Appendix I

Geotechnical Engineering Investigation

Kimley»Horn

GEOTECHNICAL • ENVIRONMENTAL • GEOLOGY • MATERIALS TESTING & INSPECTION • FORENSIC • LABORATORY

GEOTECHNICAL ENGINEERING INVESTIGATION

PROPOSED 9.99MW GROUND MOUNT SOLAR ARRAY
AND BESS STORAGE
SOUTHEAST CORNER OF LEAR AVENUE
AND MESA DRIVE
TWENTY NINE PALMS, CALIFORNIA

SALEM PROJECT NO. 3-223-1036
NOVEMBER 21, 2023

PREPARED FOR:

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November 21, 2023 Project No. 3-223-1036

Ms. Brian Madigan
RPCA Solar 15, LLC
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Subject: **GEOTECHNICAL ENGINEERING INVESTIGATION**
PROPOSED 4.99 MW GROUND MOUNT SOLAR ARRAY
AND BESS STORAGE
SOUTHEAST CORNER OF LEAR AVENUE AND MESA DRIVE
TWENTY NINE PALMS, CALIFORNIA

Dear Mr. Madigan:

At your request and authorization, SALEM Engineering Group, Inc. (SALEM) has prepared this geotechnical engineering investigation report for the site of the proposed 9.99MW ground mounted solar array and BESS storage to be located at the subject site.

The accompanying report presents our findings, conclusions, and recommendations regarding the geotechnical aspects of designing and constructing the project as presently proposed. In our opinion, the proposed project is feasible from a geotechnical viewpoint provided our recommendations are incorporated into the design and construction of the project.

We appreciate the opportunity to assist you with this project. Should you have questions regarding this report or need additional information, please contact the undersigned at (559) 271-9700.

Respectfully Submitted,

SALEM ENGINEERING GROUP, INC.

Dean B. Ledgerwood II, PE, PG, CEG
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PROPOSED 4.99 MW GROUND MOUNT SOLAR ARRAY AND BESS STORAGE
SOUTHEAST CORNER OF LEAR AVENUE AND MESA DRIVE
TWENTY-NINE PALMS, CALIFORNIA

1. PURPOSE AND SCOPE

This report presents the results of our geotechnical engineering investigation for the site of the proposed 4.99 MW ground mount solar array and BESS storage to be located at the subject site near Twenty-Nine Palms, California as depicted on Figure 1, Vicinity Map.

SALEM Engineering Group, Inc. (SALEM) has completed this geotechnical engineering investigation with the purpose to observe and sample the subsurface conditions encountered at the site, and provide conclusions and recommendations relative to the geotechnical aspects of constructing the project as presently proposed. The recommendations presented herein are based on analysis of the data obtained during the investigation and our local experience with similar soil and geologic conditions.

If project details vary significantly from those described herein, SALEM should be contacted to determine the necessity for review and possible revision of this report.

If project details vary significantly from those described herein, SALEM Engineering Group, Inc. (SALEM) should be contacted to determine the necessity for review and possible revision of this report. Earthwork and Pavement Specifications are presented in Appendix C. If text of the report conflict with the specifications in Appendix C, the recommendations in the text of the report have precedence.

2. SITE LOCATION AND DESCRIPTION

The project site is located within a vacant area at latitude and longitude of 34.1770, -116.1465, southeast of the corner of Lear Avenue and Mesa Drive near Twenty Nine Palms, California.

The area of the proposed solar was currently vacant at the time of this investigation with sparse desert vegetation. Based on review of historical aerial imagery, the subject site appears to have been vacant since at least 1985.

The entire site is relatively flat with an elevations ranging from approximately 2,204 to 2,251 feet above mean sea level (AMSL) based on Google Earth Imagery.

3. PROJECT DESCRIPTION

We understand that the project includes the installation of a 9.99MW ground mount solar array in an area comprised of approximate 65 acres. The approximate limits of the solar array limits are shown on Site Plan Figure No. 2 at the end of this report.

Structural load information and other final details pertaining to the structures are unavailable. Construction will include equipment pads for inverters and associated equipment.

Based on previous similar projects, it is understood that the PV system structure will be supported on driven piles extending to approximate depths of 6 to 10 feet below existing grade. Foundation dead loads (DL) are light to moderate. A maximum deflection of 1 inch at ground level is considered in pile design.

A site grading plan was not available at the time of preparation of this report. In the event that changes occur in the nature or design of the project, the conclusions and recommendations contained in this report will not be considered valid unless the changes are reviewed and the conclusions of our report are modified.

The site configuration and locations of proposed improvements are shown on the Site Plan, Figure 2.

4. FIELD EXPLORATION

4.1. Drilling Test Borings

Our field exploration consisted of site surface reconnaissance and subsurface exploration. On October 19, 2023, a total of thirteen (13) test borings were drilled throughout the planned solar development to depths ranging from 16.5 to 21.5 feet BSG. The locations of the test borings are shown on Figure No. 2, Site Plan. The test borings were drilled using a truck mounted CME 75 drill rig equipped with hollow stem augers.

The materials encountered in the test borings were visually classified in the field, and logs were recorded by a field engineer at that time. Visual classification of the materials encountered in the test borings was generally made in accordance with the Unified Soil Classification System (ASTM D2487). The boring location can be found on the Site Plan, attached at the end of this report.

A soil classification chart and key to sampling is presented on the Unified Soil Classification Chart, in Appendix "A." The Test Boring Log is presented in Appendix "A." The Boring Log includes the soil type, color, moisture content, dry density, and the applicable Unified Soil Classification System symbol. The location of the test boring was determined by measuring from features shown on the Site Plan, provided to us. Hence, accuracy can be implied only to the degree that this method warrants.

The actual boundaries between different soil types may be gradual and soil conditions may vary. For a more detailed description of the materials encountered, the Boring Log in Appendix "A" should be consulted. Subsurface soil samples were obtained by driving a Modified California sampler (MCS) and a Standard Penetration Test (SPT) sampler. Penetration resistance blow counts were obtained by dropping an automated 140-pound trip hammer through a 30-inch free fall to drive the sampler to a maximum depth of 18 inches. The number of blows required to drive the last 12 inches is recorded as Penetration Resistance (blows/foot) on the logs of the boring. In case very high penetration resistance is encountered, the number of blows recorded may be for less than 12 inches.

Soil samples were obtained from the test boring at the depths shown on the boring logs. The MCS samples were recovered and capped at both ends to preserve the samples at their natural moisture content; SPT samples were recovered and placed in a sealed bag to preserve their natural moisture content.

4.2. Percolation Testing

As requested, two (2) percolation tests was performed at the site within the upper 5 feet below site grade. It is our understanding that the results of the testing performed will be utilized by others for the proposed stormwater disposal system.

The percolation test was conducted using an approximately 6-5/8 inch diameter percolation borehole using hollow stem auger. Approximately 2 to 4 inches of gravel was placed in the bottom of the hole followed by a 3-inch diameter perforated pipe. The holes were pre-saturated prior to percolation testing. The findings of the percolation testing is summarized in Section 6.4 of this report. The approximate locations of the percolation tests performed are shown on Figure 2 included at the end of this report.

5. LABORATORY TESTING

Laboratory tests were performed on selected soil samples to evaluate their physical characteristics and engineering properties. The laboratory-testing program was formulated with emphasis on the evaluation of natural moisture, shear strength, consolidation characteristics, expansion index, plasticity index, and gradation of the materials encountered.

In addition, chemical tests were performed to evaluate the corrosivity of the soils to buried concrete and metal; including soluble sulfate, chloride, pH, and soil resistivity. In addition, two (2) sets of thermal resistivity tests were performed on samples remolded to approximately 90 and 95 percent relative compaction. Details of the laboratory test program and the results of laboratory test are summarized in Appendix "B." This information, along with the field observations, was used to prepare the final boring logs in Appendix "A."

6. SOIL AND GROUNDWATER CONDITIONS

6.1 Subsurface Conditions

The subsurface conditions encountered appear typical of those found in the geologic region of the site. In general, the soils encountered included silty sands to depths of approximately 10 to 15 feet BSG underlain by poorly graded sands with silt to the maximum depth explored of 21.5 feet below site grade.

A consolidation test performed on a near surface soil sample resulted in about 11 percent consolidation under a load of 16 kips per square foot. When wetted under a nominal load of 2 kips per square foot the sample exhibited about 2.5 percent collapse. Four (4) direct shear tests resulted in internal angles of friction of 46, 40, 43, and 50 degrees with cohesion values of 43, 157, 75 pounds per square foot and “no cohesion”, respectively. Four (4) Atterberg limits tests on near surface soil samples resulted in plasticity indexes of 3, 1, 0, and 3 with liquid limits values of 25, 23, 20, and 24, respectively.

Two (2) R-value tests resulted in R-values of 59 and 63.

Soil conditions described in the previous paragraphs are generalized. Therefore, the reader should consult exploratory boring logs included in Appendix A for soil type, color, moisture, consistency, and USCS classification of the materials encountered at specific locations and elevations.

6.2 Results of Percolation Testing

The infiltration rate summarized in this report was prepared based on the methodology summarized in San Bernardino County Technical Guidance Appendix VII, Infiltration Rate Evaluation Protocol and Factor of Safety Recommendations.

Two (2) percolation tests (P-1 and P-2) were performed at the site within the upper 5 feet BSG. The percolation tests were presaturated and performed in general conformance with San Bernardino County requirements. The approximate locations of the percolation tests are shown on the attached Site Plan, Figure 2. The boreholes were advanced to the depths shown on the percolation test worksheets. The holes were pre-saturated before percolation testing commenced. Percolation rates were measured by filling the test holes with clean water and measuring the water drops at a certain time interval.

Approximately 7.75-inch diameter hand auger boreholes were advanced to the depths as illustrated in the following table. Approximately 2 inches of gravel was placed in the bottom of the test boring followed by a 3-inch diameter perforated pipe. The annulus surrounding the perforated pipe was backfilled with gravel. The holes were pre- saturated a before percolation testing commenced. The stabilized percolation rates were converted to an estimated infiltration using the Porchet Method (aka Inverse Borehole Method). SALEM recommends a minimum factor of safety of 2. The results of the field percolation testing are included at the end of this report.

Location	Depth, BSG (feet)	Estimated Average Stabilized Unfactored Infiltration Rate (inches/hour)	Factor of Safety	Average Stabilized Factored Infiltration Rate, (inches/hour)*	Soil Type (USCS)
P-1	4.75	1.73	2	0.87	SM
P-2	4.8	1.25	2	0.63	SM

For proposed underground storm water disposal systems, an average factored infiltration rate of 0.75 inches per hour may be considered for design.

Variations in soil type and soil density across the infiltration area of the system can influence the infiltration rate. Due to the variable infiltration characteristics, SALEM should be contacted to perform confirmation double ring infiltration testing during construction.

6.3 Groundwater

The test borings were checked for the presence of groundwater during and after the excavation operations. Groundwater was not encountered during the time of our subsurface investigation.

Available groundwater depth records with the California Department of Water Resources (www.water.ca.gov./waterlibrary) indicate Well Number 01N08E09L001S, located approximately 0.3 miles north of the project site reported a historical high groundwater depths to be greater than 300 feet BSG between 1994 and 2017.

It should be recognized that water table elevations may fluctuate with time, being dependent upon seasonal precipitation, irrigation, land use, localized pumping, and climatic conditions as well as other factors. Therefore, water level observations at the time of the field investigation may vary from those encountered during the construction phase of the project. The evaluation of such factors is beyond the scope of this report.

6.4 Soil Corrosion Screening

Excessive sulfate in either the soil or native water may result in an adverse reaction between the cement in concrete and the soil. The 2019 Edition of ACI 318 (ACI 318) has established criteria for evaluation of sulfate and chloride levels and how they relate to cement reactivity with soil and/or water. A soil sample was obtained from the project site and was tested for the evaluation of the potential for concrete deterioration or steel corrosion due to attack by soil-borne soluble salts and soluble chloride. The water-soluble sulfate concentration in the saturation extract from two (2) soil samples were detected to be less than 50 mg/kg.

ACI 318 Tables 19.3.1.1 and 19.3.2.1 outline exposure categories, classes, and concrete requirements by exposure class. ACI 318 requirements for site concrete based upon soluble sulfate are summarized in Table 6.4 below.

TABLE 6.4
WATER SOLUBLE SULFATE EXPOSURE REQUIREMENTS

Boring/Depth BSG	Dissolved Sulfate (SO_4) in Soil % by Weight	Exposure Severity	Exposure Class	Maximum w/cm Ratio	Minimum Concrete Compressive Strength	Cementitious Materials Type (ASTM C150)
B-1 / 0-4	<0.005	negligible	S0	NA	2,500 psi	No Restrictions
B-7 /0-4-	<0.005	negligible	S0	NA	2,500 psi	No Restrictions

The water-soluble chloride concentration detected in saturation extract from the soil samples tested were 34 and 46 mg/kg. In addition, testing performed on near surface soils resulted in minimum resistivity values of 3,008 and 6,845 ohm-centimeters. Based on the results, these soils would be considered to have a "mildly corrosive" potential to buried metal objects (per National Association of Corrosion Engineers, Corrosion Severity Ratings). It is recommended that, at a minimum, applicable manufacturer's recommendations for corrosion protection of buried metal pipe be closely followed.

6.5 Thermal Conductivity Testing

Thermal conductivity tests (ASTM D5334) were conducted on a set of near surface samples collected at depths of around 3 feet BSG. The samples were remolded to a dry density of about 90 and 95 percent of the maximum dry density determined in accordance with the standard proctor (ASTM D1557) and to in-situ dry density, then were tested for thermal resistivity at the saturated moisture content, 0 percent moisture, and four (4) intermediate moisture contents. The results of the thermal resistivity tests are provided in Table No. 6.5 below and included in Appendix B of this report.

TABLE 6.5
RESULTS OF THERMAL RESISTIVITY TESTING

Location	Depth, Feet BSG	Dry Density, PCF*	Moisture Content, %	Thermal Resistivity, ˚C-cm/W
B-4 (90% Relative Compaction)	1-4	110.3	0.0%	1.993
		116.3	2.9%	1.610
		116.6	5.8%	0.932
		117.1	8.3%	0.625
		118.4	11.5%	0.614
		111.8	13.7%	0.596
B-4 (95% Relative Compaction)	1-4	116.4	0.0%	1.718
		118.8	2.4%	1.469
		118.6	4.8%	0.985
		120.7	7.4%	0.911
		119.6	9.1%	0.592
		121.7	11.1%	0.603
B-13 (90% Relative Compaction)	1-4	112.5	0.0%	2.184
		116.7	2.9%	1.852
		116.5	5.9%	1.000
		119.0	8.5%	0.591
		121.5	11.0%	0.592
		115.6	14.0%	0.574
B-13 (95% Relative Compaction)	1-4	118.7	0.0%	2.302
		119.1	2.5%	1.551
		121.3	4.8%	0.937
		123.2	7.1%	0.669
		123.9	9.0%	0.628
		119.7	11.5%	0.613

7. GEOLOGIC SETTING

The subject site is located approximately 23 miles west of Twenty Nine Palms, California, which is situated in the northern edge of Mojave Desert Province of California and lies in the Eastern California Shear Zone.

The project site is located in the northwest portion of the Mojave Desert Geomorphic province, which, in turn, is situated on the Mojave Block. The Mojave Block is a triangular fault block bound on the north by the Garlock Fault, on the southwest by the San Andreas Fault, and on the east by the Colorado River. The project site is underlain by recent age alluvium derived from local granitic rocks. The alluvium consists mainly of silts, sands, and gravels with minor amounts of clay.

Based on review of the Geologic map of the Twentynine Palms quadrangle, San Bernardino and Riverside Counties, California [1], the area the subject site is in an area mapped as older alluvial deposits (Qoa).

8. GEOLOGIC HAZARDS

8.1 Faulting and Seismicity

Based on the proximity of several dominant active faults and seismogenic structures, as well as the historic seismic record, the area of the subject site is considered subject to relatively low seismicity.

The project area is not within an Alquist-Priolo Special Studies Zone and will not require a special site investigation by an Engineering Geologist. Based on our experience in the Twenty Nine Palms region and the test borings drilled for this investigation, the soils on site are classified as Site Class D in accordance with Chapter 16 of the California Building Code. The proposed structures are determined to be in Seismic Design Category D.

To determine the distance of known active faults within 100 miles of the site, we used the United States Geological Survey (USGS) web-based application *2008 National Seismic Hazard Maps - Fault Parameters*. Site latitude is 34.1770° North; site longitude is -116.1465 ° West. The ten closest active faults are summarized below in Table 8.1.

TABLE 8.1
REGIONAL FAULT SUMMARY

Fault Name	Distance to Site (miles)	Maximum Earthquake Magnitude, M_w
Calico-Hidalgo	0.51	7.4
So Emerson-Copper Mtn	2.33	7.1
Pinto Mtn	2.39	7.3
Pisgah-Bullion Mtn-Mesquite Lk	5.17	7.3
Eureka Peak	14.6	6.7
Burnt Mtn	15.72	6.8
Landers	15.78	7.4
Johnson Valley (No)	20.2	6.9
North Frontal (East)	23.58	7.0
S. San Andreas;NSB+SSB+BG+CO	26.38	7.6

The faults tabulated above and numerous other faults in the region are sources of potential ground motion. However, earthquakes that might occur on other faults throughout California are also potential generators of significant ground motion and could subject the site to intense ground shaking.

8.2 Surface Fault Rupture

The site is not within a currently established State of California Earthquake Fault Zone for surface fault rupture hazards. The nearest potentially active faults identified by the CGS Interactive Fault Activity Map of California is the Calico-Hidalgo fault located approximately 0.5 miles north of the site. No active faults with the potential for surface fault rupture are known to pass directly beneath the site. Therefore, the potential for

[1] Dibblee, T.W., 1968, Geologic map of the Twentynine Palms quadrangle, San Bernardino and Riverside Counties, California, U.S. Geological Survey, Miscellaneous Geologic Investigations Map I-561

surface rupture due to faulting occurring beneath the site during the design life of the proposed development is considered low to moderate.

8.3 Ground Shaking

Seismic coefficients and spectral response acceleration values were developed based on the 2022 California Building Code (CBC). The CBC methodology for determining design ground motion values is based on the Office of Statewide Health Planning and Development (OSHPD) Seismic Design Maps, which incorporate both probabilistic and deterministic seismic ground motion. Table 9.6.1 include design seismic coefficients and spectral response parameters, based on the 2022 California Building Code (CBC) for the project foundation design.

Based on the 2022 CBC and limited nature of this investigation, a Site Class D was selected for the subject site. A table providing the recommended design acceleration parameters for the project site, based on a Site Class D designation, is included in section 9.6.1 of this report.

Based on Office of Statewide Health Planning and Development (OSHPD) Seismic Design Maps, the estimated design peak ground acceleration adjusted for site class effects (PGA_M) was determined to be 0.901g (based on both probabilistic and deterministic seismic ground motion).

8.4 Liquefaction

Soil liquefaction is a state of soil particles suspension caused by a complete loss of strength when the effective stress drops to zero. Liquefaction normally occurs under saturated conditions in soils such as sand in which the strength is purely frictional. Primary factors that trigger liquefaction are: moderate to strong ground shaking (seismic source), relatively clean, loose granular soils (primarily poorly graded sands and silty sands), and saturated soil conditions (shallow groundwater). Due to the increasing overburden pressure with depth, liquefaction of granular soils is generally limited to the upper 50 feet of a soil profile.

In general, the soils encountered included silty sands to depths of approximately 10 to 15 feet BSG underlain by poorly graded sands with silt to the maximum depth explored of 21.5 feet below site grade.

Free groundwater was not encountered to the depth of exploration during this investigation. Based on available water well data, historic groundwater depths are greater than 300 feet below site grade

A 50 foot deep test boring for liquefaction analysis was not included as part of this investigation. Based on our experience in the Bakersfield area and the historic depth to groundwater (greater than 100 feet BSG), liquefaction/seismic settlement is not a concern to impact the site development.

8.5 Lateral Spreading

Lateral spreading is a phenomenon in which soils move laterally during seismic shaking and is often associated with liquefaction. The amount of movement depends on the soil strength, duration and intensity of seismic shaking, topography, and free face geometry. Due to the relatively flat site topography, we judge the likelihood of lateral spreading to be low.

8.6 Landslides

There are no known landslides at the site, nor is the site in the path of any known or potential landslides. We do not consider the potential for a landslide to be a hazard to this project.

8.7 Tsunamis and Seiches

The site is not located within a coastal area. Therefore, tsunamis (seismic sea waves) are not considered a potentially significant hazard at the site.

Seiches are large waves generated in enclosed bodies of water in response to ground shaking. No major water-retaining structures are located immediately up gradient from the project site. Flooding from a seismically-induced seiche is considered unlikely.

9. CONCLUSIONS AND RECOMMENDATIONS

9.1 General

9.1.1 Based upon the data collected during this investigation, and from a geotechnical engineering standpoint, it is our opinion that the site is suitable for the proposed construction as planned, provided the recommendations contained in this report are incorporated into the project design and construction. Conclusions and recommendations provided in this report are based on our review of available literature, analysis of data obtained from our field exploration and laboratory testing program, and our understanding of the proposed development at this time.

The following recommendations were prepared based on the geotechnical engineering data obtained from the borings and laboratory testing conducted as part of this investigation. It is our understanding that pile load test data may be used to assess the capacities of the soil and the effects of soil-pile interaction. From a geotechnical engineering perspective, in-situ pile testing may be conducted and used as a basis for design, provided that the testing, design analysis and selection of safety factors are conducted in a rational method determined by the design engineer for the lightly loaded shallow piles supporting the PV systems.’

9.1.2 In general, the soils encountered included silty sands to depths of approximately 10 to 15 feet BSG underlain by poorly graded sands with silt to the maximum depth explored of 21.5 feet below site grade. Groundwater was not encountered at the time of this investigation.

9.1.3 Based on the results of the laboratory testing performed, the soils encountered have moderate to high compressibility characteristics, moderate collapse potential, and very low expansion potential.

9.1.4 Laboratory tests indicate the near surface soils are “mildly corrosive” to buried metal objects and a “negligible” (Sulfate Class S0) potential for sulfate attack on concrete.

9.1.5 Based on the subsurface conditions at the site and the anticipated structural loading, the proposed solar panels and associated equipment slabs may be supported using foundations presented in this report.

9.1.6 Provided the site is graded in accordance with the recommendations of this report and foundations constructed as described herein, we estimate that total settlement due to static will be about 1 inch and corresponding differential settlement will about ½ inch between piles.

9.1.7 Based on the results of the laboratory testing performed and average in-place density of the upper soils encountered, a shrinkage factor of 1 percent was estimated for the site.

9.1.8 All references to relative compaction and optimum moisture content in this report are based on ASTM D1557 (latest edition).

9.1.9 SALEM Engineering Group, Inc. should be retained to review the project plans as they develop further, provide engineering consultation as-needed, and perform geotechnical observation and testing services during construction.

9.2 Surface Drainage

9.2.1 Proper surface drainage is critical to the future performance of the project. Uncontrolled infiltration of irrigation excess and storm runoff into the soils can adversely affect the performance of the planned improvements. Saturation of a soil can cause it to lose internal shear strength and increase its compressibility, resulting in a change to important engineering properties. Proper drainage should be maintained at all times.

9.2.2 All site drainage should be collected and transferred away from improvements in non-erosive drainage devices. Drainage should not be allowed to pond anywhere on the site, and especially not against any foundations or retaining walls. Drainage should not be allowed to flow uncontrolled over any descending slope.

9.2.3 Positive site drainage should be provided away from structures, pavement, and the tops of slopes to swales or other controlled drainage structures. The construction pads should be fine graded such that water is not allowed to pond. Final soil grade should slope a minimum of 2 percent away from structures.

9.3 Site Grading

9.3.1 A representative of our firm should be present during all site clearing and grading operations to test and observe earthwork construction. This testing and observation is an integral part of our service as acceptance of earthwork construction is dependent upon compaction of the material and the stability of the material. The Geotechnical Engineer may reject any material that does not meet compaction and stability requirements. Further recommendations of this report are predicated upon the assumption that earthwork construction will conform to recommendations set forth in this section as well as other portions of this report.

9.3.2 A pre-construction conference should be held at the site prior to the beginning of grading operations with the owner, contractor, civil engineer and geotechnical engineer in attendance.

9.3.3 Site grading activities shall include removal of all vegetation and demolition of surface obstructions not intended to be incorporated into final site design. In addition, underground buried structures and/or utility lines encountered during demolition and construction should be properly removed and the resulting excavations backfilled with Engineered Fill. After removal and demolition activities, it is recommended that disturbed soils be recompacted as engineered fill.

9.3.4 Site preparation should begin with removal of existing surface/subsurface structures, underground utilities (as required), any existing uncertified fill, and debris. Excavations or depressions resulting from site clearing operations, or other existing excavations or depressions, should be restored with Engineered Fill in accordance with the recommendations of this report.

9.3.5 Surface vegetation should be removed by stripping to a sufficient depth to remove organic-rich topsoil. The upper 4 to 6 inches of the soils containing, vegetation, roots and other objectionable organic matter encountered at the time of grading should be stripped and removed from the surface. Deeper stripping may be required in localized areas. The stripped vegetation, will not be suitable for use as Engineered Fill. However, stripped topsoil may be stockpiled and reused in landscape or non-structural areas or exported from the site.

9.3.6 Areas of proposed BESS equipment slabs should be over-excavated to a minimum of 12 inches below bottom of proposed equipment slabs, 12 inches below preconstruction site grades, or to the depth to remove undocumented fills (if any), whichever is greater. The resulting bottom of over excavation should be scarified to a depth of at least 12 inches, worked until uniform and free from large clods, moisture conditioned to slightly above optimum moisture, and compacted to a minimum of 92 percent of the maximum density. The horizontal limits of the over-excavation should extend throughout the equipment pad over-build zone, laterally to a minimum of 3 feet beyond the outer edges of the proposed footings.

Equipment slabs on grade should be supported on a minimum of 4 inches of Class 2 aggregate base over the depth of engineered fill recommended above. Deepened edges are recommended for equipment slabs to reduce the potential for moisture fluctuations under the slabs. The thickened edges should extend to at least as deep as the bottom of the aggregate base section recommended under the slab.

9.3.7 Following stripping, to provide uniform support for the proposed tank, it is recommended that over-excavation extend to at least 24 inches below preconstruction site grade, to 12 inches below bottom of proposed foundations, to the depth required to remove root/organic material, or to the depth required to remove any undocumented fills (if encountered), whichever is greater. The resulting bottom of over excavation should be scarified to a minimum depth of at least 12 inches, worked until uniform and free from large clods, moisture-conditioned to slightly above optimum moisture, and compacted to 92 percent of the maximum density. The horizontal limits of the over-excavation should extend throughout the tank limits and over-build zone, extending laterally to a minimum of 5 feet beyond the outer edges of the proposed footings.

9.3.8 Areas of unpaved access roads should be prepared by scarification of the upper 12 inches, moisture condition to slightly above optimum and compacted to a minimum of 95 percent relative compaction (ASTM D1557). Unpaved access roads should be capped with a minimum of 8 inches of Caltrans class 2 aggregate base material compacted to 95 percent relative compaction. To improve roadway stability and reduced required aggregate base section, the unpaved roadway may comprise of 6 inches of Class 2 Aggregate base over a Tensar NX750 geogrid, or equivalent, over compacted subgrade prepared as recommended above.

9.3.9 Areas of proposed asphaltic concrete pavements should be over-excavated to a minimum of 1 foot below preconstruction site grade or 1 foot below the bottom of the proposed aggregate base section, whichever provides greater fill. The bottom of excavation should be scarified 12 inches, moisture conditioned to slightly above optimum and compacted to 92 percent relative compaction. Subgrade soils within the upper 12 inches below pavement areas should be compacted to 95 percent relative compaction. The horizontal limits of the over-excavation should extend throughout the pavement areas and laterally to a minimum of 3 feet beyond the outer edges of the proposed pavements.

9.3.10 An integral part of satisfactory fill placement is the stability of the placed lift of soil. If placed materials exhibit excessive instability as determined by a SALEM field representative, the lift will be considered unacceptable and shall be remedied prior to placement of additional fill material. Additional lifts should not be placed if the previous lift did not meet the required dry density or if soil conditions are not stable.

9.3.11 The most effective site preparation alternatives will depend on site conditions prior to grading. We should evaluate site conditions and provide supplemental recommendations immediately prior to grading, if necessary.

9.3.12 We do not anticipate groundwater or seepage to adversely affect construction. Project site stabilization consisting of placement of aggregate base and protecting exposed soils during construction should be performed. If the construction schedule requires grading operations during the wet season, we can provide additional recommendations as conditions warrant.

9.3.13 Typical remedial measures include: discing and aerating the soil during dry weather; mixing the soil with dryer materials; removing and replacing the soil with an approved fill material or placement of crushed rocks or aggregate base material; or mixing the soil with an approved lime or cement product.

The most common remedial measure of stabilizing the bottom of the excavation due to wet soil condition is to reduce the moisture of the soil to near the optimum moisture content by having the subgrade soils scarified and aerated or mixed with drier soils prior to compacting. However, the drying process may require an extended period of time and delay the construction operation. To expedite the stabilizing process, crushed rock may be utilized for stabilization provided this method is approved by the owner for the cost purpose.

If the use of crushed rock is considered, it is recommended that the upper soft and wet soils be replaced by 12 to 30 inches of ¾-inch to 1-inch crushed rocks. The thickness of the rock layer depends on the severity of the soil instability. The recommended 12 to 30 inches of crushed rock material will provide a stable platform. It is further recommended that lighter compaction equipment be utilized for compacting the crushed rock. All open graded crushed rock/gravel should be fully encapsulated with a geotextile fabric (such as Mirafi 140N) to minimize migration of soil particles into the voids of the crushed rock. Although it is not required, the use of geogrid (e.g. Tensar BX 1100, BX 1200 or TX 160) below the crushed rock will enhance stability and reduce the required thickness of crushed rock necessary for stabilization.

Our firm should be consulted prior to implementing remedial measures to provide appropriate recommendations.

9.4 Soil and Excavation Characteristics

9.4.1 Based on the soil conditions encountered in our borings, the onsite soils can be excavated with moderate effort using conventional excavation equipment.

9.4.2 It is the responsibility of the contractor to ensure that all excavations and trenches are properly shored and maintained in accordance with applicable Occupational Safety and Health Administration

(OSHA) rules and regulations to maintain safety and maintain the stability of adjacent existing improvements. Temporary excavations are further discussed in a later Section of this report.

9.4.3 The upper soils within the project site are identified primarily as clays. These soils in their present condition possess low risk to the proposed construction in terms of possible post-construction settlement if no mitigation measures are employed.

9.4.3 The near surface soils identified as part of our investigation are, generally, damp to moist due to the absorption characteristics of the soil. Earthwork operations may encounter very moist unstable soils which may require removal to a stable bottom. Exposed native soils exposed as part of site grading operations shall not be allowed to dry out and should be kept continuously moist prior to placement of subsequent fill.

9.5 Materials for Fill

9.5.1 On-site soils are considered suitable for use as engineered fill, provided these soils do not contain deleterious matter, organic material, or rock material larger than 3 inches in maximum dimension.

9.5.2 Import soil intended for use as Non-Expansive Engineered Fill soil, shall be well-graded, slightly cohesive silty sand or sandy silt. This material should be approved by the Engineer prior to use and should typically possess the soil characteristics summarized below in Table 9.5.2.

TABLE 9.5.2
IMPORT NON-EXPANSIVE FILL REQUIREMENTS

Percent Passing 3-inch Sieve	100
Percent Passing No.4 Sieve	75-100
Percent Passing No 200 Sieve	15-40
Maximum Plasticity Index	15
Maximum Expansion Index (ASTM D4829)	15

Prior to importing the Contractor should demonstrate to the Owner that the proposed import meets the requirements for import fill specified in this report. In addition, the material should be verified by the Contractor that the soils do not contain any environmental contaminates as regulated by local, state, or federal agencies, as applicable

9.5.3 All Engineered Fill (including scarified ground surfaces and backfill) should be placed in lifts no thicker than will allow for adequate bonding and compaction (typically 6 to 8 inches in loose thickness).

9.5.4 On-Site Soils used as engineered fill soils should moisture conditioned to slightly above optimum moisture content and compacted to at least 92 percent relative compaction.

9.5.5 Import Non-expansive Engineered Fill, should be placed, moisture conditioned to slightly above optimum moisture content, and compacted to at least 92 percent relative compaction.

9.5.6 The preferred materials specified for Engineered Fill are suitable for most applications with the exception of exposure to erosion. Project site winterization and protection of exposed soils during the construction phase should be the sole responsibility of the Contractor, since they have complete control of the project site.

9.5.7 Environmental characteristics and corrosion potential of import soil materials should also be considered.

9.5.8 Proposed import materials should be sampled, tested, and approved by SALEM prior to its transportation to the site.

9.5.9 Aggregate base material should meet the requirements of a Caltrans Class 2 Aggregate Base. The aggregate base material should conform to the requirements of Section 26 of the Standard Specifications for Class 2 material, ¾-inch or 1½-inches maximum size. The aggregate base material should be compacted to a minimum relative compaction of 95 percent based ASTM D1557. The aggregate base material should be spread in layers not exceeding 6 inches and each layer of aggregate material course should be tested and approved by the Soils Engineer prior to the placement of successive layers.

9.6 Seismic Design Criteria

9.6.1 For seismic design of the structures, and in accordance with the seismic provisions of the 2022 CBC, our recommended parameters are shown below. These parameters were determined using Office of Statewide Health Planning and Development (OSHPD) Seismic Design Maps by location website (https://seismicmaps.org/), in accordance with the 2022 CBC. The Site Class was determined based on the soils encountered during our field exploration.

TABLE 9.6.1
2022 CBC SEISMIC DESIGN PARAMETERS

Seismic Item	Symbol	Value	2016 ASCE 7 or 2022 CBC Reference
Site Coordinates (Datum = NAD 83)		34.1770 Lat -116.1465 Lon	
Site Class	--	D	ASCE 7-16 Table 20.3
Soil Profile Name	--	Stiff Soil	ASCE 7-16 Table 20.3
Risk Category	--	I/II	CBC Table 1604.5
Site Coefficient for PGA	F_{PGA}	1.100	ASCE 7-16 Table 11.8-1
Peak Ground Acceleration (adjusted for Site Class effects)	PGA_M	0.901	ASCE 7-16 Equation 11.8-1
Seismic Design Category	SDC	D	ASCE 7-16 Table 11.6-1 & 2
Mapped Spectral Acceleration (Short period - 0.2 sec)	S_S	1.846 g	CBC Figure 1613.2.1(1)
Mapped Spectral Acceleration (1.0 sec. period)	S_1	0.686 g	CBC Figure 1613.2.1(3)
Site Class Modified Site Coefficient	F_a	1.000	CBC Table 1613.2.3(1)
Site Class Modified Site Coefficient	F_v	**1.700 ***	CBC Table 1613.2.3(2)
MCE Spectral Response Acceleration	S_{MS}	1.846 g	CBC Equation 16-20

Seismic Item	Symbol	Value	2016 ASCE 7 or 2022 CBC Reference
(Short period - 0.2 sec) $S_{MS} = F_a S_S$			
MCE Spectral Response Acceleration (1.0 sec. period) $1.5*S_{M1} = 1.5*(F_v S_1)$	$1.5*S_{M1}$	**2.213 g***	ASCE 7-16 11.4-2/ Supplement 3
Design Spectral Response Acceleration S_{DS}=⅔S_{MS} (short period - 0.2 sec)	S_{DS}	1.231 g	CBC Equation 16-22
Design Spectral Response Acceleration S_{D1}=⅔S_{M1} (1.0 sec. period)	S_{D1}	**1.476 g***	CBC Equation 16-23
Short Period Transition Period (S_{D1}/S_{DS}), Seconds	T_S	1.199	ASCE 7-16, Section 11.4.6
Long Period Transition period (seconds)	T_L	12	ASCE 7-16, Figures 22-14 through 22-17

Note: * Values Fv, SM1, and SD1 determined per ASCE Table 11.4.2 for use in calculating TS only

These values should not be used in structural design. Site Specific Ground Motion Analysis was not included in the scope of this investigation. Per ASCE 11.4.8, Structures on Site Class D, with S_1 greater than or equal to 0.2 may require Site Specific Ground Motion Analysis. The value reported for S_{M1} includes a 50% increase in accordance with exceptions listed in ASCE 7-16 - Supplement 3. In the event a site specific ground motion analysis is required, SALEM should be contacted for these services.

9.6.2 Conformance to the criteria in the above table for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur if a large earthquake occurs. The primary goal of seismic design is to protect life, not to avoid all damage, since such design may be economically prohibitive.

9.7 Small Diameter Driven Pile Foundations

9.7.1 Solar arrays may be supported using driven steel piles (small diameter H-piles, C-Shape Piles, etc.). **Driven piles should have a minimum embedment depth of 6 feet BSG or the depth required by the structural engineer, whichever is greater.**

9.7.2 Piles should be embedded in undisturbed native soils. If disturbed soils are present from tree removal activities, these areas should be over-excavated and backfilled with engineered fill per the recommendations of section 9.3 of this report.

9.7.3 The allowable downward load capacity of the driven piles below 1-foot BSG, may be designed based on an allowable skin friction value of 200 pounds per square foot. End bearing should not be used for design. An end bearing of 3,000 pounds per square foot may be considered for design. The effective area in calculating the pile capacity should be the outer perimeter dimensions of the pile section (e.g, for a W6 x 6 x 15, the effective side friction area should be 4 sides multiplied by 6" per foot of pile length embedded into the soil). An increase of one-third may be applied when using the alternate load combination in Section 1605.3.2 of the 2019 CBC that includes wind or earthquake loads.

9.7.4 Uplift loads can be resisted by piles using 60 percent of the allowable downward side friction plus the weight of the pile.

9.7.5 Total and differential static settlement of 1 inch and ½ inch in 30 feet or between piles, whichever is less, should be considered in design.

9.7.6 Passive resistance in the upper portion of the driven piles, to a depth of 1 foot, should be neglected in design. The driven piles may be designed for an allowable lateral capacity of 400 pounds per square foot per foot of depth below the lowest adjacent grade to a maximum of 4,000 pounds per square foot. The passive pressure for driven piles spaced at a minimum of three (3) pile diameters may be applied over a width equal to two (2) pile diameters. No other increases should be applied to the allowable passive pressure.

9.7.7 9.7.7 If desired, the piles may be designed using LPILE and the parameters presented in Table 9.7.7.

TABLE 9.7.7
LPILE PARAMETERS

Depth, Feet BSG	L-Pile Soil Type	Design N-Value	Effective Unit Weight (pcf)	Design Phi Angle, degrees	Static Modulus of Subgrade Reaction, K (pci)
1-20	Sand (Reese)	20	130	42	90

The upper 1 foot should be neglected in design

9.8 Concrete Equipment Slabs-on-Grade (miscellaneous equipment and BESS pads)

9.8.1 Slab thickness and reinforcement should be determined by the structural engineer based on the anticipated loading.

9.8.2 Equipment slabs supported on a minimum of 4 inches of class 2 aggregate base over the depth of engineered fill prepared in accordance with the recommendations included in section 9.3 of this report may be designed based on an allowable bearing capacity of 1,500 pounds per square foot. A structural engineer should recommend the thickness and reinforcement details based on a total static settlement of 1 inch and ½ inch in 30 feet or across the diameter of the slab, whichever is less.

9.8.3 Equipment slabs should include a thickened edge extending to the bottom of the recommended aggregate base section.

9.8.4 The lateral resistance for equipment slab may be designed based on an allowable fluid passive pressure of 400 pounds per cubic foot. This value may be increased by 1/3 for wind and seismic loading. The bottom surface of concrete slabs may be designed based on an allowable coefficient of friction of 0.38.

9.8.5 Proper finishing and curing should be performed in accordance with the latest guidelines provided by the American Concrete Institute, Portland Cement Association, and ASTM.

9.8.6 The moisture content of the subgrade soils should be verified to be slightly percent above optimum prior to placement of the imported non-expansive engineered fill section.

9.9 Temporary Excavations

9.9.1 We anticipate that the majority of the sandy site soils will be classified as Cal-OSHA "Type C" soil when encountered in excavations during site development and construction. Excavation sloping, benching, the use of trench shields, and the placement of trench spoils should conform to the latest applicable Cal-OSHA standards. The contractor should have a Cal-OSHA-approved "competent person" onsite during excavation to evaluate trench conditions and make appropriate recommendations where necessary.

9.9.2 It is the contractor's responsibility to provide sufficient and safe excavation support as well as protecting nearby utilities, structures, and other improvements which may be damaged by earth movements. All onsite excavations must be conducted in such a manner that potential surcharges from existing structures, construction equipment, and vehicle loads are resisted. The surcharge area may be defined by a 1:1 projection down and away from the bottom of an existing foundation or vehicle load.

9.9.3 Temporary excavations and slope faces should be protected from rainfall and erosion. Surface runoff should be directed away from excavations and slopes.

9.9.4 Open, unbraced excavations in undisturbed soils should be made according to the slopes presented in Table 9.9.4 below.

TABLE 9.9.4
RECOMMENDED EXCAVATION SLOPES

Depth of Excavation (ft)	Slope (Horizontal : Vertical)
0-5	1:1
5-10	1½:1
10-15	2:1

9.9.5 If, due to space limitation, excavations near existing structures are performed in a vertical position, braced shorings or shields may be used for supporting vertical excavations. Therefore, in order to comply with the local and state safety regulations, a properly designed and installed shoring system would be required to accomplish planned excavations and installation. A Specialty Shoring Contractor should be responsible for the design and installation of such a shoring system during construction.

9.9.6 Braced shorings should be designed for a maximum pressure distribution of 20H, (where H is the depth of the excavation in feet). The foregoing does not include excess hydrostatic pressure or surcharge loading. Fifty percent of any surcharge load, such as construction equipment weight, should be added to the lateral load given herein. Equipment traffic should concurrently be limited to an area at least 3 feet from the shoring face or edge of the slope.

9.9.7 The excavation and shoring recommendations provided herein are based on soil characteristics derived from the borings within the area. Variations in soil conditions will likely be encountered during the excavations. SALEM should be afforded the opportunity to provide field review to evaluate the actual conditions and account for field condition variations not otherwise anticipated in the preparation of this recommendation. Slope height, slope inclination, or excavation depth should in no case exceed those specified in local, state, or federal safety regulation, (e.g. OSHA) standards for excavations, 29 CFR part 1926, or Assessor's regulations.

9.10 Underground Utilities

9.10.1 Underground utility trenches should be backfilled with properly compacted material. The material excavated from the trenches should be adequate for use as backfill provided it does not contain deleterious matter, vegetation or rock larger than 3 inches in maximum dimension. Trench backfill should be placed in loose lifts not exceeding 8 inches and compacted to at least 90 percent relative compaction at or above optimum moisture content. The upper 12 inches of trench backfill within asphalt or concrete paved areas shall be moisture conditioned to at or above optimum moisture content and compacted to at least 95 percent relative compaction.

9.10.2 Bedding and pipe zone backfill typically extends from the bottom of the trench excavations to approximately 12 inches above the crown of the pipe. Pipe bedding, haunches and initial fill extending to 1 foot above the pipe should consist of a clean well graded sand with 100 percent passing the #4 sieve, a maximum of 15 percent passing the #200 sieve, and a minimum sand equivalent of 20.

9.10.3 It is suggested that underground utilities crossing beneath new or existing structures be plugged at entry and exit locations to the new structures to prevent water migration. Trench plugs can consist of on-site clay soils, if available, or sand cement slurry. The trench plugs should extend 2 feet beyond each side of individual perimeter foundations.

9.10.4 The contractor is responsible for removing all water-sensitive soils from the trench regardless of the backfill location and compaction requirements. The contractor should use appropriate equipment and methods to avoid damage to the utilities and/or structures during fill placement and compaction.

9.11 Pavement Design

9.11.1 During grading subgrade samples should be tested to verify the recommendations included in this report remain valid. The pavement design recommendations provided herein are based on the State of California Department of Transportation (CALTRANS) design manual. Based on the results of the R-value testing performed near surface samples and requirements of Caltrans Highway Design Manual, an R-value of 50 was selected for design.

9.11.2 The asphaltic concrete (flexible pavement) is based on a 20-year pavement life utilizing traffic indexes of ranging from 4.0 to 8.0. The Civil Engineer should select the appropriate pavement section based on the anticipated traffic loading. The following table shows the recommended pavement sections for various traffic indices.

TABLE 9.11.2
ASPHALT CONCRETE PAVEMENT THICKNESSES

Traffic Index	Asphaltic Concrete, (inches)	Class 2 Aggregate Base, (inches)*	Compacted Subgrade, (inches)*
4.0	2.5	4.0	12.0
5.0	2.5	4.0	12.0
6.0	3.0	4.0	12.0
7.0	4.0	4.5	12.0
8.0	4.5	6.0	12.0

95% compaction based on ASTM D1557 Test Method

9.11.3 The following recommendations are for Portland Cement Concrete pavement sections.

TABLE 9.11.3
PORTLAND CEMENT CONCRETE PAVEMENT THICKNESSES

Traffic Index	Portland Cement Concrete, (inches)*	Class 2 Aggregate Base, (inches)**	Compacted Subgrade. (inches)**
4.0	6.0	4.0	12.0
5.0	6.0	4.0	12.0
6.0	6.0	4.0	12.0
7.0	6.0	4.0	12.0
8.0	6.5	4.0	12.0

**** Minimum Compressive Strength of 4,000 psi,***
***** 95% compaction based on ASTM D1557 Test Method***

9.11.4 Asphalt concrete should conform to Section 39 of Caltrans' latest Standard Specifications for ½ inch Hot Mix Asphalt (HMA) Type A. Asphaltic concrete pavements should be compacted in accordance with Caltrans Standard Specifications (current edition).

9.11.5 Excavations, depressions, or firm and pliant areas extending below planned finished subgrade levels should be cleaned to firm, undisturbed soil and backfilled with Engineered Fill. Any buried structures encountered during construction should be properly removed and backfilled.

9.11.6 Buried structures encountered during construction should be properly removed/rerouted and the resulting excavations backfilled. It is suspected that demolition activities of the existing pavement will disturb the upper soils. After demolition activities, it is recommended that disturbed soils within pavement areas be removed and/or compacted as engineered fill.

9.11.7 An integral part of satisfactory fill placement is the stability of the placed lift of soil. Prior to placement of aggregate base, the subgrade soils should be proof-rolled by a loaded water truck (or equivalent) to verify no deflections of greater than ½ inch occur. If placed materials exhibit excessive instability as determined by a SALEM field representative, the lift will be considered unacceptable and should be remedied prior to placement of additional fill material. Additional lifts should not be placed if the previous lift did not meet the required dry density or if soil conditions are not stable.

9.11.8 A representative of our firm should be present during all site clearing and grading operations to test and observe earthwork construction. This testing and observation is an integral part of our service as acceptance of earthwork construction is dependent upon compaction of the material and the stability of the material.

10. PLAN REVIEW, CONSTRUCTION OBSERVATION AND TESTING

10.1 Plan and Specification Review

10.1.1 SALEM should review the project plans and specifications prior to final design submittal to assess whether our recommendations have been properly implemented and evaluate if additional analysis and/or recommendations are required.

10.2 Construction Observation and Testing Services

10.2.1 The recommendations provided in this report are based on the assumption that we will continue as Geotechnical Engineer of Record throughout the construction phase. It is important to maintain continuity of geotechnical interpretation and confirm that field conditions encountered are similar to those anticipated during design. If we are not retained for these services, we cannot assume any responsibility for others interpretation of our recommendations, and therefore the future performance of the project.

10.2.2 SALEM should be present at the site during site preparation to observe site clearing, preparation of exposed surfaces after clearing, and placement, treatment and compaction of fill material. SALEM's observations should be supplemented with periodic compaction tests to establish substantial conformance with these recommendations. Moisture content of footings and slab subgrade should be tested immediately prior to concrete placement.

10.2.3 SALEM should observe foundation excavations prior to placement of reinforcing steel or concrete to assess whether the actual bearing conditions are compatible with the conditions anticipated during the preparation of this report.

11. LIMITATIONS AND CHANGED CONDITIONS

The analyses and recommendations submitted in this report are based upon the data obtained from the borings excavated at the approximate locations shown on the Site Plan, Figure 2. The report does not reflect variations which may occur between borings. The nature and extent of such variations may not become evident until construction is initiated. If variations then appear during construction, a re-evaluation of the recommendations of this report will be necessary after performing on-site observations during the excavation period and noting the characteristics of such variations. The findings and recommendations presented in this report are valid as of the present and for the proposed construction.

If site conditions change due to natural processes or human intervention on the property or adjacent to the site, or changes occur in the nature or design of the project, or if there is a substantial time lapse between the submission of this report and the start of the work at the site, the conclusions and recommendations contained in our report will not be considered valid unless the changes are reviewed by SALEM and the conclusions of our report are modified or verified in writing. The validity of the recommendations contained in this report is also dependent upon an adequate testing and observations program during the construction phase. Our firm assumes no responsibility for construction compliance with the design concepts or recommendations unless we have been retained to perform the on-site testing and review during construction. SALEM has prepared this report for the exclusive use of the owner and design consultants.

SALEM does not practice in the field of corrosion engineering. It is recommended that a qualified corrosion engineer be consulted regarding protection of buried steel or ductile iron piping and conduit or, at a minimum, that manufacturer's recommendations for corrosion protection be closely followed. Further, a corrosion engineer may be needed to incorporate the necessary precautions to avoid premature corrosion of concrete slabs and foundations in direct contact with native soil. The importation of soil and or aggregate materials to the site should be screened to determine the potential for corrosion to concrete and buried metal piping. The report has been prepared in accordance with generally accepted geotechnical engineering practices in the area. No other warranties, either express or implied, are made as to the professional advice provided under the terms of our agreement and included in this report.

If you have any questions, or if we may be of further assistance, please do not hesitate to contact our office at (559) 271-9700.

Respectfully Submitted,

SALEM ENGINEERING GROUP, INC.

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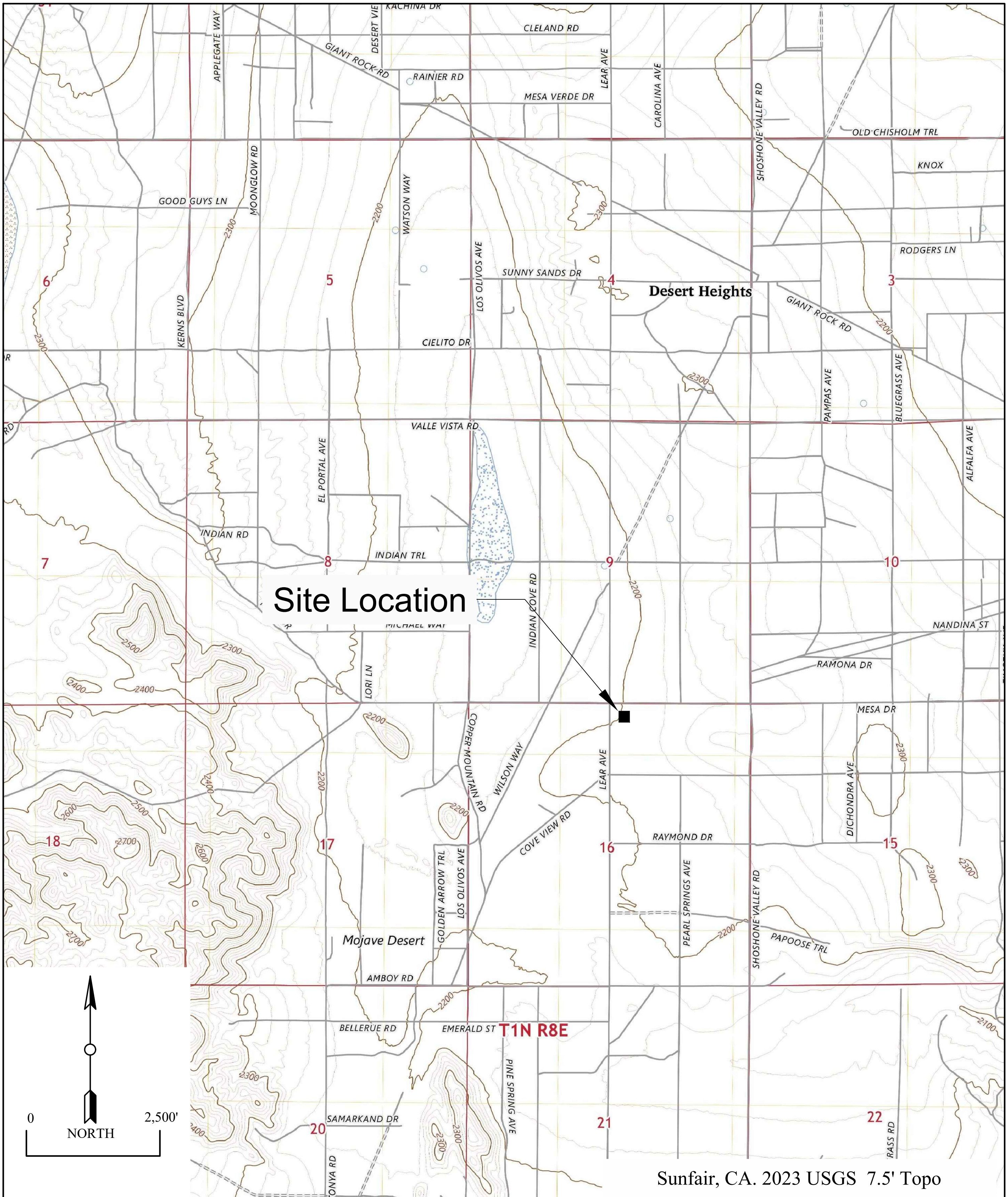
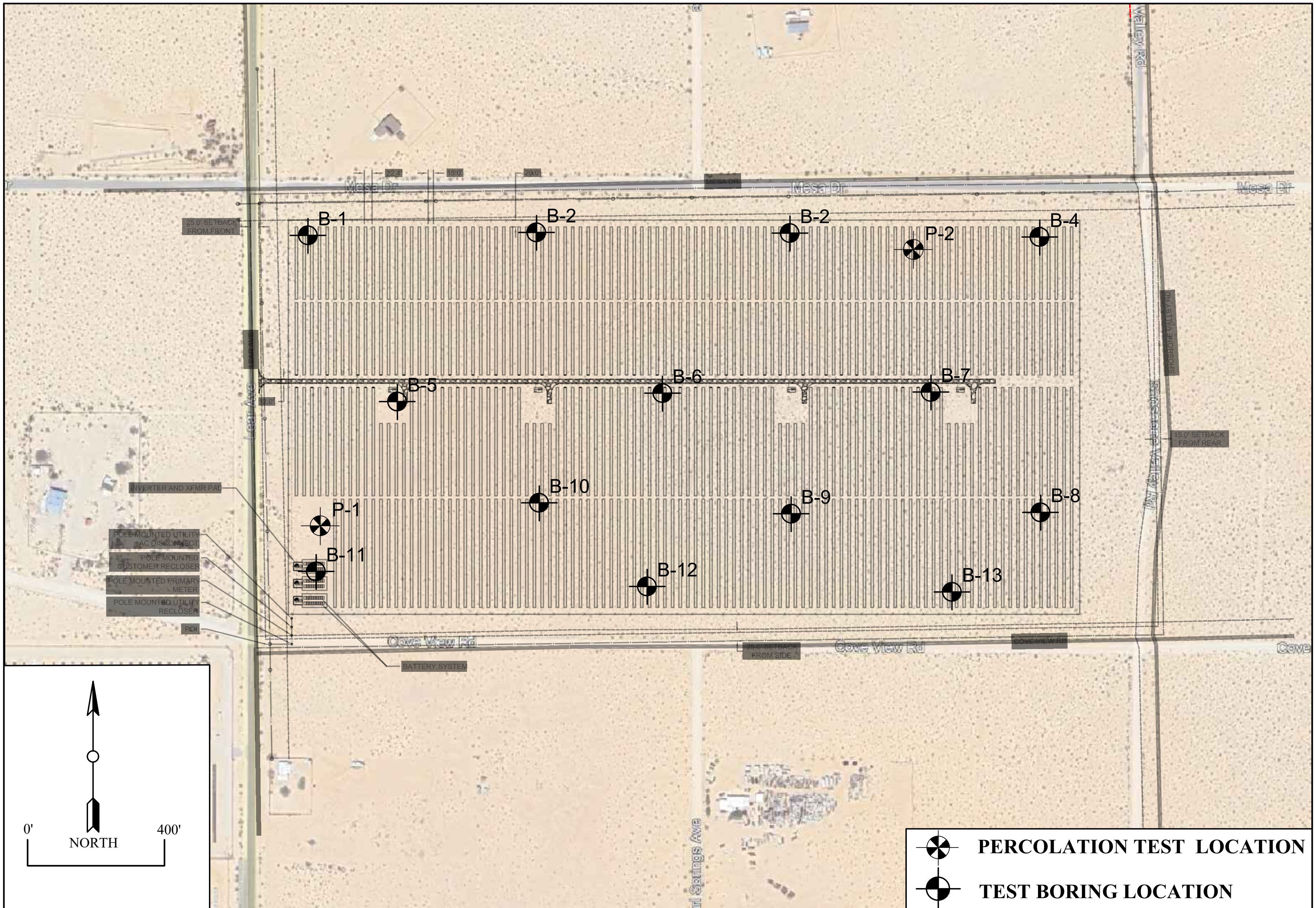


VICINITY MAP	SCALE: 1" = 2500'	DATE: November 9, 2023	SALEM engineering group, inc.
GEOTECHNICAL ENGINEERING INVESTIGATION Proposed 9.99 MW Ground Mount Solar Array & BESS SEC of Lear Ave & Mesa Drive Twentynine Palms, California	DRAWN BY: KM	APPROVED BY: DL	
	PROJECT NO. 3-223-1036	FIGURE NO. 1	



SITE PLAN	SCALE: 1" =400'	DATE: November 3, 2023
GEOTECHNICAL ENGINEERING INVESTIGATION Proposed 9.99 MW Ground Mount Solar Array & BESS SEC of Lear Ave & Mesa Drive Twentynine Palms, California	DRAWN BY: KM	APPROVED BY: DL
	PROJECT NO. 3-223-1036	FIGURE NO. 2

SALEM engineering group, inc.

APPENDIX

A

APPENDIX A
FIELD EXPLORATION

Fieldwork for our investigation was conducted on October 19, 2023 and included a site visit, subsurface exploration, and soil sampling. The locations of the exploratory borings are shown on the Site Plan, Figure 2. Boring logs for our exploration are presented in figures following the text in this appendix. Borings were located in the field using existing reference points. Therefore, actual boring locations may deviate slightly.

Our borings were drilled using a truck-mounted CME-75 drilling rig or hand tools. Sampling was accomplished by driving a 2-inch Standard Penetration Test (SPT) sampler and/or a 3-inch outside diameter Modified California Sampler (MCS) 18 inches into the soil. Penetration and/or Resistance tests were performed at selected depths. The resistance/N-Value obtained from driving was recorded based on the number of blows required to penetrate the last 12 inches. The driving energy was provided by an auto-trip hammer weighing 140 pounds, falling 30 inches. Relatively undisturbed MCS soil samples were obtained while performing this test. Bag samples of the disturbed soil were obtained from the SPT samples and auger cuttings. All samples were returned to our Fresno laboratory for evaluation. The test borings were backfilled with excavated soil upon completion of drilling and sampling.

Subsurface conditions encountered in the test borings were visually examined, classified and logged in general accordance with the American Society for Testing and Materials (ASTM) Practice for Description and Identification of Soils (Visual-Manual Procedure D2488). This system uses the Unified Soil Classification System (USCS) for soil designations. The logs depict soil and geologic conditions encountered and depths at which samples were obtained. The logs also include our interpretation of the conditions between sampling intervals. Therefore, the logs contain both observed and interpreted data. We determined the lines designating the interface between soil materials on the logs using visual observations, excavation characteristics and other factors. The transition between materials may be abrupt or gradual. Where applicable, the field logs were revised based on subsequent laboratory testing.

Test Boring: B-1 **Page** 1 **Of:** 1

Project Number: 3-223-1036

Date: October 18, 2023

Client: RPCA Solar 15, LLC

SALEM engineering group, inc.

Project: Proposed 9.99MW Ground Mount Solar Array & BESS

Location: SEC of Lear Avenue & Mesa Drive, Twentynine Palms, California

Drilled By: Salem Engineering Group, Inc. **Logged By:** C.C.

Drill Type: CME-55 **Elevation:** 2930 feet AMSL

Auger Type: 6-5/8 inch Hollow Stem AUger **Initial Depth to Groundwater:** N/E

Hammer Type: 140lbs/30in Automatic Trip **Final Depth to Groundwater:**

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
2930 / 0	1/6 3/6 4/6	SM	Silty SAND; loose, brown, damp, fine to medium grained.	7	1.5		-#200=16%
2925 / 5	24/6 24/6 28/6		Grades as above; very dense, light gray.	52	2.3	118.1	ø=46°
2920 / 10	16/6 16/6 18/6		Grades as above; dense, moist.	34	2.3		-#200=10%
2915 / 15	10/6 15/6 17/6	SP-SM	Poorly Graded SAND with silt; dense, brown, moist, fine to medium grained.	32	0.9		
2910 / 20	8/6 20/6 22/6		Grades as above;	42	1.4		
			End of boring at 21.5 feet BSG.				
2905 / 25							

Notes: *Vacant Lot*

Figure Number A-1

Test Boring: B-2 **Page** 1 **Of:** 1

Project Number: 3-223-1036

Date: October 18, 2023

Client: RPCA Solar 15, LLC

SALEM engineering group, inc.

Project: Proposed 9.99MW Ground Mount Solar Array & BESS

Location: SEC of Lear Avenue & Mesa Drive, Twentynine Palms, California

Drilled By: Salem Engineering Group, Inc. **Logged By:** C.C.

Drill Type: CME-55 **Elevation:** 2930 feet AMSL

Auger Type: 6-5/8 inch Hollow Stem AUger **Initial Depth to Groundwater:** N/E

Hammer Type: 140lbs/30in Automatic Trip **Final Depth to Groundwater:**

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
2930 / 0		SM	Silty SAND; very dense, brown, damp to moist, fine to medium grained.				
	31/6 50/5			>65	4.6	114.7	
2925 / 5	17/6 17/6 16/6		Grades as above; dense, moist.	33	2.2		
2920 / 10	8/6 10/6 13/6	SP-SM	Poorly Graded SAND with silt; medium dense, light brown, slightly moist, fine to medium grained.	23	1.4		
2915 / 15	10/6 13/6 11/6		Grades as above; light gray.	24	0.9		
			End of boring at 16.5 feet BSG.				
2910 / 20							
2905 / 25							

Notes: *Vacant Lot*

Figure Number A-2

SALEM engineering group, inc.

Test Boring: B-3 **Page** 1 **Of:** 1

Project Number: 3-223-1036

Date: October 18, 2023

Client: RPCA Solar 15, LLC

Project: Proposed 9.99MW Ground Mount Solar Array & BESS

Location: SEC of Lear Avenue & Mesa Drive, Twentynine Palms, California

Drilled By: Salem Engineering Group, Inc. **Logged By:** C.C.

Drill Type: CME-55 **Elevation:** 2930 feet AMSL

Auger Type: 6-5/8 inch Hollow Stem AUger **Initial Depth to Groundwater:** N/E

Hammer Type: 140lbs/30in Automatic Trip **Final Depth to Groundwater:**

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
2930 — 0	3/6 7/6 9/6	SM	Silty SAND; medium dense, brown, damp, fine to medium grained, trace of gravel.	16	4.1		
	9/6 8/6 10/6		Grades as above;	18	2.2		
2925 — 5							
	12/6 20/6 28/6	SP-SM	Poorly Graded SAND with silt; dense, light gray, slightly moist, fine to medium grained.	48	0.6		Dry Density Not Recorded
2920 — 10							
2915 — 15	20/6 18/6 20/6		Grades as above; dense, brown, moist.	38	7.0		
2910 — 20	16/6 16/6 18/6		Grades as above;	34	4.1		
			End of boring at 21.5 feet BSG.				
2905 — 25							

Notes: *Vacant Lot*

Figure Number A-3

SALEM engineering group, inc.

Test Boring: B-4 **Page** 1 **Of:** 1

Project Number: 3-223-1036

Date: October 19, 2023

Client: RPCA Solar 15, LLC

Project: Proposed 9.99MW Ground Mount Solar Array & BESS

Location: SEC of Lear Avenue & Mesa Drive, Twentynine Palms, California

Drilled By: Salem Engineering Group, Inc. **Logged By:** C.R.

Drill Type: CME-55 **Elevation:** 2930 feet AMSL

Auger Type: 6-5/8 inch Hollow Stem AUger **Initial Depth to Groundwater:** N/E

Hammer Type: 140lbs/30in Automatic Trip **Final Depth to Groundwater:**

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
2930 / 0		SM	Silty SAND; medium dense, light brown, damp, fine to medium grained.				
	3/6 5/6 9/6			14	2.7		
2925 / 5	12/6 15/6 21/6		Grades as above with gravel; fine to coarse grained.	36	1.5		Dry Density Not Recorded
2920 / 10	6/6 9/6 12/6		Grades as above;	21	1.4		
2915 / 15	13/6 18/6 23/6		Grades as above; dense.	41	1.8		
			End of boring at 16.5 feet BSG.				
2910 / 20							
2905 / 25							

Notes: *Vacant Lot*

Figure Number A-4

SALEM engineering group, inc.

Test Boring: B-5 **Page** 1 **Of:** 1

Project Number: 3-223-1036

Date: October 18, 2023

Client: RPCA Solar 15, LLC

Project: Proposed 9.99MW Ground Mount Solar Array & BESS

Location: SEC of Lear Avenue & Mesa Drive, Twentynine Palms, California

Drilled By: Salem Engineering Group, Inc. **Logged By:** C.C.

Drill Type: CME-55 **Elevation:** 2930 feet AMSL

Auger Type: 6-5/8 inch Hollow Stem AUger **Initial Depth to Groundwater:** N/E

Hammer Type: 140lbs/30in Automatic Trip **Final Depth to Groundwater:**

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
2930 / 0	1/6 4/6 15/6	SM	Silty SAND; medium dense, light brown, damp, fine to medium grained.	19	4.3		
	32/6 26/6 27/6	SP-SM	Poorly Graded SAND with silt; dense, light brown, moist, fine to medium grained.	53	1.6	115.5	PI=3 LL=25
2925 / 5							
	10/6 13/6 17/6		Grades as above; medium dense.	30	1.7		
2920 / 10							
2915 / 15	17/6 22/6 29/6		Grades as above;	>50	1.6		PI=1 LL=23
2910 / 20	25/6 31/6 42/6			>50	2.8		No sample recorded
			End of boring at 21.5 feet BSG.				
2905 / 25							

Notes: *Vacant Lot*

Figure Number A-5

SALEM engineering group, inc.

Test Boring: B-6 **Page** 1 **Of:** 1

Project Number: 3-223-1036

Date: October 19, 2023

Client: RPCA Solar 15, LLC

Project: Proposed 9.99MW Ground Mount Solar Array & BESS

Location: SEC of Lear Avenue & Mesa Drive, Twentynine Palms, California

Drilled By: Salem Engineering Group, Inc. **Logged By:** C.R.

Drill Type: CME-55 **Elevation:** 2930 feet AMSL

Auger Type: 6-5/8 inch Hollow Stem AUger **Initial Depth to Groundwater:** N/E

Hammer Type: 140lbs/30in Automatic Trip **Final Depth to Groundwater:**

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
2930 / 0		SM	Silty SAND; medium dense, light brown, damp, fine to medium grained.				
	2/6 7/6 9/6			16	1.4		Dry Density Not Recorded
2925 / 5	6/6 6/6 10/6		Grades as above with gravel;	16	1.1		
2920 / 10	6/6 9/6 16/6		Grades as above;	25	1.4		
2915 / 15	50/4		Grades as above; very dense, increase in percent gravel.	>50	3.9		
			End of boring at 16.5 feet BSG.				
2910 / 20							
2905 / 25							

Notes: *Vacant Lot*

Figure Number A-6

Test Boring: B-7 **Page** 1 **Of:** 1

SALEM engineering group, inc.

Project Number: 3-223-1036

Date: October 19, 2023

Client: RPCA Solar 15, LLC

Project: Proposed 9.99MW Ground Mount Solar Array & BESS

Location: SEC of Lear Avenue & Mesa Drive, Twentynine Palms, California

Drilled By: Salem Engineering Group, Inc. **Logged By:** C.R.

Drill Type: CME-55 **Elevation:** 2930 feet AMSL

Auger Type: 6-5/8 inch Hollow Stem AUger **Initial Depth to Groundwater:** N/E

Hammer Type: 140lbs/30in Automatic Trip **Final Depth to Groundwater:**

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
2930 / 0	1/6 3/6 4/6	SM	Silty SAND; loose, light brown, damp, fine to coarse grained, with trace of gravel.	7	1.7		-#200=17% SAND=77% +#4=6% PI=0 LL=20
	7/6 10/6 17/6		Grades as above; medium dense.	27	0.9		Dry Density Not Recorded
2925 / 5							
	7/6 10/6 14/6	SP-SM	Poorly Graded SAND with gravel; medium dense, brown, dry to damp, fine to medium grained, trace of silt.	24	1.3		
2920 / 10							
2915 / 15	10/6 10/6 19/6		Grades as above;	29	0.9		-#200=6% SAND=79% +#4=15%
2910 / 20	10/6 12/6 16/6		Grades as above;	28	0.9		
			End of boring at 21.5 feet BSG.				
2905 / 25							

Notes: *Vacant Lot*

Figure Number A-7

Test Boring: B-8 **Page** 1 **Of:** 1

Project Number: 3-223-1036

Date: October 19, 2023

Client: RPCA Solar 15, LLC

SALEM engineering group, inc.

Project: Proposed 9.99MW Ground Mount Solar Array & BESS

Location: SEC of Lear Avenue & Mesa Drive, Twentynine Palms, California

Drilled By: Salem Engineering Group, Inc. **Logged By:** C.R.

Drill Type: CME-55 **Elevation:** 2930 feet AMSL

Auger Type: 6-5/8 inch Hollow Stem AUger **Initial Depth to Groundwater:** N/E

Hammer Type: 140lbs/30in Automatic Trip **Final Depth to Groundwater:**

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
2930 — 0		SP-SM	Poorly Graded SAND with silt; loose, light brown, dry, fine to medium grained.	8	0.9		
	1/6 3/6 5/6						
2925 — 5	9/6 18/6 27/6		Grades as above with gravel; dense.	45	1.0		
2920 — 10	12/6 15/6 23/6		Grades as above;	39	1.0		
2915 — 15	9/6 15/6 22/6		Grades as above;	37	2.2		
			End of boring at 16.5 feet BSG.				
2910 — 20							
2905 — 25							

Notes: *Vacant Lot*

Figure Number A-8

SALEM engineering group, inc.

Test Boring: B-9 **Page** 1 **Of:** 1

Project Number: 3-223-1036

Date: October 19, 2023

Client: RPCA Solar 15, LLC

Project: Proposed 9.99MW Ground Mount Solar Array & BESS

Location: SEC of Lear Avenue & Mesa Drive, Twentynine Palms, California

Drilled By: Salem Engineering Group, Inc. **Logged By:** C.R.

Drill Type: CME-55 **Elevation:** 2930 feet AMSL

Auger Type: 6-5/8 inch Hollow Stem AUger **Initial Depth to Groundwater:** N/E

Hammer Type: 140lbs/30in Automatic Trip **Final Depth to Groundwater:**

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
2930 / 0	1/6 4/6 9/6	SM	Silty SAND; medium dense, light brown, damp, fine to medium grained.	13	2.1		
	11/6 17/6 22/6		Grades as above;	39	1.6		
2925 / 5							
	30/6 50/5		Grades as above; very dense	>50	4.1		
2920 / 10							
2915 / 15	13/6 13/6 20/6	SP-SM	Poorly Graded SAND with silt and gravel; dense, light brown, dry, fine to coarse grained.	33	1.1		
2910 / 20	10/6 15/6 22/6		Grades as above;	37	1.4		
			End of boring at 21.5 feet BSG.				
2905 / 25							

Notes: *Vacant Lot*

Figure Number A-9

Test Boring: B-10 **Page** 1 **Of:** 1

SALEM engineering group, inc.

Project Number: 3-223-1036

Date: October 18, 2023

Client: RPCA Solar 15, LLC

Project: Proposed 9.99MW Ground Mount Solar Array & BESS

Location: SEC of Lear Avenue & Mesa Drive, Twentynine Palms, California

Drilled By: Salem Engineering Group, Inc. **Logged By:** C.C.

Drill Type: CME-55 **Elevation:** 2930 feet AMSL

Auger Type: 6-5/8 inch Hollow Stem AUger **Initial Depth to Groundwater:** N/E

Hammer Type: 140lbs/30in Automatic Trip **Final Depth to Groundwater:**

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
2930 / 0		SM	Silty SAND; dense, brown, damp, fine to medium grained.				
	16/6 24/6 20/6			44	2.3	116.3	ø=40° -#200=23%
2925 / 5	15/6 14/6 12/6	SP-SM	Poorly Graded SAND; medium dense, light brown, moist fine to medium grained, with trace of silt.	26	2.8		
2920 / 10	8/6 11/6 15/6		Grades as above;	26	1.6		-#200=10%
2915 / 15	9/6 13/6 14/6		Grades as above;	27	1.2		
			End of boring at 16.5 feet BSG.				
2910 / 20							
2905 / 25							

Notes: *Vacant Lot*

Figure Number A-10

Test Boring: B-11 **Page** 1 **Of:** 1

SALEM engineering group, inc.

Project Number: 3-223-1036

Date: October 18, 2023

Client: RPCA Solar 15, LLC

Project: Proposed 9.99MW Ground Mount Solar Array & BESS

Location: SEC of Lear Avenue & Mesa Drive, Twentynine Palms, California

Drilled By: Salem Engineering Group, Inc. **Logged By:** C.C.

Drill Type: CME-55 **Elevation:** 2930 feet AMSL

Auger Type: 6-5/8 inch Hollow Stem AUger **Initial Depth to Groundwater:** N/E

Hammer Type: 140lbs/30in Automatic Trip **Final Depth to Groundwater:**

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
2930 — 0	2/6 4/6 6/6	SM	Silty SAND; medium dense, light brown, damp, fine to medium grained.	10	4.0		
2925 — 5	9/6 8/6 11/6	SP-SM	Poorly Graded SAND with silt; medium dense, mottled light brown to brown, slightly moist, fine to medium grained.	19	1.9		-#200=15% PI=3 LL=24
2920 — 10	26/6 43/6 50/4		Grades as above; very dense, mottled light gray to brown.	>65	1.1		Dry Density Not Recorded
2915 — 15	16/6 20/6 26/6		Grades as above; dense, light brown, fine to coarse grained.	46	1.1		
2910 — 20	15/6 21/6 22/6		Grades as above;	43	1.3		
			End of boring at 21.5 feet BSG.				
2905 — 25							

Notes: *Vacant Lot*

Figure Number A-11

Test Boring: B-12 **Page** 1 **Of:** 1

SALEM engineering group, inc.

Project Number: 3-223-1036

Date: October 19, 2023

Client: RPCA Solar 15, LLC

Project: Proposed 9.99MW Ground Mount Solar Array & BESS

Location: SEC of Lear Avenue & Mesa Drive, Twentynine Palms, California

Drilled By: Salem Engineering Group, Inc. **Logged By:** C.R.

Drill Type: CME-55 **Elevation:** 2930 feet AMSL

Auger Type: 6-5/8 inch Hollow Stem AUger **Initial Depth to Groundwater:** N/E

Hammer Type: 140lbs/30in Automatic Trip **Final Depth to Groundwater:**

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
2930 / 0		SM	SAND with silt; medium dense, brown, damp, fine to medium grained.				
	1/6 2/6 9/6			11	1.9		
2925 / 5	13/6 12/6 14/6		Grades as above; light brown.	26	3.1	104.6	ø=43°
2920 / 10	8/6 9/6 9/6		Grades as above; brown, with trace of silt.	18	2.1		-#200=10%
2915 / 15	10/6 16/6 32/6		Grades as above; dense, fine to coarse grained.	48	1.9		
			End of boring at 16.5 feet BSG.				
2910 / 20							
2905 / 25							

Notes: *Vacant Lot*

Figure Number A-12

Test Boring: B-13 **Page** 1 **Of:** 1

SALEM engineering group, inc.

Project Number: 3-223-1036

Date: October 19, 2023

Client: RPCA Solar 15, LLC

Project: Proposed 9.99MW Ground Mount Solar Array & BESS

Location: SEC of Lear Avenue & Mesa Drive, Twentynine Palms, California

Drilled By: Salem Engineering Group, Inc. **Logged By:** C.R.

Drill Type: CME-55 **Elevation:** 2930 feet AMSL

Auger Type: 6-5/8 inch Hollow Stem AUger **Initial Depth to Groundwater:** N/E

Hammer Type: 140lbs/30in Automatic Trip **Final Depth to Groundwater:**

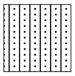
ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
2930 / 0	2/6 4/6 4/6	SM	SAND with silt; loose, light brown, dry, fine to medium grained.	8	2.8		
2925 / 5	6/6 6/6 11/6		Grades as above with gravel; medium dense.	17	1.6		
2920 / 10	11/6 22/6 42/6	SP-SM	Poorly Graded SAND with silt; dense, light brown, damp, fine to medium grained.	>50	1.5	112.8	ø=50°
2915 / 15	8/6 14/6 22/6		Grades as above;	36	2.0		
2910 / 20	10/6 18/6 22/6	SM	Silty SAND; with gravel; dense, brown, damp, fine to coarse grained.	40	2.2		
			End of boring at 21.5 feet BSG.				
2905 / 25							

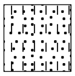
Notes: *Vacant Lot*

KEY TO SYMBOLS

Symbol Description

Strata symbols

 **Silty Sand**

 **Poorly graded sand with silt**

Soil Samplers

 **Standard penetration test**

 **California sampler**

Notes:

Granular Soils
Blows Per Foot (Uncorrected)

	MCS	SPT
Very loose	<5	<4
Loose	5-15	4-10
Medium dense	16-40	11-30
Dense	41-65	31-50
Very dense	>65	>50

Cohesive Soils
Blows Per Foot (Uncorrected)

	MCS	SPT
Very soft	<3	<2
Soft	3-5	2-4
Firm	6-10	5-8
Stiff	11-20	9-15
Very Stiff	21-40	16-30
Hard	>40	>30

MCS = Modified California Sampler
SPT = Standard Penetration Test Sampler

Percolation Test Worksheet

Project:	**9.99 MW Ground Mount Solar Array & Bess**	**Job No.:**	**3-223-1036**	Length of Pipe	61 in.
	Twentynine Palms, CA.	**Date Drilled:**	**10/18/2023**	Pipe stickup:	0.6 ft
		Soil Classification:		Hole Dia.:	8.75 in.
				Pipe Dia.:	3 in.
Test Hole No.:	**P-1**			Gravel Below Pipe:	4.25 in.
Tested By:	**CC**	**Presoaking Date:**	**10/18/2023**	Gravel pack porosity:	0.4
Drilled Hole Depth:	**4.75 Feet**	**Test Date:**	**10/18/2023**	Gravel Correc Factor:	0.5

Time Start	Time Finish	Refill-Yes or No	Elapsed Time (hrs:min)	Initial Water Level# (ft)	Final Water Level# (ft)	Δ Water Level (in.)	Δ Min.	Uncorrected Percolation Rate (min/in)	Gravel Pack Corrected Unfactored Percolation Rate (min/in)	Estimated Unfactored Infiltration Rate (inches/hr)
8:55	9:25	N	0:30	2.32	4.82	30.00	30	1.0	2.1	2.62
9:27	9:57	Y	0:30	2.68	4.53	22.20	30	1.4	2.9	1.97
9:59	10:09	Y	0:10	2.45	3.34	10.68	10	0.9	2.0	2.08
10:09	10:19	N	0:10	3.34	3.93	7.08	10	1.4	3.0	1.92
10:19	10:29	N	0:10	3.93	4.23	3.60	10	2.8	5.9	1.27
10:31	10:41	Y	0:10	2.70	3.45	9.00	10	1.1	2.4	1.88
10:41	10:51	N	0:10	3.45	4.06	7.32	10	1.4	2.9	2.11
10:51	11:01	N	0:10	4.06	4.37	3.72	10	2.7	5.7	1.45
								Estimated Unfactored Infiltration Rate (in/hr)		1.73

SALEM engineering group, inc.

Percolation Test Worksheet

Project:	**9.99 MW Ground Mount Solar Array & Bess Twentynine Palms, CA.**	**Job No.:**	**3-223-1036**	Length of Pipe	60 in.
		Date Drilled:	**10/18/2023**	Pipe stickup:	0.17 ft ##
		Soil Classification:		Hole Dia.:	6 in.
Test Hole No.:	**P-2**			Pipe Dia.:	3 in.
Tested By:	**CC**	**Presoaking Date:**	**10/18/2023**	Gravel Below Pipe:	0 in.
Drilled Hole Depth:	**4.8** Feet	**Test Date:**	**10/18/2023**	Gravel pack porosity:	0.4
				Gravel Correc Factor:	0.6

Time Start	Time Finish	Refill- Yes or No	Elapsed Time (hrs:min)	Initial Water Level# (ft)	Final Water Level# (ft)	Δ Water Level (in.)	Δ Min.	Uncorrected Percolation Rate (min/in)	Gravel Pack Corrected Unfactored Percolation Rate (min/in)	Estimated Unfactored Infiltration Rate (inches/hr)
12:00	12:30	N	0:30	2.43	3.99	18.72	30	1.6	2.9	1.34
12:32	13:02	Y	0:30	2.49	3.85	16.32	30	1.8	3.3	1.15
13:04	13:14	Y	0:10	2.46	3.18	8.64	10	1.2	2.1	1.54
13:14	13:24	N	0:10	3.18	3.57	4.68	10	2.1	3.9	1.10
13:24	13:34	N	0:10	3.57	3.83	3.12	10	3.2	5.8	0.90
13:36	13:46	Y	0:10	2.42	3.29	10.44	10	1.0	1.7	1.89
13:46	13:56	N	0:10	3.29	3.72	5.16	10	1.9	3.5	1.31
13:56	14:06	N	0:10	3.72	3.99	3.24	10	3.1	5.6	1.05

Estimated Unfactored Infiltration Rate (in/hr) 1.25

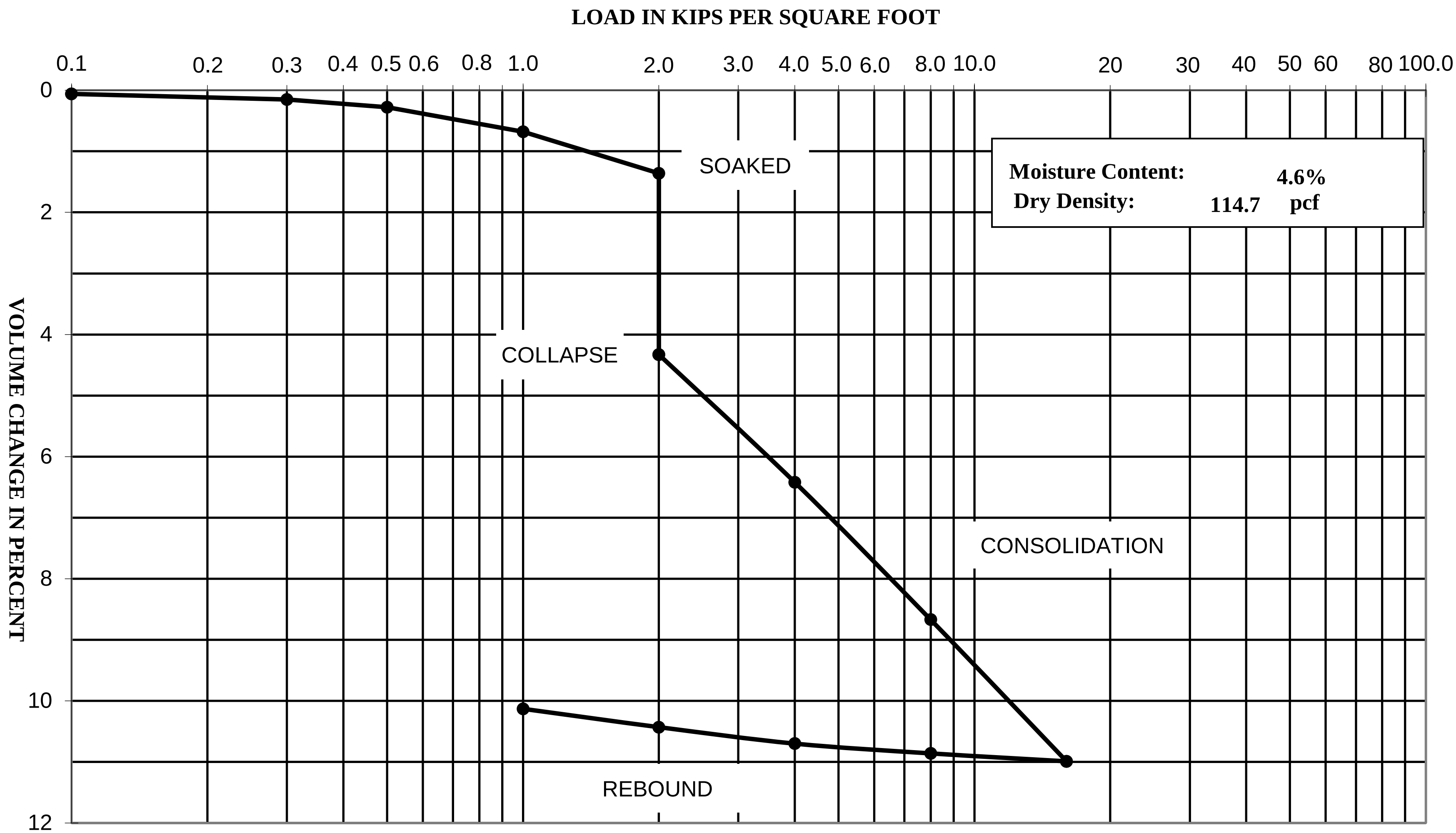
SALEM engineering group, inc.

APPENDIX B

APPENDIX B
LABORATORY TESTING

Laboratory tests were performed in accordance with generally accepted test methods of the American Society for Testing and Materials (ASTM), Caltrans, or other suggested procedures. Selected samples were tested for in-situ moisture content, corrosivity, shear strengths, expansion index, soil resistivity, plasticity index, and grain size distribution. The results of the laboratory tests are summarized in the following figures.

CONSOLIDATION - PRESSURE TEST DATA
ASTM D2435



Project Name: 9.99MW GM Solar & BESS - Twentynine Palms

Project Number: 3-223-1036

Boring: B-2 @ 1.5'

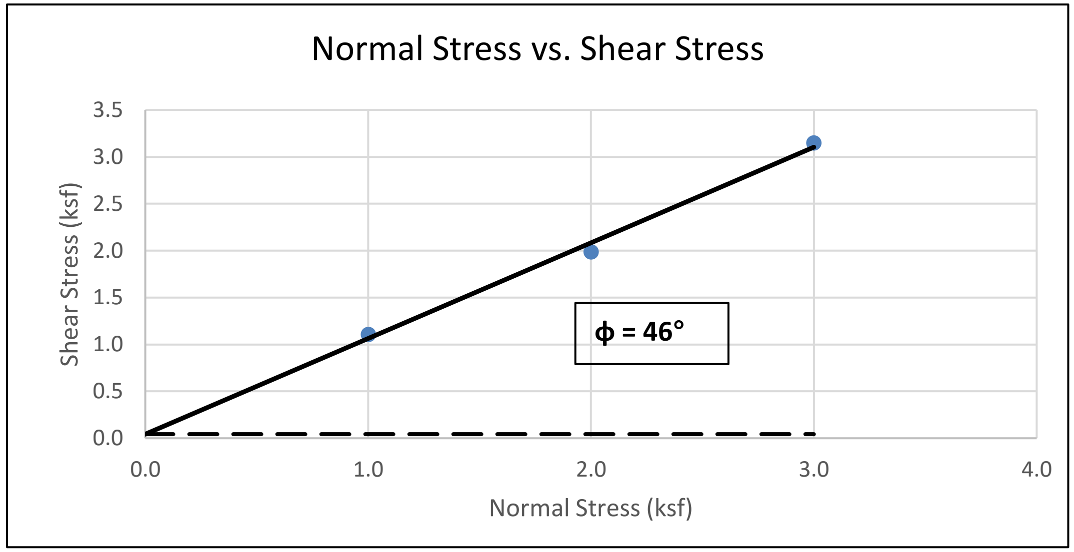
SALEM engineering group, inc.

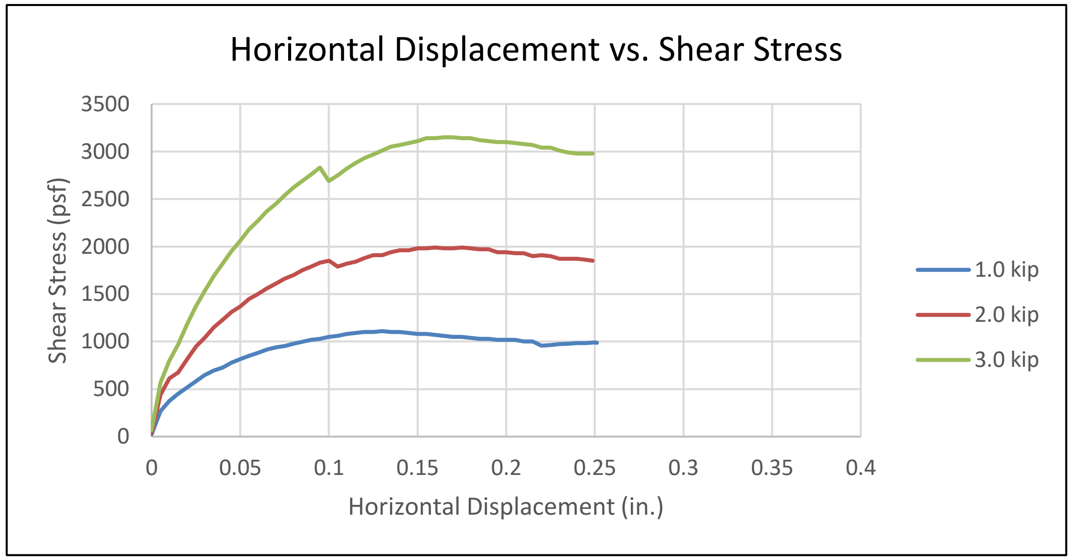
Direct Shear Test (ASTM D3080)

Project Name: 9.99MW GM Solar & BESS - Twentynine Palms
Project Number: 3-223-1036
Client:
Boring: B-1 @ 3.5'
Soil Type:
Sample Type: Undisturbed Ring
Tested By: 11/1/23 & 11/2/23
Reviewed By: NL
Date of Test: 11/1/23 & 11/2/23
Test Equipment: GeoComp ShearTrac II

	Loading		
	1.0 kip	**2.0 kip**	**3.0 kip**
Normal Stress (ksf)	1.00	2.00	3.00
Shear Rate (in/min)	0.0040	0.0040	0.0040
Peak Shear Stress (ksf)	1.11	1.99	3.15

Initial Height of Sample (in)	1.000	1.000	1.000
Post-Consol. Sample Height (in.)	0.960	0.940	0.918
Post-Shear Sample Height (in.)	0.950	0.930	0.908
Diameter of Sample (in)	2.4	2.4	2.4
Initial (pre-shear) Values			
Moisture Content (%)	2.3		
Dry Density (pcf)	109.0	113.5	114.3
Saturation %	11.5	13.0	13.2
Void Ratio	0.54	0.48	0.47
Consolidated Void Ratio	0.48	0.39	0.35
Final (post-shear) Values			
Final Moisture Content (%)	20.6	19.4	18.6
Dry Density (pcf)	102.8	109.3	116.2
Saturation %	76.5	86.0	91.5
Void Ratio	0.73	0.61	0.55





Peak Shear Strength Values	
Slope	1.02
Friction Angle	46
Cohesion (psf)	43

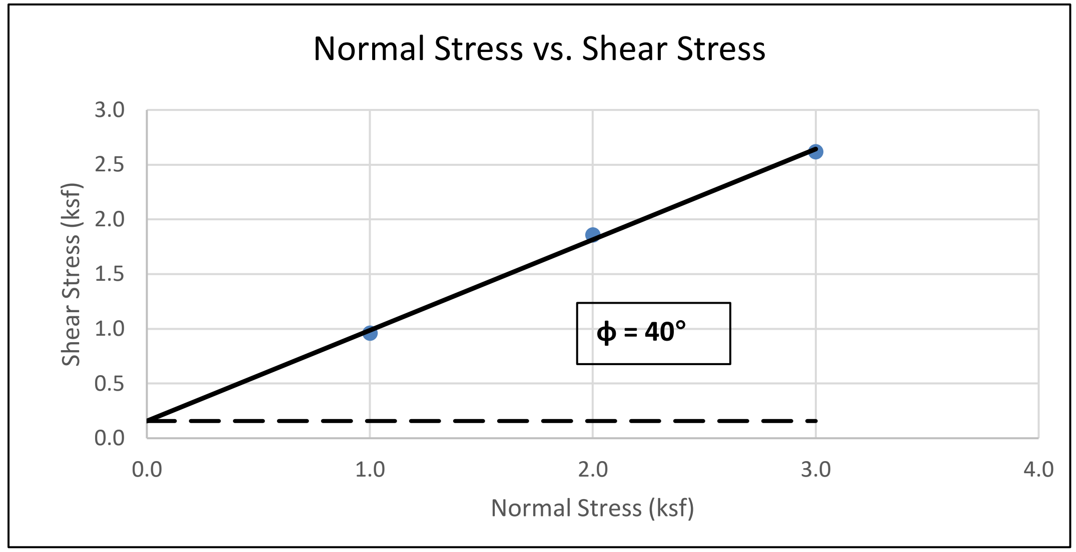
SALEM engineering group, inc.
4729 W. Jacquelyn Ave.
Fresno, CA 93722

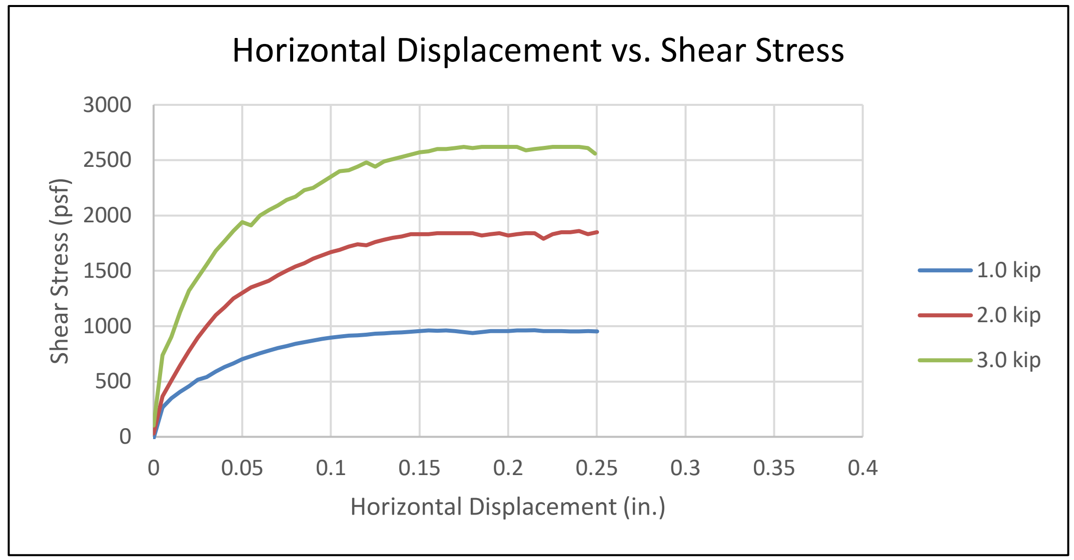
Direct Shear Test (ASTM D3080)

Project Name: 9.99MW GM Solar & BESS - Twentynine Palms
Project Number: 3-223-1036
Client:
Boring: B-10 @ 1.5'
Soil Type:
Sample Type: Undisturbed Ring
Tested By: NL
Reviewed By:
Date of Test: 11/2/23
Test Equipment: GeoComp ShearTrac II

	Loading		
	1.0 kip	**2.0 kip**	**3.0 kip**
Normal Stress (ksf)	1.00	2.00	3.00
Shear Rate (in/min)	0.0040	0.0040	0.0040
Peak Shear Stress (ksf)	0.96	1.86	2.62

Initial Height of Sample (in)	1.000	1.000	1.000
Post-Consol. Sample Height (in.)	0.899	0.880	0.870
Post-Shear Sample Height (in.)	0.882	0.858	0.847
Diameter of Sample (in)	2.4	2.4	2.4
Initial (pre-shear) Values			
Moisture Content (%)	2.3		
Dry Density (pcf)	114.5	113.1	112.6
Saturation %	13.5	13.0	12.8
Void Ratio	0.47	0.49	0.49
Consolidated Void Ratio	0.32	0.31	0.30
Final (post-shear) Values			
Final Moisture Content (%)	16.8	16.0	15.5
Dry Density (pcf)	121.4	121.4	120.5
Saturation %	94.7	96.7	98.1
Void Ratio	0.48	0.45	0.43





Peak Shear Strength Values	
Slope	0.83
Friction Angle	40
Cohesion (psf)	157

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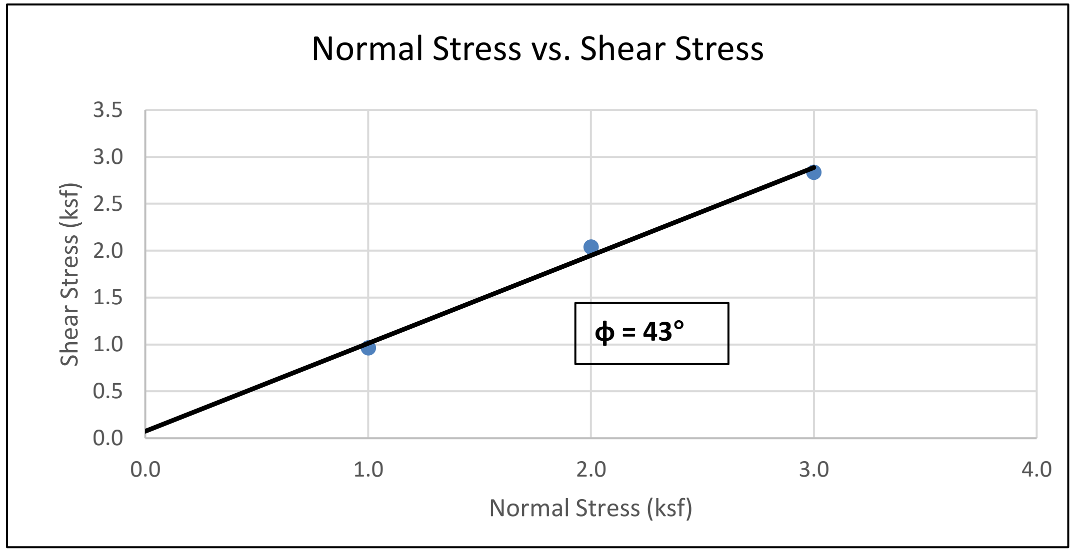
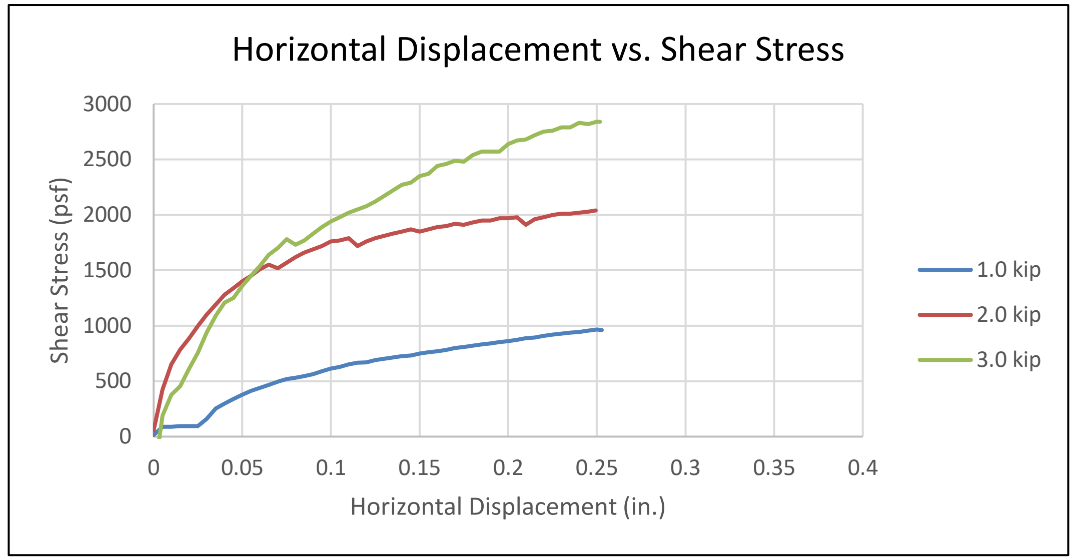
Direct Shear Test (ASTM D3080)

Project Name: 9.99MW GM Solar & BESS - Twentynine Palms
Project Number: 3-223-1036
Client:
Boring: B-12 @ 5'
Soil Type:
Sample Type: Undisturbed Ring
Tested By: MC / NL
Reviewed By:
Date of Test: 11/3/23
Test Equipment: GeoComp ShearTrac II

	Loading		
	1.0 kip	**2.0 kip**	**3.0 kip**
Normal Stress (ksf)	1.00	2.00	3.00
Shear Rate (in/min)	0.0040	0.0040	0.0040
Peak Shear Stress (ksf)	0.97	2.04	2.84

Initial Height of Sample (in)	1.000	1.000	1.000
Post-Consol. Sample Height (in.)	0.920	0.884	0.875
Post-Shear Sample Height (in.)	0.897	0.851	0.835
Diameter of Sample (in)	2.4	2.4	2.4
Initial (pre-shear) Values			
Moisture Content (%)	3.1		
Dry Density (pcf)	102.2	101.1	97.7
Saturation %	13.1	12.7	11.7
Void Ratio	0.64	0.66	0.72
Consolidated Void Ratio	0.51	0.47	0.50
Final (post-shear) Values			
Final Moisture Content (%)	23.3	20.6	21.6
Dry Density (pcf)	102.5	107.2	105.0
Saturation %	82.2	84.9	84.1
Void Ratio	0.76	0.65	0.69





Peak Shear Strength Values	
Slope	0.94
Friction Angle	43
Cohesion (psf)	75

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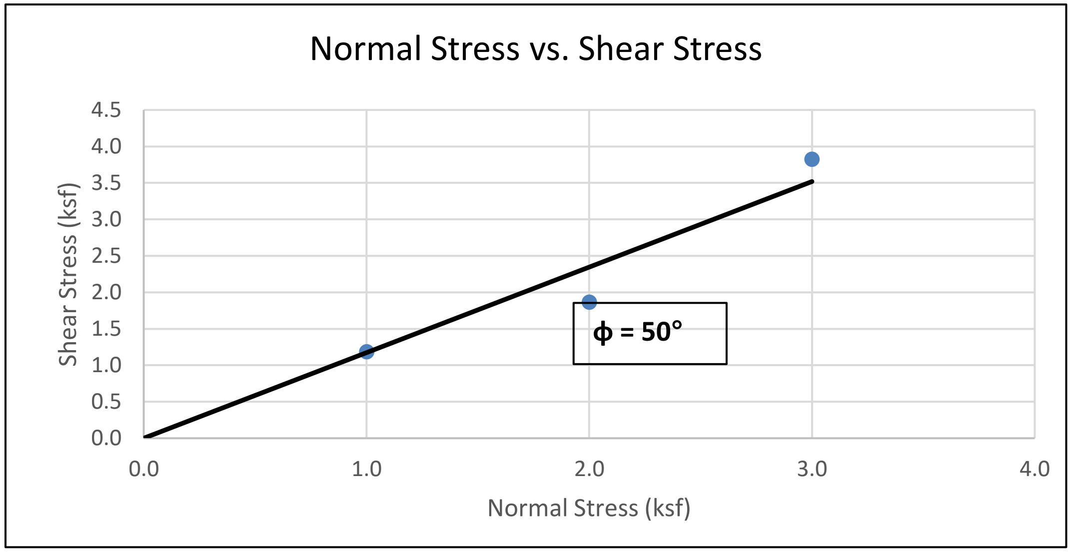
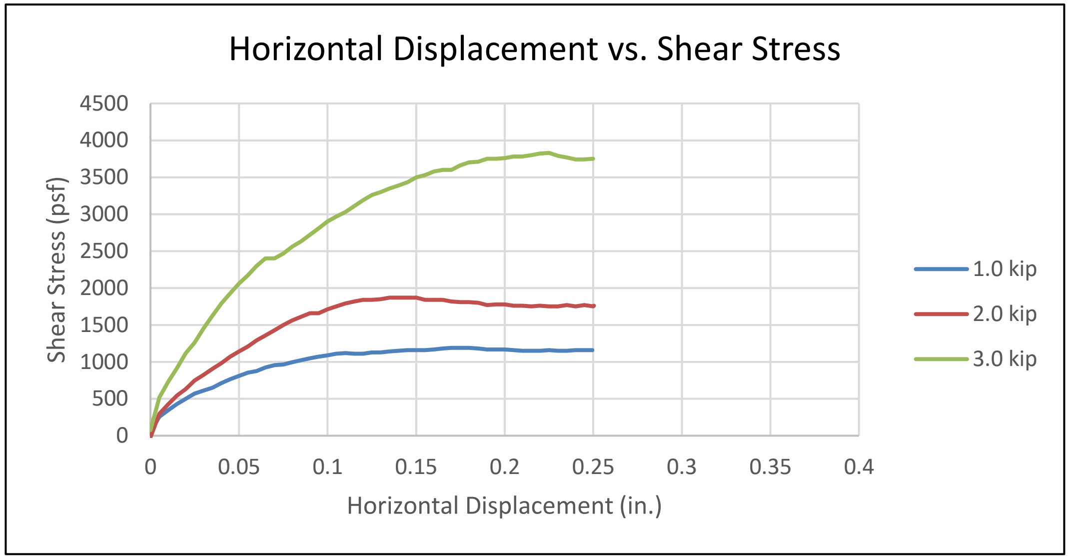
Direct Shear Test (ASTM D3080)

Project Name: 9.99MW GM Solar & BESS - Twentynine Palms
Project Number: 3-223-1036
Client:
Boring: B-13 @ 8.5'
Soil Type:
Sample Type: Undisturbed Ring
Tested By: NL
Reviewed By:
Date of Test: 11/3/23 7 11/6/23
Test Equipment: GeoComp ShearTrac II

	Loading		
	1.0 kip	2.0 kip	3.0 kip
Normal Stress (ksf)	1.00	2.00	3.00
Shear Rate (in/min)	0.0040	0.0040	0.0040
Peak Shear Stress (ksf)	1.19	1.87	3.83

Initial Height of Sample (in)	1.000	1.000	1.000
Post-Consol. Sample Height (in.)	0.939	0.907	0.935
Post-Shear Sample Height (in.)	0.934	0.903	0.937
Diameter of Sample (in)	2.4	2.4	2.4
Initial (pre-shear) Values			
Moisture Content (%)	1.4		
Dry Density (pcf)	109.8	108.8	108.3
Saturation %	7.3	7.1	7.0
Void Ratio	0.53	0.54	0.55
Consolidated Void Ratio	0.44	0.40	0.45
Final (post-shear) Values			
Final Moisture Content (%)	21.0	22.5	19.8
Dry Density (pcf)	109.1	109.7	109.0
Saturation %	80.2	88.8	74.3
Void Ratio	0.70	0.68	0.72





Peak Shear Strength Values	
Slope	1.17
Friction Angle	50
Cohesion (psf)	0

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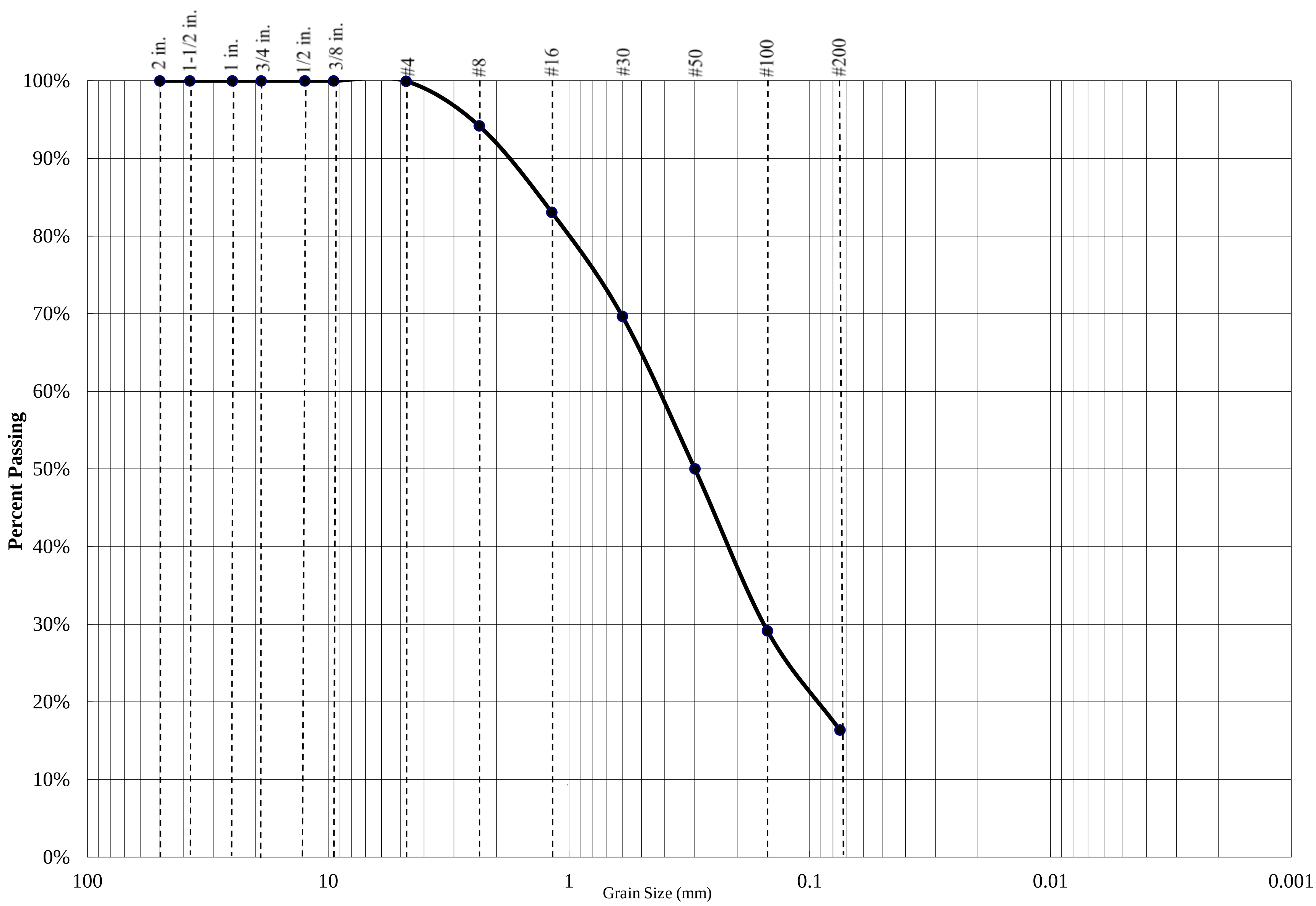
PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
0%	84%	16%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	100.0%
#4	99.9%
#8	94.2%
#16	83.1%
#30	69.7%
#50	50.0%
#100	29.2%
#200	16.4%

Atterberg Limits		
PL=	LL=	PI=

Coefficients				
D_{85}=		D_{60}=		D_{50}=
D_{30}=		D_{15}=		D_{10}=
C_u=	N/A	C_c=	N/A	

USCS CLASSIFICATION
Silty Sand (SM)

Project Name: 9.99MW GM Solar & BESS - Twentynine Palms

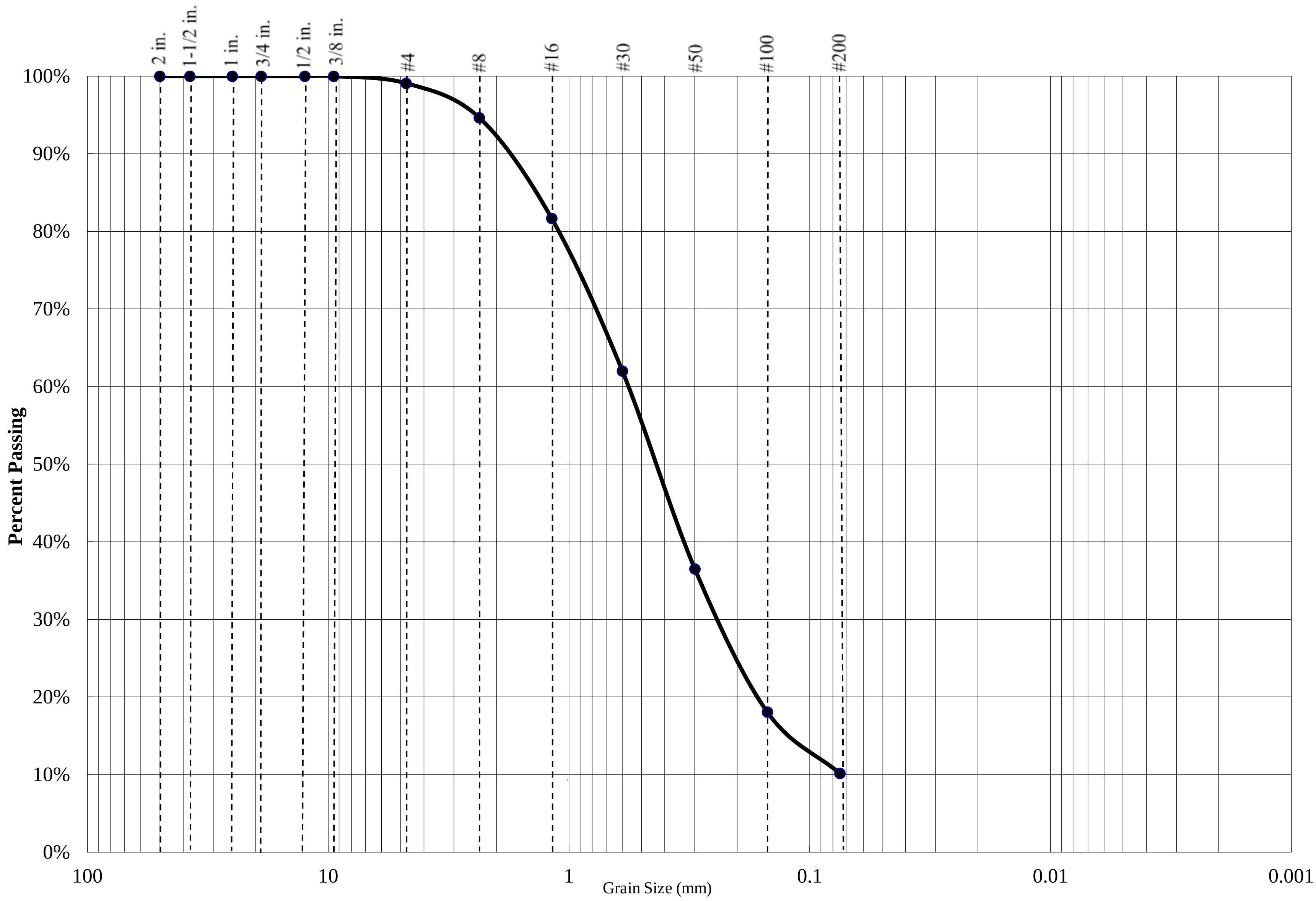
Project Number: 3-223-1036

Boring: B-1 @ 0 - 4'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
1%	89%	10%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	100.0%
#4	99.1%
#8	94.7%
#16	81.7%
#30	62.0%
#50	36.5%
#100	18.1%
#200	10.2%

Atterberg Limits		
PL=	LL=	PI=

Coefficients				
D_{85}=		D_{60}=		D_{50}=
D_{30}=		D_{15}=		D_{10}=
C_u=	N/A	C_c=	N/A	

USCS CLASSIFICATION
Poorly Graded Sand with Silt (SP-SM)

Project Name: 9.99MW GM Solar & BESS - Twentynine Palms

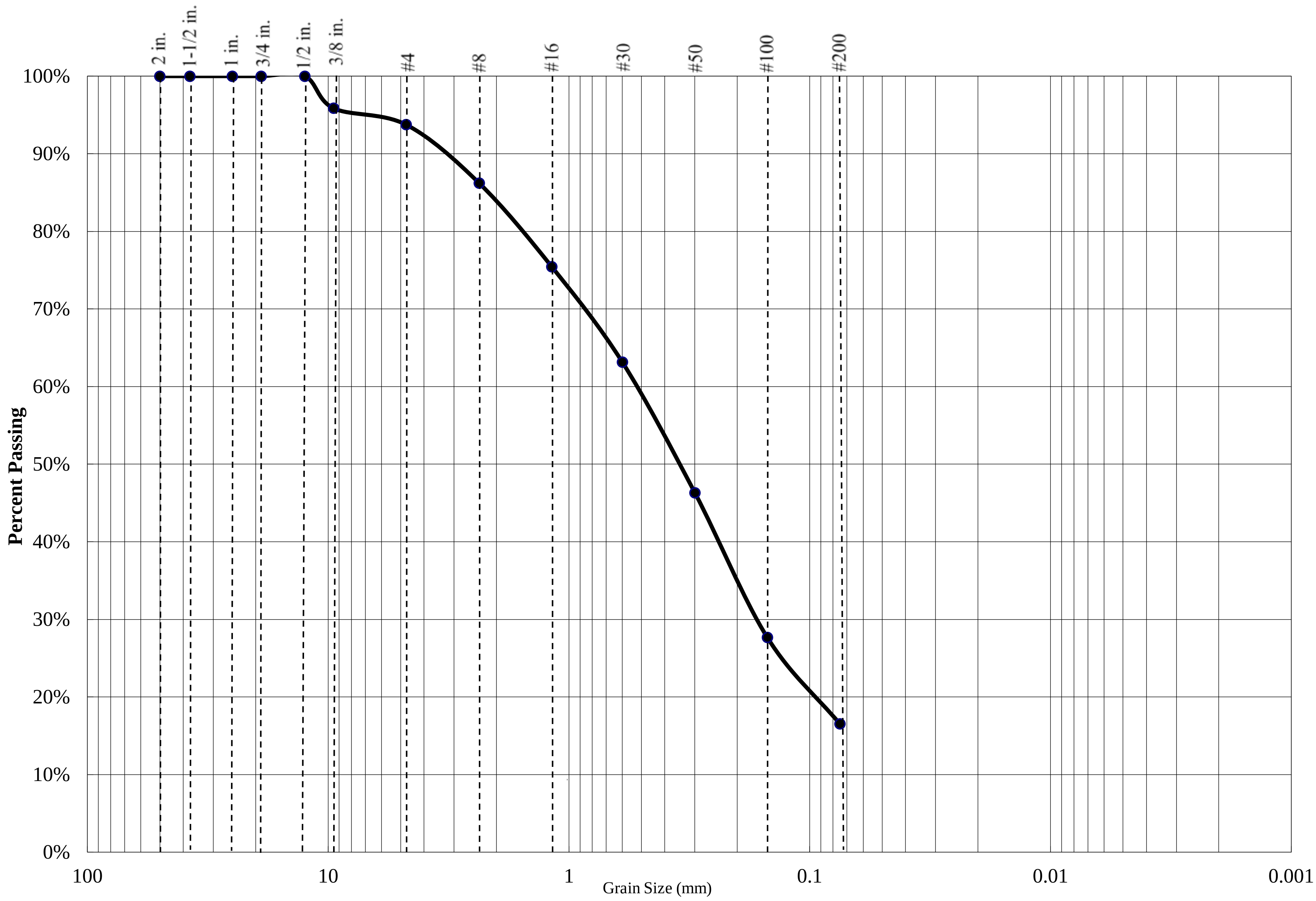
Project Number: 3-223-1036

Boring: B-1 @ 8.5'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
6%	77%	17%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	95.9%
#4	93.8%
#8	86.2%
#16	75.5%
#30	63.1%
#50	46.3%
#100	27.7%
#200	16.5%

Atterberg Limits		
PL=	**LL=**	**PI=**

Coefficients					
D_{85}=		**D_{60}=**		**D_{50}=**	
D_{30}=		**D_{15}=**		**D_{10}=**	
C_u=	N/A	**C_c=**	N/A		

USCS CLASSIFICATION
Silty Sand (SM)

Project Name: 9.99MW GM Solar & BESS - Twentynine Palms

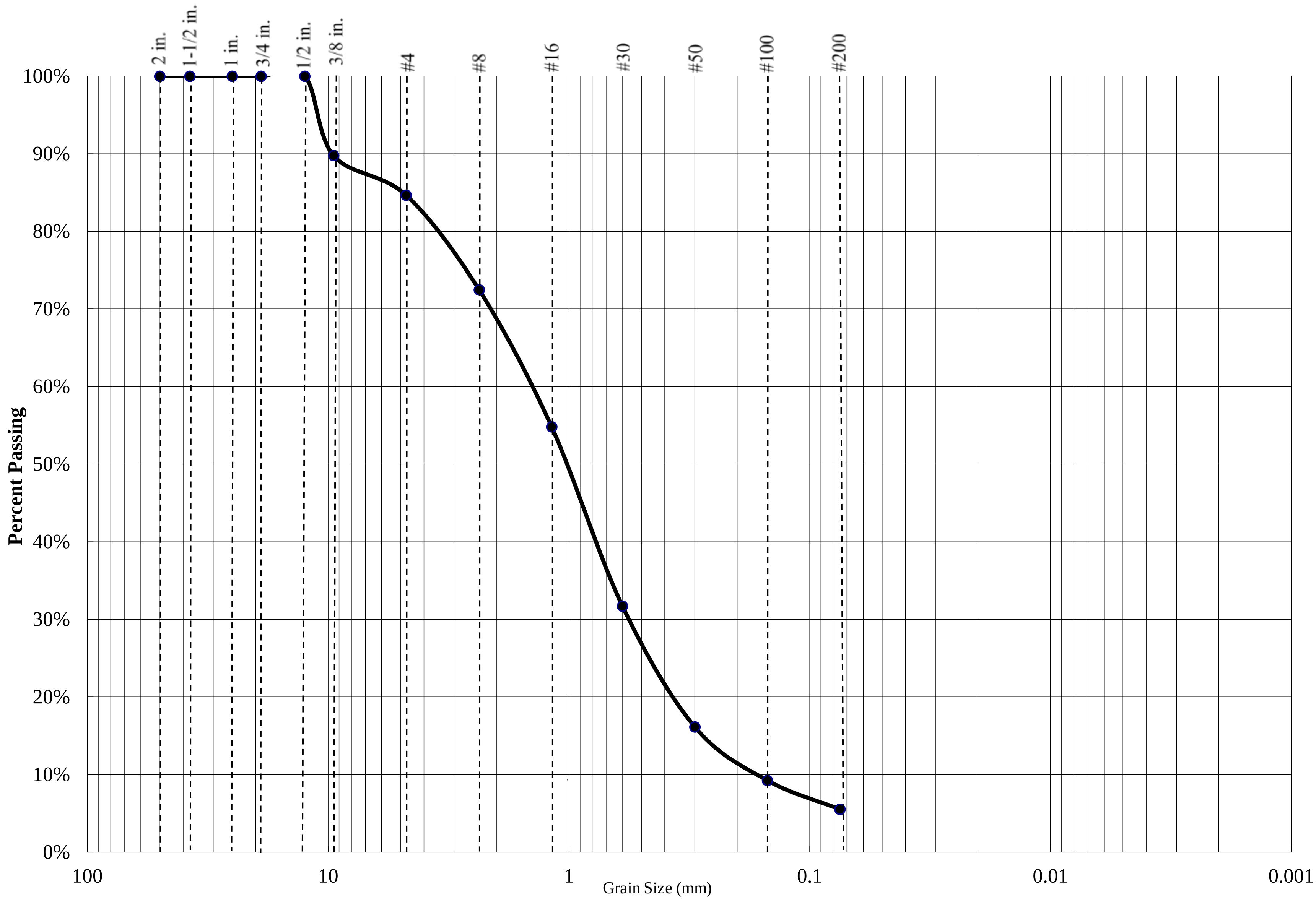
Project Number: 3-223-1036

Boring: B-7 @ 0'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
15%	79%	6%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	89.8%
#4	84.7%
#8	72.5%
#16	54.8%
#30	31.7%
#50	16.1%
#100	9.3%
#200	5.5%

Atterberg Limits		
PL=	LL=	PI=

Coefficients				
D_{85}=		D_{60}=		D_{50}=
D_{30}=		D_{15}=		D_{10}=
C_u=	N/A	C_c=	N/A	

USCS CLASSIFICATION
0

Project Name: 9.99MW GM Solar & BESS - Twentynine Palms

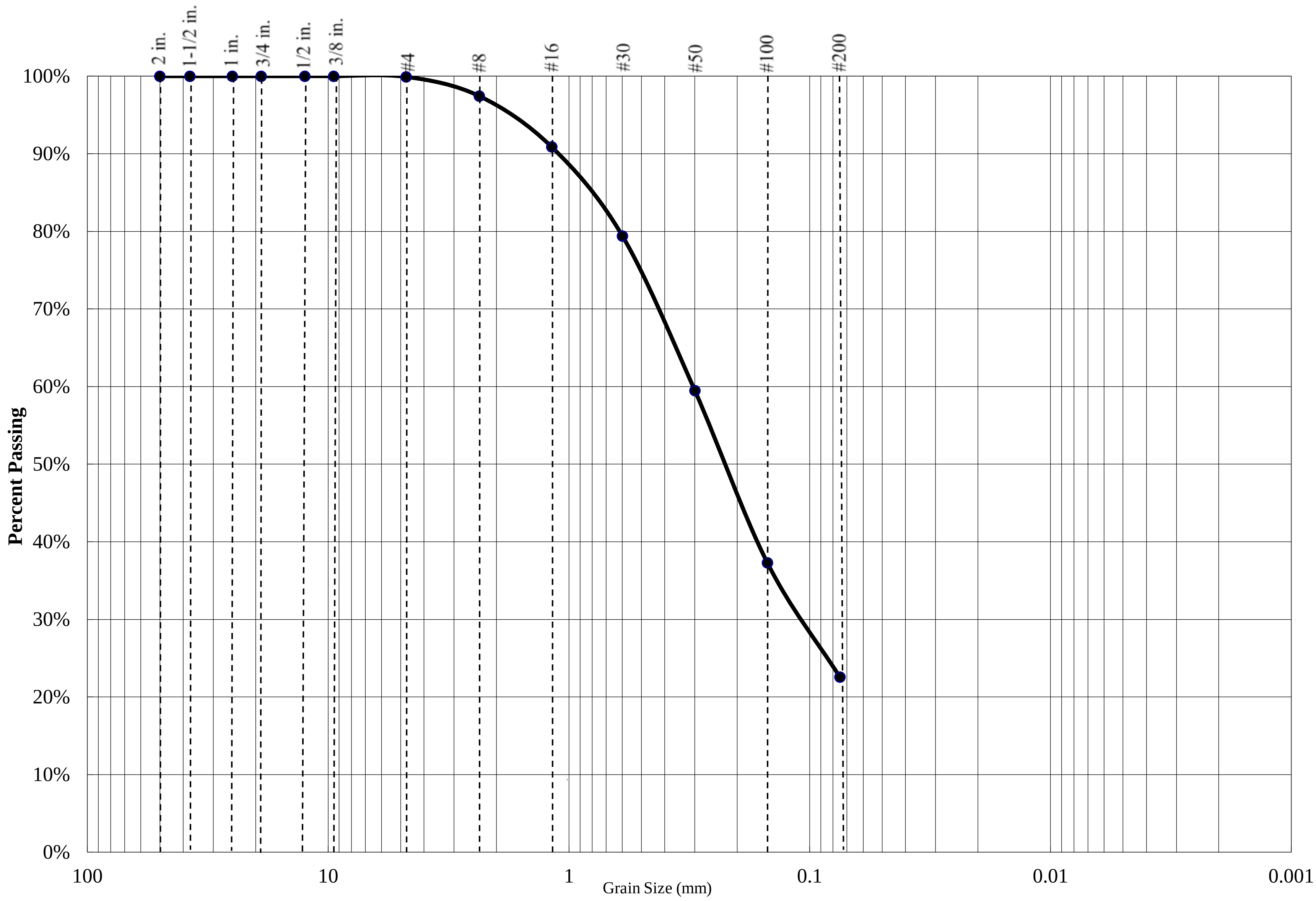
Project Number: 3-223-1036

Boring: B-7 @ 15'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
0%	77%	23%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	100.0%
#4	99.9%
#8	97.4%
#16	90.9%
#30	79.4%
#50	59.5%
#100	37.3%
#200	22.6%

Atterberg Limits		
PL=	LL=	PI=

Coefficients				
D_{85}=		D_{60}=		D_{50}=
D_{30}=		D_{15}=		D_{10}=
C_u=	N/A	C_c=	N/A	

USCS CLASSIFICATION
Silty Sand (SM)

Project Name: 9.99MW GM Solar & BESS - Twentynine Palms

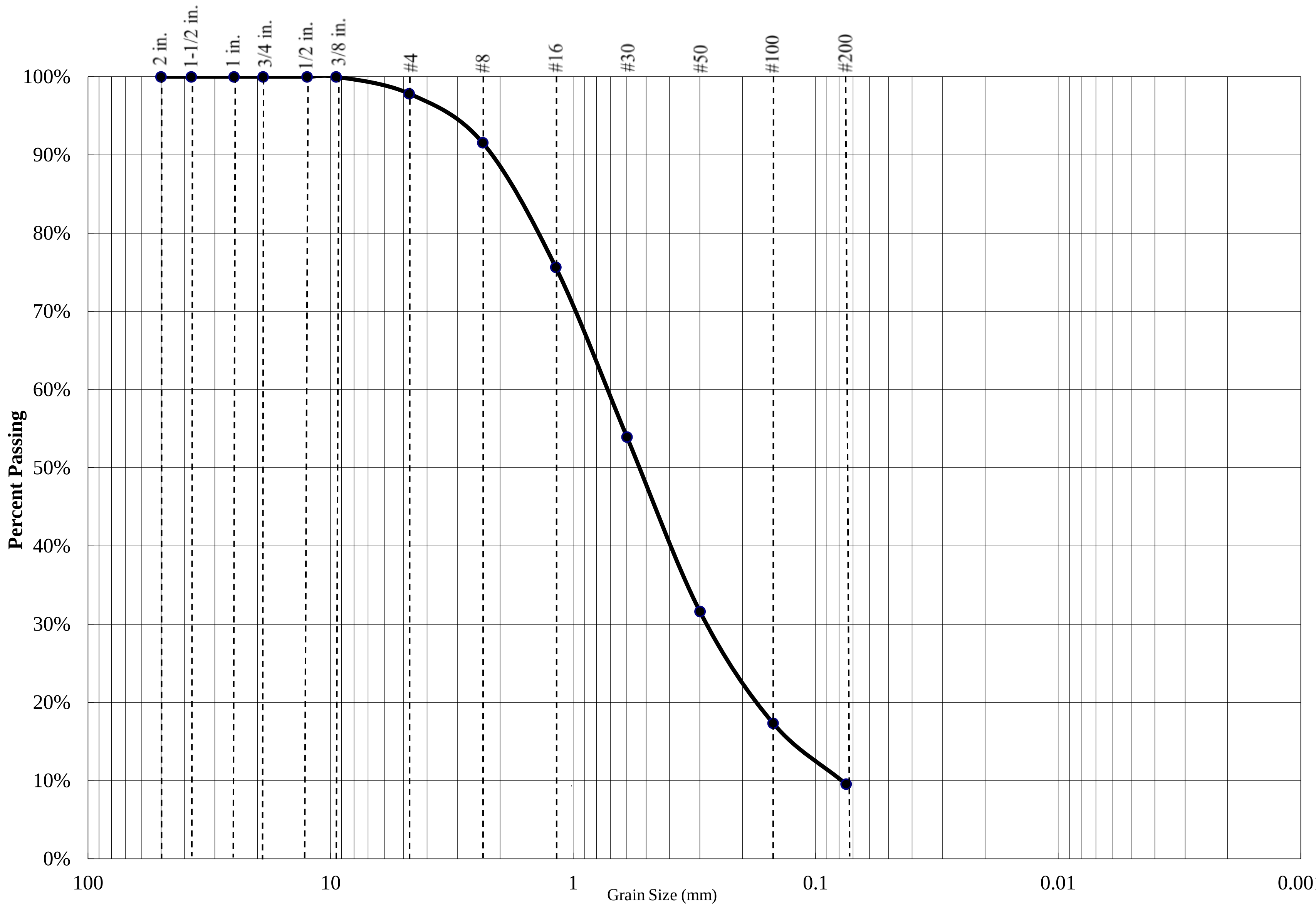
Project Number: 3-223-1036

Boring: B-10 @ 1.5'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
2%	88%	10%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	100.0%
#4	97.8%
#8	91.6%
#16	75.7%
#30	53.9%
#50	31.6%
#100	17.4%
#200	9.6%

Atterberg Limits		
PL=	LL=	PI=

Coefficients		
D_{85}=	D_{60}=	D_{50}=
D_{30}=	D_{15}=	D_{10}=
C_u= N/A	C_c= N/A	

USCS CLASSIFICATION
Poorly Graded Sand with Silt (SP-SM)

Project Name: 9.99MW GM Solar & BESS - Twentynine Palms

Project Number: 3-223-1036

Boring: B-10 @ 10'

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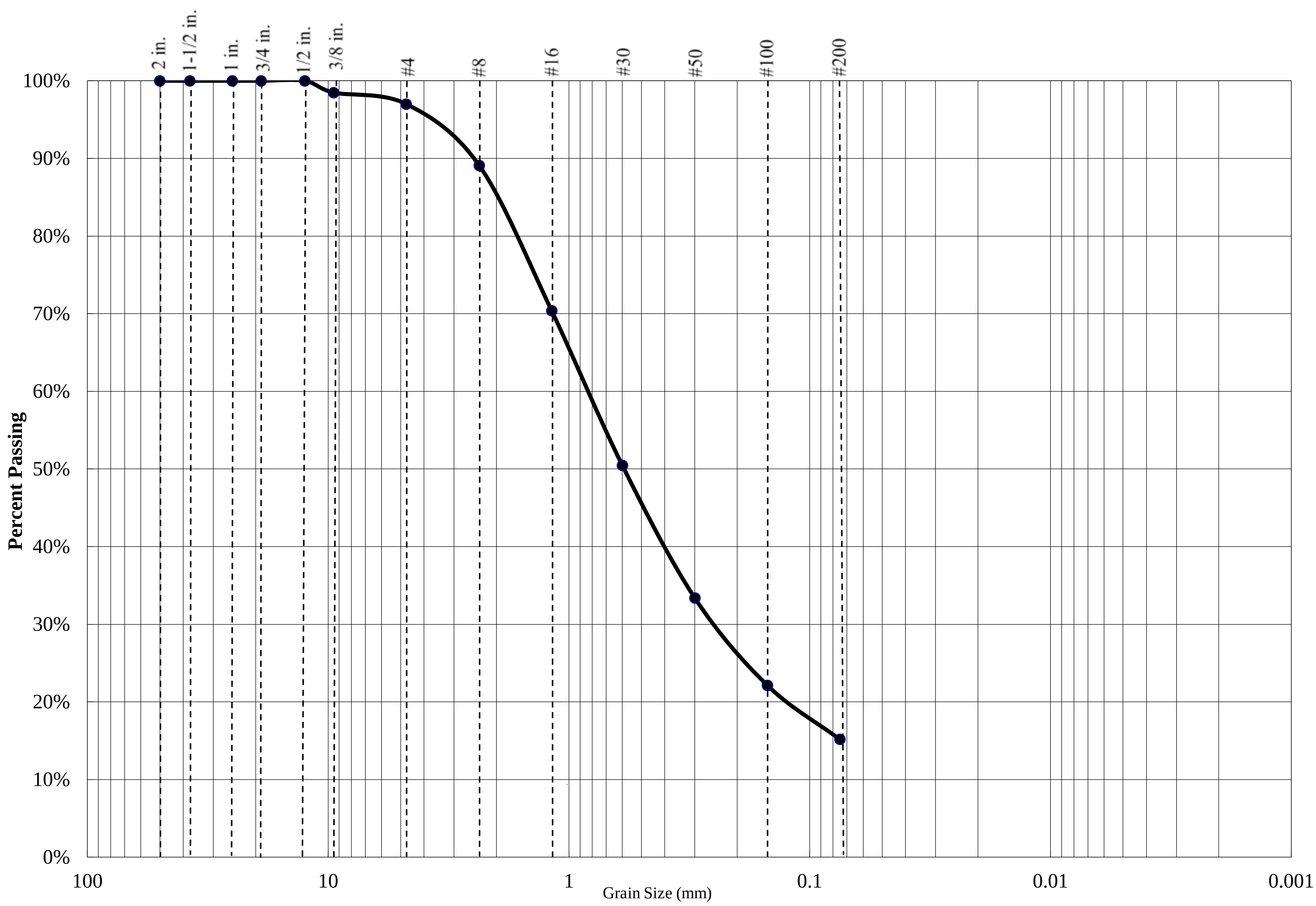
PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
3%	82%	15%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	98.5%
#4	97.0%
#8	89.1%
#16	70.4%
#30	50.5%
#50	33.4%
#100	22.1%
#200	15.2%

Atterberg Limits		
PL=	LL=	PI=

Coefficients					
D_{85}=		D_{60}=		D_{50}=	
D_{30}=		D_{15}=		D_{10}=	
C_u=	N/A	C_c=	N/A		

USCS CLASSIFICATION
Sand with Silt (SM)

Project Name: 9.99MW GM Solar & BESS - Twentynine Palms

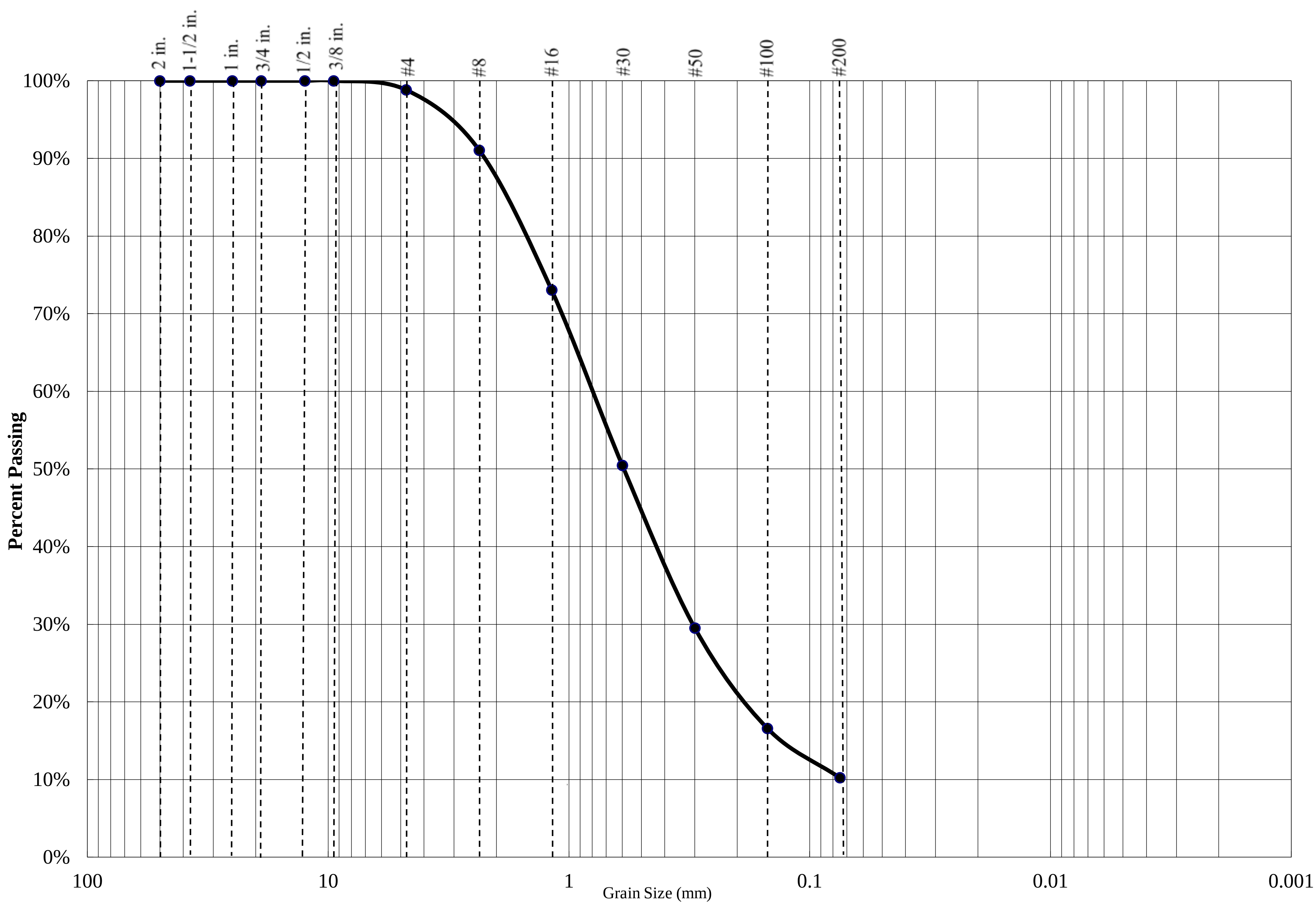
Project Number: 3-223-1036

Boring: B-11 @ 3.5'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
1%	89%	10%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	100.0%
#4	98.8%
#8	91.1%
#16	73.0%
#30	50.5%
#50	29.5%
#100	16.6%
#200	10.2%

Atterberg Limits		
PL=	LL=	PI=

Coefficients					
D_{85}=		D_{60}=		D_{50}=	
D_{30}=		D_{15}=		D_{10}=	
C_u=	N/A	C_c=	N/A		

USCS CLASSIFICATION
Poorly Graded Sand with Silt (SP-SM)

Project Name: 9.99MW GM Solar & BESS - Twentynine Palms

Project Number: 3-223-1036

Boring: B-12 @ 10'

SALEM engineering group, inc.

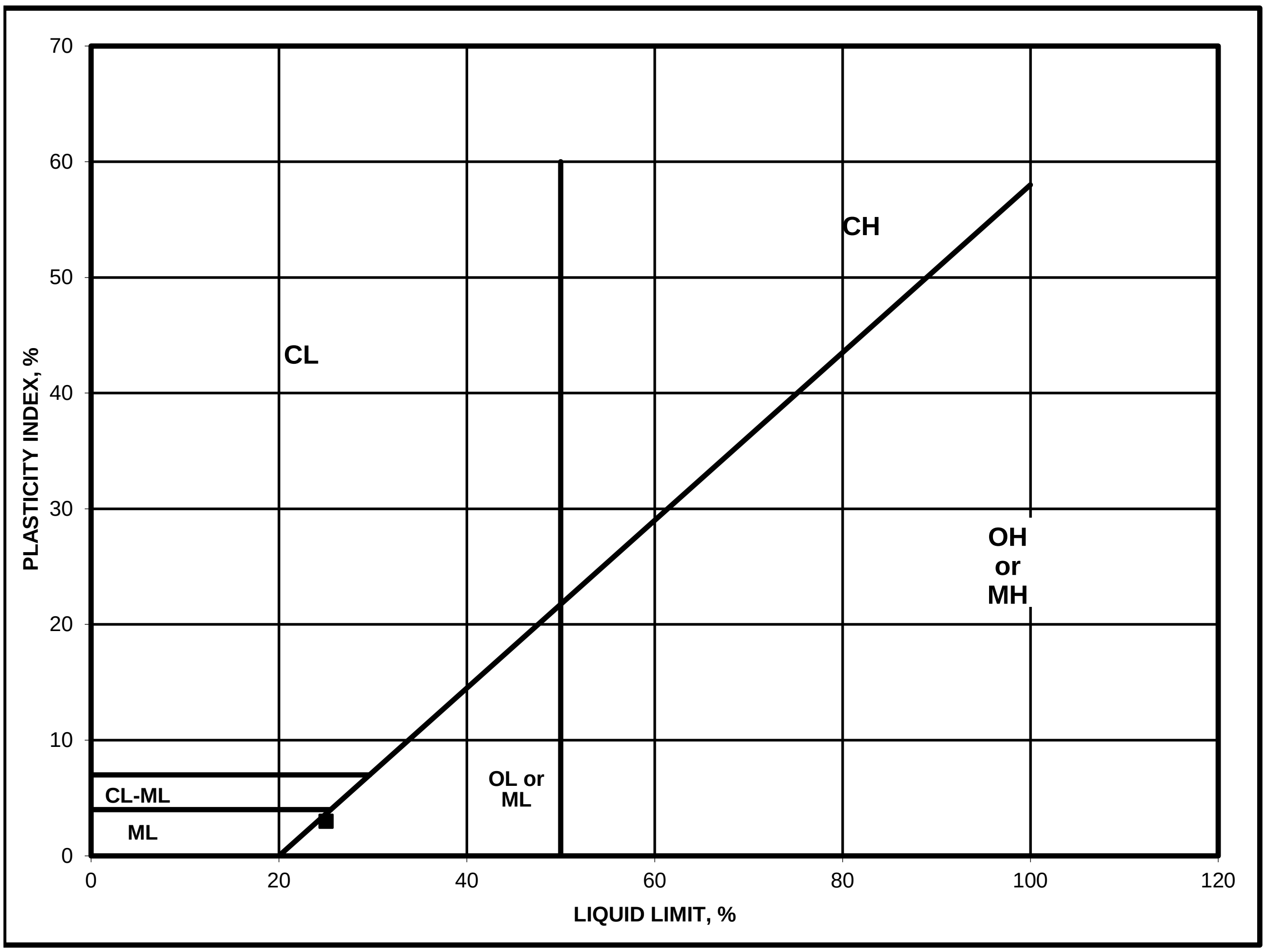
Atterberg Limits Determination
ASTM D4318

Project Name: 9.99MW GM Solar & BESS - Twentynine Palms
Project Number: 3-223-1036
Date Sampled: 10/18/23 & 10/19/23 Date Tested: 10/30/23
Sampled By: SEG Tested By: MC
Sample Location: B-5 @ 3.5'

Run Number	Plastic Limit 1	Plastic Limit 2	Plastic Limit 3	Liquid Limit 1	Liquid Limit 2	Liquid Limit 3
Weight of Wet Soil & Tare	28.97	23.57	28.77	30.86	31.48	31.68
Weight of Dry Soil & Tare	27.53	22.11	27.35	28.93	29.40	29.47
Weight of Water	1.44	1.46	1.42	1.93	2.08	2.21
Weight of Tare	21.04	15.62	21.02	20.60	20.91	21.06
Weight of Dry Soil	6.49	6.49	6.33	8.33	8.49	8.41
Water Content	22.2	22.5	22.4	23.2	24.5	26.3
Number of Blows				29	25	21

Plastic Limit : 22 **Liquid Limit : 25**

Plasticity Index : 3
Unified Soil Classification : OL/ML



SALEM engineering group, inc.

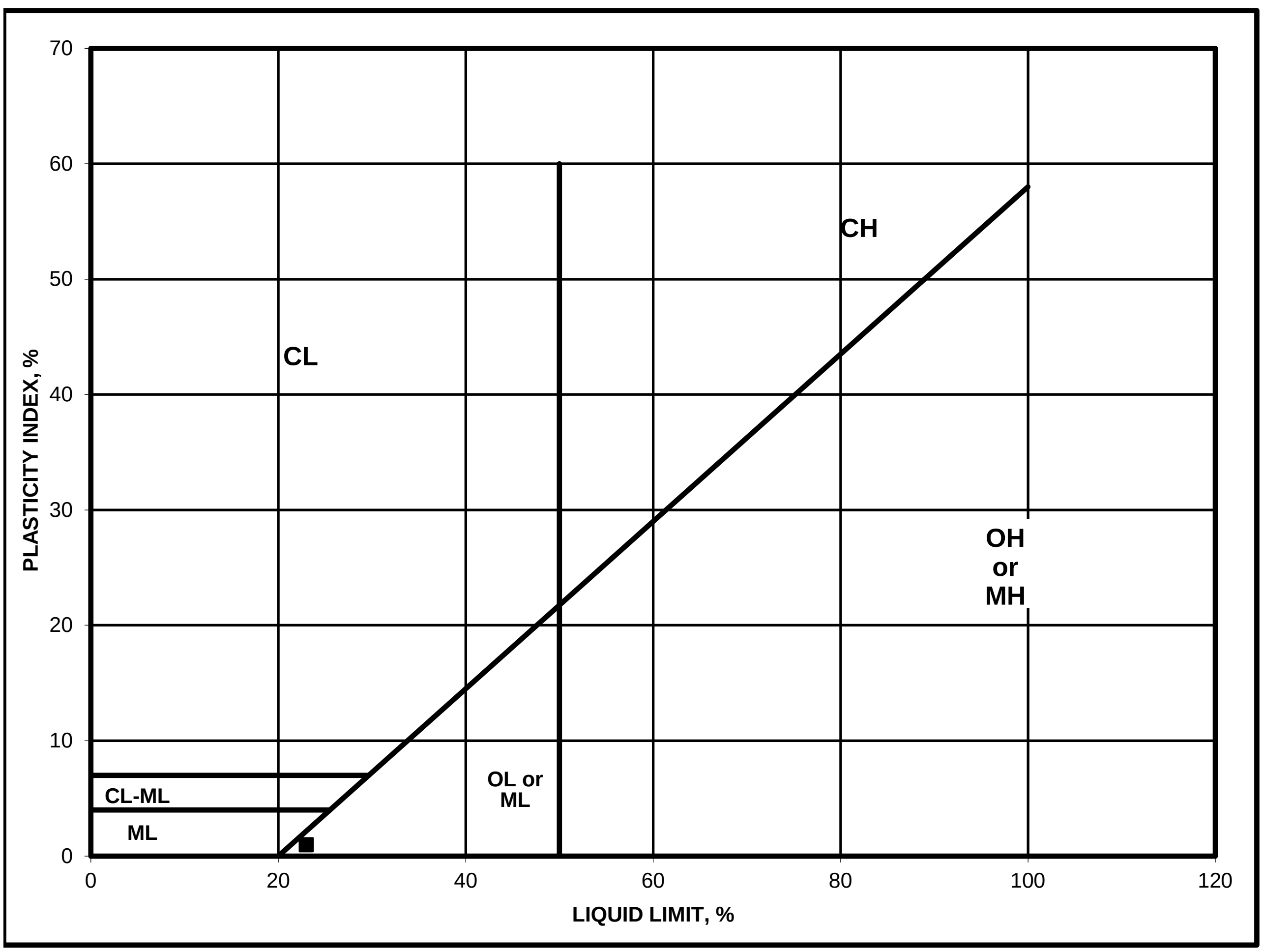
Atterberg Limits Determination
ASTM D4318

Project Name: 9.99MW GM Solar & BESS - Twentynine Palms
Project Number: 3-223-1036
Date Sampled: 10/18/23 & 10/19/23 Date Tested: 11/8/23
Sampled By: SEG Tested By: MC
Sample Location: B-5 @ 15'

	Plastic Limit			Liquid Limit		
Run Number	1	2	3	1	2	3
Weight of Wet Soil & Tare	26.73	27.71	26.36	30.12	31.37	30.56
Weight of Dry Soil & Tare	25.56	26.43	25.35	28.47	29.49	28.88
Weight of Water	1.17	1.28	1.01	1.65	1.88	1.68
Weight of Tare	20.24	20.46	20.90	21.06	21.04	21.99
Weight of Dry Soil	5.32	5.97	4.45	7.41	8.45	6.89
Water Content	22.0	21.4	22.7	22.3	22.2	24.4
Number of Blows				29	23	15

Plastic Limit : 22 **Liquid Limit : 23**

Plasticity Index : 1
Unified Soil Classification : OL/ML



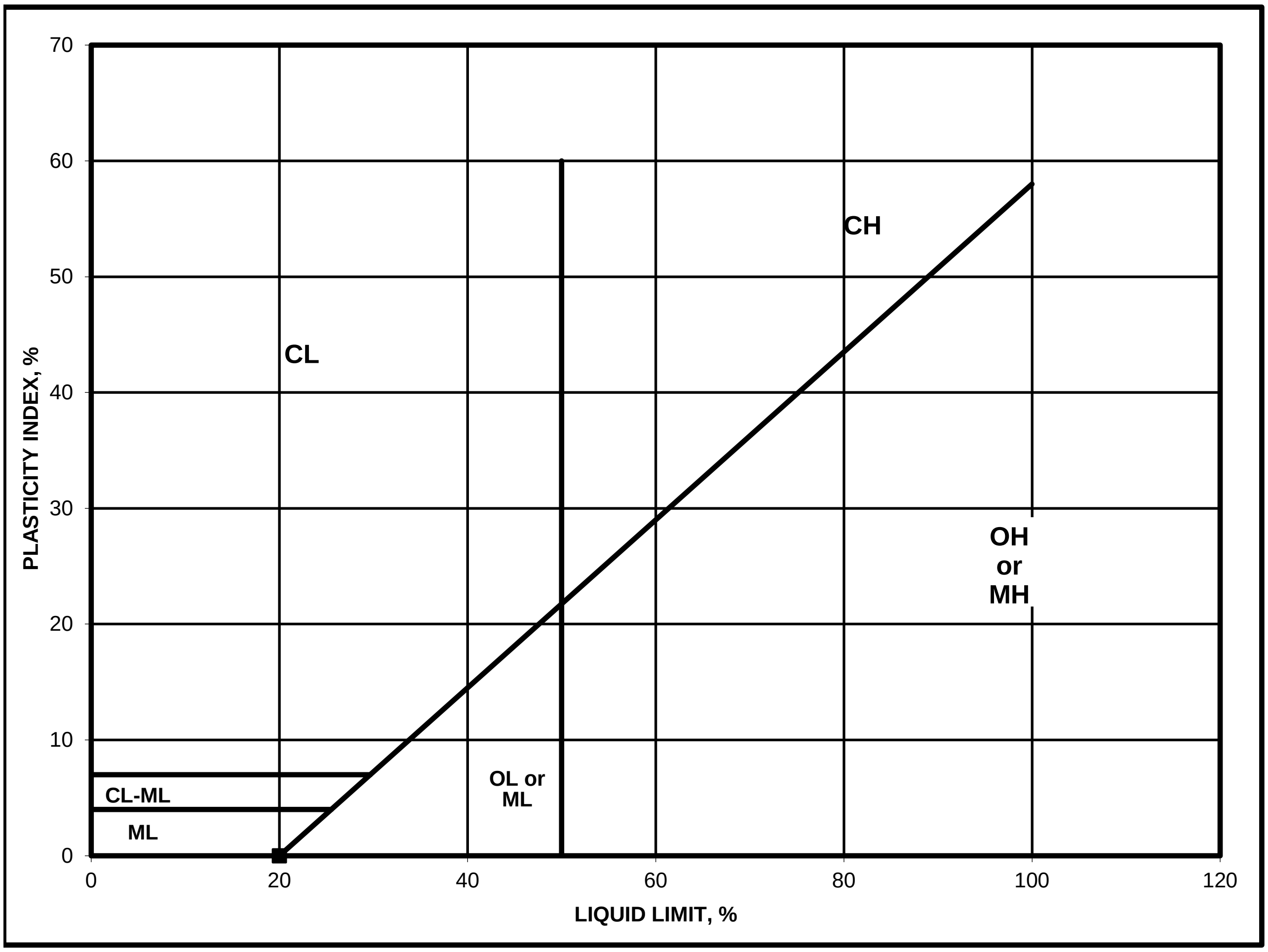
Atterberg Limits Determination
ASTM D4318

Project Name: 9.99MW GM Solar & BESS - Twentynine Palms
Project Number: 3-223-1036
Date Sampled: 10/18/23 & 10/19/23 Date Tested: 11/8/23
Sampled By: SEG Tested By: MC
Sample Location: B-7 @ 0'

	Plastic Limit			Liquid Limit		
Run Number	1	2	3	1	2	3
Weight of Wet Soil & Tare	28.22	29.17	28.23	24.83	25.01	25.46
Weight of Dry Soil & Tare	26.97	27.75	27.06	23.35	23.42	23.80
Weight of Water	1.25	1.42	1.17	1.48	1.59	1.66
Weight of Tare	20.59	20.73	20.94	15.67	15.50	15.68
Weight of Dry Soil	6.38	7.02	6.12	7.68	7.92	8.12
Water Content	19.6	20.2	19.1	19.3	20.1	20.4
Number of Blows				28	22	18

Plastic Limit : 20 **Liquid Limit : 20**

Plasticity Index : 0
Unified Soil Classification : ML



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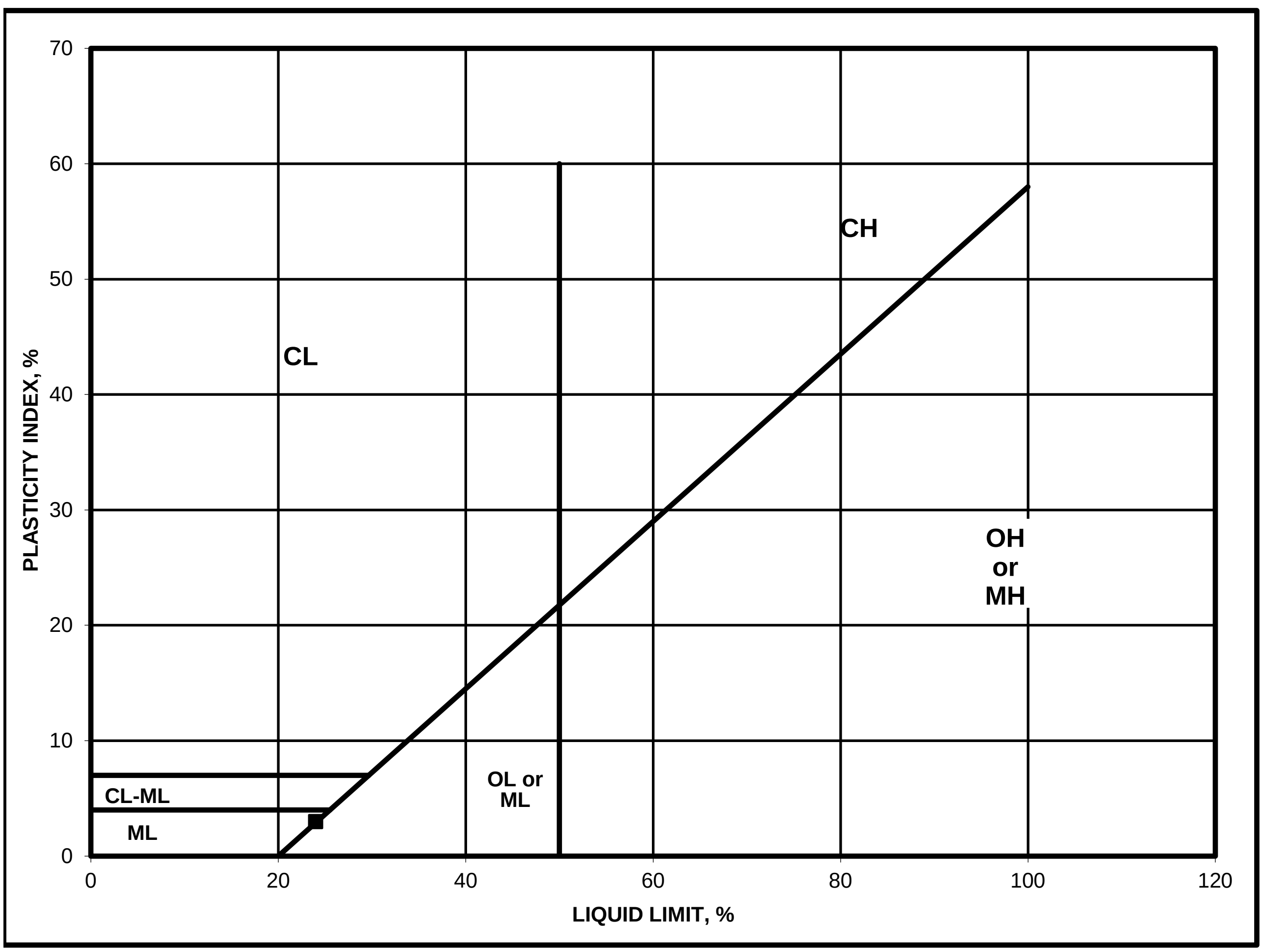
Atterberg Limits Determination
ASTM D4318

Project Name: 9.99MW GM Solar & BESS - Twentynine Palms
Project Number: 3-223-1036
Date Sampled: 10/18/23 & 10/19/23 Date Tested: 11/8/23
Sampled By: SEG Tested By: MC
Sample Location: B-11 @ 3.5'

	Plastic Limit			Liquid Limit		
Run Number	1	2	3	1	2	3
Weight of Wet Soil & Tare	28.00	23.72	28.65	29.18	30.56	31.94
Weight of Dry Soil & Tare	26.78	22.27	27.29	27.54	28.70	29.71
Weight of Water	1.22	1.45	1.36	1.64	1.86	2.23
Weight of Tare	21.05	15.61	20.90	20.53	20.86	20.85
Weight of Dry Soil	5.73	6.66	6.39	7.01	7.84	8.86
Water Content	21.3	21.8	21.3	23.4	23.7	25.2
Number of Blows				27	23	19

Plastic Limit : 21 **Liquid Limit : 24**

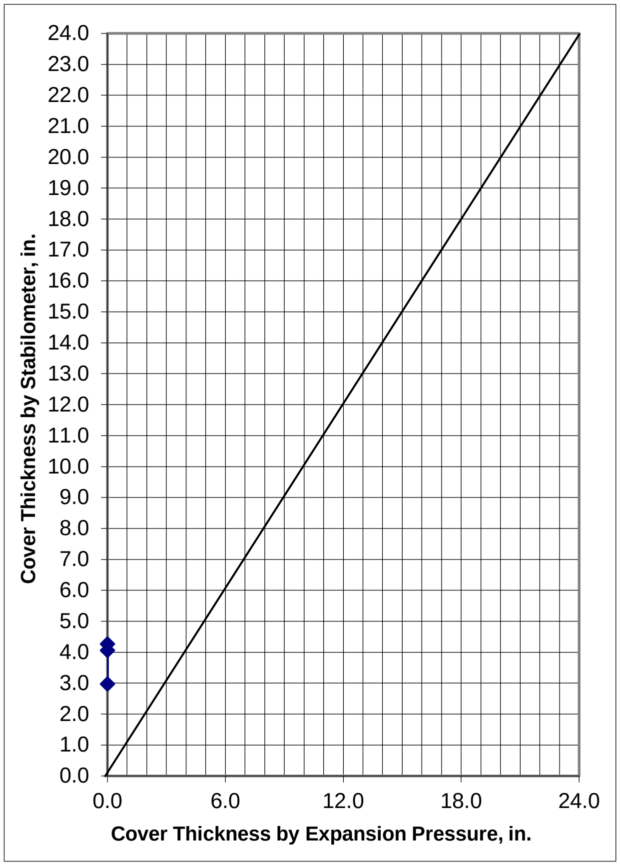
Plasticity Index : 3
Unified Soil Classification : ML

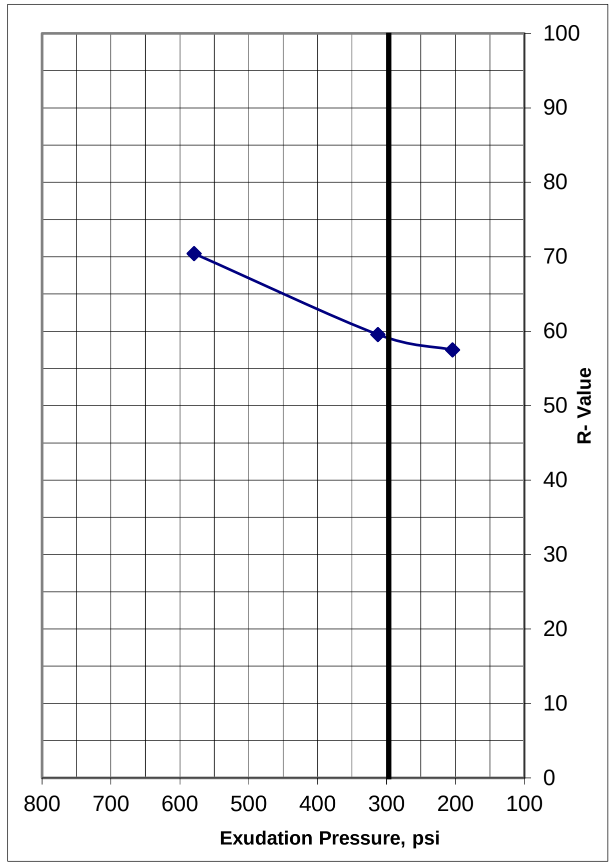


SALEM engineering group, inc.

Resistance R-Value and Expansion Pressure of Compacted Soils
ASTM D2844

Project Name: 9.99MW GM Solar & BESS - Twentynine Palms
Project Number: 3-223-1036
Date Sampled: 10/18/23 & 10/19/23
Date Tested: 11/13/23
Sampled By: SEG
Tested By: JS
Sample Location: B-1 @ 0 - 4'
Soil Description:





Specimen	1	2	3
Exudation Pressure, psi	579.2	312.7	204.1
Moisture at Test, %	8.0	8.2	8.7
Dry Density, pcf	129.5	204.0	128.8
Expansion Pressure, psf	0	0	0
Thickness by Stabilometer, in.	3.0	4.1	4.3
Thickness by Expansion Pressure, in.	0.0	0.0	0.0
R-Value by Stabilometer	70	60	57
R-Value by Expansion Pressure	N/A		
R-Value at 300 psi Exudation Pressure	59		

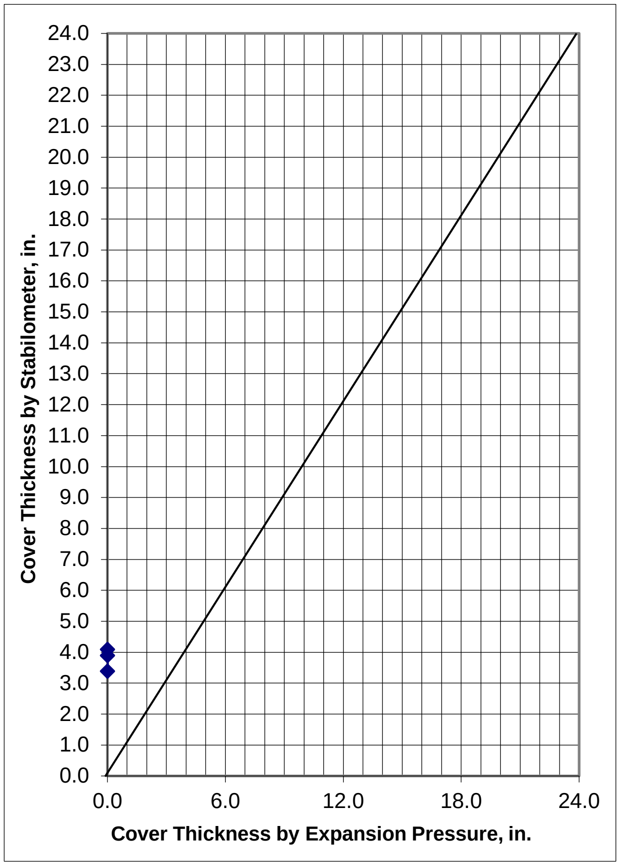
Controlling R-Value	**59**

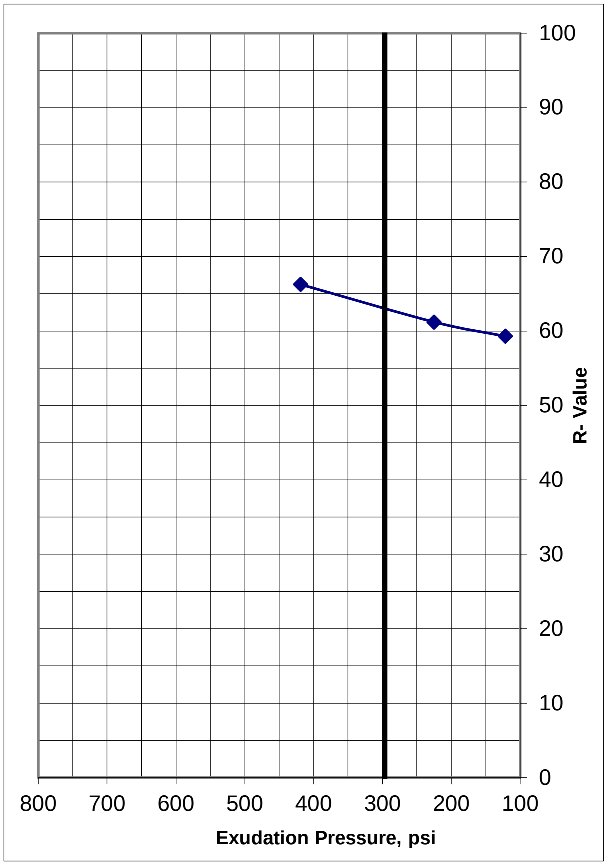
SALEM engineering group, inc.

Resistance R-Value and Expansion Pressure of Compacted Soils

ASTM D2844

Project Name: 9.99MW GM Solar & BESS - Twentynine Palms
Project Number: 3-223-1036
Date Sampled: 10/18/23 & 10/19/23
Date Tested: 11/13/23
Sampled By: SEG
Tested By: JS
Sample Location: B-13 @ 0 - 4'
Soil Description:





Specimen	1	2	3
Exudation Pressure, psi	419.2	225	121.6
Moisture at Test, %	8.6	9.3	9.6
Dry Density, pcf	126.8	125.2	126.6
Expansion Pressure, psf	0	0	0
Thickness by Stabilometer, in.	3.4	3.9	4.1
Thickness by Expansion Pressure, in.	0.0	0.0	0.0
R-Value by Stabilometer	66	61	59
R-Value by Expansion Pressure	N/A		
R-Value at 300 psi Exudation Pressure	63		

Controlling R-Value	**63**

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CHEMICAL ANALYSIS

SO_4 - Modified CTM 417 & Cl - Modified CTM 417/422

Project Name: 9.99MW GM Solar & BESS - Twentynine Palms
Project Number: 3-223-1036
Date Sampled: 10/18/23 & 10/19/23   Date Tested: 10/30/23
Sampled By: SEG   Tested By: MC
Soil Description:

Sample Number	Sample Location	Soluble Sulfate SO_4-S	Soluble Chloride Cl	pH
1a.	B-4 @ 0 - 4'	< 50 mg/kg	47 mg/kg	7.6
1b.	B-4 @ 0 - 4'	< 50 mg/kg	47 mg/kg	7.6
1c.	B-4 @ 0 - 4'	< 50 mg/kg	45 mg/kg	7.6
Average:		**< 50 mg/kg**	**46 mg/kg**	**7.6**

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CHEMICAL ANALYSIS

SO_4 - Modified CTM 417 & Cl - Modified CTM 417/422

Project Name: 9.99MW GM Solar & BESS - Twentynine Palms
Project Number: 3-223-1036
Date Sampled: 10/18/23 & 10/19/23 Date Tested: 10/30/23
Sampled By: SEG Tested By: MC
Soil Description:

Sample Number	Sample Location	Soluble Sulfate SO_4-S	Soluble Chloride Cl	pH
1a.	B-13 @ 0 - 4'	< 50 mg/kg	34 mg/kg	7.6
1b.	B-13 @ 0 - 4'	< 50 mg/kg	33 mg/kg	7.6
1c.	B-13 @ 0 - 4'	< 50 mg/kg	34 mg/kg	7.6
Average:		**< 50 mg/kg**	**34 mg/kg**	**7.6**

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SOIL RESISTIVITY
CTM 643

Project Name: 9.99MW GM Solar & BESS - Twentynine Palms

Project Number: 3-223-1036 | Date Sampled: 10/18/23 & 10/19/23

Sample Location: B-4 @ 0 - 4' | Sampled By: SEG

Soil Description: | Date Tested: | Tested By:

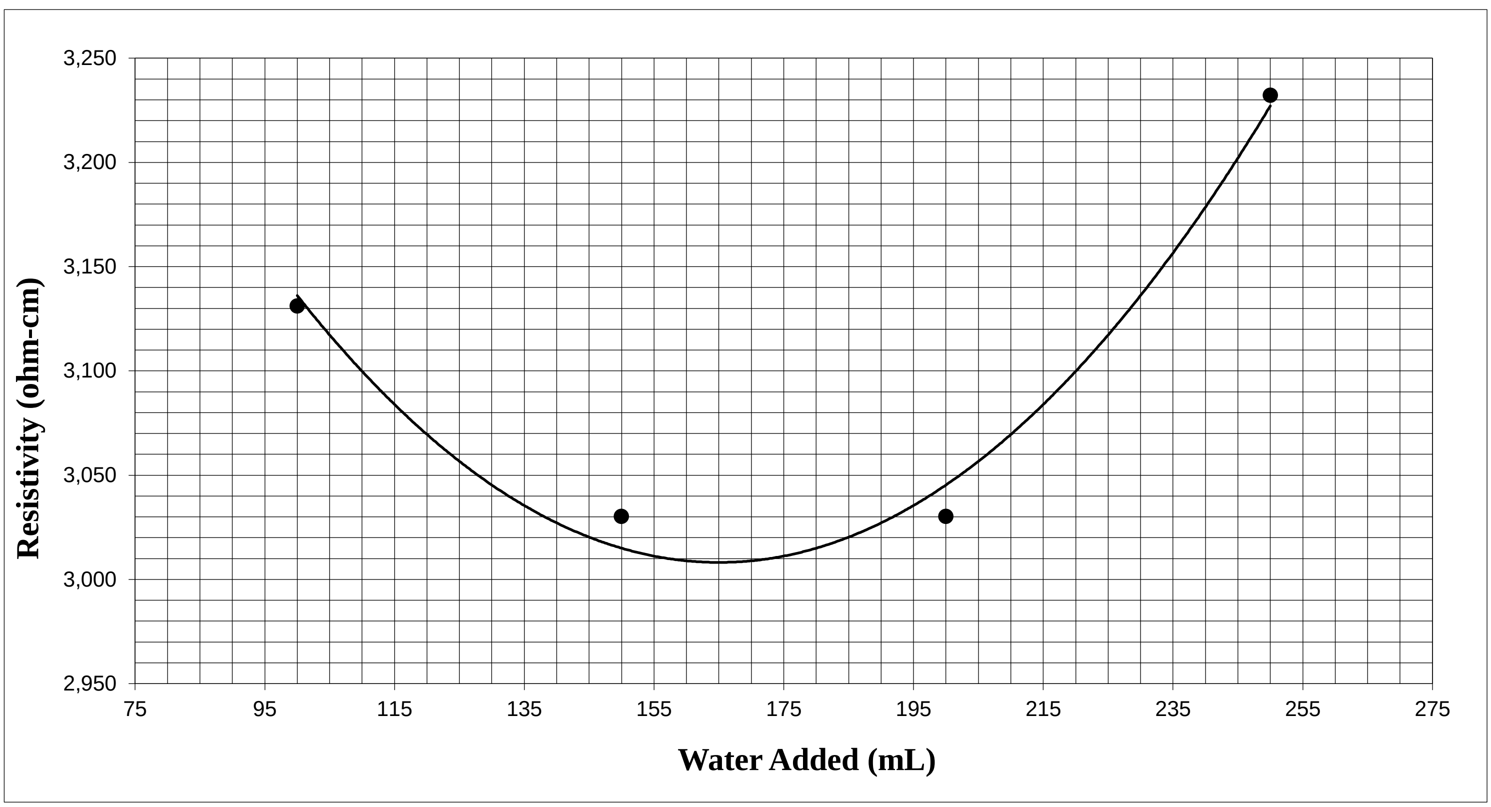
Chloride Content: 46 mg/Kg | Initial Sample Weight: 700 gms

Sulfate Content: < 50 mg/Kg | Test Box Constant: 1.010 cm

Soil pH: 7.6

Test Data:

Trial #	Water Added (mL)	Meter Dial Reading	Multiplier Setting	Resistance (ohms)	Resistivity (ohm-cm)
1	100	3.1	1,000	3,100	3,131
2	150	3.0	1,000	3,000	3,030
3	200	3.0	1,000	3,000	3,030
4	250	3.2	1,000	3,200	3,232



Minimum Resistivity:	**3,008** ohm-cm

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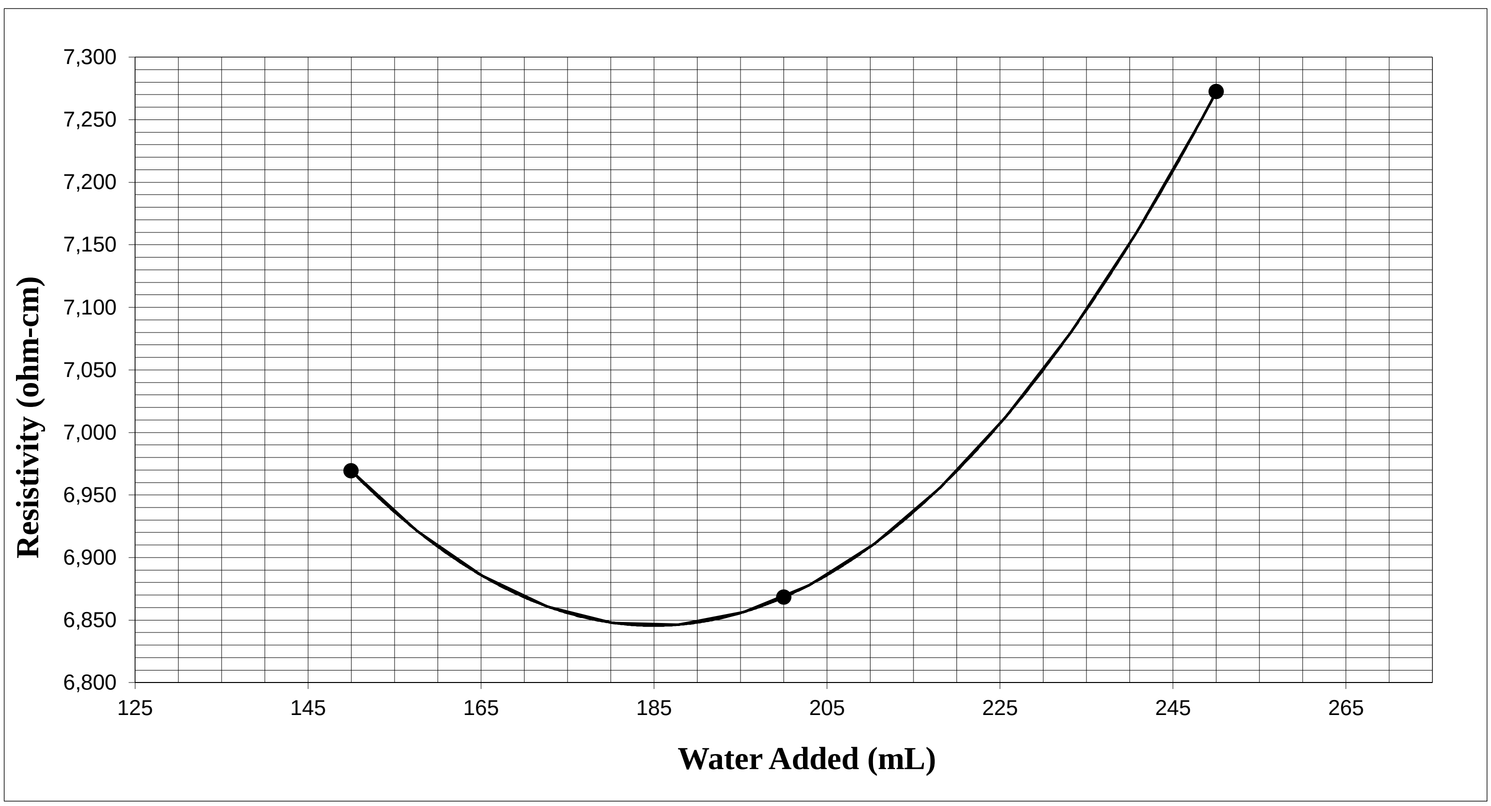
SOIL RESISTIVITY
CTM 643

Project Name: 9.99MW GM Solar & BESS - Twentynine Palms
Project Number: 3-223-1036 | Date Sampled: 10/18/23 & 10/19/23
Sample Location: B-13 @ 0 - 4' | Sampled By: SEG
Soil Description: | Date Tested: 11/3/23 | Tested By: PR

Chloride Content: 34 mg/Kg | Initial Sample Weight: 700 gms
Sulfate Content: < 50 mg/Kg | Test Box Constant: 1.010 cm
Soil pH: 7.6

Test Data:

Trial #	Water Added (mL)	Meter Dial Reading	Multiplier Setting	Resistance (ohms)	Resistivity (ohm-cm)
1	150	6.9	1,000	6,900	6,969
2	200	6.8	1,000	6,800	6,868
3	250	7.2	1,000	7,200	7,272



Minimum Resistivity:	**6,845** ohm-cm

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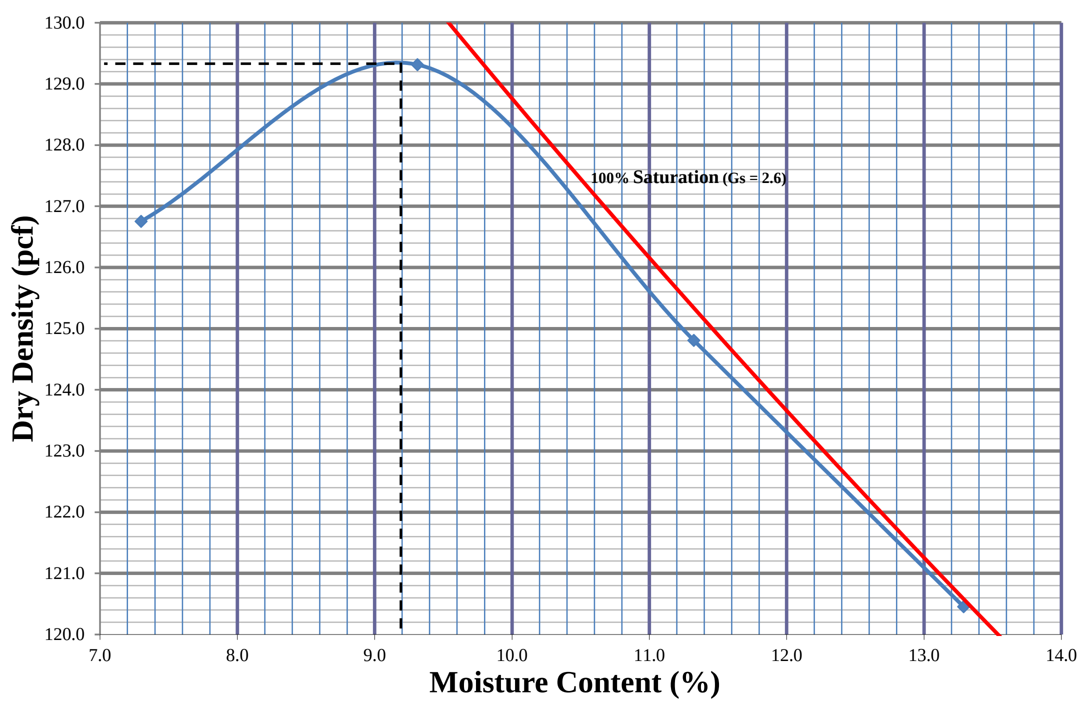
4729 W. Jacquelyn Avenue
Fresno, CA 93722
Office: (559) 271-9700
Fax: (559) 275-0827

Laboratory Compaction Curve

(ASTM D1557, Method A)

Report to:	Mr. Brian Madigan	Date Sampled:	10/19/2023
Project Name:	Proposed 99.9MW Ground Mount Solar Array	Date Tested:	11/1/2023
Sample Location:	S-1: B-4 @ 0' - 4'	Project No.:	3-223-1036
Soil Description:	Brown - Non-Cohesive - Silty Sand	Depth:	0' - 4'
Soil Described By:	ASTM D2488	Specific Gravity:	2.6
Percent Retained on 3/4":	0.0%	Sampled By:	N/A
Percent Retained on 3/8":	0.0%	Tested By:	A. Vega
Percent Retained on No. 4:	0.0%	Sample I.D.	1443-23
Percent Coarse Aggregate:	0.0%	Preparation Method:	☑ Moist ☐ Dry
As-Received Moisture:	1.3%	Type of Rammer Used:	☐ Manual ☑ Mechanical



Test Results	
Maximum Dry Density (pcf):	**129.4**
Optimum Moisture Content (%):	**9.2**

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Fresno, CA 93722
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Laboratory Compaction Curve

(ASTM D1557, Method A)

Report to:	Mr. Brian Madigan	Date Sampled:	10/19/2023
Project Name:	Proposed 99.9MW Ground Mount Solar Array	Date Tested:	10/31/2023
Sample Location:	S-2: B-7 @ 0' - 4'	Project No.:	3-223-1036
Soil Description:	Brown - Non-Cohesive - Silty Sand	Depth:	0' - 4'
Soil Described By:	ASTM D2488	Specific Gravity:	2.65
Percent Retained on 3/4":	0.0%	Sampled By:	N/A
Percent Retained on 3/8":	0.0%	Tested By:	A. Vega
Percent Retained on No. 4:	0.0%	Sample I.D.	1441-23
Percent Coarse Aggregate:	0.0%	Preparation Method:	☑ Moist ☐ Dry
As-Received Moisture:	1.3%	Type of Rammer Used:	☐ Manual ☑ Mechanical

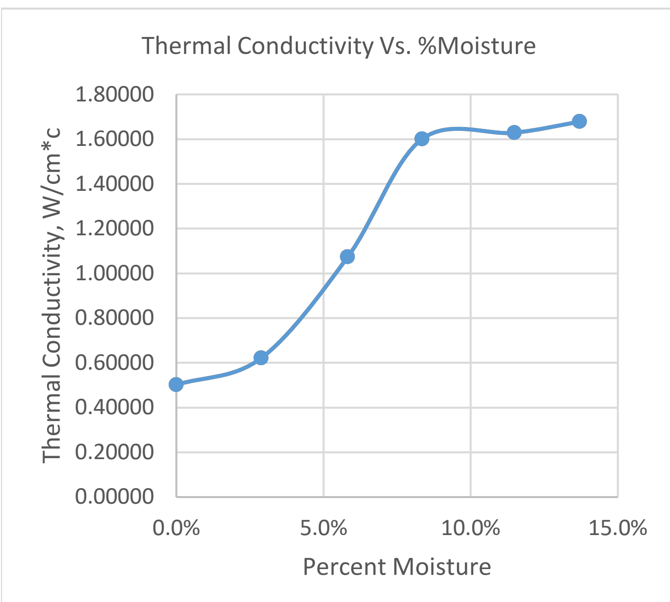
Test Results	
Maximum Dry Density (pcf):	**129.9**
Optimum Moisture Content (%):	**8.4**

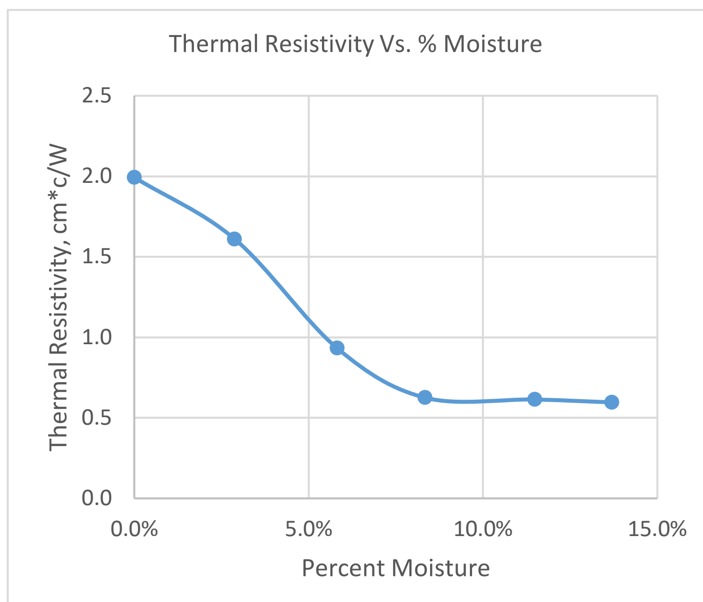
Thermal Conductivity by Thermal Probe, ASTM D5334-14

Project Name 9.99MW GM Solar & BESS - Twentynine Palms **Report Date** 1/0/1900
Project Number 3-223-1036 **Test Date** 11/10/2023

Test Boring B-4 **Maximum Dry Density, pcf** 129.4
Depth 1' - 4' Feet BSG

Wet Weight, gm	838.8	866.6	894.1	919.2	940.6	966.8
Dry Weight, gm	838.8	841.6	842.1	842.5	832.6	834.3
Moisture Content, %	0.0%	2.9%	5.8%	8.3%	11.5%	13.7%
Average Length, in	6.30	6.00	6.00	6.00	5.90	6.30
Average Diameter, in	2.42	2.42	2.42	2.42	2.42	2.42
Dry Density, pcf	110.3	116.3	116.6	117.1	118.4	111.8
Remolded Compaction, %	85%	90%	90%	91%	92%	86%
Thermal Conductivity, W/cm*c◦	0.502	0.621	1.073	1.600	1.629	1.678
Thermal Resistivity, cm*c◦/W	1.993	1.610	0.932	0.625	0.614	0.596





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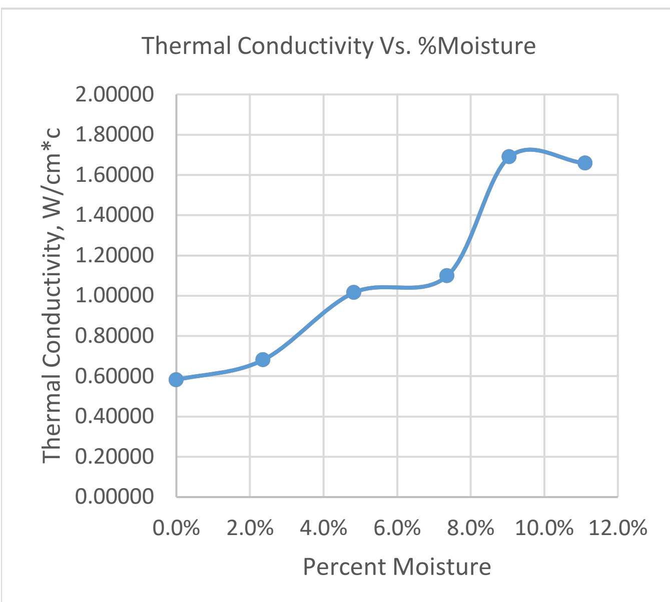
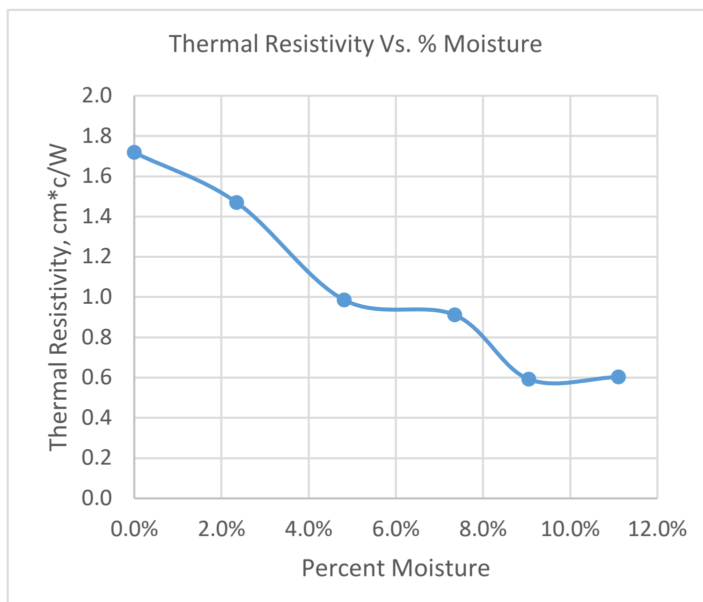
Thermal Conductivity by Thermal Probe, ASTM D5334-14

Project Name 9.99MW GM Solar & BESS - Twentynine Palms
Report Date 1/0/1900
Project Number 3-223-1036
Test Date 11/10/2023

Test Boring B-4
Depth 1' - 4' Feet BSG
Maximum Dry Density, pcf 129.4

Wet Weight, gm	885.5	910.3	931.0	954.6	976.4	995.7
Dry Weight, gm	885.5	888.9	886.1	884.4	888.0	885.1
Moisture Content, %	0.0%	2.4%	4.8%	7.4%	9.1%	11.1%
Average Length, in	6.30	6.20	6.20	6.10	6.20	6.10
Average Diameter, in	2.42	2.42	2.42	2.42	2.42	2.42
Dry Density, pcf	116.4	118.8	118.6	120.7	119.6	121.7
Remolded Compaction, %	90%	92%	92%	93%	92%	94%
Thermal Conductivity, W/cm*c◦	0.582	0.681	1.015	1.098	1.689	1.658
Thermal Resistivity, cm*c◦/W	1.718	1.469	0.985	0.911	0.592	0.603



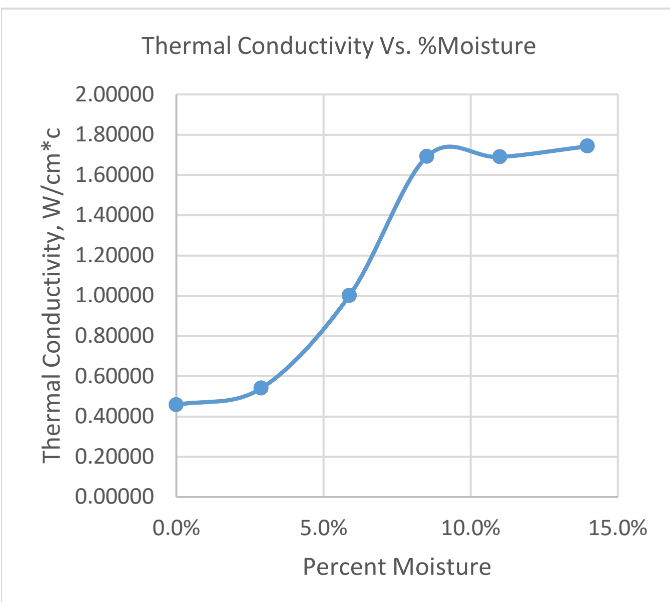


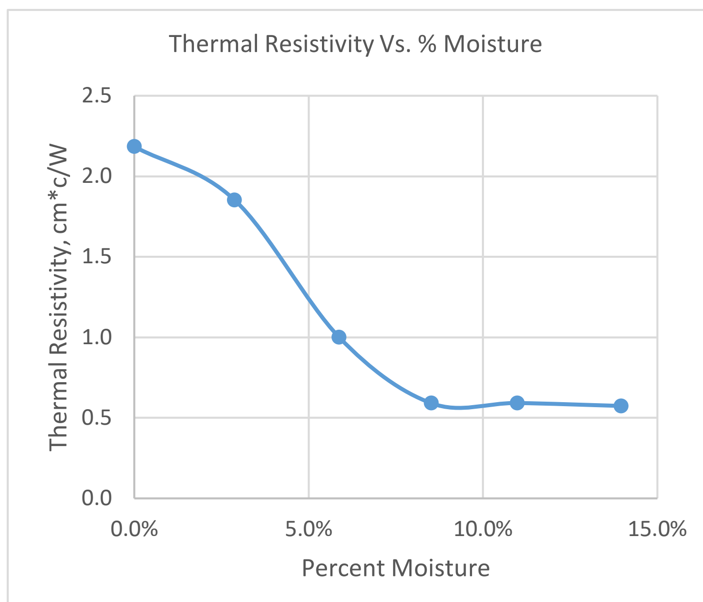
Thermal Conductivity by Thermal Probe, ASTM D5334-14

Project Name 9.99MW GM Solar & BESS - Twentynine Palms **Report Date** 1/0/1900
Project Number 3-223-1036 **Test Date** 11/10/2023

Test Boring B-7 **Maximum Dry Density, pcf** 129.9
Depth 1' - 4' Feet BSG

Wet Weight, gm	842.0	869.8	893.8	919.9	944.6	970.0
Dry Weight, gm	842.0	844.7	841.3	841.5	840.8	834.6
Moisture Content, %	0.0%	2.9%	5.9%	8.5%	11.0%	14.0%
Average Length, in	6.20	6.00	6.00	5.90	5.80	6.10
Average Diameter, in	2.42	2.42	2.42	2.42	2.42	2.42
Dry Density, pcf	112.5	116.7	116.5	119.0	121.5	115.6
Remolded Compaction, %	87%	90%	90%	92%	94%	89%
Thermal Conductivity, W/cm*c◦	0.458	0.540	1.000	1.692	1.689	1.742
Thermal Resistivity, cm*c◦/W	2.184	1.852	1.000	0.591	0.592	0.574





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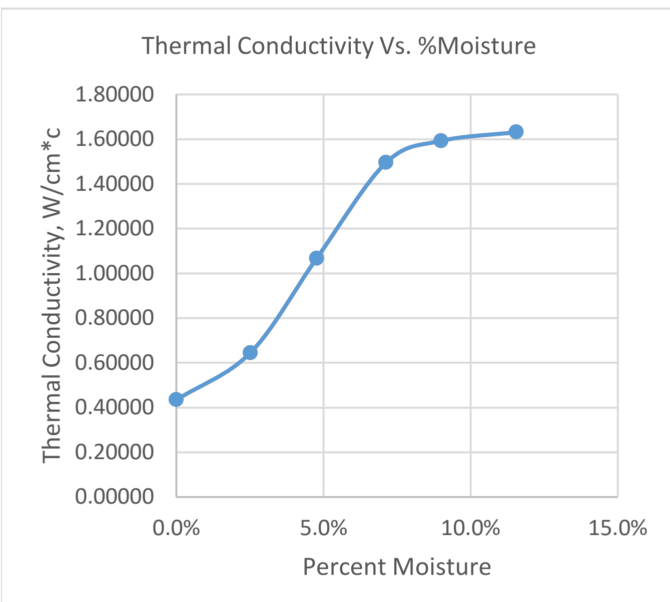
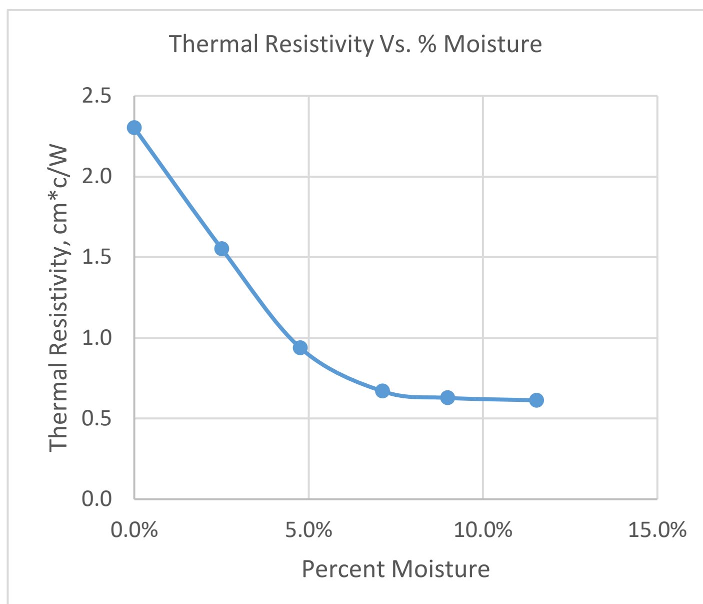
Thermal Conductivity by Thermal Probe, ASTM D5334-14

Project Name 9.99MW GM Solar & BESS - Twentynine Palms
Report Date 1/0/1900
Project Number 3-223-1036
Test Date 11/10/2023

Test Boring B-7
Depth 1' - 4' Feet BSG
Maximum Dry Density, pcf 129.9

Wet Weight, gm	888.5	914.1	936.3	956.0	978.0	999.6
Dry Weight, gm	888.5	891.1	891.7	887.9	890.1	884.2
Moisture Content, %	0.0%	2.5%	4.8%	7.1%	9.0%	11.5%
Average Length, in	6.20	6.20	6.10	6.00	6.00	6.20
Average Diameter, in	2.42	2.42	2.42	2.42	2.42	2.42
Dry Density, pcf	118.7	119.1	121.3	123.2	123.9	119.7
Remolded Compaction, %	91%	92%	93%	95%	95%	92%
Thermal Conductivity, W/cm*c◦	0.434	0.645	1.067	1.495	1.592	1.631
Thermal Resistivity, cm*c◦/W	2.302	1.551	0.937	0.669	0.628	0.613





APPENDIX

C

APPENDIX C
GENERAL EARTHWORK AND PAVEMENT SPECIFICATIONS

When the text of the report conflicts with the general specifications in this appendix, the recommendations in the report have precedence.

1.0 SCOPE OF WORK: These specifications and applicable plans pertain to and include all earthwork associated with the site rough grading, including, but not limited to, the furnishing of all labor, tools and equipment necessary for site clearing and grubbing, stripping, preparation of foundation materials for receiving fill, excavation, processing, placement and compaction of fill and backfill materials to the lines and grades shown on the project grading plans and disposal of excess materials.

2.0 PERFORMANCE: The Contractor shall be responsible for the satisfactory completion of all earthwork in accordance with the project plans and specifications. This work shall be inspected and tested by a representative of SALEM Engineering Group, Incorporated, hereinafter referred to as the Soils Engineer and/or Testing Agency. Attainment of design grades, when achieved, shall be certified by the project Civil Engineer. Both the Soils Engineer and the Civil Engineer are the Owner's representatives. If the Contractor should fail to meet the technical or design requirements embodied in this document and on the applicable plans, he shall make the necessary adjustments until all work is deemed satisfactory as determined by both the Soils Engineer and the Civil Engineer. No deviation from these specifications shall be made except upon written approval of the Soils Engineer, Civil Engineer, or project Architect.

No earthwork shall be performed without the physical presence or approval of the Soils Engineer. The Contractor shall notify the Soils Engineer at least 2 working days prior to the commencement of any aspect of the site earthwork.

The Contractor shall assume sole and complete responsibility for job site conditions during the course of construction of this project, including safety of all persons and property; that this requirement shall apply continuously and not be limited to normal working hours; and that the Contractor shall defend, indemnify and hold the Owner and the Engineers harmless from any and all liability, real or alleged, in connection with the performance of work on this project, except for liability arising from the sole negligence of the Owner or the Engineers.

3.0 TECHNICAL REQUIREMENTS: All compacted materials shall be densified to no less that 95 percent of relative compaction (90 percent for cohesive soils) based on ASTM D1557 Test Method (latest edition), UBC or CAL-216, or as specified in the technical portion of the Soil Engineer's report. The location and frequency of field density tests shall be determined by the Soils Engineer. The results of these tests and compliance with these specifications shall be the basis upon which satisfactory completion of work will be judged by the Soils Engineer.

4.0 SOILS AND FOUNDATION CONDITIONS: The Contractor is presumed to have visited the site and to have familiarized himself with existing site conditions and the contents of the data presented in the Geotechnical Engineering Report. The Contractor shall make his own interpretation of the data contained in the Geotechnical Engineering Report and the Contractor shall not be relieved of liability for any loss sustained as a result of any variance between conditions indicated by or deduced from said report and the actual conditions encountered during the progress of the work.

5.0 DUST CONTROL: The work includes dust control as required for the alleviation or prevention of any dust nuisance on or about the site or the borrow area, or off-site if caused by the Contractor's operation either during the performance of the earthwork or resulting from the conditions in which the Contractor leaves the site. The Contractor shall assume all liability, including court costs of codefendants, for all claims related to dust or wind-blown materials attributable to his work. Site preparation shall consist of site clearing and grubbing and preparation of foundation materials for receiving fill.

6.0 CLEARING AND GRUBBING: The Contractor shall accept the site in this present condition and shall demolish and/or remove from the area of designated project earthwork all structures, both surface and subsurface, trees, brush, roots, debris, organic matter and all other matter determined by the Soils Engineer to be deleterious. Such materials shall become the property of the Contractor and shall be removed from the site.

Tree root systems in proposed improvement areas should be removed to a minimum depth of 3 feet and to such an extent which would permit removal of all roots greater than 1 inch in diameter. Tree roots removed in parking areas may be limited to the upper 1½ feet of the ground surface. Backfill of tree root excavations is not permitted until all exposed surfaces have been inspected and the Soils Engineer is present for the proper control of backfill placement and compaction. Burning in areas which are to receive fill materials shall not be permitted.

7.0 SUBGRADE PREPARATION: Surfaces to receive Engineered Fill and/or building or slab loads shall be prepared as outlined above, scarified to a minimum of 12 inches, moisture-conditioned as necessary, and recompacted to 95 percent relative compaction (90 percent for cohesive soils).

Loose soil areas and/or areas of disturbed soil shall be moisture-conditioned as necessary and recompacted to 95 percent relative compaction (90 percent for cohesive soils). All ruts, hummocks, or other uneven surface features shall be removed by surface grading prior to placement of any fill materials. All areas which are to receive fill materials shall be approved by the Soils Engineer prior to the placement of any fill material.

8.0 EXCAVATION: All excavation shall be accomplished to the tolerance normally defined by the Civil Engineer as shown on the project grading plans. All over-excavation below the grades specified shall be backfilled at the Contractor's expense and shall be compacted in accordance with the applicable technical requirements.

9.0 FILL AND BACKFILL MATERIAL: No material shall be moved or compacted without the presence or approval of the Soils Engineer. Material from the required site excavation may be utilized for construction site fills, provided prior approval is given by the Soils Engineer. All materials utilized for constructing site fills shall be free from vegetation or other deleterious matter as determined by the Soils Engineer.

10.0 PLACEMENT, SPREADING AND COMPACTION: The placement and spreading of approved fill materials and the processing and compaction of approved fill and native materials shall be the responsibility of the Contractor. Compaction of fill materials by flooding, ponding, or jetting shall not be permitted unless specifically approved by local code, as well as the Soils Engineer. Both cut and fill shall be surface-compacted to the satisfaction of the Soils Engineer prior to final acceptance.

11.0 SEASONAL LIMITS: No fill material shall be placed, spread, or rolled while it is frozen or thawing, or during unfavorable wet weather conditions. When the work is interrupted by heavy rains, fill operations shall not be resumed until the Soils Engineer indicates that the moisture content and density of previously placed fill is as specified.

12.0 DEFINITIONS - The term "pavement" shall include asphaltic concrete surfacing, untreated aggregate base, and aggregate subbase. The term "subgrade" is that portion of the area on which surfacing, base, or subbase is to be placed.

The term "Standard Specifications": hereinafter referred to, is the most recent edition of the Standard Specifications of the State of California, Department of Transportation. The term "relative compaction" refers to the field density expressed as a percentage of the maximum laboratory density as determined by ASTM D1557 Test Method (latest edition) or California Test Method 216 (CAL-216), as applicable.

13.0 PREPARATION OF THE SUBGRADE - The Contractor shall prepare the surface of the various subgrades receiving subsequent pavement courses to the lines, grades, and dimensions given on the plans. The upper 12 inches of the soil subgrade beneath the pavement section shall be compacted to a minimum relative compaction of 95 percent based upon ASTM D1557. The finished subgrades shall be tested and approved by the Soils Engineer prior to the placement of additional pavement courses.

14.0 AGGREGATE BASE - The aggregate base material shall be spread and compacted on the prepared subgrade in conformity with the lines, grades, and dimensions shown on the plans. The aggregate base material shall conform to the requirements of Section 26 of the Standard Specifications for Class II material, ¾-inch or 1½-inches maximum size. The aggregate base material shall be compacted to a minimum relative compaction of 95 percent based upon CAL-216. The aggregate base material shall be spread in layers not exceeding 6 inches and each layer of aggregate material course shall be tested and approved by the Soils Engineer prior to the placement of successive layers.

15.0 AGGREGATE SUBBASE - The aggregate subbase shall be spread and compacted on the prepared subgrade in conformity with the lines, grades, and dimensions shown on the plans. The aggregate subbase material shall conform to the requirements of Section 25 of the Standard Specifications for Class II Subbase material. The aggregate subbase material shall be compacted to a minimum relative compaction of 95 percent based upon CAL-216, and it shall be spread and compacted in accordance with the Standard Specifications. Each layer of aggregate subbase shall be tested and approved by the Soils Engineer prior to the placement of successive layers.

16.0 ASPHALTIC CONCRETE SURFACING - Asphaltic concrete surfacing shall consist of a mixture of mineral aggregate and paving grade asphalt, mixed at a central mixing plant and spread and compacted on a prepared base in conformity with the lines, grades, and dimensions shown on the plans. The viscosity grade of the asphalt shall be PG 64-10, unless otherwise stipulated or local conditions warrant more stringent grade. The mineral aggregate shall be Type A or B, ½ inch maximum size, medium grading, and shall conform to the requirements set forth in Section 39 of the Standard Specifications. The drying, proportioning, and mixing of the materials shall conform to Section 39. The prime coat, spreading and compacting equipment, and spreading and compacting the mixture shall conform to the applicable chapters of Section 39, with the exception that no surface course shall be placed when the atmospheric temperature is below 50 degrees F. The surfacing shall be rolled with a combination steel-wheel and pneumatic rollers, as described in the Standard Specifications. The surface course shall be placed with an approved self-propelled mechanical spreading and finishing machine.