Addendum No. 2 to Geotechnical Evaluation

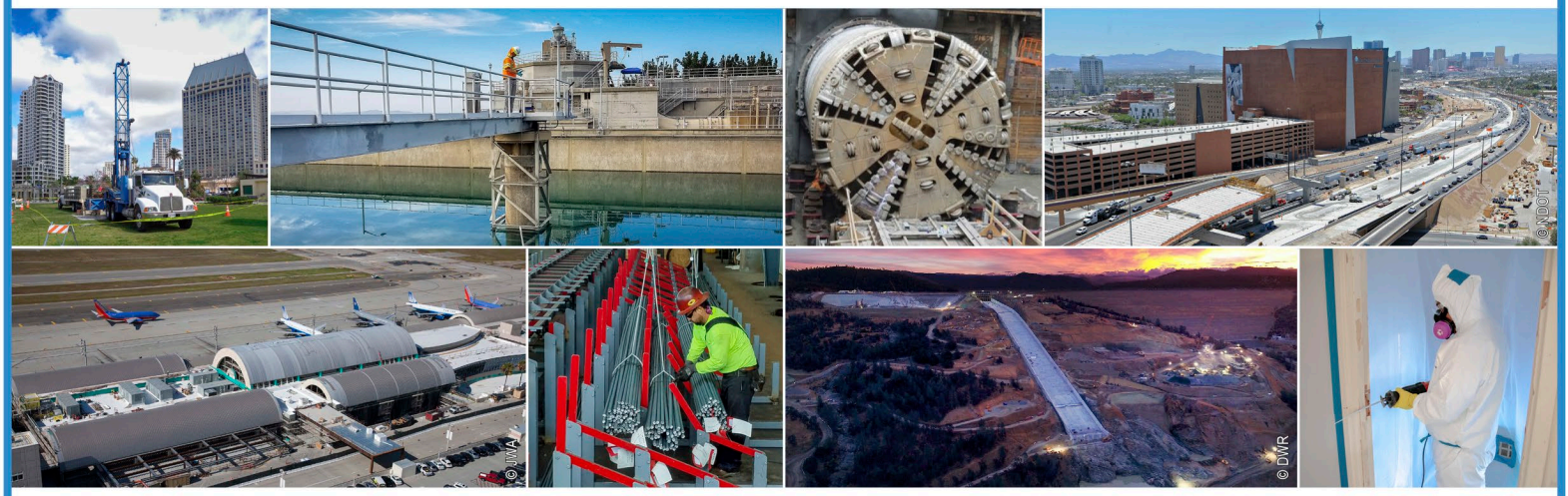
Southern Arizona Veteran Affairs Medical Center
Consolidated Mail Outpatient Pharmacy
3675 East Britannia Drive

Tucson, Arizona

H2B Engineers, Inc.

1225 North Loop West, Suite 800 | Houston, Texas 77008

April 11, 2025 | Project No. 607004001



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Ninyo & Moore

Geotechnical & Environmental Sciences Consultants

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1 INTRODUCTION

In accordance with our proposal dated February 28, 2025, and your authorization, we have performed a geotechnical evaluation for the design and construction of the Veteran's Affairs Consolidated Mail Outpatient Pharmacy (CMOP) Correct FCA & Physical Security improvements adjacent to the COMP site in Tucson, Arizona. In 2021, Ninyo & Moore performed a geotechnical evaluation for the CMOP facility, and prepared a geotechnical evaluation report dated November 24. In 2024, Ninyo & Moore prepared Addendum No. 1 to the 2021 report for the design and construction of the new solar parking lot canopies dated November 7.

We understand that this project includes additional structural improvements adjacent to the north side of the CMOP building referred to as Correct FCA & Physical Security Systems. This Addendum No. 2 presents the results of our evaluation and our geotechnical conclusions and recommendations for the new improvements. Other conclusions and recommendations provided in our 2021 report and Appendix 1 do apply, where not in conflict with those presented in this document. For brevity, the background review sections are not included in this document. This Addendum No. 2 shall be considered an integral part of the 2021 geotechnical evaluation report and the 2024 Addendum No.1.

2 SCOPE OF SERVICES

The scope of our services for this phase of the project generally included:

- Reviewing in-house pertinent background data including in-house geotechnical and soils data.
- Reviewing project design documentation provided by others.
- Conducting a visual reconnaissance of the project area and marking out the boring locations.
- Notifying Arizona 811 of the proposed exploration locations prior to conducting our field work.
- Drilling, logging, and sampling two exploratory soil boring to an approximate depth of 20 feet below ground surface (bgs). The boring logs are presented in Appendix A.
- Performing laboratory tests on selected samples collected from our boring to evaluate the in-situ moisture content and dry density, gradation, Atterberg limits, and corrosivity characteristics (including pH, minimum electrical resistivity, and soluble sulfate and chloride contents). The results of the laboratory tests are included in Appendix B.
- Preparing this report presenting our findings, conclusions, and recommendations regarding the proposed design and construction.

Our scope of services did not include environmental consulting services such as hazardous waste sampling or analytical testing at the site. A detailed scope of services and estimated fee for such services can be provided upon request.

3 SITE DESCRIPTION

The project site is located at 3675 East Britannia Drive in Tucson, Arizona. The new improvements will be located within the existing asphaltic concrete (AC) and Portland cement concrete (PCC) paved area, north of the existing CMOP.

4 PROPOSED CONSTRUCTION

Based on the 95% construction documents for the proposed improvements prepared by SPUR Design, LLC, dated August 23, 2024, we understand that the project involves the design of several concrete pads for mechanical equipment and extending an exterior concrete dock along with adding a ramp adjacent to the north side of the CMOP building. The proposed improvements include:

- new raised concrete docks;
- new concrete ramp;
- new elevated metal walkway;
- new 5,000-gallon underground diesel fuel tank;
- new concrete pads for a new generator and other equipment; and
- other minor improvements.

The foundation systems for the proposed improvements will consist of shallow spread and continuous footings as well as concrete slabs on grade. Structural loads were not provided, but are assumed to be relatively light.

5 FIELD EXPLORATION AND LABORATORY TESTING

On March 27, 2025, Ninyo & Moore conducted a subsurface exploration in order to evaluate the subsurface conditions and to collect soil samples for laboratory testing. Our evaluation consisted of drilling, logging, and sampling of two exploratory borings using a CME 75 truck mounted drill rig equipped with hollow-stem augers (Figure 1). The borings, denoted as B-1 and B-2, extended to an approximate depth of 20 feet bgs. Bulk and relatively undisturbed soil samples were collected at selected depth intervals in our borings.

Ninyo & Moore personnel logged the borings in general accordance with the Unified Soil Classification System (USCS) and American Society for Testing and Materials (ASTM) test method D 2488 by observing cuttings and drive samples. Collected ring samples were trimmed in the field, wrapped in plastic bags, and placed in cylindrical plastic containers to retain in-place moisture conditions. Similarly, Standard Penetration Test (SPT) and bulk samples were sealed in plastic bags to retain their approximate in-place moisture. Detailed descriptions of the soils encountered are presented on the boring logs in Appendix A.

The soil samples collected from our exploratory activities were transported to the Ninyo & Moore laboratory in Tucson, Arizona for geotechnical laboratory testing. The testing included in-situ moisture content and dry density, gradation, Atterberg limits, and corrosivity characteristics (including pH, minimum electrical resistivity, and soluble sulfate and chloride contents). The results of the in-situ moisture content and dry density testing are presented on the boring logs in Appendix A, and a description of each laboratory test method and the remainder of the test results is presented in Appendix B.

6 SUBSURFACE CONDITIONS

The boring logs contains our field and laboratory test results, as well as our interpretation of conditions believed to exist between actual samples retrieved. Therefore, these boring logs contains both factual and interpretive information. Lines delineating subsurface strata on the boring logs are intended to group soils having similar engineering properties and characteristics. They should be considered approximate, as the actual transition between soil types (strata) may be gradual. Detailed stratigraphic information as well as a key to the soil symbols and terms used on the boring logs are provided in Appendix A.

6.1 AC Pavement

AC pavement of approximately 3 inches in thickness was encountered at the surface of our borings B-1 and B-2. Aggregate base (AB) course was encountered below the AC layer and measures in our borings to be approximately 1 ½ to 2 inches thick.

6.2 Alluvium

Native alluvial deposits were encountered below the pavement and extended to the boring termination depths. In general, the surficial alluvial deposits consisted of a very stiff to hard sandy fat clay (B-1) and loose to dense clayey sand (B-2), with variable percentages of gravel and zones of carbonate (caliche) cementation. These deposits were underlain by medium

dense to very dense silty and clayey sands with variable percentages of gravel and zones of carbonate cementation.

7 CONCLUSIONS

Based on the results of our subsurface evaluation, laboratory testing, and data analysis, the proposed construction is feasible from a geotechnical standpoint, provided the recommendations of this report are incorporated into the design of the project, as appropriate. Geotechnical considerations include the following:

- The site soils can generally be excavated or ripped using heavy-duty earthmoving or excavation equipment. However, zones of gravel and carbonate cementation should be anticipated, which may result in difficult and/or slower excavation rates.
- Soils of variable relative densities encountered near the ground surface in our boring may be compressible upon saturation.
- The proposed improvements should be supported on a zone of engineered fill as presented in this addendum.
- The on-site soils are not be suitable for re-use as engineered fill.
- Corrosivity test results indicate that on-site soils are corrosive to ferrous materials and the sulfate content of the soils presents a negligible sulfate exposure to concrete.

8 RECOMMENDATIONS

The following sections present our geotechnical recommendations for the project design and construction. If the proposed construction is changed from that discussed in this report, Ninyo & Moore should be contacted for additional recommendations.

8.1 Earthwork

The following sections provide our earthwork recommendations for this project. In general, the earthwork specifications contained in the *Pima Association of Governments (PAG) Standard Specifications for Public Improvements (Standard Specifications)* are expected to apply unless specifically noted.

8.1.1 Site Preparation

Given the presence of adjacent existing underground utility lines and structures, consideration should be given to implementing documentation and instrumentation programs to evaluate design assumptions, existing conditions, and to monitor movements, levels, and deformations during construction. The monitoring programs may include the use of seismographs, groundwater monitoring wells, inclinometers, convergence points, and an

array of surface control points. The resulting data should be reviewed and evaluated during construction.

Refer to the Ninyo & Moore 2021 report for other recommendations.

8.1.2 Excavations

Our evaluation of the excavation characteristics of the on-site soils is based on the results of our exploratory boring, site observations, and experience with similar soils. Although, the site soils can generally be excavated or ripped using heavy-duty earthmoving or excavation equipment, zones of gravel and carbonate cementation may be encountered and may result in difficult and/or slower excavation rates.

8.1.3 Fill Materials and Reuse of On-site Soils

On-site and imported soils that exhibit relatively low plasticity indices and very low to low expansive potential are generally suitable for re-use as engineered fill. Relatively low plasticity indices are defined as a PI value of 15, or less, as evaluated by ASTM D 4318. Based on laboratory test results, the near-surface on-site soils are characterized by PI values of 23 to 31. As such, it is our opinion that the on-site soils will not be suitable for re-use as engineered fill during construction. The Contractor should perform additional testing either prior to or during construction to better understand the soil conditions. Fill soils not suitable for re-use as engineered fill can be re-used in non-structural areas (e.g., landscaping, etc.).

In addition, suitable fill should not include organic material, construction debris, or other non-soil fill materials. Clay lumps and rock particles should not be larger than 4 inches in dimension. This material should be disposed of off-site or in non-structural areas. In addition, the subgrade under new pavements should meet the design R-value recommendation in Section 8.3.2 below.

Engineered fill materials in contact with ferrous metals should also have low corrosion potential (minimum resistivity more than 2,000 ohm-cm, chloride content less than 25 parts per million [ppm]). Engineered fill material in contact with concrete should have a soluble sulfate content of less than 0.1 percent.

8.1.4 Subgrade Preparation

As stated previously, our borings disclosed near-surface alluvial soils generally consisting of sandy fat clay and clayey sand. Based on the results of our explorations and laboratory testing, the on-site soils exhibit potential for volume changes upon inundation with water.

Accordingly, we recommend that the on-site soils below the new shallow foundations be over-excavated and replaced with engineered fill that extends 3 feet below the footing base or 5 feet below existing grade, whichever is deeper. The engineered fill placed in this zone should be moisture-conditioned to 0 to +3 percent of the optimum moisture content and compacted to 95 percent of the maximum dry density as evaluated in accordance with ADTM D 698. This overexcavation zone should extend a horizontal distance from the edge of the foundation footprint that is equal to the depth of the overexcavation.

In addition, we recommend that new slab-on-grade, flatwork and pavements be supported on 2 feet of moisture-conditioned and compacted engineered fill as stipulated above. The fill thickness should be measured from the bottom of the aggregate base (AB) layer, where applicable. This subgrade improvement should extend laterally 2 feet beyond the slab/pavement footprint. In lieu of the soil overexcavation and replacement, the on-site soils under new slab-on-grade, flatwork and pavements can be treated with lime or Portland cement in accordance with relevant PAG Standard Specifications. The depth of such treatment should not be less than 12 inches below the bottom of AB.

After the overexcavation described above is finished and prior to the placement of engineered fill, exposed surfaces from excavations should be carefully evaluated by Ninyo & Moore for the presence of soft, loose, or wet soils that were not removed as part of the improvement process. This evaluation should consist of probing and visual observation of the excavation bottom. Based on this evaluation, additional remediation may be needed. This could include further scarification of the exposed surface. This additional remediation, if needed, should be addressed by the geotechnical consultant during the earthwork operations.

8.2 Foundations

For any shallow foundation (spread or continuous footings) geotechnical design recommendations, please refer to our 2021 geotechnical report.

8.3 Pavements

The new pavement design was prepared in accordance with the Pima County Roadway Design Manual, 2013 Edition with June 2016 updates (Manual). The sections below present our main design assumptions and recommended new asphaltic concrete (AC) and Portland cement concrete (PCC) pavement sections. We assumed that the subgrade preparation recommendations outlined in this report will be employed.

8.3.1 Traffic

Traffic information for this project was not available as of the date of this study. However, we anticipate that the new pavements will be used by passenger car traffic, delivery trucks, maintenance trucks, and trash compacting equipment.

8.3.2 Subgrade

The subsurface soils encountered in our borings generally consisted of clayey sand with variable percentages of gravel. Table 1 summarizes the correlated R-values evaluated in accordance with the Manual.

Table 1 – Subgrade Soil Correlated R-value Summary

Boring No.	Sample Depth (feet)	Pima County Correlated R-value
B-1	0.5 – 5.0	11
B-2	0.5 – 5.0	8

The mean R-value calculated for this project is 9.5 and indicated poor subgrade condition. Subgrade should be improved as indicated in Section 8.1.4 above. Imported engineered fill should have a minimum R-value of 20.

8.3.3 Asphalt Concrete Pavement Sections

AC pavements may be used for much of the project areas with various traffic conditions. The light traffic areas assume generally light or pick-up trucks and passenger cars. The recommended structural pavement sections are presented in Table 2 below.

Table 2 – Recommended AC Structural Pavement Sections

Pavement Section	Subgrade	Aggregate Base[1] (inches)	Asphaltic Concrete[2]
Truck traffic and ramp areas	Per Sections 8.1.4 and 8.3.2	6	4 ½ inches
Light traffic areas	Per Sections 8.1.4 and 8.3.2	6	2 ½ inches

[1] Per Standard Specification No. 303;
[2] Per Standard Specification No. 406.

The service life for the above-specified new pavement sections is estimated to be on the order of 20 years. The above pavement sections may need to be revised if future traffic projects become available.

8.3.4 PCC Pavement Section

PCC pavements are recommended for areas where vehicles will be turning or loading (e.g., adjacent to trash dumpsters). They can also be use on the new ramps as a pavement section alternative to AC. The recommended PCC pavement section is presented in Table 3 below.

Table 3 – Rigid Pavement Sections

Pavement Section	Aggregate Base (in)	PCC Slab (in)
Truck turning/loading areas	4	6

8.4 Lateral Earth Pressures

Earth pressures are calculated to compute the lateral forces acting on retaining walls and structures such as culvert wing walls, and foundations. These pressures can be classified as at-rest, active, and passive. The active pressures are exerted when the wall moves out or rotates slightly (typical for cantilever retaining walls) and the soil moves toward the wall away from the mass, thereby mobilizing the shear strength of the soil. The active pressures are typically mobilized at movements of less than about 0.1 percent of the wall height for granular soils. Passive pressures occur when the wall moves toward the soil mass. At-rest conditions exist when there is insufficient movement to fully mobilize active or passive pressures, such as a braced or rigid wall.

Retaining walls that are not restrained from movement at the top and have a level granular structure backfill behind the wall may be designed using an “active” equivalent fluid unit weight of 37 pounds per cubic foot (pcf). This value assumes compaction within about 5 feet of the wall will be accomplished with relatively light compaction equipment, and that engineered granular fill will be placed behind the wall. Unrestrained retaining walls should also be designed to resist a surcharge pressure of 0.31q. The value for “q” represents the pressure induced by adjacent light loads, slab, or traffic loads plus any adjacent footing loads.

The “at-rest” earth pressure against walls that are restrained at the top or braced so that they cannot yield, and with level backfill, may be taken as equivalent to the pressure exerted by a fluid weighing 56 pcf. Restrained retaining walls should also be designed to resist a horizontal earth pressure of 0.47q. The value of q represents the vertical surcharge pressure induced by adjacent light loads, slab, or traffic loads plus any adjacent footing loads.

For “passive” resistance to lateral loads, we recommend that an ultimate equivalent fluid pressure of 360 psf per foot of depth be used. This value assumes that the ground is horizontal

for a distance of 10 feet or more in front the wall or three times the height generating the passive pressure, whichever is more. We recommend that the upper 12 inches of soil not protected by pavement or a concrete slab be neglected when calculating passive resistance. If passive and frictional resistances are to be used in combination, we recommend that the passive resistance be limited to one-half of the ultimate lateral resistance. The passive resistance values may be increased by one-third when considering loads of short duration such as wind or seismic forces.

Measures should be taken so that moisture does not build up behind the retaining walls/buried structures. Retaining walls should be backfilled with structure fill and provided with a drain. Drainpipes should outlet away from structures, and the walls should be waterproofed in accordance with the recommendations of the project civil engineer or architect. To reduce the potential for water- and sulfate/salt-related damage to the walls, particular care should be taken in selection of the appropriate type of waterproofing material to be utilized and in the application of this material.

8.5 Corrosion

The corrosion potential of the on-site materials was analyzed to evaluate its potential effect on the foundations and structures. Corrosion potential was evaluated using the results of laboratory testing of a soil sample obtained during our subsurface evaluation that was considered representative of soils at the subject site.

Laboratory testing consisted of pH, minimum electrical resistivity, and chloride and soluble sulfate contents. The pH and minimum electrical resistivity tests were performed in general accordance with Arizona Test 236c, while sulfate and chloride tests were performed in accordance with Arizona Test 733 and 736, respectively. The results of the corrosivity tests are presented in Appendix B.

The soil pH value of the tested sample was 8.2, which is considered to be alkaline. The minimum electrical resistivity measured in the laboratory was 4,020 ohm-cm, which is considered not to be corrosive to ferrous metals. The chloride content of the sample tested was 31 parts per million (ppm), which is considered to represent a corrosive environment to ferrous metals. The soluble sulfate content of the soil sample tested was 0.005 percent by weight, which is considered to represent negligible sulfate exposure for concrete.

The results of the laboratory testing indicate that the on-site materials may be corrosive to ferrous materials. A corrosion specialist should be consulted for further recommendations.

8.6 Concrete

Laboratory chemical tests performed on soil sample indicated sulfate content of approximately 0.005 percent by weight. Based on American Concrete Institute (ACI), the on-site soils should be considered to represent negligible sulfate exposure to concrete.

We recommend the use of Type II cement for construction of concrete structures at this site. Due to potential uncertainties as to the use of reclaimed irrigation water, or topsoil that may contain higher sulfate contents, pozzolan or admixtures designed to increase sulfate resistance may be considered.

The concrete should have a water-cementitious materials ratio of no more than 0.50 by weight for normal weight aggregate concrete. The structural engineer should select the concrete design strength based on the project specific loading conditions. Higher strength concrete may be selected for increased durability and resistance to slab curling and shrinkage cracking.

We recommend that concrete cover over reinforcing steel for foundations be in accordance with the recommendations of the structural engineer. The structural engineer should be consulted for additional concrete specifications.

9 LIMITATIONS

The field evaluation, laboratory testing, and geotechnical analyses presented in this geotechnical report have been conducted in general accordance with current practice and the standard of care exercised by geotechnical consultants performing similar tasks in the project area. No warranty, expressed or implied, is made regarding the conclusions, recommendations, and opinions presented in this report. There is no evaluation detailed enough to reveal every subsurface condition. Variations may exist and conditions not observed or described in this report may be encountered during construction. Uncertainties relative to subsurface conditions can be reduced through additional subsurface exploration. Additional subsurface evaluation will be performed upon request. Please also note that our evaluation was limited to assessment of the geotechnical aspects of the project, and did not include evaluation of structural issues, environmental concerns, or the presence of hazardous materials.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Ninyo & Moore should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document.

This report is intended for design purposes only. It does not provide sufficient data to prepare an accurate bid by contractors. It is suggested that the bidders and their geotechnical consultant perform an independent evaluation of the subsurface conditions in the project areas. The independent evaluations may include, but not be limited to, review of other geotechnical reports prepared for the adjacent areas, site reconnaissance, and additional exploration and laboratory testing.

Our conclusions, recommendations, and opinions are based on an analysis of the observed site conditions. If geotechnical conditions different from those described in this report are encountered, our office should be notified and additional recommendations, if warranted, will be provided upon request. It should be understood that the conditions of a site could change with time as a result of natural processes or the activities of man at the subject site or nearby sites. In addition, changes to the applicable laws, regulations, codes, and standards of practice may occur due to government action or the broadening of knowledge. The findings of this report may, therefore, be invalidated over time, in part or in whole, by changes over which Ninyo & Moore has no control.

This report is intended exclusively for use by the client. Any use or reuse of the findings, conclusions, and/or recommendations of this report by parties other than the client is undertaken at said parties' sole risk.

10 REFERENCES

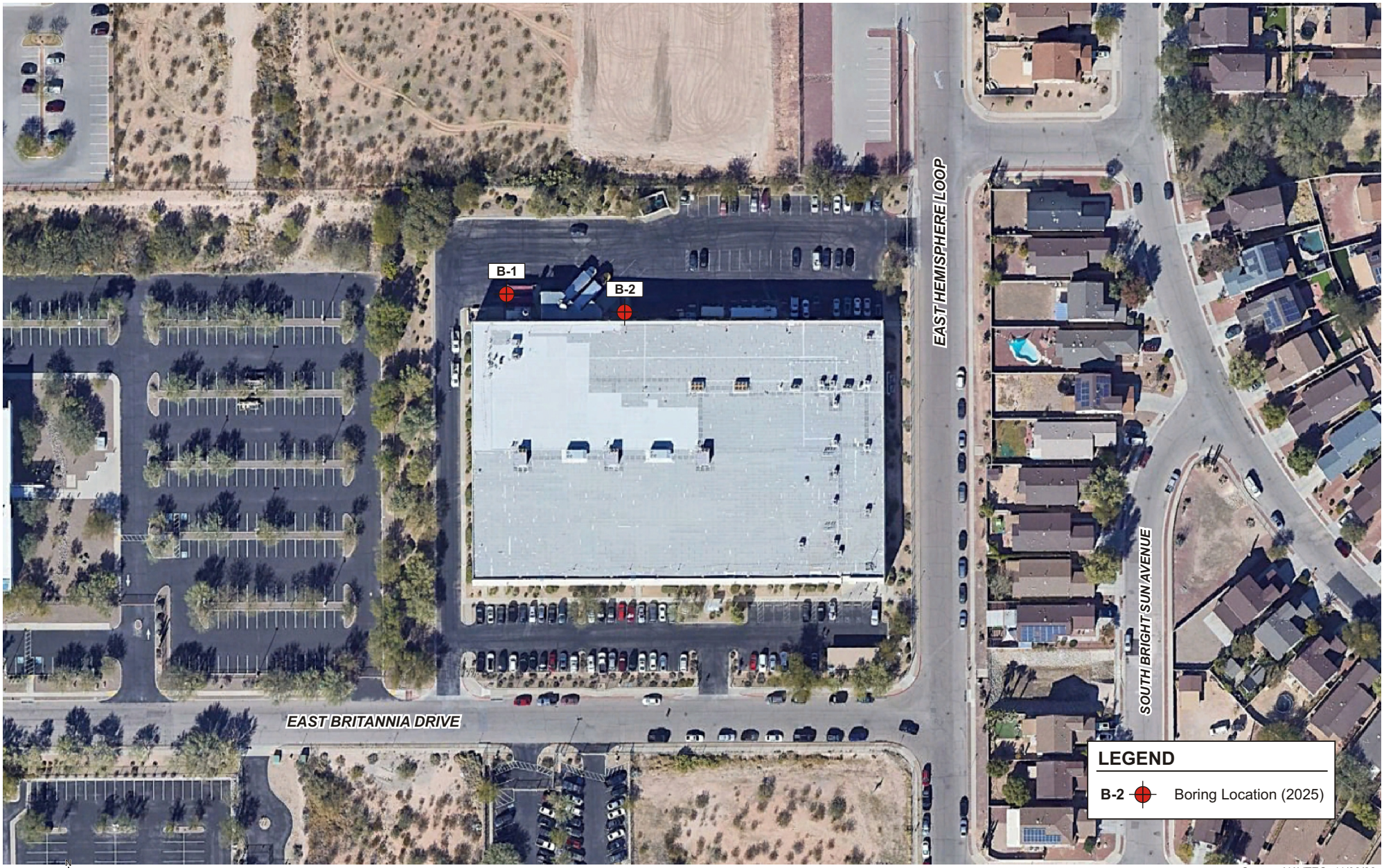
American Concrete Institute, Guidelines for Concrete Floor and Slab Construction (ACI 302.1R).

American Concrete Institute, Guidelines for Residential Cast-in-Place Concrete Construction (ACI 332R).

Ninyo & Moore, In-house proprietary information.

Pima Association of Governments (PAG) Standard Specifications for Public Improvements.

FIGURE



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NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

FIGURE 1

2025 BORING LOCATIONS

VA CONSOLIDATED MAIL OUTPATIENT PHARMACY
TUCSON, ARIZONA

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APPENDIX A

Boring Logs

APPENDIX A

BORING LOGS

Field Procedure for the Collection of Disturbed Samples
Disturbed soil samples were obtained in the field using the following methods.

Bulk Samples
Bulk samples of representative earth materials were obtained from the exploratory borings. The samples were bagged and transported to the laboratory for testing.

The Standard Penetration Test (SPT) Sampler
Disturbed drive samples of earth materials were obtained by means of a Standard Penetration Test sampler. The sampler is composed of a split barrel with an external diameter of 2 inches and an unlined internal diameter of 1-3/8 inches. The sampler was driven into the ground 12 to 18 inches with a 140-pound hammer falling freely from a height of 30 inches in general accordance with ASTM D 1586. The blow counts were recorded for every 6 inches of penetration; the blow counts reported on the log are those for the last 12 inches of penetration. Soil samples were observed and removed from the sampler, bagged, sealed and transported to the laboratory for testing.

Field Procedure for the Collection of Relatively Undisturbed Samples
Relatively undisturbed soil samples were obtained in the field using the following methods.

The Modified Split-Barrel Drive Sampler
The sampler, with an external diameter of 3.0 inches, was lined with 1-inch long, thin brass rings with inside diameters of approximately 2.4 inches. The sample barrel was driven into the ground with the weight of a hammer or the Kelly bar of the drill rig in general accordance with ASTM D 3550. The driving weight was permitted to fall freely. The approximate length of the fall, the weight of the hammer or bar, and the number of blows per foot of driving are presented on the boring log as an index to the relative resistance of the materials sampled. The samples were removed from the sample barrel in the brass rings, sealed, and transported to the laboratory for testing.

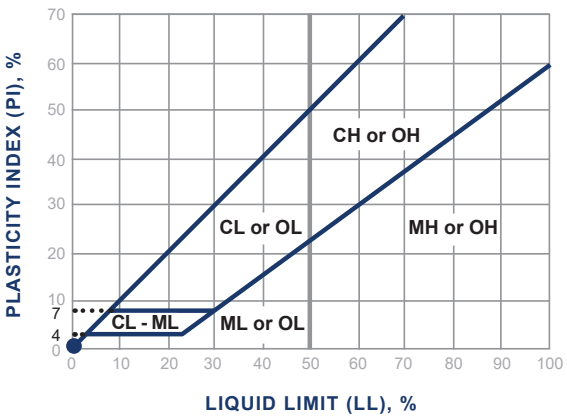
Soil Classification Chart Per ASTM D 2488

Primary Divisions			Secondary Divisions: Group Symbol	Secondary Divisions: Group Name
COARSE-GRAINED SOILS more than 50% retained on No. 200 sieve	**GRAVEL** more than 50% of coarse fraction retained on No. 4 sieve	CLEAN GRAVEL less than 5% fines	GW	well-graded GRAVEL
			GP	poorly graded GRAVEL
		GRAVEL with DUAL CLASSIFICATIONS 5% to 12% fines	GW-GM	well-graded GRAVEL with silt
			GP-GM	poorly graded GRAVEL with silt
			GW-GC	well-graded GRAVEL with clay
			GP-GC	poorly graded GRAVEL with clay
		GRAVEL with FINES more than 12% fines	GM	silty GRAVEL
			GC	clayey GRAVEL
			GC-GM	silty, clayey GRAVEL
	SAND 50% or more of coarse fraction passes No. 4 sieve	CLEAN SAND less than 5% fines	SW	well-graded SAND
			SP	poorly graded SAND
		SAND with DUAL CLASSIFICATIONS 5% to 12% fines	SW-SM	well-graded SAND with silt
			SP-SM	poorly graded SAND with silt
			SW-SC	well-graded SAND with clay
			SP-SC	poorly graded SAND with clay
		SAND with FINES more than 12% fines	SM	silty SAND
			SC	clayey SAND
			SC-SM	silty, clayey SAND
FINE-GRAINED SOILS 50% or more passes No. 200 sieve	**SILT and CLAY** liquid limit less than 50%	INORGANIC	CL	lean CLAY
			ML	SILT
			CL-ML	silty CLAY
		ORGANIC	OL (PI > 4)	organic CLAY
			OL (PI < 4)	organic SILT
	SILT and CLAY liquid limit 50% or more	INORGANIC	CH	fat CLAY
			MH	elastic SILT
		ORGANIC	OH (plots on or above "A"-line)	organic CLAY
			OH (plots below "A"-line)	organic SILT
	Highly Organic Soils		PT	Peat

Grain Size

Description		Sieve Size	Grain Size	Approximate Size
Boulders		> 12"	> 12"	Larger than basketball-sized
Cobbles		3 - 12"	3 - 12"	Fist-sized to basketball-sized
Gravel	Coarse	3/4 - 3"	3/4 - 3"	Thumb-sized to fist-sized
	Fine	#4 - 3/4"	0.19 - 0.75"	Pea-sized to thumb-sized
Sand	Coarse	#10 - #4	0.079 - 0.19"	Rock-salt-sized to pea-sized
	Medium	#40 - #10	0.017 - 0.079"	Sugar-sized to rock-salt-sized
	Fine	#200 - #40	0.0029 - 0.017"	Flour-sized to sugar-sized
Fines		Passing #200	< 0.0029"	Flour-sized and smaller

Plasticity Chart



Apparent Density - Coarse-Grained Soil

Apparent Density	Spooling Cable or Cathead: SPT (blows/foot)	Spooling Cable or Cathead: Modified Split Barrel (blows/foot)	Automatic Trip Hammer: SPT (blows/foot)	Automatic Trip Hammer: Modified Split Barrel (blows/foot)
Very Loose	≤ 4	≤ 8	≤ 3	≤ 5
Loose	5 - 10	9 - 21	4 - 7	6 - 14
Medium Dense	11 - 30	22 - 63	8 - 20	15 - 42
Dense	31 - 50	64 - 105	21 - 33	43 - 70
Very Dense	> 50	> 105	> 33	> 70

Consistency - Fine-Grained Soil

Consis-tency	Spooling Cable or Cathead: SPT (blows/foot)	Spooling Cable or Cathead: Modified Split Barrel (blows/foot)	Automatic Trip Hammer: SPT (blows/foot)	Automatic Trip Hammer: Modified Split Barrel (blows/foot)
Very Soft	< 2	< 3	< 1	< 2
Soft	2 - 4	3 - 5	1 - 3	2 - 3
Firm	5 - 8	6 - 10	4 - 5	4 - 6
Stiff	9 - 15	11 - 20	6 - 10	7 - 13
Very Stiff	16 - 30	21 - 39	11 - 20	14 - 26
Hard	> 30	> 39	> 20	> 26

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USCS METHOD OF SOIL CLASSIFICATION

BORING LOG EXPLANATION SHEET

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	
0	■							Bulk sample.
		■						Modified split-barrel drive sampler.
		☒						No recovery with modified split-barrel drive sampler.
		▬						Sample retained by others.
		◤						Standard Penetration Test (SPT).
5		◺						No recovery with a SPT.
		▯	XX/XX					Shelby tube sample. Distance pushed in inches/length of sample recovered in inches.
		◺						No recovery with Shelby tube sampler.
		▥						Continuous Push Sample.
				♀				Seepage.
10				▽				Groundwater encountered during drilling.
				▼				Groundwater measured after drilling.
						▦	SM	MAJOR MATERIAL TYPE (SOIL): Solid line denotes unit change.
						▨	CL	Dashed line denotes material change.
15								Attitudes: Strike/Dip b: Bedding c: Contact j: Joint f: Fracture F: Fault cs: Clay Seam s: Shear bss: Basal Slide Surface sf: Shear Fracture sz: Shear Zone sbs: Shear Bedding Surface
20								The total depth line is a solid line that is drawn at the bottom of the boring.

DATE DRILLED 3/27/25 BORING NO. B-1

GROUND ELEVATION 2,624' ± (MSL) SHEET 1 OF 2

METHOD OF DRILLING CME-75, 8" Diameter Hollow-Stem Auger (GSI)

DRIVE WEIGHT 140 lbs (Automatic Trip Hammer) DROP 30"

SAMPLED BY ACM LOGGED BY ACM REVIEWED BY

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							ASPHALT CONCRETE: Approximately 3 inches thick.
							AGGREGATE BASE: Approximately 2 inches thick.
						CH	ALLUVIUM: Brown, dry, very stiff, sandy fat CLAY; trace gravel.
		11					
		27	12.5	82.5			Hard.
5							
		28					Weakly cemented.
		92/7"	12.7	87.9		SM	Brown, dry, very dense, silty SAND.
10							
		42				SC	Brown, dry, very dense, clayey SAND.
15							
		76					
20							

FIGURE A- 1

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VA CONSALIDATED MAIL OUTPATIENT PHARMACY
TUCSON, ARIZONA

DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20								Total Depth = 20 feet. Groundwater not encountered during drilling. Backfilled with soil on 3/27/25 shortly after completion of drilling. <u>Notes</u>: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.
25								
30								
35								
40								

DATE DRILLED 3/27/25 BORING NO. B-1

GROUND ELEVATION 2,624' ± (MSL) SHEET 2 OF 2

METHOD OF DRILLING CME-75, 8" Diameter Hollow-Stem Auger (GSI)

DRIVE WEIGHT 140 lbs (Automatic Trip Hammer) DROP 30"

SAMPLED BY ACM LOGGED BY ACM REVIEWED BY

DATE DRILLED 3/27/25 BORING NO. B-2

GROUND ELEVATION 2,624' ± (MSL) SHEET 1 OF 2

METHOD OF DRILLING CME-75, 8" Diameter Hollow-Stem Auger (GSI)

DRIVE WEIGHT 140 lbs (Automatic Trip Hammer) DROP 30"

SAMPLED BY ACM LOGGED BY ACM REVIEWED BY

DEPTH (feet)	SAMPLES (Bulk / Driven)	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
0							ASPHALT CONCRETE: Approximately 3 inches thick.
							AGGREGATE BASE: Approximately 1.5 inches thick.
						SC	ALLUVIUM: Brown, dry, loose, clayey SAND; with gravel.
		10	12.2	85.8			
		25					Dense.
5							
		30					Medium dense.
		15					
10							
		64/8"					Very dense, weakly cemented.
15							
		33					
20							

FIGURE A- 3

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VA CONSALIDATED MAIL OUTPATIENT PHARMACY
TUCSON, ARIZONA

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DEPTH (feet)	SAMPLES Bulk	SAMPLES Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DESCRIPTION/INTERPRETATION
20								Total Depth = 20 feet. Groundwater not encountered during drilling. Backfilled with soil on 3/27/25 shortly after completion of drilling. <u>Notes</u>: Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report. The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.
25								
30								
35								
40								

DATE DRILLED 3/27/25 BORING NO. B-2

GROUND ELEVATION 2,624' ± (MSL) SHEET 2 OF 2

METHOD OF DRILLING CME-75, 8" Diameter Hollow-Stem Auger (GSI)

DRIVE WEIGHT 140 lbs (Automatic Trip Hammer) DROP 30"

SAMPLED BY ACM LOGGED BY ACM REVIEWED BY

APPENDIX B

Laboratory Testing

APPENDIX B

LABORATORY TESTING

Classification
Soils were visually and texturally classified in accordance with the Unified Soil Classification System (USCS) in general accordance with ASTM D 2488. Soil classifications are indicated on the log of the exploratory borings in Appendix A.

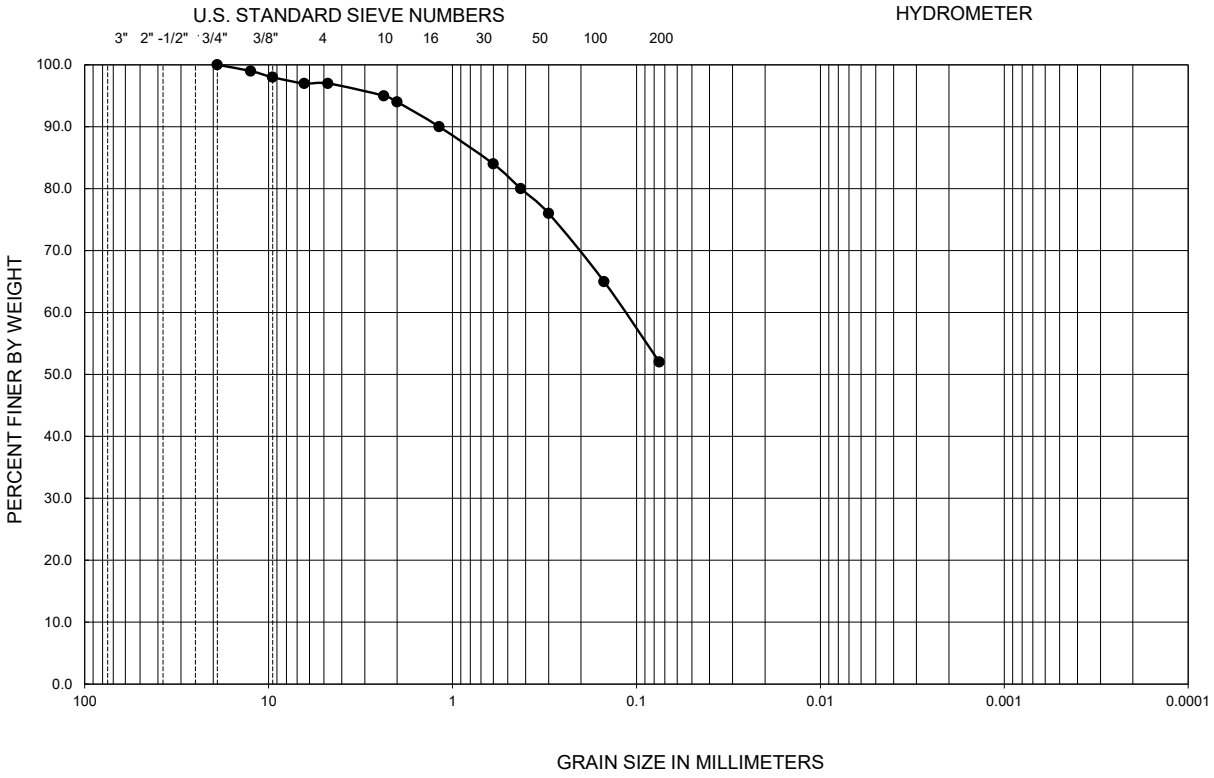
In-Place Moisture and Density Tests
The moisture content and dry density of relatively undisturbed samples obtained from the exploratory borings were evaluated in general accordance with ASTM D 2937. The test results are presented on the logs of the exploratory borings in Appendix A.

Gradation Analysis
Gradation analysis test was performed on selected representative soil samples in general accordance with ASTM D 422. The grain-size distribution curves are shown on Figures B-1 and B-2. These test results were utilized in evaluating the soil classifications in accordance with the USCS.

Atterberg Limits
Tests were performed on a selected representative fine-grained soil sample to evaluate the liquid limit, plastic limit, and plasticity index in general accordance with ASTM D 4318. These test results were utilized to evaluate the soil classification in accordance with the USCS. The test results and classifications are shown on Figure B-3.

Soil Corrosivity Tests
Soil pH and resistivity tests were performed on a representative sample in general accordance with Arizona Test Method 236c. The soluble sulfate and chloride content of the sample were evaluated in general accordance with Arizona Test Method 733 and Arizona Test Method 736, respectively. The test results are presented on Figure B-4.

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (percent)	USCS
●	B-1	8.5-9.5	50	27	23	--	--	0.11	--	--	52.0	CH

PERFORMED IN GENERAL ACCORDANCE WITH ASTM C136 / D422

FIGURE B-1

GRADATION TEST RESULTS

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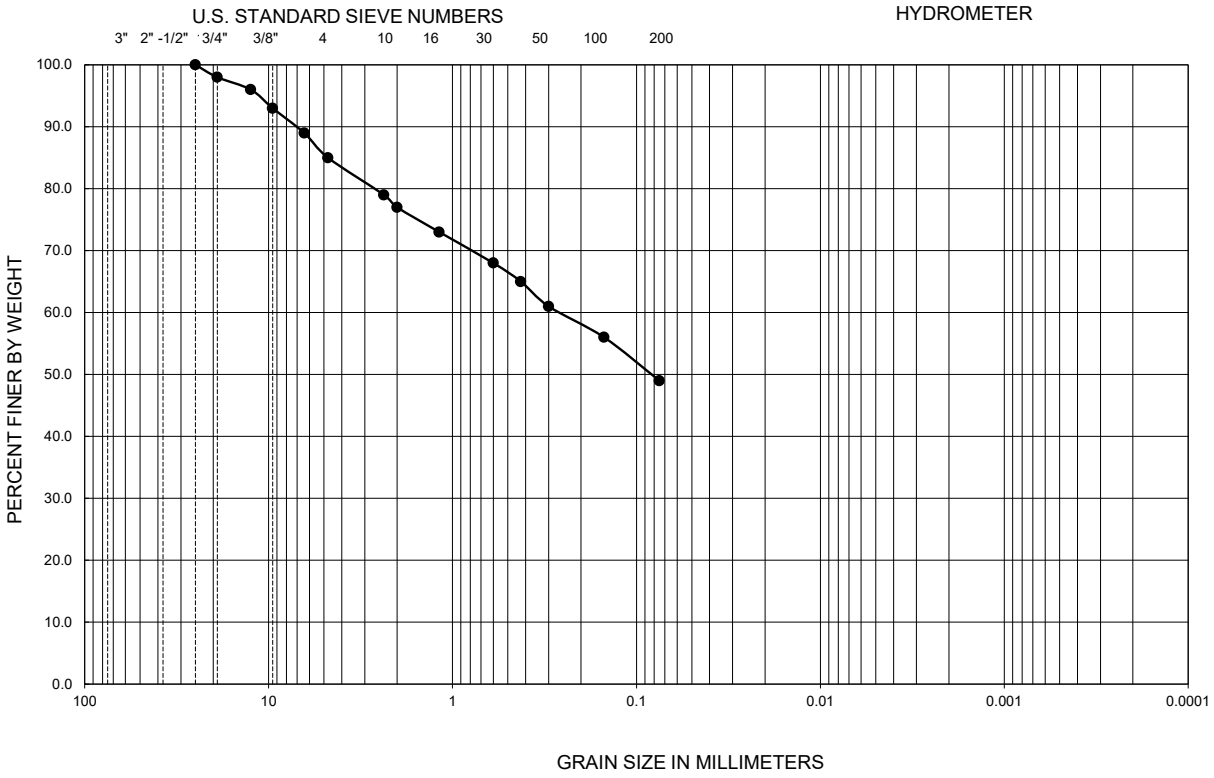
GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D_{10}	D_{30}	D_{60}	C_u	C_c	Passing No. 200 (percent)	USCS
●	B-2	0.5-5.0	59	28	31	--	--	0.26	--	--	49.0	SC

PERFORMED IN GENERAL ACCORDANCE WITH ASTM C136 / D422

FIGURE B-2

GRADATION TEST RESULTS

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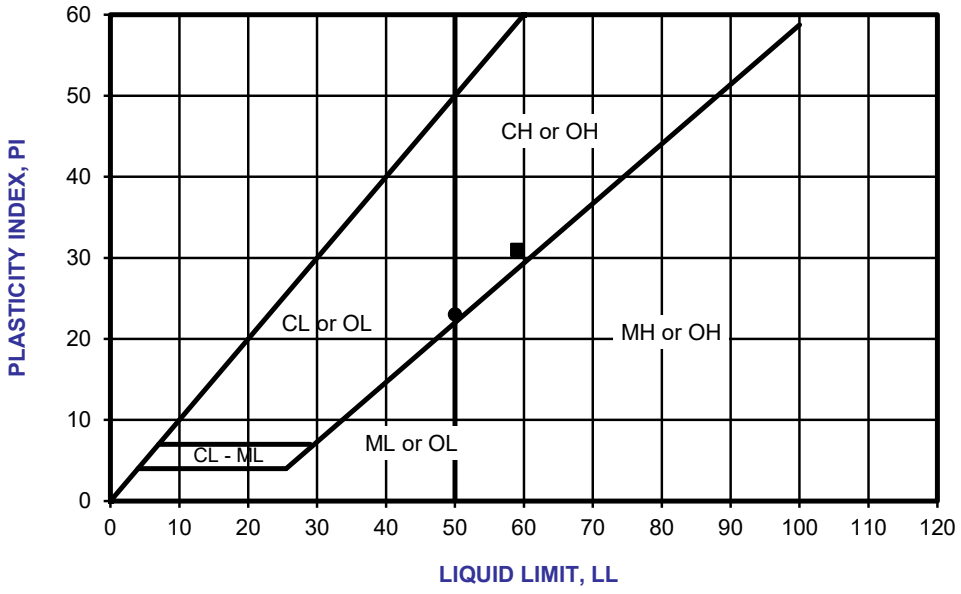
SYMBOL	LOCATION	DEPTH (ft)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	USCS CLASSIFICATION (Fraction Finer Than No. 40 Sieve)	USCS
●	B-1	8.5-9.5	50	27	23	CH	CH
■	B-2	0.5-5.0	59	28	31	CH	SC



PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4318

FIGURE B-3

ATTERBERG LIMITS TEST RESULTS

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SAMPLE LOCATION	SAMPLE DEPTH (ft)	pH [1]	RESISTIVITY [1] (Ohm-cm)	SULFATE CONTENT [2] (ppm)	(%)	CHLORIDE CONTENT [3] (ppm)
B-1	0.4-5.0	8.2	4,020	50	0.005	31

[1] PERFORMED IN GENERAL ACCORDANCE WITH ARIZONA TEST METHOD 236c
[2] PERFORMED IN GENERAL ACCORDANCE WITH ARIZONA TEST METHOD 733
[3] PERFORMED IN GENERAL ACCORDANCE WITH ARIZONA TEST METHOD 736

FIGURE B-4

CORROSIVITY TEST RESULTS

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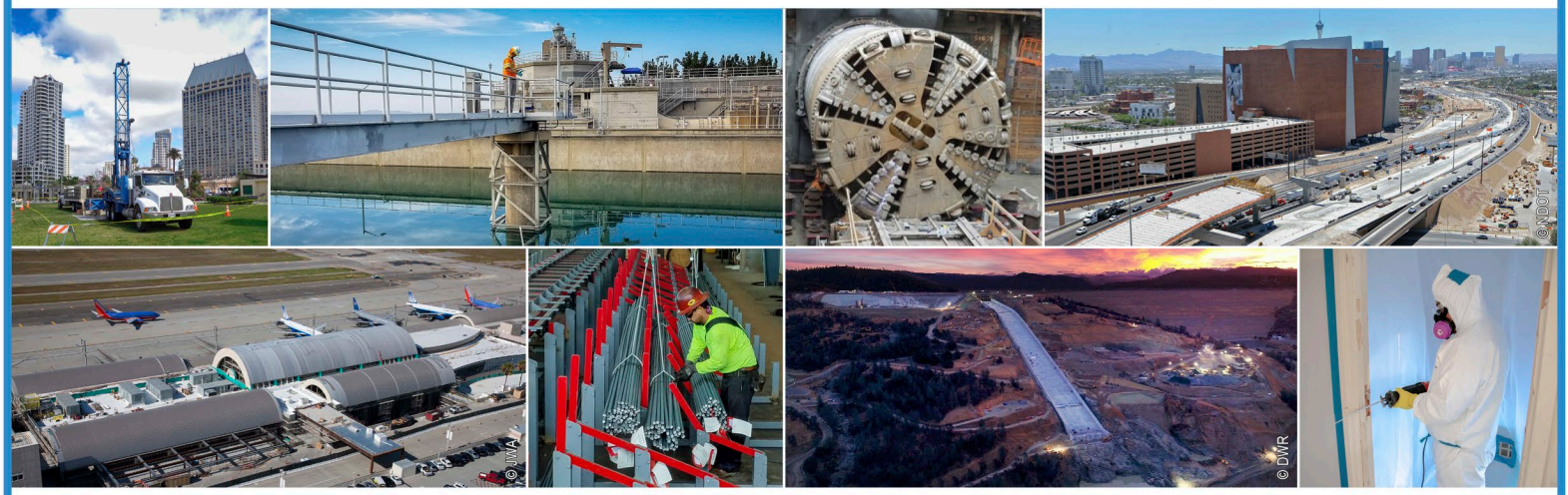

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