APPENDIX E

Geotechnical Investigation Report

Prepared by

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December 7, 2018

GEOTECHNICAL INVESTIGATION
PROPOSED DESERT WAVE RESORT
SURF LAGOON
RESORT HOTELS & RELATED AMENITIES
DESERT WILLOW COMPLEX
PALM DESERT, CALIFORNIA

DRAFT

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December 7, 2018

Project No. 544-18228
18-12-602

Desert Wave Ventures, LLC
P.O. Box 147
Solana Beach, California 92075

Subject: Geotechnical Investigation

Project: Proposed Desert Wave Resort
Desert Willow Complex
Palm Desert, California

Sladden Engineering is pleased to present the results of the geotechnical investigation performed for the proposed Desert Wave Resort to be constructed south of the Desert Willow Golf Resort clubhouse in the City of Palm Desert, California. Our services were completed in accordance with our proposal for geotechnical engineering services dated June 21, 2018 and your authorization to proceed with the work. The purpose of our investigation was to explore the subsurface conditions at the site in order to provide recommendations for design and site preparation. Evaluation of environmental issues and hazardous wastes was not included within the scope of services provided.

The opinions, recommendations and design criteria presented in this report are based on our field exploration program, laboratory testing and engineering analyses. Based on the results of our investigation, it is our professional opinion that the proposed project should be feasible from a geotechnical perspective provided the recommendations presented in this report are implemented into design and carried out through construction.

We appreciate the opportunity to provide service to you on this project. If you have any questions regarding this report, please contact the undersigned.

Respectfully submitted,
SLADDEN ENGINEERING

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GEOTECHNICAL INVESTIGATION
PROPOSED DESERT WAVE RESORT
NORTH OF COUNTRY CLUB DRIVE
DESERT WILLOW COMPLEX
PALM DESERT, CALIFORNIA

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INTRODUCTION

This report presents the results of the geotechnical investigation performed by Sladden Engineering (Sladden) for the proposed Desert Wave Resort complex to be constructed on the north side of Country Club Drive just south of the Desert Willow Resort clubhouse in the City of Palm Desert, California. The site is located at approximately 33.7640 degrees north latitude and 116.3673 degrees west longitude. The approximate location of the site is indicated on the Site Location Map (Figure 1).

Our investigation was conducted in order to evaluate the engineering properties of the subsurface materials, to evaluate their *in-situ* characteristics, and to provide engineering recommendations and design criteria for site preparation, foundation design and the design of various site improvements. This study also includes a review of published and unpublished geotechnical and geological literature regarding seismicity at and near the subject site.

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PROJECT DESCRIPTION

Based on the preliminary Site Plan (delawie, 2018), it is our understanding that the proposed project will consist of constructing a two-directional surf lagoon, surrounding viewing decks, cabanas and various amenities, a two-story surf center with subterranean parking, 2 three-story hotel buildings with subterranean parking, a two-story spa building and numerous guest villas on the site. The preliminary plans indicate that the proposed project will also include paved driveways/access roadways, parking lots, concrete flatwork, underground utilities and various associated site improvements.

Based upon the preliminary project plans, we expect that the proposed surf lagoon and wave generators will be enclosed within cast in place reinforced concrete walls supported upon conventional shallow spread footings and/or structural mat slabs. We expect that the proposed resort hotels and surf center will consist of two (2) to three (3)-story wood-frame structures overlying subterranean parking levels of cast in place reinforced concrete construction supported on conventional shallow spread foundations and concrete slabs on grade. We expect that the two-story spa building and the remainder of the guest villas and amenity structures will be of lightweight wood-frame construction supported upon conventional shallow spread footings and concrete slabs on grade.

Specific foundation loading information was not available at the time of the preparation of this report. Based on our experience with multi-story reinforced concrete and wood-frame structures, we expect that isolated column loads will be up to 300 kips and continuous wall loads will be up to 8.0 kips per linear foot for the proposed resort hotel buildings. Based on our experience with relatively lightweight structures, we expect that isolated column loads will be less than 30 kips and continuous wall loads will be less than 3.0 kips per linear foot for the surf center, spa building, various guest villas and amenity buildings. If these assumed loads vary significantly from the actual loads, we should be consulted to verify the applicability of the recommendations provided.

We expect that the surf lagoon and wave generator structures will be of cast in place reinforced concrete construction and will include subterranean walls and up to 15 feet in height. The applied loads associated with the wave generating equipment are not known at this time.

Sladden anticipates that grading within the resort hotel, surf center and surf lagoon will include excavations up to 15 feet in depth to accommodate the subterranean parking levels, lagoon enclosure walls and wave generating equipment. We expect that the grading within the remainder of the site will be limited to minor cuts and fills to accomplish the desired surface grades and provide adequate gradients for site drainage. This does not include the removal and re-compaction of the primary foundation bearing soil within the building and foundation areas. Upon completion of precise grading plans, Sladden should be retained in order to ensure that the recommendations presented within in this report are incorporated into the design of the proposed project.

SCOPE OF SERVICES

The purpose of our investigation was to determine specific engineering characteristics of the surface and near surface soil in order to develop foundation design criteria and recommendations for site preparation. Exploration of the site was achieved by drilling fourteen (14) exploratory boreholes and eleven (11) test pits to depths between approximately 10 and 71 feet below the existing ground surface (bgs). Specifically, our site characterization consisted of the following tasks:

- Site reconnaissance to assess the existing surface conditions on and adjacent to the site.
- Advancing fourteen (14) exploratory boreholes and eleven (11) test pits to depths between approximately 10 and 71 feet bgs in order to characterize the subsurface soil conditions. Representative samples of the soil were classified in the field and retained for laboratory testing and engineering analyses.
- Performing laboratory testing on selected samples to evaluate pertinent engineering characteristics.
- Reviewing geologic literature and discussing geologic hazards.
- Performing engineering analyses to develop recommendations for foundation design and site preparation.
- The preparation of this report summarizing our work at the site.

SITE CONDITIONS

The subject property is located north Country Club Drive just south of the Desert Willow Golf Resort clubhouse complex in the City of Palm Desert, California. The property is formally identified by the County of Riverside as APN: 620-420-023 and occupies approximately 14.65 acres.

The parcel identified as APN: 620-420-023 consists of undeveloped desert land. The ground surface is relatively level with a gentle descending slope to the south. The property is surrounded by golf course fairways to the south east and west and by a paved parking lot and the Desert Willow clubhouse complex to the north. Scattered desert brush and weeds exist throughout the property. Abandoned irrigation systems remain on the ground surface throughout the site.

No natural ponding of water or surface seeps were observed at or near the site during our investigation conducted on November 7, 2018 and November 19, 2018. Site drainage appears to be controlled via sheet flow and surface infiltration. Regional drainage is provided by the Whitewater River that is located approximately 1.8 miles south of the project site.

GEOLOGIC SETTING

The project site is located within the Colorado Desert Physiographic Province (also referred to as the Salton Trough) that is characterized as a northwest-southeast trending structural depression extending from the Gulf of California to the Banning Pass. The Salton Trough is dominated by several northwest trending faults, most notably the San Andreas Fault system. The Salton Trough is bounded by the Santa Rosa – San Jacinto Mountains on the southwest, the San Bernardino Mountains on the north, the Little San Bernardino - Chocolate – Orocopia Mountains on the east and extends through the Imperial Valley into the Gulf of California on the south.

A relatively thick sequence (20,000 feet) of sediment has been deposited in the Coachella Valley portion of the Salton Trough from Miocene to present times. These sediments are predominately terrestrial in nature with some lacustrian (lake) and minor marine deposits. The major contributor of these sediments has been the Colorado River. The mountains surrounding the Coachella Valley are composed primarily of Precambrian metamorphic and Mesozoic "granitic" rock.

The Salton Trough is an internally draining area with no readily available outlet to Gulf of California and with portions well below sea level (-253' msl). The region is intermittently blocked from the Gulf of California by the damming effects of the Colorado River delta (current elevation +30'msl). Between about 300AD and 1600 AD (to 1700) the Salton Trough has been inundated by the River's water, forming ancient Lake Cahuilla (max. elevation +58' msl). Since that time the floor of the Trough has been repeatedly flooded with other "fresh" water lakes (1849, 1861, and 1891), the most recent and historically long lived being the current Salton Sea (1905). The sole outlet for these waters is evaporation, leaving behind vast amounts of terrestrial sediment materials and evaporite minerals.

The site has been mapped by Rogers (1965) to be immediately underlain by Quaternary-age dune sand (Qs). The regional geologic setting for the site vicinity is presented on the Regional Geologic Map (Figure 2).

SUBSURFACE CONDITIONS

The subsurface conditions at the site were investigated by drilling fourteen (14) exploratory boreholes and eleven (11) test pits to depths between approximately 10 and 71 feet bgs. The approximate locations of the boreholes and test pits are illustrated on the Borehole/Test Pit Location Plan (Figure 3). The boreholes were advanced using a truck-mounted Mobile B-61 drill-rig equipped with 8-inch outside diameter (O.D.) hollow stem augers and the test pits were excavated with a track mounted mini-excavator. A representative of Sladden was on-site to log the materials encountered and retrieve samples for laboratory testing and engineering analysis.

During our field investigation a thin mantel of fill/disturbed soil was encountered to a maximum depth of approximately two (2) to three (3) feet bgs. The artificial fill/ disturbed soil appeared to mantel the entire site. The soil throughout the depth of our bores consisted primarily of fine grained sand of alluvial and eolian deposition. The sandy soil was very uniform in composition and appearance throughout the depth of our bores. The soil throughout the site appeared relatively firm to dense. In general density increased with depth. The artificial fill and native sandy soil was found to be generally dry throughout, fine-grained and grayish brown in in-situ color.

The final logs represent our interpretation of the contents of the field logs, and the results of the laboratory observations and tests of the field samples. The final logs are included in Appendix A of this report. The stratification lines represent the approximate boundaries between soil types although the transitions may be gradual and variable across the site.

Groundwater was not encountered to a maximum explored depth of 71 feet bgs during our field investigation. Based upon available groundwater maps, the depth to groundwater is in excess of 200 feet in the vicinity of the site. It is our opinion that groundwater should not be a factor in design or during the construction of the proposed project.

SEISMICITY AND FAULTING

The southwestern United States is a tectonically active and structurally complex region, dominated by northwest trending dextral faults. The faults of the region are often part of complex fault systems, composed of numerous subparallel faults which splay or step from main fault traces. Strong seismic shaking could be produced by any of these faults during the design life of the proposed project.

We consider the most significant geologic hazard to the project to be the potential for moderate to strong seismic shaking that is likely to occur during the design life of the project. The proposed project is located in the highly seismic Southern California region within the influence of several fault systems that are considered to be active or potentially active. An active fault is defined by the State of California as a "sufficiently active and well defined fault" that has exhibited surface displacement within the Holocene epoch (about the last 11,000 years). A potentially active fault is defined by the State as a fault with a history of movement within Pleistocene time (between 11,000 and 1.6 million years ago).

As previously stated, the site has been subjected to strong seismic shaking related to active faults that traverse through the region. Some of the more significant seismic events near the subject site within recent times include: M6.0 North Palm Springs (1986), M6.1 Joshua Tree (1992), M7.3 Landers (1992), M6.2 Big Bear (1992) and M7.1 Hector Mine (1999).

Table 1 lists the closest known potentially active faults that was generated in part using the EQFAULT computer program (Blake, 2000), as modified using the fault parameters from The Revised 2002 California Probabilistic Seismic Hazard Maps (Cao et al, 2003). This table does not identify the probability of reactivation or the on-site effects from earthquakes occurring on any of the other faults in the region.

TABLE 1
CLOSEST KNOWN ACTIVE FAULTS

Fault Name	Distance (Km)	Maximum Event
San Andreas - Coachella	8.7	7.2*
San Andreas - Southern	8.7	7.2*
Burnt Mountain	20.2	6.5
San Andreas - San Bernardino	20.5	7.5*
Eureka Peak	22.8	6.4
San Jacinto - Anza	34.5	7.2
San Jacinto - Coyote Creek	36.5	6.8
Pinto Mountain	39.3	7.2

*8.2 for multiple segment rupture.

2016 CBC SEISMIC DESIGN PARAMETERS

Sladden has reviewed the 2016 California Building Code (CBC) and summarized the current seismic design parameters for the proposed structures. The seismic design category for a structure may be determined in accordance with Section 1613 of the 2016 CBC or ASCE7. According to the 2016 CBC, Site Class D may be used to estimate design seismic loading for the proposed structures. The 2016 CBC Seismic Design Parameters are summarized below. The project Design Map Reports (USGS, 2018a) are included within Appendix C.

Risk Category (Table 1.5-1): I/II/III
Site Class (Table 1613.3.2): D
S_s (Figure 1613.3.1): 1.672g
S_1 (Figure 1613.3.1): 0.793g
F_a (Table 1613.3.3(1)): 1.0
F_v (Table 1613.5.3(2)): 1.5
S_{ms} (Equation 16-37 {F_a X S_s}): 1.672g
S_{m1} (Equation 16-38 {F_v X S_1}): 1.190g
S_{DS} (Equation 16-39 {2/3 X S_{ms}}): 1.115g
S_{D1} (Equation 16-40 {2/3 X S_{m1}}): 0.793g
Seismic Design Category: E

GEOLOGIC HAZARDS

The subject site is located in an active seismic zone and will likely experience strong seismic shaking during the design life of the proposed project. In general, the intensity of ground shaking will depend on several factors including: the distance to the earthquake focus, the earthquake magnitude, the response characteristics of the underlying materials, and the quality and type of construction. Geologic hazards and their relationship to the site are discussed below.

I. Surface Rupture. Surface rupture is expected to occur along preexisting, known active fault traces. However, surface rupture could potentially splay or step from known active faults or rupture along unidentified traces. Based on our review of Rogers (1965), Jennings (1994), and CDMG (1974), known faults are not mapped on or projecting towards the site (Figure 4). In addition, no signs of active surface faulting were observed during our review of non-stereo digitized photographs of the site and site vicinity (Google, 2018). Finally, no signs of active surface fault rupture or secondary seismic effects (lateral spreading, lurching etc.) were identified on-site during our field investigation. Therefore, it is our opinion that risks associated with primary surface ground rupture should be considered "low".

II. Ground Shaking. The site has been subjected to past ground shaking by faults that traverse through the region. Strong seismic shaking from nearby active faults is expected to produce strong seismic shaking during the design life of the proposed project. A probabilistic approach was employed to the estimate the peak ground acceleration (a_{max}) that could be experienced at the site. Based on the USGS Unified Hazard Tool (USGS, 2018b) shear wave velocity (Vs30) of 259 m/s, the site could be subjected to ground motions on the order of 0.598g. The peak ground acceleration at the site is judged to have a 475-year return period and a 10 percent chance of exceedence in 50 years.

III. Liquefaction. The project site is situated within a County of Riverside designated "moderate" liquefaction potential zone (RCPR, 2018). Liquefaction is the process in which loose, saturated granular soil loses strength as a result of cyclic loading. The strength loss is a result of a decrease in granular sand volume and a positive increase in pore pressures. Generally, liquefaction can occur if each of the following conditions apply: liquefaction-susceptible soil, groundwater within a depth of 50 feet or less, and strong seismic shaking. Based on our review of groundwater maps of the site vicinity (>50 feet bgs; Tyley, 1975), and our experience in the project vicinity, risks associated with liquefaction and liquefaction related hazards should be considered negligible.

IV. Tsunamis and Seiches. Because the site is situated at an inland location and is not immediately adjacent to any impounded bodies of water, risks associated with tsunamis and seiches are considered negligible.

V. Slope Failure, Landsliding, Rock Falls. The site is situated on relatively flat ground and not immediately adjacent to any slopes or hillsides. As such, risks associated with slope instability should be considered negligible.

VI. Expansive Soil. Generally, the site soil consists of silty sand (SM). Based on the results of our laboratory testing (EI=0), the materials underlying the site are considered to have a "very low" expansion potential. However, the expansion potential of the surface soil should be reevaluated after remedial grading.

VII. Static Settlement. Static settlement resulting from the anticipated foundation loads should be minimal provided that the recommendations included in this report are considered in foundation design and construction. The estimated ultimate static settlement is calculated to be approximately 1 inch when considering the recommended bearing pressures. As a practical matter, differential static settlement between footings can be assumed as one-half of the total settlement.

VIII. Subsidence. Land subsidence can occur in valleys where aquifer systems have been subjected to extensive groundwater pumping, such that groundwater pumping exceeds groundwater recharge. Generally, pore water reduction can result in a rearrangement of skeletal grains and could result in elastic (recoverable) or inelastic (unrecoverable) deformation of an aquifer system.

Although recent investigations have documented significant subsidence within the Coachella Valley (USGS, 2007), no fissures or other surficial evidence of subsidence were observed at the subject site. With the exception of isolated tension zones typically manifested on the ground surface as fissures and/or ground cracks, subsidence related to groundwater depletion is generally areal in nature with limited differential settlement over short distances such as across individual buildings. There was no evidence of fissures or ground cracks at the project site.

The Coachella Valley Water District has publically acknowledged regional subsidence throughout the southern portion of the Coachella Valley and has indicated a commitment to groundwater replenishment programs that are intended to limit future subsidence. At this time, subsidence is considered a regional problem requiring regional mitigation not specific to the project vicinity.

IX. Debris Flows. Debris flows are viscous flows consisting of poorly sorted mixtures of sediment and water and are generally initiated on slopes steeper than approximately six horizontal to one vertical (6H:1V). Based on the flat nature of the site and the composition of the surface soil, we judge that risks associated with debris flows should be considered remote.

X. Flooding and Erosion. No signs of flooding or erosion were observed during our field investigation. However, risks associated with flooding and erosion should be evaluated and mitigated by the project design Civil Engineer.

CONCLUSIONS

Based on the results of our investigation, it is our professional opinion that the project should be feasible from a geotechnical perspective provided that the recommendations provided in this report are incorporated into design and carried out through construction. The main geotechnical concerns are the presence of artificial fill/disturbed soil and potentially loose near surface native soil.

The near surface soil appeared loose and dry. We recommend that remedial grading within the proposed new building and foundation areas include over-excavation and re-compaction of the artificial fill soil, the primary foundation bearing soil and any loose native soil encountered during grading. Specific recommendations for site preparation are presented in the Earthwork and Grading section of this report.

Caving did occur to varying degrees within each of our exploratory bores and the surface soil may be susceptible to caving within deeper excavations. All excavations should be constructed in accordance with the normal CalOSHA excavation criteria. On the basis of our observations of the materials encountered, we anticipate that the subsoil will conform to that described by CalOSHA as Type C. Soil conditions should be verified in the field by a "Competent person" employed by the Contractor.

The following recommendations present more detailed design criteria that have been developed on the basis of our field and laboratory investigation.

EARTHWORK AND GRADING

All earthwork including excavation, backfill and preparation of the subgrade soil should be performed in accordance with the geotechnical recommendations presented in this report and applicable portions of the local grading ordinance. All earthwork should be performed under the observation and testing of a qualified geotechnical engineer. The following geotechnical engineering recommendations for the proposed project are based on our supplemental the field investigation program, laboratory testing and geotechnical engineering analyses.

a. Site Clearing. Areas to be graded should be cleared of any vegetation, associated root systems, and debris. All areas scheduled to receive fill should be cleared of old fill and any irreducible matter. The unsuitable materials should be removed off site. Voids left by obstructions should be properly backfilled in accordance with the compaction recommendations of this report.

b. Preparation of the At Grade Structure Areas: For the various at-grade structures including the spa building, cabanas and other amenity buildings, all undocumented artificial fill and low density native surface soil should be removed and re-compacted. In order to provide for firm and uniform foundation bearing conditions, the primary foundation bearing soil should be over-excavated and re-compacted. Over-excavation should extend to a minimum depth of 3 feet below existing grade or 3 feet below the bottom of the footings, whichever is deeper. Once adequate removals have been verified, the exposed native soil should be moisture conditioned to within two percent of optimum moisture content and compacted to at least 90 percent relative compaction. The previously removed material may then be placed as compacted engineered fill as outlined below. Removals should extend at least 5 feet laterally beyond the footing limits.

c. Preparation of the Below-Grade Structure Areas: For structures founded deeper than 5 feet below existing natural grade including the resort hotel buildings, surf center and surf lagoon, the primary foundation bearing soil should be over-excavated and re-compacted. Over-excavation should extend to a minimum depth of 3 foot below the bottom of the footings or structural mat slabs. Once adequate removals have been verified, the exposed native soil should be moisture conditioned to within two percent of optimum moisture content and compacted to at least 90 percent relative compaction. The previously removed material may then be placed as compacted engineered fill as outlined below. Removals should extend at least 2 feet laterally beyond the footing limits.

c. Fill Placement and Compaction: Soil to be used as engineered fill should be free of organic material, debris, and other deleterious substances, and should not contain irreducible matter greater than three inches in maximum dimension. All fill materials should be placed in thin lifts, not exceeding six inches in a loose condition. If import fill is required, the material should be of a low to non-expansive nature and should meet the following criteria:

Plastic Index	Less than 12
Liquid Limit	Less than 35
Percent Soil Passing #200 Sieve	Between 15% and 35%
Maximum Aggregate Size	3 inches

The subgrade and all fill soil should be compacted with acceptable compaction equipment, to at least 90 percent relative compaction. The bottom of the excavations should be observed by a representative of Sladden Engineering prior to fill placement. Compaction testing should be performed on all lifts in order to verify proper placement of the fill materials. Table 2 provides a summary of the excavation and compaction recommendations.

d. Shrinkage and Subsidence. Volumetric shrinkage of the material that is excavated and replaced as controlled compacted fill should be anticipated. We estimate that this shrinkage should be between 10 and 15 percent. Subsidence of the surfaces that are scarified and compacted should be less than 1 tenth of a foot. This will vary depending upon the type of equipment used, the moisture content of the soil at the time of grading and the actual degree of compaction attained.

TEMPORARY EXCAVATIONS

The preliminary plans indicate that the subject project involves the installation of numerous subsurface structures. It is our understanding that temporary excavations up to 20 feet in depth may be required to accomplish the proposed construction. The near surface soil encountered during the subsurface exploration performed throughout the site consists primarily of fine grained wind-blown sand (SP). The site soil should be classified as "C" type soil per CAL-OSHA Trenching Guidelines Section 1541.1 Appendix A.

Excavations to depths of 20 feet should have slope cuts no steeper than one horizontal to one vertical (1 to 1).

It should be noted that the allowable slope configurations provided are adequate for temporary excavations only. Excavations should not be left open for extended periods of time. We recommend a maximum exposure period of approximately 6 months.

The allowable slope configurations provided are based on the expected presence of engineered fill soil or competent native soil throughout the site. The soil exposed within the excavations may vary. If changes in the soil conditions or caving sands are encountered during excavation, a representative of Sladden Engineering should be consulted immediately. Additional observations and follow-up testing should be performed during excavation to confirm the adequacy of the given slope configurations. Particular care should be taken in the vicinity of previous trenches and other areas of potential inconsistencies and in areas where significant vibrations may occur.

Construction site safety is the sole responsibility of the Contractor, who shall also be solely responsible for the means, methods, and sequencing of the construction operations. We are providing this information solely as a service to our client. Under no circumstances should this information be interpreted to mean that Sladden Engineering is assuming responsibility for construction site safety or the Contractor's activities; such responsibility is not being implied and should not be inferred.

CONVENTIONAL SHALLOW SPREAD FOOTINGS

Conventional spread footings are expected to provide adequate support for the proposed resort buildings and surf lagoon enclosure walls. All footings should be founded upon properly compacted engineered fill soil and should have a minimum embedment depth of 18 inches measured from the lowest adjacent finished grade. Continuous and isolated footings should have minimum widths of 12 inches and 24 inches, respectively. Continuous and isolated footings supported upon properly compacted soil may be designed using allowable (net) bearing pressures of 1800 and 2000 pounds per square foot (psf), respectively. Allowable increases of 250 psf for each additional 1 foot in width and 250 psf for each additional 6 inches in depth may be utilized, if desired. The maximum allowable bearing pressure should be 4,000 psf. The maximum bearing pressure applies to combined dead and sustained live loads.

The allowable bearing pressures may be increased by one-third when considering transient live loads, including seismic and wind forces. All footings should be reinforced in accordance with the project Structural Engineer's recommendations.

Based on the recommended allowable bearing pressures, the total static settlement of the shallow footings is anticipated to be less than one-inch, provided foundation preparations conform to the recommendations described in this report. Static differential settlement is anticipated to be approximately one-half of the total settlement for similarly loaded footings spaced up to approximately 50 feet apart.

Lateral load resistance for the spread footings will be developed by passive pressure against the sides of the footings below grade and by friction acting at the base of the footings. An allowable passive pressure of 275 psf per foot of depth may be used for design purposes. An allowable coefficient of friction 0.45 may be used for dead and sustained live loads to compute the frictional resistance of the footing placed directly on compacted fill soil. Under seismic and wind loading conditions, the passive pressure and frictional resistance may be increased by one-third.

All footing excavations should be observed by a representative of the project geotechnical consultant to verify adequate embedment depths prior to placement of forms, steel reinforcement or concrete. The excavations should be trimmed neat, level and square. All loose, disturbed, sloughed or moisture-softened soil and/or any construction debris should be removed prior to concrete placement. Excavated soil generated from footing and/or utility trenches should not be stockpiled within the building envelope or in areas of exterior concrete flatwork.

SLABS-ON-GRADE

In order to provide uniform support, concrete slabs-on-grade must be placed on properly compacted engineered fill as outlined in the previous sections of this report. The slab subgrade should remain near optimum moisture content and should not be permitted to dry prior to concrete placement. Slab subgrades should be firm and unyielding. Disturbed soil should be removed and replaced with engineered fill soil compacted to a minimum of 90 percent relative compaction.

Slab thickness and reinforcement should be determined by the structural engineer. We recommend a minimum slab thickness of 4.0 inches and a minimum reinforcement consisting of #3 bars at 18 inches on center in each direction. All slab reinforcement should be supported on concrete chairs to ensure that reinforcement is placed at slab mid-height.

Slabs with moisture sensitive surfaces should be underlain with a moisture vapor retarder consisting of a polyvinyl chloride membrane such as 10-mil visqueen, or equivalent. All laps within the membrane should be sealed and at least 2 inches of clean sand should be placed over the membrane to promote uniform curing of the concrete. To reduce the potential for punctures, the membrane should be placed on a pad surface that has been graded smooth without any sharp protrusions. If a smooth surface can not be achieved by grading, consideration should be given to placing a 1-inch thick leveling course of sand across the pad surface prior to placement of the membrane.

STRUCTURAL MAT SLABS

The use of a structural mat slabs may be considered for the below grade structures associated with the wave generating equipment. An allowable soil bearing pressure of 3,000 psf (net) may be utilized for the design of mat slabs at elevations of approximately 10 feet below grade or deeper. The allowable bearing pressure may be increased by one-third when considering transient live loads, including seismic forces. A subgrade modulus of approximately 200 psi/inch should be representative of the subgrade soil at the anticipated subterranean structure depths (10 feet or deeper).

RETAINING WALLS

Retaining walls will be required for the subterranean parking levels and the surf lagoon enclosure. Cantilever retaining walls may be designed using "active" pressures. Active pressures may be estimated using an equivalent fluid weight of 35 pcf for level or gently sloping (less than 3H:1V) native backfill soil acting in a triangular pressure distribution with free-draining backfill conditions. For steeper slopes (ip to 2H:1V), the active equivalent fluid pressure should be increased to 55 pcf EFP. "At Rest" pressures should be utilized for restrained walls. At rest pressures may be estimated using an equivalent fluid weight of 60 pcf for native backfill soil with level free-draining backfill conditions.

According to the 2016 CBC, seismic loads should be considered in the design of earth retaining walls that will be relied upon for structural support. Retaining walls may be designed utilizing the Monobe-Okabe (M-O) method. The following design criteria may be used for earth retaining walls up to 15 feet in height. Seismic pressures may be estimated using uniform load of 20H psf (where H is in feet).

We recommend that a back drain be provided behind all retaining walls or that the walls be designed for full hydrostatic pressures. The back drains should consist of a heavy walled perforated pipe sloped to drain to outlets by gravity, and of clean, free-draining, three-quarter to one and one-half inch crushed rock or gravel. The crushed rock or gravel should extend to within one foot of the surface. A Mirafi 140N filter cloth should be placed between the on-site native material and the drain rock.

We recommend that the ground surface behind retaining walls be sloped to drain. Under no circumstances should the surface water be diverted into back drains. Where migration of moisture through walls would be detrimental, the walls should be waterproofed.

PRELIMINARY PAVEMENT DESIGN

Asphalt concrete pavements should be designed in accordance with Topic 608 of the Caltrans Highway Design Manual based on R-Value and Traffic Index. An R-Value of 60 was assumed to develop the following preliminary pavement sections. On-site and any imported soil should be tested for R-Value after grading. The R-Value of subgrade soil should be consistent with the pavement design. For Pavement design, a Traffic Index (TI) of 6.5 was used for the on-site pavements. We assumed Asphalt Concrete (AC) over Class II Aggregate Base (AB). The preliminary flexible pavement design is as follows:

RECOMMENDED ASPHALT PAVEMENT SECTION LAYER THICKNESS	
Pavement Material	**Recommended Thickness**
	TI = 5.0
Asphalt Concrete Surface Course	3.0 inches
Class II Aggregate Base Course	4.0 inches
Compacted Subgrade Soil	12.0 inches

Asphalt concrete should conform to Sections 203 and 302 of the latest edition of the Standard Specifications for Public Works Construction ("Greenbook"). Class II aggregate base should conform to Section 26 of the Caltrans Standard Specifications, latest edition. The aggregate base course should be compacted to at least 95 percent of the maximum dry density as determined by ASTM Method D 1557.

We expect that concrete pavement may be used for some on-site pavement areas. A concrete pavement section of 6.0 inches of Portland Cement Concrete (PCC) on compact native soil should be adequate for the on-site concrete pavement subject to light vehicle traffic and occasional heavy truck traffic.

Properly spaced and constructed control joints including expansion joints and contraction joints should be incorporated into concrete pavement design to accommodate temperature and shrinkage related cracking. Joint spacing and joint patterns should be established based upon Portland Cement Association (PCA) and American Concrete Institute (ACI) guidelines.

CORROSION SERIES

The soluble sulfate concentrations of the surface soil were determined to be 180 parts per million (ppm). The soil is considered to have a "negligible" corrosion potential with respect to concrete. The use of Type V cement and special sulfate resistant concrete mixes should not be necessary. However, soluble sulfate content of the surface soil should be reevaluated after grading and appropriate concrete mix designs should be established based upon post-grading test results.

The pH levels of the surface soil was determined to be 8.8. Based on soluble chloride concentration testing (50 ppm) the soil is considered to have a "low" corrosion potential with respect to normal grade steel. The minimum resistivity of the surface soil was found to be 8,200 ohm-cm that suggests the site soil is considered to have a "low" corrosion potential with respect to ferrous metal installations. A corrosion expert should be consulted regarding appropriate corrosion protection measures for corrosion sensitive installations.

UTILITY TRENCH BACKFILL

All utility trench backfill should be compacted to a minimum relative compaction of 90 percent. Trench backfill materials should be placed in lifts no greater than six inches in their loose state, moisture conditioned (or air-dried) as necessary to achieve near optimum moisture conditions, and then mechanically compacted in place to a minimum relative compaction of 90 percent. A representative of the project soil engineer should test the backfill to verify adequate compaction.

EXTERIOR CONCRETE FLATWORK

To minimize cracking of concrete flatwork, the subgrade soil below concrete flatwork areas should first be compacted to a minimum relative compaction of 90 percent. A representative of the project geotechnical consultant should observe and verify the density and moisture content of the soil prior to concrete placement.

DRAINAGE

All final grades should be provided with positive gradients away from foundations to provide rapid removal of surface water runoff to an adequate discharge point. No water should be allowed to be pond on or immediately adjacent to foundation elements. In order to reduce water infiltration into the subgrade soil, surface water should be directed away from building foundations to an adequate discharge point. Subgrade drainage should be evaluated upon completion of the precise grading plans and in the field during grading.

LIMITATIONS

The findings and recommendations presented in this report are based upon an interpolation of the soil conditions between the exploratory bore locations and extrapolation of these conditions throughout the proposed building areas. Should conditions encountered during grading appear different than those indicated in this report, this office should be notified.

The use of this report by other parties or for other projects is not authorized. The recommendations of this report are contingent upon monitoring of the grading operation by a representative of Sladden Engineering. All recommendations are considered to be tentative pending our review of the grading operation and additional testing, if indicated. If others are employed to perform any soil testing, this office should be notified prior to such testing in order to coordinate any required site visits by our representative and to assure indemnification of Sladden Engineering.

We recommend that a pre-job conference be held on the site prior to the initiation of site grading. The purpose of this meeting will be to assure a complete understanding of the recommendations presented in this report as they apply to the actual grading performed.

ADDITIONAL SERVICES

Once completed, final project plans and specifications should be reviewed by use prior to construction to confirm that the full intent of the recommendations presented herein have been applied to design and construction. Following review of plans and specifications, observation should be performed by the Soil Engineer during construction to document that foundation elements are founded on/or penetrate into the recommended soil, and that suitable backfill soil is placed upon competent materials and properly compacted at the recommended moisture content.

Tests and observations should be performed during grading by the Soil Engineer or his representative in order to verify that the grading is being performed in accordance with the project specifications. Field density testing shall be performed in accordance with acceptable ASTM test methods. The minimum acceptable degree of compaction should be 90 percent for engineered fil soil and 95 percent for Class II aggregate base as obtained by the ASTM D1557 test method. Where testing indicates insufficient density, additional compactive effort shall be applied until retesting indicates satisfactory compaction.

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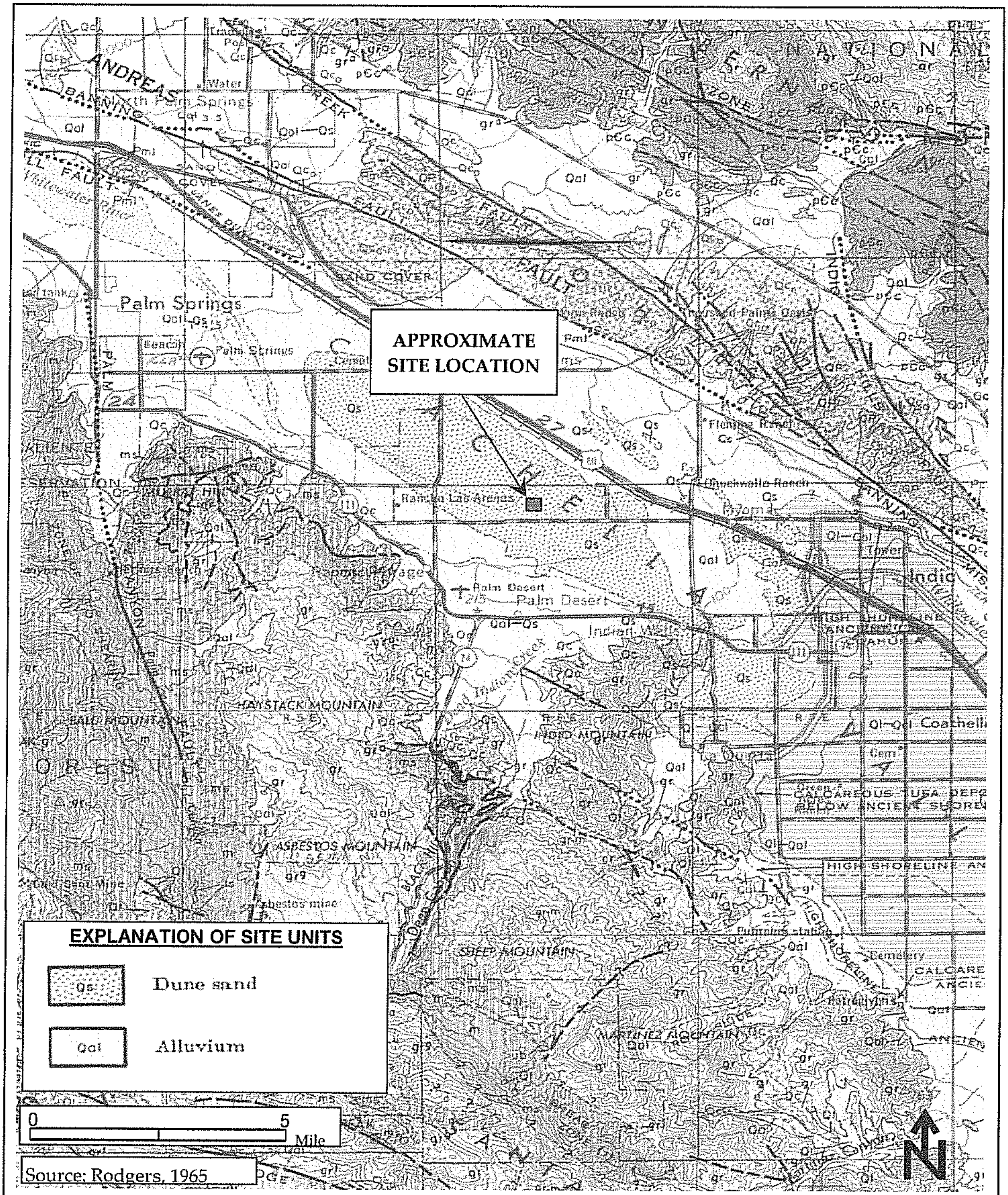
FIGURES

SITE LOCATION MAP
REGIONAL GEOLOGIC MAP
BOREHOLE/TEST PIT LOCATION PLAN

Sladden Engineering	SITE LOCATION MAP		FIGURE
	Project Number:	544-18228	1
	Report Number:	18-12-602	
	Date:	December 3, 2018	



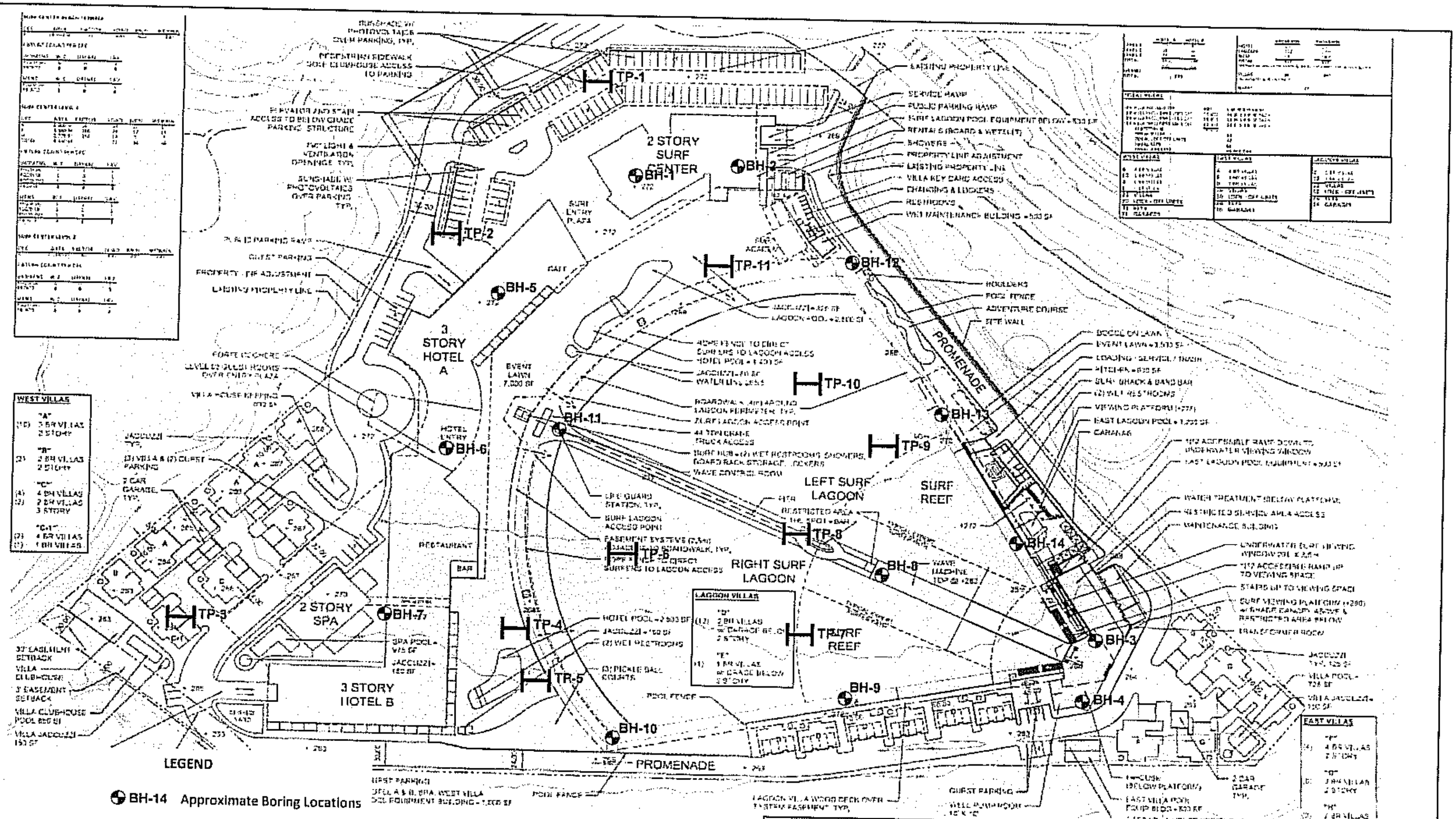
Sladden Engineering

REGIONAL GEOLOGIC MAP

Project Number:	544-18228
Report Number:	18-12-602
Date:	December 3, 2018

FIGURE

2



LEGEND

BH-14 Approximate Boring Locations

TP-11 Approximate Test Pit Locations

delawie, (2018)

Sladden Engineering

BOREHOLE/TEST PIT LOCATION PLAN		FIGURE
Project Number:	544-18228	3
Report Number:	18-12-602	
Date:	December 10, 2018	

APPENDIX A

FIELD EXPLORATION

APPENDIX A

FIELD EXPLORATION

For our field investigation fourteen (14) exploratory bores were excavated utilizing a truck mounted hollow stem auger rig (Mobile B-61) and hollow-stem augers. Additionally, eleven (11) test pits were excavated with a mini-excavator equipped with a 24-inch bucket attachment. Continuous logs of the materials encountered were made by a representative of Sladden Engineering. Materials encountered in the boreholes were classified in accordance with the Unified Soil Classification System that is presented in this appendix.

Representative undisturbed samples were obtained within our bores by driving a thin-walled steel penetration sampler (California split spoon sampler) or a Standard Penetration Test (SPT) sampler with a 140 pound automatic-trip hammer dropping approximately 30 inches (ASTM D1586). The number of blows required to drive the samplers 18 inches was recorded in 6-inch increments and blowcounts are indicated on the boring logs.

The California samplers are 3.0 inches in diameter, carrying brass sample rings having inner diameters of 2.5 inches. The standard penetration samplers are 2.0 inches in diameter with an inner diameter of 1.5 inches. Undisturbed samples were removed from the sampler and placed in moisture sealed containers in order to preserve the natural soil moisture content. Bulk samples were obtained from the excavation spoils and samples were then transported to our laboratory for further observations and testing.

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS				TYPICAL NAMES	
COARSE GRAINED SOILS	MORE THAN HALF IS LARGER THAN No.200 SIEVE	GRAVELS MORE THAN HALF COARSE FRACTION IS LARGER THAN No.4 SIEVE SIZE	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW	WELL GRADED GRAVEL-SAND MIXTURES
				GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES
			GRAVELS WITH OVER 12% FINES	GM	SILTY GRAVELS, POORLY-GRADED GRAVEL-SAND-SILT MIXTURES
				GC	CLAYEY GRAVELS, POORLY GRADED GRAVEL-SAND-CLAY MIXTURES
		SANDS MORE THAN HALF COARSE FRACTION IS SMALLER THAN No.4 SIEVE SIZE	CLEAN SANDS WITH LITTLE OR NO FINES	SW	WELL GRADED SANDS, GRAVELLY SANDS
				SP	POORLY GRADED SANDS, GRAVELLY SANDS
			SANDS WITH OVER 12% FINES	SM	SILTY SANDS, POORLY GRADED SAND-SILT MIXTURES
				SC	CLAYEY SANDS, POORLY GRADED SAND-CLAY MIXTURES
FINE GRAINED SOILS	MORE THAN HALF IS SMALLER THAN No.200 SIEVE	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS & VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS, OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, CLEAN CLAYS
				OL	ORGANIC CLAYS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
		SILTS AND CLAYS: LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACIOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS

EXPLANATION OF BORE LOG SYMBOLS

- California Split-spoon Sample
- Unrecovered Sample
- Standard Penetration Test Sample
- Groundwater depth

Note: The stratification lines on the borelogs represent the approximate boundaries between the soil types; the transitions may be gradual.

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobil B-61	Date Drilled:	11/7/2018
Elevation:	271 Ft (MSL)	Boring No:	BH-1 (1 of 2)

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
									Sand (SP); grayish brown, dry, fine-grained, well-sorted (Fill).
	18/32/43	1	0		0.4	113.0	2		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).
	15/30/50-6"			9.2	0.8	114.8	6		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).
	13/24/25				1.5		10		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).
	25/36/54				0.7	118.5	15		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).
	7/10/12				0.9		20		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
	15/23/33				0.8	110.6	25		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
	11/15/13				1.3		30		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
	12/24/28				1.1	111.5	35		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
	12/17/18				1.7		40		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
	28/38/50-6"				1.7	110.1	45		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).
	17/20/26				1.9		50		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).

Completion Notes:

PROPOSED DESERT WAVE RESORT
DESERT WILLOW COMPLEX, PALM DESERT

Project No: 544-18228
Report No: 18-12-602

SLADDEN ENGINEERING	BORE LOG			
	Drill Rig:	Mobil B-61	Date Drilled:	11/7/2018
	Elevation:	271 Ft (MSL)	Boring No:	BH-1 (2 of 2)

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							52		
							54		
	20/45/50-5"				1.6	113.0	56		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).
							58		
	14/25/33				2.0		60		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).
							62		
							64		
	24/40/50-6"				2.1	106.4	66		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).
							68		
	13/21/25			8.3	3.1		70		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).
									Terminated at ~ 71.5 feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Completion Notes:	PROPOSED DESERT WAVE RESORT DESERT WILLOW COMPLEX, PALM DESERT	
	Project No: 544-18228 Report No: 18-12-602	Page 2

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobil B-61	Date Drilled:	11/7/2018
Elevation:	270 Ft (MSL)	Boring No:	BH-2

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							0–3		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Fill).
■	12/17/23				1.0		5		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
■	31/50-5"			7.0	0.4	116.8	10		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).
■	16/23/24				0.5		15		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
■	14/16/22				0.3	105.9	20		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
							22		Terminated at ~ 21.5 feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Depth scale: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50

Completion Notes:

PROPOSED DESERT WAVE RESORT
DESERT WILLOW COMPLEX, PALM DESERT

Project No: 544-18228
Report No: 18-12-602

SLADDEN ENGINEERING	BORE LOG			
	Drill Rig:	Mobil B-61	Date Drilled:	11/7/2018
	Elevation:	260 Ft (MSL)	Boring No:	BH-3 (1 of 2)

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
									Sand (SP); grayish brown, dry, fine-grained, well-sorted (Fill).
	18/30/45				0.4	114.3	2		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
	19/31/50-5"				0.9	114.8	6		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).
	13/24/25				0.5	110.7	10		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).
	6/9/10				0.7		16		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
	8/10/16				0.3	105.7	20		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
	9/11/12				1.1		26		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
	16/25/31				0.8	107.4	30		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
	11/15/23				1.7		36		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
	14/27/50-6"			7.4	1.5	110.9	40		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).
	15/26/32				1.9		46		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).
	24/36/50-4"				1.4	110.4	50		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).

Depth scale: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50

Completion Notes:

PROPOSED DESERT WAVE RESORT
DESERT WILLOW COMPLEX, PALM DESERT

Project No: 544-18228
Report No: 18-12-602

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobil B-61	Date Drilled:	11/7/2018
Elevation:	271 Ft (MSL)	Boring No:	BH-3 (2 of 2)

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							52		
							54		
	11/13/29				1.9		56		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
							58		
	28/39/50-5"				2.0	104.4	60		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).
							62		
							64		
	12/196/28				2.9		66		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
							68		
	17/32/50-5"				2.5	107.0	70		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).
									Terminated at ~ 71.5 feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Completion Notes:

PROPOSED DESERT WAVE RESORT
DESERT WILLOW COMPLEX, PALM DESERT

Project No: 544-18228
Report No: 18-12-602

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobil B-61	Date Drilled:	11/7/2018
Elevation:	270 Ft (MSL)	Boring No:	BH-4

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							2		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Fill).
	15/28/42			8.7	1.1	115.4	6		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
	15/16/19				1.2		10		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
	13/16/23				0.9	120.5	16		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
	8/9/15				1.9		20		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
							22–50		Terminated at ~ 21.5 feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Completion Notes:

PROPOSED DESERT WAVE RESORT
DESERT WILLOW COMPLEX, PALM DESERT

Project No: 544-18228
Report No: 18-12-602

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobil B-61	Date Drilled:	11/7/2018
Elevation:	270 Ft (MSL)	Boring No:	BH-5

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							0–3		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Fill).
■	12/22/26				1.5		5		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
■	16/32/50-4"				1.7	118.5	10		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).
■	13/20/23				1.2		15		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
■	10/15/20				1.1	109.1	20		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
							22–50		Terminated at ~ 21.5 feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Completion Notes:

PROPOSED DESERT WAVE RESORT
DESERT WILLOW COMPLEX, PALM DESERT

Project No: 544-18228
Report No: 18-12-602

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobil B-61	Date Drilled:	11/7/2018
Elevation:	270 Ft (MSL)	Boring No:	BH-6

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							2		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Fill).
	16/28/50-6"				0.8	113.8	6		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).
	14/23/33				1.3		10		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).
	7/13/16				0.6	100.1	15		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
	7/10/11			7.2	1.2		20		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
	12/16/22				1.2	109.6	25		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
	14/17/21				1.8		30		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
							32–50		Terminated at ~ 31.5 feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Completion Notes:

PROPOSED DESERT WAVE RESORT
DESERT WILLOW COMPLEX, PALM DESERT

Project No: 544-18228
Report No: 18-12-602

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobil B-61	Date Drilled:	11/7/2018
Elevation:	270 Ft (MSL)	Boring No:	BH-7

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							0–3		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Fill).
■	13/24/25				1.3		5		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
■	6/12/15				0.4	99.5	10		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
■	8/10/12				1.1		15		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
■	13/17/20				1.0	105.6	20		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).

Terminated at ~ 21.5 feet bgs.
No Bedrock Encountered.
No Groundwater or Seepage Encountered.

Depth scale (Feet): 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50

Completion Notes:

PROPOSED DESERT WAVE RESORT
DESERT WILLOW COMPLEX, PALM DESERT

Project No: 544-18228
Report No: 18-12-602

SLADDEN ENGINEERING	BORE LOG			
	Drill Rig:	Mobil B-61	Date Drilled:	11/16/2018
	Elevation:	265 Ft (MSL)	Boring No:	BH-8 (1 of 2)

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							0–2		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Fill).
							2		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Qs).
■	12/18/22				1.2		5		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
■	13/23/38				1.6		10		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).
■	13/16/22				1.7		15		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
■	10/12/14				1.1		20		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
■	7/10/13				1.1		25		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
■	8/9/12			7.5	1.5		30		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
■	10/17/21				1.8		35		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
■	11/18/22				1.9		40		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
■	8/9/15				2.2		45		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
■	13/21/30				2.1		50		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).

Completion Notes:

PROPOSED DESERT WAVE RESORT
DESERT WILLOW COMPLEX, PALM DESERT

Project No: 544-18228
Report No: 18-12-602

SLADDEN ENGINEERING	BORE LOG			
	Drill Rig:	Mobil B-61	Date Drilled:	11/7/2018
	Elevation:	265 Ft (MSL)	Boring No:	BH-8 (2 of 2)

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							52		
							54		
■	15/26/31				2.0		56		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).
							58		
■	13/21/26				2.4		60		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
							62		
							64		
■	14/15/17				2.7		66		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
									Terminated at ~ 66.5 feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Completion Notes:

PROPOSED DESERT WAVE RESORT
DESERT WILLOW COMPLEX, PALM DESERT

Project No: 544-18228
Report No: 18-12-602

SLADDEN ENGINEERING	BORE LOG			
	Drill Rig:	Mobil B-61	Date Drilled:	11/16/2018
	Elevation:	260 Ft (MSL)	Boring No:	BH-9 (1 of 2)

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							2		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Fill).
							4		
■	10/16/25				1.2		6		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
							8		
■	13/18/27				1.5		10		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
							12		
							14		
■	10/13/17				1.2		16		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
							18		
■	6/8/11				1.3		20		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
							22		
							24		
■	9/11/13				1.4		26		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
							28		
■	5/8/13				1.7		30		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
							32		
							34		
■	10/16/16				2.2		36		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
							38		
■	11/13/16				2.6		40		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
							42		
							44		
■	15/16/23				2.3		46		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
							48		
■	16/26/30			5.5	2.3		50		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).

Completion Notes:

PROPOSED DESERT WAVE RESORT
DESERT WILLOW COMPLEX, PALM DESERT

Project No: 544-18228
Report No: 18-12-602

SLADDEN ENGINEERING	BORE LOG			
	Drill Rig:	Mobil B-61	Date Drilled:	11/7/2018
	Elevation:	260 Ft (MSL)	Boring No:	BH-9 (2 of 2)

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							52		
							54		
■	18/26/35				2.5		56		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).
							58		
■	6/9/12				1.5		60		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
							62		
							64		
■	16/24/28				2.9		66		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).
							68		
■	11/18/30				2.5		70		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
									Terminated at ~ 71.5 feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Completion Notes:

PROPOSED DESERT WAVE RESORT
DESERT WILLOW COMPLEX, PALM DESERT

Project No: 544-18228
Report No: 18-12-602

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobil B-61	Date Drilled:	11/16/2018
Elevation:	260 Ft (MSL)	Boring No:	BH-10 (1 of 2)

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							0–2		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Fill).
							2		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Qs).
■	10/17/22				1.5 1.8		5		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
				6.3	1.3		7		
■	17/24/30				1.3		10		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).
■	6/8/10				1.7		15		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
■	5/7/10				1.7		20		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
■	6/9/12				2.1		25		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
■	10/12/17				2.0		30		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
■	13/15/18				2.6		35		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
■	15/23/28				2.2		40		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).
■	14/19/27				2.4		45		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
■	14/20/21				2.7		50		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).

Completion Notes:

PROPOSED DESERT WAVE RESORT
DESERT WILLOW COMPLEX, PALM DESERT

Project No: 544-18228
Report No: 18-12-602

SLADDEN ENGINEERING	BORE LOG			
	Drill Rig:	Mobil B-61	Date Drilled:	11/7/2018
	Elevation:	260 Ft (MSL)	Boring No:	BH-10 (2 of 2)

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							52		
							54		
	16/28/31				2.4		56		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).
							58		
	15/31/42				2.7		60		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).
							62		
							64		
	19/25/27				2.7		66		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).
							68		
	12/17/30				2.8		70		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
									Terminated at ~ 71.5 feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Completion Notes:

PROPOSED DESERT WAVE RESORT
DESERT WILLOW COMPLEX, PALM DESERT

Project No: 544-18228
Report No: 18-12-602

SLADDEN ENGINEERING	BORE LOG			
	Drill Rig: Mobil B-61		Date Drilled: 11/16/2018	
	Elevation: 270 Ft (MSL)		Boring No: BH-11 (1 of 2)	

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							2		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Fill).
■	15/22/26				0.9		6		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
■	11/22/28				1.1		10		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
■	11/14/16				0.8		16		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
■	6/7/10				0.9		20		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
■	10/14/17			6.9	0.9		26		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
■	7/10/14				1.0		30		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
■	10/18/20				1.5		36		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
■	10/15/22				1.6		40		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
■	15/19/19				1.8		46		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
■	15/24/31				1.8		50		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).

Depth scale (feet): 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50

Completion Notes:

PROPOSED DESERT WAVE RESORT
DESERT WILLOW COMPLEX, PALM DESERT

Project No: 544-18228
Report No: 18-12-602

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobil B-61	Date Drilled:	11/7/2018
Elevation:	270 Ft (MSL)	Boring No:	BH-11 (2 of 2)

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							52		
							54		
■	16/23/31				2.2		56		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).
							58		
■	12/20/21				2.7		60		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
							62		
							64		
■	13/28/40				2.4		66		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).
							68		
■	14/23/30				2.5		70		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).
									Terminated at ~ 71.5 feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Completion Notes:

PROPOSED DESERT WAVE RESORT
DESERT WILLOW COMPLEX, PALM DESERT

Project No: 544-18228
Report No: 18-12-602

SLADDEN ENGINEERING	BORE LOG			
	Drill Rig: Mobil B-61		Date Drilled: 11/7/2018	
	Elevation: 270 Ft (MSL)		Boring No: BH-12	

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							2		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Fill).
							4		
■	13/16/24				1.1		6		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
							8		
■	23/26/25				0.9		10		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).
							12		
							14		
■	17/22/23				1.0		16		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
							18		
■	17/23/22				0.9		20		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
							22		
							24		Terminated at ~ 21.5 feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.
							26		
							28		
							30		
							32		
							34		
							36		
							38		
							40		
							42		
							44		
							46		
							48		
							50		

Completion Notes:

PROPOSED DESERT WAVE RESORT
DESERT WILLOW COMPLEX, PALM DESERT

Project No: 544-18228
Report No: 18-12-602

SLADDEN ENGINEERING	BORE LOG			
	Drill Rig:	Mobil B-61	Date Drilled:	11/7/2018
	Elevation:	265 Ft (MSL)	Boring No:	BH-13

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							2		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Fill).
■	18/22/25				0.8		6		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
■	23/22/24				0.8		10		Sand (SP); grayish brown, dry, dense, fine-grained, well-sorted (Qs).
■	13/14/16				1.0		16		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
■	12/13/12				1.5		20		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
							22–50		Terminated at ~ 21.5 feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Completion Notes:

PROPOSED DESERT WAVE RESORT
DESERT WILLOW COMPLEX, PALM DESERT

Project No: 544-18228
Report No: 18-12-602

SLADDEN ENGINEERING

BORE LOG

Drill Rig:	Mobil B-61	Date Drilled:	11/7/2018
Elevation:	260 Ft (MSL)	Boring No:	BH-14

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							2		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Fill).
■	21/26/28				1.3		6		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).
■	24/25/27				1.0		10		Sand (SP); grayish brown, dry, very dense, fine-grained, well-sorted (Qs).
■	9/11/13				0.9		16		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
■	8/9/11				1.0		20		Sand (SP); grayish brown, dry, medium dense, fine-grained, well-sorted (Qs).
							24		Terminated at ~ 21.5 feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Depth scale: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50

Completion Notes:

PROPOSED DESERT WAVE RESORT
DESERT WILLOW COMPLEX, PALM DESERT

Project No: 544-18228
Report No: 18-12-602

SLADDEN ENGINEERING

BORE LOG

Excavator:	Mini-Ex	Date Excavated:	12/7/2018
Elevation:	270 Ft (MSL)	Boring No:	TP-1

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							0–3		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Fill).
							3–10		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Qs).
							10–12		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Qs).
									Terminated at ~ 10.0 feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Depth scale: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50

Completion Notes:

PROPOSED DESERT WAVE RESORT
DESERT WILLOW COMPLEX, PALM DESERT

Project No: 544-18228
Report No: 18-12-602

SLADDEN ENGINEERING	BORE LOG			
	Excavator:	Mini-Ex	Date Excavated:	12/7/2018
	Elevation:	270 Ft (MSL)	Boring No:	TP-2

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							2		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Fill).
							4		
							6		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Qs).
							8		
							10		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Qs).
							12		
							14		Terminated at ~ 10.0 feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.
							16		
							18		
							20		
							22		
							24		
							26		
							28		
							30		
							32		
							34		
							36		
							38		
							40		
							42		
							44		
							46		
							48		
							50		

Completion Notes:

PROPOSED DESERT WAVE RESORT
DESERT WILLOW COMPLEX, PALM DESERT

Project No: 544-18228
Report No: 18-12-602

SLADDEN ENGINEERING	BORE LOG			
	Excavator:	Mini-Ex	Date Excavated:	12/7/2018
	Elevation:	260 Ft (MSL)	Boring No:	TP-3

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							0–3		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Fill).
							3–10		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Qs).
							10		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Qs).
									Terminated at ~ 10.0 feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Depth scale: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50

Completion Notes:

PROPOSED DESERT WAVE RESORT
DESERT WILLOW COMPLEX, PALM DESERT

Project No: 544-18228
Report No: 18-12-602

SLADDEN ENGINEERING

BORE LOG

Excavator:	Mini-Ex	Date Excavated:	12/7/2018
Elevation:	265 Ft (MSL)	Boring No:	TP-4

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							0–3		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Fill).
							3–10		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Qs).
							10–12		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Qs).

Depth scale (feet): 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50

Terminated at ~ 10.0 feet bgs.
No Bedrock Encountered.
No Groundwater or Seepage Encountered.

Completion Notes:

PROPOSED DESERT WAVE RESORT
DESERT WILLOW COMPLEX, PALM DESERT

Project No: 544-18228
Report No: 18-12-602

SLADDEN ENGINEERING

BORE LOG

Excavator:	Mini-Ex	Date Excavated:	12/7/2018
Elevation:	265 Ft (MSL)	Boring No:	TP-5

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							2		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Fill).
							4–8		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Qs).
							10		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Qs).
							12–50		Terminated at ~ 10.0 feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Completion Notes:

PROPOSED DESERT WAVE RESORT
DESERT WILLOW COMPLEX, PALM DESERT

Project No: 544-18228
Report No: 18-12-602

SLADDEN ENGINEERING

BORE LOG

Excavator:	Mini-Ex	Date Excavated:	12/7/2018
Elevation:	265 Ft (MSL)	Boring No:	TP-6

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							0–3		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Fill).
							3–10		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Qs).
							10		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Qs).
									Terminated at ~ 10.0 feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Depth scale: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50

Completion Notes:

PROPOSED DESERT WAVE RESORT
DESERT WILLOW COMPLEX, PALM DESERT

Project No: 544-18228
Report No: 18-12-602

SLADDEN ENGINEERING

BORE LOG

Excavator:	Mini-Ex	Date Excavated:	12/7/2018
Elevation:	260 Ft (MSL)	Boring No:	TP-7

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							0–3		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Fill).
							3–10		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Qs).
							10–12		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Qs).
									Terminated at ~ 10.0 feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Depth scale (Feet): 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50

Completion Notes:

PROPOSED DESERT WAVE RESORT
DESERT WILLOW COMPLEX, PALM DESERT

Project No: 544-18228	Page	27
Report No: 18-12-602		

SLADDEN ENGINEERING

BORE LOG

Excavator:	Mini-Ex	Date Excavated:	12/7/2018
Elevation:	265 Ft (MSL)	Boring No:	TP-8

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							0–3		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Fill).
							3–10		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Qs).
							10		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Qs).
									Terminated at ~ 10.0 feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Depth scale: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50

Completion Notes:

PROPOSED DESERT WAVE RESORT
DESERT WILLOW COMPLEX, PALM DESERT

Project No: 544-18228
Report No: 18-12-602

SLADDEN ENGINEERING	BORE LOG			
	Excavator:	Mini-Ex	Date Excavated:	12/7/2018
	Elevation:	265 Ft (MSL)	Boring No:	TP-9

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							0–3		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Fill).
							3–7		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Qs).
							10		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Qs).
									Terminated at ~ 10.0 feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Depth scale: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50

Completion Notes:

PROPOSED DESERT WAVE RESORT
DESERT WILLOW COMPLEX, PALM DESERT

Project No: 544-18228
Report No: 18-12-602

SLADDEN ENGINEERING	BORE LOG			
	Excavator:	Mini-Ex	Date Excavated:	12/7/2018
	Elevation:	265 Ft (MSL)	Boring No:	TP-10

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							0–3		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Fill).
							3–10		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Qs).
							10		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Qs).
									Terminated at ~ 10.0 feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Depth scale (Feet): 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50

Completion Notes:	PROPOSED DESERT WAVE RESORT DESERT WILLOW COMPLEX, PALM DESERT		
	Project No: 544-18228	Page	30
	Report No: 18-12-602		

SLADDEN ENGINEERING	BORE LOG			
	Excavator:	Mini-Ex	Date Excavated:	12/7/2018
	Elevation:	270 Ft (MSL)	Boring No:	TP-11

Sample	Blow Counts	Bulk Sample	Expansion Index	% Minus #200	% Moisture	Dry Density	Depth (Feet)	Graphic Lithology	Description
							2		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Fill).
							4–8		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Qs).
							10–12		Sand (SP); grayish brown, dry, fine-grained, well-sorted (Qs).
							14–50		Terminated at ~ 10.0 feet bgs. No Bedrock Encountered. No Groundwater or Seepage Encountered.

Completion Notes:

PROPOSED DESERT WAVE RESORT
DESERT WILLOW COMPLEX, PALM DESERT

Project No: 544-18228
Report No: 18-12-602

APPENDIX B

LABORATORY TESTING

APPENDIX B

LABORATORY TESTING

Representative bulk and relatively undisturbed soil samples were obtained in the field and returned to our laboratory for additional observations and testing. Laboratory testing was generally performed in two phases. The first phase consisted of testing in order to determine the compaction of the existing natural soil and the general engineering classifications of the soils underlying the site. This testing was performed in order to estimate the engineering characteristics of the soil and to serve as a basis for selecting samples for the second phase of testing. The second phase consisted of soil mechanics testing. This testing including consolidation, shear strength and expansion testing was performed in order to provide a means of developing specific design recommendations based on the mechanical properties of the soil.

CLASSIFICATION AND COMPACTION TESTING

Unit Weight and Moisture Content Determinations: Each undisturbed sample was weighed and measured in order to determine its unit weight. A small portion of each sample was then subjected to testing in order to determine its moisture content. This was used in order to determine the dry density of the soil in its natural condition. The results of this testing are shown on the Boring Logs.

Maximum Density-Optimum Moisture Determinations: Representative soil types were selected for maximum density determinations. This testing was performed in accordance with the ASTM Standard D1557-91, Test Method A. Graphic representations of the results of this testing are presented in this appendix. The maximum densities are compared to the field densities of the soil in order to determine the existing relative compaction to the soil.

Classification Testing: Soil samples were selected for classification testing. This testing consists of mechanical grain size analyses. This provides information for developing classifications for the soil in accordance with the Unified Soil Classification System which is presented in the preceding appendix. This classification system categorizes the soil into groups having similar engineering characteristics. The results of this testing is very useful in detecting variations in the soil and in selecting samples for further testing.

SOIL MECHANIC'S TESTING

Expansion Testing: One (1) bulk sample was selected for Expansion testing. Expansion testing was performed in accordance with the UBC Standard 18-2. This testing consists of remolding 4-inch diameter by 1-inch thick test specimens to a moisture content and dry density corresponding to approximately 50 percent saturation. The samples are subjected to a surcharge of 144 pounds per square foot and allowed to reach equilibrium. At that point the specimens are inundated with distilled water. The linear expansion is then measured until complete.

Direct Shear Testing: One (1) bulk sample was selected for Direct Shear testing. This test measures the shear strength of the soil under various normal pressures and is used to develop parameters for foundation design and lateral design. Tests were performed using a recompacted test specimen that was saturated prior to tests. Tests were performed using a strain controlled test apparatus with normal pressures ranging from 800 to 2300 pounds per square foot.

Corrosion Series Testing: The soluble sulfate concentrations of the surface soil were determined in accordance with California Test Method Number (CA) 417. The pH and Minimum Resistivity were determined in accordance with CA 643. The soluble chloride concentrations were determined in accordance with CA 422.

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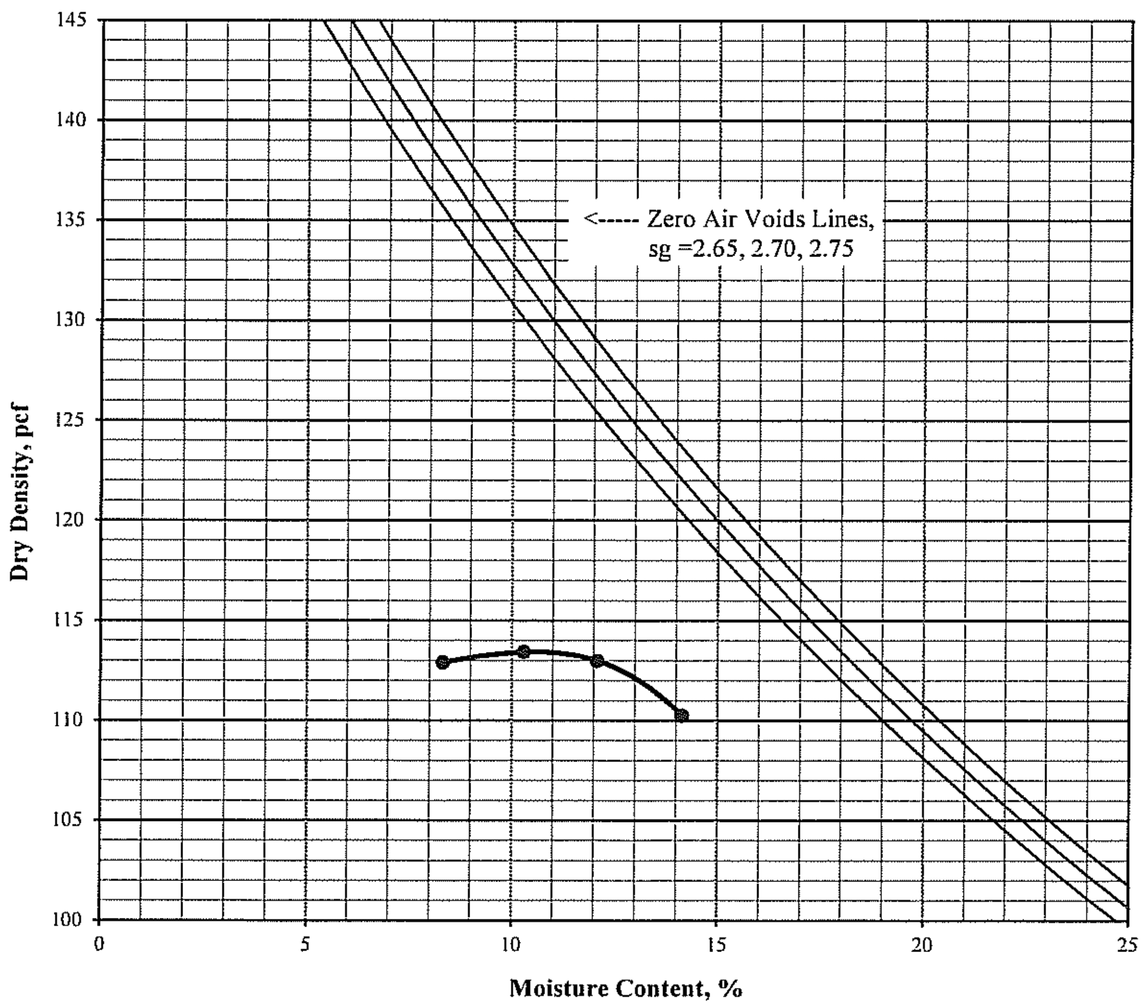
Maximum Density/Optimum Moisture

ASTM D698/D1557

Project Number:	544-18228	December 7, 2018
Project Name:	Desert Willow Country Club	
Lab ID Number:	LN6-18514	ASTM D-1557 A
Sample Location:	BH-1 Bulk 1 @ 0-5'	Rammer Type: Machine
Description:	Dark Brown Sand w/Silt (SP-SM)	

Maximum Density: **113.5 pcf**
Optimum Moisture: **11.5%**

Sieve Size	% Retained
3/4"	
3/8"	
#4	0.0



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Expansion Index

ASTM D 4829

Job Number: 544-18228 December 7, 2018

Job Name: Desert Willow Country Club

Lab ID Number: LN6-18514

Sample ID: BH-1 Bulk 1 @ 0-5'

Soil Description: Dark Brown Sand w/Silt (SP-SM)

Wt of Soil + Ring:	561.7
Weight of Ring:	191.1
Wt of Wet Soil:	370.6
Percent Moisture:	10.2%
Sample Height, in	0.95
Wet Density, pcf:	118.6
Dry Denstiy, pcf:	107.6

% Saturation:	48.7

Expansion **Rack # 4**

Date/Time	11/28/2018	3:10 PM
Initial Reading	0.0000	
Final Reading	0.0000	

Expansion Index **0**

(Final - Initial) x 1000

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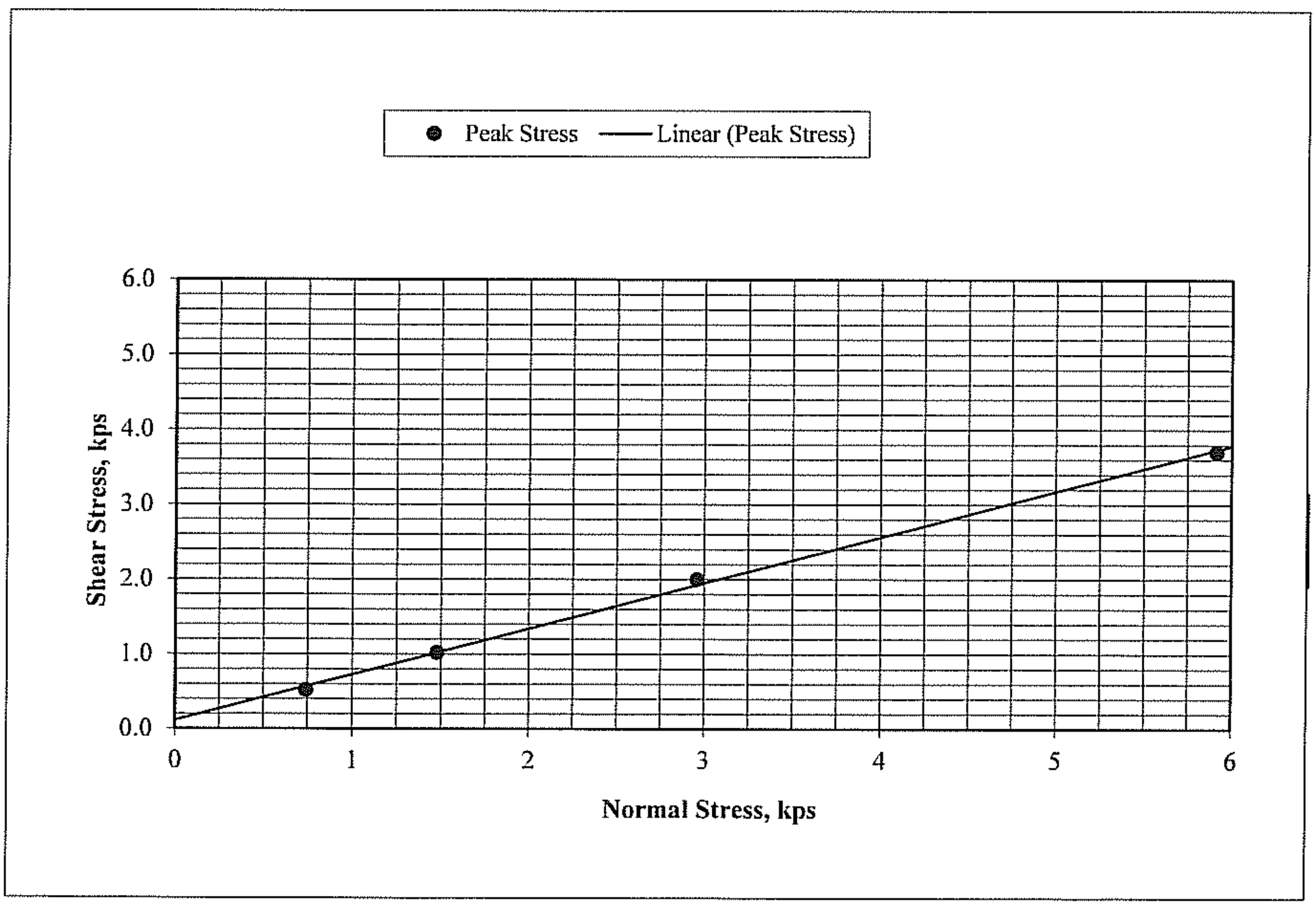
Direct Shear ASTM D 3080-04
(modified for unconsolidated condition)

Job Number: 544-18228
Job Name Desert Willow Country Club
Lab ID No. LN6-18514
Sample ID BH-1 Bulk 1 @ 0-5'
Classification Dark Brown Sand w/Silt (SP-SM)
Sample Type Remolded @ 90% of Maximum Density

December 7, 2018
Initial Dry Density: 102.9 pcf
Initial Mosture Content: 11.4 %
Peak Friction Angle (Ø): 31°
Cohesion (c): 110 psf

Test Results	1	2	3	4	Average
Moisture Content, %	18.7	18.7	18.7	18.7	18.7
Saturation, %	79.2	79.2	79.2	79.2	79.2
Normal Stress, kps	0.739	1.479	2.958	5.916	
Peak Stress, kps	0.519	1.020	1.998	3.700	



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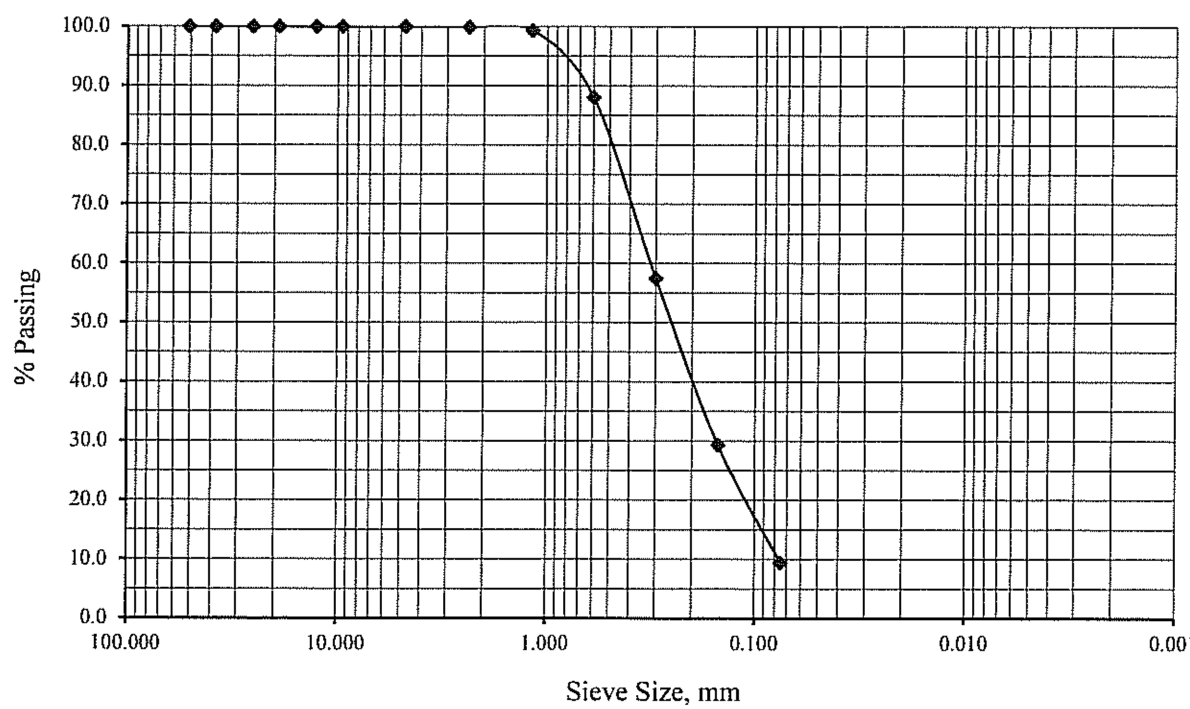
Gradation

ASTM C117 & C136

Project Number: 544-18228 December 7, 2018
Project Name: Desert Willow Country Club
Lab ID Number: LN6-18514
Sample ID: BH-1 Bulk 1 @ 0-5' Soil Classification: SP-SM

Sieve Size, in	Sieve Size, mm	Percent Passing
2"	50.8	100.0
1 1/2"	38.1	100.0
1"	25.4	100.0
3/4"	19.1	100.0
1/2"	12.7	100.0
3/8"	9.53	100.0
#4	4.75	100.0
#8	2.36	99.9
#16	1.18	99.3
#30	0.60	88.0
#50	0.30	57.4
#100	0.15	29.3
#200	0.075	9.4



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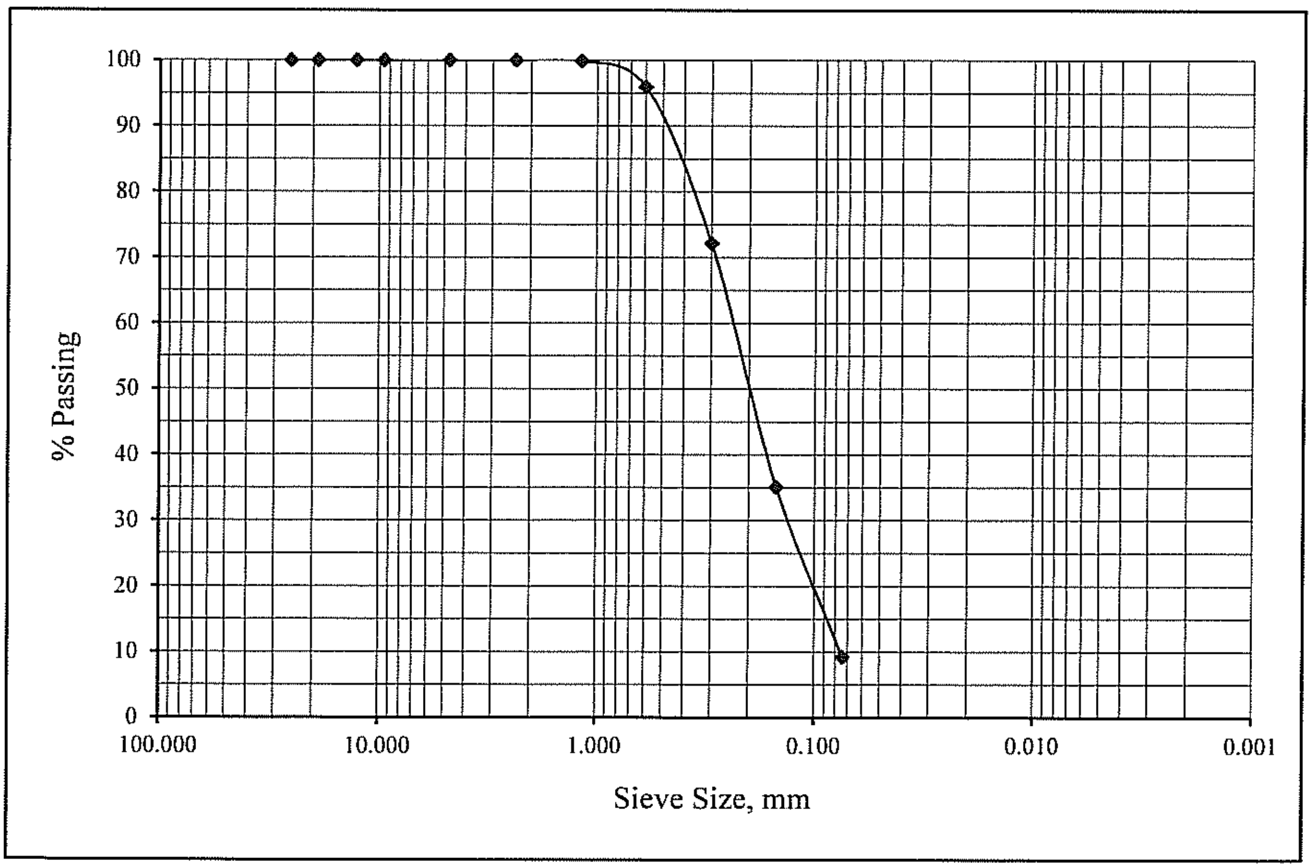
Gradation

ASTM C117 & C136

Project Number: 544-18228 December 7, 2018
Project Name: Desert Willow Country Club
Lab ID Number: LN6-18514
Sample ID: BH-1 R-2 @ 5' Soil Classification: SP-SM

Sieve Size, in	Sieve Size, mm	Percent Passing
1"	25.4	100.0
3/4"	19.1	100.0
1/2"	12.7	100.0
3/8"	9.53	100.0
#4	4.75	100.0
#8	2.36	100.0
#16	1.18	99.9
#30	0.60	95.9
#50	0.30	72.2
#100	0.15	35.1
#200	0.074	9.2



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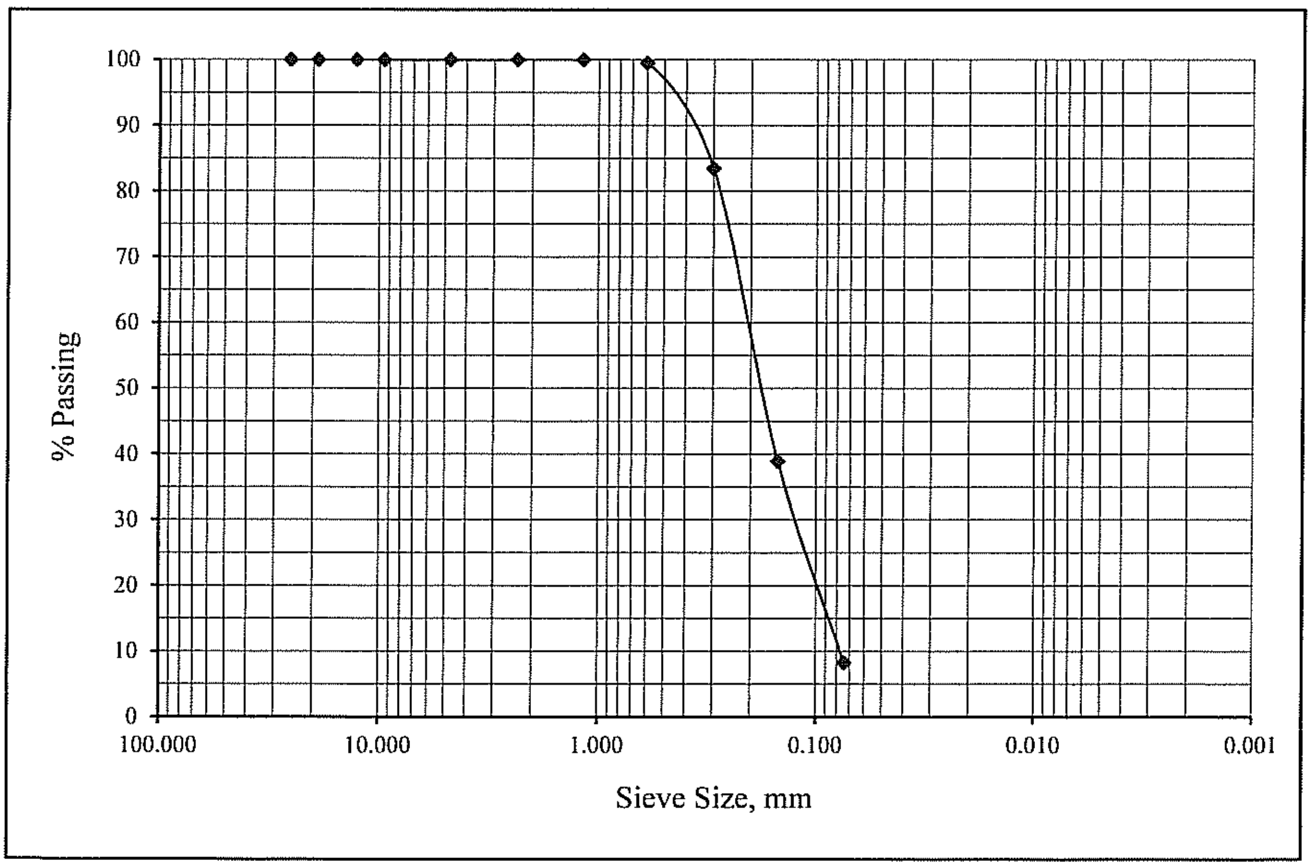
Gradation

ASTM C117 & C136

Project Number: 544-18228 December 7, 2018
Project Name: Desert Willow Country Club
Lab ID Number: LN6-18514
Sample ID: BH-1 S-15 @ 70' Soil Classification: SP-SM

Sieve Size, in	Sieve Size, mm	Percent Passing
1"	25.4	100.0
3/4"	19.1	100.0
1/2"	12.7	100.0
3/8"	9.53	100.0
#4	4.75	100.0
#8	2.36	100.0
#16	1.18	100.0
#30	0.60	99.5
#50	0.30	83.5
#100	0.15	38.9
#200	0.074	8.3



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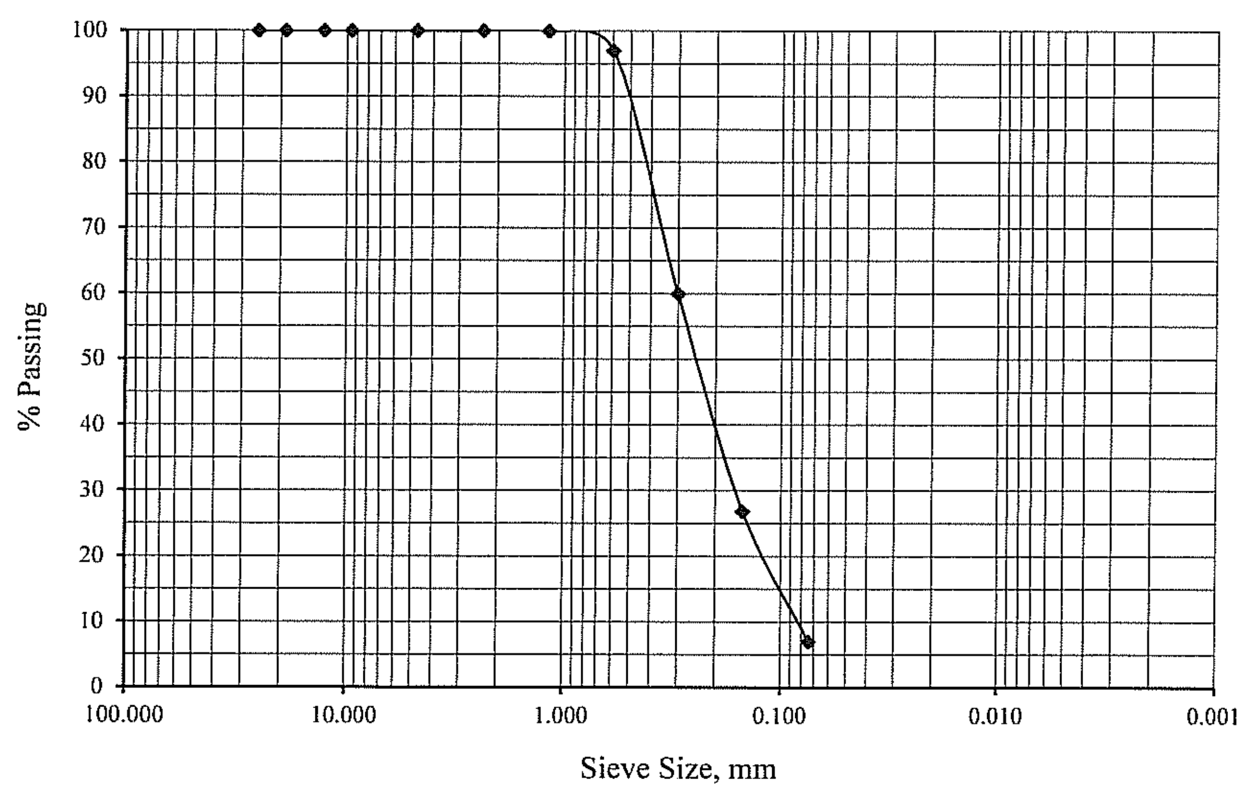
ASTM C117 & C136

Project Number: 544-18228 December 7, 2018
Project Name: Desert Willow Country Club
Lab ID Number: LN6-18514
Sample ID: BH-2 R-2 @ 10' Soil Classification: SP-SM

Sieve Size, in	Sieve Size, mm	Percent Passing
1"	25.4	100.0
3/4"	19.1	100.0
1/2"	12.7	100.0
3/8"	9.53	100.0
#4	4.75	100.0
#8	2.36	100.0
#16	1.18	99.9
#30	0.60	97.0
#50	0.30	59.9
#100	0.15	26.9
#200	0.074	7.0



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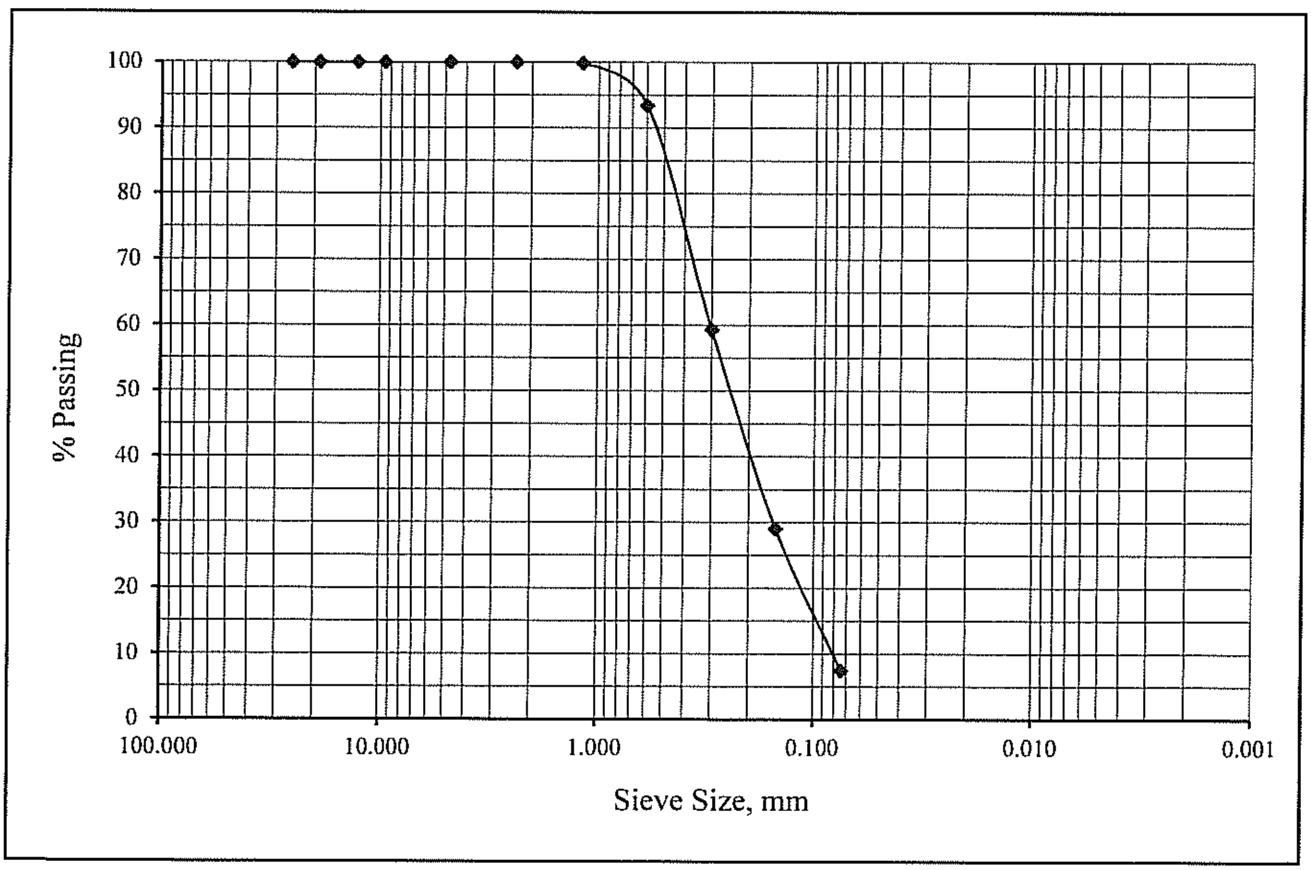
Gradation

ASTM C117 & C136

Project Number: 544-18228 December 7, 2018
Project Name: Desert Willow Country Club
Lab ID Number: LN6-18514
Sample ID: BH-3 R-9 @ 40' Soil Classification: SP-SM

Sieve Size, in	Sieve Size, mm	Percent Passing
1"	25.4	100.0
3/4"	19.1	100.0
1/2"	12.7	100.0
3/8"	9.53	100.0
#4	4.75	100.0
#8	2.36	100.0
#16	1.18	99.8
#30	0.60	93.4
#50	0.30	59.3
#100	0.15	29.0
#200	0.074	7.4



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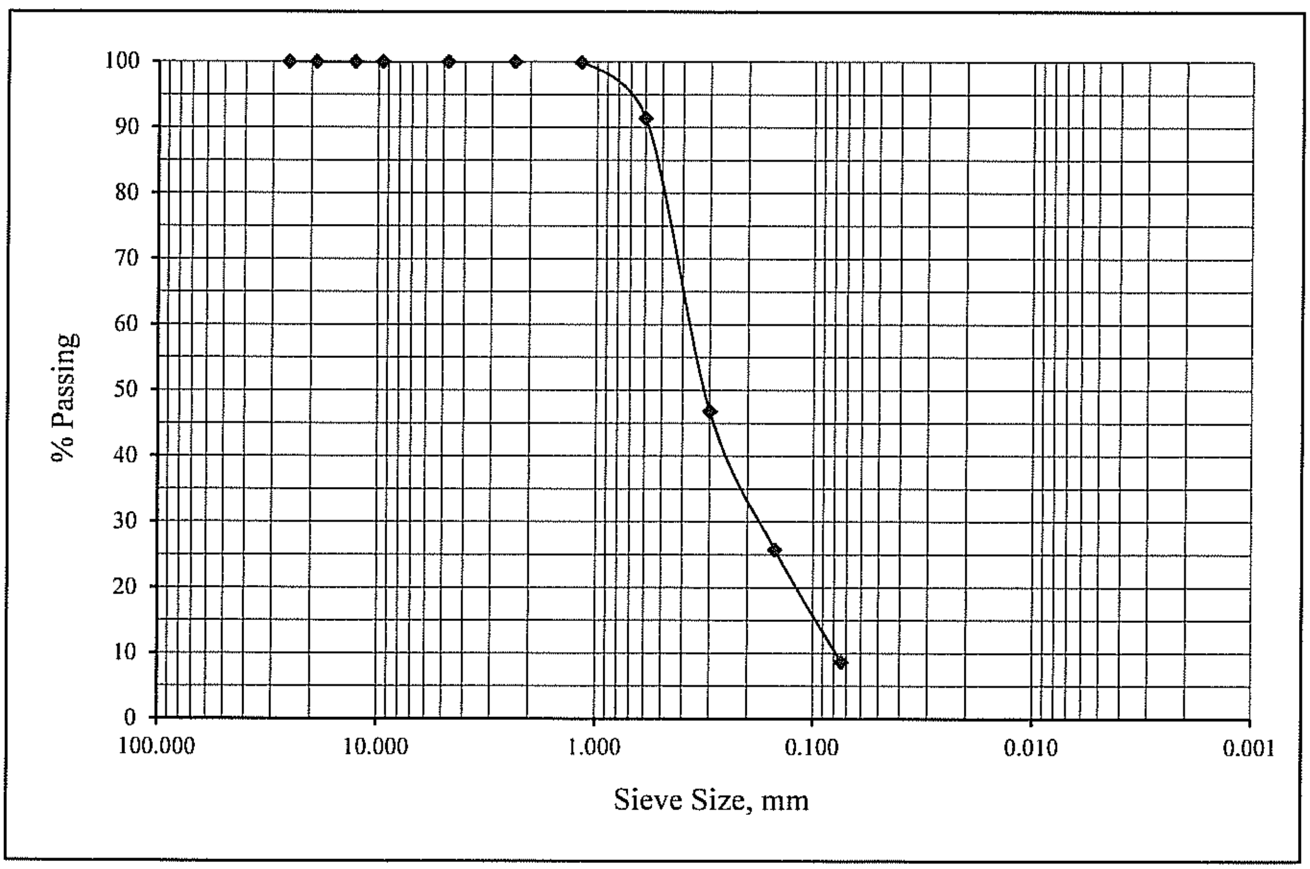
Gradation

ASTM C117 & C136

Project Number: 544-18228 December 7, 2018
Project Name: Desert Willow Country Club
Lab ID Number: LN6-18514
Sample ID: BH-4 R-1 @ 5' Soil Classification: SP-SM

Sieve Size, in	Sieve Size, mm	Percent Passing
1"	25.4	100.0
3/4"	19.1	100.0
1/2"	12.7	100.0
3/8"	9.53	100.0
#4	4.75	100.0
#8	2.36	100.0
#16	1.18	99.9
#30	0.60	91.4
#50	0.30	46.8
#100	0.15	25.8
#200	0.074	8.7



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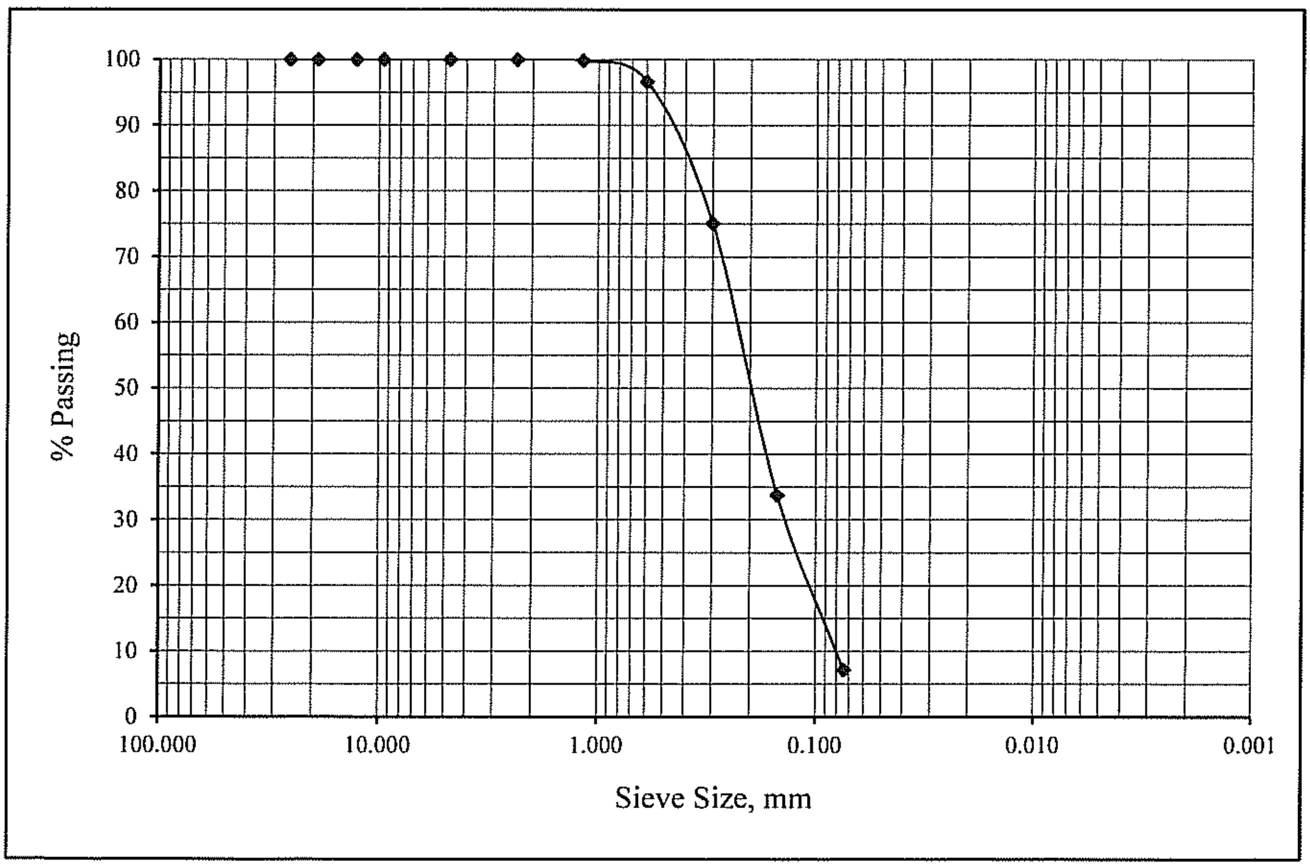
ASTM C117 & C136

Project Number: 544-18228 December 7, 2018
Project Name: Desert Willow Country Club
Lab ID Number: LN6-18514
Sample ID: BH-6 S-4 @ 20' Soil Classification: SP-SM

Sieve Size, in	Sieve Size, mm	Percent Passing
1"	25.4	100.0
3/4"	19.1	100.0
1/2"	12.7	100.0
3/8"	9.53	100.0
#4	4.75	100.0
#8	2.36	100.0
#16	1.18	99.8
#30	0.60	96.6
#50	0.30	75.1
#100	0.15	33.8
#200	0.074	7.2



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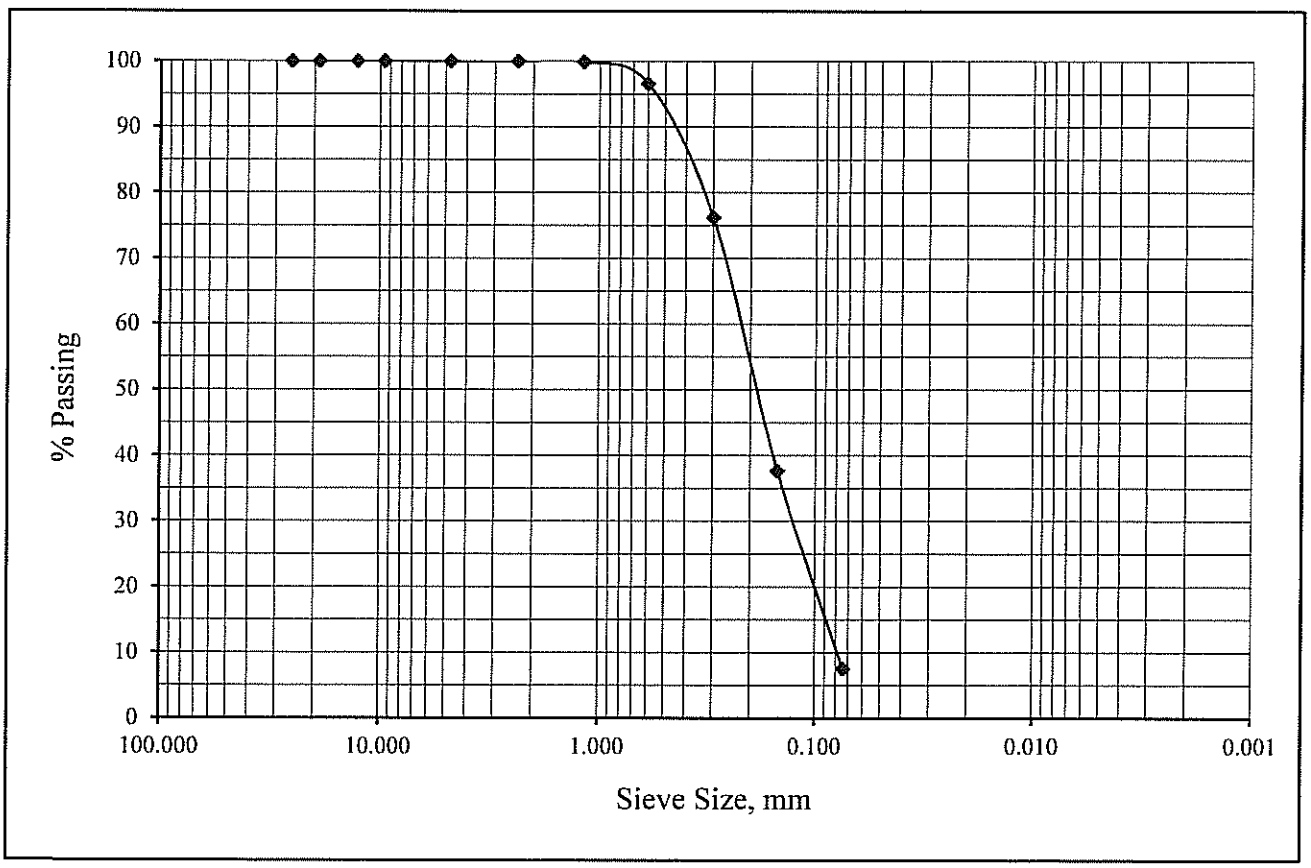
Gradation

ASTM C117 & C136

Project Number: 544-18228 December 7, 2018
Project Name: Desert Willow Country Club
Lab ID Number: LN6-18514
Sample ID: BH-8 S-6 @ 30' Soil Classification: SP-SM

Sieve Size, in	Sieve Size, mm	Percent Passing
1"	25.4	100.0
3/4"	19.1	100.0
1/2"	12.7	100.0
3/8"	9.53	100.0
#4	4.75	100.0
#8	2.36	100.0
#16	1.18	99.9
#30	0.60	96.6
#50	0.30	76.2
#100	0.15	37.7
#200	0.074	7.5



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Gradation

ASTM C117 & C136

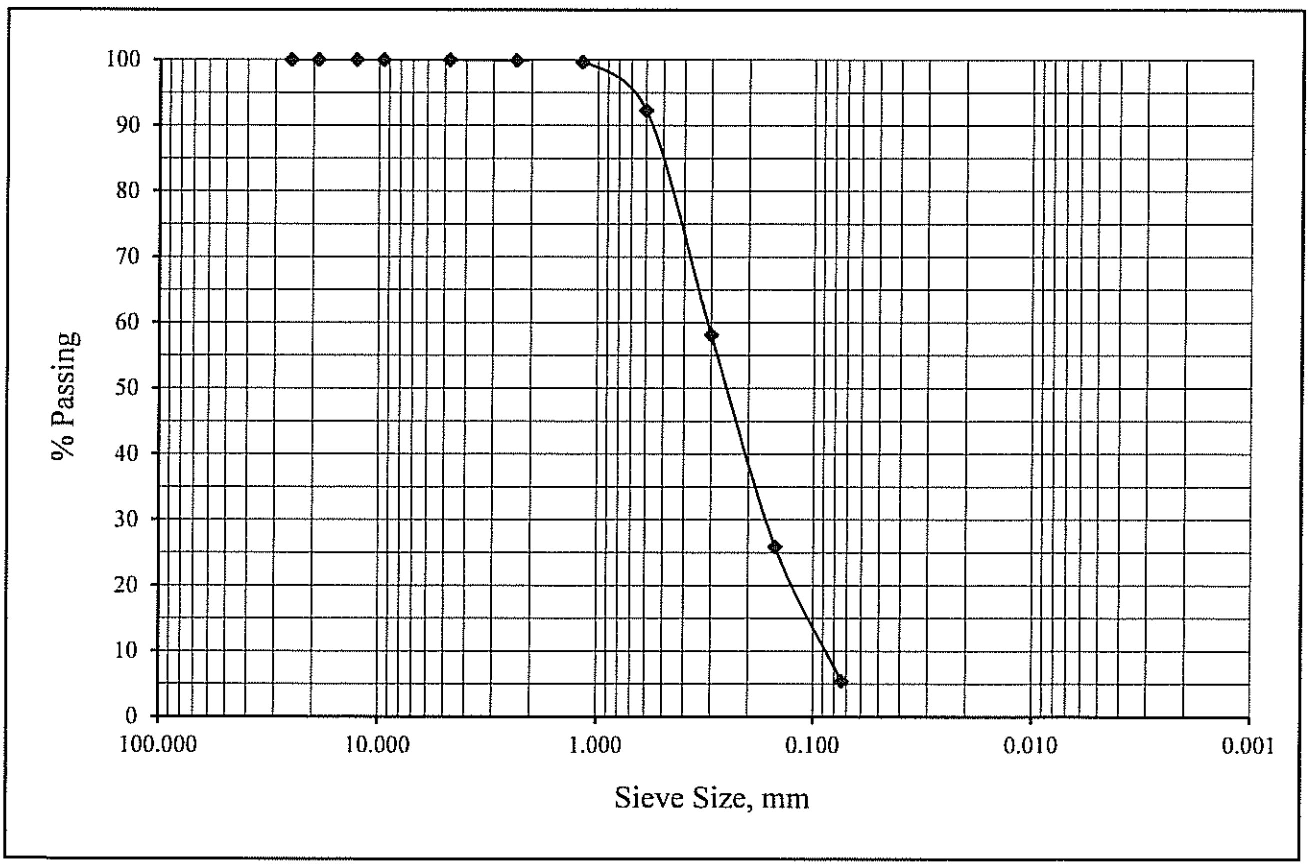
Project Number: 544-18228 December 7, 2018

Project Name: Desert Willow Country Club

Lab ID Number: LN6-18514

Sample ID: BH-9 S-10 @ 50' Soil Classification: SP-SM

Sieve Size, in	Sieve Size, mm	Percent Passing
1"	25.4	100.0
3/4"	19.1	100.0
1/2"	12.7	100.0
3/8"	9.53	100.0
#4	4.75	100.0
#8	2.36	99.9
#16	1.18	99.7
#30	0.60	92.3
#50	0.30	58.1
#100	0.15	25.9
#200	0.074	5.5



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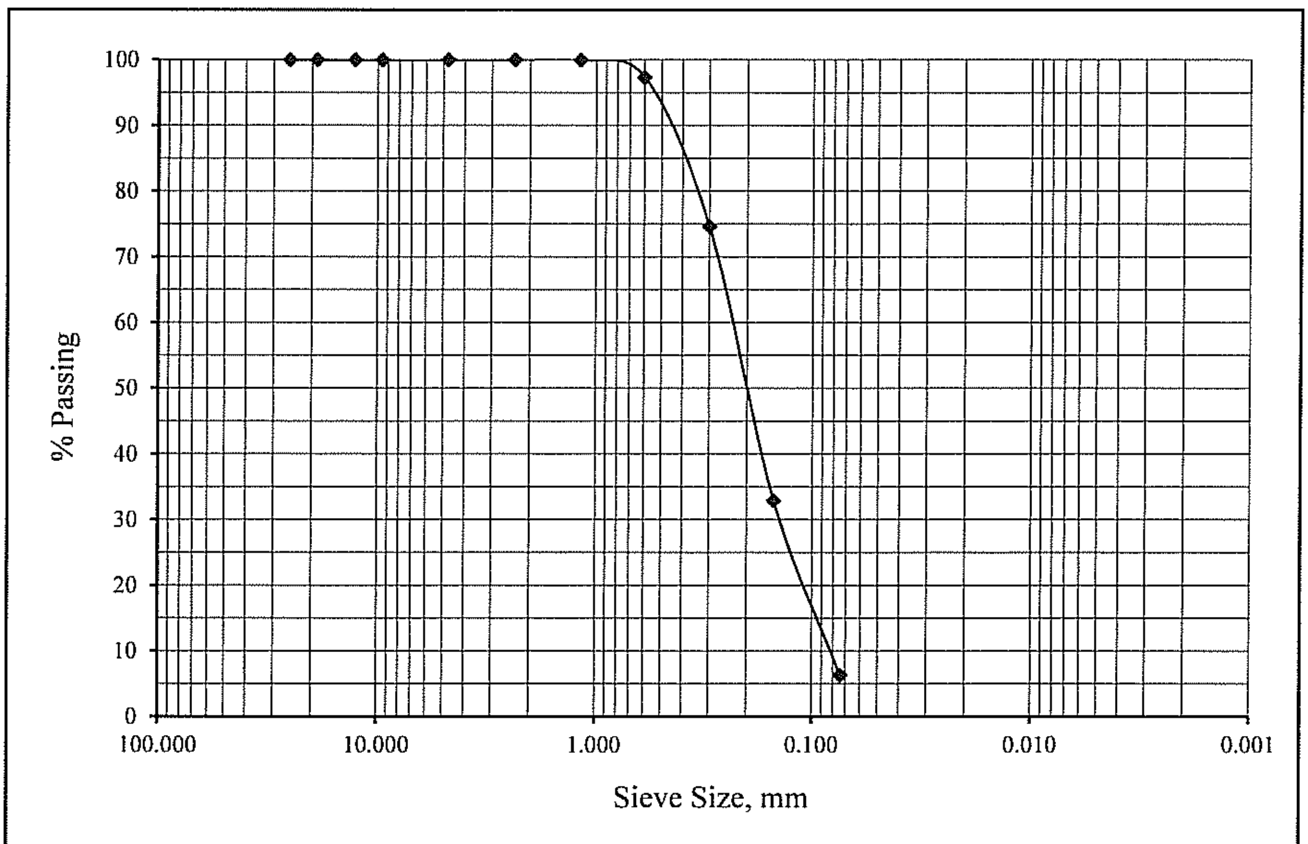
Gradation

ASTM C117 & C136

Project Number: 544-18228 December 7, 2018
Project Name: Desert Willow Country Club
Lab ID Number: LN6-18514
Sample ID: BH-10 S-3 @ 15' Soil Classification: SP-SM

Sieve Size, in	Sieve Size, mm	Percent Passing
1"	25.4	100.0
3/4"	19.1	100.0
1/2"	12.7	100.0
3/8"	9.53	100.0
#4	4.75	100.0
#8	2.36	100.0
#16	1.18	99.9
#30	0.60	97.3
#50	0.30	74.6
#100	0.15	32.9
#200	0.074	6.3



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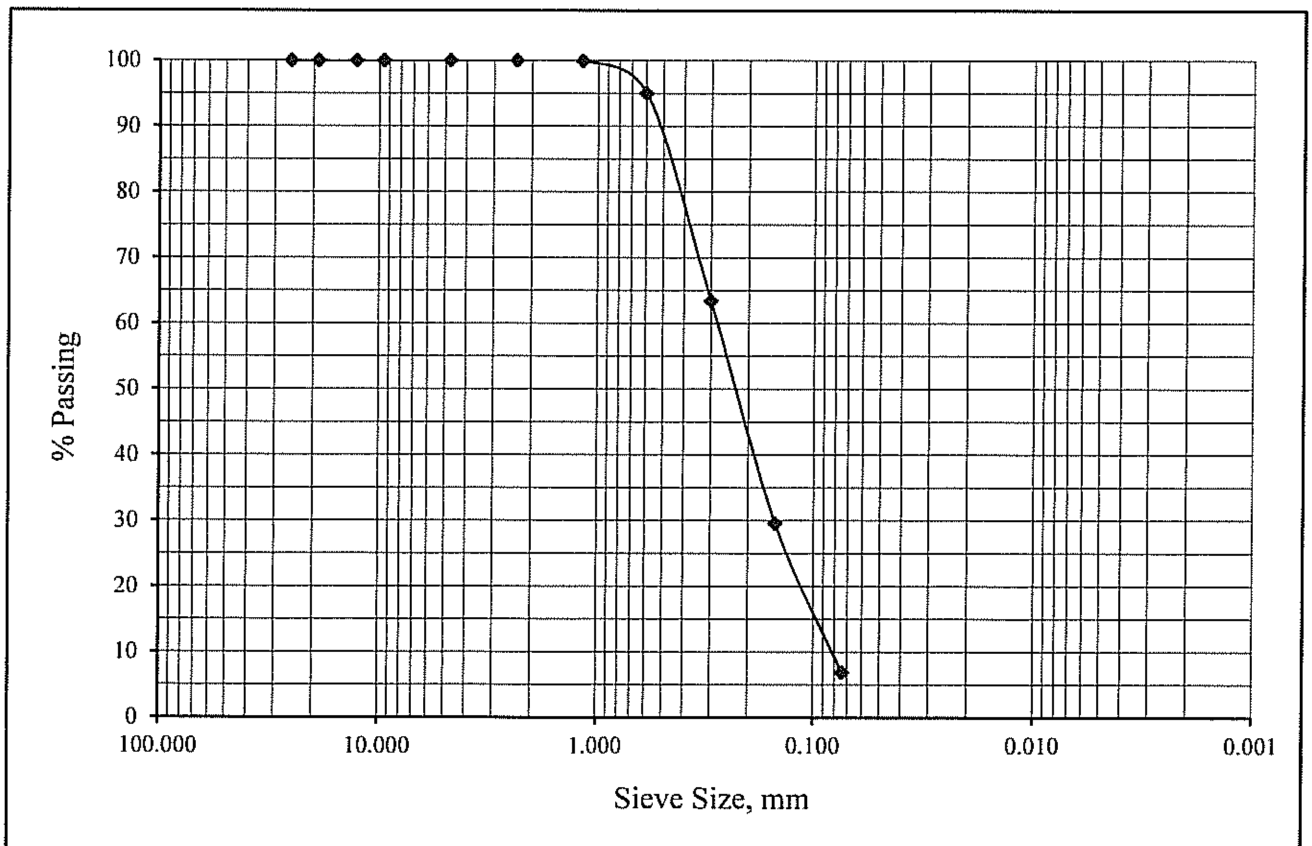
Gradation

ASTM C117 & C136

Project Number: 544-18228 December 7, 2018
Project Name: Desert Willow Country Club
Lab ID Number: LN6-18514
Sample ID: BH-11 S-5 @ 25' Soil Classification: SP-SM

Sieve Size, in	Sieve Size, mm	Percent Passing
1"	25.4	100.0
3/4"	19.1	100.0
1/2"	12.7	100.0
3/8"	9.53	100.0
#4	4.75	100.0
#8	2.36	100.0
#16	1.18	100.0
#30	0.60	95.0
#50	0.30	63.4
#100	0.15	29.6
#200	0.074	6.9



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One Dimensional Consolidation

ASTM D2435 & D5333

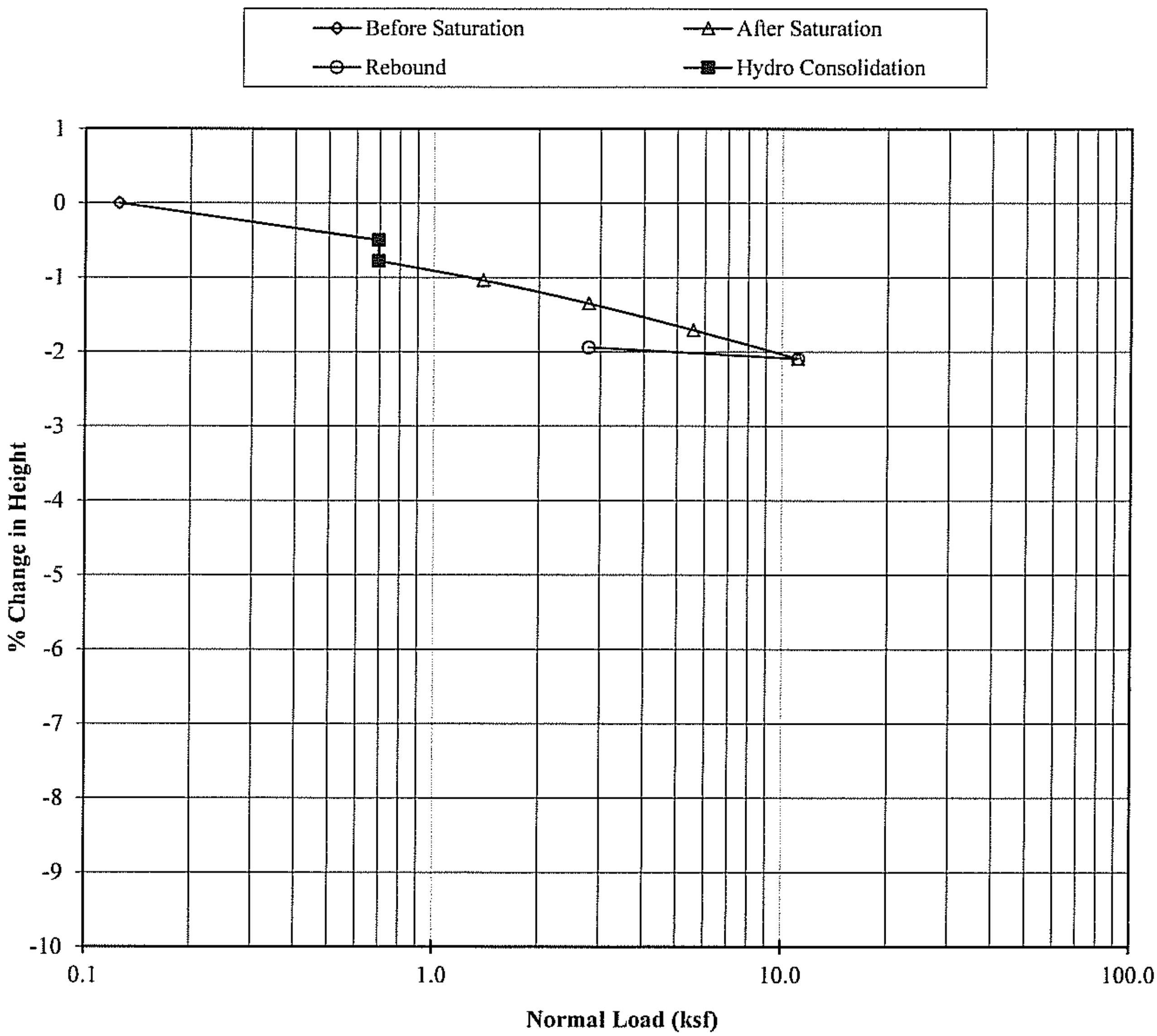
Job Number: 544-18228 December 7, 2018
Job Name: Desert Willow Country Club

Lab ID Number: LN6-18514
Sample ID: BH-1 R-2 @ 5'
Soil Description: Gray Brown Sand w/Silt (SP-SM)

Initial Dry Density, pcf: 111.1
Initial Moisture, %: 0.8
Initial Void Ratio: 0.501
Specific Gravity: 2.67

Hydrocollapse: 0.3% @ 0.694 ksf

% Change in Height vs Normal Presssure Diagram



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One Dimensional Consolidation

ASTM D2435 & D5333

Job Number: 544-18228

December 7, 2018

Job Name: Desert Willow Country Club

Lab ID Number: LN6-18514

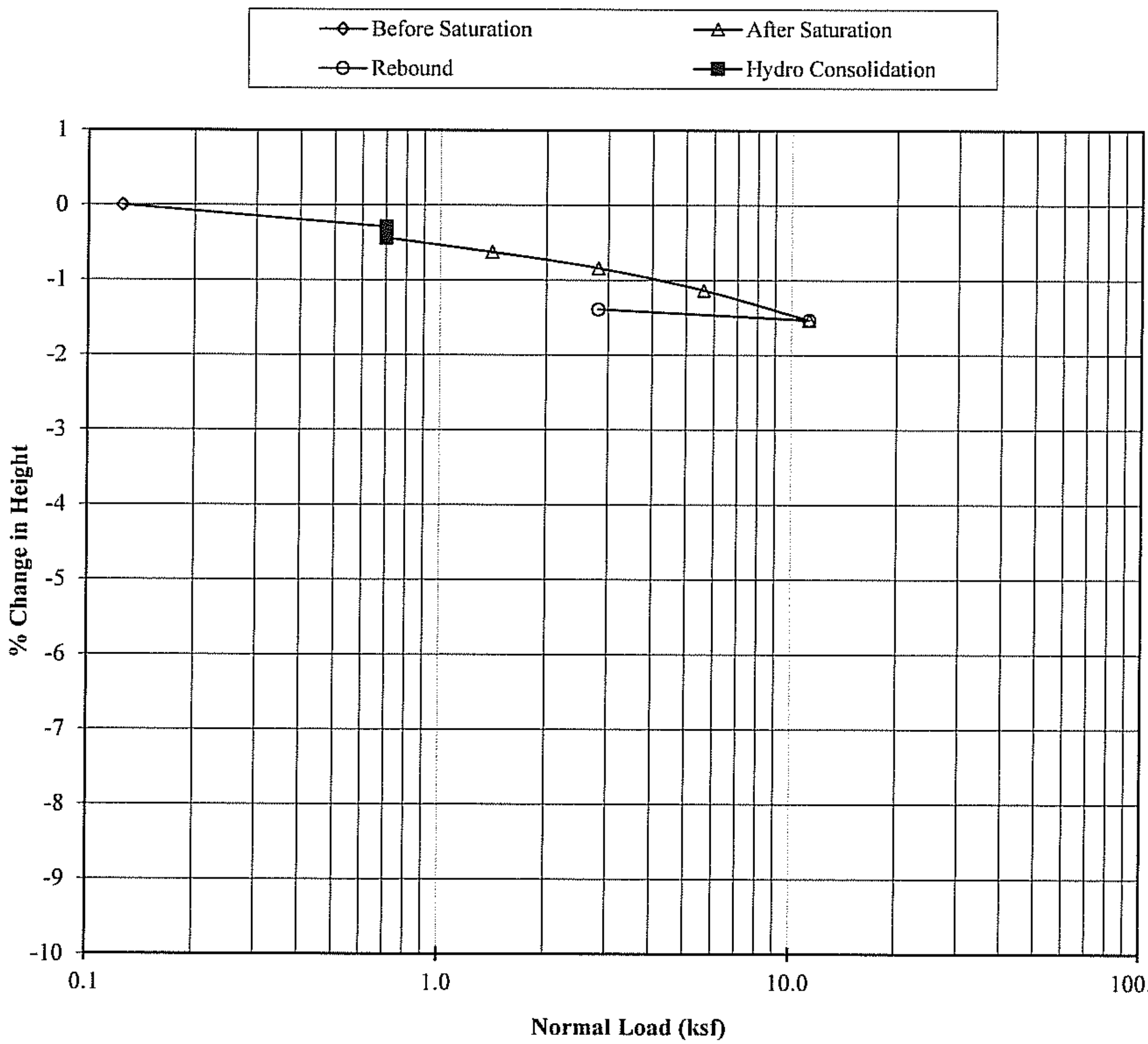
Sample ID: BH-2 R-2 @ 10'

Soil Description: Gray Brown Sand w/Silt (SP-SM)

Initial Dry Density, pcf: 112.9
Initial Moisture, %: 0.4
Initial Void Ratio: 0.476
Specific Gravity: 2.67

Hydrocollapse: 0.2% @ 0.702 ksf

% Change in Height vs Normal Presssure Diagram

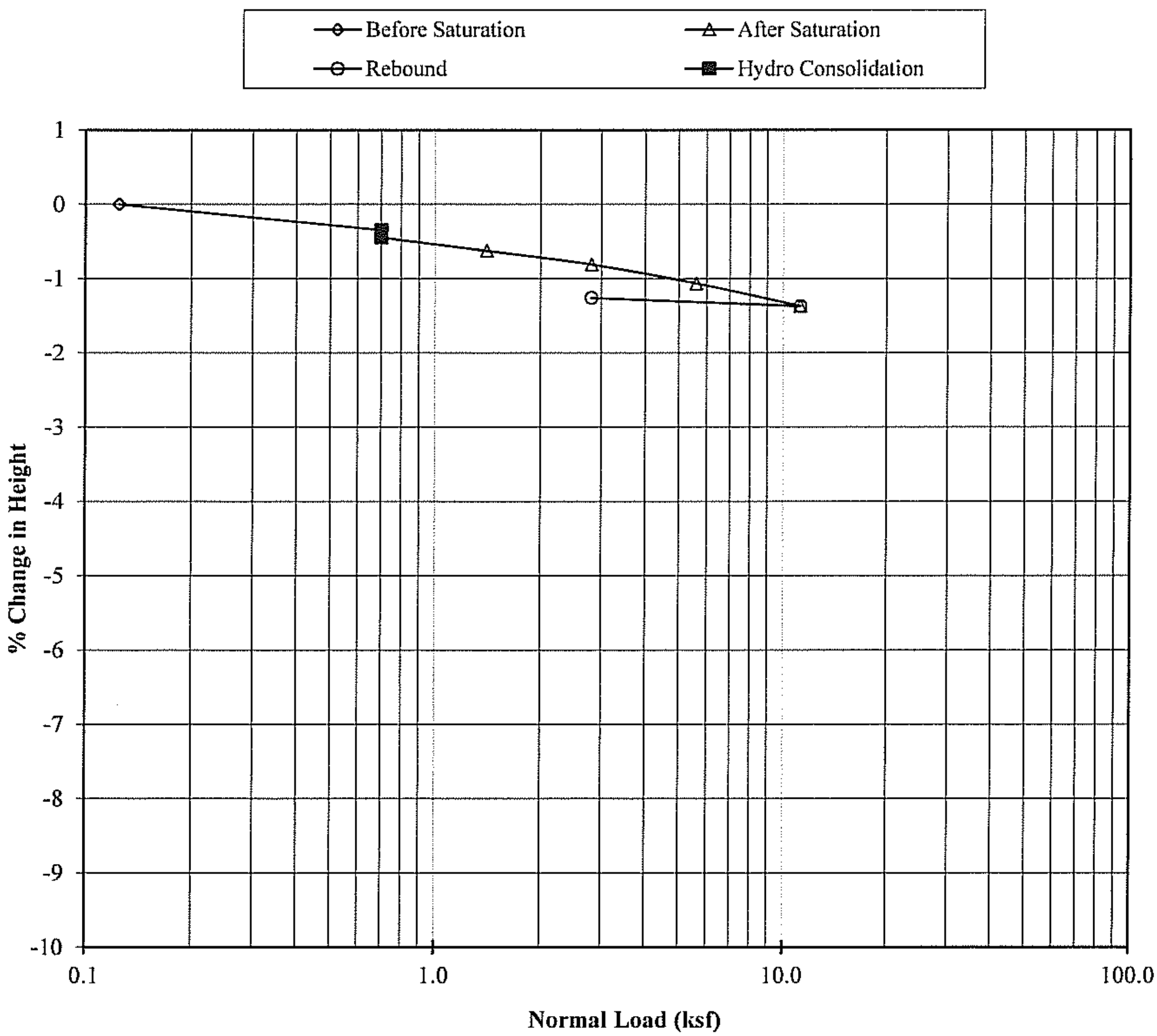


One Dimensional Consolidation

ASTM D2435 & D5333

Job Number:	544-18228		December 7, 2018
Job Name:	Desert Willow Country Club		
Lab ID Number:	LN6-18514	Initial Dry Density, pcf:	115.3
Sample ID:	BH-4 R-1 @ 5'	Initial Moisture, %:	1.1
Soil Description:	Brown Sand w/Silt (SP-SM)	Initial Void Ratio:	0.445
		Specific Gravity:	2.67

% Change in Height vs Normal Presssure Diagram



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45090 Golf Center Pkwy, Suite F, Indio, CA 92201 (760) 863-0713 Fax (760) 863-0847
450 Egan Avenue, Beaumont, CA 92223 (951) 845-7743 Fax (951) 845-8863

Date: November 29, 2018

Account No.: 544-18228

Customer: Desert Wave Ventures, LLC

Location: Country Club Drive, Desert Willow Country Club, Palm Desert

Analytical Report

Corrosion Series

	pH per CA 643	Soluble Sulfates per CA 417 ppm	Soluble Chloride per CA 422 ppm	Min. Resistivity per CA 643 ohm-cm
BH-1 @ 0-5'	8.8	180	50	8200

APPENDIX C

SEISMIC DESIGN MAP AND REPORT
DEAGGREGATION OUTPUT

USGS Design Maps Summary Report

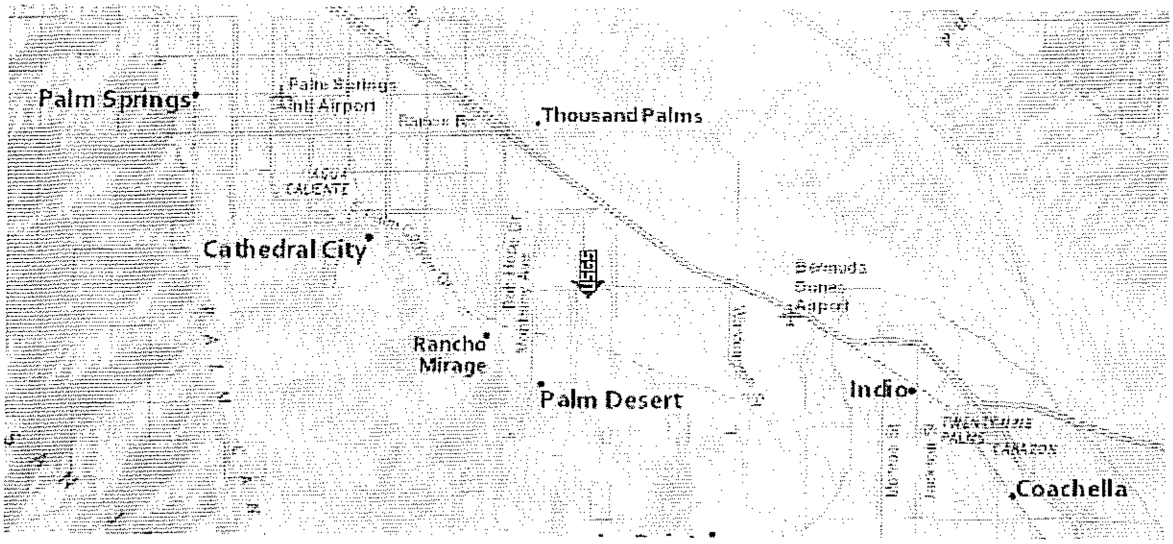
User–Specified Input

Building Code Reference Document ASCE 7-10 Standard
(which utilizes USGS hazard data available in 2008)

Site Coordinates 33.76399°N, 116.36729°W

Site Soil Classification Site Class D – "Stiff Soil"

Risk Category I/II/III

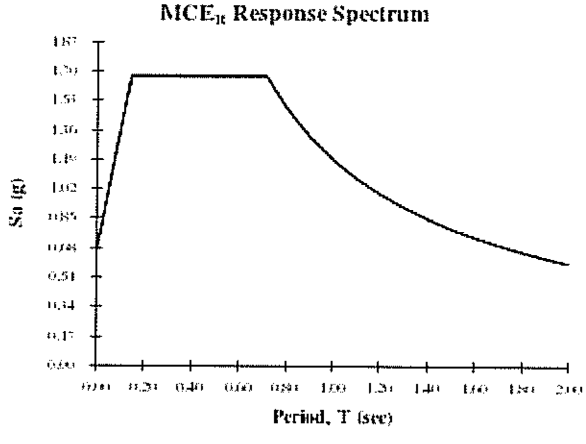


USGS–Provided Output

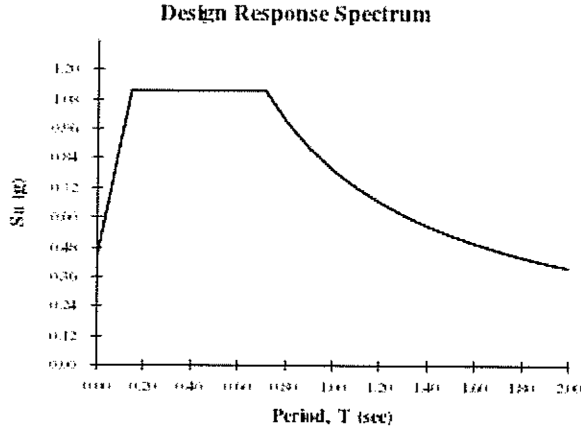
S_S =	1.672 g	S_{MS} =	1.672 g	S_{DS} =	1.115 g
S_1 =	0.793 g	S_{M1} =	1.190 g	S_{D1} =	0.793 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.

MCE_R Response Spectrum



Design Response Spectrum



For PGA_M, T_L, C_{RS}, and C_{R1} values, please view the detailed report.

USGS Design Maps Detailed Report

ASCE 7-10 Standard (33.76399°N, 116.36729°W)

Site Class D – "Stiff Soil", Risk Category I/II/III

Section 11.4.1 — Mapped Acceleration Parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_S) and 1.3 (to obtain S_1). Maps in the 2010 ASCE-7 Standard are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 11.4.3.

From Figure 22-1 [1] S_S = 1.672 g

From Figure 22-2 [2] S_1 = 0.793 g

Section 11.4.2 — Site Class

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class D, based on the site soil properties in accordance with Chapter 20.

Table 20.3–1 Site Classification

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: • Plasticity index $PI > 20$, • Moisture content $w \geq 40\%$, and • Undrained shear strength $\bar{s}_u < 500$ psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

Section 11.4.3 — Site Coefficients and Risk–Targeted Maximum Considered Earthquake (MCE_R) Spectral Response Acceleration Parameters

Table 11.4–1: Site Coefficient F_a

Site Class	Mapped MCE_R Spectral Response Acceleration Parameter at Short Period				
	$S_S \le 0.25$	$S_S = 0.50$	$S_S = 0.75$	$S_S = 1.00$	$S_S \ge 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_S

For Site Class = D and S_S = 1.672 g, F_a = 1.000

Table 11.4–2: Site Coefficient F_v

Site Class	Mapped MCE_R Spectral Response Acceleration Parameter at 1–s Period				
	$S_1 \le 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \ge 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_1

For Site Class = D and S_1 = 0.793 g, F_v = 1.500

Equation (11.4-1): $S_{MS} = F_aS_S = 1.000 \times 1.672 = 1.672$ g

Equation (11.4-2): $S_{M1} = F_vS_1 = 1.500 \times 0.793 = 1.190$ g

Section 11.4.4 — Design Spectral Acceleration Parameters

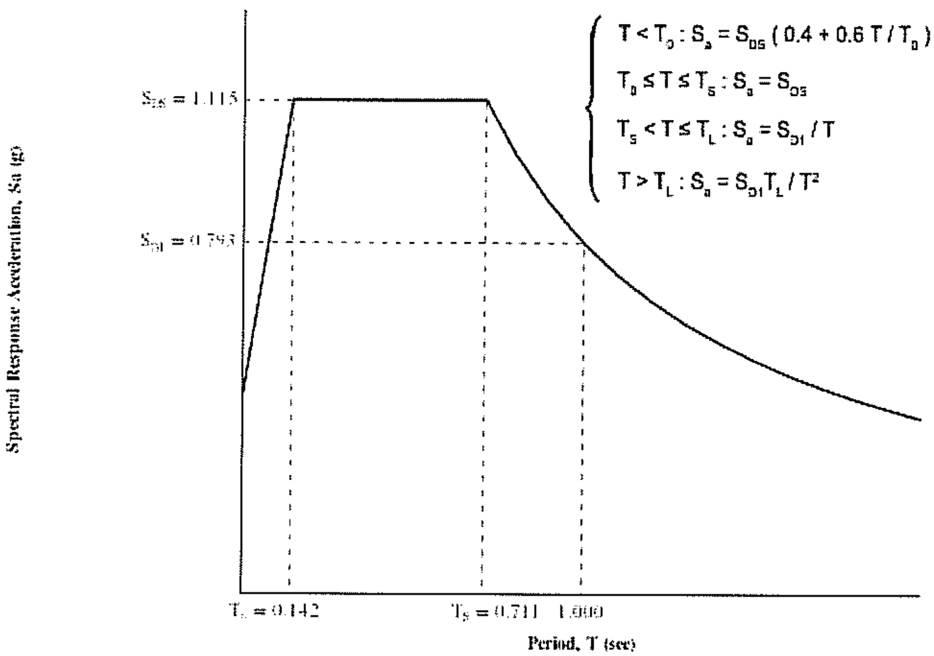
Equation (11.4-3): $S_{DS} = ⅔\, S_{MS} = ⅔ \times 1.672 = 1.115$ g

Equation (11.4-4): $S_{D1} = ⅔\, S_{M1} = ⅔ \times 1.190 = 0.793$ g

Section 11.4.5 — Design Response Spectrum

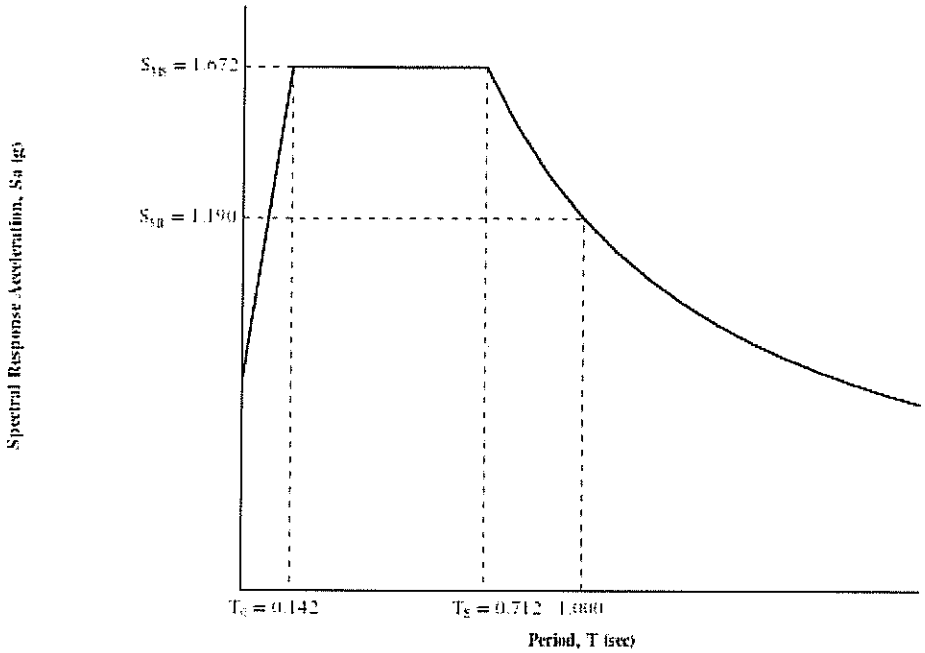
From Figure 22-12 [3] $T_L = 8$ seconds

Figure 11.4-1: Design Response Spectrum



Section 11.4.6 — Risk-Targeted Maximum Considered Earthquake (MCE_R) Response Spectrum

The MCE_R Response Spectrum is determined by multiplying the design response spectrum above by 1.5.



Section 11.8.3 — Additional Geotechnical Investigation Report Requirements for Seismic Design Categories D through F

From Figure 22-7 [4] PGA = 0.671

Equation (11.8–1): $PGA_M = F_{PGA}PGA = 1.000 \times 0.671 = 0.671$ g

Table 11.8–1: Site Coefficient F_{PGA}

Site Class	Mapped MCE Geometric Mean Peak Ground Acceleration, PGA				
	PGA ≤ 0.10	PGA = 0.20	PGA = 0.30	PGA = 0.40	PGA ≥ 0.50
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of PGA

For Site Class = D and PGA = 0.671 g, F_{PGA} = 1.000

Section 21.2.1.1 — Method 1 (from Chapter 21 – Site-Specific Ground Motion Procedures for Seismic Design)

From Figure 22-17 [5] C_{RS} = 1.022

From Figure 22-18 [6] C_{R1} = 0.980

Section 11.6 — Seismic Design Category

Table 11.6-1 Seismic Design Category Based on Short Period Response Acceleration Parameter

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \le S_{DS} < 0.33g$	B	B	C
$0.33g \le S_{DS} < 0.50g$	C	C	D
$0.50g \le S_{DS}$	D	D	D

For Risk Category = I and S_{DS} = 1.115 g, Seismic Design Category = D

Table 11.6-2 Seismic Design Category Based on 1-S Period Response Acceleration Parameter

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \le S_{D1} < 0.133g$	B	B	C
$0.133g \le S_{D1} < 0.20g$	C	C	D
$0.20g \le S_{D1}$	D	D	D

For Risk Category = I and S_{D1} = 0.793 g, Seismic Design Category = D

Note: When S_1 is greater than or equal to 0.75g, the Seismic Design Category is **E** for buildings in Risk Categories I, II, and III, and **F** for those in Risk Category IV, irrespective of the above.

Seismic Design Category ≡ "the more severe design category in accordance with Table 11.6-1 or 11.6-2" = E

Note: See Section 11.6 for alternative approaches to calculating Seismic Design Category.

References

1. *Figure 22-1*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-1.pdf
2. *Figure 22-2*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-2.pdf
3. *Figure 22-12*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-12.pdf
4. *Figure 22-7*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-7.pdf
5. *Figure 22-17*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-17.pdf
6. *Figure 22-18*: https://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-18.pdf

U.S. Geological Survey - Earthquake Hazards Program

Unified Hazard Tool

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

^ Input

Edition

Dynamic: Conterminous U.S. 2014 (v4.1.

Latitude

Decimal degrees

33.763988

Longitude

Decimal degrees, negative values for western longitudes

-116.367287

Site Class

259 m/s (Site class D)

Spectral Period

Peak ground acceleration

Time Horizon

Return period in years

475

^ Hazard Curve

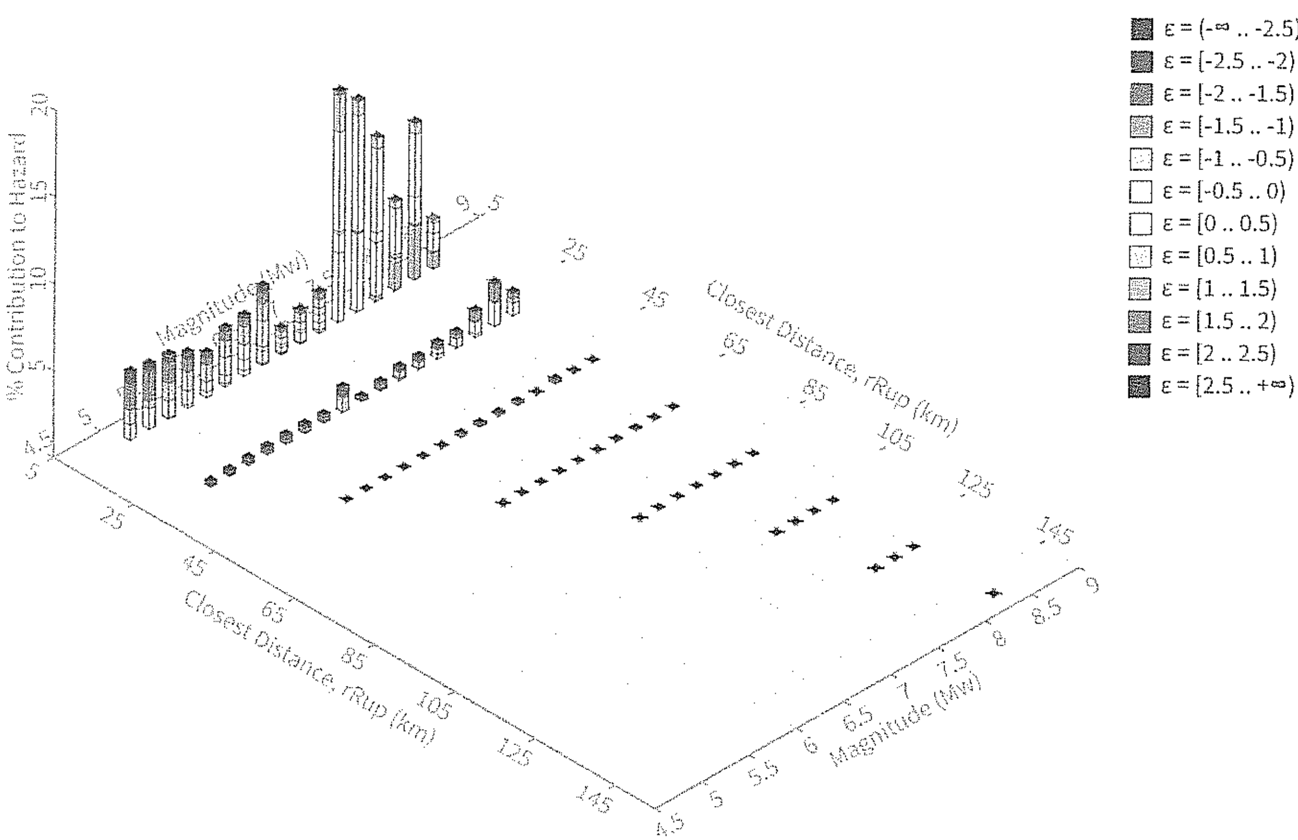
Please select "Edition", "Location" & "Site Class" above to compute a hazard curve.

Compute Hazard Curve

^ Deaggregation

Component

Total



Summary statistics for, Deaggregation: Total

Deaggregation targets

Return period: 475 yrs
Exceedance rate: 0.0021052632 yr^{-1}
PGA ground motion: 0.59827202 g

Recovered targets

Return period: 516.45448 yrs
Exceedance rate: 0.0019362791 yr^{-1}

Totals

Binned: 100 %
Residual: 0 %
Trace: 0.22 %

Mean (for all sources)

r: 12.87 km
m: 7.04
ε_0: 0.69 σ

Mode (largest r-m bin)

r: 9.27 km
m: 7.34
ε_0: 0.36 σ
Contribution: 13.25 %

Mode (largest ε_0 bin)

r: 8.57 km
m: 7.49
ε_0: 0.78 σ
Contribution: 6.69 %

Discretization

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

Epsilon keys

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

Deaggregation Contributors

Source Set ↳ Source	Type	r	m	ε_0	lon	lat	az	%
UC33brAvg_FM31	System							35.28
San Andreas (San Gorgonio Pass-Garnet Hill) [1]		8.53	7.58	0.21	116.329°W	33.833°N	24.65	22.86
San Jacinto (Anza) rev [4]		32.57	7.90	1.09	116.580°W	33.531°N	217.27	3.35
San Andreas (North Branch Mill Creek) [11]		9.47	7.87	0.10	116.303°W	33.826°N	41.01	2.69
San Andreas (Coachella) rev [0]		11.51	7.16	0.60	116.246°W	33.788°N	76.40	1.81
UC33brAvg_FM32	System							35.26
San Andreas (San Gorgonio Pass-Garnet Hill) [1]		8.53	7.58	0.21	116.329°W	33.833°N	24.65	22.76
San Jacinto (Anza) rev [4]		32.57	7.90	1.09	116.580°W	33.531°N	217.27	3.34
San Andreas (North Branch Mill Creek) [11]		9.47	7.84	0.11	116.303°W	33.826°N	41.01	2.85
San Andreas (Coachella) rev [0]		11.51	7.13	0.62	116.246°W	33.788°N	76.40	1.67
UC33brAvg_FM31 (opt)	Grid							14.73
PointSourceFinite: -116.367, 33.831		8.68	5.71	1.10	116.367°W	33.831°N	0.00	2.20
PointSourceFinite: -116.367, 33.831		8.68	5.71	1.10	116.367°W	33.831°N	0.00	2.20
PointSourceFinite: -116.367, 33.813		7.32	5.68	0.96	116.367°W	33.813°N	0.00	1.71
PointSourceFinite: -116.367, 33.813		7.32	5.68	0.96	116.367°W	33.813°N	0.00	1.71
UC33brAvg_FM32 (opt)	Grid							14.72
PointSourceFinite: -116.367, 33.831		8.68	5.71	1.10	116.367°W	33.831°N	0.00	2.20
PointSourceFinite: -116.367, 33.831		8.68	5.71	1.10	116.367°W	33.831°N	0.00	2.20
PointSourceFinite: -116.367, 33.813		7.32	5.68	0.96	116.367°W	33.813°N	0.00	1.71
PointSourceFinite: -116.367, 33.813		7.32	5.68	0.96	116.367°W	33.813°N	0.00	1.71