Appendix C: Geotechnical

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Project No. GS 1531
May 20, 2015

GEOTECHNICAL REPORT
FOR PROPOSED FOUR STORY APARTMENT BUILDING
@
2277 HARBOR BOULEVARD
COSTA MESA, CALIFORNIA.

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PREPARED FOR

MIRACLE MILE PROPERTIES, LP
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Subject

A geotechnical report for proposed four story apartment building and associated 4 story parking structure with one level of partial subterranean located at 2277 Harbor Boulevard in the City of Costa Mesa, California.

Introduction

This report presents the results of a geotechnical investigation performed at Costa Mesa Motor Inn for the proposed development of a four story luxury apartment complex consisting of wood framed type construction. The development will also include the construction of a four story concrete parking structure with a partial one-level subterranean floor along the south side of the parking structure. The area to be developed is indicated on Figure 1, Site Location Map.

The purpose of our investigation was to investigate and evaluate existing geologic and soil conditions at the site and to provide recommendations for the planned grading and development.

Our investigation was based on conceptual development plans provided by the owners architect. The plan has been utilized as the base map for our Plot Plan, Plate 1.

Location

The site is located at 2277 Harbor Boulevard in Costa Mesa, California. The proposed development is located at the site of the existing 2-story Costa Mesa Motor Inn property that will be demolished prior to the construction of the proposed development. The site is approximately 4.6 acres and is relatively flat.

Scope

The purpose of our investigation was to explore and evaluate the existing soil and geologic conditions at the site, and based on our findings; provide our conclusions and recommendations regarding grading and construction of the proposed apartment complex.
The scope of services utilized to conduct an investigation included the following tasks:

1. Review of published and unpublished maps and reports pertinent to the site.

2. Field investigation including 7 hollow stem auger borings to depths ranging from 30 to 50 feet, 2 hand auger borings to a depth of 10 feet, and 2 percolation tests at selected boring locations to evaluate the percolation rate of onsite soils.

3. Laboratory testing of representative soil samples to provide recommendations for proposed

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grading and foundation design.

4. Geotechnical analyses.

5. Preparation of a report including findings, conclusions and recommendations. Recommendations include: Grading and site preparation, UBC Seismic Parameters, foundation design, lateral load design, temporary excavations, slabs, settlement, expansiveness of soils and site drainage.

Maps

The site location is shown on Plate 1, Site Location Map. The existing conditions, proposed building and improvements, and the location of our field investigation borings are shown on Plate 2, Plot Plan.

Proposed Construction

We understand that the proposed construction will consist of the a new four-story wood framed apartment building encompassing the majority of the site. The construction will also include a swimming pool, access drives and associated courtyard, landscape, and flatwork areas.

The site is currently occupied by an existing building and associated parking which will be demolished to allow for the construction of the proposed development.

The proposed development will also include a parking garage consisting of a reinforced concrete construction with a partial half to one level subterranean along the south side of the garage structure and 4 levels above grade plus roof level parking. The parking structure will be located along the south side of the site and approximately mid-way along the length of the property.

Structural loads are anticipated to be on the order of 3 kips per lineal foot for the proposed apartment building, and approximately 4½ kips per lineal foot for the proposed parking garage. Total column loads for the parking are anticipated to be on the order of 600 kips.

Existing and proposed structures, as well as the locations of proposed parking, pool, and other ancillary structures, are indicated on the Plot Plan, Plate 1.

Site Conditions

Surface Conditions: The property consists of a rectangular shaped parcel, approximately 620 feet long by 320 feet wide, that is currently occupied by an apartment complex known as the Costa Mesa Motor Inn. The existing building is to be entirely demolished for development of the new apartment

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complex. The site is flat with a maximum of approximately one foot of relief from north to south.

The site is located west and adjacent to the roadway at 2277 Harbor Boulevard in the City of Costa Mesa. The property to the north is occupied by a golf course, the west by apartments, and the south by commercial property.

Drainage and Groundwater: Site drainage is primarily by sheetflow runoff of rainfall incident on the site. Groundwater was not encountered in our borings within the depths explored. Based on the Historically Highest Ground Water Contours, Newport Beach Quadrangle, historical high groundwater is not clearly reported but is anticipated to be well in excess of 30 feet below grade.

Field Investigation

The field investigation included the excavation of seven hollow stem auger borings to depths of 31½ to 51½ feet below existing grade within the proposed building and parking structure footprints. We also performed 2 hand auger borings to a depth of approximately 10 feet below existing grade in areas where equipment accessibility was limited.

To assist the Civil engineering design for the purposed of stormwater infiltration, percolation testing was performed in two of the borings at the site. Testing was performed in Borings B-2, and B-3 between depths of 0 to 5 feet and 5 to 15 feet below grade, respectively. Results of the percolation testing are presented in Appendix D and discussed later in this report.

All of the borings were backfilled with the excavated cuttings following logging, and obtaining bulk and relatively undisturbed samples for laboratory testing. The boring locations are shown on Plate 1 and the logs are included in Appendix B.

The relatively undisturbed soil samples, consisting of 2½ inch ring samples that were obtained with the hollow stem auger were driven by the 140 pound drill rig hammer dropped 30 inches per blow. The number of blows required to drive the sampler were recorded in six inch increments on the boring logs. Standard Penetration Test samples and blow counts, for liquefaction analyses, were also obtained and were recorded on the boring logs.

A reasonable effort was made to restore drill hole sites to their original condition. This included backfilling and tamping of the test borings, patching with asphalt, and general surface cleanup. It should be noted that as with any backfill, residual consolidation could occur at the test boring locations. The client is cautioned to periodically examine the test boring locations and if necessary, backfill any resulting depressions.

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Subsurface Conditions

Fill soils were encountered within our borings to a depth of approximately 2½ feet below existing grade. The fill soils consisted of sandy clay and clayey silt soils. Deeper fill soils may exist between and beyond our borings.

The fill soils are underlain by native soils consisting of stiff to very stiff silty clay soils to approximately 7 to 7½ feet below grade underlain by medium dense to very dense silty sand and sand to the depth explored.

Seismicity

Alquist-Priolo Zone: According to the map entitled "State of California Special Studies Zones, Newport Beach Quadrangle," dated July 1, 1986, the site is not in an Alquist Priolo Special Studies Zone.

Liquefaction: According to the maps entitled "State of California Seismic Hazard Zones, Newport Beach Quadrangle" the site is not located within a mapped zone for seismic hazard due to liquefaction.

Acceleration and Magnitude: Based on the California Department of Conservation, Division of Mines and Geology Open File Report entitled "Seismic Hazard Evaluation of the Newport Beach 7.5-Minute Quadrangle" dated 1997, a peak ground acceleration of 0.37g, with an earthquake magnitude of 6.9, can be used with a 10 percent probability of exceedance in 50 years.

Laboratory Testing

Laboratory tests were performed on representative soil samples obtained to determine their physical properties. These tests included direct and remolded shear, consolidation, maximum dry density, sieve analysis, expansion index, Atterberg Limit, R-value, corrosivity testing, and moisture density determinations. The procedures and results of these tests are presented in Appendix C.

Determination of contamination by hazardous material is beyond the scope of this study.

Liquefaction

Liquefaction occurs when loose, saturated, sandy soils experience vibration such as during an earthquake.

The site is not located within a State of California mapped liquefaction hazard zone. We did not encounter groundwater in our borings and although historical high groundwater is not clearly

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reported, it is anticipated to be well in excess of 30 feet below grade. Due to the nature of onsite materials and the relative densities of the soils encountered in our borings, it is our professional opinion that the potential for seismic settlement due to liquefaction is considered low.

Conclusions and Recommendations

Based on our subsurface exploration and laboratory testing, engineering analysis, and our experience with similar sites and developments, the proposed development is feasible from a geotechnical engineering standpoint provided the recommendations contained in this report are implemented into its design and construction.

As mentioned earlier, soils at the site consist of fill soils to a depth of approximately 2½ feet below grade. The fill soils are underlain by stiff to very stiff silts and clays underlain by medium and very dense sand and silty sands. Groundwater was not encountered within our borings to the depth explored.

The onsite fill soils are not considered suitable for the support of the proposed foundations, slabs on grade, and pavement section and should be overexcavated to the firm and unyielding native soils and recompacted as properly compacted engineered fill.

To provide a more uniform support for the proposed building, we recommend that the foundation for the building be deepened to the native soils at approximately 6 feet below grade.

Foundations for the parking structure may extend into the deeper sandier soils given the presence of a partial basement level extending to a depth of at least 10 feet below grade along the south side of the proposed parking structure. We recommend that to provide a uniform support, the proposed foundations for the parking structure should be established in the native sandy soils below a depth of at least 8 feet below grade.

Proposed slab-on-grade and pavement sections may be supported on the properly compacted engineered fill soils, following the overexcavation and recompaction of the onsite fill soils. The upper clayey soils may exhibit some expansion potential. We therefore recommend that the upper engineered fill soils directly beneath the slab on grade and pavement section, for a thickness of at least 6-inches below the section consist of relatively non-expansive (granular) soils. This thickness does not include the base or capillary break section. Sandy soils encountered during the deeper foundation excavations may be used beneath slabs and pavements following our review and approval.

The proposed building may be supported on spread foundations established in the firm and unyielding native soils at a depth of 6 feet below existing grade.

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The proposed parking garage may be supported on spread foundations established in the sandy soils below a minimum depth of approximately 8 feet below grade.

Minor foundation for secondary structures that are structurally separate from the proposed buildings, may be supported on shallow spread footings established in the native soils and/or properly compacted fill, at least 24-inches below the lowest adjacent grade.

Given the different types of construction and the different bearing materials between the proposed buildings and the parking garage, we recommend that the parking structure be structurally separate from the proposed apartment building.

Excavations for the basement level of the parking may be sloped back as recommended in the temporary excavation section below. Shoring recommendations may be provided if required.

Foundations recommendations for the proposed building are presented in the following sections.

Site Preparation:
As discussed earlier, fill soils were encountered in our borings to a depth of 2½ feet below grade. Deeper fill soils may exist between and beyond our borings.

The onsite fills soils are not considered suitable for the support of the proposed foundations, slabs-on-grade, and pavement sections and should be overexcavated to the firm and unyielding native soils. To provide a more uniform support for the proposed apartment building, we recommend that foundations be extended into the native soils as recommended in this report. Slabs-on-grade and pavement sections may be supported on properly compacted engineered fill soils prepared as recommended herein.

For support of the slabs-on-grade and pavement areas, we recommend that onsite fill soils be overexcavated to the native soils, or at least 2 feet below the slab or pavement section, whichever is deeper. The excavations should extend laterally a distance of at least 2 feet or the depth of the fill soils, whichever is deeper. Following the overexcavation, the exposed bottom should be observed by our representative for unsuitable materials and deepened as necessary. Then, the upper 6-inches of the bottom of the excavation should be scarified, brought to within 2 to 4 percent above the optimum moisture content and compacted to a minimum of 90 percent relative compaction per ASTM D1557-91.

Following the subgrade preparation, the engineered fill soils may be placed in loose lifts of 8-inches or less, brought to between 2 to 4 percent above the optimum moisture content and compacted to a minimum of 90 percent relative compaction per ASTM D1557-91.

Given the potential expansive nature of the onsite clayey soils, we recommend that slabs on grade

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and pavement sections be underlain by at least 6-inches of relatively non-expansive (granular) soils. This thickness does not include the base or capillary break section. Sandy soils encountered during the deeper foundation excavations may be used beneath slabs and pavements following our review and approval.

The onsite soils, less any debris or organic matter, may be used as fill soils. Import soils should be granular in nature and be relatively non-expansive. Import fill soils should have a minimum sand equivalent of 30, and an expansion index of less than 20. The import soils should contain sufficient fines to provide a stable subgrade and maintain low to medium permeability. All import materials should be approved by a licensed Geotechnical Engineer (or our representative) prior to import onto the Site.

If following the overexcavation, pumping subgrade is encountered due to the silty nature of the soils, this condition may be mitigated by providing a minimum of 2 feet of granular soils or crushed aggregate base material blanket over the pumping subgrade areas. Filter fabric should be used for separation or the rock or base materials from the soils.

Excavations for Utility Trenches:
All excavations for utility trenches should be backfilled with onsite materials compacted to 90 percent relative compaction per ASTM D1557-91.

Utility trenches extending beneath the proposed building slab should however be backfilled with a more cohesive backfill material in proximity of the building footprint. This is intended to act as a plug and prevent the migration of moisture to and from underneath the slab through the utility trench, that could have the potential to compromise the in place moisture of the prepared clayey subgrade soils.

Temporary Excavations:
Excavations deeper than 4 feet should be slopped back at 1:1 (H:V) or be shored for safety. Unshored excavations should not extend below a 1½:1 (H:V) plane drawn downward from adjacent existing foundations.

Earthen berms or other methods should be used during wet weather construction in order to prevent runoff water from entering the excavations. All runoff water should be collected and disposed of outside the construction limits to appropriate drainage systems.

Excavations should be observed by a representative from our firm so that modifications as a result of varying soil conditions may be facilitated.

All excavations must comply with applicable local, state, and federal safety regulations including the current OSHA Excavation and Trench Safety Standards. Construction site safety is the sole

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responsibility of the Contractor, who shall also be solely responsible for the means, methods, and sequencing of construction operations. Excavations and temporary slopes should be protected from surficial erosion and the effects of inclement weather by the project contractor. Protective measures such as plastic or jute mesh may be used to protect against the potential for surficial sloughing.

Foundation:
The proposed structures may be supported on spread foundations established in the firm and unyielding native soils at embedment depths as recommended below.

Foundations for the apartment building at least 36-inches wide, and established at least 6 feet below grade and at least 24 inches below the lowest adjacent grade may be designed for a net dead plus live load of 3,000 pounds per square foot.

The proposed parking garage may be supported on spread foundations established in the sandy soils below a depth of approximately 8 feet below grade. Foundations at least 36-inches wide and at least 24-inches below the lowest adjacent grade, may be designed for an allowable bearing capacity of 6,000 pounds per square feet.

Minor foundation for secondary structures that are structurally separate from the proposed buildings, may be supported on shallow spread footings established in the native soils and/or properly compacted fill, at least 24-inches below the lowest adjacent grade. These foundations may be at least 18-inches wide and be designed for an allowable bearing capacity of 2,000 pounds per square foot.

A one-third increase may be used for wind and seismic loading conditions. The recommended bearing value is a net value. The weight of the concrete in the footing may be taken as 50 pounds per cubic foot and the weight of the soil backfill may be neglected when determining the downward loads.

Due to the expansiveness of the underlying soils, all footings should be reinforced with a minimum of two No.4 bars near both top and bottom of the footings.

Foundation excavations should be observed and approved by our firm prior to the placement of rebar and concrete. Care should be taken to prevent disturbance of excavation bottoms. If excavations are disturbed, the bottoms should be compacted.

Lateral Design:
The bearing values recommended above are for the total of dead and frequently applied live loads. Resistance to lateral loading may be provided by friction acting at the base of foundations and by passive earth pressure within the onsite soils. An allowable coefficient of friction of 0.4 may be used with the dead load forces.

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Passive earth pressure at the ground surface is assumed to be zero and may be increased at the rate of 300 pounds per square foot per foot of depth to a maximum value of 3,000 psf. When combining passive and friction for lateral resistance, the passive component should be reduced by one-third. A one-third increase may be used for wind and seismic loading conditions.

Expansiveness of Soils:
The near surface on-site clayey soils may have expansion potential with an expansion index of 55 which is considered medium. All slabs and foundations should be reinforced as recommended in the Slab and Foundation sections.

Seismic Parameters:
The structure may be designed to resist earthquake forces following the 2013 edition of California Building Code (CBC), which is based on the 2012 edition of the International Building Code (IBC). The Site Classification, as defined in Section 1613.3.2 of the CBC, may be assumed to be a Site Class D, Stiff Soil Profile.

The mapped maximum considered earthquake spectral response accelerations, Ss and S1, are obtained from Figures 1613.3.3(1) and 1613.3.3(2) from the CBC. Using site coefficients Fa and Fv of 1.0 and 1.5 respectively, spectral response accelerations S_{MS} and S_{M1} of 1.640 and 0.905 and S_{DS} and S_{D1} of 1.094 and 0.603 may be used for a Site Class D.

Settlement:
Based on estimated foundation loads, we performed analysis using both consolidation as well as Schmertman approach for analysis which is more representative of settlements in sandy soils. Based on our analysis we anticipate the total static settlement of the proposed foundations to be on the order of ¾ to one-inch. Differential settlements are anticipated to be less than ½-inch.

Concrete Slabs:
The thickness and reinforcement of concrete slabs should reflect the anticipated use and be designed by a structural or civil engineer. As a minimum, interior floor slabs should be 6 inches thick, and reinforced with No. 4 bars placed at mid-height at 16 inches on-center. A 4-inch granular soil, base or gravel should be placed under the slabs. Slabs which will be provided with a floor covering should be protected by a 10-mil polyethylene vapor barrier placed under one inch of wetted sand. An additional one inch of sand should be placed under the vapor barrier to protect against punctures during construction.

Cracks that develop in concrete slab-on-grade should be filled and sealed prior to placing the floor covering. Frequent control joints should be incorporated into the slab construction, particularly in the areas of re-entrant corners, to help control cracking.

It is recommended that the proposed exterior perimeter slabs (sidewalks, patios, walkways, etc.) be

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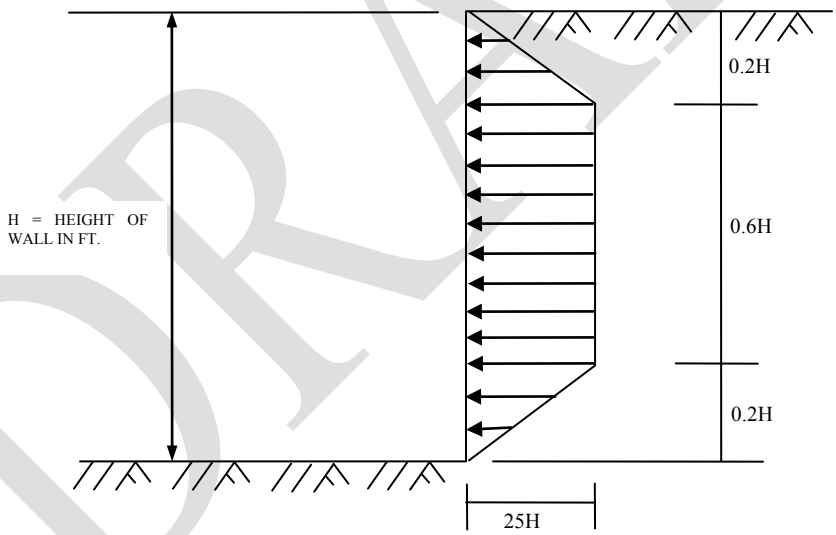
designed to be relatively independent of foundation system to help mitigate cracking due to differential settlement and/ or expansion.

Subgrade soils for all concrete flatwork should be moisture conditioned to near optimum moisture content within the 24 hours prior to placement of concrete. Measures should be taken to maintain optimum moisture until concrete is placed.

Walls Below Grade:
For drained conditions, cantilevered retaining walls may be designed on the basis of an equivalent fluid pressure of 35 pounds per cubic foot (pcf) for level backfill. Any anticipated superimposed loading within a 1:1 plane projected upward from the wall bottom, except retained earth materials, should be considered as surcharge and should be accounted for in the design of the basement walls.

For drained conditions, restrained walls below grade should be designed to resist a trapezoidal distribution of lateral earth pressure with the maximum lateral pressure of 25H in pounds per square foot, where H is the height of the wall, as shown below.



For seismic purposes, an additional lateral earth pressure may be used where a difference in retained grade greater than 6 feet exists across the site. The pressure distribution may be considered to be an inverted triangle with the maximum pressure at the top and zero on the bottom. The resultant of this force may be assumed to be at 2/3 the height of the wall from the bottom of the wall. A maximum pressure of 20H pounds per square foot may be used, where H is the difference in height of retained grade across the site in feet. This pressure is in addition to the static pressures presented above and may be considered as an ultimate load in design.

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In addition to the recommended earth pressures, the upper 10 feet of walls below grade adjacent to streets or vehicle traffic should be designed to resist a uniform lateral pressure of 100 pounds per square foot, acting as a result of an assumed 300 pounds per square foot surcharge behind the wall due to normal street traffic. If the traffic is kept back at least 10 feet, the surcharge may be neglected.

If the walls are to be designed using a drained condition, a drain blanket should be placed behind the retaining walls. In addition, an impermeable membrane should be placed vertically against the walls to prevent seepage of water from behind the wall through the wall. The drain blanket should consist of a lower gravel pack overlain by a 12-inch wide blanket of granular soil which extends to within 24 inches of the surface. Alternately, proprietary Miradrain type system or equivalent may be used behind walls below grade. The top 24 inches should be filled with cohesive soil compacted to 90 percent relative compaction, or paved. The gravel pack should be outlet through a four-inch diameter perforated pipe placed within the gravel pack and discharged to an appropriate location via a four-inch diameter solid pipe. A slope of at least 2-feet per 100 feet should be used for the drain lines. A sump pump could be used to collect water from behind the walls below grade and pumped to the street. Miradrain or equivalent product could be used in instead of the drain blanket.

Certain types of subdrain pipe and drain products are not acceptable to some municipal agencies. It is recommended that prior to purchasing subdrainage pipe, the type and brand is cleared with the proper municipal agencies

Where limited access between the retaining wall and the temporary excavation prevents the use of compaction equipment, retaining walls should be backfilled with pea gravel to within 2 feet of the ground surface. Where the area between the wall and the excavation exceeds 18 inches, the gravel must be vibrated.

Any fill placed behind the walls should be compacted to at least 95 percent relative compaction per ASTM D1557-91. However if the fill material has more than 15 percent finer than 0.005 millimeter, as demonstrated by hydrometer testing of the material actually used for fill, then it shall be compacted to 90 percent relative compaction.

<u>Waterproofing</u>
Moisture affecting retaining walls is one of the most common post construction complaints. Poorly applied or omitted waterproofing can lead to efflorescence or standing water. Efflorescence is a process in which a powdery substance is produced on the surface of the concrete by the evaporation of water. The white powder usually consists of soluble salts such as gypsum, calcite, or common salt. It is recommended that retaining walls be waterproofed. Waterproofing design and inspection of its installation is not the responsibility of the geotechnical engineer. A waterproofing consultant should be retained in order to recommend a product which would provide protection to below grade walls.

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Pavement Design:
To provide support for paving, the subgrade soils should be prepared as recommended in the Earthwork Section of this report. Our pavement recommendations are based on our findings and observations during our field investigation. Samples of the onsite soils were collected and R-value tests were performed to provide design data for asphalt and portland cement concrete pavements. The results of the test are attached to this report. The results of laboratory testing indicate an R-value of 4.

The required pavement thicknesses are based on expected wheel loads and the volume of traffic (TI or Traffic Index). Anticipated traffic indices of 4 through 7 have been used to develop pavement recommendations as presented in the tables below.

Asphalt Concrete Pavement

Traffic Usage	Traffic Index	Asphaltic Concrete (inches)	Base Course (inches)
Automobile Parking Areas	4	3	8
Automobile Traffic	5	3	10
Truck Traffic	6	3½	13
Heaving Truck Traffic	7	4	16

Portland Cement Concrete Pavement

Traffic Usage	Traffic Index	Portland Cement Concrete (inches)	Base Course (Optional) (inches)
Automobile Parking Areas	4	7	6
Automobile Traffic	5	7½	6
Truck Traffic	6	8	6
Heaving Truck Traffic	7	8	6

The above sections have been derived based on the following assumptions.

- The pavement sections should be underlain by at least 2 feet of engineered fill as recommended in the Site Preparation section above. The engineered fill soils should be brought to be between 2 to 4 percent of the optimum moisture content, and compacted to a minimum of 90 percent relative compaction in accordance with the recommendations in this report.

- The upper 6-inches of the prepared subgrade should be compacted to a minimum of 95 percent relative compaction.

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- The aggregate base is brought to within 2 percent of the optimum moisture content and compacted to a minimum of 95 percent relative compaction.

- The subgrade is stable and non-pumping.

- Adequate drainage is provided to reduce the potential of water migration and ponding under the pavement section.

- Planter curbs and gutters extend at least 4-inches into the subgrade level below the base course to reduce the migration of water into the pavement base course.

- Minimum portland cement concrete compressive strengths of 4,000 pounds per square inch have been used for design.

- Base courses should conform to Caltrans or Standard Specification for Public Works Construction (Green Book) specifications.

- Asphalt pavement materials and placement methods should be in accordance with Caltrans methods.

Percolation Testing:
It is our understanding that in order to control the stormwater flow of the proposed site improvements, stormwater infiltration devices such as dry wells or other similar concepts, are proposed for the subject site. Percolation testing was performed at the site to provide subsurface soil percolation potential and to assist in the design of the infiltration devices.

Percolation testing was performed in two borings performed at the site. The borings were drilled to depths of approximately 5 and 15 feet (Borings B-2 and B-3, respectively) and percolation testing was performed between 0 to 5 feet in Boring B-2 and between 5 to 15 feet in Boring B-3. The percolation testing was performed by drilling an 8-inch diameter boring, installing a 3-inch diameter perforated PVC pipe with openings within the abovementioned depths. Gravel was used as backfill around the pipe and water was filled into the pipe to saturate the medium overnight prior to performing the testing. Depth readings were taken every 60 minutes for Boring B-2 for a period of approximately 8 hours, and every 25 minutes for Boring B-3, for a period of approximately 2 hours, or until at least three virtually even consecutive readings, the water being replenished subsequent to each reading interval. It was decided to terminate the test since all of the readings obtained during the test period were virtually identical with near negligible changes in percolation rates as the test proceeded.

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The measured percolation rate was reduced based on a factor for bottom of hole percolation only in accordance with the County of Orange Technical Guidance Document for the preparation of WQMP dated December 20, 2013.

The results of the test is attached to this report and summarized in the following table:

Boring/Well No.	Depth (ft)	Soil Type	Approximate Percolation Rate (inch/hr)	Reduced Percolation Rate (inch/hr)
B-2	0-5	CL	1	0.06
B-3	5-15	SP	223	7.11

Perched Water Conditions

Our field investigation was performed to a depth of 51½ feet below grade. Based on the results of investigation, we anticipate the site to be generally underlain by granular materials consisting of medium dense to dense sand and silty sand soils to at least the depths explored. We anticipate bedrock materials to be relatively deep. Accordingly, it is our professional opinion that the potential for the infiltration of the stormwater into the subsurface to create a perched water condition is considered low.

Influence on Existing and Adjacent Structures

Based on the results of our field investigation, to reduce the potential for influence on adjacent and existing foundations, we recommend that the proposed infiltration locations be established a distance of at least 15 feet from any existing and proposed foundations. The onsite soils are anticipated to have a relatively low collapse potential as discussed below and therefore the influence on nearby foundations is anticipated to be negligible if the recommended setback distances are maintained.

Infiltration Devices

Based on our field investigation, the subsurface soils appear to be relatively uniform throughout the site and we anticipate variability to be generally minor.

It is our professional opinion that given the low potential for subsurface soils variability, a percolation rate of 0.06 inch/hr is anticipated for the upper 5 feet of the site within the clayey soils, and a rate of 7.11 inch/hr for the sandy soils below 8 feet may be considered relatively representative of the site soils within the depth zone of the performed test. Given the very high rate in the sandy soils, we recommend that appropriate safety factors be used for design in these zones. These rates are not a factored rate for design purpose. Applicable safety factors should be applied by the design engineer.

Groundwater was not encountered within the depth explored. Historical high groundwater is not clearly reported but is anticipated to be well in excess of 30 feet below grade. (CGS, 1997). The

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infiltration zone of the proposed device should maintain a minimum of 10 feet separation to historical high groundwater level.

Infiltration devices may consist of dry wells, infiltration trenches or similar devices. Granular materials used in the dry well or trenches may consist of open graded crushed rock material. The rock materials should be surrounded by non-woven filter fabric to reduce the potential of fines migration into the device. Prefabricated devices, if used, should also be surrounded by rock material wrapped in filter fabric. Adequate overflow capacities should be incorporated into the design of the proposed devices. Infiltration devices considered for the proposed project should be installed so as maintain a distance of at least 15 feet from proposed or existing foundations. Infiltration should not be permitted within the upper 8 feet from the ground surface

Collapsible Soils:
Collapsible soils are defined as soils with a potential for a significant decrease in strength and increase in compressibility when wet or saturated (hydro-collapse). Collapsible soils typically consist of relatively sandy soils that exhibit a degree of cementation.

Based on the results of our laboratory testing, the onsite soils do not exhibit a significant collapse potential.

Site Drainage:
Ponding and saturation of the soils in the vicinity of the proposed foundations should be avoided. To reduce this potential, we recommend that positive drainage be provided for the site, in both improvement and landscaping areas, to carry surface water away from the building foundations and slabs on grade and towards appropriate drop inlets or other surface drainage devices. Site grading adjacent to structures and foundations should be slopped away a minimum of 5 percent for a minimum distance of 10 feet away from the face of wall. Impervious surfaces within 10 feet of structures should be sloped a minimum of 2 percent away from the building. These grades should be maintained for the life of the structure. We also recommend that roof runoff be connected to a suitable collection and discharge system to avoid surface discharge and potential saturating the soils near foundations. Poor perimeter and surface drainage may result in water migration beneath building foundations, and may result in potential distress to the proposed improvements.

Planter areas adjacent to the building and foundations should be lined to reduce the infiltration of irrigation water beneath the building. Care should also be taken to maintain a leak-free irrigation system.

Soil Chemical Testing:
Selected samples of the near surface soils were collected and tested for corrosivity potential. The samples were tested for pH, resistivity, soluble chlorides, and soluble sulfates in general accordance with California Test Methods 643, 422, and 417 respectively. The results of the tests are presented in

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Appendix C. Preliminary corrosivity testing indicates that the soils have a moderate to severe corrosivity potential to buried ferrous metals and a mild to moderate potential to buried concrete structures. Based on the preliminary corrosivity results, concrete structures should comply with cement type, minimum compressive strength, and minimum water/cement ratio requirements as specified in ACI guidelines 318, Section 4.3.

These tests are only an indicator of the soil corrosivity at the site. A competent corrosion engineer should be consulted to further evaluate the corrosion potential for the onsite soils, suggest additional testing if needed, and to provide further recommendations for corrosion mitigation as applicable to the specific project and improvements.

Review:
A final set of building plans should be submitted to this office for review prior to submitting to the building officials. This office shall be promptly notified if any conditions substantially differing from those exposed by the test borings are encountered during construction. All grading and compaction work shall be observed by a representative of this office to confirm compliance with the recommendations in this report and with local ordinances. All footing excavations shall be observed by the geotechnical engineer prior to placing concrete or steel.

The following page describes the limits of our liability and warranties for data contained in this report. If you have any questions regarding the content of this report, please do not hesitate to contact us. This opportunity to be of professional service is greatly appreciated.

Respectfully Submitted,
Geotechnical Soilutions, Inc.

Mesrop A. Mesrop
Principal Engineer
RGE 2561

Attachments

Appendix A – Plates
Appendix B – Field Exploration
Appendix C - Laboratory Testing
Appendix D - Results of Percolation Testing

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WARRANTIES

In the event that any significant changes in the design or location of the structure(s), as outlined in this report, are planned, the conclusions and recommendations contained in this report may not be considered valid unless the changes are reviewed and the conclusions of this report are modified or approved by the Geotechnical Engineer.

This report is to provide geotechnical recommendations and design values for the design of the proposed apartment complex located at 2277 Harbor Boulevard in Costa Mesa, California. This investigation was performed for Center Quality Management. This report will provide design values and recommendations to assist the structural engineer in his design of the proposed building.

If conditions encountered during construction appear to differ from those disclosed, this firm shall be notified so as to consider the need for modifications. No responsibility for construction compliance with the design concepts, specifications or recommendations is assumed unless on-site construction review is performed during the course of construction which pertains to the specific recommendations contained herein.

The geotechnical engineer and/or geologist prepared this report in accordance with generally accepted engineering practice, using an effort and resources commensurate with the amount of confidence in the data requested by the Client. No other warranties are made, either expressed or implied, as to the professional advice provided under the terms of the agreement and included in this report.

DRAFT

Project No. GS 1531
May 20, 2015

A P P E N D I X A - PLATES

DRAFT

Project No. GS 1531
May 20, 2015

A P P E N D I X B - FIELD EXPLORATION

DRAFT

Project No. GS 1531
May 20, 2015

A P P E N D I X C – LABORATORY TESTING

DRAFT

Project No. GS 1531
May 20, 2015

A P P E N D I X D – RESULTS OF PERCOLATION TESTING

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FIELD EXPLORATION

The soil conditions at the site were explored by drilling seven borings using a truck mounted hollow stem auger type drilling equipment provided by Choice Drilling. We also performed 2 hand auger borings. The borings were performed on April 1, and April 2, 2015. The borings were advanced to a depth of 10 to 51½ feet below the existing grade. The boring locations are shown on Plate 2, Plot Plan. The borings were backfilled using the excavated cuttings and tamped.

The soils encountered were logged by our field engineer and relatively undisturbed and bulk samples were collected for laboratory inspection and testing. The logs of our borings are presented in Appendix B. The samples were classified in accordance with the Uniform Soil Classification Method (USCS).

A California-type ring sampler was used to collect the relatively undisturbed samples. The sampler was driven a total of 18-inches. The number of blows required to drive the sampler the final 12-inches was recorded on the borings logs. The hammer weight and drop height are also indicated on the boring logs.

Disturbed samples were also collected using a Standard Penetration Test (SPT) sampler. A brass lining was used in the samplers. The sampler was driven a total of 18-inches and a number of blows required to drive the final 12-inches were recorder and are presented on the boring logs. The SPT was driven using a 140-pound automatic trip hammer falling a drop height of 30 inches.

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LABORATORY TESTS

Maximum Density - Optimum Moisture Content

A bulk soil sample was tested in the laboratory to determine the dry density and optimum moisture content using the ASTM D1557-91 compaction test method. This test is made on the minus four (-4) fraction of the sample in a four inch diameter mold having 1/30-cubic foot volume, with 25 blows of a ten-pound hammer falling 18 inches on each of five layers. The results of the test are presented below and on the following Plates.

Direct Shear

Direct shear test (ASTM D 3080) was made on a remolded 2.5 inch diameter sample of the fill to determine the strength at 90 percent relative compaction. Direct shear tests were also performed on relatively undisturbed samples of the onsite soils to determine soil strength characteristics. The samples were sheared at a rate of 0.01 inch per minute. The test results were plotted on the following plates.

Consolidation

The apparatus used for the consolidation tests is designed to receive relatively undisturbed specimens in the field condition. Porous stones were placed in contact with the top and bottom of the specimen to permit the ready addition and release of water. Successive load increments were applied to the top of the specimen, and progressive final settlements under each load increment were recorded to an accuracy of 0.001 inch. The test was performed to the (ASTM D 2435). The final settlements obtained were plotted to determine the curves shown on the following plates.

Moisture-Density

The moisture-density information provides a summary of soil consistency for each stratum. The dry unit weight and field moisture content were determined for selected undisturbed samples. The results of the moisture-density tests are shown on the Boring Logs.

Sieve Analysis

Sieve analyses were performed on selected samples of the materials encountered at the site to evaluate the grain size distribution of the soils and to aid in the classification. Tests were performed in general accordance with ASTM Test Method D-422. The results of the testing are presented in the following plates.

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Plasticity Index

Plasticity index testing was performed on selected samples of the soils to evaluate the plasticity characteristics and to aid in classification. The tests were performed in general accordance with ASTM Standard Test Method D 4318. The results of the testing are presented in the following plates.

Expansion Potential

An expansion index test (ASTM D 4829) was performed to determine the expansion potential of the tested soil. The test results are as follows.

R-Value

R-value testing was performed on representative samples of the near surface soils at the site. The test was performed in general accordance with Caltrans Standard Test Method 301. The results of are presented in the following plates.

Corrosovity

A series of corrosivity tests were performed on selected samples of the soils encountered at the site. The tests included pH, resistivity, soluble chlorides and soluble sulfates. The tests were performed in general accordance with California Test Methods 643, 422, and 417 respectively. The results are presented as follows.

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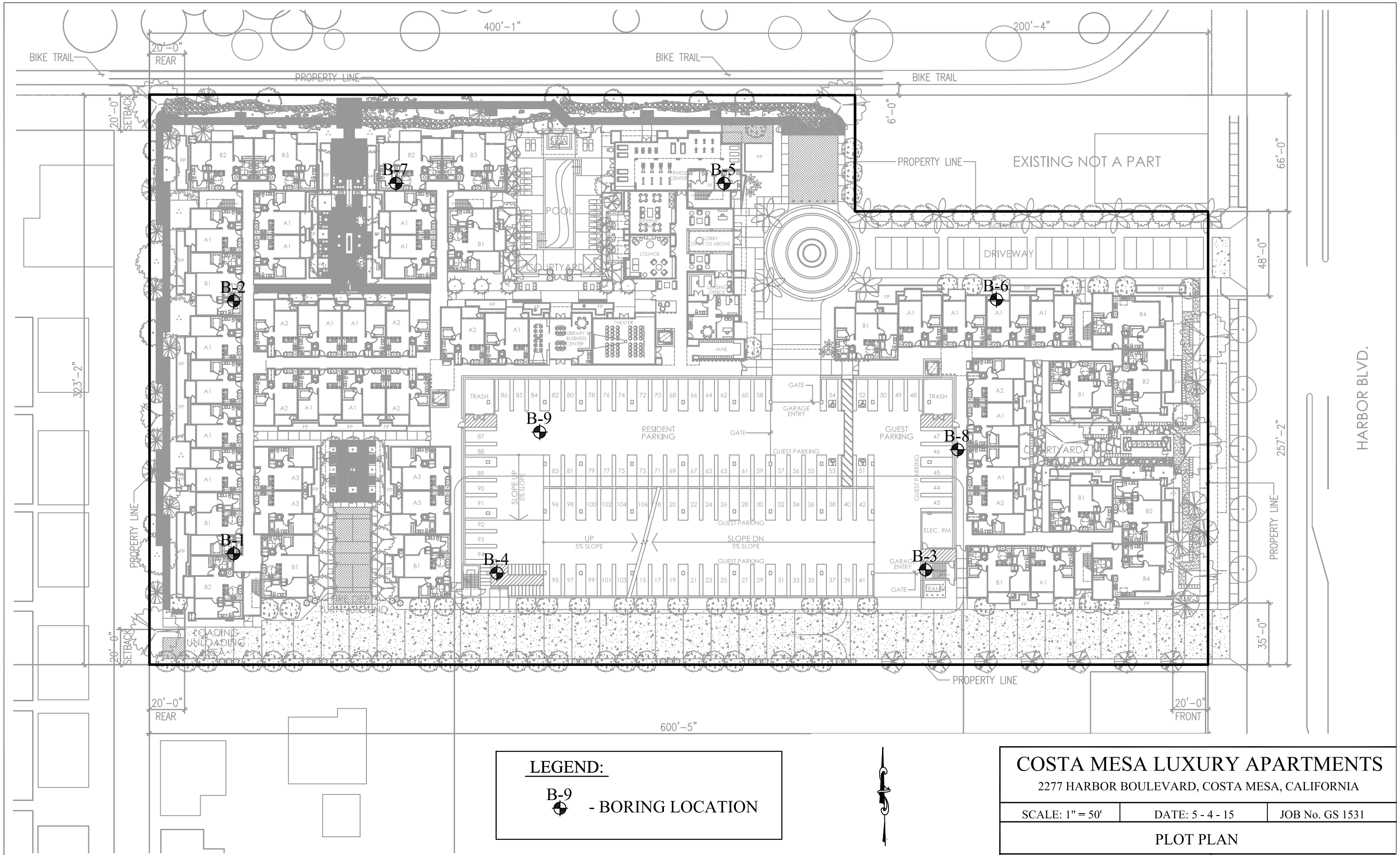


LEGEND:

B-9 - BORING LOCATION

0 25 50

SCALE: 1" = 50'

COSTA MESA LUXURY APARTMENTS

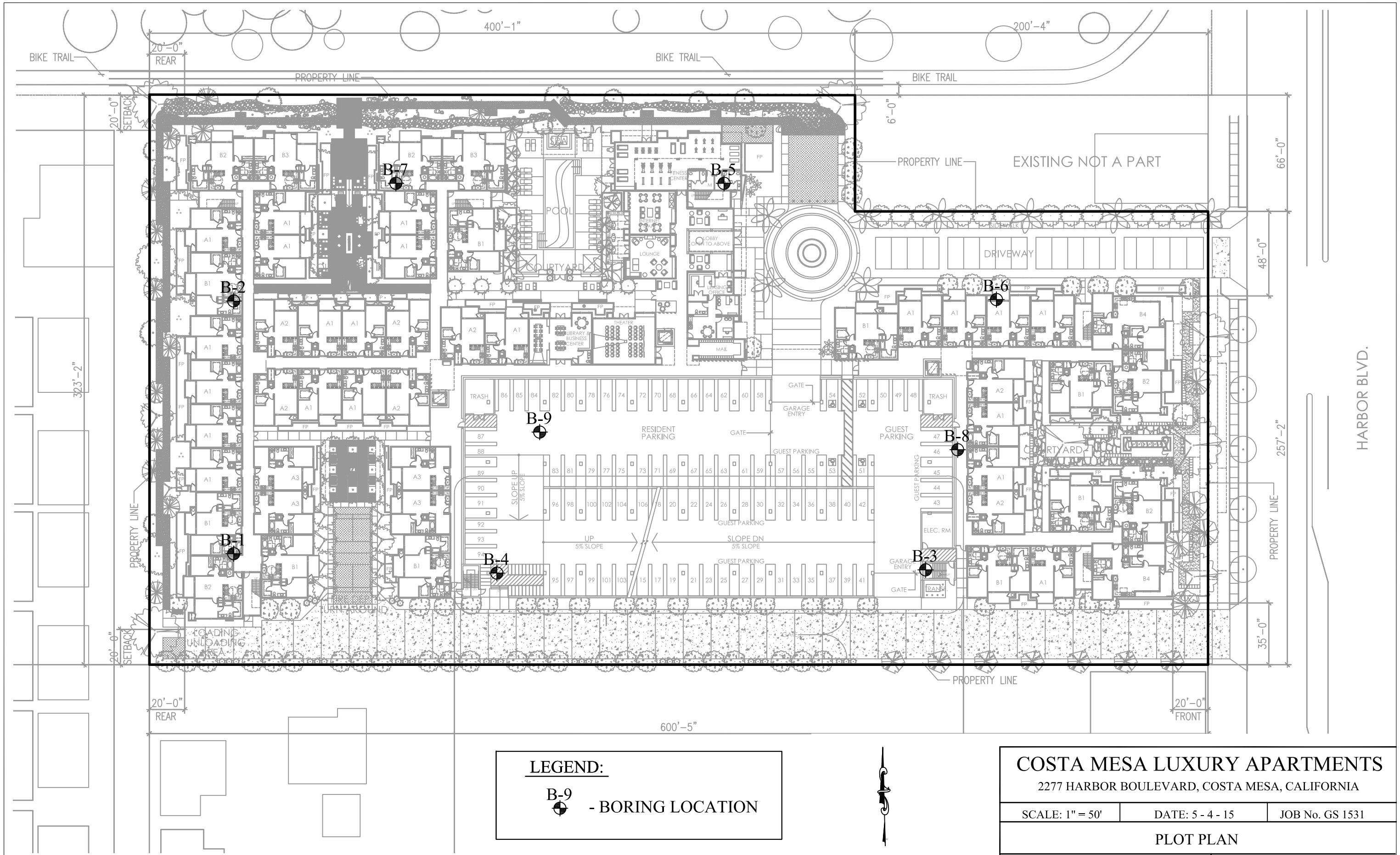
2277 HARBOR BOULEVARD, COSTA MESA, CALIFORNIA

SCALE: 1" = 50'	DATE: 5 - 4 - 15	JOB No. GS 1531

PLOT PLAN

Geotechnical Soilutions, Inc.
501 SOUTH FAIRFAX AVE., SUITE 101
LOS ANGELES, CA 90036

PLATE 1



LEGEND:

B-9 - BORING LOCATION

0 25 50

SCALE: 1" = 50'

COSTA MESA LUXURY APARTMENTS

2277 HARBOR BOULEVARD, COSTA MESA, CALIFORNIA

SCALE: 1" = 50'	DATE: 5 - 4 - 15	JOB No. GS 1531

PLOT PLAN

Geotechnical Soilutions, Inc.
501 SOUTH FAIRFAX AVE., SUITE 101
LOS ANGELES, CA 90036

PLATE 1

Geotechnical Soilutions, Inc.

LOG OF BORING # B 1

Boring No. 1	Sheet 1 of 2		
Date:	4/1/2015		
Drilling Contractor:	Choice Drilling		
Client:	Century Quality Management	Equipment:	8" Hollow Stem Auger
Project No.	GS 1531	Driving Weight:	140
Location:	2277 Harbor Blvd, Costa Mesa	Elevation:	
		Logged by:	TGH

Depth in Feet	Drive Sample	Bag Sample	Lab. Testing	Blows per 6 inches	Moisture Content %	Dry Unit Weight (pcf	Classification	Symbol	Visual Soil Description
0-									7" Pavement, 3" AC and 4" Base. Note: Hand augered to 5'
							CL		**7"-18" Fill**
									Brown, sandy clay, trace gravel, moist, firm.
									1.5'-50' Older Alluvium
5-	R		Consol. Shear	5/10/11	21.5	104.3	CL		Yellow brown, **sandy clay**, moist, stiff. Thin silty sand beds.
10-	SPT			6/7/09 (Disturbed)	4.7	92.3	SP SM		Change to dark brown, **sand** and **silty sand**, slightly moist, medium dense.
15-	R		Consol.	12/15/20	4.1	103.5	SP SM		**Sand** and **silty sand**, slightly moist, medium dense.
20-	SPT			7/15/20			SP		Change to **fine sand**, moist, dense.
25-	R			16/28/40			SP		Dense.
30-	SPT			11/12/15			SP		Medium dense.

R-Ring Sample, SPT-Standard Penetration Test.

Note: SPT reading with liner.

Geotechnical Soilutions, Inc.

LOG OF BORING # B 1

Boring No. 1	Sheet 2 of 2		
Date:	4/1/2015		
Drilling Contractor:	Choice Drilling		
Client:	Century Quality Management	Equipment:	8" Hollow Stem Auger
Project No.	GS 1531	Driving Weight:	140
Location:	2277 Harbor Blvd, Costa Mesa	Elevation:	
		Logged by:	TGH

Depth in Feet	Drive Sample	Bag Sample	Lab. Testing	Blows per 6 inches	Moisture Content %	Dry Unit Weight (pcf	Classification	Symbol	Visual Soil Description
30-	SPT			11/12/15			SP		Medium dense.
35-	R			11/19/37			CL		Change to interbeded gray **silty clay** and **fine sand**, moist, dense/hard.
40-	SPT			4/7/12			CL		Gray, **silty clay**, trace fine sand, moist, very stiff.
45-	R			50-5"			SM		Change to gray, **silty, fine-coarse sand** with fine-medium, rounded gravel, moist, dense.
50-	SPT			17/50-6"			SM		Moist very dense.
55-									Total Depth 50' No Water Backfilled with cuttings.
60-									

R-Ring Sample, SPT-Standard Penetration Test.

Note: SPT reading with liner.

Geotechnical Soilutions, Inc.

LOG OF BORING # B 2

Boring No. 2	Sheet 1 of 1		
Date:	4/1/2015		
Drilling Contractor:	Choice Drilling		
Client:	Century Quality Management	Equipment:	8" Hollow Stem Auger
Project No.	GS 1531	Driving Weight:	140
Location:	2277 Harbor Blvd, Costa Mesa	Elevation:	
		Logged by:	TGH

Depth in Feet	Drive Sample	Bag Sample	Lab. Testing	Blows per 6 inches	Moisture Content %	Dry Unit Weight (pcf	Classification	Symbol	Visual Soil Description
0-			R-Value						7" Pavement, 3" AC and 4" Base. Note: Hand augered to 5'
			R-Shear						**7"-28" Fill**
			Corrosion				CL		Brown, **sandy silt** and **sandy clay**, moist, firm.
			Sieve				ML		
			Max						**28"-5' Older alluvium**
5-	SPT		Expansion	6/9/16			CL		Yellow brown, **sandy silt** and **sandy clay**, trace sand, moist, very stiff.
			Atterberg				ML		
	R		Consol	11/14/16	11.7	112.9			Change to yellow brown, **silty fine sand**, moist, medium dense.
10-	R		Sieve	6/6/08	8.7	112.5	SM		Yellow brown sand and **silty sand**, fine-medium grained, moist, loose-medium dense.
			Consol						
15-	SPT		Sieve	3/4/07 (Disturbed)	5.0	90.2	SM		Yellow brown, **silty fine-coarse sand** with gravel, moist, medium dense.
20-	R			20/50-6"			SM		Yellowish gray, **silty, very fine sand**, moist, dense.
25-	SPT			11/24/30			SM		Very dense.
							ML		
30-	R			10/22/30			SM		Change to gray, **clayey silt/ silty sand**, moist, hard

Total Depth 30'

No water

Percolation test was performed 0-5'.

R-Ring Sample, SPT-Standard Penetration Test.

Note: SPT reading with liner.

Geotechnical Soilutions, Inc.

LOG OF BORING # B 3

Client:	Century Quality Management	Boring No. 3	Sheet 1 of 1
Project No.	GS 1531	Date:	4/1/2015
Location:	2277 Harbor Blvd, Costa Mesa	Drilling Contractor:	Choice Drilling
		Equipment:	8" Hollow Stem Auger
		Driving Weight:	140
		Elevation:	
		Logged by:	TGH

Depth in Feet	Drive Sample	Bag Sample	Lab. Testing	Blows per 6 inches	Moisture Content %	Dry Unit Weight (pcf	Classification	Symbol	Visual Soil Description
0-									7" Pavement, 3" AC and 4" Base. Note: Hand augered to 5'
							CL		**7"-26" Fill**
							ML		Brown, **sandy silt** with **sandy clay**, moist, firm.
									26"-30' Older Alluvium
							CL		Brown, **silty clay**, moist, firm.
5-	R		Consol	5/9/15	13.0	118.8			Change to pale brown, **sandy clay**, moist, very stiff.
	R		Consol	11/16/18	3.5	105.5	SM		Change to yellow brown, **silty sand** with gravel, slightly moist, medium dense.
10-	SPT			4/12/17			SP		Yellow brown **sand** with gravel, medium dense.
15-	R			18/20/25			SP		Dense.
20-	SPT			11/18/21			SM		Change to gray, **silty fine sand**, moist, medium dense- dense.
25-	R			30/50-6"			SM		Change to yellowish gray, **silty, fine-coarse sand** with gravel, moist, very dense.
30-	SPT			12/22/25			SM		Dense.

Total Depth 30'

No water

Percolation test was performed between 5' to 15'.

R-Ring Sample, SPT-Standard Penetration Test.

Note: SPT reading with liner.

Geotechnical Soilutions, Inc.

LOG OF BORING # B 4

Client:	Century Quality Management	Equipment:	8" Hollow Stem Auger
Project No.	GS 1531	Driving Weight:	140
Location:	2277 Harbor Blvd, Costa Mesa	Elevation:	
		Logged by:	TGH

Boring No. 4	Sheet 1 of 1
Date:	4/1/2015
Drilling Contractor:	Choice Drilling

Depth in Feet	Drive Sample	Bag Sample	Lab. Testing	Blows per 6 inches	Moisture Content %	Dry Unit Weight (pcf	Classification	Symbol	Visual Soil Description
0									7" Pavement, 3" AC and 4" Base. Note: Hand augered to 5'
							CL		**7"-18" Fill**
							ML		Brown, **sandy clay** with **sandy silt**, moist, firm.
									18"-30" Older Alluvium
							SC		Brown, **silty clay**, very moist.
5	SPT			1/3/07	10.9	113.3			Change to mottled gray and brown, **clayey sand**, moist, medium dense.
	R		Shear	7/8/16	8.4	98.8	SM		Change to **silty fine-medium sand**, moist, medium dense.
10	R		Shear	15/21/28	4.5	104.4	SP		Fine-medium **sand**, slightly silty, slightly moist, dense.
15	SPT			6/10/12			SP		Trace fine gravel, medium dense.
20	R			13/30/50-6"			SM		Change to gray, **very fine silty sand**, moist, very dense.
25	SPT			10/11/16			SP		Change to mottled gray and yellow brown, **fine-coarse sand** with gravel, moist, medium dense.
30	R			20/50-6"			SP		Mottled gray and yellow brown, **fine sand**, moist, dense.
									Total Depth 30'
									No water
									Backfilled with cuttings.

R-Ring Sample, SPT-Standard Penetration Test.

Note: SPT reading with liner.

Geotechnical Soilutions, Inc.

LOG OF BORING # B 5

Boring No. 5	Sheet 1 of 1		
Date:	4/2/2015		
Drilling Contractor:	Choice Drilling		
Client:	Century Quality Management	Equipment:	8" Hollow Stem Auger
Project No.	GS 1531	Driving Weight:	140
Location:	2277 Harbor Blvd, Costa Mesa	Elevation:	
		Logged by:	TGH

Depth in Feet	Drive Sample	Bag Sample	Lab. Testing	Blows per 6 inches	Moisture Content %	Dry Unit Weight (pcf	Classification	Symbol	Visual Soil Description
0									7" Pavement, 3" AC and 4" Base. Note: Hand augered to 5'
									7"-24" Fill
									Brown, **sandy silt** with clay, moist, firm.
			Sieve						**24"-30' Older Alluvium**
			Corrosion						
5	R		Atterberg	10/24/30	15.8	115.7	CL		Brown, **silty clay**, slightly moist, firm.
			Expansion						
	R		Consol	8/8/08	20.5	101.4	ML		Mottled brown and gray **sandy silt**, moist, stiff.
			Shear						
10	SPT			3/4/06			SP		Change to **sand**, moist, medium dense.
15	R			12/15/20			SM		Change to gray, **fine silty sand**, moist, medium dense.
20	SPT			5/6/10			SM		Medium dense.
25	R			20/32/45			SM		Very dense.
30	SPT			10/13/16			SM		Medium dense.
									Total Depth 30'
									No water
									Backfilled with cuttings.

R-Ring Sample, SPT-Standard Penetration Test.

Note: SPT reading with liner.

Geotechnical Soilutions, Inc.

LOG OF BORING # B 6

Boring No. 6	Sheet 1 of 2		
Date:	4/2/2015		
Drilling Contractor:	Choice Drilling		
Client:	Century Quality Management	Equipment:	8" Hollow Stem Auger
Project No.	GS 1531	Driving Weight:	140
Location:	2277 Harbor Blvd, Costa Mesa	Elevation:	
		Logged by:	TGH

Depth in Feet	Drive Sample	Bag Sample	Lab. Testing	Blows per 6 inches	Moisture Content %	Dry Unit Weight (pcf	Classification	Symbol	Visual Soil Description
0-									7" Pavement, 3" AC and 4" Base. Note: Hand augered to 5'
									7"-24" Fill
							CL		Orange brown, **silty clay** with trace some sand, moist, firm.
									2'-50' Older Alluvium
							CL		Brown, **silty clay**, moist, stiff.
5-	R		Consol	13/15/23	10.8	117.4	SC		Yellow brown, **clayey sand**, moist, very stiff.
	R			15/19/30			SP		Change to yellow brown **sand**, trace fine gravel, moist, dense.
10-	SPT			6/8/10	2.0	111.1	SP		Fine **sand**, dry to slightly moist, medium dense.
15-	R			20/28/40			SM		Change to gray, very fine **silty sand**, moist, dense.
20-	SPT			6/9/12			SM		Medium dense.
25-	R			32/50-5"			SM		Very dense.
30-	SPT			14/19/25			SM		Dense.

R-Ring Sample, SPT-Standard Penetration Test.

Note: SPT reading with liner.

Geotechnical Soilutions, Inc.

LOG OF BORING # B 6

Boring No. 6	Sheet 2 of 2		
Date:	4/2/2015		
Drilling Contractor:	Choice Drilling		
Client:	Century Quality Management	Equipment:	8" Hollow Stem Auger
Project No.	GS 1531	Driving Weight:	140
Location:	2277 Harbor Blvd, Costa Mesa	Elevation:	
		Logged by:	TGH

Depth in Feet	Drive Sample	Bag Sample	Lab. Testing	Blows per 6 inches	Moisture Content %	Dry Unit Weight (pcf	Classification	Symbol	Visual Soil Description
30-	SPT			14/19/25			SM		Dense.
35-	R		Sieve Consol	16/20/28	22.6	101.4	CL		Change to gray, **silty clay**, moist, hard.
40-	SPT			10/22/30			CL SP		Interbedded **silty clay**, as above and yellow brown medium **sand**, moist, hard.
45-	R			45/50-4"			SP		Change to yellow brown medium **sand**, moist, very dense.
50-	SPT			7/9/12			CL		Change to gray, **silty clay** with fine sand, moist, very stiff.
55-									Total Depth 50' No Water Backfilled with cuttings.
60-									

R-Ring Sample, SPT-Standard Penetration Test.

Note: SPT reading with liner.

Geotechnical Soilutions, Inc.

LOG OF BORING # B 7

Boring No. 7	Sheet 1 of 2		
Date:	4/2/2015		
Drilling Contractor:	Choice Drilling		
Client:	Century Quality Management	Equipment:	8" Hollow Stem Auger
Project No.	GS 1531	Driving Weight:	140
Location:	2277 Harbor Blvd, Costa Mesa	Elevation:	
		Logged by:	TGH

Depth in Feet	Drive Sample	Bag Sample	Lab. Testing	Blows per 6 inches	Moisture Content %	Dry Unit Weight (pcf	Classification	Symbol	Visual Soil Description
0-									7" Pavement, 3" AC and 4" Base. Note: Hand augered to 5'
									7"-28" Fill
							CL		Yellow brown, **sandy clay**, moist, firm.
									28"-45' Older Alluvium
									Brown, **sandy clay**, trace sand, moist, stiff.
5-	R		Consol	10/11/13	7.5	116.4	SM		Yellow brown, **silty sand**, trace clay, moist, medium dense.
	R		Consol	12/15/20	9.7	97.6	SM		**Silty fine-coarse sand** with gravel, moist, medium dense.
10-	R		Consol	10/30/38	4.4	105.8	SM		**Silty fine-coarse sand**, slightly moist, dense.
15-	SPT			10/14/19			SM		Dense.
20-	R			25/36/42			SM SP		Interbedded with gray, **very fine sand and silty sand**, moist, very dense.
25-	SPT			13/16/16			SM		Change to yellow brown, **fine silty sand**, moist, dense.
30-	R			29/40/50-5"			CL		Change to mottled gray and brown, **silty clay** with sand, moist, hard.

R-Ring Sample, SPT-Standard Penetration Test.

Note: SPT reading with liner.

Geotechnical Soilutions, Inc.

LOG OF BORING # B 7

Client:	Century Quality Management	Boring No. 7	Sheet 2 of 2
Project No.	GS 1531	Date:	4/2/2015
Location:	2277 Harbor Blvd, Costa Mesa	Drilling Contractor:	Choice Drilling
		Equipment:	8" Hollow Stem Auger
		Driving Weight:	140
		Elevation:	
		Logged by:	TGH

Depth in Feet	Drive Sample	Bag Sample	Lab. Testing	Blows per 6 inches	Moisture Content %	Dry Unit Weight (pcf	Classification	Symbol	Visual Soil Description
30-	R			29/40/50-5"			CL		Change to mottled gray and brown, **silty clay** with sand, moist, hard.
35-	SPT			18/25/34			SM		Change to gray, **silty, very fine sand**, moist, very dense.
40-	R			20/32/46			SP		Change to yellow brown fine **sand**, moist, very dense.
45-	SPT			45/50-6"			SP		Change to gray, **fine-coarse sand** with gravel, moist, very dense.
									Total Depth 45' No Water Backfilled with cuttings.
50-									
55-									
60-									

R-Ring Sample, SPT-Standard Penetration Test.

Note: SPT reading with liner.

Geotechnical Soilutions, Inc.

LOG OF BORING # B8

Boring No. 8	Sheet 1 of 1		
Date:	4/1/2015		
Drilling Contractor:			
Client:	Century Quality Management	Equipment:	Hand auger
Project No.	GS 1531	Driving Weight:	
Location:	2277 Harbor Blvd, Costa Mesa	Elevation:	
		Logged by:	SB

Depth in Feet	Drive Sample	Bag Sample	Lab. Testing	Blows per 6 inches	Moisture Content %	Dry Unit Weight (pcf	Classification	Symbol	Visual Soil Description
0-									**0-2' Fill**
							CL		Dark yellowish brown, **sandy clay**, damp, medium dense.
									2'-10' Older Alluvium
									Olive brown, **silty sand**, slightly moist, medium dense.
							SM		
5-									Light olive brown, **silty sand**, slightly moist, medium dense.
							SP		Light yellowish brown, **sand**, slightly moist, dense.
									Yellowish brown, **fine-coarse grained sand**, slightly moist, dense.
10-							SP		Yellowish brown, **fine-coarse grained sand**, slightly moist, dense.
									Total Depth at 10'.
									No Groundwater.
									Hand augered to 10'.
15-									
20-									
25-									
30-									

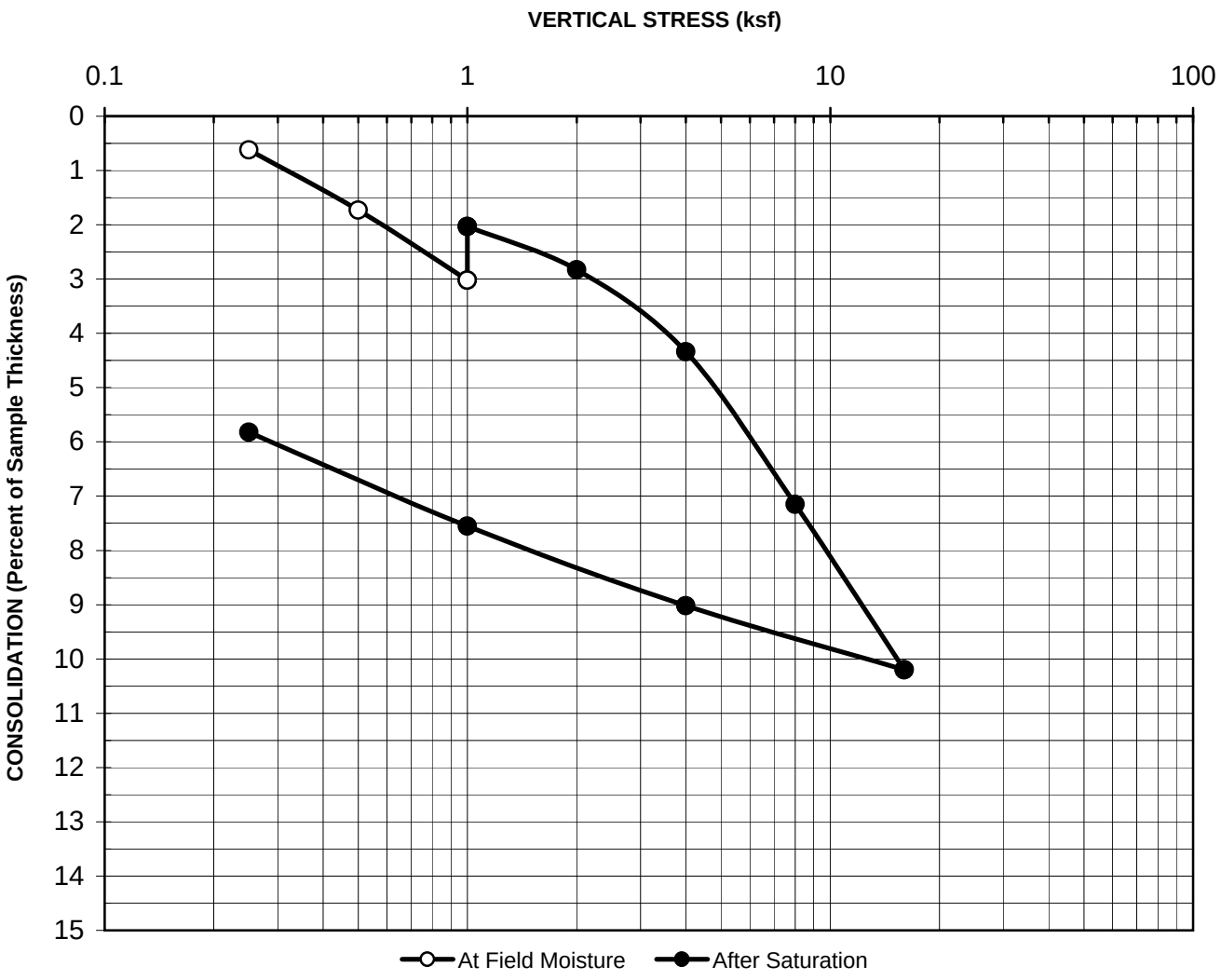
Geotechnical Soilutions, Inc.

LOG OF BORING # B9

Boring No. 9	Sheet 1 of 1		
Date:	4/1/2015		
Drilling Contractor:			
Client:	Century Quality Management	Equipment:	Hand auger
Project No.	GS 1531	Driving Weight:	
Location:	2277 Harbor Blvd, Costa Mesa	Elevation:	
		Logged by:	SB

Depth in Feet	Drive Sample	Bag Sample	Lab. Testing	Blows per 6 inches	Moisture Content %	Dry Unit Weight (pcf	Classification	Symbol	Visual Soil Description
0-									**0-2' Fill**
							CL		Dark brown, **sandy clay**, damp, soft.
									2'-10' Older Alluvium
							SM		Dark brown, **silty sand**, moist, medium dense.
5-									
									Olive brown, **silty sand** with clay, moist, medium dense.
							SM		Light olive brown, **silty sand** and sand, slightly moist, dense.
							SP		Light olive brown, **sand**, slightly moist, dense.
10-									Same as above.
									Total Depth at 10'.
									No Groundwater.
									Hand augered to 10'.
15-									
20-									
25-									
30-									

AP Engineering & Testing, Inc.



Boring No. :	B-1	Initial Dry Unit Weight (pcf):	104.3
Sample No.:	-	Initial Moisture Content (%):	21.5
Depth (feet):	5	Final Moisture Content (%):	19.7
Sample Type:	Mod Cal	Assumed Specific Gravity:	2.7
Soil Description:	Sandy Clay	Initial Void Ratio:	0.62
Remarks:	Swell = 0.99% upon inundation		

CONSOLIDATION CURVE
ASTM D 2435

Project Name:	Costa Mesa Apartments
Project No.:	GS 1531
Date:	4/17/2015
AP No:	15-0425

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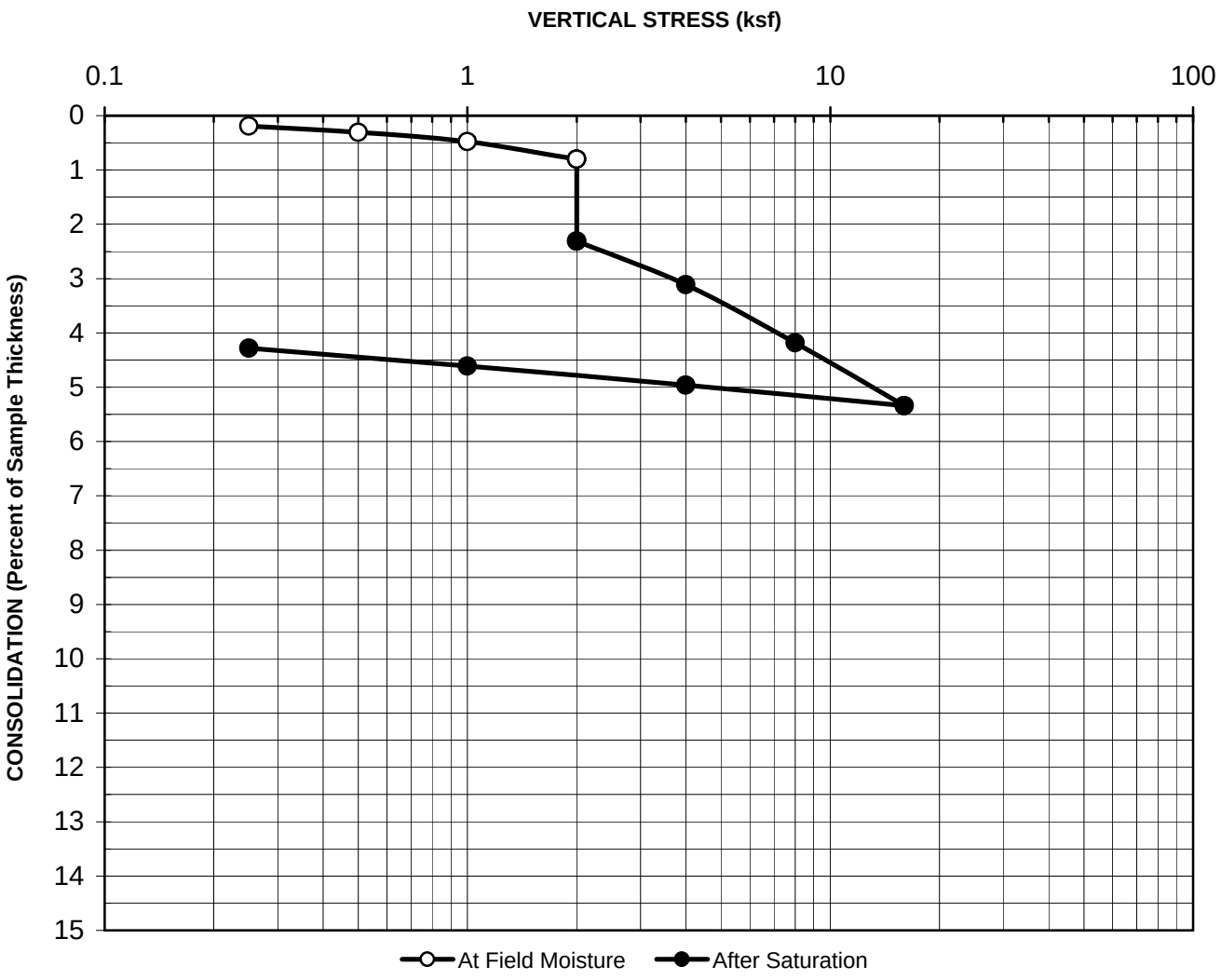


Boring No. :	B-1	Initial Dry Unit Weight (pcf):	103.5
Sample No.:	-	Initial Moisture Content (%):	4.1
Depth (feet):	15	Final Moisture Content (%):	19.7
Sample Type:	Mod Cal	Assumed Specific Gravity:	2.7
Soil Description:	Sand with silt	Initial Void Ratio:	0.63
Remarks:	Collapse= 1.51% upon inundation		

CONSOLIDATION CURVE
ASTM D 2435

Project Name:	Costa Mesa Apartments
Project No.:	GS 1531
Date:	4/17/2015
AP No:	15-0425

AP Engineering & Testing, Inc.

DIRECT SHEAR TEST DATA
ASTM D 3080

Project Name: Costa Mesa Apartments Tested By ST Date: 04/19/15

Boring No.: B-1 Checked By AP Date: 04/23/15

Sample No.: - Depth (ft): 5

Description: Sandy Clay

Sample Type: Mod. Cal.

Test Condition: Inundated

Sample Diameter (in)	2.415
Sample Height (in)	1.00
Total Soil+Ring Weight(g)	605.16
Total Ring Weight (g)	137.13
Wet Density (pcf)	129.74
Dry Density (pcf)	106.79

Moisture Determination	Before Test	After Test
Cont. Weight (g)	49.61	149.69
Wet Soil+Cont. (g)	157.58	613.50
Dry Soil+Cont. (g)	138.48	535.69
Moisture Content (%)	21.5	20.2
Degree Saturation	100.3	97.3

METHOD OF SHEARING

[X] Regular Shearing

[ ] Residual Shearing 5 Passes

Shear Rate (in/min): **0.025**

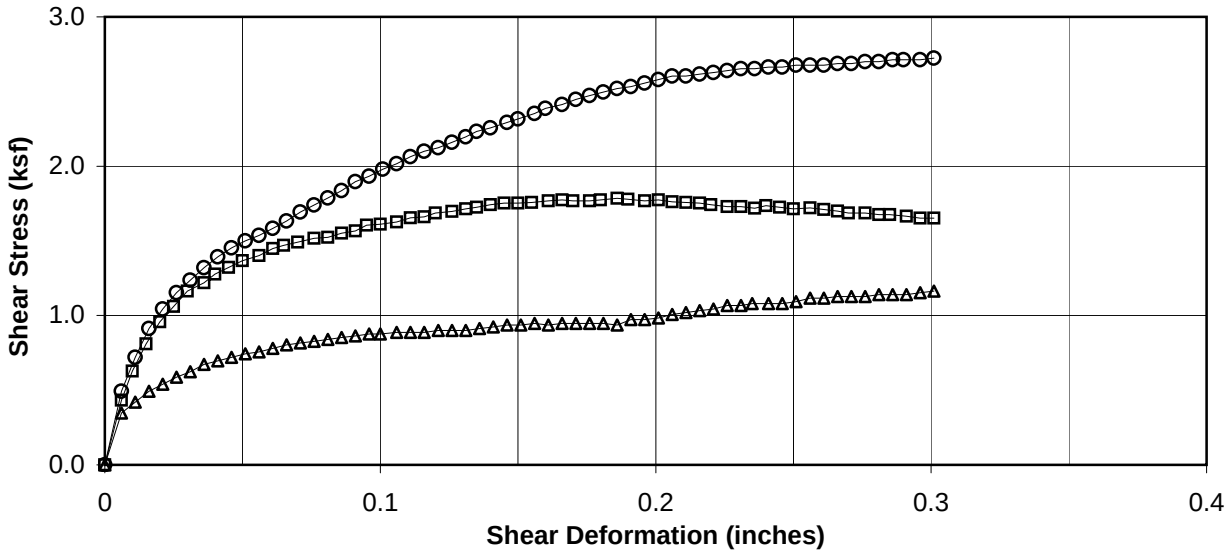
Shear Distance (in): **0.3**

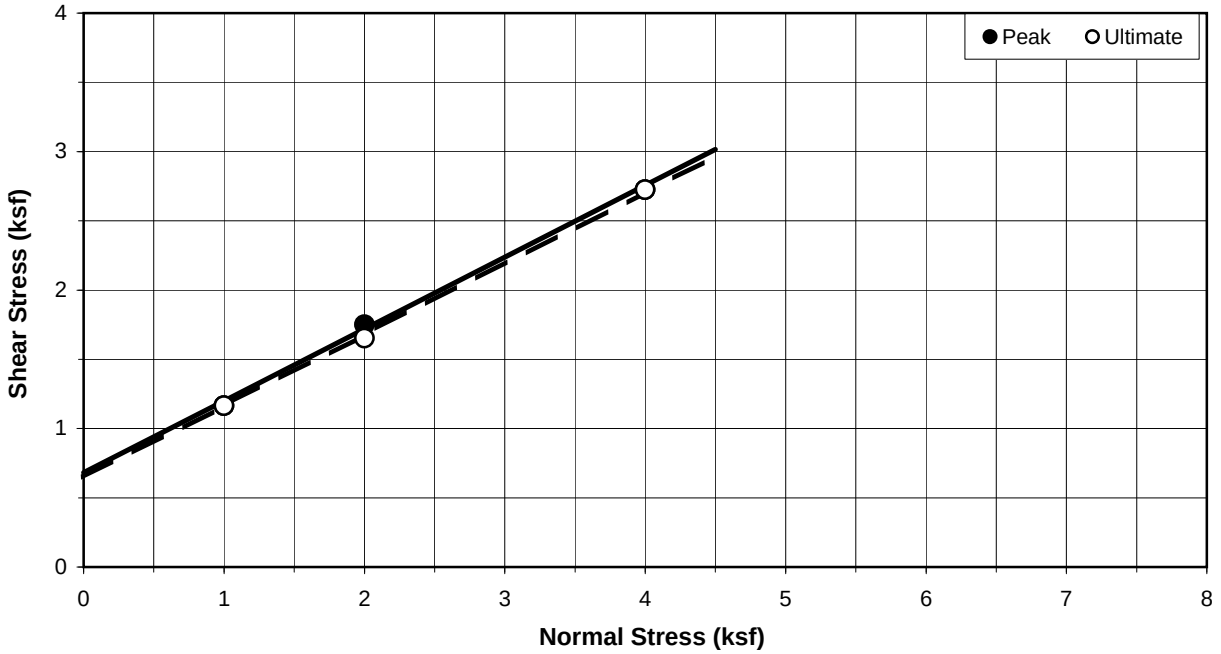
Sample Number	Sample + Ring Wt.	Ring Wt.	Normal Load (ksf)	Max. Shear Reading (psf)	Ultimate Shear Reading (psf)	Remarks
1	**203.93**	**45.92**	**1.0**	**1164**	**1164**	
2	**202.95**	**46.14**	**2.0**	**1750**	**1652**	
3	**198.28**	**45.07**	**4.0**	**2724**	**2724**	

AP Engineering & Testing, Inc.

DIRECT SHEAR TEST RESULTS
ASTM D 3080

Project Name:	Costa Mesa Apartments	Initial Dry Density:	106.8	pcf
Boring No.:	B-1	Moisture Content (before):	21.5	%
Sample No.:	-	Moisture Content (after):	20.2	%
Depth (ft):	5			
Sample Type:	Mod. Cal.			
Soil Description:	Sandy Clay			
Test Condition:	Inundated			





Strength Parameters	Peak	Ultimate
Cohesion (psf):	700	650
Friction Angle:	27 °	27 °

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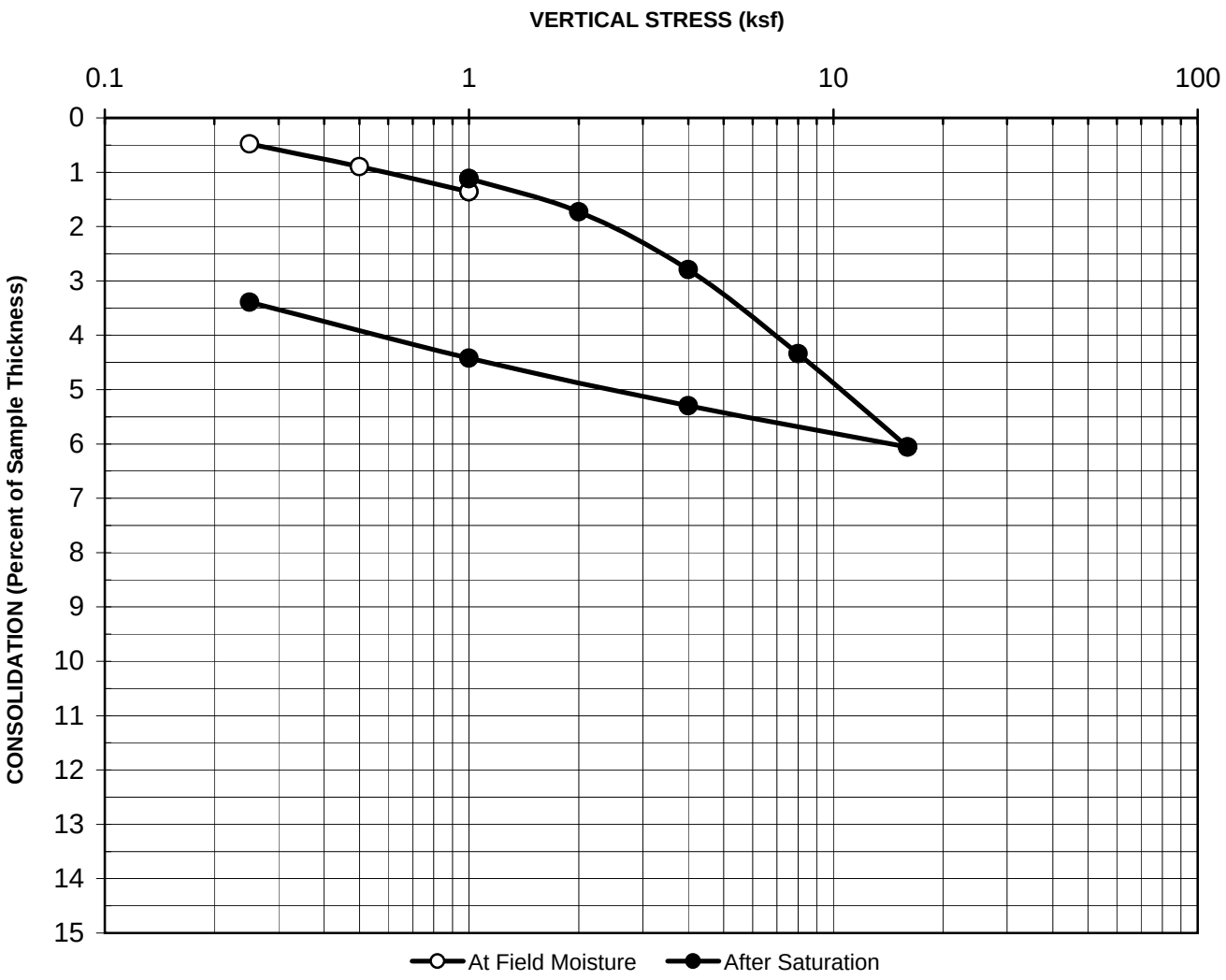

Boring No. :	B-2	Initial Dry Unit Weight (pcf):	112.9
Sample No.:	-	Initial Moisture Content (%):	11.7
Depth (feet):	7.5	Final Moisture Content (%):	16.5
Sample Type:	Mod Cal	Assumed Specific Gravity:	2.7
Soil Description:	Clayey Sand	Initial Void Ratio:	0.49
Remarks:	Swell= 0.24% upon inundation		

CONSOLIDATION CURVE
ASTM D 2435

Project Name:	Costa Mesa Apartments
Project No.:	GS 1531
Date:	4/17/2015
AP No:	15-0425

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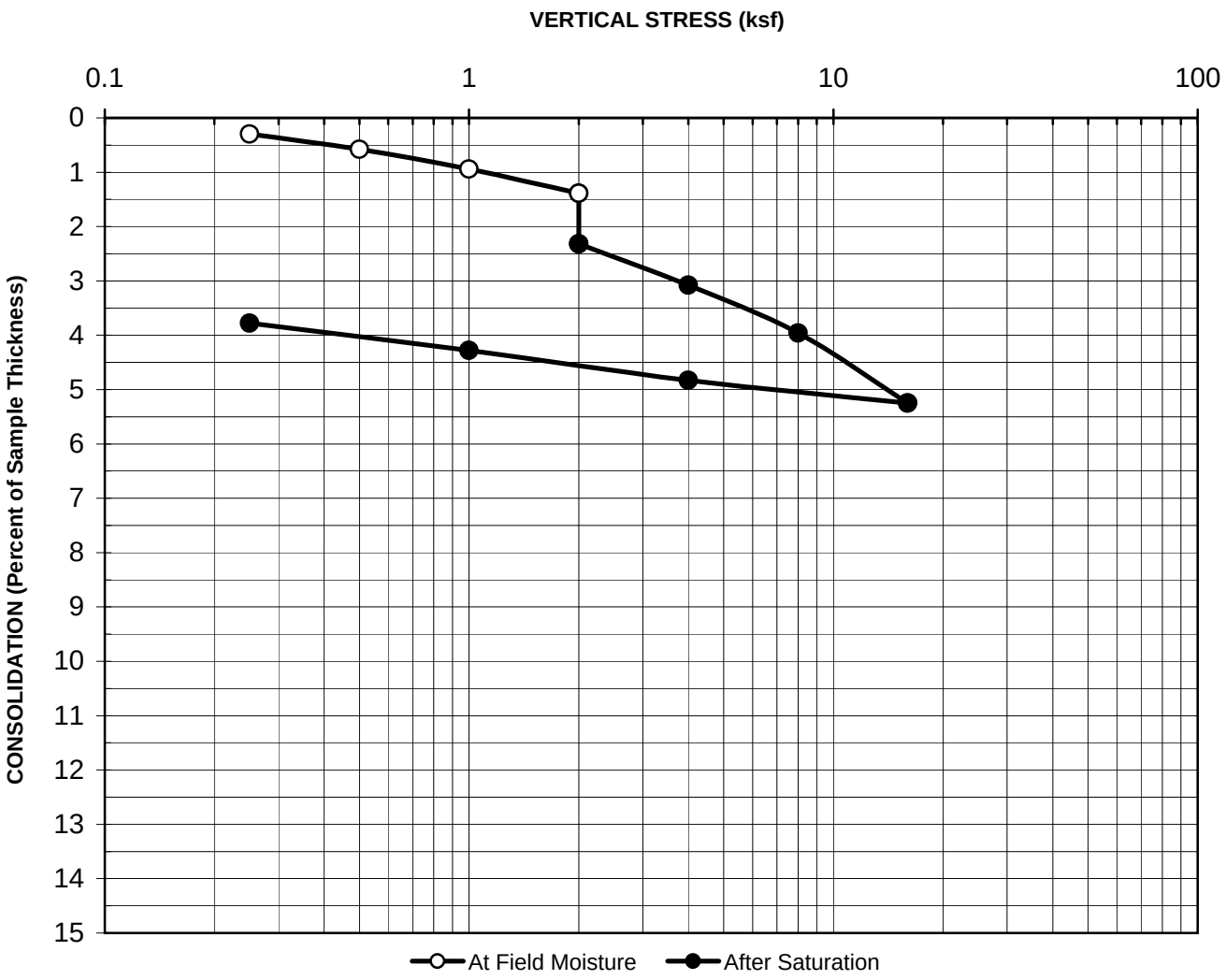

Boring No. :	B-2	Initial Dry Unit Weight (pcf):	112.5
Sample No.:	-	Initial Moisture Content (%):	8.7
Depth (feet):	10	Final Moisture Content (%):	15.6
Sample Type:	Mod Cal	Assumed Specific Gravity:	2.7
Soil Description:	Silty Sand	Initial Void Ratio:	0.50
Remarks:	Collapse= 0.93% upon inundation		

CONSOLIDATION CURVE
ASTM D 2435

Project Name: Costa Mesa Apartments
Project No.: GS 1531
Date: 4/17/2015
AP No: 15-0425

AP Engineering and Testing, Inc.
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CORROSION TEST RESULTS

Client Name: Geotechnical Soilutions
Project Name: Costa Mesa Apartments
Project No.: GS 1531

AP Job No.: 14-0425
Date 04/23/15

Boring No.	Sample No.	Depth (feet)	Soil Type	Minimum Resistivity (ohm-cm)	pH	Sulfate Content (ppm)	Chloride Content (ppm)
B-2	-	0-4	CL-ML	7036	7.4	57	36
B-5	-	3-6	CL	998	7.7	412	413

NOTES:
Resistivity Test and pH: California Test Method 643
Sulfate Content : California Test Method 417
Chloride Content : California Test Method 422
ND = Not Detectable
NA = Not Sufficient Sample
NR = Not Requested

AP Engineering & Testing, Inc.

EXPANSION INDEX TEST RESULTS

ASTM D 4829

Client Name: Geotechnical Soilutions

Project Name: Costa Mesa Apartments

Project No.: GS 1531

AP Job No.: 15-0425

Date: 04/23/15

Boring No.	Sample No.	Depth (ft)	Soil Description	Molded Dry Density (pcf)	Molded Moisture Content (%)	Init. Degree Saturation (%)	Measured Expansion Index	Corrected Expansion Index
B-2	Bag	0-4	Sandy Clay to Sandy Silt	114.4	9.5	54.2	0	0
B-5	Bag	3-6	Sandy Clay	109.0	9.6	47.5	57	55

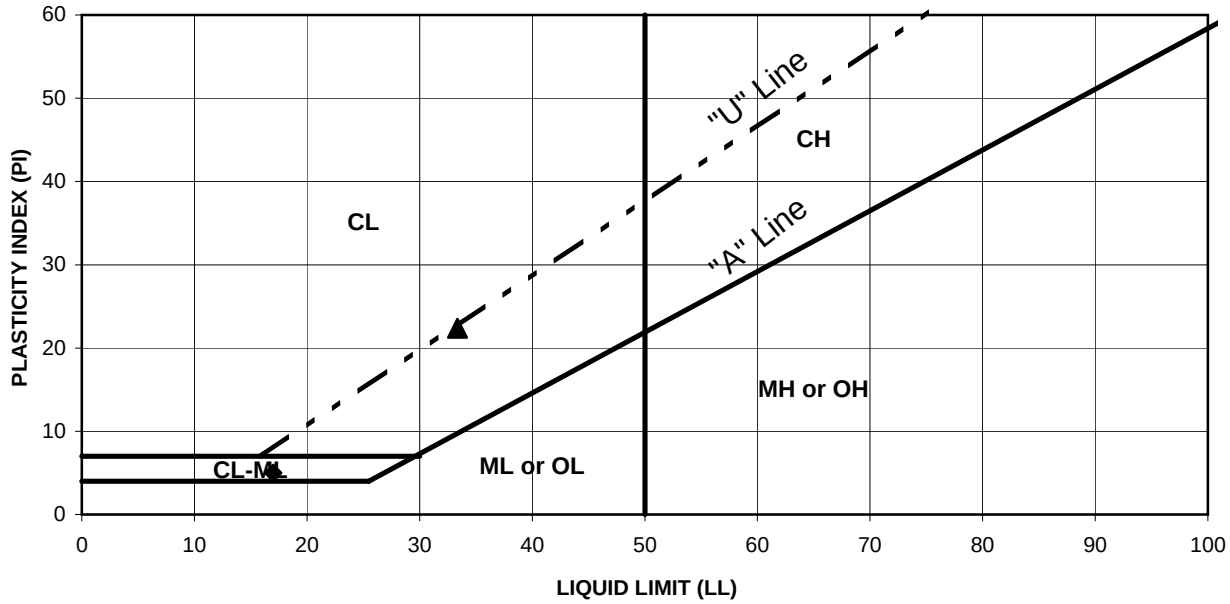
ASTM EXPANSION CLASSIFICATION

Expansion Index	Classification
0-20	V. Low
21-50	Low
51-90	Medium
91-130	High
>130	V. High

AP Engineering & Testing, Inc.

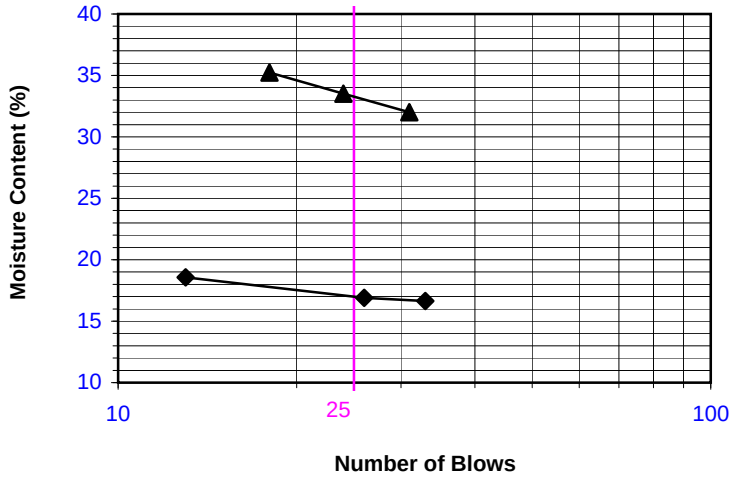
ATTERBERG LIMITS
ASTM D 4318

Project Name: Costa Mesa Apartments **Tested By:** ST Date: 04/22/15
Project No.: GS-1531 **Checked By:** AP Date: 04/23/15



PROCEDURE USED

- [ ] Wet Preparation
- [x] Dry Preparation
- [x] Procedure A Multipoint Test
- [ ] Procedure B One-point Test



Symbol	Boring Number	Sample Type	Depth (feet)	LL	PL	PI	Plasticity Chart Symbol
♦	B-2	Bag	0-4	17	12	5	CL-ML
▲	B-5	Bag	3-6	33	11	22	CL

AP Engineering & Testing, Inc.

DIRECT SHEAR TEST DATA
ASTM D 3080

Project Name: Costa Mesa Apartments Tested By: ST Date: 04/19/15

Boring No.: B-2 Checked By: AP Date: 04/23/15

Sample No.: Bag Depth (ft): 0-4

Description: Sandy Clay to Sandy Silt

Sample Type: Mod. Cal.

Test Condition: Inundated

Sample Diameter (in)	2.415
Sample Height (in)	1.00
Total Soil+Ring Weight(g)	587.29
Total Ring Weight (g)	125.66
Wet Density (pcf)	127.97
Dry Density (pcf)	118.12

Moisture Determination	Before Test	After Test
Cont. Weight (g)	803.91	147.67
Wet Soil+Cont. (g)	909.83	621.74
Dry Soil+Cont. (g)	901.68	561.35
Moisture Content (%)	8.3	14.6
Degree Saturation	52.7	96.6

METHOD OF SHEARING

[X] Regular Shearing Shear Rate (in/min): **0.025**

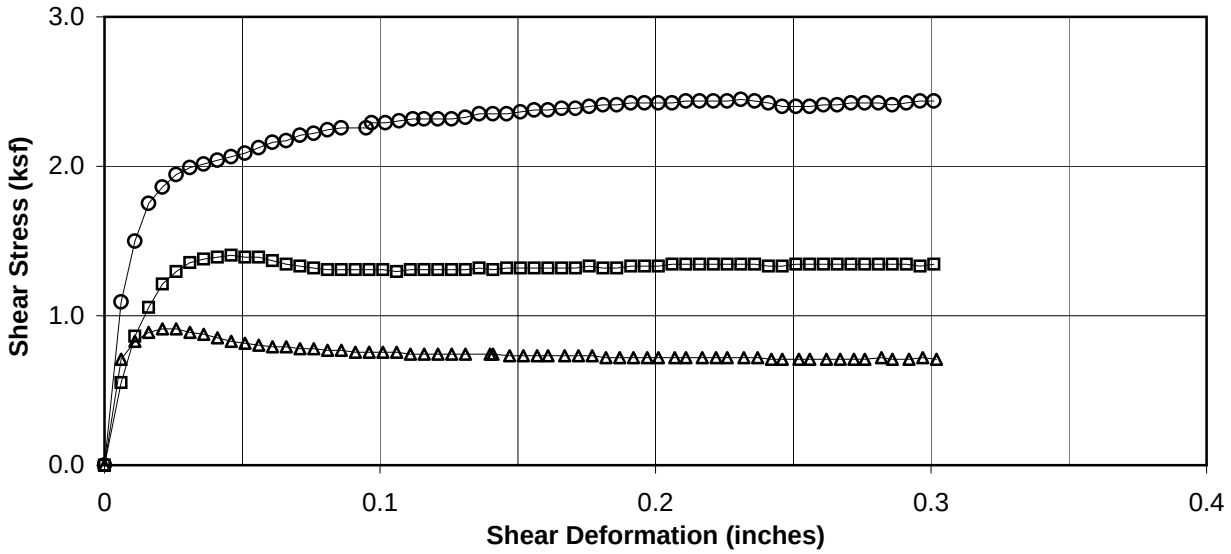
[ ] Residual Shearing 5 Passes Shear Distance (in): **0.3**

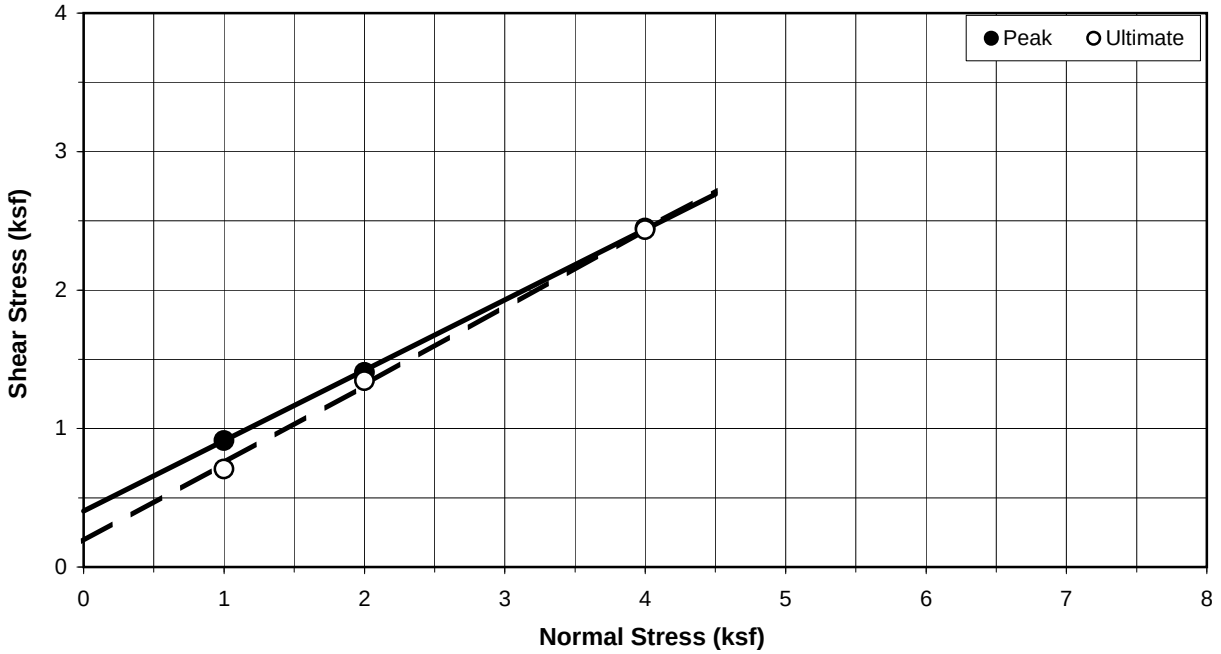
Sample Number	Sample + Ring Wt.	Ring Wt.	Normal Load (ksf)	Max. Shear Reading (psf)	Ultimate Shear Reading (psf)	Remarks
1	**195.50**	**41.68**	**1.0**	**912**	**708**	
2	**196.17**	**42.18**	**2.0**	**1404**	**1344**	
3	**195.62**	**41.80**	**4.0**	**2448**	**2436**	

AP Engineering & Testing, Inc.

DIRECT SHEAR TEST RESULTS
ASTM D 3080

Project Name:	Costa Mesa Apartments	Initial Dry Density:	118.1	pcf
Boring No.:	B-2	Moisture Content (before):	8.3	%
Sample No.:	Bag	Moisture Content (after):	14.6	%
Depth (ft):	0-4			
Sample Type:	Mod. Cal.			
Soil Description:	Sandy Clay to Sandy Silt			
Test Condition:	Inundated			





Strength Parameters	Peak	Ultimate
Cohesion (psf):	400	200
Friction Angle:	27 °	29 °

AP Engineering & Testing, Inc.

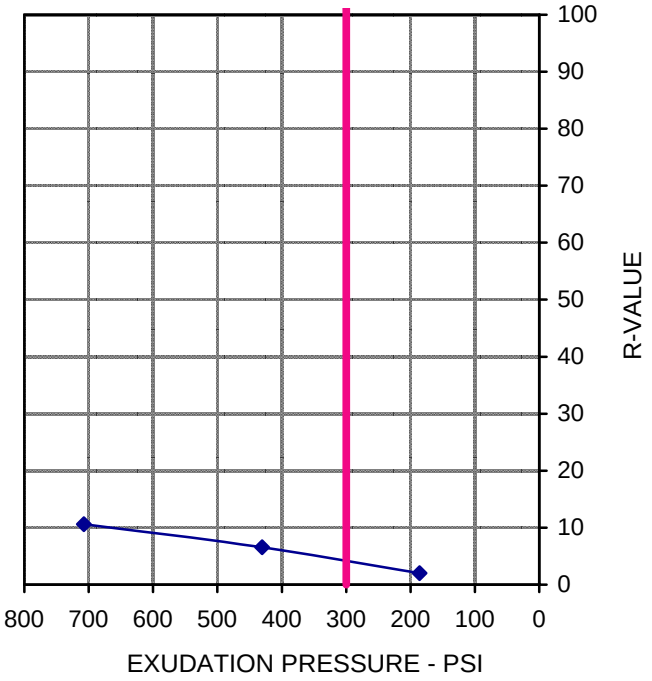
R-VALUE TEST DATA

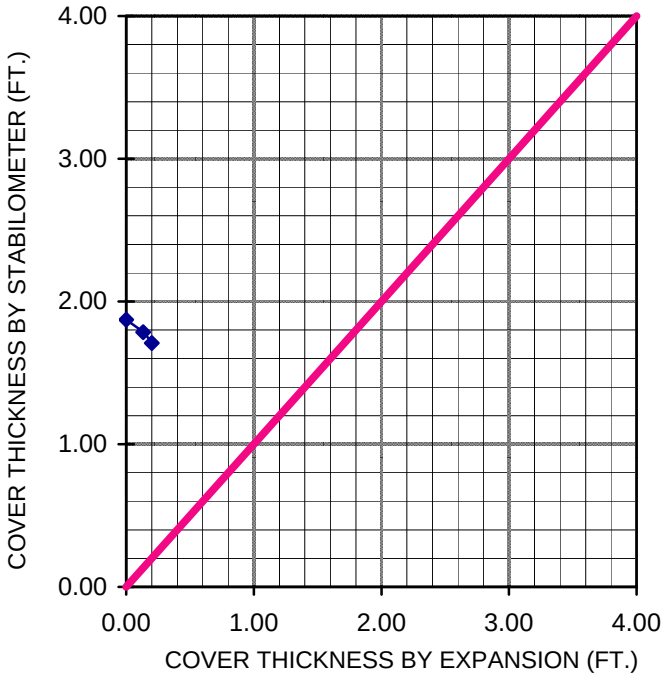
ASTM D2844

Project Name:	Costa Mesa Apartments	Tested By:	ST	Date:	04/20/15
Project Number:	GS 1531	Computed By:	KM	Date:	04/22/15
Boring No.:	B-2	Checked By:	AP	Date:	04/23/15
Sample No.:	Bag	Depth (ft):	0-4		
Location:	N/A				
Soil Description:	Sandy Clay to Sandy Silt				

Mold Number	G	I	H	
Water Added, g	0	10	20	
Compact Moisture(%)	11.7	12.8	13.8	
Compaction Gage Pressure, psi	50	50	50	
Exudation Pressure, psi	708	430	186	
Sample Height, Inches	2.5	2.5	2.6	
Gross Weight Mold, g	2889	2934	2925	
Tare Weight Mold, g	1829	1839	1820	
Net Sample Weight, g	1060	1095	1105	
Expansion, inchesx10^{-4}	6	4	0	
Stability 2,000 (160 psi)	58/132	62/140	70/152	
Turns Displacement	4.48	5.09	5.58	
R-Value Uncorrected	11	7	2	
R-Value Corrected	11	7	2	
Dry Density, pcf	115.0	117.7	113.2	
Traffic Index	8.0	8.0	8.0	
G.E. by Stability	1.71	1.79	1.87	
G.E. by Expansion	0.20	0.13	0.00	

R-VALUE	By Exudation:	4
	By Expansion:	*N/A
	At Equilibrium: (by Exudation)	4
Remarks	Gf = 1.34, and 0.5 % Retained on the ¾" *Not Applicable	





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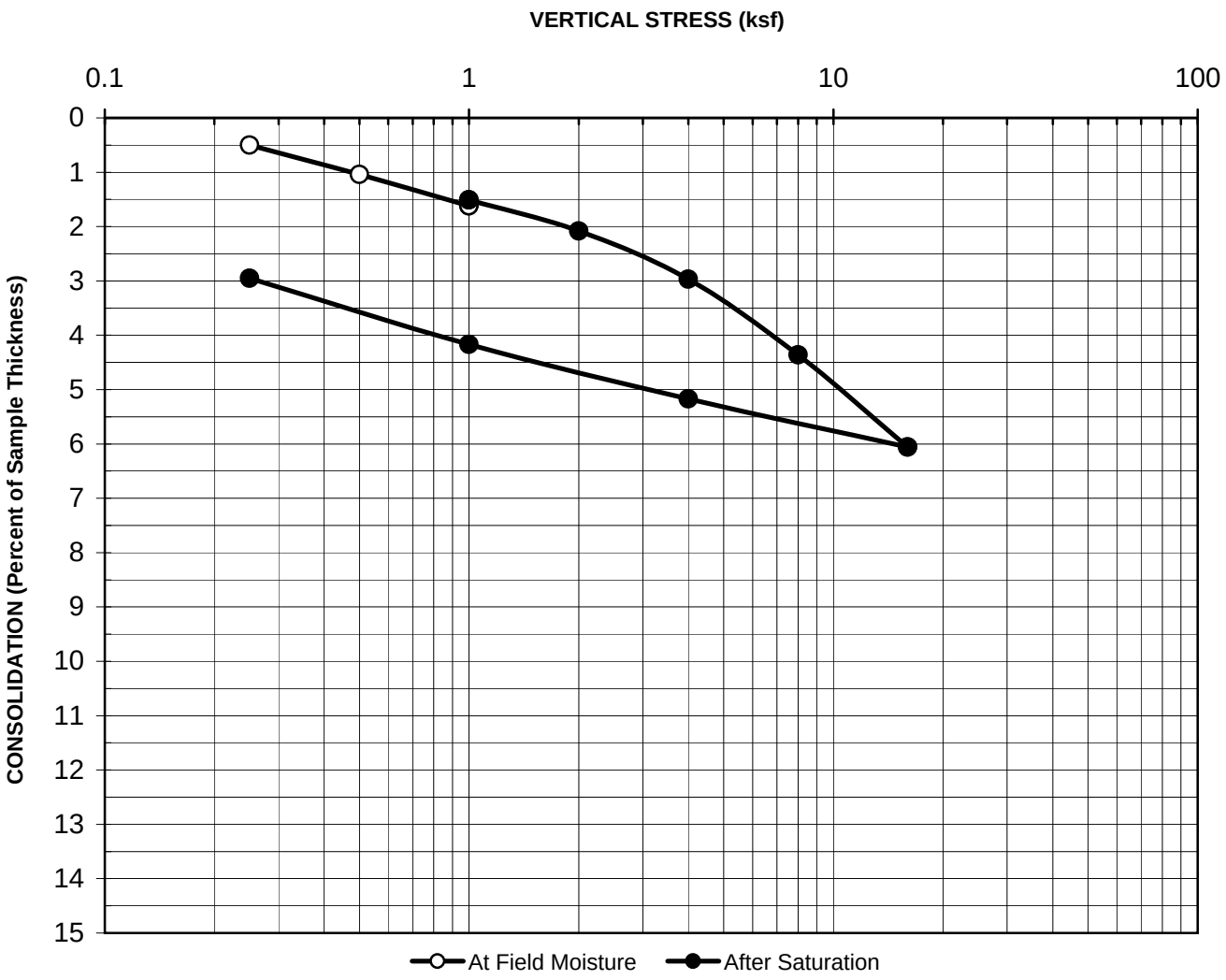
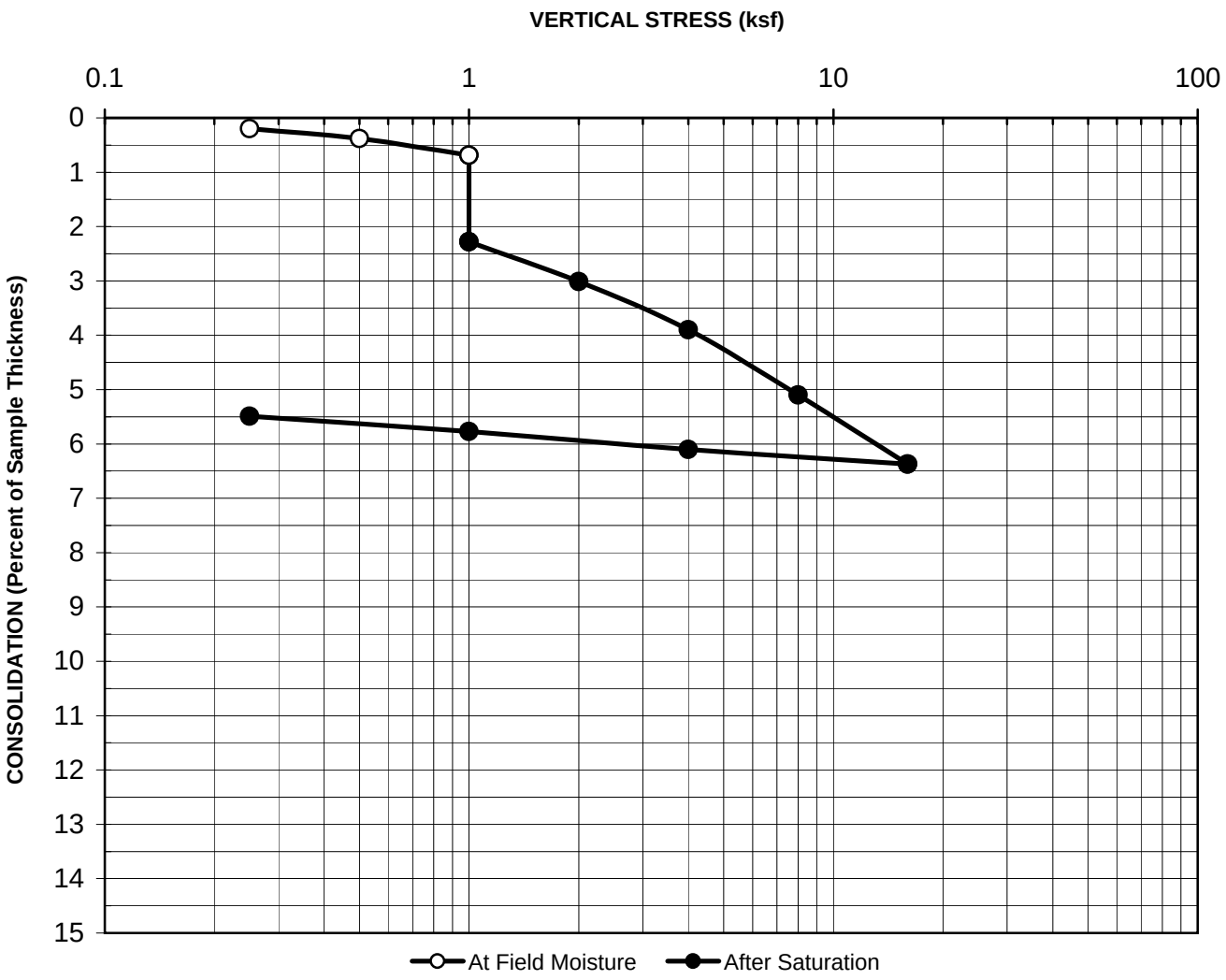


Boring No. :	B-3	Initial Dry Unit Weight (pcf):	118.8
Sample No.:	-	Initial Moisture Content (%):	13.0
Depth (feet):	5	Final Moisture Content (%):	14.1
Sample Type:	Mod Cal	Assumed Specific Gravity:	2.7
Soil Description:	Sandy Clay	Initial Void Ratio:	0.42
Remarks:	Swell = 0.11% upon inundation		

CONSOLIDATION CURVE
ASTM D 2435

Project Name:	Costa Mesa Apartments
Project No.:	GS 1531
Date:	4/17/2015
AP No:	15-0425

AP Engineering & Testing, Inc.



Boring No. :	B-3	Initial Dry Unit Weight (pcf):	105.5
Sample No.:	-	Initial Moisture Content (%):	3.5
Depth (feet):	7.5	Final Moisture Content (%):	15.2
Sample Type:	Mod Cal	Assumed Specific Gravity:	2.7
Soil Description:	Silty Sand	Initial Void Ratio:	0.60
Remarks:	Collapse= 1.59% upon inundation		

CONSOLIDATION CURVE
ASTM D 2435

Project Name:	Costa Mesa Apartments
Project No.:	GS 1531
Date:	4/17/2015
AP No:	15-0425

AP Engineering & Testing, Inc.

DIRECT SHEAR TEST DATA
ASTM D 3080

Project Name: Costa Mesa Apartments Tested By: ST Date: 04/20/15

Boring No.: B-4 Checked By: AP Date: 04/23/15

Sample No.: - Depth (ft): 7.5

Description: Silty Sand

Sample Type: Mod. Cal.

Test Condition: Inundated

Sample Diameter (in)	2.415
Sample Height (in)	1.00
Total Soil+Ring Weight(g)	517.57
Total Ring Weight (g)	131.20
Wet Density (pcf)	107.10
Dry Density (pcf)	98.77

Moisture Determination	Before Test	After Test
Cont. Weight (g)	152.20	149.34
Wet Soil+Cont. (g)	411.33	560.40
Dry Soil+Cont. (g)	391.17	481.67
Moisture Content (%)	8.4	23.7
Degree Saturation	32.2	93.0

METHOD OF SHEARING

[X] Regular Shearing Shear Rate (in/min): **0.025**

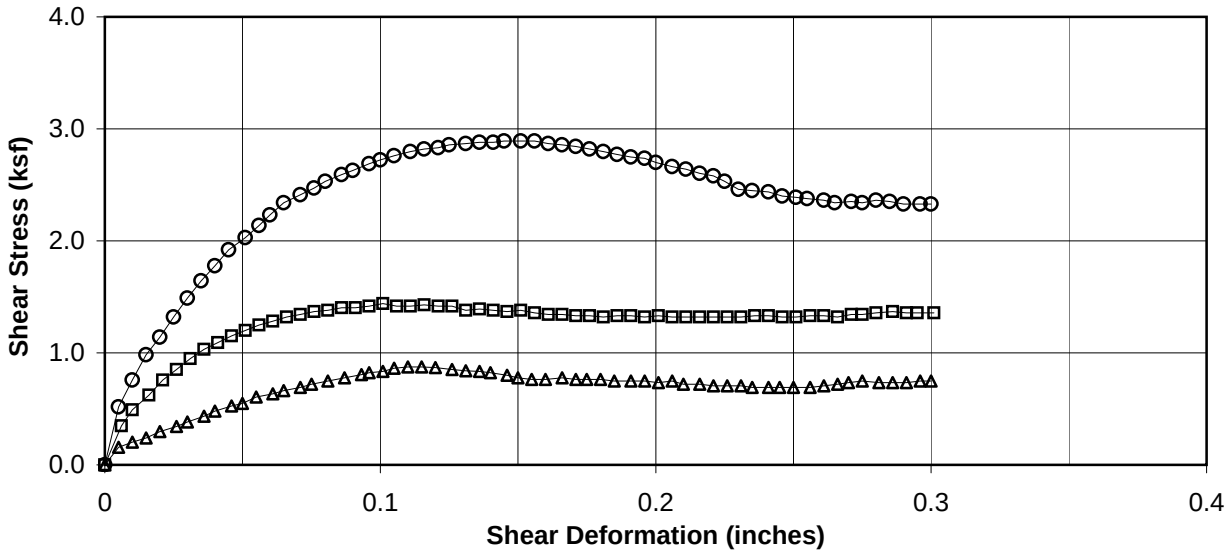
[ ] Residual Shearing 5 Passes Shear Distance (in): **0.3**

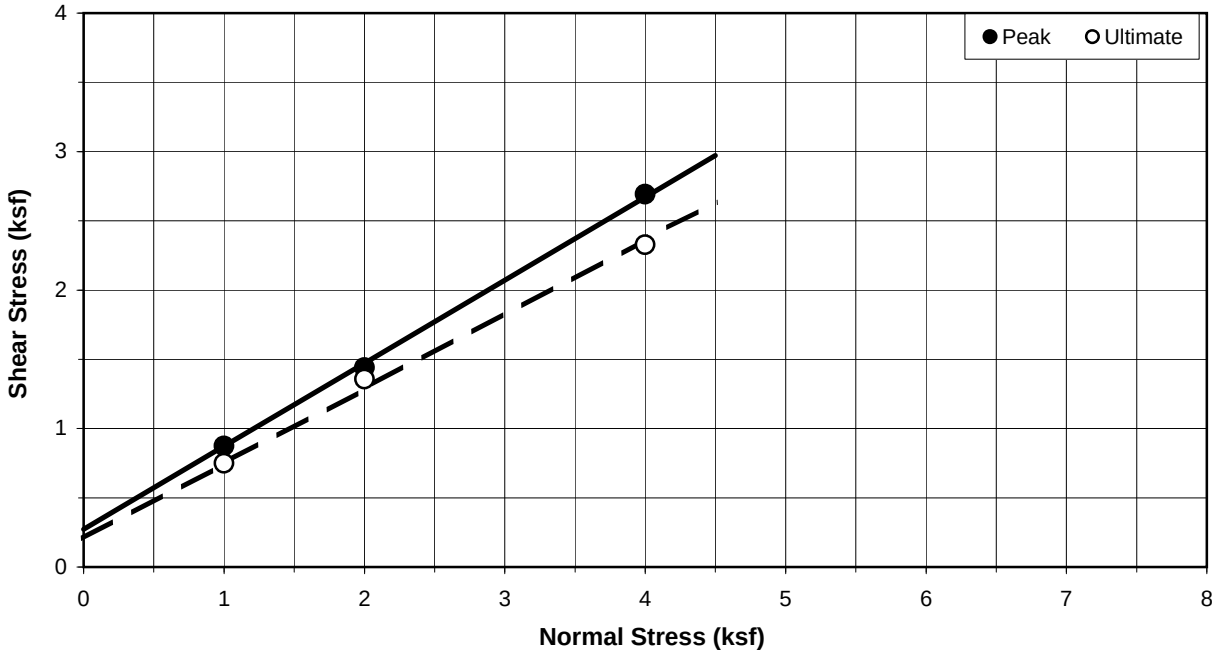
Sample Number	Sample + Ring Wt.	Ring Wt.	Normal Load (ksf)	Max. Shear Reading (psf)	Ultimate Shear Reading (psf)	Remarks
1	**175.92**	**46.76**	**1.0**	**873**	**748**	
2	**170.75**	**42.62**	**2.0**	**1440**	**1356**	
3	**170.90**	**41.82**	**4.0**	**2692**	**2328**	

AP Engineering & Testing, Inc.

DIRECT SHEAR TEST RESULTS
ASTM D 3080

Project Name:	Costa Mesa Apartments	Initial Dry Density:	98.8	pcf
Boring No.:	B-4	Moisture Content (before):	8.4	%
Sample No.:	-	Moisture Content (after):	23.7	%
Depth (ft):	7.5			
Sample Type:	Mod. Cal.			
Soil Description:	Silty Sand			
Test Condition:	Inundated			





Strength Parameters	Peak	Ultimate
Cohesion (psf):	250	200
Friction Angle:	31 °	28 °

AP Engineering & Testing, Inc.

DIRECT SHEAR TEST DATA
ASTM D 3080

Project Name: Costa Mesa Apartments Tested By: AP Date: 04/20/15

Boring No.: B-4 Checked By: AP Date: 04/23/15

Sample No.: - Depth (ft): 10

Description: Sand with silt

Sample Type: Mod. Cal.

Test Condition: Inundated

Sample Diameter (in)	2.415
Sample Height (in)	1.00
Total Soil+Ring Weight(g)	527.47
Total Ring Weight (g)	133.91
Wet Density (pcf)	109.10
Dry Density (pcf)	104.45

Moisture Determination	Before Test	After Test
Cont. Weight (g)	49.97	151.66
Wet Soil+Cont. (g)	154.12	567.07
Dry Soil+Cont. (g)	149.68	495.37
Moisture Content (%)	4.5	20.9
Degree Saturation	19.6	94.7

METHOD OF SHEARING

[X] Regular Shearing Shear Rate (in/min): **0.025**

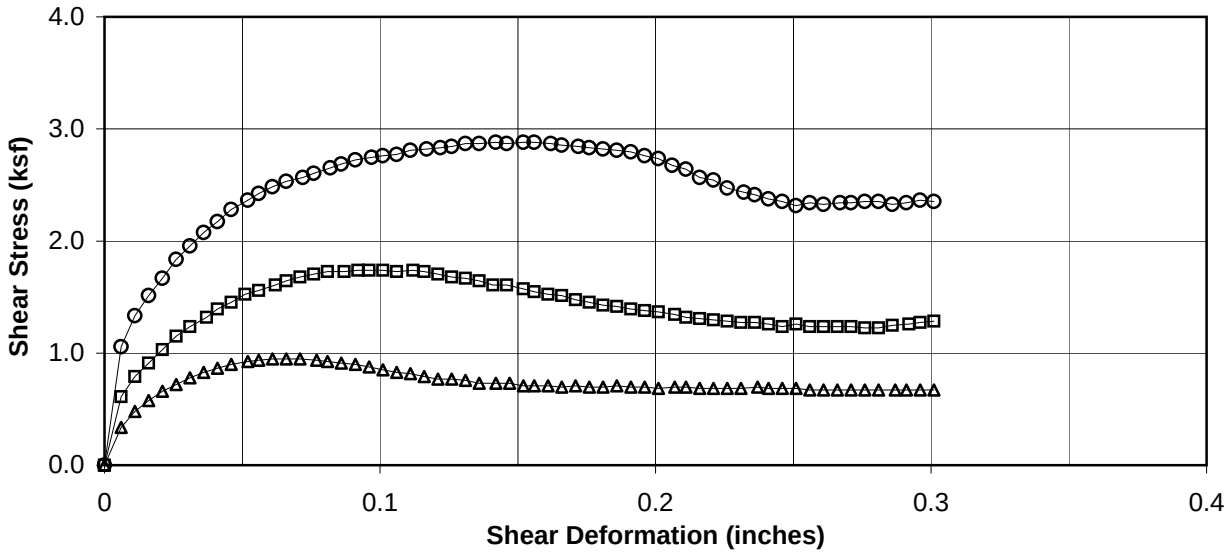
[ ] Residual Shearing 5 Passes Shear Distance (in): **0.3**

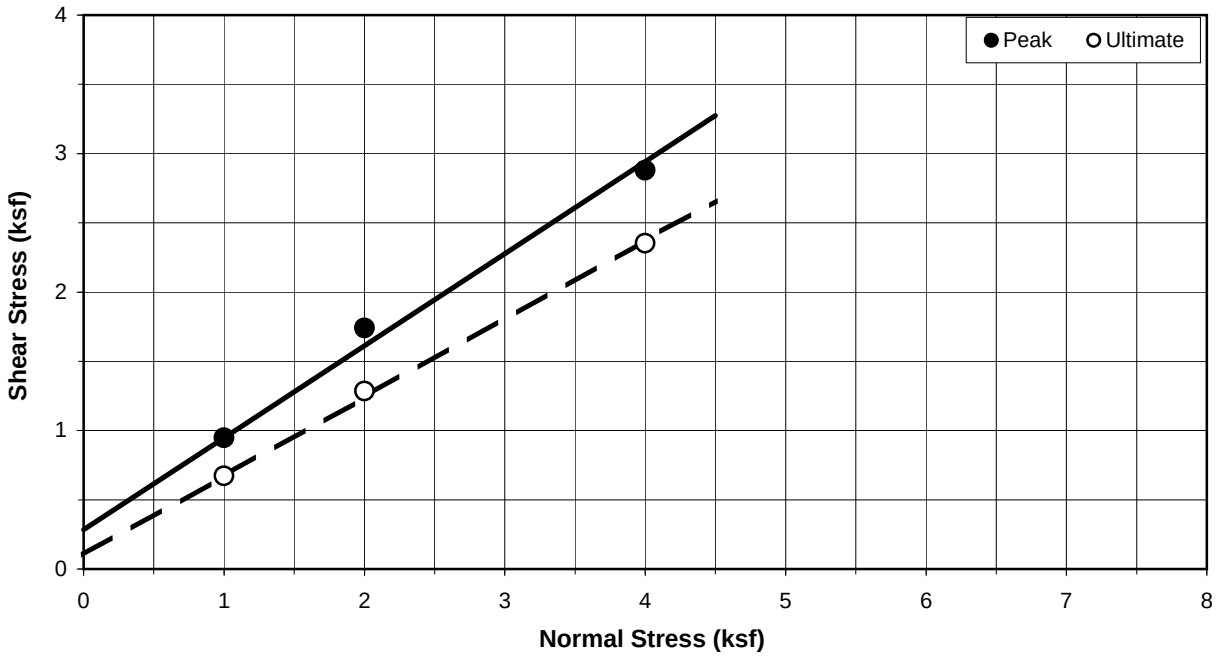
Sample Number	Sample + Ring Wt.	Ring Wt.	Normal Load (ksf)	Max. Shear Reading (psf)	Ultimate Shear Reading (psf)	Remarks
1	**171.44**	**44.46**	**1.0**	**948**	**672**	
2	**184.58**	**46.68**	**2.0**	**1740**	**1284**	
3	**171.45**	**42.77**	**4.0**	**2880**	**2352**	

AP Engineering & Testing, Inc.

DIRECT SHEAR TEST RESULTS
ASTM D 3080

Project Name:	Costa Mesa Apartments	Initial Dry Density:	104.4	pcf
Boring No.:	B-4	Moisture Content (before):	4.5	%
Sample No.:	-	Moisture Content (after):	20.9	%
Depth (ft):	10			
Sample Type:	Mod. Cal.			
Soil Description:	Sand with silt			
Test Condition:	Inundated			





Strength Parameters	Peak	Ultimate
Cohesion (psf):	300	100
Friction Angle:	34 °	30 °

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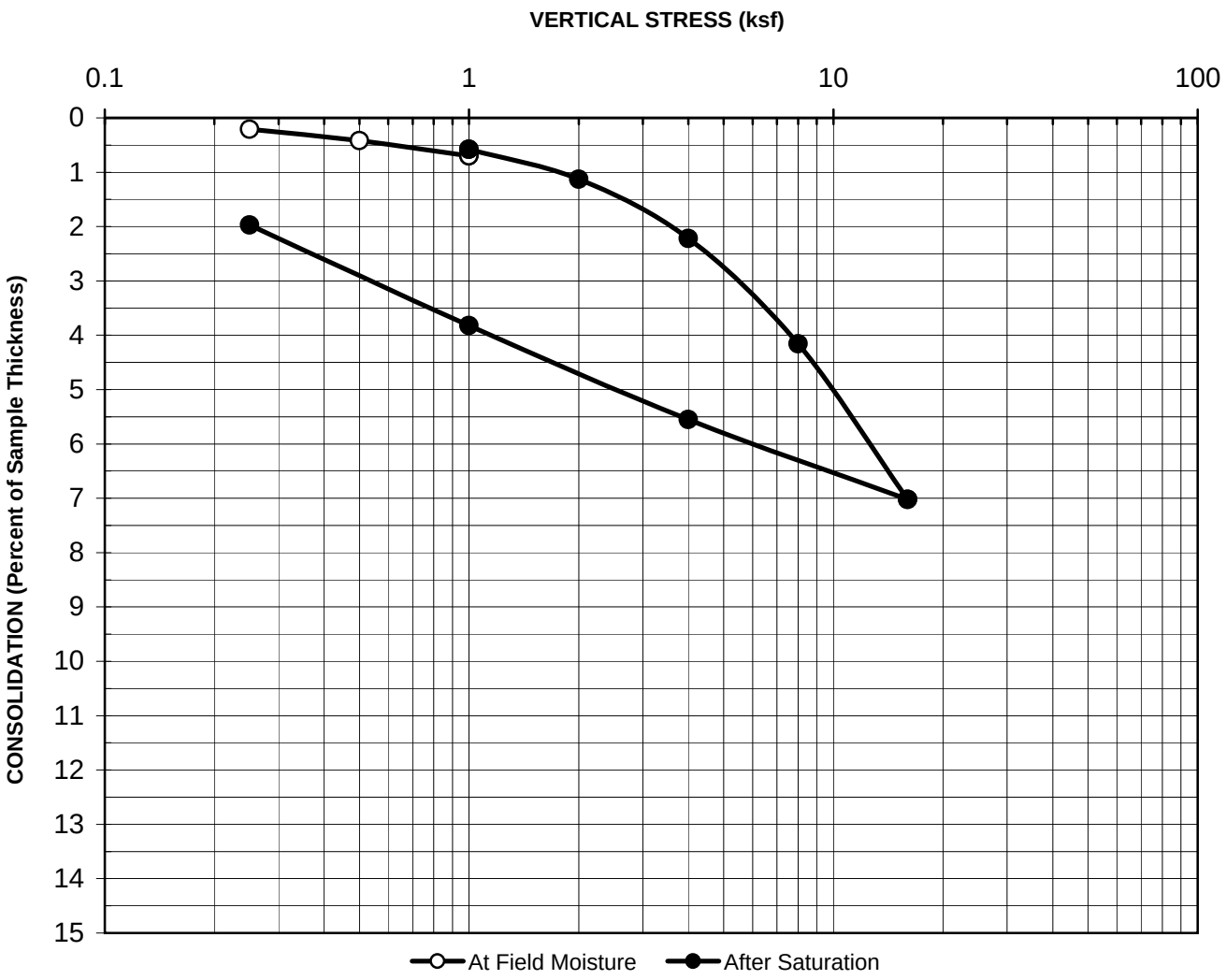


Boring No. :	B-5	Initial Dry Unit Weight (pcf):	100.8
Sample No.:	-	Initial Moisture Content (%):	20.5
Depth (feet):	7.5	Final Moisture Content (%):	26.3
Sample Type:	Mod Cal	Assumed Specific Gravity:	2.7
Soil Description:	Sandy Silt	Initial Void Ratio:	0.67
Remarks:	Swell = 0.12% upon inundation		

CONSOLIDATION CURVE
ASTM D 2435

Project Name:	Costa Mesa Apartments
Project No.:	GS 1531
Date:	4/17/2015
AP No:	15-0425

AP Engineering & Testing, Inc.

DIRECT SHEAR TEST DATA
ASTM D 3080

Project Name: Costa Mesa Apartments Tested By: ST Date: 04/20/15

Boring No.: B-5 Checked By: AP Date: 04/23/15

Sample No.: - Depth (ft): 7.5

Description: Sandy Silt

Sample Type: Mod. Cal.

Test Condition: Inundated

Sample Diameter (in)	2.415
Sample Height (in)	1.00
Total Soil+Ring Weight(g)	575.92
Total Ring Weight (g)	135.17
Wet Density (pcf)	122.18
Dry Density (pcf)	101.37

Moisture Determination	Before Test	After Test
Cont. Weight (g)	49.85	149.73
Wet Soil+Cont. (g)	109.67	592.39
Dry Soil+Cont. (g)	99.48	506.82
Moisture Content (%)	20.5	24.0
Degree Saturation	83.6	100.5

METHOD OF SHEARING

[X] Regular Shearing Shear Rate (in/min): **0.025**

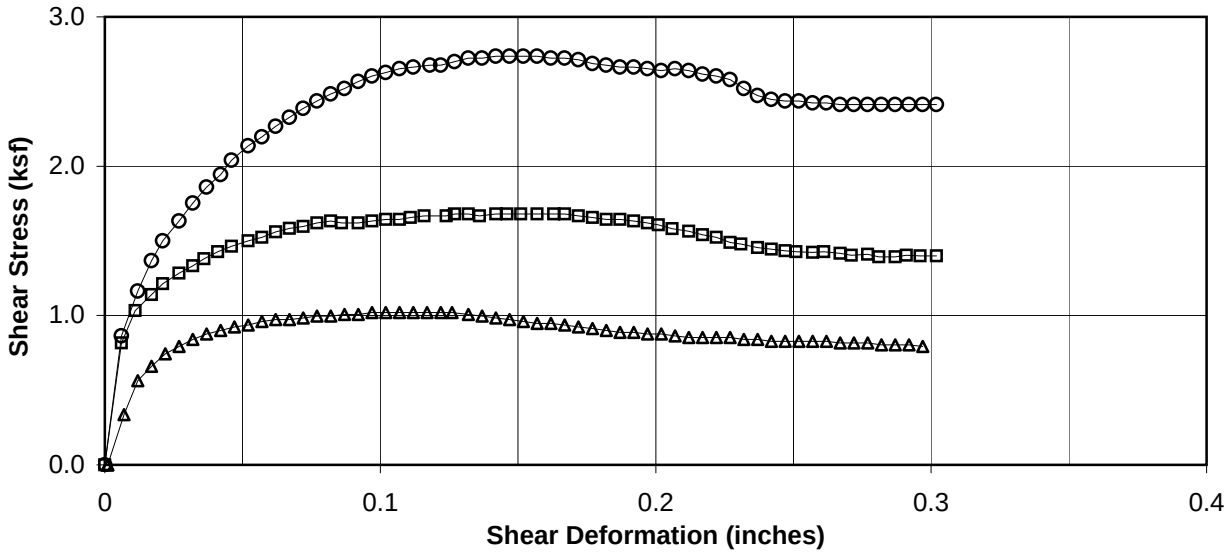
[ ] Residual Shearing 5 Passes Shear Distance (in): **0.3**

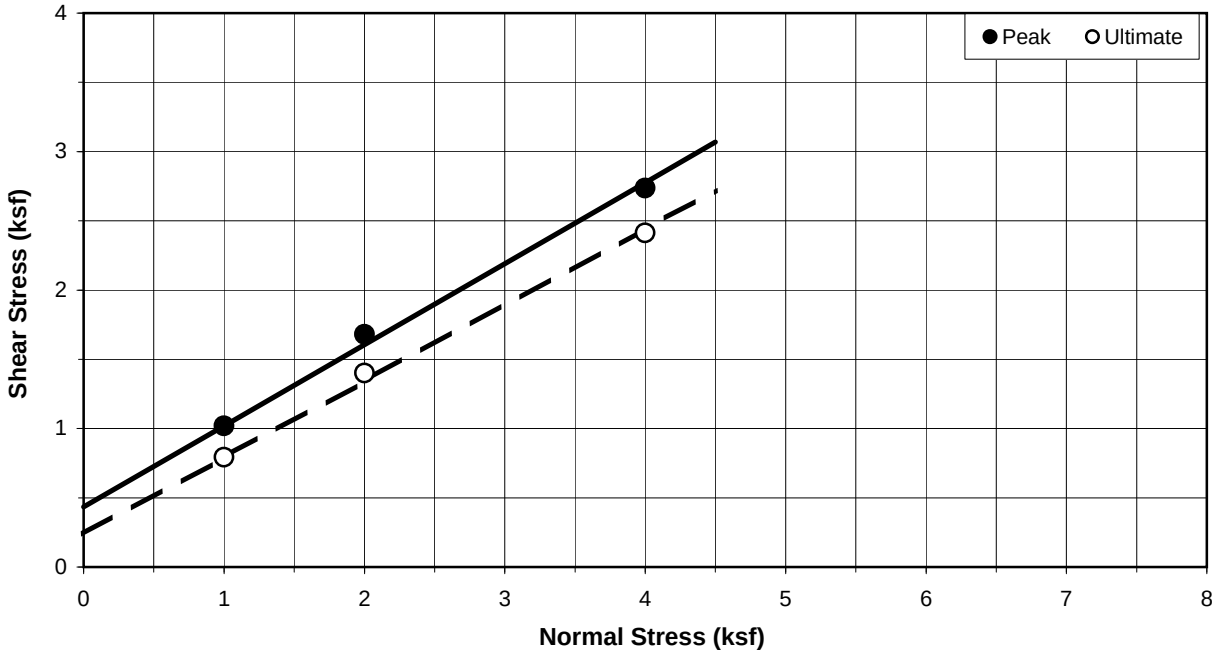
Sample Number	Sample + Ring Wt.	Ring Wt.	Normal Load (ksf)	Max. Shear Reading (psf)	Ultimate Shear Reading (psf)	Remarks
1	**186.81**	**43.12**	**1.0**	**1020**	**792**	
2	**193.67**	**44.02**	**2.0**	**1680**	**1400**	
3	**195.44**	**48.03**	**4.0**	**2736**	**2412**	

AP Engineering & Testing, Inc.

DIRECT SHEAR TEST RESULTS
ASTM D 3080

Project Name:	Costa Mesa Apartments	Initial Dry Density:	101.4	pcf
Boring No.:	B-5	Moisture Content (before):	20.5	%
Sample No.:	-	Moisture Content (after):	24.0	%
Depth (ft):	7.5			
Sample Type:	Mod. Cal.			
Soil Description:	Sandy Silt			
Test Condition:	Inundated			





Strength Parameters	Peak	Ultimate
Cohesion (psf):	450	250
Friction Angle:	30 °	29 °

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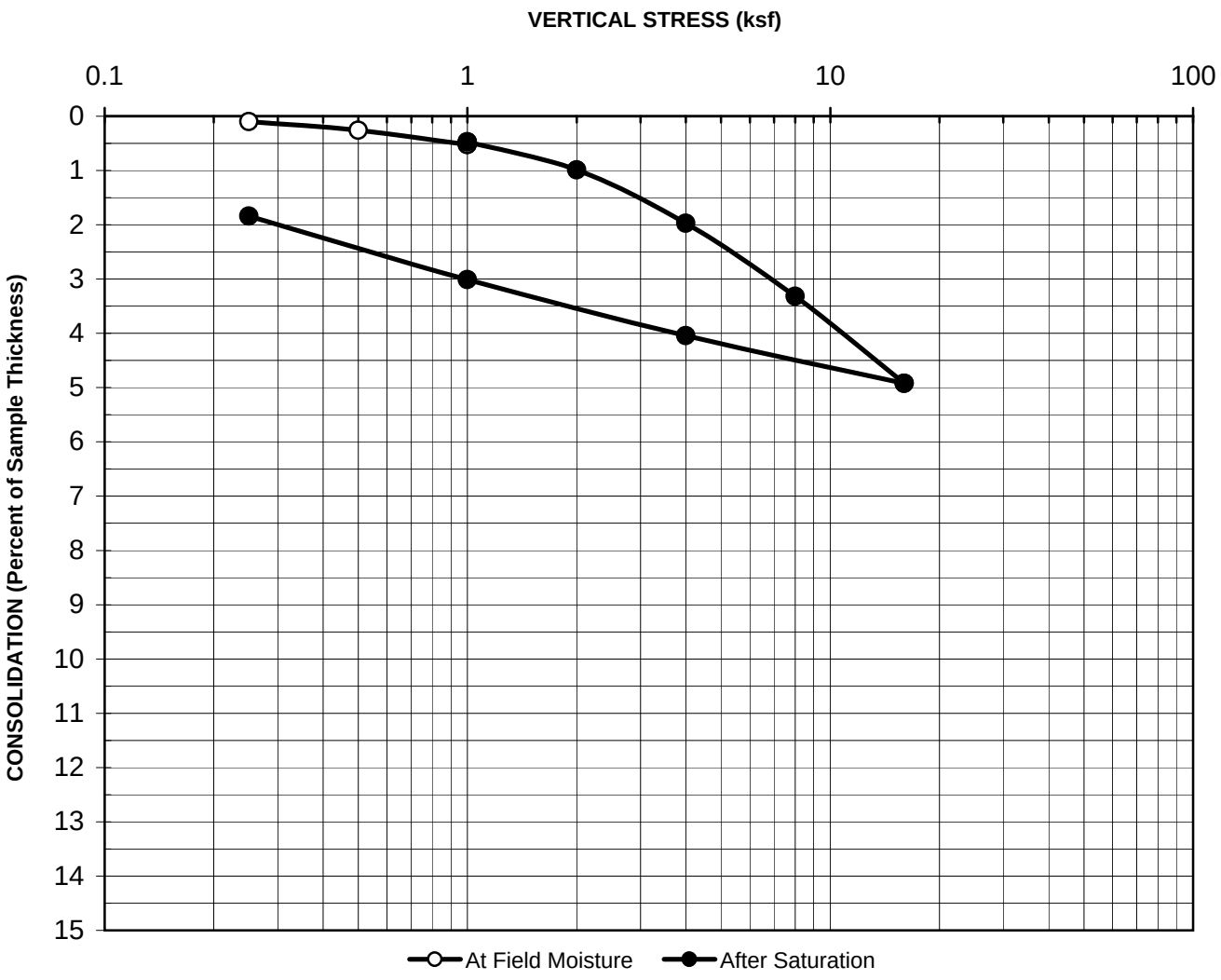
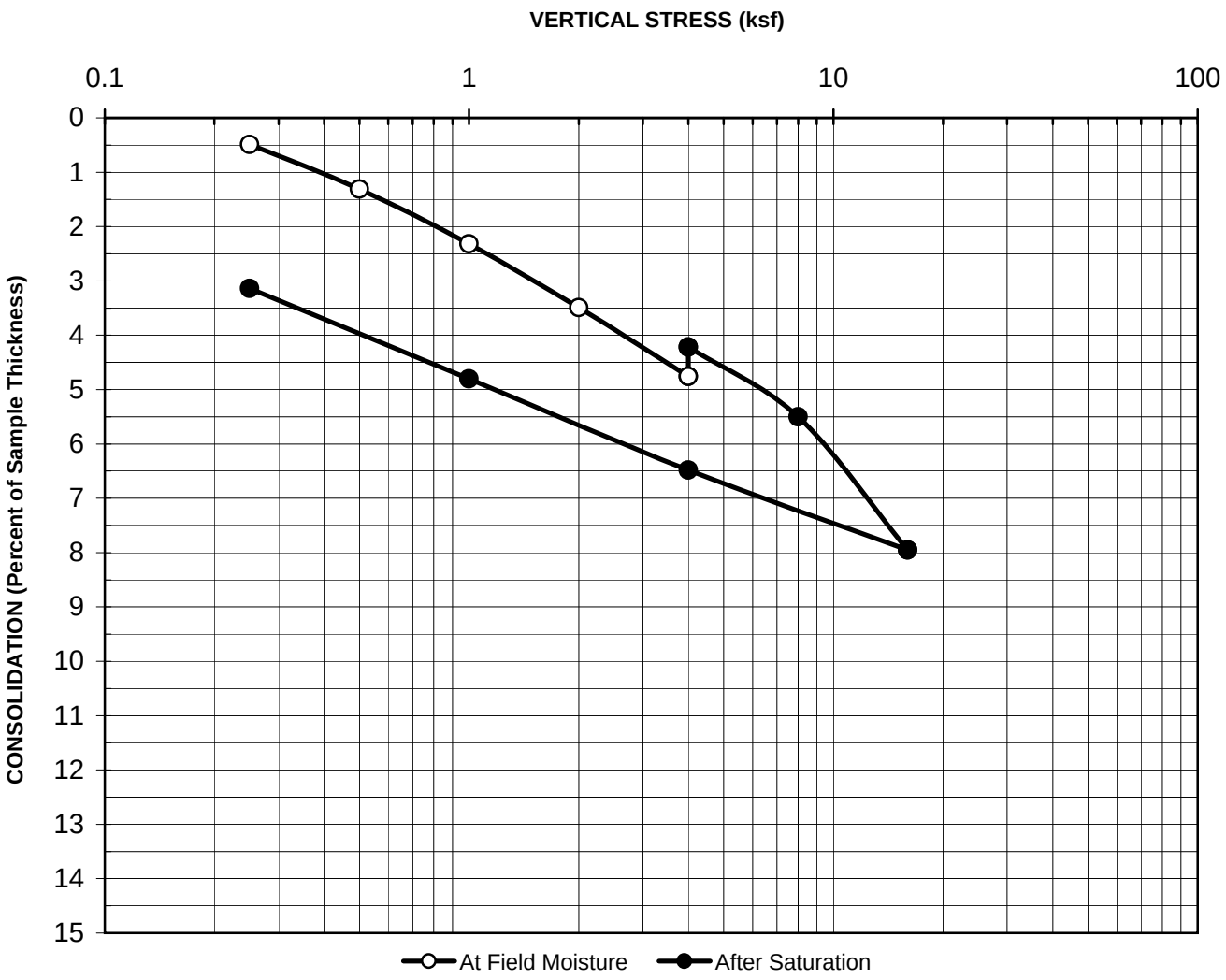


Boring No. :	B-6	Initial Dry Unit Weight (pcf):	117.4
Sample No.:	-	Initial Moisture Content (%):	10.8
Depth (feet):	5	Final Moisture Content (%):	15.0
Sample Type:	Mod Cal	Assumed Specific Gravity:	2.7
Soil Description:	Clayey Sand	Initial Void Ratio:	0.44
Remarks:	Swell = 0.05% upon inundation		

CONSOLIDATION CURVE
ASTM D 2435

Project Name: Costa Mesa Apartments
Project No.: GS 1531
Date: 4/17/2015
AP No: 15-0425

AP Engineering & Testing, Inc.

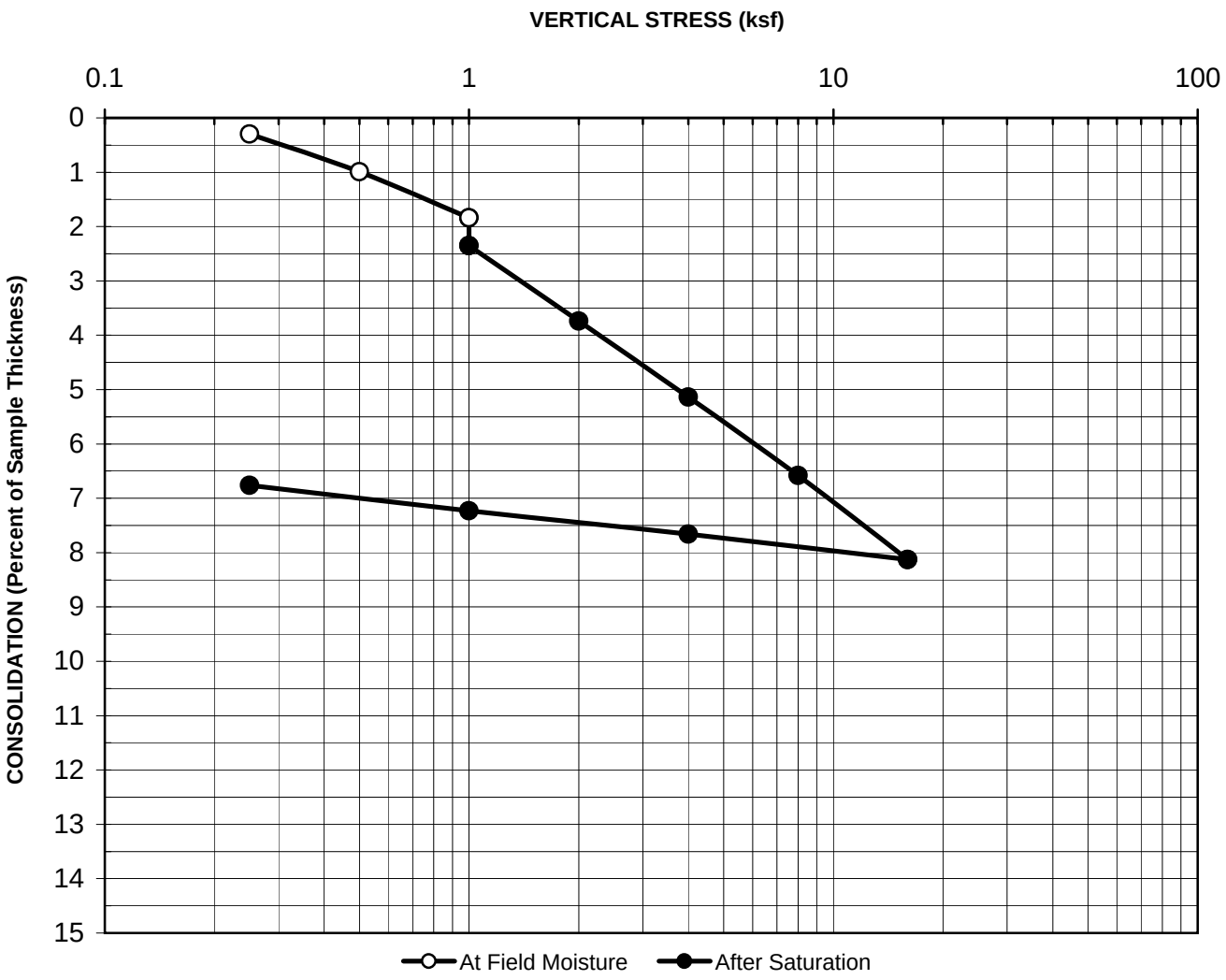


Boring No. :	B-6	Initial Dry Unit Weight (pcf):	101.4
Sample No.:	-	Initial Moisture Content (%):	22.6
Depth (feet):	35	Final Moisture Content (%):	23.7
Sample Type:	Mod Cal	Assumed Specific Gravity:	2.7
Soil Description:	Lean Clay	Initial Void Ratio:	0.66
Remarks:	Swell = 0.54% upon inundation		

CONSOLIDATION CURVE
ASTM D 2435

Project Name:	Costa Mesa Apartments
Project No.:	GS 1531
Date:	4/17/2015
AP No:	15-0425

AP Engineering & Testing, Inc.

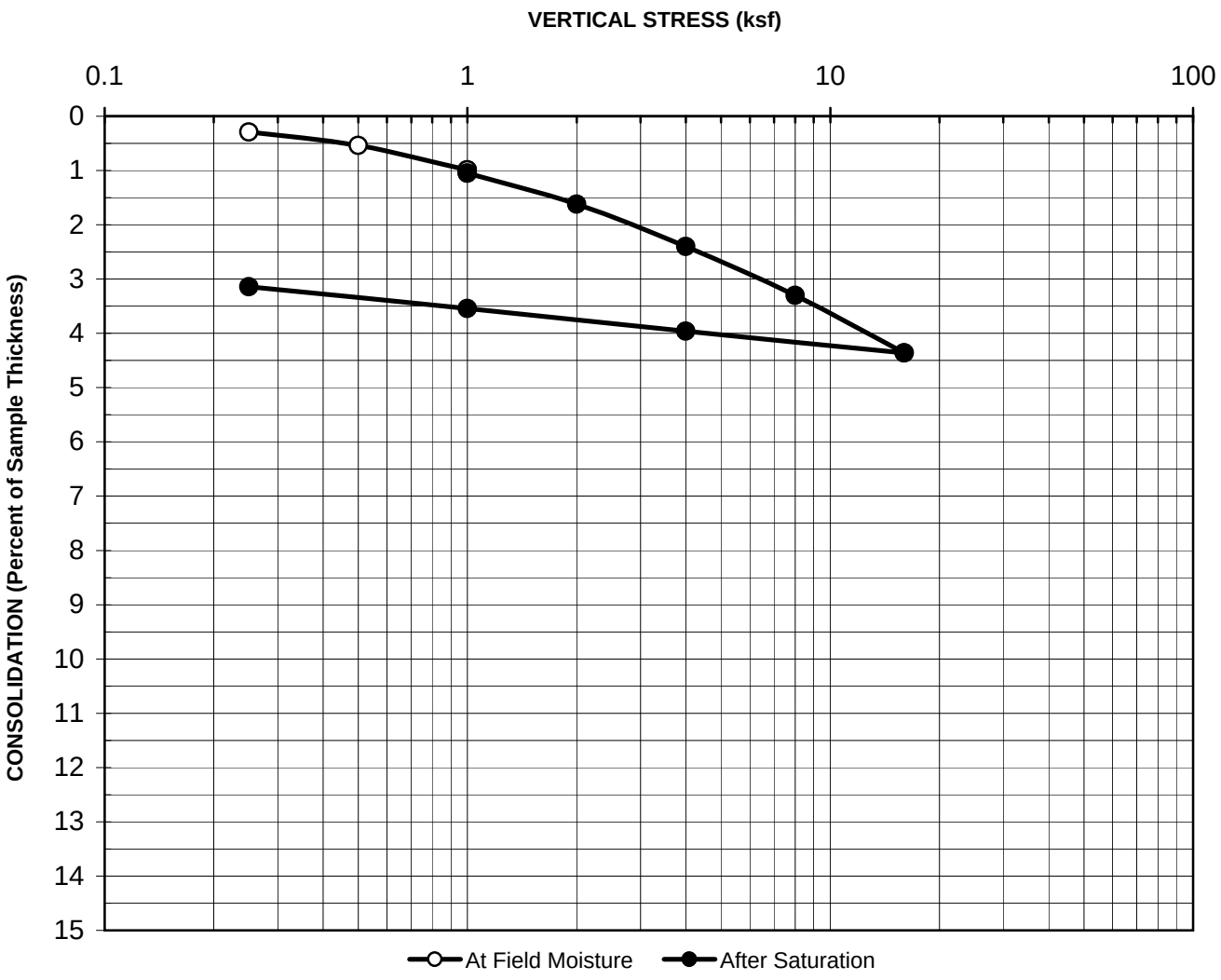


Boring No. :	B-7	Initial Dry Unit Weight (pcf):	116.4
Sample No.:	-	Initial Moisture Content (%):	7.5
Depth (feet):	5	Final Moisture Content (%):	12.1
Sample Type:	Mod Cal	Assumed Specific Gravity:	2.7
Soil Description:	Silty Sand	Initial Void Ratio:	0.45
Remarks:	Collapse= 0.51% upon inundation		

CONSOLIDATION CURVE
ASTM D 2435

Project Name:	Costa Mesa Apartments
Project No.:	GS 1531
Date:	4/17/2015
AP No:	15-0425

AP Engineering & Testing, Inc.

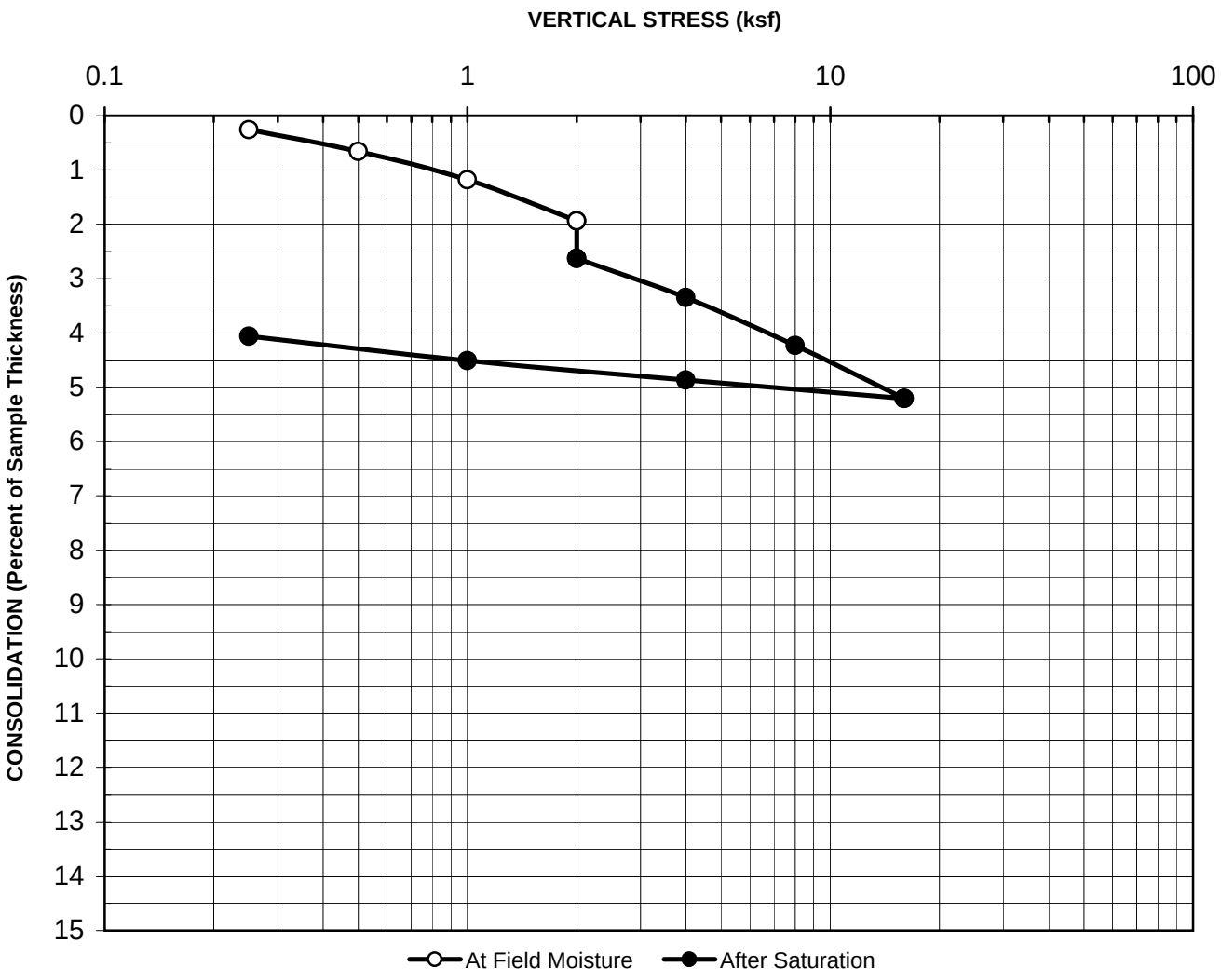


Boring No. :	B-7	Initial Dry Unit Weight (pcf):	97.6
Sample No.:	-	Initial Moisture Content (%):	9.7
Depth (feet):	7.5	Final Moisture Content (%):	21.6
Sample Type:	Mod Cal	Assumed Specific Gravity:	2.7
Soil Description:	Sand w/silt	Initial Void Ratio:	0.73
Remarks:	Collapse= 0.06% upon inundation		

CONSOLIDATION CURVE
ASTM D 2435

Project Name:	Costa Mesa Apartments
Project No.:	GS 1531
Date:	4/17/2015
AP No:	15-0425

AP Engineering & Testing, Inc.



Boring No. :	B-7	Initial Dry Unit Weight (pcf):	105.8
Sample No.:	-	Initial Moisture Content (%):	4.4
Depth (feet):	10	Final Moisture Content (%):	16.8
Sample Type:	Mod Cal	Assumed Specific Gravity:	2.7
Soil Description:	Silty Sand	Initial Void Ratio:	0.59
Remarks:	Collapse= 0.69% upon inundation		

CONSOLIDATION CURVE
ASTM D 2435

Project Name: Costa Mesa Apartments
Project No.: GS 1531
Date: 4/17/2015
AP No: 15-0425

AP Engineering & Testing, Inc.

COMPACTION TEST

Client:	Geotechnical Soilutions			AP Number:	15-0425
Project Name:	Costa Mesa Apartments	Tested By:	ST	Date:	04/21/15
Project No. :	GS 1531	Calculated By:	JP	Date:	04/21/15
Boring No.:	B-2	Checked By:	AP	Date:	04/23/15
Sample No.:	Bag	Depth(ft.):	0-4		
Visual Sample Description:	Sandy Clay to Sandy Silt				

		Compaction Method	X ASTM D1557
			ASTM D698
METHOD	A	Preparation Method	Moist
MOLD VOLUME (CU.FT)	0.0333		X Dry

Wt. Comp. Soil + Mold (gm.)	3940	4019	3946	3775		
Wt. of Mold (gm.)	1866	1866	1866	1866		
Net Wt. of Soil (gm.)	2074	2153	2080	1909		
Container No.						
Wt. of Container (gm.)	149.63	151.55	149.72	150.39		
Wet Wt. of Soil + Cont. (gm.)	313.03	288.44	278.64	258.98		
Dry Wt. of Soil + Cont. (gm.)	303.17	277.76	265.44	254.52		
Moisture Content (%)	6.42	8.46	11.41	4.28		
Wet Density (pcf)	137.17	142.39	137.57	126.27		
Dry Density (pcf)	128.89	131.28	123.48	121.09		

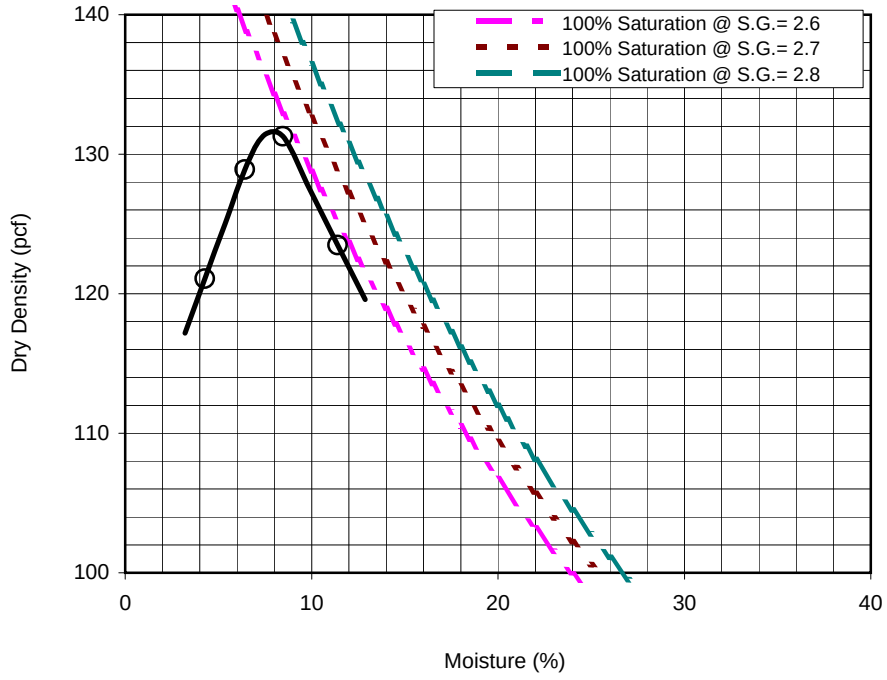
Maximum Dry Density (pcf)	**131.3**	Optimum Moisture Content (%)	**8.0**
Maximum Dry Density w/ Rock Correction (pcf)	**N/A**	Optimum Moisture Content w/ Rock Correction (%)	**N/A**

PROCEDURE USED

X *METHOD A: Percent of Oversize:* *4.3%*
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)

☐ *METHOD B: Percent of Oversize:* *N/A*
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)

☐ *METHOD C: Percent of Oversize:* *N/A*
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)



AP Engineering and Testing, Inc.
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t. 909.869.6316 | f. 909.869.6318 | www.aplaboratory.com

MOISTURE AND DENSITY TEST RESULTS

Client: Geotechnical Soilutions
Project Name: Costa Mesa Apartments
Project No.: GS 1531

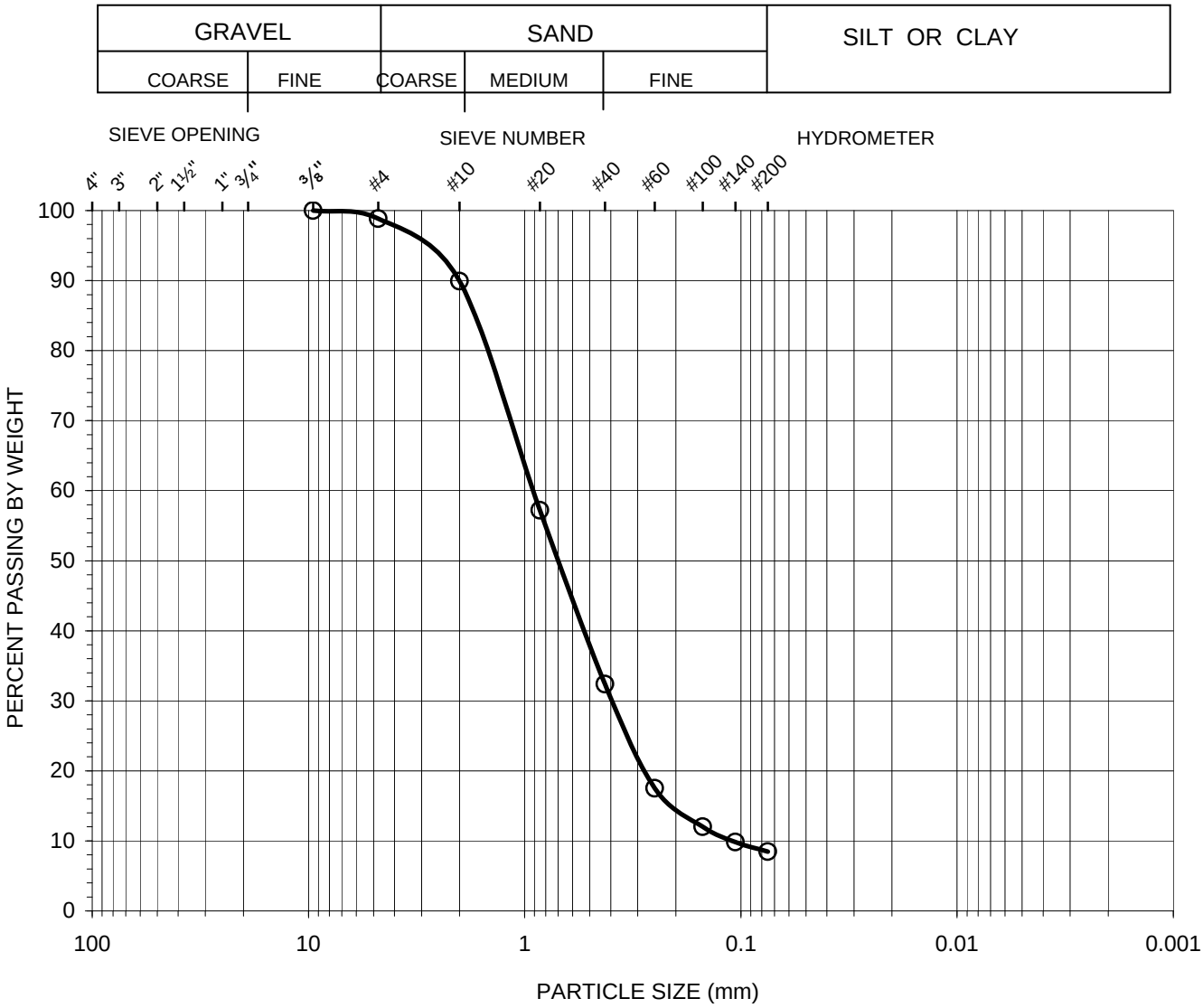
Laboratory No.: 15-0425
Date: 04/20/15

Boring No.	Sample No.	Sample Depth	Moisture Content (%)	Dry Density (pcf)
B-1		10	4.7	92.3
B-2		15	5.0	90.2
B-4		5	10.9	113.3
B-5		5	15.8	115.7
B-6		10	2.0	111.1
B-6		20	MISSING	MISSING

AP Engineering & Testing, Inc.

GRAIN SIZE DISTRIBUTION CURVE
ASTM D 6913

Client Name:	Geotechnical Soilutions	Tested by:	LS	Date:	04/17/15
Project Name:	Costa Mesa Apartments	Computed by:	NN	Date:	04/22/15
Project No.:	GS-1531	Checked by:	AP	Date:	04/23/15

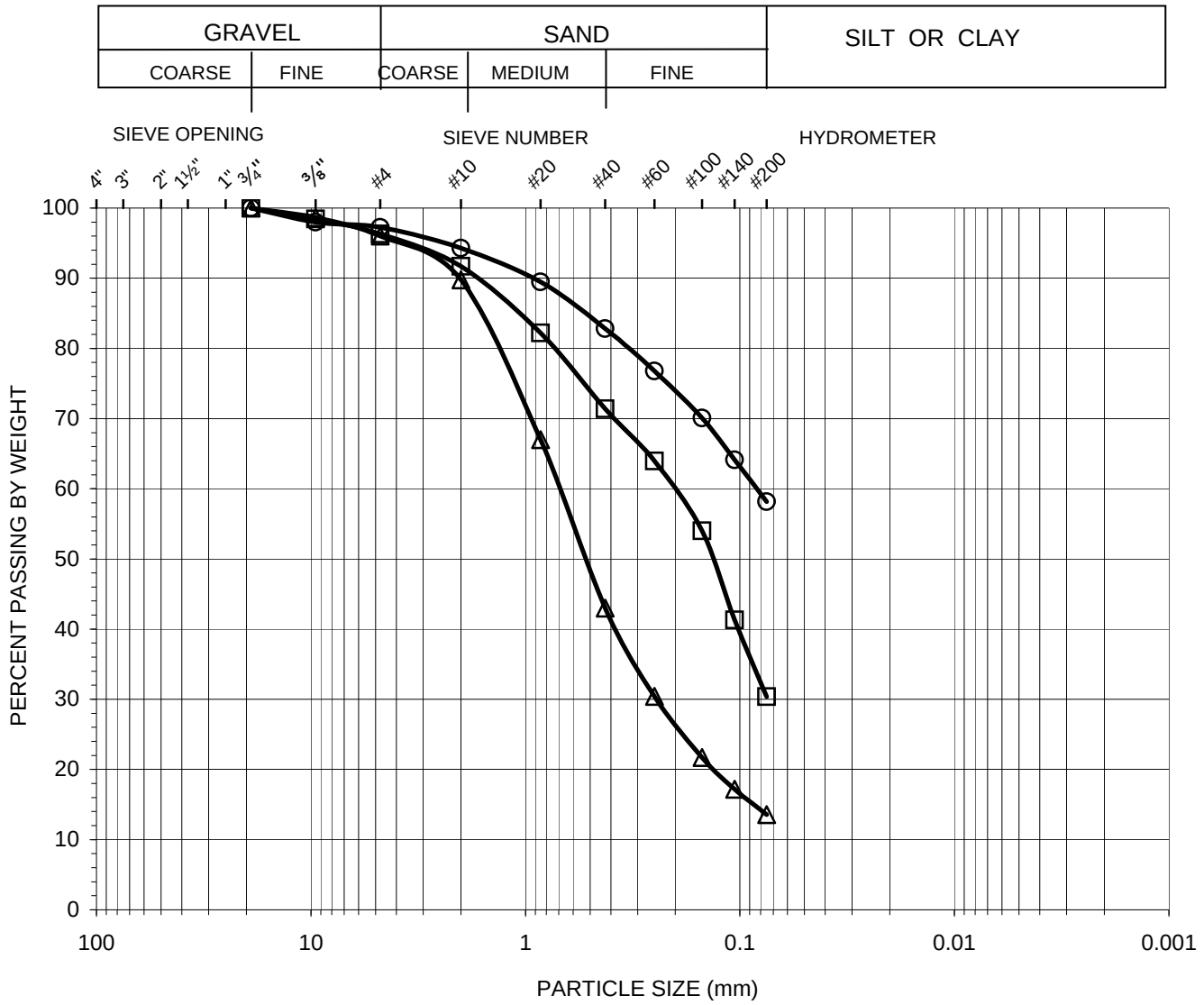


Symbol	Boring No.	Sample Type	Sample Depth (feet)	Percent			Atterberg Limits LL:PL:PI	Soil Symbol ASTM D 2487
				Gravel	Sand	Fines		
○	B-1	R	15	1	91	8	N/A	SW-SM

AP Engineering & Testing, Inc.

GRAIN SIZE DISTRIBUTION CURVE
ASTM D 6913

Client Name:	Geotechnical Soilutions	Tested by:	LS	Date:	04/17/15
Project Name:	Costa Mesa Apartments	Computed by:	NN	Date:	04/22/15
Project No.:	GS-1531	Checked by:	AP	Date:	04/23/15

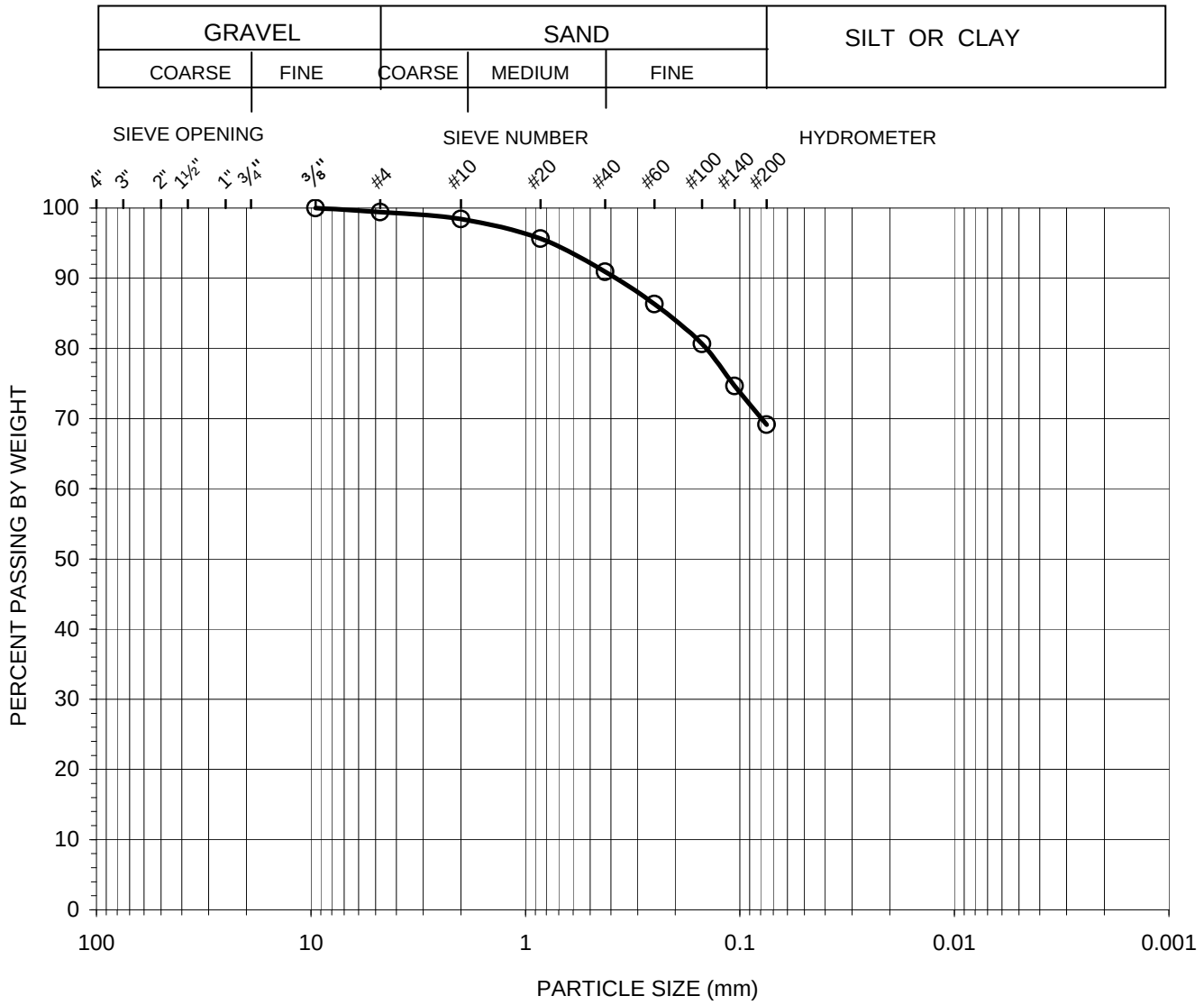


Symbol	Boring No.	Sample Type	Sample Depth (feet)	Percent			Atterberg Limits LL:PL:PI	Soil Symbol ASTM D 2487
				Gravel	Sand	Fines		
○	B-2	Bag	0-4	3	39	58	17:12:5	CL-ML
□	B-2	R	10	4	66	30	N/A	SM
△	B-2	R	15	4	82	14	N/A	SM

AP Engineering & Testing, Inc.

GRAIN SIZE DISTRIBUTION CURVE
ASTM D 6913

Client Name:	Geotechnical Soilutions	Tested by:	LS	Date:	04/17/15
Project Name:	Costa Mesa Apartments	Computed by:	NN	Date:	04/22/15
Project No.:	GS-1531	Checked by:	AP	Date:	04/23/15

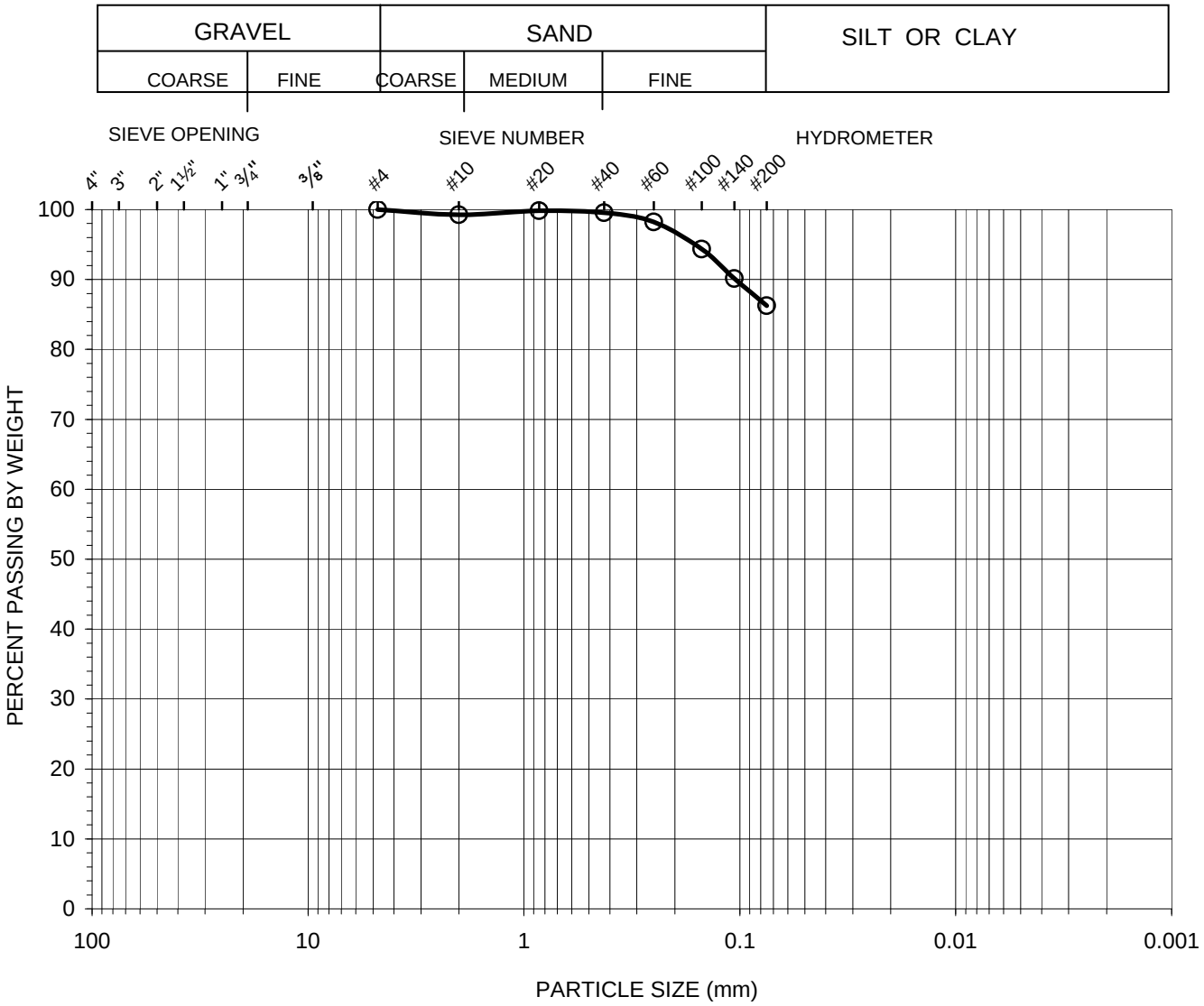


Symbol	Boring No.	Sample Type	Sample Depth (feet)	Percent			Atterberg Limits LL:PL:PI	Soil Symbol ASTM D 2487
				Gravel	Sand	Fines		
○	B-5	Bag	3-6	1	30	69	33:11:22	CL

AP Engineering & Testing, Inc.

GRAIN SIZE DISTRIBUTION CURVE
ASTM D 6913

Client Name:	Geotechnical Soilutions	Tested by:	LS	Date:	04/17/15
Project Name:	Costa Mesa Apartments	Computed by:	NN	Date:	04/22/15
Project No.:	GS-1531	Checked by:	AP	Date:	04/23/15



Symbol	Boring No.	Sample Type	Sample Depth (feet)	Percent			Atterberg Limits LL:PL:PI	Soil Symbol ASTM D 2487
				Gravel	Sand	Fines		
○	B-6	R	35	0	14	86	N/A	CL*

Note: * The plasticity is based on visual.