TGR

Geotechnical
Environmental
Hydrogeology
Material Testing
Construction Inspection

March 10, 2020 Project No. 20-6999

Xebec Realty
3010 Old Ranch Parkway, Suite 470
Seal Beach, CA 92660

Attention: Jake Spring, Vice President of Acquisitions

Subject: Limited Geotechnical Investigation Report, 2889 Locust Avenue, Rialto, California

Mr. Spring,

In accordance with your request and authorization, TGR Geotechnical, Inc. (TGR) has performed a preliminary geotechnical investigation for the proposed development at the subject site in the City of Rialto, California. The subject site is currently a 4.8-acre vacant dirt, gravel and cobble covered parcel of land. The site also has stockpiled soils and debris up to approximately 10 feet in height in the northwest, center, and western portions of the site. It is our understanding that the proposed development will consist of a 98,188-sq. ft. industrial building with associated truck docks, drive aisles and vehicle parking. This report presents the findings of our geotechnical investigation, including site seismicity, seismic settlement, liquefaction potential and provides geotechnical design recommendations for the proposed improvements. The work was performed in general accordance with our proposal dated January 16, 2020.

Based on our investigation the proposed development is feasible from a geotechnical viewpoint provided the recommendations presented in this report are implemented during design and construction.

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

Respectfully submitted,

TGR GEOTECHNICAL, INC.

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ATTACHMENTS

Plate 1 – Boring Location Map

Figure 1 – Site Location Map
Figure 2 – Regional Geology Map
Figure 3 – Regional Fault Map
Figure 4 – Seismic Hazard Zone Map

Table 1 – Percolation Test Worksheet

Appendix A – References
Appendix B – Log of Borings
Appendix C – Laboratory Testing Procedures and Results
Appendix D – Site Seismic Design and De-Aggregated Parameters
Appendix E – Standard Grading Specifications

EXECUTIVE SUMMARY

Presented below are significant elements of our findings from a geotechnical viewpoint. These findings are based on our field exploration, laboratory testing, and geologic and engineering analysis.

Geotechnical/Geologic Concerns

- There are no known faults passing through or adjacent to the subject site. The subject site is not located within an Alquist-Priolo Earthquake Fault Zone. The nearest faults to the subject site are the Lytle Creek Fault mapped approximately 1.1 miles to the northeast of the site, the San Jacinto Fault mapped 1.6 miles south of the site, the Cucamonga Fault mapped approximately 3.0 miles northwest of the site, the Rialto-Colton Fault mapped 3.9 miles southeast of the subject site and the Etiwanda Avenue Fault mapped 6.0 miles west of the subject site.
- Onsite soils are granular in nature, correlating to a “ very low” expansion potential.
- It is anticipated that significant quantities of oversized material will be encountered during grading. Oversized material greater than 24 inches shall be disposed of or crushed and mixed with soil to be used as fill.
- Onsite soil stockpile material consists of debris and soils. The stockpile soils without organics are suitable for use as engineered fill provided the soils are cleaned of the debris.
- Excavations in site soils may be cut vertical to a maximum depth of 4 feet. All excavations exceeding 4 feet shall be shored or laid back 1:1 (horizontal to vertical) or flatter.
- At the time of our drilling, groundwater was not encountered to a depth of 17 feet below ground surface. Per USGS groundwater well data, the depth to historic high groundwater is approximately 244 feet below existing ground surface. Groundwater is not expected to impact the proposed development.
- The subject site is not located within an area having a potential for liquefaction. The total seismic settlement is estimated to be approximately 0.5 inches with a differential settlement of 0.25 inches over 30 feet.
- All depressions resulting from demolition activities shall be properly backfilled with engineered fill (minimum 90 percent) under the direction of the geotechnical consultant.
- Percolation test results utilizing the Porchet method indicate an infiltration rate of 15.56 to 30.07 inches per hour within the upper 5 feet within the native soils. A design infiltration rate of 15.5 inches per hour is recommended. These results do not include an applied factor of safety.

Foundations

- The proposed buildings may be supported on conventional shallow pad or continuous footing foundation systems.
- An allowable bearing capacity of 2,500 psf may be utilized for foundation design for footings supported on minimum ninety (90) percent relative compacted engineered fill.

- The minimum recommended footing width is eighteen (18) inches for continuous footing and twenty-four (24) inches for pad footing.
- All shallow foundations should extend a minimum of twenty-four (24) inches below the lowest adjacent grade.
- All shallow foundations shall be supported on three (3) feet or half the width of the footing (whichever is greater) of engineered fill with minimum ninety (90) percent relative compaction at near optimum moisture content.
- Laboratory test results indicate that concrete in contact with onsite soils should be designed for exposure class S0 (minimum 2,500 psi concrete).

Slab-on-Grade

- Slab-on-grade should be a minimum of 5-inches thick.
- Slab-on-grade shall be reinforced with a minimum of No. 4 reinforcing bar on 18-inch centers in two horizontally perpendicular directions.
- The subgrade material should be compacted to a minimum of 90 percent of the maximum laboratory dry density (ASTM 1557) to a minimum depth of three (3) feet.
- Areas requiring moisture sensitive flooring shall be underlain by a minimum 15-mil visqueen (Stego Wrap or equivalent).

Pavement Design

- The pavement section was developed based on a tested “R-Value” for compacted site subgrade soils of 72.

ASPHALT PAVEMENT SECTION					**PCC PAVEMENT SECTION**		
Pavement Utilization	Traffic Index	Asphalt (Inch)	Aggregate Base (Inch)	Total (Inch)	*PCC	Aggregate Base (Inch)	Total (Inch)
Parking Stalls	4.5	3.0	4.0	7.0	--	--	--
Auto Driveways	5.0	3.0	4.0	7.0	--	--	--
Truck Aisles/ Driveways	6.0	4.0	6.0	10.0	*7	-	7
Loading Dock	7.0	4.0	6.0	10.0	*7	-	7

*Minimum concrete compressive strength of 3,500 psi.

INTRODUCTION

Site Descriptions and Proposed Project Development

The subject site is located at 2889 Locust Avenue Avenue (Figure 1) in the City of Rialto, California. The subject site is currently a 4.8-acre vacant dirt, gravel and cobble covered parcel of land. The site also has stockpiled soils and debris up to approximately 10 feet in height in the northwest, center, and western portions of the site. We understand that the proposed development will consist of a 98,188-sq. ft. industrial building with associated truck docks, drive aisles and vehicle parking.

Scope of Work

The scope of work for this geotechnical investigation included the following:

- Site reconnaissance to assess current site conditions and mark borings.
- Sampling and logging six (6) hollow stem auger borings utilizing a hollow stem drill rig to depths ranging from 6 to 17 feet at the subject site to evaluate subsurface soil conditions. The borings were backfilled with cuttings and any excess soil was disposed onsite.
- Percolation testing of the near surface soils (upper 5 feet) at two (2) locations.
- Laboratory testing of selected samples to include in-situ moisture density, maximum density and optimum moisture content, shear, consolidation, corrosion, passing No. 200 sieve and R-value.
- Engineering analysis including site seismicity, foundation design, and settlement potential.
- Preparation of this report summarizing subsurface soil conditions, site seismicity, seismic settlement, hydro-collapse potential and provide pertinent geotechnical/geologic information that may influence the proposed development.

Field Investigation

Field exploration was performed on February 19, 2020 by an engineer from our firm who logged the borings and obtained representative samples, which were subsequently transported to the laboratory for further review and testing. The approximate locations of the borings are indicated on the enclosed Boring Location Map (Plate 1).

The subsurface conditions were explored by drilling, sampling, and logging six (6) borings with a truck mounted hollow stem auger drill rig. Borings B-1 through B-6 were advanced to an approximate depth of six (6) to seventeen (17) feet below existing grade, encountering refusal in each boring. Two (2) borings, P-1 and P-2, were advanced to an approximate depth of five (5) feet for percolation testing. Subsequent to drilling, all borings were backfilled with cuttings and the surface compacted. The log of borings presenting soil conditions and descriptions are presented in Appendix B.

The drill rig was equipped with a sampling apparatus to allow for recovery of driven modified California Ring Sampler (CRS), 3-inch outside diameter, and 2.42-inch inside diameter and SPT samples.

The samples were driven using an automatic 140-pound hammer falling freely from a height of 30 inches. The blow counts for CRS were converted to equivalent SPT blow counts. Soil descriptions were entered on the logs in general accordance with the Unified Soil Classification System (USCS). Driven samples and bulk samples of the earth materials encountered at selected intervals were recovered from the borings. The locations and depths of the soil samples recovered are indicated on the boring logs in Appendix B.

Percolation Testing

Percolation testing was performed at the subject site. Presented below are the infiltration rates per the Porchet Method from the percolation tests performed within the upper 5 feet. These do not include any factor of safety.

• P-1 at 0-5 feet	15.56 inches per hour
• P-8 at 0-5 feet	30.07 inches per hour

Based on the results of the percolation testing, an infiltration rate of 15.5 inches per hour is recommended for the design of storm water infiltration at the subject site. The infiltration test rates were determined utilizing the County of San Bernardino guidelines.

Laboratory Testing

Laboratory tests were performed on representative samples to verify the field classification of the recovered samples and to evaluate the geotechnical properties of the subsurface soils. The following tests were performed:

- In-situ moisture content (ASTM D2216) and dry density (ASTM D7263);
- Maximum Dry Density and Optimum Moisture Content (ASTM D1557);
- Consolidation (ASTM D2435);
- Direct Shear Strength (ASTM D3080);
- R-Value (CAL 301);
- Passing No. 200 sieve (ASTM 1140); and
- Corrosion series:
    1. Soluble Sulfate (CAL.417A);
    2. Soluble Chlorides (CAL.422);
    3. Minimum Resistivity (CAL.643); and
    4. pH.

Laboratory tests for geotechnical characteristics were performed in general accordance with the ASTM procedures. The results of the in-situ moisture content and density tests are shown on the borings logs. The results of the laboratory tests are presented in Appendix C.

GEOTECHNICAL FINDINGS

Geology

Regional Geologic Setting

The project site is located in the southeast portion of the Devore 7.5-minute Quadrangle, San Bernardino, California. Per the Geologic Map of the Devore 7.5-minute Quadrangle, California (Dibblee, 2003), the subject site is underlain by Quaternary alluvial gravel and sand of valley areas, comprised of boulder gravel near mountains, grading outward into finer gravel and sand. Figure 2 presents the Regional Geology Map.

Earth Units

Based on our subsurface investigation, the subject area is underlain by approximately 5 to 10 feet of light brown silty sand and gravel in a dry to slightly moist condition. The silty sand and gravel is underlain by brown to yellow brown gravelly sand a moist condition to 17 feet below existing grade, the maximum depth explored. Detailed descriptions of the earth units encountered in our borings are presented in the log of the borings. (Appendix B)

Onsite soil stockpile material consists of organics and soils with varying amounts of debris. The stockpile soils without organics are suitable for use as engineered fill provided the soils are cleaned of the debris and oversized particles.

Groundwater

Subsurface water was not encountered to a depth of approximately 17 feet below existing grade during the subsurface exploration. USGS groundwater data from wells nearest to the subject site indicate a historic high of approximately 244 feet below existing grade. Seasonal and long-term fluctuations in the groundwater may occur as a result of variations in subsurface conditions, rainfall, run-off conditions and other factors. Therefore, variations from our observations may occur. Static groundwater is not anticipated to impact the proposed development.

Seismic Review

Faulting and Seismicity

The subject site, like the rest of Southern California, is located within a seismically active region as a result of being located near the active margin between the North American and Pacific tectonic plates. The principal source of seismic activity is movement along the northwest-trending regional faults such as the San Andreas, San Jacinto and Elsinore fault zones. These fault systems produce approximately 5 to 35 millimeters per year of slip between the plates.

By definition of the State Mining and Geology Board, an active fault is one which has had surface displacement within the Holocene Epoch (roughly the last 11,000 years). The State Mining and Geology Board has defined a potentially active fault as any fault which has been active during the Quaternary Period (approximately the last 1,600,000 years). These definitions are used in delineating Earthquake Fault Zones as mandated by the Alquist-Priolo Geologic

Hazard Zones Act of 1972 and as subsequently revised in 1994 (Hart, 1997) as the Alquist-Priolo Geologic Hazard Zoning Act and Earthquake Fault Zones.

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

The subject site is not included within any Earthquake Fault Zones as created by the Alquist-Priolo Earthquake Fault Zoning Act (Hart, 1997). Our review of geologic literature pertaining to the site area indicates that there are no known active or potentially active faults located within or immediately adjacent to the subject property.

The nearest fault to the subject site is the Lytle Creek Fault mapped approximately 1.1 miles to the northeast of the site. Other faults nearby include San Jacinto Fault mapped 1.6 miles south of the site, the Cucamonga Fault mapped approximately 3.0 miles northwest of the site, the Rialto-Colton Fault mapped 3.9 miles southeast of the subject site and the Etiwanda Avenue Fault mapped 6.0 miles west of the subject site. The regional fault map, Figure 4, shows the location of the subject site in respect to the regional faults.

Secondary Seismic Hazards

Surface Fault Rupture and Ground Shaking

Since no known faults are located within the site, surface fault rupture is not anticipated. However, due to the close proximity of known active and potentially active faults, severe ground shaking should be expected during the life of the proposed structures.

Liquefaction

Liquefaction is a seismic phenomenon in which loose, saturated, fine-grained granular soils behave similarly to a fluid when subjected to high-intensity ground shaking. Liquefaction occurs when these ground conditions exist: 1) Shallow groundwater; 2) Low density, fine, clean sandy soils; and 3) High-intensity ground motion. Effects of liquefaction can include sand boils, settlement, and bearing capacity failures below foundations.

A review of the Seismic Hazard Zone Map, Ontario Quadrangle indicates that the subject site is not located in an area identified as having a potential for soil liquefaction. Moreover, due to the absence of shallow groundwater, it is our opinion that the potential for liquefaction as a result of ground shaking at the subject site is very low.

Landslide

Landslide involves downhill motion of earth materials during or subsequent to earth shaking. Historically, landslides triggered by earthquakes have been a significant cause of damage. Areas that are most susceptible to earthquake induced landslides are areas with steep slopes in poorly cemented or highly fractured bedrock, areas underlain by loose, weak soils, and areas on or adjacent to existing landslide deposits.

This property is not located within a mapped zone of earthquake induced landslide and is located in a relatively flat area. Based on the above, the potential for earthquake induced landslide is considered very low.

Lateral Spreading

Seismically induced lateral spreading involves primarily movement of earth materials due to earth shaking. Lateral spreading is demonstrated by near-vertical cracks with predominantly horizontal movement of the soil mass involved. The topography in the vicinity of the subject site is relatively flat. Therefore, the potential for lateral spreading at the subject site is considered very low.

DISCUSSIONS AND CONCLUSIONS

General

Based on our field exploration, laboratory testing and engineering analysis, it is our opinion that the proposed structure and proposed grading will be safe against hazard from landslide, settlement, or slippage and the proposed construction will have no adverse effect on the geologic stability of the adjacent properties provided our recommendations presented in this report are followed.

Conclusions

Based on our findings and analyses, the subject site is likely to be subjected to moderate to severe ground shaking due to the proximity of known active and potentially active faults. This may reasonably be expected during the life of the structure and should be designed accordingly.

The primary conditions affecting the proposed project site development are as follows:

- The site is underlain by alluvium generally composed of gravels, cobbles and boulders in a silty sand matrix. **As such, oversized materials are anticipated to be encountered during grading operations.**
- Potential for hydro collapse.

The engineering evaluation performed concerning site preparation and the recommendations presented are based on information provided to us and obtained by us during our office and fieldwork. This report is prepared for the development of a 98,188-sq. ft. industrial building with associated truck docks, drive aisles and vehicle parking at the subject property. In the event that any significant changes are made to the proposed development, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed, and the recommendations of this report are verified or modified in writing by TGR.

RECOMMENDATIONS

Seismic Design Parameters

When reviewing the 2019 California Building Code the following data should be incorporated into the design.

Parameter	**Value**
Latitude (degree)	34.1518
Longitude (degree)	-117.4087
Site Class	D
Site Coefficient, F_a	1.0
Site Coefficient, F_v	2.5
Mapped Spectral Acceleration at 0.2-sec Period, S_s	2.239 g
Mapped Spectral Acceleration at 1.0-sec Period, S_1	0.811 g
Spectral Acceleration at 0.2-sec Period Adjusted for Site Class, S_{MS}	2.239 g
Spectral Acceleration at 1.0-sec Period Adjusted for Site Class, S_{M1}	N/A
Design Spectral Acceleration at 0.2-sec Period, S_{DS}	1.492 g
Design Spectral Acceleration at 1.0-sec Period, S_{D1}	N/A

Site Specific Response Spectra

The USGS Unified Hazard tool, the USGS RTGM Calculator and the USGS App for Deterministic Spectra Acceleration were utilized to develop site specific ground motion spectra. The analysis was performed utilizing the following attenuation relationships that are part of NGA as required by 2019 CBC code requirements.

- Campbell & Bozorgnia (2014)
- Boore, Stewart, Seyhan & Atkinson (2014)
- Chiou & Youngs (2014)
- Abrahamson, Silva & Kamal (2014)

The results of the Site Specific Response Spectra are incorporated in Table 1 and on Figure 1 in Appendix D. The results include deterministic spectra at 5% damping, maximum rotated component at 0.84 fractile and the probabilistic spectra, maximum rotated component at 5% damping for a return period of 2475 year and subsequently multiplied by risk coefficient to obtain the MCER probabilistic spectral acceleration. The Vs30 utilized was 260 m/s.

The above generated spectral accelerations were compared against the minimum code requirements in ASCE7-16 (Chapters 11 and 21) resulting in the final design response spectra which is presented in Table 1 and on Figure 1 in Appendix D.

Based on Table 1 and Figure 1, the recommended Site Specific S_{DS} and S_{D1} are as follows:

$S_{DS} = 1.620$
$S_{D1} = 2.059$

The structural consultant should review the above parameters and the 2019 California Building Code to evaluate the seismic design.

Conformance to the criteria presented in the above table for seismic design does not constitute any type of guarantee or assurance that significant structural damage or ground failure will not occur during a large earthquake event. The intent of the code is “life safety” and not to completely prevent damage of the structure, since such design may be economically prohibitive.

Foundation Design Recommendations

The proposed buildings may be supported on continuous and/or spread footings. Bearing capacity recommendations for shallow foundations are presented below. These recommendations assume that the footings will be supported on a minimum of three (3) feet or half the width of the footing (whichever is greater) of engineered fill.

For foundations supported on three (3) feet or half the width of the footing (whichever is greater) of engineered fill with minimum ninety (90) percent relative compaction at near optimum moisture content, an allowable bearing pressure of 2500 pounds per square foot may be used in design.

All shallow foundations should extend a minimum of twenty-four (24) inches below the lowest adjacent grade. The minimum recommended footing width is eighteen (18) inches for continuous footing and twenty-four (24) inches for pad footing. A minimum reinforcement of two (2) No. 4 steel bar top and two (2) No. 4 steel bar bottom is required for continuous footings from a geotechnical viewpoint. Foundation design details such as concrete strength, reinforcements, etc should be established by the Structural Engineer.

A one-third (1/3) increase on the aforementioned bearing pressure may be used in design for short-term wind or seismic loads.

The total and differential static settlement is anticipated to be 1 inch and 0.5 inches over 60 feet or less. The total and differential seismic settlement is estimated to be 0.5 inches and 0.25 inches over 30 feet, respectively.

Resistance to lateral loads including wind and seismic forces may be provided by frictional resistance between the bottom of concrete and the underlying fill soils and by passive pressure against the sides of the foundations. A coefficient of friction of 0.40 may be used between concrete foundation and underlying soil. The recommended passive pressure of the engineered fill may be taken as an equivalent fluid pressure of 250 pounds per cubic foot (2,500 psf max).

Footings located near property lines where the lateral removal cannot be achieved shall be designed for a reduced bearing capacity of 1,500 pounds per square foot and the passive resistance shall be ignored.

Retaining Wall Recommendations

The following soil parameters may be used for the design of the retaining wall with level backfill and a maximum height of six (6) feet:

Conditions	**Parameters**
Friction Angle	32°
Active (Level)	40 psf/ft
Passive	250 (maximum 2,500 psf)
Friction Coefficient	0.40

- The passive pressure in the upper 6 inches of soil not confined by slabs or pavement should be neglected.
- All footings should meet the setback requirements presented in 2019 CBC.
- The retaining wall should be provided with a drainage system (Miradrain or equivalent) to prevent buildup of hydrostatic pressure behind the walls. We do not recommend omitting the drains behind walls.

In addition to the above lateral forces due to retained earth, surcharge due to improvements, such as an adjacent structure, should be considered in the design of the retaining wall. Loads applied within a 1:1 projection from the surcharging structure on the stem of the wall shall be considered as lateral surcharge. For lateral surcharge conditions, we recommend utilizing a horizontal load equal to 50 percent of the vertical load, as a minimum. This horizontal load should be applied below the 1:1 projection plane. To minimize the surcharge load from an adjacent footing, deepened footings may be considered.

Slab-On-Grade

Slab-on-grade should be a minimum of 5-inches thick and reinforced with a minimum of No. 4 reinforcing bar on 18-inch centers in two horizontally perpendicular directions. Reinforcing should be properly supported to ensure placement near the vertical midpoint of the slab. "Hooking" of the reinforcement is not considered an acceptable method of positioning the steel. The slab should not be structurally connected to the buildings. The subgrade material should be compacted to a minimum of 90 percent of the maximum laboratory dry density to a minimum depth of three (3) feet. Prior to placement of concrete, the subgrade soils should be moistened to near optimum moisture content and verified by our field representative.

The actual thickness and reinforcement of the slab shall be designed by the structural engineer and should include the anticipated loading condition (fork lift etc.) and the anticipated use of the building. For moisture sensitive flooring, the floor slab should be underlain by minimum 15-mil impermeable polyethylene membrane (Stego Wrap, Moistop Plus, or any equivalent meeting the requirements of ASTM E1745, Class A rating) as a capillary break. Sand may be placed above and below the impermeable polyethylene membrane at the discretion of the project structural engineer/concrete contractor for proper curing and finish of the concrete slab-on-grade and protection of the membrane and is considered outside the scope of geotechnical engineering.

Flatwork

Flatwork should be a minimum of 4-inches thick should be reinforced with a minimum of No. 3 reinforcing bar on 24-inch centers in two horizontally perpendicular directions. Reinforcing should be properly supported to ensure placement near the vertical midpoint of the slab. "Hooking" of the reinforcement is not considered an acceptable method of positioning the steel. The subgrade material should be compacted to a minimum of 90 percent of the maximum laboratory dry density (ASTM 1557) to a minimum depth of two (2) feet. Prior to placement of concrete, the subgrade soils should be moistened to near percent of optimum moisture content and verified by our field representative. The actual thickness and reinforcement of the slab shall be designed by the structural engineer and should include the anticipated loading condition.

Modulus of Subgrade Reaction

The modulus of subgrade reaction may be taken as 175 pci (K_1) for one (1) square foot footing/slab founded on site soils. This value should be reduced for change in size per the following formula:

$$K = K_1 \left(\frac{\mathbf{B+1}}{\mathbf{2B}}\right)^2$$

Where B = Width of Mat;
K = Coefficient of Subgrade Reaction of Footings Measuring B(ft) x B(ft).

Cement Type and Corrosion

Based on laboratory testing concrete used should be designed in accordance with the provisions of ACI 318-14, Chapter 19 for Exposure Class S0 with a minimum unconfined compressive strength of 2,500 psi.

Corrosion tests indicate a mild corrosion potential for ferrous metals exposed to site soils.

TGR does not practice corrosion engineering. If needed, a qualified specialist should review the site conditions and evaluate the corrosion potential of the site soil to the proposed improvements and to provide the appropriate corrosion mitigations for the project.

Expansive Soil

Onsite soils are granular in nature, correlating to a “very low” expansion potential.

Shrinkage/Subsidence

Removal and recompaction of the near surface soils is estimated to result in shrinkage ranging from 5 to 10 percent. Minor ground subsidence is expected to occur in the soils below the zone of removal, due to settlement and machinery working. The subsidence is estimated to be between one and two tenths of a foot.

Site Development Recommendations

General

During earthwork construction, all site preparation and the general procedures of the contractor should be observed, and the fill selectively tested by a representative of TGR. If unusual or unexpected conditions are exposed in the field, they should be reviewed by this office and if warranted, modified and/or additional recommendations will be offered. During demolition of the existing building and associated site work, voids created from removal of buried elements (footings, pipelines, septic pits, etc.) shall be backfilled with engineered fill (min 90% relative compaction per ASTM D1557) under the observation of TGR.

Grading

All grading should conform to the guidelines presented in the California Building Code (2019 edition), except where specifically superseded in the text of this report. Prior to grading, TGR's representative should be present at the pre-construction meeting to provide grading guidelines, if needed, and review any earthwork. Oversize particles may be encountered during grading. All particles greater than 4-inches shall be removed and disposed offsite.

It is recommended that at a minimum the upper 5 feet of site soils below existing grade be removed and replaced as engineered fill within the building footprint. The footings shall be supported on a minimum of three (3) feet or half the width of the footing (whichever is greater) of engineered fill. A minimum two (2) feet of engineered fill is recommended under flatwork and pavement. Site soils could be reused as engineered fill provided, they are free of oversized particles and the recommendations presented in this report are implemented. Exposed bottoms should be scarified a minimum of 6-inches, moisture conditioned to near optimum moisture and compacted to a minimum ninety (90) percent relative compaction. Subsequently, site fill soils should be re-compacted to a minimum of ninety (90) percent relative compaction at near optimum moisture content. The lateral extent of removals beyond the building/structure/footing limits should be equal to at least 5 feet.

The depth of over-excavation should be reviewed by the Geotechnical Consultant during the actual construction. Any subsurface obstruction buried structural elements, and unsuitable material encountered during grading, should be immediately brought to the attention of the Geotechnical Consultant for proper exposure, removal and processing, as recommended.

Fill Placement

Prior to any fill placement TGR should observe the exposed surface soils. The site soils may be re-used as engineered fill provided, they are free of organic content and particle size greater than 4-inches. All particles greater than 4-inches shall be removed and disposed offsite. Fill shall be moisture conditioned to near optimum moisture and compacted to a minimum relative compaction of ninety (90) percent in accordance with ASTM D1557. Any import soils shall be non-expansive and approved by TGR Geotechnical Inc.

Based on our investigation, it is anticipated that significant quantities of oversized material (particles greater than 12 inches requiring special handling for disposal may be encountered during construction. Oversized material between 12 and 24 inches may be placed in areas of deep fill at depths below anticipated excavations (i.e. footings, utility trenches, etc.). Oversized material greater than 24 inches should be disposed of, either as landscape material or by removal from the site. Alternatively, oversized material may be crushed and mixed with soil to be used as fill. When placing fill with significant quantities of rock, it is essential that complete flooding occurs during grading to wash finer particles of soil into the voids between the rock.

Compaction

Prior to fill placement, the exposed surface should be scarified to a minimum depth of six (6) inches, fill placed in six (6) inch loose lifts moisture conditioned to near optimum moisture and compacted to a minimum relative compaction of ninety (90) percent in accordance with ASTM D 1557.

Trenching

All excavations should conform to CAL-OSHA and local safety codes.

Temporary Excavation and Shoring

Temporary construction excavations may be anticipated during the proposed development. Soils may be cut vertically without shoring to a depth of approximately four (4) feet below adjacent surrounding grade. For deeper cuts, the slopes should be properly shored or sloped back to at least 1H:1.5V (Horizontal: Vertical) or flatter. The exposed slope face should be kept moist (but not saturated) during construction to reduce local sloughing. No surcharge loads should be permitted within a horizontal distance equal to the height of cut from the toe of excavation unless the cut is properly shored. Excavations that extend below an imaginary plane inclined at 45 degrees below the edge of any nearby adjacent existing site facilities should be properly shored to maintain foundation support at the adjacent structures. Temporary excavation adjacent to existing footings may require A-B-C slot cuts.

Drainage

Positive site drainage should be maintained at all times. Water should be directed away from foundations and not allowed to pond and/or seep into the ground. Pad drainage should be directed towards the street/parking or other approved area.

Utility Trench Backfill

All utility trench backfills in structural areas and beneath hardscape features should be brought to near optimum moisture content and compacted to a minimum relative compaction of ninety (90) percent of the laboratory standard. Flooding/jetting is not recommended.

Sand backfill, (unless trench excavation material), should not be allowed in parallel exterior trenches adjacent to and within an area extending below a 1:1 plane projected from the outside bottom edge of the footing. All trench excavations should minimally conform to CAL-OSHA and local safety codes. Soils generated from utility trench excavations may be used provided it is moisture conditioned and compacted to ninety (90) percent minimum relative compaction.

Due to the presence of rock it is suggested that areas of proposed underground utilities be over excavated to a minimum of 12 inches below the bottom of and on either side of the proposed utilities to prevent over breaking or loosening of the rock during trench excavation by the underground utility contractor.

Preliminary Pavement Design

The Caltrans method of design was utilized to develop the following asphalt pavement section. The section was developed based on a tested "R-Value" for compacted site subgrade soils of 72.

Traffic indices of 4.5, 5, 6, and 7 were assumed for use in the evaluation of automobile parking stalls and driveways, and medium and heavy truck driveways, respectively. The traffic indices are subject to approval by controlling authorities and shall be approved by the project civil engineer.

ASPHALT PAVEMENT SECTION					**PCC PAVEMENT SECTION**		
Pavement Utilization	Traffic Index	Asphalt (Inch)	Aggregate Base (Inch)	Total (Inch)	*PCC	Aggregate Base (Inch)	Total (Inch)
Parking Stalls	4.5	3.0	4.0	7.0	--	--	--
Auto Driveways	5.0	3.0	4.0	7.0	--	--	--
Truck Aisles/ Driveways	6.0	4.0	6.0	10.0	*7	-	7
Loading Dock	7.0	4.0	6.0	10.0	*7	-	7

*Minimum concrete compressive strength of 3,500 psi.

Aggregate base material for Asphalt Pavement should consist of CMB complying with the specifications in Section 200.2.4 of the current "Standard Specifications for Public Works Construction" and should be compacted to at least ninety-five (95) percent of the maximum dry density (ASTM D1557). The surface of the base should exhibit a firm and unyielding condition just prior to the placement of asphalt concrete paving. The asphalt concrete shall be compacted to a minimum of ninety-five (95) percent relative compaction.

The pavement subgrade should be constructed in accordance with the recommendations presented in the grading section of this report.

The R-value and the associated pavement section should be confirmed at the completion of site grading.

An increase in the PCC pavement slab thickness, placement of steel reinforcement (or other alternatives such as Fibermesh) and joint spacing due to loading conditions including shrinkage and thermal effects may be necessary and should be incorporated by the structural engineer as necessary to prevent adverse impact on pavement performance and maintenance.

Geotechnical Review of Plans

All grading and foundation plans should be reviewed and accepted by the geotechnical consultant prior to construction. If significant time elapses since preparation of this report, the geotechnical consultant should verify the current site conditions, and provide any additional recommendations (if necessary) prior to construction.

Geotechnical Observation/Testing During Construction

The geotechnical consultant should perform observation and/or testing at the following stages:

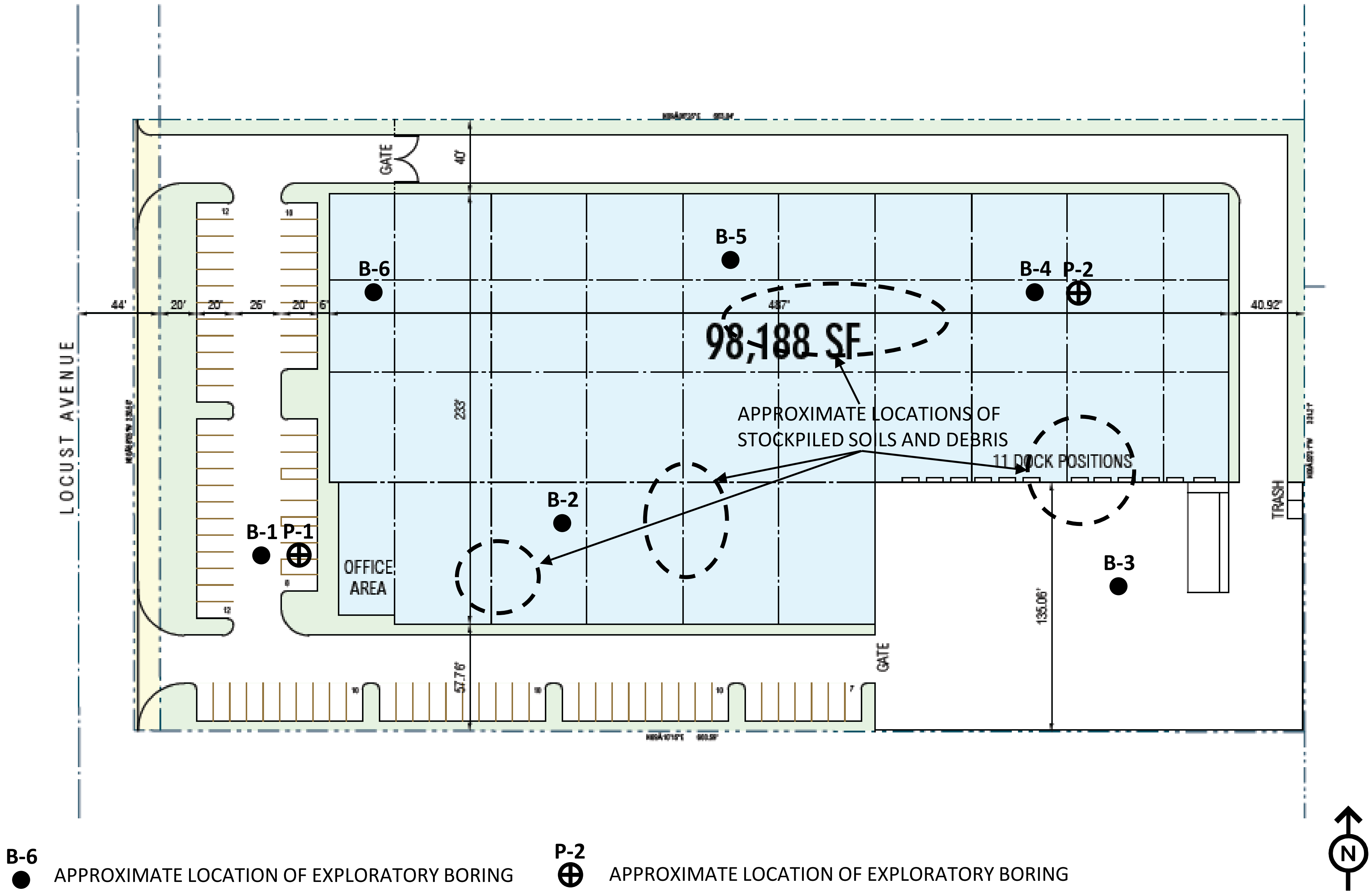
- During any grading and fill placement;
- During utility trench excavation and backfill;
- After foundation excavation and prior to placing concrete;
- During placement of aggregate base and asphalt concrete or Portland cement concrete;
- When any unusual soil conditions are encountered during any construction operation subsequent to issuance of this report.

Limitations

This report was prepared for a specific client and a specific project, based on the client's needs, directions and requirements at the time.

This report was necessarily based upon data obtained from a limited number of observances, site visits, soil and/or other samples, tests, analyses, histories of occurrences, spaced subsurface exploration and limited information on historical events and observations. Such information is necessarily incomplete. Variations can be experienced within small distances and under various climatic conditions. Changes in subsurface conditions can and do occur over time.

This report is not authorized for use by and is not to be relied upon by any party except the client with whom TGR contracted for the work. Use or reliance on this report by any other party is that party's sole risk. Unauthorized use of or reliance on this report constitutes an agreement to defend and indemnify TGR from and against any liability which may arise as a result of such use or reliance, regardless of any fault, negligence, or strict liability of TGR.



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BORING LOCATION MAP
2889 LOCUST AVENUE
RIALTO, CALIFORNIA

PROJECT NO. 20-6999

PLATE 1

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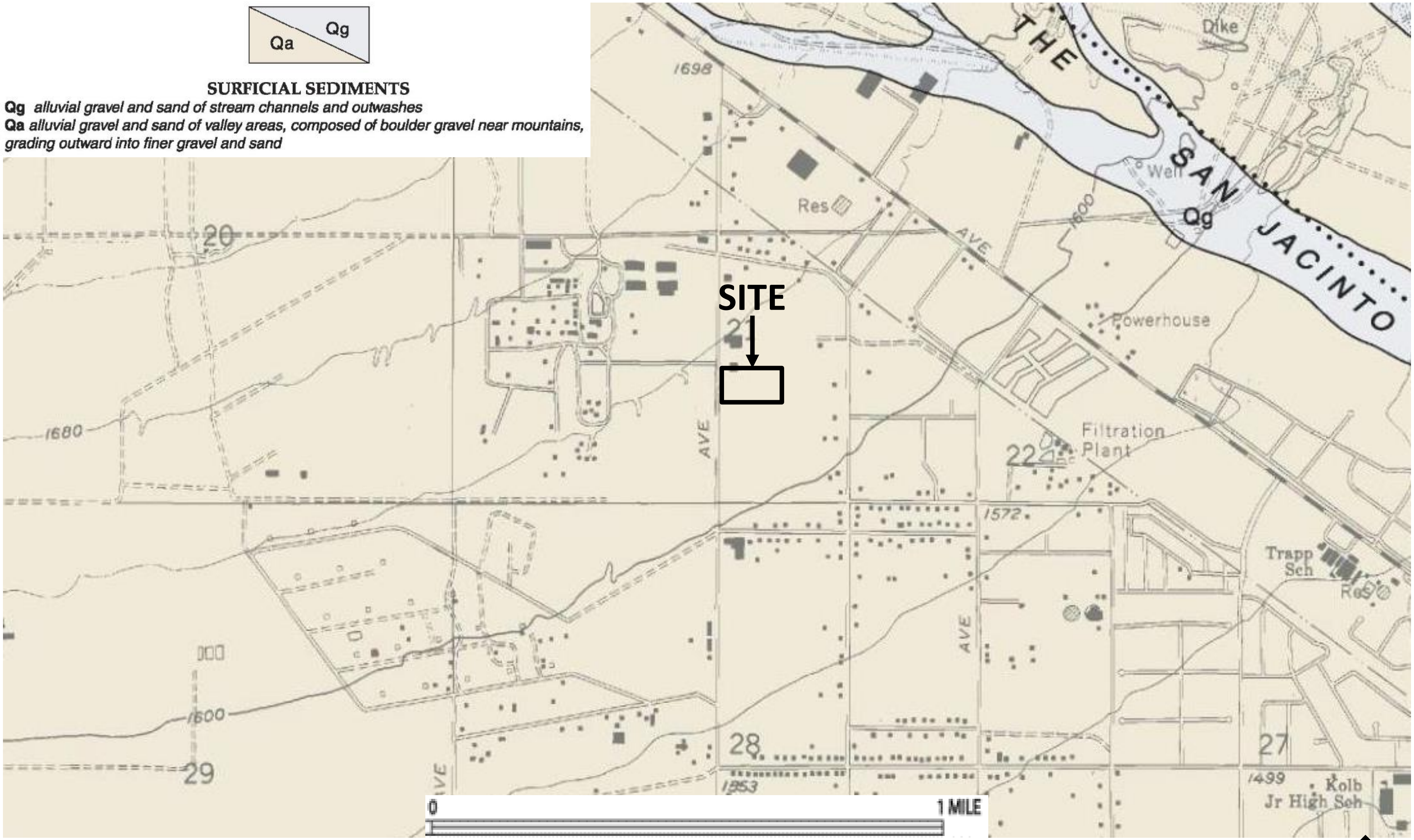
SITE LOCATION MAP
2889 LOCUST AVENUE
RIALTO, CALIFORNIA

PROJECT NO. 20-6999

FIGURE 1



Dibblee, T.W., and Minch, J.A., 2003, Geologic map of the Devore quadrangle, San Bernardino County, California: Dibblee Geological Foundation, Dibblee Foundation Map DF-105, scale 1:24,000..

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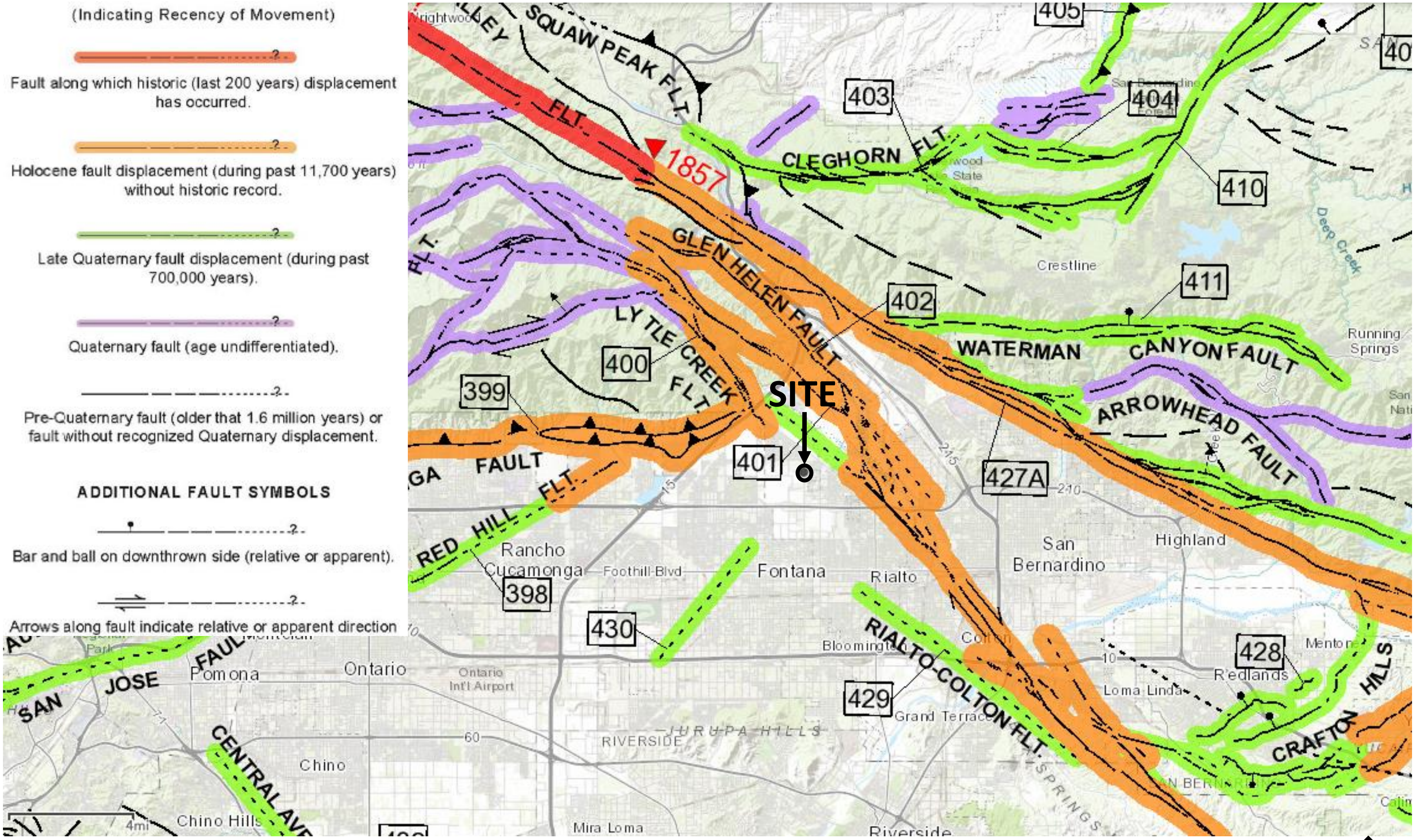
REGIONAL GEOLOGY MAP
2889 LOCUST AVENUE
RIALTO, CALIFORNIA

PROJECT NO. 20-6999

FIGURE 2



Modified From: Jennings, C. W., 2010, Fault Activity Map of California and Adjacent Areas, California Division of Mines and Geology, Geologic Data Map Series, No. 6, Scale 1:750,000.

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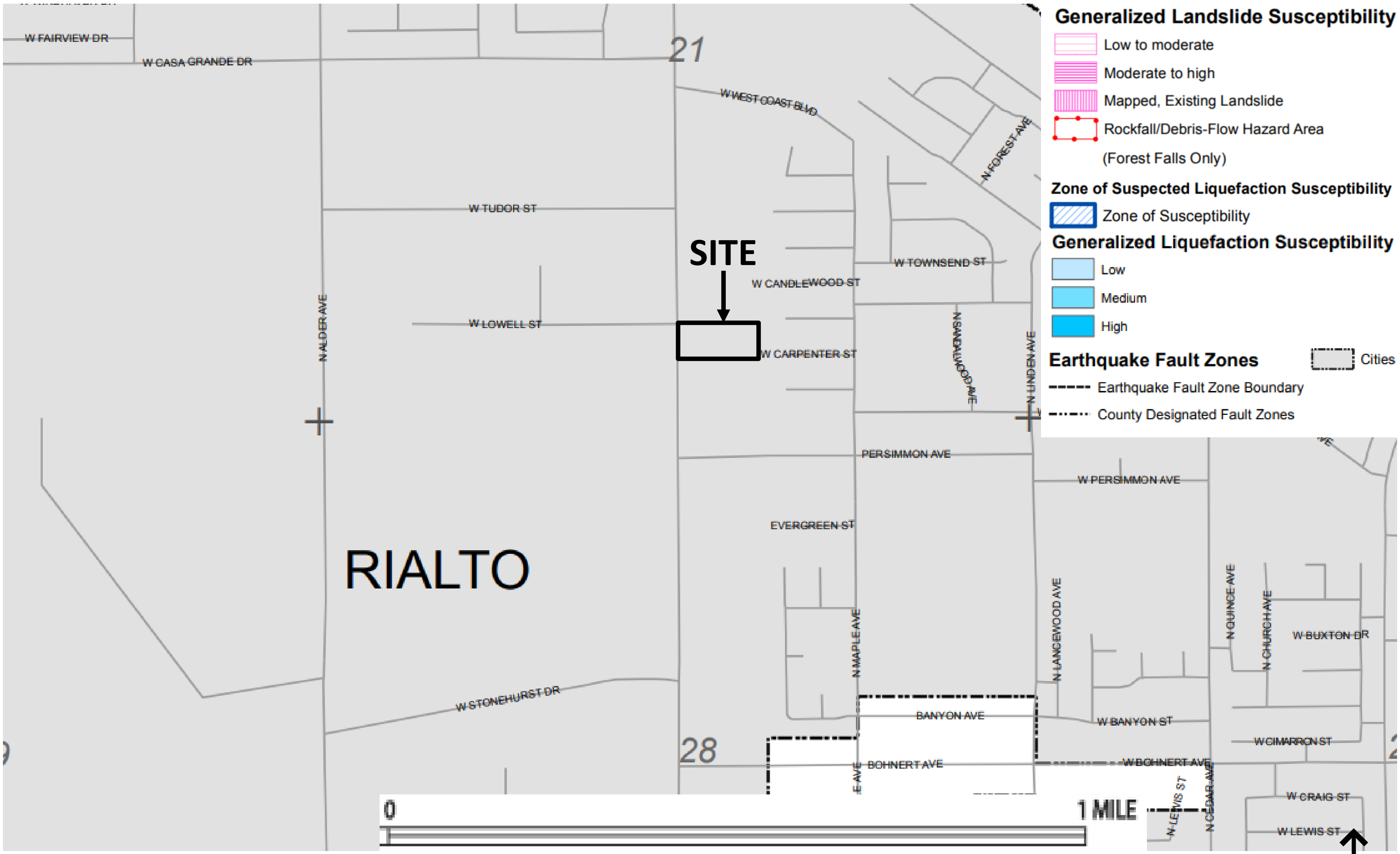
REGIONAL FAULT MAP
2889 LOCUST AVENUE
RIALTO, CALIFORNIA

PROJECT NO. 20-6999

FIGURE 3



Modified From: San Bernardino Land Use Plan, 2010, General Plan, Geologic Hazard Overlay, Map No. FH21-C, plotted March 9, 2010.

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SEISMIC HAZARD ZONE MAP
2889 LOCUST AVENUE
RIALTO, CALIFORNIA

PROJECT NO. 20-6999

FIGURE 4

Percolation Test Worksheet

Table 1

Test Hole	Total Depth (in)	Initial Depth (in)	Final Depth (in)	ΔWater Level (in)	Initial Time (min)	Final Time (min)	Δ Time (min)	Initial Height of Water (in)	Final Height of Water (in)	Average Height of Water (in)	Infiltration Rate (in/hr)
P-1	60	5	12	7	0.0	1.0	1.0	55	48	51.50	15.70
	60	4.5	11.5	7	0.0	1.0	1.0	55.5	48.5	52.00	15.56
	60	4.5	11.75	7.25	0.0	1.0	1.0	55.5	48.25	51.88	16.15
	60	5	12.5	7.5	0.0	1.0	1.0	55	47.5	51.25	16.90
	60	4.75	12	7.25	0.0	1.0	1.0	55.25	48	51.63	16.22
	60	4	11.5	7.5	0.0	1.0	1.0	56	48.5	52.25	16.59
P-2	60	3.75	22	18.25	0.0	1.0	1.0	56.25	38	47.13	44.58
	60	3.5	21.25	17.75	0.0	1.0	1.0	56.5	38.75	47.63	42.92
	60	6	20.25	14.25	0.0	1.0	1.0	54	39.75	46.88	34.99
	60	2.5	15.75	13.25	0.0	1.0	1.0	57.5	44.25	50.88	30.07
	60	2.5	16.5	14	0.0	1.0	1.0	57.5	43.5	50.50	32.00
	60	3	17.5	14.5	0.0	1.0	1.0	57	42.5	49.75	33.62
	60	3	17.5	14.5	0.0	1.0	1.0	57	42.5	49.75	33.62
	60	3	17	14	0.0	1.0	1.0	57	43	50.00	32.31

$$I_t = \frac{\Delta H(60r)}{\Delta t(r + 2H_{avg})}$$

ΔH = Change in height

Δt = Time interval

r = Radius

I_t Infiltration Rate

H_{ave} Average Head Height over the time interval

APPENDIX A
REFERENCES

APPENDIX A

References

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San Bernardino Land Use Plan, 2010, General Plan, Geologic Hazard Overlay, Map No. FH21-C, plotted March 9, 2010.

APPENDIX B
LOG OF BORINGS

THE FOLLOWING DESCRIBES THE TERMS AND SYMBOLS USED ON THE LOG OF BORINGS TO SUMMARIZE THE RESULTS OBTAINED IN THE FIELD INVESTIGATION AND SUBSEQUENT LABORATORY TESTING

DENSITY AND CONSISTENCY

The consistency of fine grained soils and the density of coarse grained soils are described on the basis of the Standard Penetration Test as follows:

COARSE GRAINED SOILS		ESTIMATED UNCONFINED COMPRESSIVE STRENGTH (Tsf)	FINE GRAINED SOILS	
Very Loose	< 4	< 0.25	Very Soft	< 2
Loose	4 – 10	0.35 – 0.50	Soft	2 – 4
Medium	10 – 30	0.50 – 1.0	Firm (Medium)	4 – 8
Dense	30 – 50	1.0 – 2.0	Stiff	8 – 15
Very Dense	> 50	2.0 – 4.0	Very Stiff	15 – 30
		> 4.0	Hard	> 30

PARTICLE SIZE DEFINITION (As per ASTM D2487 and D422)

Boulder	⇒ Larger than 12 inches	Coarse Sands	⇒ No. 10 to No. 4 sieve
Cobbles	⇒ 3 to 12 inches	Medium Sands	⇒ No. 40 to No. 10 sieve
Coarse Gravel	⇒ 3/4 to 3 inches	Fine Sands	⇒ No. 200 to 40 sieve
Fine Gravel	⇒ No. 4 to 3/4 inches	Silt	⇒ 5μm to No. 200 sieve
		Clay	⇒ Smaller than 5μm

SOIL CLASSIFICATION

Soils and bedrock are classified and described based on their engineering properties and characteristics using ASTM D2487 and D2488.

Percentage description of minor components:

Trace	1 – 10%	Some	20 – 35%
Little	10 – 20%	And or y	25 – 50%

Stratified soils description:

Parting	0 to 1/16 inch thick	Layer	½ to 12 inches thick
Seam	1/16 to ½ inch thick	Stratum	> 12 inches thick

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LOG OF BORING EXPLANATION

SOIL CLASSIFICATION CHART

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)		
	Clean Gravels (Less than 5% fines)	
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
	GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)	
	GM	Silty gravels, gravel-sand-silt mixtures
	GC	Clayey gravels, gravel-sand-clay mixtures
	Clean Sands (Less than 5% fines)	
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	SW	Well-graded sands, gravelly sands, little or no fines
	SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)	
	SM	Silty sands, sand-silt mixtures
	SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)		
SILTS AND CLAYS Liquid limit less than 50%	ML	Inorganic silts and very fine sands, rock flour, silty of 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 AND CLAYS Liquid limit 50% or greater	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
	CH	Inorganic clays of high plasticity, fat clays
	OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS	PT	Peat and other highly organic soils

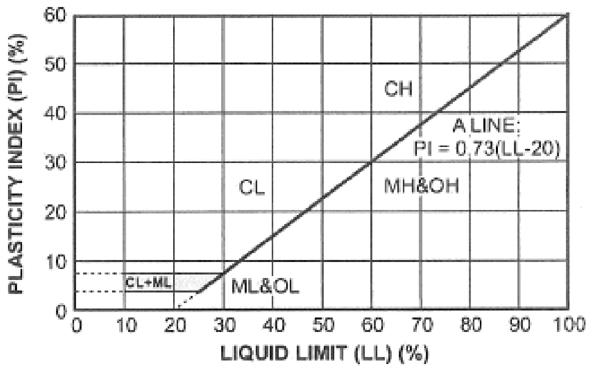
LABORATORY CLASSIFICATION CRITERIA

GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with P.I. greater than 7	
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for GW	
SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
SC	Atterberg limits above "A" line with P.I. greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent	GW, GP, SW, SP
More than 12 percent	GM, GC, SM, SC
5 to 12 percent	Borderline cases requiring dual symbols

PLASTICITY CHART



PARTICLE SIZE LIMITS

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

3” ¾” NO. 4 NO. 10 NO. 40 NO. 200

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LOG OF BORING EXPLANATION

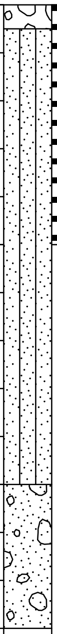
LOG OF EXPLORATORY BORING B-1

Sheet **1** of **1**

Project Number: **20-6999**
Project Name: **2889 Locust Avenue, Rialto**
Date Drilled: **2/19/20 - 2/19/20**
Ground Elev:

Logged By: **RA**
Project Engineer: **SG**
Drill Type: **Hollow Stem**
Drive Wt & Drop: **140lbs / 30in**

■ Shelby Tube
☒ Standard Split Spoon
◉ No recovery
⧗ Modified California
▼ Water Table ATD



Depth (ft)	Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	Moisture Content (%)	Dry Density, (pcf)	Other Tests
	▤					Surface is dirt, gravel, cobbles and boulders.			
	▤					Silty Sand and Gravel- light brown, moist, dense, fine grained sand, abundant fine to coarse grained gravel and cobbles.			Max, Corrosion, Shear
5		⧗	25		SM	...Same as above, medium dense.	6	111	Consol
10		⧗	>50		SPG	Gravelly Sand- yellow brown, slightly moist, very dense, fine to coarse grained sand, fine to coarse grained gravel.	2	129	
						Total Depth: 13 feet due to refusal in rocks. No groundwater encountered during drilling. Caving observed at 3 feet. Boring backfilled with soil cuttings upon completion.			
15									
20									
25									

PLATE 2

TGR GEOTECHNICAL, INC.

LOG OF EXPLORATORY BORING B-2

Sheet **1** of **1**

Project Number:	**20-6999**	Logged By:	**RA**
Project Name:	**2889 Locust Avenue, Rialto**	Project Engineer:	**SG**
Date Drilled:	**2/19/20 - 2/19/20**	Drill Type:	**Hollow Stem**
Ground Elev:		Drive Wt & Drop:	**140lbs / 30in**

■ Shelby Tube ☒ Standard Split Spoon ◉ No recovery

⧗ Modified California ▼ Water Table ATD

Depth (ft)	Graphic Log	FIELD RESULTS					SUMMARY OF SUBSURFACE CONDITIONS	LAB RESULTS		
		Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS		Moisture Content (%)	Dry Density, (pcf)	Other Tests
							Surface is dirt, gravel, cobbles and boulders.			
							Silty Sand and Gravel- light brown, dry, dense, fine grained sand, abundant fine to coarse grained gravel and cobbles.			
5			⧗	48		SPG	Gravelly Sand- light brown, moist, dense, fine to coarse grained sand, fine to coarse grained gravel.	2	129	
10			⧗	>50		SPG	...Same as above, very dense.	5	130	
15			⧗	>50		SPG	...Same as above, slightly moist, very dense.	3	133	
							Total Depth: 17 feet due to refusal in rocks. No groundwater encountered during drilling. Caving observed at 5 feet. Boring backfilled with soil cuttings upon completion.			
20										
25										

This Boring Log should be evaluated in conjunction with the complete geotechnical report. This Boring Log represents conditions observed at the specific location and date indicated, it is not warranted to be representative of subsurface conditions at other locations and times.

PLATE 3

TGR GEOTECHNICAL, INC.

LOG OF EXPLORATORY BORING B-3

Sheet **1** of **1**

Project Number:	**20-6999**	Logged By:	**RA**
Project Name:	**2889 Locust Avenue, Rialto**	Project Engineer:	**SG**
Date Drilled:	**2/19/20 - 2/19/20**	Drill Type:	**Hollow Stem**
Ground Elev:		Drive Wt & Drop:	**140lbs / 30in**

■ Shelby Tube
☒ Standard Split Spoon
◉ No recovery
⧗ Modified California
▼ Water Table ATD

Depth (ft)	Graphic Log	FIELD RESULTS					SUMMARY OF SUBSURFACE CONDITIONS	LAB RESULTS		
		Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS		Moisture Content (%)	Dry Density, (pcf)	Other Tests
							Surface is dirt, gravel, cobbles and boulders.			
							Silty Sand and Gravel- light brown, slightly moist, dense, fine grained sand, fine to coarse grained gravel.			
5			⧗	49		SPG	Gravelly Sand- brown, moist, dense, fine to coarse grained sand, fine to coarse grained gravel.	3	133	
							Total Depth: 8 feet due to refusal in rocks. No groundwater encountered during drilling. Caving observed at 3 feet. Boring backfilled with soil cuttings upon completion.			
10										
15										
20										
25										

This Boring Log should be evaluated in conjunction with the complete geotechnical report. This Boring Log represents conditions observed at the specific location and date indicated, it is not warranted to be representative of subsurface conditions at other locations and times.

PLATE 4

TGR GEOTECHNICAL, INC.

LOG OF EXPLORATORY BORING B-4

Sheet **1** of **1**

Project Number:	**20-6999**	Logged By:	**RA**
Project Name:	**2889 Locust Avenue, Rialto**	Project Engineer:	**SG**
Date Drilled:	**2/19/20 - 2/19/20**	Drill Type:	**Hollow Stem**
Ground Elev:		Drive Wt & Drop:	**140lbs / 30in**

■ Shelby Tube
☒ Standard Split Spoon
● No recovery
⧓ Modified California
▼ Water Table ATD

Depth (ft)	FIELD RESULTS Graphic Log	Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	LAB RESULTS Moisture Content (%)	Dry Density, (pcf)	Other Tests
0		▬					Surface is dirt, gravel, cobbles and boulders.			
		▬					Silty Sand and Gravel- light brown, dry, very dense, fine grained sand, fine to coarse grained gravel, cobbles.			R-Value
5			●	>50						
6							Total Depth: 6 feet due to refusal in rocks. No groundwater encountered during drilling. Caving observed at 2 feet. Boring backfilled with soil cuttings upon completion.			
10										
15										
20										
25										

This Boring Log should be evaluated in conjunction with the complete geotechnical report. This Boring Log represents conditions observed at the specific location and date indicated, it is not warranted to be representative of subsurface conditions at other locations and times.

PLATE 5

TGR GEOTECHNICAL, INC.

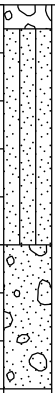
LOG OF EXPLORATORY BORING B-5

Sheet **1** of **1**

Project Number: **20-6999**
Project Name: **2889 Locust Avenue, Rialto**
Date Drilled: **2/19/20 - 2/19/20**
Ground Elev:

Logged By: **RA**
Project Engineer: **SG**
Drill Type: **Hollow Stem**
Drive Wt & Drop: **140lbs / 30in**

■ Shelby Tube
☒ Standard Split Spoon
◉ No recovery
⧗ Modified California
▼ Water Table ATD



Depth (ft)	Graphic Log	FIELD RESULTS Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	LAB RESULTS Moisture Content (%)	Dry Density, (pcf)	Other Tests
							Surface is dirt, gravel, cobbles and boulders.			
							Silty Sand and Gravel- brown, slightly moist, dense, fine grained sand, fine to coarse grained gravel, cobbles.			
5			⧗	>50		SPG	Gravelly Sand- brown, moist, very dense, fine to coarse grained sand, fine to coarse grained gravel, cobbles.	2	128	Consol
							Total Depth: 8 feet due to refusal in rocks. No groundwater encountered during drilling. Caving observed at 5 feet. Boring backfilled with soil cuttings upon completion.			
10										
15										
20										
25										

This Boring Log should be evaluated in conjunction with the complete geotechnical report. This Boring Log represents conditions observed at the specific location and date indicated, it is not warranted to be representative of subsurface conditions at other locations and times.

PLATE 6

TGR GEOTECHNICAL, INC.

LOG OF EXPLORATORY BORING B-6

Sheet **1** of **1**

Project Number: **20-6999**
Project Name: **2889 Locust Avenue, Rialto**
Date Drilled: **2/19/20 - 2/19/20**
Ground Elev:

Logged By: **RA**
Project Engineer: **SG**
Drill Type: **Hollow Stem**
Drive Wt & Drop: **140lbs / 30in**

■ Shelby Tube
☒ Standard Split Spoon
◉ No recovery
⧗ Modified California
▼ Water Table ATD

Depth (ft)	Graphic Log	FIELD RESULTS Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	LAB RESULTS Moisture Content (%)	Dry Density, (pcf)	Other Tests
							Surface is dirt, gravel, cobbles and boulders.			
							Silty Sand and Gravel- light brown, moist, dense, fine grained sand, fine to coarse grained gravel.			
5			⧗	>50		SPG	Gravelly Sand- brown, moist, very dense, fine to coarse grained sand, fine to coarse grained gravel, cobbles.	4	131	
10							Total Depth: 9 feet due to refusal in rocks. No groundwater encountered during drilling. Caving observed at 3 feet. Boring backfilled with soil cuttings upon completion.			
15										
20										
25										

This Boring Log should be evaluated in conjunction with the complete geotechnical report. This Boring Log represents conditions observed at the specific location and date indicated, it is not warranted to be representative of subsurface conditions at other locations and times.

PLATE 7

TGR GEOTECHNICAL, INC.

LOG OF EXPLORATORY BORING P-1

Sheet **1** of **1**

Project Number: **20-6999**
Project Name: **2889 Locust Avenue, Rialto**
Date Drilled: **2/19/20 - 2/19/20**
Ground Elev:

Logged By: **RA**
Project Engineer: **SG**
Drill Type: **Hollow Stem**
Drive Wt & Drop: **140lbs / 30in**

■ Shelby Tube
☒ Standard Split Spoon
◉ No recovery
⧗ Modified California
▼ Water Table ATD

Depth (ft)	Graphic Log	FIELD RESULTS					SUMMARY OF SUBSURFACE CONDITIONS	LAB RESULTS		
		Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS		Moisture Content (%)	Dry Density, (pcf)	Other Tests
	▨	▤					Surface is dirt, gravel, cobbles and boulders.			
	▨	▤				SM	Silty Sand and Gravel- light brown, slightly moist to dry, dense, fine grained sand, abundant fine to coarse grained gravel and cobbles.			-200= 19.0%
5							Total Depth: 5 feet. No groundwater encountered during drilling. No caving observed. Boring utilized for percolation testing Boring backfilled with soil cuttings upon completion.			
10										

This Boring Log should be evaluated in conjunction with the complete geotechnical report. This Boring Log represents conditions observed at the specific location and date indicated, it is not warranted to be representative of subsurface conditions at other locations and times.

PLATE 8

TGR GEOTECHNICAL, INC.

LOG OF EXPLORATORY BORING P-2

Sheet **1** of **1**

Project Number:	**20-6999**	Logged By:	**RA**
Project Name:	**2889 Locust Avenue, Rialto**	Project Engineer:	**SG**
Date Drilled:	**2/19/20 - 2/19/20**	Drill Type:	**Hollow Stem**
Ground Elev:		Drive Wt & Drop:	**140lbs / 30in**

■ Shelby Tube ☒ Standard Split Spoon ◉ No recovery
⧓ Modified California ▼ Water Table ATD

Depth (ft)	Graphic Log	FIELD RESULTS Bulk Sample	Drive Sample	SPT blows/ft (or equivalent N)	Pocket Pen (tsf)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	LAB RESULTS Moisture Content (%)	Dry Density, (pcf)	Other Tests
							Surface is dirt, gravel, cobbles and boulders.			
						SM	Silty Sand and Gravel- light brown, dry, very dense, fine grained sand, fine to coarse grained gravel, cobbles.			-200= 8.5%
5							Total Depth: 5 feet. No groundwater encountered during drilling. No caving observed. Boring utilized for percolation testing Boring backfilled with soil cuttings upon completion.			
10										

This Boring Log should be evaluated in conjunction with the complete geotechnical report. This Boring Log represents conditions observed at the specific location and date indicated, it is not warranted to be representative of subsurface conditions at other locations and times.

PLATE 9

TGR GEOTECHNICAL, INC.

APPENDIX C
LABORATORY TEST RESULTS

APPENDIX C

Laboratory Testing Procedures and Results

Moisture and Density Determination Tests: Moisture content and dry density determinations were performed on relatively undisturbed samples obtained from the test borings. The results of these tests are presented in the boring logs. Where applicable, only moisture content was determined from "undisturbed" or disturbed samples.

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

Sample Location	**Sample Description**	**Maximum Dry Density (pcf)**	**Optimum Moisture Content (%)**
B-1 @ 0-5 feet	Silty Sand and Gravel	135.5	6.0

Direct Shear Tests: Direct shear test was performed on selected remolded and/or undisturbed sample, which was soaked for a minimum of 24 hours under a surcharge equal to the applied normal force during testing. After transfer of the sample to the shear box, and reloading the sample, pore pressures set up in the sample due to the transfer were allowed to dissipate for a period of approximately 1-hour prior to application of shearing force. The sample was tested under various normal loads, a motor-driven, strain-controlled, direct-shear testing apparatus at a strain rate of less than 0.001 to 0.5 inches per minute (depending upon the soil type). The test results are presented in the test data and in the table below:

Sample Location	**Sample Description**	**Friction Angle (degrees)**	**Apparent Cohesion (psf)**
B-1 @ 0-5 feet	Silty Sand and Gravel (Remolded)	32	84

Consolidation Tests (ASTM D2435): Consolidation test were performed on selected, relatively undisturbed ring samples. Samples were placed in a consolidometer and loads were applied in geometric progression. The percent consolidation for each load cycle was recorded as the ratio of the amount of vertical compression to the original 1-inch height. The consolidation pressure curves are presented in the test data.

Corrosivity Test: Electrical conductivity, pH, and soluble chloride tests were conducted on representative samples and the results are presented in the test data and in the table below:

Sample Location	**Sample Description**	**Soluble Chloride (CAL.422) ppm**	**Electrical Resistivity (CAL.643) (ohm-cm)**	**PH (CAL.747)**	**Potential Degree of Attack on Steel**
B-1 @ 0-5 feet	Silty Sand and Gravel	59	17,200	6.7	Mild

Soluble Sulfates: The soluble sulfate content of selected sample was determined by standard geochemical methods. The test result is presented in the table below:

Sample Location	**Sample Description**	**Water Soluble Sulfate in Soil, (% by Weight)**	**Sulfate Content (ppm)**	**Exposure Class***
B-1 @ 0-5 feet	Silty Sand and Gravel	0.0152	152	S0

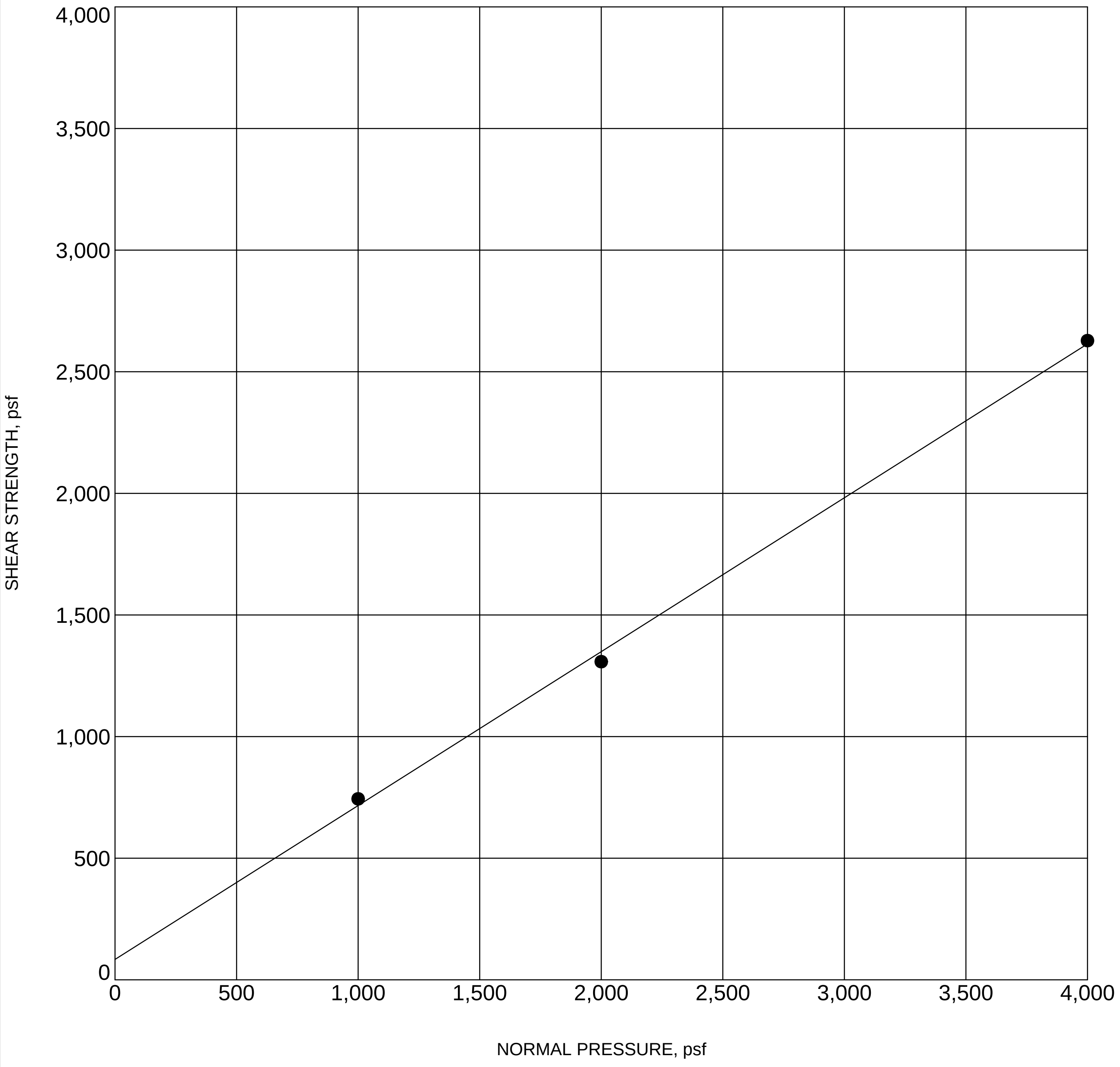
* Based on the current version of ACI 318-14 Building Code, Table No. 19.3.1.1; Exposure Categories and Classes.

Wash Sieve Test: Typical materials were washed over No. 200 sieve (ASTM Test Method D1140). The test results are presented below:

Sample Location	**% Passing No. 200 Sieve**
P-1 @ 0-5 feet	19.0%
P-2 @ 0-5 feet	8.5%

R-Value: The resistance “R”-Value was determined by the California Materials Method No. 301 for subgrade soils. One sample was prepared and exudation pressure and “R”-Value determined. The graphically determined “R”-Value at exudation pressure of 300 psi is presented in the test data and summarized in the table below:

Sample Location	**Sample Description**	**R-Value**
B-4 @ 0-5 feet	Silty Sand and Gravel	72



Specimen Identification			Classification	γ_d	MC%	c	ϕ
●	**B-1**	**0-5**	**Silty Sand and Gravel - Remolded - 90% RC**	**122**	**6**	**84**	**32**

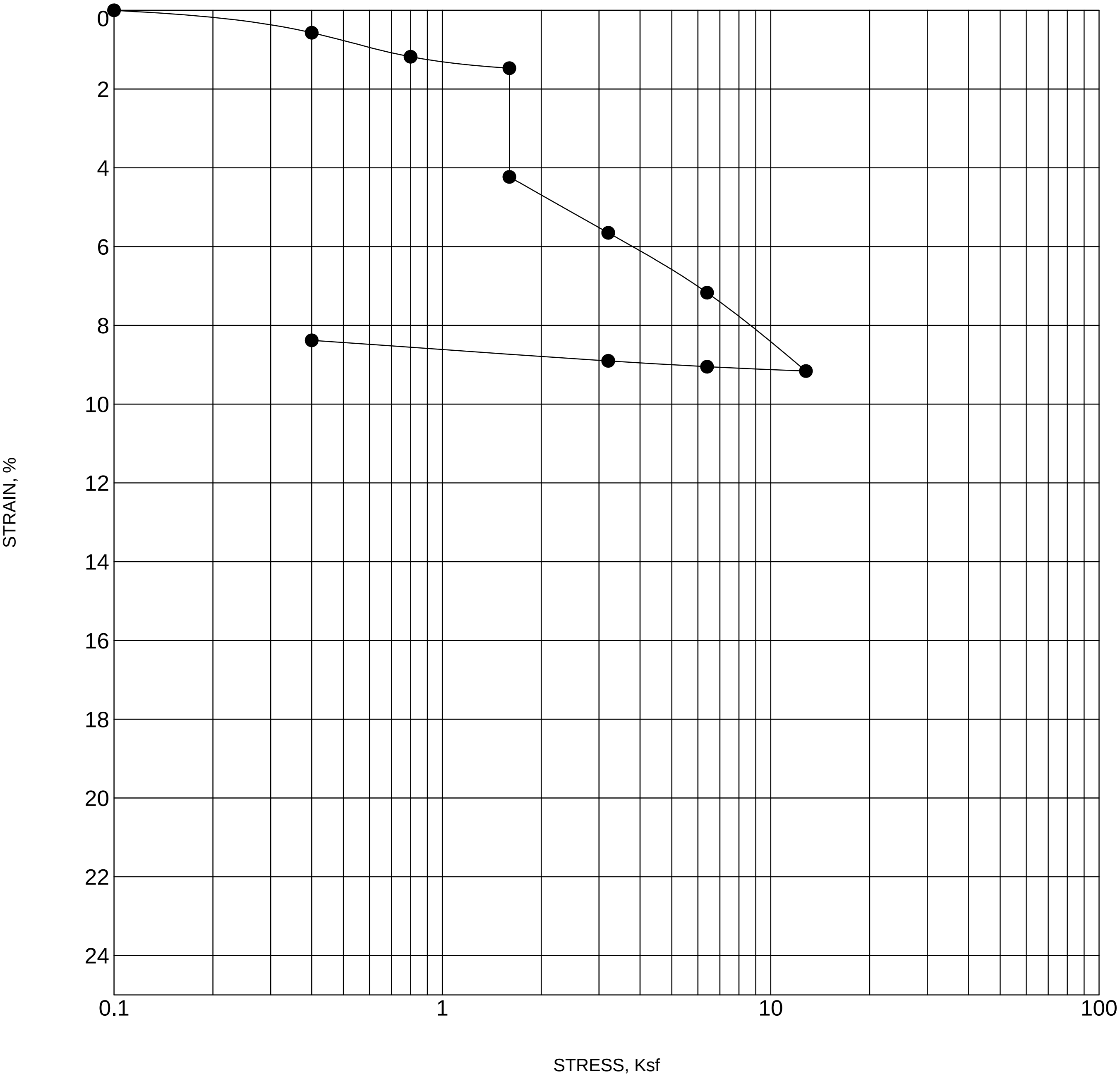
TGR GEOTECHNICAL, INC.

3037 S. Harbor Blvd
Santa Ana, CA 92704
Telephone: 714-641-7189
Fax: 714-641-7190

DIRECT SHEAR TEST

Project Number: 20-6999

Project Name: 2889 Locust Avenue, Rialto



	Specimen Identification		Classification	γ_d	MC%
●	**B-1**	**5.0**	**Silty Sand and Gravel**	**111**	**6**

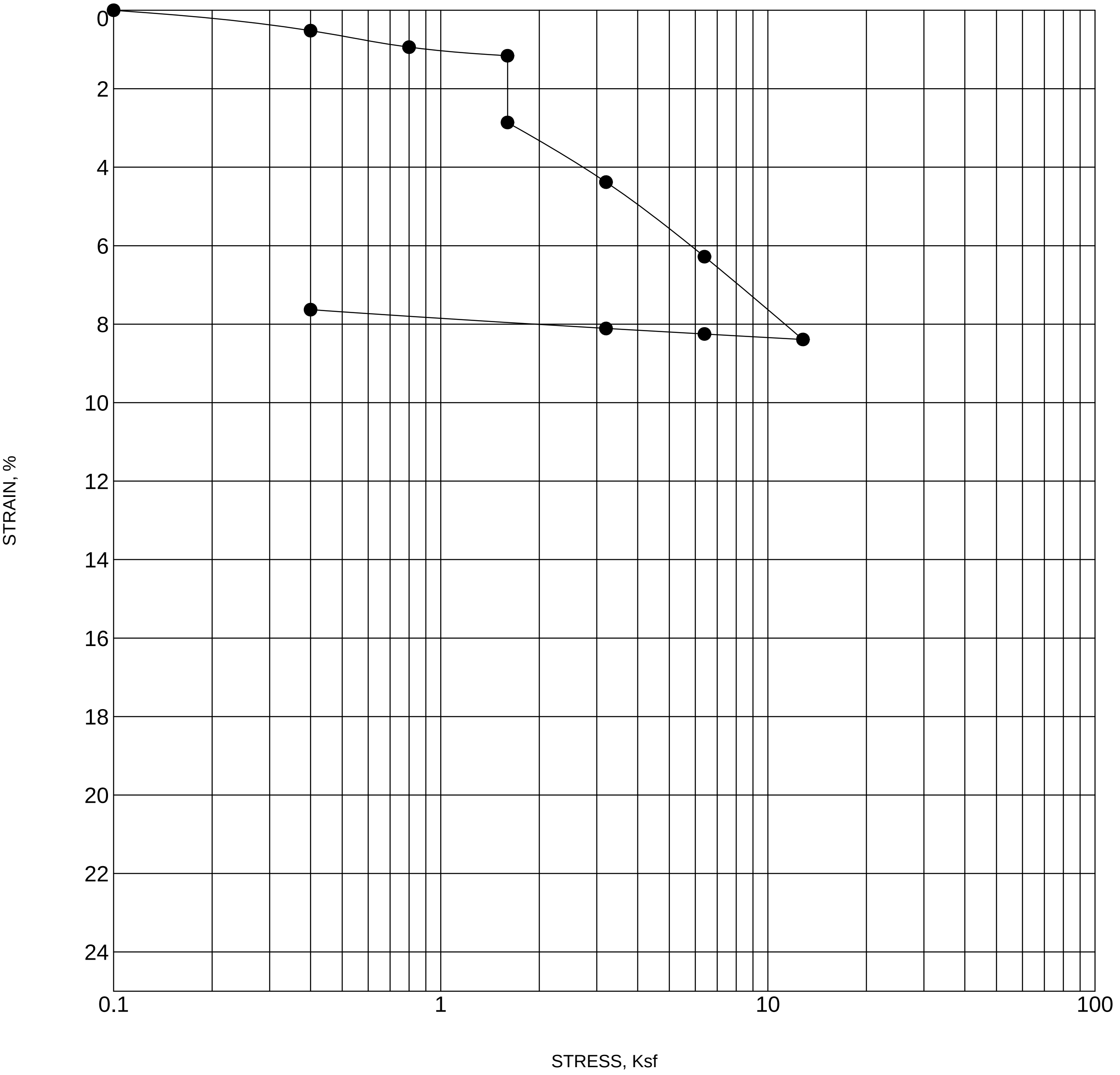
TGR GEOTECHNICAL, INC.

3037 S. Harbor Blvd
Santa Ana, CA 92704
Telephone: 714-641-7189
Fax: 714-641-7190

CONSOLIDATION TEST

Project Number: 20-6999

Project Name: 2889 Locust Avenue, Rialto



	Specimen Identification		Classification	γ_d	MC%
●	**B-5**	**5.0**	**Gravelly Sand**	**128**	**2**

TGR GEOTECHNICAL, INC.

3037 S. Harbor Blvd
Santa Ana, CA 92704
Telephone: 714-641-7189
Fax: 714-641-7190

CONSOLIDATION TEST

Project Number: 20-6999

Project Name: 2889 Locust Avenue, Rialto

ANAHEIM TEST LAB, INC
196 Technology Dr., Unit D
Irvine, CA 92618
Phone (949)336-6544

TO:

TGR GEOTECHNICAL
3037 S. HARBOR BLVD.
SANTA ANA, CA 92704

DATE: 02/26/2020

P.O. NO: VERBAL

LAB NO: C-3609

SPECIFICATION: CTM-417/422/643

MATERIAL: Soil

Project No.: 20-6999
Project: XEBEC- Rialto
Sample ID: B-1 @ 0-5’

ANALYTICAL REPORT

CORROSION SERIES

SUMMARY OF DATA

pH	SOLUBLE SULFATES per CT. 417 ppm	SOLUBLE CHLORIDES per CT. 422 ppm	MIN. RESISTIVITY per CT. 643 ohm-cm
6.7	152	59	17,200

RESPECTFULLY SUBMITTED

WES BRIDGER LAB MANAGER

ANAHEIM TEST LAB, INC
196 Technology Drive, Unit D
Irvine, CA 92618
Phone (949) 336-6544

TO:

TGR GEOTECHNICAL
3037 S. HARBOR BLVD.
SANTA ANA, CA. 92704

DATE: 02/26/2020

P.O. NO.: VERBAL

LAB NO.: C-3610

SPECIFICATION: CTM- 301

MATERIAL: Brown, Silty Sand
w. Gravel

Project No.: 20-6999
Project: XEBEC- Rialto
Sample ID: B-4 @ 0'-5'

ANALYTICAL REPORT

"R" VALUE

BY EXUDATION	BY EXPANSION
72	N/A

RESPECTFULLY SUBMITTED

WES BRIDGER LAB MANAGER

"R" VALUE CA 301

Client: TGR **ATL No.:** C-3610 **Date:** 2/26/2020

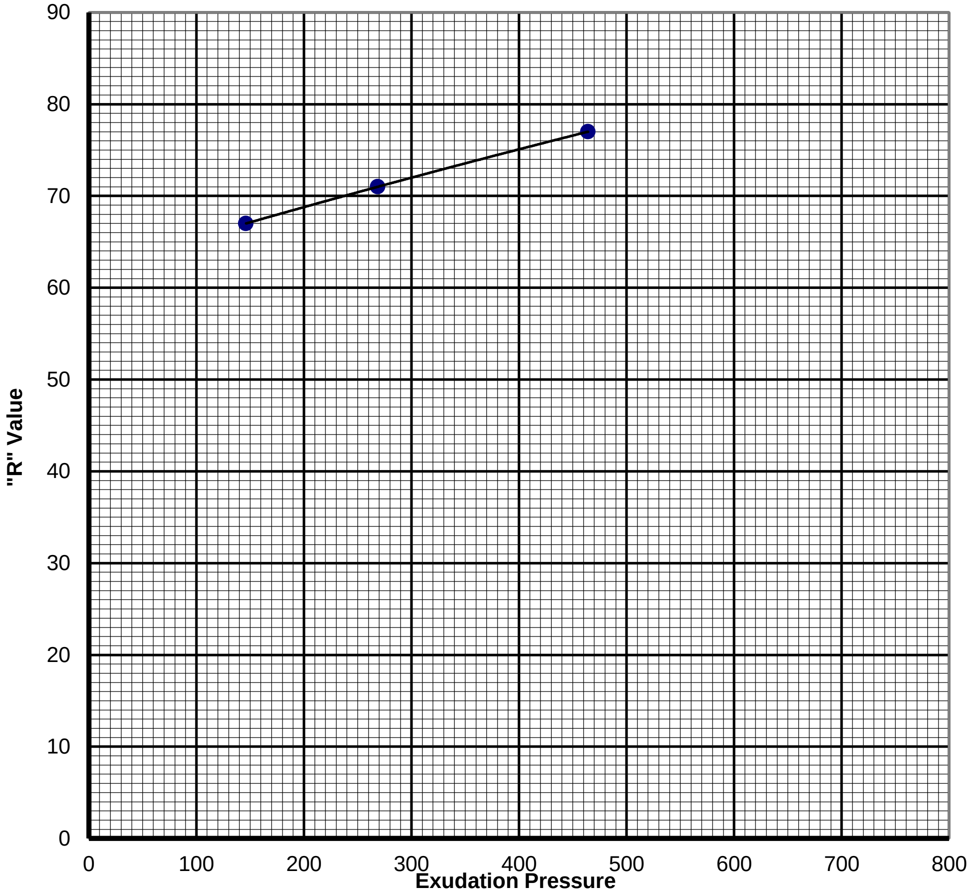
Client Reference No.: 20-6999

Sample: B4 @ 0'-5' **Soil Type:** Brown, Silty Sand w. Gravel

.

TEST SPECIMEN		A	B	C	D
Compactor Air Pressure	psi	350	350	350	
Initial Moisture Content	%	1.4	1.4	1.4	
Moisture at Compaction	%	10.2	9.8	9.4	
Briquette Height	in.	2.47	2.52	2.53	
Dry Density	pcf	121.0	121.8	123.1	
EXUDATION PRESSURE	psi	146	269	464	
EXPANSION dial	(x .0001)	0	0	0	
Ph at 1000 pounds	psi	20	18	15	
Ph at 2000 pounds	psi	36	32	26	
Displacement	turns	4.3	4.1	3.88	
"R" Value		67	71	77	
CORRECTED "R" VALUE		67	71	77	

Final "R" Value	
BY EXUDATION: @ 300 psi	**72**
BY EXPANSION: TI = 5.0	**N/A**



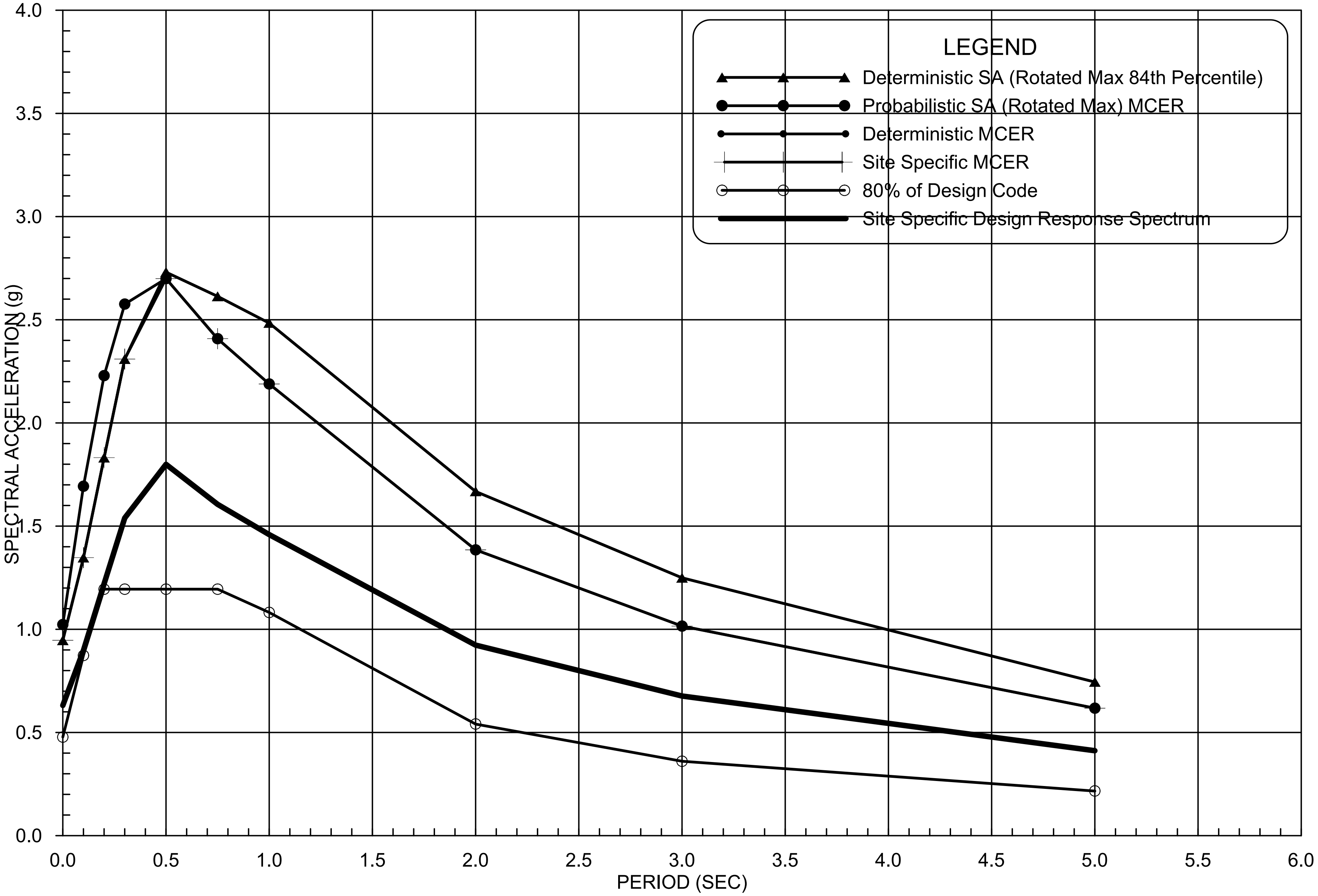
APPENDIX D
SITE SEISMIC DESIGN AND DE-AGGREGATED PARAMETERS

TABLE 1
SITE SPECIFIC GROUND MOTION ANALYSIS

20-6999 Xebec Rialto

SA Period (sec)	Probabilistic Spectral Acceleration (g)	Risk Coefficients	Probabilistic Spectral Acceleration MCER (g)	Deterministic Spectral Acceleration (g)	Is Largest Deterministic Spectral Acceleration <1.5*Fa	Deterministic MCER	Site Specific MCER	2/3 of Spite Specific MCER	80% Code Design	Site Specific Design Response Spectrum
	Rotated Maximum		Rotated Maximum	Rotated Maximum 84th Percentile						
0	1.1132	0.919	1.0230	0.9465	No	0.9465	0.9465	0.6310	0.4777	0.6310
0.1	1.8425	0.919	1.6933	1.3468		1.3468	1.3468	0.8979	0.8733	0.8979
0.2	2.4255	0.919	2.2290	1.8311		1.8311	1.8311	1.2207	1.1941	1.2207
0.3	2.8058	0.918	2.5757	2.3088		2.3088	2.3088	1.5392	1.1941	1.5392
0.5	2.9469	0.916	2.6994	2.7305		2.7305	2.6994	1.7996	1.1941	1.7996
0.75	2.6359	0.914	2.4079	2.6131		2.6131	2.4079	1.6052	1.1941	1.6052
1	2.4024	0.911	2.1886	2.4838		2.4838	2.1886	1.4591	1.0813	1.4591
2	1.5201	0.911	1.3848	1.6680		1.6680	1.3848	0.9232	0.5407	0.9232
3	1.1144	0.911	1.0152	1.2494		1.2494	1.0152	0.6768	0.3604	0.6768
5	0.6780	0.911	0.6177	0.7445		0.7445	0.6177	0.4118	0.2163	0.4118

Code Sds	1.493	Crs =	0.919	Code Ss =	2.239	**Site Specific SDS =**	**1.620**
Code Sd1	1.352	Cr1 =	0.911	Code S1 =	0.811	**Site Specific SD1 =**	**2.059**
To	0.18	Code Fa =	1	Sms =	2.239		
Ts	0.91	Code Fv =	2.5	Sm1 =	2.0275		
TL	12						
Input							



TGR
Geotechnical
Environmental
Hydrogeology
Material Testing
Construction Inspection

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3037 S. HARBOR BLVD
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f: 714.641.7190

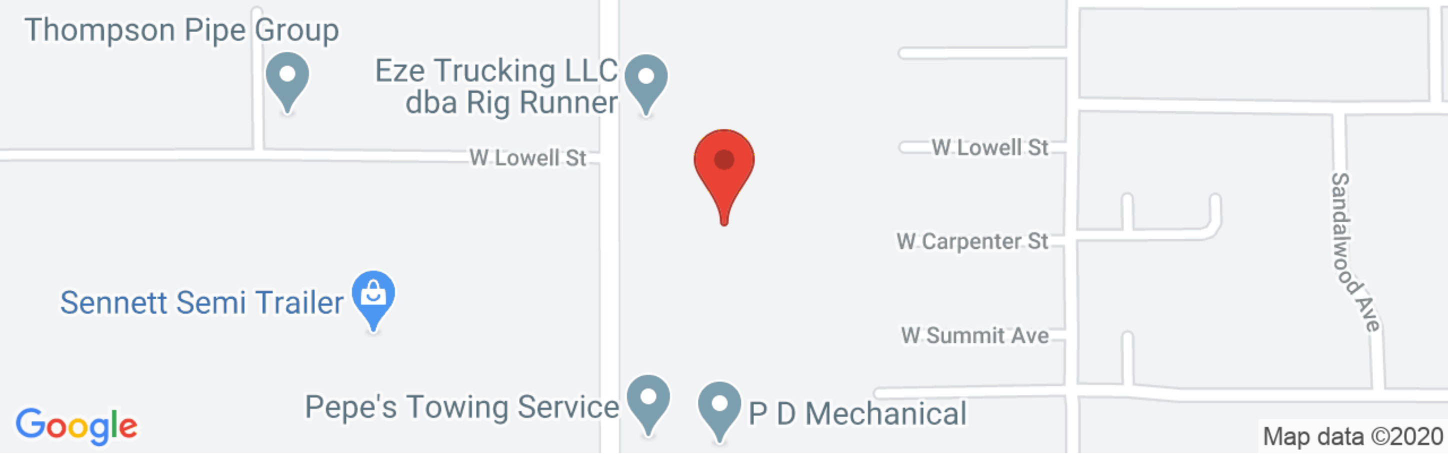
SITE SPECIFIC DESIGN RESPONSE SPECTRA
XEBEC - RIALTO

Project No.: 20-6999

FIGURE 1

2889 Locust Avenue, Rialto

Latitude, Longitude: 34.1518, -117.4087



Date	2/21/2020, 3:29:18 PM
Design Code Reference Document	ASCE7-16
Risk Category	III
Site Class	D - Stiff Soil

Type	Value	Description
S_S	2.239	MCE_R ground motion. (for 0.2 second period)
S_1	0.811	MCE_R ground motion. (for 1.0s period)
S_{MS}	2.239	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	1.492	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	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.919	MCE_G peak ground acceleration
F_{PGA}	1.1	Site amplification factor at PGA
PGA_M	1.011	Site modified peak ground acceleration
T_L	12	Long-period transition period in seconds
SsRT	2.552	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	2.802	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	2.239	Factored deterministic acceleration value. (0.2 second)
S1RT	1.028	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	1.157	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.811	Factored deterministic acceleration value. (1.0 second)
PGAd	0.919	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.911	Mapped value of the risk coefficient at short periods
C_{R1}	0.888	Mapped value of the risk coefficient at a period of 1 s

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U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

Please do not use this tool to obtain ground motion parameter values for the design code reference documents covered by the U.S. Seismic Design Maps web tools (e.g., the International Building Code and the ASCE 7 or 41 Standard). The values returned by the two applications are not identical.

Input

Edition

Dynamic: Conterminous U.S. 2014 (update) (v4.2.0)

Latitude

Decimal degrees

34.1518

Longitude

Decimal degrees, negative values for western longitudes

-117.4087

Site Class

259 m/s (Site class D)

Spectral Period

Peak Ground Acceleration

Time Horizon

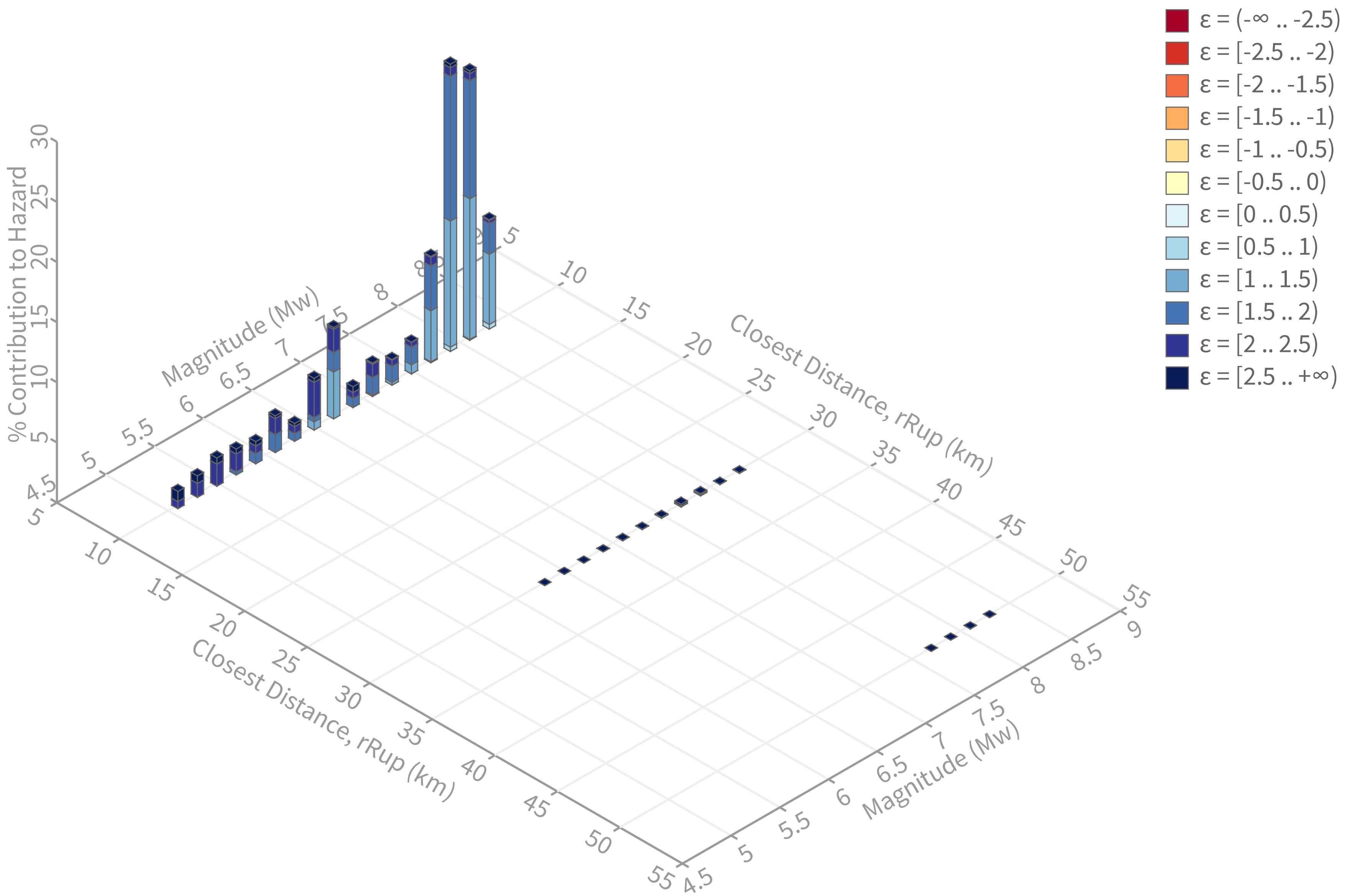
Return period in years

2475

Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 2475 yrs
Exceedance rate: 0.0004040404 yr^{-1}
PGA ground motion: 1.0490641 g

Recovered targets

Return period: 3277.103 yrs
Exceedance rate: 0.00030514756 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.02 %

Mean (over all sources)

m: 7.44
r: 6.16 km
ε₀: 1.66 σ

Mode (largest m-r bin)

m: 7.9
r: 5.72 km
ε₀: 1.5 σ
Contribution: 23.89 %

Mode (largest m-r-ε₀ bin)

m: 7.91
r: 7.89 km
ε₀: 1.7 σ
Contribution: 12.01 %

Discretization

r: min = 0.0, max = 1000.0, Δ = 20.0 km
m: min = 4.4, max = 9.4, Δ = 0.2
ε: min = -3.0, max = 3.0, Δ = 0.5 σ

Epsilon keys

ε0: [-∞ .. -2.5)
ε1: [-2.5 .. -2.0)
ε2: [-2.0 .. -1.5)
ε3: [-1.5 .. -1.0)
ε4: [-1.0 .. -0.5)
ε5: [-0.5 .. 0.0)
ε6: [0.0 .. 0.5)
ε7: [0.5 .. 1.0)
ε8: [1.0 .. 1.5)
ε9: [1.5 .. 2.0)
ε10: [2.0 .. 2.5)
ε11: [2.5 .. +∞]

Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
UC33brAvg_FM31	System							43.47
San Andreas (San Bernardino N) [3]		8.61	7.69	1.81	117.360°W	34.218°N	31.69	15.60
San Jacinto (San Bernardino) [1]		4.03	8.02	1.36	117.379°W	34.177°N	44.05	14.26
San Jacinto (Lytle Creek connector) [1]		1.69	7.97	1.17	117.406°W	34.156°N	29.45	5.23
Fontana (Seismicity) [0]		1.75	6.61	1.40	117.411°W	34.146°N	201.70	3.52
Cucamonga [0]		5.69	7.36	1.60	117.445°W	34.192°N	323.39	1.92
UC33brAvg_FM32	System							42.71
San Andreas (San Bernardino N) [3]		8.61	7.71	1.80	117.360°W	34.218°N	31.69	15.71
San Jacinto (San Bernardino) [1]		4.03	8.01	1.36	117.379°W	34.177°N	44.05	14.18
San Jacinto (Lytle Creek connector) [1]		1.69	7.97	1.17	117.406°W	34.156°N	29.45	5.24
Fontana (Seismicity) [0]		1.75	6.61	1.40	117.411°W	34.146°N	201.70	2.88
Cucamonga [0]		5.69	7.38	1.59	117.445°W	34.192°N	323.39	1.80
UC33brAvg_FM31 (opt)	Grid							6.91
PointSourceFinite: -117.409, 34.201		7.46	5.65	2.18	117.409°W	34.201°N	0.00	2.72
PointSourceFinite: -117.409, 34.201		7.46	5.65	2.18	117.409°W	34.201°N	0.00	2.72
UC33brAvg_FM32 (opt)	Grid							6.91
PointSourceFinite: -117.409, 34.201		7.46	5.65	2.18	117.409°W	34.201°N	0.00	2.72
PointSourceFinite: -117.409, 34.201		7.46	5.65	2.18	117.409°W	34.201°N	0.00	2.72

APPENDIX E
STANDARD GRADING GUIDELINES

STANDARD GRADING SPECIFICATIONS

These specifications present the usual and minimum requirements for grading operations performed under the observation and testing of TGR Geotechnical, Inc.

No deviation from these specifications will be allowed, except where specifically superseded in the Preliminary Geotechnical Investigation report, or in other written communication signed by the Soils Engineer or Engineering Geologist.

1.0 GENERAL

- The Soils Engineer and Engineering Geologist are the Owner's or Builder's representatives on the project. For the purpose of these specifications, observation and testing by the Soils Engineer includes that observation and testing performed by any person or persons employed by, and responsible to, the licensed Geotechnical Engineer or Geologist signing the grading report.

- All clearing, site preparation or earthwork performed on the project shall be conducted by the Contractor under the observation of the Geotechnical Engineer.

- It is the Contractor's responsibility to prepare the ground surface to receive the fills to the satisfaction of the Geotechnical Engineer and to place, spread, mix, water and compact the fill in accordance with the specifications of the Geotechnical Engineer. The Contractor shall also remove all material considered unsatisfactory by the Geotechnical Engineer.

- It is also the Contractor's responsibility to have suitable and sufficient compaction equipment on the job site to handle the amount of fill being placed. If necessary, excavation equipment will be shut down to permit completion of Compaction. Sufficient watering apparatus will also be provided by the Contractor, with due consideration for the fill material, rate of placement and time of year.

- A final report will be issued by the Geotechnical Engineer and Engineering Geologist attesting to the Contractor's conformance with these specifications.

2.0 SITE PREPARATION

- All vegetation and deleterious material such as rubbish shall be disposed of off-site. The removal must be concluded prior to placing fill.

- The Civil Engineer shall locate all houses, sheds, sewage disposal systems, large trees or structures on the site, or on the grading plan to the best of his knowledge prior to preparing the ground surface.

- Soil, alluvium or rock materials determined by the Geotechnical Engineer as being unsuitable for placement in compacted fills shall be removed and wasted from the site. Any material incorporated as part of a compacted fill must be approved by the Geotechnical Engineer.

- After the ground surface to receive fill has been cleared, it shall be scarified, disced or bladed by the Contractor until it is uniform and free from ruts, hollows, hummocks or other uneven features which may prevent uniform compaction.

  The scarified ground surface shall then be brought to optimum moisture content, mixed as required, and compacted as specified. If the scarified zone is greater than twelve inches in depth, the excess shall be removed and placed in lifts restricted to six inches. Prior to placing fill, the ground surface to receive fill shall be inspected, tested and approved by the Geotechnical Engineer.

- Any underground structures such as cesspools, cisterns, mining shafts, tunnels, septic tanks, wells, pipe lines or others not located prior to grading are to be removed or treated in a manner prescribed by the Geotechnical Engineer.

3.0 COMPACTED FILLS

- Any material imported or excavated on the property may be utilized in the fill, provided each material has been determined to be suitable by the Geotechnical Engineer. Roots, tree branches and other matter missed during clearing shall be removed from the fill as directed by the Geotechnical Engineer.
- Rock fragments less than six inches in diameter may be utilized in the fill, provided:

  - ■ They are not placed in concentrated pockets.
  - ■ There is a sufficient percentage of fine-grained material to surround the rocks.
  - ■ The distribution of the rocks is observed by the Geotechnical Engineer.

- Rocks greater than six inches in diameter shall be taken off-site, or placed in accordance with the recommendations of the Geotechnical Engineer in areas designated as suitable for rock disposal. Details for rock disposal such as location, moisture control, percentage of the rock placed, etc., will be referred to in the “Conclusions and Recommendations” section of the Geotechnical Report, if applicable.

  If rocks greater than six inches in diameter were not anticipated in the Preliminary Geotechnical report, rock disposal recommendations may not have been made in the “Conclusions and Recommendations” section. In this case, the Contractor shall notify the Geotechnical Engineer if rocks greater than six inches in diameter are encountered. The Geotechnical Engineer will then prepare a rock disposal recommendation or request that such rocks be taken off-site.

- Material that is spongy, subject to decay, or otherwise considered unsuitable shall not be used in the compacted fill.

- Representative samples of materials to be utilized as compacted fill shall be analyzed in the laboratory by the Geotechnical Engineer to determine their physical properties. If any material other than that previously tested is encountered during grading, the appropriate analysis of this material shall be conducted by the Geotechnical Engineer as soon as possible.

- Material used in the compacting process shall be evenly spread, watered or dried, processed and compacted in thin lifts not to exceed six inches in thickness to obtain a uniformly dense layer. The fill shall be placed and compacted on a horizontal plane, unless otherwise approved by the Geotechnical Engineer.

- If the moisture content or relative compaction varies from that required by the Geotechnical Engineer, the Contractor shall rework the fill until it is approved by the Geotechnical Engineer.

- Each layer shall be compacted to 90 percent of the maximum dry density in compliance with the testing method specified by the controlling governmental agency; (in general, ASTM D1557 will be used.)

  If compaction to a lesser percentage is authorized by the controlling governmental agency because of a specific land use of expansive soil conditions, the area to receive fill compacted to less than 90 percent shall either be delineated on the grading plan or appropriate reference made to the area in the grading report.

- All fill shall be keyed and benched through all topsoil, colluvium, alluvium or creep material, into sound bedrock or firm material where the slope receiving fill exceeds a ratio of five horizontal to one vertical, in accordance with the recommendations of the Geotechnical Engineer.

- The key for side hill fills shall be a minimum of 15 feet within bedrock or firm materials, unless otherwise specified in the Preliminary report. (See details)

- Drainage terraces and subdrainage devices shall be constructed in compliance with the ordinances of the controlling governmental agency, or with the recommendation of the Geotechnical Engineer and Engineer Geologist.

- The Contractor will be required to obtain a minimum relative compaction of 90 percent out to the finish slope face of fill slopes, buttresses and stabilization fills. This may be achieved by either overbuilding the slope and cutting back to the compacted core, or by direct compaction of the slope face with suitable equipment, or by any other procedure which produces the required compaction.

The Contractor shall prepare a written detailed description of the method or methods he will employ to obtain the required slope compaction. Such documents shall be submitted to the Geotechnical Engineer for review and comments prior to the start of grading.

If a method other than overbuilding and cutting back to the compacted core is to be employed, slope tests will be made by the Geotechnical Engineer during construction of the slopes to determine if the required compaction is being achieved. Where failing tests occur or other field problems arise, the contractor will be notified by the Geotechnical Engineer.

If the method of achieving the required slope compaction selected by the Contractor fails to produce the necessary results, the Contractor shall rework or rebuild such slopes until the required degree of compaction is obtained, at no additional cost to the Owner or Geotechnical Engineer.

- All fill slopes should be planted or protected from erosion by methods specified in the preliminary report or by means approved by the governing authorities.

- Fill-over-cut slopes shall be properly keyed through topsoil, colluvium or creep material into rock or firm materials; and the transition shall be stripped of all soil prior to placing fill. (See detail)

4.0 CUT SLOPES

- The Engineering Geologist shall inspect all cut slopes excavated in rock, lithified or formation material at vertical intervals not exceeding ten feet.

- If any conditions not anticipated in the preliminary report such as perched water, seepage, lenticular or confined strata of a potentially adverse nature, unfavorably inclined bedding, joints or fault planes are encountered during grading, these conditions shall be analyzed by the Engineering Geologist and Geotechnical Engineer; and recommendations shall be made to treat these problems.

- Cut slopes that face in the same direction as the prevailing drainage shall be protected from slope wash by a non-erosive interceptor swale placed at the top of the slope.

- Unless otherwise specified in the soils and geological report, no cut slopes shall be excavated higher or steeper than that allowed by the ordinances of controlling governmental agencies.

- Drainage terraces shall be constructed in compliance with the ordinances of controlling governmental agencies, or with the recommendations of the Geotechnical Engineer or Engineering Geologist.

5.0 GRADING CONTROL

- Inspection of the fill placement shall be provided by the Geotechnical Engineer during the progress of grading.

- In general, density tests should be made at intervals not exceeding two feet of fill height or every 500 cubic yards of fill placed. This criteria will vary depending on soil conditions and the size of the job. In any event, an adequate number of field density tests shall be made to verify that the required compaction of being achieved.
- Density tests should be made on the surface material to receive fill as required by the Geotechnical Engineer.

- All cleanout, processed ground to receive fill, key excavations, subdrains and rock disposal must be inspected and approved by the Geotechnical Engineer (and often by the governing authorities) prior to placing any fill. It shall be the Contractor’s responsibility to notify the Geotechnical Engineer and governing authorities when such areas are ready for inspection.

6.0 CONSTRUCTION CONSIDERATIONS

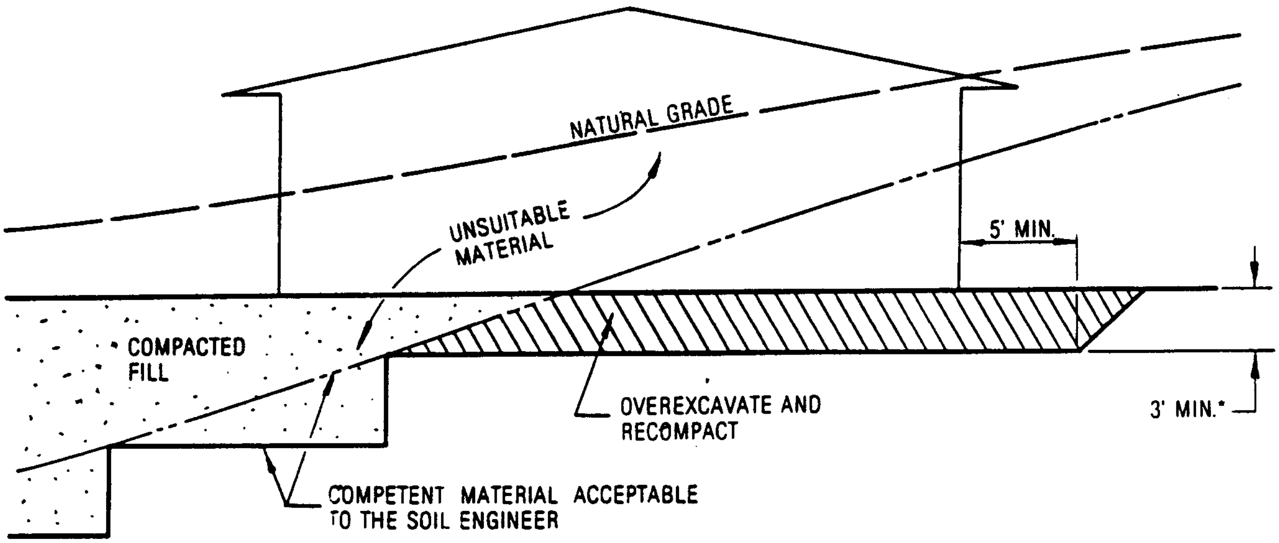
- Erosion control measures, when necessary, shall be provided by the Contractor during grading and prior to the completion and construction of permanent drainage controls.

- Upon completion of grading and termination of observations by the Geotechnical Engineer, no further filling or excavating, including that necessary for footings, foundations, large tree wells, retaining walls, or other features shall be performed without the approval of the Geotechnical Engineer or Engineering Geologist.

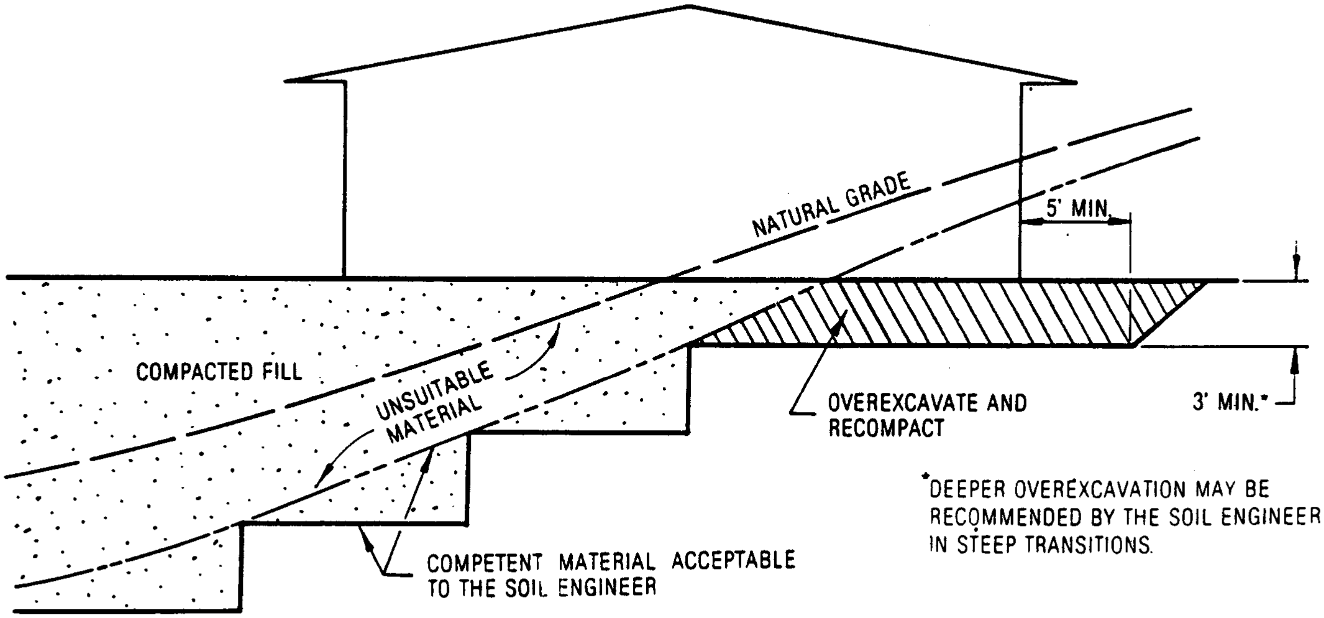
- Care shall be taken by the Contractor during final grading to preserve any berms, drainage terraces, interceptor swales, or other devices of a permanent nature on or adjacent to the property.

TYPICAL OVEREXCAVATION OF DAYLIGHT LINE

CUT LOT

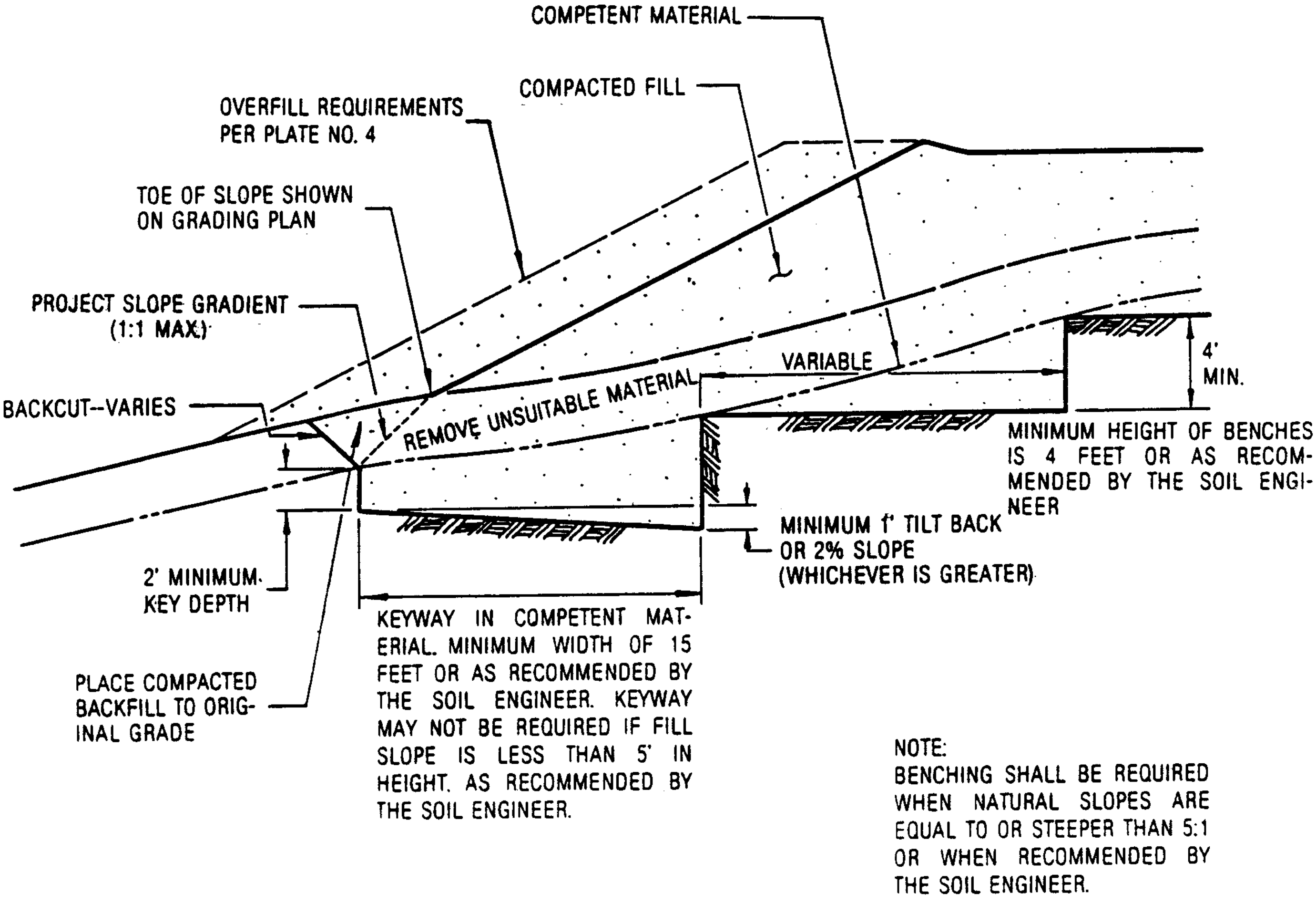


CUT FILL LOT (TRANSITION)



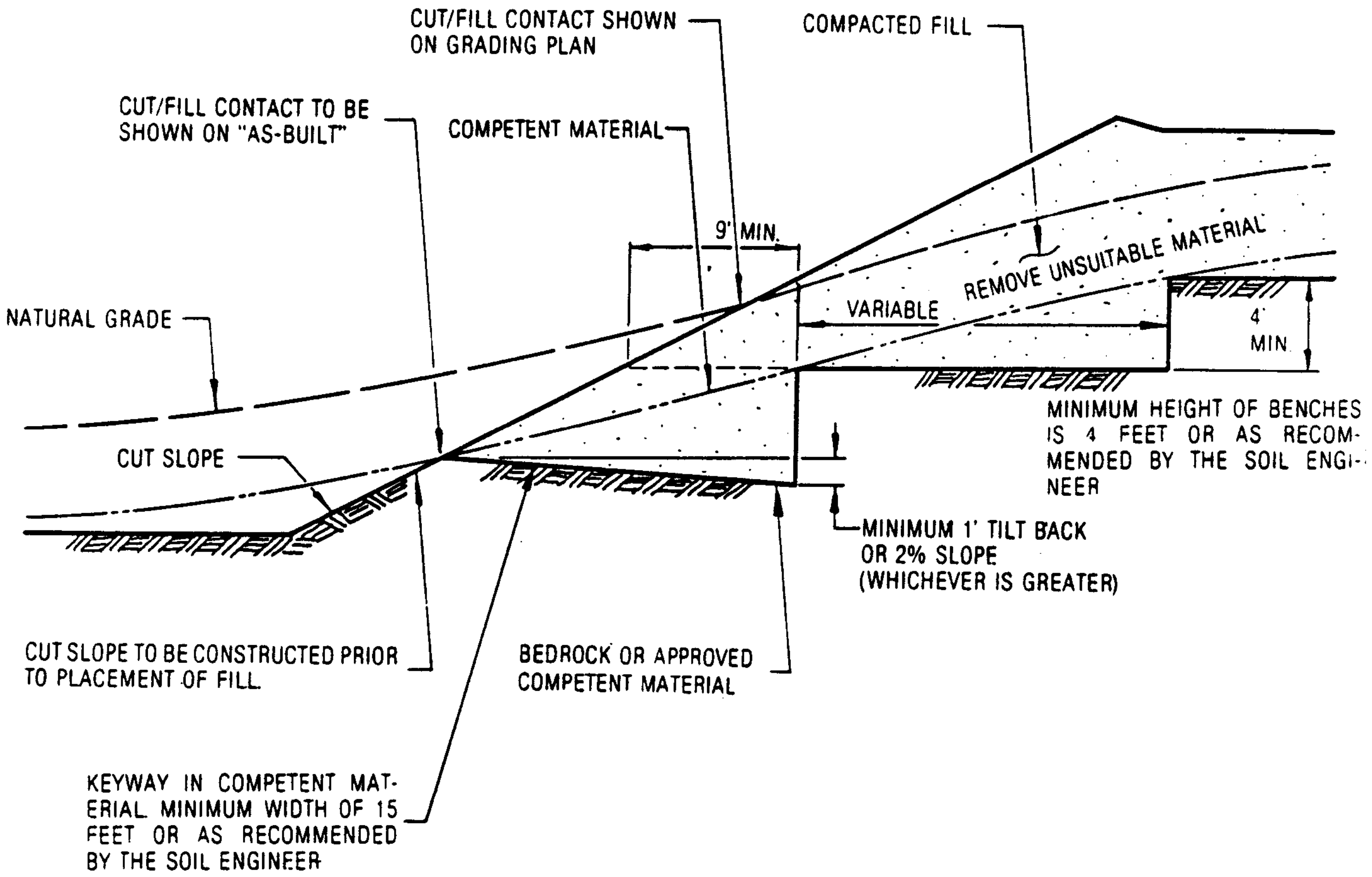
*DEEPER OVEREXCAVATION MAY BE RECOMMENDED BY THE SOIL ENGINEER IN STEEP TRANSITIONS.

TYPICAL FILL OVER NATURAL SLOPE

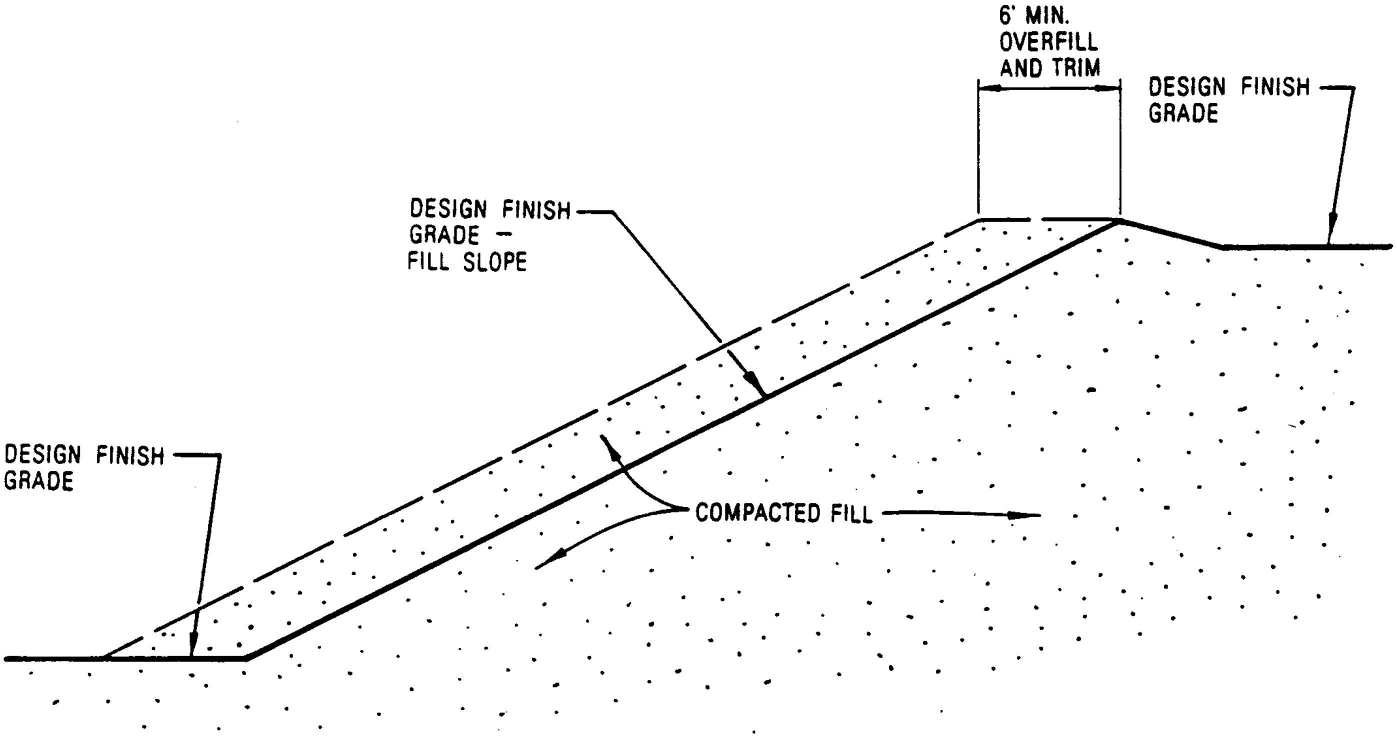


NOTE:
BENCHING SHALL BE REQUIRED WHEN NATURAL SLOPES ARE EQUAL TO OR STEEPER THAN 5:1 OR WHEN RECOMMENDED BY THE SOIL ENGINEER.

TYPICAL FILL-OVER-CUT SLOPE



TYPICAL FILL SLOPE CONSTRUCTION

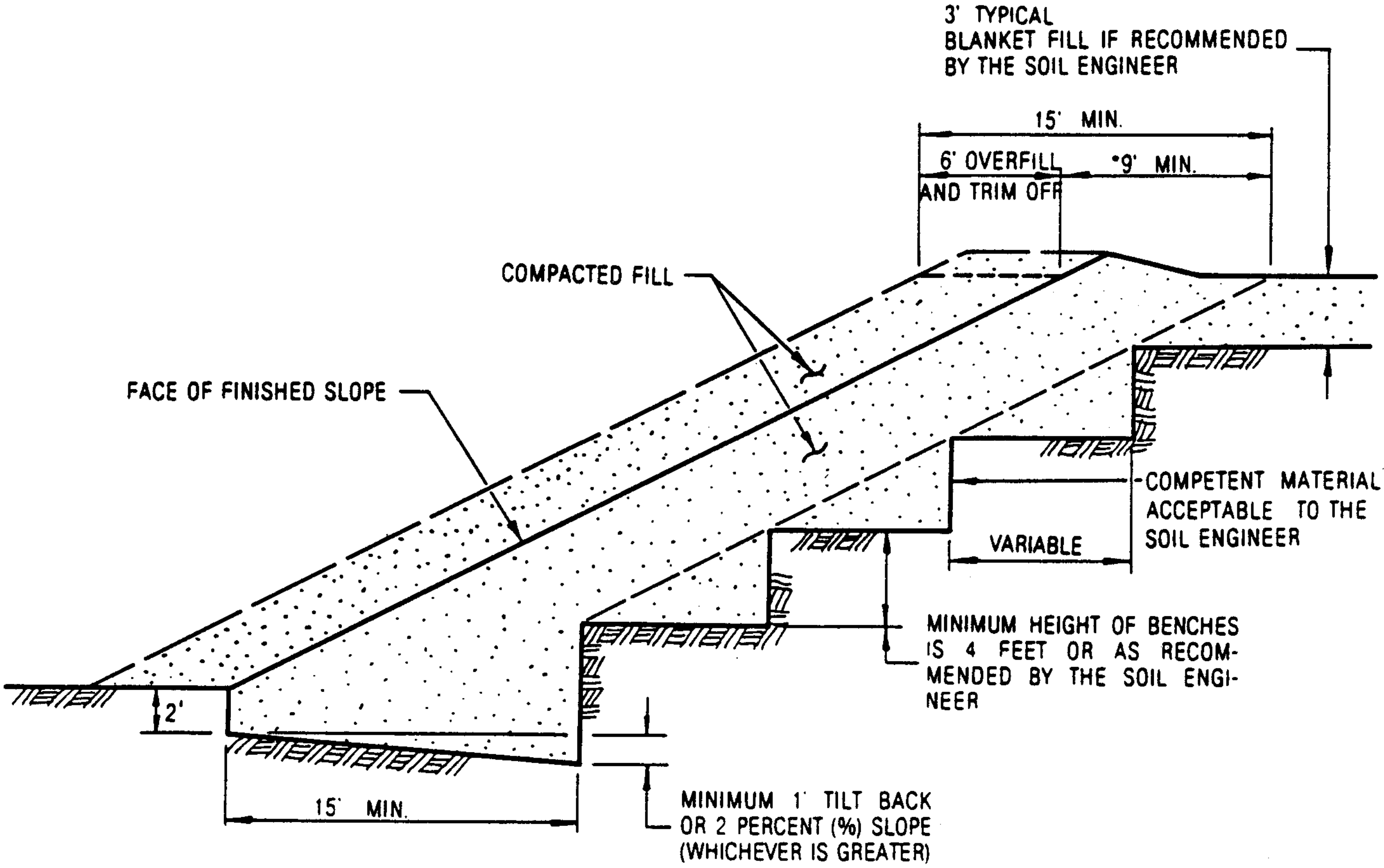


NOTES:

1. ALL FILL SLOPES, INCLUDING BUTTRESS AND STABILIZATION FILLS, SHALL BE OVERFILLED A MINIMUM OF SIX FEET HORIZONTALLY WITH COMPACTED FILL AND TRIMMED TO THE DESIGN FINISH GRADE.

   EXCEPTIONS:
   - A. FILL SLOPE OVER CUT SLOPE.
   - B. FILL SLOPE ADJACENT TO EXISTING IMPROVEMENTS.
2. THE EXCEPTIONS ABOVE WHICH DO NOT HAVE THE 6 FOOT SLOPE OVERFILL AND TRIM SHALL BE COMPACTED AS STATED IN THE PROJECT SPECIFICATIONS.

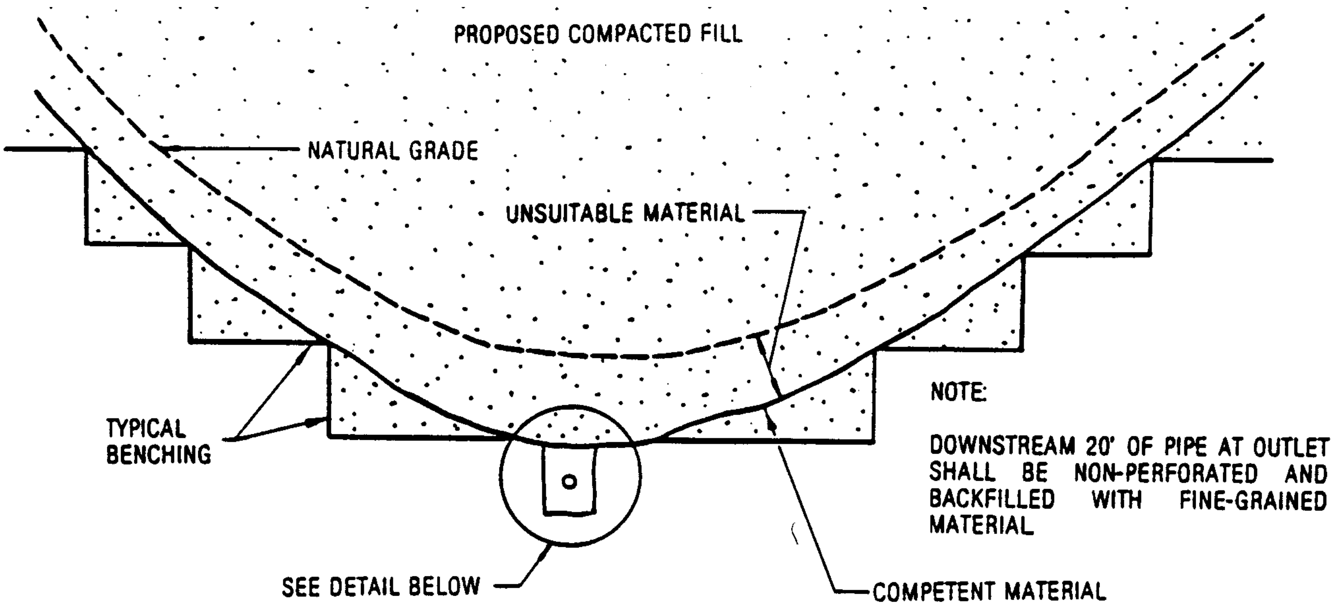
TYPICAL STABILIZATION FILL



NOTE:
SEE PLATE 6 FOR TYPICAL SUBDRAIN DETAILS FOR STABILIZATION FILLS. IF RECOMMENDED BY THE SOIL ENGINEER.

*GREATER THAN 9' IF RECOMMENDED BY THE SOIL ENGINEER; 15' WHERE NO 6' OVERFILL

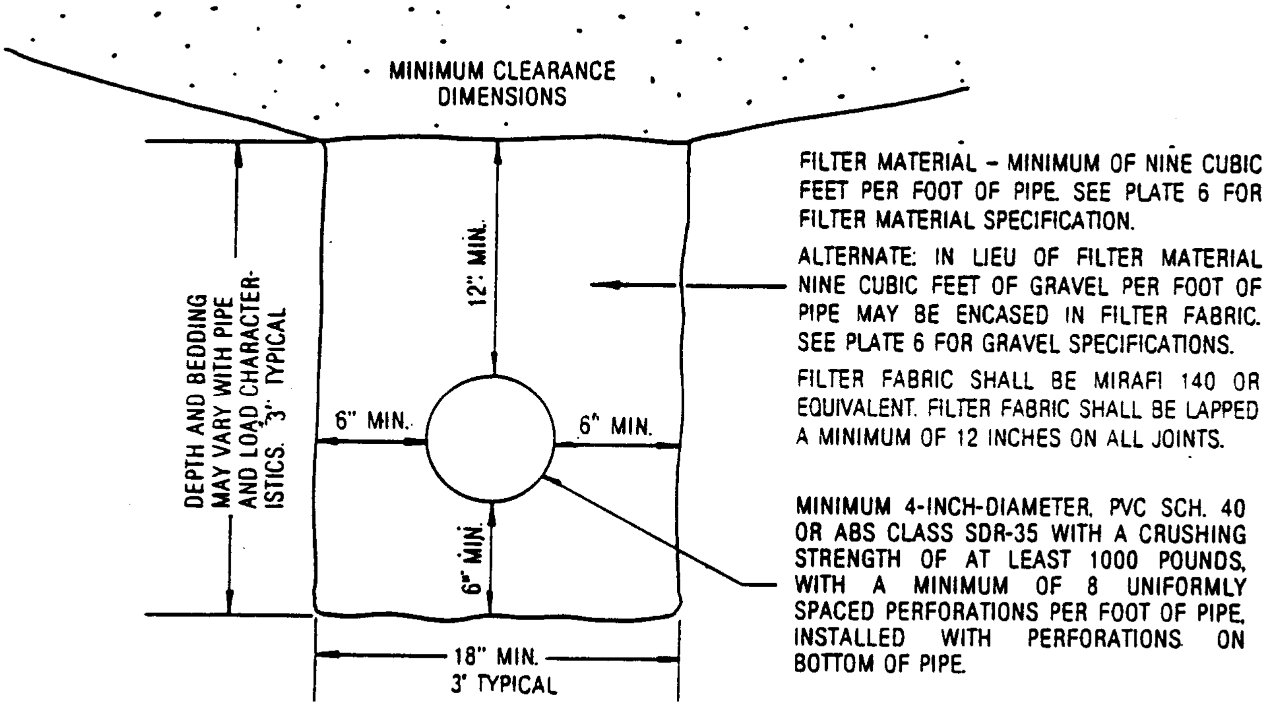
TYPICAL CANYON SUBDRAIN



NOTE:

DOWNSTREAM 20' OF PIPE AT OUTLET SHALL BE NON-PERFORATED AND BACKFILLED WITH FINE-GRAINED MATERIAL

NOTES:
PIPE SHALL BE A MINIMUM OF 4 INCHES DIAMETER AND RUNS OF 500 FEET OR MORE USE 6-INCH DIAMETER PIPE, OR AS RECOMMENDED BY THE SOIL ENGINEER



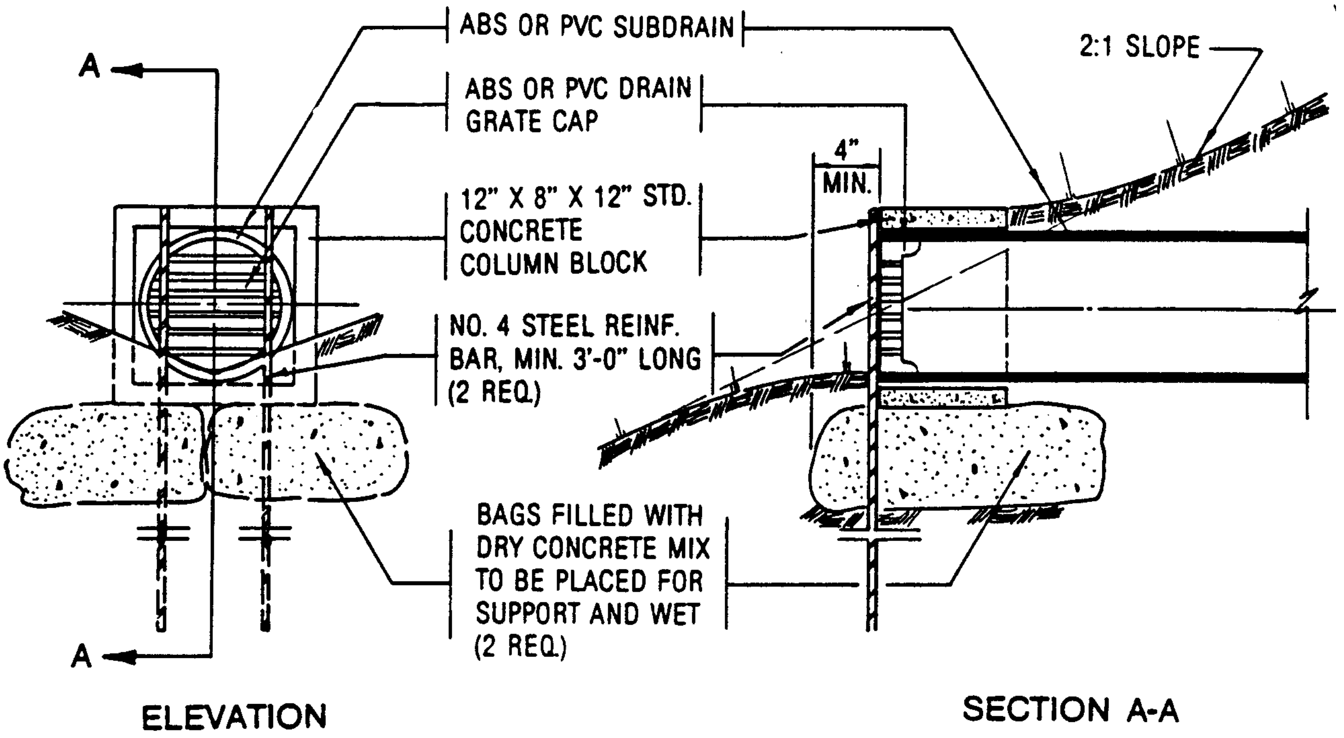
FILTER MATERIAL - MINIMUM OF NINE CUBIC FEET PER FOOT OF PIPE. SEE PLATE 6 FOR FILTER MATERIAL SPECIFICATION.

ALTERNATE: IN LIEU OF FILTER MATERIAL NINE CUBIC FEET OF GRAVEL PER FOOT OF PIPE MAY BE ENCASED IN FILTER FABRIC. SEE PLATE 6 FOR GRAVEL SPECIFICATIONS.

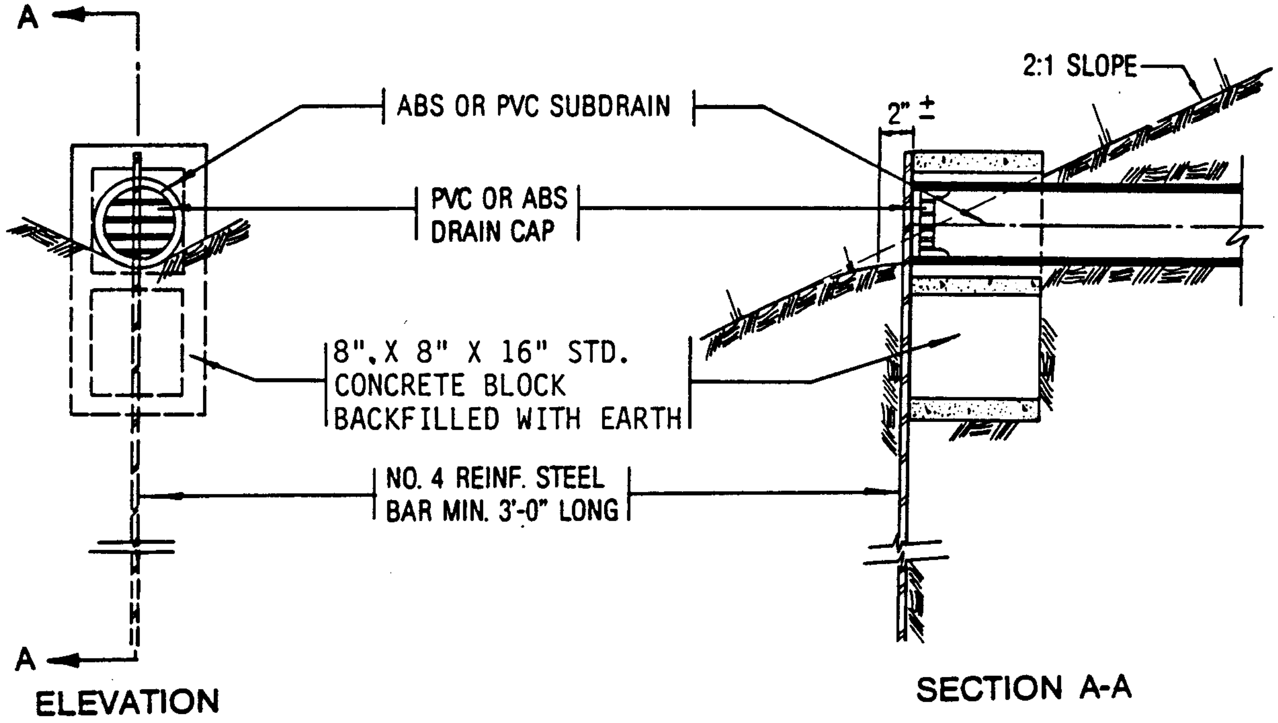
FILTER FABRIC SHALL BE MIRAFI 140 OR EQUIVALENT. FILTER FABRIC SHALL BE LAPPED A MINIMUM OF 12 INCHES ON ALL JOINTS.

MINIMUM 4-INCH-DIAMETER, PVC SCH. 40 OR ABS CLASS SDR-35 WITH A CRUSHING STRENGTH OF AT LEAST 1000 POUNDS, WITH A MINIMUM OF 8 UNIFORMLY SPACED PERFORATIONS PER FOOT OF PIPE, INSTALLED WITH PERFORATIONS ON BOTTOM OF PIPE.

SUBDRAIN OUTLET MARKER

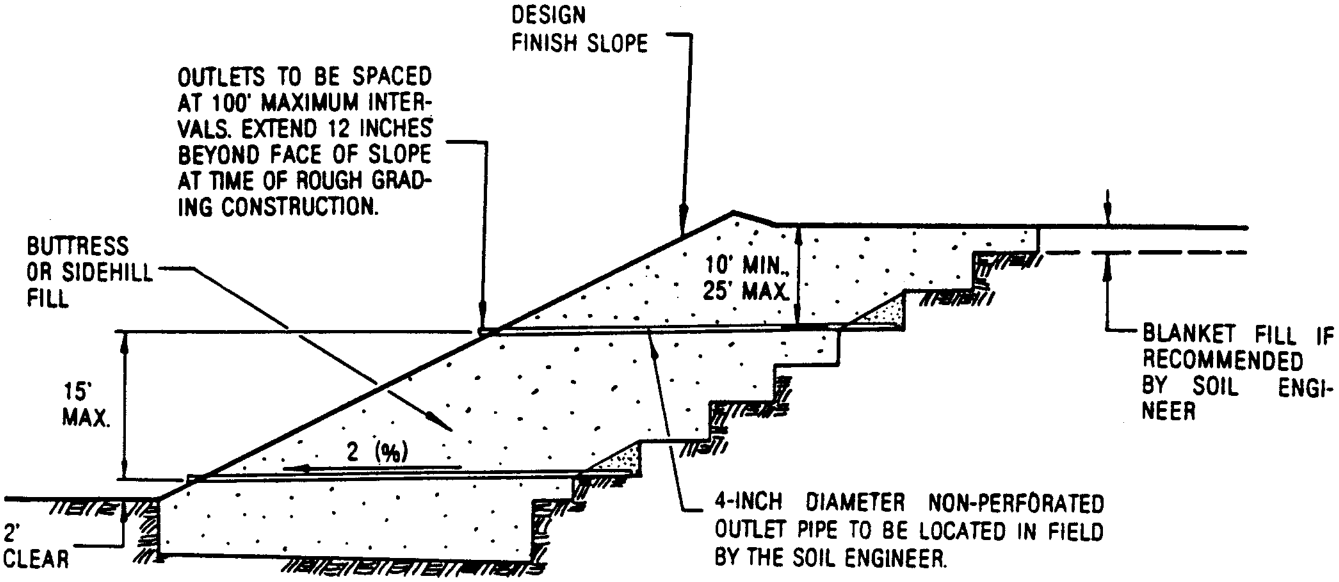


SUBDRAIN OUTLET MARKER FOR 6" AND 8" PIPES



SUBDRAIN OUTLET MARKER – 4" PIPE

TYPICAL STABILIZATION AND BUTTRESS FILL SUBDRAIN



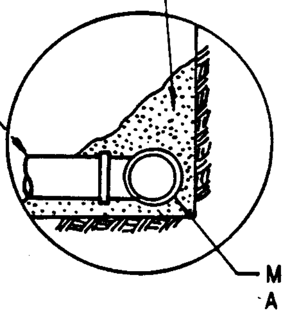
FILTER MATERIAL" TO MEET FOLLOWING SPECIFI-
ATION OR APPROVED EQUIVALENT: (CONFORMS TO
MA STD. PLAN 323)

SIEVE SIZE	PERCENTAGE 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

"GRAVEL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT:

SIEVE SIZE	MAXIMUM PERCENTAGE PASSING
1½"	100
NO. 4	50
NO. 200	8

SAND EQUIVALENT = MINIMUM OF 50



OUTLET PIPE TO BE CONNECTED TO SUBDRAIN PIPE WITH TEE OR ELBOW

FILTER MATERIAL – MINIMUM OF FIVE CUBIC FEET PER FOOT OF PIPE. SEE ABOVE FOR FILTER MATERIAL SPECIFICATION.

ALTERNATIVE: IN LIEU OF FILTER MATERIAL, FIVE CUBIC FEET OF GRAVEL PER FOOT OF PIPE MAY BE ENCASED IN FILTER FABRIC. SEE ABOVE FOR GRAVEL SPECIFICATION.

FILTER FABRIC SHALL BE MIRAFI 140 OR EQUIVALENT. FILTER FABRIC SHALL BE LAPPED A MINIMUM OF 12 INCHES ON ALL JOINTS.

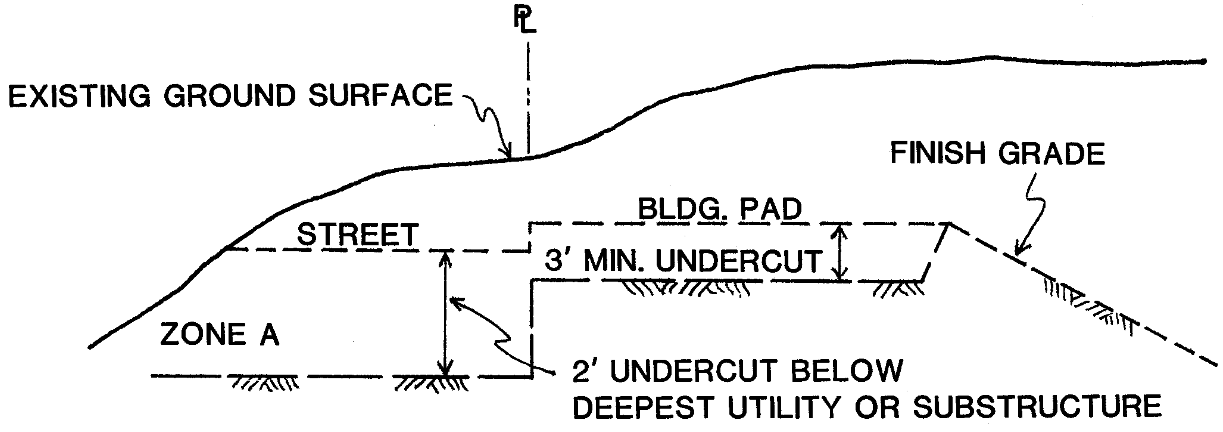
MINIMUM 4-INCH DIAMETER PVC SCH 40 OR ABS CLASS SDR 35 WITH A CRUSHING STRENGTH OF AT LEASE 1,000 POUNDS, WITH A MINIMUM OF 8 UNIFORMLY SPACED PERFORATIONS PER FOOT OF PIPE INSTALLED WITH PERFORATIONS ON BOTTOM OF PIPE. PROVIDE CAP AT UPSTREAM END OF PIPE. SLOPE AT 2 PERCENT TO OUTLET PIPE.

NOTES:

1. TRENCH FOR OUTLET PIPES TO BE BACKFILLED WITH ON-SITE SOIL.

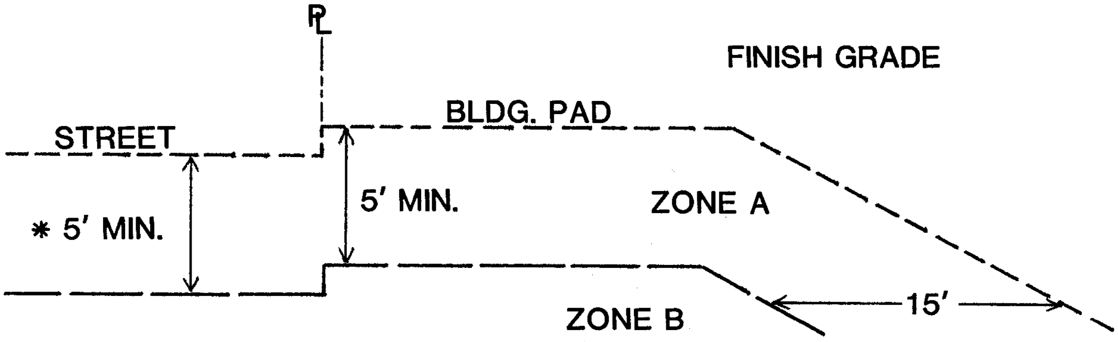
TYPICAL CUT AND FILL GRADING DETAILS

TYPICAL GRADING WITHIN PROPOSED DEEP BEDROCK CUT AREAS



NO SCALE

TYPICAL GRADING WITHIN PROPOSED FILL AREAS



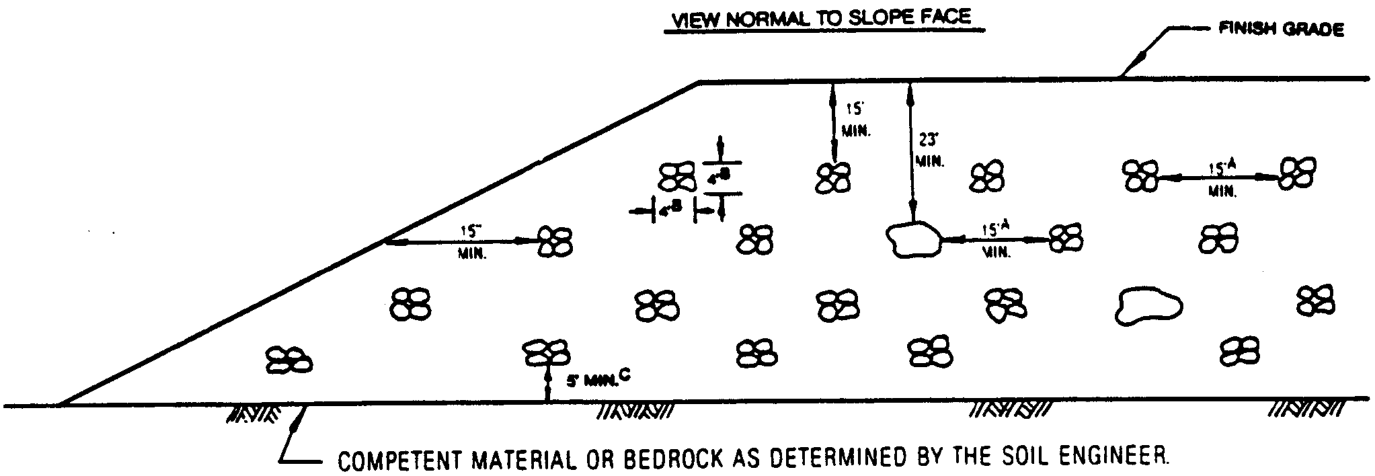
LEGEND

ZONE A ......"SOIL" FILL PLACED IN ACCORDANCE WITH THE RECOMMENDATIONS PRESENTED IN SECTION 11.2.3 OF THIS REPORT

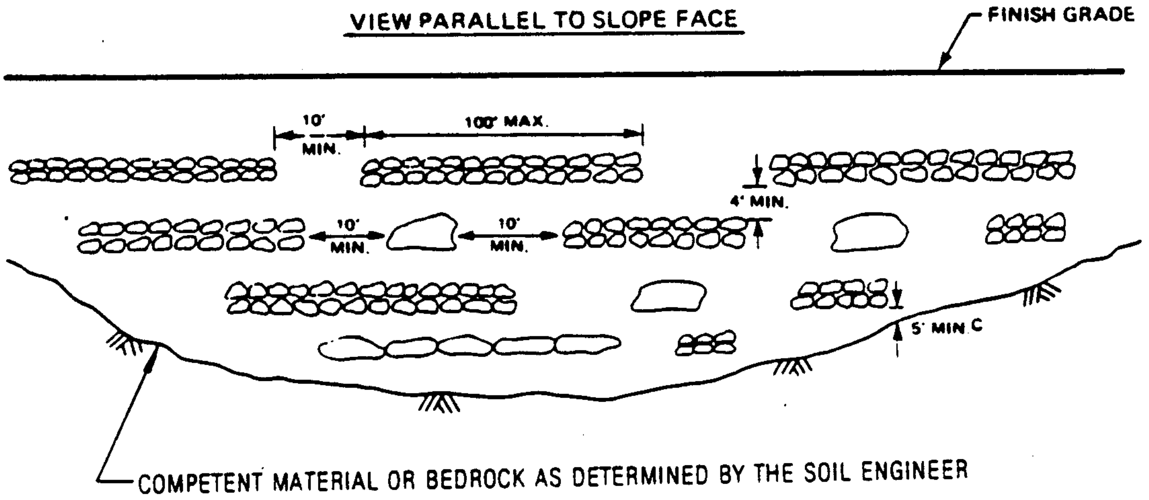
ZONE B ......"SOIL-ROCK" AND/OR "ROCK" FILL PLACED IN ACCORDANCE WITH THE RECOMMENDATIONS PRESENTED IN SECTION 11.2.3 OF THIS REPORT

✱ 5' OR 1' BELOW DEEPEST UTILITY, WHICHEVER IS GREATER

TYPICAL OVERSIZE ROCK DISPOSAL – “SOIL-ROCK” FILL



NOTE:
ORIENTATION OF WINDROWS MAY VARY BUT SHALL BE AS RECOMMENDED BY SOIL ENGINEER.



NOTES:

A. ONE EQUIPMENT WIDTH OR A MINIMUM OF 15 FEET.

B. HEIGHT AND WIDTH MAY VARY DEPENDING ON ROCK SIZE AND TYPE OF EQUIPMENT.

C. IF APPROVED BY THE SOIL ENGINEER, WINDROWS MAY BE PLACED DIRECTLY ON COMPETENT MATERIALS OR BEDROCK PROVIDING ADEQUATE SPACE IS AVAILABLE FOR COMPACTION.

D. VOIDS IN WINDROW TO BE FILLED BY FLOODING GRANULAR SOIL INTO PLACE. GRANULAR SOIL SHALL MEAN ANY SOIL WHICH HAS A UNIFIED SOIL CLASSIFICATION SYSTEM (UBC 29-1) DESIGNATION OF SM, SP, SW, GM, GP, OR GW.

E. AFTER FILL BETWEEN WINDROWS IS PLACED AND COMPACTED WITH THE LIFT OF FILL COVERING WINDROW, WINDROW SHALL BE PROOF-ROLLED WITH D-9 DOZER OR EQUIVALENT.

F. OVERSIZED ROCK IS DEFINED AS LARGER THAN 12" IN SIZE.