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GEOTECHNICAL INVESTIGATION
QUINCE STREET SENIOR HOUSING DEVELOPMENT
220 NORTH QUINCE STREET
ESCONDIDO, CALIFORNIA

PREPARED FOR:

MATTHEW B. JUMPER
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PREPARED BY:

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Providing Professional Engineering Services Since 1959

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November 6, 2017

SCST No. 170308N
Report No. 1

Matthew B. Jumper
220 Quince, L.P.
7956 Lester Avenue
Lemon Grove, California 91945

Subject: GEOTECHNICAL INVESTIGATION
QUINCE STREET SENIOR HOUSING DEVELOPMENT
220 NORTH QUINCE STREET
ESCONDIDO, CALIFORNIA

Dear Mr. Jumper:

SCST, Inc. (SCST) is pleased to present our report describing the geotechnical investigation performed for the subject project. We conducted the geotechnical investigation in general conformance with the scope of work presented in our proposal dated May 17, 2017. Based on the results of our investigation, we consider the planned construction feasible from a geotechnical standpoint provided the recommendations of this report are followed. If you have any questions, please call us at (619) 280-4321.

Respectfully submitted,
SCST, INC.

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EXECUTIVE SUMMARY

This report presents the results of the geotechnical investigation SCST, Inc. (SCST) performed for the subject project. We understand the project will consist of the design and construction of a five-story building consisting of four stories of wood-framed residential units over an at-grade concrete parking structure and associated storm water BMP facilities. The purpose of our work is to provide conclusions and recommendations regarding the geotechnical aspects of the project.

We explored the subsurface conditions by drilling 6 borings and 2 percolation test holes to depths between about 5 and 35½ feet below the existing ground surface using a truck-mounted drill rig equipped with a hollow-stem auger. An SCST geologist logged the borings and test holes and collected samples of the materials encountered for laboratory testing. SCST tested selected samples from the borings and test holes to evaluate pertinent soil classification and engineering properties to assist in developing geotechnical conclusions and recommendations.

The materials encountered in the borings and percolation test holes consist of fill, old alluvial flood-plain deposits, and granodiorite. The fill extends to depths up to about 10 feet below the existing ground surface and consists of loose to medium dense silty to clayey sand with varying amounts of gravel. The alluvium consists of very loose to dense sands and silts and medium stiff to very stiff clays. The granodiorite encountered in our borings is intensely weathered and when broken down consists of very dense poorly graded sand with silt and silty to clayey sand. Groundwater was encountered at depths between about 14 and 18½ feet below existing grade.

We performed two borehole percolation tests. Tested infiltration rates of 0.0 inch per hour were measured at both locations. The tested infiltration rates do not support infiltration of storm water in any appreciable quantity. Onsite storm water BMP facilities should be lined with an impermeable liner and a subdrain and collection pipe system installed to reduce the potential for lateral migration of the introduced water beneath structures and improvements.

The main geotechnical considerations affecting the planned development are the presence of potentially compressible soils (fill and alluvium) and potentially liquefiable alluvium. To reduce the potential for static settlement, the top 5 feet of existing soil should be over-excavated and recompacted below the planned structure, settlement sensitive improvements and new fills. Our liquefaction analysis shows that dynamic and post-liquefaction settlements beneath the planned building are estimated to be up to about 7 inches total and 3½ inches differential across the structure. Due to groundwater, over-excavation and recompaction of the potentially liquefiable alluvium is not feasible. However, ground improvement can be used to densify the soils in placed and mitigate liquefaction and the resulting settlements to acceptable levels. We understand that rammed aggregate piers extending to granodiorite will be used for ground improvement, and that settlements will be reduced to 2 inches total and 1 inch differential over a distance of 40 feet. Following ground improvement, the planned building can be supported on shallow spread footings with bottoms levels on aggregate piers. The recommendations presented herein may need to be updated once final plans are developed.

1. INTRODUCTION

This report presents the results of the geotechnical investigation SCST, Inc. (SCST) performed for the subject project. We understand the project will consist of the design and construction of a five-story building consisting of four stories of wood-framed residential units over an at-grade concrete parking structure and associated storm water BMP facilities. The purpose of our work is to provide conclusions and recommendations regarding the geotechnical aspects of the project. Figure 1 presents a site vicinity map.

2. SCOPE OF WORK

2.1 FIELD INVESTIGATION

We explored the subsurface conditions by drilling 6 borings and 2 percolation tests to depths between about 5 and 35½ feet below the existing ground surface using a truck-mounted drill rig equipped with a hollow-stem auger. Figure 2 shows the approximate locations of the borings and percolation tests. An SCST geologist logged the borings and percolation test holes and collected samples of the materials encountered for laboratory testing. Logs of the borings and test holes are presented in Appendix I. Soils are classified according to the Unified Soil Classification System illustrated on Figure I-1.

2.2 LABORATORY TESTING

Selected samples obtained from the borings and percolation test holes were tested to evaluate pertinent soil classification and engineering properties and enable development of geotechnical conclusions and recommendations. The laboratory tests consisted of in situ moisture and density, grain size distribution, Atterberg limits, fines content, R-value, expansion index, and corrosivity. The results of the laboratory tests and brief explanations of the test procedures are presented in Appendix II.

2.3 ANALYSIS AND REPORT

The results of the field and laboratory tests were evaluated to develop conclusions and recommendations regarding:

- Subsurface conditions beneath the site
- Potential geologic and seismic hazards, including liquefaction potential
- Criteria for seismic design in accordance with the 2016 California Building Code (CBC)
- Site preparation and grading
- Foundation alternatives and geotechnical engineering criteria for design of the foundations
- Estimated foundation settlements
- Support for concrete slabs-on-grade
- Lateral pressures for the design of retaining walls
- Pavement sections
- Soil corrosivity
- Infiltration feasibility

3. SITE DESCRIPTION

The subject site is located at the northeast corner of North Quince Street and West Valley Parkway in the City of Escondido, California. Existing site improvements consist of three warehouse buildings, a maintenance shed and associated pavements. The site is located within the Escondido Creek drainage basin. Escondido Creek flows in a general east-west direction within a concrete-lined channel along the northern edge of the site. The site is relatively flat with elevations ranging from about 642 to 644 feet.

4. PROPOSED DEVELOPMENT

We understand the project will consist of the design and construction of a five-story building consisting of four stories of wood-framed residential units over an at-grade concrete parking structure and associated storm water BMP facilities. As currently planned, the proposed building will have a finish floor elevation of 642.10 feet. Minor site grading will be needed to achieve finish site grades.

5. GEOLOGY AND SUBSURFACE CONDITIONS

The materials encountered in the borings and percolation test holes consist of fill, old alluvial flood-plain deposits and granodiorite. Descriptions of the materials are presented below. Figure 2 presents the site-specific geology. Figure 3 presents a geologic cross section. Figure 4 presents the regional geology in the vicinity of the site.

Fill: Fill was encountered in each of the borings and percolation test holes. The fill consists of loose to medium dense silty to clayey sand with varying amounts of gravel. The fill encountered in the explorations extends to depths varying from about 2 feet to 10 feet below the existing ground surface.

Old Alluvial Flood-Plain Deposits: Alluvial deposits were encountered beneath the fill in each of the explorations. The alluvium consists of very loose to dense sands and silts and medium stiff to very stiff clays. The alluvium encountered in the explorations extends to depths between about 18 and 30 feet below the existing ground surface.

Granodiorite: Granodiorite underlies the entire site at depth. The granodiorite encountered in our borings is intensely weathered and when broken down consists of very dense poorly graded sand with silt and silty to clayey sand.

Groundwater: Groundwater was encountered at depths between about 14 and 18½ feet below the existing ground surface. Groundwater levels may fluctuate in the future due to rainfall, irrigation, broken pipes, or changes in site drainage. Because groundwater rise or seepage is difficult to predict, such conditions are typically mitigated if and when they occur.

6. GEOLOGIC HAZARDS

6.1 FAULTING AND SURFACE RUPTURE

The closest known active fault is the Elsinore fault zone located 15.7 miles (25.3 kilometers) northeast of the site. The site is not located in an Alquist-Priolo Earthquake Fault Zone. No active faults are known to underlie or project toward the site. Therefore, the probability of fault rupture at the site is low.

6.2 CBC SEISMIC DESIGN PARAMETERS

A geologic hazard likely to affect the project is ground shaking as a result of movement along an active fault zone in the vicinity of the site. Assuming ground improvement is performed to mitigate liquefaction, the site coefficients and maximum considered earthquake (MCE$_R$) spectral response acceleration parameters in accordance with the 2016 CBC are as follows:

Site Coordinates: Latitude 33.11998°

Longitude -117.08895°
Site Class: D
Site Coefficients, F_a = 1.091
F_v = 1.607
Mapped Spectral Response Acceleration at Short Period, S_s = 1.023g
Mapped Spectral Response Acceleration at 1-Second Period, S_1 = 0.397g
Design Spectral Acceleration at Short Period, S_{DS} = 0.744g
Design Spectral Acceleration at 1-Second Period, S_{D1} = 0.425g
Site Peak Ground Acceleration, PGA$_M$ = 0.427g

6.3 LIQUEFACTION AND DYNAMIC SETTLEMENT

Liquefaction is a process in which soil grains in a saturated deposit lose contact after the occurrence of earthquakes or other sources of ground shaking. The soil deposit temporarily behaves as a viscous fluid; pore pressures rise, and the strength of the deposit is greatly diminished. Liquefiable soils typically consist of cohesionless sands and silts that are loose to medium dense, and saturated. Recent studies also show that some relatively soft cohesive soils can be subject to cyclic softening during significant earthquake shaking. To liquefy, saturated soils must be subjected to ground shaking of sufficient magnitude and duration. For our analysis we used a PGA of 0.427g, an earthquake magnitude of 7.7, and groundwater depths of 14 to 18½ feet. Based on our analysis, there is a potential for liquefaction to occur within the very loose to medium dense alluvial sands and silts underlying the site. Dynamic and post-liquefaction settlements are estimated to be about 7 inches total and 3½ inches differential across the structure. Based on our analysis, the site is not susceptible to lateral spreading. We that understand ground improvement will be performed to reduce settlements to 2 inches total and 1 inch differential over a distance of 40 feet.

6.4 LANDSLIDES AND SLOPE STABILITY

Evidence of landslides or slope instabilities was not observed. The potential for landslides or slope instabilities to occur at the site is considered low.

6.5 TSUNAMIS, SEICHES AND FLOODING

The site is located within a 0.2% annual chance flood area (FEMA, 2012) associated with Escondido Creek. The site is not located within a mapped area on the State of California Tsunami Inundation Maps (Cal EMA, 2009); therefore, damage due to tsunamis is considered negligible. Seiches are periodic oscillations in large bodies of water such as lakes, harbors, bays, or reservoirs. The site is not located immediately adjacent to any lakes or confined bodies of water; therefore, the potential for a seiche to affect the site is low.

6.6 SUBSIDENCE

The site is not located in an area of known subsidence associated with fluid withdrawal (groundwater or petroleum); therefore, the potential for subsidence due to the extraction of fluids is negligible.

6.7 HYDRO-CONSOLIDATION

Hydro-consolidation can occur in recently deposited (less than 10,000 years old) sediments that were deposited in a semi-arid environment. Examples of such sediments are aolian sands, alluvial fan deposits, and mudflow sediments deposited during flash floods. The pore space between particle grains can re-adjust when inundated by groundwater causing the material to consolidate. The fill and alluvial soils are susceptible to hydro-consolidation. The proposed ground improvement should effectively mitigate this hazard.

7. CONCLUSIONS

Based on the results of our investigation, we consider the planned construction feasible from a geotechnical standpoint provided the recommendations of this report are followed. The main geotechnical considerations affecting the planned development are the presence of potentially compressible and potentially liquefiable soils. To mitigate the potentially compressible soils and reduce the potential for static settlement and distress to the planned building and improvements, remedial grading of the existing upper soil will need to be performed. To mitigate the liquefaction hazard and the resulting settlements to acceptable levels, we understand that ground improvement consisting of rammed aggregate piers extending down to the underlying granodiorite will be performed. Following ground improvement, the planned building can be supported on shallow spread footings with bottoms levels on rammed aggregate piers. The recommendations presented herein may need to be updated once final plans are developed.

8. RECOMMENDATIONS

8.1 SITE PREPARATION AND GRADING

8.1.1 Site Preparation

Site preparation should begin with the removal of existing improvements, topsoil, vegetation and debris. Subsurface improvements that are to be abandoned should be removed and the resulting excavations should be backfilled and compacted in accordance with the recommendations of this report. Pipeline abandonment can consist of capping or rerouting at the project perimeter and removal within the project perimeter. If appropriate, abandoned pipelines can be filled with grout or slurry as recommended by and observed by the geotechnical consultant.

8.1.2 Remedial Grading

To reduce the potential for static settlement, the top 5 feet of existing soil should be excavated beneath the planned building, settlement sensitive improvements and new fills. Horizontally, the excavations should extend at least 5 feet outside the planned perimeter foundations, at least 2 feet outside the planned hardscape and pavements, or up to existing improvements or the project boundary, whichever is less. An SCST representative should observe conditions exposed in the bottom of the excavation to determine if additional excavation is required.

8.1.3 Ground Improvement

Various ground improvement methods are available to mitigate liquefaction and the resulting settlements to acceptable levels. They include stone columns, earthquake drains, rammed aggregate piers or pressure grouting. The specifications for each type of ground improvement are unique to the method used and to the contractor performing the services, as each contractor’s methods and equipment vary. The only control is to perform post-treatment testing to verify that the soils have been densified as required to mitigate the potential for liquefaction. Verification testing of the soils should be performed after the ground improvement is completed. We understand that rammed aggregate piers extending down to granodiorite will be used for ground improvement, and that settlements will be reduced to 2 inches total and 1 inch differential over a distance of 40 feet. Following ground improvement and post-treatment verification that liquefaction potential has been mitigated to acceptable levels, the planned building can be supported on shallow spread footings with bottoms levels on aggregate piers. An SCST representative should observe the ground improvement operations.

8.1.4 Compacted Fill

Prior to placing fill, the exposed surface should be scarified to a depth of 12 inches, moisture conditioned to near optimum moisture content, and compacted to at least 90% relative compaction. Excavated material, except for vegetation, debris and rocks greater than 6 inches can be used as compacted fill. Material with an expansion index of 20 or less determined in accordance with ASTM D4829 should be used as compacted fill. We expect that most of the onsite materials will meet the expansion index criteria and can be used as compacted fill. Concrete slabs should be underlain by at least 2 feet of material with an expansion index of 20 or less. Fill should be moisture conditioned to near optimum moisture content and compacted to at least 90% relative compaction. Fill should be placed in horizontal lifts at a thickness appropriate for the equipment spreading, mixing, and compacting the material, but generally should not exceed 8 inches in loose thickness. The maximum dry density and optimum moisture content for evaluating relative compaction should be determined in accordance with ASTM D 1557. Fills should be benched into sloping ground inclined steeper than 5:1 (horizontal:vertical). Utility trench backfill beneath structures, pavements and hardscape should be compacted to at least 90% relative compaction. The top 12 inches of subgrade beneath pavements should be compacted to at least 95%.

8.1.5 Expansive Soil

The onsite soils tested have a very low expansion potential. The grading and foundation recommendations presented in this report reflect a very low expansion potential.

8.1.6 Imported Soil

Imported soil should consist of predominately granular soil free of organic matter and rocks greater than 6 inches. Imported soil should be observed and, if appropriate, tested by SCST prior to transport to the site to determine suitability for the intended use.

8.1.7 Excavation Characteristics

It is anticipated that excavations can be achieved with conventional earthwork equipment in good working order.

8.1.8 Temporary Dewatering

Groundwater seepage may occur locally due to broken pipes, local irrigation or following heavy rain. Groundwater should be anticipated in the planned excavations. Dewatering can be accomplished by sloping the excavation bottom to a sump and pumping from the sump. A layer of gravel about 6 inches thick placed in the bottom of the excavation will facilitate groundwater flow and can be used as a working platform.

8.1.9 Temporary Excavations

Temporary excavations 3 feet deep or less can be made vertically. Deeper temporary excavations should be laid back no steeper than 1:1 (horizontal:vertical). The faces of temporary slopes should be inspected daily by the contractor’s Competent Person before personnel are allowed to enter the excavation. Any zones of potential instability, sloughing or raveling should be brought to the attention of the Engineer and corrective action implemented before personnel begin working in the excavation. Excavated soils should not be stockpiled behind temporary excavations within a distance equal to the depth of the excavation. SCST should be notified if other surcharge loads are anticipated so that lateral load criteria can be developed for the specific situation. If temporary slopes are to be maintained during the rainy season, berms are recommended along the tops of slopes to prevent runoff water from entering the excavation and eroding the slope faces.

Slopes steeper than those described above will require shoring. Additionally, temporary excavations that extend below a plane inclined at 1½:1 (horizontal:vertical) downward from the outside bottom edge of existing structures or improvements will require shoring or underpinning. Soldier piles and lagging, internally braced shoring or trench boxes could be used. If trench boxes are used, the soil immediately adjacent to the trench box is not directly supported. Ground surface deformations immediately adjacent to the pit or trench could be greater where trench boxes are used compared to other methods of shoring.

As an alternative to shoring/underpinning, maximum 10-foot wide slots can be excavated and immediately backfilled adjacent to existing structures and improvement. Care should be taken to not undermine existing footings. Slot excavations should be filled prior to performing adjacent excavations.

8.1.10 Temporary Shoring

For design of cantilevered shoring, an active soil pressure equal to a fluid weighing 35 pcf can be used for level retained ground or 55 pcf for 2:1 (horizontal:vertical) sloping ground. The surcharge loads on shoring from traffic and construction equipment adjacent to the excavation can be modeled by assuming an additional 2 feet of soil behind the shoring. For design of soldier piles, an allowable passive pressure of 350 psf per foot of embedment over twice the pile diameter up to a maximum of 5,000 psf can be used. Soldier piles should be spaced at least three pile diameters, center to center. Continuous lagging will be required throughout. The soldier piles should be designed for the full anticipated lateral pressure; however, the pressure on the lagging will be less due to arching in the soils. For design of lagging, the earth pressure but can be limited to a maximum value of 400 psf.

8.1.11 Slopes

All permanent slopes should be constructed no steeper than 2:1 (horizontal:vertical). Faces of fill slopes should be compacted either by rolling with a sheep-foot roller or other suitable equipment, or by overfilling and cutting back to design grade. All slopes are susceptible to surficial slope failure and erosion. Water should not be allowed to flow over the top of slope. Additionally, slopes should be planted with vegetation that will reduce the potential for erosion.

8.1.12 Surface Drainage

Final surface grades around structures should be designed to collect and direct surface water away from the structure and toward appropriate drainage facilities. The ground around the structure should be graded so that surface water flows rapidly away from the structure without ponding. In general, we recommend that the ground adjacent to the structure slope away at a gradient of at least 2%. Densely vegetated areas where runoff can be impaired should have a minimum gradient of at least 5% within the first 5 feet from the structure. Roof gutters with downspouts that discharge directly into a closed drainage system are recommended on structures. Drainage patterns established at the time of fine grading should be maintained throughout the life of the proposed structures. Site irrigation should be limited to the minimum necessary to sustain landscape growth. Should excessive irrigation, impaired drainage, or unusually high rainfall occur, saturated zones of perched groundwater can develop.

8.1.13 Grading Plan Review

SCST should review the grading plans and earthwork specifications to ascertain whether the intent of the recommendations contained in this report have been implemented, and that no revised recommendations are needed due to changes in the development scheme.

8.2 FOUNDATIONS

8.2.1 Shallow Spread Footings

The proposed building can be supported on shallow spread footings with bottoms levels on rammed aggregate piers. Footings should extend at least 24 inches below lowest adjacent finished grade. Continuous footings should be at least 12 inches wide. Isolated or retaining wall footings should be at least 24 inches wide. An allowable bearing capacity of 6,000 psf can be used. The bearing value can be increased by ⅓ when considering the total of all loads, including wind or seismic forces. Footings located adjacent to or within slopes should be extended to a depth such that a minimum horizontal distance of 7 feet exists between the lower outside footing edge and the face of the slope.

Lateral loads will be resisted by friction between the bottoms of footings and passive pressure on the faces of footings and other structural elements below grade. An allowable coefficient of friction of 0.45 can be used. Passive pressure can be computed using an allowable lateral pressure of 350 psf per foot of depth below the ground surface. The passive pressure can be increased by ⅓ when considering the total of all loads, including wind or seismic forces. The upper 1 foot of soil should not be relied on for passive support unless the ground is covered with pavements or slabs.

8.2.2 Settlement Characteristics

We understand that the ground improvement program will be designed to result in foundation settlements of 2 inches total and 1 inch differential over a distance of 40 feet for static and seismic.

8.2.3 Foundation Plan Review

SCST should review the foundation plans to ascertain that the intent of the recommendations in this report has been implemented and that revised recommendations are not necessary as a result of changes after this report was completed.

8.2.4 Foundation Excavation Observations

A representative from SCST should observe the foundation excavations prior to forming or placing reinforcing steel.

8.3 SLABS-ON-GRADE

8.3.1 Parking Structure Slab-on-Grade

The project structural engineer should design the parking structure slabs-on-grade. However, we recommend that the slab have a minimum thickness of 5½ inches. The slab should be reinforced with at least No. 4 reinforcing bars placed at 16 inches on center each way. Reinforcement should be placed approximately at mid-height of the slab. Concrete should have a minimum compressive strength of 3,250 psi.

A vapor barrier should be placed beneath the slab-on-grade where moisture sensitive floor coverings or equipment are planned. If plastic is used, a minimum 10-mil is recommended. The plastic should comply with ASTM E1745. Installation should comply with ASTM E1643. Current construction practice typically includes placement of a 2-inch thick sand cushion between the bottom of the concrete slab and the moisture vapor barrier. This cushion can provide some protection to the vapor barrier during construction, and may assist in reducing the potential for edge curling in the slab during curing. However, the sand layer also provides a source of moisture to the underside of the slab that can increase the time required to reduce vapor emissions to limits acceptable for the type of floor covering placed on top of the slab. The slab can be placed directly on the vapor barrier. The floor covering manufacturer should be contacted to determine the volume of moisture vapor allowable and any treatment needed to reduce moisture vapor emissions to acceptable limits for the particular type of floor covering installed.

8.3.2 Exterior Slabs-on-Grade

Exterior slabs should be at least 4 inches thick and reinforced with at least No. 3 bars at 18 inches on center each way. Slabs should be provided with weakened plane joints. Joints should be placed in accordance with the American Concrete Institute (ACI) guidelines. The project architect should select the final joint patterns. A 1-inch maximum size aggregate mix is recommended for concrete for exterior slabs. The corrosion potential of on-site soils with respect to reinforced concrete will need to be taken into account in concrete mix design. Coarse and fine aggregate in concrete should conform to the “Greenbook” Standard Specifications for Public Works Construction.

8.4 CONVENTIONAL RETAINING WALLS

8.4.1 Foundations

The recommendations provided in the foundation section of this report are also applicable to conventional retaining walls.

8.4.2 Lateral Earth Pressures

The active earth pressure for the design of unrestrained retaining walls with level backfill can be taken as equivalent to the pressure of a fluid weighing 35 pcf. The at-rest earth pressure for the design of restrained retaining walls with level backfills can be taken as equivalent to the pressure of a fluid weighing 55 pcf. These values assume a granular and drained backfill condition. Higher lateral earth pressures would apply if walls retain expansive clay soils. An additional 20 pcf should be added to these values for walls with a 2:1 (horizontal:vertical) sloping backfill. An increase in earth pressure equivalent to an additional 2 feet of retained soil can be used to account for surcharge loads from light traffic. The above values do not include a factor of safety. Appropriate factors of safety should be incorporated into the design. If any other surcharge loads are anticipated, SCST should be contacted for the necessary increase in soil pressure.

Retaining walls should be designed to resist hydrostatic pressures or be provided with a backdrain to reduce the accumulation of hydrostatic pressures. Backdrains may consist of a 2-foot wide zone of ¾-inch crushed rock. The backdrain should be separated from the adjacent soils using a non-woven filter fabric, such as Mirafi 140N or equivalent. Weep holes should be provided or a perforated pipe should be installed at the base of the backdrain and sloped to discharge to a suitable storm drain facility. As an alternative, a geocomposite drainage system such as Miradrain 6000 or equivalent placed behind the wall and connected to a suitable storm drain facility can be used. The project architect should provide waterproofing specifications and details. Figure 5 presents typical conventional retaining wall backdrain details.

8.4.3 Seismic Earth Pressure

If required, the seismic earth pressure can be taken as equivalent to the pressure of a fluid weighing 15 pcf. This value is for level backfill and does not include a factor of safety. Appropriate factors of safety should be incorporated into the design. This pressure is in addition to the un-factored, static active earth pressure. The passive pressure and bearing capacity can be increased by ⅓ in determining the seismic stability of the wall.

8.4.4 Backfill

Wall backfill should consist of granular, free-draining material having an expansion index of 20 or less. The backfill zone is defined by a 1:1 plane projected upward from the heel of the wall. Expansive or clayey soil should not be used. We anticipate that most of the onsite soils will not be suitable for wall backfill. Additionally, backfill within 3 feet from the back of the wall should not contain rocks greater than 3 inches in dimension. Backfill should be compacted to at least 90% relative compaction. Backfill should not be placed until walls have achieved adequate structural strength. Compaction of wall backfill will be necessary to minimize settlement of the backfill and overlying settlement sensitive improvements. However, some settlement should still be anticipated. Provisions should be made for some settlement of concrete slabs and pavements supported on backfill. Any utilities supported on backfill should be designed to tolerate differential settlement.

8.5 MECHANICALLY STABILIZED EARTH RETAINING WALLS

The following soil parameters can be used for design of mechanically stabilized earth (MSE) retaining walls.

MSE Wall Design Parameters

Soil Parameter	Reinforced Soil	Retained Soil	Foundation Soil
Internal Friction Angle (degrees)	32°	32°	32°
Cohesion (psf)	0	0	0
Moist Unit Weight (pcf)	130	130	130

The reinforced soil should consist of granular, free-draining material with an expansion index of 20 or less. The bottom of wall should extend to such a depth that 5 feet exists between the bottom of the wall and the face of the slope. Figure 6 presents a typical MSE wall backdrain detail. MSE walls may experience lateral movement over time. The wall engineer should review the configuration of proposed improvements adjacent to the wall and provide measures to help reduce the potential for distress to these improvements from lateral movement.

8.6 PIPELINES

8.6.1 Thrust Blocks

For level ground conditions, a passive earth pressure of 300 psf per foot of depth below the lowest adjacent final grade can be used to compute allowable thrust block resistance. A value of 150 psf per foot should be used below groundwater level, if encountered.

8.6.2 Modulus of Soil Reaction

A modulus of soil reaction (E') of 2,000 psi can be used to evaluate the deflection of buried flexible pipelines. This value assumes that granular bedding material is placed adjacent to the pipe and is compacted to at least 90% relative compaction.

8.6.3 Pipe Bedding

Pipe bedding as specified in the "Greenbook" Standard Specifications for Public Works Construction can be used. Bedding material should consist of clean sand having a sand equivalent not less than 30 and should extend to at least 12 inches above the top of pipe. Alternative materials meeting the intent of the bedding specifications are also acceptable. Samples of materials proposed for use as bedding should be provided to the engineer for inspection and testing before the material is imported for use on the project. The onsite materials are not expected to meet "Greenbook" bedding specifications. The pipe bedding material should be placed over the full width of the trench. After placement of the pipe, the bedding should be brought up uniformly on both sides of the pipe to reduce the potential for unbalanced loads. No voids or uncompacted areas should be left beneath the pipe haunches. Ponding or jetting the pipe bedding should not be allowed.

8.6.4 Backfill

Excavated materials free of organic debris and rocks greater than 6 inches in any dimension are generally expected to be suitable for use as utility trench backfill, unless beneath structures or hardscape. Imported material should not contain rocks greater than 3 inches in any dimension or organic debris. Imported material should have an expansion index of 20 or less. SCST should observe and, if appropriate, test proposed import materials before they are delivered to the site. Backfill should be placed in lifts 8 inches or less in loose thickness, moisture conditioned to optimum moisture content or slightly above, and compacted to at least 90% relative compaction. The top 12 inches of soil beneath pavement subgrade should be compacted to at least 95% relative compaction.

8.7 PAVEMENT SECTION RECOMMENDATIONS

The pavement support characteristics of the soils encountered during our investigation are considered good. An R-value of 50 was assumed for design of preliminary pavement sections. The actual R-value of the subgrade soils should be determined after grading and final pavement sections be provided. Based on an R-value of 50, the following pavement structural sections are recommended for the assumed Traffic Indices.

Flexible Pavement Sections

Traffic Type	Traffic Index	Asphalt Concrete (inches)	Aggregate Base* (inches)
Parking Stalls	4.5	3	4
Drive Lanes	6.0	4	4
Fire Lanes	7.5	5	4

Portland Cement Concrete Pavement Sections

Traffic Type	Traffic Index	Full-Depth JPCP* (inches)
Parking Stalls	4.5	5½
Drive Lanes	6.0	6
Heavy Traffic Areas	7.5	7

***Jointed Plain Concrete Pavement**

The top 12 inches of subgrade should be scarified, moisture conditioned to near optimum moisture content and compacted to at least 95% relative compaction. All soft or yielding areas should either be stabilized or removed and replaced with compacted fill or aggregate base. Aggregate base and asphalt concrete should conform to the Caltrans Standard Specifications or the “Greenbook” and should be compacted to at least 95% relative compaction. Aggregate base should have an R-value of not less than 78. All materials and methods of construction should conform to good engineering practices and the requirements of the City of Escondido.

8.8 PERVIOUS PAVEMENT SECTION RECOMMENDATIONS

Pervious pavement section recommendations are based on Caltrans (2014) pavement structural design guidelines. The pavement sections below are based on the strength of the materials. However, the actual thickness of the sections may be controlled by the reservoir layer design, which the project civil engineer should determine.

Pervious Asphalt Pavement

Traffic Type	Category	*Asphalt Treated Permeable Base (ATPB) (inches)	Class 4 Aggregate Base (inches)
Parking Stalls	B	5	6

***1¼ inches of an open graded friction course (OGFC) should be placed on top of the ATPB.**

Pervious Concrete Pavement

Traffic Type	Category	Pervious Concrete (inches)	Class 4 Aggregate Base (inches)
Parking Stalls	B	6	6

Permeable Interlocking Concrete Pavers (PICP)

Traffic Type	Category	PICP (inches)	Class 3 Permeable (inches)	Class 4 Aggregate Base (inches)
Parking Stalls	B	3⅛	5	6

The top 12 inches of subgrade should be scarified, moisture conditioned to near optimum moisture content and compacted to at least 95% relative compaction. All soft or yielding subgrade areas should be removed and replaced with compacted fill or permeable base. All materials and methods of construction should conform to good engineering practices and the minimum local standards. Pervious pavement sections should be lined with an impermeable geomembrane to reduce the potential for water-related distress to adjacent structures or improvements. A suitable subdrain system should be installed at the base of the pervious section.

8.9 SOIL CORROSIVITY

A representative sample of the onsite soils were tested to evaluate corrosion potential. The test results are presented in Appendix II. The project design engineer can use the sulfate results in conjunction with ACI 318 to specify the water/cement ratio, compressive strength and cementitious material types for concrete exposed to soil. A corrosion engineer should be contacted to provide specific corrosion control recommendations.

8.10 INFILTRATION FEASIBILITY

We performed two borehole percolation tests at the approximate locations shown on Figure 2 to assess storm water infiltration feasibility. Appendix III presents the field data and test results. The table below presents the tested infiltration rates.

Infiltration Rate Test Results

Test Location	Test Depth (feet)	Material Type at Test Depth (USCS Classification)	Infiltration Rate (inch/hour)
P-1	5	SILTY SAND (SM)	0.0
P-2	5	SANDY SILT (ML)	0.0

The tested infiltration rates do not support storm water infiltration in any appreciable quantity. Based on our test results, the feasibility screening category is No Infiltration. BMP facilities should be lined with an impermeable geomembrane to reduce the potential for water-related distress to adjacent structures or improvements. A subdrain system should be installed at the bottom of BMP facilities. Foundations should be set back at least 10 feet from BMP facilities, or the foundation should be deepened to a depth that extends below the bottom of the BMP.

9. GEOTECHNICAL ENGINEERING DURING CONSTRUCTION

The geotechnical engineer should review project plans and specifications prior to bidding and construction to check that the intent of the recommendations in this report has been incorporated. Observations and tests should be performed during construction. If the conditions encountered during construction differ from those anticipated based on the subsurface exploration program, the presence of the geotechnical engineer during construction will enable an evaluation of the exposed conditions and modifications of the recommendations in this report or development of additional recommendations in a timely manner.

10. CLOSURE

SCST should be advised of any changes in the project scope so that the recommendations contained in this report can be evaluated with respect to the revised plans. Changes in recommendations will be verified in writing. The findings in this report are valid as of the date of this report. Changes in the condition of the site can, however, occur with the passage of time, whether they are due to natural processes or work on this or adjacent areas. In addition, changes in the standards of practice and government regulations can occur. Thus, the findings in this report may be invalidated wholly or in part by changes beyond our control. This report should not be relied upon after a period of two years without a review by us verifying the suitability of the conclusions and recommendations to site conditions at that time.

In the performance of our professional services, we comply with that level of care and skill ordinarily exercised by members of our profession currently practicing under similar conditions and in the same locality. The client recognizes that subsurface conditions may vary from those encountered at the boring location, and that our data, interpretations, and recommendations are based solely on the information obtained by us. We will be responsible for those data, interpretations, and recommendations, but shall not be responsible for interpretations by others of the information developed. Our services consist of professional consultation and observation only, and no warranty of any kind whatsoever, express or implied, is made or intended in connection with the work performed or to be performed by us, or by our proposal for consulting or other services, or by our furnishing of oral or written reports or findings.

11. REFERENCES

American Concrete Institute (ACI) (2012), Building Code Requirements for Structural Concrete (ACI 318-11) and Commentary, August.

California Emergency Management Agency (Cal EMA) (2009), Tsunami Inundation Map for Emergency Planning, California Geological Survey, University of Southern California.

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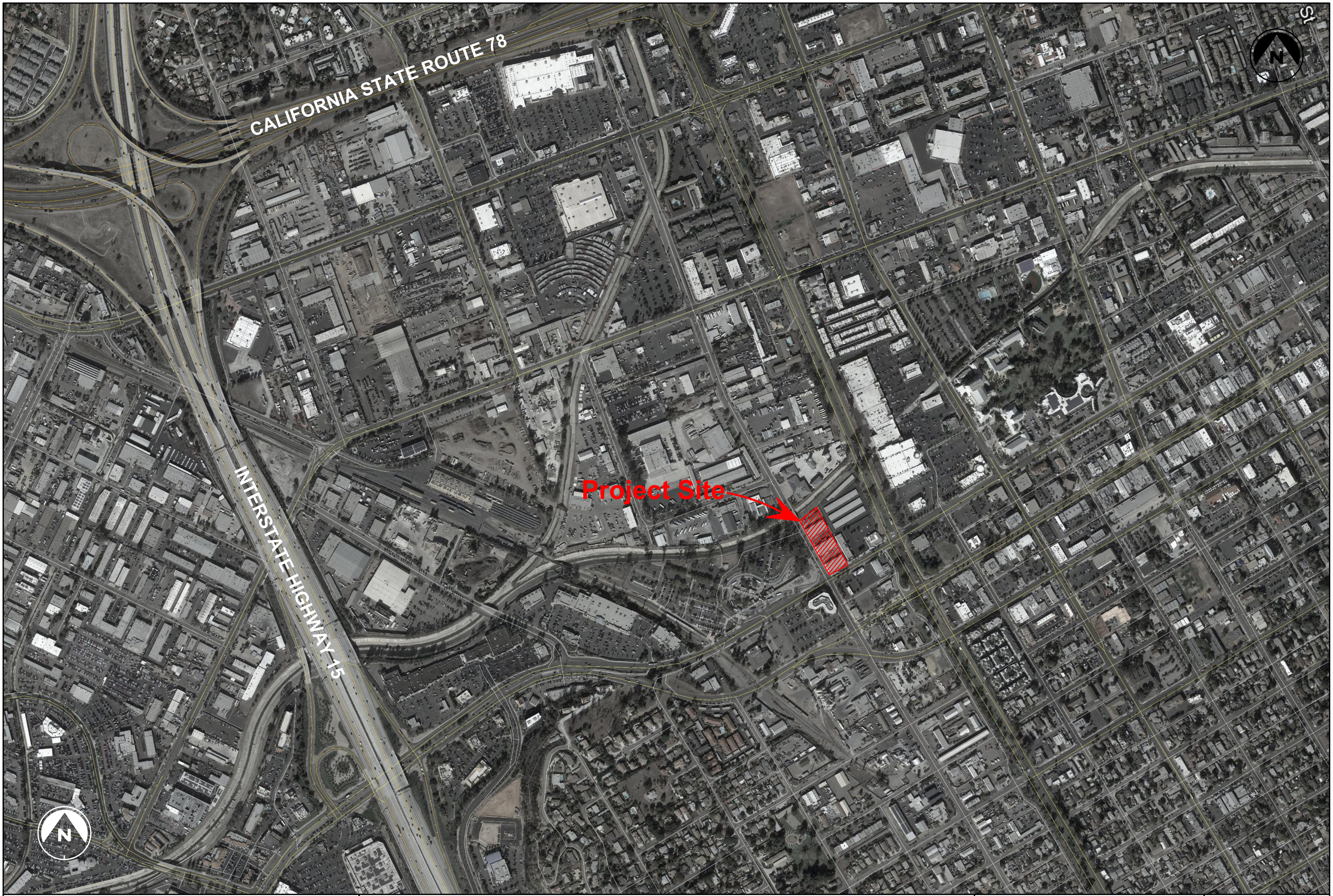
Caltrans (2014), Pervious Pavement Design Guidance, August

Federal Emergency Management Agency (2012), FIRM Flood Insurance Rate Map, San Diego County, California and Incorporated Areas, Map Number 06073C1077G, May 16.

International Code Council (2015), 2016 California Building Code, California Code of Regulations, Title 24, Part 2, Volume 2 of 2, Based on the 2015 International Existing Building Code, Effective January 1, 2017.

Kennedy, M.P. and Tan, S.S. (2007), Geologic Map of the Oceanside 30' x 60' Quadrangle, California, California Geological Survey.

Public Works Standards, Inc. (2015), The "Greenbook," Standard Specifications for Public Works Construction, 2015 Edition.

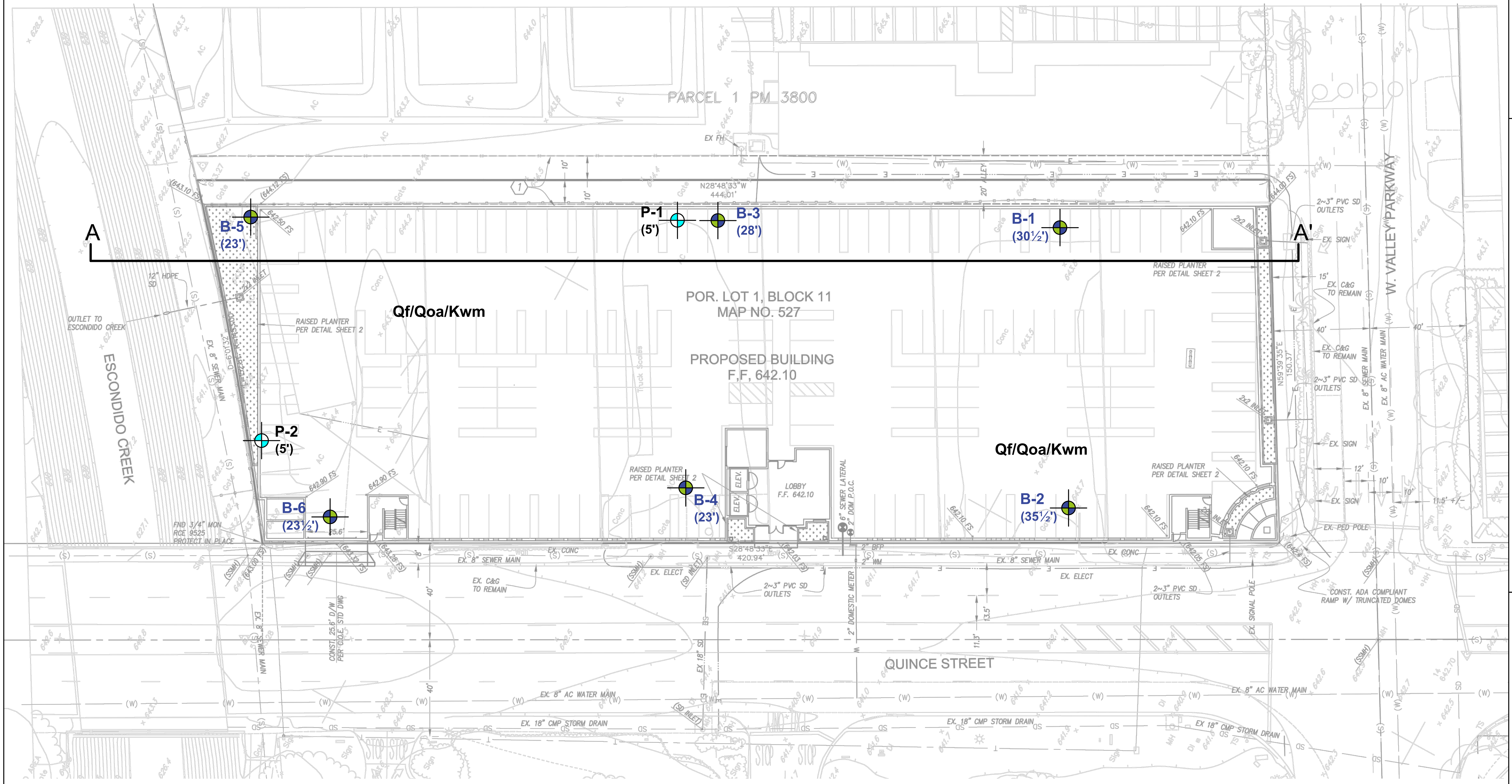


SCST, Inc.

SITE VICINITY MAP
Quince Street Senior Housing Development
220 North Quince Street
Escondido, California

Date: November 2017
By: MAW
Job No.: 170308N-1

Figure:
1



SCST LEGEND:

B-6 (23½')	Approximate Location of Boring (Depth in Feet)
P-2 (5')	Approximate Location of Percolation Test (Depth in Feet)
A A'	Approximate Location of Geologic Cross Section
Qf/Qoa/Kwm	Fill underlain by Old alluvial flood-plain deposits underlain by Granodiorite

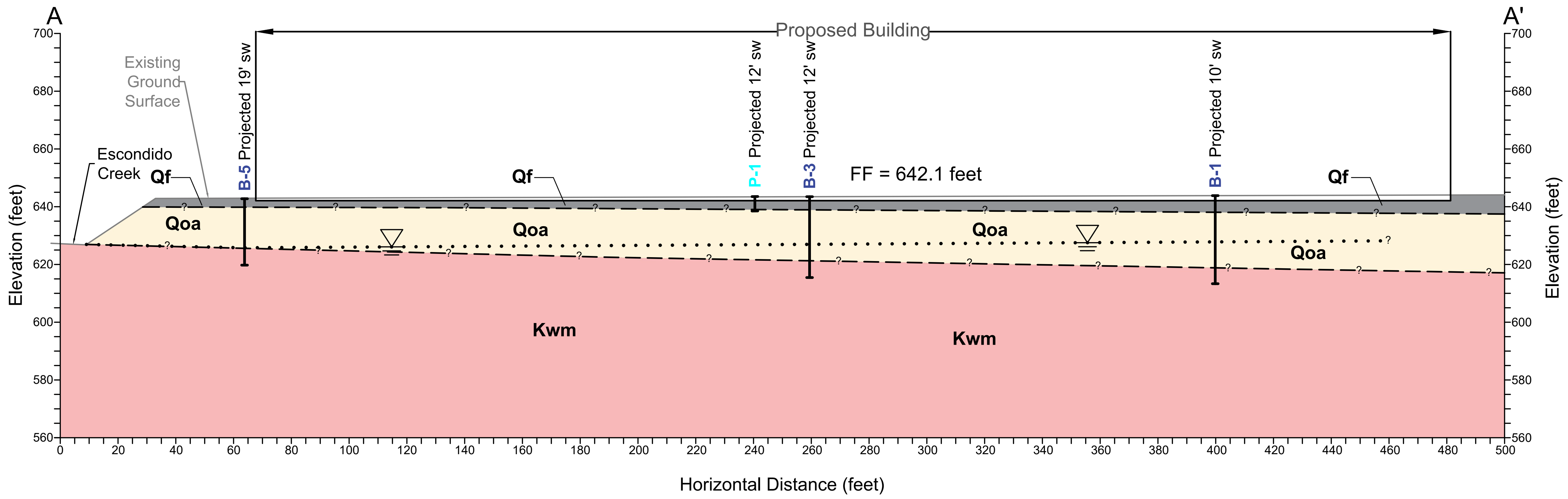
0 40' 80'
SCALE

Date: August, 2017
By: MAW
Job No.: 170308N-1

GEOTECHNICAL MAP
Quince Street Senior Housing Development
220 North Quince Street
Escondido, California

SCST, Inc.

Figure:
2



SCST LEGEND:

B-5 Approximate Location of Boring

P-1 Approximate Location of Percolation Test

? Approximate Location of Geologic Contact, Queried Where Uncertain

• • ▽ • • ? Approximate Groundwater Level

Qf	Fill
Qoa	Old alluvial flood-plain deposits
Kwm	Granodiorite of Woodson Mountain

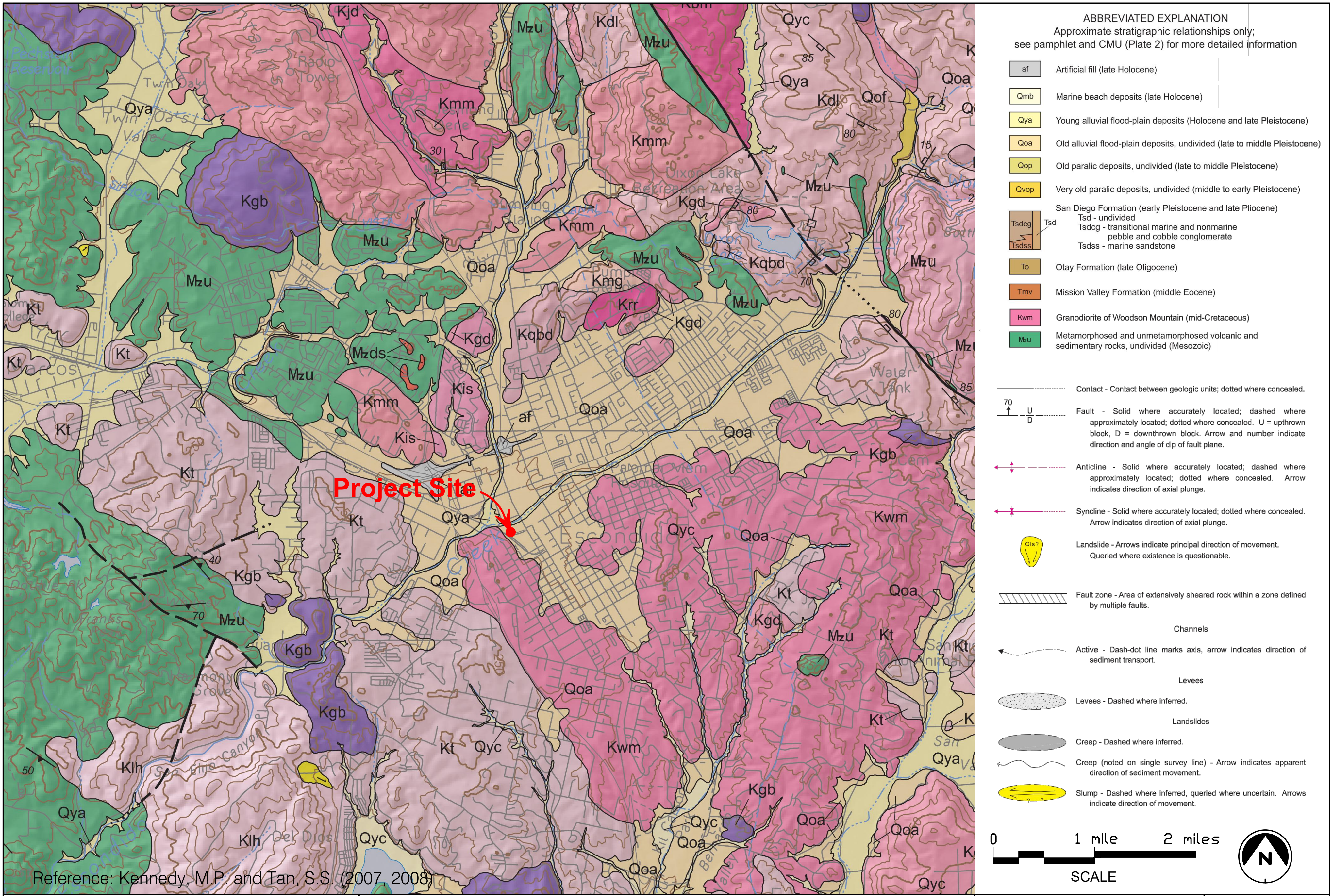
SCALE
1" = 40'

Date: August, 2017
By: MAW
Job No.: 170308N-1

GEOLOGIC CROSS SECTION
Quince Street Senior Housing Development
220 North Quince Street
Escondido, California

SCST, Inc.

Figure:
3



Reference: Kennedy, M.P. and Tan, S.S. (2007, 2008)

ABBREVIATED EXPLANATION
Approximate stratigraphic relationships only;
see pamphlet and CMU (Plate 2) for more detailed information

af	Artificial fill (late Holocene)
Qmb	Marine beach deposits (late Holocene)
Qya	Young alluvial flood-plain deposits (Holocene and late Pleistocene)
Qoa	Old alluvial flood-plain deposits, undivided (late to middle Pleistocene)
Qop	Old paralic deposits, undivided (late to middle Pleistocene)
Qvop	Very old paralic deposits, undivided (middle to early Pleistocene)
Tsdcg Tsd Tsdss	San Diego Formation (early Pleistocene and late Pliocene) Tsd - undivided Tsdcg - transitional marine and nonmarine pebble and cobble conglomerate Tsdss - marine sandstone
To	Otay Formation (late Oligocene)
Tmv	Mission Valley Formation (middle Eocene)
Kwm	Granodiorite of Woodson Mountain (mid-Cretaceous)
Mzu	Metamorphosed and unmetamorphosed volcanic and sedimentary rocks, undivided (Mesozoic)

Contact - Contact between geologic units; dotted where concealed.

Fault - Solid where accurately located; dashed where approximately located; dotted where concealed. U = upthrown block, D = downthrown block. Arrow and number indicate direction and angle of dip of fault plane.

Anticline - Solid where accurately located; dashed where approximately located; dotted where concealed. Arrow indicates direction of axial plunge.

Syncline - Solid where accurately located; dotted where concealed. Arrow indicates direction of axial plunge.

Landslide - Arrows indicate principal direction of movement. Queried where existence is questionable.

Fault zone - Area of extensively sheared rock within a zone defined by multiple faults.

Channels

Active - Dash-dot line marks axis, arrow indicates direction of sediment transport.

Levees

Levees - Dashed where inferred.

Landslides

Creep - Dashed where inferred.

Creep (noted on single survey line) - Arrow indicates apparent direction of sediment movement.

Slump - Dashed where inferred, queried where uncertain. Arrows indicate direction of movement.

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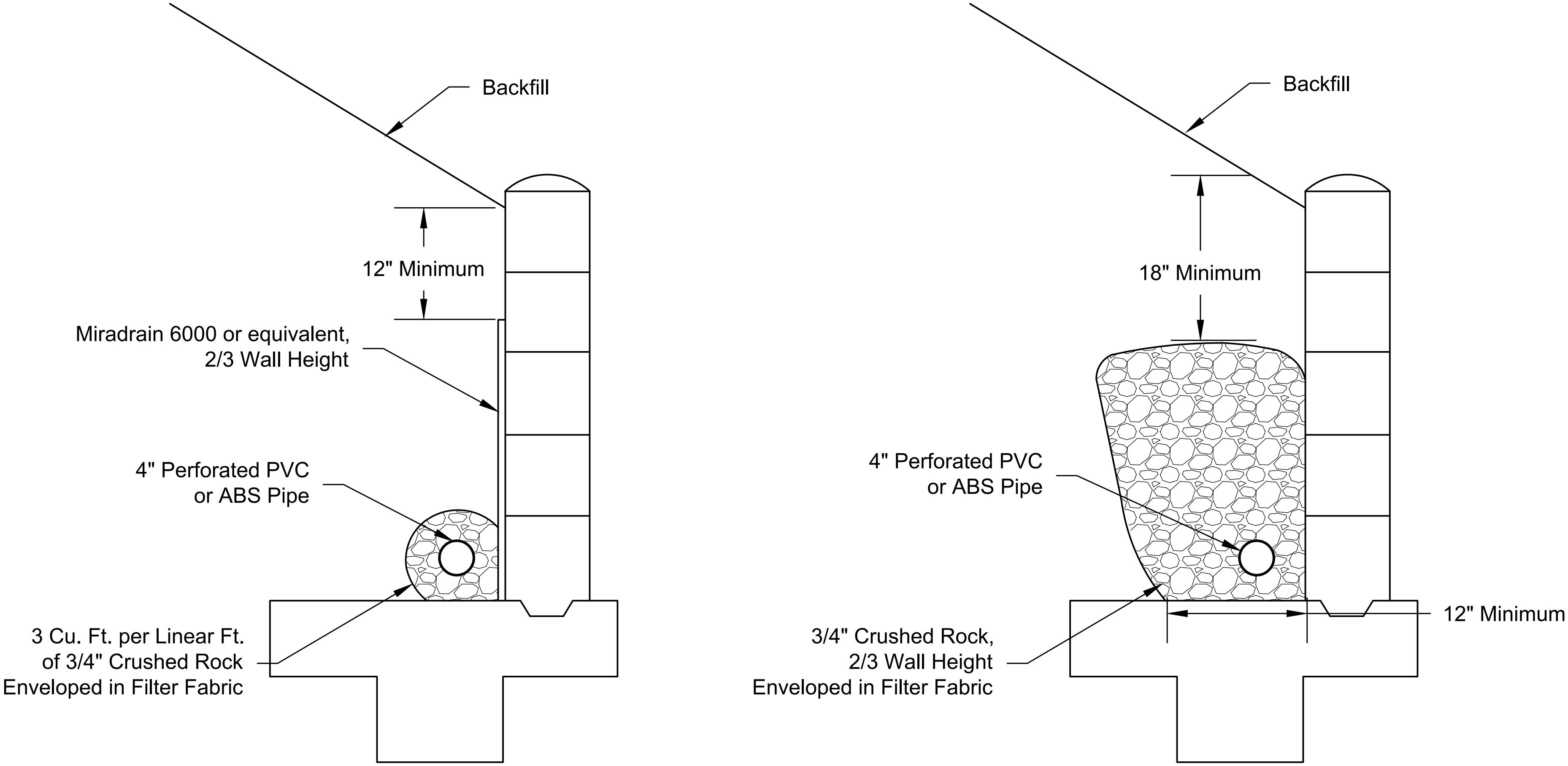
REGIONAL GEOLOGY MAP
Quince Street Senior Housing Development
220 North Quince Street
Escondido, California

Date: August, 2017
By: MAW
Job No.: 170308N-1

Figure:
4



NOT TO SCALE

NOTES:

1) Dampproof or waterproof back of wall following architect's specifications.
2) 4" minimum perforated pipe, SDR35 or equivalent, holes down, 1% fall to outlet. Provide solid outlet pipe at suitable locations.
3) Drain installation and outlet connection should be observed by the geotechnical consultant.

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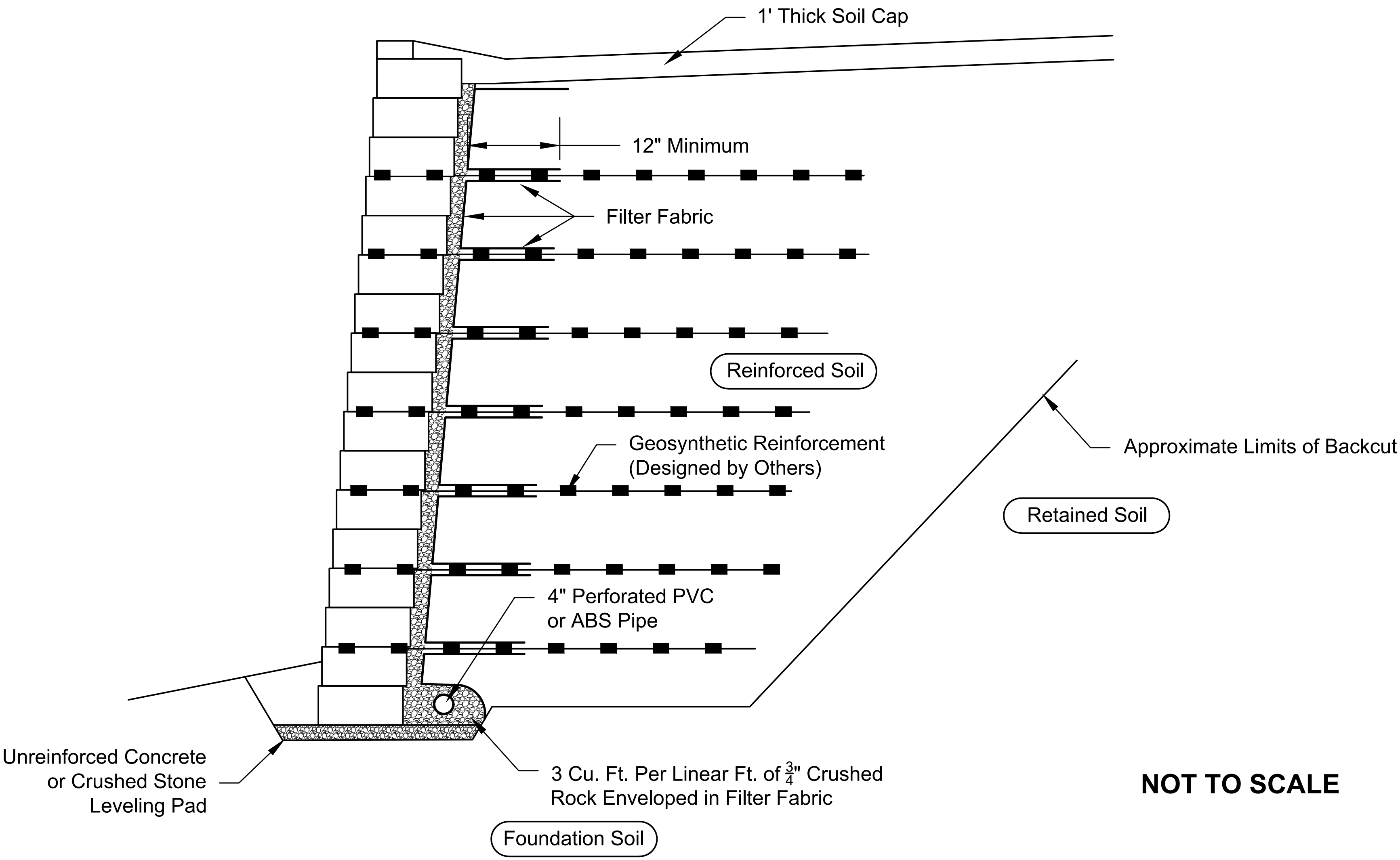
TYPICAL RETAINING WALL BACKDRAIN DETAILS
Quince Street Senior Housing Development
220 North Quince Street
Escondido, California

Date: November 2017
By: MAW
Job No.: 170308N-1

Figure:
5



NOT TO SCALE

NOTES:

1) Backcut as recommended by the geotechnical report or field evaluation
2) Additional drain at excavation backcut may be recommended base on conditions obsewrved during construction.
3) Filter fabric should be installed between crushed rock and soil. Filter farbric should consist of Mirafi 140N or equivalent. Filter fabric should be overlapped approximately 6 inches.
4) Perforated pipe should outlet through a solid pipe to an appropriate gravity outfall. Perforated pipe and outlet pipe should have a fall of at least 1%.

SCST, Inc.

TYPICAL MSE RETAINING WALL DETAIL
Quince Street Senior Housing Development
220 North Quince Street
Escondido, California

Date: November 2017
By: MAW
Job No.: 170308N-1

Figure:
6

APPENDIX I
FIELD INVESTIGATION

Our field investigation consisted of drilling 6 borings and 2 percolation test holes on July 20 and 21, 2017 to depths between about 5 and 35½ feet below the existing ground surface using a truck-mounted drill rig equipped with a hollow-stem auger. Auger refusal within the granodiorite was encountered in boring B-4. Figure 2 shows the approximate locations of the borings and percolation tests. The field investigation was performed under the observation of an SCST geologist who also logged the boring and test holes and obtained samples of the materials encountered.

Relatively undisturbed samples were obtained using a modified California (CAL) sampler, which is a ring-lined split tube sampler with a 3-inch outer diameter and 2½-inch inner diameter. Standard Penetration Tests (SPT) were performed using a 2-inch outer diameter and 1⅜-inch inner diameter split tube sampler. The CAL and SPT samplers were driven with a 140-pound weight dropping 30 inches. The number of blows needed to drive the samplers the final 12 inches of an 18-inch drive is noted on the boring logs as “Driving Resistance (blows/ft. of drive).” SPT and CAL sampler refusal was encountered when 50 blows were applied during any one of the three 6-inch intervals, a total of 100 blows was applied, or there was no discernible sampler advancement during the application of 10 successive blows. The SPT penetration resistance was normalized to a safety hammer (cathead and rope) with a 60% energy transfer ratio in accordance with ASTM D6066. The normalized SPT penetration resistance is noted on the boring logs as “N_{60}.” Disturbed bulk samples were obtained from the SPT sampler and the drill cuttings.

The soils are classified in accordance with the Unified Soil Classification System as illustrated on Figure I-1. Logs of the borings and test holes are presented on Figures I-2 through I-15.

SUBSURFACE EXPLORATION LEGEND

UNIFIED SOIL CLASSIFICATION CHART

SOIL DESCRIPTION		GROUP SYMBOL	TYPICAL NAMES
I. COARSE GRAINED, more than 50% of material is larger than No. 200 sieve size.			
GRAVELS More than half of coarse fraction is larger than No. 4 sieve size but smaller than 3".	CLEAN GRAVELS	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 (Appreciable amount of fines)	GM	Silty gravels, poorly graded gravel-sand-silt mixtures.
		GC	Clayey gravels, poorly graded gravel-sand, clay mixtures.
SANDS More than half of coarse fraction is smaller than No. 4 sieve size.	CLEAN SANDS	SW	Well graded sand, gravelly sands, little or no fines.
		SP	Poorly graded sands, gravelly sands, little or no fines.
		SM	Silty sands, poorly graded sand and silty mixtures.
		SC	Clayey sands, poorly graded sand and clay mixtures.
II. FINE GRAINED, more than 50% 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, sandy silt or clayey-silt-sand mixtures 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 or low plasticity.
	SILTS AND CLAYS (Liquid Limit greater than 50)	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.
III. HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils.

SAMPLE SYMBOLS

☒ - Bulk Sample
CAL - Modified California sampler
CK - Undisturbed Chunk sample
MS - Maximum Size of Particle
ST - Shelby Tube
SPT - Standard Penetration Test sampler

GROUNDWATER SYMBOLS

▽ - Water level at time of excavation or as indicated

≀≀ - Water seepage at time of excavation or as indicated

LABORATORY TEST SYMBOLS

AL - Atterberg Limits
CON - Consolidation
COR - Corrosivity Tests (Resistivity, pH, Chloride, Sulfate)
DS - Direct Shear
EI - Expansion Index
MAX - Maximum Density
RV - R-Value
SA - Sieve Analysis
FC - Fines Content
(57%) (Percent Finer Than No. 200 Sieve)
RW - Response to Wetting

SCST, Inc.

Quince Street Senior Housing Development Escondido, California			
By:	CJM	Date:	November, 2017
Job Number:	170308N-1	Figure:	I-1

LOG OF BORING B-1

Date Drilled: 7/20/2017
Equipment: CME-95 with 8-inch Diameter Hollow-Stem Auger
Elevation (ft): 644

Logged by: CJM
Project Manager: TBC
Depth to Groundwater (ft): 16

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES DRIVEN	SAMPLES BULK	DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LABORATORY TESTS
		5 inches of concrete.							
1	SM	**FILL (Qf):** SILTY SAND, dark yellowish brown, fine to medium grained, some gravel, moist, loose.		☒					SA AL EI COR
2		Less gravel.							
3			CAL		8		6.8	101.4	
4									
5	SP-SM	**OLD ALLUVIAL FLOOD-PLAIN DEPOSITS (Qoa):** Poorly Graded SAND with SILT, yellowish brown, fine to coarse grained, trace gravel, moist, loose.							
6			SPT		6	8			
7									
8									
9									
10	CL	SANDY CLAY, moderate brown, fine grained, trace gravel, moist, medium stiff.							
11			SPT		6	8			
12									
13		Dark brown.	SPT		5	7			
14									
15		Medium stiff to stiff, oxidation.							
16		▽ Groundwater encountered at 16 feet.	SPT		8	11			AL FC (57%)
17									
18		SILTY SAND, dark grayish brown, fine grained, wet, medium dense.	SPT		12	16			AL FC (35%)
19									
20									

BORING CONTINUED ON I-3

SCST, Inc.

Quince Street Senior Housing Development
Escondido, California

By: CJM
Date: November, 2017
Job Number: 170308N-1
Figure: I-2

LOG OF BORING B-1 (Continued)

Date Drilled: 7/20/2017
Equipment: CME-95 with 8-inch Diameter Hollow-Stem Auger
Elevation (ft): 644

Logged by: CJM
Project Manager: TBC
Depth to Groundwater (ft): 16

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES DRIVEN	SAMPLES BULK	DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LABORATORY TESTS
21	SM	**OLD ALLUVIAL FLOOD-PLAIN DEPOSITS (Qoa):** SILTY SAND, greenish brown, fine to medium grained, trace gravel, wet, medium dense.	SPT		19	25			
22									
23	SP-SM	Poorly Graded SAND with SILT, dark gray, fine to medium grained, wet, medium dense.	SPT		15	20			AL FC (10%)
24									
25			SPT		50/3"	67/3"			
26		**GRANODIORITE (Kwm):** Mottled black, white, and brown, intensely to moderately weathered, breaks down to SILTY SAND, fine to coarse grained, trace gravel, wet, very dense, micaceous.							
27									
28									
29									
30			SPT		50/3"	67/3"			
31		**BORING TERMINATED AT 30½ FEET**							
32									
33									
34									
35									
36									
37									
38									
39									
40									

SCST, Inc.

Quince Street Senior Housing Development
Escondido, California

By:	CJM	Date:	November, 2017
Job Number:	170308N-1	Figure:	I-3

LOG OF BORING B-2

Date Drilled: 7/20/2017
Equipment: CME-95 with 8-inch Diameter Hollow-Stem Auger
Elevation (ft): 644

Logged by: CJM
Project Manager: TBC
Depth to Groundwater (ft): 15

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES DRIVEN	SAMPLES BULK	DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LABORATORY TESTS
		5 inches of concrete.							
1	SC	**FILL (Qf):** CLAYEY SAND, dark brown, fine grained, gravel, moist, loose to medium dense.		☒					RV
2	SM	**OLD ALLUVIAL FLOOD-PLAIN DEPOSITS (Qoa):** SILTY SAND, yellowish brown, fine grained, trace gravel, moist, medium dense.							
3			CAL		18		13.7	110.9	
4									
5		Mottled dark yellowish brown, less gravel, loose.							
6			SPT		6	8			
7									
8									
9									
10	CL	SANDY CLAY, yellowish brown, fine grained, moist, very stiff.							
11			SPT		14	19			
12									
13	SM	SILTY SAND, mottled dark gray, fine to medium grained, moist, medium dense.	SPT		9	12			
14									
15		▽ Groundwater encountered at 15 feet.							
16	SP-SM	Poorly Graded SAND with SILT, yellowish brown, fine to coarse grained, trace gravel, wet, medium dense.	SPT		17	23			
17									
18		Massive.	SPT		21	28			AL FC (6%)
19									
20									

BORING CONTINUED ON I-5

SCST, Inc.

Quince Street Senior Housing Development
Escondido, California

By:	CJM	Date:	November, 2017
Job Number:	170308N-1	Figure:	I-4

LOG OF BORING B-2 (Continued)

Date Drilled: 7/20/2017
Equipment: CME-95 with 8-inch Diameter Hollow-Stem Auger
Elevation (ft): 644
Logged by: CJM
Project Manager: TBC
Depth to Groundwater (ft): 15

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES		DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LABORATORY TESTS
			DRIVEN	BULK					
21	SP-SM	**OLD ALLUVIAL FLOOD-PLAIN DEPOSITS (Qoa):** Poorly Graded SAND with SILT, yellowish brown, fine to medium grained, trace gravel, wet, very loose.	SPT		2	3			
22									
23	SM	SILTY SAND, dark yellowish brown, fine to medium grained, wet, loose.	SPT		7	9			AL FC (16%)
24									
25	SC	CLAYEY SAND, yellowish brown to orangish brown, fine to medium grained, wet, loose, sub-horizontal bedding, oxidation.	SPT		7	9			
26									
27									
28	SP	Poorly Graded SAND, yellowish brown, fine to coarse grained, gravel, wet, medium dense.	SPT		10	13			AL FC (4%)
29									
30		**GRANODIORITE (Kwm):** Mottled greenish brown, white, and black, intensely to moderately weathered, breaks down to CLAYEY SAND, fine to medium grained, wet, very dense, micaceous.	SPT		50/4"	67/4"			
31									
32									
33									
34									
35		Breaks down to SILTY SAND, less fines.	SPT		50/4"	67/4"			
36		**BORING TERMINATED AT 35½ FEET**							
37									
38									
39									
40									

SCST, Inc.

Quince Street Senior Housing Development
Escondido, California

By:	CJM	Date:	November, 2017
Job Number:	170308N-1	Figure:	I-5

LOG OF BORING B-3

Date Drilled: 7/20/2017
Equipment: CME-95 with 8-inch Diameter Hollow-Stem Auger
Elevation (ft): 644

Logged by: CJM
Project Manager: TBC
Depth to Groundwater (ft): 16½

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES DRIVEN	SAMPLES BULK	DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LABORATORY TESTS
0		**3½ inches of asphalt concrete underlain by 3 inches of aggregate base.**							
1	SM	**FILL (Qf):** SILTY SAND, dark brown, fine to medium grained, some gravel, moist, medium dense.		X					SA AL EI COR
2		Fine grained, less gravel.							
3			CAL		26		12.5	118.3	
4									
5	SC	**OLD ALLUVIAL FLOOD-PLAIN DEPOSITS (Qoa):** CLAYEY SAND, dark yellowish brown, fine grained, trace gravel, moist, loose.							
6			SPT		6	8			
7									
8									
9									
10	CL	SANDY CLAY, mottled moderate brown, fine grained, trace gravel, moist, medium stiff.							
11			SPT		6	8			
12									
13		SILTY SAND, mottled olive green and brown, fine grained, moist, medium dense.	SPT		8	11			
14									
15		Moderate brown.							
16		▽ Groundwater encountered at 16½ feet.	SPT		10	13			AL FC (28%)
17									
18		Trace gravel, wet, sub-horizontal bedding.	SPT		22	29			
19									
20									

BORING CONTINUED ON I-7

SCST, Inc.

Quince Street Senior Housing Development
Escondido, California

By:	CJM	Date:	November, 2017
Job Number:	170308N-1	Figure:	I-6

LOG OF BORING B-3 (Continued)

Date Drilled: 7/20/2017
Equipment: CME-95 with 8-inch Diameter Hollow-Stem Auger
Elevation (ft): 644

Logged by: CJM
Project Manager: TBC
Depth to Groundwater (ft): 16½

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES DRIVEN	SAMPLES BULK	DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LABORATORY TESTS
21	SM	**OLD ALLUVIAL FLOOD-PLAIN DEPOSITS (Qoa):** SILTY SAND, moderate brown, fine grained, trace gravel, wet, dense, fragments of granodiorite.	SPT		30	40			
22									
23		**GRANODIORITE (Kwm):** Mottled black, white, and brown, intensely to moderately weathered, breaks down to SILTY SAND, fine to coarse grained, trace gravel, wet, very dense, micaceous.	SPT		50/3"	67/3"			
24									
25		Difficult drilling.	SPT		50/4"	67/4"			
26									
27		Breaks down to Poorly Graded SAND with SILT, fine to medium grained, trace gravel, wet, very dense.							
28			SPT		50/3"	67/3"			
		BORING TERMINATED AT 28 FEET							
29									
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									

SCST, Inc.

Quince Street Senior Housing Development
Escondido, California

By:	CJM	Date:	November, 2017
Job Number:	170308N-1	Figure:	I-7

LOG OF BORING B-4

Date Drilled: 7/21/2017
Equipment: CME-95 with 8-inch Diameter Hollow-Stem Auger
Elevation (ft): 644

Logged by: CJM
Project Manager: TBC
Depth to Groundwater (ft): 14

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES		DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LABORATORY TESTS
			DRIVEN	BULK					
		3 inches of asphalt concrete underlain by 3 inches of aggregate base.							
1	SM	**<u>FILL (Qf)</u>:** SILTY SAND, dark brown, fine to medium grained, trace gravel, moist, loose to medium dense.		☒					
2				☒					
3									
4									
5		Dark yellowish brown, fine grained, moist, loose to medium dense.	CAL		14		12.1	113.3	
6									
7									
8									
9									
10	SP-SM	**<u>OLD ALLUVIAL FLOOD-PLAIN DEPOSITS (Qoa)</u>:** Poorly Graded SAND with SILT, yellowish brown, fine to medium grained, trace gravel, moist, medium dense.	CAL		37		4.2	103.7	
11									
12									
13									
14		▽ Groundwater encountered at 14 feet.							
15		Wet, loose.	CAL		8		23.0	110.8	
16									
17									
18									
19									
20									

BORING CONTINUED ON I-9

SCST, Inc.

Quince Street Senior Housing Development
Escondido, California

By:	CJM	Date:	November, 2017
Job Number:	170308N-1	Figure:	I-8

LOG OF BORING B-4 (Continued)

Date Drilled: 7/21/2017
Equipment: CME-95 with 8-inch Diameter Hollow-Stem Auger
Elevation (ft): 644

Logged by: CJM
Project Manager: TBC
Depth to Groundwater (ft): 14

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES		DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LABORATORY TESTS
			DRIVEN	BULK					
21	SP-SM	**OLD ALLUVIAL FLOOD-PLAIN DEPOSITS (Qoa):** Poorly Graded SAND with SILT, yellowish brown, fine to medium grained, trace gravel, moist, medium dense.	SPT		60/8"	80/8"			
22		**GRANODIORITE (Kwm):** Mottled black, white, and brown, intensely to moderately weathered, breaks down to Poorly Graded SAND with SILT, fine to medium grained, trace gravel, wet, very dense.							
23		Breaks down to SILTY SAND, fine to medium grained, trace gravel, wet, very dense, micaceous.	SPT		50/3"	67/3"			
24		**AUGER REFUSAL AT 23 FEET**							
25									
26									
27									
28									
29									
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									

SCST, Inc.

Quince Street Senior Housing Development
Escondido, California

By:	CJM	Date:	November, 2017
Job Number:	170308N-1	Figure:	I-9

LOG OF BORING B-5

Date Drilled: 7/21/2017
Equipment: CME-95 with 8-inch Diameter Hollow-Stem Auger
Elevation (ft): 644

Logged by: CJM
Project Manager: TBC
Depth to Groundwater (ft): 17

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES DRIVEN	SAMPLES BULK	DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LABORATORY TESTS
		3 inches of asphalt concrete.							
1	SC	**<u>FILL (Qf)</u>:** CLAYEY SAND, moderate brown, fine grained, some gravel, moist, loose to medium dense.		☒					
2	SC	**<u>OLD ALLUVIAL FLOOD-PLAIN DEPOSITS (Qoa)</u>:** CLAYEY SAND, moderate brown, fine grained, some gravel, moist, medium dense.							
3			SPT		12	16			
4									
5									
6			CAL		13		18.2	106.0	
7									
8									
9									
10		Less fines, trace gravel.							
11			SPT		16	21			
12									
13		Mottled olive green and brown, fine to medium grained, oxidation.	SPT		10	13			
14									
15		Mottled orangish brown, dense, massive.							
16			SPT		28	37			
17		▽ Groundwater encountered at 17 feet.							
18		**<u>GRANODIORITE (Kwm)</u>:** Mottled black, white, and brown, intensely to moderately weathered, breaks down to SILTY SAND, fine to medium grained, trace gravel, wet, very dense, micaceous.	SPT		50/3"	67/3"			
19									
20									

BORING CONTINUED ON I-11

SCST, Inc.

Quince Street Senior Housing Development
Escondido, California

By:	CJM	Date:	November, 2017
Job Number:	170308N-1	Figure:	I-10

LOG OF BORING B-5 (Continued)

Date Drilled: 7/21/2017
Equipment: CME-95 with 8-inch Diameter Hollow-Stem Auger
Elevation (ft): 644

Logged by: CJM
Project Manager: TBC
Depth to Groundwater (ft): 17

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES		DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LABORATORY TESTS
			DRIVEN	BULK					
		<u>GRANODIORITE (Kwm)</u>: Mottled black, white, and brown, intensely to moderately weathered, breaks down to SILTY SAND, fine to coarse grained, trace gravel, wet, very dense, micaceous.	SPT		50/5"	67/5"			
21									
22			SPT		50/3"	67/3"			
23		**BORING TERMINATED AT 23 FEET**							
24									
25									
26									
27									
28									
29									
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									

SCST, Inc.

Quince Street Senior Housing Development
Escondido, California

By:	CJM	Date:	November, 2017
Job Number:	170308N-1	Figure:	I-11

LOG OF BORING B-6

Date Drilled: 7/21/2017
Equipment: CME-95 with 8-inch Diameter Hollow-Stem Auger
Elevation (ft): 644

Logged by: CJM
Project Manager: TBC
Depth to Groundwater (ft): 18½

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES DRIVEN	SAMPLES BULK	DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LABORATORY TESTS
		2½ inches of asphalt concrete.							
1	SC	**FILL (Qf):** CLAYEY SAND, moderate brown, fine grained, gravel, moist, loose to medium dense.		☒					
2	SC	**OLD ALLUVIAL FLOOD-PLAIN DEPOSITS (Qoa):** CLAYEY SAND, moderate brown, fine grained, trace gravel, moist, medium dense.							
3			CAL		26		15.4	112.1	
4									
5		Less gravel.							
6			SPT		8	11			
7									
8									
9									
10	CL	SANDY CLAY, mottled olive green and orangish brown, fine grained, trace gravel, moist, medium stiff, oxidation, manganese staining.							
11			SPT		6	8			
12									
13	SC	CLAYEY SAND, mottled olive green, fine grained, moist, loose.	SPT		6	8			
14									
15		Dense, oxidation.							
16			SPT		24	32			
17									
18	SM	SILTY SAND, orangish brown, fine to medium grained, trace gravel, wet, dense. ▽ Groundwater encountered at 18½ feet.	SPT		25	33			
19									
20									

BORING CONTINUED ON I-13

SCST, Inc.

Quince Street Senior Housing Development Escondido, California	
By: CJM	Date: November, 2017
Job Number: 170308N-1	Figure: I-12

LOG OF BORING B-6 (Continued)

Date Drilled: 7/21/2017
Equipment: CME-95 with 8-inch Diameter Hollow-Stem Auger
Elevation (ft): 644

Logged by: CJM
Project Manager: TBC
Depth to Groundwater (ft): 18½

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES		DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LABORATORY TESTS
			DRIVEN	BULK					
		GRANODIORITE (Kwm): Mottled black, white, and brown, intensely to moderately weathered, breaks down to SILTY SAND, fine to medium grained, trace gravel, wet, very dense, micaceous.	SPT		50/5"	67/5"			
21									
22									
23									
24									
25			SPT		50/4"	67/4"			
		BORING TERMINATED AT 25½ FEET							
26									
27									
28									
29									
30									
31									
32									
33									
34									
35									
36									
37									
38									
39									
40									

SCST, Inc.

Quince Street Senior Housing Development
Escondido, California

By:	CJM	Date:	November, 2017
Job Number:	170308N-1	Figure:	I-13

LOG OF BORING P-1

Date Drilled: 7/20/2017
Equipment: CME-95 with 8-inch Diameter Hollow-Stem Auger
Elevation (ft): 644
Logged by: CJM
Project Manager: TBC
Depth to Groundwater (ft): Not Encountered

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES DRIVEN	SAMPLES BULK	DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LABORATORY TESTS
		3 inches of asphalt concrete underlain by 3 inches of aggregate base.							
1 2 3	SM	**FILL (Qf):** SILTY SAND, dark brown, fine grained, trace gravel, moist, loose to medium dense.							
4	SM	**OLD ALLUVIAL FLOOD-PLAIN DEPOSITS (Qoa):** SILTY SAND, mottled moderate brown and light brown, fine grained, trace gravel, moist, medium dense.	SPT		16	21			
5		**BORING TERMINATED AT 5 FEET**							
6 7 8 9 10 11 12 13 14 15 16 17 18 19 20									

SCST, Inc.

Quince Street Senior Housing Development
Escondido, California

By:	CJM	Date:	November, 2017
Job Number:	170308N-1	Figure:	I-14

LOG OF BORING P-2

Date Drilled: 7/20/2017
Equipment: CME-95 with 8-inch Diameter Hollow-Stem Auger
Elevation (ft): 644

Logged by: CJM
Project Manager: TBC
Depth to Groundwater (ft): Not Encountered

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES		DRIVING RESISTANCE (blows/ft of drive)	N_{60}	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LABORATORY TESTS
			DRIVEN	BULK					
		4 inches of asphalt concrete.							
1 2 3	SC	**<u>FILL (Qf)</u>:** CLAYEY SAND, dark yellowish brown, fine grained, gravel, moist, loose to medium dense.		☒					
4 5	ML	**<u>OLD ALLUVIAL FLOOD-PLAIN DEPOSITS (Qoa)</u>:** SANDY SILT, dark yellowish brown, fine grained, moist, medium dense.	SPT		8	11			SA AL
6 7 8 9 10 11 12 13 14 15 16 17 18 19 20		**BORING TERMINATED AT 5 FEET**							

SCST, Inc.

Quince Street Senior Housing Development
Escondido, California

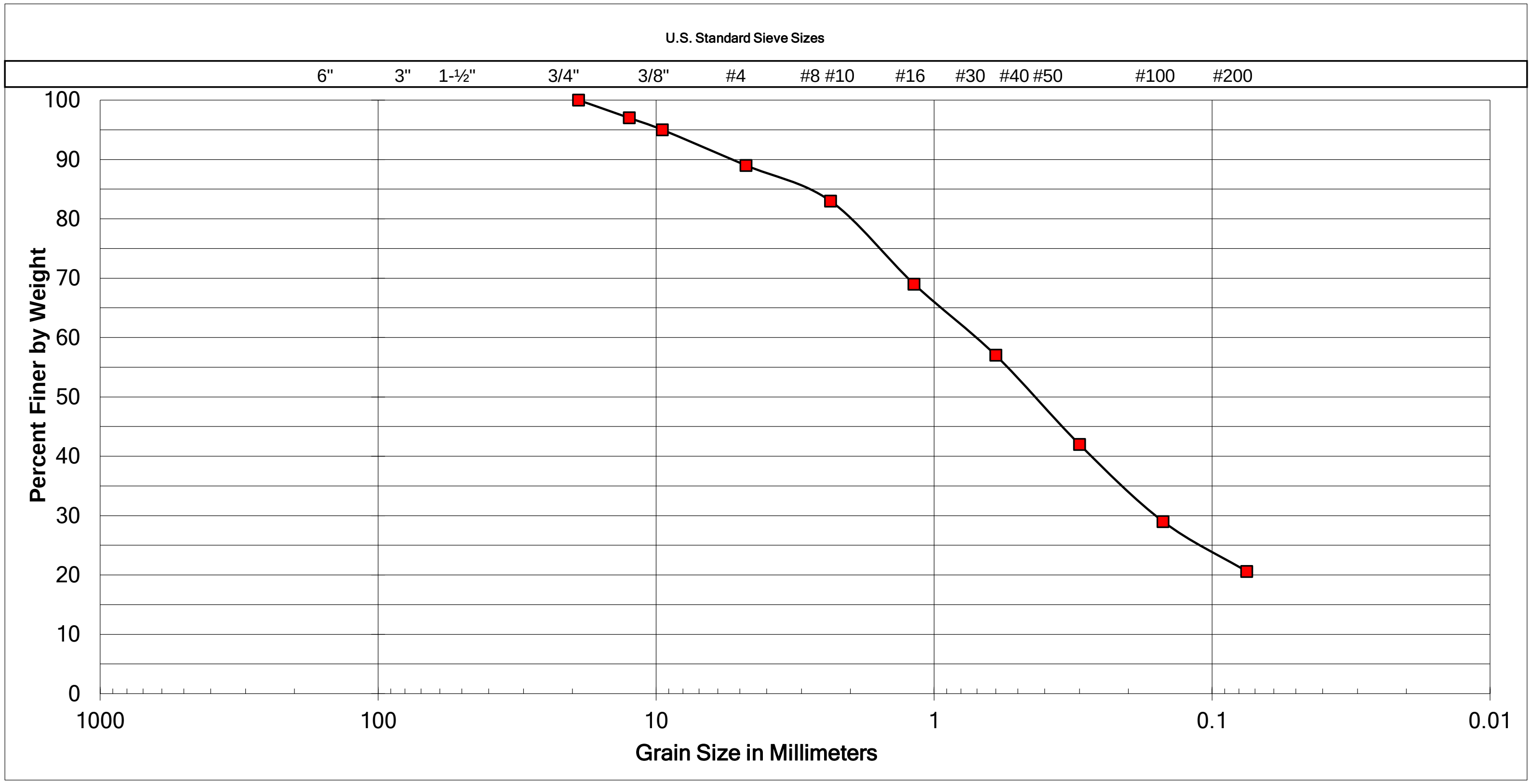
By:	CJM	Date:	November, 2017
Job Number:	170308N-1	Figure:	I-15

APPENDIX II
LABORATORY TESTING

Laboratory tests were performed to provide geotechnical parameters for engineering analyses. The following tests were performed:

- **CLASSIFICATION:** Field classifications were verified in the laboratory by visual examination. The final soil classifications are in accordance with the Unified Soil Classification System.
- **IN SITU MOISTURE AND DENSITY:** The in situ moisture content and dry unit weight were determined on samples collected from the borings. The test results are presented on the boring logs in Appendix I.
- **GRAIN SIZE DISTRIBUTION:** The grain size distribution was determined on four samples in accordance with ASTM D422. Figures II-1 through II-3 present the test results.
- **ATTERBERG LIMITS:** The Atterberg limits were determined on 10 soil samples in accordance with ASTM D4318. Figures II-1 through II-4 present the test results.
- **FINES CONTENT:** The amount of material finer than the No. 200 sieve was determined on seven samples in accordance with ASTM D1140. Figure II-4 presents the test results.
- **R-VALUE:** An R-value test was performed on one soil sample in accordance with California Test Method 301. Figure II-4 presents the test result.
- **EXPANSION INDEX:** The expansion index was determined on two soil samples in accordance with ASTM D4829. Figure II-4 presents the test results.
- **CORROSIVITY**: Corrosivity tests were performed on two soil samples. The pH and minimum resistivity were determined in general accordance with California Test 643. The soluble sulfate content was determined in accordance with California Test 417. The total chloride ion content was determined in accordance with California Test 422. Figure II-4 presents the test results.

Soil samples not tested are now stored in our laboratory for future reference and analysis, if needed. Unless notified to the contrary, all samples will be disposed of 30 days from the date of this report.



Cobbles	Gravel		Sand			Silt or Clay
	Coarse	Fine	Coarse	Medium	Fine	

SAMPLE LOCATION
B-1 at ½ to 3 Feet

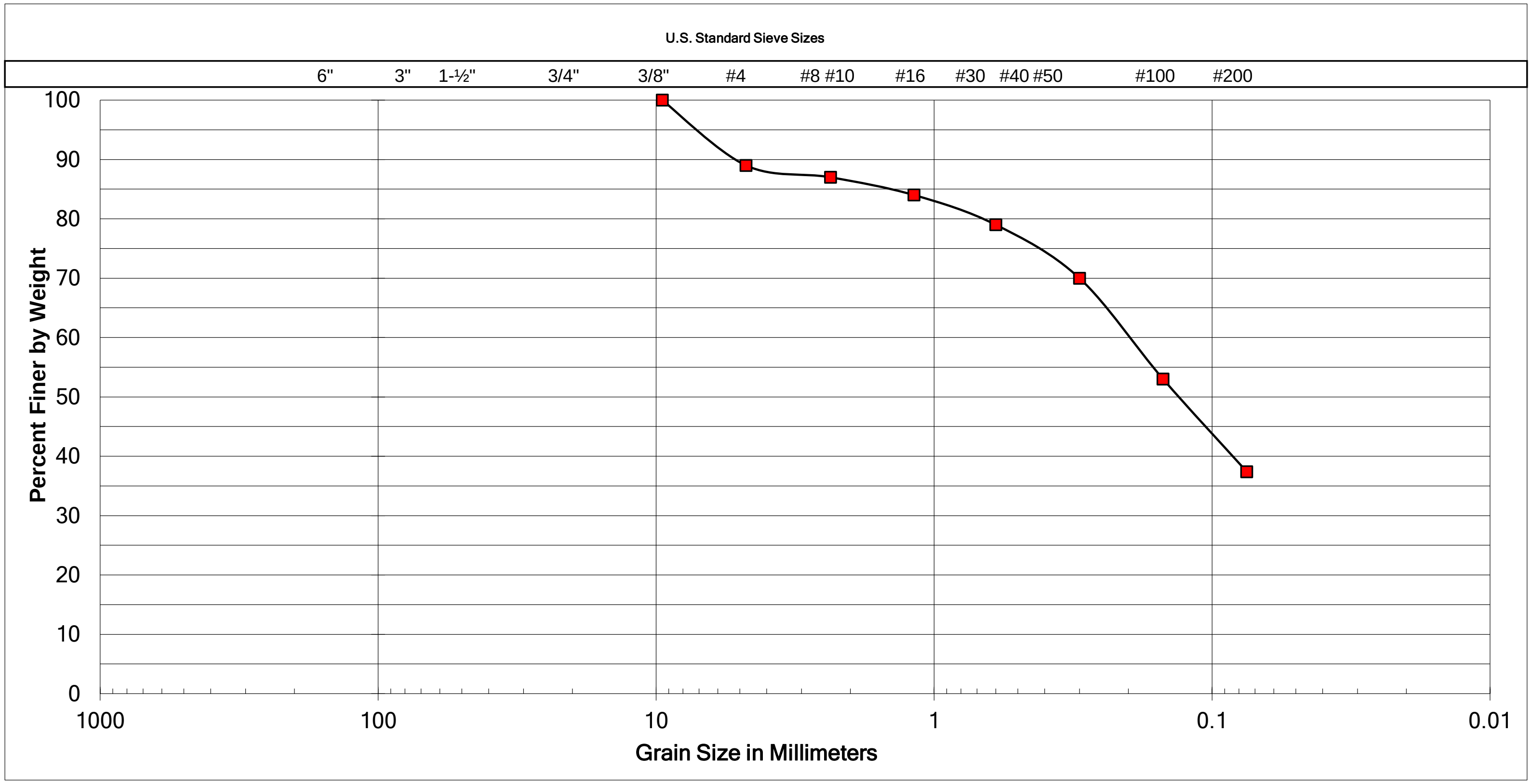
UNIFIED SOIL CLASSIFICATION:	SM
DESCRIPTION	SILTY SAND

ATTERBERG LIMITS	
LIQUID LIMIT	NP
PLASTIC LIMIT	NP
PLASTICITY INDEX	NP

SCST, Inc.

Quince Street Senior Housing Development
Escondido, California

By:	CJM	Date:	November, 2017
Job Number:	170308N-1	Figure:	II-1



Cobbles	Gravel		Sand			Silt or Clay
	Coarse	Fine	Coarse	Medium	Fine	

SAMPLE LOCATION
B-3 at ½ to 3 Feet

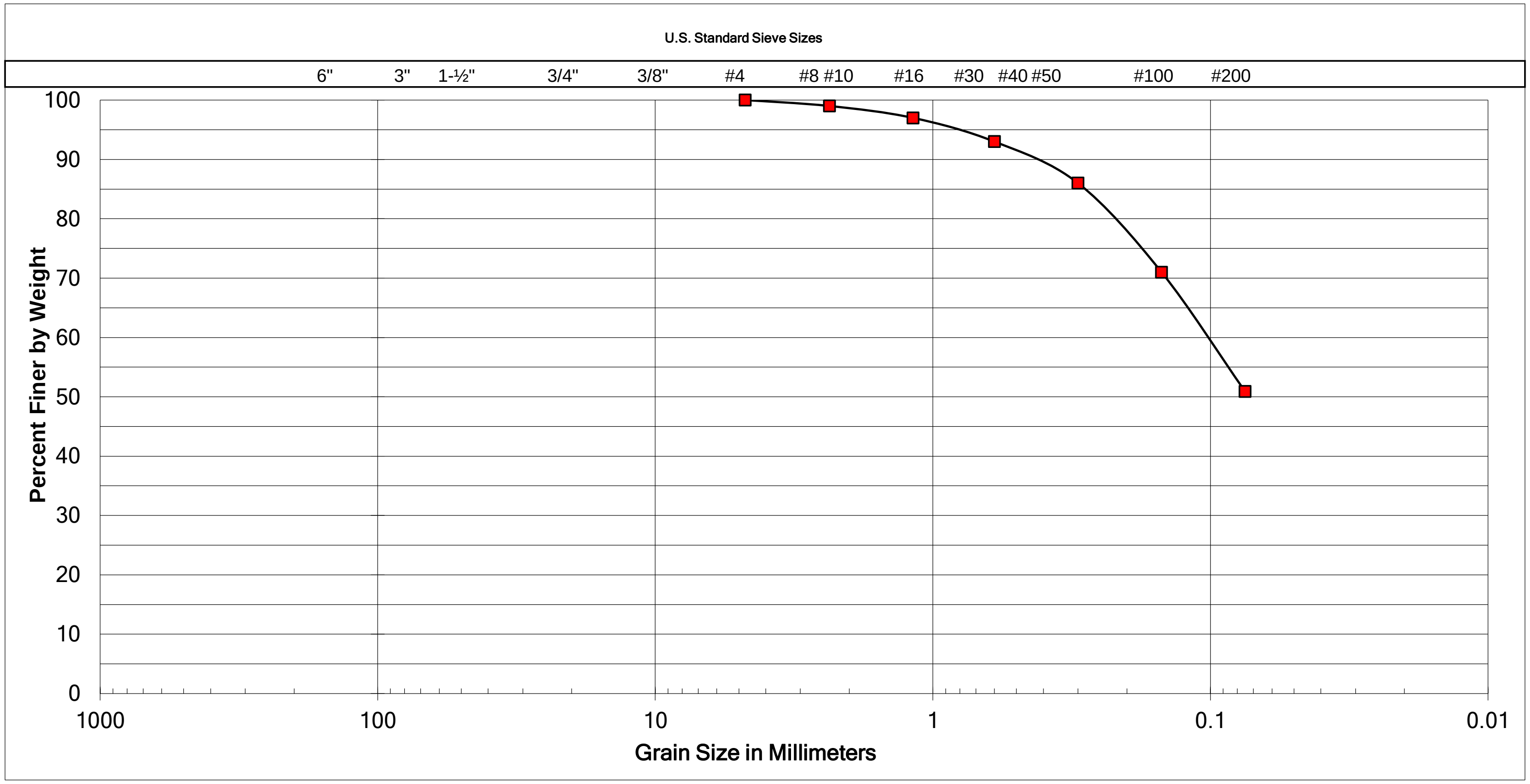
UNIFIED SOIL CLASSIFICATION:	SM
DESCRIPTION	SILTY SAND

ATTERBERG LIMITS	
LIQUID LIMIT	NP
PLASTIC LIMIT	NP
PLASTICITY INDEX	NP

SCST, Inc.

Quince Street Senior Housing Development
Escondido, California

By:	CJM	Date:	November, 2017
Job Number:	170308N-1	Figure:	II-2



Cobbles	Gravel		Sand			Silt or Clay
	Coarse	Fine	Coarse	Medium	Fine	

SAMPLE LOCATION
P-2 at 3½ to 5 Feet

UNIFIED SOIL CLASSIFICATION:	ML
DESCRIPTION	SANDY SILT

ATTERBERG LIMITS	
LIQUID LIMIT	NP
PLASTIC LIMIT	NP
PLASTICITY INDEX	NP

SCST, Inc.

Quince Street Senior Housing Development
Escondido, California

By:	CJM	Date:	November, 2017
Job Number:	170308N-1	Figure:	II-3

FINES CONTENT AND ATTERBERG LIMITS

ASTM D1140 AND ASTM D4318

SAMPLE	DESCRIPTION	FINES CONTENT	ATTERBERG LIMITS
B-1 at 15 to 16½ Feet	SANDY CLAY, dark brown	57%	LL=42; PL=22; PI=20
B-1 at 17½ to 19 Feet	SILTY SAND, dark grayish brown	35%	Non Plastic
B-1 at 22½ to 24 Feet	Poorly Graded SAND with SILT, dark gray	10%	Non Plastic
B-2 at 17½ to 19 Feet	Poorly Graded SAND with SILT, yellowish brown	6%	Non Plastic
B-2 at 22½ to 24 Feet	SILTY SAND, dark yellowish brown	16%	Non Plastic
B-2 at 27½ to 29 Feet	Poorly Graded SAND, yellowish brown	4%	Non Plastic
B-3 at 15 to 16½ Feet	SILTY SAND, moderate brown	28%	Non Plastic

R-VALUE

CALIFORNIA TEST 301

SAMPLE	DESCRIPTION	R- VALUE
B-2 at 1 to 2 Feet	CLAYEY SAND, dark brown	51

EXPANSION INDEX

ASTM D2489

SAMPLE	DESCRIPTION	EXPANSION INDEX
B-1 at ½ to 3 Feet	SILTY SAND, dark yellowish brown	1
B-3 at ½ to 3 Feet	SILTY SAND, dark brown	7

CLASSIFICATION OF EXPANSIVE SOIL [1]

EXPANSION INDEX	POTENTIAL EXPANSION
1 - 20	Very Low
21 - 50	Low
51 - 90	Medium
91 - 130	High
Above 130	Very High

1. ASTM - D4829

RESISTIVITY, pH, SOLUBLE CHLORIDE and SOLUBLE SULFATE

SAMPLE	RESISTIVITY (Ω-cm)	pH	CHLORIDE (%)	SULFATE (%)
B-1 at ½ to 3 Feet	3,550	8.3	0.003	0.005
B-3 at ½ to 3 Feet	4,320	8	0.003	0.001

SULFATE EXPOSURE CLASSES [2]

Class	Severity	Water-Soluble Sulfate (SO_4) in Soil, Percent by Mass
S0	Not applicable	$SO_4 < 0.10$
S1	Moderate	$0.10 \leq SO_4 < 0.20$
S2	Severe	$0.20 \leq SO_4 \leq 2.00$
S3	Very Severe	$SO_4 > 2.00$

2. ACI 318, Table 19.3.1.1

SCST, Inc.

Quince Street Senior Housing Development
Escondido, California

By:	CJM	Date:	November, 2017
Job Number:	170308N-1	Figure:	II-4

APPENDIX III
INFILTRATION RATE TEST RESULTS

We performed borehole percolation testing at two locations (P-1 and P-2) in general conformance with the San Diego BMP Design Manual. Prior to starting the testing, the test holes were presoaked with clean potable water for about 24 hours. The infiltration tests were performed after presoaking by placing clean potable water in the holes and measuring the drop in the water level. Because water remained in the holes after presoaking, the water level was adjusted and the testing performed for two readings 30 minutes apart. Figures III-1 and III-2 present the results of the testing.

Report of Borehole Percolation Testing

Storm Water Infiltration

Project Name: Quince Street Senior Housing
Job Number: 170308N-1
Date Drilled: 7/20/2017
Drilling Method: 8-inch diameter hollow stem auger
Test Depth (feet): 5.0
Test Hole Diameter (inches): 8.0
Gravel Pack: Yes
Pipe Diameter (inches): 4

Test Number: **P-1**
Tested By: CF
Date Tested: 7/21/2017
Presoak Time: 24 hours

Trial No.	Time	Time Interval, ΔT (min)	Initial Water Height, H_o (ft)	Final Water Height, H_f (ft)	Change in Water Height, ΔH (in)	Percolation Rate (min/in)
1	10:31 11:01	0:30	2.00	2.00	0.0	0
2	11:01 11:31	0:30	2.00	2.00	0.0	0
3						
4						
5						
6						
7						
8						
Observed Percolation Rate:					0 0.0	min/in in/hr
Gravel Correction Factor:					1.95	
Corrected Percolation Rate:					0 0.0	min/in in/hr
***Tested Infiltation Rate, I_t:**					**0**	**in/hr**

*Tested infiltration rate using the Porchet Method:

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

ΔH = Change in water head height over the time interval [in] = 0.0

r = Test hole radius [in] = 1.5

ΔT = Time interval [min] = 30

H_{avg} = Average water height over time interval = $12(H_o + H_f)/2$ [in] = 24.0

SCST, Inc.

Quince Street Senior Housing
Escondido, California

By:	CF/VAU	Date:	November, 2017
Job No:	170308N-1	Figure:	III-1

Report of Borehole Percolation Testing

Storm Water Infiltration

Project Name: Quince Street Senior Housing
Job Number: 170308N-1
Date Drilled: 7/20/2017
Drilling Method: 8-inch diameter hollow stem auger
Test Depth (feet): 5.0
Test Hole Diameter (inches): 8.0
Gravel Pack: Yes
Pipe Diameter (inches): 4

Test Number: **P-2**
Tested By: CF
Date Tested: 7/21/2017
Presoak Time: 24 hours

Trial No.	Time	Time Interval, ΔT (min)	Initial Water Height, H_o (ft)	Final Water Height, H_f (ft)	Change in Water Height, ΔH (in)	Percolation Rate (min/in)
1	12:08 12:38	0:30	0.60	0.58	0.2	125
2	12:38 13:08	0:30	0.58	0.57	0.1	250
3						
4						
5						
6						
7						
8						

Observed Percolation Rate:	125 min/in 0.5 in/hr
Gravel Correction Factor:	1.95
Corrected Percolation Rate:	244 min/in 0.2 in/hr
***Tested Infiltation Rate, I_t:**	**0 in/hr**

*Tested infiltration rate using the Porchet Method:

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

ΔH = Change in water head height over the time interval [in] = 0.0

r = Test hole radius [in] = 1.5

ΔT = Time interval [min] = 30

H_{avg} = Average water height over time interval = $12(H_o + H_f)/2$ [in] = 7.0

SCST, Inc.

Quince Street Senior Housing Escondido, California			
By:	CF/VAU	Date:	November, 2017
Job No:	170308N-1	Figure:	III-2