

**CADDO WARD II INDUSTRIAL
DEVELOPMENT CORPORATION**

for

**DEEP SOIL BORING REPORT- PHASE 1
WARD II INDUSTRIAL PARK
KSA PROJECT NO. CPW.007-3**

PREPARED BY

KSA

1111 HAWN AVENUE
SHREVEPORT, LA 71107
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OCTOBER 30, 2019

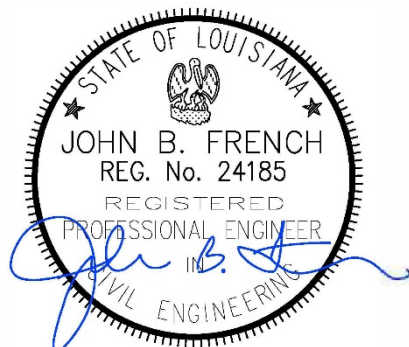


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SUMMARY

KSA was hired by Caddo Ward II Industrial Development Corporation to perform Geotechnical Engineering Services of deep borings for the Caddo Ward II Industrial Development Corporation at the Ward II Industrial Park. The deep borings are planned to be taken in three (3) phases with depths alternating between 30 and 50 feet below existing ground elevation.

The purpose was to evaluate the subsurface conditions and make recommendations for the safe and economical design of potential foundation system(s), pavement sections and subgrade preparation. The locations of the borings are throughout the industrial park and located along Roy “Hoppy” Hopkins Drive between Louisiana Highway 1 and Louisiana Highway 170 in Caddo Parish, Louisiana. The proposed boring and phase map is located in Appendix A of this report.

TIMELINE

Phase 1 of the deep boring consisted of eight (8) borings along the north and south sides of Roy “Hoppy” Hopkins Drive in Ward II Industrial Park. The borings were taken between January 14 and 16, 2019. The Boring Numbers for Phase 1 are 9 and 12 through 18. The boring depths are either 30 ft. or 50 ft. below existing ground elevation. See Appendix A for the approximate locations. The boring number and depth of the borings performed are listed in the following table:

DEEP BORINGS – PHASE 1	
BORING NUMBER	BORING DEPTH (ft.)
9	30
12	50
13	50
14	50
15	50
16	50
17	30
18	30

The samples were returned to the laboratory, visually logged in accordance with the Unified Soils Classification System, and then subjected to standard laboratory tests to determine pertinent engineering properties. The results were tabulated on the Logs of Boring listed in Appendix B.

RECOMMENDATIONS

Shallow Foundation Systems

It was determined that shallow foundation systems can be utilized for support of the proposed structures in the areas tested, but fill or excavation may be required, as necessary. Either continuous footings and/or isolated spread footings appear feasible in the areas. An allowable bearing pressure range of 1600 to 2800 psf, depending on the bearing stratum and condition of said stratum at the time of construction, can be used for the design. See ATL Geotechnical Exploration report located in Appendix C for more details on shallow foundations.

Deep Foundation Systems

If the design loads become too large for shallow foundations to be feasible or site grading plans put the footing bearing elevation at or near the volumetrically fat clay, the deep foundation option is also acceptable in lieu of uniformly cutting significant amounts of in-situ soils. The deep foundation option would be done with drilled and cast in place concrete piers in conjunction with a uniform thickness of select fill material placed directly beneath the top of subgrade elevation. The following table lists the minimum allowable loads for various diameter shafts with minimum shaft lengths as required:

Diameter (in)	Depth (ft.)	Allowable Loads (kips)
18	10	12
	15	20
	20	28
	25	38
	30	47
24	10	17
	15	27
	20	39
	25	53
	30	65
30	10	22
	15	36
	20	50
	25	68
	30	84
36	10	28
	15	44
	20	62
	25	85
	30	105

See ATL Geotechnical Exploration report located in Appendix C for more details on deep foundations.

Pavement Sections

The design of pavement sections for this site is based upon the upper twelve (12) inches of subgrade meeting the requirements of compaction and material type of either in-situ lean clays or volumetrically unstable clay soils. Depending upon the material type the subgrade should either be undercut as such to provide placement of a minimum of one (1) foot of select fill material or the soils may be lime stabilized. Typical pavement sections are provided for both Automobile Parking and Drive Areas and Channelized Heavy Truck Traffic Areas. Rigid pavement sections of six (6) inches and eight (8) inches of Portland Cement Concrete are listed as well as flexible pavement sections of two (2) inches and four (4) inches of Hot Mixed Asphaltic

Concrete. The complete pavement sections are listed in the ATL Geotechnical Exploration report located in Appendix C.

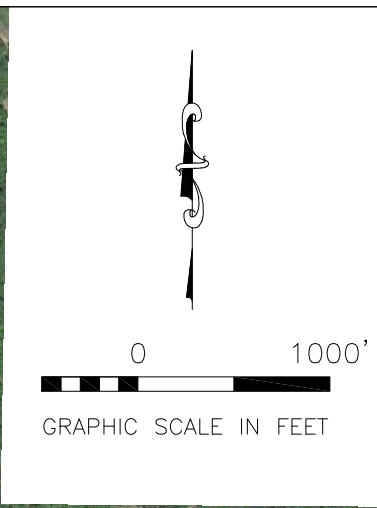
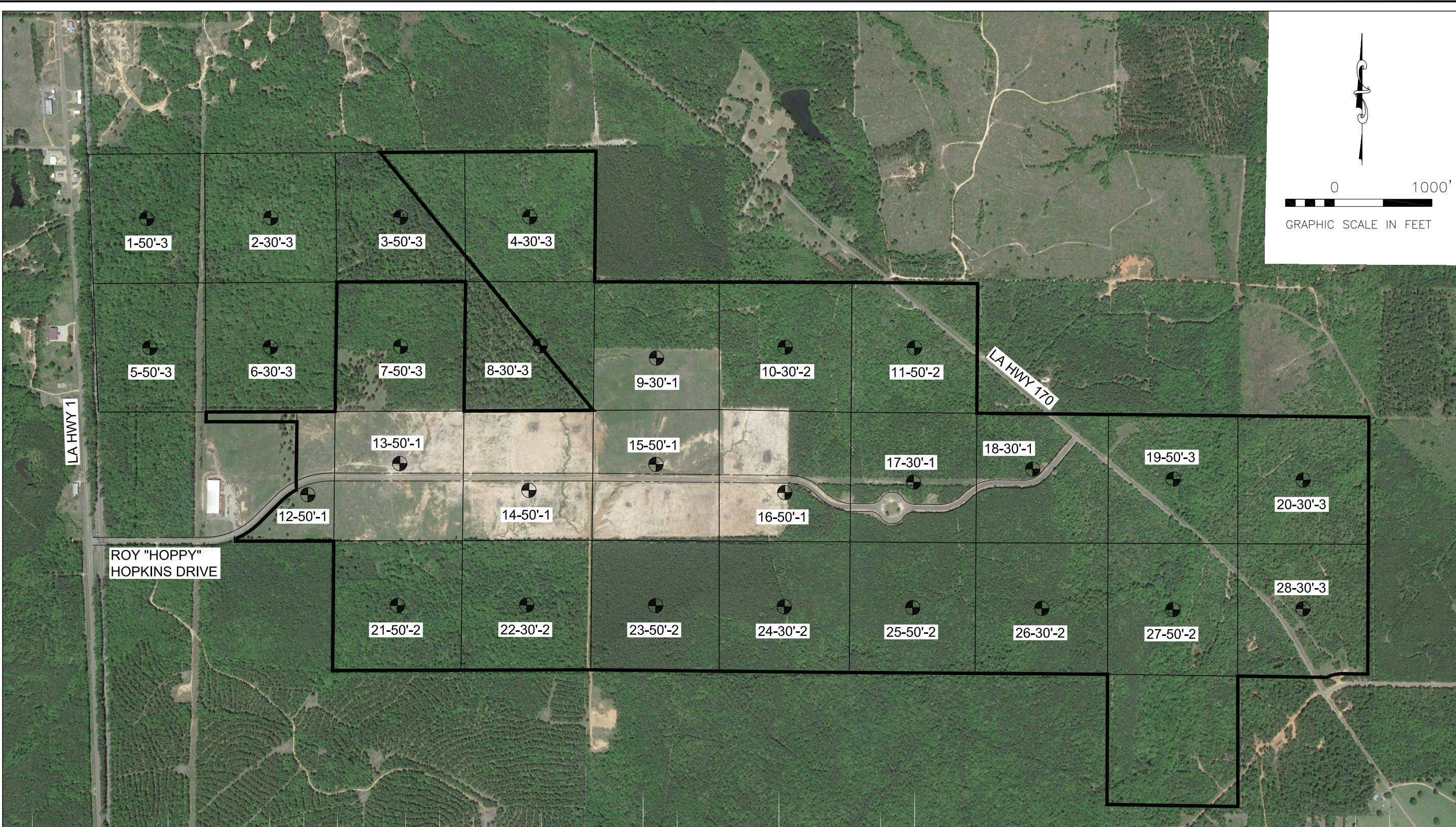
Site Preparation

Site preparation should include clearing and grubbing of trees, debris and organic laden soils in the construction area to a depth of six (6) to twelve (12) inches. Areas to receive select fill or to bear foundation elements or the pavement structure should be undercut, stabilized, processed and re-compacted or excavated and replaced with select fill, whichever is appropriate. See ATL Geotechnical Exploration report located in Appendix C for specific requirements.

LIMITATIONS

Sound engineering practices and procedures were used in the preparation of this report. This report does not reflect any variations, which may occur at the site. The nature and extent of such variations may not become evident until construction.

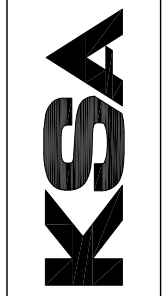
APPENDIX A



CPW.007-3
DEEP BORINGS PHASES 1-3
ATTACHMENT 1

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WARD II INDUSTRIAL PARK

BORING FORMAT
X-YY'-Z
X = BORING NUMBER
YY' = DEPTH
Z = PHASE

APPENDIX B

LOG OF BORING B-9



American Testing Lab, LLC
 1317 Canyon Court
 Bossier City, LA 71111
 Telephone: 318-752-6605
 Fax: 318-752-6617

CLIENT: KSA Engineers, Inc.
 PROJECT: Caddo Ward II Industrial Park - Phase 1
 LOCATION: Vivian, Caddo Parish, Louisiana
 NUMBER: G18-12-153

DATE(S) DRILLED: 1/15/19

LOG A GNNL01 - LOG A GNNL01.GDT - 2/11/19 09:20 - \ATLINKSYS\ATL.LLC\SHARE DRIVE\CURRENT JOBS\AFINAL REPORTS - GEO ETC\GINT GEOTECHNICAL\2018\G-18-12-153.KSA - CADDO WARD II INDUSTRIAL PARK.GPJ

FIELD DATA		LABORATORY DATA									
DEPTH (FT)	SAMPLES N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS			DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ.FT)	FAILURE STRAIN (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	SOIL SYMBOL
			LL	PL	PI						
	N = 3	20									
	N = 9	21									
5	P = 4.25	23	41	22	19	99	1.77	4.24	75		
	P = 2.0	31	51	24	27	90	1.97	5.77			
10	P = 4.5+	31	38	24	14	**			39		
15	P = 4.5+	28	47	24	23	**			75		
20	P = 4.5+	33				78	7.13	4.94			
25	P = 4.5+	24				103	9.31	9.06			
30	P = 4.5+	28	41	22	19	**					
Boring Terminated 30 ft											

DRILLING METHOD(S):
 Continuous Flight Auger

GROUNDWATER INFORMATION:
 Groundwater encountered at 8 ft during drilling operations.
 Water level recorded at 4 ft upon completion.

SURFACE ELEVATION: Unknown

DESCRIPTION OF STRATUM

Soft tan and gray silty lean clay (CL)
 Stiff gray and red lean-to-fat clay (CL-CH) with sand
 -- Medium stiff below 6 ft
 Firm gray and tan clayey sand (SC)
 Very stiff dark gray lean clay (CL) with silt partings
 -- with occasional lignite layers below 17 ft

N - STANDARD PENETRATION TEST RESISTANCE
 P - POCKET PENETROMETER RESISTANCE
 T - TXDOT CONE PENETRATION RESISTANCE
 R - ROCK CORE RECOVERY
 RQD - ROCK QUALITY DESIGNATION

REMARKS:
 GPS Coordinates: 32° 50' 33.24" N, -93° 57' 48.54" W
 ** Sample disturbed upon extrusion.

LOG OF BORING B-12



American Testing Lab, LLC
 1317 Canyon Court
 Bossier City, LA 71111
 Telephone: 318-752-6605
 Fax: 318-752-6617

CLIENT: KSA Engineers, Inc.
 PROJECT: Caddo Ward II Industrial Park - Phase 1
 LOCATION: Vivian, Caddo Parish, Louisiana
 NUMBER: G18-12-153

DATE(S) DRILLED: 1/14/19

DRILLING METHOD(S):
 Continuous Flight Auger

GROUNDWATER INFORMATION:
 Perched water encountered at 6 ft during drilling operations.
 Groundwater encountered at 46 ft during drilling operations.
 Water level recorded at 20 ft after 36 hours.

SURFACE ELEVATION: Unknown

DESCRIPTION OF STRATUM

73	Soft tan and gray silty lean clay (CL) with sand
75	Medium stiff gray and red lean clay (CL) with sand -- Stiff below 4 ft -- Gray and tan with no sand below 6 ft
72	Hard tan and gray silty lean clay (CL) with silty sand seams and layers
24	Very dense gray and tan silty sand (SM) with occasional clay layers
	Very hard dark gray sandy lean clay (CLS) with silt seams and partings -- Very stiff below 43 ft
	Auger Refusal 47 ft

REMARKS:

GPS Coordinates: 32° 50' 18.80" N, -93° 58' 31.45" W
 ** Sample disturbed upon extrusion.

LOG A GNNL01 - LOG A GNNL01.GDT - 2/11/19 09:19 - \ATLINKSYS\ATL.LLC\SHARE DRIVE\CURRENT JOBS\AFINAL REPORTS - GEO ETC\GINT GEOTECHNICAL\2018\G18-12-153 KSA - CADDO WARD II INDUSTRIAL PARK GPJ

SOIL SYMBOL	FIELD DATA				LABORATORY DATA						
	DEPTH (FT)	SAMPLES N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS			DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ FT)	FAILURE STRAIN (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)
				LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI					
		N = 2	24	24	16	8					73
		N = 6	22								
	5	P = 2.5	22	40	20	20	99	1.83	8.92		75
		P = 1.5	22				**				
	10	P = 2.5	21	49	18	31	109	2.22	7.98		
		P = 2.5	22				**				
	20	N = 50	19	34	21	13					72
	25	N = 51	19								
	30	N = 66	13								
	35	N = 58	20	NP	NP	NP					24
	40	N = 50@4"	21	32	23	9					
	45	N = 25	31								

N - STANDARD PENETRATION TEST RESISTANCE
 P - POCKET PENETROMETER RESISTANCE
 T - TXDOT CONE PENETRATION RESISTANCE
 R - ROCK CORE RECOVERY
 RQD - ROCK QUALITY DESIGNATION

LOG OF BORING B-13



American Testing Lab, LLC
 1317 Canyon Court
 Bossier City, LA 71111
 Telephone: 318-752-6605
 Fax: 318-752-6617

CLIENT: KSA Engineers, Inc.
 PROJECT: Caddo Ward II Industrial Park - Phase 1
 LOCATION: Vivian, Caddo Parish, Louisiana
 NUMBER: G18-12-153

DATE(S) DRILLED: 1/14/19

LOG A GNNI.01 - LOG A GNNI.01.GDT - 2/11/19 09:19 - VATLINKSYSIATL.LLC SHARE DRIVE\CURRENT JOBS\AFINAL REPORTS - GEO ETC\GINT GEOTECHNICAL\2018\G18-12-153 KSA - CADDO WARD II INDUSTRIAL PARK.GPJ

FIELD DATA		LABORATORY DATA								DRILLING METHOD(S): Continuous Flight Auger
DEPTH (FT)	SAMPLES N: BLOWS/FT P: TONS/SQ.FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS			DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ.FT)	FAILURE STRAIN (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)
			LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI					
5	N = 10	16								57
	P = 3.0	20	42	19	23	106	3.20	5.01		
	P = 3.0	18				**				
10	N = 23	13	31	20	11					42
	N = 19	18								
	N = 20	17	29	19	10					38
15	N = 24	23								26
20	N = 12	26	36	20	16					26
25	N = 25	30								98
30	N = 50	28	63	28	35					97
35	N = 50 @ 5"	37								97
40	N = 59	25	51	23	28					97
45	N = 63	20								
50	N = 69	19	57	23	34					97

GROUNDWATER INFORMATION:
 Groundwater encountered at 13 ft during drilling operations.

SURFACE ELEVATION: Unknown

DESCRIPTION OF STRATUM

Stiff red and tan sandy lean clay (CLS)

Firm tan, reddish tan and gray clayey sand (SC)

Firm light gray clayey sand (SC)

Very stiff dark gray and gray fat clay (CH) with silt seams and partings

-- Hard below 29 ft

-- with lignite layers below 33 ft

-- Very hard below 39 ft

Boring Terminated 50 ft

N - STANDARD PENETRATION TEST RESISTANCE
 P - POCKET PENETROMETER RESISTANCE
 T - TXDOT CONE PENETRATION RESISTANCE
 R - ROCK CORE RECOVERY
 RQD - ROCK QUALITY DESIGNATION

REMARKS:
 GPS Coordinates: 32° 50' 21.56" N, -93° 58' 20.26" W
 ** Sample disturbed upon extrusion.

LOG OF BORING B-17



American Testing Lab, LLC
 1317 Canyon Court
 Bossier City, LA 71111
 Telephone: 318-752-6605
 Fax: 318-752-6617

CLIENT: KSA Engineers, Inc.
 PROJECT: Caddo Ward II Industrial Park - Phase 1
 LOCATION: Vivian, Caddo Parish, Louisiana
 NUMBER: G18-12-153

DATE(S) DRILLED: 1/16/19

DRILLING METHOD(S):
 Continuous Flight Auger

GROUNDWATER INFORMATION:
 Groundwater encountered at 12.5 ft during drilling operations.
 Water level recorded at 8.5 ft upon completion.

SURFACE ELEVATION: Unknown

DESCRIPTION OF STRATUM

LOG A GNNL01 - LOG A GNNL01.GDT - 2/11/19 09:20 - VATLINKSYSIATLLC SHARE DRIVE\CURRENT_JOBS\FINAL REPORTS - GEO ETC\GINT GEOTECHNICAL\2018\G18-12-153 KSA - CADDO WARD II INDUSTRIAL PARK.GPJ

DEPTH (FT)	SOIL SYMBOL	FIELD DATA				LABORATORY DATA							MINUS NO. 200 SIEVE (%)	DESCRIPTION OF STRATUM
		N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS			DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ.FT)	FAILURE STRAIN (%)	CONFINING PRESSURE (POUNDS/SQ IN)				
				LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI								
5	X	N = 19	15	NP	NP	NP						27	Firm brown silty sand (SM)	
	X	N = 23	12											
	X	N = 10	16	29	18	11						61	Stiff reddish brown and brown sandy lean clay (CLS)	
	X	N = 6	17	20	14	6						49	Loose gray and tan silty clayey sand (SC-SM) -- Firm below 7 ft	
	X	N = 12	15											
10	X	N = 20	15	NP	NP	NP						40	Firm gray and tan silty sand (SM)	
	X	N = 16	22											
15	P	P = 2.5	24	44	21	23	103	2.07	9.03			50	Very stiff gray, tan and red sandy lean clay (CLS) with silt partings	
20	P	P = 2.25	28	66	29	37	92	2.03	5.27			100	Very stiff gray, tan and red fat clay (CH) with silt partings	
25	P	P = 3.0	19											
30	X	N = 50	21									42	Dense gray and tan clayey sand (SC)	
														Boring Terminated 30 ft

N - STANDARD PENETRATION TEST RESISTANCE
 P - POCKET PENETROMETER RESISTANCE
 T - TXDOT CONE PENETRATION RESISTANCE
 R - ROCK CORE RECOVERY
 RQD - ROCK QUALITY DESIGNATION

REMARKS:
 GPS Coordinates: 32° 50' 19.97" N, -93° 57' 19.53" W

LOG OF BORING B-18



American Testing Lab, LLC
 1317 Canyon Court
 Bossier City, LA 71111
 Telephone: 318-752-6605
 Fax: 318-752-6617

CLIENT: KSA Engineers, Inc.
 PROJECT: Caddo Ward II Industrial Park - Phase 1
 LOCATION: Vivian, Caddo Parish, Louisiana
 NUMBER: G18-12-153

DATE(S) DRILLED: 1/16/19

LOG A GNNL01 - LOG A GNNL01.GDT - 2/11/19 09:20 - VATLINKSYSIATLLC SHARE DRIVECURRENT_JOBS\FINAL REPORTS - GEO ETC\GINT GEOTECHNICAL\2018\G18-12-153 KSA - CADDO WARD II INDUSTRIAL PARK.GPJ

FIELD DATA		LABORATORY DATA										DRILLING METHOD(S): Continuous Flight Auger
DEPTH (FT)	SAMPLES N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS			DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ.FT)	FAILURE STRAIN (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	GROUNDWATER INFORMATION: Groundwater encountered at 7 ft during drilling operations. Water level recorded at 5.5 ft upon completion.	
			LIQUID LIMIT LL	PLASTIC LIMIT PL	PLASTICITY INDEX PI						SURFACE ELEVATION: Unknown	
DESCRIPTION OF STRATUM												
5	N = 6 P = 2.0 P = 2.0 N = 23	27 21 14 17	44	23	21	*			60	40	Medium stiff gray, tan and red sandy lean clay (CLS)	
10	P = 3.0	20	43	24	19	106	2.35	4.22	60		Very stiff gray, tan and red sandy lean clay (CLS)	
15	P = 2.25	23	54	23	31	102	1.39	6.31	87		Stiff gray and tan fat clay (CH) with occasional sandy silt seams	
20	P = 4.5+	37	45	26	19	81	0.85	3.39			Very stiff dark brown lean clay (CL) with silt partings	
25	P = 3.0	23	34	21	13				63		Very stiff dark gray sandy lean clay (CLS) with silty sand seams and layers -- with iron ore seams and layers below 27 ft	
30	P = 4.5+	21	40	25	15						Boring Terminated 30 ft	

N - STANDARD PENETRATION TEST RESISTANCE
 P - POCKET PENETROMETER RESISTANCE
 T - TXDOT CONE PENETRATION RESISTANCE
 R - ROCK CORE RECOVERY
 RQD - ROCK QUALITY DESIGNATION

REMARKS:
 GPS Coordinates: 32° 50' 19.78" N, -93° 57' 5.30" W
 ** Sample disturbed upon extrusion.