigation was performed with the understanding that the subject site is proposed for residential and commercial development. The client is referred to Appendix D regarding important information provided by the GBA (Geoprofessional Business Association) on geotechnical engineering studies and reports and their applicability.

This report was prepared for Coastal Commercial Properties based on Coastal Commercial Properties needs, directions, and requirements at the time of our investigation. This report is not authorized for use by, and is not to be relied upon by any party except Coastal Commercial Properties, and its successors and assigns as owner of the property, with whom Leighton and Associates, 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 and Associates, 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 and Associates, Inc.

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Project: 12994.001	Eng/Geol: SIS/RFR	SITE LOCATION MAP	Figure 1
Scale:1 " = 4,000 '	Date: January 2021	Proposed 18.925-Acre Residential Development Northeast of Lurin Avenue & Wood Street Woodcrest Area, Riverside County, California	Leighton
Base Map: ESRI ArcGIS Online 2021 Thematic Information: Leighton Author: Leighton Geomatics (btran)			

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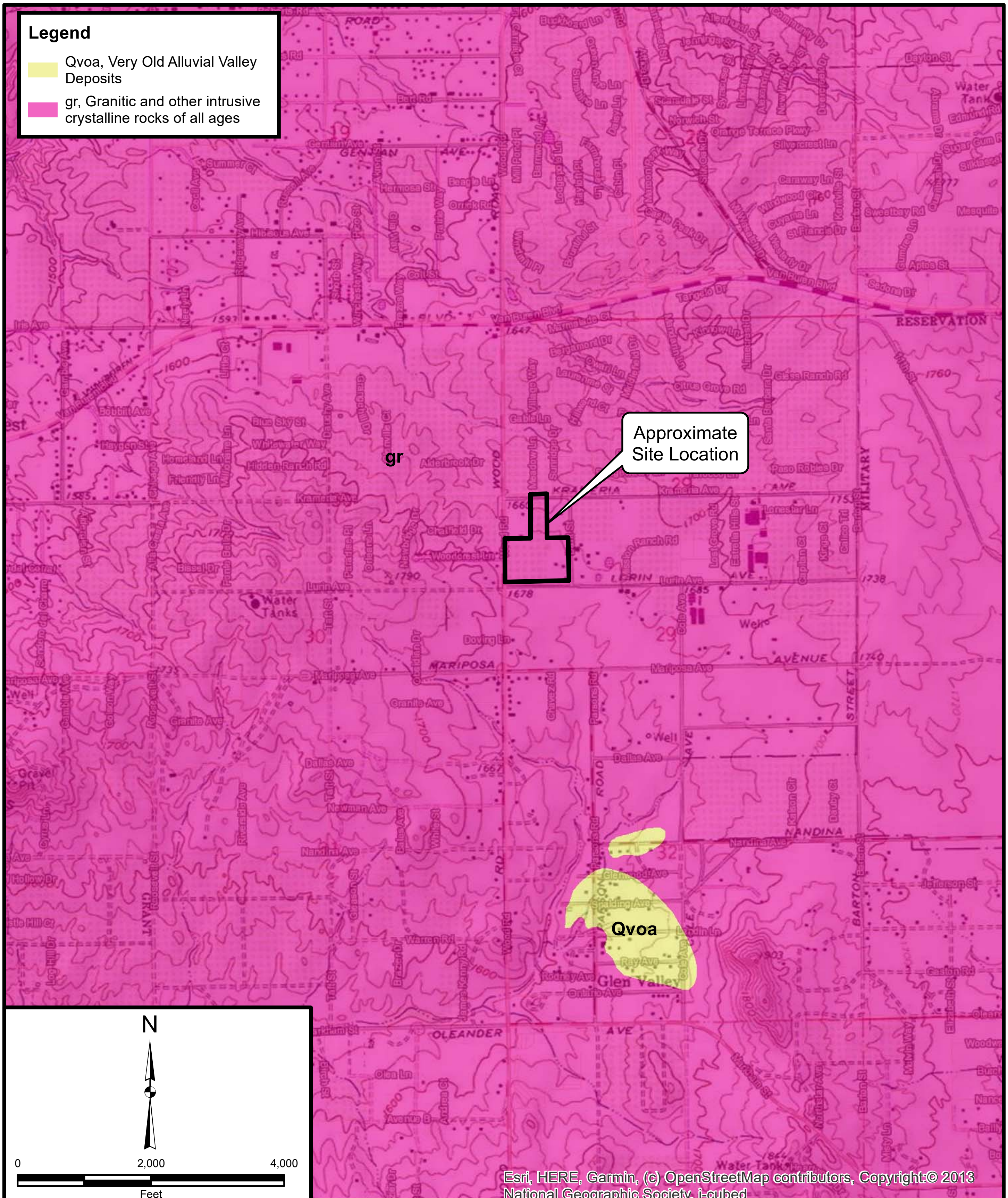

Project: 12994.001	Eng/Geol: SIS/RFR
Scale:1 " = 2,000 '	Date: January 2021

Base Map: ESRI ArcGIS Online 2021
Thematic Information: Leighton, USGS
Author: Leighton Geomatics (btran)

REGIONAL GEOLOGY MAP

Proposed 18.925-Acre Residential Development
Northeast of Lurin Avenue & Wood Street
Woodcrest Area, Riverside County, California

Figure 2

Leighton

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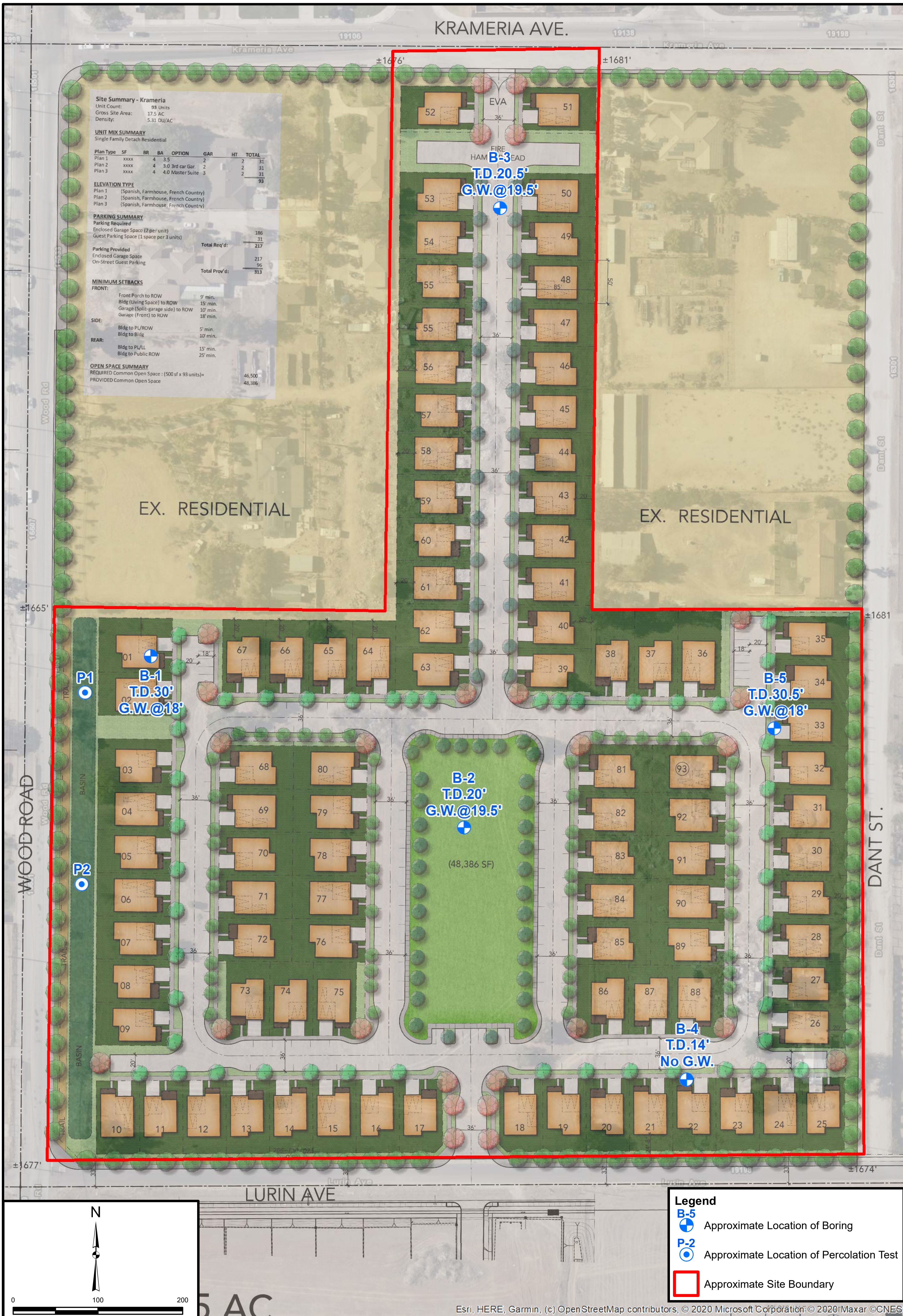

Project: 12994.001 | Eng/Geol: SIS/RFR

Scale: 1 " = 100 ' | Date: January 2021

Base Map: Conceptual Site Plan - SP1
Coastal Commercial Properties, Date: 11/25/20
Riverside, California
Thematic Information: Leighton
Author: Leighton Geomatics (btran)

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BORING LOCATION MAP

Proposed 18.925-Acre Residential Development Northeast of Lurin Avenue & Wood Street Woodcrest Area, Riverside County, California

Figure 3

Leighton

APPENDIX A

FIELD EXPLORATION / LOGS OF BORINGS

GEOTECHNICAL BORING LOG LB-1

Project No.	12994.001	**Date Drilled**	12-31-20
Project	Proposed 18.925 Residential Development NE of Lurin and Wood	**Logged By**	DAP
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	NA'
Location	See Boring Location Map	**Sampled By**	DAP

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
									This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.	
	0			B-1				SC	**Quaternary Alluvium (Qaf)** CLAYEY SAND with silt (SC), dense, light reddish brown, moist, fine sand, EI = 40, PPM Sulfate = 226	EI, Sulfate
				R-1	21 20 50	120	8			
				R-2					**Granitic Bedrock (Kgr)** recovered as: Well graded SAND with Silt (SW-SM), very dense, light yellowish brown, moist	
	5			R-3	50/6"	103	17			
				R-4	50/3"				Well graded SAND with Silt (SW-SM), light reddish brown, very dense, slightly moist	
	10			S-1	50/6"				Well graded SAND (SW), light reddish brown, very dense, dry	
	15			S-2	50/5"				Well graded SAND (SW), light reddish brown, very dense, slightly moist	
	18 (GWT ▽)									
	20			S-3	50/4"				Well graded SAND (SW), light reddish brown, very dense, wet	
	25									
	30			S-4	50/4"				Well graded SAND (SW), light reddish brown, very dense, wet	
									Boring Terminated at 30'4", GWT at 18', Boring filled with cuttings.	

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

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

*** This log is a part of a report by Leighton and should not be used as a stand-alone document. ***

GEOTECHNICAL BORING LOG LB-2

Project No.	12994.001	**Date Drilled**	12-31-20
Project	Proposed 18.925 Residential Development NE of Lurin and Wood	**Logged By**	DAP
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	NA'
Location	See Boring Location Map	**Sampled By**	DAP

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0								**Granitic Bedrock (Kgr)** recovered as: Well graded SAND with Silt (SW-SM), dense, light reddish brown, slightly moist, fine sand	
				R-1	15 26 40	134	5		Well graded SAND with Silt (SW-SM), light reddish brown, dense	
	5			R-2	12 14 50/4"	132	6		Well graded SAND with Silt (SW-SM), light reddish brown, dense, slightly moist	
	10			S-1	50/6"				Well graded SAND (SW), light reddish brown, very dense, slightly moist	
	15									
▽										
	20			S-2	50/5"				Well graded SAND (SW), light reddish brown, very dense, slightly moist	
									Boring Terminated at 20'6" Groundwater at 19'6" Boring filled with cuttings.	
	25									
	30									

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

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

*** * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * ***

GEOTECHNICAL BORING LOG LB-3

Project No.	12994.001	**Date Drilled**	12-31-20
Project	Proposed 18.925 Residential Development NE of Lurin and Wood	**Logged By**	DAP
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	NA'
Location	See Boring Location Map	**Sampled By**	DAP

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0							SC	**Quaternary Alluvium (Qaf)** CLAYEY SAND (SC), dense, light reddish brown, slightly moist, fine sand	
				R-1	50'5"	111	6		Well graded SAND with Silt (SW-SM), light reddish brown, very dense, slightly moist	
									Granitic Bedrock (Kgr) recovered as: Well graded SAND with Silt (SW-SM), very dense, yellowish brown, slightly moist	
	5			R-2	35 50/4"	122	3			
	10			R-3	50/5"	113	2		Well graded SAND with Silt (SW-SM), light reddish brown, very dense, slightly moist	
	15			S-2	50/3"				Well graded SAND (SW), light reddish brown, very dense, slightly moist	
	20								Boring Terminated at 19' (Auger Refusal) No Groundwater Boring filled with cuttings	
	25									
	30									

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

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LB-4

Project No.	12994.001	**Date Drilled**	12-31-20
Project	Proposed 18.925 Residential Development NE of Lurin and Wood	**Logged By**	DAP
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	NA'
Location	See Boring Location Map	**Sampled By**	DAP

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	Soil Description	Type of Tests
	0							SC	**Quaternary Alluvium (Qaf)** CLAYEY SAND (SC), dense, light reddish brown, slightly moist, fine sand	
									Granitic Bedrock (Kgr) recovered as: Well graded SAND (SW), very dense, yellowish brown, slightly moist	
				R-1	50/6" 26 40					
	5			R-2	50/5"				Well graded SAND (SW), yellowish brown, very dense, slightly moist	
	10			S-1	50/6"				Well graded SAND (SW), yellowish brown, very dense, slightly moist	
				S-2	50"/0"					
	15								Boring Terminated at 14' Groundwater at 12' Boring filled with cuttings	
	20									
	25									
	30									

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

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

*** * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * ***

GEOTECHNICAL BORING LOG LB-5

Project No.	12994.001	**Date Drilled**	12-31-20
Project	Proposed 18.925 Residential Development NE of Lurin and Wood	**Logged By**	DAP
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	NA'
Location	See Boring Location Map	**Sampled By**	DAP

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0							SC	**Quaternary Alluvium (Qaf)** CLAYEY SAND with silt (SC), dense, reddish brown, moist	
				R-1	18 32 50	124	10		**Granitic Bedrock (Kgr)** recovered as: Well graded SAND with Silt (SW-SM), very dense, reddish gray, slightly moist	
	5			R-2	35 50/4"	129	5		Well graded SAND (SW), reddish gray, very dense, slightly moist	
	10			R-3	50/6"	122	5		Well graded SAND (SW), reddish gray, very dense, slightly moist	
	15			R-4	50/6"				Well graded SAND (SW), reddish gray, very dense, moist	
	20			R-5	50/5"				Well graded SAND (SW), reddish gray, very dense, moist	
	25									
	30			S-1	50/6"				Well graded SAND (SW), reddish gray, very dense, moist	
									Boring Terminated at 30'4"; Groundwater at 18'	

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

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		

*** This log is a part of a report by Leighton and should not be used as a stand-alone document. ***

GEOTECHNICAL BORING LOG LP-1

Project No.	12994.001	**Date Drilled**	12-31-20
Project	Proposed 18.925 Residential Development NE of Lurin and Wood	**Logged By**	DAP
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	NA'
Location	See Boring Location Map	**Sampled By**	DAP

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
	0							SC	**Quaternary Alluvium (Qaf)** CLAYEY SAND with silt (SC), dense, light reddish brown, moist, fine sand	
	5								Boring Terminated at 5'0" for Percolation Test	
	10									
	15									
	20									
	25									
	30									

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

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
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- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

* * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * *

GEOTECHNICAL BORING LOG LP-2

Project No.	12994.001	**Date Drilled**	12-31-20
Project	Proposed 18.925 Residential Development NE of Lurin and Wood	**Logged By**	DAP
Drilling Co.	2R Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	NA'
Location	See Boring Location Map	**Sampled By**	DAP

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
	0							SC	**Quaternary Alluvium (Qaf)** CLAYEY SAND with silt (SC), dense, light reddish brown, moist, fine sand	
									Granitic Bedrock (Kgr) recovered as: Well graded SAND with Clay (SW-SC), very dense, light yellowish brown, moist	
	5									
									Boring Terminated at 5'0" for Percolation Test	
	10									
	15									
	20									
	25									
	30									

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

TYPE OF TESTS:
- -200 % FINES PASSING
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- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

*** This log is a part of a report by Leighton and should not be used as a stand-alone document. ***

APPENDIX B

GEOTECHNICAL LABORATORY TEST RESULTS

EXPANSION INDEX of SOILS

ASTM D 4829

Leighton

Project Name:	Coast Comm Krameria & Wood Geo	Tested By: FLM/MRV	Date: 1/14/21
Project No. :	12994.001	Checked By: M. Vinet	Date: 1/15/21
Boring No.:	LB-1	Depth: 0 - 5.0	
Sample No. :	B-1	Location: N/A	
Sample Description:	Clayey Sand (SC), Dark Yellowish Brown.		

Dry Wt. of Soil + Cont. (gm.)	3146.3
Wt. of Container No. (gm.)	0.0
Dry Wt. of Soil (gm.)	3146.3
Weight Soil Retained on #4 Sieve	6.7
Percent Passing # 4	99.8

MOLDED SPECIMEN	Before Test	After Test
Specimen Diameter (in.)	4.01	4.01
Specimen Height (in.)	1.0000	1.0400
Wt. Comp. Soil + Mold (gm.)	597.1	634.4
Wt. of Mold (gm.)	188.3	188.3
Specific Gravity (Assumed)	2.70	2.70
Container No.	7	7
Wet Wt. of Soil + Cont. (gm.)	577.1	634.4
Dry Wt. of Soil + Cont. (gm.)	552.3	375.0
Wt. of Container (gm.)	277.1	188.3
Moisture Content (%)	9.0	18.9
Wet Density (pcf)	123.3	129.4
Dry Density (pcf)	113.1	108.8
Void Ratio	0.490	0.550
Total Porosity	0.329	0.355
Pore Volume (cc)	68.1	76.4
Degree of Saturation (%) [S meas]	**49.6**	**93.0**

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.)
1/14/21	11:30	1.0	0	0.5000
1/14/21	11:40	1.0	10	0.5000
	Add Distilled Water to the Specimen			
1/15/21	7:30	1.0	1190	0.5400
1/15/21	8:30	1.0	1250	0.5400

Expansion Index (EI meas) =	((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	40.0
Expansion Index (Report) =	Nearest Whole Number or Zero (0) if Initial Height is > than Final Height	**40**

Rev. 03-08

TESTS for SULFATE CONTENT

Leighton

Project Name: Coast Comm Krameria & Wood Geo | Tested By : M. Vinet | Date: 01/15/21

Project No. : 12994.001 | Data Input By: M. Vinet | Date: 01/15/21

Boring No.	LB-1			
Sample No.	B-1			
Sample Depth (ft)	0 - 5.0			
Soil Identification:	SC			
Wet Weight of Soil + Container (g)	100.00			
Dry Weight of Soil + Container (g)	100.00			
Weight of Container (g)	0.00			
Moisture Content (%)	0.00			
Weight of Soaked Soil (g)	100.00			

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	5			
Crucible No.	5			
Furnace Temperature (°C)	850			
Time In / Time Out	Timer			
Duration of Combustion (min)	45			
Wt. of Crucible + Residue (g)	25.6980			
Wt. of Crucible (g)	25.6925			
Wt. of Residue (g) (A)	0.0055			
PPM of Sulfate (A) x 41150	226.33			
PPM of Sulfate, Dry Weight Basis	**226**			

APPENDIX C

EARTHWORK AND GRADING SPECIFICATIONS

APPENDIX C

GENERAL EARTHWORK AND GRADING SPECIFICATIONS

TABLE OF CONTENTS

Standard Details

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. 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.

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).

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). 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.

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. 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 Safety

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

7.2 Bedding and Backfill

All bedding and backfill of utility trenches shall be performed 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 relative compaction from 1 foot above the top of the conduit to the surface.

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.

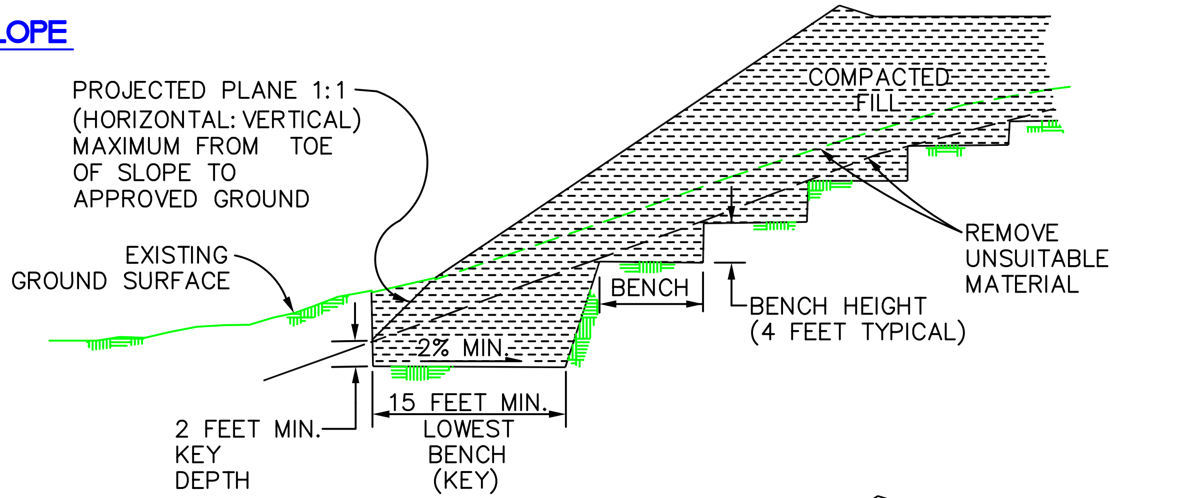
7.3 Lift Thickness

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.

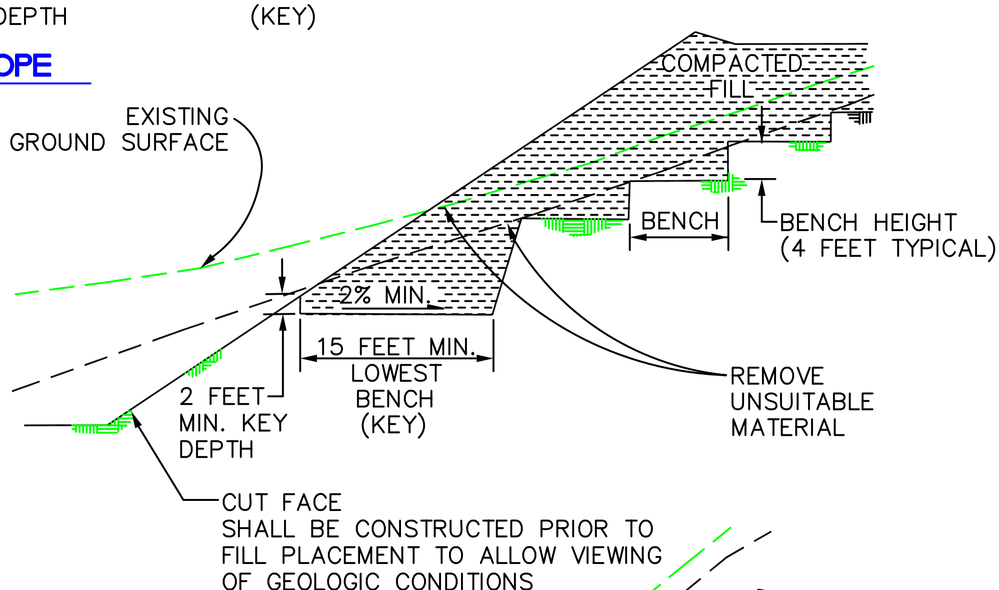
7.4 Observation and Testing

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

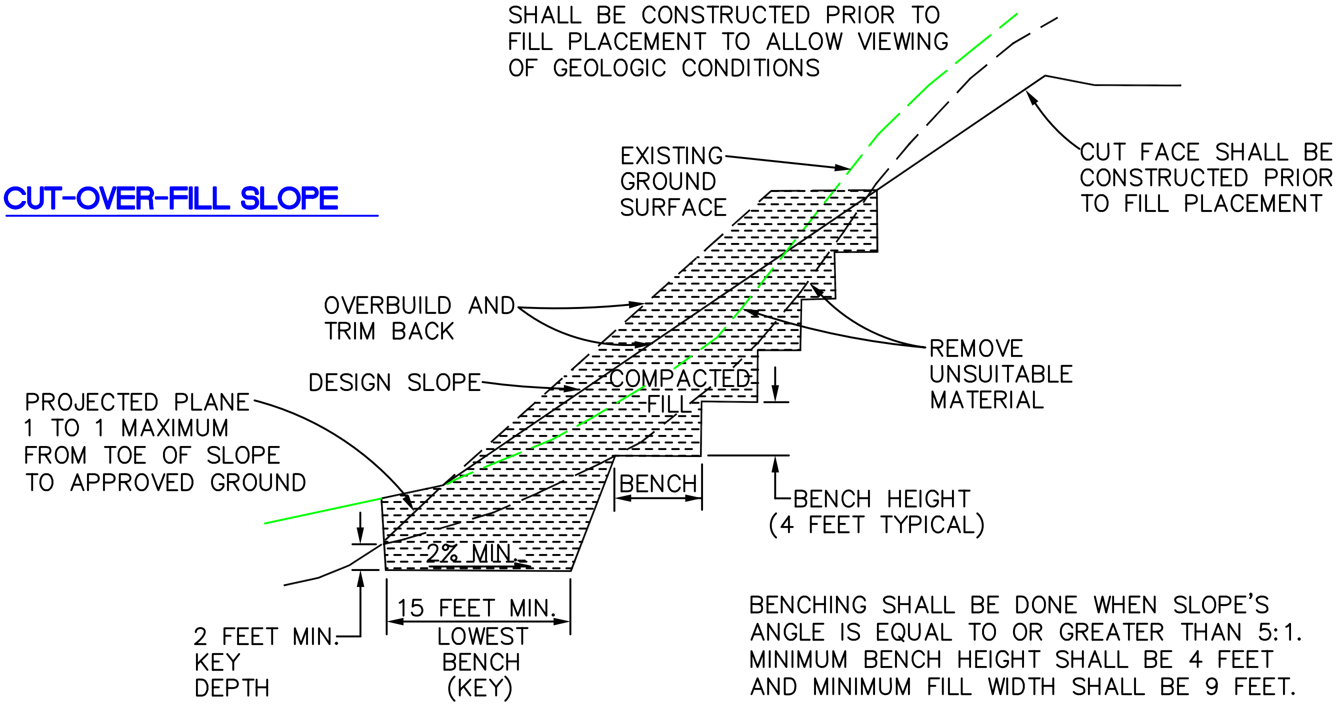
FILL SLOPE



FILL-OVER-CUT SLOPE

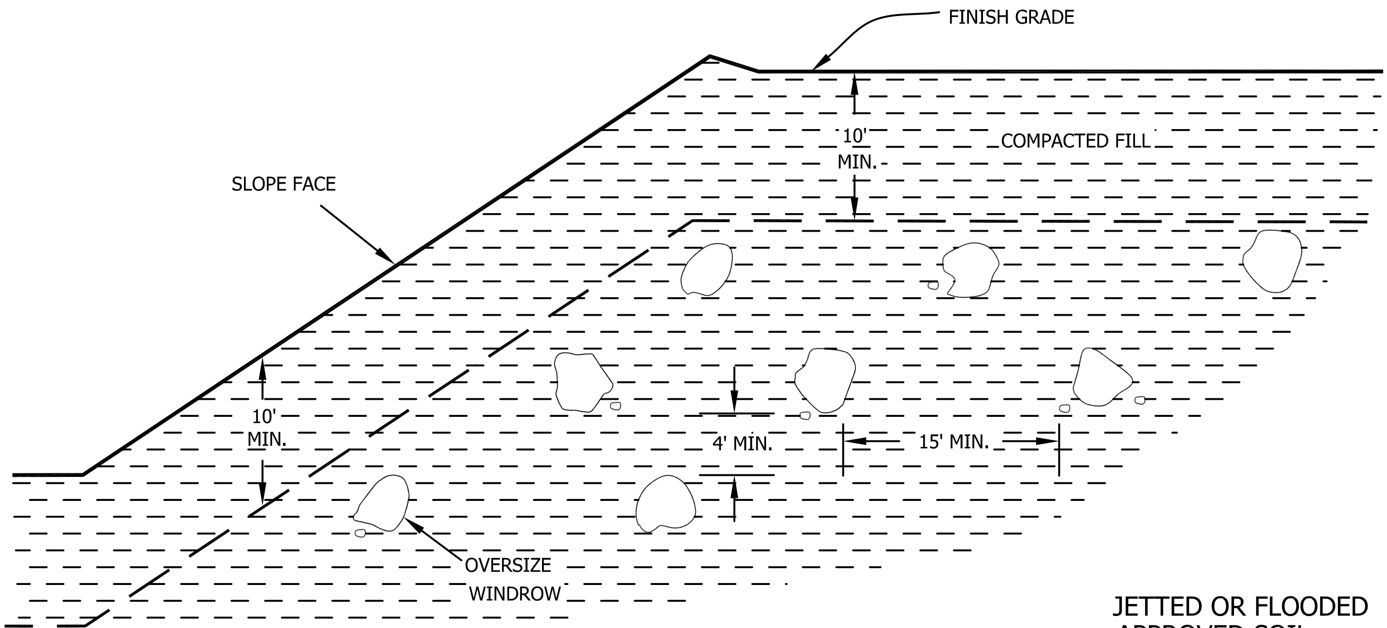


CUT-OVER-FILL SLOPE

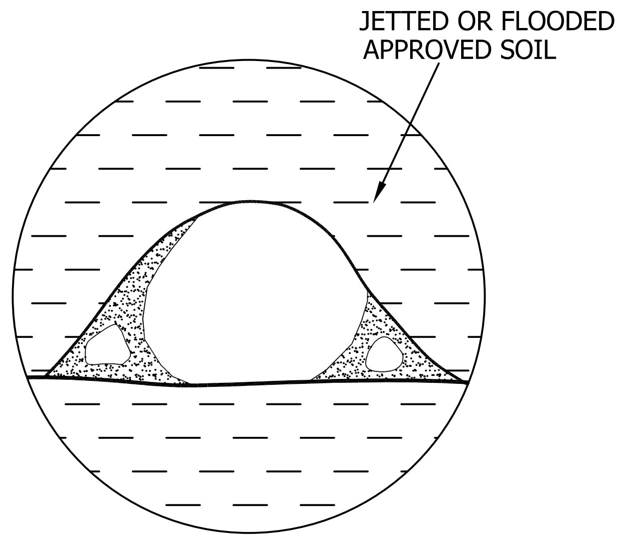


BENCHING SHALL BE DONE WHEN SLOPE'S ANGLE IS EQUAL TO OR GREATER THAN 5:1. MINIMUM BENCH HEIGHT SHALL BE 4 FEET AND MINIMUM FILL WIDTH SHALL BE 9 FEET.

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

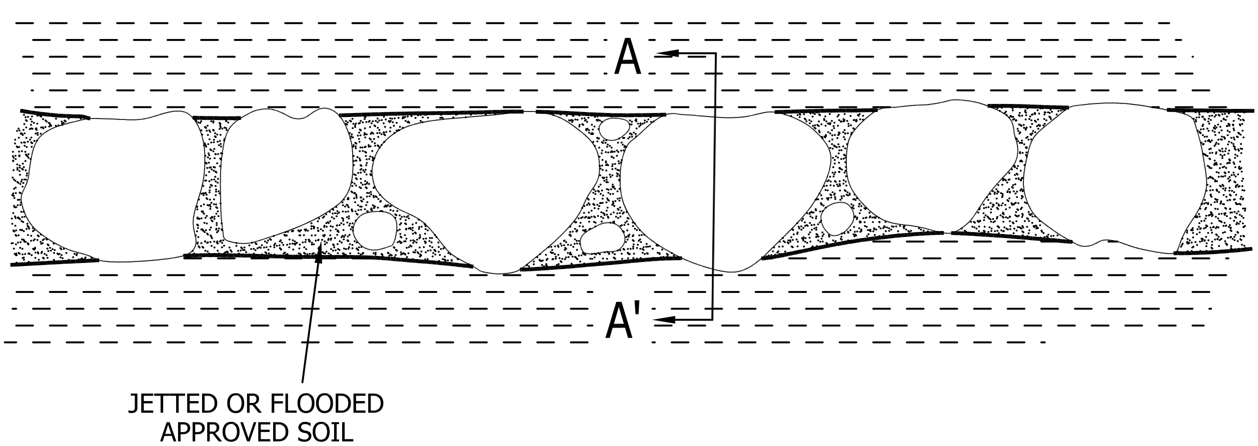


- Oversize rock is larger than 8 inches in largest dimension.
- Backfill with approved soil jetted or flooded in place to fill all the voids.
- Do not bury rock within 10 feet of finish grade.
- Windrow of buried rock shall be parallel to the finished slope face.



SECTION A-A'

PROFILE ALONG WINDROW



OVERSIZE ROCK DISPOSAL

GENERAL EARTHWORK AND GRADING SPECIFICATIONS
STANDARD DETAILS B

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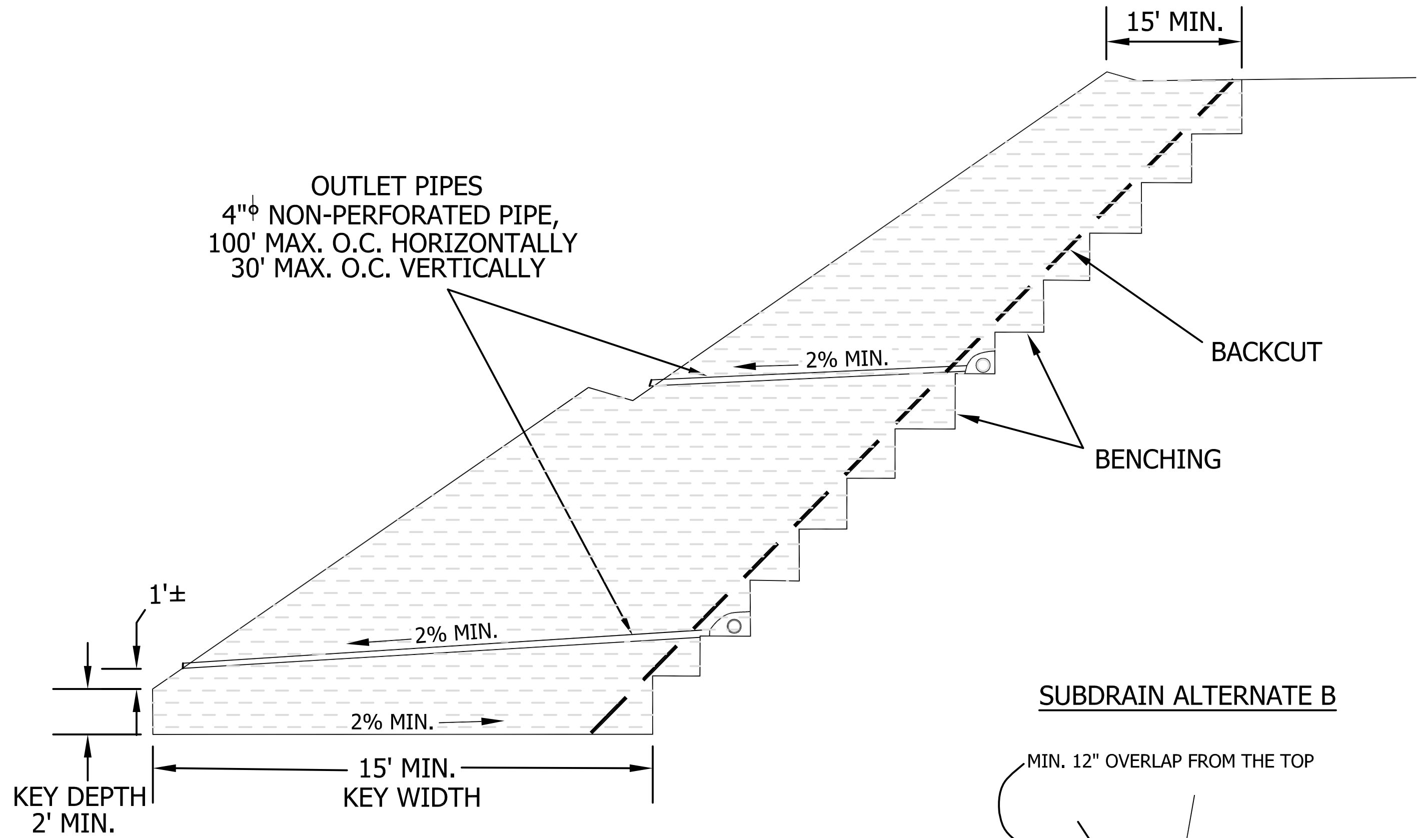
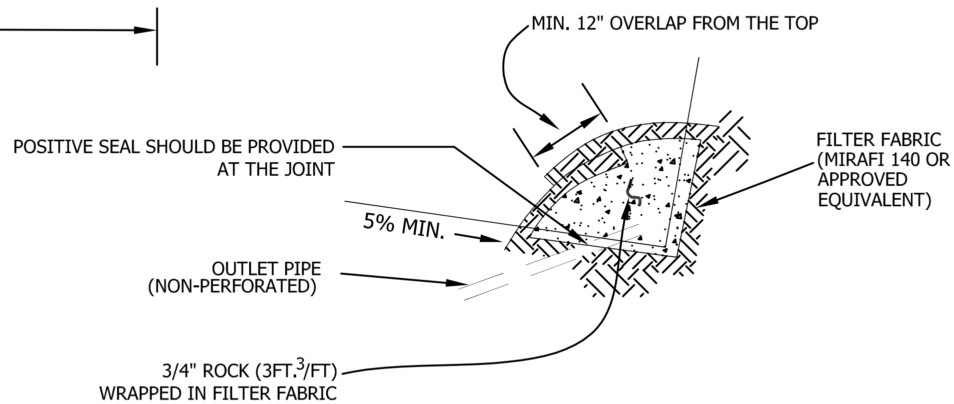
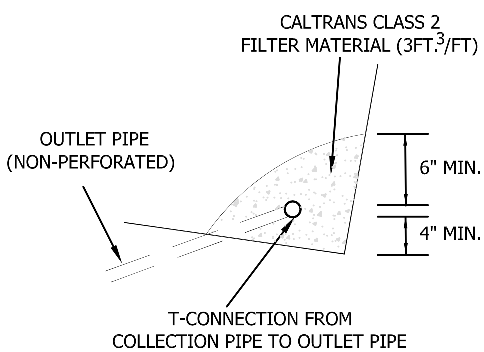


SUBDRAIN ALTERNATE B



SUBDRAIN ALTERNATE A



- 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

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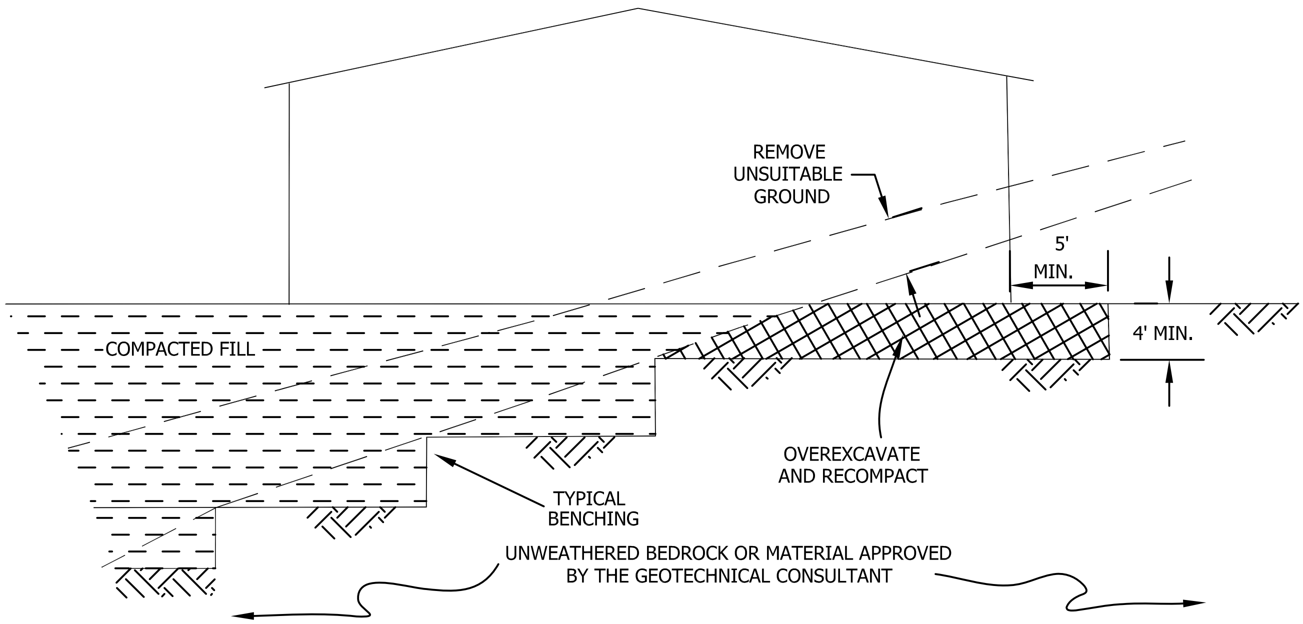
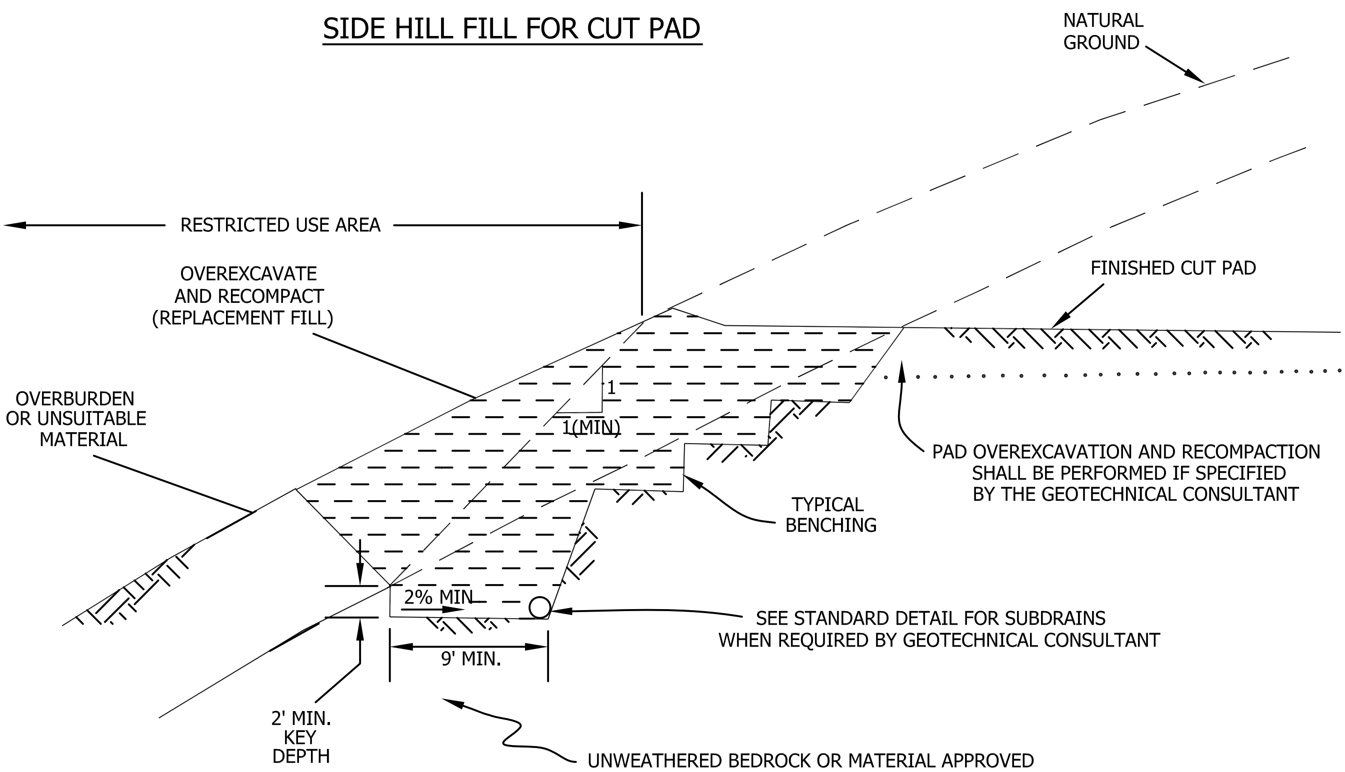
CUT-FILL TRANSITION LOT OVEREXCAVATION



SIDE HILL FILL FOR CUT PAD



TRANSITION LOT FILLS AND SIDE HILL FILLS

GENERAL EARTHWORK AND GRADING SPECIFICATIONS
STANDARD DETAILS E

Leighton

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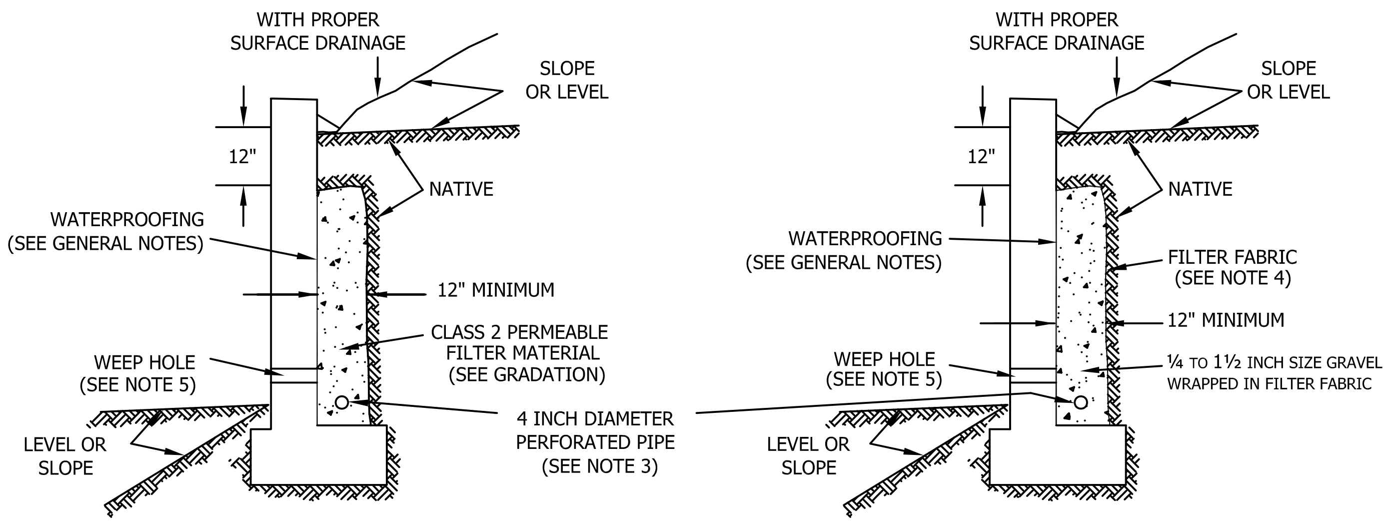
SUBDRAIN OPTIONS AND BACKFILL WHEN NATIVE MATERIAL HAS EXPANSION INDEX OF ≤50

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

Figure

APPENDIX D

GBA IMPORTANT INFORMATION ABOUT THIS GEOTECHNICAL ENGINEERING REPORT

Important Information about This

Geotechnical-Engineering Report

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

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:
- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:
- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept* *responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are <u>not</u> final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include 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 <u>Not</u> Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will <u>not</u> of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are <u>not</u> building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

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e-mail: info@geoprofessional.org www.geoprofessional.org