Confidential

Navajo Tribal Utility Authority

HOUCK WELL PUMPHOUSE

GEOTECHNICAL ENGINEERING REPORT

10/07/2025

Project No.: US0045322.1649

October 07, 2025

Confidential

Navajo Tribal Utility Authority
North Navajo Route 12
Houck, Arizona

Attention: **Ms. Corey Higdon**

Re: **Geotechnical Engineering Report**
Houck Well Pumphouse
Houck, Arizona

Dear Ms. Higdon,

WSP USA Earth and Environment (WSP) is pleased to submit this report, describing our geotechnical engineering study of the above reference project. The results of our field investigation and laboratory testing programs along with geotechnical engineering recommendations for the project are presented in this report.

Should you have any questions concerning the recommendations presented in this report, please do not hesitate in contacting us.

Sincerely,

WSP USA

Rashidatu Ossai, Ph.D.
Consultant, Geotechnical Engineering

Reviewed by:

Bardia Tabiatnejad, Ph.D.
Senior Consultant Geotechnical

Geotechnical Engineering Report

Houck Well Pumphouse
WSP Project # US0045322.1649

Prepared for:

Navajo Tribal Utility Authority

Prepared by:

WSP USA
4221 Balloon Park Rd. N.E.
Albuquerque, NM 87109

10/1/2025

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TABLES

1 INTRODUCTION

WSP performed a geotechnical engineering evaluation for a proposed pumphouse for Houck Well in Arizona. The objectives of this study were to evaluate the properties of the soils under the proposed site and provide criteria for foundation design in accordance with the Indian Health Service (IHS) standard detail (two-room precast pumphouse W-29), slab support, reuse of on-site soils as structural fill, site preparations, and other related earthwork.

The scope of work for this project included:

- field testing,
- laboratory testing,
- engineering analysis of the field test results,
- and preparation of a written report.

The conclusions and recommendations contained in this report are based on our understanding of the project and information supplied to us. Consequently, if any significant changes are made to the currently proposed project, we may need to modify our conclusions and recommendations contained herein to reflect those changes.

2 PROPOSED CONSTRUCTION

The project site is located near the intersection of Saint Anslem Road and North Frontage Road. The proposed structure is a 127 square-foot, single-story, concrete masonry unit (CMU) walled pumphouse. Table 1 shows loading condition assumptions made by WSP to support the recommendations made in this report.

Table 1: Project Details

CONDITIONS	DESCRIPTION
Site layout	See Appendix A, Figures, Site Map and Borehole Location,
Maximum wall loading[1]	2 kips per foot
Maximum allowable settlements	1 inch

Note(s):

1. If estimated loading is not correct, please notify author of this report.

Should final design details vary significantly from those outlined above, WSP's Project Manager should be notified for review and possible modification of recommendations.

3 SUBSURFACE INVESTIGATION

Our reconnaissance was conducted on September 2, 2025. A borehole was drilled to approximately 20 feet below the existing grade. A truck mounted CME-75 drill rig equipped with a 7.25-inch outer diameter (OD) hollow-stemmed auger was used. Standard penetration testing (ASTM D 1586) was performed at selected intervals in the subsurface. The soil samples were collected using split-spoon and California modified samplers. The soils were continuously examined, visually classified, and logged by WSP's field geologist. Neither bedrock, cobbles, nor water was encountered during the field investigation.

The following laboratory tests were conducted on selected soil samples:

- moisture content and in-situ density (ASTM D2216 and ASTM D7263),

- sieve analysis (ASTM D6913),
- Atterberg limits (ASTM D4318), and
- collapse potential of soils (ASTM D5333),
- specific gravity of soil solids (ASTM D854),
- sulfate and chlorides tests (AASHTO T290 and T291), and
- pH and minimum resistivity of soils (ASTM D4972 and ASTM G187)

It should be noted that the exploration performed and used for this report reveals subsurface conditions only at a discrete location of the project, and that actual conditions in other locations could vary. Furthermore, the nature and extent of these variations would not become evident until additional explorations are performed or until construction activities have begun. If significant variations are observed at that time, we may need to modify our conclusions and recommendations contained in this report to reflect the actual site conditions.

4 SITE CONDITIONS AND GEOTECHNICAL PROFILE

4.1 SITE CONDITIONS

At the time of our reconnaissance, the project area was undeveloped, with vegetation consisting of native grasses and shrubs.

4.2 GEOTECHNICAL PROFILE

The soils encountered below the proposed pumphouse were comprised of clayey and silty sands and lean clays (i.e. SC, SM, and CL).

The laboratory test results are presented in Appendix B. Table 2 summarizes test results for selected samples upon which grain-size analyses were performed. Laboratory tests revealed that some on-site soils had a high content of fines (silt and clay passing the #200 US Sieve - 75 micrometers), ranging from 46 to 59 percent. The moisture content of these soils ranged from 3.5% to 10.3%.

Table 2: Laboratory Test Results

Borehole, Depth (feet)	Soil Type (USCS Soil Type)	P.I.	Moisture Content (percent)	Grain Size Analysis		
				Gravel (percent)	Sand (percent)	Silt/Clay (percent)
B-01, 2.5	--	--	3.6	0	41	59
B-01, 15.0	CL	13	8.2	0	50	50
B-01, 20.0	SM	NP(1)	4.1	1	53	46

Note(s):

1. NP = non-plastic

Collapse/swell upon wetting tests were performed on samples from depths of 5 and 10 feet. Results are summarized in Table 3 and indicates the soil has the potential for minor collapse upon wetting. Laboratory test results are presented in Appendix B.

Table 3: Collapse/Expansion upon Wetting Test Results

Sample	Collapse/ expansion	Comment

B-01 @ 5.0 feet	-1.4%	Collapsed upon wetting
B-01 @ 10.0 feet	-1.7%	Collapsed upon wetting

Bulk samples, from a depth of 0 to 5 feet, were tested to determine the specific gravity, electrical resistivity, pH, sulfate, and chloride, of the soil. These results are summarized in Table 4. Soil in the upper 5 feet is moderately corrosive (resistivity between 2,000 and 10,000 ohms-centimeters). Laboratory test results are presented in Appendix B.

Table 4: Chemical Test Results

Borehole, Depth	Specific Gravity, G	pH	Minimum Resistivity (Ω-cm)	Sulfate Content (ppm)	Chloride Content (ppm)
B-01 @ 0 - 5.0 feet	2.6	7.8	3,192	103	14

4.3 GROUNDWATER CONDITIONS

At the time of drilling (September 2nd, 2025), groundwater was not encountered in the exploration boring. Throughout the year, groundwater levels will fluctuate in response to changing precipitation patterns, construction activities, and site use.

5 DISCUSSION & RECOMMENDATIONS

5.1 Site Preparation

The clayey material near the proposed bottom of the footing excavation is dry, and may collapse upon wetting. It should be noted that a degree of risk is involved with shallow foundations. Should a broken water line or other source of water occur, movements of slabs and lightly loaded foundations could occur. The site preparation, drainage, and moisture protection provisions presented herein are considered critical design details.

The soils encountered at the project site within the upper 10 feet are comprised of clayey sands and medium plasticity lean clay with a high percentage of silt/clay content (i.e., greater than 30 percent). The clayey materials are not recommended to be used as compacted structural fill based on their percent of silt/clay content. However, based on the N-value (blows per foot as defined by ASTM D 1586), and initial moisture content, foundations for the structures can be supported by the on-site soil with special subgrade preparation at the bottom of excavation.

Over-excavation below the bottom of footings is not required for the support of the structures at this site, however, to receive the foundation, exposed bearing surfaces should be moisture conditioned, scarified, mixed to a depth of 10 inches, and recompacted. Moisture content at time of compaction should range between optimum moisture content and 3 percent above. A density of between 95 and 97 percent of maximum dry density within the building pad should be obtained. Optimum moisture content and maximum dry density for the exposed native soils should be determined in accordance with ASTM D1557. Any soft or pumping soil observed within the foundation subgrade should be dried and compacted to the specified moisture content and density.

Erosion Control Measures: Prior to disturbing the ground surface with earthwork, temporary erosion and sediment controls should be constructed. The project civil engineer should prepare plans and specifications to

prevent erosion and runoff during the construction phase. Design plans and specifications represent the minimum requirements and additional measures may be needed throughout the construction period that are specific to the activities and weather.

Clearing and Stripping: After temporary erosion and sediment controls are in place, construction areas should be cleared and stripped of all vegetation, topsoil, and debris. If the stripping is performed during wet weather, a greater depth might be necessary to remove disturbed, wet soils; therefore, stripping is best performed during a period of dry weather.

5.2 Excavation

Soils encountered on this site can be excavated with conventional earth moving equipment. Our borehole did not disclose rubble, cobbles, or boulders.

Temporary open cuts and utility trenches can be made where adequate lateral space is available, but all excavation sidewalls should be adequately sloped back to minimize sloughing and erosion. All temporary sloping and shoring is required to adhere to the Occupational Safety and Health Administration (OSHA) requirements. Table 5 presents our interpretations of soil types based on our explorations, and corresponding OSHA cut slope inclinations when workers are below. In all cases, however, the appropriate angle will be dictated by actual soil and groundwater conditions exposed in the excavation.

Table 5: Estimated Soil Types and Recommended Slope Inclination for Temporary Excavations

Soil Type	Typical Depth Interval (Feet)	OSHA Soil Type	Maximum Inclination
Medium dense clayey and silty sand, very stiff to hard lean clay	0 to 20	C	1.5H:1V

Abbreviations
H = horizontal
OSHA = Occupational Safety and Health Administration
V = vertical

Note(s):
1. Slopes are recommended for temporary cuts to depths of up to 20 feet.

During construction, the Contractor should realize that temporary cuts in loose materials may result in sloughing and raveling, and the Contractor should be prepared to flatten slopes as needed.

Safety Considerations: The stability of temporary excavation slopes is a function of many factors, including soil type, soil density, slope inclination, slope height, the presence of groundwater, and the duration of exposure. Generally, the likelihood of slope failure increases as the cut is deepened and as the duration of exposure increases. For this reason, we recommend that during construction the contractor maintain adequate slopes and/or setbacks. Temporary slope safety should remain the responsibility of the contractor, who is continually present at the site and is able to monitor the performance of the excavation and modify his activities to reflect varying conditions. In all cases, cut-slope inclinations should conform to applicable governmental safety guidelines.

Slope Protection: Regardless of inclination, temporary slopes should be protected from surface-runoff erosion. Typically, this can be accomplished by means of berms or swales located along the top of the slope, and possibly by means of plastic tarpaulins placed over the slope.

5.3 Foundations

We recommend the use of a spread or continuous type (i.e. strip) footings bearing at 2.5 feet, or deeper, below finished grade for frost protection, in conjunction with the recommended site preparation and moisture protection provisions (Section 5.5), for support of the structure. An allowable soil bearing pressure of 2,000 pounds per square foot (psf) is recommended for the design of spread or strip footings. The bearing pressure recommended above applies to dead load plus realistic live loads (i.e., service loads).

Based on the bearing resistance, the total vertical movements (i.e., settlement) of the proposed foundations will be within one (1) inch. Differential movements are estimated to be 50% of maximum vertical movements. Significant moisture increases could lead to additional movement in some areas of the site. To avoid wetting of foundation support soils, site drainage should be maintained as recommended in Section 5.5.

5.4 Slab-on-Grade Floors

Soil-supported slab-on-grade floors can be used if the excavation and fill is properly prepared in accordance with Section 5.6. To reduce differential settlement and cracking, and improve construction conditions, we recommend a subbase of imported sand and gravel be used. The subbase should be at least 6 inches thick and meet the following grading requirements as determined in accordance with ASTM C136 or ASTM D6913.

Table 6: Imported structural subbase fill grain size requirements

Sieve Size (square openings)	Percent Passing by Dry Weight
1 inch	100
¾ inch	85-100
No. 4	45-95
No. 200	0-8

Soil-supported slab-on-grade floors can deflect downward when vertical loads are applied, due to elastic compression of the subgrade. A subgrade reaction modulus of 175 pounds per cubic inch (pci) can be used to estimate such deflections.

5.5 Drainage Systems

The structure should have a permanent drainage system. Roof and surface water runoff should not be allowed to flow into the foundation drainage systems. Instead, these sources should flow into separate tight-line pipes and routed away from the structure. The final site grades should be sloped downward, away from the structure, so that runoff water will flow by gravity to suitable collection points, rather than pond near the structure. Alternatively, the area surrounding the structure could be capped with concrete, asphalt, or low-permeability (clayey) soils to minimize surface-water infiltration next to the footings.

Construction Considerations: Positive site drainage should be provided during construction and maintained thereafter. Where pavements or sidewalks do not immediately adjoin the structure, the ground surface should be sloped away from the structure perimeter in a manner to allow flow along the drainage lines at a minimum grade of 5 percent to points at least 15 feet away. A minimum grade of at least 2 percent should be provided from these points to streets or natural water courses. In no case should long-term ponding of water be allowed around the perimeter of the structure.

5.6 Structural Fill

Structural fill refers to any materials used to support concrete pads, foundations, and/or interior slab-on-grade floors.

Materials: Excavation of the near surface clay is not required. Moisture protection of the dry, on-site soil, is important to avoid loss of soil strength and increase of settlement.

Fill Placement: If structural fill is required, it should be placed in horizontal lifts not exceeding 8 inches in loose thickness, and each lift should be thoroughly compacted with a mechanical vibratory compactor. Other procedures may be appropriate for some materials.

Compaction Criteria: The structural fill shall be moisture conditioned and compacted. Moisture content, at the time of compaction, shall be within ±2 percent of optimum moisture content. A density of not less than 95 percent of maximum dry density within the building pad shall be obtained. Fill outside the building pad shall be compacted to 90 percent of maximum dry density. Optimum moisture content and maximum dry density for the imported structural fill shall be determined in accordance with ASTM D1557.

Subgrade Verification and Compaction Testing: Regardless of material or location, all structural fill should be placed over dense, unyielding subgrades. The condition of all subgrades should be verified by a WSP representative before filling or construction begins. Compaction of fill should be verified by means of in-place density tests, performed during fill placement, so the adequacy of the soil compaction efforts may be evaluated as earthwork progresses.

Soil Moisture Considerations: The suitability of soils used for structural fill depends primarily on their grain-size distribution and moisture content when they are placed. As the "fines" content (the soil fraction passing the U.S. No. 200 sieve) increases, soils become more sensitive to small changes in moisture content.

Import Fill Considerations: If an imported fill material is required, we recommend using a well-graded sand and gravel meeting the following grading requirements as determined in accordance with ASTM C136.

Table 7: Imported Structural Fill Grain Size Requirements

Sieve Size (square openings)	Percent Passing by Dry Weight
1 inch	100
¾ inch	85 - 100
No. 4	45 – 95
No. 200	0 - 30

The plasticity index of the material, as determined in accordance with ASTM D 4318, shall not exceed 12. The structural fill material shall be free from roots, grass, other vegetable matter, clay lumps, rocks larger than 3 inches in any dimension, or other deleterious materials.

5.7 Construction Observations & Testing

Recommendations presented in previous sections of this report are predicated on the fact that there will be continuous observation and testing by the geotechnical engineer's representative during earthwork operations. Verification of recommended excavation and required degree of compaction should be performed in accordance with the specifications outlined in this report.

6 CLOSURE

The conclusions and recommendations presented in this report are based, in part, on the explorations WSP performed and used for this study; therefore, if variations in the subgrade conditions are observed, we may need to modify this report to reflect those changes. WSP is available to provide geotechnical engineering throughout the design process and to perform monitoring services throughout construction.

A

FIELD EXPLORATION PROCEDURES, SITE LOCATION AND EXPLORATION PLAN, BORING LOGS

Appendix A – Field Exploration Procedures and Logs

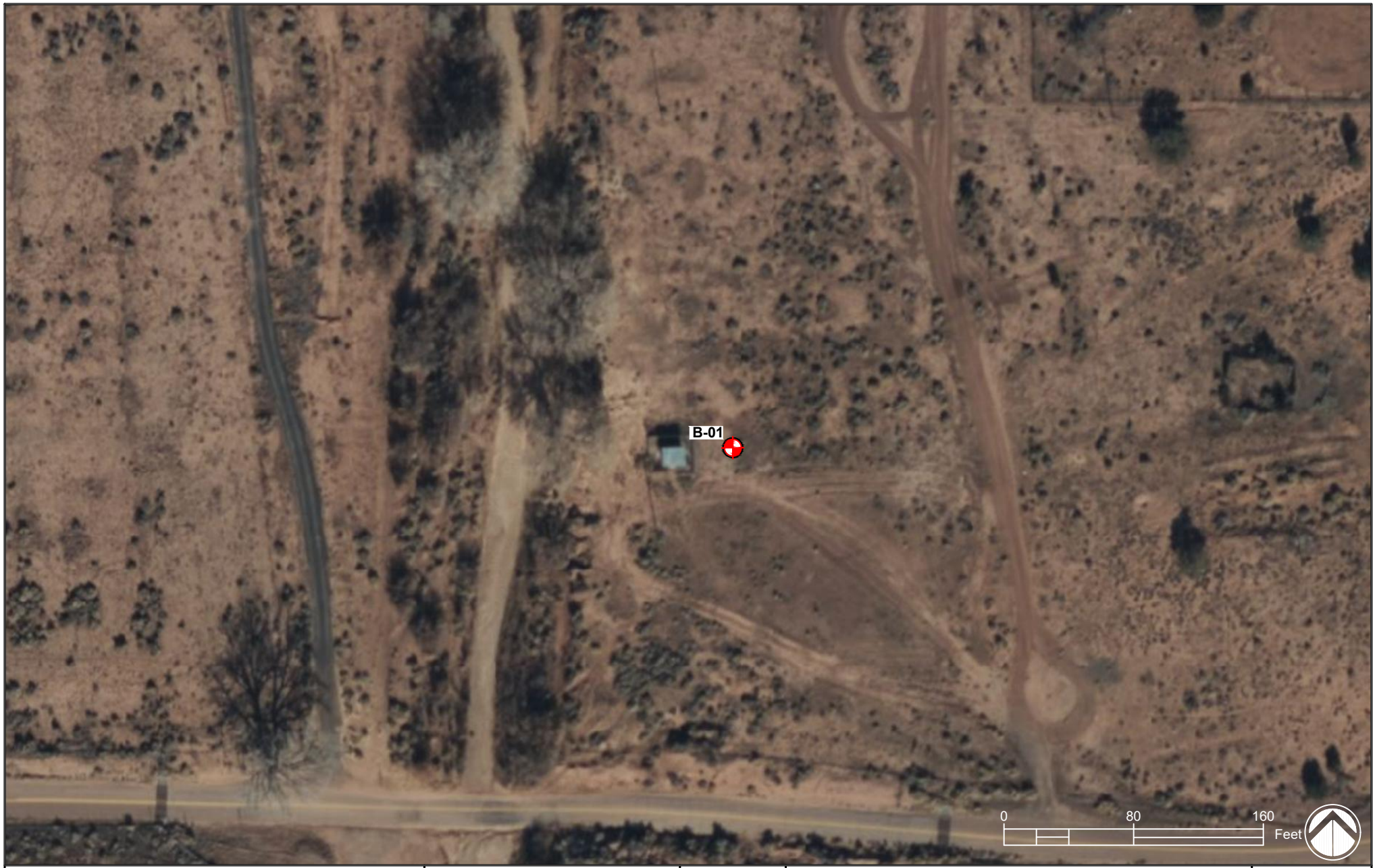
The following paragraphs describe the procedures used for field explorations and field tests that WSP conducted for this project. Descriptive logs of our explorations are enclosed in this appendix.

Auger boring procedures

Exploratory borings were advanced with a hollow-stem auger using a truck-mounted drill rig operated by an independent drilling firm working under subcontract to WSP. A geologist from WSP continuously observed the borings, logged the subsurface conditions, and collected representative soil samples. All samples were stored in watertight containers and later transported to the laboratory for further visual examination and testing. After each boring was completed, the borehole was backfilled soil cuttings.

Throughout the drilling operation, soil samples were obtained at 2.5- or 5-foot depth intervals by means of the Standard Penetration Test (SPT) per ASTM D-1586. This testing and sampling procedure consists of driving a standard 2-inch-diameter steel split-spoon sampler 18 inches into the soil with a 140-pound hammer free-falling 30 inches. The number of blows required to drive the sampler through each 6-inch interval was counted, and the total number of blows struck during the final 12 inches was recorded as the Standard Penetration Resistance, or "SPT blow count." If a total of 50 blows were struck within any 6-inch interval, the driving was stopped and the blow count was recorded as 50 blows for the actual penetration distance. The resulting Standard Penetration Resistance values indicate the relative density of granular soils and the relative consistency of cohesive soils. "Undistrubed" samples of firmer soils are often obtained with 3-inch O.D. samplers lined with 2.42-inch I.D. brass rings with the same driving energy and recording of blows in 6-inch increments. However in stratified soils, driving resistance is sometimes recorded in 2 or 3-in increments so that soil changes and presence of scattered gravel or cemented layers can be readily detected and realistic penetration values obtained for consideration in design. Taking larger bulk samples from auger cuttings is also necessary for testing.

The enclosed Boring Logs describe the vertical sequence of soils and materials encountered in each boring, based primarily on field classifications and supported by subsequent laboratory examination and testing. Where a soil contact was observed to be gradational, boring logs indicate the average contact depth. Where a soil type changed between sample intervals, we inferred the contact depth. The boring logs also graphically indicate the blow count, sample type, sample number, and approximate depth of each soil sample obtained from the borings, as well as any laboratory tests performed on these soil samples. If any groundwater was encountered in a borehole, the approximate groundwater depth is depicted on the boring log. Groundwater depth estimates are typically based on the moisture content of soil samples, the wetted height on the drilling rods, and the water level measured in the borehole after the auger has been extracted.



CLIENT:
Navajo Tribal Utility Authority (NTUA)

Global Inc.
4221 Balloon Park Rd. N.E.
Albuquerque, NM 87109

LEGEND

B-01 Sample Number and Approximate Location

DWN BY:	JA
CHK'D BY:	RO
DATUM:	NAD83
PROJECTION:	N/A
SCALE:	AS SHOWN

PROJECT:
Houck Well Pumphouse
Houck, Arizona

TITLE:
Site and Exploration Plan - Houck Well Pumphouse

REV. NO.:	
DATE:	09/30/2025
PROJECT NO:	US0045322.1649
CONTRACT NO:	N/A
FIGURE NO:	1

C:\Users\US\A713657\Downloads\Site and Exploration Plan – US0045322.1649 Houck Well Pumphouse.dwg

RECORD OF BOREHOLE: B01

CLIENT:	Navajo Tribal Utility Authority	DATE:	September 02, 2025	ELEVATION:	Data Not Available
PROJECT:	Houck Well			COORDINATES:	Lat: 35.283952° Long: -109.215175°
PROJECT NO:	US0045322.1649	INCLINATION:	90.0°	COORD SYS:	Geographical Coordinates
LOCATION:	Houck, AZ	CONTRACTOR:	GEOMAT INC.	HORZ DATUM:	NAD83
NOTES:	DRILLER: Jesse H.			HOLE LOC:	East side of pumphouse

DEPTH (ft)	DRILL RIG	DRILL METHOD	MATERIAL PROFILE: DESCRIPTION	USCS	STRATA PLOT	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	REC %	BLOWS	N-VALUE	GROUNDWATER OBSERVATIONS	ADDITIONAL OBSERVATIONS
0	CME 75	Hollow Stem Auger	(SC) Clayey sand, mostly fine SAND, little low plasticity fines; reddish brown, weak HCL reaction; dry, uncemented.	SC		0.0		AS					0.00 ft: Moisture (%): 3.5
2.5			(SC) Clayey sand, mostly fine SAND, little low plasticity fines; reddish brown, weak HCL reaction; dry, stiff, uncemented.			2.5	01	SS		3-6-6	12		2.50 ft: Moisture (%): 3.6
5.0			(CL) Sandy lean clay, mostly medium plasticity FINES, mostly SAND; dark reddish brown, no odor, moderate cementation; dry, slightly striated, very stiff.	CL		5.0	02	MC		9-20	29		5.00 ft: Moisture (%): 6.2, Dry Density (pcf): 115.7
7.5			(CL) Lean clay, mostly medium plasticity FINES, trace sand; dark reddish brown, blocky, strong cementation, weak HCL reaction; dry, slightly striated, hard.			7.5	03	SS		8-15-16	31		7.50 ft: Moisture (%): 10.3
10.0			(CL) Sandy lean clay, mostly medium plasticity FINES, mostly SAND; dark reddish brown, blocky, strong cementation, weak HCL reaction; dry, slightly striated, stiff, stringers of caliche.			10.0	04	MC		9-14	23		10.00 ft: Moisture (%): 7.0
15.0			(CL) Sandy lean clay, mostly medium plasticity FINES, mostly SAND; dark reddish brown, slickensided, no odor, strong cementation, weak HCL reaction; moist, very stiff.			15.0	05	SS		8-16-17	33		15.00 ft: Moisture (%): 8.2
20.0			(SM) Silty sand, mostly fine subrounded SAND, little non plastic fines; reddish brown; moist, compact, uncemented.	SM		20.0	06	SS		3-5-7	12		20.00 ft: Moisture (%): 4.1
			End of hole at 21.50 ft. Auger ended at 20 feet. Sampling ended at 21.5 feet.										

HAMMER TYPE:

SS: Standard Penetration Test
MC: Modified California Sampler
AS: Auger Sample

REV: 1

LOGGED: Antionette Jim DATE: Sep 02, 2025
CHECKED: DATE:

B

LAB PROCEDURES & RESULTS

Appendix B – Laboratory Testing Procedures and Results

This appendix describes procedures associated with the laboratory tests WSP assigned for this project. Geotechnical laboratory testing was performed by a local, accredited geotechnical testing laboratory, subcontracted to WSP. Results of certain laboratory tests are enclosed in this appendix.

Visual Classification Procedures

Visual soil classifications were conducted on all samples in the field and on selected samples in the laboratory. All soils were classified in general accordance with the Unified Soil Classification System, which includes color, relative moisture content, primary soil type (based on grain size), and any accessory soil types. The resulting soil classifications are presented on the exploration logs contained in Appendix A.

Moisture Content Determination Procedures

Moisture content determinations were performed on representative samples to aid in identification and correlation of soil types. All determinations were made in general accordance with ASTM D-2216. The results of these tests are shown on the exploration logs contained in Appendix A.

Grain-size Analysis Procedures

A grain-size analysis indicates the range of soil particle diameters included in a particular sample. Grain-size analyses were performed on representative samples in general accordance with ASTM D-422. The results of these tests are presented on the enclosed grain-size distribution graphs and were used in soil classifications shown on the exploration logs contained in Appendix A.

Client: Navajo Tribal Utility Authority
P.O. Box 170
Ft. Defiance, AZ 86504-

Attn: Dave Shoultz

Project Name: NTUA Houck Well #4 Pumphouse

Houck, AZ

Project Manager: Jeffrey Samson

Report Date: September 19, 2025

Project #: US0045322.1649
Report #: 2645
Work Order #: 1
Sampled By: Toni Jim
Date Sampled: 9/2/2025

SOILS / AGGREGATES

MOISTURE CONTENT OF SOIL (ASTM D2216-19) AND IN-SITU DENSITY

Lab #	Color & Type of Material	Sample Source	Test Method	Oven Temp. (C)	Mass less than Min Req.	Material Type *	Moisture (%)	Dry Density (pcf)
25-0484-01	See Boring Log	B-01 @ 0-5.0'	B	110	☐	☐	3.5	
25-0484-02	See Boring Log	B-01 @ 2.5'	B	110	☐	☐	3.6	
25-0484-03	See Boring Log	B-01 @ 5.0'	B	110	☐	☐	6.2	115.7
25-0484-04	See Boring Log	B-01 @ 7.5'	B	110	☐	☐	10.3	
25-0484-05	See Boring Log	B-01 @ 10.0'	B	110	☐	☐	7.0	
25-0484-06	See Boring Log	B-01 @ 15.0'	B	110	☐	☐	8.2	
25-0484-07	See Boring Log	B-01 @ 20.0'	B	110	☐	☐	4.1	

***Sample contains more than one type of material.**

Distribution: **Client:** ☐ **File:** ☐ **Supplier:** ☐ **Email:** ☐ **Other:**

WSP USA Inc.
4221 Balloon Park Rd NE
Albuquerque, NM 87109
Tel 5058211801

www.wsp.com

Client: Navajo Tribal Utility Authority
P.O. Box 170
Ft. Defiance, AZ 86504-

Attention: Dave Shoultz

Project Name: NTUA Houck Well #4 Pumphouse

Houck, AZ

Project Manager: Jeffrey Samson

Report Date: September 12, 2025

Project #: US0045322.1649
Work Order #: 1
Sampled By: Toni Jim
Date Sampled: 9/2/2025

Sieve Analysis (ASTM C117-17/C136-19)
Plasticity Index (ASTM D4318-17)
Soil Classification (ASTM D2487-17)

SOILS / AGGREGATES

				Sieve Sizes									Sieve Result are as Percent Passing.											
Sample Location	Soil Class.	L.L.	P.I.	#200	#100	#50	#40	#30	#16	#10	#8	#4	1/4"	3/8"	1/2"	3/4'	1"	1 1/4"	1 1/2"	2"	2 1/2"	3"	6"	12"	Lab Number
B-01 @ 2.5'				59	88	97	98	99	100																25-0484-02
B-01 @ 15.0'	CL	25	13	50	65	77	85	91	98	99	99	100													25-0484-06
B-01 @ 20.0'	SM	NV	NP	46	74	88	93	96	98	98	99	99		99	100										25-0484-07

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Client: Navajo Tribal Utility Authority
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Ft. Defiance, AZ 86504-

Attention: Dave Shoultz

Project Name: NTUA Houck Well #4 Pumphouse

Houck, AZ

Project Manager: Jeffrey Samson

Report Date: September 12, 2025

Project #: US0045322.1649
Work Order #: 1
Sampled By: Toni Jim
Date Sampled: 9/2/2025

Sieve Analysis (ASTM C117-17/C136-19)
Plasticity Index (ASTM D4318-17)
Soil Classification (ASTM D2487-17)

SOILS / AGGREGATES

Lab Number	Sample Location	Soil Class.	L.L.	P.I.	D10	D20	D30	D50	D60	D70	CC	CU	Cmu
25-0484-02	B-01 @ 2.5'				0	0	0	0	0.076	0.097	0	0	0
25-0484-06	B-01 @ 15.0'	CL	25	13	0	0	0	0.074	0.120	0.201	0	0	0
25-0484-07	B-01 @ 20.0'	SM	NV	NP	0	0	0	0.082	0.105	0.135	0	0	0

Distribution: **Client:** ☐ **File:** ☐ **Supplier:** ☐ **Email:** ☐ **Other:**

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4221 Balloon Park Rd NE
Albuquerque, NM 87109
Tel 5058211801

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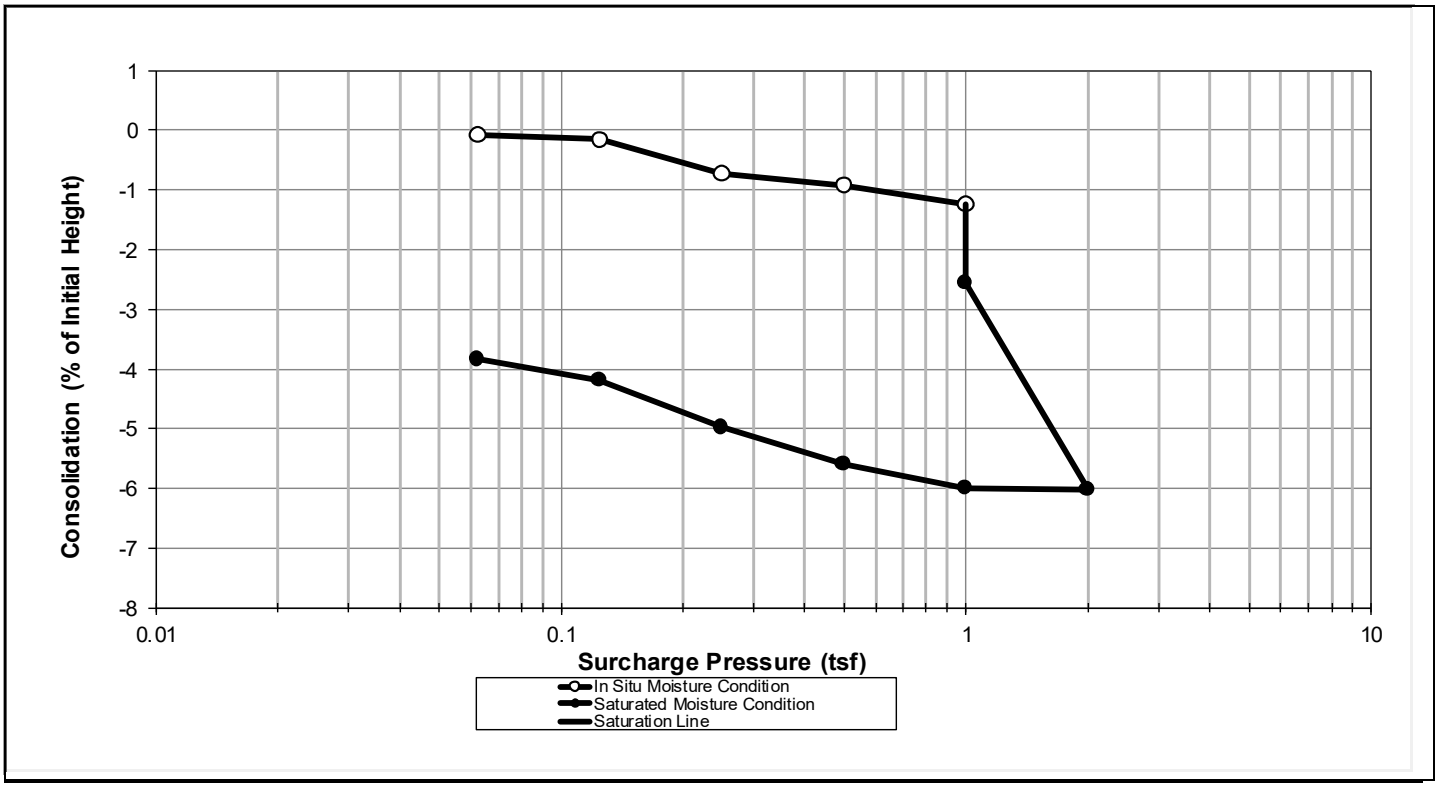
Client:	Navajo Tribal Utility Authority P.O. Box 170 Ft. Defiance, AZ 86504-	**Report Date:**	September 19, 2025
		Project #:	US0045322.1649
		Work Order #:	1
Attn:	Dave Shoultz	**Lab #:**	25-0484-03
Project Name:	NTUA Houck Well #4 Pumphouse	**Sampled By:**	Toni Jim
		Date Sampled:	9/2/2025
	Houck, AZ	**Visual Description of Material:**	See Boring Log
		Sample Source:	B-01 @ 5.0'
Project Manager:	Jeffrey Samson	**SOILS / AGGREGATES**	

Measurement of Collapse Potential of Soils (ASTM D5333-03)

Sample Preparation: ..

Initial Volume (cu.in.):	4.60	**Final Volume (cu.in.):**	4.43
Initial Moisture (%):	10.9%	**Final Moisture (%):**	24.6%
Initial Dry Density (pcf):	93.8	**Final Dry Density (pcf):**	97.4
Initial Degree of Saturation:	38%	**Final Degree Saturation:**	94%
Initial Void Ratio:	0.77	**Final Void Ratio:**	0.70
Estimated Specific Gravity:	2.651	**Saturated at:**	1 tsf
Soil Classification:		**Consolidation at Max Load:**	6.03%



Distribution: **Client:** ☐ **File:** ☐ **Supplier:** ☐ **Email:** ☐ **Other:**

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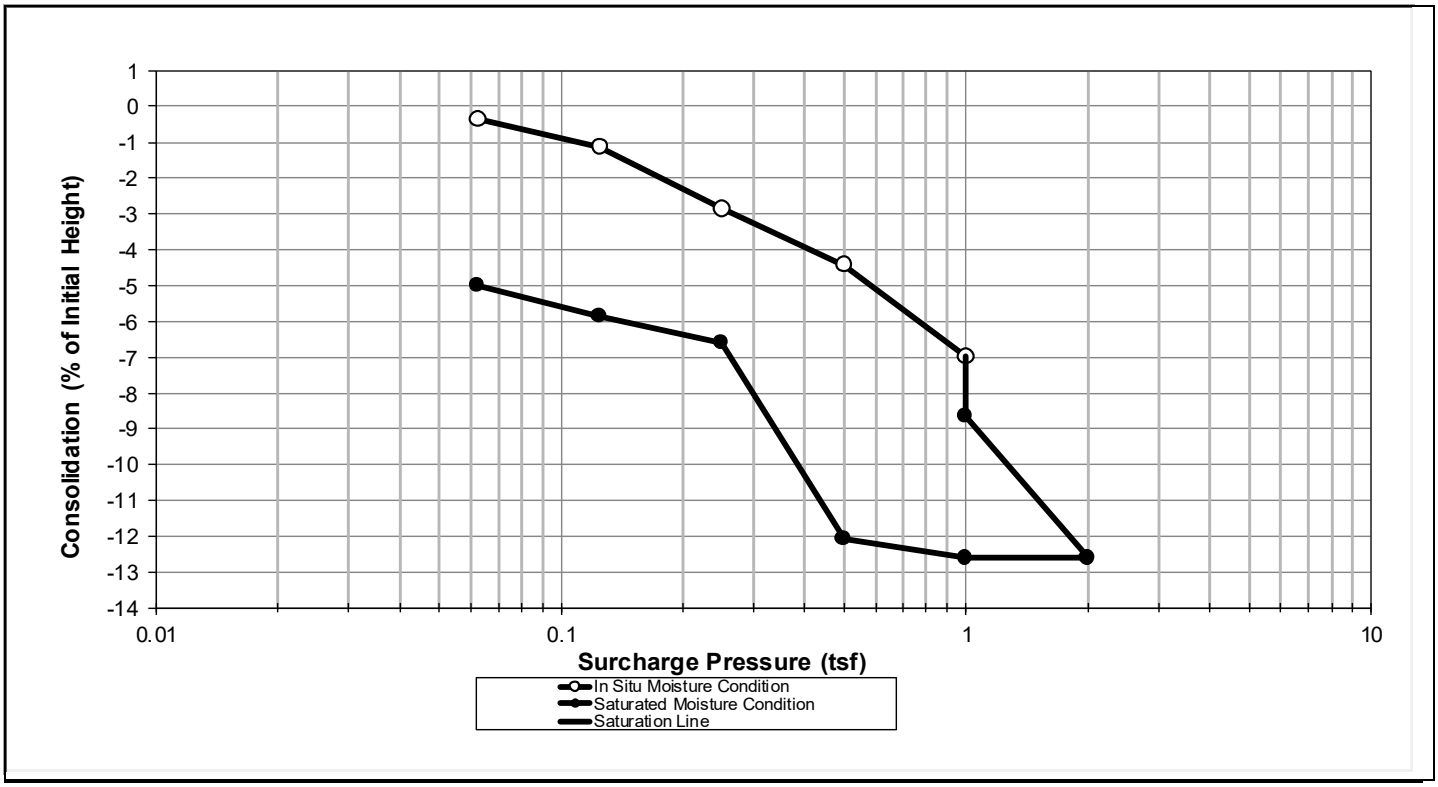
4221 Balloon Park Rd NE
Albuquerque, NM 87109
Tel 5058211801

Client:	Navajo Tribal Utility Authority P.O. Box 170 Ft. Defiance, AZ 86504-	**Report Date:**	September 26, 2025
		Project #:	US0045322.1649
		Work Order #:	1
Attn:	Dave Shoultz	**Lab #:**	25-0484-05
Project Name:	NTUA Houck Well #4 Pumphouse	**Sampled By:**	Toni Jim
		Date Sampled:	9/2/2025
	Houck, AZ	**Visual Description of Material:**	See Boring Log
		Sample Source:	B-01 @ 10.0'
Project Manager:	Jeffrey Samson	**SOILS / AGGREGATES**	

Measurement of Collapse Potential of Soils (ASTM D5333-03)

Initial Volume (cu.in.):	4.60	**Final Volume (cu.in.):**	4.39
Initial Moisture (%):	11.4%	**Final Moisture (%):**	29.2%
Initial Dry Density (pcf):	91.9	**Final Dry Density (pcf):**	96.3
Initial Degree of Saturation:	38%	**Final Degree Saturation:**	109%
Initial Void Ratio:	0.80	**Final Void Ratio:**	0.72
Estimated Specific Gravity:	2.651	**Saturated at:**	1 tsf
Soil Classification:		**Consolidation at Max Load:**	12.62%



Distribution: **Client:** ☐ **File:** ☐ **Supplier:** ☐ **Email:** ☐ **Other:**

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Client:	Navajo Tribal Utility Authority P.O. Box 170 Ft. Defiance, AZ 86504-	**Report Date:**	September 26, 2025
		Project #:	US0045322.1649
		Work Order #:	1
Attn:	Dave Shoultz	**Lab #:**	25-0484-03
Project Name:	NTUA Houck Well #4 Pumphouse	**Sampled By:**	Toni Jim
		Date Sampled:	9/2/2025
	Houck, AZ	**Visual Description of Material:**	See Boring Log
		Sample Source:	B-01 @ 5.0'
Project Manager:	Jeffrey Samson	**SOILS / AGGREGATES**	

Specific Gravity of Soil Solids by Water Pycnometer (ASTM D854-14)

Test Method: B

Spec Gravity of Soils at Test Temperature:	2.599
Temperature Corrected Spec Gravity (at 20°C):	2.596

Reviewed By:_____

Distribution: **Client:** ☐ **File:** ☐ **Supplier:** ☐ **Email:** ☐ **Other:**

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Albuquerque, NM 87109
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Client:	Navajo Tribal Utility Authority P.O. Box 170 Ft. Defiance, AZ 86504-	**Report Date:**	September 19, 2025
		Project #:	US0045322.1649
		Work Order #:	1
Attn:	Dave Shoultz	**Lab #:**	25-0484-01
Project Name:	NTUA Houck Well #4 Pumphouse	**Sampled By:**	Toni Jim
		Date Sampled:	9/2/2025
	Houck, AZ	**Visual Description of Material:**	See Boring Log
		Sample Source:	B-01 @ 0-5.0'
Project Manager:	Jeffrey Samson	**SOILS / AGGREGATES**	

Determining Soil Resistivity Using the Two-Electrode Soil Box Method (ASTM G187-20)

Soil Resistivity: 3192 Ωcm

Distribution: **Client:** ☐ **File:** ☐ **Supplier:** ☐ **Email:** ☐ **Other:**

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Albuquerque, NM 87109
Tel 5058211801

Client:	Navajo Tribal Utility Authority P.O. Box 170 Ft. Defiance, AZ 86504-	**Report Date:**	September 19, 2025
		Project #:	US0045322.1649
		Work Order #:	1
Attn:	Dave Shoultz	**Lab #:**	25-0484-01
Project Name:	NTUA Houck Well #4 Pumphouse	**Sampled By:**	Toni Jim
		Date Sampled:	9/2/2025
	Houck, AZ	**Visual Description of Material:**	See Boring Log
		Sample Source:	B-01 @ 0-5.0'
Project Manager:	Jeffrey Samson		

SOILS / AGGREGATES

pH of Soils (ASTM D4972)

Method Used: A

pH Value Tested In Water: 7.8

Distribution: **Client:** ☐ **File:** ☐ **Supplier:** ☐ **Email:** ☐ **Other:**

WSP USA Inc.
4221 Balloon Park Rd NE
Albuquerque, NM 87109
Tel 5058211801

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MOTZZ LABORATORY, INC.

Report: 957859
Reported: 9/26/2025
Received: 9/24/2025
PO: C012800826

Laboratory Analysis Report

WSP USA Environment & Infrastructure Inc.
Jesse Boam
8519 Jefferson NE
Albuquerque, NM 87113

Project: US0045322.1649

Lab Number	Sample ID	
957859-1	25-0484-01	B-01 (0-5.0')

Test Parameter

Test	*Method*	*Result*	*Units*
Chloride	AASHTO T291	14	ppm
Sulfate	AASHTO T290	103	ppm