GEO-ETKA, INC.
Established 1965

Soil Engineering and Geology
Material Testing and Inspections

1801 East Heim Avenue, Suite 202, Orange, California 92865 ● Phone (714) 771-6911● Email: geoetka@aol.com

PRELIMINARY SOIL INVESTIGATION REPORT

FOR

PROPOSED FITNESS MANIA
2895 SOUTH MAIN STREET
CORONA, CALIFORNIA 92881

FOR

BALBAS CONSTRUCTION, INC.
ATTN: MR. JOE BALBAS
3189 AIRWAY AVENUE, UNIT D
COSTA MESA, CALIFORNIA 92626

Date: December 20, 2022
Project No: FP-11936-22

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December 20, 2022

Balbas Construction, Inc.
3189 Airway Avenue, Unit D
Costa Mesa, California 92626

Attention: Mr. Job Balbas:

Subject: Preliminary Soil Investigation Report
Geo-Etka, Inc. Job No.: FP-11936-22

Project: Proposed Fitness Mania
2895 South Main Street, Corona, California 92881

Dear Mr. Balbas,

In accordance with your authorization, we have performed a preliminary soil investigation at the subject site. The accompanying report presents a summary of our findings, recommendations, and limitation of work for the proposed site development.

The primary purpose of this investigation and report is to provide an evaluation of the existing geotechnical conditions at the site as they relate to the design and construction of the proposed development. More specifically, this investigation was to address geotechnical conditions for the preliminary design of the proposed building's foundation.

Based on the results of our investigation, the proposed development is feasible from a geotechnical standpoint and it is our professional opinion that the proposed development will not be subject to a hazard from settlement, slippage, or landslide, provided the recommendations of this report are incorporated into the proposed development. It is also our opinion that the proposed development will not adversely affect the geologic stability of the site or adjacent properties provided the recommendations contained in this report are incorporated into the proposed construction.

Questions, if any, regarding this report should be directed to our office.

Respectfully submitted,
GEO-ETKA, INC.

GHAYASUDDIN A. KHAN
C 038344

Ghayas A. Khan, P. E.
Civil Engineer, C-038344
Expires 3-31-23

Ahmad Ali

Ahmed Ali, President
MS, REA

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1.0 INTRODUCTION

1.1 EXISTING SITE CONDITIONS

The subject site is located on the northeast corner of S. Main Street and E. Chase Drive, in the City of Corona, California. Currently, access on site is limited to two openings in the chain link fence along Chase Drive and a driveway entrance on Main Street. Main Street is a paved road with existing concrete curb and gutter and Chase Drive is a paved road without concrete curb and gutter improvements. The geographical relationship of the site and surrounding vicinity is shown on the Site Location Map, Figure 1.

The site is a flag-shaped lot. There is an existing single-family residence onsite with attached garage and associated concrete hardscape driveway. The remainder of the site is generally covered in citrus groves.

1.2 PROPOSED DEVELOPMENT

According to the Site Plan prepared by Knitter Partners International, Inc. (Sheet A-0.01, December 1, 2022), the site is proposed for a two-story, gymnasium building for Fitness Mania. We have not been provided with foundation plans but we assume that the structure will be supported on conventional shallow concrete foundations and slab-on-grade. Continuous wall loads are not expected to exceed 10 kips per linear foot and isolated column loads of up to 400 kips.

Once the design phase and foundation loading configuration proceeds to a more finalized plan, the recommendations within this report should be reviewed and revised, if necessary. Any changes in the design, location or elevation of any structure, as outlined in this report, should be reviewed by this office. GEOETKA, Inc. should be contacted to determine the necessity for review and possible revision of this report.

1.3 FIELD WORK

Access through the grove is difficult for drilling rig without damaging tree branches; as instructed. An attempt was made to drill four exploratory boreholes. Exploratory boreholes were drilled up to 15 feet below ground surface on February 5, 2022 utilizing a CME-45 mobile drill rig equipped with 6-inch diameter hollow stem augers, refer to Plate 1 for borehole locations. Relatively undisturbed samples were obtained utilizing the California Ring Sampler (ASTM D 1587). Additional representative samples have been recovered with the SPT (Standard Penetration Test, ASTM D 1586) sampler. Bulk samples were also collected from the auger cuttings during drilling. The samples were collected in plastic bags, tied, and tagged for the location and depth. The geotechnical boring logs are presented in Appendix B and may include a description and classification of each stratum, sample locations, blow counts, groundwater conditions encountered during drilling, results from selected types of laboratory tests, and drilling information.

1.4 LABORATORY TESTING

Laboratory tests were performed on selected soil samples. The tests consisted primarily of the following:

• Moisture Content	(ASTM D2216)
• Dry Density	(ASTM D2937)
• Atterberg Limits	(ASTM D4318)
• Sieve Analysis	(ASTM C136)
• Direct Shear	(ASTM D3080)
• Expansion Index	(ASTM D4829)
• Hydrocollapse	(ASTM D4546, Method B)
• Soluble Sulfate Content	(Extinction/Turbidimetric Method)

The soil classifications are in conformance with the Unified Soil Classifications System (USCS), as outlined in the Classification and Symbols Chart (Appendix B). A summary of our laboratory testing, ASTM designation, and graphical presentation of test results is presented in Appendix C.

2.0 GEOTECHNICAL CONDITIONS

2.1 REGIONAL GEOLOGIC FINDINGS

Based on the Geologic Map of the Corona South 7.5' quadrangle (USGS, Open-File Report OF-02-21) the site is located in an area mapped as younger alluvial-fan deposits (Qyf), see Figure 2. Alluvium is weathered bedrock material and sediments that have been eroded from natural slopes and deposited in generally flat lying areas.

2.1.1 Surface Fault Rupture

There are no mapped active or potentially active faults with surface expression that trend through or are adjacent to the subject property, according to those references cited herein. The site does not lie within a designated Alquist-Priolo Earthquake Fault Zone (CDMG, 2000). According to the California Department of Conservation, Fault Activity Map of California 2010, the site is located approximately 1 mile northeast of the Elsinore fault zone, see Figure 3.

The subject site, as is the case with most of the tectonically-active California area, will be periodically subject to moderate to intense earthquake-induced ground shaking from nearby faults. Significant damage can occur to the site and structural improvements during a strong seismic event. Neither the location nor magnitude of earthquakes can accurately be predicted at this time.

2.1.2 Liquefaction Potential

Liquefaction is a soil strength and stiffness loss phenomenon that typically occurs in loose, saturated cohesionless soils as a result of strong ground shaking during earthquakes. The potential for liquefaction at a site is usually determined based on the results of a subsurface geotechnical investigation and the groundwater conditions beneath the site. Hazards to buildings associated with liquefaction include bearing capacity failure, lateral spreading, and differential settlement of soils below foundations, which can contribute to structural damage or collapse.

According to the City of Corona General Plan, the site is located within an area considered to have a low potential for liquefaction. Therefore, the potential for liquefaction associated ground deformation (seismic settlement and differential compaction) beneath the site is considered very low.

2.2 SUBSURFACE CONDITIONS

Detailed logs of the exploratory excavations are presented in Appendix B of this report. The earth materials encountered within the exploratory excavations are generally described below.

Based on our exploratory boreholes, the site soil generally consists of at least five feet mantle of soil classified as silty sand with gravel (USCS "SM"). This material is underlain with fine and coarse grained soil sandy lean clay (USCS "CL"), sand with silt and gravel (USCS "SWSM"), and silty gravel with sand (USCS "GM"). All exposed soil were moist. The density ranged from moderately dense to very dense and moderately firm to very firm. The fine grained soil is moderately cohesive and considered expansive. No groundwater was encountered.

2.2.1 Cal/OSHA Soil Type & Caving Potential

The subsurface soil expected to be encountered during site development may be classified as "Soil Type B" per the California Occupational Safety and Health Administration (Cal/OSHA). Caving of the exploratory borings did not occur. Due to the presence of apparent cohesion encountered within the boreholes, caving is not expected to be a major concern during site development.

2.2.2 Expansive Soil

Expansive soils are characterized by their ability to undergo significant volume changes (shrink or swell) due to variations in moisture content. Changes in soil moisture content can result from precipitation, landscape irrigation, utility leakage, roof drainage, perched groundwater, drought, or other factors and may result in unacceptable settlement or heave of structures or concrete slabs supported on grade.

Based on laboratory classification and testing, the soil onsite is expected to have a very low to low expansion potential (EI=37), as defined in ASTM D4829. This would require verification subsequent to completion of new footing excavations.

2.2.3 Corrosive Soil

To preliminarily assess the sulfate exposure of concrete in contact with the site soils, a representative soil sample was tested for water-soluble sulfate content. The test results suggest the site soils have a potential for sulfate attack (0.06 percent) based on commonly accepted criteria. We recommend following the procedures provided in ACI 318-19, Section 19.3, Table 19.3.2.1 for exposure “S0”. We also recommend Type II cement for all concrete work in contact with soil.

Ferrous metal pipes should be protected from potential corrosion by bituminous coating, etc. We recommend that all utility pipes be nonmetallic and/or corrosion resistant. Recommendations should be verified by soluble sulfate and corrosion testing of soil samples obtained from specific locations at the completion of rough grading.

2.2.4 Collapsible Soil

Soil hydroconsolidation (hydro-collapse) is a phenomenon that results in relatively rapid settlement of soil deposits due to addition of water. This generally occurs in soils having a loose particle structure cemented together with soluble minerals or with small quantities of clay. Water infiltration into such soils can break down the interparticle cementation, resulting in collapse of the soil structure. Collapsible soils are found primarily in Holocene alluvial fan deposits.

A soil sample, representing the upper alluvial soil, was tested in the laboratory for collapse potential. Test results indicate that less than 1% of hydro-collapse occurred in the tested samples. Therefore, the severity of hydrocollapse potential onsite is considered “No Problem” based on NAVFAC DM7.01, see Appendix C for Results.

2.3 GROUNDWATER

Groundwater study is not within the scope of this work. Groundwater was not encountered in our exploratory borehole excavated onsite to a depth of 15 feet below ground surface.

Historical groundwater elevations were researched using the California Department of Water Resources, Water Data Library (WDL) Station Map and the USGS, National Water Information System interactive webpages and no pertinent groundwater information was available for the subject site or adjacent properties.

Please note that the potential for rain or irrigation water locally seeping through from elevated areas and showing up near grades cannot be precluded. Our experience indicates that surface or near-surface groundwater conditions can develop in areas where groundwater conditions did not exist prior to site development, especially in areas where a substantial increase in surface water infiltration results from landscape irrigation. Fluctuations in perched water elevations are likely to occur in the future due to variations in precipitation, temperature, consumptive uses, and other factors including mounding of perched water over bedrock or natural soil. Mitigation for nuisance shallow seeps moving from elevated lower areas will be needed if encountered. These mitigations may include subdrains, horizontal drains, toe drains, french drains, heel drains or other devices.

2.4 SEISMIC DESIGN PARAMETERS

Based on current standards, the proposed development is expected to be designed in accordance with the requirements of the 2019 California Building Code (CBC). The 2019 California Building Code (CBC) provides procedures for earthquake resistant structural design that include considerations for on-site soil conditions, occupancy, and the configuration of the structure including the structural system and height.

Based on the soils encountered in the exploratory borehole within the subject site and with consideration of the geologic units mapped in the area, it is our opinion that the site soil profile corresponds to Site Class D in accordance with Section 1613.2.2 of the California Building Code (CBC 2019) and Chapter 20 of ASCE/SEI 7-16.

We have downloaded the seismic design parameters in accordance with the provisions of the current California Building Code (CBC, 2019) and ASCE/SEI 7-16 Standard using the Structural Engineers Association of California, OSHPD Seismic Design Maps Web Application (https://seismicmaps.org). The mapped seismic parameters are attached to this report in Appendix D.

The 2019 CBC is based on the guidelines contained within ASCE 7-16 which stipulates that where S_1 is greater than 0.2 times gravity (g) for Site Class D, a ground motion hazard analysis is needed unless the seismic response coefficient (C_S) value will be calculated as outlined in Section 11.4.8, Exception 2. Assuming the C_S value will be calculated as outlined in Section 11.4.8, Exception 2, we recommend the following seismic design parameters.

Parameter	ASCE 7-16	2019 CBC	Coefficient	Value
0.2-second Period MCE	Figure 22-1	Figure 1613.2.1(1)	S_S	2.350
1.0-second Period MCE_R	Figure 22-2	Figure 1613.2.1(2)	S_1	0.905
Soil Site Class	Figure 20.3-1	Section 1613.2.2	Site Class	D
Site Coefficient	Figure 11.4-1	Section 1613.2.3(1)	F_a	1.200
Site Coefficient	Figure 11.4-2	Section 1613.2.3(2)	F_v	1.700*
Adjusted MCE Spectral Response Parameters	Equation 11.4-1	Equation 16-36	S_{MS}	2.820
	Equation 11.4-2	Equation 16-37	S_{M1}	1.539*
Design Spectral Acceleration Parameters	Equation 11.4-3	Equation 16-38	S_{DS}	1.880
	Equation 11.4-4	Equation 16-39	S_{D1}	1.026*

*The values provided are valid provided the requirements in Exception Note No. 2 in Section 11.4.8 of ASCE 7-16 are met. If not, a site specific ground motion hazard analysis will be required.

3.0 TENTATIVE RECOMMENDATIONS

3.1 GENERAL EARTHWORK RECOMMENDATIONS

The following recommendations are provided regarding aspects of the anticipated earthwork construction. These recommendations should be considered subject to revision based on additional geotechnical evaluation of the conditions observed by the Geotechnical Engineer during grading operations. All grading should be performed in accordance with our General Earthwork and Grading Specifications presented in Appendix E except as modified within the text of this report.

3.1.1 Site Clearing, Grubbing and Fill Removal

All debris, undocumented fill, abandoned utility lines, concrete slab, roots, irrigation appurtenances, underground structures, storage tanks, deleterious materials, etc., should be removed from structural fill areas and hauled offsite. Cavities created during site clearance should be backfilled in a controlled manner.

3.1.2 Moisture Content

Based on our experience in south Corona, soil moisture content on properties that was supporting groves is elevated. Rough grading should be conducted at ±2 percent from optimum moisture. Drying back soils prior to its use as engineered fill should be anticipated. The contractor is responsible for moisture control. Methods such as aeration, mixing wet soils with drier soils, or the use of aggregate base and a geotextile stabilization fabric may be required to achieve a stable condition. The contractor will be required to treat wet, unstable soils to obtain the compaction requirements and to achieve stable soil conditions.

3.1.3 Building Pad Preparation

In order to provide adequate support for the proposed structure, the building pad should be overexcavated to a depth of at least 5 feet below existing grade and at least 2 feet below the proposed footings, whichever is greater. The lateral extent of overexcavation should be at least 5 feet, where achievable.

Once the bottom of the excavation is observed by a representative of this firm to be in competent native soil, the bottom of the overexcavation should be scarified, moisture conditioned, and recompacted to at least 90 percent of the maximum dry density, as determined by ASTM D1557 Test Method; prior to placement of fill. Deeper overexcavation, especially to remove loose soils, fill, or deleterious material, may be required depending upon field observations of excavation bottom by the soil engineer or his representative.

3.1.4 Trench Backfill

All utility trench backfills should be mechanically compacted to the minimum requirements of at least 90 percent relative compaction. Onsite soils derived from trench excavations can be used as trench backfill except for deleterious materials. Soils with sand equivalent greater than 30 may be utilized for pipe bedding and shading. Pipe bedding should be required to provide uniform support for piping. Excavated material from footing trenches should not be placed in slab-on-grade areas unless properly compacted and tested.

3.1.5 Compacted Fills/Imported Soils

Any soil to be placed as fill, whether presently onsite or import, should be approved by the soil engineer or his representative prior to their placement. All onsite soils to be used as fill should be cleansed of any roots, or other deleterious materials. Rocks larger than 12-inches in diameter should be removed from soil to be used as compacted fill.

All fills should be placed in 6- to 8-inch loose lifts, thoroughly watered, or aerated to near optimum moisture content, mixed and compacted to at least 90 or 95 percent relative compaction depending on the material (subgrade soil or aggregate base) and application (pavement subgrade, building pad, etc.). This is relative to the maximum dry density determined by ASTM D1557 Test Method.

Any imported soils should be sandy (preferably USCS "SM" or "SW", and very low in expansion potential) and approved by the soil engineer. The soil engineer or his representative should observe the placement of all fill and take sufficient tests to verify the moisture content and the uniformity and degree of compaction obtained.

3.2 TEMPORARY EXCAVATIONS

All excavation slopes and shoring systems should meet the minimum requirements of the Occupational Safety and Health (OSHA) Standards. Maintaining safe and stable slopes on excavations is the responsibility of the contractor and will depend on the nature of the soils and groundwater conditions encountered and his method of excavation. Excavations during construction should be carried out in such a manner that failure or ground movement will not occur. The contractor should perform any additional studies deemed necessary to supplement the information contained in this report for the purpose of planning and executing his excavation plan.

3.2.1 Excavation Characteristics

The soil onsite is generally composed of younger alluvium which is not expected to exhibit difficult excavation resistance for conventional grading and trenching equipment in good working condition.

3.2.2 Safe Vertical Cuts

Temporary un-surcharged excavations of 4 feet high may be made at a vertical gradient for short periods of time. Temporary un-surcharged excavations greater than 4 feet may be trimmed back at 1H:1V gradients to a maximum height of 10 feet. Exposed excavation conditions should be verified by the project geotechnical engineer during construction. No excavations should take place without the direct supervision of the project geotechnical engineer. If potentially unstable soil conditions are encountered, modifications of slope ratios for temporary cuts may be required.

3.2.3 Excavation Setbacks

No excavations should be conducted, without special considerations, along property lines, public right-of-ways, or existing foundations, where the excavation depth will encroach within the “zone of influence”. The “zone of influence” of the existing footings, property lines, or public right-of-way may be assumed to be below a 45-degree line projected down from the bottom edge of the footing, property line, or right-of-way.

3.2.4 Slot-Cut Excavations

Where excavations encroach within a 45-degree line projected down from the property line at ground surface, A-B-C slot cut excavations should be utilized. Slot cut excavations (refer to Plate 2) may be conducted onsite to a maximum width and height of 20 feet and 12 feet, respectively. No excavations should take place without the direct supervision of the project geotechnical engineer. If potentially unstable soil conditions are encountered, modifications of slope ratios for temporary cuts may be required.

3.3 FOUNDATION RECOMMENDATIONS

The proposed building may be supported on conventional shallow foundations deriving support in compacted fill. All foundation excavations must be observed and approved by the Geotechnical Engineer’s representative, prior to placing steel reinforcement or concrete.

3.3.1 Bearing Capacity

Spread and continuous foundations carried at least 24-inches below the lowest adjacent grade may be designed to impose a net dead-plus-live load pressure of 2000 psf. The bearing capacity may be increased 15 percent for every additional foot of embedment. A one-third increase may be used for wind or seismic loads.

3.3.2 Lateral Resistance

Resistance to lateral footing will be provided by passive earth pressure and base friction. For footings bearing against firm native material, passive earth pressure may be considered to be developed at a rate of 240 psf per foot of depth to a maximum of 2000 psf. Base friction may be computed at 0.35 times the normal load. If passive earth pressure and friction are combined to provide required resistance to lateral forces, the value of the passive pressure should be reduced to two-thirds the value.

3.3.3 Settlement

The onsite soils below the foundation depth have relatively high strengths and will not be subject to significant stress increases from foundations of the new structure. Therefore, estimated total long-term static and seismic settlement between similarly loaded adjacent foundation systems should not exceed 1-inch. The structures should be designed to tolerate a differential settlement on the order of 1/2-inch over a 30-foot span.

3.3.4 Reinforcement

Footing reinforcement should be determined by the structural engineer; however, minimum reinforcement should be at least two No. 5 reinforcing bars, top and bottom. Reinforcement and size recommendations presented in this report are considered the minimum necessary for the soil conditions present at the foundation level and are not intended to supersede the design of the project structural engineer or criteria of the governing agencies for the project.

3.4 SLABS-ON-GRADE

Office slabs should be at least 4-inches thick. Warehouse/storage slabs and slabs subject to traffic should be at least 6-inches thick. Slab-on-grade reinforcement should be at least No. 4 bars at 16-inches on-center both ways, properly centered in mid thickness of slabs. The structural engineer should design the actual slab thickness and reinforcement based on structural load requirements.

3.4.1 Modulus of Subgrade Reaction

A coefficient of vertical subgrade reaction (K_V) of 150 psi/in may be assumed for the building pad compacted fill soils. The modulus of subgrade reaction was estimated based on the NAVFAC 7.1 design charts. This value is for a small loaded area (1 sq. ft or less) such as for wheel loads or point loads and should be adjusted for larger loaded areas, as necessary.

3.4.2 Capillary Break / Vapor Membrane / Expansive Soil Mitigation

If vinyl or other moisture-sensitive floor coverings are planned, we recommend that the floor slab in those areas be underlain by a vapor membrane and capillary break consisting of a minimum 10-mil vapor-retarding membrane over a 6-inch thick layer of clean sand. The 6-inch thick layer of sand should be placed between the subgrade soil and the membrane to decrease the possibility of damage to the membrane.

3.4.3 Slab Curling Precautions

A low-slump concrete should be used to minimize possible curling of the slab. Additionally, a layer of sand may be placed over the vapor retarding membrane to reduce slab curling. If this sand bedding is used, care should be taken during the placement of the concrete to prevent displacement of the sand. However, the need for sand and/or the thickness of sand above the moisture vapor barrier should be specified by the structural engineer or concrete contractor. The selection of sand above the barrier is not a geotechnical engineering issue and hence outside our purview.

3.4.4 Subgrade Exposure

Construction activities and exposure to the environment can cause deterioration of the prepared subgrade. Therefore, we recommend that our field representative observe the condition of the final subgrade soils immediately prior to slab-on-grade construction, and, if necessary, perform further density and moisture content tests to determine the suitability of the final prepared subgrade.

Additionally, the slab subgrade should be moisture conditioned to 2 to 4 percent above the optimum moisture content, to a depth of 12 inches. The moisture content of the floor slab subgrade soils should be verified by the geotechnical engineer within 24 hours prior to placing the vapor retarding membrane.

3.5 RETAINING WALLS

The following lateral earth pressures and soil parameters may be used for the design of retaining walls with free draining compacted backfills. If passive earth pressure and friction are combined to provide required resistance to lateral forces, the value of the passive pressure should be reduced to two-thirds the following recommendations.

Lateral Earth Pressure Condition	Soil Backfill Condition	Equivalent Fluid Pressure (pcf)	Lateral Earth Pressure Coefficient
Active Case (Drained)*	Level	40	$K_a = 0.33$
	2H:1V	66	$K_a = 0.55$
At-Rest Case (Drained)	Level	60	$K_o = 0.50$
	2H:1V	87	$K_o = 0.73$
Unit Soil Weight	120 pcf		

3.5.1 Seismic Earth Pressure

Retaining walls exceeding 6 feet in height shall be designed to resist the additional earth pressure caused by seismic ground shaking. A seismic load of 36 pcf should be used for design of walls that support more than 6 feet of backfill in accordance with Section 1803.5.12 of the 2019 CBC. This incremental pseudo-static pressure was calculated using the methods recommended in NAVFAC 7.2 and a horizontal coefficient equal to one-half of two-thirds PGA_M.

The seismic load is applied as an equivalent fluid pressure along the height of the wall and the calculated loads result in a maximum load exerted at the base of the wall and zero at the top of the wall. When using the load combination equations from the building code, the seismic earth pressure should be combined with the lateral active earth pressure for analyses of restrained basement walls under seismic loading conditions.

3.5.2 Surcharge Loading

Retaining walls should also be designed to resist any lateral surcharges due to the traffic, nearby buildings, construction loads, etc. Surcharge loads within a 1H:1V plane extending up from the base of the wall should be included in the design lateral pressures by multiplying the associated lateral earth pressure coefficient (see table above) with the applied surcharge load. This surcharge load should be applied as a uniform load along the height of the wall. Additional static lateral pressures due to other surcharge loadings in the vicinity of the wall can be estimated using the guidelines provided in Plate 3.

3.5.3 Waterproofing

The backfilled side of all retaining walls should be coated with an approved waterproofing compound or covered with a similar material to inhibit migration of moisture through the walls. It is recommended that the waterproofing system should be inspected and approved by the project civil engineer. The use of a water-stop should be considered for all concrete joints. We recommend contacting a waterproofing professional/consultant for specific recommendations for placement, sealing and protection of below grade walls.

3.5.4 Drainage and Backfill

We recommend drainage for retaining walls to be provided in accordance with Plate 4 of this report. The backdrain pipe should be connected to a system of closed pipe(s) (non-perforated) that lead to the storm runoff discharge facilities. Wall backdrain must be observed by the geotechnical engineer prior to wall backfill.

The above earth pressures assume that sufficient drainage will be provided behind the walls to prevent the build-up of hydrostatic pressures from surface and subsurface water infiltration. Back-cut distance for conventional retaining walls should be at least 18 inches to facilitate compaction. All retaining wall backfill must be compacted to at least 90 percent relative compaction (ASTM D-1557), utilizing equipment that will not damage the wall. Maximum precautions should be taken when placing drainage materials and during backfilling. Onsite soils may be used as backfill.

3.6 PAVEMENT RECOMMENDATIONS

3.6.1 Subgrade Preparation

The pavement subgrade should be overexcavated/processed to provide at least 18-inches of compacted subgrade soil below the proposed pavement structural section. The subgrade for pavement support must be firm, unyielding, and uniform with no abrupt horizontal changes in degree of support. The subgrade soil should be uniform materials and density. Soft spots, if encountered, should be excavated and recompacted with the same type of soil as found in adjacent subgrade.

3.6.2 Aggregate Base

The aggregate base should conform to Caltrans Class 2 Aggregate Base or the Standard Specifications for Public Works for Crushed Miscellaneous Base, should be firm and unyielding, and without pumping conditions prior to placement of pavement. Aggregate base should be compacted to at least 95 percent of the maximum dry density as determined by ASTM D1557.

3.6.3 Flexible Pavement Design

The following recommended pavement section is based on the following assumed Traffic Index and R-value. The minimum recommended asphalt concrete (AC) pavement thickness is as follows:

Pavement Use	Assumed Traffic Index (TI)	R-Value (Assumed)	Minimum Recommended Pavement Section	
			AC	AB
Light Duty	4	40	2.5”	4.0”
Heavy Duty	6	40	3.5”	5.5”

AC: Asphalt Concrete, AB: Aggregate Base.

Final pavement design recommendations should be based on laboratory test results of representative pavement subgrade soils upon the completion of rough grading.

3.7 STORMWATER INFILTRATION

Infiltration testing was conducted utilizing the double ring infiltration test method at a depth of approximately 12 inches below existing ground surface. The infiltration testing was performed in general accordance with the guidelines published in the Riverside County Design Handbook for Low Impact Development Best Management Practices, Infiltration Testing Guidelines. The following table summarizes the result of the infiltration feasibility study. Refer to Appendix F for field infiltration test data.

Test No.	Test Depth Below Ground Surface	Adjusted Infiltration Rate (in/hr)
P-1	12”	0.39
P-2	12”	0.78

The raw percolation rate is the rate of water infiltration in the horizontal and vertical direction. This percolation rate is adjusted using the “Porchet Method” to obtain the adjusted water infiltration rate in the vertical direction only.

Long-term infiltration rates may be reduced significantly by factors such as soil variability and inaccuracy in the infiltration rate measurement. The correction factor for site variability is between 3 and 10. Safety factors for operating the system, maintenance, siltation, biofouling, etc. should also be considered by the design civil engineer at his discretion. Minimum safety factor required by the County of Riverside for tests conducted when a deep exploratory borehole has been drilled at the site is 3.

The infiltration system must be located such that the closest distance between an adjacent foundation is at least 10 feet in all directions from the zone of saturation. The zone of saturation may be assumed to project downward from the discharge of the infiltration facility at a gradient of 1H:1V. Additional property line or foundation setbacks may be required by the governing jurisdiction and should be incorporated into the stormwater infiltration system design as necessary.

If applicable, 4- to 6-inch diameter observation well(s), with locking cap, extending vertically into the system’s bottom is suggested as an observation point. Observation well(s) should be checked regularly and after large storm event. Once performance stabilizes, frequency of monitoring may be reduced.

GEOETKA should observe the subgrade of excavation. Additional laboratory testing including but not limited to grain size analysis, sand equivalent, sulfate content, etc. should be conducted during construction.

3.8 SITE DRAINAGE

Adequate lot surface drainage is a very important factor in reducing the likelihood of adverse performance of foundations, hardscape, and slopes. Surface drainage should be sufficient to prevent ponding of water anywhere on a lot, and especially near structures and tops of slopes. Lot surface drainage should be carefully taken into consideration during fine grading, landscaping, and building construction. Therefore, care should be taken that future landscaping or construction activities do not create adverse drainage conditions.

Positive site drainage within common areas should be provided and maintained at all times. Drainage should not flow uncontrolled down any descending slope. Water should be directed away from foundations and not allowed to pond and/or seep into the ground. In general, the area within 5 feet around a structure should slope away from the structure. We recommend that unpaved lawn and landscape areas have a minimum gradient of 2 percent sloping away from structures, and whenever possible, should be above adjacent paved areas. Consideration should be given to avoiding construction of planters adjacent to structures.

Planters around the site should be provided with drainage. Planters adjacent to foundation, if constructed, should be provided with sealed bottom. Onsite drainage should be directed to approve drainage collection devices, per the civil engineer recommendations. Location of drainage devices should be in accordance with the design civil engineer’s drainage and erosion control recommendations.

Pad drainage should be directed toward the street or other approved area(s). Although not a geotechnical requirement, roof gutters, downspouts, or other appropriate, means may be utilized to control roof drainage. Downspouts, or drainage devices, should outlet a minimum of 5 feet from structures or into a subsurface drainage system. Areas of seepage may develop due to irrigation or heavy rainfall, and should be anticipated. Minimizing irrigation will lessen this potential. If areas of nuisance seepage develop, recommendations such as subdrains, French drains, etc., for minimizing this effect could be provided upon request.

4.0 ADDITIONAL SERVICES

4.1 PLAN REVIEWS

The recommendations provided in this report are based on preliminary information and subsurface conditions as interpreted from limited exploratory boreholes at the site. We should be retained to review the final project plans to revise our conclusions and recommendations, as necessary. Professional fees will apply for each review.

Our conclusions and recommendations should also be reviewed and verified during site grading and revised accordingly if exposed geotechnical conditions vary from our preliminary findings and interpretations.

4.2 ADDITIONAL OBSERVATION AND/OR TESTING

GEOETKA, Inc. should observe and/or test at the following stages of construction.

- During overexcavation and fill placement
- Following footing excavation and prior to placement of footing materials.
- During wetting of slab subgrade and prior to placement of slab materials.
- When any unusual conditions are encountered.

4.3 FINAL REPORT OF COMPACTION DURING GRADING

A final report of compaction control should be prepared subsequent to the completion of grading. The report should include a summary of work performed, laboratory test results, and the results and locations of field density tests performed during grading.

5.0 GEOTECHNICAL RISK

The concept of risk is an important aspect of the geotechnical evaluation. The primary reason for this is that the analytical methods used to develop geotechnical recommendations do not comprise an exact science. The analytical tools which geotechnical engineers use are generally empirical and must be used in conjunction with engineering judgment and experience. Therefore, the solutions and recommendations presented in the geotechnical evaluation should not be considered risk-free and, more importantly, are not a guarantee that the interaction between the soils and the proposed structure will perform as planned.

The engineering recommendations presented in the preceding sections constitute GEOETKA, INC. professional estimate of those measures that are necessary for the proposed development to perform according to the proposed design based on the information generated and referenced during this evaluation, and GEOETKA, INC. experience in working with these conditions.

6.0 LIMITATION OF INVESTIGATION

This report was prepared for the exclusive use on the new construction. The use by others, or for the purposes other than intended, is at the user’s sole risk.

Our investigation was performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable Geotechnical Engineers practicing in this or similar locations within the limitations of scope, schedule, and budget. No other warranty, expressed or implied, is made as to the conclusions and professional advice included in this report.

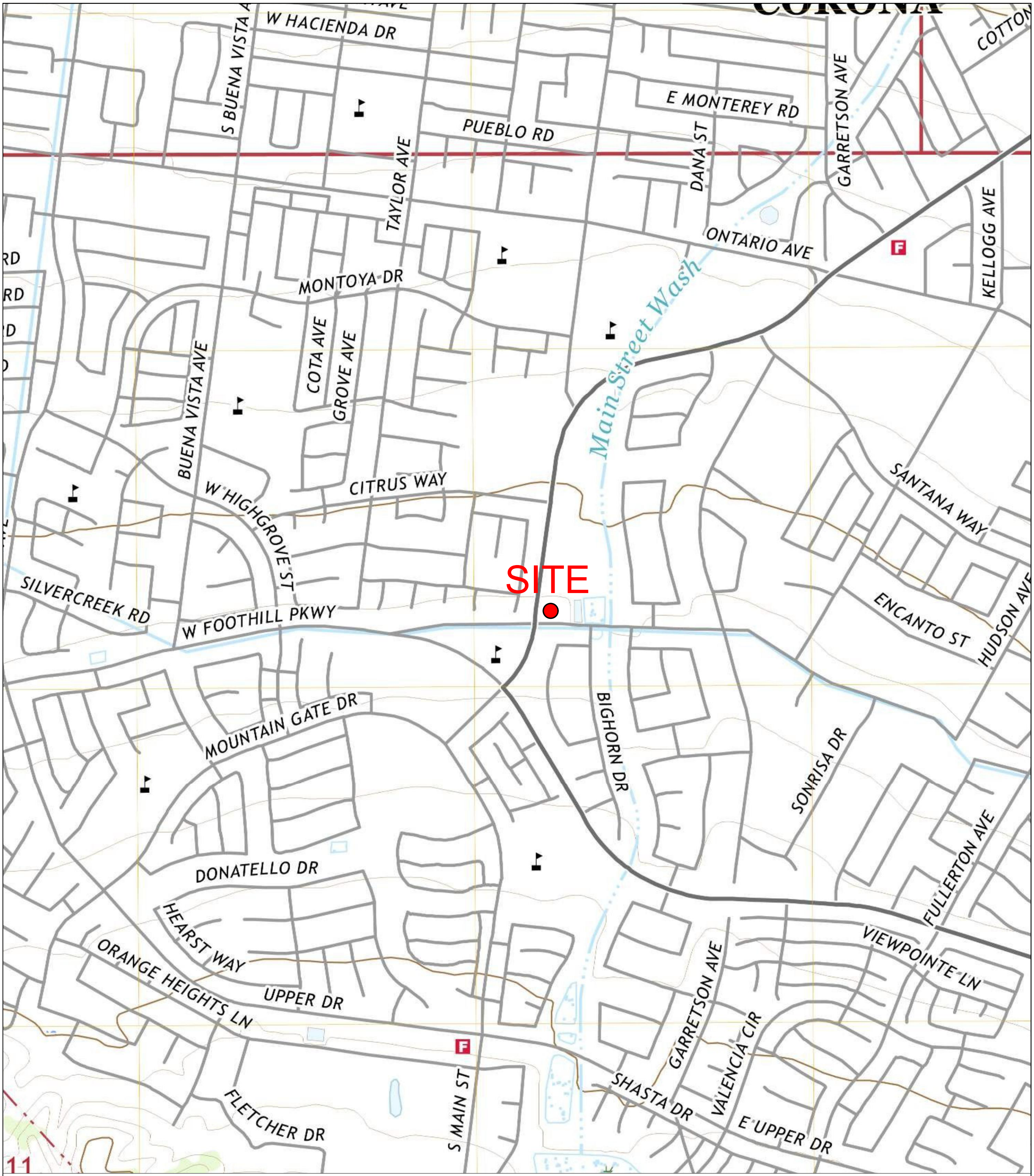
The field and laboratory test data are believed representative of the site; however, soil conditions can vary significantly. As in most projects, conditions revealed during construction may be at variance with preliminary findings. If this condition occurs, the possible variations must be evaluated by the Project Geotechnical Engineer and adjusted as required or alternate design recommended.

This report is issued with the understanding that it is the responsibility of the owner, or his representative, to ensure that the information and recommendations contained herein are brought to the attention of the engineer for the development and incorporated into the plans, and the necessary steps are taken to see that the contractor and subcontractor carry out such recommendations in the field.

This firm does not practice or consult in the field of safety engineering. We do not direct the contractor's operations, and we cannot be responsible for other than our own personnel on the site; therefore, the safety of others is the responsibility of the contractor. The contractor should notify the owner if he considers any of the recommended actions presented herein to be unsafe.

The findings, conclusions, and recommendations presented herein are based on our understanding of the development and on subsurface conditions observed during our site work, and are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether they be due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge.

FIGURES & PLATES



USGS, THE NATIONAL MAP, US TOPO, CORONA SOUTH, 2018

ALL LOCATIONS ARE APPROXIMATE

0 0.5 1.0 2.0

N

APPROXIMATE SCALE (MILES)

GEO-ETKA, INC.

DWN BY:	AM
CHK'D BY:	MN
DATUM:	--
PROJECTION:	--
SCALE:	1" = 1/4 MILE
REV. NO.:	--

PROJECT: PRELIMINARY SOIL INVESTIGATION REPORT
2895 MAIN STREET
CORONA, CALIFORNIA

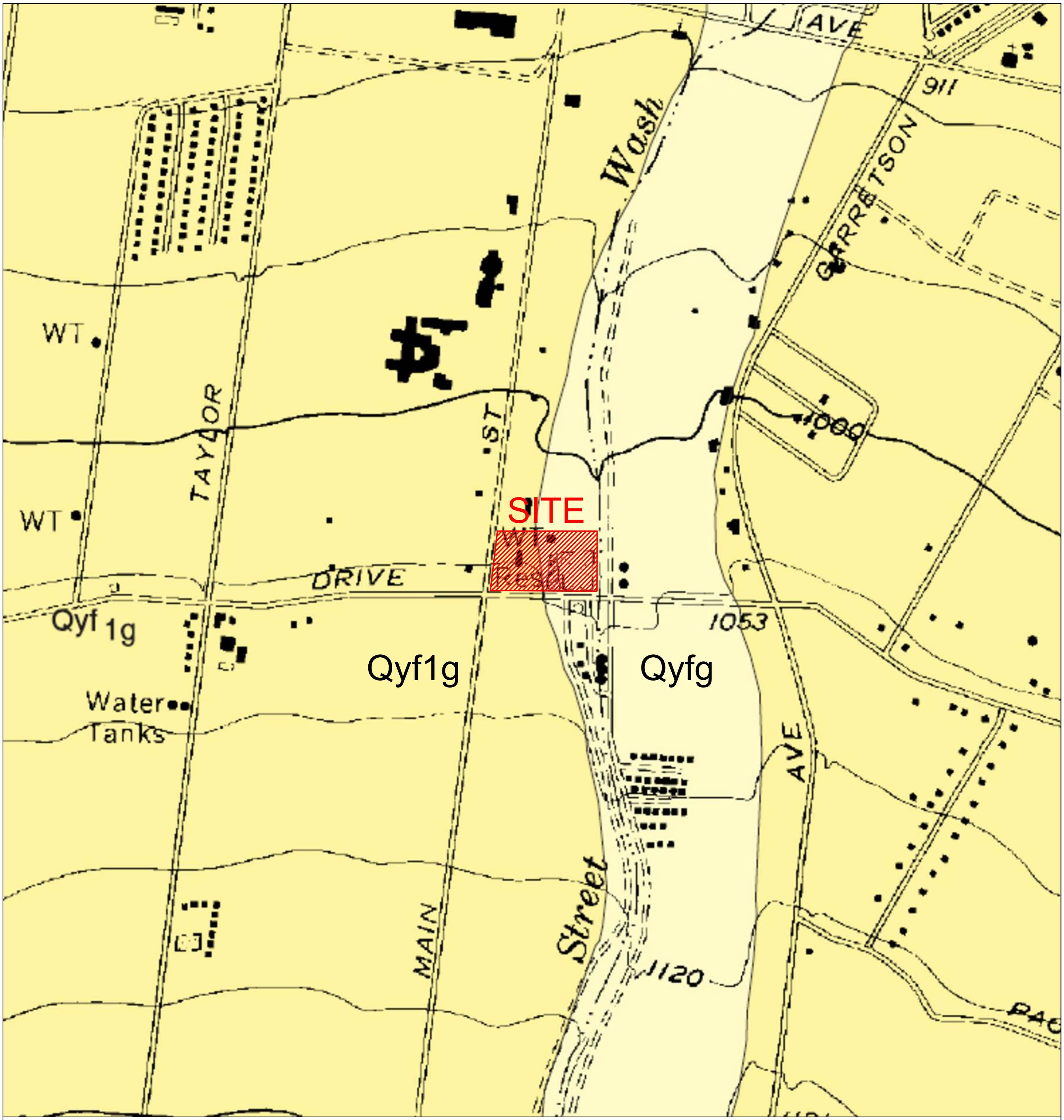
TITLE:

SITE LOCATION MAP

DATE: FEBRUARY 2022

PROJECT NO.: FP-11936-22

FIGURE NO.: Figure 1



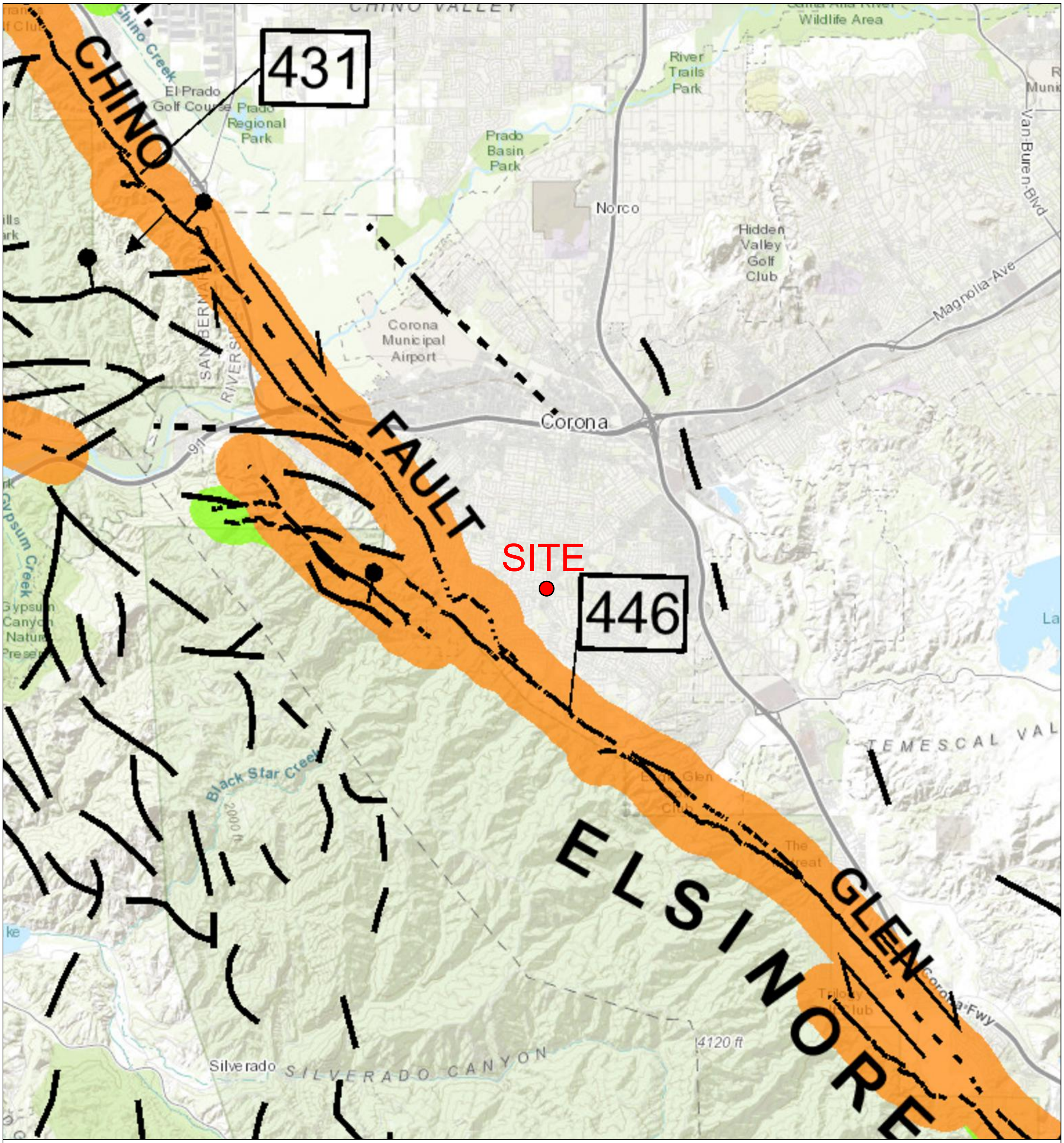
LEGEND:

Qyf1: Young alluvial-fan deposits, unit 1
Qyf: Young alluvial-fan deposits

REFERENCE MAP:

Gray, C.H., Morton, D.M., Weber, F.H., Bovard, K.R., and O'Brien, Timothy, 2002, Geologic map of the Corona South 7.5' quadrangle, Riverside and Orange Counties, California, U.S. Geological Survey, Open-File Report OF-2002-21, 1:24,000.

GEO-ETKA, INC.	DWN BY: AM	PROJECT: PRELIMINARY SOIL INVESTIGATION REPORT 2895 MAIN STREET CORONA, CALIFORNIA	DATE:	FEBRUARY 2022
	CHK'D BY: MN			
	DATUM: --		PROJECT NO.:	FP-11936-22
	PROJECTION: --	TITLE: REGIONAL GEOLOGIC MAP		
	SCALE: --		FIGURE NO.:	Figure 2
	REV. NO.: --			



FAULT EXPLANATION:

🟥 Historic Fault Displacement

🟧 Holocene Fault Displacement

🟩 Evidence of Late Quaternary Fault Displacement

🟪 Undivided Quaternary Faults

REFERENCES: Jennings, C.W. and Bryant, W.A., 2010,“Fault Activity Map of California,” California Geological Survey, GDM-006, May 2010

GEO-ETKA, INC.	DWN BY:	AM	PROJECT: PRELIMINARY SOIL INVESTIGATION REPORT 2895 MAIN STREET CORONA, CALIFORNIA	DATE: FEBRUARY 2022
	CHK'D BY:	MN		
	DATUM:	--		PROJECT NO.: FP-11936-22
	PROJECTION:	--	TITLE: REGIONAL FAULT MAP	
	SCALE:	--		FIGURE NO.: Figure 3
	REV. NO.:	--		

EXPLORATORY BOREHOLE LOCATION MAP

PRELIMINARY SOIL INVESTIGATION REPORT
2895 S. MAIN STREET
CORONA, CALIFORNIA

PREPARED BY: GEOETKA, INC.	DATE:	DECEMBER 2022	PLATE 1
	DRAWN BY:	AM	
	CHECKED BY:	HMN	
	PROJECT NO.:	FP-11936-22	
	SCALE:	1" = 20' (11"x17")	

LEGEND:

B-4 ⌖ EXPLORATORY BOREHOLE
P-4 ⌖ INFILTRATION TEST

ALL LOCATIONS ARE APPROXIMATE

STABILITY OF TEMPORARY SLOT CUT EXCAVATIONS

SOIL PROPERTIES

Unit Weight of Soil γ = 120 pcf
Cohesion c = 150 psf
Friction Angle φ = 30 deg.
Ko = 0.500

EXCAVATION DETAILS

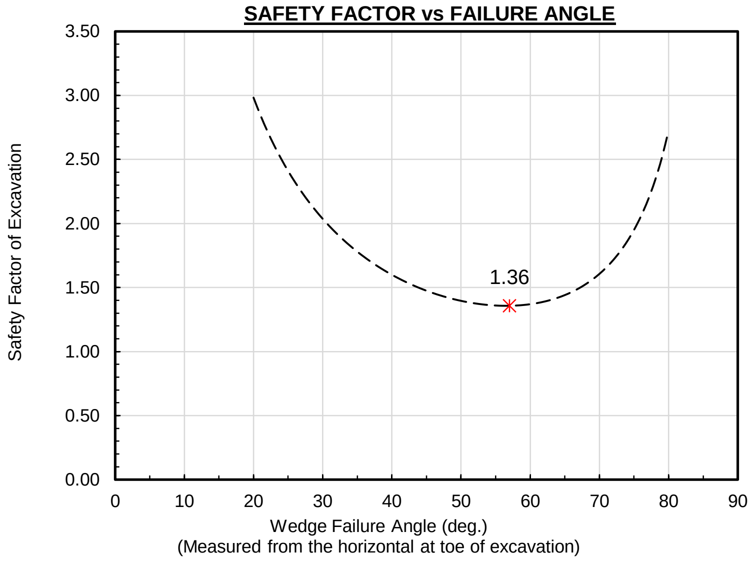
Height of Vertical Cut = H = 12 ft
Slot Cut Width = B = 20 deg.
Slope Angle above Cut = β = 0 deg.

SURCHARGE DETAILS

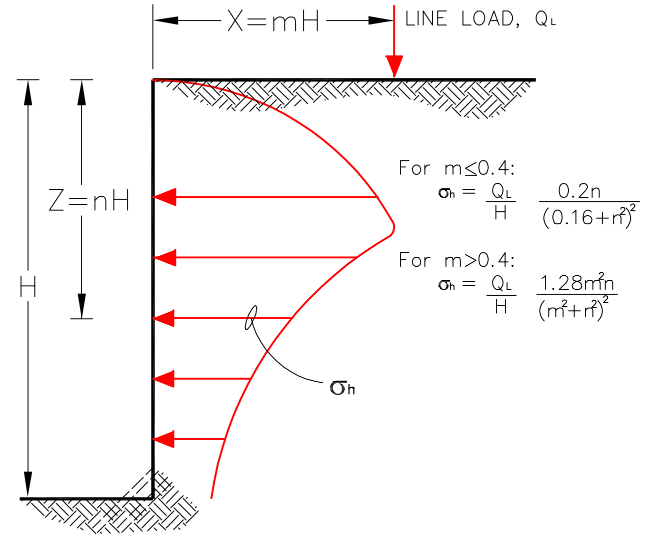
Surcharge = q = 0 psf
Surcharge Width = b = 2 ft
Surcharge Setback = x = 3 ft

Summary of Results

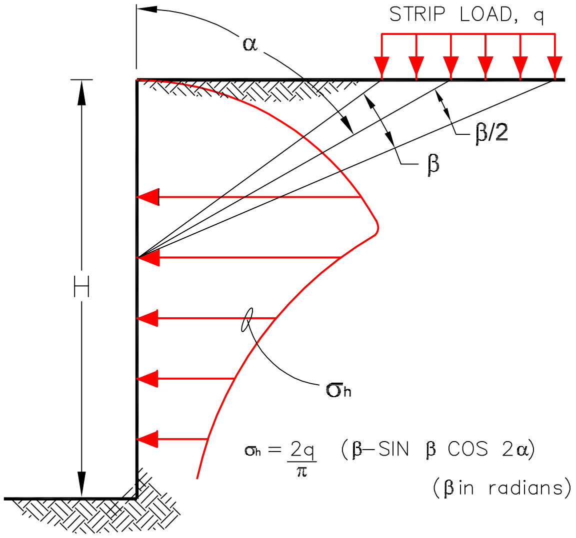
Critical Failure Angle = 57 deg.
Safety Factor = 1.36
Critical Wedge Driving Force = 51.26 kip
Critical Wedge Resisting Force = 69.58 kip



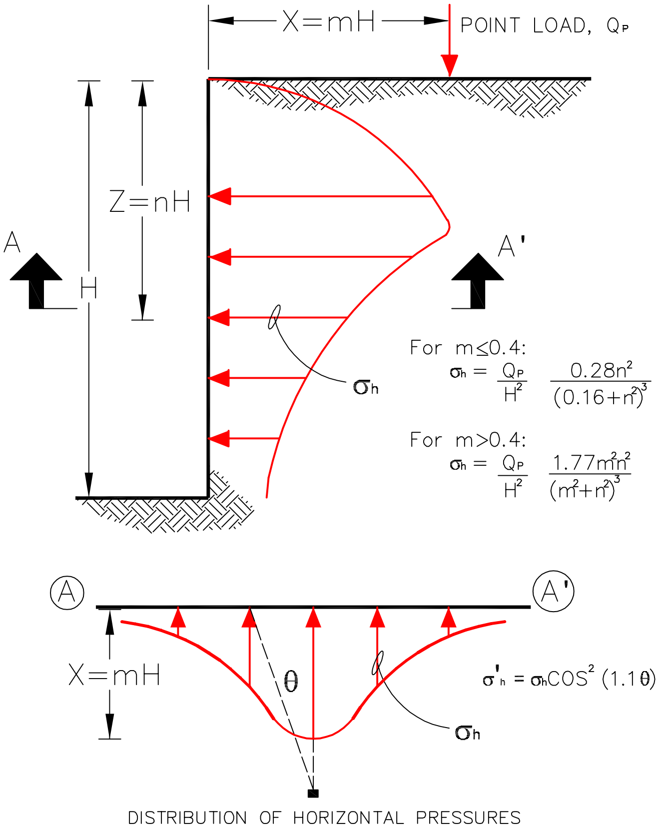
Failure Angle α (deg.)	Wedge Height H (ft)	Failure Plane Lb (ft)	Width of Wedge B (ft)	Area of Wedge A (ft^2)	Wedge Weight W (lb)	Surcharge Q (psf)	Driving Force	Resisting Force	Factor of Safety
20	12.0	35.1	33.0	198	23738	0.0	152586	455116	2.98
21	12.0	33.5	31.3	188	22508	0.0	150608	428554	2.85
22	12.0	32.0	29.7	178	21385	0.0	148551	404229	2.72
23	12.0	30.7	28.3	170	20355	0.0	146418	381855	2.61
24	12.0	29.5	27.0	162	19406	0.0	144213	361195	2.50
25	12.0	28.4	25.7	154	18529	0.0	141937	342050	2.41
26	12.0	27.4	24.6	148	17715	0.0	139593	324250	2.32
27	12.0	26.4	23.6	141	16957	0.0	137185	307652	2.24
28	12.0	25.6	22.6	135	16249	0.0	134714	292134	2.17
29	12.0	24.8	21.6	130	15587	0.0	132185	277589	2.10
30	12.0	24.0	20.8	125	14965	0.0	129600	263926	2.04
31	12.0	23.3	20.0	120	14379	0.0	126962	251064	1.98
32	12.0	22.6	19.2	115	13827	0.0	124275	238935	1.92
33	12.0	22.0	18.5	111	13304	0.0	121542	227477	1.87
34	12.0	21.5	17.8	107	12809	0.0	118766	216636	1.82
35	12.0	20.9	17.1	103	12339	0.0	115951	206363	1.78
36	12.0	20.4	16.5	99	11892	0.0	113099	196617	1.74
37	12.0	19.9	15.9	96	11466	0.0	110215	187360	1.70
38	12.0	19.5	15.4	92	11059	0.0	107302	178557	1.66
39	12.0	19.1	14.8	89	10670	0.0	104364	170178	1.63
40	12.0	18.7	14.3	86	10297	0.0	101403	162196	1.60
41	12.0	18.3	13.8	83	9939	0.0	98425	154585	1.57
42	12.0	17.9	13.3	80	9596	0.0	95431	147323	1.54
43	12.0	17.6	12.9	77	9265	0.0	92427	140390	1.52
44	12.0	17.3	12.4	75	8947	0.0	89415	133767	1.50
45	12.0	17.0	12.0	72	8640	0.0	86400	127436	1.47
46	12.0	16.7	11.6	70	8344	0.0	83385	121382	1.46
47	12.0	16.4	11.2	67	8057	0.0	80373	115591	1.44
48	12.0	16.1	10.8	65	7779	0.0	77369	110049	1.42
49	12.0	15.9	10.4	63	7511	0.0	74375	104744	1.41
50	12.0	15.7	10.1	60	7250	0.0	71397	99663	1.40
51	12.0	15.4	9.7	58	6997	0.0	68436	94797	1.39
52	12.0	15.2	9.4	56	6750	0.0	65498	90136	1.38
53	12.0	15.0	9.0	54	6511	0.0	62585	85669	1.37
54	12.0	14.8	8.7	52	6277	0.0	59701	81388	1.36
55	12.0	14.6	8.4	50	6050	0.0	56849	77285	1.36
56	12.0	14.5	8.1	49	5828	0.0	54034	73353	1.36
57	12.0	14.3	7.8	47	5611	0.0	51258	69582	1.36
58	12.0	14.2	7.5	45	5399	0.0	48525	65967	1.36
59	12.0	14.0	7.2	43	5191	0.0	45838	62500	1.36
60	12.0	13.9	6.9	42	4988	0.0	43200	59175	1.37
61	12.0	13.7	6.7	40	4789	0.0	40615	55986	1.38
62	12.0	13.6	6.4	38	4594	0.0	38086	52927	1.39
63	12.0	13.5	6.1	37	4402	0.0	35615	49992	1.40
64	12.0	13.4	5.9	35	4214	0.0	33207	47176	1.42
65	12.0	13.2	5.6	34	4029	0.0	30863	44473	1.44
66	12.0	13.1	5.3	32	3847	0.0	28587	41877	1.46
67	12.0	13.0	5.1	31	3667	0.0	26382	39385	1.49
68	12.0	12.9	4.8	29	3491	0.0	24249	36990	1.53
69	12.0	12.9	4.6	28	3317	0.0	22192	34688	1.56
70	12.0	12.8	4.4	26	3145	0.0	20214	32475	1.61
71	12.0	12.7	4.1	25	2975	0.0	18316	30345	1.66
72	12.0	12.6	3.9	23	2807	0.0	16501	28294	1.71
73	12.0	12.5	3.7	22	2642	0.0	14771	26318	1.78
74	12.0	12.5	3.4	21	2477	0.0	13129	24411	1.86
75	12.0	12.4	3.2	19	2315	0.0	11575	22571	1.95
76	12.0	12.4	3.0	18	2154	0.0	10113	20792	2.06
77	12.0	12.3	2.8	17	1995	0.0	8744	19070	2.18
78	12.0	12.3	2.6	15	1836	0.0	7470	17401	2.33
79	12.0	12.2	2.3	14	1679	0.0	6291	15781	2.51
80	12.0	12.2	2.1	13	1523	0.0	5211	14205	2.73



LINE LOAD PARALLEL TO WALL



STRIP LOAD PARALLEL TO WALL



VERTICAL POINT LOAD

NOTES:

1. These guidelines apply to rigid walls with Poisson's ratio assumed to be 0.5 for backfill materials.
2. Lateral pressures from any combination of above loads may be determined by the principle of superposition.

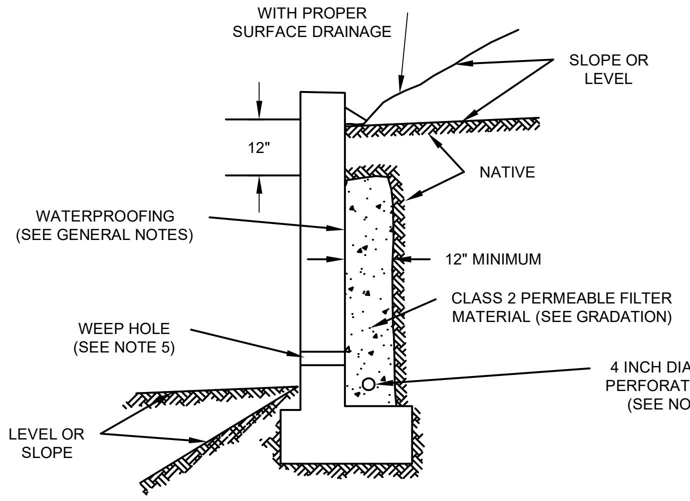
GEO-ETKA, INC.

RETAINING WALL SURCHARGE

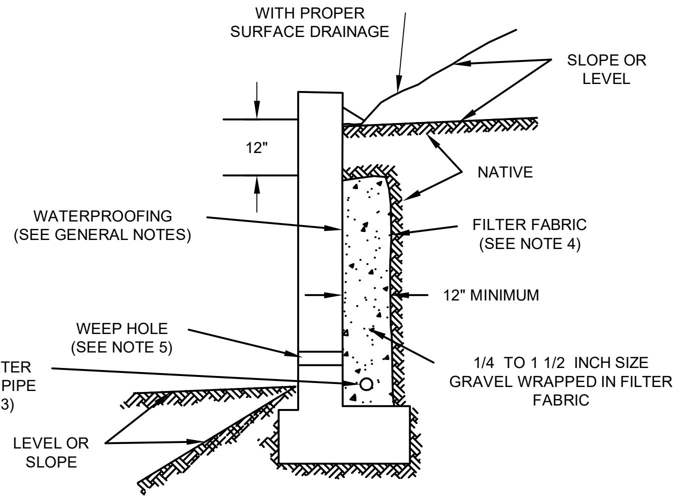
PLATE
3

SUBDRAIN OPTIONS AND BACKFILL WHEN NATIVE MATERIAL HAS EXPANSION INDEX ≤ 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 undesireable.
*Water proofing of the walls is not under the 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 diamater 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 Chlorise 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.

GEO-ETKA, INC.

RETAINING WALL BACKFILL AND SUBDRAIN DETAIL

PLATE
4

APPENDIX A

SELECTED REFERENCES

Knitter Partners International, Inc., Fitness Mania, 2895 South Main Street, Corona, California 92882, Site Plan, Sheet A-0.01, December 1, 2022.

AQX Engineering, Inc., Fitness Mania Corona, 2895 South Main Street, Corona, California 92882, (Preliminary) Foundation Plan, Sheet S-1, October 10, 2022.

Gray, C.H., Morton, D.M., Weber, F.H., Bovard, K.R., and O'Brien, Timothy, 2002, Geologic map of the Corona South 7.5' quadrangle, Riverside and Orange Counties, California, U.S. Geological Survey, Open-File Report OF-2002-21, 1:24,000.

City of Corona, 2020-2040 General Plan

USGS TopoView Interactive Webpage (https://ngmdb.usgs.gov/topoview/viewer/#4/39.98/-107.53)

Structural Engineers Association of California, OSHPD Seismic Design Maps Interactive Website (https://seismicmaps.org/)

California Geological Survey, Map No. 6, Fault Activity Map of California, Compiled by Charles W. Jennings and William A. Bryant, California Geologic Data Map Series, 2010

Department of the Navy, Design Manual 7.01, Soil Mechanics, September 1986.

Department of the Navy, Design Manual 7.02, Foundation and Earth Structures, September 1986.

APPENDIX B

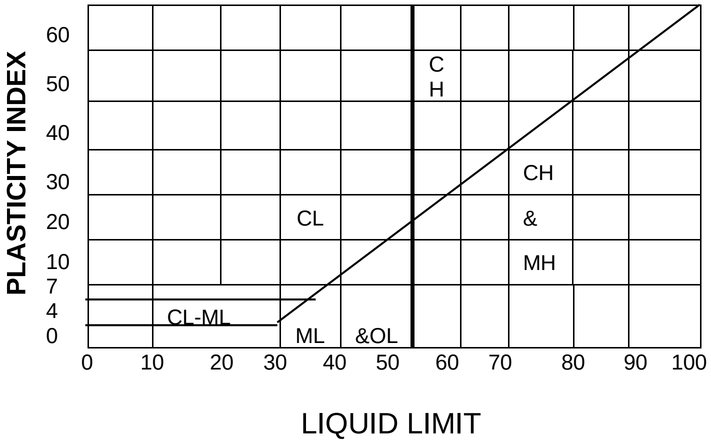
MAJOR DIVISIONS			SYMBOLS		TYPICAL NAMES
COARSE-GRAINED SOILS	(More than ½ of soil < No. 200 sieve)	**GRAVELS** (More than ½ of coarse fraction > No. 4 sieve size)	**GW**	▨	Well-graded gravels or gravel-sand mixtures, little or no fines
			GP	▨	Poorly graded gravels or gravel-sand mixtures, little or no fines
			GM	▨	Silty gravels, gravel-sand-silt mixtures
			GC	▨	Clayey gravels, gravel-sand-clay mixtures
		SANDS (More than ½ of coarse fraction < No. 4 sieve size)	**SW**	▨	Well-graded sands or gravely sands, little or no fines
			SP	▨	Poorly graded sands or gravelly sands, little or no fines
			SM	▨	Silty sands, sand-salt mixtures
			SC	▨	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS	(More than ½ of soil < No. 200 sieve)	**SILTS & CLAYS** LL < 50	**ML**	▨	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
			CL	▨	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	▨	Organic silts and organic silty clays of low plasticity.
		SILTS & CLAYS LL > 50	**MH**	▨	Inorganic silts, caceous or diatonaceous fine sandy or silty soils, elastic silts
			CH	▨	Inorganic clays of medium to high plasticity, organic silty clays, organic silts
			OH	▨	Organic clays of medium to high plasticity, organic silty clays, organic silts
		HIGHLY ORGANIC SOILS	**Pt**	▨	Peat and other highly organic soils

CLASSIFICATION CHART

(UNIFIED SOIL CLASSIFICATION SYSTEM)

CLASSIFICATION	RANGE OF GRAIN SIZES	
	U.S. Standard Sieve Size	**Grain Size in Millimeters**
BOULDER	ABOVE 12”	ABOVE 305
COBBLES	3” to 12”	305 to 76.2
GRAVEL COARSE FINE	3” to No. 4 3” TO ¾” ¾'”to No. 4	762 to 4.76 76.2 to 19.1 19.1 to 4.76
SAND COARSE MEDIUM FINE	No. 4 to 200 No. 4 to 10 No. 10 to 40 No. 40 to 200	4.76 to 0.074 4.76 to 2.00 2.00 to 0.420 0.420 to 0.074
SILT & CLAY	BELOW No. 200	BELOW 0.074

GRAIN SIZE CHART



PLASTICITY CHART

METHOD OF SOIL CLASSIFICATION

PROJECT: **2895 S. Main Street**
Corona, California

Log of Boring B-1

Longitude:
Latitude:
Elevation:

Project No.	**FP-11936-22**	Location:	**See Plate 1**	Borehole Logged by:	MN
Excavating Co. / Rig:	**GEOETKA / CME-45**	Date Started:	**2/5/2022**	Depth to Groundwater:	ft
Method:	**Hollow-Stem Auger**	Date Finished:	**2/5/2022**	Depth to Bedrock:	N/A ft
Hammer Weight / Drop:	**140 lbs./30-inches**	Hammer Type:	**Automatic**	Total Depth of Borehole:	15 ft

SAMPLES								LABORATORY TEST DATA						
Depth (ft)	Type	Sample	Blows / 6"	SPT "N" Value	Symbol	Classification (USCS)	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Pocket Pen (tsf)	Liquid Limit	Plastic Limit	Plast. Index
	B	▦			▤	SM	**SILTY SAND WITH GRAVEL** Medium brown, fine to coarse graiend, moist							
5	R	☒	15 15 20	23	▨		**SANDY LEAN CLAY WITH GRAVEL** medium brown, cohesive, mosit, very firm	14	113	68				
10	S	▯	6 6 7	13	▨									
		▦			▤		**SILTY SAND WITH GRAVEL** Medium brown, fine to coarse grained, moist	11		34				
15	S	▯	8 8 15	23	▭		**WELL GRADED SAND WITH SILT AND GRAVEL** Medium brown, fine to coarse grained, moist	12		6				
20														
25														
30														
35														
40														
45														
50														

LOG LEGEND

		▤	Silty Sands	▦	Bulk "Grab" Sample (B)	▽	Groundwater (Groundwater (During Drillin
▩	Bedrock/Formation	▥	Silts	☒	Modified California Ring (R)	▼	Groundwater (Groundwater (Stabilized)
▩	Gravels	▦	Clayey Sands	▯	Standard Penetration (S)	D	Disturbed Sample
▭	Clean Sands	▨	Clays	⍂	Modified Dames & Moore (D)	N	No Sample Recovery

This log is part of the report prepared for this project and should be read together with the report. This summary applies only at the location of the exploration and at the time of drilling or excavation. Subsurface conditions may differ at other locations and may change at this location with tiume. Data presented are a simplification of actual conditions encountered.

PROJECT:	2895 S. Main Street Corona, California	**Log of Boring B-2**		Longitude: Latitude: Elevation:

Project No.	**FP-11936-22**	Location:	**See Plate 1**	Borehole Logged by:	MN	
Excavating Co. / Rig:	**GEOETKA / CME-45**	Date Started:	**2/5/2022**	Depth to Groundwater:		ft
Method:	**Hollow-Stem Auger**	Date Finished:	**2/5/2022**	Depth to Bedrock:	N/A	ft
Hammer Weight / Drop:	**140 lbs./30-inches**	Hammer Type:	**Automatic**	Total Depth of Borehole:	15	ft

SAMPLES								LABORATORY TEST DATA						
Depth (ft)	Type	Sample	Blows / 6"	SPT "N" Value	Symbol	Classification (USCS)	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Pocket Pen (tsf)	Liquid Limit	Plastic Limit	Plast. Index
	B	▦			▤	SM	**SILTY SAND WITH GRAVEL** Medium brown, fine to coarse graiend, moist							
	R	☒	8 8 12	13										
5		▦			▨	CL	**SANDY LEAN CLAY WITH GRAVEL** medium brown, cohesive, mosit, very firm	18	112			29	17	12
	S	▯	3 3 3	6										
10					▦	SC	**CLAYEY SAND WITH GRAVEL** medium brown, moist. Medium firm. Caliche <5%							
		▦			▤	GM	**SILTY GRAVEL WITH SAND** Dark brown, fine to coasre grained, moist	7		18				
	S	▯	18 18 24	42	▤	SM	**SILTY SAND WITH GRAVEL** Dark brown, fine to coasre grained, dense moist							
15														
20														
25														
30														
35														
40														
45														
50														

LOG LEGEND							
		▤	Silty Sands	▦	Bulk "Grab" Sample (B)	▽	Groundwater (Groundwater (During Drillin
■	Bedrock/Formation	▥	Silts	☒	Modified California Ring (R)	▼	Groundwater (Groundwater (Stabilized)
▩	Gravels	▦	Clayey Sands	▯	Standard Penetration (S)	D	Disturbed Sample
☐	Clean Sands	▨	Clays	⧅	Modified Dames & Moore (D)	N	No Sample Recovery

This log is part of the report prepared for this project and should be read together with the report. This summary applies only at the location of the exploration and at the time of drilling or excavation. Subsurface conditions may differ at other locations and may change at this location with tiume. Data presented are a simplification of actual conditions encountered.

PROJECT: **2895 S. Main Street**
Corona, California

Log of Boring B-3

Longitude:
Latitude:
Elevation:

Project No.	**FP-11936-22**	Location:	**See Plate 1**	Borehole Logged by:	MN
Excavating Co. / Rig:	**GEOETKA / CME-45**	Date Started:	**2/5/2022**	Depth to Groundwater:	ft
Method:	**Hollow-Stem Auger**	Date Finished:	**2/5/2022**	Depth to Bedrock:	N/A ft
Hammer Weight / Drop:	**140 lbs./30-inches**	Hammer Type:	**Automatic**	Total Depth of Borehole:	15 ft

SAMPLES								LABORATORY TEST DATA						
Depth (ft)	Type	Sample	Blows / 6"	SPT "N" Value	Symbol	Classification (USCS)	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Pocket Pen (tsf)	Liquid Limit	Plastic Limit	Plast. Index
		▦			▤	SM	**SILTY SAND WITH GRAVEL**							
	B	▦			▤		Medium brown, fine to coarse graiend, moist							
5	R	☒	10 15 15	20	▤		Medium Dense	14	112					
10	S	▯	7 14 16	30	▤		Dense	7		13				
15	S	▯	15 18 22	40	▤		Dense							
20														
25														
30														
35														
40														
45														
50														

LOG LEGEND

		▤	Silty Sands	▦	Bulk "Grab" Sample (B)	▽	Groundwater (Groundwater (During Drillin
■	Bedrock/Formation	▥	Silts	☒	Modified California Ring (R)	▼	Groundwater (Groundwater (Stabilized)
▩	Gravels	▦	Clayey Sands	▯	Standard Penetration (S)	D	Disturbed Sample
☐	Clean Sands	▨	Clays	⍂	Modified Dames & Moore (D)	N	No Sample Recovery

PROJECT:	**2895 S. Main Street Corona, California**	**Log of Boring**	**B-4**	Longitude: Latitude: Elevation:

Project No.	**FP-11936-22**	Location:	**See Plate 1**	Borehole Logged by:	MN
Excavating Co. / Rig:	**GEOETKA / CME-45**	Date Started:	**2/5/2022**	Depth to Groundwater:	ft
Method:	**Hollow-Stem Auger**	Date Finished:	**2/5/2022**	Depth to Bedrock:	N/A ft
Hammer Weight / Drop:	**140 lbs./30-inches**	Hammer Type:	**Automatic**	Total Depth of Borehole:	15 ft

SAMPLES								LABORATORY TEST DATA						
Depth (ft)	Type	Sample	Blows / 6"	SPT "N" Value	Symbol	Classification (USCS)	MATERIAL DESCRIPTION	Moisture Content (%)	Dry Density (pcf)	Fines Content (%)	Pocket Pen (tsf)	Liquid Limit	Plastic Limit	Plast. Index
	B	▦			▤	SM	**SILTY SAND WITH GRAVEL** Medium brown, fine to coarse graiend, moist							
	R	☒	20 22 28	33	▤			5	107	7				
5		▦			▤	SWSM	**WELL GRADED SAND WITH SILT AND GRAVEL** medium brown, fine to coarse graind							
	S	▯	8 9 13	22	▤									
10		▦			▩	GM	**SILTY GRAVEL WITH SAND** Dark brown, fine to coasre grained, moist							
	S	▯	9 19 31	50	▩		Very Dense							
15														
20														
25														
30														
35														
40														
45														
50														

LOG LEGEND

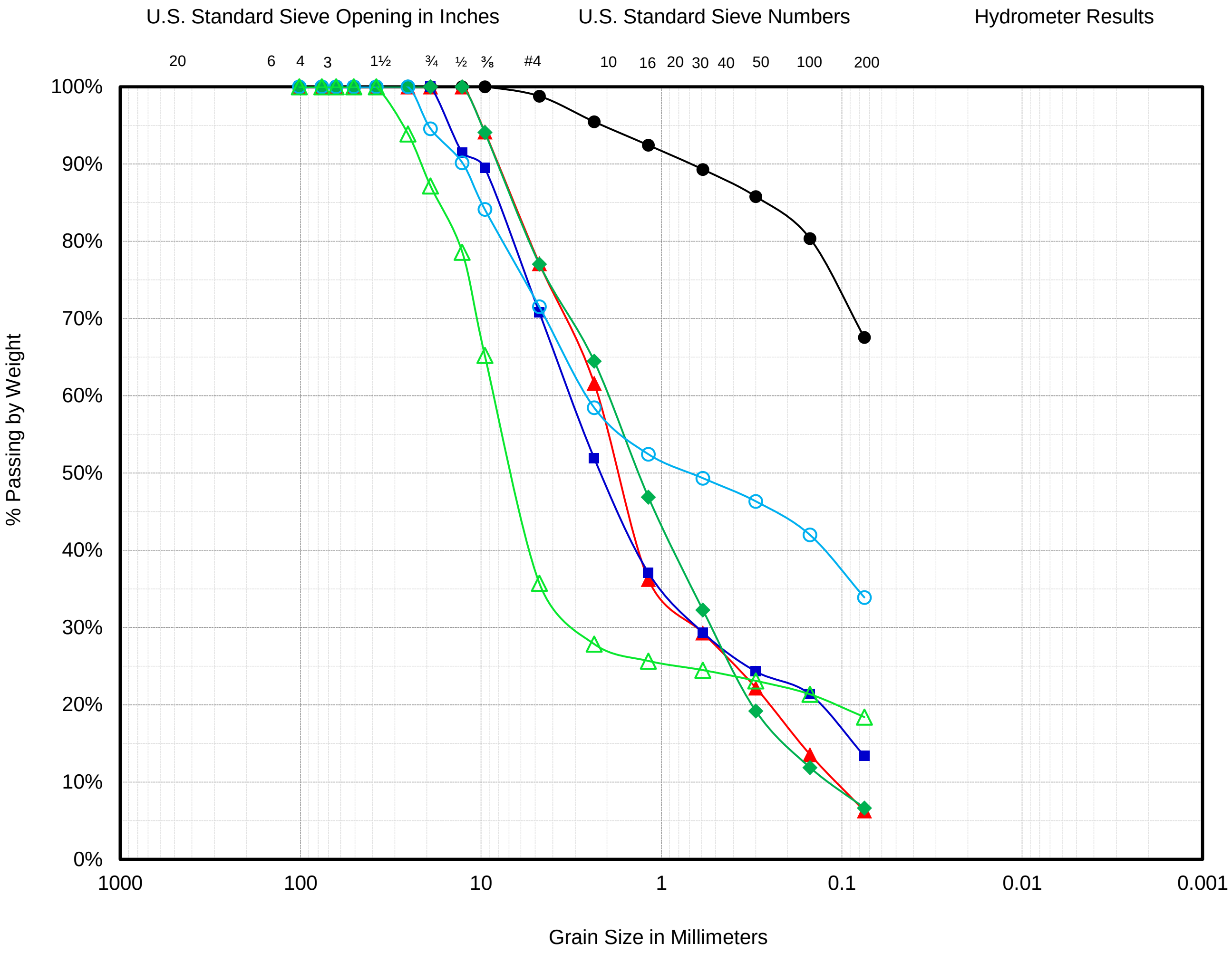
		▤	Silty Sands	▦	Bulk "Grab" Sample (B)	▽	Groundwater (Groundwater (During Drillin
■	Bedrock/Formation	▥	Silts	☒	Modified California Ring (R)	▼	Groundwater (Groundwater (Stabilized)
▩	Gravels	▦	Clayey Sands	▯	Standard Penetration (S)	D	Disturbed Sample
□	Clean Sands	▨	Clays	◫	Modified Dames & Moore (D)	N	No Sample Recovery

This log is part of the report prepared for this project and should be read together with the report. This summary applies only at the location of the exploration and at the time of drilling or excavation. Subsurface conditions may differ at other locations and may change at this location with tiume. Data presented are a simplification of actual conditions encountered.

APPENDIX C

GRAIN SIZE DISTRIBUTION

(ASTM C136)



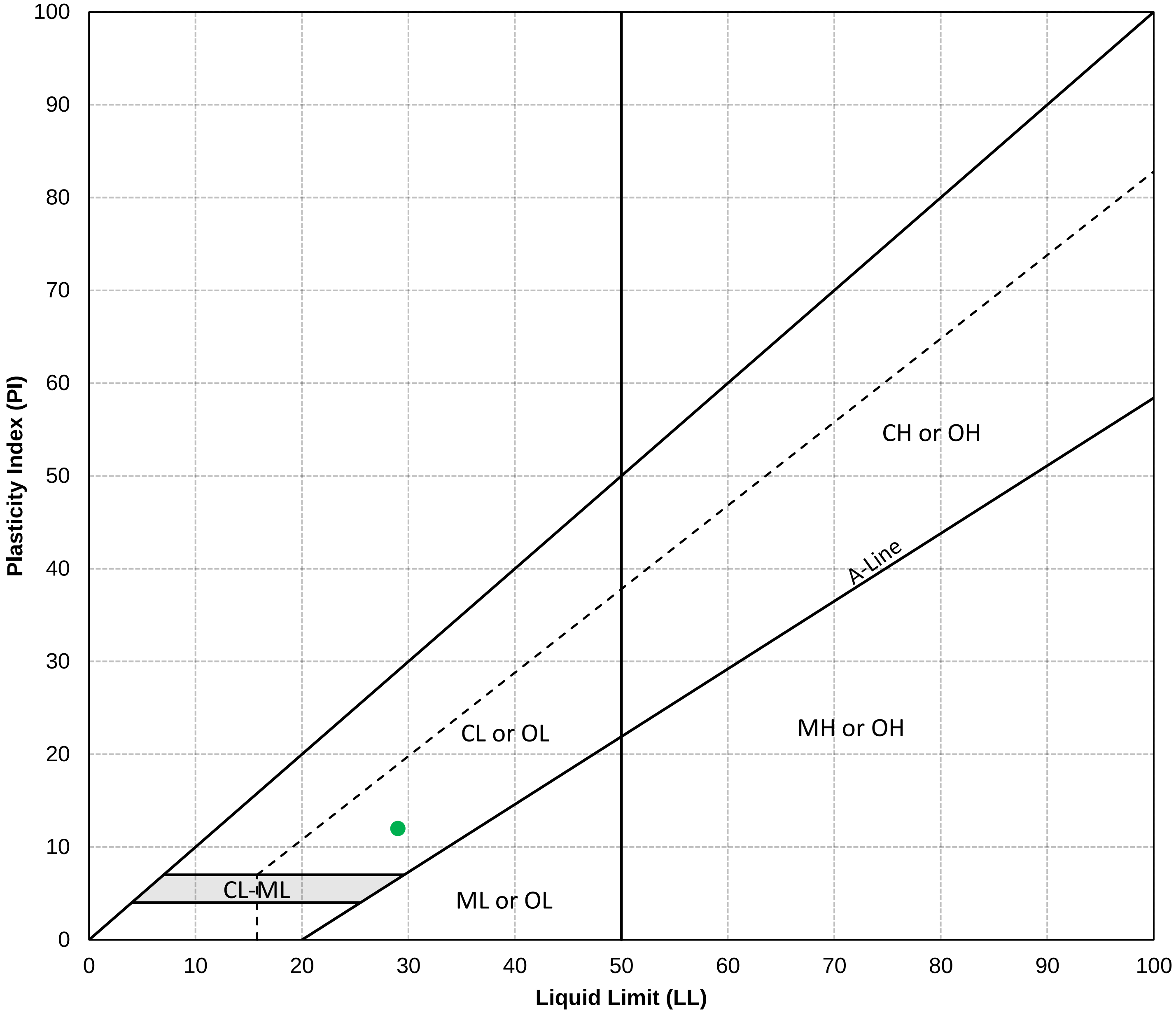
Cobbles	Gravels		Sands			Silts	Clays
	Coarse	Fine	Coarse	Medium	Fine		

Symbol	Location	Depth	USCS	Classification	Moisture (%)	Fines (%)	D10	D30	D60	Cc	Cu
●	B-1	5'	CL	Sandy Lean Clay	13.5	68	0.01	0.03	0.07	6.00	1.50
▲	B-1	15'	SW-SM	Well-Graded Sand with Silt & Gravel	12.1	6	0.11	0.65	2.28	20.16	1.62
■	B-3	10'	SM	Silty Sand with Gravel	7.4	13	0.06	0.64	3.38	60.30	2.14
◆	B-4	5'	SW-SM	Well-Graded Sand with Silt & Gravel	4.8	7	0.12	0.54	2.06	1.15	16.75
o	B-1	13'	SM	Silty Sand with Gravel	10.7	34	0.02	0.07	2.64	0.08	119.29
△	B-2	13'-15'	GM	Silty Gravel with Sand	6.9	18	0.04	3.00	8.68	25.56	213.09

PRELIMINARY SOIL INVESTIGATION REPORT
Proposed Commercial Development
2895 S. Main Street
Corona, California

Project No.:	FP-11936-22
Date Tested:	2/25/2022
Tested by:	RM
Exhibit:	Appendix C

PLASTICITY CHART



ATTERBERG LIMITS TEST RESULTS

	LEGEND	SOIL CLASSIFICATION	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)
●	B-2 @ 7'	Sandy Lean Clay	29.0	17.0	12.0

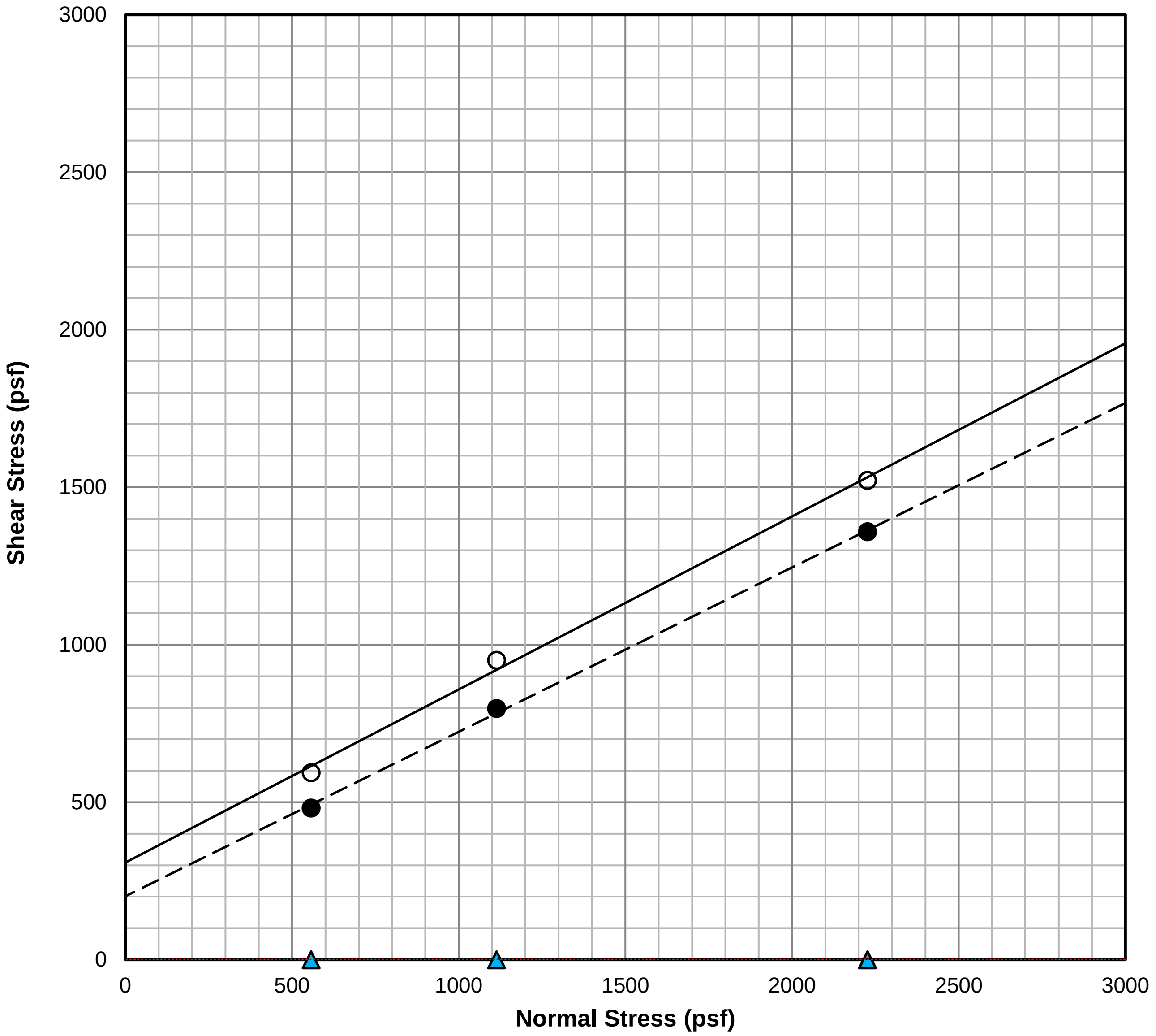
GEOETKA, INC.

Standard Test Method for Atterberg Limits (ASTM D4318)

Proposed Commercial Development
2895 S. Main Street
Corona, California

Project No.:	F-11936-22
Date:	2/25/2022
Tested by:	
Checked by:	
Exhibit:	Appendix C

DIRECT SHEAR TEST RESULTS



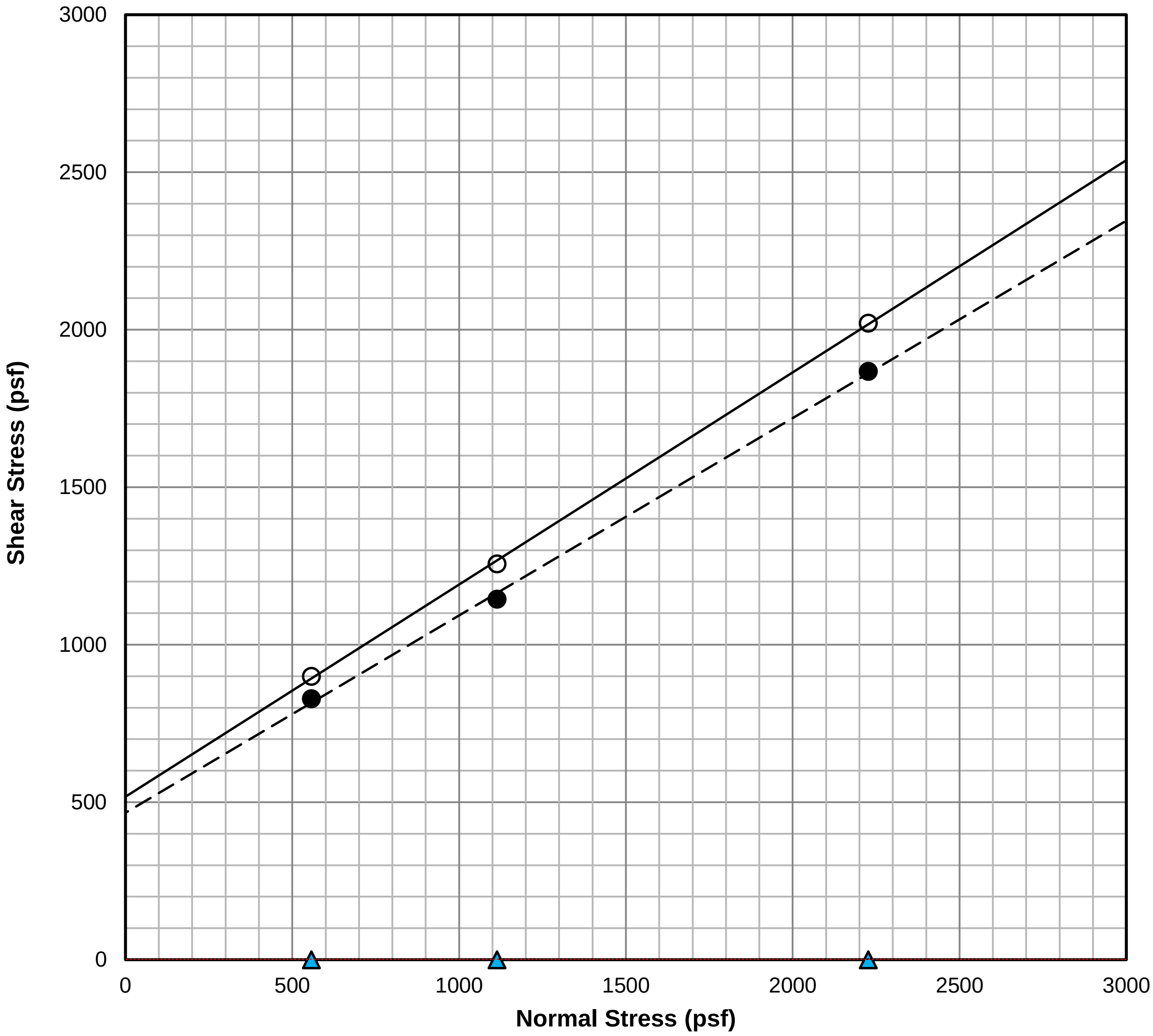
Sample	Symbol	Description	Soil Type [USCS]	Shear Strength	Friction Angle φ [degrees]	Cohesion c [psf]
B-2 @ 5'	—○—	Clayey Sand	SC	Peak	29	308
B-2 @ 5'	— ● —	Clayey Sand	SC	Ultimate	28	201
B-2 @ 5'	- - ▲ - -	Clayey Sand	SC	*Residual	N/A	N/A

Sample Moisture [%]	Saturated Moisture [%]	Dry Unit Weight [pcf]
17.8	20.0	111.5

ASTM D-3080 (MODIFIED FOR CONSOLIDATED UNDRAINED CONDITION)

GEO-ETKA, INC.

DIRECT SHEAR TEST RESULTS



Sample	Symbol	Description	Soil Type [USCS]	Shear Strength	Friction Angle φ [degrees]	Cohesion c [psf]
B-4 @ 5'	—○—	Silty Sand w/ Gravel	SM	Peak	34	517
B-4 @ 5'	— —●— —	Silty Sand w/ Gravel	SM	Ultimate	32	466
B-4 @ 5'	- - ▲ - - -	Silty Sand w/ Gravel	SM	*Residual	N/A	N/A

Sample Moisture [%]	Saturated Moisture [%]	Dry Unit Weight [pcf]
13.1	17.9	107.0

ASTM D-3080 (MODIFIED FOR CONSOLIDATED UNDRAINED CONDITION)

GEO-ETKA, INC.

EXPANSION INDEX TEST

(ASTM D4829)

BORING NUMBER AND SAMPLE DEPTH:	B-1 @ 5'
SOIL TYPE (USCS):	CL
CONFINING PRESSURE (psf):	144
INITIAL MOISTURE CONTENT (%):	11.1
FINAL MOISTURE CONTENT (%):	20.3
DRY DENSITY (pcf):	108.6
EXPANSION INDEX:	37
EXPANSION POTENTIAL:	Low
DATE TESTED:	2/25/2022
TESTED BY:	HMN

GEO-ETKA, INC.	PRELIMINARY SOIL INVESTIGATION REPORT Proposed Commercial Development 2895 S. Mail Street Corona, California	Project No. Checked: Checked by: Exhibit:	FP-11936-22 2/25/2022

SOLUBLE SULFATE AND CHLORIDE TEST RESULTS

Project Name 2895 S. Main Street

Test Date 2/25/2022

Project No. PF-11936-22

Date Sampled 2/05/2022

Project Location Corona, Ca.

Sampled By MN

Location in Structure B-4 @ 0-5’

Sample Type Bulk

Sampled Classification SM

Tested By MN

TESTING INFORMATION

Sample weight before drying	327.4
Sample weight after drying	300.0
Sample Weight Passing No. 10 Sieve	100.0
Moisture	9.1%

Location	Mixing Ratio	Dilution Factor	Sulfate Reading (ppm)	Sulfate Content (ppm)	(%)
B-1	3	1	200	600	0.06
			Average		

Chloride Reading (ppm)	Chloride Content (ppm)	(%)
Average		

pH	
Average	

ACI 318-19 Table 19.3.2.1 - Requirements for Concrete by Exposure Class

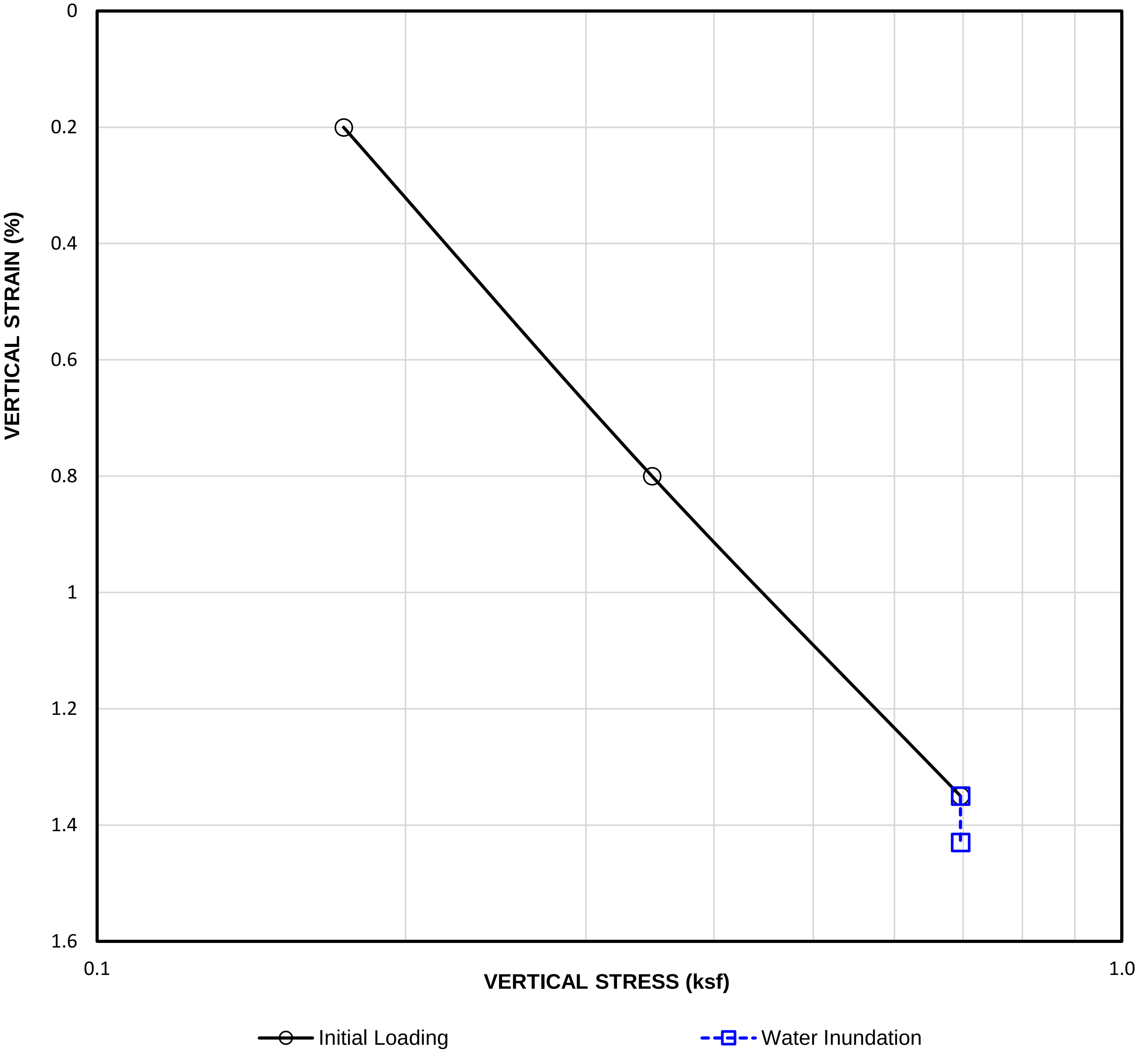
Exposure Class		Water-Soluble Sulfate (%)	Maximum *w/cm*	Minimum f’*c* (psi)	Cementitous Material (Types) ASTM C150-	ASTM C595	ASTM C1157	Calcium Chloride Admixture
S0		<0.10	N/A	2500	No Type Restriction	No Type Restriction	No Type Restriction	No Restriction
S1		0.10 to 0.20	0.50	4000	II	Type IP, IS, or IT with (MS) Designation	MS	No Restriction
S2		0.20 to 2.00	0.45	4500	V	Type IP, IS, or IT with (HS) Designation	HS	Not Permitted
S3	Option 1	>2.00	0.45	4500	V + Pozzolan or Slag Cement	Type IP, IS, or IT with (HS) Designation + Pozzolan or Slag Cement	HS + Pozzolan or Slag Cement	Not Permitted
	Option 2	>2.00	0.40	5000	V	Types with (HS) designation	HS	Not Permitted

Exposure Class	Maximum *w/cm*	Minimum f’*c* (psi)	Maximum Water-Soluble Chloride ion (Cl^-) Content in Concrete, Percent by Wight of Cement Nonprestressed Concrete	Prestressed Concrete	Additional Provisions
C0	N/A	2500	1.00	0.06	None
C1	N/A	2500	0.30	0.06	None
C2	0.40	5000	0.15	0.06	Concrete Cover

Caltrans classifies a site as corrosive to structural concrete as an area where soil and/or water contains >500pp chloride, >2000ppm sulfate, or has a pH <5.5. A minimum resistivity of less than 1000 ohm-cm indicates the potential for corrosive environment requiring testing for the above criteria.

The information in this form is not intended for corrosion engineering design. If corrosion is critical, a corrosion specialist should be contacted to provide further recommendations.

SWELL/COLLAPSE TEST REPORT



Sampler Type:	California Ring Sampler		
Diameter(in):	2.41	Height(in):	1.0
Overburden Pressure, P_0	0.3	tsf	
Preconsol. Pressure, P_c	N/A	ksf	
LL: --	PL: --	PI: --	
Specific Gravity, G_S	2.6	(Assumed)	
% Collapse:	0.08 %	"No Problem"	
Sample Location:	B-3 @ 5'		
Soil Classification:	SM		

Condition:		Before Test			After Test	
Water Content:	w_0 =	16.4	%	w_f =	19.4	%
Void Ratio:	e_0 =	0.466		e_f =	0.445	
Saturation:	S_0 =	91.8	%	S_f =	113.3	%
Dry Density:	γ_d =	110.6	pcf	γ_d =	112.3	pcf

SWELL/COLLAPSE TEST

(ASTM D4546, Method B)

GEO-ETKA, INC.

APPENDIX D

Latitude, Longitude: 33.846352, -117.570124

Date	2/25/2022, 9:41:45 AM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Default (See Section 11.4.3)

Type	Value	Description
S_S	2.35	MCE_R ground motion. (for 0.2 second period)
S_1	0.905	MCE_R ground motion. (for 1.0s period)
S_{MS}	2.82	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	1.88	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	1.2	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.988	MCE_G peak ground acceleration
F_{PGA}	1.2	Site amplification factor at PGA
PGA_M	1.186	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
SsRT	2.566	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	2.841	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	2.35	Factored deterministic acceleration value. (0.2 second)
S1RT	0.905	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	1.015	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.932	Factored deterministic acceleration value. (1.0 second)
PGAd	0.988	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.903	Mapped value of the risk coefficient at short periods
C_{R1}	0.892	Mapped value of the risk coefficient at a period of 1 s

DISCLAIMER

APPENDIX E

TABLE OF CONTENT

GENERAL

The guidelines contained herein and the standard details attached hereto represent this firm's standard recommendation for grading and other associated operations on construction projects. These guidelines should be considered a portion of the project specifications.

All plates attached hereto shall be considered as part of these guidelines.

The Contractor should not vary from these guidelines without prior recommendation by the Geotechnical Consultant and the approval of the Client or his authorized representative. Recommendation by the Geotechnical Consultant and/or Client should not be considered to preclude requirements for the approval by the controlling agency prior to the execution of any changes.

These Standard Grading Guidelines and Standard Details may be modified and/or superseded by recommendations contained in the text of the preliminary Geotechnical Report and/or subsequent reports.

If disputes arise out of the interpretation of these grading guidelines or standard details, the Geotechnical Consultant shall provide the governing interpretation.

DEFINITION OF TERMS

ALLUVIUM
Unconsolidated soil deposits resulting from flow of water, including sediments deposited in river beds, canyons, flood plains, lakes, fans and estuaries.

AS-GRADED (AS-BUILT): The surface and subsurface conditions at completion of grading.

BACKCUT: A temporary construction slope at the rear of earth retaining structures such as buttresses, shear keys, stabilization fills or retaining walls.

BACKDRAIN: Generally a pipe and gravel or similar drainage system placed behind earth retaining structures such buttresses, stabilization fills, and retaining walls.

BEDROCK: Relatively undisturbed formational rock, more or less solid, either at the surface or beneath superficial deposits of soil.

BENCH: A relatively level step and near vertical rise excavated into sloping ground on which fill is to be placed.

BORROW (Import): Any fill material hauled to the project site from off-site areas.

BUTTRESS FILL::A fill mass, the configuration of which is designed by engineering calculations to retain slope conditions containing adverse geologic features. A buttress is generally specified by minimum key width and depth and by maximum backcut angle. A buttress normally contains a back-drainage system.

CIVIL ENGINEER: The Registered Civil Engineer or consulting firm responsible for preparation of the grading plans, surveying and verifying as-graded topographic conditions.

CLIENT: The Developer or his authorized representative who is chiefly in charge of the project. He shall have the responsibility of reviewing the findings and recommendations made by the Geotechnical Consultant and shall authorize the Contractor and/or other consultants to perform work and/or provide services.

COLLUVIUM: Generally loose deposits usually found near the base of slopes and brought there chiefly by gravity through slow continuous downhill creep (also see Slope Wash).

COMPACTION : Densification of man-placed fill by mechanical means.

CONTRACTOR – A person or company under contract or otherwise retained by the Client to perform demolition, grading and other site improvements.

DEBRIS: All products of clearing, grubbing, demolition, and contaminated soil materials unsuitable for reuse as compacted fill, and/or any other material so designated by the Geotechnical Consultant.

ENGINEERING GEOLOGIST: A Geologist holding a valid certificate of registration in the specialty of Engineering Geology.

ENGINEERED FILL: A fill of which the Geotechnical Consultant or his representative, during grading, has made sufficient tests to enable him to conclude that the fill has been placed in substantial compliance with the recommendations of the Geotechnical Consultant and the governing agency requirements.

EROSION: The wearing away of ground surface as a result of the movement of wind, water, and/or ice.

EXCAVATION: The mechanical removal of earth materials.

EXISTING GRADE: The ground surface configuration prior to grading.

FILL: Any deposits of soil, rock, soil-rock blends or other similar materials placed by man.

FINISH GRADE: The ground surface configuration at which time the surface elevations conform to the approved plan.

GEOFABRIC: Any engineering textile utilized in geotechnical applications including subgrade stabilization and filtering.
GEOLOGIST: A representative of the Geotechnical Consultant educated and trained in the field of geology.
GEOTECHNICAL CONSULTANT: The Geotechnical Engineering and Engineering Geology consulting firm retained to provide technical services for the project. For the purpose of these specifications, observations by the Geotechnical Consultant include observations by the Soil Engineer, Geotechnical Engineer, Engineering Geologist and those performed by persons employed by and responsible to the Geotechnical Consultants.
GEOTECHNICAL ENGINEER: A licensed Geotechnical Engineer or Civil Engineer who applies scientific methods, engineering principles and professional experience to the acquisition, interpretation and use of knowledge of materials of the earth's crust for the evaluation of engineering problems. Geotechnical Engineering encompasses many of the engineering aspects of soil mechanics, rock mechanics, geology, geophysics, hydrology and related sciences.
GRADING: Any operation consisting of excavation, filling or combinations thereof and associated operations.
LANDSIDE DEBRIS: Material, generally porous and of low density, produced from instability of natural or man-made slopes.
MAXIMUM DENSITY: Standard laboratory test for maximum dry unit weight. Unless otherwise specified, the maximum dry unity weight shall be determined in accordance with ASTM Method of Test D 1557-91.
OPTIMUM MOISTURE – Soil moisture content at the test maximum density.
RELATIVE COMPACTION: The degree of compaction (expressed as a percentage) of dry unit weight of a material as compared to the maximum dry unit weight of the material.
ROUGH GRADE: The ground surface configuration at which time the surface elevations approximately conform to the approved plan.
SITE: The particular parcel of land where grading is being performed.
SHEAR KEY: Similar to buttress, however, it is generally constructed by excavating a slot within a natural slope, in order to stabilize the upper portion of the slope without grading encroaching into the lower portion of the slope.
SLOPE: An inclined ground surface, the steepness of which is generally specified as a ration of horizontal:vertical (e.g., 2:1)
SLOPE WASH: Soil and/or rock material that has been transported down a slope by action of gravity assisted by runoff water not confined by channels (also see Colluvium).
SOIL: Naturally occurring deposits of sand, silt, clay, etc., or combinations thereof.
SOIL ENGINEER: Licensed Geotechnical Engineer or Civil Engineer experienced in soil mechanics (also see Geotechnical Engineer).
STABILIZATION FILL: A fill mass, the configuration of which is typically related to slope height and specified by the standards of practice for enhancing the stability of locally adverse conditions. A stabilization fill is normally specified by minimum key width and depth and by maximum backcut angle. A stabilization fill may or may not have a backdrainage system specified.
SUBDRAIN: Generally a pipe and gravel or similar drainage system placed beneath a fill in the alignment of canyons or formed drainage channels.
SLOUGH: Loose, non-compacted fill material generated during grading operations.
TAILINGS: Non-engineered fill which accumulates on or adjacent to equipment haul-roads.
TERRACE: Relatively level step constructed in the face of a graded slope surface for drainage control and maintenance purposes.
TOPSOIL: The presumable fertile upper zone of soil, which is usually darker in color and loose.
WINDROW: A string of large rocks buried within engineered fill in accordance with guidelines set forth by the Geotechnical Consultant.

OBLIGATIONS OF PARTIES

The Geotechnical Consultant should provide observation and testing services and should make evaluations in order to advise the Client on Geotechnical matters. The Geotechnical Consultant should report his findings and recommendations to the Client or his authorized representative.
The client should be chiefly responsible for all aspects of the project. He or his authorized representative has the responsibility of reviewing the findings and recommendations of the Geotechnical Consultant. He shall authorize or cause to have authorized the Contractor and/or other consultants to perform work and/or provide services.

During grading the Client or his authorized representative should remain on-site or should remain reasonably accessible to all concerned parties in order to make decisions necessary to maintain the flow of the project. The Contractor should be responsible for the safety of the project and satisfactory completion of all grading and other associated operations on construction projects, including but not limited to, earthwork in accordance with the project plans, specifications and controlling agency requirements. During grading, the Contractor or his authorized representative should remain on-site. Overnight and on days off, the Contractor should remain accessible.

SITE PREPARATION

The Client, prior to any site preparation or grading, should arrange and attend a meeting among the Grading Contractor, the Design Engineer, the Geotechnical Consultant, representatives of the appropriate governing authorities as well as any other concerned parties. All parties should be given at least 48 hours notice.

Clearing and grubbing should consist of the removal of vegetation such as brush, grass, woods, stumps, trees, roots of trees and otherwise deleterious natural materials from the areas to be graded. Clearing and grubbing should extend to the outside of all proposed excavation and fill areas.

Demolition should include removal of buildings, structures, foundations, reservoirs, utilities (including underground pipelines, septic tanks, leach fields, seepage pits, cisterns, mining shafts, tunnels, etc.) and man-made surface and subsurface improvements from the areas to be graded. Demolition of utilities should include proper capping and/or re-routing pipelines at the project perimeter and cutoff and capping of wells in accordance with the requirements of the governing authorities and the recommendations of the Geotechnical Consultant at the time of the demolition.

Trees, plants or man-made improvements not planned to be removed or demolished should be protected by the Contractor from damage or injury.

Debris generated during clearing, grubbing and/or demolition operations should be wasted from areas to be graded and disposed off-site. Clearing, grubbing and demolition operations should be performed under the observation of the Geotechnical Consultant.

The Client or Contractor should obtain the required approvals for the controlling authorities for the project prior, during and/or after demolition, site preparation and removals, etc. The appropriate approvals should be obtained prior to proceeding with grading operations.

SITE PROTECTION

Protection of the site during the period of grading should be the responsibility of the Contractor. Unless other provisions are made in writing and agreed upon among the concerned parties, completion of a portion of the project should not be considered to preclude that portion or adjacent areas from the requirements for site protection until such time as the entire project is complete as identified by the Geotechnical Consultant, the Client and the regulating agencies.

The Contractor should be responsible for the stability of all temporary excavations. Recommendations by the Geotechnical Consultant pertaining to temporary excavations (e.g., backcuts) are made in consideration of stability of the completed project and therefore, should not be considered to preclude the responsibilities of the Contractor. Recommendations by the Geotechnical Consultant should not be considered to preclude more restrictive requirements by the regulating agencies.

Precautions should be taken during the performance of site clearing, excavations and grading to protect the work site from flooding, ponding, or inundation by poor or improper surface drainage. Temporary provisions should be made during the rainy season to adequately direct surface drainage away from and off the work site. Where low areas can not be avoided, pumps should be kept on hand to continually remove water during periods of rainfall.

During periods of rainfall, plastic sheeting should be kept reasonably accessible to prevent unprotected slopes from becoming saturated. Where necessary during periods of rainfall, the Contractor should install check-dams de-silting basins, rip-rap, sandbags or other devices or methods necessary to control erosion and provide safe conditions.

During periods of rainfall, the Geotechnical Consultant should be kept informed by the Contractor as to the nature of remedial or preventative work being performed (e.g., pumping, placement of sandbags or plastic sheeting, other labor, dozing, etc.).

Following periods of rainfall, the Contractor should contact the Geotechnical Consultant and arrange a walk-over of the site in order to visually assess rain related damage. The Geotechnical Consultant may also recommend excavations and testing in order to aid in his assessments. At the request of the Geotechnical Consultant, the Contractor shall make excavations in order to evaluate the extent of rain related damage.
Rain-related damage should be considered to include, but may not be limited to, erosion, silting, saturation, swelling, structural distress and other adverse conditions identified by the Geotechnical Consultant. Soil adversely affected should be classified as Unsuitable Materials and should be subject to overexcavation and replaced with compacted fill or other remedial grading as recommended by the Geotechnical Consultant.
Relatively level areas, where saturated soils and/or erosion gullies exist to depths greater then 1 foot, should be overexcavated to unaffected, competent material. Where less than 1 foot in depth, unsuitable materials may be processed in-place to achieve near optimum moisture conditions, then thoroughly recompacted in accordance with the applicable specifications. If the desired results are not achieved, the affected materials should be overexcavated then replaced in accordance with the applicable specifications.
In slope areas, where saturated soil and/or erosion gullies exist to depths of greater than 1 foot, should be over-excavated to unaffected, competent material. Where affected materials exist to depths of 1 foot or less below proposed finished grade, remedial grading by moisture conditioning in-place, followed by thorough recompaction in accordance with the applicable grading guidelines herein may be attempted. If the desired results are not achieved, all affected materials should be overexcavated and replaced as compacted fill in accordance with the slope repair recommendations herein. As field conditions dictate, other slope repair procedures may be recommended by the Geotechnical Consultant.

EXCAVATIONS

UNSUITABLE MATERIALS:

Materials which are unsuitable should be excavated under observation and recommendations of the Geotechnical Consultant. Unsuitable materials include, but may not be limited to dry, loose, soft, wet, organic compressible natural soils and fractured, weathered, soft, bedrock and nonengineered or otherwise deleterious fill materials.
Materials identified by the Geotechnical Consultant as unsatisfactory due to its moisture conditions should be overexcavated, watered or dried, as needed, and thoroughly blended to uniform near optimum moisture condition (per Moisture guidelines presented herein) prior to placement as compacted fill.

CUT SLOPES:

Unless otherwise recommended by the Geotechnical Consultant and approved by the regulating agencies, permanent cut slopes should not be steeper than 2:1 (horizontal:vertical).
If excavations for cut slopes expose loose, cohesionless, significantly fractured or otherwise suitable material, overexcavation and replacement of the unsuitable materials with a compacted stabilization fill should be accomplished as recommended by the Geotechnical Consultant. Unless otherwise specified by the Geotechnical Consultant, stabilization fill construction should conform to the requirements of the Standard Details.
The Geotechnical Consultant should review cut slopes during excavation. The Geotechnical Consultant should be notified by the contractor prior to beginning slope excavations.
If during the course of grading, adverse or potentially adverse geotechnical conditions are encountered which were not anticipated in the preliminary report, the Geotechnical Consultant should explore, analyze and make recommendations to treat these problems.
When cuts slopes are made in the direction of the prevailing drainage, a non-erodible diversion swale (brow ditch) should be provided at the top-of-cut.

PAD AREAS:

All lot pad areas, including side yard terraces, above stabilization fills or buttresses should be over-excavated to provide for a minimum of 3-feet (refer to Standard Details) of compacted fill over the entire pad area. Pad areas with both fill and cut materials exposed and pad areas containing both very shallow (less than 3-feet) and deeper fill should be over- thickness (refer to Standard Details).
Cut areas exposing significantly varying material types should also be overexcavated to provide for at least a 3-foot thick compacted fill blanket. Geotechnical conditions may require greater depth of overexcavation. The actual depth should be delineated by the Geotechnical Consultant during grading.

For pad areas created above cut or natural slopes, positive drainage should be established away from the top-of-slope. This may be accomplished utilizing a berm and/or an appropriate pad gradient. A gradient in soil areas away from the top-of-slope of 2 percent or greater is recommended.

COMPACTED FILL

All fill materials should be compacted as specified below or by other methods specifically recommended by the Geotechnical Consultant. Unless otherwise specified, the minimum degree of compaction (relative compaction) should be 90 percent of the laboratory maximum density.

PLACEMENT

Prior to placement of compacted fill, the Contractor should request a review by the Geotechnical Consultant of the exposed ground surface. Unless otherwise recommended, the exposed ground surface should then be scarified (6-inches minimum), watered or dried as needed, thoroughly blended to achieve near optimum moisture conditions, then thoroughly compacted to a minimum of 90 percent of the maximum density. The review by the Geotechnical Consultants should not be considered to preclude requirements of inspection and approval by the governing agency.

Compacted fill should be placed in thin horizontal lifts not exceeding 8-inches in loose thickness prior to compaction. Each lift should be watered or dried as needed, thoroughly blended to achieve near optimum moisture conditions then thoroughly compacted by mechanical methods to a minimum of 90 percent of laboratory maximum dry density. Each lift should be treated in a like manner until the desired finished grades are achieved.

The Contractor should have suitable and sufficient mechanical compaction equipment and watering apparatus on the job site to handle the amount of fill being placed in consideration of moisture retention properties of the materials. If necessary, excavation equipment should be “shut down” temporarily in order to permit proper compaction of fills. Earth moving equipment should only be considered a supplement and not substituted for conventional compaction equipment.

When placing fill in horizontal lifts adjacent to areas sloping steeper than 5:1 (horizontal:vertical), horizontal keys and vertical benches should be excavated into the adjacent slope area. Keying and benching should be sufficient to provide at least 6-foot wide benches and minimum of 4-feet of vertical bench height within the firm natural ground, firm bedrock or engineered compacted fill. No compacted fill should be placed in an area subsequent to keying and benching until the area has been reviewed by the Geotechnical Consultant. Material generated by the benching operation should be moved sufficiently away from the bench area to allow for the recommended review of the horizontal bench prior to placement of fill. Typical keying and benching details have been included within the accompanying Standard Details.

Within a single fill area where grading procedures dictate two or more separate fills, temporary slopes (false slopes) may be created. When placing fill adjacent to a false slope, benching should be conducted in the same manner as above described. At least a 3-foot vertical bench should be established within the firm core of adjacent approved compacted fill prior to placement of additional fill. Benching should proceed in at least 3-foot vertical increments until the desired finished grades are achieved.

Fill should be tested for compliance with the recommended relative compaction and moisture conditions. Field density testing should conform to ASTM Method of Testing D 1556-64, D 2922-78 and/or D2937-71. Tests should be provided for about every 2 vertical feet or 1,000 cubic yards of fill placed. Actual test intervals may vary as field conditions dictate. Fill found not to be in conformance with the grading recommendations should be removed or otherwise handled as recommended by the Geotechnical Consultant.

The Contractor should assist the Geotechnical Consultant and/or his representative by digging test pits for removal determinations and/or for testing compacted fill.

As recommended by the Geotechnical Consultant, the Contractor should “shutdown” or remove any grading equipment from an area being tested.

The Geotechnical Consultant should maintain a plan with estimated locations of field tests. Unless the client provides for actual surveying of test locations, by the Geotechnical Consultant should only be considered rough estimates and should not be utilized for the purpose of preparing cross sections showing test locations or in any case for the purpose of after-the-fact evaluating of the sequence of fill placement.

MOISTURE

For field testing purposes, “near optimum” moisture will vary with material type and other factors including compaction procedures. “Near optimum” may be specifically recommended in Preliminary Investigation Reports and/or may be evaluated during grading.

Prior to placement of additional compacted fill following an overnight or other grading delay, the exposed surface of previously compacted fill should be processed by scarification, watered or dried as needed, thoroughly blended to near-optimum moisture conditions, then recompacted to a minimum of 90 percent of laboratory maximum dry density. Where wet or other dry or other unsuitable materials exist to depths of greater than one foot, the unsuitable materials should be overexcavated.

Following a period of flooding, rainfall or overwatering by other means, no additional fill should be placed until damage assessments have been made and remedial grading performed as described herein.

FILL MATERIAL

Excavated on-site materials which are acceptable to the Geotechnical Consultant may be utilized as compacted fill, provided trash, vegetation and other deleterious materials are removed prior to placement.

Where import materials are required for use on-site, the Geotechnical Consultant should be notified at least 72 hours in advance of importing, in order to sample and test materials from proposed borrow sites. No import materials should be delivered for use on-site without prior sampling and testing by Geotechnical Consultant.

Where oversized rock or similar irreducible material is generated during grading, it is recommended, where practical, to waste such material off-site or on-site in areas designated as “nonstructural rock disposal areas”. Rock placed in disposal areas should be placed with sufficient fines to fill voids. The rock should be compacted in lifts to an unyielding condition. The disposal area should be covered with at least 3-feet of compacted fill, which is free of oversized material. The upper 3-feet should be placed in accordance with the guidelines for compacted fill herein.

Rocks 3 inches in maximum dimension and smaller may be utilized within the compacted fill, provided they are placed in such a manner that nesting of the rock in avoided. Fill should be placed and thoroughly compacted over and around all rock. The amount of rock should not exceed 40 percent by dry weight passing the $^3/_4$-inch sieve size. The 3-inch and 40 percent recommendations herein may vary as field conditions dictate.

During the course of grading operations, rocks or similar irreducible materials greater than 3-inch maximum dimension (oversized material) may be generated. These rocks should not be placed within the compacted fill unless placed as recommended by the Geotechnical Consultant.

Where rocks or similar irreducible materials of greater that 3-inches but less than 4-feet of maximum dimension are generated during grading, or otherwise desired to be placed within an engineered fill, special handling in accordance with the accompanying Standard Details is recommended. Rocks greater than 4 feet should be broken down or disposed off-site. Rocks up to 4-feet maximum dimension should be placed below the upper 10-feet of any fill and should not be closer than 20-feet to any slope face. These recommendations could vary as locations of improvements dictate. Where practical, oversized material should not be placed below areas where structures of deep utilities are proposes.

Oversized material should be placed in windrows on a clean, overexcavated or unyielding compacted fill or firm natural ground surface. Select native or imported granular soil (S.E. 30 or higher) should be placed and thoroughly flooded over and around all windrowed rock, such that voids are filled. Windrows of oversized material should be staggered so that successive strata of oversized material are not in the same vertical plane.

It may be possible to dispose of individual larger rock as field conditions dictate and as recommended by the Geotechnical Consultant at time of placement.

Material that is considered unsuitable by the Geotechnical Consultant should not be utilized in the compacted fill.

During grading operations, placing and mixing the materials from the cut and/or borrow areas may result in soil mixtures which possess unique physical properties. Testing may be required of samples obtained directly from the fill areas in order to verify conformance with the specifications. Processing of these additional samples may take two or more working days. The Contractor may elect to move the operation to other areas within the project, or may continue placing compacted fill pending laboratory and field test results. Should he elect the second alternative, fill placed is done so at the Contractor’s risk.

Any fill placed in areas not previously reviewed and evaluated by the Geotechnical Consultant, and/or in other areas, without prior notification to the Geotechnical Consultant may require removal and recompaction at the Contractor's expense. Determination of overexcavations should be made upon review of field conditions by the Geotechnical Consultant.

FILL SLOPES

Unless otherwise recommended by the Geotechnical Consultant and approved by the regulating agencies, permanent fill slopes should not be steeper than 2:1 (horizontal to vertical).

Except as specifically recommended otherwise or as otherwise provided for in these grading guidelines (Reference Fill Materials), compacted fill slopes should be overbuilt and cut back to grade, exposing the firm, compacted fill inner core. The actual amount of overbuilding may vary as field conditions dictate. If the desired results are not achieved, the existing slopes should be overexcavated and reconstructed under the guidelines of the Geotechnical Consultant. The degree of overbuilding shall be increased until the desired compacted slope surface condition is achieved. Care should be taken by the Contractor to provide thorough mechanical compaction to the outer edge of the overbuilt slope surface.

Although no construction procedure produces a slope free from risk of future movement, overfilling and cutting back of slope to a compacted inner core is, given no other constraints, the most desirable procedure. Other constraints, however, must often be considered. These constraints may include property line situations, access, the critical nature of the development, and cost. Where such constraints are identified, slope face compaction may be attempted by conventional construction procedures including backrolling techniques upon specific recommendations by the Geotechnical Consultant.

As a second best alternative for slopes of 2:1 (horizontal to vertical) or flatter, slope construction may be attempted as outlined herein. Fill placement should proceed in thin lifts, (i.e., 6 to 8 inch loose thickness). Each lift should be moisture conditioned and thoroughly compacted. The desired moisture condition should be maintained and/or reestablished, where necessary, during the period between successive lifts. Selected lifts should be tested to ascertain that desired compaction is being achieved. Care should be taken to extend compactive effort to the outer edge of the slope. Each lift should extend horizontally to the desired finished slope surface or more as needed to ultimately establish desired grades. Grade during construction should not be allowed to roll off at the edge of the slope. It may be helpful to elevate slightly the outer edge of the slope. Slough resulting from the placement of individual lifts should not be allowed to drift down over previous lifts. At intervals not exceeding 4-feet in vertical slope height or the capability of available equipment, whichever is less, fill slopes should be thoroughly backrolled utilizing a conventional sheepsfoot-type roller. Care should be taken to maintain the desired moisture conditions and/or reestablishing same as needed prior to backrolling. Upon achieving final grade, the slopes should again be moisture conditioned and thoroughly backrolled. The use of a side-boom roller will probably be necessary and vibratory methods are strongly recommended. Without delay, so as to avoid (if possible) further moisture conditioning, the slopes should then be grid-rolled to achieve a relatively smooth surface and uniformly compact condition.

In order to monitor slope construction procedures, moisture and density tests will be taken at regular intervals. Failure to achieve the desired results will likely result in a recommendation by the Geotechnical Consultant to overexcavate the slope surfaces followed by reconstruction of the slopes utilizing overfilling and cutting back procedures and/or further attempt at the conventional backrolling approach. Other recommendations may also be provided which would be commensurate with field conditions.

Where placement of fill above a natural slope or above a cut slope is proposed, the fill slope configuration as presented in the accompanying standard Details should be adopted.

For pad areas above fill slopes, positive drainage should be established away from the top-of-slope. This may be accomplished utilizing a berm and pad gradients of at least 2-percent in soil area.

OFF-SITE FILL

Off-site fill should be treated in the same manner as recommended in these specifications for site preparation, excavation, drains, compaction, etc.

Off-site canyon fill should be placed in preparation for future additional fill, as shown in the accompanying Standard Details.

Off-site fill subdrains temporarily terminated (up canyon) should be surveyed for future relocation and connection.

DRAINAGE

Canyon sub-drain systems specified by the Geotechnical Consultant should be installed in accordance with the Standard Details.

Typical sub-drains for compacted fill buttresses, slope stabilization or sidehill masses, should be installed in accordance with the specifications of the accompanying Standard Details.

Roof, pad and slope drainage should be directed away from slopes and areas of structures to suitable disposal areas via non-erodible devices (i.e., gutters, downspouts, concrete swales).

For drainage over soil areas immediately away from structures (i.e., within 4-feet), a minimum of 4 percent gradient should be maintained. Pad drainage of at least 2 percent should be maintained over soil areas. Pad drainage may be reduced to at least 1 percent for projects where no slopes exist, either natural or man-made, or greater than 10-feet in height and where no slopes are planned, either natural or man-made, steeper than 2:1 (horizontal to vertical slope ratio).

Drainage patterns established at the time of fine grading should be maintained throughout the life of the project. Property owners should be made aware that altering drainage patterns can be detrimental to slope stability and foundation performance.

STAKING

In all fill areas, the fill should be compacted prior to the placement of the stakes. This particularly is important on fill slopes. Slope stakes should not be placed until the slope is thoroughly compacted (backrolled). If stakes must be placed prior to the completion of compaction procedures, it must be recognized that they will be removed and/or demolished at such time as compaction procedures resume.

In order to allow for remedial grading operations, which could include overexcavations or slope stabilization, appropriate staking offsets should be provided. For finished slope and stabilization backcut areas, we recommend at least 10-feet setback from proposed toes and tops-of-cut.

SLOPE MAINTENANCE LANDSCAPE PLANTS

In order to enhance superficial slope stability, slope planting should be accomplished at the completion of grading. Slope planting should consist of deep-rooting vegetation requiring little watering. Plants native to the Southern California area and plants relative to native plants are generally desirable. Plants native to other semiarid and arid areas may also be appropriate. A Landscape Architect would be the best party to consult regarding actual types of plants and planting configuration.

IRRIGATION

Irrigation pipes should be anchored to slope faces, not placed in trenches excavated into slope faces.

Slope irrigation should be minimized. If automatic timing devices are utilized on irrigation systems, provisions should be made for interrupting normal irrigation during periods of rainfall.

Though not a requirement, consideration should be give to the installation of near-surface moisture monitoring control devices. Such devices can aid in the maintenance of relatively uniform and reasonably constant moisture conditions.

Property owners should be made aware that overwatering of slopes is detrimental to slope stability.

MAINTENANCE

Periodic inspections of landscaped slope areas should be planned and appropriate measures should be taken to control weeds and enhance growth of the landscape plants. Some areas may require occasional replanting and/or reseeding.

Terrace drains and downdrains should be periodically inspected and maintained free of debris. Damage to drainage improvements should be repaired immediately.

Property owners should be made aware that burrowing animals can be detrimental to slope stability. A preventative program should be established to control burrowing animals.

As a precautionary measure, plastic sheeting should be readily available, or kept on hand, to protect all slope areas from saturation by periods of heavy or prolonged rainfall. This measure is strongly recommended, beginning with the period of time prior to landscape planting.

REPAIRS

If slope failures occur, the Geotechnical Consultant should be contacted for a field review of site conditions and development of recommendations for evaluation and repair.

If slope failure occurs as a result of exposure to periods of heavy rainfall, the failure areas and currently unaffected areas should be covered with plastic sheeting to protect against additional saturation.

In the accompanying Standard Details, appropriate repair procedures are illustrated for superficial slope failures (i.e., occurring typically within the outer 1 foot to 3 feet of a slope face).

TRENCH BACKFILL

Utility trench backfill should, unless otherwise recommended, be compacted by mechanical means. Unless otherwise recommended, the degree of compaction should be a minimum of 95 percent of the laboratory maximum density.

Approved granular material (sand equivalent greater than 30) should be used to bed and backfill utilities to a depth of at least 1 foot over the pipe. This backfill should be uniformly watered, compacted and/or wheel-rolled from the surface to a firm condition for pipe support.

The remainder of the backfill shall be typical on-site soil or imported soil which should be placed in lifts not exceeding 8 inches in thickness, watered or aerated to at least 3 percent above the optimum moisture content, and mechanically compacted to at least 95 percent of maximum dry density (based on ASTM D1557).

Backfill of exterior and interior trenches extending below a 1:1 projection from the outer edge of foundations should be mechanically compacted to a minimum of 95 percent of the laboratory maximum density.

Within slab areas, but outside the influence of foundations, trenches up to 1 foot wide and 2 feet deep may be backfilled with sand and consolidated by uniformly watering or by mechanical means. If on-site materials are utilized, they should be wheel-rolled, tamped or otherwise compacted to a firm condition. For minor interior trenches, density testing may be deleted or spot testing may be elected if deemed necessary, based on review of back-fill operations during construction.

If utility contractors indicate that it is undesirable to use compaction equipment in close proximity to a buried conduit, the Contractor may elect the utilization of light weight compaction equipment and/or shading of the conduit with clean, granular material, which should be thoroughly jetted in-place above the conduit, prior to initiating mechanical compaction procedures. Other methods of utility trench compaction may also be appropriate, upon review by the Geotechnical Consultant at the time of construction.

In cases where clean granular materials are proposed for use in lieu of native materials or where flooding or jetting is proposed, the procedures should be considered subject to review by the Geotechnical Consultant.

Clean Granular backfill and/or bedding are not recommended in slope areas unless provisions are made for a drainage system to mitigate the potential build-up of seepage forces.

STATUS OF GRADING

Prior to proceeding with any grading operation, the Geotechnical Consultant should be notified at least two working days in advance in order to schedule the necessary observation and testing services.

Prior to any significant expansion of cut back in the grading operation, the Geotechnical Consultant should be provided with adequate notice (i.e., two days) in order to make appropriate adjustments in observation and testing services.

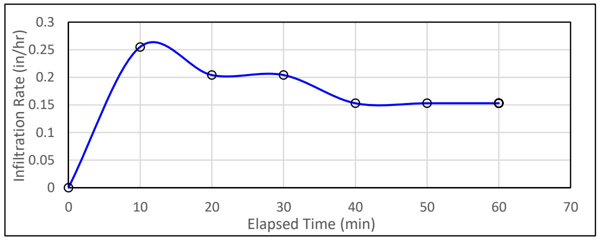
Following completion of grading operations and/or between phases of a grading operation, the Geotechnical Consultant should be provided with at least two working days notice in advance of commencement of additional grading operations.

APPENDIX F

DOUBLE RING INFILTROMETER TEST DATA

(Falling Head Method)

P-1



Project Identification: 2895 S. Main Street, Corona, CA
Project No.: FP-11936-22
Tested By: AM & HMN
Tested Depth: 12"
Depth to water table: N/A
Ground Temp: 23.0 ºC @ depth 12"
Liquid Used: Water pH 7.6

Constants	Area, cm^2	Liq depth, cm	Liquid containers No.	Liquid containers Vol / ΔH
Inner ring	182.3			
Annular space	717.2			

Inner ring penetration 7.7 cm
Outer ring penetration 6.4 cm
Liquid level maintained using: N/A

No.	S or E	Date	Time (hr)	Elpd Time Δ / total (min)	Flow Readings Inner height, cm	Flow Readings Inner flow, cm^3	Flow Readings Annular height, cm	Flow Readings Annular flow, cm^3	Liq Temp ºC	Infiltration Rate Inner in / h	Infiltration Rate Annular in / h	Remarks
1	S	2/7/22	0:00	10	121.0	50	120.0	700	24.0 ºC	0.65	2.31	
	E	2/7/22	0:10		115.0		112.0					
2	S	2/7/22	0:00	20	121.0	40	120.0	650		0.52	2.14	
	E	2/7/22	0:10		116.0		114.0					
3	S	2/7/22	0:00	30	121.0	40	120.0	600		0.52	1.98	
	E	2/7/22	0:10		115.0		115.0					
4	S	2/7/22	0:00	40	121.0	30	120.0	600		0.39	1.98	
	E	2/7/22	0:10		116.0		115.0					
5	S	2/7/22	0:00	50	121.0	30	120.0	650		0.39	2.14	
	E	2/7/22	0:10		116.0		116.0					
6	S	2/7/22	0:00	60	121.0	30	120.0	600		0.39	1.98	
	E	2/7/22	0:10		116.0		116.0					
7	S											
	E											
8	S											
	E											
9	S											
	E											
10	S											
	E											
11	S											
	E											
12	S											
	E											
13	S											
	E											
14	S											
	E											
15	S											
	E											

Formulas:

Inner Infiltration Rate:
$V_{IR} = \Delta V_{IR} / (A_{IR} * \Delta t)$

Annular space infiltration rate:
$V_A = \Delta V_A / (A_A * \Delta t)$

NOTE: When recording Inner height and Annular height, record the total volume of liquid that has left the cylinders (i.e. if cylinders are refilled, add the volume added to all subsequent readings).

DOUBLE RING INFILTROMETER TEST DATA

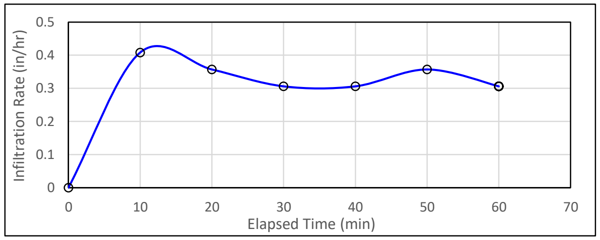
(Falling Head Method)

P-2

Project Identification: 2895 S. Main Street, Corona, CA
Project No.: FP-11936-22
Tested By: AM & HMN
Tested Depth: 12"
Depth to water table: N/A
Ground Temp: 23.0 ºC @ depth 12"
Liquid Used: Water pH 7.6

Constants	Area, cm^2	Liq depth, cm	Liquid containers No.	Liquid containers Vol / ΔH
Inner ring	182.3			
Annular space	717.2			

Inner ring penetration: 7.9 cm
Outer ring penetration: 6.6 cm
Liquid level maintained using: N/A



No.	S or E	Date	Time (hr)	Elpd Time Δ / total (min)	Flow Readings Inner height, cm	Flow Readings Inner flow, cm^3	Flow Readings Annular height, cm	Flow Readings Annular flow, cm^3	Liq Temp ºC	Infiltration Rate Inner in / h	Infiltration Rate Annular in / h	Remarks
1	S	2/7/22	0:00	10	125.0	80	126.0	920	25.0 ºC	1.04	3.03	
	E	2/7/22	0:10		113.0		115.0					
2	S	2/7/22	0:00	20	125.0	70	126.0	680		0.91	2.24	
	E	2/7/22	0:10		117.0		111.0					
3	S	2/7/22	0:00	30	125.0	60	126.0	660		0.78	2.17	
	E	2/7/22	0:10		118.0		113.0					
4	S	2/7/22	0:00	40	125.0	60	126.0	620		0.78	2.04	
	E	2/7/22	0:10		118.0		115.0					
5	S	2/7/22	0:00	50	125.0	70	126.0	630		0.91	2.07	
	E	2/7/22	0:10		118.0		115.0					
6	S	2/7/22	0:00	60	125.0	60	126.0	620		0.78	2.04	
	E	2/7/22	0:10		118.0		116.0					
7	S											
	E											
8	S											
	E											
9	S											
	E											
10	S											
	E											
11	S											
	E											
12	S											
	E											
13	S											
	E											
14	S											
	E											
15	S											
	E											

Formulas:

Inner Infiltration Rate:
$V_{IR} = \Delta V_{IR} / (A_{IR} * \Delta t)$

Annular space infiltration rate:
$V_A = \Delta V_A / (A_A * \Delta t)$

NOTE: When recording Inner height and Annular height, record the total volume of liquid that has left the cylinders (i.e. if cylinders are refilled, add the volume added to all subsequent readings).

Appendix F

GEO-ETKA, INC.