

Figure 9 – Total Unit Weight versus Depth

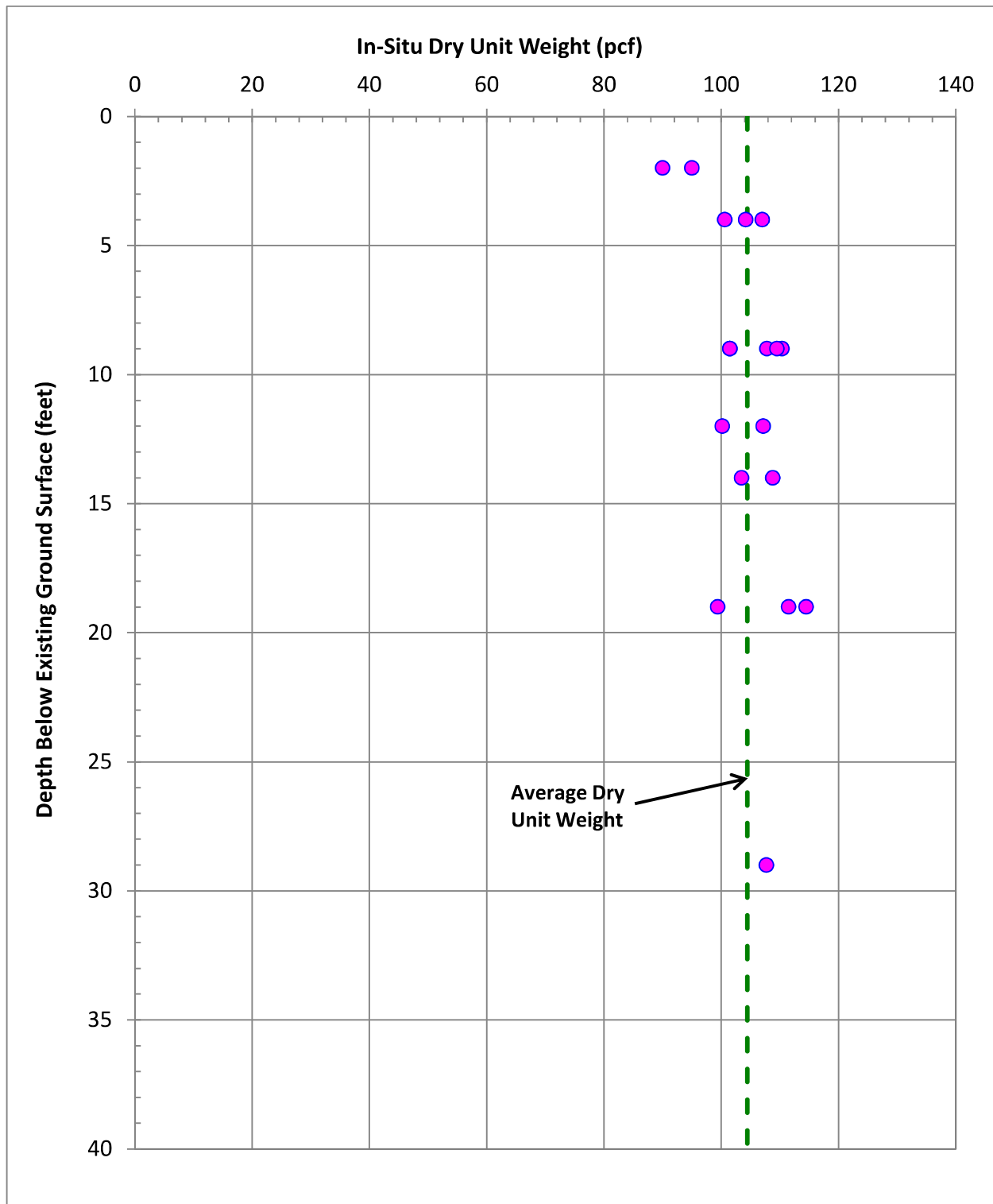























Figure 10 – Dry Unit Weight versus Depth

	Continuous Flight Auger/Hollow-stem Auger/Wet Rotary/NX Core <b>DRILLING METHOD(S):</b> Push Tube/SPT/Auger/THD
	<b>GROUNDWATER INFORMATION:</b> Subsurface water was not encountered either during or upon completion of the drilling operations

FIELD DATA		LABORATORY DATA							DRILLING METHOD(S):							
SOIL SYMBOL	DEPTH (FT)	SAMPLE	N: BLOWN/FT (SPT)	P: TONS/SQ FT (Modified CA Sampler)	R: %	L: %	ATTERBERG LIMITS			DRY DENSITY POUNDS/CU.FT	COMPRESSIVE STRENGTH (TONS/SQ.FT)	FAILURE STRAIN (%)	CONFINING PRESSURE (POUNDS/SQ IN)	MINUS NO. 200 SIEVE (%)	<b>GROUNDWATER INFORMATION:</b> Subsurface water was not encountered either during or upon completion of the drilling operations.	
							LIMIT	LIMIT	PLASTICITY INDEX							
DESCRIPTION OF STRATUM																

- WATER LEVEL AT END OF DRILLING, OR AS SHOWN

### TYPICAL SOIL AND ROCK SYMBOLS (USCS CLASSIFICATION)

 Lean Clay (CL)	 Poorly-Graded Sand (SP)	 Claystone
 Fat Clay (CH)	 Well-Graded Sand (SW)	 BASALT
 Silt (ML)	 Poorly-Graded Gravel (GP)	 Limestone
 Elastic Silt (MH)	 Well-Graded Gravel (GW)	 Sandstone
 Silty Sand (SM)	 Clayey Gravel (GC)	 Siltstone
 Clayey Sand (SC)	 Silty Gravel (GM)	 Fill Material
 Silty, Clayey Sand (SC-SM)	 Silty Clay (CL-ML)	 Shale

### DEGREE OF WEATHERING

- 1) Unweathered: No evidence of any chemical or mechanical alteration.
- 2) Slightly weathered: Slight discoloration on surface, slight alteration along discontinuities, less than 10% of the rock volume altered.
- 3) Moderately weathered: Discoloring evident, surface pitted and altered with alteration penetrating well below rock surfaces, weathering "halos" evident, 10% to 50% of the rock volume altered.
- 4) Highly weathered: Entire mass discolored, alteration pervading nearly all of the rock with some pockets of slightly weathered rock noticeable, some minerals leached away.
- 5) Decomposed: rock reduced to a soil with relic rock texture, generally molded and crumbled by hand.

### SOIL STRUCTURE

- Calcareous..... Containing calcium carbonate
- Slickensided..... The presence of planes of weakness having a slick and glossy appearance
- Interbedded..... Alternating layers of varying material

# LOG OF BORING: Substation



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 Fax: (512) 251-2518

CLIENT: Mortenson Construction  
 PROJECT: Chilocco Wind Farm  
 LOCATION: Chilocco, OK  
 NUMBER: 130222  
 DATE(S) DRILLED: 8/21/13

RENEWABLE LOG - LOG A.GNNL01.GDT - 9/11/13 11:36 - Z:\GINT\PROJECTS\2013\130222 CHILOCCO WIND FARM.GPJ

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: Lat. 36.956548, Long. -97.064465

# LOG OF BORING: T-012



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CLIENT: Mortenson Construction  
 PROJECT: Chilocco Wind Farm  
 LOCATION: Chilocco, OK  
 NUMBER: 130222  
 DATE(S) DRILLED: 8/26/13

RENEWABLE LOG - LOG A.GNNL01.GDT - 9/11/13 11:36 - Z:\GINT\PROJECTS\2013\130222 CHILOCCO WIND PROJECT\130222 CHILOCCO WIND FARM.GPJ

# LOG OF BORING: T-015



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CLIENT: Mortenson Construction  
 PROJECT: Chilocco Wind Farm  
 LOCATION: Chilocco, OK  
 NUMBER: 130222  
 DATE(S) DRILLED: 8/22/13

FIELD DATA		LABORATORY DATA										DRILLING METHOD(S): Hollow Stem Auger
SOIL SYMBOL	DEPTH (FT)	SAMPLES N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS			DRY DENSITY POUNDS/CU.FT	UNDRAINED SHEAR STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ.IN)	MINUS NO. 200 SIEVE (%)	GROUNDWATER INFORMATION: Groundwater encountered at 49 ft. during drilling and at 28 ft. after drilling
				LL	PL	PI						SURFACE ELEVATION:
												DESCRIPTION OF STRATUM
	0											18 in. Topsoil
	5	N = 8 N = 20 N = 14	27									FAT CLAY (CH), trace Sand, dark brown, medium stiff to very stiff, moist, with Organics Grading brown to brownish gray  Grading trace calcareous nodules
	10	P = 2.75	24	55	28	27	102	1.4	6.0	7.0	98	
	15	N = 26 N = 34	19									SANDY LEAN CLAY (CL), olive, very stiff, moist, iron stained LEAN CLAY (CL), trace Sand, brown, hard, moist
	20	N = 30										FAT CLAY (CH), trace Sand, greenish gray to dark brown, very stiff to hard, moist  Grading greenish gray
	25	N = 50/4"										Grading reddish brown
	30	N = 50										
	35	N = 33	22									FAT CLAY (CH), with Gravel, olive, very stiff to hard, moist to wet  Grading with calcareous nodules
	40	N = 29										
	45	N = 65/11"										
	50	N = 37										
	55	N = 28	25									FAT CLAY (CH), brown, very stiff, moist
												Total Depth = 55.5 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: Lat. 36.961501, Long. -97.104337

RENEWABLE LOG - LOG A.GNNL01.GDT - 9/11/13 11:36 - Z:\GINT\PROJECTS\2013\130222 - CHILOCCO WIND PROJECT\130222 - CHILOCCO WIND FARM.GPJ

# LOG OF BORING: T-017



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CLIENT: Mortenson Construction  
 PROJECT: Chilocco Wind Farm  
 LOCATION: Chilocco, OK  
 NUMBER: 130222  
 DATE(S) DRILLED: 8/26/13

RENEWABLE LOG - LOG A.GNNL01.GDT - 9/11/13 11:36 - Z:\GINT\PROJECTS\2013\130222 CHILOCCO WIND PROJECT\130222 CHILOCCO WIND FARM.GPJ

FIELD DATA		LABORATORY DATA										DRILLING METHOD(S):
SOIL SYMBOL	DEPTH (FT)	SAMPLES N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS			DRY DENSITY POUNDS/CU.FT	UNDRAINED SHEAR STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ.IN)	MINUS NO. 200 SIEVE (%)	Hollow Stem Auger
				LL	PL	PI						GROUNDWATER INFORMATION: Groundwater encountered at 29 ft. during drilling and at 28.5 ft. after drilling
												SURFACE ELEVATION:
												DESCRIPTION OF STRATUM
12 in. Topsoil												
FAT CLAY (CH), trace Sand, dark brown, stiff, moist												
LEAN CLAY (CL), with Sand, brown, very stiff to hard, moist, iron stained	5	N = 19	21									
		N = 17										
LEAN CLAY (CL), trace Sand, brown, very stiff, moist	10	P = 4.5	19	45	15	30	110	1.4	7.0	0.0	85	
		N = 25										
		N = 21										
CLAYEY SAND (SC), brown, moist, fine to medium grained	15											
SANDY LEAN CLAY (CL), brown, very stiff to hard, moist, iron stained	20	P = 4.5	18	47	15	32	115	1.4	7.9	0.0	69	
		N = 27										
CLAYEY SAND (SC), trace Gravel, yellowish brown to brown, medium dense, wet, fine to coarse grained	30	N = 30	15	32	14	18					29	
		N = 27	27									
FAT CLAY (CH), trace to with Sand, yellowish brown to light gray, hard, moist, iron stained, with Gypsum seams	40	N = 32										
		N = 59	25									
		N = 56										
	55	N = 50/5"										
Total Depth = 55 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: Lat. 36.990233, Long. -97.100389

# LOG OF BORING: T-019



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CLIENT: Mortenson Construction  
 PROJECT: Chilocco Wind Farm  
 LOCATION: Chilocco, OK  
 NUMBER: 130222  
 DATE(S) DRILLED: 8/22/13

FIELD DATA		LABORATORY DATA								DRILLING METHOD(S): Hollow Stem Auger	
SOIL SYMBOL	DEPTH (FT)	SAMPLES N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS			DRY DENSITY POUNDS/CU.FT	UNDRAINED SHEAR STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ.IN)	MINUS NO. 200 SIEVE (%)
				LL	PL	PI					
GROUNDWATER INFORMATION: Groundwater encountered at 39.5 ft. during drilling and not recorded after drilling											
SURFACE ELEVATION:											
DESCRIPTION OF STRATUM											
	0	N = 7									1 ft. Topsoil
	5	N = 24									FAT CLAY (CH), trace Sand, dark brown, medium to very stiff, moist, with Organics
	10	N = 20 N = 13	18								Grading iron stained Grading brown, calcareous
	15	P = 3.5 N = 28	21	52	17	35	107	1.7	15.0	10.0	91 Grading greenish gray to brown
	20	N = 26	25								FAT CLAY (CH), trace Sand, dark brown, very stiff to hard, moist Grading greenish gray, iron stained, calcareous
	25	N = 75/10"									
	30	N = 38	24								Grading olive to yellowish brown
	35	N = 26									
	40	N = 46									6 in. Sandstone seam at 39 ft.
	45	N = 40									Grading gray
	50	N = 27	25								LEAN CLAY (CL), trace Sand, greenish gray, very stiff, moist, iron stained
	55	N = 53									SHALE, brown, hard, moist
Total Depth = 55.5 ft.											
<p><b>REMARKS:</b>                      GPS COORDINATES: Lat. 36.962787, Long. -97.100057</p>											

RENEWABLE LOG - LOG A.GNNL01.GDT - 9/11/13 11:36 - Z:\GINT\PROJECTS\2013\130222 CHILOCCO WIND PROJECT\130222 CHILOCCO WIND FARM.GPJ

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: T-025



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CLIENT: Mortenson Construction  
 PROJECT: Chilocco Wind Farm  
 LOCATION: Chilocco, OK  
 NUMBER: 130222  
 DATE(S) DRILLED: 8/23/13

RENEWABLE LOG - LOG A.GNNL01.GDT - 9/11/13 11:36 - Z:\GINT\PROJECTS\2013\130222 CHILOCCO WIND PROJECT\130222 CHILOCCO WIND FARM.GPJ

# LOG OF BORING: T-041



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CLIENT: Mortenson Construction  
 PROJECT: Chilocco Wind Farm  
 LOCATION: Chilocco, OK  
 NUMBER: 130222  
 DATE(S) DRILLED: 8/23/13

RENEWABLE LOG - LOG A.GNNL01.GDT - 9/11/13 11:36 - Z:\GINT\PROJECTS\2013\130222 CHILOCCO WIND PROJECT\130222 CHILOCCO WIND FARM.GPJ

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: Lat. 36.997004, Long. -97.086545

# LOG OF BORING: T-063



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CLIENT: Mortenson Construction  
 PROJECT: Chilocco Wind Farm  
 LOCATION: Chilocco, OK  
 NUMBER: 130222  
 DATE(S) DRILLED: 8/24/13

FIELD DATA		LABORATORY DATA							DRILLING METHOD(S): Hollow Stem Auger		
SOIL SYMBOL	DEPTH (FT)	SAMPLES N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS			DRY DENSITY POUNDS/CU.FT	UNDRAINED SHEAR STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ.IN)	MINUS NO. 200 SIEVE (%)
				LL	PL	PI					
GROUNDWATER INFORMATION: Groundwater encountered at 29 ft. during drilling and not recorded after drilling											
SURFACE ELEVATION:											
DESCRIPTION OF STRATUM											
12 in. Topsoil											
5	N = 11	21									
	N = 9										
	N = 13										
10	N = 21										
	N = 16	20	51	16	35					96	
15	N = 12										
	N = 10	22	32	15	17					85	
20	N = 6	20								18	
	N = 17	20	29	13	16					59	
25	N = 32										
	N = 75/9"										
30	N = 50/4"										
	N = 50/2"										
35											
40											
45											
50											
											Total Depth = 54.5 ft.
N - STANDARD PENETRATION TEST RESISTANCE P - POCKET PENETROMETER RESISTANCE T - TXDOT CONE PENETRATION RESISTANCE R - ROCK CORE RECOVERY RQD - ROCK QUALITY DESIGNATION											<b>REMARKS:</b> GPS COORDINATES: Lat. 36.992868, Long. -97.070974

RENEWABLE LOG - LOG A.GNNL01.GDT - 9/11/13 11:36 - Z:\GINT\PROJECTS\2013\130222 CHILOCCO WIND PROJECT\130222 CHILOCCO WIND FARM.GPJ

# LOG OF BORING: T-067



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 Telephone: (512) 992-2087  
 Fax: (512) 251-2518

CLIENT: Mortenson Construction  
 PROJECT: Chilocco Wind Farm  
 LOCATION: Chilocco, OK  
 NUMBER: 130222  
 DATE(S) DRILLED: 8/21/13

FIELD DATA		LABORATORY DATA								DRILLING METHOD(S): Hollow Stem Auger				
SOIL SYMBOL	DEPTH (FT)	SAMPLES N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)			ATTERBERG LIMITS			DRY DENSITY POUNDS/CU.FT	UNDRAINED SHEAR STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ.IN)	MINUS NO. 200 SIEVE (%)	
			LL	PL	PI	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX						
<b>GROUNDWATER INFORMATION:</b> Groundwater encountered at 14 ft. during drilling and at 7 ft. after drilling														
<b>SURFACE ELEVATION:</b>														
<b>DESCRIPTION OF STRATUM</b>														
														18 in. Topsoil
	5	N = 12 N = 9												FAT CLAY (CH), trace Sand, dark brown, stiff to very stiff, moist, with Organics Grading dark reddish brown
	10	N = 14 P = 2.5	22	57	17	40			110	2.5	15.0	7.0	96	Grading brown
	15	N = 10 P = 2.25	20	52	16	36			109	0.8	14.9	7.0	65	Grading greenish gray to brown, with Sand seams SANDY LEAN CLAY (CL), greenish gray to brown, very stiff, moist
	20	N = 61	24											SHALE, olive, hard to very hard, moist
	25	N = 50/3"												Grading light olive to greenish gray
	30	N = 50/4"												Grading brown to olive
	35	N = 50/5.5"												SANDY SHALE, gray, very hard, moist
														Auger Refusal at 36.5 ft

RENEWABLE LOG - LOG A.GNNL01.GDT - 9/11/13 11:36 - Z:\GINT\PROJECTS\2013\130222 CHILOCCO WIND PROJECT\130222 CHILOCCO WIND FARM.GPJ

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: Lat. 36.958553, Long. -97.067550

# LOG OF BORING: T-071



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CLIENT: Mortenson Construction  
 PROJECT: Chilocco Wind Farm  
 LOCATION: Chilocco, OK  
 NUMBER: 130222  
 DATE(S) DRILLED: 8/22/13

RENEWABLE LOG - LOG A.GNNL01.GDT - 9/11/13 11:36 - Z:\GINT\PROJECTS\2013\130222 CHILOCCO WIND PROJECT\130222 CHILOCCO WIND FARM.GPJ

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: Lat. 36.968496, Long. -97.063727

# LOG OF BORING: T-086



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CLIENT: Mortenson Construction  
 PROJECT: Chilocco Wind Farm  
 LOCATION: Chilocco, OK  
 NUMBER: 130222  
 DATE(S) DRILLED: 8/26/13

FIELD DATA		LABORATORY DATA							DRILLING METHOD(S): Hollow Stem Auger				
SOIL SYMBOL	DEPTH (FT)	SAMPLES N: BLOWS/FT P: TONS/SQ FT T: BLOWS R: % RQD: %	MOISTURE CONTENT (%)	ATTERBERG LIMITS			DRY DENSITY POUNDS/CU.FT	UNDRAINED SHEAR STRENGTH (TONS/SQ. FT)	STRAIN AT FAILURE (%)	CONFINING PRESSURE (POUNDS/SQ.IN)	MINUS NO. 200 SIEVE (%)	GROUNDWATER INFORMATION: Groundwater encountered at 19 ft. during drilling and at 20.5 ft. after drilling	
				LL	PL	PI						SURFACE ELEVATION:	
												DESCRIPTION OF STRATUM	
12 in. Topsoil													
5	N = 14	23	57	19	38						98	FAT CLAY (CH), trace Sand, dark brown, medium stiff to hard, moist Grading reddish, iron stained	
	N = 8	23	58	16	42						95		
10	N = 21											Grading, brown to reddish brown to light gray	
	P = 4.25												
15	N = 23											LEAN CLAY (CL), trace Sand, reddish brown to light gray, very stiff, moist to wet, iron stained	
	N = 18	19											
20	P = 2.75	25	39	15	24	99	1.1	11.6	15.0	99		POORLY GRADED SAND (SP), brown, loose to medium dense, wet, fine to medium grained	
25	N = 8	19									5		
30	N = 13											LEAN CLAY (CL), trace Sand, brown, medium stiff, moist	
35	N = 4	17									29		
40	N = 50/1"											SHAPE, yellowish brown, very hard, moist	
												Auger Refual at 43.5 ft.	

RENEWABLE LOG - LOG A.GNNL01.GDT - 9/11/13 11:36 - Z:\GINT\PROJECTS\2013\130222 CHILOCCO WIND PROJECT\130222 CHILOCCO WIND FARM.GPJ

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: Lat. 36.988345, Long. -97.051775



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---

## **APPENDIX B**

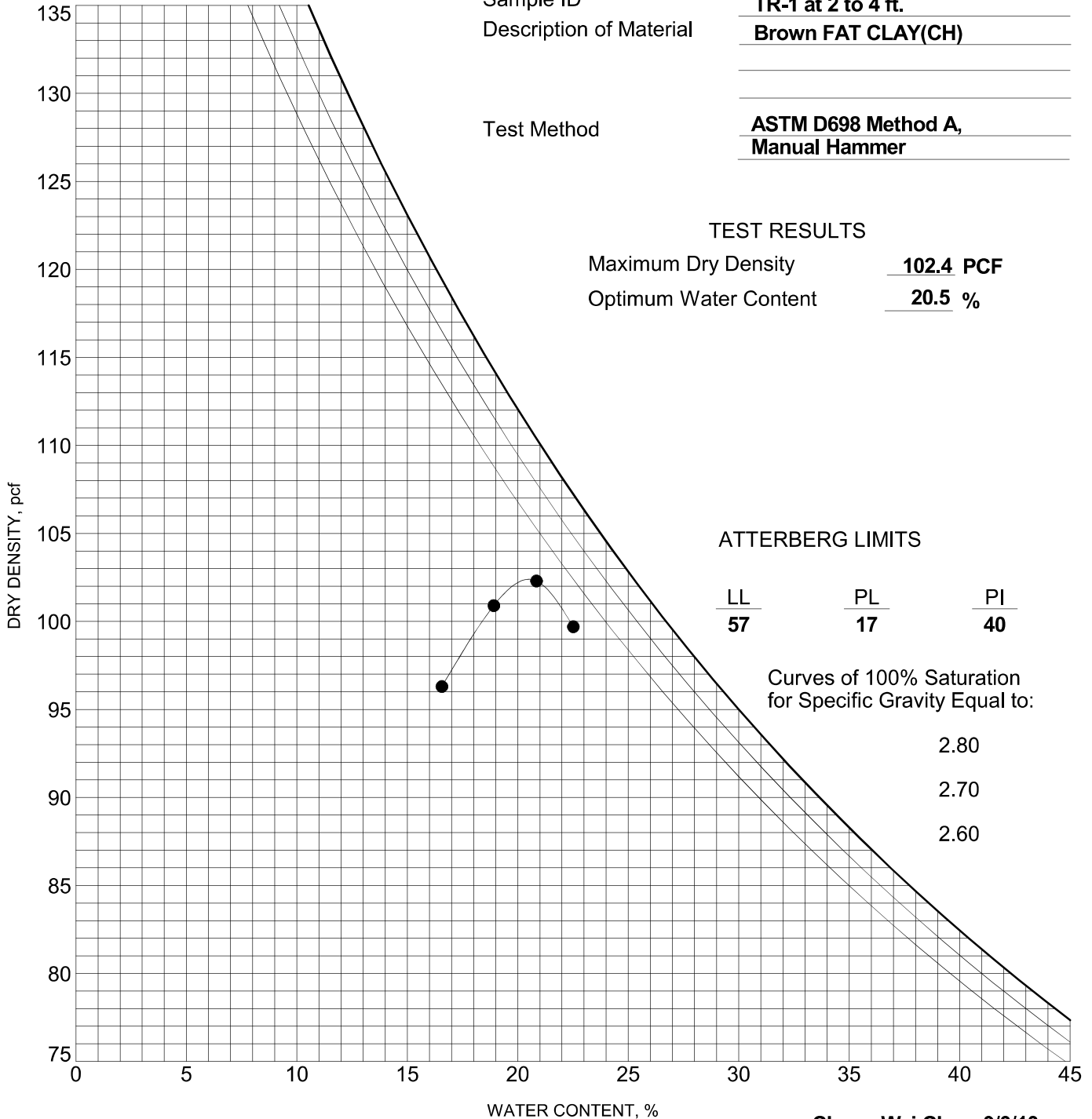


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# MOISTURE-DENSITY RELATIONSHIP

CLIENT: Mortenson Construction  
 PROJECT: Chilocco Wind Farm  
 LOCATION: Chilocco, OK  
 NUMBER: 130222

Sample ID TR-1 at 2 to 4 ft.  
 Description of Material Brown FAT CLAY(CH)  
 Test Method ASTM D698 Method A,  
 Manual Hammer



**Cheng-Wei Chen, 9/3/13**

Analysis & Quality Review/Date

Specimens prepared by: C.M. & M.D.

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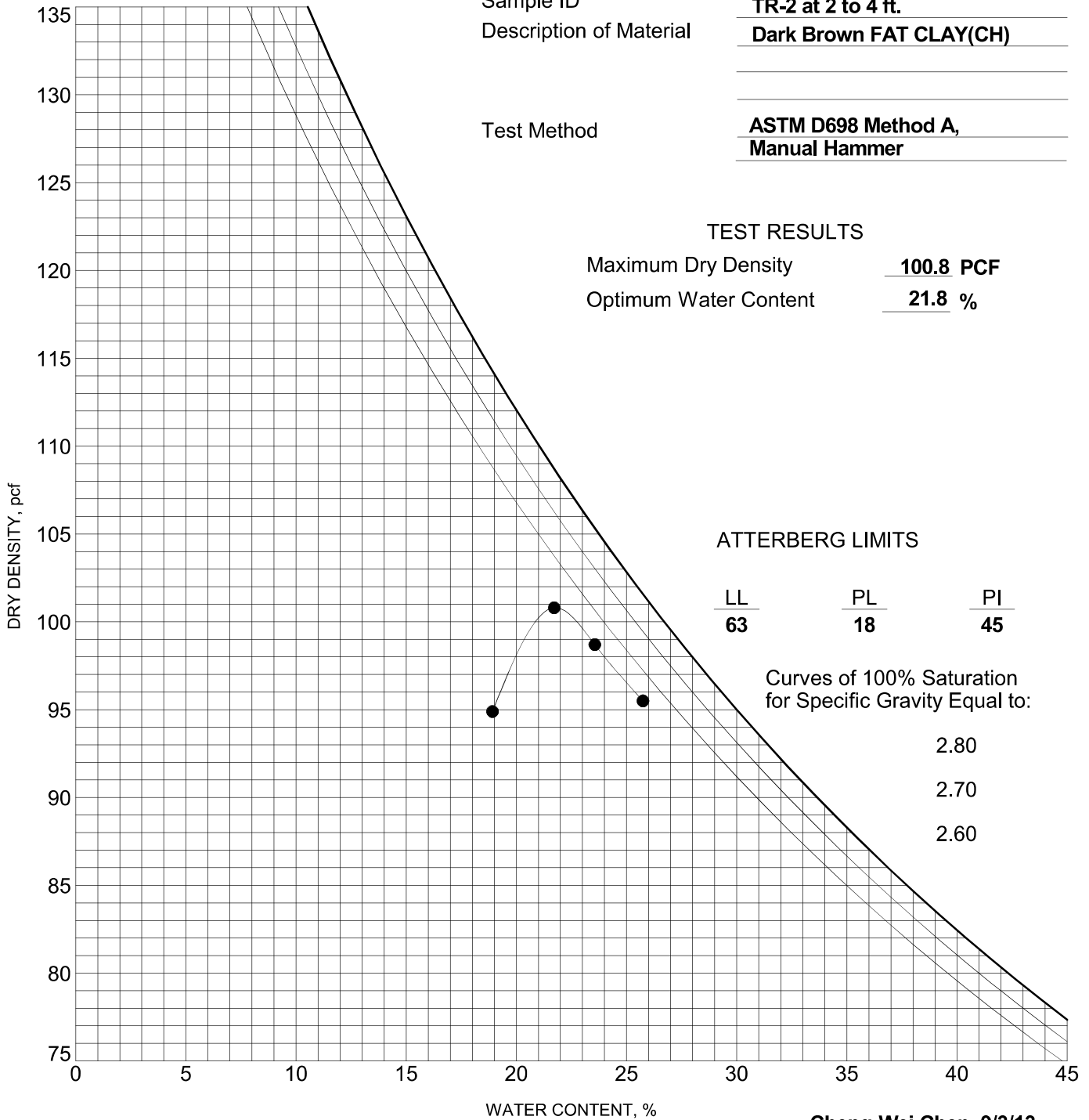


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# MOISTURE-DENSITY RELATIONSHIP

CLIENT: Mortenson Construction  
 PROJECT: Chilocco Wind Farm  
 LOCATION: Chilocco, OK  
 NUMBER: 130222

Sample ID: TR-2 at 2 to 4 ft.  
 Description of Material: Dark Brown FAT CLAY(CH)  
 Test Method: ASTM D698 Method A, Manual Hammer



**Cheng-Wei Chen, 9/3/13**

Analysis & Quality Review/Date

Specimens prepared by: C.M. & M.D.

The results shown on this report are for the exclusive use of the client for whom they were obtained and apply only to the sample tested and / or inspected. They are not intended to be indicative of qualities of apparently identical products. The use of our name must receive prior written approval. Reports must be reproduced in their entirety. Unauthorized use or copying of this document is strictly prohibited by anyone other than the client for the specific project.

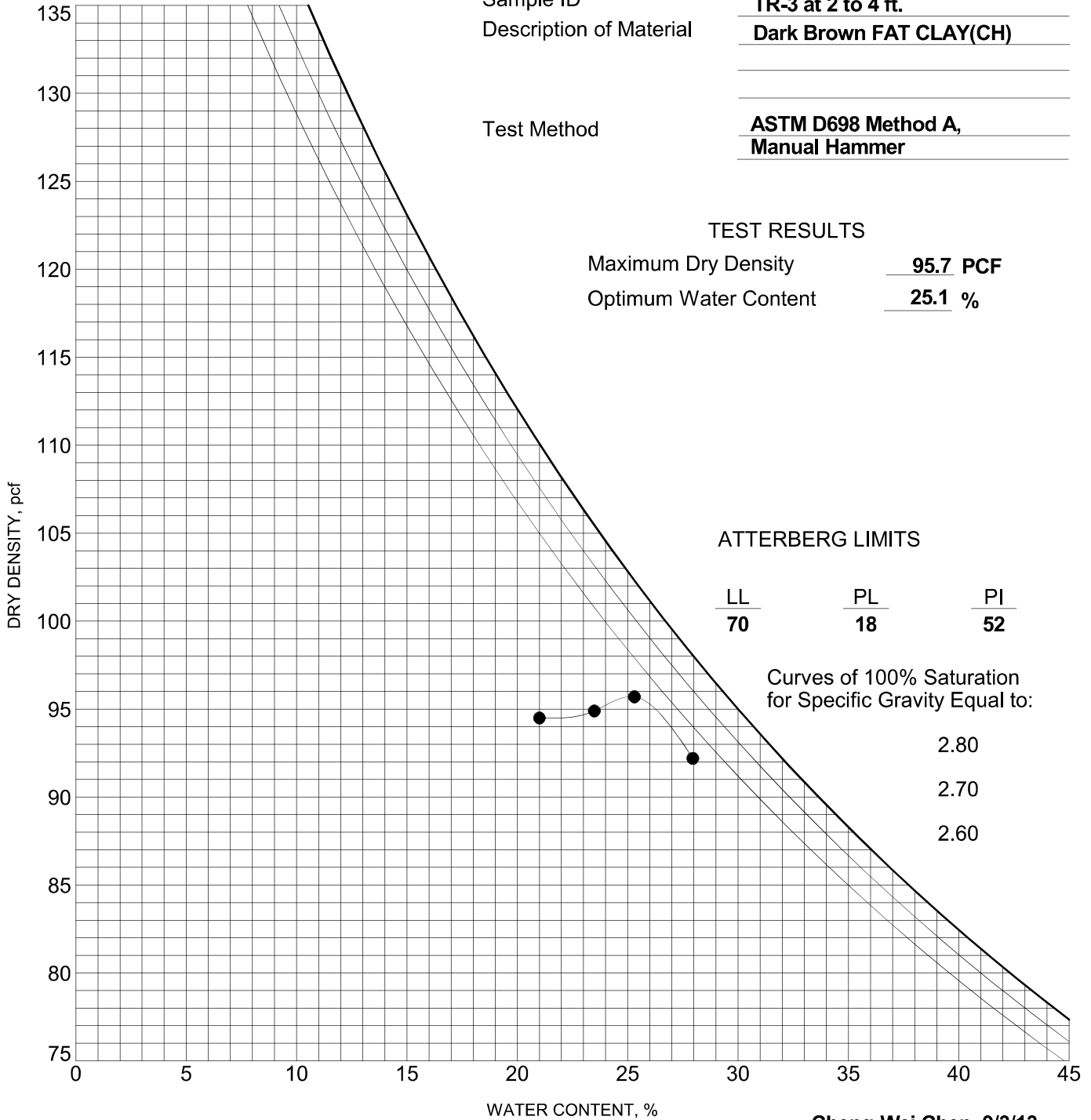


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# MOISTURE-DENSITY RELATIONSHIP

CLIENT: Mortenson Construction  
 PROJECT: Chilocco Wind Farm  
 LOCATION: Chilocco, OK  
 NUMBER: 130222

Sample ID TR-3 at 2 to 4 ft.  
 Description of Material Dark Brown FAT CLAY(CH)  
 Test Method ASTM D698 Method A,  
 Manual Hammer



**Cheng-Wei Chen, 9/3/13**

Analysis & Quality Review/Date

Specimens prepared by: C.M. & M.D.

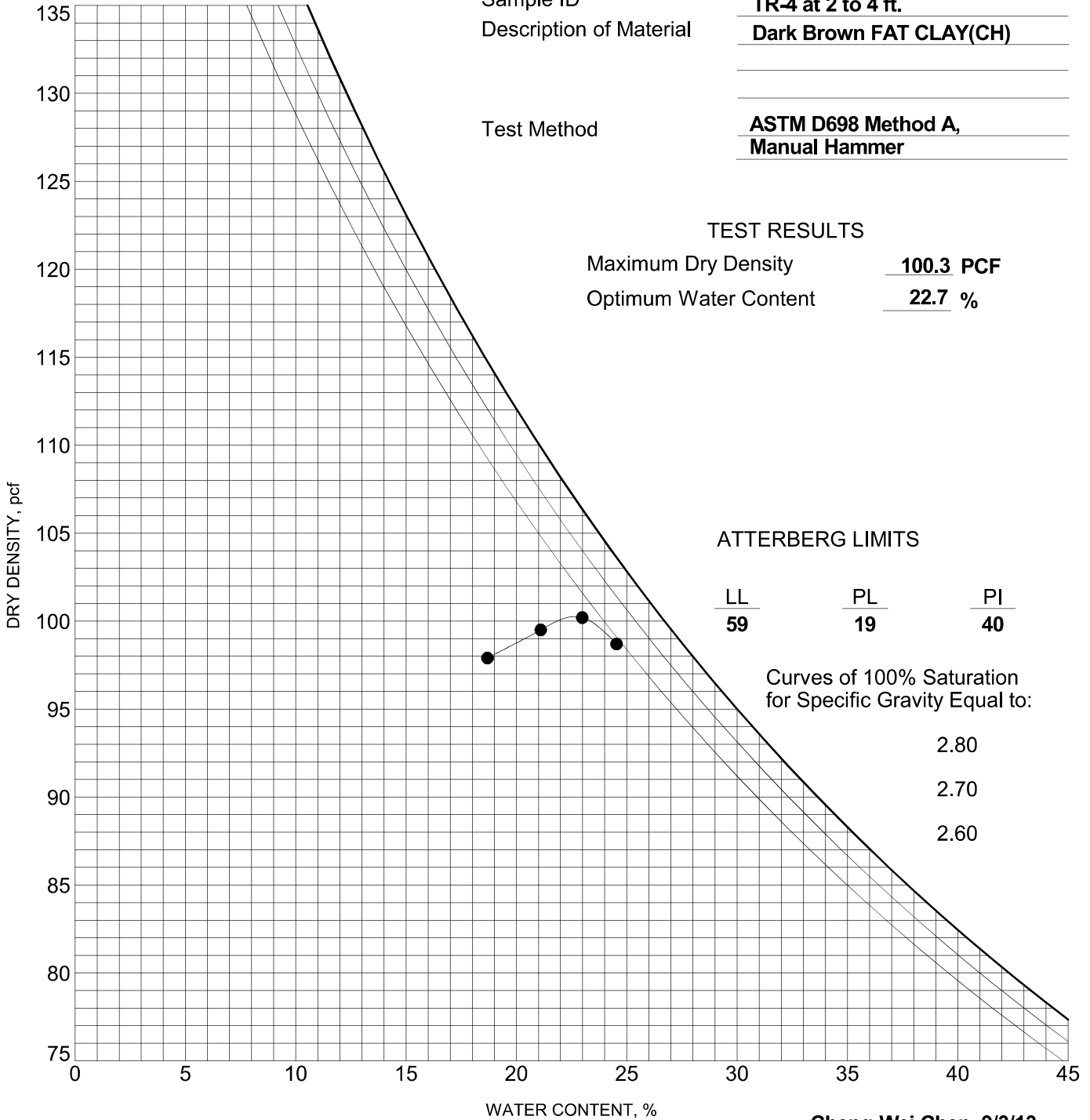


Renewable Resource Consultants, LLC  
 3801 Doris Lane  
 Round Rock, TX 78664  
 Telephone: (512) 992-2087  
 Fax: (512) 251-2518

# MOISTURE-DENSITY RELATIONSHIP

CLIENT: Mortenson Construction  
 PROJECT: Chilocco Wind Farm  
 LOCATION: Chilocco, OK  
 NUMBER: 130222

Sample ID: TR-4 at 2 to 4 ft.  
 Description of Material: Dark Brown FAT CLAY(CH)  
 Test Method: ASTM D698 Method A, Manual Hammer



**Cheng-Wei Chen, 9/3/13**

Analysis & Quality Review/Date

Specimens prepared by: C.M. & M.D.

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# MOISTURE-DENSITY RELATIONSHIP

CLIENT: Mortenson Construction  
 PROJECT: Chilocco Wind Farm  
 LOCATION: Chilocco, OK  
 NUMBER: 130222

Sample ID TR-5 at 2 to 4 ft.  
 Description of Material Dark Brown FAT CLAY(CH)  
 Test Method ASTM D698 Method A,  
 Manual Hammer

### TEST RESULTS

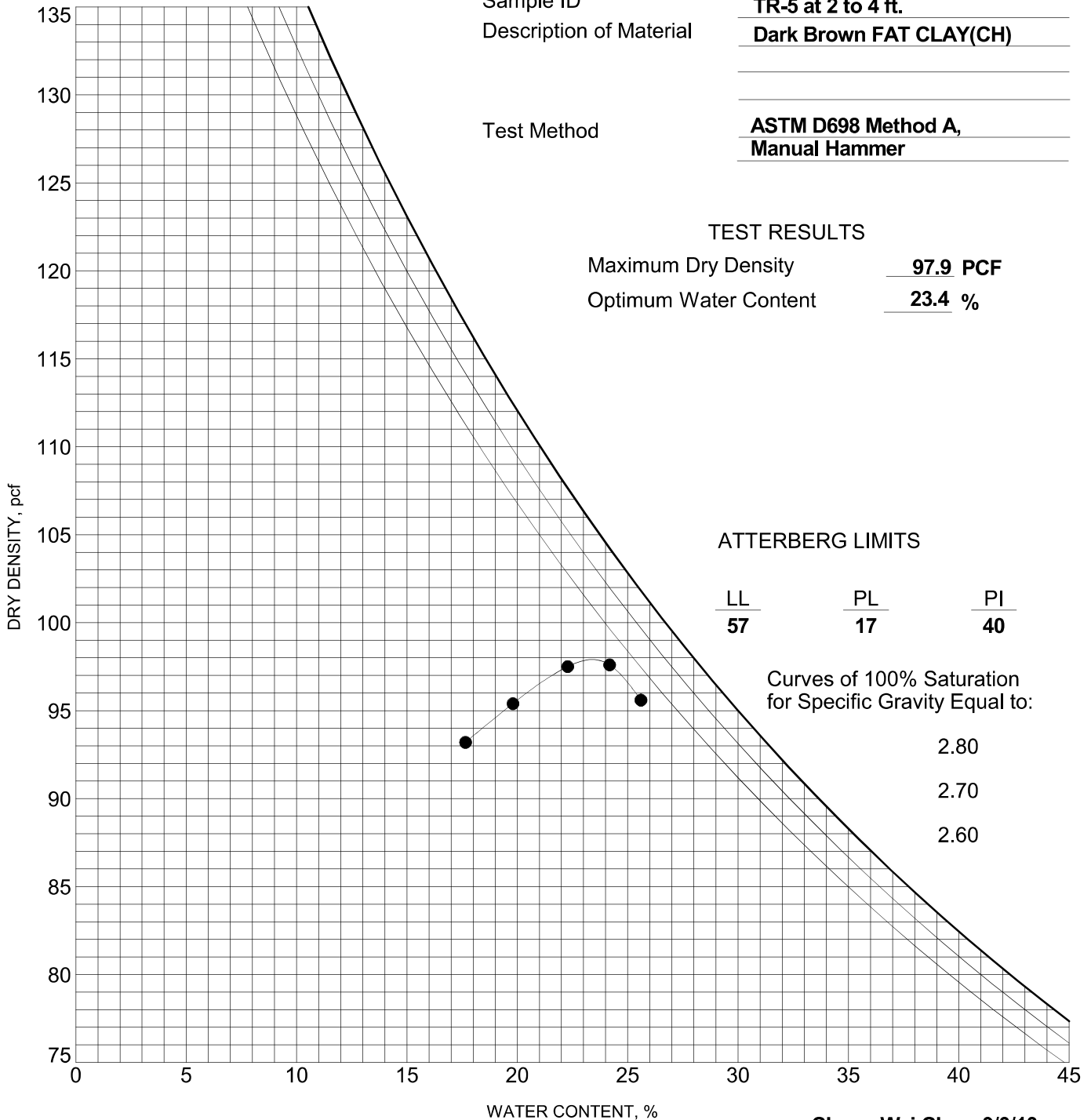
Maximum Dry Density 97.9 PCF  
 Optimum Water Content 23.4 %

### ATTERBERG LIMITS

LL	PL	PI
57	17	40

Curves of 100% Saturation  
 for Specific Gravity Equal to:

2.80  
 2.70  
 2.60



**Cheng-Wei Chen, 9/3/13**

Analysis & Quality Review/Date

Specimens prepared by: C.M. & M.D.

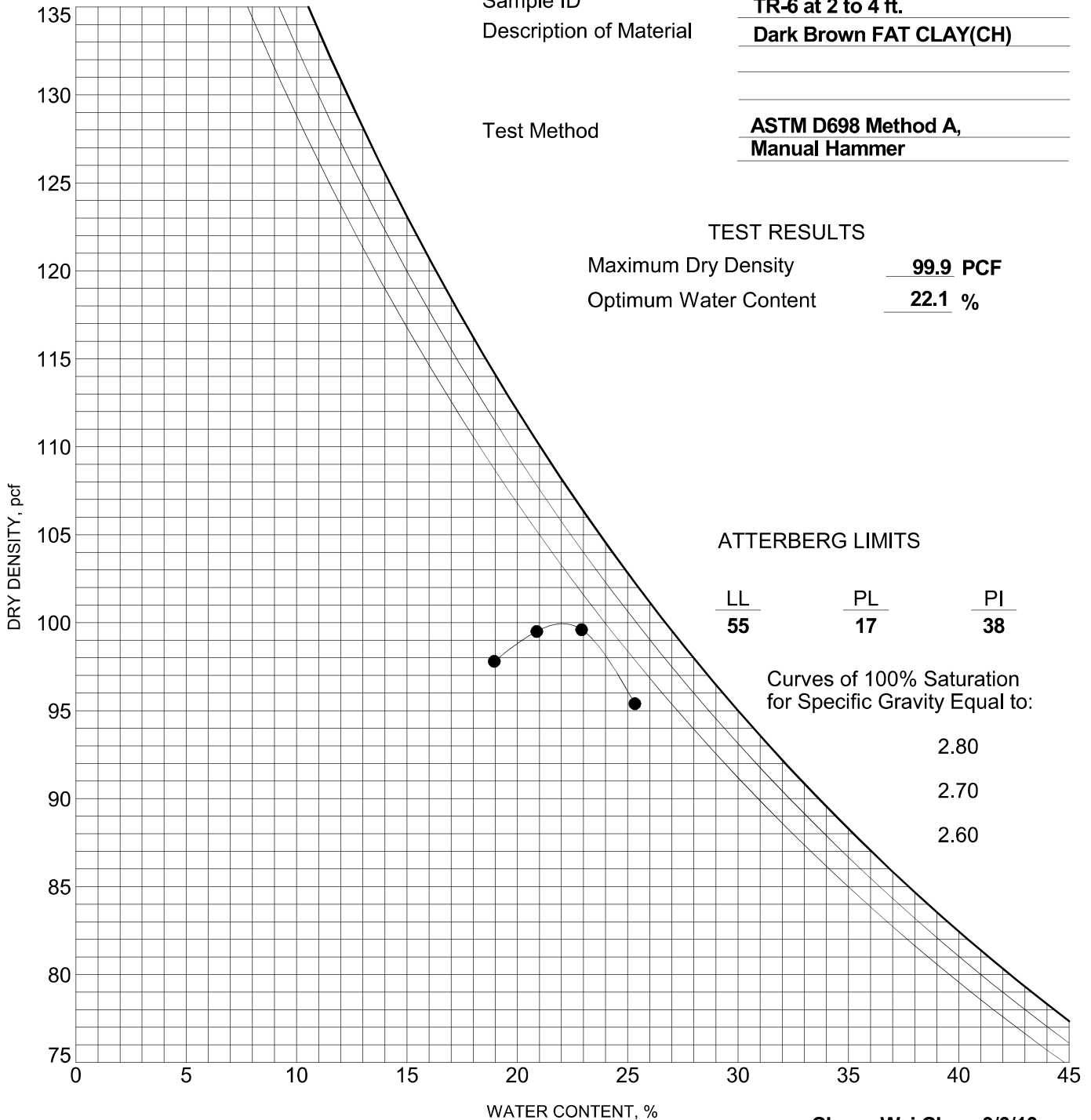


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# MOISTURE-DENSITY RELATIONSHIP

CLIENT: Mortenson Construction  
 PROJECT: Chilocco Wind Farm  
 LOCATION: Chilocco, OK  
 NUMBER: 130222

Sample ID TR-6 at 2 to 4 ft.  
 Description of Material Dark Brown FAT CLAY(CH)  
 Test Method ASTM D698 Method A,  
 Manual Hammer



**Cheng-Wei Chen, 9/3/13**

Analysis & Quality Review/Date

Specimens prepared by: C.M. & M.D.

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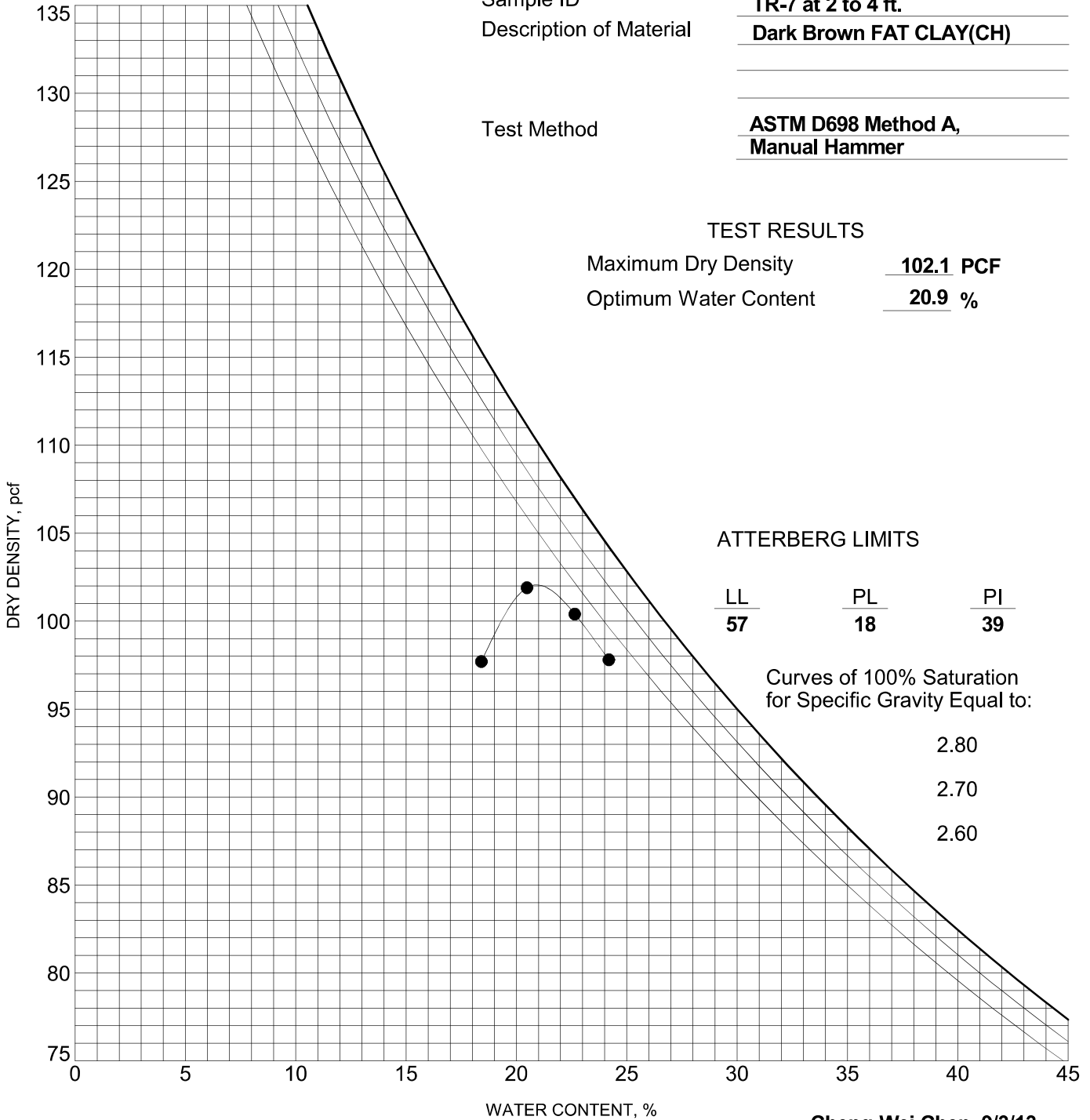


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# MOISTURE-DENSITY RELATIONSHIP

CLIENT: Mortenson Construction  
 PROJECT: Chilocco Wind Farm  
 LOCATION: Chilocco, OK  
 NUMBER: 130222

Sample ID TR-7 at 2 to 4 ft.  
 Description of Material Dark Brown FAT CLAY(CH)  
 Test Method ASTM D698 Method A,  
 Manual Hammer



**Cheng-Wei Chen, 9/3/13**

Analysis & Quality Review/Date

Specimens prepared by: C.M. & M.D.

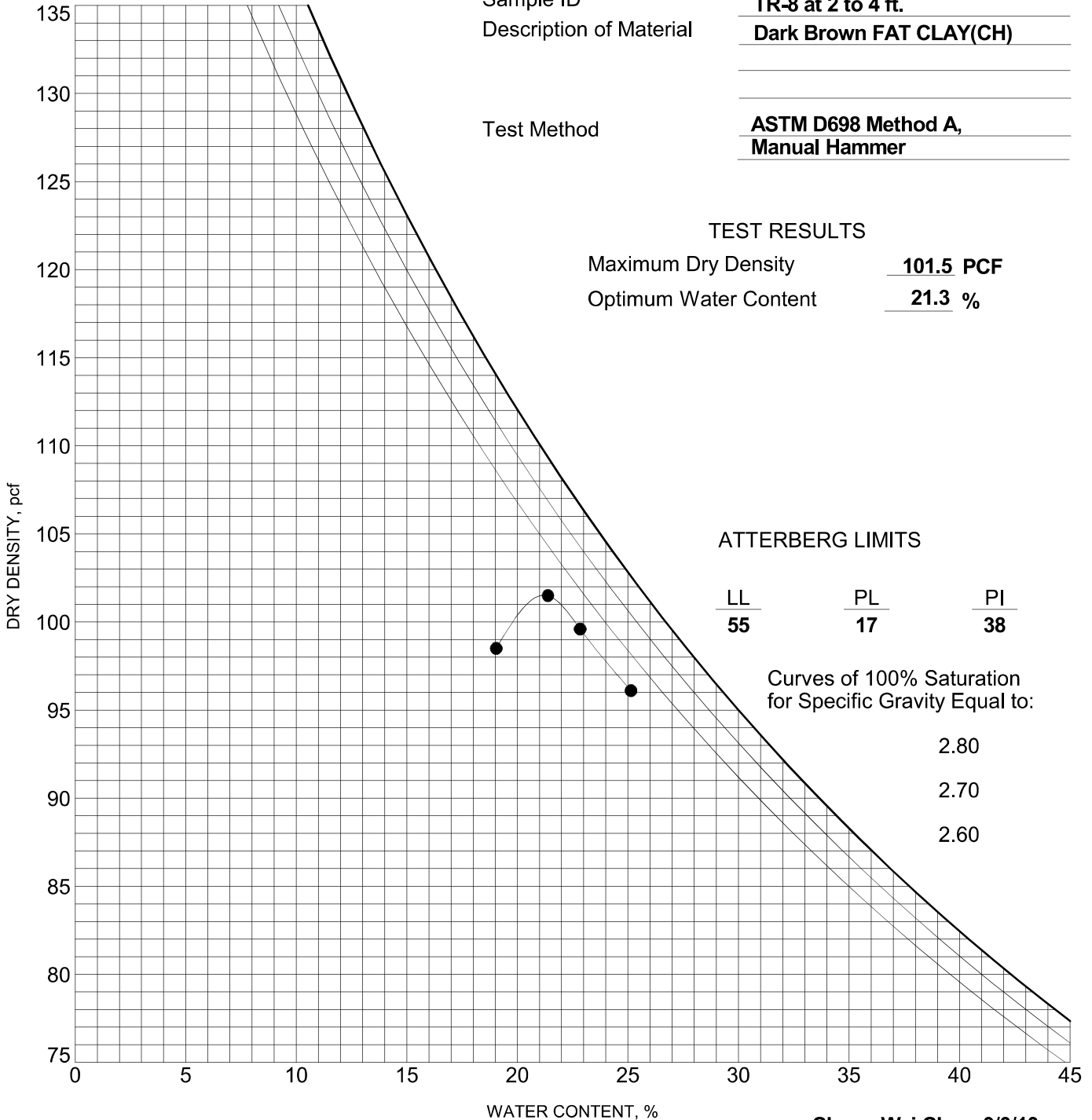


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# MOISTURE-DENSITY RELATIONSHIP

CLIENT: Mortenson Construction  
 PROJECT: Chilocco Wind Farm  
 LOCATION: Chilocco, OK  
 NUMBER: 130222

Sample ID TR-8 at 2 to 4 ft.  
 Description of Material Dark Brown FAT CLAY(CH)  
 Test Method ASTM D698 Method A,  
 Manual Hammer



**Cheng-Wei Chen, 9/3/13**

Analysis & Quality Review/Date

Specimens prepared by: C.M. & M.D.

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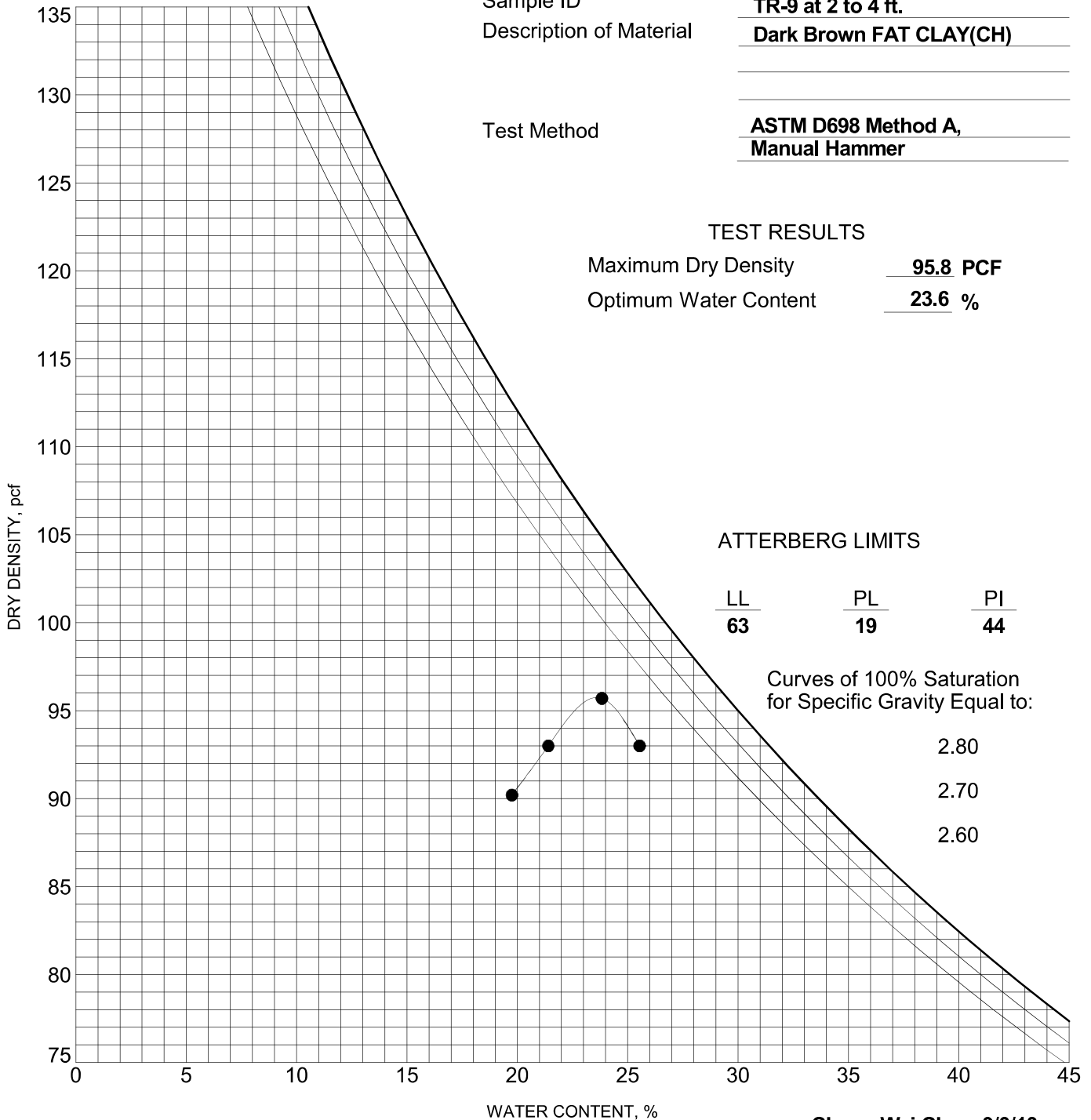


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# MOISTURE-DENSITY RELATIONSHIP

CLIENT: Mortenson Construction  
 PROJECT: Chilocco Wind Farm  
 LOCATION: Chilocco, OK  
 NUMBER: 130222

Sample ID TR-9 at 2 to 4 ft.  
 Description of Material Dark Brown FAT CLAY(CH)  
 Test Method ASTM D698 Method A,  
 Manual Hammer



**Cheng-Wei Chen, 9/3/13**

Analysis & Quality Review/Date

Specimens prepared by: C.M. & M.D.

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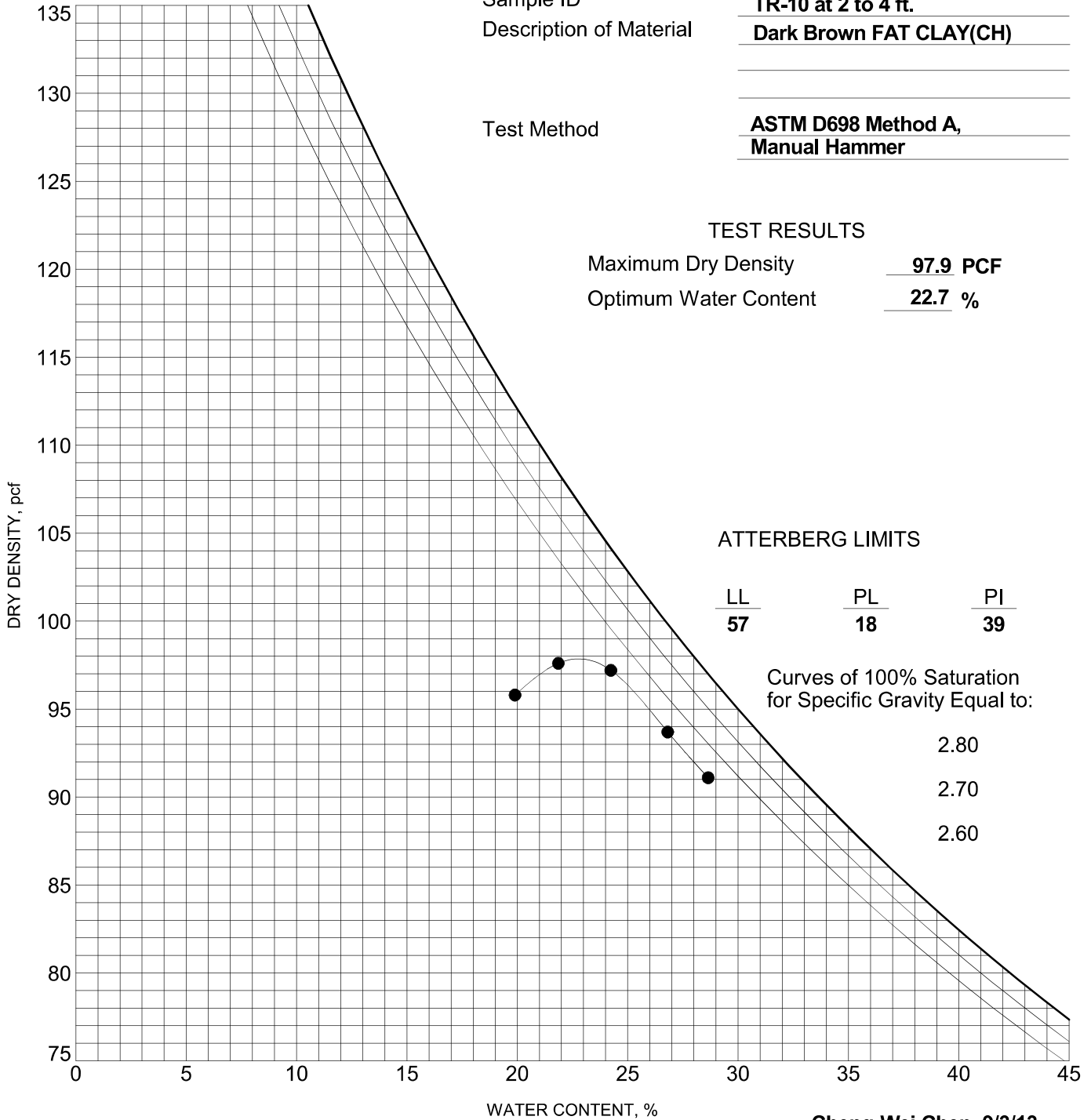


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# MOISTURE-DENSITY RELATIONSHIP

CLIENT: Mortenson Construction  
 PROJECT: Chilocco Wind Farm  
 LOCATION: Chilocco, OK  
 NUMBER: 130222

Sample ID: TR-10 at 2 to 4 ft.  
 Description of Material: Dark Brown FAT CLAY(CH)  
 Test Method: ASTM D698 Method A, Manual Hammer



Curves of 100% Saturation for Specific Gravity Equal to:  
 2.80  
 2.70  
 2.60

**Cheng-Wei Chen, 9/3/13**

Analysis & Quality Review/Date

Specimens prepared by: C.M. & M.D.

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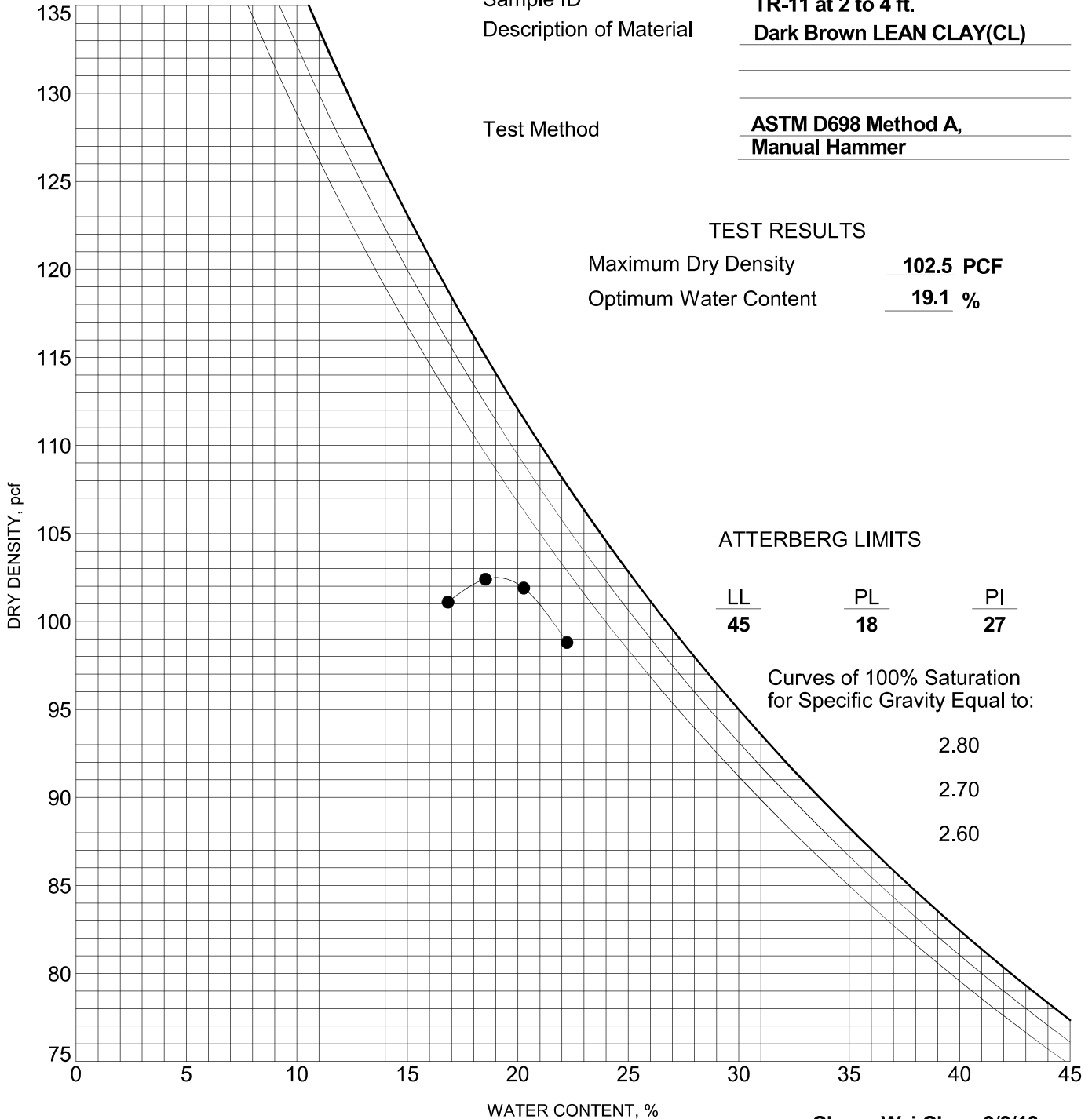


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# MOISTURE-DENSITY RELATIONSHIP

CLIENT: Mortenson Construction  
 PROJECT: Chilocco Wind Farm  
 LOCATION: Chilocco, OK  
 NUMBER: 130222

Sample ID TR-11 at 2 to 4 ft.  
 Description of Material Dark Brown LEAN CLAY(CL)  
 Test Method ASTM D698 Method A,  
 Manual Hammer



**Cheng-Wei Chen, 9/3/13**

Analysis & Quality Review/Date

Specimens prepared by: C.M. & M.D.

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## One-Dimensional Swell Potential Test

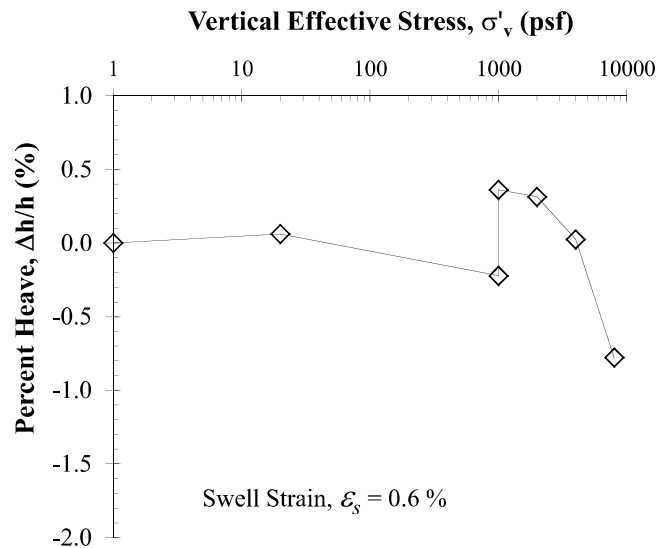
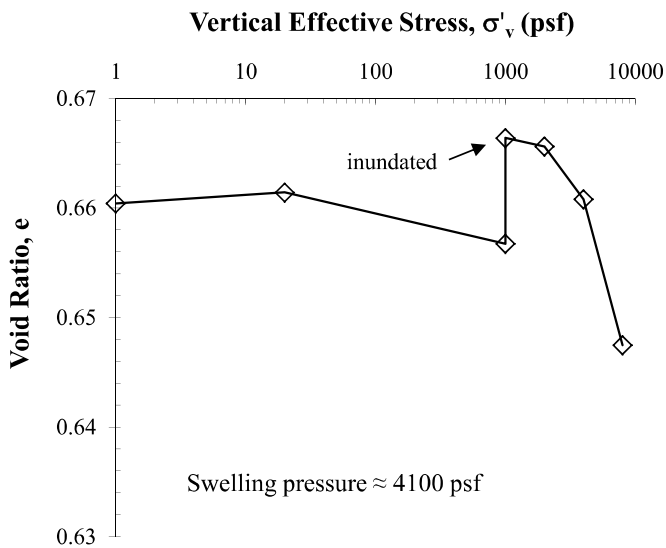
Client: M. A. Mortenson Company  
 Project Name: Chilocco Wind Farm  
 Specimen ID: T-12 at 9 ft

RRC Project No.: 130222  
 Test Method: ASTM D 4546-08, Method C  
 Test Date: 08/30/13

Soil Specimen Properties	
Average Water Content of Trimmings (%)	21.8
Initial Specimen Water Content (%)	21.8
Final Specimen Water Content (%)	24.8
Initial Specimen Height (in)	0.798
Final Specimen Height (in)	0.791
Initial Dry Unit Weight, $\gamma_o$ (pcf)	101.5
Final Dry Unit Weight, $\gamma_f$ (pcf)	102.4
Initial Void Ratio, $e_o$	0.661
Final Void Ratio, $e_f$	0.646
Initial Degree of Saturation (%)	89.2
Seating Load (psf)	20
Swell Pressure at Initial Void Ratio (psf)	4100
Swell Strain, $\mathcal{E}_s$ (%)	0.6

Specimen was inundated with tap water during testing. Loading increment duration was minimum 24 hours.  $G_s$  assumed to be 2.70. The calculation included the machine deflections that measured in each loading steps.

Specimen Diameter: 2.495 inches



$\sigma'_v$ (psf)	1	20	1000	1000	2000	4000	8000
$e$	0.660	0.661	0.657	0.666	0.666	0.661	0.647
$\Delta h/h$ (%)	0.00	0.06	-0.22	0.36	0.31	0.02	-0.78

Cheng-Wei Chen, 09/09/13

Analysis & Quality Review/Date  
 Specimen prepared & tested by: Caleb McCord



## One-Dimensional Swell Potential Test

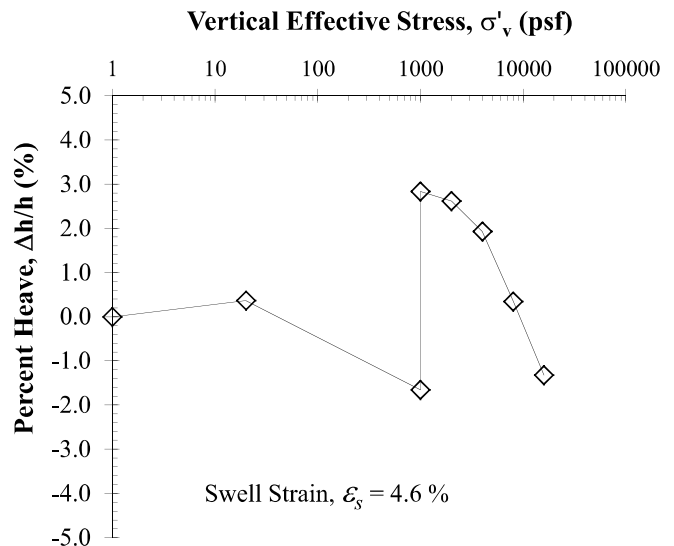
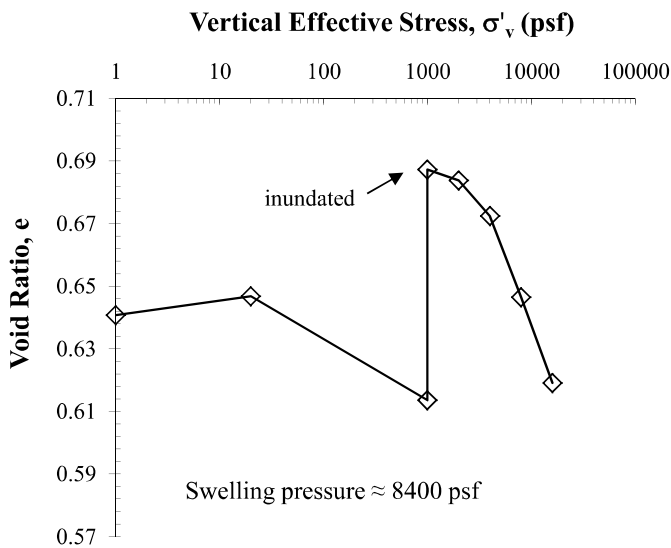
Client: M. A. Mortenson Company  
 Project Name: Chilocco Wind Farm  
 Specimen ID: T-19 at 12 ft

RRC Project No.: 130222  
 Test Method: ASTM D 4546-08, Method C  
 Test Date: 08/30/13

Soil Specimen Properties	
Average Water Content of Trimmings (%)	23.0
Initial Specimen Water Content (%)	23.0
Final Specimen Water Content (%)	24.5
Initial Specimen Height (in)	0.793
Final Specimen Height (in)	0.782
Initial Dry Unit Weight, $\gamma_o$ (pcf)	102.7
Final Dry Unit Weight, $\gamma_f$ (pcf)	104.2
Initial Void Ratio, $e_o$	0.641
Final Void Ratio, $e_f$	0.618
Initial Degree of Saturation (%)	96.9
Seating Load (psf)	20
Swell Pressure at Initial Void Ratio (psf)	8400
Swell Strain, $\mathcal{E}_s$ (%)	4.6

Specimen was inundated with tap water during testing. Loading increment duration was minimum 24 hours.  $G_s$  assumed to be 2.70. The calculation included the machine deflections that measured in each loading steps.

Specimen Diameter: 2.492 inches



$\sigma'_v$ (psf)	1	20	1000	1000	2000	4000	8000	16000
$e$	0.641	0.647	0.614	0.687	0.684	0.672	0.647	0.619
$\Delta h/h$ (%)	0.00	0.37	-1.66	2.83	2.62	1.93	0.35	-1.32

Cheng-Wei Chen, 09/09/13

Analysis & Quality Review/Date  
 Specimen prepared & tested by: Caleb McCord



## One-Dimensional Swell Potential Test

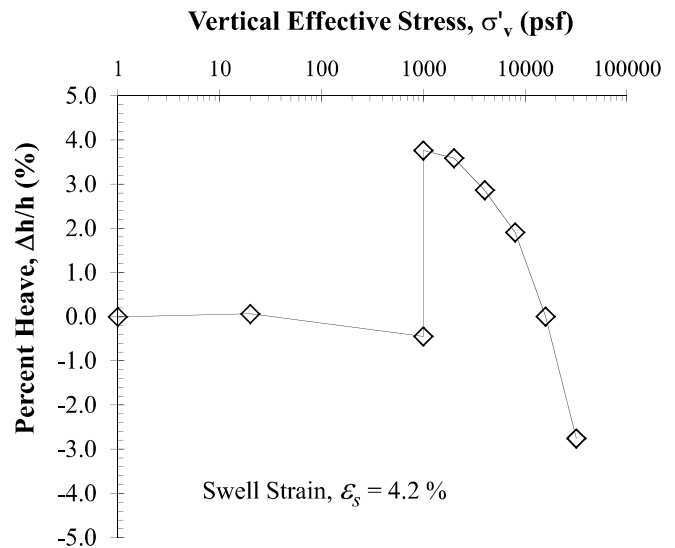
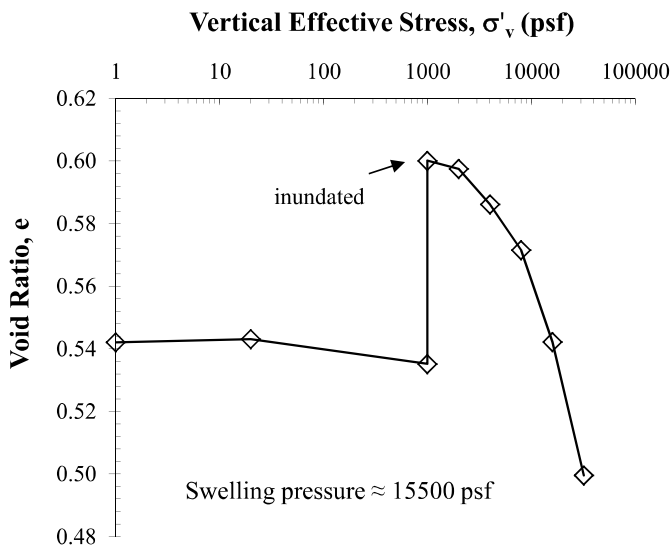
Client: M. A. Mortenson Company  
 Project Name: Chilocco Wind Farm  
 Specimen ID: T-41 at 9 ft

RRC Project No.: 130222  
 Test Method: ASTM D 4546-08, Method C  
 Test Date: 08/30/13

Soil Specimen Properties	
Average Water Content of Trimmings (%)	18.2
Initial Specimen Water Content (%)	18.2
Final Specimen Water Content (%)	18.0
Initial Specimen Height (in)	0.793
Final Specimen Height (in)	0.770
Initial Dry Unit Weight, $\gamma_o$ (pcf)	109.3
Final Dry Unit Weight, $\gamma_f$ (pcf)	112.5
Initial Void Ratio, $e_o$	0.542
Final Void Ratio, $e_f$	0.499
Initial Degree of Saturation (%)	90.6
Seating Load (psf)	20
Swell Pressure at Initial Void Ratio (psf)	15500
Swell Strain, $\mathcal{E}_s$ (%)	4.2

Specimen was inundated with tap water during testing. Loading increment duration was minimum 24 hours.  $G_s$  assumed to be 2.70. The calculation included the machine deflections that measured in each loading steps.

Specimen Diameter: 2.495 inches



$\sigma'_v$ (psf)	1	20	1000	1000	2000	4000	8000	16000	32000
e	0.542	0.543	0.535	0.600	0.597	0.586	0.571	0.542	0.500
$\Delta h/h$ (%)	0.00	0.07	-0.45	3.76	3.59	2.86	1.91	0.01	-2.76

Cheng-Wei Chen, 09/09/13

Analysis & Quality Review/Date  
 Specimen prepared & tested by: Caleb McCord



## One-Dimensional Swell Potential Test

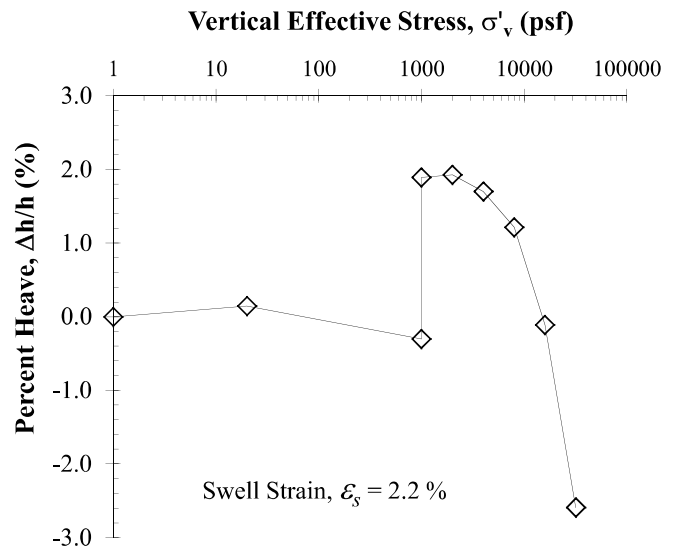
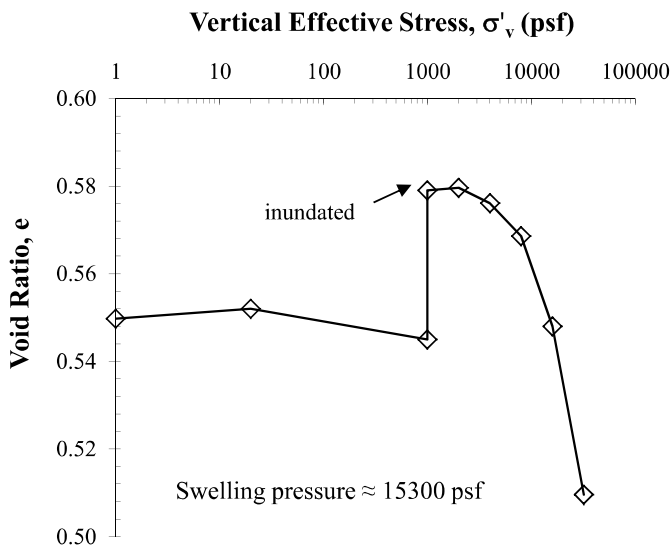
Client: M. A. Mortenson Company  
 Project Name: Chilocco Wind Farm  
 Specimen ID: T-67 at 9 ft

RRC Project No.: 130222  
 Test Method: ASTM D 4546-08, Method C  
 Test Date: 08/30/13

Soil Specimen Properties	
Average Water Content of Trimmings (%)	20.1
Initial Specimen Water Content (%)	20.1
Final Specimen Water Content (%)	19.4
Initial Specimen Height (in)	0.795
Final Specimen Height (in)	0.774
Initial Dry Unit Weight, $\gamma_o$ (pcf)	108.7
Final Dry Unit Weight, $\gamma_f$ (pcf)	111.7
Initial Void Ratio, $e_o$	0.550
Final Void Ratio, $e_f$	0.509
Initial Degree of Saturation (%)	98.8
Seating Load (psf)	20
Swell Pressure at Initial Void Ratio (psf)	15300
Swell Strain, $\mathcal{E}_s$ (%)	2.2

Specimen was inundated with tap water during testing. Loading increment duration was minimum 24 hours.  $G_s$  assumed to be 2.70. The calculation included the machine deflections that measured in each loading steps.

Specimen Diameter: 2.497 inches



$\sigma'_v$ (psf)	1	20	1000	1000	2000	4000	8000	16000	32000
$e$	0.550	0.552	0.545	0.579	0.580	0.576	0.569	0.548	0.510
$\Delta h/h$ (%)	0.00	0.15	-0.30	1.89	1.93	1.70	1.21	-0.11	-2.59

Cheng-Wei Chen, 09/09/13

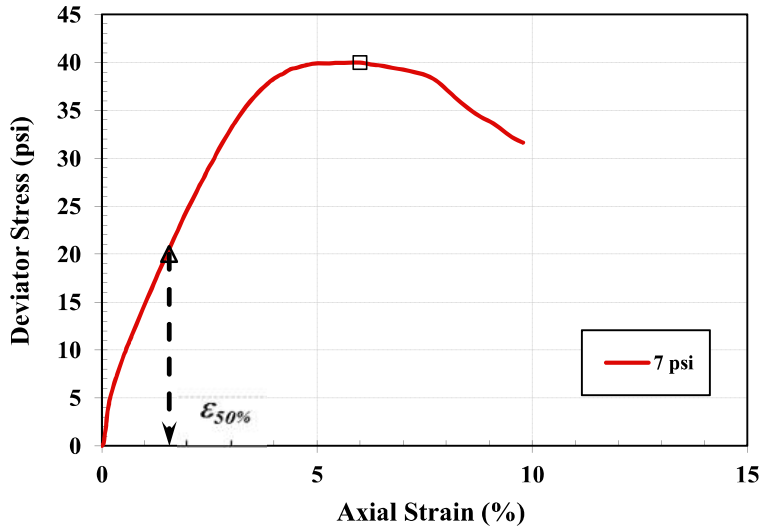
Analysis & Quality Review/Date  
 Specimen prepared & tested by: Caleb McCord



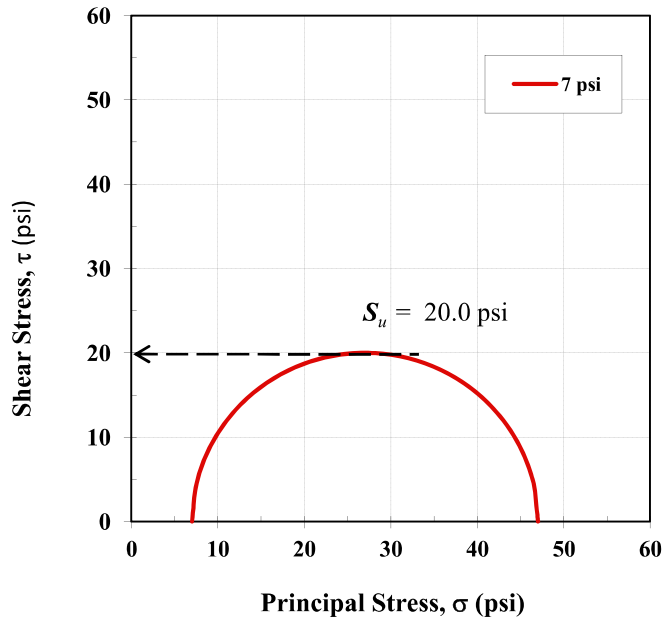
## Unconsolidated-Undrained Triaxial Compression Test Report

Client: M. A. Mortenson Company      RRC Project No.: 130222      Type of Specimen: Shelby Tube  
 Project: Chilocco Wind Farm      Test Method: ASTM D 2850      Strain Rate (%/min): 1 % / min  
 Sample No.: T-15 at 9 ft.      Test Date: 9/3/2013      Type of Test: Q-Test

Principal Stress Difference vs. Axial Strain



Mohr Circles (Total Stress) for Peak Stress at Failure



Initial Specimen Conditions		
Specimen No.	1	
Confining Pressure (psi)	7.0	
Avg. Diameter (in)	D <sub>o</sub>	2.83
Avg. Height (in)	H <sub>o</sub>	5.69
In-situ Moisture Content (%)	w <sub>o</sub>	24.3
Total Unit Weight (pcf)	γ <sub>total</sub>	126.1
Dry Unit Weight (pcf)	γ <sub>dry</sub>	101.5
Saturation (%)	S <sub>r</sub>	99.6
Void Ratio	e <sub>o</sub>	0.66
Specific Gravity (Assumed)	G <sub>s</sub>	2.70

Stresses at Failure	
Maximum Deviator Stress (psi)	40.0
Axial Strain at Failure (%)	6.0
Axial Strain at 50% of q <sub>u</sub> (%)	1.6
Total Stresses at Failure	
Major Principal Stress, σ <sub>1</sub> (psi)	47.0
Minor Principal Stress, σ <sub>3</sub> (psi)	7.0

Test Results	
Friction Angle, φ <sub>u</sub> (°)	--
Cohesion Intercept, C <sub>u</sub> (psi)	--
Undrained Shear Strength, S <sub>u</sub> (tsf)	1.44

Note: The test specimen was nearly saturated; the Mohr-Coulomb failure envelope was taken as a horizontal straight line. Failure was determined at the maximum deviator stress or deviator stress at 15 % axial strain, whenever is obtained first.

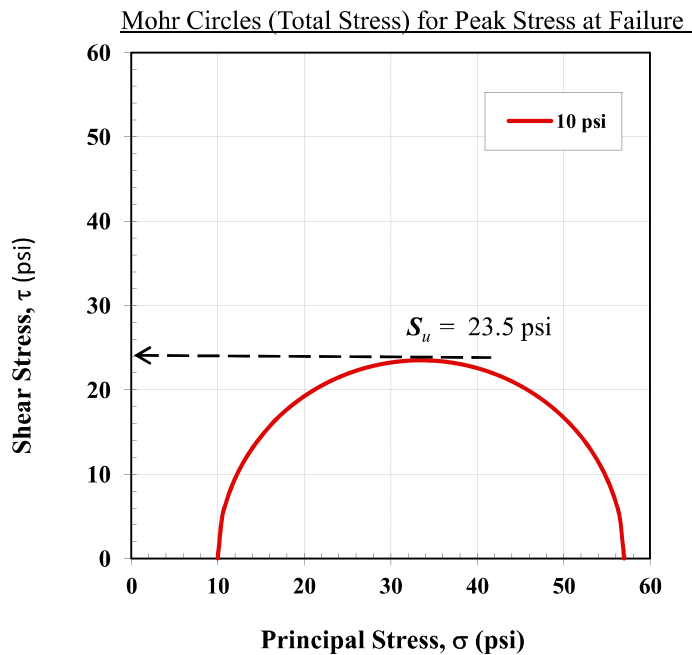
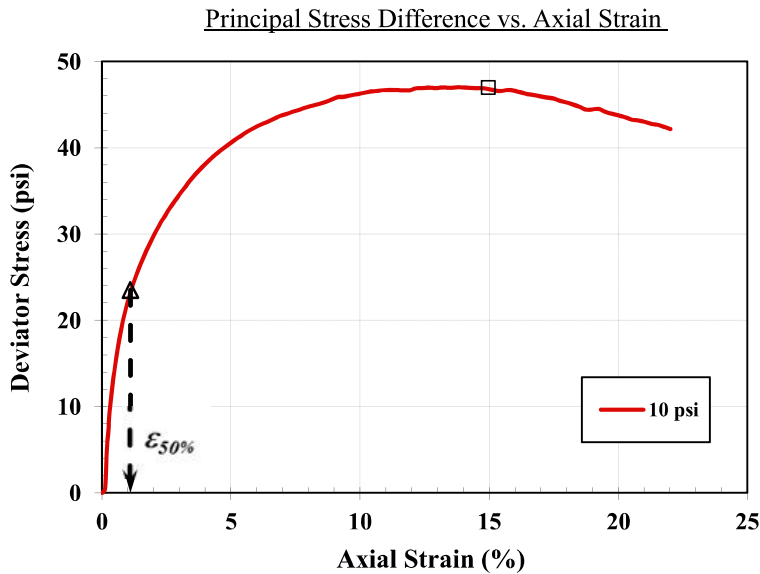
Cheng-Wei Chen, 09/05/13

Analysis & Quality Review/Date  
 Specimen Prepared by: C.M.



## Unconsolidated-Undrained Triaxial Compression Test Report

Client: M. A. Mortenson Company      RRC Project No.: 130222      Type of Specimen: Shelby Tube  
 Project: Chilocco Wind Farm      Test Method: ASTM D 2850      Strain Rate (%/min): 1 % / min  
 Sample No.: T-19 at 12 ft.      Test Date: 9/3/2013      Type of Test: Q-Test



Initial Specimen Conditions		
Specimen No.	1	
Confining Pressure (psi)	10.0	
Avg. Diameter (in)	$D_o$	2.81
Avg. Height (in)	$H_o$	5.68
In-situ Moisture Content (%)	$w_o$	21.0
Total Unit Weight (pcf)	$\gamma_{total}$	129.7
Dry Unit Weight (pcf)	$\gamma_{dry}$	107.2
Saturation (%)	$S_r$	100.0
Void Ratio	$e_o$	0.57
Specific Gravity (Assumed)	$G_s$	2.70

Stresses at Failure	
Maximum Deviator Stress (psi)	47.0
Axial Strain at Failure (%)	15.0
Axial Strain at 50% of $q_u$ (%)	1.1
Total Stresses at Failure	
Major Principal Stress, $\sigma_1$ (psi)	57.0
Minor Principal Stress, $\sigma_3$ (psi)	10.0

Test Results	
Friction Angle, $\phi_u$ ( $^\circ$ )	--
Cohesion Intercept, $C_u$ (psi)	--
Undrained Shear Strength, $S_u$ (tsf)	1.69

Note: The test specimen was nearly saturated; the Mohr-Coulomb failure envelope was taken as a horizontal straight line. Failure was determined at the maximum deviator stress or deviator stress at 15 % axial strain, whenever is obtained first.

Cheng-Wei Chen, 09/05/13

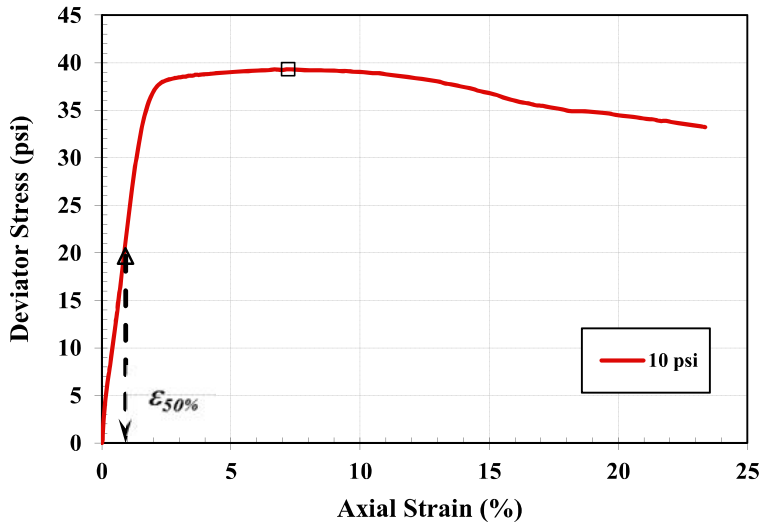
Analysis & Quality Review/Date  
 Specimen Prepared by: C.M.



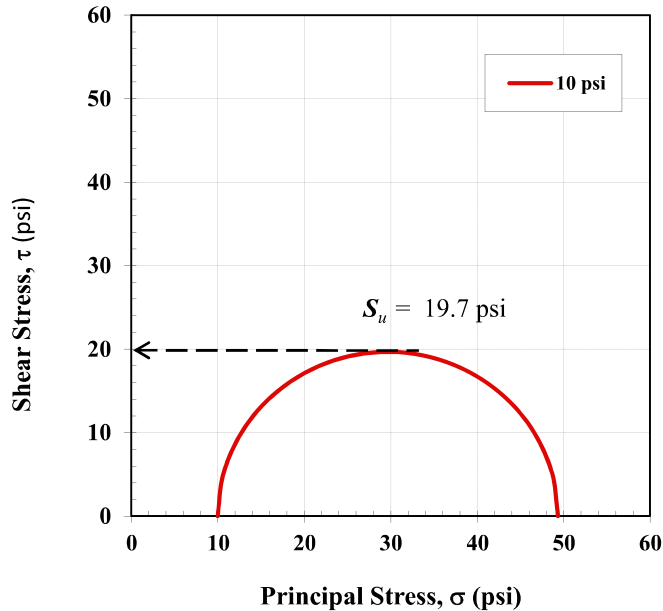
## Unconsolidated-Undrained Triaxial Compression Test Report

Client: M. A. Mortenson Company      RRC Project No.: 130222      Type of Specimen: Shelby Tube  
 Project: Chilocco Wind Farm      Test Method: ASTM D 2850      Strain Rate (%/min): 1 % / min  
 Sample No.: T-41 at 14 ft.      Test Date: 9/4/2013      Type of Test: Q-Test

Principal Stress Difference vs. Axial Strain



Mohr Circles (Total Stress) for Peak Stress at Failure



Initial Specimen Conditions		
Specimen No.	1	
Confining Pressure (psi)	10.0	
Avg. Diameter (in)	D <sub>o</sub>	2.83
Avg. Height (in)	H <sub>o</sub>	5.67
In-situ Moisture Content (%)	w <sub>o</sub>	20.7
Total Unit Weight (pcf)	γ <sub>total</sub>	124.9
Dry Unit Weight (pcf)	γ <sub>dry</sub>	103.5
Saturation (%)	S <sub>r</sub>	87.9
Void Ratio	e <sub>o</sub>	0.63
Specific Gravity (Assumed)	G <sub>s</sub>	2.70

Stresses at Failure	
Maximum Deviator Stress (psi)	39.3
Axial Strain at Failure (%)	7.2
Axial Strain at 50% of q <sub>u</sub> (%)	0.9
Total Stresses at Failure	
Major Principal Stress, σ <sub>1</sub> (psi)	49.3
Minor Principal Stress, σ <sub>3</sub> (psi)	10.0

Test Results	
Friction Angle, φ <sub>u</sub> (°)	--
Cohesion Intercept, C <sub>u</sub> (psi)	--
<b>Corresponding Undrained Shear Strength, S<sub>u</sub> (tsf)</b>	1.42

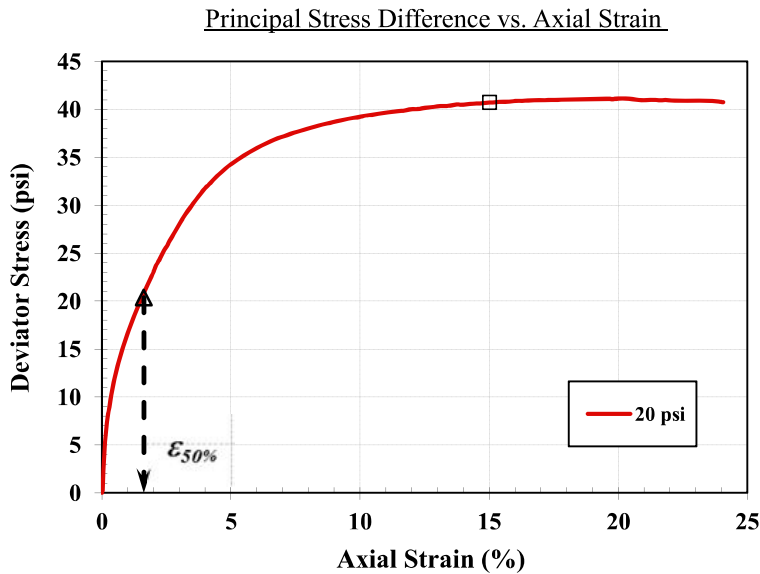
Note: The test specimens were partially saturated. Failure was determined at the maximum deviator stress or deviator stress at 15 % axial strain, whichever is obtained first.

Cheng-Wei Chen, 09/06/13  
 Analysis & Quality Review/Date  
 Specimen Prepared by: C.M.



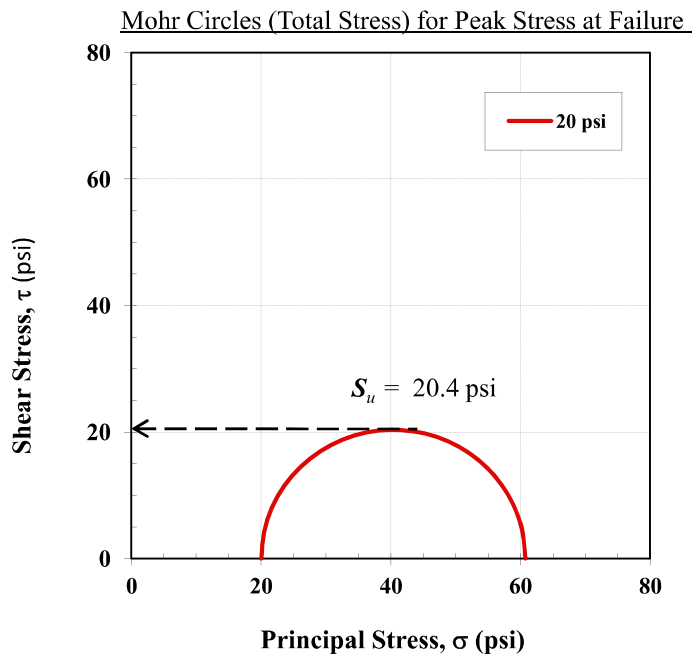
## Unconsolidated-Undrained Triaxial Compression Test Report

Client: M. A. Mortenson Company      RRC Project No.: 130222      Type of Specimen: Shelby Tube  
 Project: Chilocco Wind Farm      Test Method: ASTM D 2850      Strain Rate (%/min): 1 % / min  
 Sample No.: T-41 at 29 ft.      Test Date: 9/3/2013      Type of Test: Q-Test



Initial Specimen Conditions		
Specimen No.	1	
Confining Pressure (psi)	20.0	
Avg. Diameter (in)	$D_o$	2.84
Avg. Height (in)	$H_o$	5.68
In-situ Moisture Content (%)	$w_o$	21.9
Total Unit Weight (pcf)	$\gamma_{total}$	131.3
Dry Unit Weight (pcf)	$\gamma_{dry}$	107.7
Saturation (%)	$S_r$	100.0
Void Ratio	$e_o$	0.56
Specific Gravity (Assumed)	$G_s$	2.70

Stresses at Failure	
Maximum Deviator Stress (psi)	40.7
Axial Strain at Failure (%)	15.0
Axial Strain at 50% of $q_u$ (%)	1.6
Total Stresses at Failure	
Major Principal Stress, $\sigma_1$ (psi)	60.7
Minor Principal Stress, $\sigma_3$ (psi)	20.0



Test Results	
Friction Angle, $\phi_u$ ( $^\circ$ )	--
Cohesion Intercept, $C_u$ (psi)	--
Undrained Shear Strength, $S_u$ (tsf)	1.47

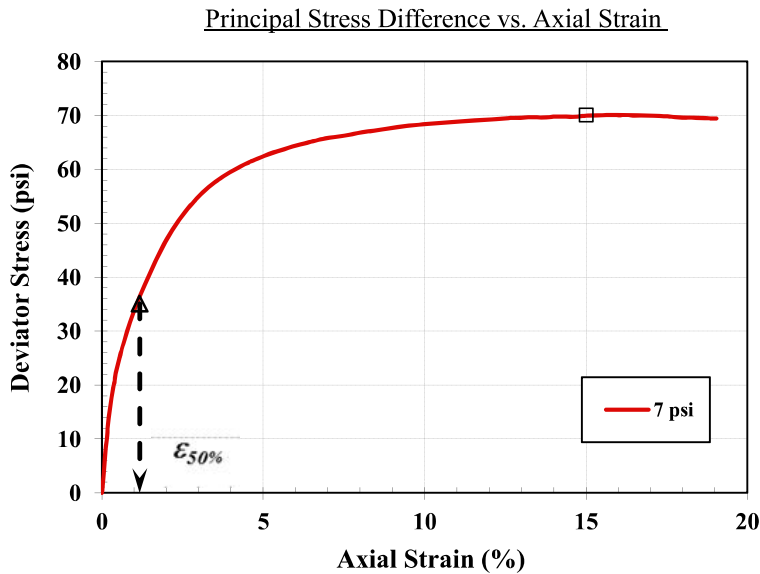
Note: The test specimen was nearly saturated; the Mohr-Coulomb failure envelope was taken as a horizontal straight line. Failure was determined at the maximum deviator stress or deviator stress at 15 % axial strain, whenever is obtained first.

Cheng-Wei Chen, 09/06/13  
 Analysis & Quality Review/Date  
 Specimen Prepared by: C.M.



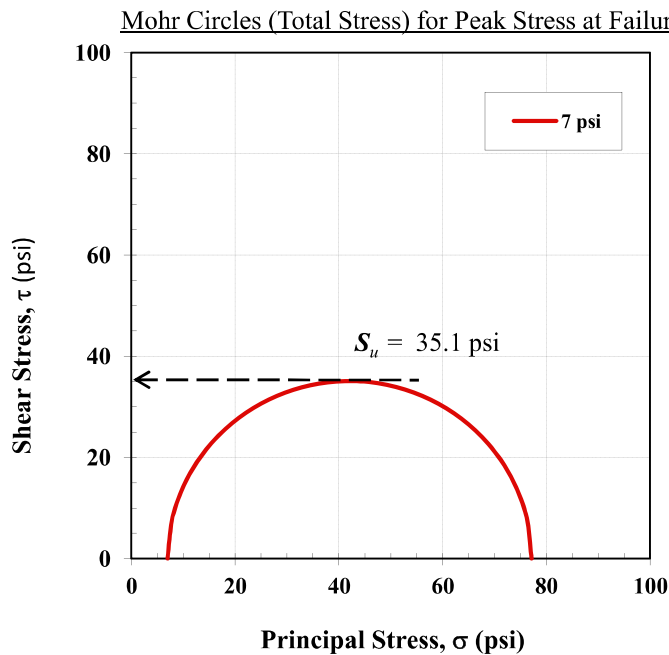
## Unconsolidated-Undrained Triaxial Compression Test Report

Client: M. A. Mortenson Company      RRC Project No.: 130222      Type of Specimen: Shelby Tube  
 Project: Chilocco Wind Farm      Test Method: ASTM D 2850      Strain Rate (%/min): 1 % / min  
 Sample No.: T-67 at 9 ft.      Test Date: 9/3/2013      Type of Test: Q-Test



Initial Specimen Conditions		
Specimen No.	1	
Confining Pressure (psi)	7.0	
Avg. Diameter (in)	$D_o$	2.84
Avg. Height (in)	$H_o$	5.68
In-situ Moisture Content (%)	$w_o$	20.1
Total Unit Weight (pcf)	$\gamma_{total}$	131.5
Dry Unit Weight (pcf)	$\gamma_{dry}$	109.5
Saturation (%)	$S_r$	100.0
Void Ratio	$e_o$	0.54
Specific Gravity (Assumed)	$G_s$	2.70

Stresses at Failure	
Maximum Deviator Stress (psi)	70.1
Axial Strain at Failure (%)	15.0
Axial Strain at 50% of $q_u$ (%)	1.2
Total Stresses at Failure	
Major Principal Stress, $\sigma_1$ (psi)	77.1
Minor Principal Stress, $\sigma_3$ (psi)	7.0



Test Results	
Friction Angle, $\phi_u$ ( $^\circ$ )	--
Cohesion Intercept, $C_u$ (psi)	--
Undrained Shear Strength, $S_u$ (tsf)	2.52

Note: The test specimen was nearly saturated; the Mohr-Coulomb failure envelope was taken as a horizontal straight line. Failure was determined at the maximum deviator stress or deviator stress at 15 % axial strain, whenever is obtained first.

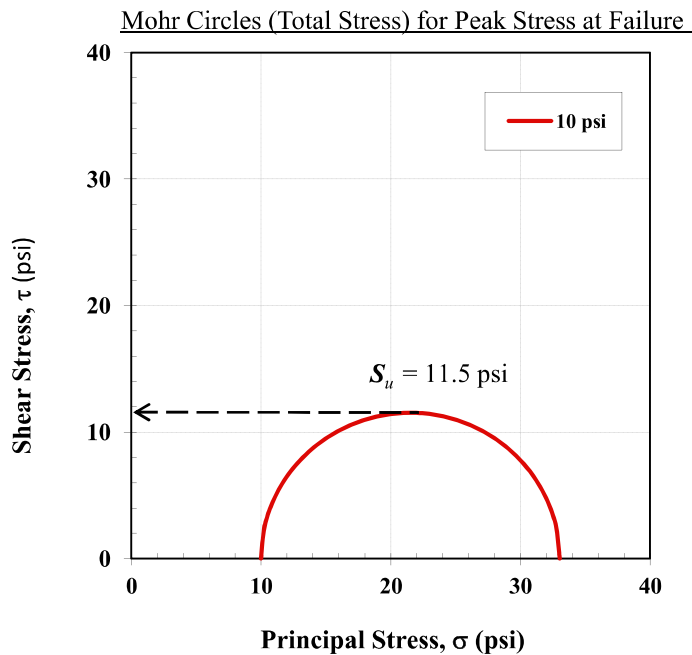
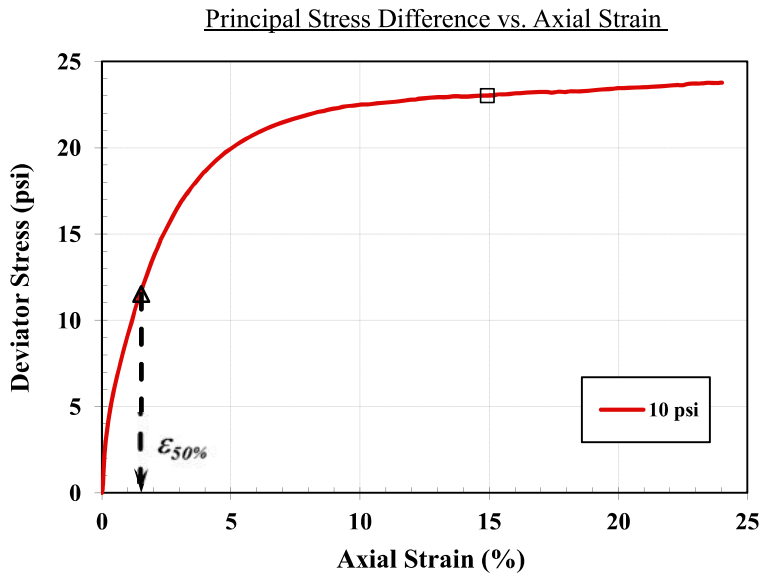
Cheng-Wei Chen, 09/05/13

Analysis & Quality Review/Date  
 Specimen Prepared by: C.M.



## Unconsolidated-Undrained Triaxial Compression Test Report

Client: M. A. Mortenson Company	RRC Project No.: 130222	Type of Specimen: Shelby Tube
Project: Chilocco Wind Farm	Test Method: ASTM D 2850	Strain Rate (%/min): 1 % / min
Sample No.: T-67 at 14 ft.	Test Date: 9/3/2013	Type of Test: Q-Test



Initial Specimen Conditions	
Specimen No.	1
Confining Pressure (psi)	7.0
Avg. Diameter (in)	$D_o$ 2.79
Avg. Height (in)	$H_o$ 5.68
In-situ Moisture Content (%)	$w_o$ 20.7
Total Unit Weight (pcf)	$\gamma_{total}$ 131.2
Dry Unit Weight (pcf)	$\gamma_{dry}$ 108.8
Saturation (%)	$S_r$ 100.0
Void Ratio	$e_o$ 0.55
Specific Gravity (Assumed)	$G_s$ 2.70

Stresses at Failure	
Maximum Deviator Stress (psi)	23.0
Axial Strain at Failure (%)	14.9
Axial Strain at 50% of $q_u$ (%)	1.5
Total Stresses at Failure	
Major Principal Stress, $\sigma_1$ (psi)	33.0
Minor Principal Stress, $\sigma_3$ (psi)	10.0

Test Results	
Friction Angle, $\phi_u$ ( $^\circ$ )	--
Cohesion Intercept, $C_u$ (psi)	--
Undrained Shear Strength, $S_u$ (tsf)	0.83

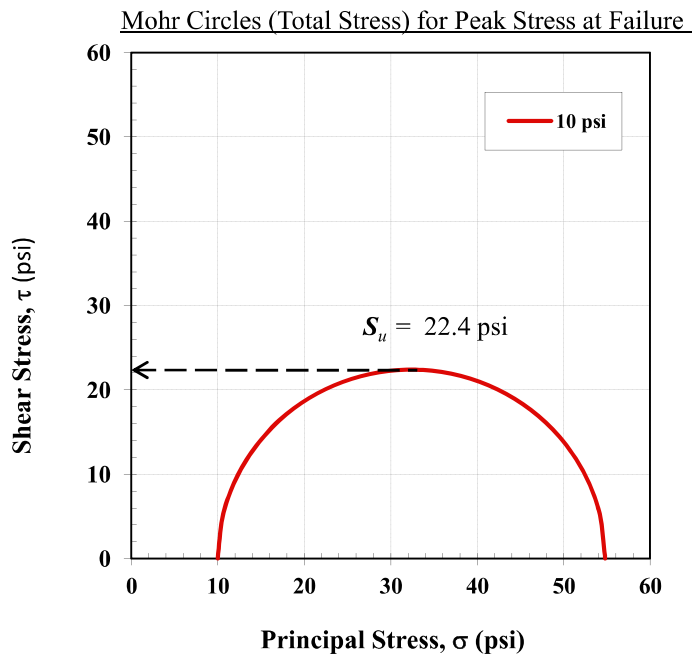
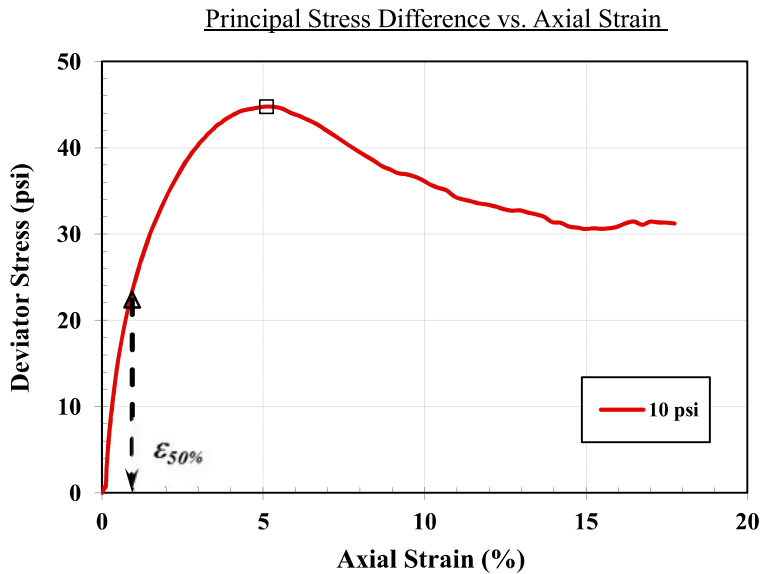
Note: The test specimen was nearly saturated; the Mohr-Coulomb failure envelope was taken as a horizontal straight line. Failure was determined at the maximum deviator stress or deviator stress at 15 % axial strain, whenever is obtained first.

Cheng-Wei Chen, 09/05/13  
Analysis & Quality Review/Date  
Specimen Prepared by: C.M.



## Unconsolidated-Undrained Triaxial Compression Test Report

Client: M. A. Mortenson Company      RRC Project No.: 130222      Type of Specimen: Shelby Tube  
 Project: Chilocco Wind Farm      Test Method: ASTM D 2850      Strain Rate (%/min): 1 % / min  
 Sample No.: T-71 at 12 ft.      Test Date: 9/4/2013      Type of Test: Q-Test



Initial Specimen Conditions		
Specimen No.	1	
Confining Pressure (psi)	10.0	
Avg. Diameter (in)	$D_o$	2.84
Avg. Height (in)	$H_o$	5.68
In-situ Moisture Content (%)	$w_o$	24.3
Total Unit Weight (pcf)	$\gamma_{total}$	124.5
Dry Unit Weight (pcf)	$\gamma_{dry}$	100.2
Saturation (%)	$S_r$	97.1
Void Ratio	$e_o$	0.68
Specific Gravity (Assumed)	$G_s$	2.70

Stresses at Failure	
Maximum Deviator Stress (psi)	44.8
Axial Strain at Failure (%)	5.1
Axial Strain at 50% of $q_u$ (%)	0.9
Total Stresses at Failure	
Major Principal Stress, $\sigma_1$ (psi)	54.8
Minor Principal Stress, $\sigma_3$ (psi)	10.0

Test Results	
Friction Angle, $\phi_u$ ( $^\circ$ )	--
Cohesion Intercept, $C_u$ (psi)	--
Undrained Shear Strength, $S_u$ (tsf)	1.61

Note: The test specimen was nearly saturated; the Mohr-Coulomb failure envelope was taken as a horizontal straight line. Failure was determined at the maximum deviator stress or deviator stress at 15 % axial strain, whenever is obtained first.

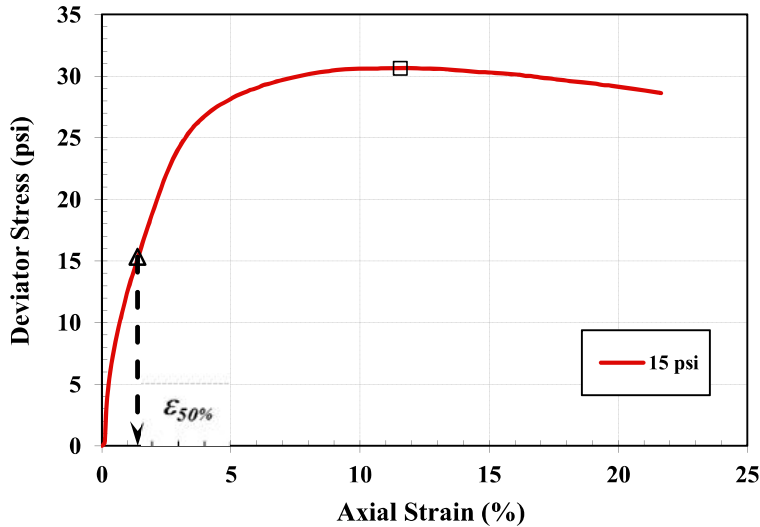
Cheng-Wei Chen, 09/06/13  
 Analysis & Quality Review/Date  
 Specimen Prepared by: C.M.



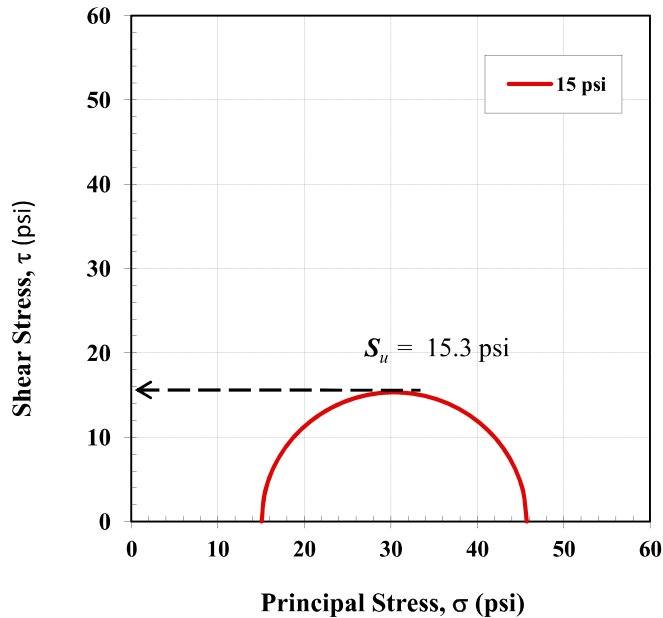
## Unconsolidated-Undrained Triaxial Compression Test Report

Client: M. A. Mortenson Company      RRC Project No.: 130222      Type of Specimen: Shelby Tube  
 Project: Chilocco Wind Farm      Test Method: ASTM D 2850      Strain Rate (%/min): 1 % / min  
 Sample No.: T-86 at 19 ft.      Test Date: 9/4/2013      Type of Test: Q-Test

Principal Stress Difference vs. Axial Strain



Mohr Circles (Total Stress) for Peak Stress at Failure



Initial Specimen Conditions		
Specimen No.	1	
Confining Pressure (psi)	15.0	
Avg. Diameter (in)	$D_o$	2.85
Avg. Height (in)	$H_o$	5.68
In-situ Moisture Content (%)	$w_o$	24.5
Total Unit Weight (pcf)	$\gamma_{total}$	123.7
Dry Unit Weight (pcf)	$\gamma_{dry}$	99.4
Saturation (%)	$S_r$	95.0
Void Ratio	$e_o$	0.70
Specific Gravity (Assumed)	$G_s$	2.70

Stresses at Failure	
Maximum Deviator Stress (psi)	30.7
Axial Strain at Failure (%)	11.6
Axial Strain at 50% of $q_u$ (%)	1.4
Total Stresses at Failure	
Major Principal Stress, $\sigma_1$ (psi)	45.7
Minor Principal Stress, $\sigma_3$ (psi)	15.1

Test Results	
Friction Angle, $\phi_u$ ( $^\circ$ )	--
Cohesion Intercept, $C_u$ (psi)	--
Undrained Shear Strength, $S_u$ (tsf)	1.10

Note: The test specimen was nearly saturated; the Mohr-Coulomb failure envelope was taken as a horizontal straight line. Failure was determined at the maximum deviator stress or deviator stress at 15 % axial strain, whenever is obtained first.

Cheng-Wei Chen, 09/06/13

Analysis & Quality Review/Date  
 Specimen Prepared by: C.M.

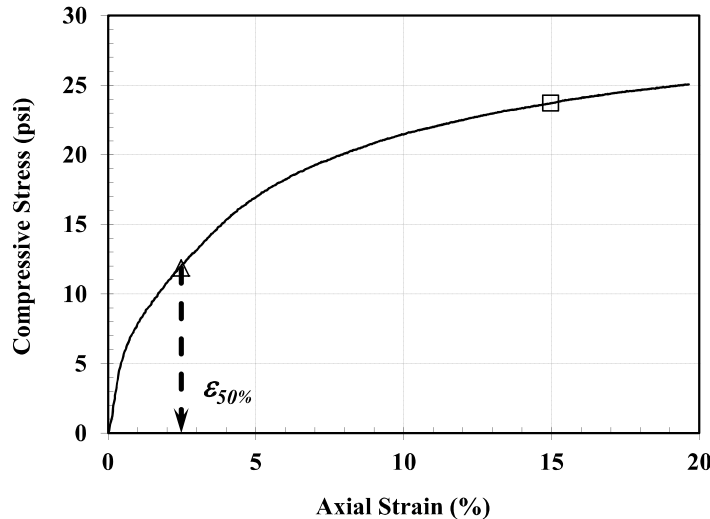


## Unconfined Compression Test Report

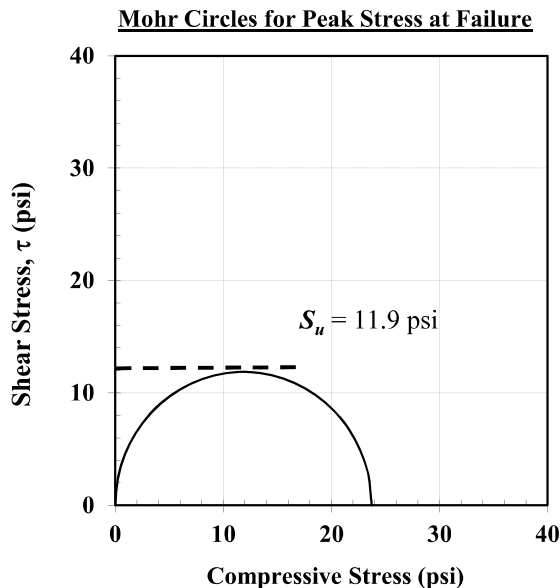
Client: M. A. Mortenson Company  
 Project: Chilocco Wind Farm  
 Sample I.D.: Substation at 4 ft

RRC Project No.: 130222  
 Test Method: ASTM D 2166  
 Test Date: 9/4/2013

Type of Specimen: Shelby Tube  
 Strain Rate (%/min): 1 % / min



Initial Specimen Conditions		
Specimen No.		1
Avg. Diameter (in)	$D_o$	2.83
Avg. Height (in)	$H_o$	5.68
In-situ Moisture Content (%)	$w_o$	19.1
Total Unit Weight (pcf)	$\gamma_{total}$	127.5
Dry Unit Weight (pcf)	$\gamma_{dry}$	107.0
Saturation (%)	$S_r$	95.1
Void Ratio	$e_o$	0.55
Specific Gravity (Assumed)	$G_s$	2.65



Stresses at Failure	
Unconfined Compressive Strength, $q_u$ (psi)	23.7
Axial Strain at Failure (%)	15.0
Axial Strain at 50% of $q_u$ (%)	2.5
Total Stresses at Failure	
Major Principal Stress, $\sigma_1$ (psi)	23.7
Minor Principal Stress, $\sigma_3$ (psi)	0.0
<b>Undrained Shear Strength, <math>S_u</math> (tsf)</b>	<b>0.85</b>

Note: Failure was determined at the maximum deviator stress or deviator stress at 15 % axial strain, whenever is obtained first.

Cheng-Wei Chen, 09/06/13

Quality Review/Date  
 Specimen prepared & tested by: : C.M.

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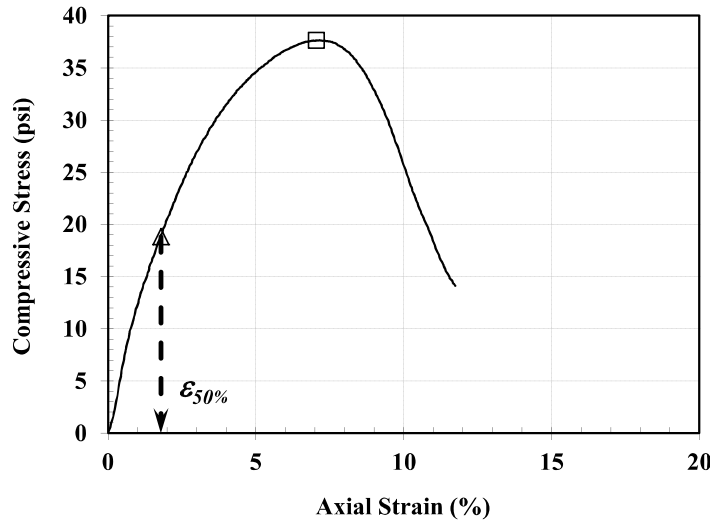


## Unconfined Compression Test Report

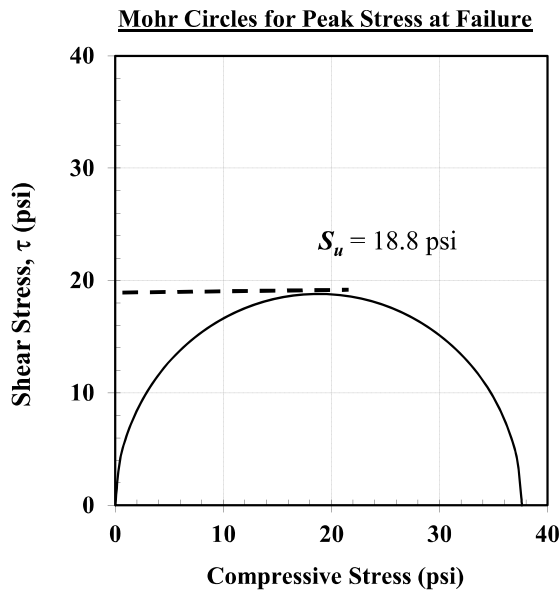
Client: M. A. Mortenson Company  
 Project: Chilocco Wind Farm  
 Sample I.D.: T-17 at 9 ft

RRC Project No.: 130222  
 Test Method: ASTM D 2166  
 Test Date: 9/4/2013

Type of Specimen: Shelby Tube  
 Strain Rate (%/min): 1 % / min



Initial Specimen Conditions		
Specimen No.		1
Avg. Diameter (in)	$D_o$	2.83
Avg. Height (in)	$H_o$	5.68
In-situ Moisture Content (%)	$w_o$	19.3
Total Unit Weight (pcf)	$\gamma_{total}$	131.7
Dry Unit Weight (pcf)	$\gamma_{dry}$	110.4
Saturation (%)	$S_r$	100.0
Void Ratio	$e_o$	0.50
Specific Gravity (Assumed)	$G_s$	2.65



Stresses at Failure	
Unconfined Compressive Strength, $q_u$ (psi)	37.6
Axial Strain at Failure (%)	7.0
Axial Strain at 50% of $q_u$ (%)	1.8
Total Stresses at Failure	
Major Principal Stress, $\sigma_1$ (psi)	37.6
Minor Principal Stress, $\sigma_3$ (psi)	0.0
<b>Undrained Shear Strength, <math>S_u</math> (tsf)</b>	<b>1.35</b>

Note: Failure was determined at the maximum deviator stress or deviator stress at 15 % axial strain, whenever is obtained first.

Cheng-Wei Chen, 09/06/13

Quality Review/Date  
 Specimen prepared & tested by: : C.M.

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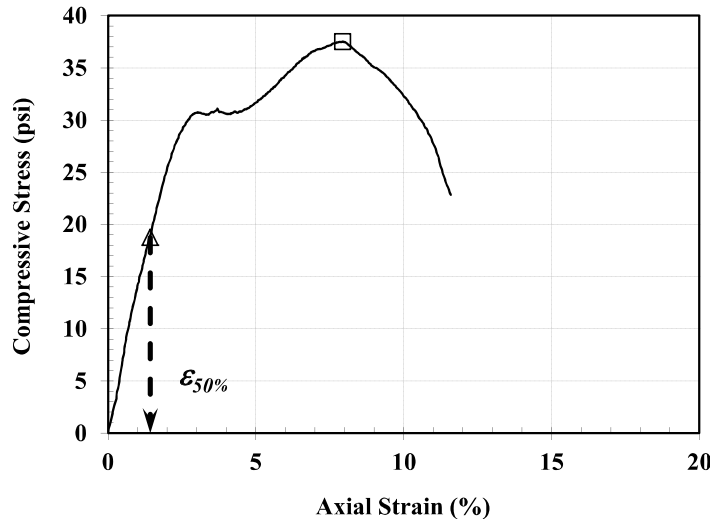


## Unconfined Compression Test Report

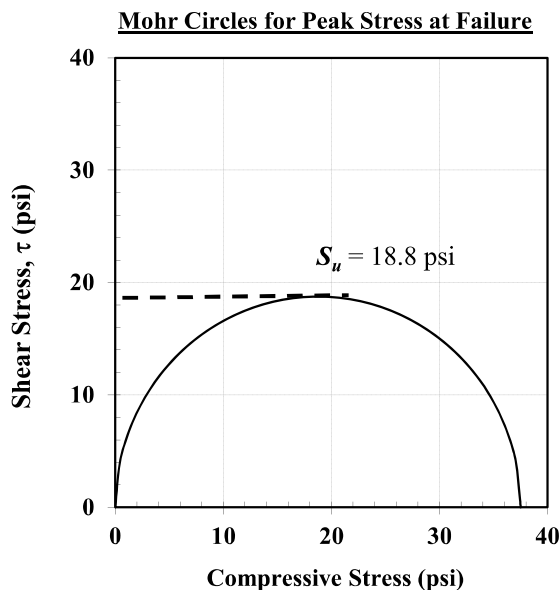
Client: M. A. Mortenson Company  
 Project: Chilocco Wind Farm  
 Sample I.D.: T-17 at 19 ft

RRC Project No.: 130222  
 Test Method: ASTM D 2166  
 Test Date: 9/4/2013

Type of Specimen: Shelby Tube  
 Strain Rate (%/min): 1 % / min



Initial Specimen Conditions		
Specimen No.		1
Avg. Diameter (in)	$D_o$	2.80
Avg. Height (in)	$H_o$	5.68
In-situ Moisture Content (%)	$w_o$	17.9
Total Unit Weight (pcf)	$\gamma_{total}$	134.9
Dry Unit Weight (pcf)	$\gamma_{dry}$	114.5
Saturation (%)	$S_r$	100.0
Void Ratio	$e_o$	0.45
Specific Gravity (Assumed)	$G_s$	2.65



Stresses at Failure	
Unconfined Compressive Strength, $q_u$ (psi)	37.5
Axial Strain at Failure (%)	7.9
Axial Strain at 50% of $q_u$ (%)	1.4
Total Stresses at Failure	
Major Principal Stress, $\sigma_1$ (psi)	37.5
Minor Principal Stress, $\sigma_3$ (psi)	0.0
<b>Undrained Shear Strength, <math>S_u</math> (tsf)</b>	<b>1.35</b>

Note: Failure was determined at the maximum deviator stress or deviator stress at 15 % axial strain, whenever is obtained first.

Cheng-Wei Chen, 09/06/13

Quality Review/Date  
 Specimen prepared & tested by: : C.M.

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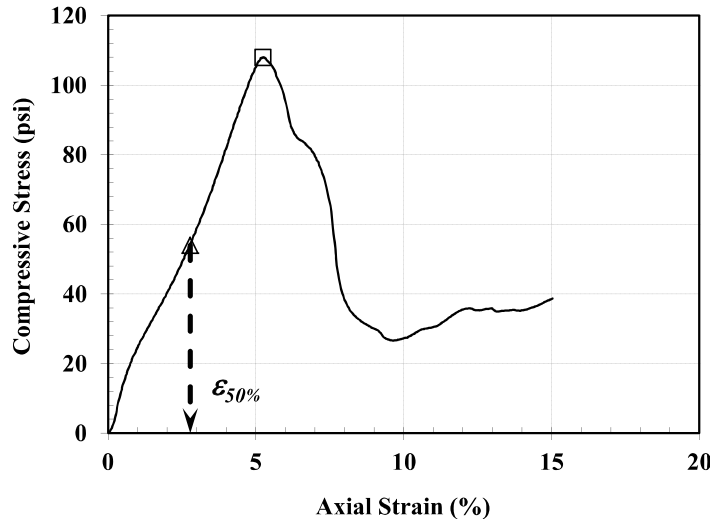


## Unconfined Compression Test Report

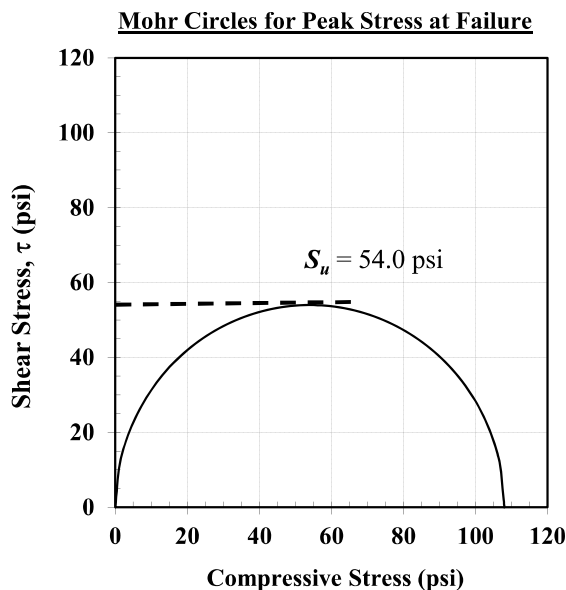
Client: M. A. Mortenson Company  
 Project: Chilocco Wind Farm  
 Sample I.D.: T-25 at 4 ft

RRC Project No.: 130222  
 Test Method: ASTM D 2166  
 Test Date: 9/4/2013

Type of Specimen: Shelby Tube  
 Strain Rate (%/min): 1 % / min



Initial Specimen Conditions		
Specimen No.		1
Avg. Diameter (in)	$D_o$	2.83
Avg. Height (in)	$H_o$	5.68
In-situ Moisture Content (%)	$w_o$	20.7
Total Unit Weight (pcf)	$\gamma_{total}$	125.8
Dry Unit Weight (pcf)	$\gamma_{dry}$	104.2
Saturation (%)	$S_r$	93.8
Void Ratio	$e_o$	0.59
Specific Gravity (Assumed)	$G_s$	2.65



Stresses at Failure	
Unconfined Compressive Strength, $q_u$ (psi)	108.0
Axial Strain at Failure (%)	5.2
Axial Strain at 50% of $q_u$ (%)	2.8
Total Stresses at Failure	
Major Principal Stress, $\sigma_1$ (psi)	108.0
Minor Principal Stress, $\sigma_3$ (psi)	0.0
<b>Undrained Shear Strength, <math>S_u</math> (tsf)</b>	<b>3.89</b>

Note: Failure was determined at the maximum deviator stress or deviator stress at 15 % axial strain, whenever is obtained first.

Cheng-Wei Chen, 09/06/13

Quality Review/Date  
 Specimen prepared & tested by: : C.M.

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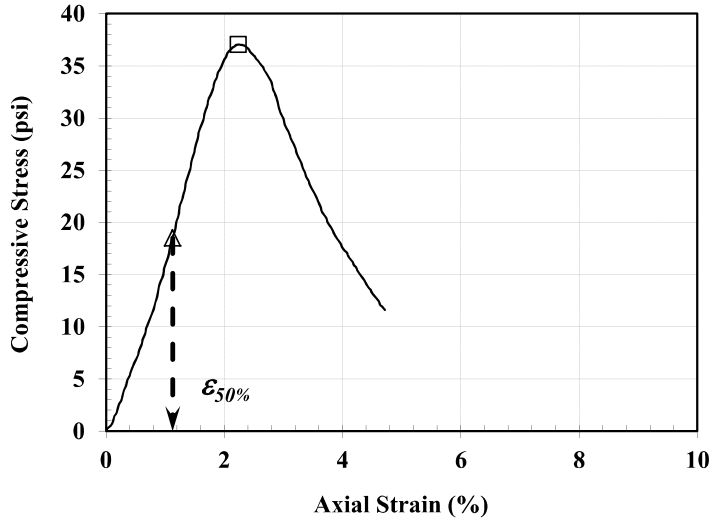


## Unconfined Compression Test Report

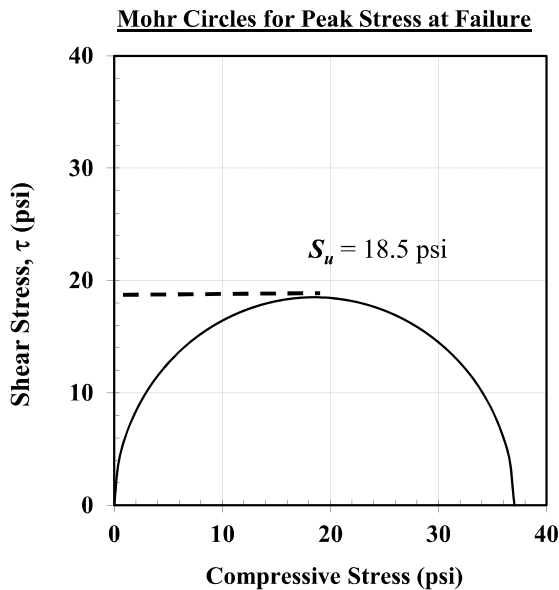
Client: M. A. Mortenson Company  
 Project: Chilocco Wind Farm  
 Sample I.D.: T-41 at 9 ft

RRC Project No.: 130222  
 Test Method: ASTM D 2166  
 Test Date: 9/4/2013

Type of Specimen: Shelby Tube  
 Strain Rate (%/min): 1 % / min



Initial Specimen Conditions		
Specimen No.		1
Avg. Diameter (in)	$D_o$	2.84
Avg. Height (in)	$H_o$	5.68
In-situ Moisture Content (%)	$w_o$	18.6
Total Unit Weight (pcf)	$\gamma_{total}$	127.9
Dry Unit Weight (pcf)	$\gamma_{dry}$	107.8
Saturation (%)	$S_r$	92.3
Void Ratio	$e_o$	0.53
Specific Gravity (Assumed)	$G_s$	2.65



Stresses at Failure	
Unconfined Compressive Strength, $q_u$ (psi)	37.0
Axial Strain at Failure (%)	2.2
Axial Strain at 50% of $q_u$ (%)	1.1
Total Stresses at Failure	
Major Principal Stress, $\sigma_1$ (psi)	37.0
Minor Principal Stress, $\sigma_3$ (psi)	0.0
<b>Undrained Shear Strength, <math>S_u</math> (tsf)</b>	<b>1.33</b>

Note: Failure was determined at the maximum deviator stress or deviator stress at 15 % axial strain, whenever is obtained first.

Cheng-Wei Chen, 09/06/13

Quality Review/Date  
 Specimen prepared & tested by: : C.M.

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## Unconfined Compression Test Report

Client: M. A. Mortenson Company

RRC Project No.: 130222

Type of Specimen: Shelby Tube

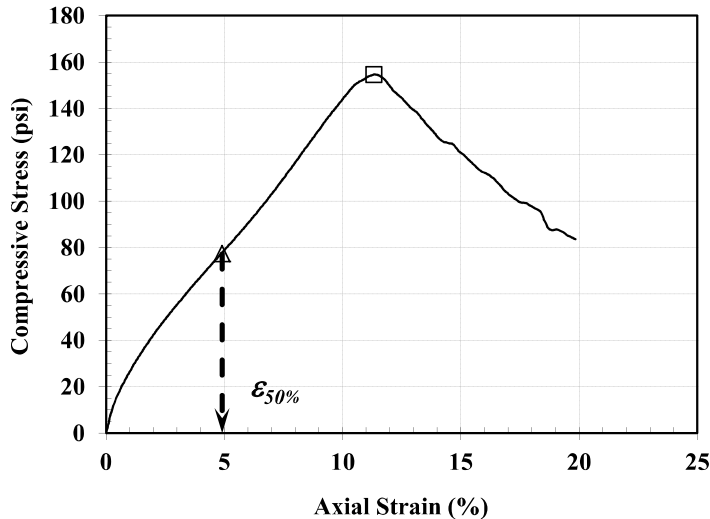
Project: Chilocco Wind Farm

Test Method: ASTM D 2166

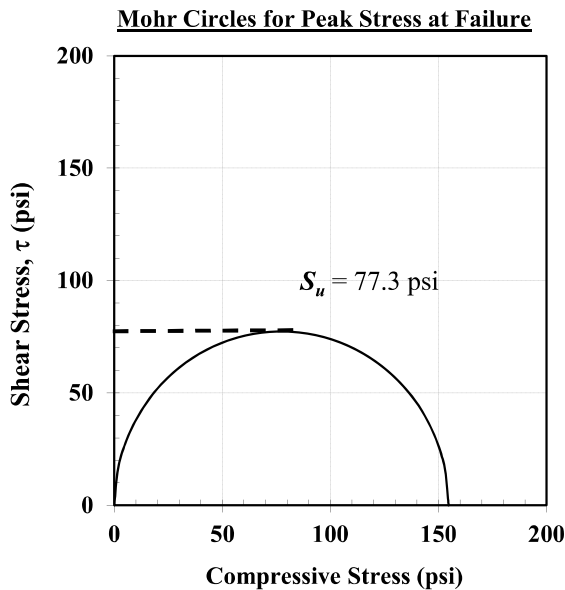
Strain Rate (%/min): 1 % / min

Sample I.D.: T-71 at 4 ft

Test Date: 9/5/2013



Initial Specimen Conditions		
Specimen No.		1
Avg. Diameter (in)	$D_o$	2.83
Avg. Height (in)	$H_o$	5.69
In-situ Moisture Content (%)	$w_o$	16.2
Total Unit Weight (pcf)	$\gamma_{total}$	116.9
Dry Unit Weight (pcf)	$\gamma_{dry}$	100.6
Saturation (%)	$S_r$	67.4
Void Ratio	$e_o$	0.64
Specific Gravity (Assumed)	$G_s$	2.65



Stresses at Failure	
Unconfined Compressive Strength, $q_u$ (psi)	154.7
Axial Strain at Failure (%)	11.3
Axial Strain at 50% of $q_u$ (%)	4.9
Total Stresses at Failure	
Major Principal Stress, $\sigma_1$ (psi)	154.7
Minor Principal Stress, $\sigma_3$ (psi)	0.0
<b>Undrained Shear Strength, <math>S_u</math> (tsf)</b>	<b>5.57</b>

Note: Failure was determined at the maximum deviator stress or deviator stress at 15 % axial strain, whenever is obtained first.

Cheng-Wei Chen, 09/06/13

Quality Review/Date  
 Specimen prepared & tested by: : C.M.

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Renewable Resource Consultants, LLC  
 3801 Doris Lane  
 Round Rock, TX 78664  
 Telephone: (512) 992-2087  
 Fax: (512) 251-2518

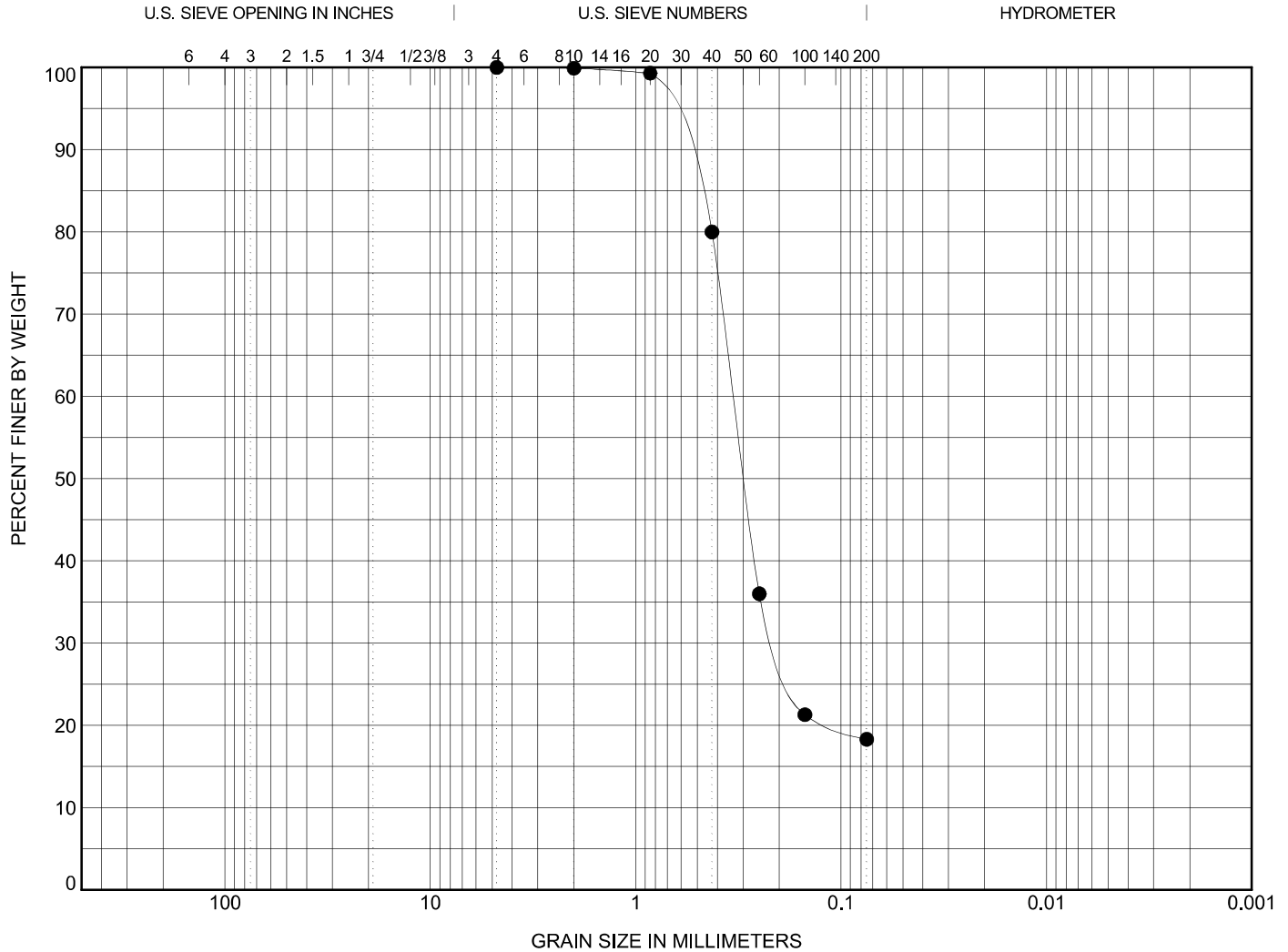
# GRAIN SIZE DISTRIBUTION

CLIENT: Mortenson Construction  
 PROJECT: Chilocco Wind Farm  
 LOCATION: Chilocco, OK  
 NUMBER: 130222

Sample ID: T-063 at 29 ft.

Date: 9/9/2013

Test Method: ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Classification	LL	PL	PI	Cc	Cu

D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
4.75	0.334	0.203		0.0	81.7	18.3	

**Cheng-Wei Chen, 9/9/13**

Analysis & Quality Review/Date

Specimens prepared by: C.M. & M.D.

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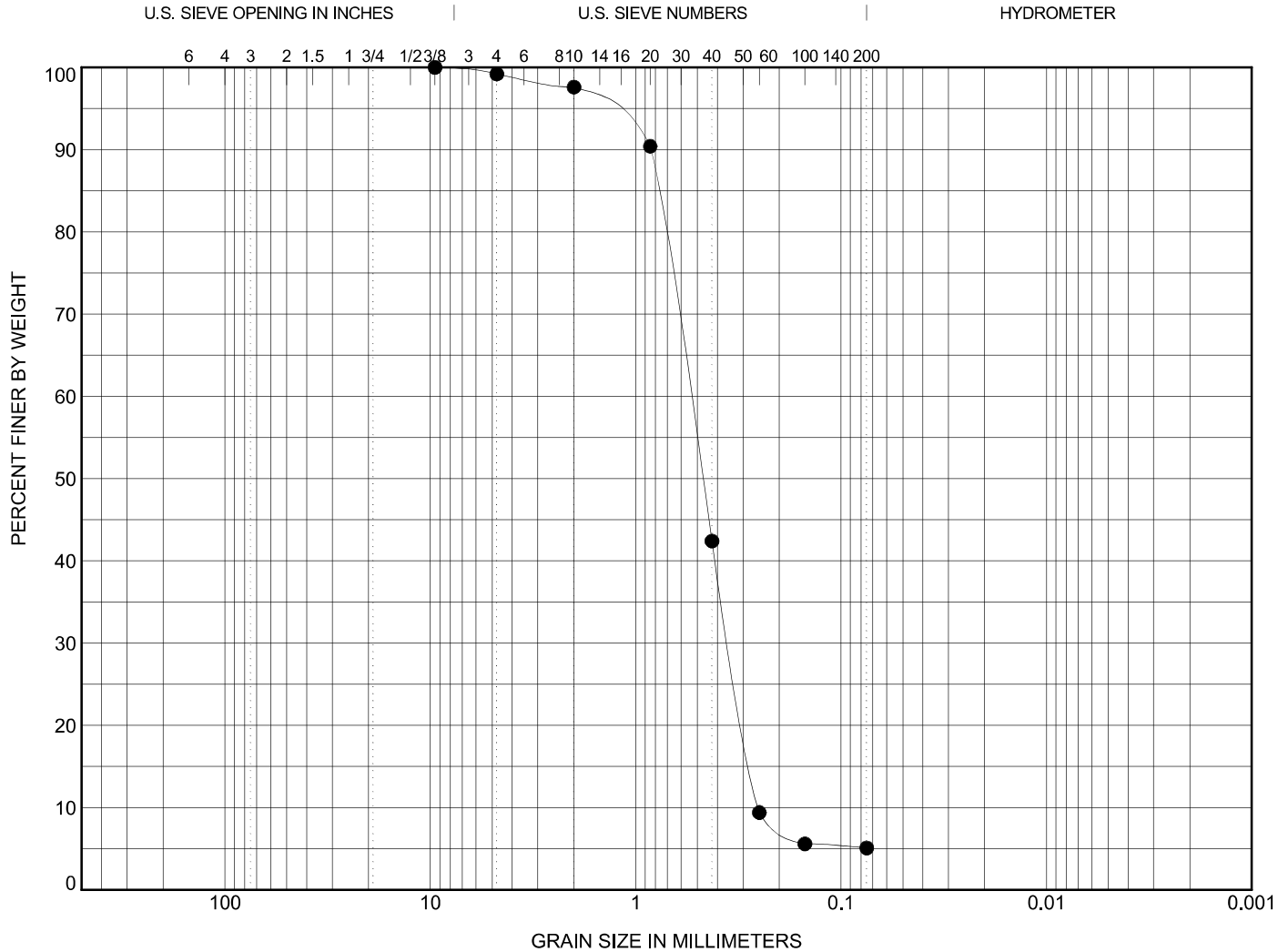
# GRAIN SIZE DISTRIBUTION

CLIENT: Mortenson Construction  
 PROJECT: Chilocco Wind Farm  
 LOCATION: Chilocco, OK  
 NUMBER: 130222

Sample ID: T-086 at 24 ft.

Date: 9/9/2013

Test Method: ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Classification					LL	PL	PI	Cc	Cu
								<b>0.88</b>	<b>2.17</b>

D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
<b>9.5</b>	<b>0.548</b>	<b>0.348</b>	<b>0.252</b>	<b>0.8</b>	<b>94.1</b>	<b>5.1</b>	

**Cheng-Wei Chen, 9/9/13**

Analysis & Quality Review/Date

Specimens prepared by: C.M. & M.D.

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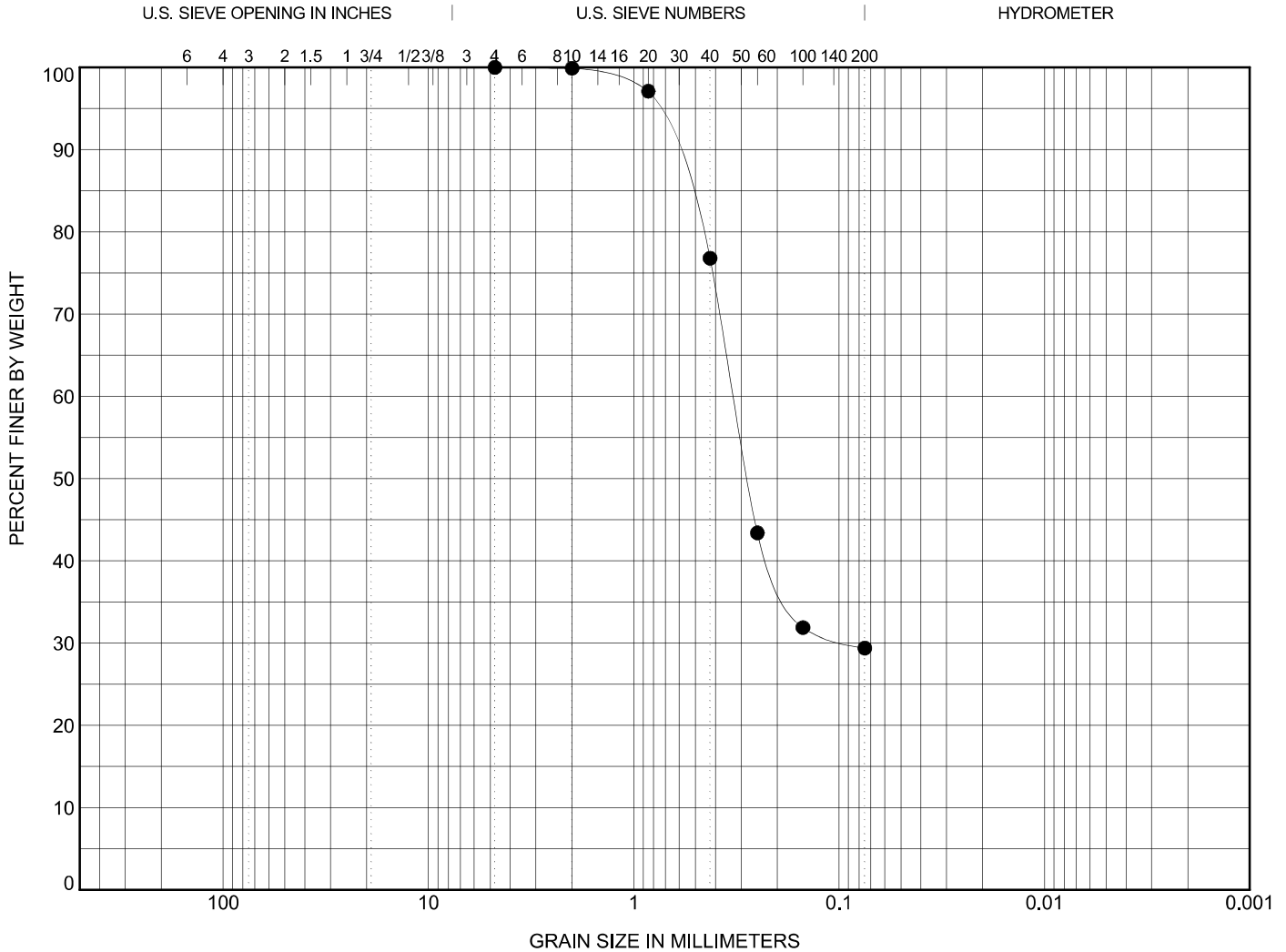
# GRAIN SIZE DISTRIBUTION

CLIENT: Mortenson Construction  
 PROJECT: Chilocco Wind Farm  
 LOCATION: Chilocco, OK  
 NUMBER: 130222

Sample ID: T-086 at 34 ft.

Date: 9/9/2013

Test Method: ASTM D422



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Classification						LL	PL	PI	Cc	Cu

D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
4.75	0.325	0.089		0.0	70.6	29.4	

**Cheng-Wei Chen, 9/9/13**

Analysis & Quality Review/Date

Specimens prepared by: C.M. & M.D.

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## SUMMARY OF LABORATORY RESULTS

CLIENT: Mortenson Construction  
 PROJECT: Chilocco Wind Farm  
 LOCATION: Chilocco, OK  
 NUMBER: 130222

Borehole	Depth (ft)	USCS	Water Content (%)	Dry Unit Weight (pcf)	< No. 200	LL	PL	PI	Undrained Shear Strength (tsf)	Strain at Failure (%)	Confining Pressure (psi)	Chlorides (ppm)	Sulfates (ppm)	pH	Minimum Resistivity (ohm-cm)
Sub	1		25											7.2	1000
Sub	4	CL	19	107	91	48	16	32	0.9	15.0	0.0	BRL	45.3		
Sub	9		15												
Sub	14		21												
Sub	24		19												
T-012	4		19												
T-012	9	CH	22	102	80	53	21	32							
T-012	19		25	112											
T-012	29		19												
T-012	39		26												
T-012	49		14												
T-015	1		27												
T-015	9	CH	24	102	98	55	28	27	1.4	6.0	7.0				
T-015	14		19												
T-015	34		22												
T-015	54		25												
T-017	4		21												
T-017	9	CL	19	110	85	45	15	30	1.4	7.0	0.0				
T-017	19	CL	18	115	69	47	15	32	1.4	7.9	0.0				
T-017	29	SC	15		29	32	14	18							
T-017	34		27												
T-017	44		25												
T-019	7		18												
T-019	12	CH	21	107	91	52	17	35	1.7	15.0	10.0				
T-019	19		25												
T-019	29		24												
T-019	49		25												
T-025	1		22											6.3	820
T-025	4	CH	21	104	98	55	17	38	3.9	5.2	0.0	72.5	54.1		
T-025	7		21												
T-025	14		23												
T-025	24		16												
T-025	39		18												
T-025	54		20												
T-041	4		22											6.2	1800
T-041	7	CH	18		94	60	17	43				BRL	21.1		
T-041	9	CH	19	108	90	56	16	40	1.3	2.2	0.0				
T-041	14	CL	21	104	94	48	16	32	1.4	7.2	10.0				
T-041	24	CL	22		87	33	17	16							
T-041	29	CL	22	108	68	43	14	29	1.5	15.0	20.0				
T-041	44		33												
T-041	54		24												
T-063	1		21												

\*BRL Below Reporting Limit



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## SUMMARY OF LABORATORY RESULTS

CLIENT: Mortenson Construction  
 PROJECT: Chilocco Wind Farm  
 LOCATION: Chilocco, OK  
 NUMBER: 130222

Borehole	Depth (ft)	USCS	Water Content (%)	Dry Unit Weight (pcf)	< No. 200	LL	PL	PI	Undrained Shear Strength (tsf)	Strain at Failure (%)	Confining Pressure (psi)	Chlorides (ppm)	Sulfates (ppm)	pH	Minimum Resistivity (ohm-cm)
T-063	14	CH	20		96	51	16	35							
T-063	24	CL	22		85	32	15	17							
T-063	29		20		18										
T-063	34	CL	20		59	29	13	16							
T-067	7	CH	22		96	57	17	40							
T-067	9	CH	20	110	93	52	16	36	2.5	15.0	7.0				
T-067	14	CL	21	109	65	44	18	26	0.8	14.9	7.0				
T-067	19		24												
T-071	4	CL	16	101	97	49	16	33	5.6	11.3	0.0			6.2	1800
T-071	7		18									BRL	BRL		
T-071	12	CH	24	100	95	50	18	32	1.6	5.1	10.0				
T-071	19		20												
T-071	29		18												
T-086	1	CH	23		98	57	19	38						5.7	1400
T-086	4	CH	23		95	58	16	42				BRL	19.3		
T-086	14		19												
T-086	19	CL	25	99	99	39	15	24	1.1	11.6	15.0				
T-086	24		19		5										
T-086	34		17		29										
TR-1	2	CH			95	57	17	40							
TR-2	2	CH	22	95	98	63	18	45							
TR-3	2	CH	26	90	98	70	18	52							
TR-4	2	CH	16		96	59	19	40							
TR-5	2	CH			98	57	17	40							
TR-6	2	CH	18		97	55	17	38							
TR-7	2	CH	20		98	57	18	39							
TR-8	2	CH	21		96	55	17	38							
TR-9	2	CH	23		99	63	19	44							
TR-10	2	CH	23		97	57	18	39							
TR-11	2	CL	26		97	45	18	27							

\*BRL Below Reporting Limit



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## **APPENDIX C**



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[info@geothermusa.com](mailto:info@geothermusa.com)

September 10, 2013

**Renewable Resource Consultants**  
 3801 Doris Lane  
 Round Rock, TX 78664  
**Attn: Mohammed Abusalih**

**Re: Thermal Analysis of Native Soil Samples  
 Chilocco Wind Project, RRC Project No.130222**

The following is the report of thermal dryout characterization tests conducted on a total of 11 bulk samples of native soil from the referenced project. The samples were from 2'-4' depth.

**Test Procedure:** For thermal dryout characterization tests the bulk samples were re-compacted at the 'as received' moisture content and at 90% of the standard Proctor density provided by RRC. The tests were conducted in accordance with the IEEE standard (442). The results are tabulated below and the thermal dryout curves are presented in **Figures 1 to 3.**

**Sample ID, Moisture, Density and Thermal Resistivity**

Sample ID	Visual Description	Thermal Resistivity (°C-cm/W)		Moisture Content (%)	Dry Density (lb/ft <sup>3</sup> )
		Wet	Dry		
TR-01	Brown FAT CLAY(CH)	87	188	18	92
TR-02	Dark Brown FAT CLAY(CH)	84	182	20	91
TR-03	Dark Brown FAT CLAY(CH)	92	216	19	86
TR-04	Dark Brown FAT CLAY(CH)	94	193	16	90
TR-05	Dark Brown FAT CLAY(CH)	87	203	23	88
TR-06	Dark Brown FAT CLAY(CH)	88	183	19	90
TR-07	Dark Brown FAT CLAY(CH)	93	172	21	92
TR-08	Dark Brown FAT CLAY(CH)	97	194	25	91



**Sample ID, Moisture, Density and Thermal Resistivity (Tube Samples)**

Sample ID	Visual Description	Thermal Resistivity (°C-cm/W)		Moisture Content (%)	Dry Density (lb/ft <sup>3</sup> )
		Wet	Dry		
TR-09	Dark Brown FAT CLAY(CH)	87	222	27	86
TR-10	Dark Brown FAT CLAY(CH)	97	193	22	88
TR-11	Dark Brown LEAN CLAY(CL)	77	154	21	92

**Comments:**

The thermal dryout characteristics depicted in **Figures 1 to 3** apply for the soils at their respective test dry density.

Please contact us if you have any questions, wish to discuss any part of this report or if we can be of further assistance.

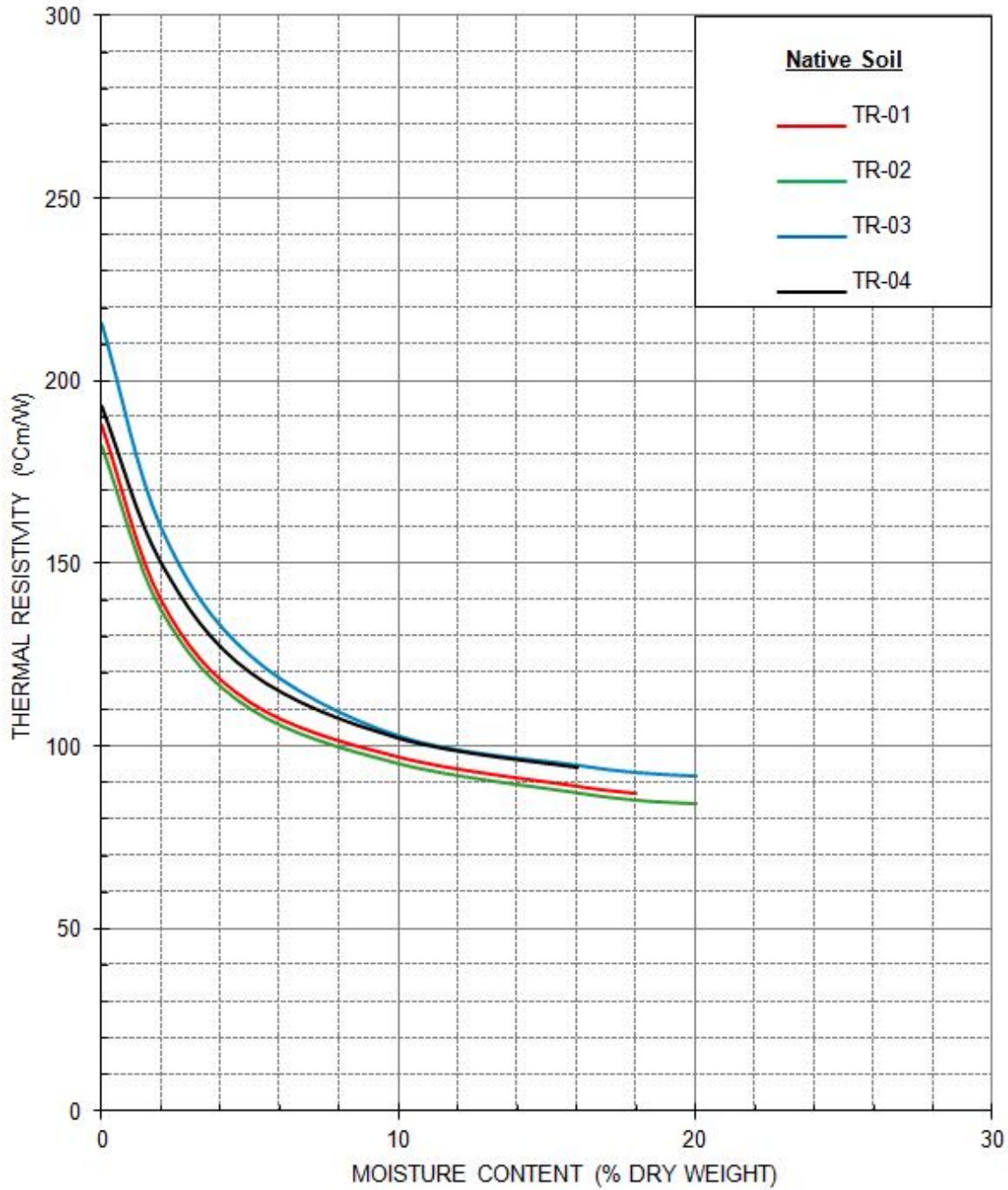
**Geotherm USA**

A handwritten signature in black ink, appearing to read "Nimesh Patel".

Nimesh Patel

**Please Note: Samples will be disposed of after 5 days from date of report**

## THERMAL DRYOUT CURVES

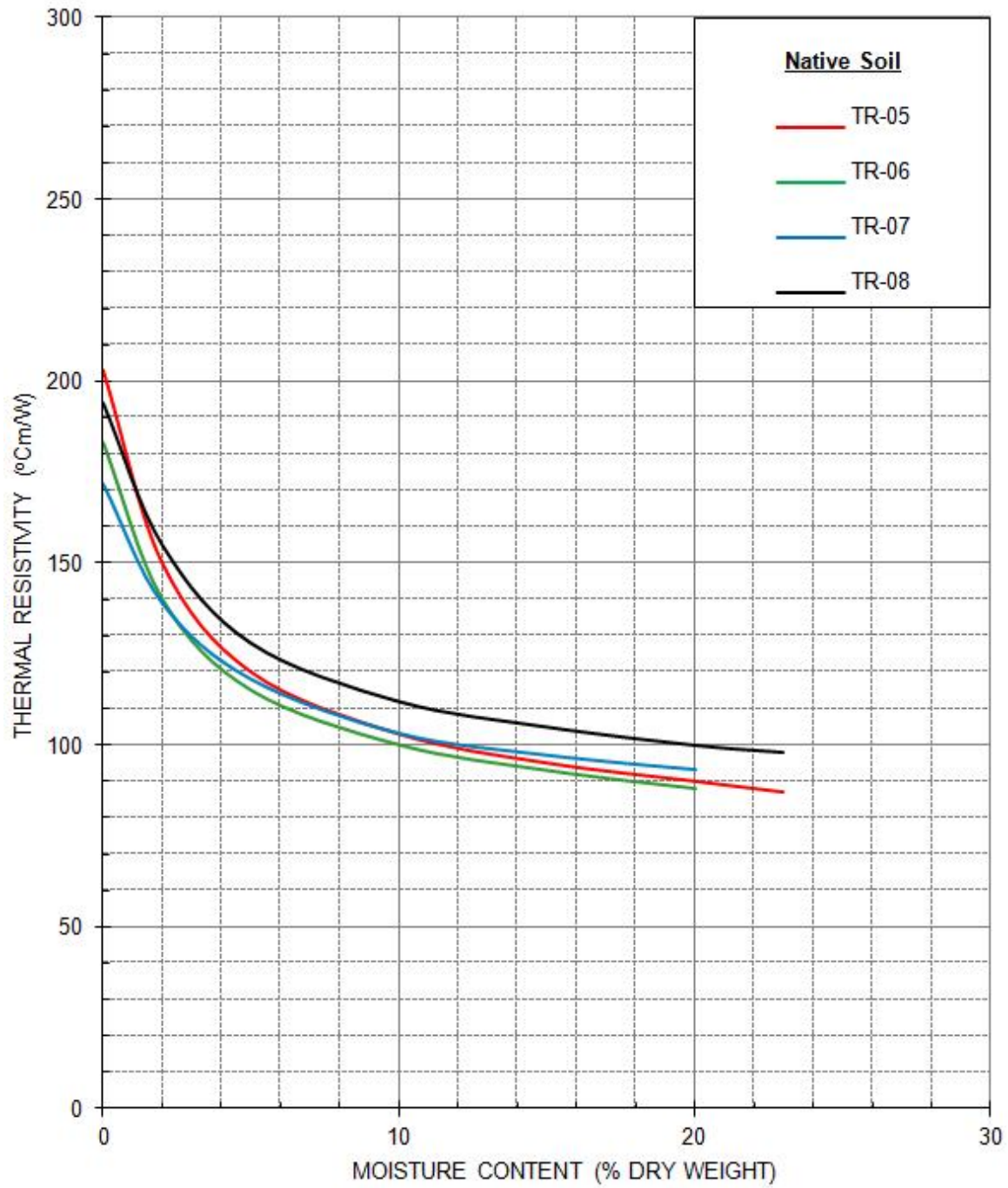


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Thermal Analysis of Native Soil

Chilocco Wind Project - RRC Project No. 130222

## THERMAL DRYOUT CURVES

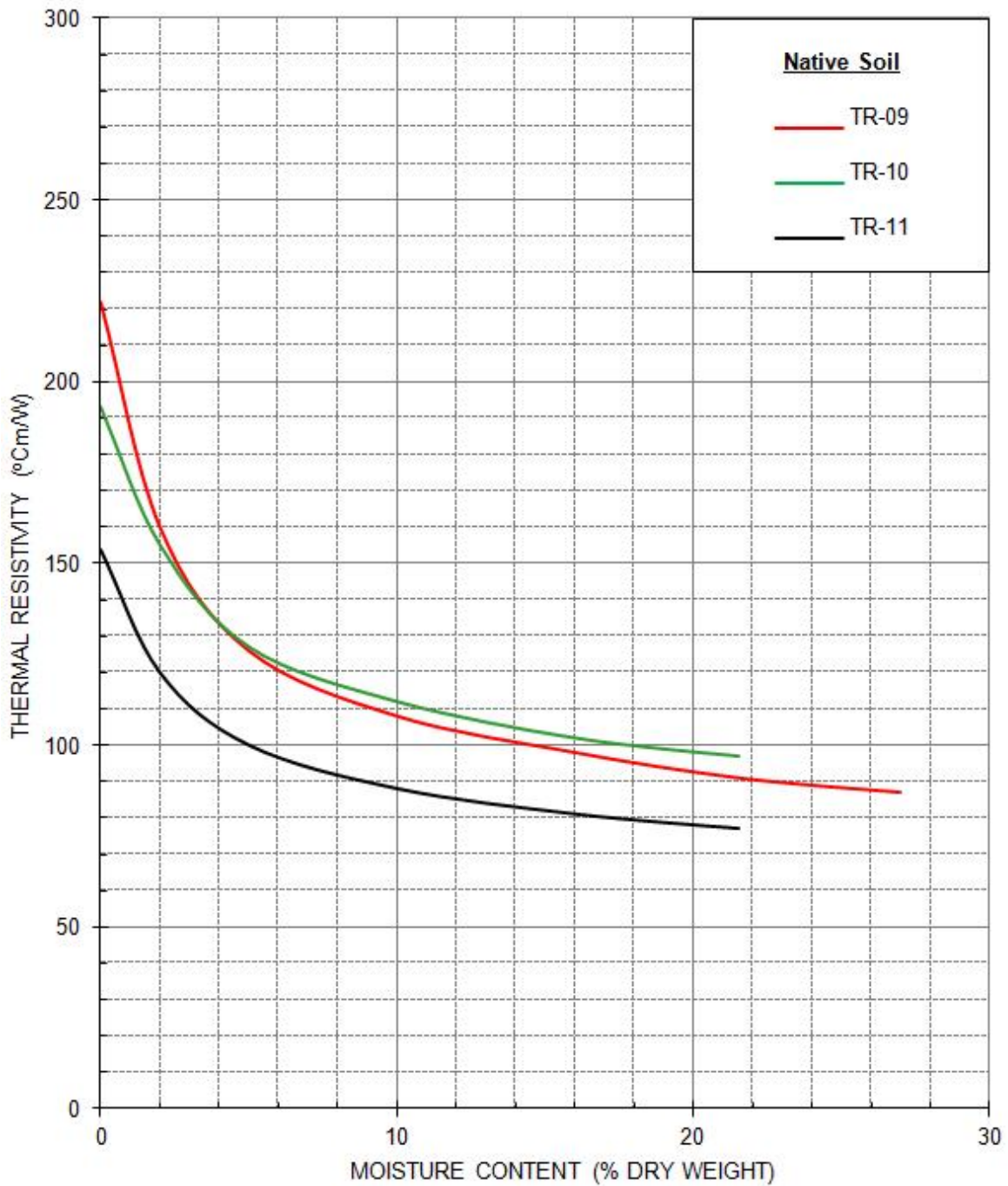


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Thermal Analysis of Native Soil

Chilocco Wind Project - RRC Project No. 130222

### THERMAL DRYOUT CURVES



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## **APPENDIX D**

**Table D-1**  
**LPILE Computer Program Parameters for Lateral Load Analysis at Boring No. Substation (Substation Location)**

Soil Layer	Depth Interval (inches)	LPILE Soil Type	K (pci)		$\gamma'$ (pci)	C (psi)	$\phi$ (deg)	$\epsilon_{50}$ (in/in)	$E_{50}$ (psi)	UCS (psi)	RQD (%)	$K_{rm}$
			Static	Cyclic								
1*	0 to 60	--	--	--	0.064	--	--	--	--	--	--	--
2	60 to 228	Stiff Clay w/o Free Water (3)	--	--	0.033	14	--	0.0063	--	--	--	--
3	228 to 288	Weak Rock (9)	--	--	0.045	--	--	--	27,000	180	0	0.0004
4	288 to 420	Stiff Clay w/o Free Water (3)	--	--	0.045	40	--	0.0040	--	--	--	--

**Notes:** K is the modulus of subgrade reaction;  $\gamma$  is the effective unit weight; C is the cohesion of soil;  $\phi$  is the friction angle of soil;  $\epsilon_{50}$  is the soil strain parameter;  $E_{50}$  is the average elastic modulus of rock; UCS is average Unconfined Compressive Strength of rock; RQD is average Rock Quality Designation;  $K_{rm}$  is the rock strain parameter.

\* Upper 5 feet of soils should be neglected due to tension crack and reasonable moisture change



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September 10, 2013

**Renewable Resource Consultants**  
 3801 Doris Lane  
 Round Rock, TX 78664  
**Attn: Mohammed Abusalih**

**Re: Thermal Analysis of Native Soil Samples  
Chilocco Wind Project, RRC Project No.130222**

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**Sample ID, Moisture, Density and Thermal Resistivity**

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TR-06	Dark Brown FAT CLAY(CH)	88	183	19	90
TR-07	Dark Brown FAT CLAY(CH)	93	172	21	92
TR-08	Dark Brown FAT CLAY(CH)	97	194	25	91



**Sample ID, Moisture, Density and Thermal Resistivity (Tube Samples)**

Sample ID	Visual Description	Thermal Resistivity (°C-cm/W)		Moisture Content (%)	Dry Density (lb/ft <sup>3</sup> )
		Wet	Dry		
TR-09	Dark Brown FAT CLAY(CH)	87	222	27	86
TR-10	Dark Brown FAT CLAY(CH)	97	193	22	88
TR-11	Dark Brown LEAN CLAY(CL)	77	154	21	92

**Comments:**

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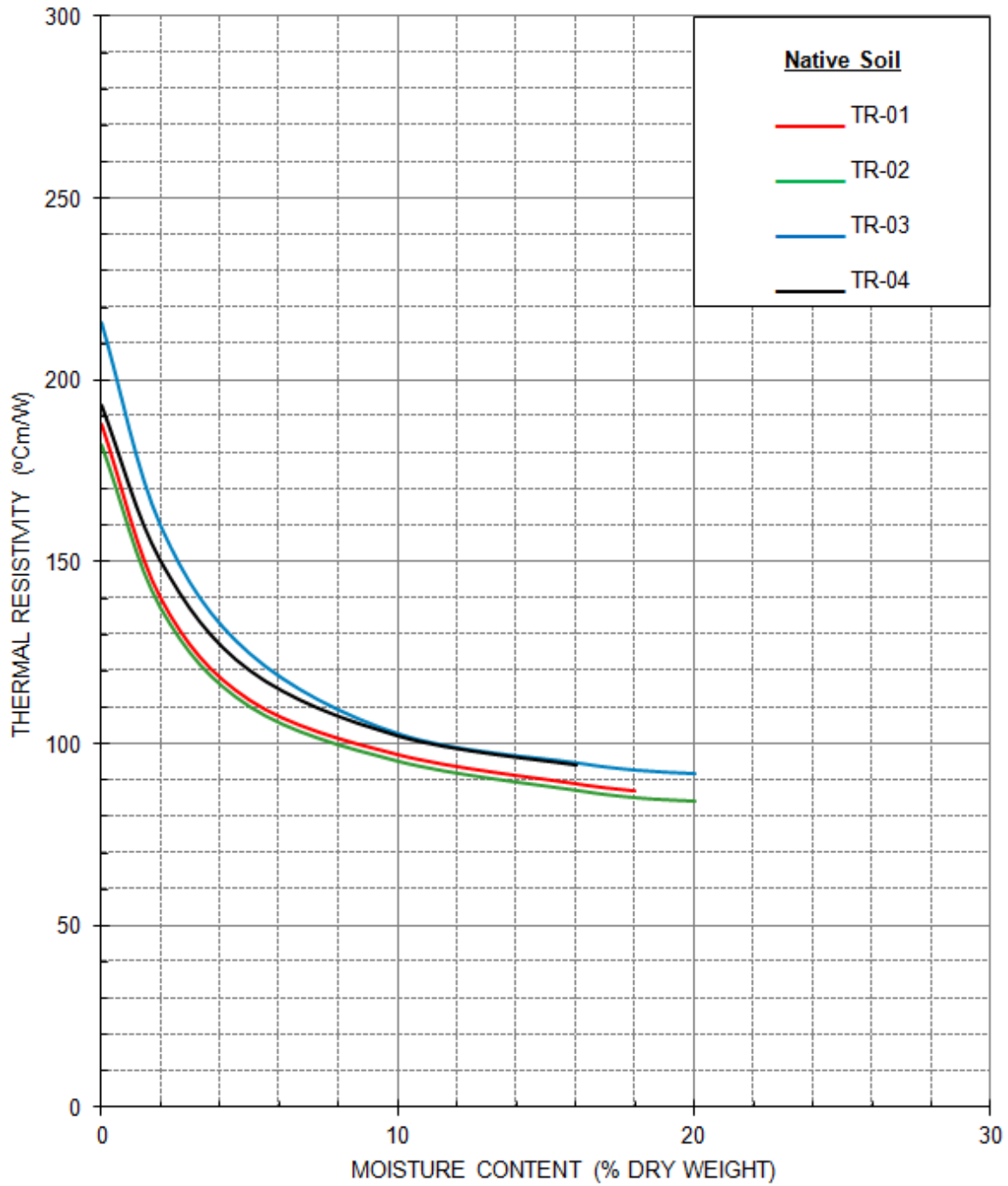
**Geotherm USA**

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Nimesh Patel

**Please Note: Samples will be disposed of after 5 days from date of report**

## THERMAL DRYOUT CURVES

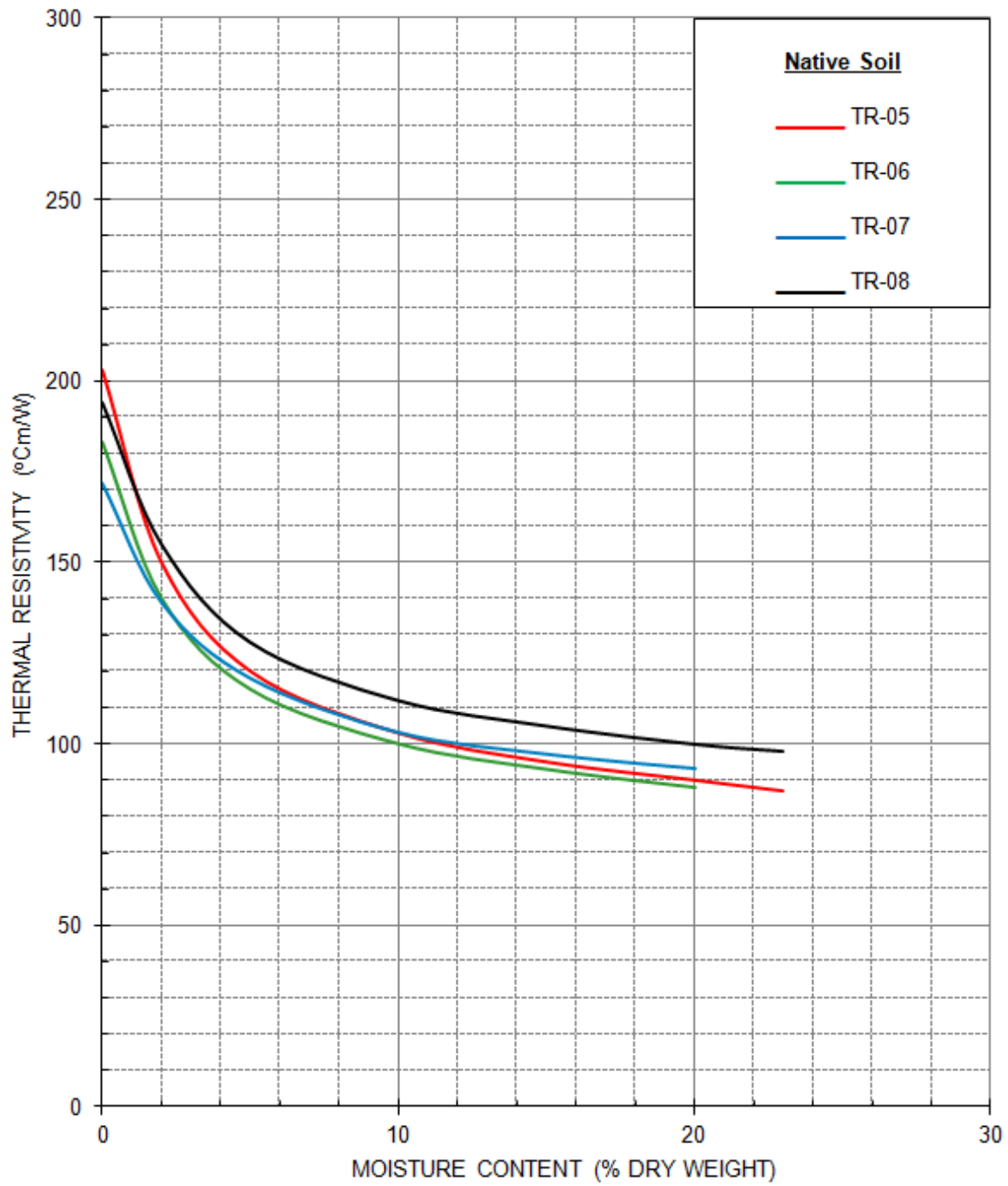


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Thermal Analysis of Native Soil

Chilocco Wind Project - RRC Project No. 130222

## THERMAL DRYOUT CURVES

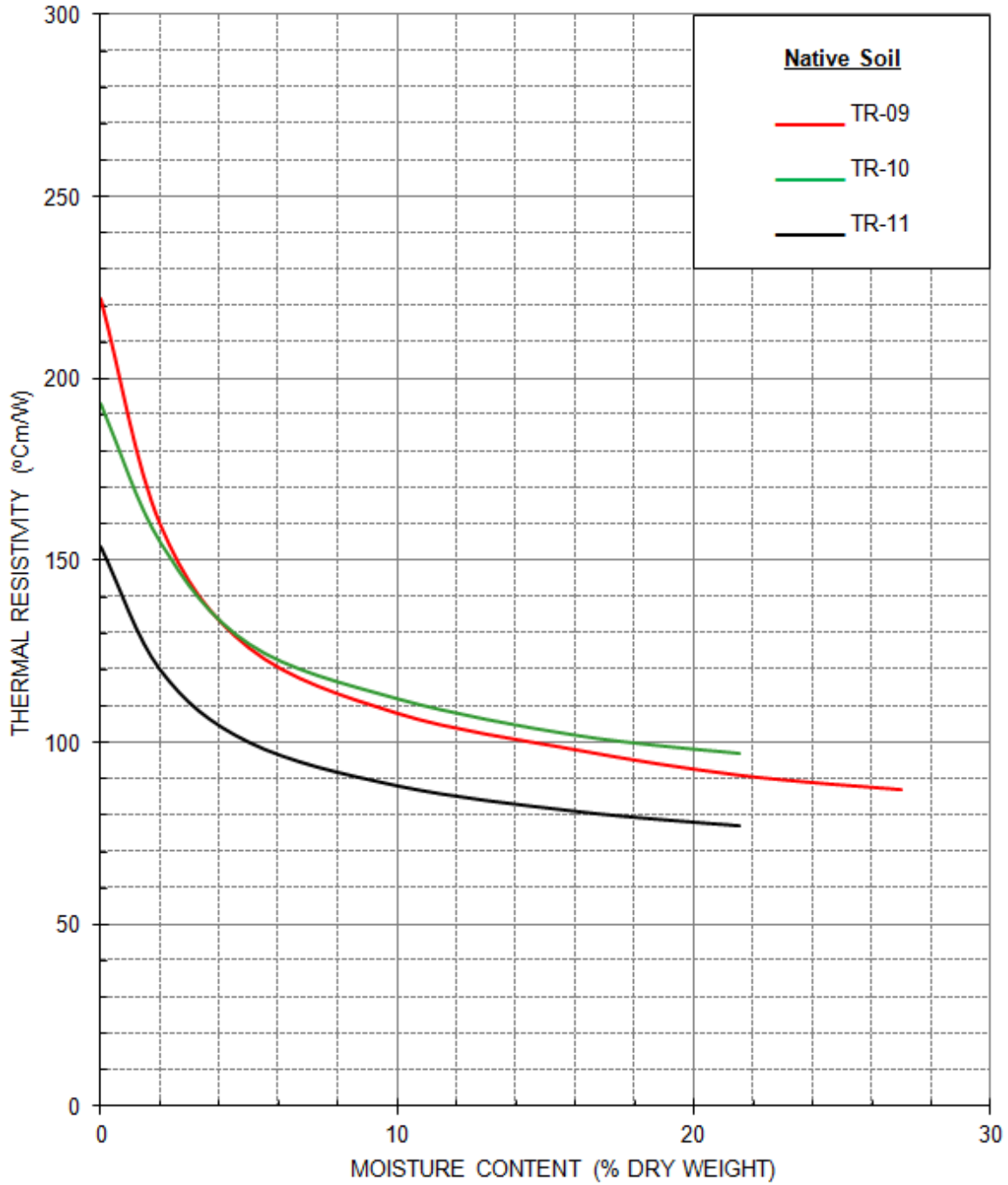


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Thermal Analysis of Native Soil

Chilocco Wind Project - RRC Project No. 130222

## THERMAL DRYOUT CURVES



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Thermal Analysis of Native Soil

Chilocco Wind Project - RRC Project No. 130222

Appendix I

Preliminary Mechanical and Electrical Engineering Design Specs

Redacted for Confidentiality

**Chilocco - COLLECTION SYSTEM - GENERAL DESIGN DATA**

**GE 2.5MW Generator**

Apparent Power (S)		Power	Primary Voltage (V)	Primary Current (I) Amperes	Secondary Voltage (V)	Current (I) Amperes
2777.778	kVA	2500	690	2324.3	34.5kV	46.49

Wind Farm Capacity	No. of Turbines	No. of Feeder Circuits	Turbine/Feeder
200 MW	80	8	10

**Conductor Ampacity (Verify Parameters and Assumptions) Estimated Amps**

1	1/0 Al TRXPLE	Direct Buried, 48"	120
2	4/0 Al TRXPLE	Direct Buried, 48"	226
3	500MCM Al TRXLPE	Direct Buried, 48"	357
4	750MCM Al TRXLPE	Direct Buried, 48"	435
5	1000MCM Al TRXLPE	Direct Buried, 48"	504
6	1250MCM Al TRXLPE	Direct Buried, 48"	566

**Design Parameters**

1	Spacing between turbines estimated off of conceptual site layout			2.5MW	1	46.5
2	Cable lengths does not account for cable tails required for installation.				2	93.0
3	Number of turbines per 1/0 Circuit (2.5MW)	1-2	Verify Voltage Drop on Ckt.		3	139.5
4	Number of turbines per 4/0 Circuit (2.5MW)	3-4	Verify Voltage Drop on Ckt.		4	185.9
5	Number of turbines per 500 Circuit (2.5MW)	5-7	Verify Voltage Drop on Ckt.		5	232.4
6	Number of turbines per 750Circuit (2.5MW)	8	Verify Voltage Drop on Ckt.		6	278.9
7	Number of turbines per 1000 Circuit (2.5MW)	9-10	Verify Voltage Drop on Ckt.		7	325.4
8	Number of turbines per 1250 Circuit (2.5MW)	11	Verify Voltage Drop on Ckt.		8	371.9
					9	418.4
					10	464.9
					11	511.3

GE - 2.5MW design

From	To	Total Length	Conductor Size	(Ohms/1000')					Ohms					
				R1	X1	R0	X0	Capacitance (μF/ft)	R1	X1	R0	X0	Capacitance (μF/ft)	
<b>Feeder 1</b>														
1	8	1850	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.4403	0.09805	0.6142	0.04403	0.07955	
8	2	1360	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.32368	0.07208	0.45152	0.032368	0.05848	
2	13	1775	4/0 Cable	0.10873	0.04741	0.20811	0.02869	0.0486	0.19299575	0.08415275	0.36939525	0.05092475	0.086265	
13	JB2	540	4/0 Cable	0.10873	0.04741	0.20811	0.02869	0.0486	0.0587142	0.0256014	0.1123794	0.0154926	0.026244	
27	21	1365	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.32487	0.072345	0.45318	0.032487	0.058695	
21	28	1635	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.38913	0.086655	0.54282	0.038913	0.070305	
28	17	1685	4/0 Cable	0.10873	0.04741	0.20811	0.02869	0.0486	0.18321005	0.07988585	0.35066535	0.04834265	0.081891	
17	JB1	1630	4/0 Cable	0.10873	0.04741	0.20811	0.02869	0.0486	0.1772299	0.0772783	0.3392193	0.0467647	0.079218	
31	24	1045	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.24871	0.055385	0.34694	0.024871	0.044935	
24	JB1	50	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.0119	0.00265	0.0166	0.00119	0.00215	
JB1	JB2	1525	500 KCMIL	0.04753	0.04126	0.17477	0.02283	0.0662	0.07248325	0.0629215	0.26652425	0.03481575	0.100955	
JB2	Sub	21720	1000 KCMIL	0.02585	0.03739	0.15387	0.01942	0.0861	0.561462	0.8121108	3.3420564	0.4218024	1.870092	
<b>Feeder 2</b>														
3	10	1290	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.30702	0.06837	0.42828	0.030702	0.05547	
10	JB1	50	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.0119	0.00265	0.0166	0.00119	0.00215	
18	JB1	1515	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.36057	0.080295	0.50298	0.036057	0.065145	
JB1	12	1715	4/0 Cable	0.10873	0.04741	0.20811	0.02869	0.0486	0.18647195	0.08130815	0.35690865	0.04920335	0.083349	
12	JB2	50	4/0 Cable	0.10873	0.04741	0.20811	0.02869	0.0486	0.0054365	0.0023705	0.0104055	0.0014345	0.00243	
4	JB2	1435	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.34153	0.076055	0.47642	0.034153	0.061705	
29	20	2226	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.529788	0.117978	0.739032	0.0529788	0.095718	
20	JB2	1700	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.4046	0.0901	0.5644	0.04046	0.0731	
JB2	11	1740	500 KCMIL	0.04753	0.04126	0.17477	0.02283	0.0662	0.0827022	0.0717924	0.3040998	0.0397242	0.115188	
11	5	1210	750 KCMIL	0.0322	0.0388	0.20183	0.02067	0.0775	0.038962	0.046948	0.2442143	0.0250107	0.093775	
5	6	1730	1000 KCMIL	0.02585	0.03739	0.15387	0.01942	0.0861	0.0447205	0.0646847	0.2661951	0.0335966	0.148953	
6	Sub	16667	1000 KCMIL	0.02585	0.03739	0.15387	0.01942	0.0861	0.43084195	0.62317913	2.56455129	0.32367314	1.4350287	
<b>Feeder 3</b>														
37	JB1	1675	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.39865	0.088775	0.5561	0.039865	0.072025	
60	51	2000	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.476	0.106	0.664	0.0476	0.086	
51	JB1	50	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.0119	0.00265	0.0166	0.00119	0.00215	
JB1	47	1850	4/0 Cable	0.10873	0.04741	0.20811	0.02869	0.0486	0.2011505	0.0877085	0.3850035	0.0530765	0.08991	
47	JB2	1325	4/0 Cable	0.10873	0.04741	0.20811	0.02869	0.0486	0.14406725	0.06281825	0.27574575	0.03801425	0.064395	
16	25	1670	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.39746	0.08851	0.55444	0.039746	0.07181	
25	33	1500	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.357	0.0795	0.498	0.0357	0.0645	
33	39	1490	4/0 Cable	0.10873	0.04741	0.20811	0.02869	0.0486	0.1620077	0.0706409	0.3100839	0.0427481	0.072414	
39	JB2	50	4/0 Cable	0.10873	0.04741	0.20811	0.02869	0.0486	0.0054365	0.0023705	0.0104055	0.0014345	0.00243	
JB2	40	1910	750 KCMIL	0.0322	0.0388	0.20183	0.02067	0.0775	0.061502	0.074108	0.3854953	0.0394797	0.148025	
40	55	3057	1000 KCMIL	0.02585	0.03739	0.15387	0.01942	0.0861	0.07902345	0.11430123	0.47038059	0.05936694	0.2632077	
55	66	3396	1000 KCMIL	0.02585	0.03739	0.15387	0.01942	0.0861	0.0877866	0.12697644	0.52254252	0.06595032	0.2923956	

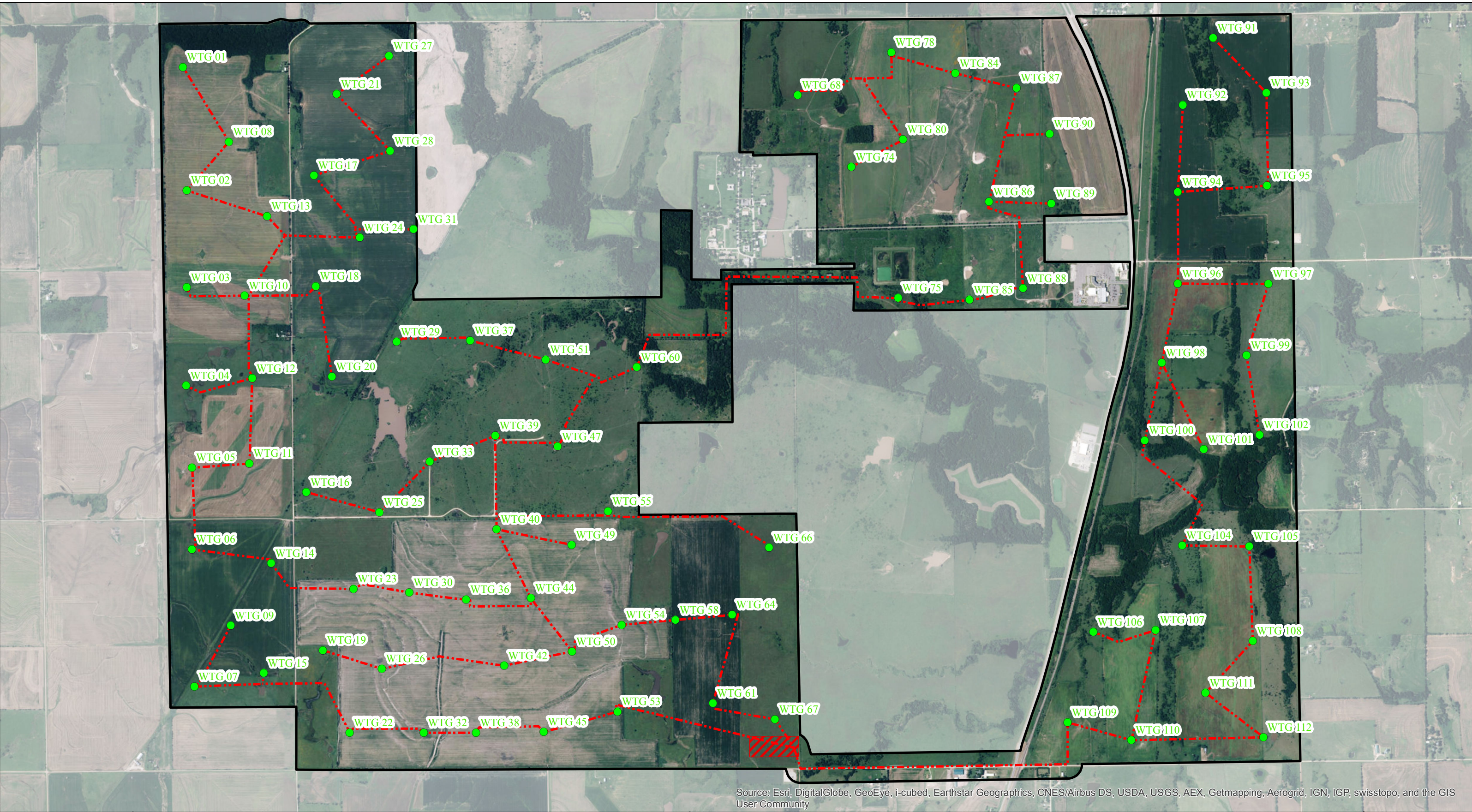
66	Sub	5034	1250 KCMIL	0.019	0.038	0.109	0.0206	0.1	0.095646	0.191292	0.548706	0.1037004	0.5034
Feeder 4													
30	36	1210	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.28798	0.06413	0.40172	0.028798	0.05203
36	44	1420	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.33796	0.07526	0.47144	0.033796	0.06106
44	JB1	1365	4/0 Cable	0.10873	0.04741	0.20811	0.02869	0.0486	0.14841645	0.06471465	0.28407015	0.03916185	0.066339
42	50	1465	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.34867	0.077645	0.48638	0.034867	0.062995
50	JB1	50	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.0119	0.00265	0.0166	0.00119	0.00215
JB1	54	1200	500 KCMIL	0.04753	0.04126	0.17477	0.02283	0.0662	0.057036	0.049512	0.209724	0.027396	0.07944
54	58	1135	500 KCMIL	0.04753	0.04126	0.17477	0.02283	0.0662	0.05394655	0.0468301	0.19836395	0.02591205	0.075137
58	64	1205	500 KCMIL	0.04753	0.04126	0.17477	0.02283	0.0662	0.05727365	0.0497183	0.21059785	0.02751015	0.079771
64	61	1945	750 KCMIL	0.0322	0.0388	0.20183	0.02067	0.0775	0.062629	0.075466	0.39255935	0.04020315	0.1507375
61	67	1360	1000 KCMIL	0.02585	0.03739	0.15387	0.01942	0.0861	0.035156	0.0508504	0.2092632	0.0264112	0.117096
67	Sub	955	1000 KCMIL	0.02585	0.03739	0.15387	0.01942	0.0861	0.02468675	0.03570745	0.14694585	0.0185461	0.0822255
Feeder 5													
7	15	1365	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.32487	0.072345	0.45318	0.032487	0.058695
15	22	1570	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.37366	0.08321	0.52124	0.037366	0.06751
22	32	1600	4/0 Cable	0.10873	0.04741	0.20811	0.02869	0.0486	0.173968	0.075856	0.332976	0.045904	0.07776
32	JB1	50	4/0 Cable	0.10873	0.04741	0.20811	0.02869	0.0486	0.0054365	0.0023705	0.0104055	0.0014345	0.00243
19	26	1310	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.31178	0.06943	0.43492	0.031178	0.05633
26	JB1	1620	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.38556	0.08586	0.53784	0.038556	0.06966
JB1	38	1060	500 KCMIL	0.04753	0.04126	0.17477	0.02283	0.0662	0.0503818	0.0437356	0.1852562	0.0241998	0.070172
38	45	1500	500 KCMIL	0.04753	0.04126	0.17477	0.02283	0.0662	0.071295	0.06189	0.262155	0.034245	0.0993
45	53	1615	750 KCMIL	0.0322	0.0388	0.20183	0.02067	0.0775	0.052003	0.062662	0.32595545	0.03338205	0.1251625
53	Sub	3629	1000 KCMIL	0.02585	0.03739	0.15387	0.01942	0.0861	0.09380965	0.13568831	0.55839423	0.07047518	0.3124569
Feeder 6													
68	JB1	1510	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.35938	0.08003	0.50132	0.035938	0.06493
74	80	1240	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.29512	0.06572	0.41168	0.029512	0.05332
80	JB1	1545	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.36771	0.081885	0.51294	0.036771	0.066435
JB1	78	840	4/0 Cable	0.10873	0.04741	0.20811	0.02869	0.0486	0.0913332	0.0398244	0.1748124	0.0240996	0.040824
78	84	1580	4/0 Cable	0.10873	0.04741	0.20811	0.02869	0.0486	0.1717934	0.0749078	0.3288138	0.0453302	0.076788
84	87	1380	500 KCMIL	0.04753	0.04126	0.17477	0.02283	0.0662	0.0655914	0.0569388	0.2411826	0.0315054	0.091356
87	90	1898	500 KCMIL	0.04753	0.04126	0.17477	0.02283	0.0662	0.09021194	0.07831148	0.33171346	0.04333134	0.1256476
90	86	2340	500 KCMIL	0.04753	0.04126	0.17477	0.02283	0.0662	0.1112202	0.0965484	0.4089618	0.0534222	0.154908
			1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0	0	0	0	0
86	88	2320	750 KCMIL	0.0322	0.0388	0.20183	0.02067	0.0775	0.074704	0.090016	0.4682456	0.0479544	0.1798
88	85	1150	1000 KCMIL	0.02585	0.03739	0.15387	0.01942	0.0861	0.0297275	0.0429985	0.1769505	0.022333	0.099015
85	75	1600	1000 KCMIL	0.02585	0.03739	0.15387	0.01942	0.0861	0.04136	0.059824	0.246192	0.031072	0.13776
75	Sub	18830	1250 KCMIL	0.019	0.038	0.109	0.0206	0.1	0.35777	0.71554	2.05247	0.387898	1.883
Feeder 7													
104	105	1415	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.33677	0.074995	0.46978	0.033677	0.060845
105	108	2000	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.476	0.106	0.664	0.0476	0.086
108	111	1490	4/0 Cable	0.10873	0.04741	0.20811	0.02869	0.0486	0.1620077	0.0706409	0.3100839	0.0427481	0.072414
111	112	1545	4/0 Cable	0.10873	0.04741	0.20811	0.02869	0.0486	0.16798785	0.07324845	0.32152995	0.04432605	0.075087
112	JB1	2770	500 KCMIL	0.04753	0.04126	0.17477	0.02283	0.0662	0.1316581	0.1142902	0.4841129	0.0632391	0.183374
106	107	1390	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.33082	0.07367	0.46148	0.033082	0.05977

107	110	2375	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.56525	0.125875	0.7885	0.056525	0.102125
110	JB1	50	4/0 Cable	0.10873	0.04741	0.20811	0.02869	0.0486	0.0054365	0.0023705	0.0104055	0.0014345	0.00243
JB1	109	1425	750 KCMIL	0.0322	0.0388	0.20183	0.02067	0.0775	0.045885	0.05529	0.28760775	0.02945475	0.1104375
109	Sub	7106	1250 KCMIL	0.019	0.038	0.109	0.0206	0.1	0.135014	0.270028	0.774554	0.1463836	0.7106
Feeder 8													
91	92	1590	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.37842	0.08427	0.52788	0.037842	0.06837
92	94	1840	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.43792	0.09752	0.61088	0.043792	0.07912
94	JB1	50	4/0 Cable	0.10873	0.04741	0.20811	0.02869	0.0486	0.0054365	0.0023705	0.0104055	0.0014345	0.00243
93	95	1825	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.43435	0.096725	0.6059	0.043435	0.078475
95	JB1	2075	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.49385	0.109975	0.6889	0.049385	0.089225
JB1	JB2	1890	500 KCMIL	0.04753	0.04126	0.17477	0.02283	0.0662	0.0898317	0.0779814	0.3303153	0.0431487	0.125118
99	97	1615	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.38437	0.085595	0.53618	0.038437	0.069445
97	96	1730	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.41174	0.09169	0.57436	0.041174	0.07439
96	JB2	50	4/0 Cable	0.10873	0.04741	0.20811	0.02869	0.0486	0.0054365	0.0023705	0.0104055	0.0014345	0.00243
JB2	JB3	1710	750 KCMIL	0.0322	0.0388	0.20183	0.02067	0.0775	0.055062	0.066348	0.3451293	0.0353457	0.132525
101	JB3	2010	1/0 Cable	0.238	0.053	0.332	0.0238	0.043	0.47838	0.10653	0.66732	0.047838	0.08643
JB3	100	1000	1000 KCMIL	0.02585	0.03739	0.15387	0.01942	0.0861	0.02585	0.03739	0.15387	0.01942	0.0861
100	Sub	16400	1250 KCMIL	0.019	0.038	0.109	0.0206	0.1	0.3116	0.6232	1.7876	0.33784	1.64

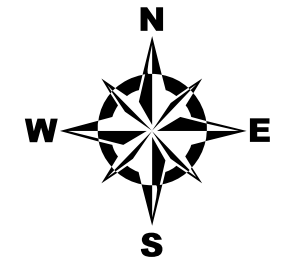
Appendix K

Preliminary Civil Engineering Design Specs

Redacted for Confidentiality



Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



**Legend**

	Collector System		Substation
	87 WTG Layout		87 WTG Boundary

Miles

0    0.225    0.45    0.9    1.35    1.8

# Chilocco Project Site Overview

## *Layout Map*

Confidential and Proprietary - For Internal Use Only - Not For Construction

Date: 03/08/2016    Coordinate System: UTM 14  
 Document: Chilocco    Map Datum: NAD 83

FIGURE

1

# **Wetland and Waterway Delineation**

*Associated with the*

**PNE Wind USA, Inc. – Chilocco Project  
Kay County, Oklahoma**

**October 2016**

*Prepared for:*

**PNE Wind USA, Inc.  
150 N. Michigan Ave., Ste. 1500  
Chicago, IL 60601**

*Prepared By:*



**BLACKSHARE**  
ENVIRONMENTAL SOLUTIONS

5121 S. Wheeling Ave.  
Tulsa, OK 74105  
918.388.0970  
[www.blackshare-env.com](http://www.blackshare-env.com)

**Project Area:**  
**Approximately 2,370 Acres**  
**Of Wetland Survey Area**

*Associated with the*

**PNE Chilocco Project**  
**Kay County, Oklahoma**

Prepared by

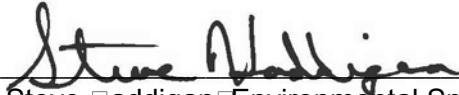
**BLACKSHARE ENVIRONMENTAL SOLUTIONS**

1000 S. Heeling Ave.  
Lawton, Oklahoma

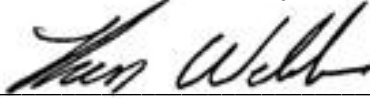
Phone: (800) 888-8888

Project: 0000000000 Projects: 000000000000

Prepared by

  
Steve Maddigan, Environmental Specialist

Reviewed by



Ken Keene

1/1/00

Date

## DISCLAIMER

This investigation was performed by MacShare Environmental Solutions MacShare using the degree of care and skill ordinarily exercised under similar circumstances by professional consultants practicing in this or similar localities and no other warranty

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## Appendices

Appendix A – Maps

Appendix B – Photographic Log

Appendix C – Wetland/Waterway Chart

Appendix D – Reference Documents

## 1.0 Introduction and Background

Per directives received from P&E and SA/Inc/P&E a wetland/waterway investigation was performed by LacShare Environmental Solutions. LacShare personnel on August 11, 2011 for the 100-acre approximate project proposed by P&E within Kay County, Oklahoma. Enclosed in Appendix A are S&S 10-minute series Ponca City quadrangle 1000 topographic map and aerial maps exhibiting the location of the referenced project area.

The referenced project consists of constructing approximately twenty-one 1000' and 1200' lines for energy production. Specifically, the proposed project would commence approximately four miles north of Deer Creek, Oklahoma within Section 10 Township 10 North Range 1 East Section 10 Township 10 North Range 1 East and Section 10 Township 10 North Range 1 East. P&E will utilize an approximate 100-foot temporary right-of-way ROW corridor during the construction phase of the project not including any additional temporary workspace. Roadways constructed will utilize a 100-foot temporary right-of-way ROW corridor during the construction phase of the project. Following construction of the access roads a permanent maintained ROW will be sixteen (16) feet wide.

The purpose of the investigation was to determine if any potentially jurisdictional wetlands/waterways are located within the surveyed project area. All areas identified as waters of the United States will be considered jurisdictional and subject to regulation under section 404 of the Clean Water Act (CWA). If the identified areas are expected to be disturbed to an extent greater than 1000' of an acre a authorization from the US Army Corps of Engineers (SACE) would be required prior to construction. The proposed project area was investigated to determine the location and extent of any identified wetlands and waterways.

By definition, wetlands are a subset of waters of the United States and thus subject to Section 404 of the CWA. The term waters of the United States has a broad meaning and incorporates both deep water aquatic habitats and special aquatic sites including wetlands. *Federal Register* 1983 as follows:

a. the territorial seas with respect to the discharge of fill material.

- b. Coastal and inland waters, lakes, rivers, and streams that are navigable waters of the United States, including their adjacent wetlands;
- c. Tributaries to navigable waters of the United States, including adjacent wetlands;
- d. Interstate waters and their tributaries, including adjacent wetlands;
- e. All other waters of the United States not identified above, such as isolated wetlands and lakes, intermittent streams, prairie potholes, and other waters that are not a part of a tributary system to interstate waters or navigable waters of the United States, the degradation or destruction of which could affect interstate commerce.

Potential waters of the United States, other than wetlands (hereinafter referred to as "waterways"), include, but are not limited to, unvegetated ephemeral pools, lakes, and perennial, intermittent, and ephemeral stream channels that consist of navigable waters, tributaries to navigable waters, or waters that the destruction or degradation of which could affect or impact navigable waters.

Field methodologies were executed by a trained MacShare wetlands specialist. In addition to the visual assessment, this evaluation was completed based on comprehensive data acquired from the following resources:

- Aerial photographs & topographic maps
- National Wetland Inventory (NWI) maps
- Natural Resources Conservation Service (NRCS) website
- United States Department of Agriculture (USDA) eSoil Survey

MacShare was to identify potential jurisdictional wetlands, waterways, and/or identify pertinent conservation measures to avoid or minimize impacts to these features when necessary.

## 2.0 Technical Guidance

The following is technical guidance on the subject.

The interaction of hydrology, vegetation, and soil results in the development of characteristics unique to wetlands. Therefore, the following technical guideline for wetlands is based on these three parameters, and diagnostic environmental characteristics used in applying the technical guideline are represented by various indicators of these parameters.

Because wetlands may be bordered by both wetter areas (aquatic habitats) and by drier areas (non-wetlands), guidelines are presented for wetlands, deep-water aquatic habitats, and non-wetlands. However, procedures for applying the technical guidelines for deep-water aquatic habitats and non-wetlands are not included in the Manual.

### 2.1 Wetlands

The following definition, diagnostic environmental characteristics, and technical approach comprise a guideline for the identification and delineation of wetlands.

**A. Definition** The SACE Federal Register (1983) and the EPA Federal Register (1983) jointly define wetlands as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Wetlands generally include swamps, marshes, bogs, and similar areas.

**B. Diagnostic environmental characteristics** Wetlands have the following general diagnostic environmental characteristics:

□□□ *Vegetation* □ The prevalent vegetation consists of hydrophytes that are typically adapted to areas having hydrologic and soil conditions described in A □ Definition □ above □ hydrophytic species □ due to morphological □ physiological □ and/or □ reproductive adaptations □ have the ability to grow □□ effectively compete □ reproduce □ and/or □ persist in anaerobic soil conditions □

□□□ *Soil* □ Soils are present and have □ been classified as hydric □ or they possess characteristics that are associated □ with reducing soil conditions □

□□□ *Hydrology* □ The area is inundated either permanently or periodically at mean □ water depths □□□□ ft □ or the soil is saturated to the surface at some time during the growing season of the prevalent vegetation □ The period of inundation or soil saturation varies according to the hydrologic □ soil moisture regime and occurs in □ both tidal and nontidal situations □

C □ *Technical approach for the identification and delineation of wetlands* □ Except in certain situations defined in the Manual □ evidence of a minimum of one positive □ wetland indicator from each parameter □ hydrology □ soil □ and vegetation □ must be found in order to make a positive □ wetland determination □

## 2.2 Deepwater Aquatic Habitats

The following definition □ diagnostic environmental characteristics □ and technical approach comprise a guideline for deepwater aquatic habitats □

A □ *Definition* □ Deepwater aquatic habitats are areas that are permanently inundated at mean annual □ water depths greater than □□□ ft or permanently inundated areas less than □□□ ft in depth that do not support rooted □ emergent or □ woody plant species □ Areas less than □□□ ft mean annual depth that support only □ submerged aquatic plants are vegetated shallows □ not □ wetlands □

□□ *Diagnostic environmental characteristics* □ Deepwater aquatic habitats have the following diagnostic environmental characteristics □

□□□ *Vegetation* □ No rooted emergent or woody plant species are present in these permanently inundated areas □

□□□ *Soil* □ The substrate technically is not defined as a soil if the mean water depth is greater than 100 ft or if it will not support rooted emergent or woody plants □

□□□ *Hydrology* □ The area is permanently inundated at mean water depths greater than 100 ft □

C □ *Technical approach for the identification and delineation of deepwater aquatic habitats* □ When any one of the diagnostic characteristics identified in □ above is present □ the area is a deepwater aquatic habitat □

## 2.3 Nonwetlands

□ The following definition □ diagnostic environmental characteristics □ and technical approach comprise a guideline for the identification and delineation of nonwetlands □

A □ *Definition* □ Nonwetlands include uplands and lowland areas that are neither deepwater aquatic habitats □ wetlands □ nor other special aquatic sites □ They are seldom or never inundated □ or if frequently inundated □ they have saturated soils for only brief periods during the growing season □ and □ if vegetated □ they normally support a prevalence of vegetation typically adapted for life only in aerobic soil conditions □

□□ *Diagnostic environmental characteristics* □ Nonwetlands have the following general diagnostic environmental characteristics □

□□□ *Vegetation* □ The prevalent vegetation consists of plant species that are typically adapted for life only in aerobic soils □

These mesophytic and/or xerophytic macrophytes cannot persist in predominantly anaerobic soil conditions. Some species due to their broad ecological tolerances occur in both wetlands and nonwetlands.

**Soil** Soils when present are not classified as hydric and possess characteristics associated with aerobic conditions.

**Hydrology** Although the soil may be inundated or saturated by surface water or ground water periodically during the growing season of the prevalent vegetation, the average annual duration of inundation or soil saturation does not preclude the occurrence of plant species typically adapted for life in aerobic soil conditions. *Technical approach for the identification and delineation of nonwetlands* When any one of the diagnostic characteristics identified in above is present, the area is a nonwetland.

In addition to distinguishing characteristics of wetlands versus nonwetlands, jurisdictional determinations of waterways and their boundaries are largely dependent on following parameters:

**Ordinary High Water Marks (OHWM)** The presence or absence of an OHWM is considered an indication of whether or not the waterway conveys water for a sufficient duration of the year to have a significant impact to navigable waters of the United States. Section 101 of the CWA defines the landward limit of jurisdiction as the high tide line in tidal waters and the OHWM as the limit in non-tidal waters. When adjacent wetlands are present, the limit of jurisdiction extends to the limit of the wetland.

**Topographic Map Classification.** Waterways that are illustrated on topographic maps by the US Geological Survey (USGS) typically signify resources that eventually drain into tributary system to interstate waters or navigable waters of the United States.

Listing under Federal Register and/or other regulatory publications (i.e., water quality standards) Direct tributaries (non isolated) of listed aquatic resources should fall under the jurisdiction of USACE and other applicable agencies (i.e., Oklahoma Department of Environmental Quality) from the standpoint of maintaining water quality in conformance with the CWA

## 2.4 USACE Consultation

MacShare consulted with the USACE specifically for this project. MacShare had conversations with Ryan Elliott and Michael Ware. Their instructions were to conduct a delineation on the property in accordance with the USACE Wetlands Delineation Manual Appendix as well as the Great Plains Interim Regional Supplement with a transect spacing of 100 feet. This is the exact protocol by which MacShare staff are trained in wetlands delineation.

Since the majority of the property is cultivated cropland and therefore not considered eligible for wetlands or jurisdictional waterway only non-cultivated areas were delineated. Essentially, this yielded that the areas to be evaluated were similar to corridors. These corridors were evaluated on 100m transects. Sample points for which wetlands delineation forms were completed both those that resulted in classification as wetlands and several representative points that were not classified as wetlands are identified on the maps in Appendix A. The corresponding forms are included in Appendix D. Resources identified as waters of the United States are included both on the maps in Appendix A and in the wetland/waterway chart in Appendix C.

In addition, Mr. [redacted] are indicated that the utility line waterway crossings could be permitted under [redacted] P [redacted] and considered separately, the road waterway crossings could be permitted under [redacted] P [redacted] and considered separately, and the turbine tower impacts could be permitted under [redacted] P [redacted] [redacted] P [redacted] however, is cumulative meaning that crossings/impacts are added together to compare against the criteria allowed under the [redacted] P [redacted]

### 3.0 Field Results

The proposed project area was investigated to determine the location and extent of aquatic resources. The descriptions for all areas identified as aquatic resources are contained below according to Field Site Number which correspond to locations on the maps in Appendix A. Appendix B is a photo log of each FS site. Appendix C contains two Wetland/Waterway charts. The first is a list of aquatic resources identified within the project boundary corresponding to a FS number. Note that all FS within the project area are described whether they are impacted by the proposed construction or not. If a FS is within the construction right-of-way ROW that is indicated in the individual FS description. The second chart is an impacts chart which identifies both permanent and temporary impacts.

Finally, note that only impacts from utility line and road crossings are referenced in the descriptions below under the assumption that any impacts from turbines to towers will be relocated to avoid impacts.

**FS-1** is identified as an intermittent stream waterway originating outside the investigated property on the north and traveling south through the investigated property as an unnamed tributary to Chilocco Cree. The stream channel had a full channel width of 10 feet with a full channel depth of 2 feet and an 800 M of 10 feet. At the time of investigation no water was observed within the referenced stream channel. Nevertheless, based on the stream features and a discernible 800 M it would appear that FS-1 meets the criteria necessary for jurisdictional classification by the SACE.

Utility line construction activities cross FS-1 and will have an area of disturbance of 0.0000 acres. Therefore, FS-1 can be disturbed utilizing conventional trenching methods operating under BMPs set forth under 33 P 00 provisions.

**FS-2** is identified as a man-made surface impoundment (stock pond) located outside of the construction right-of-way ROW. Stock ponds usually are not considered to be jurisdictional by the SACE.

**FS-3** has been identified as an emergent wetland located outside of the construction right-of-way (ROW). This area was investigated during the field survey and was found to exhibit positive indicators from all of the three parameters (hydrophytic vegetation, hydric soil, and hydrology).

Dominant herbaceous vegetation in the area consisted of lacustrine rushes, algae, and cattails. Hydrology indicators included surface water, high water table, saturation, and hydrogen sulfide odor.

Based on information obtained from the RCS site, the assessment site is underlain by Agricultural complex to 1 percent slopes. In addition, the soils observed during the site visit consisted of a layer of loam chroma. Detailed soil survey maps are located in Appendix D. According to the SACE problem area wetlands are naturally occurring wetlands that may lack one or more indicators either periodically due to seasonal or annual variability, or permanently due to the nature of the soil or plant species of the site. Furthermore, some soils that meet the definition of hydric soil may not exhibit any of the definitive hydric soil indicators listed by the SACE. Based on the clear soil and hydrology indicators, this site is potentially a recently developed wetland that has not been in place long enough to develop clear hydrophytic vegetation indicators.

Based on the above findings, this area is considered to be an emergent wetland and in lacustrine's opinion meets the criteria necessary for jurisdictional classification by the SACE. Wetland determination sheets for this aquatic resource are included in Appendix D.

**FS-4** has been identified as an emergent wetland located outside of the construction right-of-way (ROW). This area was investigated during the field survey and was found to exhibit positive indicators from all of the three parameters (hydrophytic vegetation, hydric soil, and hydrology). Dominant herbaceous vegetation in the area consisted of lacustrine rushes, algae, and cattails. Hydrology indicators included surface water, high water table, saturation, and hydrogen sulfide odor. Based on information obtained from the RCS site, the assessment site is Agricultural complex to 1 percent slopes. In addition, the soils observed during the site visit consisted of a layer of loam chroma. Detailed soil survey maps are located in Appendix D.

According to the SACE problem area wetlands are naturally occurring wetlands that may lack one or more indicators either periodically due to seasonal or annual variability or permanently due to the nature of the soil or plant species of the site. Furthermore, some soils that meet the definition of hydric soil may not exhibit any of the definitive hydric soil indicators listed by the SACE.

Based on the clear soil and hydrology indicators, this site is potentially a recently developed wetland that has not been in place long enough to develop clear hydrophytic vegetation indicators.

Based on the above findings, this area is considered to be an emergent wetland and in LacShare's opinion meets the criteria necessary for jurisdictional classification by the SACE wetland determination sheets for this aquatic resource are included in Appendix D.

**FS-5** is identified as an ephemeral stream that may originate outside the project area on the north and traveling south through the project area as an unnamed tributary to Chilocco Creek. The stream channel had a full channel width of 10 feet with a full channel depth of 2 feet and an 800 M of 10 feet. At the time of investigation, no water was observed within the referenced stream channel. Nevertheless, based on the stream features and a discernible 800 M, it would appear that FS-5 meets the criteria necessary for jurisdictional classification by the SACE.

Utility line construction activities cross FS-5 and will have an area of disturbance of 0.0000 acres. Therefore, FS-5 can be disturbed utilizing conventional trenching methods operating under BMPs set forth under 33 P 00 provisions.

**FS-6** is identified as a man-made surface impoundment (stock pond) located outside of the construction right-of-way. Stock ponds locally are not considered to be jurisdictional by the SACE.

**FS-6A** has been identified as an herbaceous wetland located outside of the construction right-of-way. This area was investigated during the field survey and was found to exhibit positive indicators from each of the three parameters (hydrophytic vegetation, hydric soil, and hydrology).

Dominant herbaceous vegetation in the area consisted of cattail, lac, illo, d, c, eed, and spire. Hydrology indicators included surface water high, water table, saturation, and hydrogen sulfide odor. Based on information obtained from the RCS, the site the assessment site is underlain by rainola Ashport complex with percent slopes. In addition, the soils observed during the site visit consisted of a layer of lochroma. Detailed soil survey maps are located in Appendix D.

Based on the above findings, this area is considered to be an herbaceous wetland and in accordance with the opinion meets the criteria necessary for jurisdictional classification by the SACE. Wetland determination sheets for this aquatic resource are included in Appendix D.

**FS-7** is identified as an intermittent stream waterway originating outside of the project area on the west and traveling east within the project area as an unnamed tributary to Chilocco Creek. The stream channel had a full bank width of feet with a full bank depth of feet and an M of feet. At the time of investigation, no water was observed within the referenced stream channel. Nevertheless, based on the stream features and a discernible M, it would appear that S meets the criteria necessary for jurisdictional classification by the SACE.

Utility line construction activities cross S and will have an area of disturbance of acres. Therefore, S can be disturbed utilizing conventional trenching methods operating under MPs set forth under P provisions.

**FS-7A** is identified as an ephemeral stream waterway originating outside of the project area on the north and traveling south through the project area as an unnamed tributary to Chilocco Creek.

The stream channel had a full channel width of 10 feet with a full channel depth of 2 feet and an average M of 10 feet. At the time of investigation, no water was observed within the referenced stream channel. Nevertheless, based on the stream features and a discernible 100 M, it would appear that SAA meets the criteria necessary for jurisdictional classification by the SACE. Utility line and construction activities cross SAA and will have an area of disturbance of 0.0000 acres. In addition, construction activities include the installation of a permanent road that crosses SAA and will have a permanent disturbance of 0.0000 acres. Therefore, SAA can be disturbed utilizing conventional trenching methods operating under BMPs set forth under 22 P and 22 P provisions.

**FS-8** is identified as a perennial stream waterway known as Chilocco Cree, originating outside of the project area on the west and traveling east inside the project area as a tributary to the Arkansas River. The stream channel had a full channel width of 10 feet with a full channel depth of 2 feet and an average M of 10 feet. At the time of investigation, the stream dimensions were approximately 10 feet wide and 2 feet deep. Based on the stream features, flow characteristics and a discernible 100 M, it would appear that SAA meets the criteria necessary for jurisdictional classification by the SACE.

Utility line construction activities cross SAA and will have an area of disturbance of 0.0000 acres. Therefore, SAA can be disturbed utilizing conventional trenching methods operating under BMPs set forth under 22 P provisions.

**FS-9** is identified as an intermittent stream waterway located outside of the construction right-of-way (ROW). It originates outside of the project area on the west and travels northeast within the project area as an unnamed tributary to Chilocco Cree. The stream channel had a full channel width of 10 feet with a full channel depth of 2 feet and an average M of 10 feet. At the time of investigation, no water was observed within the referenced stream channel. Nevertheless, based on the stream features and a discernible 100 M, it would appear that SAA meets the criteria necessary for jurisdictional classification by the SACE.

**FS-10** is identified as an ephemeral stream waterway originating outside of the project area on the south and traveling north through the project area as an unnamed tributary to Chilocco Creek. The stream channel had a full bank width of 10 feet with a full bank depth of 10 feet and an 800 M of 10 feet. At the time of investigation, no water was observed within the referenced stream channel. Nevertheless, based on the stream features and a discernible 800 M, it would appear that S1000 meets the criteria necessary for jurisdictional classification by the SACE. Utility line construction activities cross S1000 and will have an area of disturbance of 0.0000 acres. Therefore, S1000 can be disturbed utilizing conventional trenching methods operating under BMPs set forth under 22 P 00 provisions.

**FS-11** is identified as an intermittent stream waterway originating outside of the project area on the south and traveling north through the project area as an unnamed tributary to Chilocco Creek. The stream channel had a full bank width of 10 feet with a full bank depth of 10 feet and an 800 M of 10 feet. At the time of investigation, no water was observed within the referenced stream channel. Nevertheless, based on the stream features and a discernible 800 M, it would appear that S1000 meets the criteria necessary for jurisdictional classification by the SACE.

Utility line construction activities cross S1000 and will have an area of disturbance of 0.0000 acres. Therefore, S1000 can be disturbed utilizing conventional trenching methods operating under BMPs set forth under 22 P 00 provisions.

**FS-12** is identified as a man-made surface impoundment (stock pond) located outside of the construction right-of-way (ROW). Stock ponds usually are not considered to be jurisdictional by the SACE.

**FS-13** is identified as an ephemeral stream waterway located outside of the construction right-of-way (ROW). It originates outside of the project area on the north and travels south through the project area as an unnamed tributary to Chilocco Creek. The stream channel had a full bank width of 10 feet with a full bank depth of 10 feet and an 800 M of 10 feet.

At the time of investigation, no water was observed within the referenced stream channel. Nevertheless, based on the stream features and a discernible M, it would appear that S meets the criteria necessary for jurisdictional classification by the SACE.

**FS-13A** is identified as an ephemeral stream waterway located outside of the construction right-of-way. It originates outside of the project area on the north and travels south through the project area as an unnamed tributary to Chilocco Creek. The stream channel had a full channel width of 10 feet with a full channel depth of 2 feet and an M of 10 feet. At the time of investigation, no water was observed within the referenced stream channel. Nevertheless, based on the stream features and a discernible M, it would appear that S-13A meets the criteria necessary for jurisdictional classification by the SACE.

**FS-14** is identified as a man-made surface impoundment (storage pond) located outside of the construction right-of-way. Storage ponds usually are not considered to be jurisdictional by the SACE.

**FS-15** is identified as a man-made surface impoundment (storage pond) located outside of construction right-of-way. Storage ponds usually are not considered to be jurisdictional by the SACE.

**FS-16** has been identified as a forested wetland located outside of the construction right-of-way. This area was investigated during the field survey and was found to exhibit positive indicators from each of the three parameters: hydrophytic vegetation, hydric soil, and hydrology. Dominant herbaceous vegetation in the area consisted of lac, milo, cotton, wood, elm, and reeds.

Hydrology indicators included surface water, high water table, saturation, and hydrogen sulfide odor, based on information obtained from the RCS site. The assessment site is underlain by Agronora complex with 10 to 15 percent slopes, eroded.

In addition, the soils observed during the site visit consisted of a layer of low chroma. Detailed soil survey maps are located in Appendix D.

Based on the above findings, this area is considered to be a forested wetland and in  
LacShare's opinion meets the criteria necessary for jurisdictional classification by the  
SACE wetland determination sheets for this aquatic resource are included in Appendix  
D.

## 4.0 Conclusions

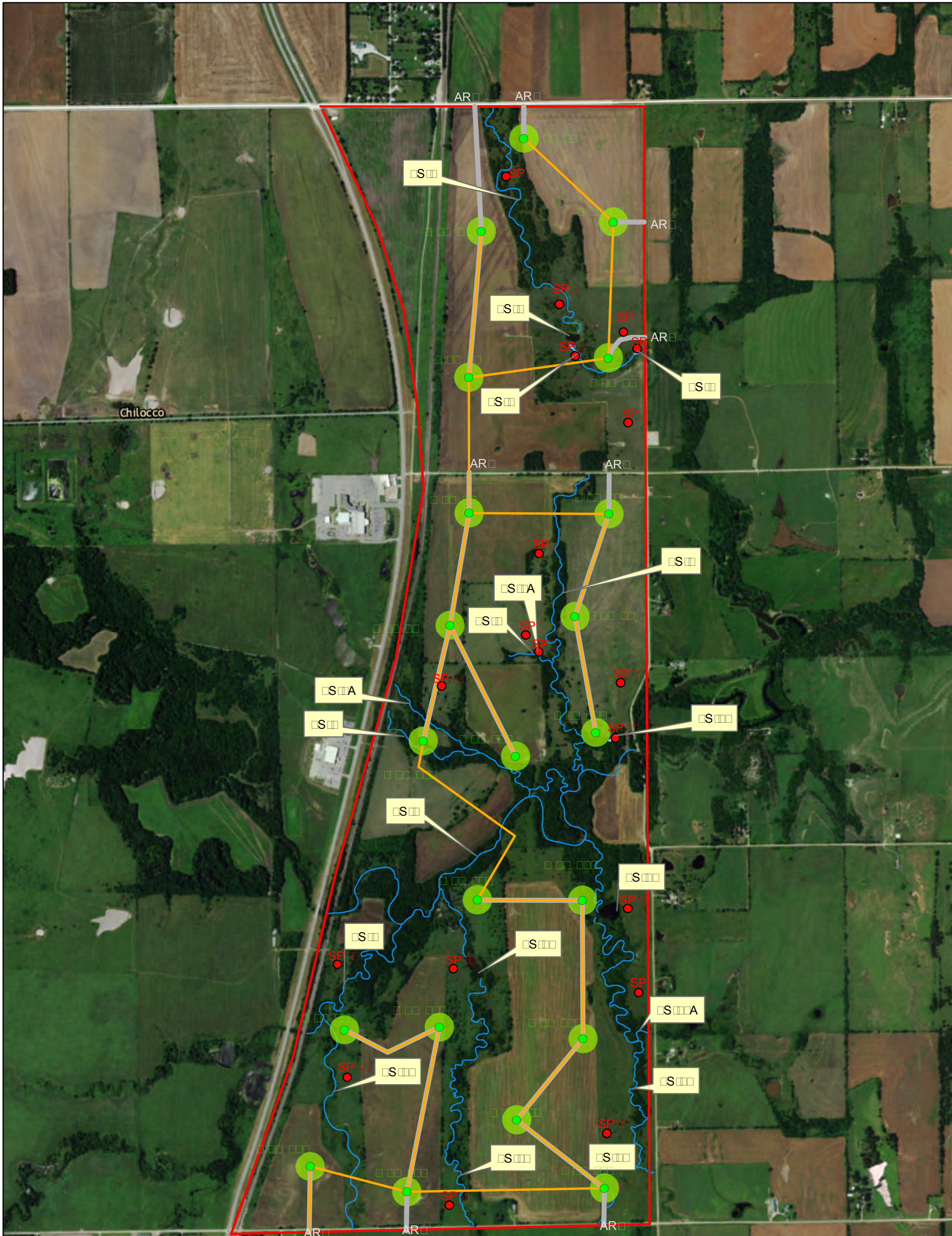
Based on MacShare's assessment of the project area, the proposed project will warrant Section 401 coverage via a 401 P for the utility line crossings and 401 P for the roads. Impacts from turbine tower construction currently exceed coverage allowances under 401 P and would require an Individual Permit (IP) to ever moving several of the turbines towers by only small distances avoids impacts altogether and therefore the need for use of 401 P.

Coverage under 401 P for the utility line and 401 P for the road crossings will be achieved via self-verification. A Pre-Construction Notification (PCN) will not be submitted to the SACE offices due to the fact no criteria have been met that would trigger a PCN submission for 401 P concurrence. The distance of an acre. All waterways that could potentially result in a distance greater than of an acre and all identified wetlands are avoided.

If changes in the construction plan results in increased distance of the jurisdictional resources or discharges that result in loss of greater than of an acre, P/E will need to submit a PCN to the Isak District SACE office for 401 P concurrence.

Similarly, if **any** impact is anticipated with the turbines towers, PCN is required for 401 P. Note also that the criteria of coverage under 401 P are restricted to acres and/or linear feet of streamed distance in WA for the project. The current construction plan results as indicated in the impact chart in Appendix C in distance because of turbine construction of jurisdictional resources above 401 P criteria which would require an Individual Permit (IP). Measures which could avoid IP and 401 P altogether are provided in the impact chart.

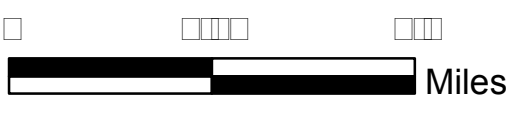
**Appendix A**  
**Maps**



KAY COUNTY, OKLAHOMA



- PROJECT BOUNDARY
- WETLAND BOUNDARY
- WETLAND NODE
- WETLAND PAD
- SAMPLE POINT
- S
- S A
- AR



**PNE WIND USA, INC  
CHILOCCO PROJECT  
WETLAND WATERWAY MAP  
SITE MAP OVERVIEW  
KAY COUNTY, OKLAHOMA**

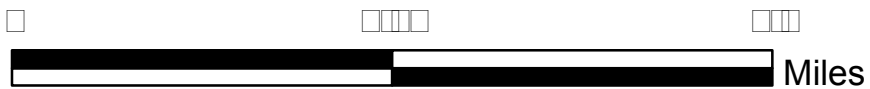
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KAY COUNTY, OKLAHOMA

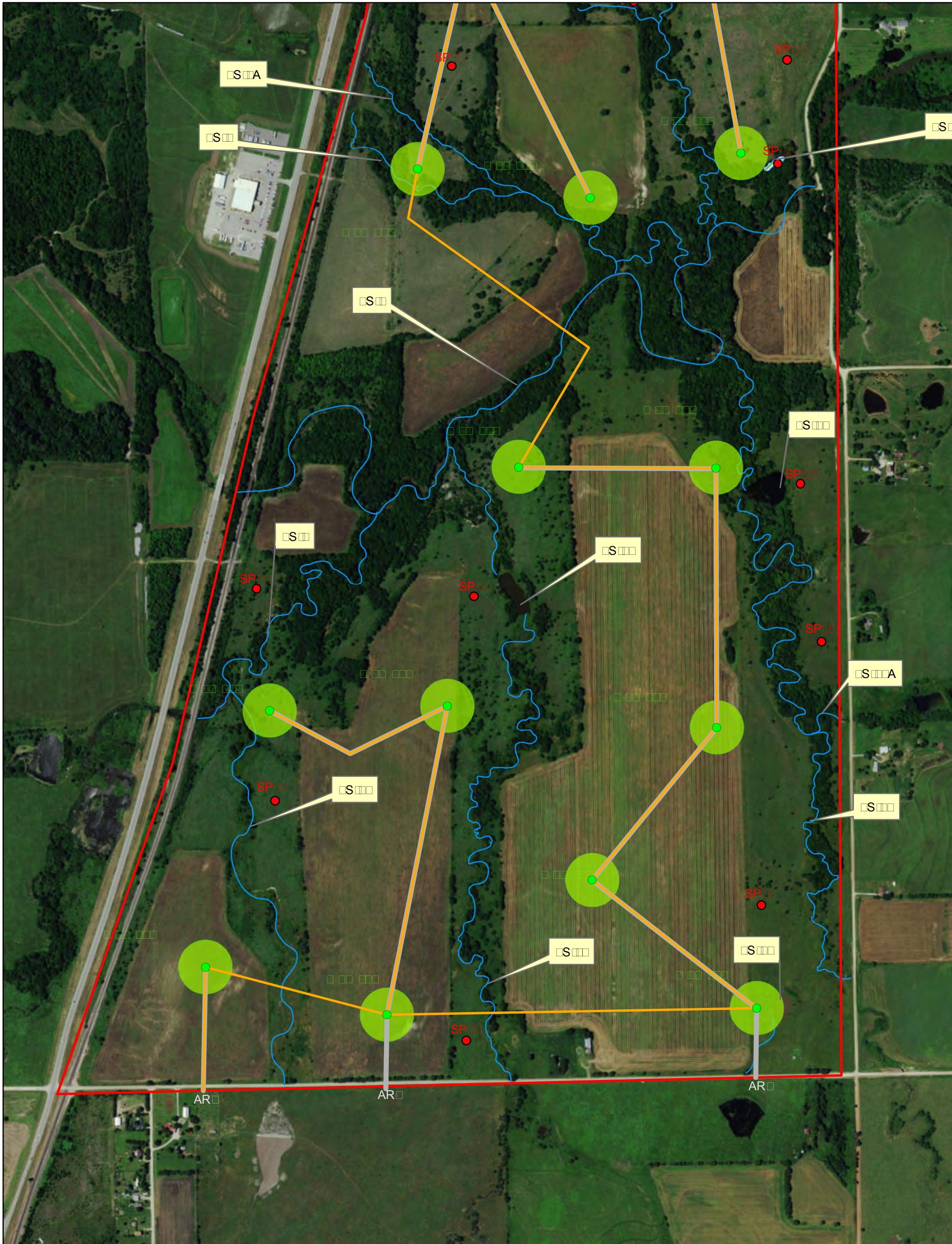


- PROJECT BOUNDARY
- JURISDICTIONAL WATERWAY
- RICHWOOD EASEMENT
- IMPROVEMENT
- WETLAND
- NETWORK
- ACCESS ROAD
- WETLAND PAD
- SAMPLE POINT



**PNE WIND USA, INC  
CHILocco PROJECT  
WETLAND WATERWAY MAP  
DETAIL VIEW - NORTH MAP  
KAY COUNTY, OKLAHOMA**

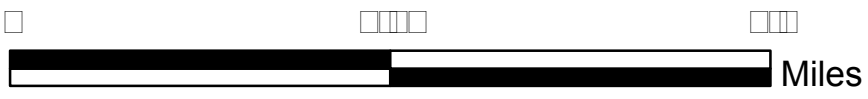
PROJECT: 3463-16 DATE:09-13-2016 BY: STH



KAY COUNTY, OKLAHOMA



- PROJECT BOUNDARY
- WETLAND WATERWAY
- RICHWOOD ELEVATION
- IMPROVEMENT
- 100' RADIUS BUFFER
- 100' RADIUS BUFFER
- ACCESS ROAD
- 100' RADIUS PAD
- SAMPLE POINT



**PNE WIND USA, INC  
CHILOCOCCO PROJECT  
WETLAND WATERWAY MAP  
DETAIL VIEW - SOUTH MAP  
KAY COUNTY, OKLAHOMA**

PROJECT: 3463-16 DATE: 09-13-2016 BY: STH

**Appendix B**  
**Photographic Log**

**PHOTOGRAPHIC LOG**

Description:  
FS-1



**PHOTOGRAPHIC LOG**

Description:  
FS-2



**PHOTOGRAPHIC LOG**

Description:  
FS-3



**PHOTOGRAPHIC LOG**

Description:  
FS-4



**PHOTOGRAPHIC LOG**

Description:  
FS-5



**PHOTOGRAPHIC LOG**

Description:  
FS-6



**PHOTOGRAPHIC LOG**

Description:  
FS-6A



**PHOTOGRAPHIC LOG**

Description:  
FS-7



**PHOTOGRAPHIC LOG**

Description:  
FS-7A



**PHOTOGRAPHIC LOG**

Description:  
FS-8



**PHOTOGRAPHIC LOG**

Description:  
FS-9



**PHOTOGRAPHIC LOG**

Description:  
FS-10



**PHOTOGRAPHIC LOG**

**Description:**

**FS-11**



**PHOTOGRAPHIC LOG**

**Description:**

**FS-12**



**PHOTOGRAPHIC LOG**

**Description:**

**FS-13**



**PHOTOGRAPHIC LOG**

**Description:**

**FS-13-A**



**PHOTOGRAPHIC LOG**

**Description:**

**FS-14**



**PHOTOGRAPHIC LOG**

**Description:**

**FS-15**



**PHOTOGRAPHIC LOG**

**Description:**

**FS-16**



**Appendix C**  
**Wetland/Waterway Charts**

## Aquatic Resources

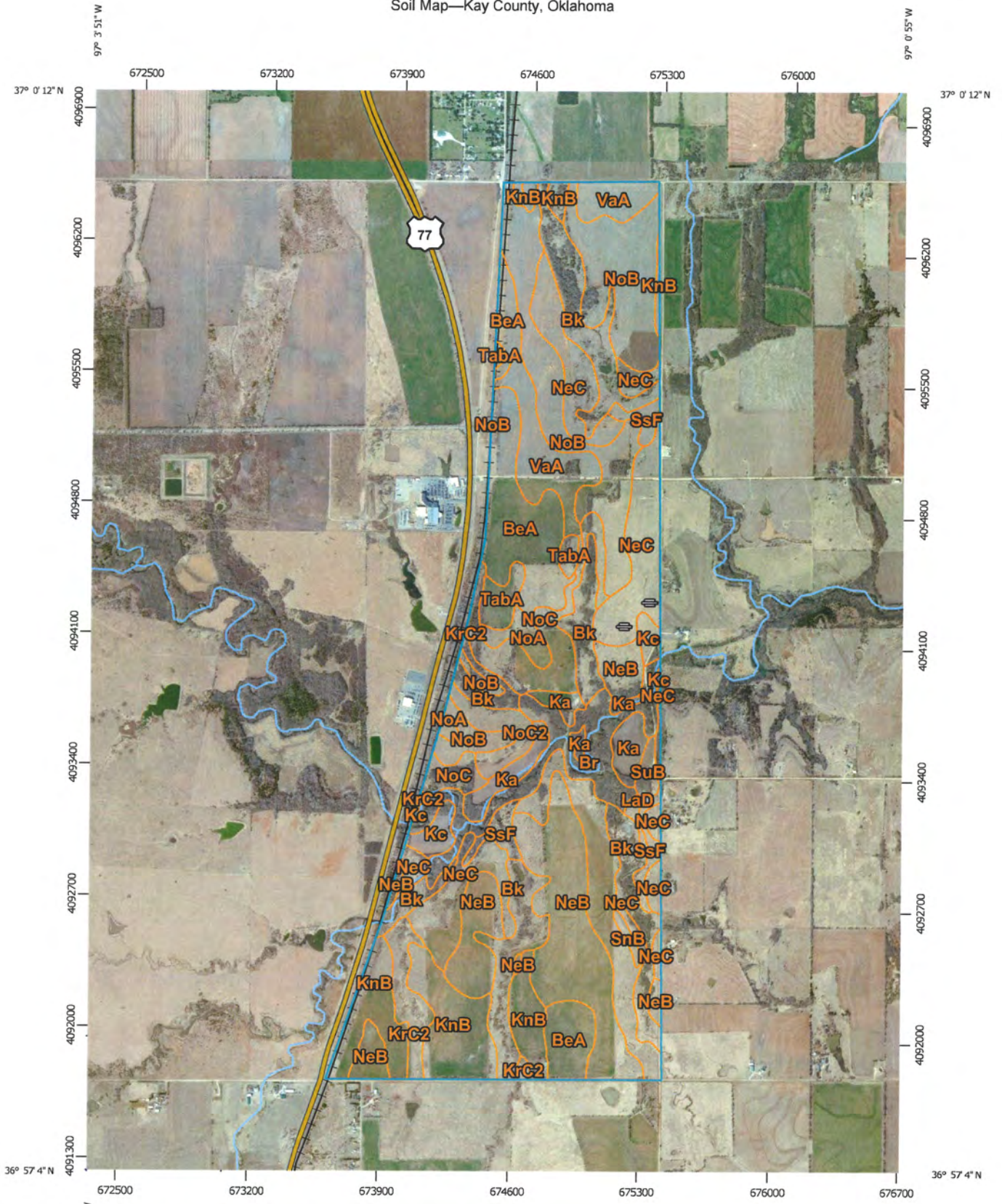
Waters_Name	Cowardin_Code	HGM_Code	Measurement_Type	Amount	Units	Waters_Type	Latitude	Longitude	Local_Waterway
FS-1	R4SB	RIVERINE	Linear	6324	FOOT	RPW	36.993663	-97.036512	Chilocco Creek
FS-2	PUB	DEPRESS	Area	0.636643	ACRE	NRPW	36.989916	-97.33348	Chilocco Creek
FS-3	PEM	DEPRESS	Area	0.178975	ACRE	NRPW	36.889754	-97.033259	Chilocco Creek
FS-4	PEM	DEPRESS	Area	0.103274	ACRE	NRPW	36.989135	-97.03064	Chilocco Creek
FS-5	R4SB	RIVERINE	Linear	5788	FOOT	RPW	36.982302	-97.34258	Chilocco Creek
FS-6	PUB	DEPRESS	Area	0.268875	ACRE	NRPW	36.977673	-97.035277	Chilocco Creek
FS-6A	PSS	DEPRESS	Area	0.03391	ACRE	NRPW	36.977929	-97.035118	Chilocco Creek
FS-7	R4SB	RIVERINE	Linear	4160	FOOT	RPW	36.974508	-97.040473	Chilocco Creek
FS-7A	R4SB	RIVERINE	Linear	1630	FOOT	RPW	36.975372	-97.038983	Chilocco Creek
FS-8	R4SB	RIVERINE	Linear	8905	FOOT	RPW	36.970826	-97.03746	Arkansas River
FS-9	R4SB	RIVERINE	Linear	3534	FOOT	RPW	36.96649	-97.043619	Chilocco Creek
FS-10	R4SB	RIVERINE	Linear	3595	FOOT	RPW	36.961334	-97.045343	Chilocco Creek
FS-11	R4SB	RIVERINE	Linear	6786	FOOT	RPW	36.966827	-97.038715	Chilocco Creek
FS-12	PUB	DEPRESS	Area	0.90273	ACRE	NRPW	36.965653	-97.03826	Chilocco Creek
FS-13	R4SB	RIVERINE	Linear	7870	FOOT	RPW	36.9691	-97.032621	Chilocco Creek
FS-13A	R4SB	RIVERINE	Linear	341	FOOT	RPW	36.963151	-97.030055	Chilocco Creek
FS-14	PUB	DEPRESS	Area	1.449859	ACRE	NRPW	36.96792	-97.031956	Chilocco Creek
FS-15	PUB	DEPRESS	Area	0.50645	ACRE	NRPW	36.957315	-97.031618	Chilocco Creek
FS-16	PFO	DEPRESS	Area	0.232004	ACRE	NRPW	36.974605	-97.031553	Chilocco Creek

## Impacts

Waters_Name	Name	Activity	Resource_Type	Permanent_Loss	Impact_Duration	Initially_Proposed_Area	Proposed_Area	Authorized_Area	Units_Area	Area_Type	Initially_Proposed_Linear	Proposed_Linear	Authorized_Linear	Units_Linear	Debits	Notes
FS-1	WTG95 - WTG94	Work (non-fill, Section 10)	River/Stream	NO	Temporary	0.007	0.007	0.007	Acres	Fill						Permitted under NWP 12
FS-5	WTG97 - WTG96	Work (non-fill, Section 10)	River/Stream	NO	Temporary	0.006	0.006	0.006	Acres	Fill						Permitted under NWP 12
FS-7	WTG100 - WTG10	Work (non-fill, Section 10)	River/Stream	NO	Temporary	0.004	0.004	0.004	Acres	Fill						Permitted under NWP 12
FS-7A	AR 6	Structure (Sec 10 only)	River/Stream	YES	Permanent	0.0007	0.0007	0.0007	Acres	Structure						Permitted under NWP 14
FS-7A	WTG98 - WTG100	Work (non-fill, Section 10)	River/Stream	NO	Temporary	0.003	0.003	0.003	Acres	Fill						Permitted under NWP 12
FS-8	WTG100 - WTG10	Work (non-fill, Section 10)	River/Stream	NO	Temporary	0.069	0.069	0.069	Acres	Fill						Permitted under NWP 12
FS-10	WTG 110 - WTG10	Work (non-fill, Section 10)	River/Stream	NO	Temporary	0.003	0.003	0.003	Acres	Fill						Permitted under NWP 12
FS-11	WTG 110 - WTG11	Work (non-fill, Section 10)	River/Stream	NO	Temporary	0.004	0.004	0.004	Acres	Fill						Permitted under NWP 12
FS-1	WTG 95	Work (non-fill, Section 10)	River/Stream	NO	Temporary	0.026	0.026	0.026	Acres	Fill						Avoid by moving turbine 50' North
FS-5	WTG102	Work (non-fill, Section 10)	River/Stream	NO	Temporary	0.003	0.003	0.003	Acres	Fill						Avoid by moving turbine 25' North or fence off waterway
FS-7	WTG 100	Work (non-fill, Section 10)	River/Stream	NO	Temporary	0.031	0.031	0.031	Acres	Fill						Avoid by moving turbine 400' South
FS-7	WTG 101	Work (non-fill, Section 10)	River/Stream	NO	Temporary	0.004	0.004	0.004	Acres	Fill						Avoid by moving turbine 25' North or fence off waterway
FS-10	WTG 106	Work (non-fill, Section 10)	River/Stream	NO	Temporary	0.011	0.011	0.011	Acres	Fill						Avoid by moving turbine 75' East
FS-13	WTG 105	Work (non-fill, Section 10)	River/Stream	NO	Temporary	0.006	0.006	0.006	Acres	Fill						Avoid by moving turbine 50' West
FS-1	WTG 95	Work (non-fill, Section 10)	River/Stream	NO	Temporary	225 Linear ft.	225 Linear ft.	225 Linear ft.	Square Feet	Fill						Avoid by moving turbine 50' North
FS-5	WTG102	Work (non-fill, Section 10)	River/Stream	NO	Temporary	34 Linear ft.	34 Linear ft.	34 Linear ft.	Square Feet	Fill						Avoid by moving turbine 25' North or fence of waterway
FS-7	WTG 100	Work (non-fill, Section 10)	River/Stream	NO	Temporary	444 Linear ft.	444 Linear ft.	444 Linear ft.	Square Feet	Fill						Avoid by moving turbine 400' South
FS-7	WTG 101	Work (non-fill, Section 10)	River/Stream	NO	Temporary	51 Linear ft.	51 Linear ft.	51 Linear ft.	Square Feet	Fill						Avoid by moving turbine 25' North or fence off waterway
FS-10	WTG 106	Work (non-fill, Section 10)	River/Stream	NO	Temporary	240 Linear ft.	240 Linear ft.	240 Linear ft.	Square Feet	Fill						Avoid by moving turbine 75' East
FS-13	WTG 105	Work (non-fill, Section 10)	River/Stream	NO	Temporary	138 Linear ft.	138 Linear ft.	138 Linear ft.	Square Feet	Fill						Avoid by moving turbine 50' West

**Appendix D**  
**Reference Documents**

Soil Map—Kay County, Oklahoma



Map Scale: 1:28,100 if printed on A portrait (8.5" x 11") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 14N WGS84







































Natural Resources Conservation Service

Web Soil Survey National Cooperative Soil Survey

8/26/2016 Page 1 of 3

### MAP LEGEND

- |  |  |   |  |
|--|--|---|--|
| <b>Area of Interest (AOI)</b>  |  |  Spoil Area            |  |
|  Area of Interest (AOI) |  |  Stony Spot            |  |
| <b>Soils</b>   |  |  Very Stony Spot       |  |
|  Soil Map Unit Polygons |  |  Wet Spot              |  |
|  Soil Map Unit Lines    |  |  Other                 |  |
|  Soil Map Unit Points   |  |  Special Line Features |  |
| <b>Special Point Features</b>  |  | <b>Water Features</b>   |  |
|  Blowout                |  |  Streams and Canals    |  |
|  Borrow Pit             |  | <b>Transportation</b>   |  |
|  Clay Spot              |  |  Rails                 |  |
|  Closed Depression      |  |  Interstate Highways   |  |
|  Gravel Pit             |  |  US Routes             |  |
|  Gravelly Spot          |  |  Major Roads           |  |
|  Landfill               |  |  Local Roads           |  |
|  Lava Flow              |  | <b>Background</b>   |  |
|  Marsh or swamp         |  |  Aerial Photography    |  |
|  Mine or Quarry         |  |   |  |
|  Miscellaneous Water    |  |   |  |
|  Perennial Water        |  |   |  |
|  Rock Outcrop           |  |   |  |
|  Saline Spot           |  |   |  |
|  Sandy Spot           |  |   |  |
|  Severely Eroded Spot |  |   |  |
|  Sinkhole             |  |   |  |
|  Slide or Slip        |  |   |  |
|  Sodic Spot           |  |   |  |

### MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

Source of Map: Natural Resources Conservation Service  
 Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>  
 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: Kay County, Oklahoma  
 Survey Area Data: Version 11, Sep 29, 2015

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

Date(s) aerial images were photographed: Feb 28, 2011—Mar 23, 2011





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

Kay County, Oklahoma (OK071)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BeA	Bethany silt loam, 0 to 1 percent slopes	116.8	8.5%
Bk	Grainola-Ashport complex, 0 to 12 percent slopes	169.9	12.3%
Br	Ashport, Port, and Pulaski soils, 0 to 1 percent slopes, frequently flooded	74.0	5.4%
Ka	Port silt loam, 0 to 1 percent slopes, occasionally flooded	40.6	2.9%
Kc	Port silty clay loam, 0 to 1 percent slopes, occasionally flooded	18.1	1.3%
KnB	Kirkland silt loam, 1 to 3 percent slopes	120.4	8.7%
KrC2	Kirkland-Renfrow complex, 3 to 5 percent slopes, eroded	26.9	2.0%
LaD	Foraker clay loam, 5 to 8 percent slopes	3.6	0.3%
NeB	Agra-Foraker complex, 1 to 3 percent slopes	175.9	12.8%
NeC	Agra-Foraker complex, 3 to 5 percent slopes	219.2	15.9%
NoA	Milan loam, 0 to 1 percent slopes	15.5	1.1%
NoB	Milan loam, 1 to 3 percent slopes	189.1	13.7%
NoC	Milan loam, 3 to 5 percent slopes	63.2	4.6%
NoC2	Milan loam, 3 to 5 percent slopes, eroded	21.6	1.6%
SnB	Shidler silty clay loam, 1 to 3 percent slopes	3.3	0.2%
SsF	Shilder-Westsum complex, 5 to 20 percent slopes	27.9	2.0%
SuB	Westsum silty clay loam, 1 to 3 percent slopes	6.8	0.5%
TabA	Tabler silt loam, 0 to 1 percent slopes	19.9	1.4%
VaA	Vanoss silt loam, 0 to 1 percent slopes	64.0	4.6%
<b>Totals for Area of Interest</b>		<b>1,376.9</b>	<b>100.0%</b>

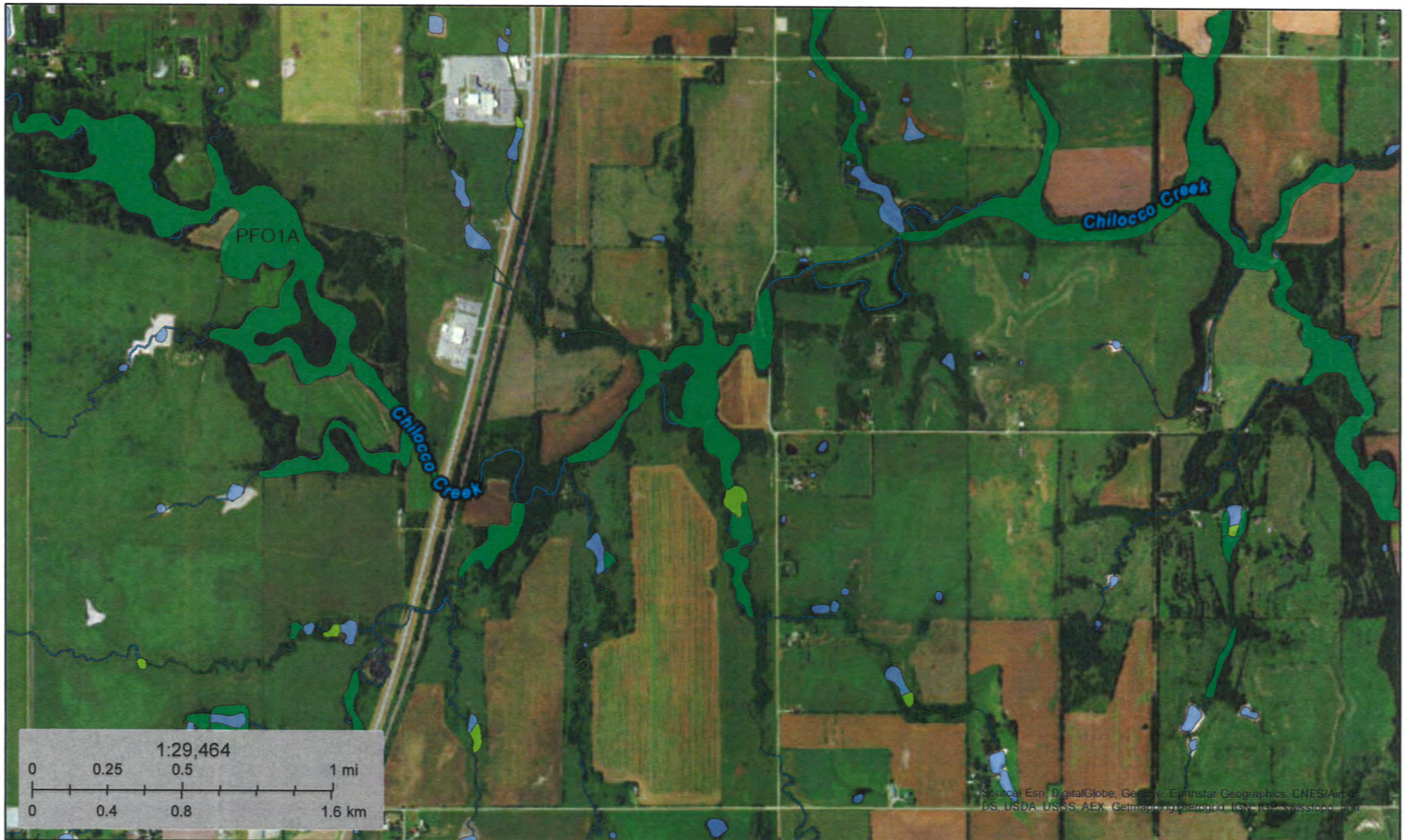


September 1, 2016

- |   |                                |   |                                   |   |          |
|---|--------------------------------|---|-----------------------------------|---|----------|
|  | Estuarine and Marine Deepwater |  | Freshwater Forested/Shrub Wetland |  | Other    |
|  | Estuarine and Marine Wetland   |  | Freshwater Pond                   |  | Riverine |
|  | Freshwater Emergent Wetland    |  | Lake                              |   |          |

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Geomatics, Aergrid, IGN, IGP, swisstopo, and

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.



September 1, 2016

- |                                |                                   |          |
|--------------------------------|-----------------------------------|----------|
| Estuarine and Marine Deepwater | Freshwater Forested/Shrub Wetland | Other    |
| Estuarine and Marine Wetland   | Freshwater Pond                   | Riverine |
| Freshwater Emergent Wetland    | Lake                              |          |

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

## WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: \_\_\_\_\_ City/County: \_\_\_\_\_ Sampling Date: \_\_\_\_\_  
 Applicant/Owner: \_\_\_\_\_ State: \_\_\_\_\_ Sampling Point: \_\_\_\_\_  
 Investigator(s): \_\_\_\_\_ Section, Township, Range: \_\_\_\_\_  
 Landform (hillslope, terrace, etc.): \_\_\_\_\_ Local relief (concave, convex, none): \_\_\_\_\_ Slope (%): \_\_\_\_\_  
 Subregion (LRR): \_\_\_\_\_ Lat: \_\_\_\_\_ Long: \_\_\_\_\_ Datum: \_\_\_\_\_  
 Soil Map Unit Name: \_\_\_\_\_ NWI classification: \_\_\_\_\_

Are climatic / hydrologic conditions on the site typical for this time of year? Yes \_\_\_\_\_ No \_\_\_\_\_ (If no, explain in Remarks.)  
 Are Vegetation \_\_\_\_\_, Soil \_\_\_\_\_, or Hydrology \_\_\_\_\_ significantly disturbed? Are "Normal Circumstances" present? Yes \_\_\_\_\_ No \_\_\_\_\_  
 Are Vegetation \_\_\_\_\_, Soil \_\_\_\_\_, or Hydrology \_\_\_\_\_ naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes _____ No _____ Hydric Soil Present? Yes _____ No _____ Wetland Hydrology Present? Yes _____ No _____	<b>Is the Sampled Area within a Wetland?</b> Yes _____ No _____
Remarks: _____ _____ _____	

### VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status	
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
_____ = Total Cover				
Sapling/Shrub Stratum (Plot size: _____)				
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
_____ = Total Cover				
Herb Stratum (Plot size: _____)				
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
5. _____	_____	_____	_____	
6. _____	_____	_____	_____	
7. _____	_____	_____	_____	
8. _____	_____	_____	_____	
9. _____	_____	_____	_____	
10. _____	_____	_____	_____	
_____ = Total Cover				
Woody Vine Stratum (Plot size: _____)				
1. _____	_____	_____	_____	
2. _____	_____	_____	_____	
_____ = Total Cover				
% Bare Ground in Herb Stratum _____				

**Dominance Test worksheet:**  
 Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC-): \_\_\_\_\_ (A)  
 Total Number of Dominant Species Across All Strata: \_\_\_\_\_ (B)  
 Percent of Dominant Species That Are OBL, FACW, or FAC: \_\_\_\_\_ (A/B)

**Prevalence Index worksheet:**  
 Total % Cover of: \_\_\_\_\_ Multiply by: \_\_\_\_\_  
 OBL species \_\_\_\_\_ x 1 = \_\_\_\_\_  
 FACW species \_\_\_\_\_ x 2 = \_\_\_\_\_  
 FAC species \_\_\_\_\_ x 3 = \_\_\_\_\_  
 FACU species \_\_\_\_\_ x 4 = \_\_\_\_\_  
 UPL species \_\_\_\_\_ x 5 = \_\_\_\_\_  
 Column Totals: \_\_\_\_\_ (A) \_\_\_\_\_ (B)  
 Prevalence Index = B/A = \_\_\_\_\_

**Hydrophytic Vegetation Indicators:**  
 \_\_\_ 1 - Rapid Test for Hydrophytic Vegetation  
 \_\_\_ 2 - Dominance Test is >50%  
 \_\_\_ 3 - Prevalence Index is ≤3.0<sup>1</sup>  
 \_\_\_ 4 - Morphological Adaptations<sup>1</sup> (Provide supporting data in Remarks or on a separate sheet)  
 \_\_\_ Problematic Hydrophytic Vegetation<sup>1</sup> (Explain)

<sup>1</sup>Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes \_\_\_\_\_ No \_\_\_\_\_

Remarks: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

**SOIL**

Sampling Point: \_\_\_\_\_

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type <sup>1</sup>	Loc <sup>2</sup>		

<sup>1</sup>Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains.      <sup>2</sup>Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Stratified Layers (A5) **(LRR F)**
- 1 cm Muck (A9) **(LRR F, G, H)**
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1)
- 2.5 cm Mucky Peat or Peat (S2) **(LRR G, H)**
- 5 cm Mucky Peat or Peat (S3) **(LRR F)**
- Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- Loamy Mucky Mineral (F1)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)
- High Plains Depressions (F16) **(MLRA 72 & 73 of LRR H)**

**Indicators for Problematic Hydric Soils<sup>3</sup>:**

- 1 cm Muck (A9) **(LRR I, J)**
- Coast Prairie Redox (A16) **(LRR F, G, H)**
- Dark Surface (S7) **(LRR G)**
- High Plains Depressions (F16) **(LRR H outside of MLRA 72 & 73)**
- Reduced Vertic (F18)
- Red Parent Material (TF2)
- Very Shallow Dark Surface (TF12)
- Other (Explain in Remarks)

<sup>3</sup>Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: \_\_\_\_\_  
 Depth (inches): \_\_\_\_\_

**Hydric Soil Present? Yes \_\_\_\_\_ No \_\_\_\_\_**

Remarks:

**HYDROLOGY**

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- Surface Water (A1)
- High Water Table (A2)
- Saturation (A3)
- Water Marks (B1)
- Sediment Deposits (B2)
- Drift Deposits (B3)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- Salt Crust (B11)
- Aquatic Invertebrates (B13)
- Hydrogen Sulfide Odor (C1)
- Dry-Season Water Table (C2)
- Oxidized Rhizospheres on Living Roots (C3) **(where not tilled)**
- Presence of Reduced Iron (C4)
- Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- Surface Soil Cracks (B6)
- Sparsely Vegetated Concave Surface (B8)
- Drainage Patterns (B10)
- Oxidized Rhizospheres on Living Roots (C3) **(where tilled)**
- Crayfish Burrows (C8)
- Saturation Visible on Aerial Imagery (C9)
- Geomorphic Position (D2)
- FAC-Neutral Test (D5)
- Frost-Heave Hummocks (D7) **(LRR F)**

**Field Observations:**

Surface Water Present? Yes \_\_\_\_\_ No \_\_\_\_\_ Depth (inches): \_\_\_\_\_  
 Water Table Present? Yes \_\_\_\_\_ No \_\_\_\_\_ Depth (inches): \_\_\_\_\_  
 Saturation Present? Yes \_\_\_\_\_ No \_\_\_\_\_ Depth (inches): \_\_\_\_\_  
 (includes capillary fringe)

**Wetland Hydrology Present? Yes \_\_\_\_\_ No \_\_\_\_\_**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

## WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: Chilocco, OK City/County: Kay Sampling Date: 8-11-2016  
 Applicant/Owner: PNE Wind USA, Inc. State: OK Sampling Point: FS-3  
 Investigator(s): Steve Haddigan, Lindsay McClendon Section, Township, Range: S13 T29N R2E  
 Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): 2%  
 Subregion (LRR): Subregion H Lat: 36.889754 Long: -97.033259 Datum: \_\_\_\_\_  
 Soil Map Unit Name: Bk - Grainola-Ashport Complex NWI classification: \_\_\_\_\_  
 Are climatic / hydrologic conditions on the site typical for this time of year? Yes  No \_\_\_\_\_ (If no, explain in Remarks.)  
 Are Vegetation \_\_\_\_\_, Soil \_\_\_\_\_, or Hydrology \_\_\_\_\_ significantly disturbed? Are "Normal Circumstances" present? Yes  No \_\_\_\_\_  
 Are Vegetation \_\_\_\_\_, Soil \_\_\_\_\_, or Hydrology \_\_\_\_\_ naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No _____ Hydric Soil Present? Yes <input checked="" type="checkbox"/> No _____ Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No _____	<b>Is the Sampled Area within a Wetland?</b> Yes <input checked="" type="checkbox"/> No _____
Remarks: Wetland present in study location.	

### VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1. <u>Black Willow</u>	30	Yes	FACW	Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC-): <u>4</u> (A)  Total Number of Dominant Species Across All Strata: <u>4</u> (B)  Percent of Dominant Species That Are OBL, FACW, or FAC: <u>100</u> (A/B)
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
30 = Total Cover				<b>Prevalence Index worksheet:</b> Total % Cover of: _____ Multiply by: _____ OBL species _____ x 1 = _____ FACW species _____ x 2 = _____ FAC species _____ x 3 = _____ FACU species _____ x 4 = _____ UPL species _____ x 5 = _____ Column Totals: _____ (A) _____ (B)  Prevalence Index = B/A = _____
<b>Sapling/Shrub Stratum (Plot size: _____)</b> 1. _____ 2. _____ 3. _____ 4. _____ 5. _____ _____ = Total Cover				
<b>Herb Stratum (Plot size: _____)</b> 1. <u>Cattails</u> 15 Yes OBL 2. <u>Sedges</u> 15 Yes OBL 3. <u>Spike rush</u> 15 Yes OBL 4. _____ 5. _____ 6. _____ 7. _____ 8. _____ 9. _____ 10. _____ _____ = Total Cover				
<b>Woody Vine Stratum (Plot size: _____)</b> 1. _____ 2. _____ _____ = Total Cover				
% Bare Ground in Herb Stratum: <u>0</u>				
Remarks: Hydrophytic vegetation present.				<b>Hydrophytic Vegetation Indicators:</b> ___ 1 - Rapid Test for Hydrophytic Vegetation <input checked="" type="checkbox"/> 2 - Dominance Test is >50% ___ 3 - Prevalence Index is ≤3.0 <sup>1</sup> ___ 4 - Morphological Adaptations <sup>1</sup> (Provide supporting data in Remarks or on a separate sheet) ___ Problematic Hydrophytic Vegetation <sup>1</sup> (Explain)  <sup>1</sup> Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No _____				



## WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: Chilocco, OK City/County: Kay Sampling Date: 8-11-2016  
 Applicant/Owner: PNE Wind USA, Inc. State: OK Sampling Point: FS-4  
 Investigator(s): Steve Haddigan, Lindsay McClendon Section, Township, Range: S13 T29N R2E  
 Landform (hillslope, terrace, etc.): Depression Local relief (concave, convex, none): Concave Slope (%): 2%  
 Subregion (LRR): Subregion H Lat: 36.989135 Long: -97.030640 Datum: \_\_\_\_\_  
 Soil Map Unit Name: Bk - Grainola-Ashport Complex NWI classification: \_\_\_\_\_  
 Are climatic / hydrologic conditions on the site typical for this time of year? Yes  No \_\_\_\_\_ (If no, explain in Remarks.)  
 Are Vegetation \_\_\_\_\_, Soil \_\_\_\_\_, or Hydrology \_\_\_\_\_ significantly disturbed? Are "Normal Circumstances" present? Yes  No \_\_\_\_\_  
 Are Vegetation \_\_\_\_\_, Soil \_\_\_\_\_, or Hydrology \_\_\_\_\_ naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No _____ Hydric Soil Present? Yes <input checked="" type="checkbox"/> No _____ Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No _____	<b>Is the Sampled Area within a Wetland?</b> Yes <input checked="" type="checkbox"/> No _____
Remarks: Wetland present in study location.	

### VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status	Dominance Test worksheet:
1. <u>Black Willow</u>	<u>20</u>	<u>Yes</u>	<u>FACW</u>	Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC-): <u>4</u> (A)  Total Number of Dominant Species Across All Strata: <u>4</u> (B)  Percent of Dominant Species That Are OBL, FACW, or FAC: <u>100</u> (A/B)
2. _____	_____	_____	_____	
3. _____	_____	_____	_____	
4. _____	_____	_____	_____	
<u>20</u> = Total Cover				<b>Prevalence Index worksheet:</b> Total % Cover of: _____ Multiply by: _____ OBL species _____ x 1 = _____ FACW species _____ x 2 = _____ FAC species _____ x 3 = _____ FACU species _____ x 4 = _____ UPL species _____ x 5 = _____ Column Totals: _____ (A) _____ (B)  Prevalence Index = B/A = _____
<b>Sapling/Shrub Stratum (Plot size: _____)</b> 1. _____ 2. _____ 3. _____ 4. _____ 5. _____ _____ = Total Cover				
<b>Herb Stratum (Plot size: _____)</b> 1. <u>Cattails</u> 30 Yes OBL 2. <u>Sedges</u> 20 Yes OBL 3. <u>Spike rush</u> 20 Yes OBL 4. _____ 5. _____ 6. _____ 7. _____ 8. _____ 9. _____ 10. _____ _____ = Total Cover				
<b>Woody Vine Stratum (Plot size: _____)</b> 1. _____ 2. _____ _____ = Total Cover				
% Bare Ground in Herb Stratum: <u>0</u>				
Remarks: Hydrophytic vegetation present.				



## WETLAND DETERMINATION DATA FORM – Great Plains Region

Project/Site: Chilocco, Oklahoma City/County: Kay County Sampling Date: 8-11-2016  
 Applicant/Owner: PNE Wind USA, Inc. State: OK Sampling Point: SP #4  
 Investigator(s): Steve Haddigan, Lindsay McClendon Section, Township, Range: S13 T29N R2E  
 Landform (hillslope, terrace, etc.): Upland Prairie Local relief (concave, convex, none): \_\_\_\_\_ Slope (%): 1  
 Subregion (LRR): Subregion H Lat: 36.991146 Long: -97.034081 Datum: \_\_\_\_\_  
 Soil Map Unit Name: Bk - Grainola-Ashport complex NWI classification: \_\_\_\_\_

Are climatic / hydrologic conditions on the site typical for this time of year? Yes  No \_\_\_\_\_ (If no, explain in Remarks.)  
 Are Vegetation \_\_\_\_\_, Soil \_\_\_\_\_, or Hydrology \_\_\_\_\_ significantly disturbed? Are "Normal Circumstances" present? Yes  No \_\_\_\_\_  
 Are Vegetation \_\_\_\_\_, Soil \_\_\_\_\_, or Hydrology \_\_\_\_\_ naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes _____ No <input checked="" type="checkbox"/> Hydric Soil Present? Yes _____ No <input checked="" type="checkbox"/> Wetland Hydrology Present? Yes _____ No <input checked="" type="checkbox"/>	Is the Sampled Area within a Wetland? Yes _____ No <input checked="" type="checkbox"/>
Remarks: No wetland present in study location. Upland grassland.	

### VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status	
1. <u>N/A</u>				<b>Dominance Test worksheet:</b> Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC-): _____ (A)  Total Number of Dominant Species Across All Strata: _____ (B)  Percent of Dominant Species That Are OBL, FACW, or FAC: _____ (A/B)
2. _____				
3. _____				
4. _____				
_____ = Total Cover				
Sapling/Shrub Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status	
1. <u>N/A</u>				<b>Prevalence Index worksheet:</b> Total % Cover of: _____ Multiply by: _____ OBL species <u>0</u> x 1 = _____ FACW species <u>0</u> x 2 = _____ FAC species <u>1</u> x 3 = <u>3</u> FACU species <u>3</u> x 4 = <u>12</u> UPL species <u>1</u> x 5 = <u>5</u> Column Totals: <u>5</u> (A) <u>20</u> (B)  Prevalence Index = B/A = <u>4</u>
2. _____				
3. _____				
4. _____				
5. _____				
_____ = Total Cover				
Herb Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status	
1. <u>Switchgrass</u>		Yes	FAC	<b>Hydrophytic Vegetation Indicators:</b> ___ 1 - Rapid Test for Hydrophytic Vegetation ___ 2 - Dominance Test is >50% ___ 3 - Prevalence Index is ≤3.0 <sup>1</sup> ___ 4 - Morphological Adaptations <sup>1</sup> (Provide supporting data in Remarks or on a separate sheet) ___ Problematic Hydrophytic Vegetation <sup>1</sup> (Explain)
2. <u>Blue stem</u>		Yes	FACU	
3. <u>Milk thistle</u>		No		
4. <u>Indiangrass</u>		Yes	FACU	
5. <u>Milk weed</u>			UPL	
6. <u>Ragweed</u>		Yes	FACU	
7. _____				
8. _____				
9. _____				
10. _____				
_____ = Total Cover				
Woody Vine Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status	
1. _____				<sup>1</sup> Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.
2. _____				
_____ = Total Cover				
% Bare Ground in Herb Stratum _____ = Total Cover				<b>Hydrophytic Vegetation Present?</b> Yes _____ No <input checked="" type="checkbox"/>
Remarks: No hydrophytic vegetation present.				

**SOIL**

Sampling Point: SP #4

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type <sup>1</sup>	Loc <sup>2</sup>		

<sup>1</sup>Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains.      <sup>2</sup>Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Stratified Layers (A5) (LRR F)
- 1 cm Muck (A9) (LRR F, G, H)
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1)
- 2.5 cm Mucky Peat or Peat (S2) (LRR G, H)
- 5 cm Mucky Peat or Peat (S3) (LRR F)
- Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)
- Loamy Mucky Mineral (F1)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)
- High Plains Depressions (F16) (MLRA 72 & 73 of LRR H)

**Indicators for Problematic Hydric Soils<sup>3</sup>:**

- 1 cm Muck (A9) (LRR I, J)
- Coast Prairie Redox (A16) (LRR F, G, H)
- Dark Surface (S7) (LRR G)
- High Plains Depressions (F16) (LRR H outside of MLRA 72 & 73)
- Reduced Vertic (F18)
- Red Parent Material (TF2)
- Very Shallow Dark Surface (TF12)
- Other (Explain in Remarks)

<sup>3</sup>Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: \_\_\_\_\_  
Depth (inches): \_\_\_\_\_

**Hydric Soil Present? Yes \_\_\_\_\_ No**

Remarks:

No hydric soils present.

**HYDROLOGY**

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- Surface Water (A1)
- High Water Table (A2)
- Saturation (A3)
- Water Marks (B1)
- Sediment Deposits (B2)
- Drift Deposits (B3)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Inundation Visible on Aerial Imagery (B7)
- Water-Stained Leaves (B9)
- Salt Crust (B11)
- Aquatic Invertebrates (B13)
- Hydrogen Sulfide Odor (C1)
- Dry-Season Water Table (C2)
- Oxidized Rhizospheres on Living Roots (C3) (where not tilled)
- Presence of Reduced Iron (C4)
- Thin Muck Surface (C7)
- Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- Surface Soil Cracks (B6)
- Sparsely Vegetated Concave Surface (B8)
- Drainage Patterns (B10)
- Oxidized Rhizospheres on Living Roots (C3) (where tilled)
- Crayfish Burrows (C8)
- Saturation Visible on Aerial Imagery (C9)
- Geomorphic Position (D2)
- FAC-Neutral Test (D5)
- Frost-Heave Hummocks (D7) (LRR F)

**Field Observations:**

Surface Water Present? Yes \_\_\_\_\_ No  Depth (inches): \_\_\_\_\_  
 Water Table Present? Yes \_\_\_\_\_ No  Depth (inches): \_\_\_\_\_  
 Saturation Present? Yes \_\_\_\_\_ No  Depth (inches): \_\_\_\_\_  
 (includes capillary fringe)

**Wetland Hydrology Present? Yes \_\_\_\_\_ No**

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No wetland hydrology present.

**WETLAND DETERMINATION DATA FORM – Great Plains Region**

Project/Site: Chilocco, Oklahoma City/County: Kay County Sampling Date: 8-11-2016  
 Applicant/Owner: PNE Wind USA, Inc. State: OK Sampling Point: SP #5  
 Investigator(s): Steve Haddigan, Lindsay McClendon Section, Township, Range: S13 T29N R2E  
 Landform (hillslope, terrace, etc.): \_\_\_\_\_ Local relief (concave, convex, none): \_\_\_\_\_ Slope (%): 2  
 Subregion (LRR): Subregion H Lat: 36.996233 Long: -97.036434 Datum: \_\_\_\_\_  
 Soil Map Unit Name: Bk - Grainola-Ashport complex NWI classification: Freshwater Forested Wetland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes  No \_\_\_\_\_ (If no, explain in Remarks.)  
 Are Vegetation \_\_\_\_\_, Soil \_\_\_\_\_, or Hydrology \_\_\_\_\_ significantly disturbed? Are "Normal Circumstances" present? Yes  No \_\_\_\_\_  
 Are Vegetation \_\_\_\_\_, Soil \_\_\_\_\_, or Hydrology \_\_\_\_\_ naturally problematic? (If needed, explain any answers in Remarks.)

**SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.**

Hydrophytic Vegetation Present? Yes _____ No <input checked="" type="checkbox"/> Hydric Soil Present? Yes _____ No <input checked="" type="checkbox"/> Wetland Hydrology Present? Yes _____ No <input checked="" type="checkbox"/>	<b>Is the Sampled Area within a Wetland?</b> Yes _____ No <input checked="" type="checkbox"/>
Remarks: No wetland present in study location.	

**VEGETATION – Use scientific names of plants.**

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status	
1. <u>Oak</u>	<u>10</u>	<u>No</u>		
2. _____				
3. _____				
4. _____				
_____ = Total Cover				
Sapling/Shrub Stratum (Plot size: _____)				
1. <u>N/A</u>				
2. _____				
3. _____				
4. _____				
5. _____				
_____ = Total Cover				
Herb Stratum (Plot size: _____)				
1. <u>Switchgrass</u>	<u>30</u>	<u>Yes</u>	<u>FAC</u>	
2. <u>Milkthistle</u>	<u>2</u>	<u>No</u>		
3. <u>Ragweed</u>	<u>48</u>	<u>Yes</u>	<u>FACU</u>	
4. <u>Indiangrass</u>	<u>20</u>	<u>Yes</u>	<u>FACU</u>	
5. _____				
6. _____				
7. _____				
8. _____				
9. _____				
10. _____				
_____ = Total Cover				
Woody Vine Stratum (Plot size: _____)				
1. _____				
2. _____				
_____ = Total Cover				
% Bare Ground in Herb Stratum _____				

**Dominance Test worksheet:**  
 Number of Dominant Species That Are OBL, FACW, or FAC (excluding FAC-): \_\_\_\_\_ (A)  
 Total Number of Dominant Species Across All Strata: \_\_\_\_\_ (B)  
 Percent of Dominant Species That Are OBL, FACW, or FAC: \_\_\_\_\_ (A/B)

**Prevalence Index worksheet:**  
 Total % Cover of: \_\_\_\_\_ Multiply by: \_\_\_\_\_  
 OBL species 0 x 1 = \_\_\_\_\_  
 FACW species 0 x 2 = \_\_\_\_\_  
 FAC species 1 x 3 = 3  
 FACU species 2 x 4 = 8  
 UPL species 0 x 5 = \_\_\_\_\_  
 Column Totals: 3 (A) 11 (B)  
 Prevalence Index = B/A = 3.66

**Hydrophytic Vegetation Indicators:**  
 \_\_\_ 1 - Rapid Test for Hydrophytic Vegetation  
 \_\_\_ 2 - Dominance Test is >50%  
 \_\_\_ 3 - Prevalence Index is ≤3.0<sup>1</sup>  
 \_\_\_ 4 - Morphological Adaptations<sup>1</sup> (Provide supporting data in Remarks or on a separate sheet)  
 \_\_\_ Problematic Hydrophytic Vegetation<sup>1</sup> (Explain)

<sup>1</sup>Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes \_\_\_\_\_ No

Remarks:  
 No hydrophytic vegetation present.