



GEOTECH REPORT

WCR130 EXTENSION - FROM
SCR1232 TO SCR1210
MIDLAND COUNTY, TEXAS

CLIENT:
Midland County

PROJECT NUMBER:
23-170

REPORT DATE:
August 11, 2023

August 11, 2023

Mr. Andrew Avis
Midland County
500 N. Loraine Street
Midland, TX 79701

Re: **Geotechnical Report**
County Road 130
Midland, TX

Dear Mr. Avis:

Magrym Consulting Inc. is pleased to present this geotechnical report for County Road 130 project in Midland, Texas. This report includes the results of our investigation as well as recommendations for construction.

We appreciate the opportunity to work together. Should you have any questions, please do not hesitate to give us a call.

Sincerely,

Magrym Consulting, Inc.



Claudius Sanchez Czyzewska, P.E.
Principal Engineer



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1.0 INTRODUCTION

1.1 Project Description

Midland County is planning to extend and pave a section of West County Road 130 between South County Road 1232 and South County Road 1210. This unpaved section of roadway is approximately 2.2 miles long.

1.2 Scope of Work

This geotechnical exploration was authorized by Mr. Andrew Avis, Public Works Director, for Midland County. The purpose of this geotechnical study was to evaluate general soil conditions and to provide engineering and design recommendations. To accomplish this purpose, a boring plan was created, boreholes were drilled, and soil samples were obtained. Select samples were tested by a soils and construction materials laboratory for engineering properties. Field and laboratory data were analyzed, and recommendations were developed. Please note, recommendations are specific to this project site and should not be used for any other project site.

2.0 GEOLOGY

2.1 Regional Geology

USGS Map shows the surface geology of the project site to be Quaternary Windblown Cover Sand (Qcs). Defined as : fine to medium grained quartz, silty, calcareous, caliche nodules common, massive, grayish red; distinct soil profile; thickness up to 10 feet, feathers out locally (mostly Illinoian, may include younger deposits).

2.2 Site Geology

The United States Department of Agriculture (USDA) websoil survey provides soil data for the upper 60 inches of subsurface soils. The websoil survey identifies this section of CR 130 primarily as Amarillo fine sandy loam (AfA/AfB). Such soils consist of 0 to 10 inches of fine sandy loam, underlain by 70 inches of sandy clay loam (Appendix E). The presence of sandy loam soils was confirmed during the geotechnical exploration.

3.0 EXISTING GEOTECHNCIAL INFORMATION

There are no known geotechnical reports that exist for this project site.



4.0 SUBSURFACE EXPLORATION PROGRAM

4.1 Field Exploration

On April 11, 2023, twelve exploratory borings were advanced between 4.5 and 5.5 feet below ground surface utilizing a track-mounted Geoprobe drill rig equipped with a 140-lb. automatic hammer. As outlined in ASTM D 1586: Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils, disturbed samples were obtained by driving a split spoon 18 inches with a free-falling hammer that was dropped 30 inches. Soil samples were obtained at the intervals shown on the Boring Logs (Appendix B). Each sample was carefully sealed in plastic containers, labeled and secured for delivery to the laboratory. A field log was prepared for each boring. Each log depicts the visual classification of materials encountered during drilling. Boreholes were backfilled after the completion of drilling and sample collection. These borehole locations are shown on the Borehole Map (Appendix A) and summarized in Table 1.

Table 1 - Borehole Identification and Depth (*NAVD88)

Borehole Number	Latitude	Longitude	Elevation (ft)*	Borehole Depth (ft)	Groundwater Depth
BH-1	31.927183°	-102.133575°	2814.1	5.5	N/A
BH-2	31.927811°	-102.130172°	2833.6	5.5	N/A
BH-3	31.928575°	-102.127141°	--	5.5	N/A
BH-4	31.929290°	-102.124043°	2825.2	5.5	N/A
BH-5	31.930047°	-102.120830°	2827.4	5.5	N/A
BH-6	31.930734°	-102.117886°	2831.3	5.5	N/A
BH-7	31.931549°	-102.114503°	--	4.5	N/A
BH-8	31.932221°	-102.111426°	--	5.5	N/A
BH-9	31.932221°	-102.111426°	2812.3	5.5	N/A
BH-10	31.933664°	-102.105065°	2805.2	5.5	N/A
BH-11	31.934423°	-102.101877°	2806.8	5.5	N/A
BH-12	31.935351°	-102.098040°	2801.1	5.5	N/A

4.2 Laboratory Testing

Upon completion of field exploration, samples were evaluated for physical properties and combined as necessary. Soil samples were delivered to Beyond Testing & Engineering construction materials testing lab in Midland, Texas for testing. Each test was performed in accordance with the most recent ASTM Standards. The following tests were performed.

- ASTM D6913-17 *Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis*
- ASTM D4318-17 *Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils*



- ASTM D2487-17 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Soils within the borings were identified as sands and clays. These materials presented fine-grained particles ranging from 14 to 45 percent passing the No. 200 sieve. Plastic Indexes ranged from non-plastic to 13. Laboratory test results are summarized in Table 2 and presented in Appendix C.

Table 2 - Summary of Laboratory Tests

Borehole Number	Sample ID	Sample Interval (ft)	Atterberg Limits	% Passing #200 Sieve	USCS Soil Classification
BH-1	S01	0.0-1.5	LL=20; PI=7	32	SC-SM
BH-2	S02	2.0-4.0	LL=15; PI=1	20	SM
BH-3	S03	2.0-4.5	LL=23; PI=13	47	SC
BH-4	S04	0.0-1.5	LL=22; PI=5	14	SC-SM
BH-4	S05	0.2-2.3	LL=15; PI=3	31	SM
BH-5	S06	4.0-5.5	LL=21; PI=9	34	SC
BH-6	S07	5.0-5.6	LL=18; PI=5	24	SC-SM
BH-7	S08	0.6-4.3	LL=16; PI=3	24	SM
BH-9	S09	0.0-4.0	LL=15; PI=2	21	SM
BH-10	S10	3.0-3.6	LL=22; PI=10	42	SC
BH-10	S11	4.0-5.5	LL=21; PI=9	45	SC
BH-11	S12	4.0-5.5	LL=17; PI=4	29	SC-SM
BH-12	S13	0.0-3.0	LL=NP; PI=NP	19	SM

5.0 SITE CONDITIONS

5.1 Surface Conditions

5.1.1 Vegetation

The west half of the project site (Borings 2-7) is developed with a caliche road. Borings 8-12 were sampled north of an existing caliche lease road that will parallel the new roadway. This eastern portion of the roadway is exhibited by hummocky sand, wild grasses, and mesquite brush.

5.1.2 Topography

The topography of the proposed roadway (between Borings 2 through 12) generally slopes eastward toward South County Road 1210 with an elevation change of approximately 32 feet. Boring 1 is significantly lower than the existing caliche roadway with an elevation change of approximately 19 feet.



5.1.3 General

Significant garbage and debris were observed between Borings 1 and 2. Between Borings 2 and 7, furniture was observed along the south side of the caliche roadway. West of Boring 7, Endeavor was constructing a pond that appeared to be within the County right-of-way.

5.2 Subsurface Conditions

5.2.1 Stratigraphy

For analysis, the site was divided into three sections (Figure 1) based on similarity in colors, soil properties and n-values (blow counts). Utilizing laboratory test results and field logs, a typical subsurface profile was developed and illustrated in Tables 3 through 5.

Figure 1- Site delineation (Sections A-C)



Table 3 - Subsurface Profile - Section A

Strata	Depth Interval (feet)	Description
Stratum 1a	0-2	Silty Clayey Sand (SC-SM)
Stratum 2b	2-5.5	Clayey Sand (SC)

Table 4 - Subsurface Profile - Section B

Strata	Depth Interval (feet)	Description
Stratum 1b	0-0.33 (varies 2-6")	Silty Clayey Sand (SC-SM)
Stratum 2a	0.33-5.5	Silty Sand (SM)/ Silty Clayey Sand (SC-SM)
Stratum 2b	0.33-5.5	Clayey Sand (SC)

Table 5 - Subsurface Profile - Section C

Strata	Depth Interval (feet)	Description
Stratum 1b	0-2	Silty Sand (SM)
Stratum 2a	2-5.5	Silty Sand (SM)/ Silty Clayey Sand (SC-SM)
Stratum 2b	2-5.5	Clayey Sand (SC)



5.2.2 Soil Properties

As illustrated in Tables 3 through 5, Sections A, B and C exhibited similar soil strata. Borings were terminated at 5.5 feet below ground surface.

Section A is not paved and serves as a connection between the paved CR 1232 and the caliche capped portion of CR 130. This section includes Boring 1 and it is situated approximately 19 feet lower than the existing caliche roadway. This section was sandy consisted of 3 accesses to the caliche roadway.

Section B consisted of an upper surface profile of silty clayey sand (caliche roadway) underlain by reddish brown silty sand and clayey sand.

Section C was similar in composition to Section B, however, this section of roadway is proposed and the caliche cap is missing.

Table 6 - Soil Properties Summary

Soil Property	SC-SM	SC	SM
Cohesion (psf) ¹	1050	1550	1050
Unit Weight (pcf) ²	113	113	115
Angle of Friction (°) ³	33	31	34
Active Pressure (K _a) ⁴	0.295	0.320	0.283

5.2.3 Groundwater Conditions

Groundwater was not encountered at the time of this investigation. Water well reports within the vicinity of the project site indicate the water depth is 36 to 60 feet below ground level (Texas Water Development Board).

5.2.4 Swell Potential derived from Atterberg Limits

Atterberg limit tests were performed for each stratum encountered. The SC-SM soils near the surface exhibited a plasticity index (PI) of 5 to 7. The PI's of the SM soils ranged from non-plastic to 3, while SC soils ranged from 9 to 13. These soils have a moderate potential for shrinking and swelling with changes in moisture content, however, positive drainage should be established to avoid ponding and pooling in the roadway.

6.0 FOUNDATION RECOMMENDATIONS

6.1 Site Preparation

1 <http://www.geotechnicalinfo.com/cohesion.html>

2 TM 5-624/NAVFAC DM MO-102/AFJMAN 32-1040

3 (Earth Manual Part 1 (Third Edition), 1998)

4 Calculated Rankin coefficient



- 6.1.1 Remove surface debris, trees, stumps, roots, organic matter, and other obstructions in accordance with TXDOT Items 100 and 735. (Texas Department of Transportation, 2014)
- 6.1.2 Where trees are removed, root-balls shall also be removed. Such excavations will be deeper than typical clearing and grubbing and shall be filled with select fill that is moisture conditioned and compacted as defined herein.
- 6.1.3 Topsoil with organic materials shall not be used or mixed with other materials for use beneath any structures, paving or fill. Organic matter decays overtime creating voids which may lead to settlement. These soils should be removed from the site or set aside for landscaping areas.
- 6.1.4 After topsoil and roots are removed, soils should be compacted and proof-rolled with a fully loaded water truck, a dump truck loaded with 4 cubic yards of soil or a 15-ton pneumatic tired roller Section 3.14.1 (United Facilities Guide Specifications, 2008). A qualified representative should observe for rutting and pumping. Any soft areas should be compacted or removed and replaced with fill. When testing by nuclear density gauge, subgrade density shall be greater than 95% compaction per ASTM 1557 near optimum moisture content.

6.2 Fills

- 6.2.1 All fills should be derived from the same source. Fill soils should be free of deleterious materials and not contain lumps or stones larger than 2 inches.

- 6.2.2 Select Fill

Onsite soils are suitable for select fills. Such soils are classified as SM, SC, and SC-SM in accordance with the Unified Soil Classification System.

- 6.2.3 Flexible Base Course (TXDOT Standard Specification Item No. 247)

Proposed flexible base course should be composed of stone, crushed stone, crushed or screened gravel and be in accordance with material requirements shown in the table below. Grades 4-5 are not recommended and thus shaded in the table below:



**Table 1
Material Requirements**

Property	Test Method	Grade 1-2	Grade 3	Grade 4 ²	Grade 5
Sampling	Tex-400-A				
Master gradation sieve size (cumulative % retained)	Tex-110-E				
2-1/2"		0	0		
1-3/4"		0-10	0-10		
7/8"		10-35	-		
3/8"		30-65	-		
#4		45-75	45-75		
#40		65-90	50-85		
Liquid Limit, % Max	Tex-104-E	40	40		
Plasticity Index, Max ¹	Tex-106-E	10	12		
Plasticity index, Min ¹		As shown on the plans	As shown on the plans		
Wet ball mill, % Max	Tex-116-E	40	-		
Wet ball mill, % Max increase passing the #40 sieve		20	-		
Min compressive strength, psi	Tex-117-E				
lateral pressure 0 psi		35	-		
lateral pressure 3 psi		-	-		
lateral pressure 15 psi		175	-		

- Determine plastic index in accordance with [Tex-107-E](#) (linear shrinkage) when liquid limit is unattainable as defined in [Tex-104-E](#).
- Grade 4 may be further designated as Grade 4A, Grade 4B, etc.

6.3 Compaction

- 6.3.1 Soils should be placed in loose lifts not exceeding 8 inches and compacted to 95 percent maximum dry density of ASTM D 1557. Moisture content shall be between optimum and plus or minus 2 percent.
- 6.3.2 Any subgrade to receive fill shall be scarified a minimum of 6 inches and compacted to 95 percent maximum dry density per ASTM D 1557 with a moisture content of plus or minus 2 percent.

6.4 Excavations

Area soils are classified as Type C, in accordance with the Occupational Safety and Health Administration (OSHA). Such soils exhibit the following properties:

Type C soil is the least stable type of soil. Type C includes granular soils in which particles don't stick together and cohesive soils with a low unconfined compressive strength; 0.5 tons per square foot or less. Examples of Type C soil include gravel, and sand. Because it is not stable, soil with water seeping through it is also automatically classified as Type C soil, regardless of its other characteristics.



Excavations Made in Type C Soil

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1½:1.
2. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1½:1.
3. All other sloped excavations shall be in accordance with the other options permitted in § 1926.652(b).

6.5 Utility Trench Backfill

Trenches shall be prepared in accordance with TXDOT Item 402. (Texas Department of Transportation, 2014)

6.6 Footings and Foundations

6.6.1 Frost Depth

Foundation elements exposed to freezing conditions should be placed a minimum of 10 inches below grade in accordance with Severe Frost Penetration Levels (inches). (2015 IBC Performing Structural Plan Reviews, n.d.)

7.0 PAVEMENT RECOMMENDATIONS

We anticipate this roadway will have an AADT of 5,000 per the TXDOT District Traffic Web Viewer. This new section of roadway will connect CR 1232 and CR 1210. As the traffic counts are not broken down to denote the amount of large truck traffic, this design assumes 20% of the traffic will be 18-wheelers. The pavement sections included are based upon experience with similar pavements with a 20-year design life.

7.1 Pavement Subgrade Preparation

Prepare subgrade in accordance with Section 6.1 of this report.

7.2 Recommended Design Sections

Table 7 - Pavement Section Recommendation Summary

Material Type	Asphalt Concrete	
	Light Load Vehicles	Heavy Load Vehicles
Hot Mix Asphalt (HMAC)	3 inches	3 inches
Flexible Base Course (TXDOT Item No. 247)	6 inches	12 inches



8.0 CONSTRUCTION RECOMMENDATIONS

Field compaction tests should be performed in accordance with ASTM D 6938, *Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)*, at the testing frequencies provided in Table I of the TXDOT Guide Schedule of Sampling & Testing (March 2015).

9.0 CLOSURE

The geotechnical investigation was performed using the standard of care and skill ordinarily exercised by geotechnical engineers practicing in this area and under similar circumstances. No warranty, expressed or implied, is made as to the conclusions and professional advice included in this report.

The samples taken and used for testing and the observation are believed to be representative of the entire area. However, soil and geologic conditions can vary significantly between test pits. As in many developments, conditions revealed by excavations may differ with preliminary findings. The geotechnical engineer shall evaluate any discrepancies encountered in the field.



APPENDICES

Appendix A: Borehole Map

Appendix B: Borings Logs

Appendix C: Laboratory Test Data

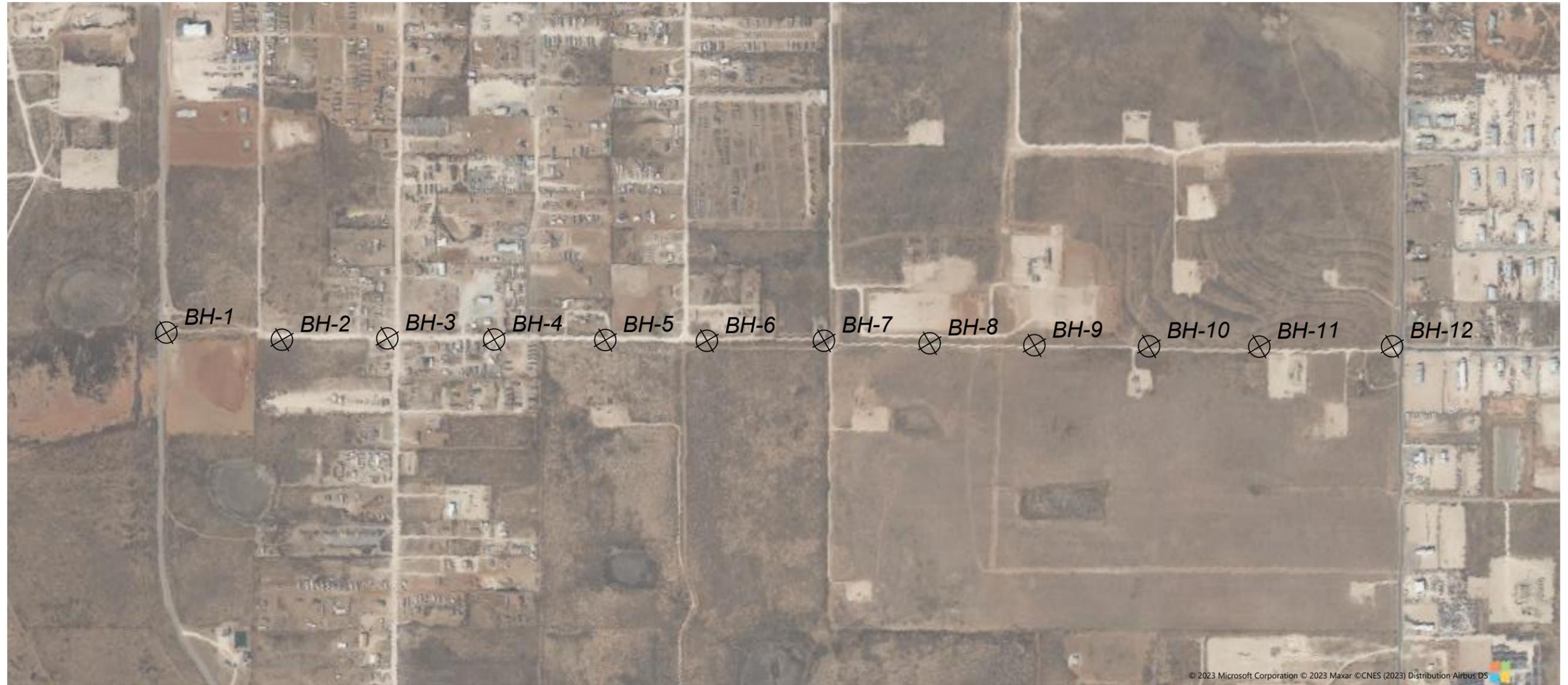
Appendix D: References & Terminology

Appendix E: USDA Websoil Survey

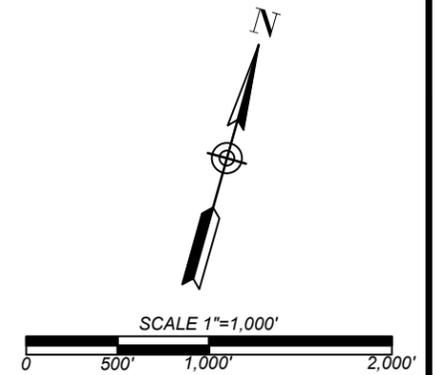


APPENDIX A: BOREHOLE MAP





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R-X	DESCRIPTION	DATE	BY
REVISIONS (OR CHANGE NOTICES)			



MIDLAND COUNTY
 TEXAS
 MIDLAND COUNTY PUBLIC WORKS DEPARTMENT
 500 N. LORAIN STREET
 MIDLAND, TX 79701

WEST COUNTY ROAD 130 EXTENSION
 FROM SOUTH COUNTY ROAD 1232
 TO SOUTH COUNTY ROAD 1210

BOREHOLE MAP	
HORIZONTAL SCALE: 1"=1000'	VERTICAL SCALE: NTS
PRINT DATE: 5/25/2023	DESIGNED BY: ZZ
PROJECT NO. 23-170	CHECKED BY: CSC
SUBSET: CIVIL	APPROVED BY: CSC

SHEET:
 G - 100

APPENDIX B: BOREHOLE LOGS



Client: Midland County		Project Number: 23-170	Project: County Road 130	
Boring No.: BH-1		Date Drilled: 4/11/2023	Drilling Contractor: Talon LPE	Drill Rig Type Geoprobe on tracks
Lat:	31.927183°	Groundwater Depth: N/A	Elevation: 2814.1'	Total Depth of boring: 5'6"
Long:	-102.133575°			

Depth (feet)	Graphic Log	Sample Type	blows/foot (n-value)	Tests	USCS Soil Classification	Material Description and Comments
1		SPT	7		SC-SM	Tan Silty Clayey Sand <i>18" recovery</i>
2		SPT	12		SC	Light Brown Clayey Sand
3		SPT	23			
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						

Total Depth: 5.5'

Borehole Summary

Client Midland County Project/Project No. CR 130, Midland, TX BH No. 1 Date 4/11/2023

LAT 31.927183°
LONG -102.133575°

Depth	Soil Description	USCS	Sieve Analysis (percent passing)					Atterberg Limits		Moisture	Qu	Blow Counts		
			3/4"	#4	#10	#40	#200	LL	PI	%	psi	6"	6"	6"
0-2	Tan Silty Clayey Sand	SC-SM	100	100	100	90	32	20	7	1.1		6	4	3
2-4	Light Brown Clayey Sand	SC	100	98	97	94	47	23	13	1.3		4	6	6
4-4'9	Light Brown Clayey Sand											6	--	--
4'9-5'6	Light Brown Clayey Sand											--	9	13



Client: Midland County		Project Number: 23-170		Project: County Road 130			
Boring No. BH-2		Date Drilled: 4/11/2023		Drilling Contractor: Talon LPE		Drill Rig Type Geoprobe on tracks	
Lat:	31.927811°	Groundwater Depth:		Elevation:	Total Depth of boring:		
Long:	-102.130172°	N/A		2833.6'	5'6"		

Depth (feet)	Graphic Log	Sample Type	blows/foot (n-value)	Tests	USCS Soil Classification	Material Description and Comments
1		SPT	3		SC-SM	Tan Silty Clayey Sand
2		SPT	13/6"			<i>18" recovery</i>
3		SPT	12		SM	Tan Silty Sand
4		SPT	7			
5		SPT				
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						

Total Depth: 5.5'

Borehole Summary

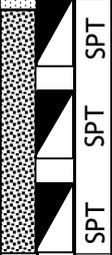
Client Midland County Project/Project No. CR 130, Midland, TX BH No. 2 Date 4/11/2023

LAT 31.927811°
LONG -102.130172°

Depth	Soil Description	USCS	Sieve Analysis (percent passing)					Atterberg Limits		Moisture	Qu	Blow Counts		
			3/4"	#4	#10	#40	#200	LL	PI	%	psi	6"	6"	6"
0-1	Tan Silty Clayey Sand	SC-SM	100	100	100	90	32	20	13	7		1	2	--
1-2	Tan Silty Sand	SM	100	99	99	94	20	15	14	1		--	--	13
2-4	Tan Silty Sand											2	3	9
4-5'6	Tan Silty Sand											3	3	4



Client: Midland County		Project Number: 23-170		Project: County Road 130		MAGTYM	
Boring No.: BH-3		Date Drilled: 4/11/2023		Drilling Contractor: Talon LPE		Drill Rig Type Geoprobe on tracks	
Lat:	31.928575°	Groundwater Depth: N/A		Elevation: --		Total Depth of boring: 5'6"	
Long:	-102.127141°						

Depth (feet)	Graphic Log	Sample Type	blows/foot (n-value)	Tests	USCS Soil Classification	Material Description and Comments
1		SPT	16/6"		SC-SM	Light Brown Silty Clayey Sand with Gravel (Roadway)
2			14		SM	Tan Silty Sand
3			8			
4			11			
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						

Total Depth: 5.5'

Borehole Summary

Client Midland County Project/Project No. CR 130, Midland, TX BH No. 3 Date 4/11/2023
 LAT 31.928575°
 LONG -102.127141°

Depth	Soil Description	USCS	Sieve Analysis (percent passing)					Atterberg Limits		Moisture	Qu	Blow Counts		
			3/4"	#4	#10	#40	#200	LL	PI	%	psi	6"	6"	6"
0-0'3"	Light Brown Silty Clayey Sand with Gravel (Roadway)	SC-SM	80	59	51	41	14	22	5	0.9		16	--	--
0'3"-2	Tan Silty Sand	SM	100	99	99	94	20	15	1	0.7		--	7	7
2-4	Tan Silty Sand											3	3	5
4-5'6"	Tan Silty Sand											4	5	6



Client: Midland County		Project Number: 23-170		Project: County Road 130		MAGTYM	
Boring No.: BH-4		Date Drilled: 4/11/2023		Drilling Contractor: Talon LPE		Drill Rig Type Geoprobe on tracks	
Lat:	31.929290°	Groundwater Depth: N/A		Elevation: 2825.2'		Total Depth of boring: 5'6"	
Long:	-102.124043°						

Depth (feet)	Graphic Log	Sample Type	blows/foot (n-value)	Tests	USCS Soil Classification	Material Description and Comments
1		SPT	18/6"		SC-SM	Light Brown Silty Clayey Sand with Gravel (Roadway)
2			10		SM	Tan Silty Sand
3		SPT	6		SC	Tan Clayey Sand
4			17		SC	Light Brown Clayey Sand
5		SPT				
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						

Total Depth: 5.5'

Borehole Summary

Client Midland County Project/Project No. CR 130, Midland, TX BH No. 4 Date 4/11/2023

LAT 31.929290°
LONG -102.124043°

Depth	Soil Description	USCS	Sieve Analysis (percent passing)					Atterberg Limits		Moisture	Qu	Blow Counts		
			3/4"	#4	#10	#40	#200	LL	PI	%	psi	6"	6"	6"
0-0'2"	Light Brown Silty Clayey Sand with Gravel (Roadway)	SC-SM	80	59	51	41	14	22	5	0.9		18	--	--
0'2"-2	Tan Silty Sand	SM	100	100	99	94	31	15	3	1.7		--	6	4
2-2'3"	Tan Silty Sand											2	--	--
2'3"-4	Tan Clayey Sand	SC	100	100	100	96	34	21	9	1.4		--	2	4
4-4'6	Tan Clayey Sand											5	--	--
4'6"-5'6	Light Brown Clayey Sand	SC	100	98	97	94	47	23	13	1.3		--	9	8



Client: Midland County		Project Number: 23-170	Project: County Road 130	
Boring No.: BH-5		Date Drilled: 4/11/2023	Drilling Contractor: Talon LPE	Drill Rig Type Geoprobe on tracks
Lat:	31.930047°	Groundwater Depth: N/A	Elevation: 2827.4'	Total Depth of boring: 5'6"
Long:	-102.120830°			

Depth (feet)	Graphic Log	Sample Type	blows/foot (n-value)	Tests	USCS Soil Classification	Material Description and Comments
1		SPT	21/6"		SC-SM	Light Brown Silty Clayey Sand with Gravel (Roadway)
2			15		SM	Tan Silty Sand
3			18			
4			25		SC	Tan Clayey Sand
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						

Total Depth: 5.5'

Borehole Summary

Client Midland County Project/Project No. CR 130, Midland, TX BH No. 5 Date 4/11/2023

LAT 31.930047°
LONG -102.120830°

Depth	Soil Description	USCS	Sieve Analysis (percent passing)					Atterberg Limits		Moisture	Qu	Blow Counts		
			3/4"	#4	#10	#40	#200	LL	PI	%	psi	6"	6"	6"
0-0'3"	Light Brown Silty Clayey Sand with Gravel (Roadway)	SC-SM	80	59	51	41	14	22	5	0.9		21	--	--
0'3-2	Tan Silty Sand	SM	100	100	99	94	31	15	3	1.7		--	9	6
2-4	Tan Silty Sand											6	7	11
4-5'6	Tan Clayey Sand	SC	100	100	100	96	34	21	9	1.4		2	12	13



Client: Midland County		Project Number: 23-170		Project: County Road 130		MAGTYM	
Boring No.: BH-6		Date Drilled: 4/11/2023		Drilling Contractor: Talon LPE		Drill Rig Type Geoprobe on tracks	
Lat:	31.930734°	Groundwater Depth: N/A		Elevation: 2831.3'		Total Depth of boring: 5'6"	
Long:	-102.117886°						

Depth (feet)	Graphic Log	Sample Type	blows/foot (n-value)	Tests	USCS Soil Classification	Material Description and Comments
1		SPT	14/6"		SC-SM	Light Brown Silty Clayey Sand with Gravel (Roadway)
2			16		SM	Tan Silty Sand
3			18			
4			18		SM	Light Brown Silty Sand
5			19/6"		SC-SM	Light Brown Silty Clayey Sand
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						

Total Depth: 5.5'

Borehole Summary

Client Midland County Project/Project No. CR 130, Midland, TX BH No. 6 Date 4/11/2023

LAT 31.930734°
LONG -102.117886°

Depth	Soil Description	USCS	Sieve Analysis (percent passing)					Atterberg Limits		Moisture	Qu	Blow Counts		
			3/4"	#4	#10	#40	#200	LL	PI	%	psi	6"	6"	6"
0-0'5"	Light Brown Silty Clayey Sand with Gravel (Roadway)	SC-SM	80	59	51	41	14	22	5	0.9		14	--	--
0'5"-2'	Tan Silty Sand	SM	100	100	99	94	31	15	3	1.7		--	10	6
2'-4'	Tan Silty Sand											7	8	10
4'-5'	Light Brown Silty Sand	SM	100	99	99	95	24	16	3	0.9		6	12	--
5'-5'6"	Light Brown Silty Clayey Sand	SC-SM	100	98	95	89	24	18	5	0.9		--	--	19



Client: Midland County		Project Number: 23-170	Project: County Road 130	
Boring No.: BH-7		Date Drilled: 4/11/2023	Drilling Contractor: Talon LPE	Drill Rig Type Geoprobe on tracks
Lat:	31.931549°	Groundwater Depth: N/A	Elevation: --	Total Depth of boring: 4'6"
Long:	-102.114503°			

Depth (feet)	Graphic Log	Sample Type	blows/foot (n-value)	Tests	USCS Soil Classification	Material Description and Comments
1		SPT	16/6"		SC-SM	Light Brown Silty Clayey Sand with Gravel (Roadway)
2			21			
3		SPT	15		SM	Light Brown Silty Sand
4		SPT	39/6"			
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						

Total Depth: 4.5'

Borehole Summary

Client Midland County Project/Project No. CR 130, Midland, TX BH No. 7 Date 4/11/2023

LAT 31.931549°
LONG -102.114503°

Depth	Soil Description	USCS	Sieve Analysis (percent passing)					Atterberg Limits		Moisture	Qu	Blow Counts		
			3/4"	#4	#10	#40	#200	LL	PI	%	psi	6"	6"	6"
0-0'6"	Light Brown Silty Clayey Sand with Gravel (Roadway)	SC-SM	80	59	51	41	14	22	5	0.9		16		
0'6"-2'	Light Brown Silty Sand	SM	100	99	99	95	24	16	3	0.9			12	9
2'-4'	Light Brown Silty Sand											4	5	10
4'-4'3"	Light Brown Silty Sand											39/6"		
4'3"-4'6"	Rock													



Client: Midland County		Project Number: 23-170	Project: County Road 130	
Boring No.: BH-8		Date Drilled: 4/11/2023	Drilling Contractor: Talon LPE	
Lat:	31.932221°	Groundwater Depth: N/A	Elevation: --	Total Depth of boring: 5'6"
Long:	-102.111426°			

Depth (feet)	Graphic Log	Sample Type	blows/foot (n-value)	Tests	USCS Soil Classification	Material Description and Comments
1		SPT	14		SM	Light Brown Silty Sand
2		SPT	15			
3		SPT	17			
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						

Total Depth: 5.5'

Borehole Summary

Client Midland County Project/Project No. CR 130, Midland, TX BH No. 8 Date 4/11/2023

LAT 31.932221°
LONG -102.111426°

Depth	Soil Description	USCS	Sieve Analysis (percent passing)					Atterberg Limits		Moisture	Qu	Blow Counts		
			3/4"	#4	#10	#40	#200	LL	PI	%	psi	6"	6"	6"
0-2	Light Brown Silty Sand	SM	100	100	100	98	21	15	2	0.8		3	5	9
2-4	Light Brown Silty Sand											6	6	9
4-6	Light Brown Silty Sand											8	7	10



Client: Midland County		Project Number: 23-170		Project: County Road 130		MAGTYM	
Boring No.: BH-9		Date Drilled: 4/11/2023		Drilling Contractor: Talon LPE		Drill Rig Type Geoprobe on tracks	
Lat:	31.932221°	Groundwater Depth: N/A		Elevation: 2812.3'		Total Depth of boring: 5'6"	
Long:	-102.111426°						

Depth (feet)	Graphic Log	Sample Type	blows/foot (n-value)	Tests	USCS Soil Classification	Material Description and Comments
1		SPT	16		SM	Light Brown Silty Sand
2			20			
3			27			
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						

Total Depth: 5.5'

Borehole Summary

Client Midland County Project/Project No. CR 130, Midland, TX BH No. 9 Date 4/11/2023

LAT 31.932221°
 LONG -102.111426°

Depth	Soil Description	USCS	Sieve Analysis (percent passing)					Atterberg Limits		Moisture	Qu	Blow Counts		
			3/4"	#4	#10	#40	#200	LL	PI	%	psi	6"	6"	6"
0-2	Light Brown Silty Sand	SM	100	100	100	98	21	15	2	0.8		2	7	9
2-4	Light Brown Silty Sand											9	8	12
4-6	Light Brown Silty Sand											7	12	15



Client: Midland County		Project Number: 23-170		Project: County Road 130		MAGTYM	
Boring No.: BH-10		Date Drilled: 4/11/2023		Drilling Contractor: Talon LPE		Drill Rig Type Geoprobe on tracks	
Lat:	31.933664°	Groundwater Depth: N/A		Elevation: 2805.2'		Total Depth of boring: 5'6"	
Long:	-102.105065°						

Depth (feet)	Graphic Log	Sample Type	blows/foot (n-value)	Tests	USCS Soil Classification	Material Description and Comments
1		SPT	15		SM	Brown Silty Clayey Sand with Gravel <i>18" recovery</i>
2		SPT	17		SC	Light Brown Clayey Sand
3		SPT	27		SC	Tan Clayey Sand
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						

Total Depth: 5.5'

Borehole Summary

Client Midland County Project/Project No. CR 130, Midland, TX BH No. 10 Date 4/11/2023

LAT 31.933664°
LONG -102.105065°

Depth	Soil Description	USCS	Sieve Analysis (percent passing)					Atterberg Limits		Moisture %	Qu psi	Blow Counts		
			3/4"	#4	#10	#40	#200	LL	PI			6"	6"	6"
0-2	Light Brown Silty Sand	SM	100	100	100	98	21	15	2	0.8		3	6	9
2-3	Light Brown Silty Sand											4	9	--
3-3'6	Light Brown Clayey Sand	SC	100	100	100	96	42	22	10	0.9		--	--	8
4-5	Light Brown Clayey Sand											9	12	--
5-5'6	Tan Clayey Sand	SC	100	100	100	96	45	21	9	0.6		--	--	15



Client: Midland County		Project Number: 23-170		Project: County Road 130		MAGTYM	
Boring No.: BH-11		Date Drilled: 4/11/2023		Drilling Contractor: Talon LPE		Drill Rig Type Geoprobe on tracks	
Lat:	31.934423°	Groundwater Depth: N/A		Elevation: 2806.8'		Total Depth of boring: 5'6"	
Long:	-102.101877°						

Depth (feet)	Graphic Log	Sample Type	blows/foot (n-value)	Tests	USCS Soil Classification	Material Description and Comments
1		SPT	16		SM	Light Brown Silty Sand
2		SPT	19			
3		SPT				
4		SPT	19		SC-SM	Tan Silty Clayey Sand
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						

Total Depth: 5.5'

Borehole Summary

Client Midland County Project/Project No. CR 130, Midland, TX BH No. 11 Date 4/11/2023

LAT 31.934423°
LONG -102.101877°

Depth	Soil Description	USCS	Sieve Analysis (percent passing)					Atterberg Limits		Moisture %	Qu psi	Blow Counts		
			3/4"	#4	#10	#40	#200	LL	PI			6"	6"	6"
0-2	Light Brown Silty Sand	SM	100	100	100	96	19	SNP	SNP	0.6		3	6	10
2-3	Light Brown Silty Sand											6	8	--
3-3'6	Light Brown Silty Sand											--	--	11
4-5	Tan Silty Clayey Sand	SC-SM	100	100	100	96	29	17	4	0.8		6	8	--
5-5'6	Tan Silty Clayey Sand											--	--	11



Client: Midland County		Project Number: 23-170		Project: County Road 130		MAGTYM	
Boring No.: BH-12		Date Drilled: 4/11/2023		Drilling Contractor: Talon LPE		Drill Rig Type Geoprobe on tracks	
Lat:	31.935351°	Groundwater Depth: N/A		Elevation: 2801.1'		Total Depth of boring: 5'6"	
Long:	-102.098040°						

Depth (feet)	Graphic Log	Sample Type	blows/foot (n-value)	Tests	USCS Soil Classification	Material Description and Comments
1		SPT	17		SM	Light Brown Silty Sand
2		SPT	11			
3		SPT	12			
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						

Total Depth: 5.5'

Borehole Summary

Client Midland County Project/Project No. CR 130, Midland, TX BH No. 12 Date 4/11/2023

LAT 31.935351°
LONG -102.098040°

Depth	Soil Description	USCS	Sieve Analysis (percent passing)					Atterberg Limits		Moisture %	Qu psi	Blow Counts		
			3/4"	#4	#10	#40	#200	LL	PI			6"	6"	6"
0-2	Light Brown Silty Sand	SM	100	100	100	96	19	SNP	SNP			3	8	9
2-3	Light Brown Silty Sand											3	5	--
3-3'6	Light Brown Silty Sand											--	--	6
4-5'6	Light Brown Silty Sand											6	5	7



APPENDIX C: LABORATORY TESTING RESULTS



TO: Magrym Consulting, PC
 Claudius Sanchez
 1510 North Acres Dr
 Lovington, New Mexico, 88260

PROJECT: Magrym Misc. Testing

-
-

PROJECT NO.: WT1909260

DATE: May 17, 2023

Test By: Maui Rodriguez
Test Date: May 16, 2023

REPORT NO.:

REVISION:

MATERIAL QUALIFICATIONS - Soils

Test Procedure: ASTM D1140 & D6913
Sample ID: BH-1
Sample Location 0-1.6'
Material Description Tan Silty, Clayey Sand
Sample By: Client
Sample Date: 4/11/2023
Sample Received: 5/10/2023

<u>Sieve Size</u>	<u>Cumulative Percent Retained</u>	<u>Specifications</u>
No. 4	0	N/A
No. 10	0	-
No. 40	10	-
No. 200	68	-

In situ moisture = 1.1%
 Material Finer than 75 um (No. 200) sieve by washing = 30.3%

Remarks: Sample soak a minimum of 10 min

Beyond Engineering and Testing, LLC



Quality Review

S01

TO: Magrym Consulting, PC
Claudius Sanchez
1510 North Acres Dr
Lovington, New Mexico, 88260

PROJECT: Magrym Misc. Testing

-
-

PROJECT NO.: WT1909260

DATE: May 17, 2023

Test By: Poonam Kumari
Test Date: May 11, 2023

REPORT NO.:
REVISION:

MATERIAL QUALIFICATIONS - Soils

Test Procedure: ASTM D4318, D2487
Sample ID: BH-1
Sample Location: 0-1.6'
Material Description: Tan Silty, Clayey Sand
Sample By: Client
Sample Date: N/A
Sample Received: 5/10/2023

Test Method: Method B (Single Point)
Equipment: Plastic Limit (Hand rolled)
Liquid Limit (Mechanical)

Atterberg Limits

Specifications

Liquid Limit:	20	N/A
Plastic Limit:	13	-
Plasticity Index:	7	-

Soil Classification

Silty, clayey sand (SC-SM)

Beyond Engineering and Testing, LLC



Quality Review

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S02

West Texas
3011-B South County Road 1260
Midland, Texas 79706
432.561.5780

TO: Magrym Consulting, PC
Claudius Sanchez
1510 North Acres Dr
Lovington, New Mexico, 88260

PROJECT: Magrym Misc. Testing

-
-

PROJECT NO.: WT1909260

DATE: May 17, 2023

Test By: Maui Rodriguez
Test Date: May 16, 2023

REPORT NO.:

REVISION:

MATERIAL QUALIFICATIONS - Soils

Test Procedure: ASTM D1140 & D6913
Sample ID: BH-2
Sample Location: 2-4'
Material Description: Tan Silty Sand
Sample By: Client
Sample Date: N/A
Sample Received: 5/10/2023

<u>Sieve Size</u>	<u>Cumulative Percent Retained</u>	<u>Specifications</u>
3/8"	0	N/A
No. 4	1	-
No. 10	1	-
No. 40	6	-
No. 200	80	-

In situ moisture = 0.7%
Material Finer than 75 um (No. 200) sieve by washing = 18.5%

Remarks: Sample soak a minimum of 10 min

Beyond Engineering and Testing, LLC



Quality Review

S02

TO: Magrym Consulting, PC
Claudius Sanchez
1510 North Acres Dr
Lovington, New Mexico, 88260

PROJECT: Magrym Misc. Testing

-
-

PROJECT NO.: WT1909260

DATE: May 17, 2023

Test By: Poonam Kumari
Test Date: May 11, 2023

REPORT NO.:
REVISION:

MATERIAL QUALIFICATIONS - Soils

Test Procedure: ASTM D4318, D2487
Sample ID: BH-2
Sample Location: 2-4'
Material Description: Tan Silty Sand
Sample By: Client
Sample Date: N/A
Sample Received: 5/10/2023

Test Method: Method B (Single Point)
Equipment: Plastic Limit (Hand rolled)
Liquid Limit (Mechanical)

Atterberg Limits

Specifications

Liquid Limit:	15	N/A
Plastic Limit:	14	-
Plasticity Index:	1	-

Soil Classification

Silty sand (SM)

Beyond Engineering and Testing, LLC



Quality Review

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S03

West Texas
3011-B South County Road 1260
Midland, Texas 79706
432.561.5780

TO: Magrym Consulting, PC
Claudius Sanchez
1510 North Acres Dr
Lovington, New Mexico, 88260

PROJECT: Magrym Misc. Testing

-
-

PROJECT NO.: WT1909260

DATE: May 17, 2023

Test By: Maui Rodriguez
Test Date: May 16, 2023

REPORT NO.:

REVISION:

MATERIAL QUALIFICATIONS - Soils

Test Procedure: ASTM D1140 & D6913
Sample ID: BH-3
Sample Location: 2-4.6'
Material Description: Light Brown Clayey Sand
Sample By: Client
Sample Date: N/A
Sample Received: 5/10/2023

<u>Sieve Size</u>	<u>Cumulative Percent Retained</u>	<u>Specifications</u>
3/8"	0	N/A
No. 4	2	-
No. 10	3	-
No. 40	6	-
No. 200	53	-

In situ moisture = 1.3%
Material Finer than 75 um (No. 200) sieve by washing = 45.9%

Remarks: Sample soak a minimum of 10 min

Beyond Engineering and Testing, LLC



Quality Review

S03

TO: Magrym Consulting, PC
Claudius Sanchez
1510 North Acres Dr
Lovington, New Mexico, 88260

PROJECT: Magrym Misc. Testing

-
-

PROJECT NO.: WT1909260

DATE: May 17, 2023

Test By: Poonam Kumari
Test Date: May 11, 2023

REPORT NO.:
REVISION:

MATERIAL QUALIFICATIONS - Soils

Test Procedure: ASTM D4318, D2487
Sample ID: BH-3
Sample Location: 2-4.6'
Material Description: Light Brown Clayey Sand
Sample By: Client
Sample Date: N/A
Sample Received: 5/10/2023

Test Method: Method B (Single Point)
Equipment: Plastic Limit (Hand rolled)
Liquid Limit (Mechanical)

Atterberg Limits

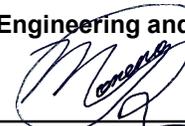
Specifications

Liquid Limit:	23	N/A
Plastic Limit:	10	-
Plasticity Index:	13	-

Soil Classification

Clayey sand (SC)

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S04

TO: Magrym Consulting, PC
 Claudius Sanchez
 1510 North Acres Dr
 Lovington, New Mexico, 88260

PROJECT: Magrym Misc. Testing

-
-

PROJECT NO.: WT1909260

DATE: May 17, 2023

Test By: Maui Rodriguez
Test Date: May 16, 2023

REPORT NO.:

REVISION:

MATERIAL QUALIFICATIONS - Soils

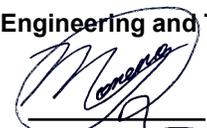
Test Procedure: ASTM D1140 & D6913
Sample ID: BH-4
Sample Location: 0-2'
Material Description: Light Brown Silty, Clayey Sand w/Gravel
Sample By: Client
Sample Date: N/A
Sample Received: 5/10/2023

<u>Sieve Size</u>	<u>Cumulative Percent Retained</u>	<u>Specifications</u>
1"	0	N/A
3/4"	20	-
3/8"	33	-
No. 4	41	-
No. 10	49	-
No. 40	59	-
No. 200	86	-

In situ moisture = 0.9%
 Material Finer than 75 um (No. 200) sieve by washing = 13.6%

Remarks: Sample soak a minimum of 10 min

Beyond Engineering and Testing, LLC


 Quality Review

S04

TO: Magrym Consulting, PC
Claudius Sanchez
1510 North Acres Dr
Lovington, New Mexico, 88260

PROJECT: Magrym Misc. Testing

-
-

PROJECT NO.: WT1909260

DATE: May 17, 2023

Test By: Poonam Kumari
Test Date: May 11, 2023

REPORT NO.:

REVISION:

MATERIAL QUALIFICATIONS - Soils

Test Procedure: ASTM D4318, D2487
Sample ID: BH-4
Sample Location: 0-2'
Material Description: Light Brown Silty Clayey Sand w/Gravel
Sample By: Client
Sample Date: N/A
Sample Received: 5/10/2023

Test Method: Method B (Single Point)
Equipment: Plastic Limit (Hand rolled)
Liquid Limit (Mechanical)

Atterberg Limits

Specifications

Liquid Limit:	22	N/A
Plastic Limit:	17	-
Plasticity Index:	5	-

Soil Classification

Silty clayey sand with garvel (SC-SM)

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S05

TO: Magrym Consulting, PC
Claudius Sanchez
1510 North Acres Dr
Lovington, New Mexico, 88260

PROJECT: Magrym Misc. Testing

-
-

PROJECT NO.: WT1909260

DATE: May 17, 2023

Test By: Maui Rodriguez
Test Date: May 16, 2023

REPORT NO.:

REVISION:

MATERIAL QUALIFICATIONS - Soils

Test Procedure: ASTM D1140 & D6913
Sample ID: BH-4
Sample Location: 2-3'
Material Description: Tan Silty Sand
Sample By: Client
Sample Date: N/A
Sample Received: 5/10/2023

<u>Sieve Size</u>	<u>Cumulative Percent Retained</u>	<u>Specifications</u>
3/8"	0	N/A
No. 4	0	-
No. 10	1	-
No. 40	6	-
No. 200	69	-

In situ moisture = 1.7%
Material Finer than 75 um (No. 200) sieve by washing = 29.1%

Remarks: Sample soak a minimum of 10 min

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Quality Review

S05

TO: Magrym Consulting, PC
Claudius Sanchez
1510 North Acres Dr
Lovington, New Mexico, 88260

PROJECT: Magrym Misc. Testing

-
-

PROJECT NO.: WT1909260

DATE: May 17, 2023

Test By: Poonam Kumari
Test Date: May 11, 2023

REPORT NO.:
REVISION:

MATERIAL QUALIFICATIONS - Soils

Test Procedure: ASTM D4318, D2487
Sample ID: BH-4
Sample Location: 0-2'
Material Description: Tan Silty Sand
Sample By: Client
Sample Date: N/A
Sample Received: 5/10/2023

Test Method: Method B (Single Point)
Equipment: Plastic Limit (Hand rolled)
Liquid Limit (Mechanical)

Atterberg Limits

Specifications

Liquid Limit:	15	N/A
Plastic Limit:	12	-
Plasticity Index:	3	-

Soil Classification

Silty sand (SM)

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Quality Review

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S06

TO: Magrym Consulting, PC
Claudius Sanchez
1510 North Acres Dr
Lovington, New Mexico, 88260

PROJECT: Magrym Misc. Testing
-
-

PROJECT NO.: WT1909260
DATE: May 17, 2023

Test By: Maui Rodriguez
Test Date: May 16, 2023

REPORT NO.:
REVISION:

MATERIAL QUALIFICATIONS - Soils

Test Procedure: ASTM D1140 & D6913
Sample ID: BH-5
Sample Location 4-6"
Material Description Tan Clayey Sand
Sample By: Client
Sample Date: N/A
Sample Received: 5/10/2023

<u>Sieve Size</u>	<u>Cumulative Percent Retained</u>	<u>Specifications</u>
3/8"	0	N/A
No. 4	0	-
No. 10	0	-
No. 40	4	-
No. 200	66	-

In situ moisture = 1.4%
Material Finer than 75 um (No. 200) sieve by washing = 32.8%

Remarks: Sample soak a minimum of 10 min

Beyond Engineering and Testing, LLC



Quality Review

S06

TO: Magrym Consulting, PC
Claudius Sanchez
1510 North Acres Dr
Lovington, New Mexico, 88260

PROJECT: Magrym Misc. Testing

-
-

PROJECT NO.: WT1909260

DATE: May 17, 2023

Test By: Poonam Kumari
Test Date: May 11, 2023

REPORT NO.:
REVISION:

MATERIAL QUALIFICATIONS - Soils

Test Procedure: ASTM D4318, D2487
Sample ID: BH-5
Sample Location: 4-6'
Material Description: Tan Clayey Sand
Sample By: Client
Sample Date: N/A
Sample Received: 5/10/2023

Test Method: Method B (Single Point)
Equipment: Plastic Limit (Hand rolled)
Liquid Limit (Mechanical)

Atterberg Limits

Specifications

Liquid Limit:	21	N/A
Plastic Limit:	12	-
Plasticity Index:	9	-

Soil Classification

Clayey sand (SC)

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Quality Review

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S07

TO: Magrym Consulting, PC
Claudius Sanchez
1510 North Acres Dr
Lovington, New Mexico, 88260

PROJECT: Magrym Misc. Testing

-
-

PROJECT NO.: WT1909260

DATE: May 17, 2023

Test By: Maui Rodriguez
Test Date: May 16, 2023

REPORT NO.:

REVISION:

MATERIAL QUALIFICATIONS - Soils

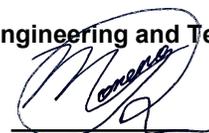
Test Procedure: ASTM D1140 & D6913
Sample ID: BH-6
Sample Location 5-5.6'
Material Description Light Brown Silty, Clayey Sand
Sample By: Client
Sample Date: N/A
Sample Received: 5/10/2023

<u>Sieve Size</u>	<u>Cumulative Percent Retained</u>	<u>Specifications</u>
3/8"	0	N/A
No. 4	2	-
No. 10	5	-
No. 40	11	-
No. 200	76	-

In situ moisture = 0.9%
Material Finer than 75 um (No. 200) sieve by washing = 22.4%

Remarks: Sample soak a minimum of 10 min

Beyond Engineering and Testing, LLC



Quality Review

S07

TO: Magrym Consulting, PC
Claudius Sanchez
1510 North Acres Dr
Lovington, New Mexico, 88260

PROJECT: Magrym Misc. Testing

-
-

PROJECT NO.: WT1909260

DATE: May 17, 2023

Test By: Poonam Kumari
Test Date: May 11, 2023

REPORT NO.:
REVISION:

MATERIAL QUALIFICATIONS - Soils

Test Procedure: ASTM D4318, D2487
Sample ID: BH-6
Sample Location: 5-5.6'
Material Description: Light Brown Silty, Clayey Sand
Sample By: Client
Sample Date: N/A
Sample Received: 5/10/2023

Test Method: Method B (Single Point)
Equipment: Plastic Limit (Hand rolled)
Liquid Limit (Mechanical)

Atterberg Limits

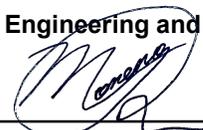
Specifications

Liquid Limit:	18	N/A
Plastic Limit:	13	-
Plasticity Index:	5	-

Soil Classification

Silty, clayey sand (SC-SM)

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S08

West Texas
3011-B South County Road 1260
Midland, Texas 79706
432.561.5780

TO: Magrym Consulting, PC
Claudius Sanchez
1510 North Acres Dr
Lovington, New Mexico, 88260

PROJECT: Magrym Misc. Testing

-
-

PROJECT NO.: WT1909260

DATE: May 17, 2023

Test By: Maui Rodriguez
Test Date: May 16, 2023

REPORT NO.:

REVISION:

MATERIAL QUALIFICATIONS - Soils

Test Procedure: ASTM D1140 & D6913
Sample ID: BH-7
Sample Location: 5.3-6
Material Description: Light Brown Silty Sand
Sample By: Client
Sample Date: N/A
Sample Received: 5/10/2023

<u>Sieve Size</u>	<u>Cumulative Percent Retained</u>	<u>Specifications</u>
3/8"	0	N/A
No. 4	1	-
No. 10	1	-
No. 40	5	-
No. 200	76	-

In situ moisture = 0.9%
Material Finer than 75 um (No. 200) sieve by washing = 23.2%

Remarks: Sample soak a minimum of 10 min

Beyond Engineering and Testing, LLC



Quality Review

S08

TO: Magrym Consulting, PC
Claudius Sanchez
1510 North Acres Dr
Lovington, New Mexico, 88260

PROJECT: Magrym Misc. Testing

-
-

PROJECT NO.: WT1909260

DATE: May 17, 2023

Test By: Poonam Kumari
Test Date: May 11, 2023

REPORT NO.:
REVISION:

MATERIAL QUALIFICATIONS - Soils

Test Procedure: ASTM D4318, D2487
Sample ID: BH-7
Sample Location: 5.3-6
Material Description: Light Brown Silty Sand
Sample By: Client
Sample Date: N/A
Sample Received: 5/10/2023

Test Method: Method B (Single Point)
Equipment: Plastic Limit (Hand rolled)
Liquid Limit (Mechanical)

Atterberg Limits

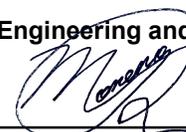
Specifications

Liquid Limit:	16	N/A
Plastic Limit:	13	-
Plasticity Index:	3	-

Soil Classification

Silty sand (SM)

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Quality Review

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TO: Magrym Consulting, PC
Claudius Sanchez
1510 North Acres Dr
Lovington, New Mexico, 88260

PROJECT: Magrym Misc. Testing

-
-

PROJECT NO.: WT1909260

DATE: May 17, 2023

Test By: Maui Rodriguez
Test Date: May 16, 2023

REPORT NO.:

REVISION:

MATERIAL QUALIFICATIONS - Soils

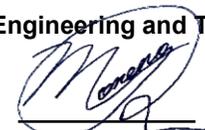
Test Procedure: ASTM D1140 & D6913
Sample ID: BH-9
Sample Location 0-4'
Material Description Light Brown Silty Sand
Sample By: Client
Sample Date: N/A
Sample Received: 5/10/2023

<u>Sieve Size</u>	<u>Cumulative Percent Retained</u>	<u>Specifications</u>
3/8"	0	N/A
No. 4	0	-
No. 10	0	-
No. 40	2	-
No. 200	79	-

In situ moisture = 0.8%
Material Finer than 75 um (No. 200) sieve by washing = 18.4%

Remarks: Sample soak a minimum of 10 min

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Quality Review

S09

TO: Magrym Consulting, PC
Claudius Sanchez
1510 North Acres Dr
Lovington, New Mexico, 88260

PROJECT: Magrym Misc. Testing

-
-

PROJECT NO.: WT1909260

DATE: May 17, 2023

Test By: Poonam Kumari
Test Date: May 11, 2023

REPORT NO.:
REVISION:

MATERIAL QUALIFICATIONS - Soils

Test Procedure: ASTM D4318, D2487
Sample ID: BH-9
Sample Location: 0-4'
Material Description: Light Brown Silty Sand
Sample By: Client
Sample Date: N/A
Sample Received: 5/10/2023

Test Method: Method B (Single Point)
Equipment: Plastic Limit (Hand rolled)
Liquid Limit (Mechanical)

Atterberg Limits

Specifications

Liquid Limit:	15	N/A
Plastic Limit:	13	-
Plasticity Index:	2	-

Soil Classification

Silty sand (SM)

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S10

West Texas
3011-B South County Road 1260
Midland, Texas 79706
432.561.5780

TO: Magrym Consulting, PC
Claudius Sanchez
1510 North Acres Dr
Lovington, New Mexico, 88260

PROJECT: Magrym Misc. Testing

-
-

PROJECT NO.: WT1909260

DATE: May 17, 2023

Test By: Maui Rodriguez
Test Date: May 16, 2023

REPORT NO.:

REVISION:

MATERIAL QUALIFICATIONS - Soils

Test Procedure: ASTM D1140 & D6913
Sample ID: BH-10
Sample Location 3-3.6'
Material Description Light Brown Clayey Sand
Sample By: Client
Sample Date: N/A
Sample Received: 5/10/2023

<u>Sieve Size</u>	<u>Cumulative Percent Retained</u>	<u>Specifications</u>
3/8"	0	N/A
No. 4	0	-
No. 10	0	-
No. 40	4	-
No. 200	58	-

In situ moisture = 4.1%
Material Finer than 75 um (No. 200) sieve by washing = 40.5%

Remarks: Sample soak a minimum of 10 min

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Quality Review

S10

TO: Magrym Consulting, PC
Claudius Sanchez
1510 North Acres Dr
Lovington, New Mexico, 88260

PROJECT: Magrym Misc. Testing

-
-

PROJECT NO.: WT1909260

DATE: May 17, 2023

Test By: Poonam Kumari
Test Date: May 11, 2023

REPORT NO.:
REVISION:

MATERIAL QUALIFICATIONS - Soils

Test Procedure: ASTM D4318, D2487
Sample ID: BH-10
Sample Location 3-3.6
Material Description Light Brown Clayey Sand
Sample By: Client
Sample Date: N/A
Sample Received: 5/10/2023

Test Method: Method B (Single Point)
Equipment: Plastic Limit (Hand rolled)
Liquid Limit (Mechanical)

Atterberg Limits

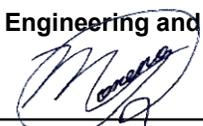
Specifications

Liquid Limit:	22	N/A
Plastic Limit:	12	-
Plasticity Index:	10	-

Soil Classification

Clayey sand (SC)

Beyond Engineering and Testing, LLC



Quality Review

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TO: Magrym Consulting, PC
Claudius Sanchez
1510 North Acres Dr
Lovington, New Mexico, 88260

PROJECT: Magrym Misc. Testing
-
-

PROJECT NO.: WT1909260
DATE: May 17, 2023

Test By: Maui Rodriguez
Test Date: May 16, 2023

REPORT NO.:
REVISION:

MATERIAL QUALIFICATIONS - Soils

Test Procedure: ASTM D1140 & D6913
Sample ID: BH-10
Sample Location 4.6-5'
Material Description Tan Clayey Sand
Sample By: Client
Sample Date: N/A
Sample Received: 5/10/2023

<u>Sieve Size</u>	<u>Cumulative Percent Retained</u>	<u>Specifications</u>
3/8"	0	N/A
No. 4	0	-
No. 10	0	-
No. 40	4	-
No. 200	55	-

In situ moisture = 0.6%
Material Finer than 75 um (No. 200) sieve by washing = 36.3%

Remarks: Sample soak a minimum of 10 min

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Quality Review

S11

TO: Magrym Consulting, PC
Claudius Sanchez
1510 North Acres Dr
Lovington, New Mexico, 88260

PROJECT: Magrym Misc. Testing

-
-

PROJECT NO.: WT1909260

DATE: May 17, 2023

Test By: Poonam Kumari
Test Date: May 11, 2023

REPORT NO.:
REVISION:

MATERIAL QUALIFICATIONS - Soils

Test Procedure: ASTM D4318, D2487
Sample ID: BH-10
Sample Location: 4.6-5'
Material Description: Tan Clayey Sand
Sample By: Client
Sample Date: N/A
Sample Received: 5/10/2023

Test Method: Method B (Single Point)
Equipment: Plastic Limit (Hand rolled)
Liquid Limit (Mechanical)

Atterberg Limits

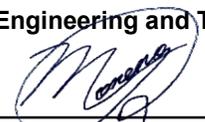
Specifications

Liquid Limit:	21	N/A
Plastic Limit:	12	-
Plasticity Index:	9	-

Soil Classification

Clayey sand (SC)

Beyond Engineering and Testing, LLC



Quality Review

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TO: Magrym Consulting, PC
 Claudius Sanchez
 1510 North Acres Dr
 Lovington, New Mexico, 88260

PROJECT: Magrym Misc. Testing

-
-

PROJECT NO.: WT1909260

DATE: May 17, 2023

Test By: Maui Rodriguez
Test Date: May 16, 2023

REPORT NO.:

REVISION:

MATERIAL QUALIFICATIONS - Soils

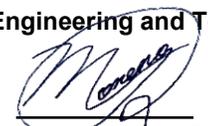
Test Procedure: ASTM D1140 & D6913
Sample ID: BH-11
Sample Location 4-5.6'
Material Description Tan Silty, Clayey Sand
Sample By: Client
Sample Date: N/A
Sample Received: 5/10/2023

<u>Sieve Size</u>	<u>Cumulative Percent Retained</u>	<u>Specifications</u>
3/8"	0	N/A
No. 4	0	-
No. 10	0	-
No. 40	4	-
No. 200	71	-

In situ moisture = 0.8%
 Material Finer than 75 um (No. 200) sieve by washing = 27.2%

Remarks: Sample soak a minimum of 10 min

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 Quality Review

S12

TO: Magrym Consulting, PC
Claudius Sanchez
1510 North Acres Dr
Lovington, New Mexico, 88260

PROJECT: Magrym Misc. Testing

-

-

PROJECT NO.: WT1909260

DATE: May 17, 2023

Test By: Poonam Kumari
Test Date: May 11, 2023

REPORT NO.:

REVISION:

MATERIAL QUALIFICATIONS - Soils

Test Procedure: ASTM D4318, D2487
Sample ID: BH-11
Sample Location: 4-5.6'
Material Description: Tan Silty, Clayey Sand
Sample By: Client
Sample Date: N/A
Sample Received: 5/10/2023

Test Method: Method B (Single Point)
Equipment: Plastic Limit (Hand rolled)
Liquid Limit (Mechanical)

Atterberg Limits

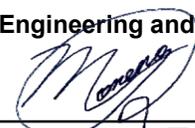
Specifications

Liquid Limit:	17	N/A
Plastic Limit:	13	-
Plasticity Index:	4	-

Soil Classification

Silty, clayey sand (SC-SM)

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TO: Magrym Consulting, PC
Claudius Sanchez
1510 North Acres Dr
Lovington, New Mexico, 88260

PROJECT: Magrym Misc. Testing
-
-

PROJECT NO.: WT1909260
DATE: May 17, 2023

Test By: Maui Rodriguez
Test Date: May 16, 2023

REPORT NO.:
REVISION:

MATERIAL QUALIFICATIONS - Soils

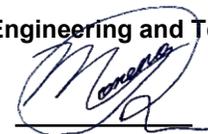
Test Procedure: ASTM D1140 & D6913
Sample ID: BH-12
Sample Location: 0-3'
Material Description: Light Brown Silty Sand
Sample By: Client
Sample Date: N/A
Sample Received: 5/10/2023

<u>Sieve Size</u>	<u>Cumulative Percent Retained</u>	<u>Specifications</u>
3/8"	0	N/A
No. 4	0	-
No. 10	0	-
No. 40	4	-
No. 200	81	-

In situ moisture = 0.6%
Material Finer than 75 um (No. 200) sieve by washing = 17.8%

Remarks: Sample soak a minimum of 10 min

Beyond Engineering and Testing, LLC



Quality Review

S13

TO: Magrym Consulting, PC
Claudius Sanchez
1510 North Acres Dr
Lovington, New Mexico, 88260

PROJECT: Magrym Misc. Testing

-
-

PROJECT NO.: WT1909260

DATE: May 17, 2023

Test By: Poonam Kumari
Test Date: May 11, 2023

REPORT NO.:
REVISION:

MATERIAL QUALIFICATIONS - Soils

Test Procedure: ASTM D4318, D2487
Sample ID: BH-12
Sample Location: 0-3
Material Description: Light Brown Silty Sand
Sample By: Client
Sample Date: N/A
Sample Received: 5/10/2023

Test Method: Method B (Single Point)
Equipment: Plastic Limit (Hand rolled)
Liquid Limit (Mechanical)

Atterberg Limits

Specifications

Liquid Limit:	-	N/A
Plastic Limit:	Non Plastic	-
Plasticity Index:	-	-

Soil Classification

Silty sand (SM)

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APPENDIX D: REFERENCES AND TERMINOLOGY

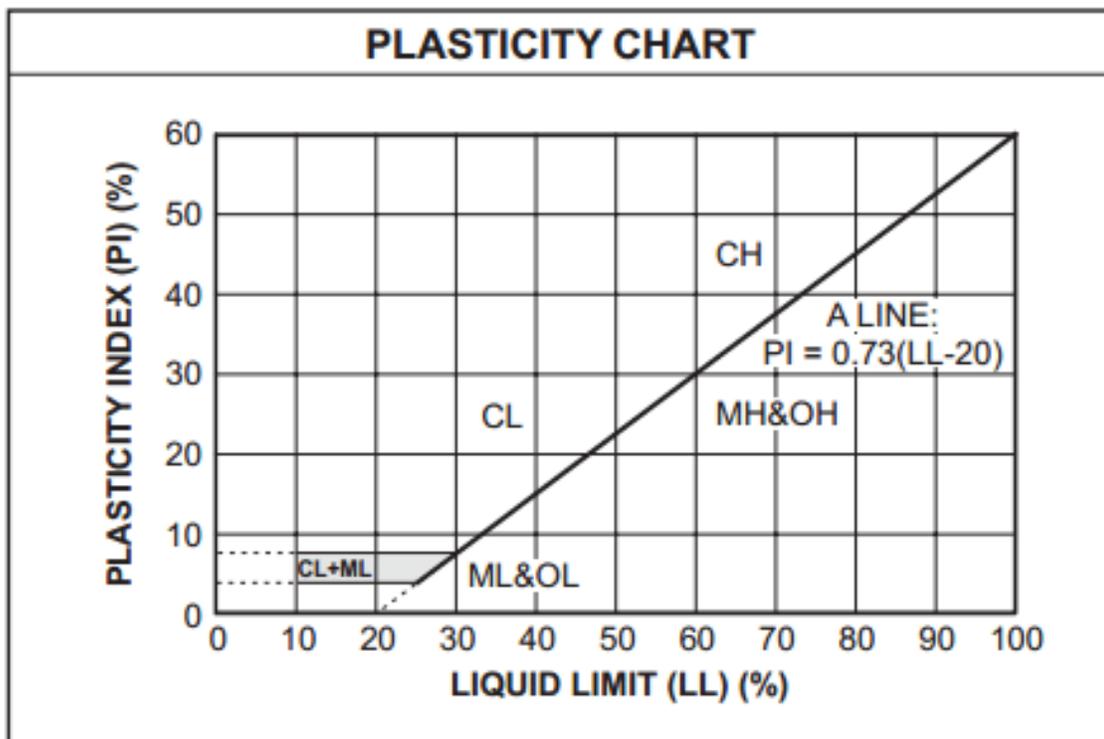
Soil Properties

Soil classification table



Unified Soil Classification System and Symbol Chart:

COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)			FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)			
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravels (Less than 5% fines)		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	
	GW	Well-graded gravels, gravel-sand mixtures, little or no fines		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
	GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines		OL	Organic silts and organic silty clays of low plasticity	
	Gravels with fines (More than 12% fines)			SILTS AND CLAYS Liquid limit 50% or greater	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
	GM	Silty gravels, gravel-sand-silt mixtures			CH	Inorganic clays of high plasticity, fat clays
	GC	Clayey gravels, gravel-sand-clay mixtures			OH	Organic clays of medium to high plasticity, organic silts
Clean Sands (Less than 5% fines)		HIGHLY ORGANIC SOILS	PT		Peat and other highly organic soils	
SW	Well-graded sands, gravelly sands, little or no fines					
SP	Poorly graded sands, gravelly sands, little or no fines					
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	Sands with fines (More than 12% fines)					
	SM	Silty sands, sand-silt mixtures				
	SC	Clayey sands, sand-clay mixtures				



Works Sited:

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[https://www.nmcoa.org/wp-](https://www.nmcoa.org/wp-content/uploads/2018/05/2015_IBC_Performing_Structural_Plan_Review_4up1.pdf)

[content/uploads/2018/05/2015_IBC_Performing_Structural_Plan_Review_4up1.pdf](https://www.nmcoa.org/wp-content/uploads/2018/05/2015_IBC_Performing_Structural_Plan_Review_4up1.pdf)

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APPENDIX E: USDA WEBSOIL SURVEY





United States
Department of
Agriculture

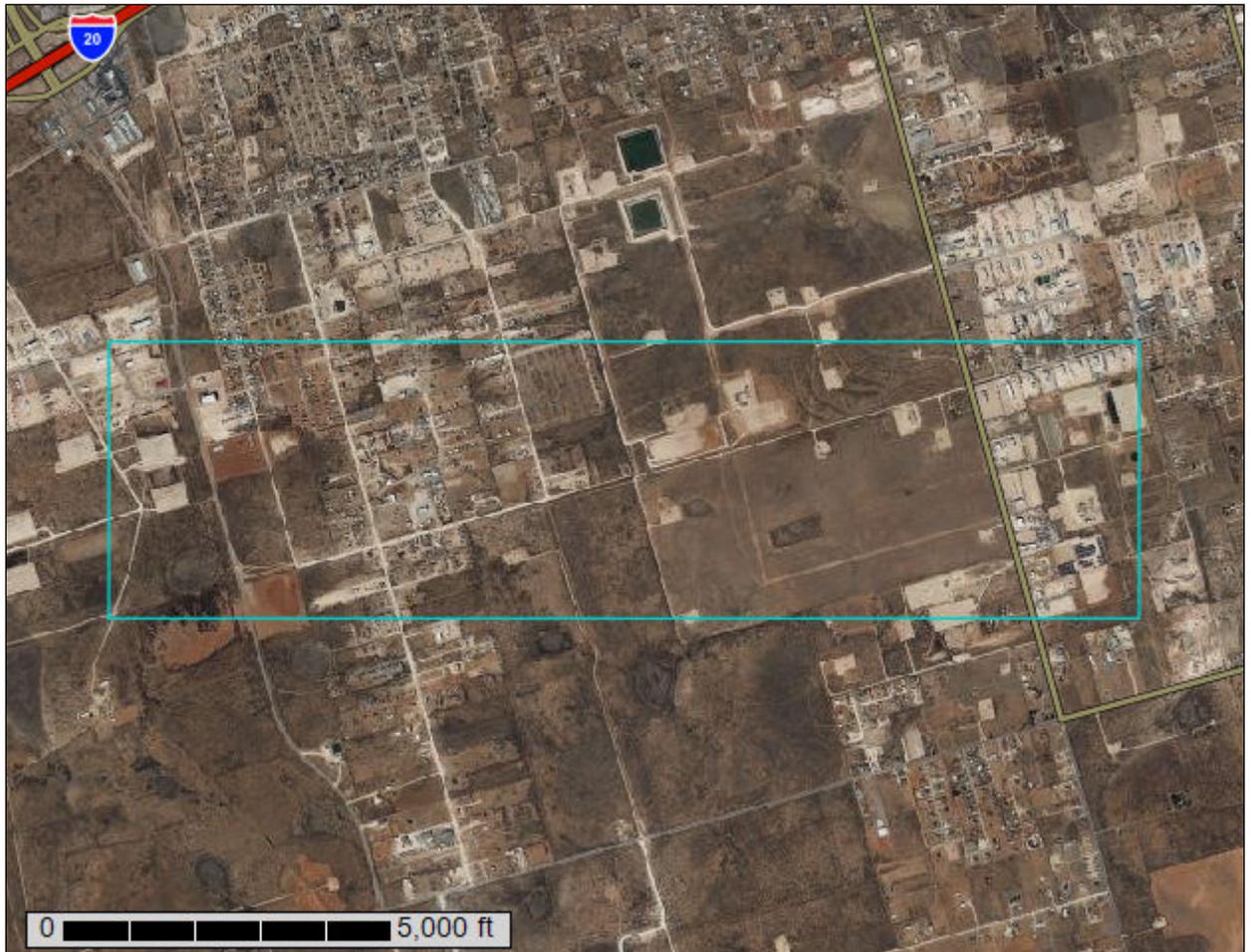
NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for Midland County, Texas

MC_CR130



Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

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scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

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identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

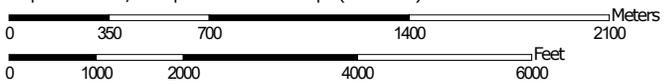
Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report Soil Map



Map Scale: 1:26,300 if printed on A landscape (11" x 8.5") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features

-  Blowout
-  Borrow Pit
-  Clay Spot
-  Closed Depression
-  Gravel Pit
-  Gravelly Spot
-  Landfill
-  Lava Flow
-  Marsh or swamp
-  Mine or Quarry
-  Miscellaneous Water
-  Perennial Water
-  Rock Outcrop
-  Saline Spot
-  Sandy Spot
-  Severely Eroded Spot
-  Sinkhole
-  Slide or Slip
-  Sodic Spot

-  Spoil Area
-  Stony Spot
-  Very Stony Spot
-  Wet Spot
-  Other
-  Special Line Features

Water Features

 Streams and Canals

Transportation

-  Rails
-  Interstate Highways
-  US Routes
-  Major Roads
-  Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:31,700.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
 Web Soil Survey URL:
 Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Midland County, Texas
 Survey Area Data: Version 21, Aug 24, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Feb 10, 2022—Feb 13, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AfA	Amarillo fine sandy loam, 0 to 1 percent slopes	244.7	16.1%
AfB	Amarillo fine sandy loam, 1 to 3 percent slopes	1,079.1	70.9%
ArB	Arvana fine sandy loam, 1 to 3 percent slopes	149.2	9.8%
Kb	Kimbrough loam, 0 to 3 percent slopes	26.1	1.7%
Lp	Lipan clay, 0 to 1 percent slopes, frequently ponded	5.6	0.4%
MmB	Amarose loamy fine sand, 0 to 3 percent slopes	16.8	1.1%
Totals for Area of Interest		1,521.7	100.0%

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it

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was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Midland County, Texas

AfA—Amarillo fine sandy loam, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: f5r6
Elevation: 2,600 to 5,100 feet
Mean annual precipitation: 16 to 21 inches
Mean annual air temperature: 57 to 63 degrees F
Frost-free period: 185 to 220 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Amarillo and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Amarillo

Setting

Landform: Plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy eolian deposits

Typical profile

Ap - 0 to 10 inches: fine sandy loam
Bt - 10 to 41 inches: sandy clay loam
Btkk - 41 to 56 inches: sandy clay loam
Btk - 56 to 80 inches: sandy clay loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 65 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Moderate (about 8.1 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: R077CY036TX - Sandy Loam 16-21" PZ
Hydric soil rating: No

Minor Components

Arvana

Percent of map unit: 4 percent
Landform: Plains
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R077CY036TX - Sandy Loam 16-21" PZ
Hydric soil rating: No

Posey

Percent of map unit: 4 percent
Landform: Plains
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R077CY028TX - Limy Upland 16-21" PZ
Hydric soil rating: No

Sharvana

Percent of map unit: 2 percent
Landform: Plains
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: R077CY037TX - Very Shallow 16-21" PZ
Hydric soil rating: No

AfB—Amarillo fine sandy loam, 1 to 3 percent slopes

Map Unit Setting

National map unit symbol: f5r7
Elevation: 2,600 to 5,100 feet
Mean annual precipitation: 16 to 21 inches
Mean annual air temperature: 57 to 63 degrees F
Frost-free period: 185 to 220 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Amarillo and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Amarillo

Setting

Landform: Plains, playa slopes
Down-slope shape: Convex, concave
Across-slope shape: Linear
Parent material: Loamy eolian deposits

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Typical profile

Ap - 0 to 10 inches: fine sandy loam
Bt - 10 to 41 inches: sandy clay loam
Btkk - 41 to 56 inches: sandy clay loam
Btk - 56 to 85 inches: sandy clay loam

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 65 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Moderate (about 8.1 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: R077CY036TX - Sandy Loam 16-21" PZ
Hydric soil rating: No

Minor Components

Arvana

Percent of map unit: 4 percent
Landform: Plains, playa slopes
Down-slope shape: Convex, concave
Across-slope shape: Linear
Ecological site: R077CY036TX - Sandy Loam 16-21" PZ
Hydric soil rating: No

Posey

Percent of map unit: 4 percent
Landform: Plains, playa slopes
Down-slope shape: Convex, concave
Across-slope shape: Linear
Ecological site: R077CY028TX - Limy Upland 16-21" PZ
Hydric soil rating: No

Sharvana

Percent of map unit: 2 percent
Landform: Plains
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: R077CY037TX - Very Shallow 16-21" PZ
Hydric soil rating: No

ArB—Arvana fine sandy loam, 1 to 3 percent slopes

Map Unit Setting

National map unit symbol: f5rp

Elevation: 2,600 to 5,100 feet

Mean annual precipitation: 16 to 21 inches

Mean annual air temperature: 57 to 63 degrees F

Frost-free period: 185 to 220 days

Farmland classification: Farmland of statewide importance, if irrigated

Map Unit Composition

Arvana and similar soils: 85 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Arvana

Setting

Landform: Plains, playa slopes

Down-slope shape: Convex, concave

Across-slope shape: Linear

Parent material: Loamy eolian deposits from the blackwater draw formation of pleistocene age

Typical profile

Ap - 0 to 9 inches: fine sandy loam

Bt - 9 to 26 inches: sandy clay loam

Bkkm - 26 to 37 inches: cemented material

Bkk - 37 to 80 inches: very gravelly loam

Properties and qualities

Slope: 1 to 3 percent

Depth to restrictive feature: 20 to 40 inches to petrocalcic

Drainage class: Well drained

Runoff class: High

Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.14 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum content: 80 percent

Maximum salinity: Nonsaline to slightly saline (0.0 to 5.0 mmhos/cm)

Sodium adsorption ratio, maximum: 5.0

Available water supply, 0 to 60 inches: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): 3e

Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: C

Ecological site: R077CY036TX - Sandy Loam 16-21" PZ

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Hydric soil rating: No

Minor Components

Sharvana

Percent of map unit: 7 percent

Landform: Plains

Down-slope shape: Linear

Across-slope shape: Convex

Ecological site: R077CY037TX - Very Shallow 16-21" PZ

Hydric soil rating: No

Amarillo

Percent of map unit: 6 percent

Landform: Plains, playa slopes

Down-slope shape: Convex, concave

Across-slope shape: Linear

Ecological site: R077CY036TX - Sandy Loam 16-21" PZ

Hydric soil rating: No

Posey

Percent of map unit: 2 percent

Landform: Plains, playa slopes

Down-slope shape: Convex, concave

Across-slope shape: Linear

Ecological site: R077CY028TX - Limy Upland 16-21" PZ

Hydric soil rating: No

Kb—Kimbrough loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2qmyr

Elevation: 2,500 to 4,800 feet

Mean annual precipitation: 14 to 16 inches

Mean annual air temperature: 57 to 63 degrees F

Frost-free period: 180 to 220 days

Farmland classification: Not prime farmland

Map Unit Composition

Kimbrough and similar soils: 85 percent

Minor components: 15 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kimbrough

Setting

Landform: Plains

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Loamy eolian deposits derived from sedimentary rock

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Typical profile

A - 0 to 3 inches: loam
Bw - 3 to 10 inches: loam
Bkkm1 - 10 to 16 inches: cemented material
Bkkm2 - 16 to 80 inches: cemented material

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: 4 to 18 inches to petrocalcic
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.01 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 95 percent
Maximum salinity: Nonsaline (0.0 to 1.0 mmhos/cm)
Sodium adsorption ratio, maximum: 1.0
Available water supply, 0 to 60 inches: Very low (about 1.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: R077DY049TX - Very Shallow 12-17" PZ
Hydric soil rating: No

Minor Components

Eunice

Percent of map unit: 6 percent
Landform: Plains
Down-slope shape: Linear
Across-slope shape: Convex
Ecological site: R077DY049TX - Very Shallow 12-17" PZ
Hydric soil rating: No

Spraberry

Percent of map unit: 5 percent
Landform: Plains, playa rims
Down-slope shape: Linear, convex
Across-slope shape: Linear
Ecological site: R077DY049TX - Very Shallow 12-17" PZ
Hydric soil rating: No

Kenhill

Percent of map unit: 4 percent
Landform: Plains
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R077DY038TX - Clay Loam 12-17" PZ
Hydric soil rating: No

Lp—Lipan clay, 0 to 1 percent slopes, frequently ponded

Map Unit Setting

National map unit symbol: 2tw2k
Elevation: 2,650 to 3,150 feet
Mean annual precipitation: 12 to 17 inches
Mean annual air temperature: 59 to 65 degrees F
Frost-free period: 205 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Lipan, frequently ponded, and similar soils: 70 percent
Minor components: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lipan, Frequently Ponded

Setting

Landform: Playa floors
Microfeatures of landform position: Circular gilgai
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Clayey lacustrine deposits of quaternary age

Typical profile

Ap - 0 to 6 inches: clay
Bw - 6 to 30 inches: clay
Bss - 30 to 50 inches: clay
BcK - 50 to 80 inches: clay

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 10 percent
Maximum salinity: Nonsaline (0.0 to 0.5 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: D
Ecological site: R077DY041TX - Lakebed 12-17" PZ
Hydric soil rating: Yes

Minor Components

Sparenberg, occasionally ponded

Percent of map unit: 10 percent
Landform: Playa floors
Microfeatures of landform position: Circular gilgai
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R077CY027TX - Playa 16-21" PZ
Hydric soil rating: No

Chapel, occasionally ponded

Percent of map unit: 10 percent
Landform: Playa floors
Microfeatures of landform position: Circular gilgai
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R077CY027TX - Playa 16-21" PZ
Hydric soil rating: No

Portales

Percent of map unit: 10 percent
Landform: Plains, interdunes, playa steps
Landform position (two-dimensional): Shoulder
Down-slope shape: Concave, linear, convex
Across-slope shape: Linear
Ecological site: R077CY028TX - Limy Upland 16-21" PZ
Hydric soil rating: No

MmB—Amarose loamy fine sand, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 1idyj
Elevation: 2,500 to 4,600 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 57 to 63 degrees F
Frost-free period: 180 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Amarose and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Amarose

Setting

Landform: Plains
Down-slope shape: Linear
Across-slope shape: Linear

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Parent material: Loamy eolian deposits

Typical profile

A - 0 to 10 inches: loamy fine sand
Bt1 - 10 to 34 inches: sandy clay loam
Bt2 - 34 to 42 inches: fine sandy loam
Btk - 42 to 80 inches: loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.57 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 55 percent
Maximum salinity: Nonsaline (0.0 to 1.0 mmhos/cm)
Sodium adsorption ratio, maximum: 2.0
Available water supply, 0 to 60 inches: Moderate (about 8.2 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Ecological site: R077DY046TX - Sandy 12-17" PZ
Hydric soil rating: No

Minor Components

Elida

Percent of map unit: 8 percent
Landform: Plains, playa slopes
Landform position (two-dimensional): Backslope
Down-slope shape: Linear
Across-slope shape: Linear, concave
Ecological site: R077DY046TX - Sandy 12-17" PZ
Hydric soil rating: No

Douro

Percent of map unit: 4 percent
Landform: Plains
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R077DY046TX - Sandy 12-17" PZ
Hydric soil rating: No

Triomas

Percent of map unit: 3 percent
Landform: Plains
Down-slope shape: Convex
Across-slope shape: Linear
Ecological site: R077DY046TX - Sandy 12-17" PZ
Hydric soil rating: No

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