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GEOTECHNICAL INVESTIGATION
SAN DIEGO RIVER TRAIL
CARLTON OAKS GOLF COURSE SEGMENT
SAN DIEGO AND SANTEE, CALIFORNIA

PREPARED FOR:

MR. SAMUEL WAISBORD, PE
NASLAND ENGINEERING
4740 RUFFNER STREET
SAN DIEGO, CALIFORNIA 92111

PREPARED BY:

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6280 RIVERDALE STREET
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Providing Professional Engineering Services Since 1959

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October 28, 2016

SCST Project No. 160413P3
Report No. 1

Mr. Samuel Waisbord, PE
Project Manager
Nasland Engineering
4740 Ruffner Street
San Diego, California 92111

Subject: GEOTECHNICAL INVESTIGATION
SAN DIEGO RIVER TRAIL
CARLTON OAKS GOLF COURSE SEGMENT
SAN DIEGO AND SANTEE, CALIFORNIA

Dear Mr. Waisbord:

SCST, Inc. 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 agreement dated August 17, 2016. 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 questions, please call us at (619) 280-4321.

Respectfully submitted,
SCST, INC.

THOMAS B. CANADY
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1. INTRODUCTION

This report presents the results of the geotechnical investigation SCST, Inc. performed for the subject project. We understand the project will consist of the design and construction of a bikeway on the existing berm located along the southern edge of Carlton Oaks Golf Course in the City of San Diego and the City of Santee, California. Figure 1 presents a site vicinity map. The purpose of our work is to provide conclusions and recommendations regarding the geotechnical aspects of the project.

2. SCOPE OF WORK

2.1 FIELD INVESTIGATION

We explored the subsurface conditions by excavating four test pits along the existing berm to depths of about 4 to 5 feet below the existing ground surface using hand tools. We also collected three samples of near-surface soils within the San Diego River channel (one at the project site, one mile upstream, and one mile downstream) for use in scour analysis by others. Figures 2A and 2B show the approximate locations of the test pits and scour analysis samples. An SCST engineer logged the test pits and collected samples of the materials encountered for laboratory testing. Appendix I presents logs of the test pits. Soils are classified according to the Unified Soil Classification System illustrated on Figure I-1.

2.2 LABORATORY TESTING

Selected samples obtained from the test pits and the San Diego River channel were tested to evaluate pertinent soil classification and engineering properties and enable development of geotechnical conclusions and recommendations. The laboratory tests consisted of grain size distribution, Atterberg Limits, maximum dry density and optimum moisture content, expansion index, corrosivity and direct shear. Appendix II presents the results of the laboratory tests and brief explanations of the test procedures.

2.3 ANALYSIS AND REPORT PREPARATION

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

- Subsurface conditions beneath the site, including groundwater levels
- General geologic conditions and potential geologic hazards
- Criteria for seismic design in accordance with the 2013 California Building Code (CBC)
- Site preparation and grading, including excavation characteristics
- General construction-related considerations, including temporary sloped excavations and shoring, construction dewatering, and trench backfilling operations
- Slope stability
- Allowable soil bearing capacity and resistance to lateral loads
- Estimated foundation settlements
- Lateral earth pressures for retaining wall design
- Modulus of soil reaction for pipeline design
- Pavement sections

3. SITE DESCRIPTION

The site consists of an existing earthen berm located between the southern edge of Carlton Oaks Golf Course and the northern edge of the San Diego River within the City of San Diego and the City of Santee, California. The site is part of the planned San Diego River Trail that is envisioned as a regional bikeway that extends along the San Diego River from the Pacific Ocean to its headwaters near Julian. The Carlton Oaks Golf Course Segment of the trail is about 2 miles long and extends between West Hills Parkway on the west and Carlton Hills Boulevard on the east. The existing unpaved berm is up to about 10 feet in height with side slopes generally inclined flatter than 2:1 (horizontal to vertical). Portions of the side slopes on the San Diego River side are locally steeper than 2:1 due to scour/erosion. Dense vegetation exists on the San Diego River side slopes.

4. PROPOSED DEVELOPMENT

We understand that the proposed development will consist of Class I bikeway, which is a path that provides a separated right-of-way for the exclusive use of people walking and riding bikes. The proposed bikeway will consist of a 10-foot-wide paved bike path with 2-foot wide shoulders. Additional improvements will include retaining walls, fencing, lighting and drainage facilities. Minor fills will be placed to widen the existing berm, with fill slopes constructed at 2:1 (horizontal to vertical) or flatter.

5. GEOLOGY AND SUBSURFACE CONDITIONS

The materials encountered in the test pits consist of berm fill. The entire site is underlain by young alluvial flood-plain deposits. The materials encountered in the San Diego River channel consist of alluvial deposits. Descriptions of the materials are presented below. Figure 3 presents the regional geology in the vicinity of the site.

Fill: Fill was encountered in each of the test pits. The fill is associated with the berm construction and consists of loose to medium dense silty sand with trace amounts of gravel. The fill extends to maximum depth explored of about 5 feet below the existing ground surface.

Young Alluvial Flood-Plain Deposits: Young alluvial flood-plain deposits were encountered in the San Diego River channel. The near-surface alluvial deposits consist of poorly graded sand with silt and silty sand.

Groundwater: Groundwater was encountered in test pit TP-4 at a depth of about 4½ feet below the existing ground surface. Groundwater levels may fluctuate in the future due to river flow, 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 Rose Canyon fault zone (Silver Strand Section) located about 11½ miles (18½ kilometers) southwest 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 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 subject site. The site coefficients and adjusted maximum considered earthquake spectral response accelerations in accordance with the 2013 CBC are presented below:

Site Coordinates: Latitude 32.83767°
Longitude -117.01196°
Site Class: D
Site Coefficients, $F_a = 1.150$
$F_v = 1.719$
Mapped Spectral Response Acceleration at Short Period, $S_s = 0.875g$
Mapped Spectral Response Acceleration at 1-Second Period, $S_1 = 0.340g$
Design Spectral Acceleration at Short Period, $S_{DS} = 0.671g$
Design Spectral Acceleration at 1-Second Period, $S_{D1} = 0.390g$
Site Peak Ground Acceleration, $PGA_M = 0.387g$

6.3 LIQUEFACTION

Liquefaction occurs when loose, saturated, generally fine sands and silts are subjected to strong ground shaking. The soils lose shear strength and become liquid; potentially resulting in large total and differential ground surface settlements as well as possible lateral spreading. Liquefaction analysis was not part of our scope of work. However, according to the City of San Diego Seismic Safety Study map, the site is located in an area with a high liquefaction potential. Although liquefaction may occur, we anticipate that the site will generally behave as a Site Class D with respect to seismic response of the planned improvements.

6.4 FLOODING, TSUNAMIS AND SEICHES

The site is located within a flood zone (FEMA, 2012); therefore, the potential for flooding at the site is high. 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.

7. CONCLUSIONS

The planned bikeway, retaining walls and other improvements will be underlain by potentially compressible fill soils. Remedial grading will need to be performed to reduce the potential for distress to the planned improvements under static loading. Remedial grading recommendations are provided in Sections 8.1.2 and 8.1.3 of this report. The planned retaining walls can be supported on shallow spread footings with bottoms levels on compacted fill. If the soils beneath the site liquefy, significant distress to the planned improvements should be anticipated.

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 existing soils should be excavated to a depth of at least 1 foot below finished subgrade elevation for pavements and 2 feet below the footing bottom level for retaining walls. Horizontally, the excavations should extend a distance equal to the depth of excavation or up to the limits of disturbance, 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 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 and retaining wall footings 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. Fill should be benched into sloping ground inclined steeper than 5:1 (horizontal to vertical), such as for the berm widening. The maximum dry density and optimum moisture content for evaluating relative compaction should be determined in accordance with ASTM D 1557. 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%.

8.1.4 Imported Soil

Imported soil should consist of predominately granular soil free of organic matter and rocks greater than 6 inches. Imported soil should have an expansion index of 20 or less and should be inspected and, if appropriate, tested by SCST prior to transport to the site.

8.1.5 Excavation Characteristics

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

8.1.6 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. A shoring system consisting of soldier piles and lagging can be used.

8.1.7 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.

8.1.8 Temporary Dewatering

Groundwater seepage may occur locally and should be anticipated in 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 Oversized Material

Excavations may generate oversized material. Oversized material is defined as rocks or cemented clasts greater than 6 inches in largest dimension. Oversized material should be broken down to no greater than 6 inches in largest dimension for use in fill, used as landscape material, or disposed offsite.

8.1.10 Slopes

All permanent slopes should be constructed no steeper than 2:1 (horizontal to vertical). In our opinion, slopes constructed no steeper than 2:1 will possess an adequate factor of safety. 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. Fill should be benched into sloping ground inclined steeper than 5:1. 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.

Portions of the existing berm slope on the San Diego River side show indications of erosion or scour failure. In our opinion, the slopes will remain susceptible to erosion and failure unless armored with rip-rap. We recommend using rip-rap that conforms to Section 72 of the Caltrans Standard Specifications. A fabric separator such as Mirafi FW300 should be placed between the rip-rap and soil to reduce the potential for piping erosion. Existing vegetation should be removed throughout the remediation area prior to placing the fabric. Sufficient rip-rap should be placed to restore the slope face to a 2:1 gradient.

8.1.11 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.

8.1.12 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 CONVENTIONAL RETAINING WALLS

8.2.1 Foundations

Shallow spread footings with bottom levels on compacted fill can be used to support retaining walls. Footings should extend at least 18 inches below lowest adjacent finished grade and be at least 24 inches wide. 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.

8.2.2 Allowable Soil Bearing

An allowable bearing capacity of 2,000 psf can be used. The bearing value can be increased by ⅓ when considering the total of all loads, including wind or seismic forces.

8.2.3 Resistance to Lateral Loads

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 0.35 can be used. Passive pressure can be computed using an allowable lateral pressure of 300 psf per foot of depth below the ground surface for level ground conditions. Reductions for sloping ground should be made. 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.

8.2.4 Settlement Characteristics

Total foundation settlements are estimated to be less than 1 inch. Differential settlements across continuous footings are estimated to be less than ¾ inch over a distance of 40 feet. Settlements should be completed shortly after structural loads are applied.

8.2.5 Foundation Excavation Observations

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

8.2.6 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. 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 4 presents typical conventional retaining wall backdrain details.

8.2.7 Seismic Earth Pressure

If required, the seismic earth pressure can be taken as equivalent to the pressure of a fluid weighing 14 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.

8.2.8 Backfill

Wall backfill should consist of granular, free-draining material. Expansive or clayey soil should not be used. Additionally, backfill within 3 feet from the back of the wall should not contain rocks greater than 3 inches in dimension. We anticipate that a portion of the onsite soils will be suitable for wall backfill. 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. Additionally, any utilities supported on backfill should be designed to tolerate differential settlement.

8.3 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	32°	32°	32°
Cohesion	0	0	0
Moist Unit Weight	125 pcf	125 pcf	125 pcf

The reinforced soil should consist of granular, free-draining material with a sand equivalent of 20 or more. The bottom of MSE walls should extend to such a depth that a total of 5 feet exists between the bottom of the wall and the face of the slope. Figure 5 presents a typical MSE retaining wall backdrain detail. MSE retaining 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.

8.4 PIPELINES

8.4.1 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.

8.4.2 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.

8.4.3 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.

8.4.4 Cutoff Walls

Where pipeline inclinations exceed 15 percent, cutoff walls may be necessary in trench excavations. Additionally, we do not recommend that open graded rock be used for pipe bedding or backfill because of the potential for piping erosion. The recommended bedding is clean sand having a sand equivalent not less than 30. Alternatively, 2-sack sand-cement slurry can be used for the pipe bedding. If sand-cement slurry is used for pipe bedding to at least 1 foot over the top of the pipe, cutoff walls are not considered necessary. The need for cutoff walls should be further evaluated by the project civil engineer designing the pipeline.

8.4.5 Backfill

Excavated material free of organic debris and rocks greater than 6 inches in any dimension are generally expected to be suitable for use as backfill unless beneath buildings or hardscape. Imported material should not contain rocks greater than 4 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 imported 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.

8.5 PAVEMENT SECTION RECOMMENDATIONS

The pavement support characteristics of the soils encountered during our investigation are considered moderate. An R-value of 30 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 30, the following pavement structural sections are recommended for an assumed Traffic Index of 5.0. The project civil engineer should review the assumed Traffic Index to determine if it is appropriate.

Flexible Pavement Sections

Traffic Type	Traffic Index	Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)
Bikeway and Light Vehicle	5.0	3	6

Portland Cement Concrete Pavement Sections

Traffic Type	Traffic Index	Full-Depth JPCP* (inches)
Bikeway and Light Vehicle	5.0	6

***Jointed Plain Concrete Pavement**

Pervious pavement sections are recommended below. They are based on Caltrans (2014) pavement structural design guidelines. The pavement sections 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)
Bikeway and Light Vehicle	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)
Bikeway and Light Vehicle	B	6	6

Permeable Interlocking Concrete Pavers (PICP)

Traffic Type	Category	PICP (inches)	Class 3 Permeable (inches)	Class 4 Aggregate Base (inches)
Bikeway and Light Vehicle	B	3⅛	4¼	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 areas should be removed and replaced with compacted fill or aggregate base. Aggregate base should be compacted to at least 95% relative compaction. 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 consisting of 30 mil HDPE or PVC to reduce the potential for berm slope instabilities or water-related distress to adjacent improvements. A suitable subdrain system should be installed at the base of the pervious section.

8.6 SOIL CORROSIVITY

A representative sample of the onsite soils was 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.

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 test pit locations, 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, California Geological Survey, University of Southern California (Cal EMA) (2009), Tsunami Inundation Map for Emergency Planning, June 1.

Caltrans (2010), Standard Specifications.

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 06073C1634G, May 16.

International Code Council (2012), 2013 California Building Code, California Code of Regulations, Title 24, Part 2, Volume 2 of 2, Based on the 2012 International Existing Building Code, Effective Date: January 1, 2014.

Kennedy, M.P. and Tan, S.S. (2008), Geologic Map of the San Diego 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.

ENGINEERING

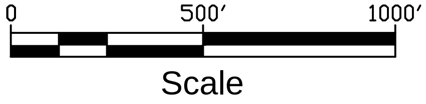
SITE VICINITY MAP
San Diego River Trail
Carlton Oaks Golf Course Segment

Date: October, 2016
By: VAU
Job No.:160413P3-1

Figure:
1

SCST LEGEND:

TP-2 (4') ☒	Approximate Location of Test Pit (Depth in feet)
S-2 ⊕	Approximate Location of Scour Analysis Sample



SCST ENGINEERING

SCST, Inc.

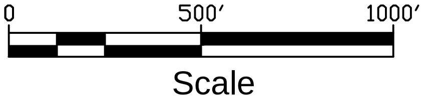
SUBSURFACE EXPLORATION MAP
San Diego River Trail
Carlton Oaks Golf Course Segment

Date: October, 2016
By: VAU
Job No.: 160413P3-1

Figure:
2A

SCST LEGEND:

TP-4 (5') ☒	Approximate Location of Test Pit (Depth in feet)
S-3 ⊕	Approximate Location of Scour Analysis Sample



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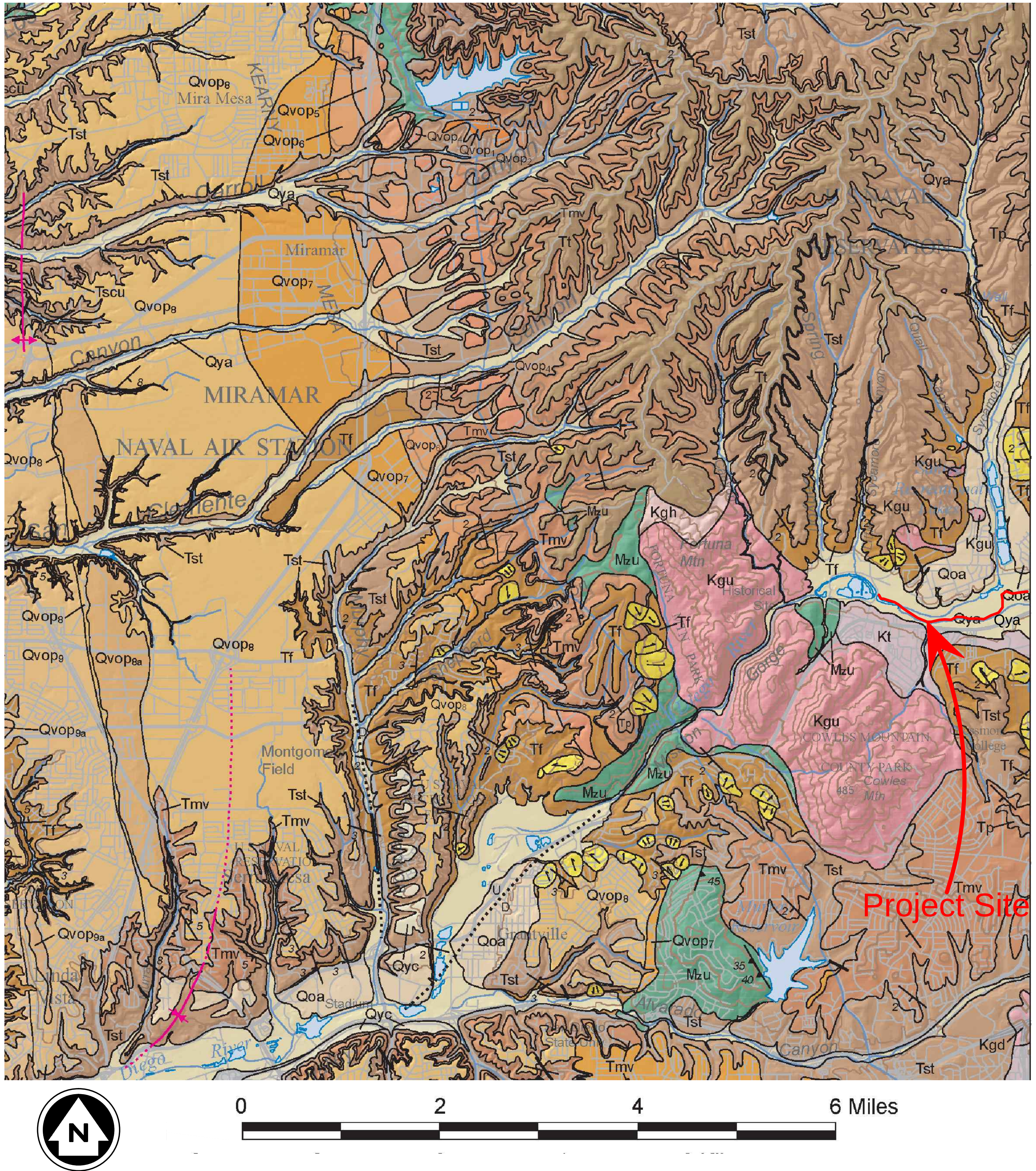
SUBSURFACE EXPLORATION MAP
San Diego River Trail
Carlton Oaks Golf Course Segment

Date: October, 2016
By: VAU
Job No.: 160413P3-1

Figure:
2B



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

ABBREVIATED EXPLANATION

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

MODERN SURFICIAL DEPOSITS

Holocene	af	Artificial fill (late Holocene)
	Qw	Wash deposits (late Holocene)
	Qls	Landslide deposits, undivided (Holocene and Pleistocene)
	Qmb	Marine beach deposits (late Holocene)
	Qpe	Paralic estuarine deposits (late Holocene)
	Qmo	Undivided marine deposits in offshore region (late Holocene)
	Qcf	Canyon fill deposits in offshore region (late Holocene)

YOUNG SURFICIAL DEPOSITS

Qya	Young alluvial flood-plain deposits (Holocene and late Pleistocene)
Qyc	Young colluvial deposits (Holocene and late Pleistocene)
Qct	Undivided canyon terrace deposits in offshore region (Holocene and Pleistocene)

OLD SURFICIAL DEPOSITS

Qoa	Old alluvial flood-plain deposits, undivided (late to middle Pleistocene)
Qop	Old paralic deposits, undivided (late to middle Pleistocene)
Qop$_7$	Unit 7
Qop$_6$	Unit 6
Qop$_{2-4}$	Units 2-4, undivided

VERY OLD SURFICIAL UNITS

Pleistocene

Qvoa	Very old alluvial flood-plain deposits, undivided (middle to early Pleistocene)
Qvop	Very old paralic deposits, undivided (middle to early Pleistocene)

Qvop$_7$	Unit 7				
Qvop$_6$	Unit 6	Qvop$_{13}$	Unit 13		
Qvop$_5$	Unit 5	Qvop$_{12}$	Unit 12		
Qvop$_4$	Unit 4	Qvop$_{11}$	Unit 11	Qvop$_{11a}$	Unit 11a
Qvop$_3$	Unit 3	Qvop$_{10}$	Unit 10	Qvop$_{10a}$	Unit 10a
Qvop$_2$	Unit 2	Qvop$_9$	Unit 9	Qvop$_{9a}$	Unit 9a
Qvop$_1$	Unit 1	Qvop$_8$	Unit 8	Qvop$_{8a}$	Unit 8a

SEDIMENTARY AND VOLCANIC BEDROCK UNITS

	QTso	Undivided sediments and sedimentary rocks in offshore region (Holocene, Pleistocene, Pliocene and Miocene)
Pliocene	Tsdcg / Tsdss / Tsd	San Diego Formation (early Pleistocene and late Pliocene) Tsd - undivided Tsdcg - transitional marine and nonmarine pebble and cobble conglomerate Tsdss - marine sandstone
Miocene	Tba	Basaltic-andesite dike (Miocene)
	Tmo	Undivided sedimentary rocks in offshore region (Miocene)
	Tmvo	Undivided volcanic rocks in offshore region (Miocene)
	Tmuo	Undivided volcanic and sedimentary rocks in offshore region (Miocene)
Oligo-cene	To	Otay Formation (late Oligocene)
Eocene	Tp / Tpm	Pomerado Conglomerate (middle Eocene) Tpm - Miramar Sandstone Member
	Tmv	Mission Valley Formation (middle Eocene)
	Tst	Stadium Conglomerate (middle Eocene)
	Tf	Friars Formation (middle Eocene)
	Tsc / Tscu	Scripps Formation (middle Eocene) Tscu - upper unit
	Ta	Ardath Shale (middle Eocene)
	Tt	Torrey Sandstone (middle Eocene)
	Td	Delmar Formation (middle Eocene)
	Td+Tf	Delmar Formation and Friars Formation, undivided (middle Eocene)
	Tmss / Tmsc	Mount Soledad Formation (middle Eocene) Tmss - sandstone Tmsc - cobble conglomerate
	Teo	Undivided Eocene rocks in offshore region (Eocene)
Upper Cretaceous	Kcs / Kccg	Cabrillo Formation (Upper Cretaceous) Kcs - sandstone Kccg - cobble conglomerate
	Kp	Point Loma Formation (Upper Cretaceous)
	Kl	Lusardi Formation (Upper Cretaceous)
	Kuo	Undivided rocks of the Rosario Group in the offshore area (Upper Cretaceous)

UNNAMED CRETACEOUS ROCKS OF THE PENINSULAR RANGES BATHOLITH

mid-Cretaceous	Kgu	Granodiorite and tonalite, undivided (mid-Cretaceous)
	Kgd	Granodiorite, undivided (mid-Cretaceous)
	Kt	Tonalite, undivided (mid-Cretaceous)
	Kd	Diorite, undivided (mid-Cretaceous)
	Kgh	Hypabyssal rocks, undivided (mid-Cretaceous)

118°0
33°00'

ONSHORE MAP SYMBOLS

Contact - Contact between geologic units; dotted where concealed.

70 U D

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.

Qls?

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

Strike and dip of beds

70 Inclined

Strike and dip of igneous joints

60 Inclined

Vertical

Strike and dip of metamorphic foliation

55 Inclined

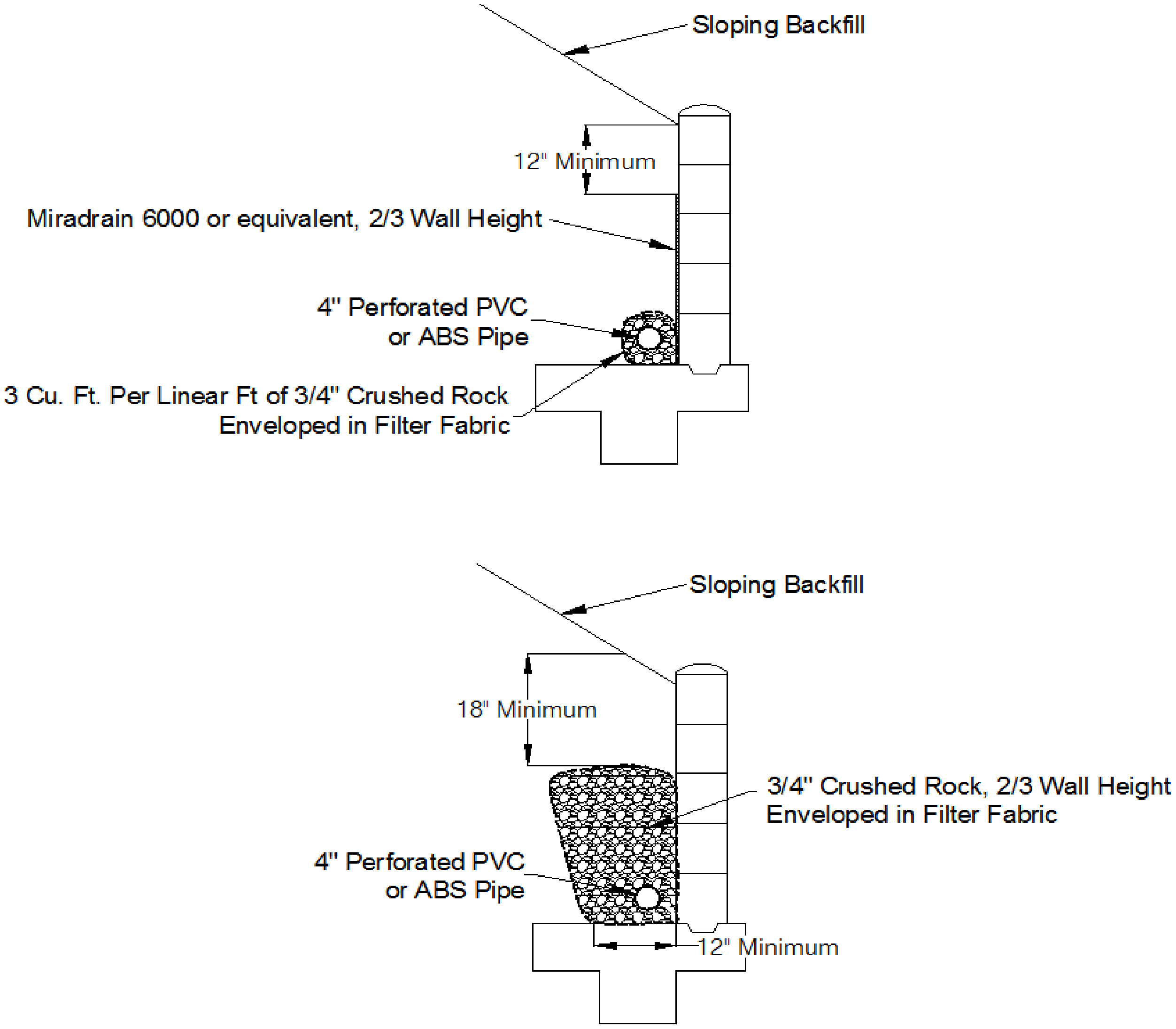
SCST ENGINEERING

SCST, Inc.

REGIONAL GEOLOGY AND FAULT MAP
San Diego River Trail
Carlton Oaks Golf Course Segment

Date: October, 2016
By: JCU/VAU
Job No.: 160413P3-1

Figure:
3



Not to Scale

NOTES

1) Waterproof back of wall following architect's specifications.

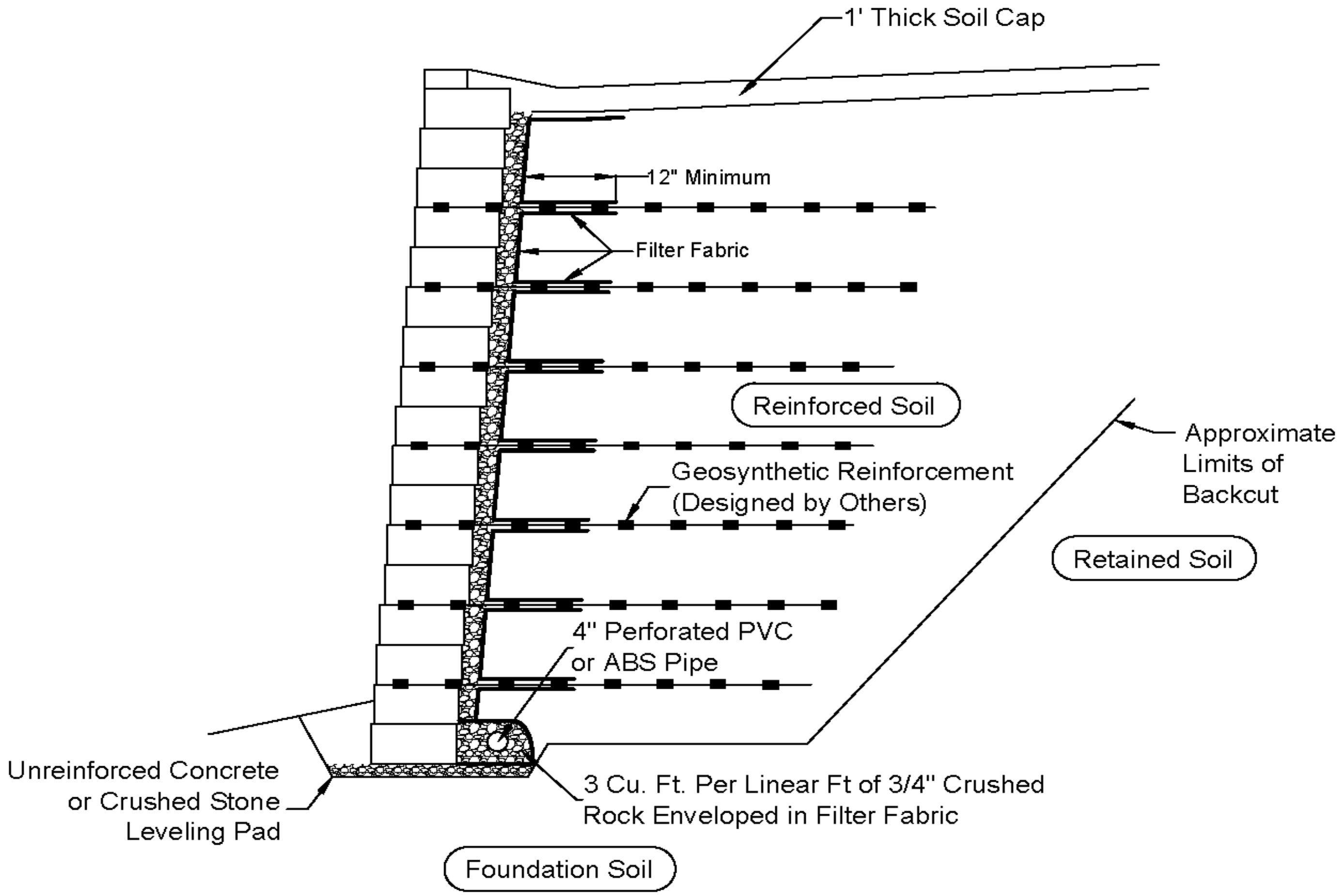
2) 4" minimum perforated pipe, SDR35 or equivalent, holes down, 1% fall to outlet. Provide solid outlet pipe at suitable locations.

3) Drain instalation and outlet connection should be observed by the geotechnical consultant.

SCST, Inc.

TYPICAL RETAINING WALL BACKDRAIN DETAILS
San Diego River Trail
Carlton Oaks Golf Course Segment

By:	JCU	Date:	October, 2016
Job Number:	160413P3-1	Figure:	4



Not to Scale

NOTES

1) Backcut as recommended by the geotechnical report or field evaluation.
2) Additional drain at excavation backcut may be recommended based on conditions observed during construction.
3) Filter fabric should be installed between crushed rock and soil. Filter fabric 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%.
5) Drain installation and outlet connection should be observed by the geotechnical consultant.

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TYPICAL MRE RETAINING WALL DETAIL
San Diego River Trail
Carlton Oaks Golf Course Segment

By:	JCU	Date:	October, 2016
Job No:	160413P3-1	Figure:	5

APPENDIX I
FIELD INVESTIGATION

Our field investigation consisted of excavating four test pits on October 14, 2016 along the existing berm to depths of about 4 to 5 feet below the existing ground surface using hand tools. We also collected three samples of near-surface soils within the San Diego River channel (one at the project site, one mile upstream, and one mile downstream) for use in scour analysis by others. Figures 2A and 2B present the approximate locations of the test pits and scour analysis samples. The field investigation was performed under the observation of an SCST engineer who also logged the test pits and obtained samples of the materials encountered.

The soils are classified in accordance with the Unified Soil Classification System as illustrated on Figure I-1. Logs of the test pits are presented on Figures I-2 through I-5.

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
UC	- Unconfined Compression

	San Diego River Trail Carlton Oaks Golf Course Segment			
SCST, Inc.	By:	VAU	Date:	October, 2016
	Job Number:	160413P3-1	Figure:	I-1

LOG OF TEST PIT TP-1

Date Drilled: 10/14/2016
Equipment: Hand Tools
Elevation (ft):
Logged by: VAU
Project Manager: TBC
Depth to Groundwater (ft): Not Encountered

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES		MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LABORATORY TESTS
			DRIVEN	BULK			
1 2 3	SM	**<u>FILL (Qf)</u>:** SILTY SAND, moderate brown, fine to medium grained, trace gravel, moist, loose to medium dense.		X			
4 5 6 7 8 9 10		**TEST PIT TERMINATED AT 4 FEET.**					

SCST, Inc.

San Diego River Trail
Carlton Oaks Golf Course Segment

By:	VAU	Date:	October, 2016
Job Number:	160413P3-1	Figure:	I-2

LOG OF TEST PIT TP-2

Date Drilled: 10/14/2016
Equipment: Hand Tools
Elevation (ft):

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

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES		MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LABORATORY TESTS
			DRIVEN	BULK			
	SM	**<u>FILL (Qf)</u>:** SILTY SAND, moderate brown, fine to medium grained, trace gravel, moist, loose to medium dense.		☒			
1							
2							AL SA COR
3							
4		**TEST PIT TERMINATED AT 4 FEET.**					
5							
6							
7							
8							
9							
10							

SCST, Inc.

San Diego River Trail
Carlton Oaks Golf Course Segment

By:	VAU	Date:	October, 2016
Job Number:	160413P3-1	Figure:	I-3

LOG OF TEST PIT TP-3

Date Drilled: 10/14/2016
Equipment: Hand Tools
Elevation (ft):

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

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES		MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LABORATORY TESTS
			DRIVEN	BULK			
1 2 3 4	SM	**<u>FILL (Qf)</u>:** SILTY SAND, moderate brown, fine to medium grained, trace gravel, moist, loose to medium dense.		☒			MAX DS
5 6 7 8 9 10		**TEST PIT TERMINATED AT 5 FEET.**					

SCST, Inc.
ENGINEERING

San Diego River Trail
Carlton Oaks Golf Course Segment

By:	VAU	Date:	October, 2016
Job Number:	160413P3-1	Figure:	I-4

LOG OF TEST PIT TP-4

Date Drilled: 10/14/2016
Equipment: Hand Tools
Elevation (ft):

Logged by: VAU
Project Manager: TBC
Depth to Groundwater (ft): 4½

DEPTH (ft)	USCS	SUMMARY OF SUBSURFACE CONDITIONS	SAMPLES DRIVEN	SAMPLES BULK	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (pcf)	LABORATORY TESTS
1 2 3 4	SM	**FILL (Qf):** SILTY SAND, moderate brown, fine to medium grained, trace clay, low plasticity, moist, loose to medium dense. ▽ Groundwater encountered at 4½ feet.		☒			AL SA EI
5 6 7 8 9 10		**TEST PIT TERMINATED AT 5 FEET.**					

SCST, Inc.

San Diego River Trail
Carlton Oaks Golf Course Segment

By:	VAU	Date:	October, 2016
Job Number:	160413P3-1	Figure:	I-5

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.

- **GRAIN SIZE DISTRIBUTION:** The grain size distribution was determined on five samples in accordance with ASTM D422. Figures II-1 through II-5 present the test results.

- **ATTERBERG LIMITS:** The Atterberg limits were determined on two samples in accordance with ASTM D4318. Figures II-1 and II-2 present the test results.

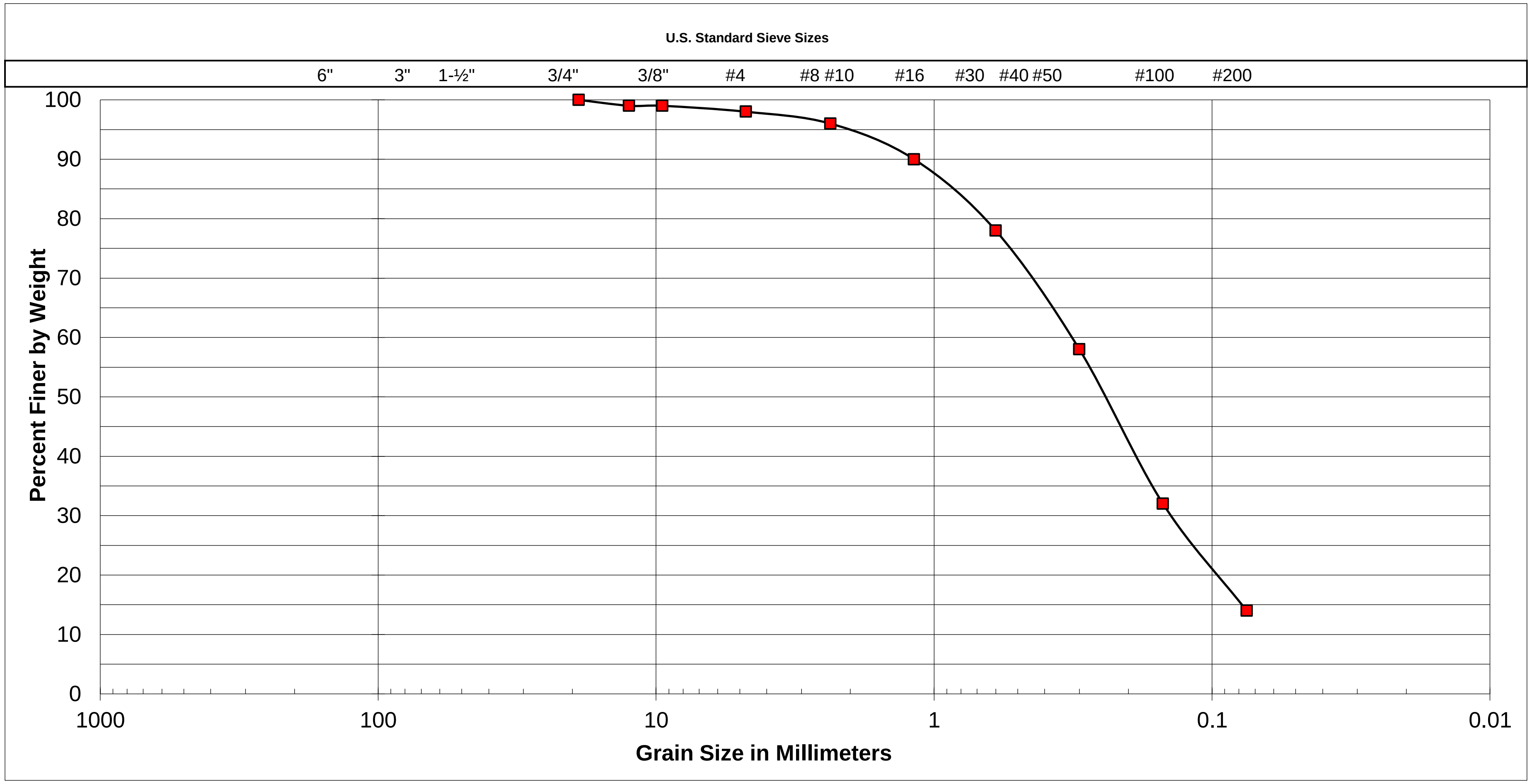
- **MAXIMUM DENSITY/OPTIMUM MOISTURE**: The maximum dry density and optimum moisture content were determined on one soil sample in accordance with ASTM D1557. Figure II-6 presents the test results.

- **EXPANSION INDEX:** The expansion index was determined on one sample in accordance with ASTM D4829. Figure II-6 presents the test results.

- **CORROSIVITY**: Corrosivity tests were performed on one sample. 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-6 presents the test results.

- **DIRECT SHEAR:** A direct shear test was performed on one sample in accordance with ASTM D3080. The sample was remolded to approximately 90% relative compaction. The shear stress was applied at a constant rate of strain of 0.003 inch per minute. Figure II-7 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
TP-2 at 0 to 4 feet

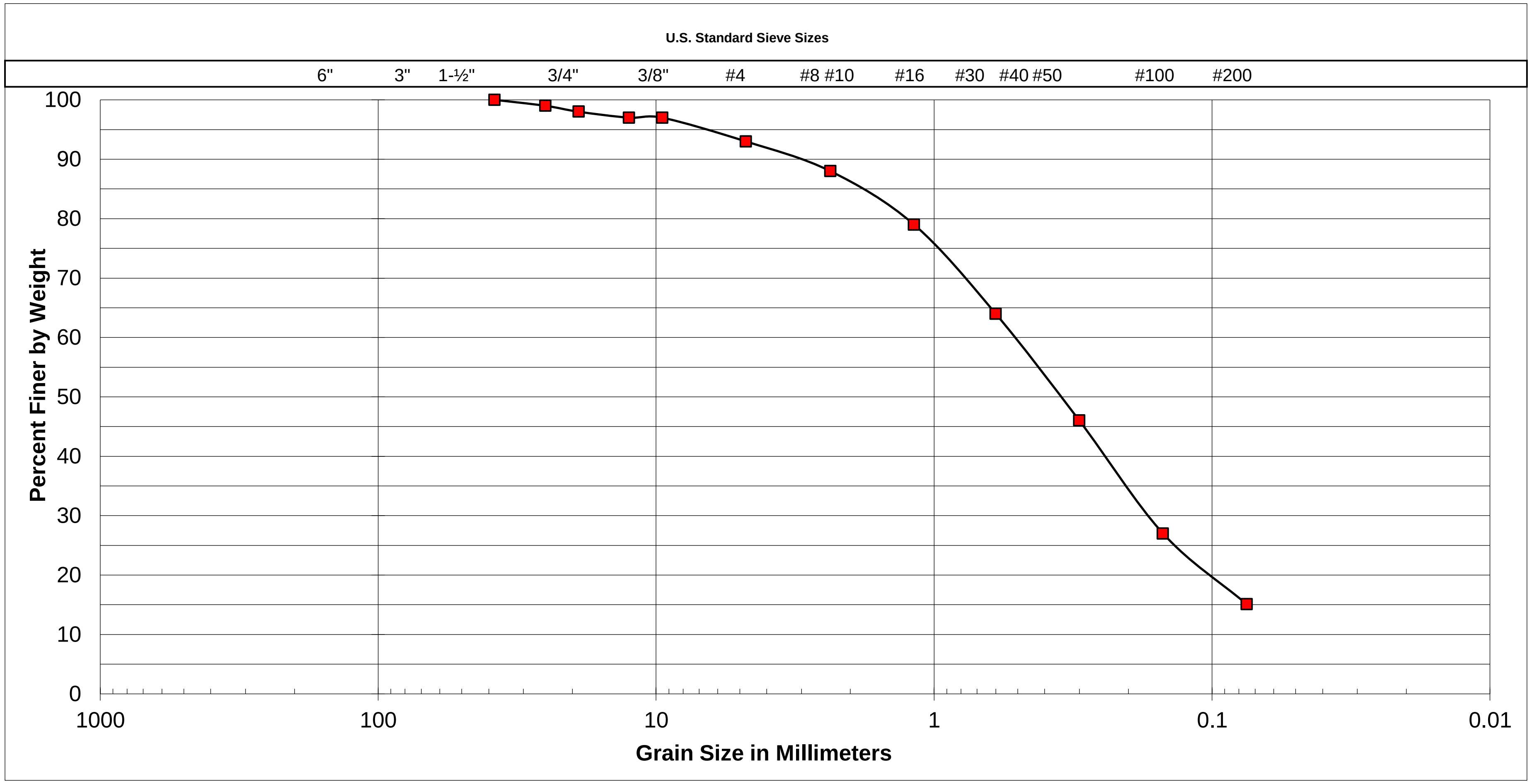
UNIFIED SOIL CLASSIFICATION:	SM
DESCRIPTION	SILTY SAND

ATTERBERG LIMITS	
LIQUID LIMIT	NP
PLASTIC LIMIT	NP
PLASTICITY INDEX	NP

SCST, Inc.

San Diego River Trail
Carlton Oaks Golf Course Segment

By:	PE/VAU	Date:	October, 2016
Job Number:	160413P3-1	Figure:	II-1



Cobbles	Gravel		Sand			Silt or Clay
	Coarse	Fine	Coarse	Medium	Fine	

SAMPLE LOCATION
TP-4 at 0 to 5 feet

UNIFIED SOIL CLASSIFICATION:	SM
DESCRIPTION	SILTY SAND

ATTERBERG LIMITS	
LIQUID LIMIT	NP
PLASTIC LIMIT	NP
PLASTICITY INDEX	NP

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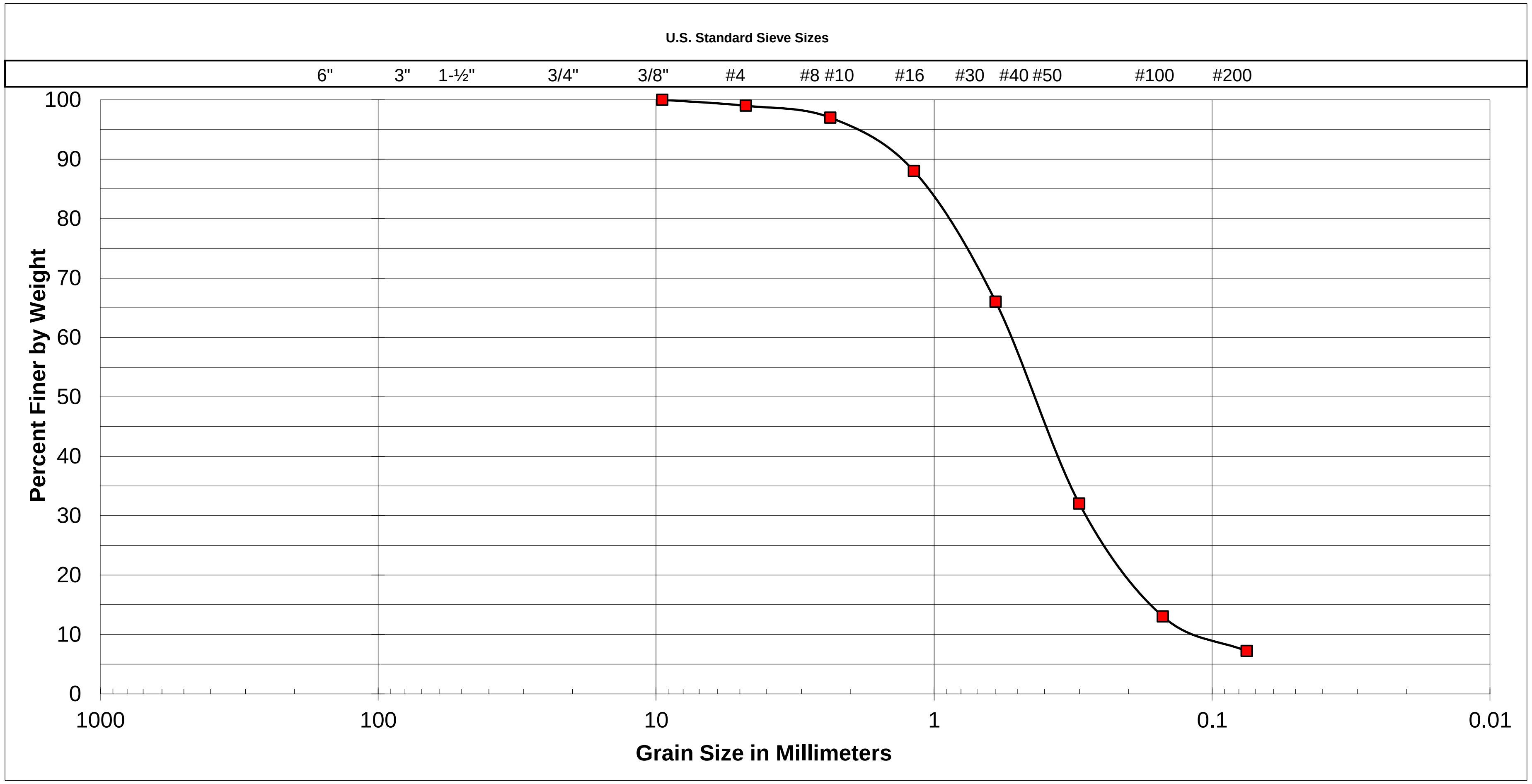
San Diego River Trail
Carlton Oaks Golf Course Segment

By:	PE/VAU	Date:	October, 2016
Job Number:	160413P3-1	Figure:	II-2



Cobbles	Gravel		Sand			Silt or Clay
	Coarse	Fine	Coarse	Medium	Fine	

SAMPLE LOCATION
S-1

UNIFIED SOIL CLASSIFICATION:	SP-SM
DESCRIPTION	POORLY GRADED SAND wth SILT

ATTERBERG LIMITS	
LIQUID LIMIT	-
PLASTIC LIMIT	-
PLASTICITY INDEX	-

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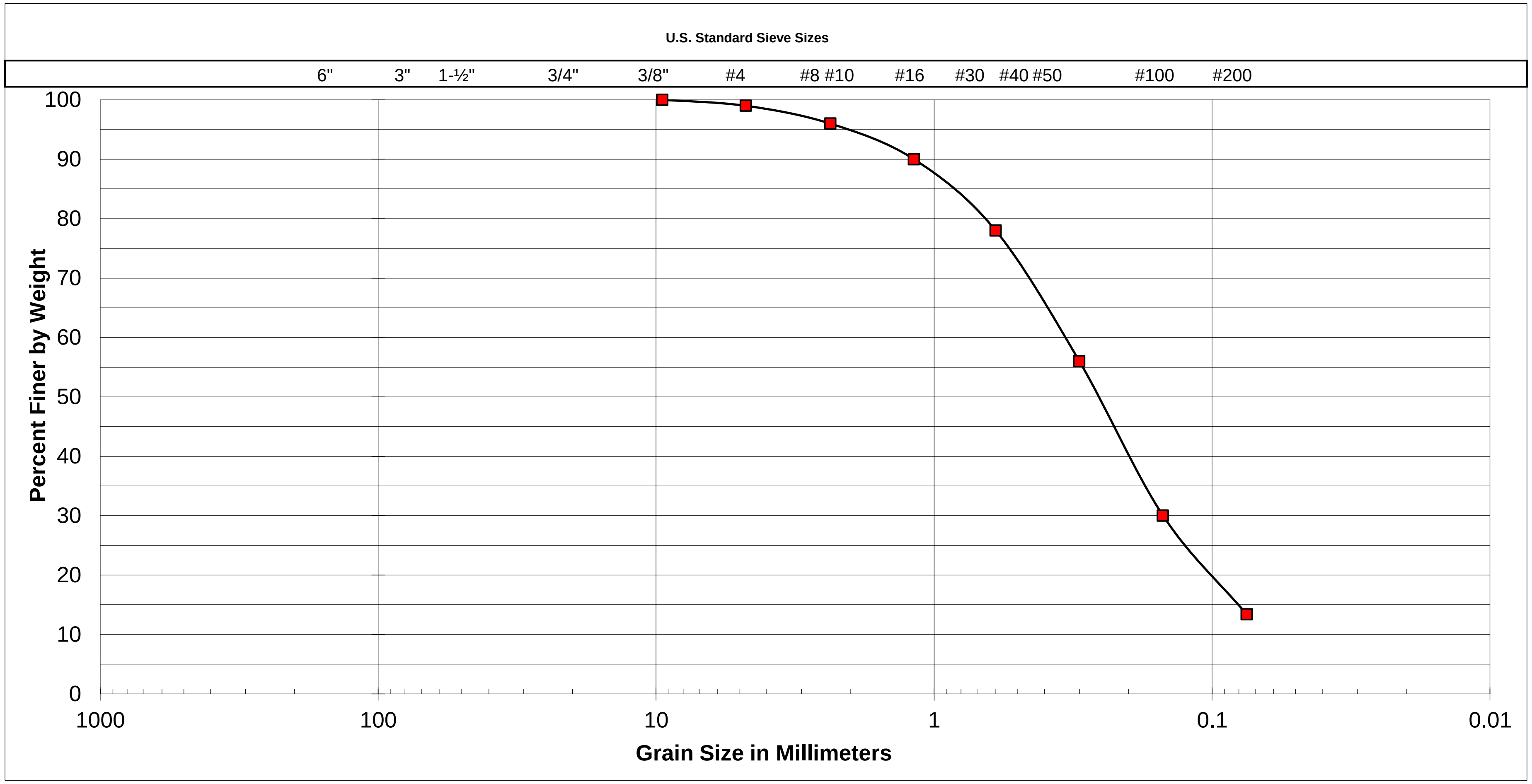
San Diego River Trail
Carlton Oaks Golf Course Segment

By:	PE/VAU	Date:	October, 2016
Job Number:	160413P3-1	Figure:	II-3



Cobbles	Gravel		Sand			Silt or Clay
	Coarse	Fine	Coarse	Medium	Fine	

SAMPLE LOCATION
S-2

UNIFIED SOIL CLASSIFICATION:	SM
DESCRIPTION	SILTY SAND

ATTERBERG LIMITS	
LIQUID LIMIT	-
PLASTIC LIMIT	-
PLASTICITY INDEX	-

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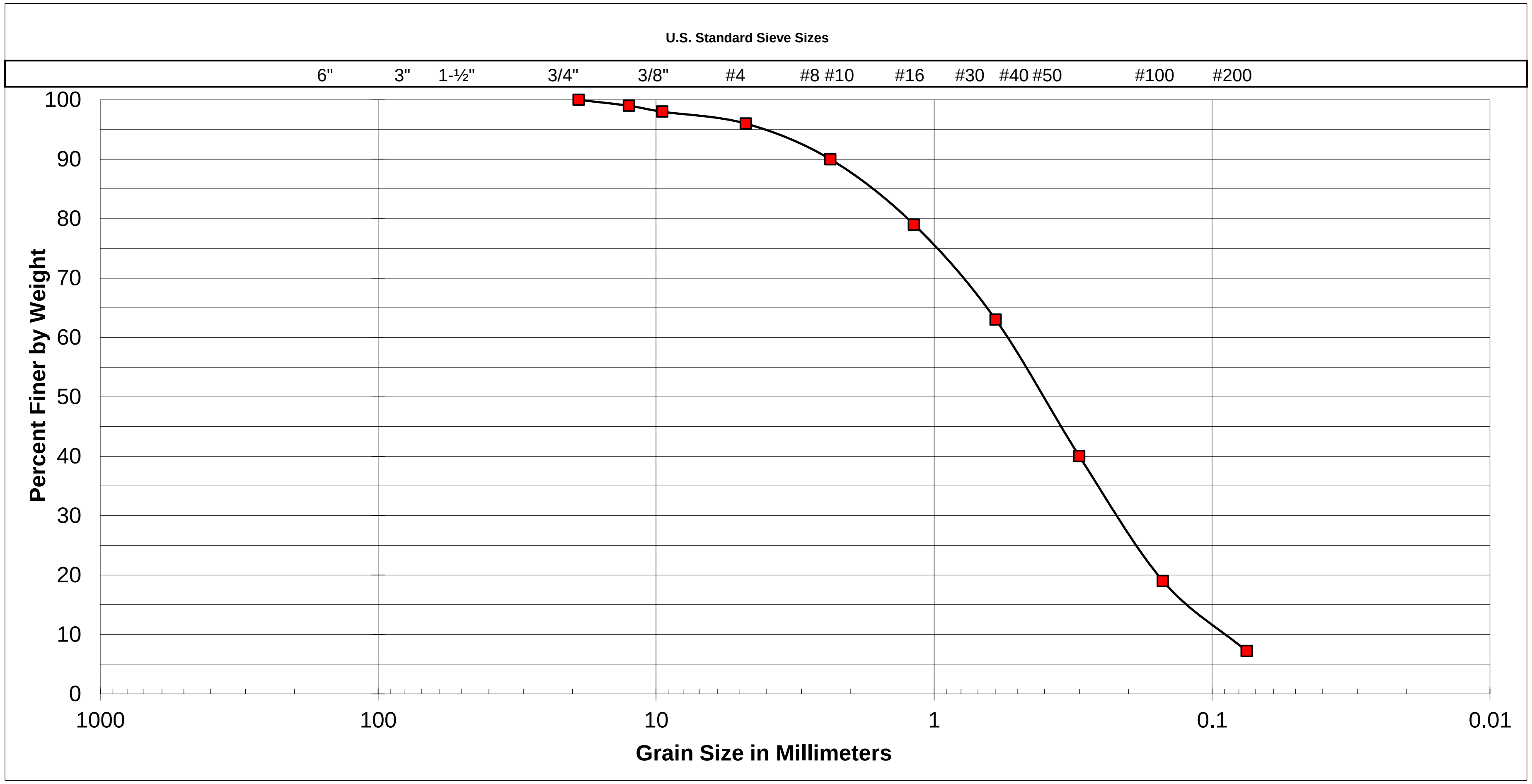
San Diego River Trail
Carlton Oaks Golf Course Segment

By:	PE/VAU	Date:	October, 2016
Job Number:	160413P3-1	Figure:	II-4



Cobbles	Gravel		Sand			Silt or Clay
	Coarse	Fine	Coarse	Medium	Fine	

SAMPLE LOCATION
S-3

UNIFIED SOIL CLASSIFICATION:	SP-SM
DESCRIPTION	POORLY GRADED SAND with SILT

ATTERBERG LIMITS	
LIQUID LIMIT	-
PLASTIC LIMIT	-
PLASTICITY INDEX	-

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San Diego River Trail
Carlton Oaks Golf Course Segment

By:	PE/VAU	Date:	October, 2016
Job Number:	160413P3-1	Figure:	II-5

MAXIMUM DENSITY AND OPTIMUM MOISTURE CONTENT

ASTM D1557

SAMPLE	DESCRIPTION	MAXIMUM DRY DENSITY (lbs/ft^3)	OPTIMUM MOISTURE (%)
TP-3 at 0 to 5 feet	SILTY SAND	123.7	9.6

EXPANSION INDEX

ASTM D2489

SAMPLE	DESCRIPTION	EXPANSION INDEX
TP-4 at 0 to 5 feet	SILTY SAND	1

CLASSIFICATION OF EXPANSIVE SOIL [1]

EXPANSION INDEX	POTENTIAL EXPANSION
0 - 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 (%)
TP-2 at 0 to 4 feet	797	7.2	0.048	0.054

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 4.2.1

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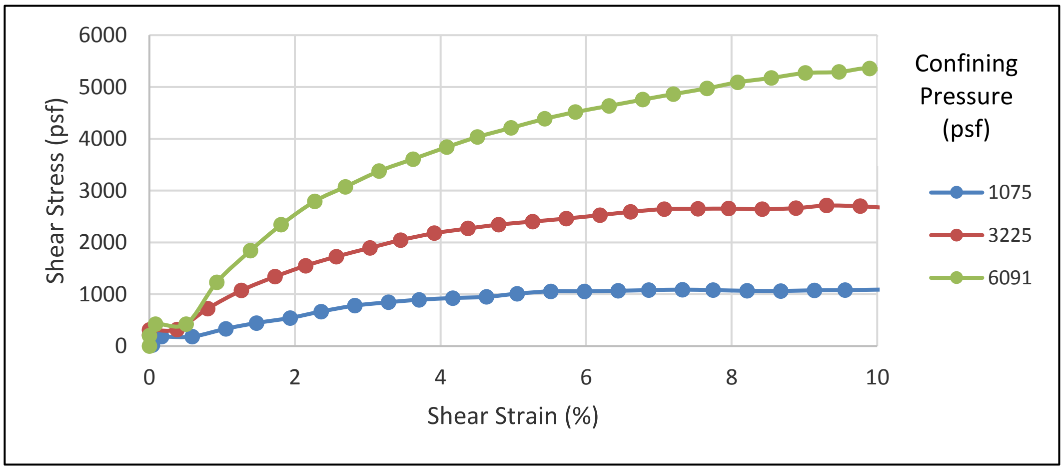
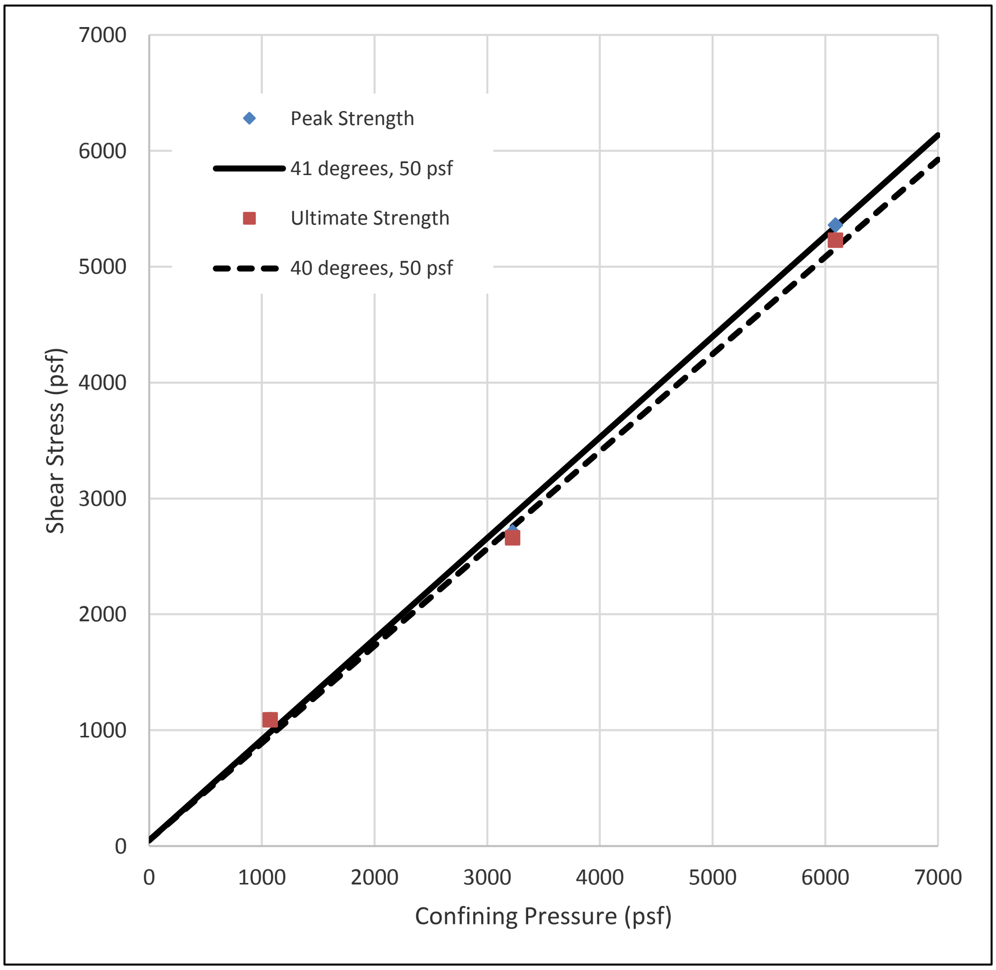
San Diego River Trail
Carlton Oaks Golf Course Segment

By:	VAU	Date:	October, 2016
Job Number:	160413P3-1	Figure:	II-6





SAMPLE ID: TP-3 at 0 to 5 feet

SILTY SAND, moderate brown

NOTES: Remolded to 90% Relative Compaction
Strain Rate: 0.003 in/min
Sample was consolidated and drained

	Peak	Ultimate
Φ	41 °	40 °
c	50 psf	50 psf

	Initial	Final
γ_d	111.4 pcf	111.4 pcf
w_c	9.9 %	17.6 %
Saturation	53 %	94 %

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San Diego River Trail
Carlton Oaks Golf Course Segment

By:	TBC	Date:	October, 2016
Job Number:	160413P3-1	Figure:	II-7