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REPORT ON
GEOTECHNICAL INVESTIGATION

Registered Professional Engineer (Civil)
CERTIFICATE NO.
37292
KEITH R.
GRAVEL
Date Signed 4-21-2023
ARIZONA, U.S.A.

DESIGNATION: 17-Acre Mobile Home Park

LOCATION: North of NEC Thornton Road & O'Neill Drive
Casa Grande, AZ

CLIENT: JDM Group, LLC

PROJECT NO: 230305SA

DATE: April 21, 2023

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1.0 INTRODUCTION

This report presents the results of a subsoil investigation carried out at the site of the proposed *17-Acre Mobile Home Park* development to be constructed north of the northeast corner of Thornton Road and O'Neill Drive in Casa Grande, Arizona.

We understand that the design and construction will consist of a 111-lot mobile home park with a community center, pool, and tennis/pickleball courts on 17 undeveloped acres. The community center will be one or two stories with slab on grade and masonry, wood frame or steel frame construction. It is anticipated that the lots will have modular buildings. Structural loads are expected to be light to moderate and no special considerations regarding settlement tolerances are known at this time, although we assume that the industry standard of a maximum of 1-inch of total settlement will be allowed and used for design. Adjacent areas will be landscaped or paved to support moderate passenger and truck traffic. Landscaped areas will be utilized for storm water retention and disposal.

2.0 GENERAL SITE AND SOIL CONDITIONS

2.1 Site Conditions

The site is currently native desert land, consisting of sparse to medium dense vegetation and dirt roads. There is a structure to the southwest of the subject site. The site is generally bound on the north by contiguous native desert with a structure to the northwest and a hill with a water tank on top adjacent to it, on the east by contiguous native desert followed by Shultz Street, on the west by Thornton Road, and on the south by O'Neill Drive. The northern edge of the property abuts a large hill and then the site generally slopes down to the south.

A cursory review of historical aerial photographs was conducted. The site has not undergone any significant development and is still native desert land. It is recommended to obtain and review any Phase I/II Environmental Site Assessments (ESA) that may have been completed at the subject site that will better detail any potential hazards that may impact site development. Refer to the following figures for additional details.

Figure 2.1.1 Dated 1996

Figure 2.1.2 Dated 2002

Figure 2.1.3 Dated 2010

Figure 2.1.4 Dated 2022

"Google Earth," *ArcGIS Web Application*. [Online]. Available: Google Earth [Accessed: 19-Apr-2023].

2.2 Geologic Conditions

The site is **near known areas** that have undergone considerable subsidence due to groundwater removal. Areas of subsidence are known to produce earth fissuring, which has affected areas within several miles of the site. Subsidence is a basin wide phenomenon that would result in differential elevation changes over long distances, which would not affect the type of buildings proposed for this site. No evidence of earth fissures was observed on the site, and no fissures have been discovered within the immediate vicinity. Fissure gullies form over subsurface irregularities such as bedrock highs, which cause tensional stresses and differential subsidence. Where such anomalies are not present, subsidence tends to be uniform over a wide area, this having minimal effect on surficial structures. The closest known earth fissures are located approximately 2 miles to the northeast of the site, in the Signal Peak Study Area, and approximately 2 miles to the southeast in the Toltec Buttes Study Area. It is not known if subsidence at this site has stopped, if it is continuing, or at what rate it may be occurring. However, the absence of observable fissures indicates that the structural effects on buildings should be minimal. Subsidence is a basin wide phenomenon that would result in differential elevation changes over long distances, which should not affect the type of buildings proposed for this site.

If any cracks, crevasses, or fissures are noted during site excavation this office should be notified immediately. Representatives from this office will then visit the site, assess the features, and make recommendations regarding restorative measures.

2.3 Seismic Design Parameters

The project area is in a seismic zone that is considered to have low historical seismicity. The seismicity of the Phoenix area has had only three magnitude 3.0 events in over 100 years. Liquefaction is not considered a concern as groundwater exceeds 50 feet below ground surface.

Although borings were not advanced to 100 feet, based on the nature of the subsoils encountered in the borings and geology in the area, Site Class Definition, Class C may be used for design of the structures. In addition, the following seismic parameters may be used for design (based on IBC 2012/15 and ASCE 7-16 (IBC 2018), utilizing the ATC Hazards by Location Tool):

Table 2.3.1 Seismic Parameters

Design Code:	IBC 2018	IBC 2015
MCE[1] spectral response acceleration for 0.2 second period, S_S:	0.175g	0.177g
MCE[1] spectral response acceleration for 1.0 second period, S_1:	0.065g	0.058g
Site coefficient, Fa:	1.3	1.2
Site coefficient, Fv:	1.5	1.7
MCE[1] spectral response acceleration adjusted for site class, S_{MS}:	0.227g	0.212g
MCE[1] spectral response acceleration adjusted for site class, S_{M1}:	0.097g	0.099g
5% Damped spectral response acceleration, S_{DS}:	0.151g	0.141g
5% Damped spectral response acceleration, S_{D1}:	0.065g	0.066g
NOTE 1: MCE = maximum considered earthquake		

2.4 General Subsurface Conditions

Subsoil conditions generally consist primarily of silty sand with layers of clayey sand, silty/clayey sand, poorly graded sand, silty/clayey gravel, and silty gravel to depths of 6.5 to 16.4 feet below existing grades. In addition, subordinate amounts of gravel, cobble, and varying degrees of calcareous cementation were noted in the soil profile. The Standard Penetration Test (SPT) results range from 16 to 50+ blows per foot (bpf), varying with depth. Auger refusal on cobbles (or possible bedrock) was encountered at borings B-1, B-2, B-3, and B-5. Groundwater was not encountered during the investigation. The upper soils were in a 'dry' to 'dry to moist' condition at the time of the investigation. Refer to the attached logs for a detailed description of the soil profile.

Laboratory testing indicates in-situ dry densities of the upper soils range from 81.7 to 111.5 pcf with water contents of 2.4 to 8.9 percent at the time of the investigation. Liquid limits range from non-plastic (NP) to 34 percent with plasticity indices ranging from NP to 15 percent. The upper clayey soils exhibit a volume increase (**swell**) due to wetting of **less than 1 percent** when compacted to moisture and density levels normally expected during construction. 'Undisturbed' samples displayed moderate (2.5 to 5.7 percent) compression under incremental loading a maximum confining load of 3,200 psf and moderate to **significant** (2.0 to **6.5 percent**) additional compression due to inundation (**hydro-collapse**).

2.5 Corrosivity

Laboratory testing for sulfate contents resulted in concentrations of 7.8 ppm. This value represents a negligible potential for sulfate attack on concrete. Subsurface concrete should use Type I or II cement, which is readily available and used in the area. Type C fly-ash should not be used unless the soils are tested to determine that the sulfate content is sufficiently low as to not cause a reaction with the soils.

Laboratory testing of the native soil concluded a pH of 8.5 with a laboratory minimum resistivity of 5,700 ohm-cm. Chloride concentrations were on the order of 37 ppm. In the field, saturation of the soils should not be expected which would thereby increase the resistivity. Based on the soil classification, test results and local experience, the soil will likely be **mildly corrosive** to direct buried metal. Accordingly, suitable pipe wall thickness and corrosion protection should be selected per the lifetime requirements of the project.

3.0 ANALYSIS AND RECOMMENDATIONS

3.1 Analysis

Analysis of the field and laboratory data indicates that subsoils at the site are generally suitable to support the structures on shallow foundations and slab-on-grade construction subject to remedial earthwork. Although not identified in the borehole logs, it is possible that some shallow fills exist on the site from the infill of old washes and 'wildcat' dumping. It is assumed that the site grades will remain essentially unchanged (± 2 feet). For the mobile homes, jack stands and tie down anchors may also be used. The depth of the anchor's tie-down system may need to be increased due to some areas of loose soil that extend down more than 5 feet deep (primarily in the southern half of the site). Check the anchor manufacture installation details. Load testing may be required.

The northern half of the site, which abuts the large hill and water tank encountered very dense soils with possible cobble and bedrock and the southern half of the site encountered loose to medium dense conditions to depths on the order of 5 feet below existing grades. Field and laboratory testing indicates that the fine-grained upper soils are of variable relative density and susceptible to additional compression, potentially significant and rapid, due to inundation (**hydro-collapse**). In addition, removal of the existing site features (vegetation and minor washes) will result in disturbance of the upper soils. This could cause excessive differential settlement resulting in cracking problems. Accordingly, recommendations are made to over-excavate and re-compact the bearing soils to increase density and reduce the potential for collapse. The over-excavated and recompacted soil will mitigate, but not eliminate the potential for additional settlement if the deeper soils become wet. This will also ensure a uniform bearing condition for the new foundations. Attention must be paid to provide and maintain proper drainage to limit the potential for water infiltration of deeper soils.

The current plans indicated the community center will be located on the northern edge of the property, near the large hill. This area encountered very dense soil and possible bedrock at a relatively shallow depth. As an alternative to over-excavation and re-compaction the footings may be deepened beyond the upper disturbed zone to bear in these very dense soils, which are less likely to be inundated with moisture. Deeper footings will also provide a higher allowable bearing capacity. If grading plans require raising the building pad more than 1 foot in this area, this option may not be a feasible.

A post-tensioned (P-T) slab-on-grade foundation may be used for the proposed sports courts. This type of foundation system is more flexible and may require special design and construction of the superstructure to allow for this flexibility. As noted above some over-excavation and re-compaction of the existing soil is still recommended for this option. Deeper edge turndowns are recommended to limit moisture transfer under the slab. Refer to Section 3.5 for design parameters and additional recommendations for this option.

For proposed RV pads, it is recommended to place a minimum of 6 inches of aggregate base material. Concrete strip footings or structural mats can also be used.

Excavation operations in the northern half of the site will be difficult due to the very dense soils, which may contain cobbles, boulders, and depending on final grades possible bedrock. These conditions will likely require the use of heavier equipment. Deeper excavations along the northern edge of the property may have the potential to encounter shallow bedrock. This area of the site is located at the base of a hillside. **Heavy-duty equipment and/or rock removal will be required for deeper excavations**. The fact that a 7-inch diameter boring using carbide teeth was able to penetrate to a certain depth does not mean that the soils may be excavatable with standard equipment. Excavating contractors must determine means and methods. Groundwater is **not** expected to be a factor in the design or construction of shallow foundations and underground utilities. Perched water may sometimes be found at the interface of bedrock formations during high rainfall events.

For standard foundations to perform as expected, attention must be paid to provide proper drainage to limit the potential for water infiltration of deeper soils. It is assumed that the landscape plan will use mostly low water use or "green" desert type plants (xeriscape). It is preferred to keep irrigated plants at least 5 feet away from structures with irrigation schedules set and maintained to run intermittingly. **Unpaved planter areas should be sloped at least 5 percent for a distance of at least 10 feet away from the building.** It is understood that this may not be possible due to ADA maximum slope requirements for the adjacent sidewalks and patios. The slope may be reduced to 2 percent provided extra care is taken to ensure sidewalks and other hardscape features do not create a “dam” that prevents positive drainage away from the buildings, creating a "pond" adjacent to the building. Roof drainage should also be directed away from the building in paved scuppers. Pre-cast loose splash blocks should not be used as they can be dislodged and/or eroded. Roof drains should not be allowed to discharge into planters adjacent to the structure. It is preferred that they be directed to discharge to pavement (per photo example), retention basins or discharge points located at least 10 feet away from the building.

For the proposed structures it is reiterated that shallow spread footings or P-T slabs are recommended for the exterior walls and other light interior columns since this is the most economical system available. However, this shallow system relies on the dry strength of the unsaturated native soils. A limited depth of re-compaction is a recommended to increase density of the near surface soils that are more likely to encounter seasonal moisture changes, or deeper foundations. The deeper native soils are moisture sensitive and could experience differential settlement if subjected to significant surface water infiltration. Recognizing the need to minimize significant water penetration adjacent to the building perimeter that could detrimentally impact the building foundation, the following additional recommendations are made to protect foundations:

1. Take extra precaution to backfill and compact native soil fill to 95 percent in all exterior wall locations.
2. Avoid utility trenches passing through retention basins leading to the building. If unavoidable, backfill the trench with MAG Section 728 ½-sack CLSM to cut off preferred drainage paths.
3. Avoid placing retention basins next to building foundations. **A distance of at least 10 feet should be maintained between structures and the location of any retention basin maximum fill level and 15 feet from any UST.**
4. Create and maintain positive drainage away from the exterior wall for a minimum of 10 feet.
5. Avoid sidewalks, curbs or other elements that create a dam that could cause water to pond within 5 feet of the perimeter wall.
6. Include no irrigated landscape materials in the first 3 feet next to the building.
7. Between 3 feet and 5 feet, include only landscape materials that can be irrigated with a maximum of 1 gallon per hour emitter heads. Set and maintain irrigation controllers to prevent 24/7 flows.
8. Any landscape materials requiring greater than 1 gallon per hour irrigation, including turf, shall be at least 5 feet from the outside face of the building.
9. All irrigation feeder lines, other than those that supply individual emitters, shall not be placed closer than 5 feet to the building.

For exterior slabs-on-grade, frequent jointing is recommended to control cracking and reduce tripping hazards should differential movement occur. It is also recommended to pin the landing slab to the building floor/stem wall. This will reduce the potential for the exterior slab lifting and block the operation of out-swinging doors. Pinning typically consists of 24-inch-long No. 4 reinforcing steel dowels placed at 12-inch centers.

3.2 Site Preparation

The entire area to be occupied by the proposed construction should be stripped of all vegetation, debris, rubble, undocumented fills (if encountered), and obviously loose surface soils. Tree removal should include the major root ball and any associated disturbed soils.

Special attention must be paid to areas where depressions from man-made and/or natural stream channels (washes) appear to trend. In areas where loose channel fills occur, the loose material should be removed, generally to a depth of 2 feet, re-placed and compacted. The fill placed should be placed in level lifts. Within the wash areas, level benches should be cut into the sides as the fill progresses, especially where it is undercut to remove trash (if any) and/or loose soils. Infill of the washes should be as recommended in the Fill and Backfill section of this report.

For both the conventional standard spread footing and P-T slab alternate, subsoils should be over-excavated at least 1.5 feet below proposed footing bottom elevation or below existing grade, **whichever is greater,** extending 5 feet beyond the footing edges. The entire building pad does not require over-excavation provided footing lines can be accurately located during grading operations. Given the relatively small building size it may be more feasible to over-ex the entire building pad. **For the P-T Slab option the entire pad should be over-excavated as the slab is part of the foundation element.** Over-excavation of bedrock (if encountered) is not required. A representative of the geotechnical engineer should examine the subgrade once sub-excavation is complete and prior to backfilling to ensure removal of deleterious materials. A representative of the Geotechnical Engineer should examine the subgrade once sub-excavation is complete and prior to backfilling to ensure removal of deleterious materials. Fill placement and quality should be as defined in the "Fill and Backfill" section of this report.

As an alternative recommendation, footings may be deepened to bear on very dense native soils at a minimum depth of 2.5 feet below existing grades. Footings must still be inspected by a representative of the Geotechnical engineer to confirm suitable bearing soils. Inadvertent over-excavation of footings with this option should not be backfilled with soil, but should be placed at the deeper depth or backfilled with a 2-sack controlled low strength material (CLSM) or structural concrete.

Prior to placing structural fill below footing bottom elevation, the exposed grade should be scarified to a depth of 8 inches, moisture conditioned to optimum (±2 percent) and compacted to at least 95 percent of maximum dry density as determined by ASTM D-698. Pavement areas should be scarified, moisture-conditioned and compacted in a similar manner.

The silty fine sand soils may be sensitive to excessive moisture content and will become unstable at elevated moisture content. Accordingly, it may be necessary to compact soils on the dry side of optimum, especially in asphalt pavement areas. The reduced moisture content under slabs-on-grade should only be used upon approval of the engineer in the field.

3.3 Foundation Design

The following bearing capacities can be utilized for design:

Table 3.3.1 Foundation Bearing Capacities

Structure	Foundation Type	Foundation Depth (1)	Bearing Medium	Bearing Capacity	Comments
Minor Structures & Modular Buildings	Spread	1.5 ft.	Compacted Subgrade	1,500 psf	2
	Mat Slab	0.5 ft.		k=150 pci	2
	Jack Stands	At-grade	Compacted Subgrade or Aggregate Base	1,000 psf	2,3
Community Center	Spread	1.5 ft.	1.5 feet Engineered Fill	2,500 psf	4
		2.5 ft.	Very Dense Native	3,000 psf	5

Comments:

1. Foundation Depth refers to minimum depth to bottom of footing below lowest adjacent finished exterior grade within 5 feet of the structure.
2. For minor structures such as screen walls, planter walls, modular buildings, etc. not connected to any main structure. The bottom of footing excavation or exposed grade should be scarified to a depth of 8 inches, moisture-conditioned to optimum (±2 percent) and compacted to at least 95 percent of maximum dry density as determined by ASTM D-698.
3. For jack stands with base plates bearing on compacted subgrade or a minimum layer of 6 inches of compacted aggregate base course. An allowable bearing pressure of 1,000 psf can be used for design.
4. Shallow spread footings bearing on ***minimum*** of 1.5 feet of engineered fill plus 8 inches pre-compacted subgrade extending at least 5 feet beyond the footing edges. Refer to figure 3.3.1.
5. Shallow Spread footings bearing a minimum of 2.5 feet below **existing grades** on dense to very dense undisturbed native soils. Inadvertent over-excavation of footing depth should not be backfilled with soil, but the footing should either be deepened or backfilled with a 2-sack CLSM. If the site requires fill or the structure is moved to the south, this option may not be feasible.

These bearing capacities refer to the total of all loads, dead and live, and are net pressures. They may be increased one-third for wind, seismic or other loads of short duration. All footing excavations should be level and cleaned of all loose or disturbed materials. Positive drainage away from the proposed buildings **must** always be maintained.

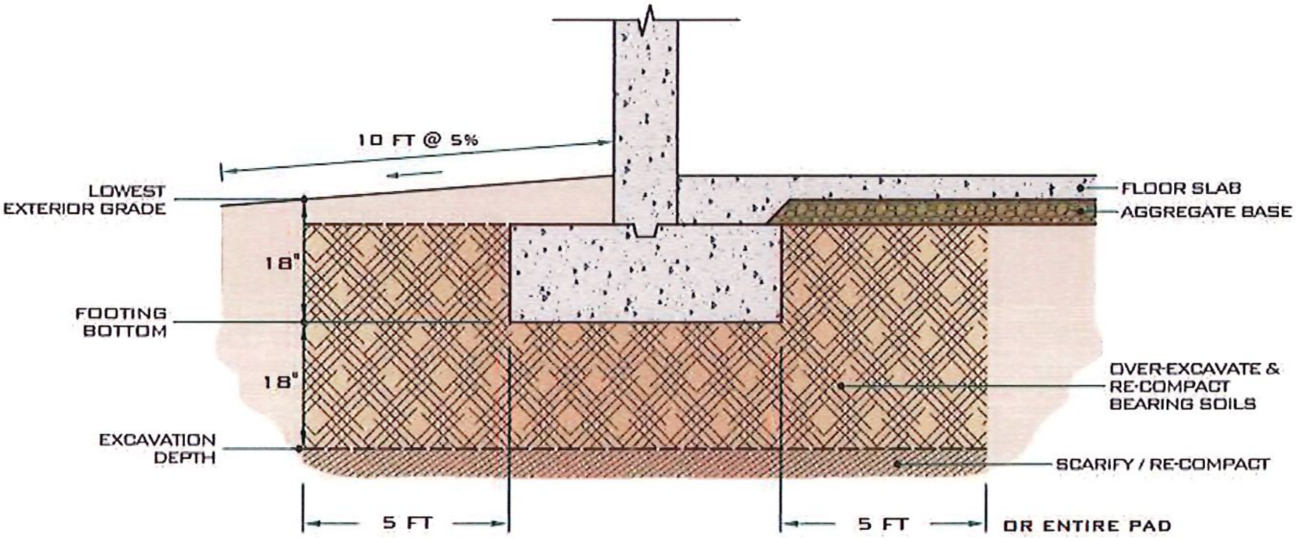


Figure 3.3.1 Foundation Detail – Bearing on Engineered Fill

Continuous masonry wall footings and isolated rectangular footings should be designed with minimum widths of 16 and 24 inches respectively, regardless of the resultant bearing pressure. Lightly loaded interior partitions (less than 800 plf) may be supported on reinforced thickened slab sections (minimum 12 inches of bearing width).

Mat foundations (if used) should be designed and reinforced to withstand any potential overturning moments from the equipment that is placed on the mat. Loading should be evenly distributed and concentrated near the center of the mat.

Estimated settlements under design loads are on the order of ½ to 1-inch, virtually all of which will occur during construction. Post-construction differential settlements will be on the order of one-half the total settlement, under existing and compacted moisture contents. Additional localized settlements of the same magnitude could occur if native supporting soils were to experience a significant increase in moisture content. **Positive drainage away from structures and controlled routing of roof runoff must be provided and maintained to prevent ponding adjacent to perimeter walls.** Planters requiring heavy water should **not** be placed adjacent to or within 5 feet of the building. Care should be taken in design and construction to ensure that domestic and interior storm drain water is contained to prevent seepage. Roof drainage should be directed to paved areas or storm drains. They should not discharge into planters adjacent to the structures.

Continuous footings and stem walls should be reinforced to distribute stresses arising from small differential movements, and long walls should be provided with control joints to accommodate these movements. Reinforcement and frequent control joints are suggested to allow slight movement and prevent minor floor slab cracking, especially in floor areas covered with hard tile.

3.4 Lateral Pressures

The following equivalent lateral pressure values may be utilized for the proposed construction:

Active Pressures	
Unrestrained Walls	35 pcf
Restrained Walls	60 pcf
Passive Pressures	
Continuous Footings	300 pcf
Spread Footings	350 pcf
Coefficient of Friction (w/ passive pressure)	0.35
Coefficient of Friction (w/out passive pressure)	0.45

All backfill must be compacted to not less than 95 percent (ASTM D-698) to mobilize these passive values at low strain. Expansive soils should not be used as retaining wall backfill, except as a surface seal to limit infiltration of storm/irrigation water. The expansive pressures could greatly increase active pressures.

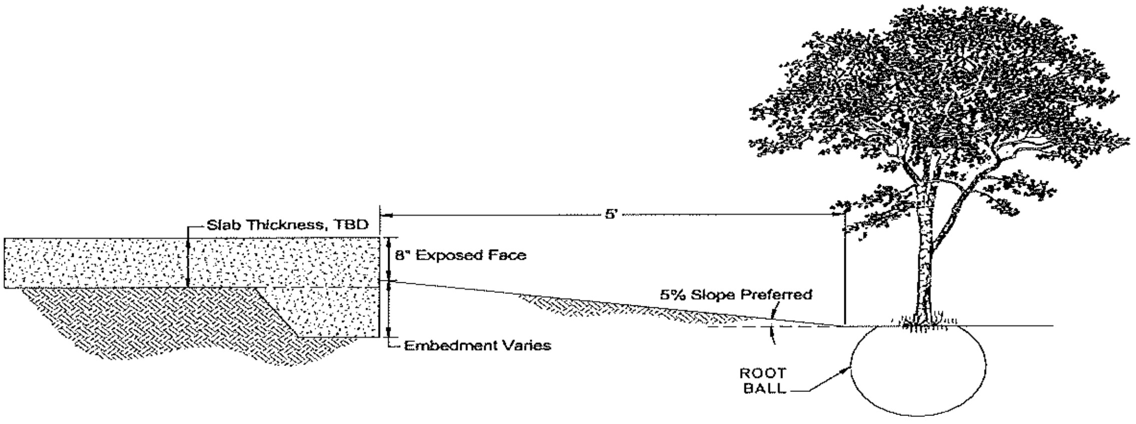
3.5 Foundation Design (P-T Slab)

The field investigation and laboratory data indicated an average Plasticity Index (PI) of the upper, surface soils of approximately 10 percent in the upper soils, and a moderate to significant consolidation potential. When the native soils are re-compacted at low moisture content, the clayey soils exhibit a swell potential of less than 1 percent. In addition, it was recommended above to over-excavate and re-compact the native soils under the slab. Based on these conditions it is our opinion that the consolidation potential will control the design.

It is recommended to use a BRAB Type II slab for stable soils. This type of foundation is for inherently stable soils and is used to reduce joints and cracks in the slab. Since stabilization of the upper soils will be accomplished as part of the site preparation this type of foundation will provide added crack protection. **We recommend design of a BRAB slab based on the settlement potential with a delta of 0.75 inches.**

The P-T Slab can be cast directly on the prepared and approved 18 inches of engineered fill (re-compacted native) below bottom of slab and turn down as specified in the Site Preparation Section above. If the subgrade has been allowed to dry-out, then additional site preparation will include scarifying the exposed grade to a depth of 8 inches moisture conditioning to optimum (±2 percent) and re-compacting to at least 95 percent of maximum dry density as determined by ASTM D-698. If a base material is used, such as sand, or other granular material, or other membrane, such as polyethylene sheeting, the structural design should consider a proper slab-subgrade coefficient of friction value for the selected material. Most contractors prefer granular material to aid in fine grading or concrete curing. Typically, a minimum 2-inch layer of crushed rock is enough.

A Modulus of Subgrade Reaction, k, of 150 pci may be used for the design of slabs-on-grade. The P-T Slab should be designed with a preferred minimum 14-inch edge turndowns that have a minimum embedment depth of 6 inches below lowest finished exterior grade within 5 feet of the structure. With this embedment depth, an allowable bearing capacity of 1,500 psf may be utilized for design of P-T Slabs. A less desired option is to use 12-inch turndowns that have a minimum embedment depth of 4 inches below lowest finished exterior grade. With this shallower embedment depth, a maximum allowable bearing capacity of 1,250 psf should be utilized for design of P-T Slabs. This option has a greater risk for erosion concerns and exposing the underside of the slab. Embedment depth from final grade, for exterior turndowns can be accomplished by either cutting into the prepared soils, or by backfilling and compacting up against the turndowns, or a combination thereof. Backfill up against the turn down (4 to 6 inches) must be compacted to at least 95 percent.



Post-tensioned slabs-on-grade should be designed in accordance with the Post-Tensioning Institute guidelines "Design and Construction of Post-Tensioned Slabs-on-Grade", Third Edition. **This type of foundation system is more flexible and may require special design and construction of the super-structure to allow for this flexibility. Use of a P-T slab foundation system does not preclude the need for**

proper site preparation and positive drainage. Accordingly, it is paramount to provide proper drainage to limit the potential for water infiltrating under slabs. The reinforced slab can bend without cracking when subject to edge settlement. However, if the bend approaches or exceeds the design limits, the less flexible walls which are supported on the slab will crack. The minimal embedment depth recommended is very shallow. Extra care should be taken to ensure that this backfill is compacted and graded to drain away from the structure. If this is not properly completed **and maintained**, erosion and poor drainage can result in exposure of the bottom of the foundation and excessive slab movement. It additional protection is desired to reduce this risk, it is recommended to increase the turn down to a minimum of 18 inches. Planters requiring heavy water should **not** be placed adjacent to or within 5 feet of the building. Trees with invasive root systems should not be planted near the structure. Care should be taken in design and construction to ensure that domestic and interior storm drain water is contained to prevent seepage. Roof drainage should be directed to paved areas or storm drains. They should not discharge into planters adjacent to the structures.

It must also be understood that Post-Tensioning Institute guidelines are in part based on the assumptions that soil-moisture changes around and beneath the P-T slabs are influenced strictly and only by climatological changes. Soil moisture below foundations and floor slabs is generally the most critical factor in damage/failure relating to expansive soil. The PTI design method **does not** consider pre-saturation, landscape irrigation, or any other non-climate related influences on moisture exposure of the subgrade soils. **Therefore, use of a P-T slab foundation system does not preclude the need for proper site preparation and positive** drainage recommendations discussed earlier in this report.

3.6 Fill and Backfill

Native soils are considered suitable for use in general grading and engineered structural fill. Oversized material greater than 3 inches should be screened out. The fine sandy soils may be sensitive to excessive moisture content and will become unstable at elevated moisture content. Accordingly, it may be necessary to compact soils on the dry side of optimum, especially in asphalt pavement areas. The reduced moisture content under slabs-on-grade should only be used upon approval of the engineer in the field.

Imported common fill for use in site grading should be examined by a Soils Engineer to ensure that it is of low swell potential and free of organic or otherwise deleterious material. In general, the fill should have 100 percent passing the 3-inch sieve and no more than 40 percent passing the #200 sieve. For the fine fraction (passing the 40 sieve), the liquid limit and plasticity index should not exceed 30 percent and 10 percent, respectively. It should exhibit less than 1.5 percent swell potential when compacted to 95 percent of maximum dry density (ASTM D-698) at a moisture content of 2 percent below optimum, confined under a 100 psf surcharge, and inundated.

Fill should be placed on subgrade which has been properly prepared and approved by a Soils Engineer. The fill must be wetted and thoroughly mixed to achieve optimum moisture content, ±2 percent. Fill should be placed in horizontal lifts of 8-inch thickness (or as dictated by compaction equipment) and compacted to the percent of maximum dry density per ASTM D-698 set forth as follows:

A.	Building Areas		
	1.	Below footing level	95 (or CLSM)
	2.	Below slabs-on-grade (non-expansive soils)	95
B.	Pavement Subgrade or Fill		95
C.	Utility Trench Backfill (onsite)		95
D.	Aggregate Base Course		
	1.	Below floor slabs	95
	2.	Below asphalt paving	100
E.	Landscape Areas		90

3.7 Utilities Installation

Trench excavations for utilities can be accomplished by conventional trenching equipment, however very dense gravel and cobble-laden soils may impede progress and require heavier equipment, especially on the northern half of the property. It should be noted that the fact that a boring was advanced to a particular depth should not lead to the assumption that it is necessarily excavatable by conventional means. The excavating contractor must make their own assessment as to excavatability. Trench walls should stand near vertical for the short periods of time required to install shallow utilities **although some sloughing may occur in the upper sandy soils requiring laying back of side slopes** and/or temporary shoring. Adequate precautions must be taken to protect workmen in accordance with all current governmental regulations.

The backfill of narrow trenches may be carried out with native excavated material. This material should be moisture-conditioned, placed in 8-inch lifts and mechanically compacted. Water settling is not recommended. Compaction requirements are summarized in the "Fill and Backfill" section of this report. Native soils may meet the typical granular bedding and initial backfill (see MAG Standard Specification Section 601.4.4) requirements of larger diameter CMP Tanks. These materials need to meet MAG Standard Specification Section 601 or drainage engineers design and manufacture recommendations.

3.8 Slabs-on-Grade

To facilitate fine grading operations and aid in concrete curing, a 4-inch-thick layer of granular material conforming to the gradation for Aggregate Base (A.B.) as per M.A.G. Specification Section 702 should be utilized beneath the slab. Dried subgrade soils **must** be re-moistened prior to placing the aggregate base if allowed to dry out, especially if fine-grained soils are used in the top 12-inches of the pad.

The native soil can store a significant amount of moisture, which could increase the natural vapor drive through the slab. Accordingly, if moisture sensitive flooring and/or adhesive are planned, the use of a vapor barrier or low permeability concrete should be considered. Vapor barriers should be a minimum 15-mil thick polyolefin (or equivalent), which meets ASTM E 1745 Class A specifications. The vapor barrier should be placed **directly under the slab**. Vapor barriers do increase the potential for slab curling and water entrapment under the slab. Accordingly, if a vapor barrier is used, additional precautions such as low slump concrete, frequent jointing and proper curing will be required to reduce curling potential and detailed to prevent the entrapment of outside water sources.

3.9 Asphalt Concrete Pavement

If earthwork in paved areas is carried out to finish subgrade elevation as set forth herein, the subgrade will provide adequate support for pavements. The location designation is for reference only. **The designer/owner should choose the appropriate sections to meet the anticipated traffic volume and life expectancy.** The section capacity is reported as daily ESALs, Equivalent 18-kip Single Axle Loads. Typical heavy trucks impart 1.0 to 2.5 ESALs per truck depending on load. It takes approximately 1,200 passenger cars to impart 1 ESAL.

<u>Pavement Design Parameters</u>:

Assume:	One 18-kip Equivalent Single Axle Load (ESAL)/Truck
Life:	20 years

Subgrade Soil Profile:

% Passing #200 sieve:	23%
Plasticity Index:	10%
k:	150 pci (assumed)
R value:	51 (per ADOT tables)
M_R:	26,000 (maximum per ADOT design)

Table 3.9.1 Pavement Sections

Area of Placement	Flexible (AC Pavement)			Rigid (PCC Pavement)	
	Thickness		Daily 18-kip ESALs	Thickness	Daily 18-kip ESALs
	AC (0.39)	ABC (0.12)		PCCP	
Auto Parking, Light Duty	2.0"	4.0"	5	5.0"	8
Truck Parking, Main Drives, & Fire Lanes	3.0"	4.0"	25	6.0"	21
	3.0"	6.0"	57	7.0"	46

Notes:

1. Designs are based on AASHTO design equations and ADOT correlated R-Values.
2. The PCCP thickness is increased to provide better load transfer and reduce potential for joint & edge failures. Design PCCP per ACI 330.
3. Full depth asphalt or increased asphalt thickness can be increased by adding 1.0-inch asphalt for each 3 inches of base course replaced.

These designs assume that all subgrades are prepared in accordance with the recommendations contained in the "Site Preparation" and "Fill and Backfill" sections of this report, and paving operations are carried out in a proper manner. If pavement subgrade preparation is not carried out immediately prior to paving, the entire area should be proof-rolled at that time with a heavy pneumatic-tired roller to identify locally unstable areas for repair.

Pavement base course material should be aggregate base per M.A.G. Section 702 Specifications. Asphalt concrete materials and mixed design should conform to M.A.G. 710. It is recommended that a ½-inch or ¾-inch mix designation be used for the pavements. The actual mix design may be dependent on the selected pavement section and the specified minimum lift thicknesses for the different types of mixes. Follow M.A.G. Section 710 for recommended minimum lift thicknesses. Pavement installation should be carried out under applicable portions of M.A.G. Section 321 and municipality standards. The asphalt supplier should be informed of the pavement use and be required to provide a mix that will provide stability and be aesthetically acceptable. Some of the newer M.A.G. mixes are very coarse and could cause placing and finish problems. A mix design should be submitted for review to determine if it will be acceptable for the intended use.

For sidewalks and other areas not subjective to vehicular traffic a 4-inch section of concrete will be enough. For trash and dumpster enclosures a thicker section of 6 inches of concrete is recommended.

Portland Cement Concrete Pavement must have a minimum 28-day flexural strength of 550 psi (compressive strength of approximately 3,700 psi). It may be cast directly on the prepared subgrade with proper compaction (reduced) and the elevated moisture content as recommended in the report. Lacking an aggregate base course, attention must be paid to using low slump concrete and proper curing, especially on the thinner sections. No reinforcement is necessary. Joint design and spacing should be in accordance with ACI recommendations. Construction joints should contain dowels or be tongue-and-grooved to provide load transfer. Tie bars are recommended on the joints adjacent to unsupported edges. Maximum joint spacing in feet should not exceed 2 to 3 times the thickness in inches. Joint sealing with a quality silicone sealer is recommended to prevent water from entering the subgrade allowing pumping and loss of support.

Proper subgrade preparation and joint sealing will reduce (but not eliminate) the potential for slab movements (thus cracking) on the expansive native soils. Frequent jointing will reduce uncontrolled cracking and increase the efficiency of aggregate interlock joint transfer.

4.0 GENERAL

The scope of this investigation and report includes only regional published considerations for seismic activity and ground fissures resulting from subsidence due to groundwater withdrawal, not any site-specific studies. The scope does not include any considerations of hazardous releases or toxic contamination of any type.

Our analysis of data and the recommendations presented herein assume that soil conditions do not vary significantly from those found at specific sample locations. Our work has been performed in accordance with generally accepted engineering principles and practice for a preliminary investigation; this warranty is in lieu of all other warranties expressed or implied.

We recommend that a representative of the Geotechnical Engineer observe and test the earthwork and foundation portions of this project to ensure compliance to project specifications and the field applicability of subsurface conditions which are the basis of the recommendations presented in this report. If any significant changes are made in the scope of work or type of construction that was assumed in this report, we must review such revised conditions to confirm our findings if the conclusions and recommendations presented herein are to apply.

Respectfully submitted,
SPEEDIE & ASSOCIATES, LLC

Registered Professional Engineer (Civil)
Certificate No. 70209
NICHOLAS JOHN VITALE
Date Signed 4-21-2023
ARIZONA U.S.A.

Nicholas J. Vitale, P.E.

Registered Professional Engineer (Civil)
Certificate No. 37292
KEITH R. GRAVEL
Date Signed 4-21-2023
ARIZONA, U.S.A.

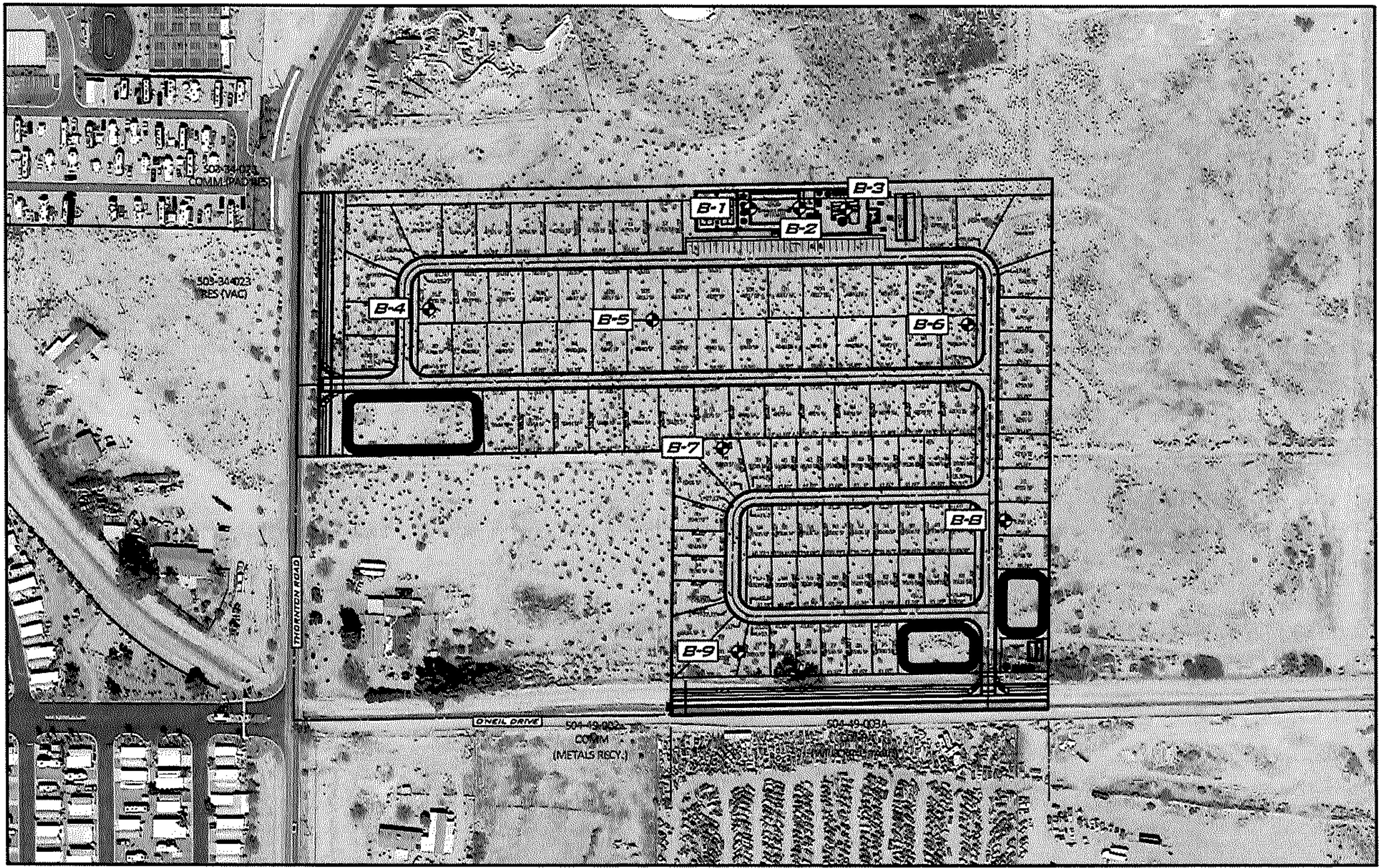
Keith R. Gravel, P.E.

APPENDIX

FIELD AND LABORATORY INVESTIGATION

On February 27, 2023, soil test borings were drilled at the approximate locations shown on the attached Soil Boring Location Plan. All exploration work was carried out under the full-time supervision of our staff engineer, who recorded subsurface conditions and obtained samples for laboratory testing. The soil bores were advanced with a truck-mounted CME-75 drill rig utilizing 7-inch diameter hollow stem flight augers. Detailed information regarding the borings and samples obtained can be found on an individual Log of Test Boring prepared for each drilling location.

Laboratory testing consisted of moisture content, dry density, grain-size distribution, and plasticity (Atterberg Limits) tests for classification and pavement design parameters. Remolded swell tests were performed on samples compacted to densities and moisture contents expected during construction. Compression tests were performed on a selected ring sample to estimate settlements and determine effects of inundation. All field and laboratory data are presented in this appendix.



⌖ - APPROXIMATE SOIL BORING LOCATIONS

SOIL BORING LOCATION PLAN

SHEET: 1 OF 1 | DR: NJV | REV: XXX | DATE: 02/24/23 | PROJECT NO.: 230305SA

17 ACRE MOBILE HOME PARK
N/O NEC THORNTON ROAD & O'NEILL DRIVE
CASA GRANDE, ARIZONA

SPEEDIE AND ASSOCIATES
A UES Company

SOIL LEGEND

SAMPLE DESIGNATION	DESCRIPTION	
AS	**Auger Sample**	A grab sample taken directly from auger flights.
BS	**Large Bulk Sample**	A grab sample taken from auger spoils or from bucket of backhoe.
S	**Spoon Sample**	Standard Penetration Test (ASTM D-1586) Driving a 2.0 inch outside diameter split spoon sampler into undisturbed soil for three successive 6-inch increments by means of a 140 lb. weight free falling through a distance of 30 inches. The cumulative number of blows for the final 12 inches of penetration is the Standard Penetration Resistance.
RS	**Ring Sample**	Driving a 3.0 inch outside diameter spoon equipped with a series of 2.42-inch inside diameter, 1-inch long brass rings, into undisturbed soil for one 12-inch increment by the same means of the Spoon Sample. The blows required for the 12 inches of penetration are recorded.
LS	**Liner Sample**	Standard Penetration Test driving a 2.0-inch outside diameter split spoon equipped with two 3-inch long, 3/8-inch inside diameter brass liners, separated by a 1-inch long spacer, into undisturbed soil by the same means of the Spoon Sample.
ST	**Shelby Tube**	A 3.0-inch outside diameter thin-walled tube continuously pushed into the undisturbed soil by a rapid motion, without impact or twisting (ASTM D-1587).
--	**Continuous Penetration Resistance**	Driving a 2.0-inch outside diameter "Bullnose Penetrometer" continuously into undisturbed soil by the same means of the spoon sample. The blows for each successive 12-inch increment are recorded.

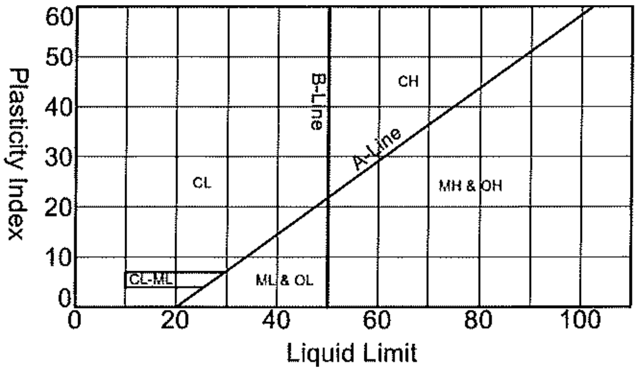
CONSISTENCY			RELATIVE DENSITY	
Clays & Silts	Blows/Foot	Strength (tons/sq ft)	Sands & Gravels	Blows/Foot
Very Soft	0 - 2	0 - 0.25	Very Loose	0 - 4
Soft	2 - 4	0.25 - 0.5	Loose	5 - 10
Firm	5 - 8	0.5 - 1.0	Medium Dense	11 - 30
Stiff	9 - 15	1 - 2	Dense	31 - 50
Very Stiff	16 - 30	2 - 4	Very Dense	> 50
Hard	> 30	> 4		

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		(LITTLE OR NO FINES)		GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS	CLEAN SANDS		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE		(LITTLE OR NO FINES)		SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES		SM	SILTY SANDS, SAND - SILT MIXTURES
		(APPRECIABLE AMOUNT OF FINES)		SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

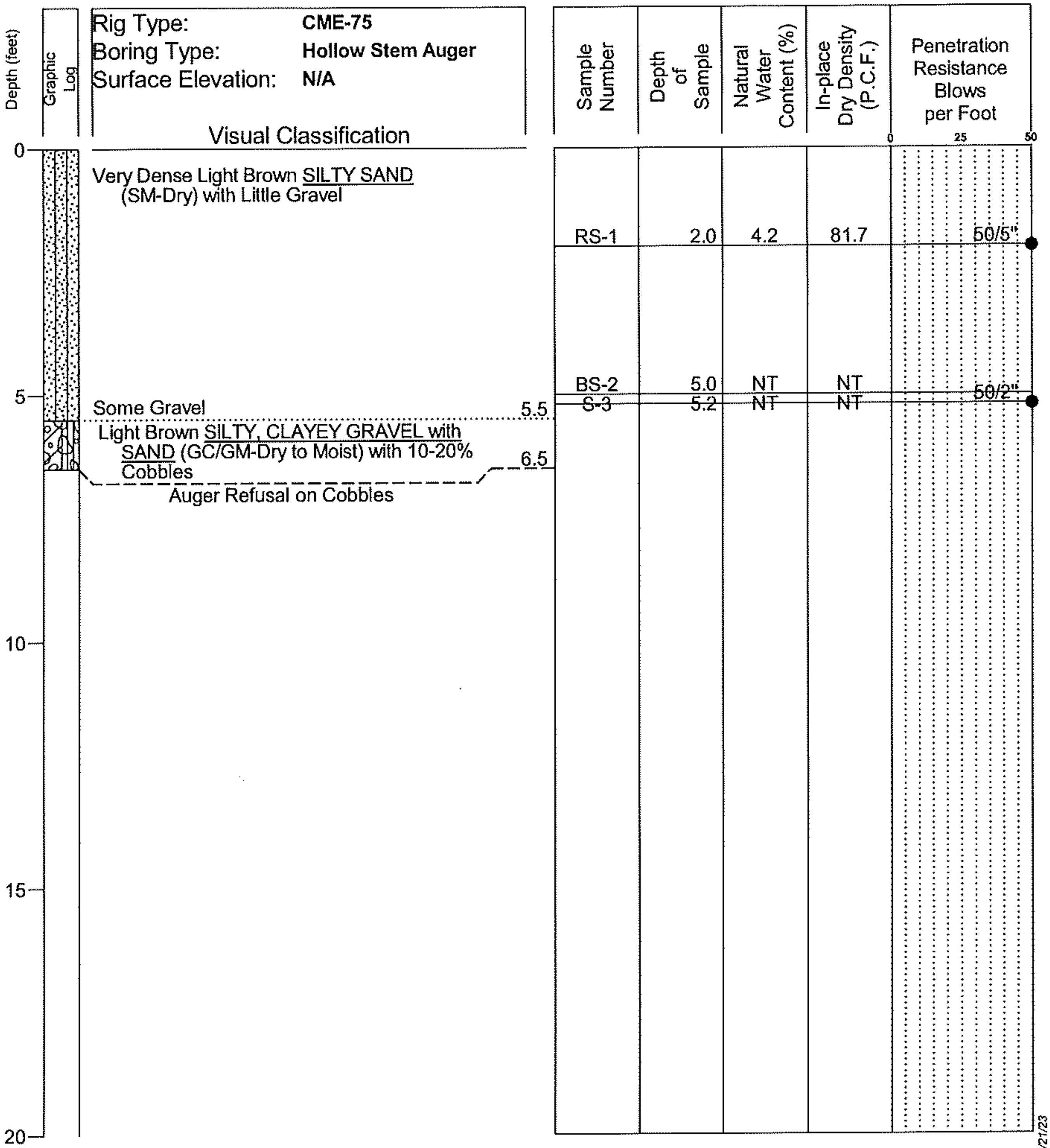
NOTE: DUAL OR MODIFIED SYMBOLS MAY BE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS OR TO PROVIDE A BETTER GRAPHICAL PRESENTATION OF THE SOIL

MATERIAL SIZE	PARTICLE SIZE			
	Lower Limit		Upper Limit	
	mm	Sieve Size ♦	mm	Sieve Size ♦
SANDS				
Fine	0.075	#200	0.42	#40
Medium	0.420	#40	2.00	#10
Coarse	2.000	#10	4.75	#4
GRAVELS				
Fine	4.75	#4	19	0.75" ×
Coarse	19	0.75" ×	75	3" ×
COBBLES	75	3" ×	300	12" ×
BOULDERS	300	12" ×	900	36" ×

♦U.S. Standard ×Clear Square Openings



Rig Type: **CME-75**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **N/A**



Visual Classification

Very Dense Light Brown SILTY SAND (SM-Dry) with Little Gravel

Some Gravel — 5.5

Light Brown SILTY, CLAYEY GRAVEL with SAND (GC/GM-Dry to Moist) with 10-20% Cobbles — 6.5

Auger Refusal on Cobbles

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot
RS-1	2.0	4.2	81.7	50/5"
BS-2	5.0	NT	NT	
S-3	5.2	NT	NT	50/2"

Boring Date: **2-27-23**
Field Engineer/Technician: **N. Wagner**
Driller: **O. Mariscal**
Contractor: **Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

▽
▼

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-1**

17 Acre Mobile Home Park

North of NEC Thornton Road & O'Neill Drive

Casa Grande, Arizona

Project No.: **230305SA**

_SPEEDIE 230305SA.GPJ GENGEO.GDT 4/21/23

Rig Type: **CME-75**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **N/A**

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 25 50)
0	Very Dense Light Brown SILTY SAND (SM-Dry) with Little Gravel					
		RS-1	2.0	NT	NT	50/5"
5	Some Gravel	S-2	5.3	NT	NT	50/3"
	6.0					
	Light Brown SILTY, CLAYEY GRAVEL with SAND (GC/GM-Dry) with 1-10% Cobbles					
	7.0					
	Light Brown SILTY GRAVEL with SAND (GM-Dry) with 10-20% Cobbles					
	8.0					
	Auger Refusal on Cobbles					
10						
15						
20						

Boring Date: **2-27-23**
Field Engineer/Technician: **N. Wagner**
Driller: **O. Mariscal**
Contractor: **Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-2**

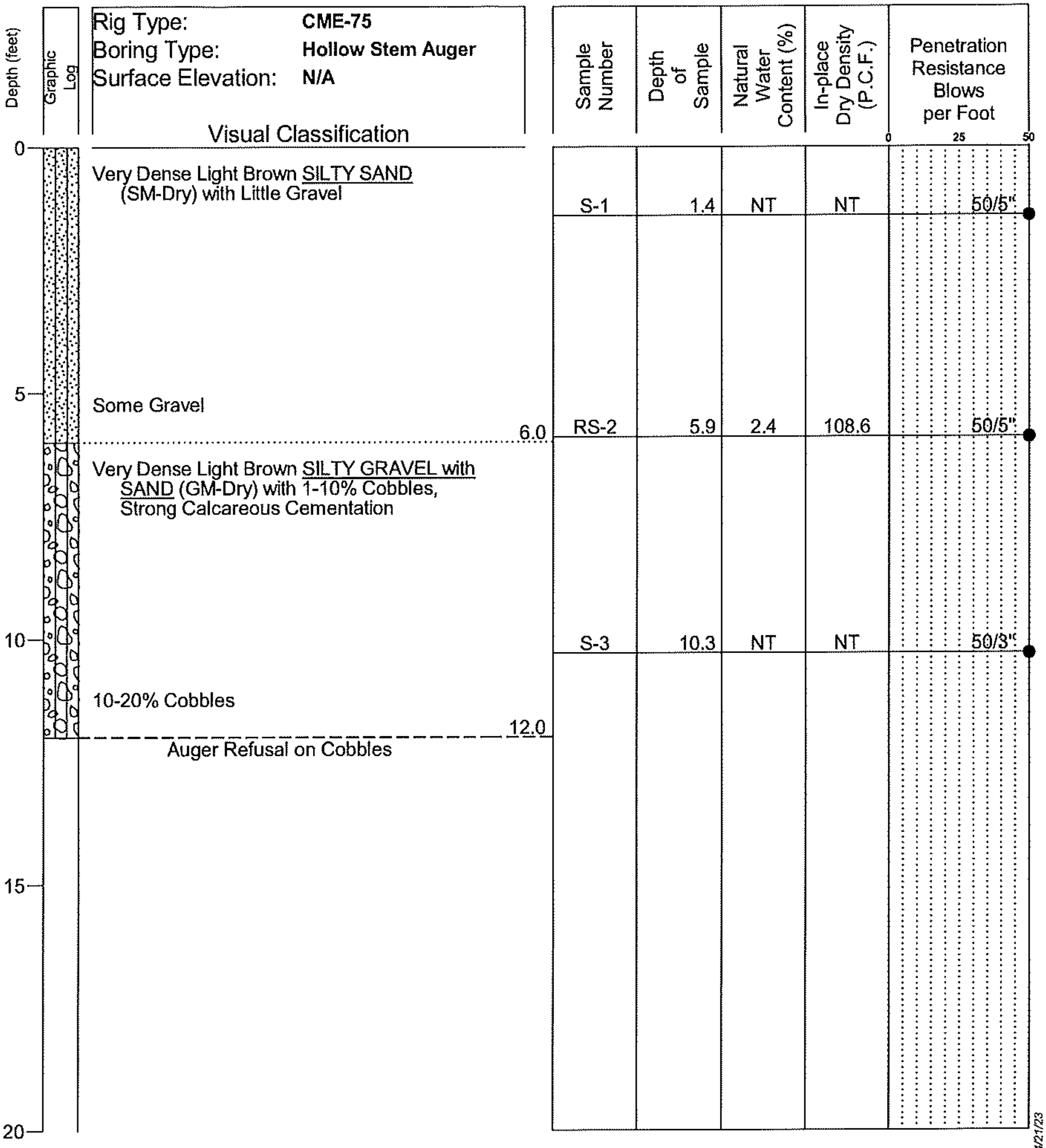
17 Acre Mobile Home Park

North of NEC Thornton Road & O'Neill Drive

Casa Grande, Arizona

Project No.: **230305SA**

Rig Type: **CME-75**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **N/A**



Visual Classification

Depth (feet)	Visual Classification
0	Very Dense Light Brown SILTY SAND (SM-Dry) with Little Gravel
	Some Gravel
6.0	Very Dense Light Brown SILTY GRAVEL with SAND (GM-Dry) with 1-10% Cobbles, Strong Calcareous Cementation
	10-20% Cobbles
12.0	Auger Refusal on Cobbles

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot
S-1	1.4	NT	NT	50/5"
RS-2	5.9	2.4	108.6	50/5"
S-3	10.3	NT	NT	50/3"

Boring Date: **2-27-23**
Field Engineer/Technician: **N. Wagner**
Driller: **O. Mariscal**
Contractor: **Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-3**

17 Acre Mobile Home Park

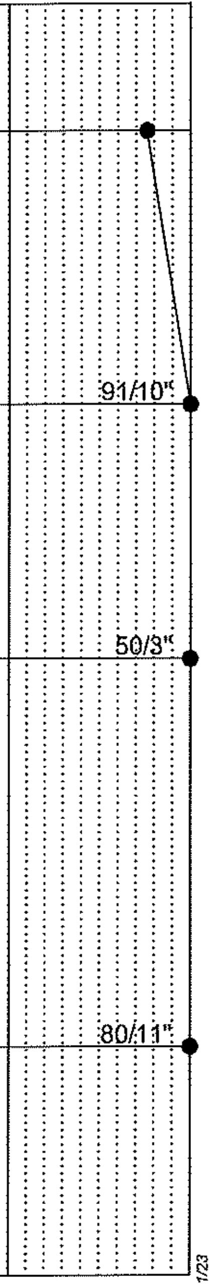
North of NEC Thornton Road & O'Neill Drive

Casa Grande, Arizona

Project No.: **230305SA**

Rig Type: **CME-75**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **N/A**

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot
0	Dense Light Brown to Whitish Brown <u>CLAYEY SAND</u> (SC-Dry) with Little Gravel, Weak Calcareous Cementation	RS-1	2.0	5.3	100.2	
3.0	Very Dense Light Brown <u>SILTY SAND</u> (SM-Dry) with Some Gravel	S-2	6.3	NT	NT	91/10"
	1-10% Cobbles, Strong Calcareous Cementation	S-3	10.3	NT	NT	50/3"
	Moderate Calcareous Cementation	S-4	16.4	NT	NT	80/11"
16.4	End of Boring					



Boring Date: **2-27-23**
Field Engineer/Technician: **N. Wagner**
Driller: **O. Mariscal**
Contractor: **Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-4**

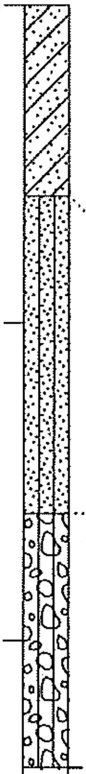
17 Acre Mobile Home Park

North of NEC Thornton Road & O'Neill Drive

Casa Grande, Arizona

Project No.: **230305SA**

Rig Type: **CME-75**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **N/A**



Depth (feet)	Visual Classification
0	Very Dense Brown <u>CLAYEY SAND</u> (SC-Dry) with Little Gravel, Weak Calcareous Cementation
	Light Brown, 1-10% Cobbles, Interbedded Layer of SILTY, CLAYEY GRAVEL with SAND
3.0	Very Dense Light Brown <u>SILTY SAND</u> (SM-Dry) with Some Gravel
8.0	Very Dense Light Brown <u>SILTY GRAVEL with SAND</u> (GM-Dry) with 1-10% Cobbles
	10-20% Cobbles, Strong Calcareous Cementation
12.0	Auger Refusal on Cobbles

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 25 50)
S-1	1.9	NT	NT	50/4"
S-2	5.4	NT	NT	50/5"
S-3	10.2	NT	NT	50/2"

Boring Date: **2-27-23**
Field Engineer/Technician: **N. Wagner**
Driller: **O. Mariscal**
Contractor: **Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

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▼

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-5**

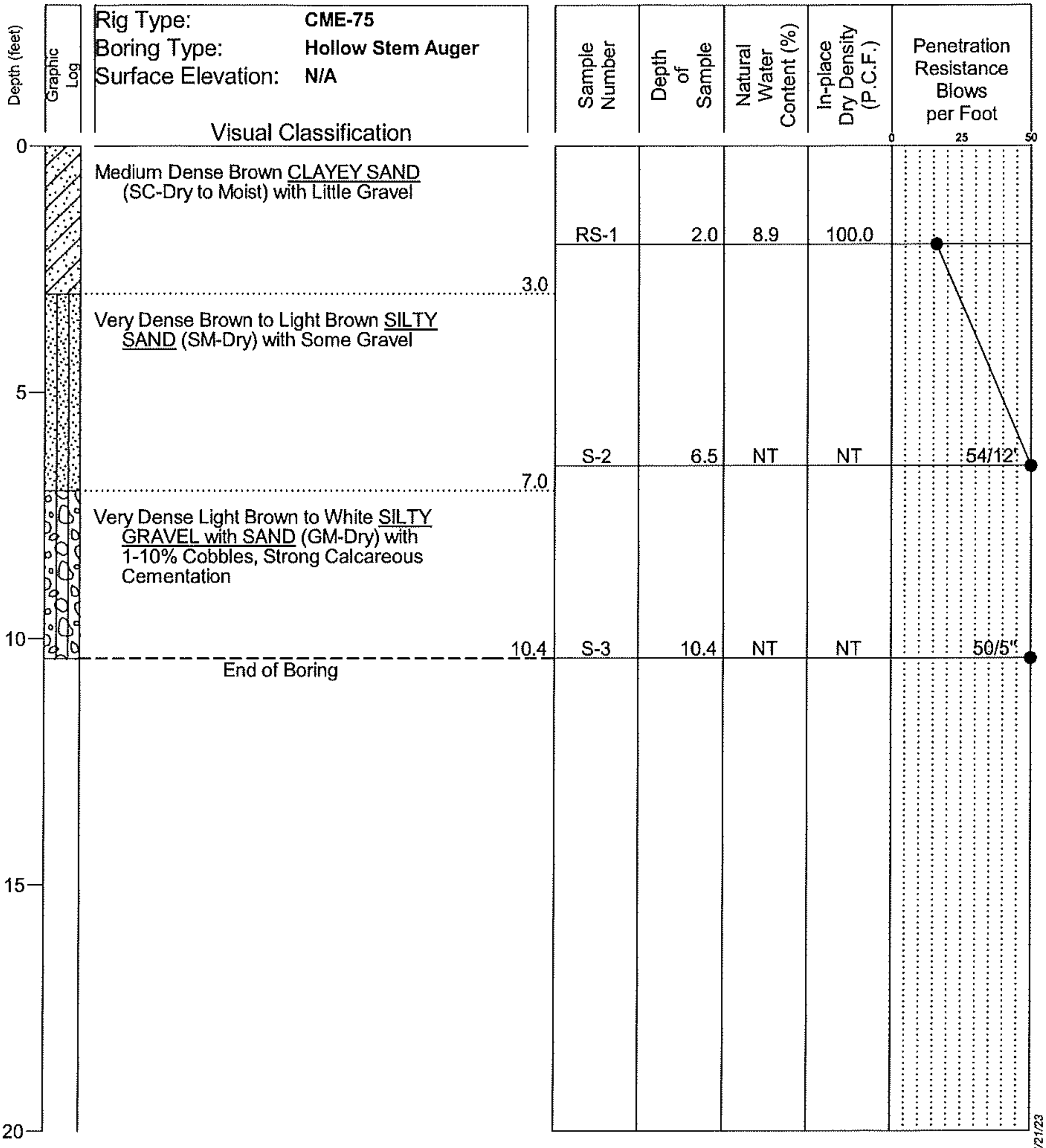
17 Acre Mobile Home Park

North of NEC Thornton Road & O'Neill Drive

Casa Grande, Arizona

Project No.: **230305SA**

Rig Type: **CME-75**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **N/A**



Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot
Medium Dense Brown CLAYEY SAND (SC-Dry to Moist) with Little Gravel	RS-1	2.0	8.9	100.0	
3.0					
Very Dense Brown to Light Brown SILTY SAND (SM-Dry) with Some Gravel	S-2	6.5	NT	NT	54/12
7.0					
Very Dense Light Brown to White SILTY GRAVEL with SAND (GM-Dry) with 1-10% Cobbles, Strong Calcareous Cementation	S-3	10.4	NT	NT	50/5
10.4					
End of Boring					

Boring Date: **2-27-23**
Field Engineer/Technician: **N. Wagner**
Driller: **O. Mariscal**
Contractor: **Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-6**

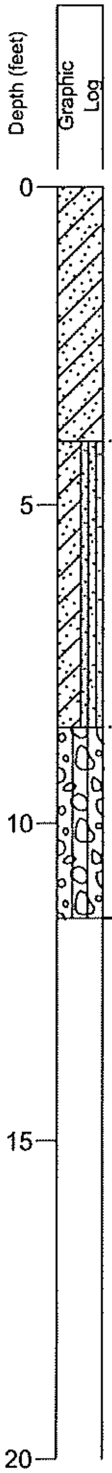
17 Acre Mobile Home Park

North of NEC Thornton Road & O'Neill Drive

Casa Grande, Arizona

Project No.: **230305SA**

Rig Type: **CME-75**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **N/A**

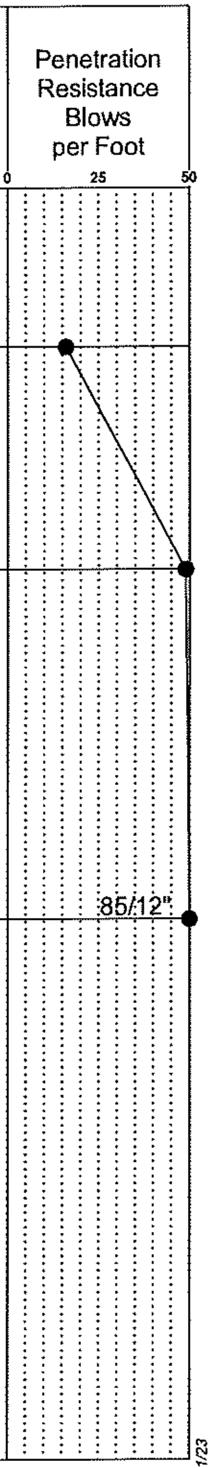


Visual Classification

Depth (feet)	Visual Classification
0 – 4.0	Medium Dense Light Brown CLAYEY SAND (SC-Dry) with Little Gravel
4.0 – 8.5	Dense Light Brown SILTY, CLAYEY SAND (SC/SM-Dry) with Some Gravel
8.5 – 11.5	Very Dense Light Brown SILTY GRAVEL with SAND (GM-Dry) with 1-10% Cobbles, Weak Calcareous Cementation

End of Boring

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)
S-1	2.5	NT	NT
RS-2	6.0	2.5	111.5
S-3	11.5	NT	NT



Boring Date: **2-27-23**
Field Engineer/Technician: **N. Wagner**
Driller: **O. Mariscal**
Contractor: **Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-7**

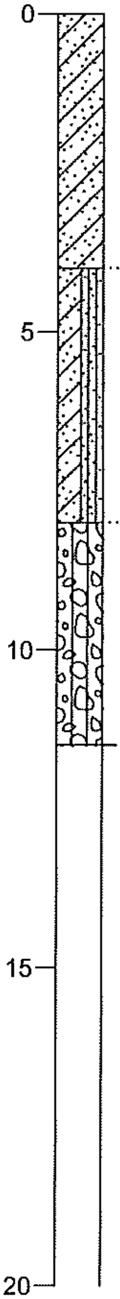
17 Acre Mobile Home Park

North of NEC Thornton Road & O'Neill Drive

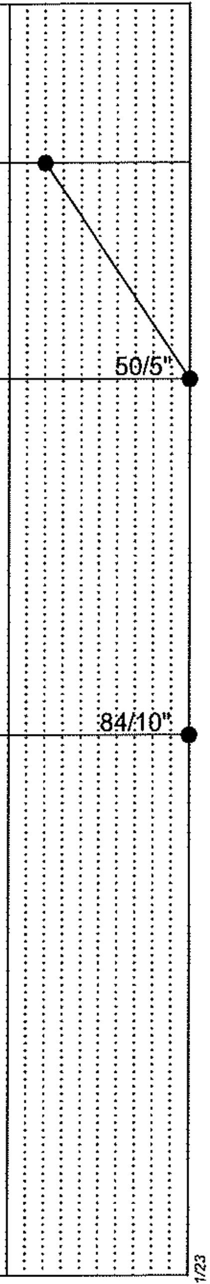
Casa Grande, Arizona

Project No.: **230305SA**

Rig Type: **CME-75**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **N/A**



Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot
0	Loose Brown CLAYEY SAND (SC-Dry to Moist) with Little Gravel	S-1	2.5	NT	NT	
4.0	Very Dense Light Brown to Whitish Brown SILTY, CLAYEY SAND (SC/SM-Dry) with Some Gravel, Moderate Calcareous Cementation Interbedded Layer of SILTY, CLAYEY GRAVEL with SAND	S-2	5.9	NT	NT	50/5"
8.0	Very Dense Light Brown to Whitish Brown SILTY GRAVEL with SAND (GM-Dry) with 1-10% Cobbles	S-3	11.5	NT	NT	84/10"
11.5	End of Boring					



Boring Date: **2-27-23**
Field Engineer/Technician: **N. Wagner**
Driller: **O. Mariscal**
Contractor: **Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

▽
▼

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-8**

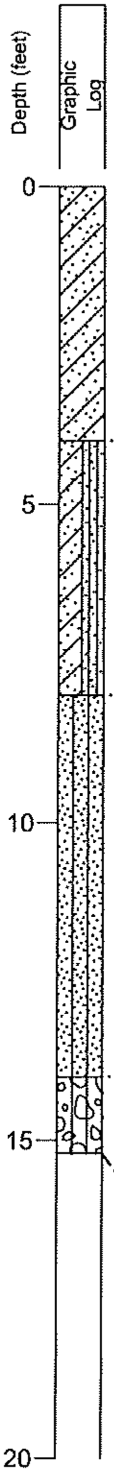
17 Acre Mobile Home Park

North of NEC Thornton Road & O'Neill Drive

Casa Grande, Arizona

Project No.: **230305SA**

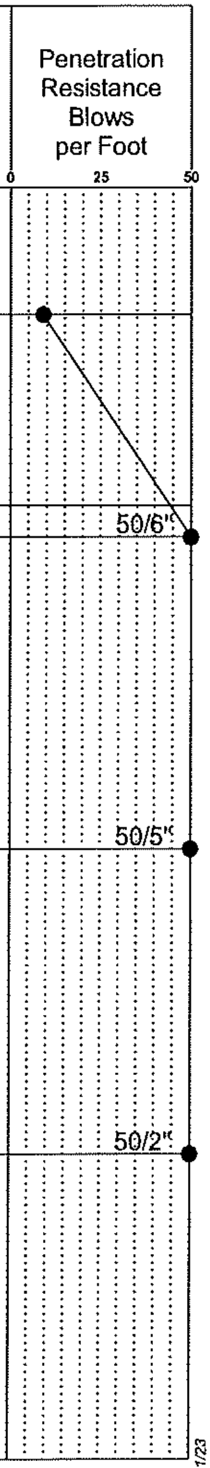
Rig Type: **CME-75**
Boring Type: **Hollow Stem Auger**
Surface Elevation: **N/A**



Visual Classification

Depth (feet)	Visual Classification
0	Loose Brown CLAYEY SAND (SC-Dry to Moist) with Little Gravel
4.0	Very Dense Light Brown to Whitish Brown SILTY, CLAYEY SAND (SC/SM-Dry) with Some Gravel Interbedded Layer of SILTY GRAVEL with SAND
8.0	Very Dense Light Brown SILTY SAND (SM-Dry) with Some Gravel, Moderate Calcareous Cementation
14.0	Very Dense Light Brown SILTY GRAVEL with SAND (GM-Dry) with 1-10% Cobbles, Strong Calcareous Cementation
15.2	End of Boring

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot
RS-1	2.0	6.8	99.4	
BS-2	5.0	NT	NT	
S-3	5.5	NT	NT	50/6"
S-4	10.4	NT	NT	50/5"
S-5	15.2	NT	NT	50/2"



Boring Date: **2-27-23**
Field Engineer/Technician: **N. Wagner**
Driller: **O. Mariscal**
Contractor: **Resilient Drilling**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-9**

17 Acre Mobile Home Park

North of NEC Thornton Road & O'Neill Drive

Casa Grande, Arizona

Project No.: **230305SA**

_SPEEDIE 230305SA.GPJ GENGEO.GDT 4/21/23

TABULATION OF TEST DATA

SOIL BORING or TEST PIT NUMBER	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE INTERVAL (ft)	NATURAL WATER CONTENT (Percent of Dry Weight)	IN-PLACE DRY DENSITY (Pounds Per Cubic Foot)	PARTICLE SIZE DISTRIBUTION (Percent Finer)					ATTERBERG LIMITS			UNIFIED SOIL CLASSIFICATION	SPECIMEN DESCRIPTION
						#200 SIEVE	#40 SIEVE	#10 SIEVE	#4 SIEVE	3" SIEVE	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX		
B-1	BS-2	BULK	0.0 - 5.0	NT	NT	16.4	34	62	80	100	20	17	3	SM	SILTY SAND with GRAVEL
B-1	RS-1	RING	1.0 - 2.0	4.2	81.7	NT	NT	NT	NT	NT	NT	NT	NT		
B-3	RS-2	RING	5.0 - 5.9	2.4	108.6	18.1	34	59	77	100	NP	NP	NP	SM	SILTY SAND with GRAVEL
B-4	RS-1	RING	1.0 - 2.0	5.3	100.2	22.3	45	59	80	NT	34	19	15	SC	CLAYEY SAND with GRAVEL
B-6	RS-1	RING	1.0 - 2.0	8.9	100.0	NT	NT	NT	NT	NT	NT	NT	NT		
B-7	RS-2	RING	5.0 - 6.0	2.5	111.5	18.3	37	61	78	100	28	22	6	SC-SM	SILTY, CLAYEY SAND with GRAVEL
B-9	BS-2	BULK	0.0 - 5.0	NT	NT	29.7	65	80	89	100	27	16	11	SC	CLAYEY SAND
B-9	RS-1	RING	1.0 - 2.0	6.8	99.4	NT	NT	NT	NT	NT	NT	NT	NT		

Sieve analysis results do not include material greater than 3". Refer to the actual boring logs for the possibility of cobble and boulder sized materials.

NT=Not Tested

Sheet 1 of 1

17 Acre Mobile Home Park
North of NEC Thornton Road & O'Neill Drive
Casa Grande, Arizona
Project No. 230305SA

SPEEDIE AND ASSOCIATES

CONSOLIDATION TEST

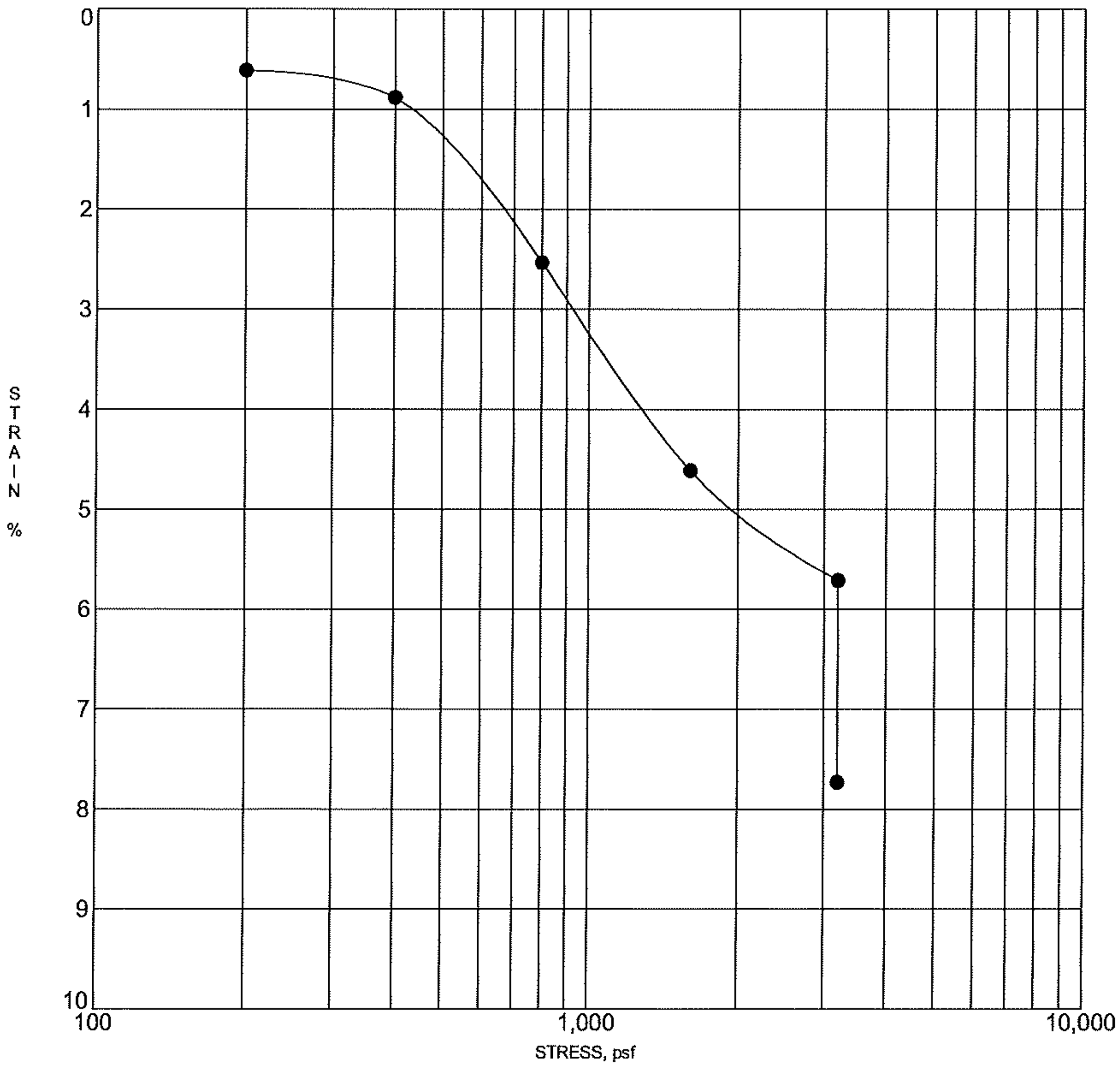
PROJECT: 17 Acre Mobile Home Park **PROJECT NO.:** 230305SA

LOCATION: North of NEC Thornton Road & O'Neill Drive **DATE:** 2/27/23

BORING NO.: B-7 **SAMPLE NO.:** RS-2 **SAMPLE DEPTH:** 5 to 6 **LABORATORY NO.:**

LIQUID LIMIT: 28 **PLASTIC LIMIT:** 22 **PLASTICITY INDEX:** 6

CLASSIFICATION: SC-SM **ASTM SOIL DESCRIPTION:** SILTY, CLAYEY SAND with GRAVEL



Sample inundated at end of test at 3200 psf

SPEEDIE AND ASSOCIATES

CONSOLIDATION TEST

PROJECT: 17 Acre Mobile Home Park

PROJECT NO.: 230305SA

LOCATION: North of NEC Thornton Road & O'Neill Drive

DATE: 2/27/23

BORING NO.: B-9

SAMPLE NO.: RS-1

SAMPLE DEPTH: 1 to 2

LABORATORY NO.:

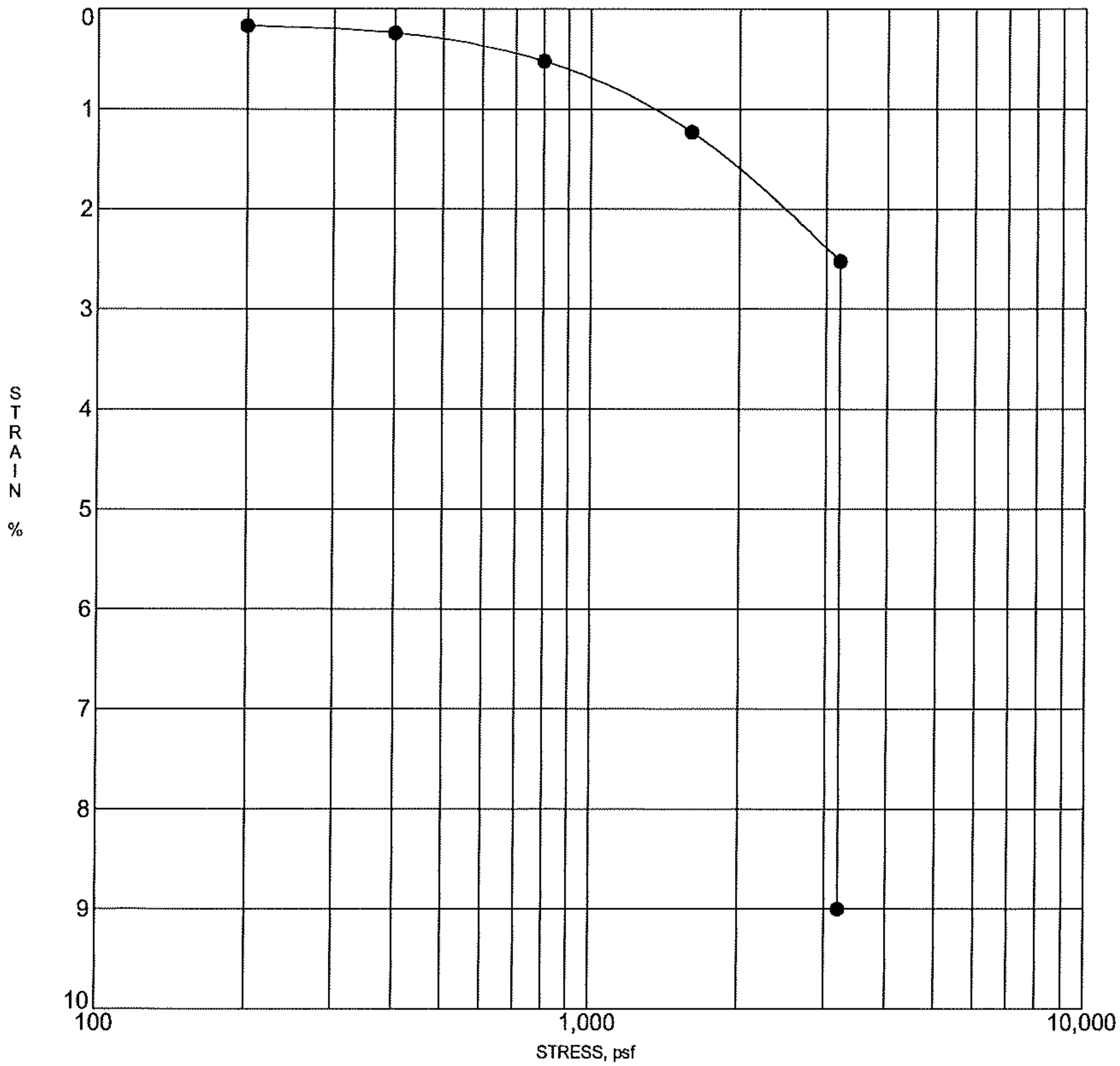
LIQUID LIMIT:

PLASTIC LIMIT:

PLASTICITY INDEX:

CLASSIFICATION:

ASTM SOIL DESCRIPTION:



Sample inundated at end of test at 3200 psf

SPEEDIE AND ASSOCIATES

MOISTURE-DENSITY RELATIONS

PROJECT: 17 Acre Mobile Home Park **PROJECT NO.:** 230305SA

LOCATION: North of NEC Thornton Road & O'Neill Drive **DATE:** 2/27/23

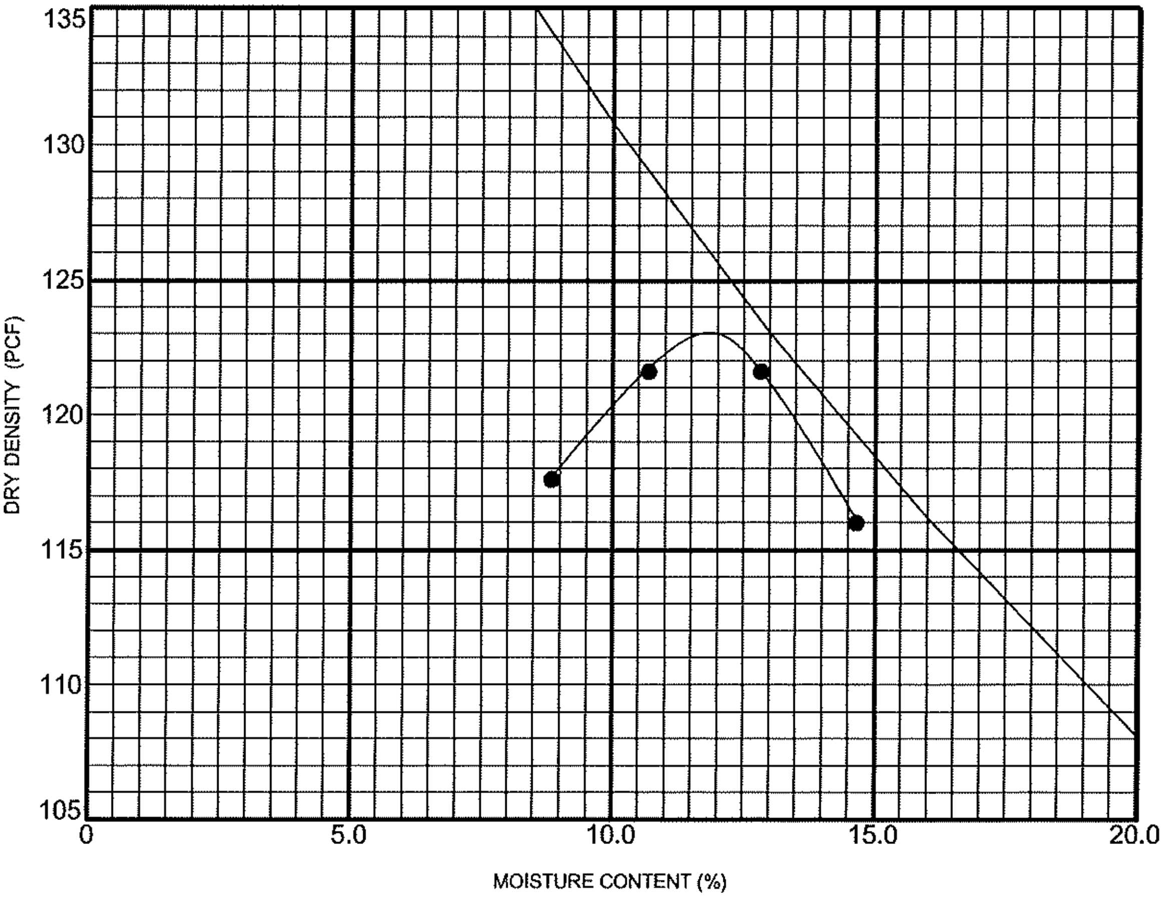
BORING NO.: B-9 **SAMPLE NO.:** BS-2 **SAMPLE DEPTH:** 0 to 5 **LABORATORY NO.:**

METHOD OF COMPACTION: D698A

LIQUID LIMIT: 27 **PLASTIC LIMIT:** 16 **PLASTICITY INDEX:** 11

CLASSIFICATION: SC **ASTM SOIL DESCRIPTION:** CLAYEY SAND

MAXIMUM DRY DENSITY: **123.0 PCF** OPTIMUM MOISTURE CONTENT: **12.0%**



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SWELL TEST DATA

BORING or TEST PIT No.	SAMPLE DEPTH, ft	MAXIMUM DRY DENSITY (pcf)	OPTIMUM MOISTURE CONTENT (%)	REMOLDED DRY DENSITY (pcf)	INITIAL MOISTURE CONTENT (%)	PERCENT COMPACTION	FINAL MOISTURE CONTENT (%)	CONFINING LOAD (psf)	TOTAL SWELL (%)
B-9, BS-2	5.0	123.0	12.0	117.4	9.8	95.4	14.8	100	0.2

Sheet 1 of 1

17 Acre Mobile Home Park
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Project No. 230305SA

SPEEDIE AND ASSOCIATES

CORROSIVE TEST DATA

SOIL BORING or TEST PIT NUMBER	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE INTERVAL (ft)	PERCENT FINER #200 SIEVE	pH	RESISTIVITY (Ohm-Centimeters)	SULFATE (SO4) (ppm)	CHLORIDE (CL) (ppm)	SULFIDE (+ or -)	REDOX (millivolts)	UNIFIED SOIL CLASSIFICATION	SPECIMEN DESCRIPTION
B-1	BS-2	BULK	0.0 - 5.0	16.4	8.5	5700	7.8	37	NT	NT	SM	SILTY SAND with GRAVEL

Sheet 1 of 1

17 Acre Mobile Home Park
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