

Appendix C: Laboratory Data

Big Bend Dam RW Collector Pipe Replacement
Fort Thompson, SD
Received 6-28-2021
Terracon Project No. 05215156

Boring and Sample Nos.	Depth (ft)	Description	USCS	Sieve % Passing										Atterberg			Required Tests
				1"	3/4"	1/2"	3/8"	#4	#10	#20	#40	#80	#200	LL	PL	PI	
PH21-01 D-3	1.7'-2.0'	2.5Y 4/3 Olive Brown Clayey Sand	SC	100.0	100.0	100.0	100.0	100.0	97.8	89.4	75.9	51.9	15.3				Visual Class, Sieve Hydro
D-4	3.0'-4.1'	10YR 4/2 Dark Grayish Brown Poorly Graded Sand with Clay	SP-SC	100.0	100.0	100.0	100.0	100.0	98.5	76.8	29.4	14.4	7.9				Visual Class, Sieve Hydro
D-6	5.5'-5.9'	2.5Y 5/2 Grayish Brown Silty, Clayey Sand	SC-SM	100.0	100.0	100.0	100.0	100.0	100.0	99.7	95.3	64.6	15.1				Visual Class, Sieve Hydro
D-8	8.0'-9.5'	2.5Y 5/1 Gray Lean Clay with Sand	CL	100.0	100.0	100.0	100.0	100.0	100.0	99.4	97.2	90.8	82.8	30	22	8	Visual Class, Sieve Hydro, AL
D-10	18.0'-19.5'	2.5Y 6/2 Light Brownish Gray Poorly Graded Sand with Clay	SP-SC	100.0	100.0	100.0	100.0	100.0	100.0	97.7	88.5	49.9	5.7				Visual Class, Sieve Hydro
D-12	28.0'-29.5'	2.5Y 4/3 Olive Brown Poorly Graded Sand with Clay	SP-SC	100.0	100.0	100.0	100.0	100.0	100.0	98.6	86.9	43.7	5.8				Visual Class, Sieve Hydro
D-14	38.0'-39.5'	2.5Y 4/3 Olive Brown Poorly Graded Sand with Clay	SP-SC	100.0	100.0	100.0	100.0	100.0	100.0	98.9	85.7	43.3	7.5				Visual Class, Sieve Hydro
PH21-02 D-2	1.0'-2.0'	10YR 4/4 Dark Yellowish Brown Clayey Sand	SC	100.0	100.0	100.0	97.6	95.5	89.3	63.4	27.6	17.6	13.0				Visual Class, Sieve Hydro
D-3	3.0'-4.0'	2.5Y 5/1 Gray Clayey Sand	SC	100.0	100.0	100.0	97.0	95.1	93.8	91.5	83.1	55.2	14.5				Visual Class, Sieve Hydro
D-4	4.0'-4.5'	2.5Y 4/1 Dark Gray Sandy Lean Clay	CL	100.0	100.0	100.0	100.0	100.0	96.2	90.2	84.2	73.9	60.7	32	19	13	Visual Class, Sieve Hydro, AL
D-7	8.6'-9.5'	2.5Y 6/2 Light Brownish Gray Poorly Graded Sand with Clay	SP-SC	100.0	100.0	100.0	100.0	100.0	100.0	99.9	97.6	63.8	9.5				Visual Class, Sieve Hydro
D-9	18.0'-19.5'	2.5Y 5/3 Light Olive Brown Poorly Graded Sand with Clay	SP-SC	100.0	100.0	100.0	100.0	100.0	100.0	98.7	90.4	52.9	6.8				Visual Class, Sieve Hydro
D-10	23.0'-24.5'	2.5Y 5/2 Grayish Brown Poorly Graded Sand	SP	100.0	100.0	100.0	100.0	100.0	99.9	94.9	73.6	19.1	4.1				Visual Class, Sieve Hydro
D-12	33.0'-34.5'	2.5Y 5/2 Grayish Brown Poorly Graded Sand	SP	100.0	100.0	100.0	100.0	100.0	100.0	95.1	51.3	10.8	4.0				Visual Class, Sieve Hydro
PH21-03 D-2	28.0'-29.5'	2.5Y 4/3 Olive Brown Poorly Graded Sand with Silt	SP-SM	100.0	100.0	100.0	100.0	100.0	99.8	95.6	77.7	44.3	6.2				Visual Class, Sieve Hydro
D-3	33.0'-34.5'	2.5Y 4/3 Olive Brown Poorly Graded Sand with Clay	SP-SC	100.0	100.0	100.0	100.0	100.0	100.0	99.6	93.2	45.7	6.0				Visual Class, Sieve Hydro

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Fort Thompson, SD
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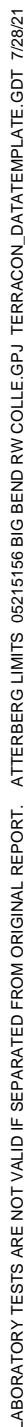
Boring and Sample Nos.	Depth (ft)	Description	USCS	Sieve % Passing										Atterberg			Required Tests
				1"	3/4"	1/2"	3/8"	#4	#10	#20	#40	#80	#200	LL	PL	PI	
D-4	38.0'-39.5'	2.5Y 5/2 Grayish Brown Poorly Graded Sand	SP	100.0	100.0	100.0	100.0	100.0	100.0	96.6	51.9	9.6	3.0				Visual Class, Sieve Hydro
PH21-04 D-1	18.0'-19.5'	2.5Y 6/1 Dark Gray Poorly Graded Sand	SP	100.0	100.0	100.0	100.0	100.0	99.9	97.3	80.1	35.2	2.7				Visual Class, Sieve Hydro
D-3	28.0'-29.5'	2.5Y 6/1 Dark Gray Poorly Graded Sand	SP	100.0	100.0	100.0	100.0	100.0	100.0	98.2	84.2	40.8	4.2				Visual Class, Sieve Hydro
PH21-05 D-1	18.0'-19.5'	2.5Y 5/1 Gray Poorly Graded Sand	SP	100.0	100.0	100.0	100.0	100.0	100.0	98.0	75.2	33.1	3.8				Visual Class, Sieve Hydro
D-2	23.0'-24.5'	2.5Y 5/1 Gray Poorly Graded Sand	SP	100.0	100.0	100.0	100.0	100.0	100.0	98.4	68.2	7.9	2.4				Visual Class, Sieve Hydro
D-11	63.0'-64.5'	Gley 1 4/N Dark Gray Sandy Silt	ML	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.9	99.0	53.1				Visual Class, Sieve Hydro
D-13	74.5'-76.0'	Gley 1 5/N Gray Poorly Graded Sand with Silt	SP-SM	100.0	100.0	100.0	100.0	99.1	97.8	94.2	78.5	26.3	10.2				Visual Class, MA
D-14	78.0'-79.5'	2.5Y 5/1 Gray Silty Sand	SM	100.0	100.0	100.0	100.0	100.0	99.4	97.2	76.9	39.8	17.3				Visual Class, Sieve Hydro
D-16	84.1'-84.5'	2.5Y 4/1 Dark Gray Well Graded Sand with Silt and Gravel	SW-SM	100.0	100.0	94.3	91.8	83.5	72.4	53.0	32.7	14.0	7.0				Visual Class, MA
PH21-06B D-3	4.0'-4.5'	2.5Y 5/1 Gray Sandy Lean Clay	CL	100.0	100.0	100.0	100.0	99.7	98.5	96.0	90.8	75.4	60.2	26	18	8	Visual Class, Sieve Hydro, AL
D-5	8.0'-9.5'	2.5Y 5/2 Grayish Brown Silty Sand	SM	100.0	100.0	100.0	100.0	100.0	100.0	99.0	86.2	44.8	14.5				Visual Class, Sieve Hydro
D-6	13.0'-14.5'	2.5Y 5/2 Grayish Brown Poorly Graded Sand with Clay	SP-SC	100.0	100.0	100.0	100.0	100.0	100.0	99.2	87.2	44.6	8.1				Visual Class, Sieve Hydro
PH21-06 D-2	23.0'-24.5'	2.5Y 4/3 Olive Brown Poorly Graded Sand with Clay	SP-SC	100.0	100.0	100.0	100.0	100.0	100.0	99.5	90.4	51.5	7.9				Visual Class, Sieve Hydro
D-9	48.0'-49.5'	2.5Y 5/1 Gray Sandy Silt	ML	100.0	100.0	100.0	100.0	100.0	100.0	99.9	99.2	95.7	64.4				Visual Class, Sieve Hydro
D-10	53.0'-53.7'	2.5Y 3/1 Very Dark Gray Silty Sand	SM	100.0	100.0	100.0	100.0	98.9	98.5	95.8	88.8	44.7	19.6				Visual Class, Sieve Hydro
D-11	53.7'-54.5'	2.5Y 3/1 Very Dark Gray Sandy Silt	ML	100.0	100.0	100.0	100.0	100.0	99.9	99.8	99.4	96.6	51.3				Visual Class, Sieve Hydro

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Boring and Sample Nos.	Depth (ft)	Description	USCS	Sieve % Passing										Atterberg			Required Tests
				1"	3/4"	1/2"	3/8"	#4	#10	#20	#40	#80	#200	LL	PL	PI	
D-12	58.0'-60.0'	2.5Y 3/1 Very Dark Gray Poorly Graded Sand	SP	100.0	100.0	100.0	100.0	100.0	100.0	99.6	91.6	19.9	4.8				Visual Class, Sieve Hydro
D-13	63.5'-65.0'	2.5Y 3/2 Very Dark Grayish Brown Clayey Sand	SC	100.0	100.0	100.0	100.0	99.5	99.3	98.8	94.9	59.8	12.6				Visual Class, Sieve Hydro
D-15	69.0'-69.5'	10YR 5/2 Grayish Brown Well Graded Sand with Silt	SW-SM	100.0	100.0	100.0	98.9	91.0	82.5	72.3	36.3	12.1	8.3				Visual Class, MA
D-16	73.0'-73.8'	10YR 5/2 Grayish Brown Well Graded Sand with Clay	SW-SC	100.0	100.0	93.6	93.6	88.6	76.4	39.4	17.0	11.4	9.3				Visual Class, Sieve Hydro
D-17	73.8'-74.5'	2.5Y 4/2 Dark Grayish Brown Silty Sand	SM	100.0	100.0	96.0	96.0	95.1	94.6	93.9	87.5	48.7	15.2				Visual Class, Sieve Hydro
D-18	78.0'-79.5'	2.5Y 5/2 Grayish Brown Poorly Graded Sand with Silt	SP-SM	100.0	100.0	100.0	100.0	99.8	98.9	90.9	61.3	25.4	7.7				Visual Class, MA
BH20-01 D-7	9.0'-10.0'	2.5Y 6/2 Light Brownish Gray Poorly Graded Sand with Clay	SP-SC	100.0	100.0	100.0	100.0	100.0	100.0	91.6	63.9	31.1	5.8				Visual Class, Sieve Hydro
BH20-02 D-5	8.0'-10.0'	2.5Y 6/2 Light Brownish Gray Silty Sand	SM	100.0	100.0	100.0	100.0	100.0	100.0	99.4	90.2	59.0	16.0				Visual Class, Sieve Hydro
BH20-03 D-4	3.0'-40'	10YR 4/4 Dark Yellowish Brown Clayey Sand	SC	100.0	100.0	100.0	98.5	93.8	86.1	62.4	36.0	25.1	17.3				Visual Class, Sieve Hydro
BH20-04 D-5	6.5'-8.5'	2.5Y 6/3 Light Yellowish Brown Silty Sand	SM	100.0	100.0	100.0	100.0	100.0	99.6	95.9	87.1	74.0	45.9				Visual Class, Sieve Hydro
BH20-06 D-8	13.0'-14.5'	2.5Y 6/3 Light Yellowish Brown Silty Sand	SM	100.0	100.0	100.0	100.0	100.0	99.5	97.3	92.7	59.3	24.1				Visual Class, Sieve Hydro

Terracon

ASTM D4318

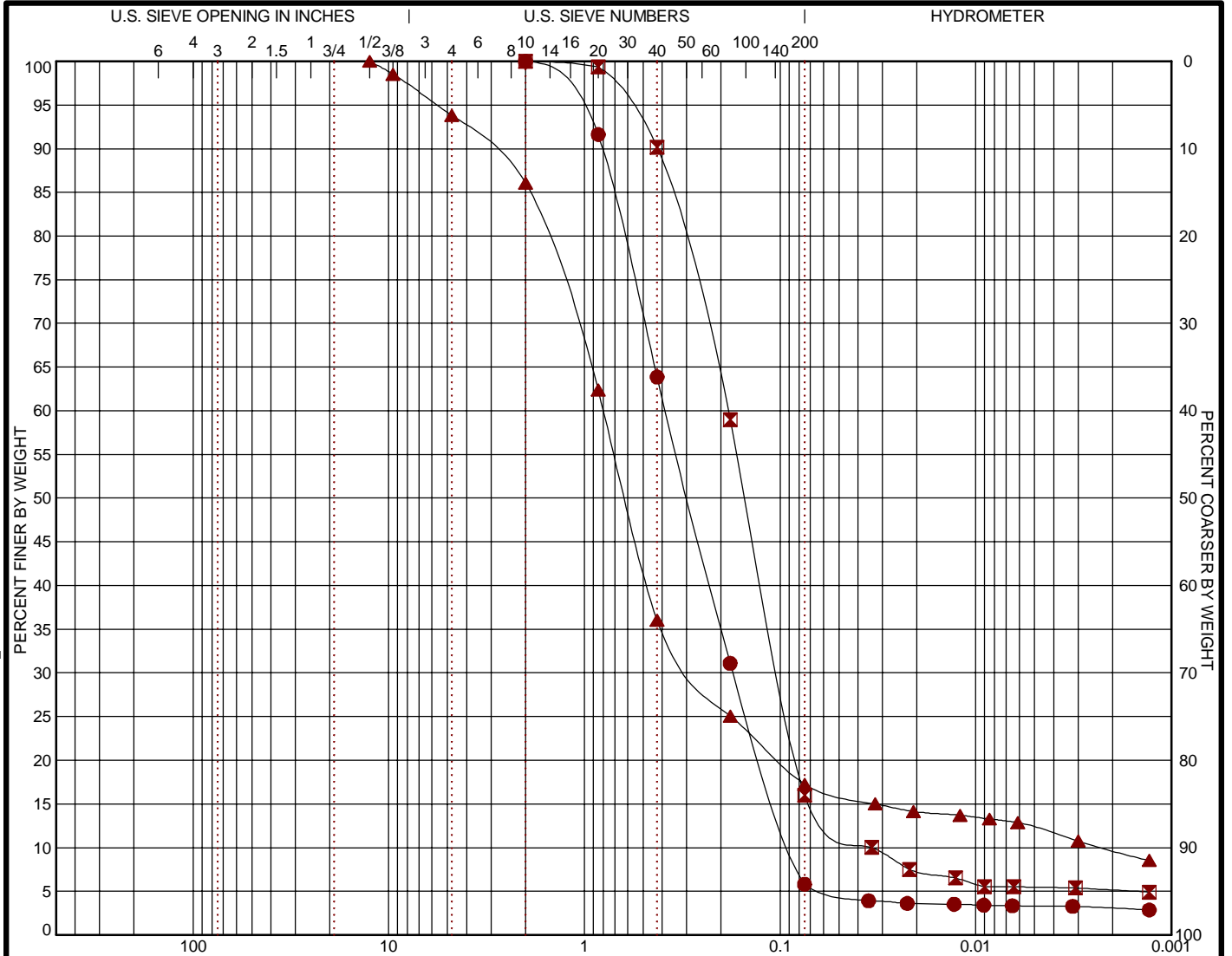


LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. ATTERBERG LIMITS 05215156 BIG BEND RW COLLE.GPJ TERRACON DATATEMPLATE.GDT 7/28/21

EXHIBIT: B-1

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	BH20-01	9 - 10	0.0	0.0	94.2	2.5		3.3	SP-SC
⊠	BH20-02	8 - 10	0.0	0.0	84.0	10.6		5.5	SM
▲	BH20-03	3 - 4	0.0	6.2	76.6	5.0		12.3	SC

	GRAIN SIZE		
	●	⊠	▲
D ₆₀	0.384	0.185	0.798
D ₃₀	0.173	0.1	0.265
D ₁₀	0.087	0.034	0.002
	COEFFICIENTS		
	C _c	C _u	
	0.90	1.58	38.79
	4.43	5.45	351.77

Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
#10	100.0	#10	100.0	1/2"	100.0
#20	91.62	#20	99.36	3/8"	98.53
#40	63.86	#40	90.16	#4	93.82
#80	31.09	#80	58.98	#10	86.08
#200	5.8	#200	16.03	#20	62.39
				#40	36.02
				#80	25.06
				#200	17.26

SOIL DESCRIPTION	
●	Poorly Graded Sand with Clay (SP-SC)
⊠	Silty Sand (SM)
▲	Clayey Sand (SC)
REMARKS	
●	2.5Y 6/2 Light Grayish Brown
⊠	2.5Y 6/2 Light Grayish Brown
▲	10YR 4/4 Dark Yellowish Brown

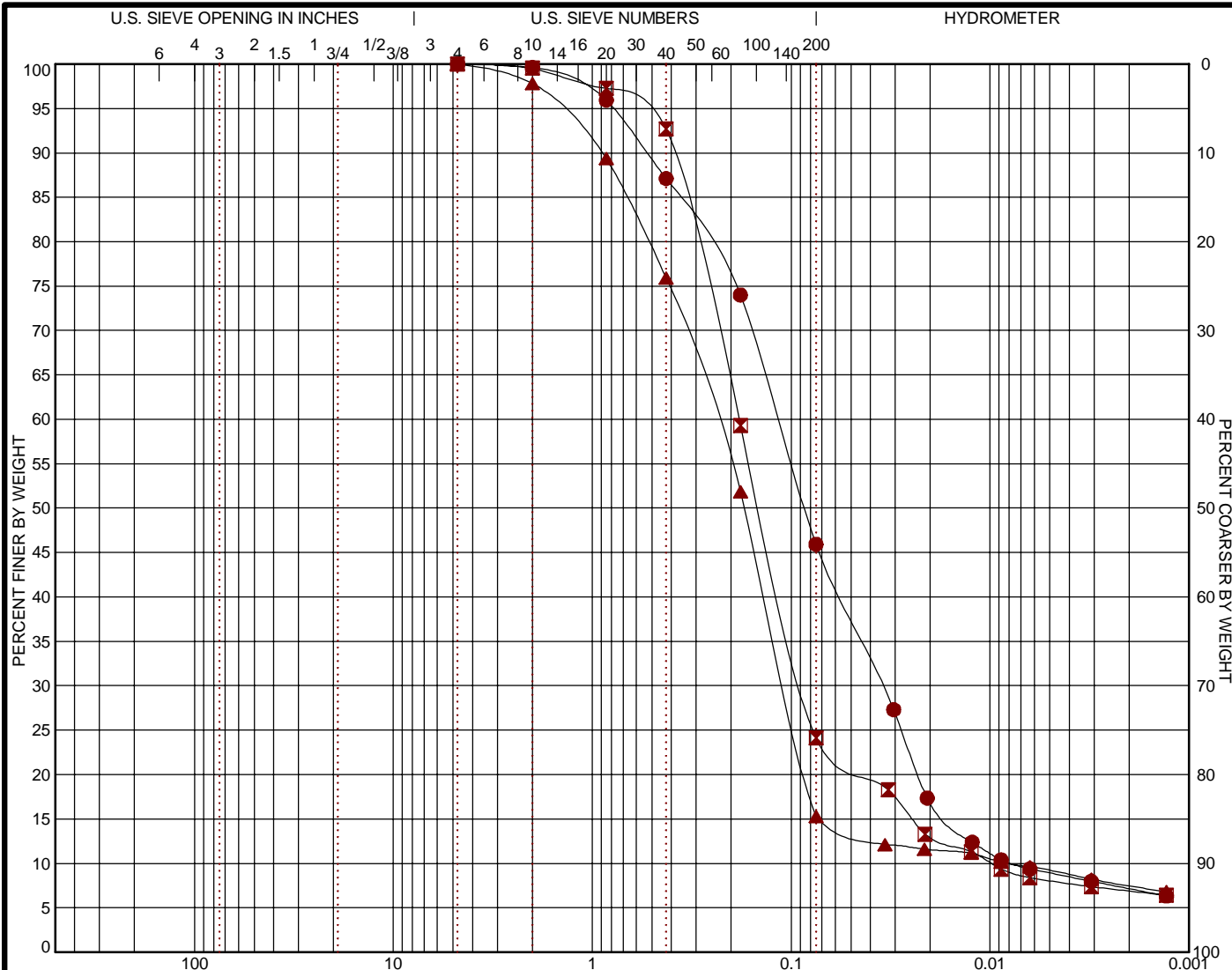
PROJECT: Big Bend RW Collector Pipe Replacement FFP Pilot Hole
 SITE: BIA Rd 4 and Native American Scenic Byway
 Fort Thompson, SD



PROJECT NUMBER: 05215156
 CLIENT: US Army Corps of Engineers (USACE)
 Omaha, NE
 EXHIBIT: B-1

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	BH20-04	6.5 - 8.5	0.0	0.0	54.1	37.0		8.9	SM
⊠	BH20-06	13 - 14.5	0.0	0.0	75.9	16.1		8.1	SM
▲	PH21-01	1.7 - 2	0.0	0.0	84.7	6.1		9.2	SC

	GRAIN SIZE		
	●	⊠	▲
D ₆₀	0.116	0.183	0.241
D ₃₀	0.035	0.087	0.107
D ₁₀	0.008	0.01	0.008
	COEFFICIENTS		
	C _c	C _u	
C _c	1.34	4.18	5.88
C _u	15.05	18.60	29.93

Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
#4	100.0	#4	100.0	#4	100.0
#10	99.6	#10	99.53	#10	97.81
#20	95.93	#20	97.26	#20	89.36
#40	87.11	#40	92.68	#40	75.93
#80	73.99	#80	59.33	#80	51.86
#200	45.92	#200	24.12	#200	15.26

SOIL DESCRIPTION

● Silty Sand (SM)

⊠ Silty Sand (SM)

▲ Clayey Sand (SC)

REMARKS

● 2.5Y 6/3 Light Yellowish Brown

⊠ 2.5Y 6/3 Light Yellowish Brown

▲ 2.5Y 4/3 Olive Brown

PROJECT: Big Bend RW Collector Pipe Replacement FFP Pilot Hole

SITE: BIA Rd 4 and Native American Scenic Byway
Fort Thompson, SD



PROJECT NUMBER: 05215156

CLIENT: US Army Corps of Engineers (USACE)
Omaha, NE

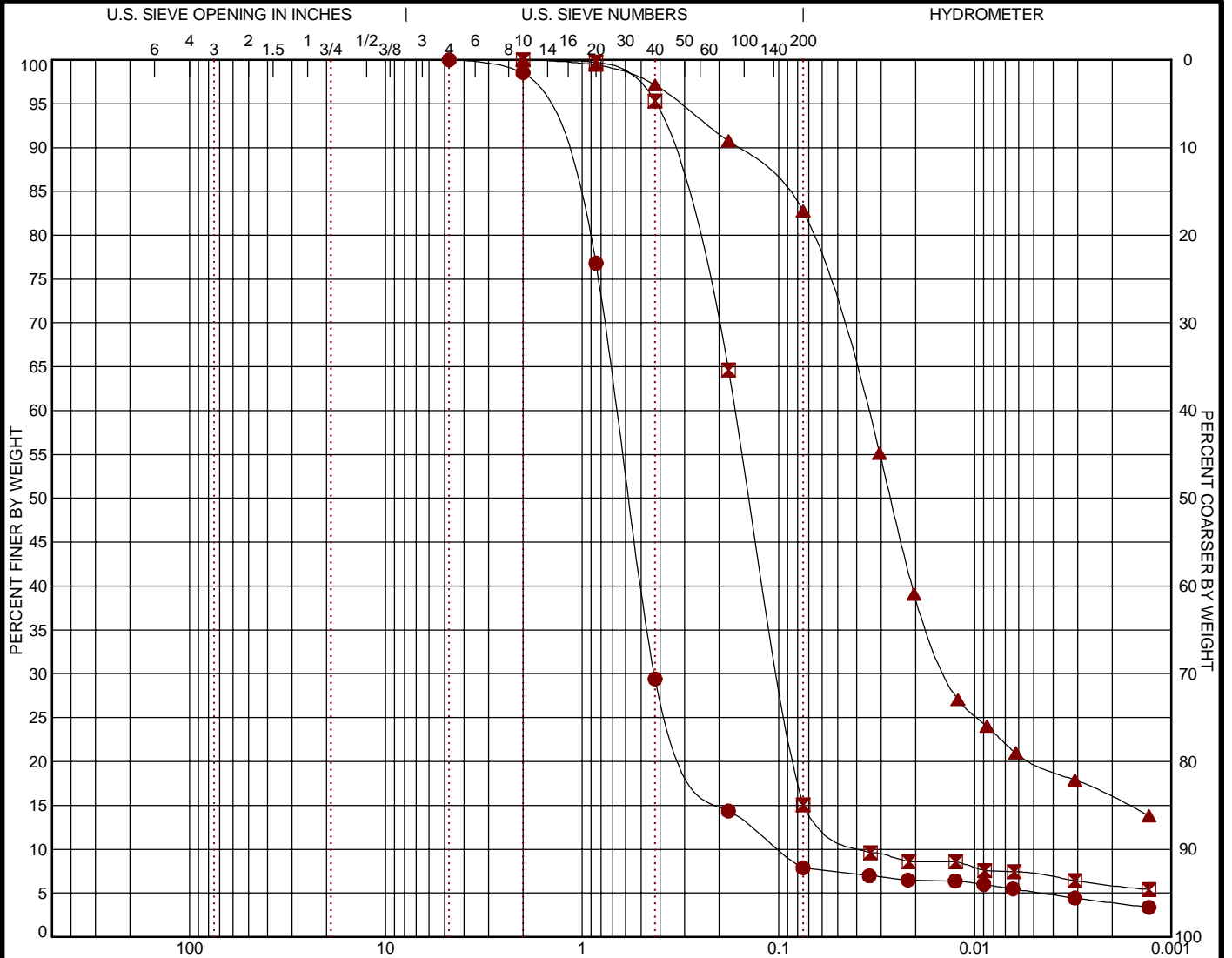
EXHIBIT: B-2

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 05215156 BIG BEND RW COLLE.GPJ TERRACON_DATATEMPLATE.GDT 7/28/21

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136

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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	PH21-01	3 - 4.1	0.0	0.0	92.1	2.8		5.1	SP-SC
×	PH21-01	5.5 - 5.9	0.0	0.0	84.9	7.9		7.1	SC-SM
▲	PH21-01	8 - 9.5	0.0	0.0	17.2	62.7		20.0	CL

	GRAIN SIZE		
	●	⊠	▲
D ₆₀	0.665	0.166	0.036
D ₃₀	0.429	0.098	0.014
D ₁₀	0.1	0.036	
	COEFFICIENTS		
C _C	2.77	1.59	
C _U	6.65	4.60	

Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
#4	100.0	#10	100.0	#10	100.0
#10	98.54	#20	99.72	#20	99.4
#20	76.81	#40	95.29	#40	97.15
#40	29.41	#80	64.63	#80	90.76
#80	14.36	#200	15.06	#200	82.75
#200	7.88				

SOIL DESCRIPTION
● Poorly Graded Sand with Clay (SP-SC)
×
▲ Lean Clay with Sand (CL)
REMARKS
● 10YR 4/2 Dark Grayish Brown
×
▲ 2.5Y 5/1 Gray

PROJECT: Big Bend RW Collector Pipe
Replacement FFP Pilot Hole

SITE: BIA Rd 4 and Native American Scenic
Byway
Fort Thompson, SD



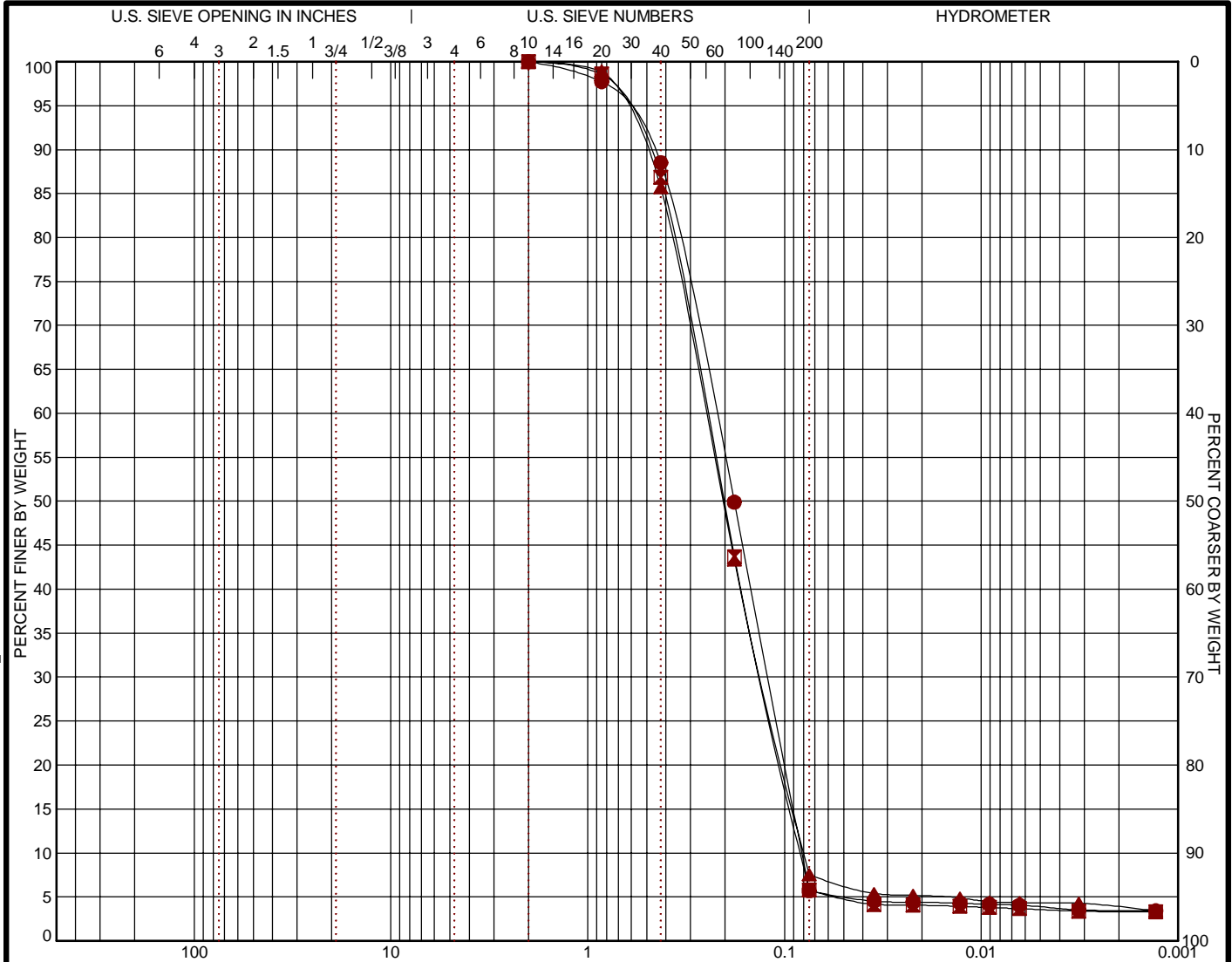
PROJECT NUMBER: 05215156

CLIENT: US Army Corps of Engineers (USACE)
Omaha, NE

EXHIBIT: B-3

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	PH21-01	18 - 19.5	0.0	0.0	94.3	1.8		3.9	SP-SC
⊠	PH21-01	28 - 28.5	0.0	0.0	94.2	2.2		3.6	SP-SC
▲	PH21-01	38 - 39.5	0.0	0.0	92.5	3.2		4.3	SP-SC

	GRAIN SIZE		
	●	⊠	▲
D ₆₀	0.225	0.249	0.253
D ₃₀	0.121	0.131	0.13
D ₁₀	0.082	0.083	0.08
	COEFFICIENTS		
	●	⊠	▲
C _c	0.80	0.84	0.84
C _u	2.76	3.01	3.17

Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
#10	100.0	#10	100.0	#10	100.0
#20	97.73	#20	98.6	#20	98.94
#40	88.52	#40	86.85	#40	85.67
#80	49.9	#80	43.71	#80	43.3
#200	5.7	#200	5.76	#200	7.51

SOIL DESCRIPTION
● Poorly Graded Sand with Clay (SP-SC)
⊠ Poorly Graded Sand with Clay (SP-SC)
▲ Poorly Graded Sand with Clay (SP-SC)
REMARKS
● 2.5Y 6/2 Light Brownish Gray
⊠ 2.5Y 4/3 Olive Brown
▲ 2.5Y 4/3 Olive Brown

PROJECT: Big Bend RW Collector Pipe Replacement FFP Pilot Hole
 SITE: BIA Rd 4 and Native American Scenic Byway
 Fort Thompson, SD

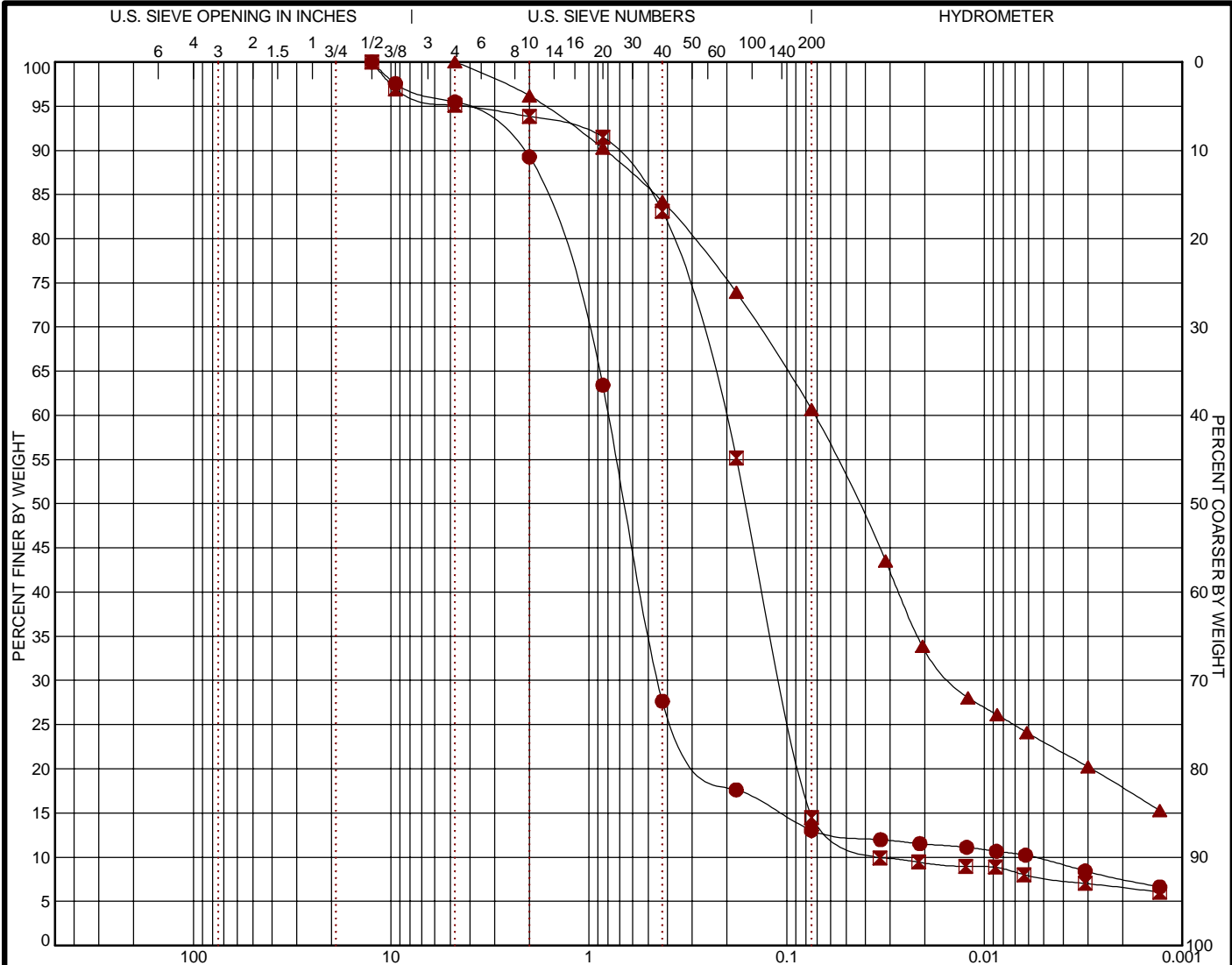


PROJECT NUMBER: 05215156
 CLIENT: US Army Corps of Engineers (USACE)
 Omaha, NE
 EXHIBIT: B-4

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GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	PH21-02	1 - 2	0.0	4.5	82.5	3.4		9.7	SC
☒	PH21-02	3 - 4	0.0	4.9	80.6	6.8		7.7	SC
▲	PH21-02	4 - 4.5	0.0	0.0	39.3	37.7		23.0	CL

	GRAIN SIZE		
	●	☒	▲
D ₆₀	0.796	0.209	0.072
D ₃₀	0.445	0.105	0.014
D ₁₀	0.006	0.034	
COEFFICIENTS			
C _c	43.67	1.53	
C _u	139.67	6.07	

Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
1/2"	100.0	1/2"	100.0	#4	100.0
3/8"	97.57	3/8"	96.96	#10	96.17
#4	95.49	#4	95.1	#20	90.23
#10	89.25	#10	93.83	#40	84.23
#20	63.42	#20	91.51	#80	73.93
#40	27.64	#40	83.1	#200	60.68
#80	17.62	#80	55.17		
#200	13.03	#200	14.48		

SOIL DESCRIPTION	
●	Clayey Sand (SC)
☒	Clayey Sand (SC)
▲	Sandy Lean Clay (CL)

REMARKS	
●	10YR 4/4 Dark Yellowish Brown
☒	2.5Y 5/1 Gray
▲	2.5Y 4/1 Dark Gray

PROJECT: Big Bend RW Collector Pipe Replacement FFP Pilot Hole
 SITE: BIA Rd 4 and Native American Scenic Byway
 Fort Thompson, SD



PROJECT NUMBER: 05215156

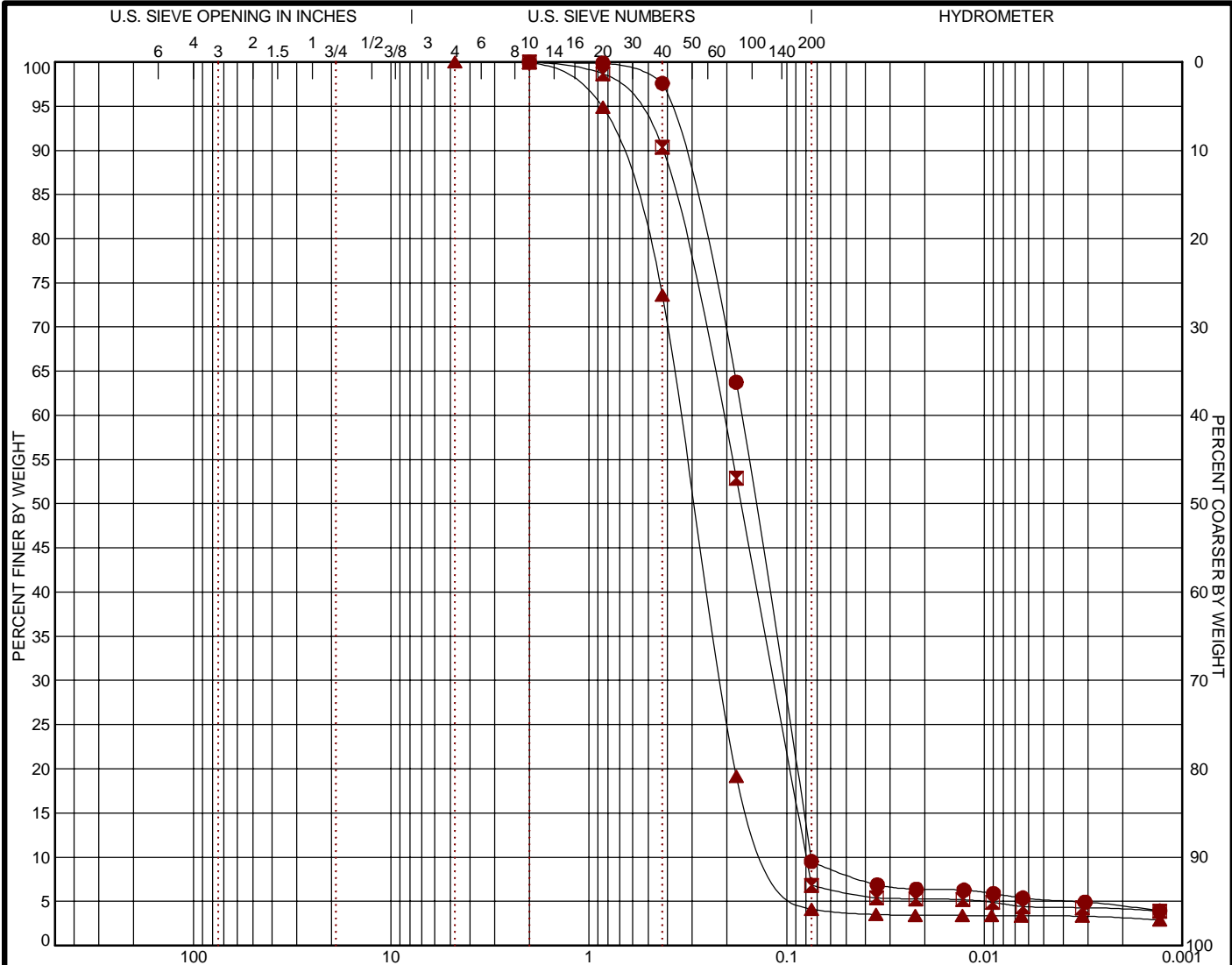
CLIENT: US Army Corps of Engineers (USACE)
 Omaha, NE

EXHIBIT: B-5

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GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	PH21-02	8.6 - 9.5	0.0	0.0	90.5	4.3		5.2	SP-SC
⊠	PH21-02	18 - 19.5	0.0	0.0	93.2	2.5		4.4	SP-SC
▲	PH21-02	23 - 24.5	0.0	0.0	95.9	0.8		3.3	SP

	GRAIN SIZE		
	●	⊠	▲
D ₆₀	0.169	0.212	0.343
D ₃₀	0.104	0.117	0.214
D ₁₀	0.076	0.08	0.106
	COEFFICIENTS		
	C _c	C _u	
C _c	0.85	0.80	1.26
C _u	2.24	2.66	3.24

Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
#10	100.0	#10	100.0	#4	100.0
#20	99.88	#20	98.67	#10	99.89
#40	97.59	#40	90.35	#20	94.88
#80	63.76	#80	52.86	#40	73.63
#200	9.51	#200	6.8	#80	19.12
				#200	4.11

SOIL DESCRIPTION

- Poorly Graded Sand with Clay (SP-SC)
- ⊠ Poorly Graded Sand with Clay (SP-SC)
- ▲ Poorly Graded Sand (SP)

REMARKS

- 2.5Y 6/2 Light Brownish Gray
- ⊠ 2.5Y 5/3 Light Olive Brown
- ▲ 2.5Y 5/2 Grayish Brown

PROJECT: Big Bend RW Collector Pipe
Replacement FFP Pilot Hole

SITE: BIA Rd 4 and Native American Scenic
Byway
Fort Thompson, SD



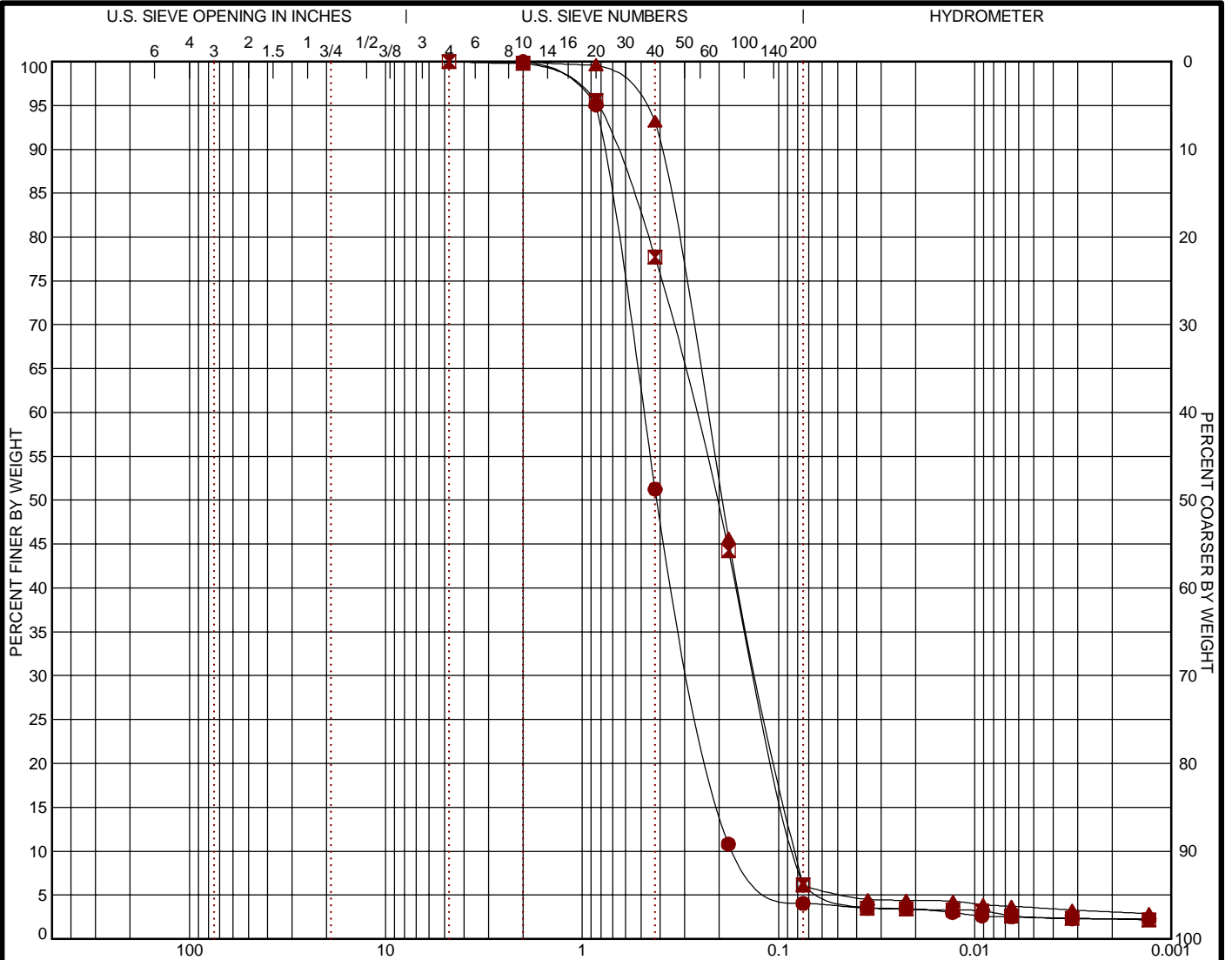
PROJECT NUMBER: 05215156

CLIENT: US Army Corps of Engineers (USACE)
Omaha, NE

EXHIBIT: B-6

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY			
	coarse	fine	coarse	medium	fine				

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	PH21-02	33 - 34.5	0.0	0.0	96.0	1.6		2.4	SP
⊠	PH21-03	28 - 29.5	0.0	0.0	93.8	3.6		2.5	SP-SM
▲	PH21-03	33 - 34.5	0.0	0.0	94.0	2.5		3.6	SP-SC

GRAIN SIZE			
	●	⊠	▲
D ₆₀	0.488	0.27	0.233
D ₃₀	0.271	0.13	0.127
D ₁₀	0.162	0.082	0.082
COEFFICIENTS			
C _c	0.92	0.76	0.85
C _u	3.01	3.29	2.85

Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
#10	100.0	#4	100.0	#10	100.0
#20	95.06	#10	99.79	#20	99.63
#40	51.26	#20	95.57	#40	93.2
#80	10.8	#40	77.71	#80	45.66
#200	4.04	#80	44.26	#200	6.03
		#200	6.15		

SOIL DESCRIPTION	
●	Poorly Graded Sand (SP)
⊠	Poorly Graded Sand with Silt (SP-SM)
▲	Poorly Graded Sand with Clay (SP-SC)
REMARKS	
●	2.5Y 5/2 Grayish Brown
⊠	2.5Y 4/3 Olive Brown
▲	2.5Y 4/3 Olive Brown

PROJECT: Big Bend RW Collector Pipe Replacement FFP Pilot Hole

SITE: BIA Rd 4 and Native American Scenic Byway
Fort Thompson, SD



PROJECT NUMBER: 05215156

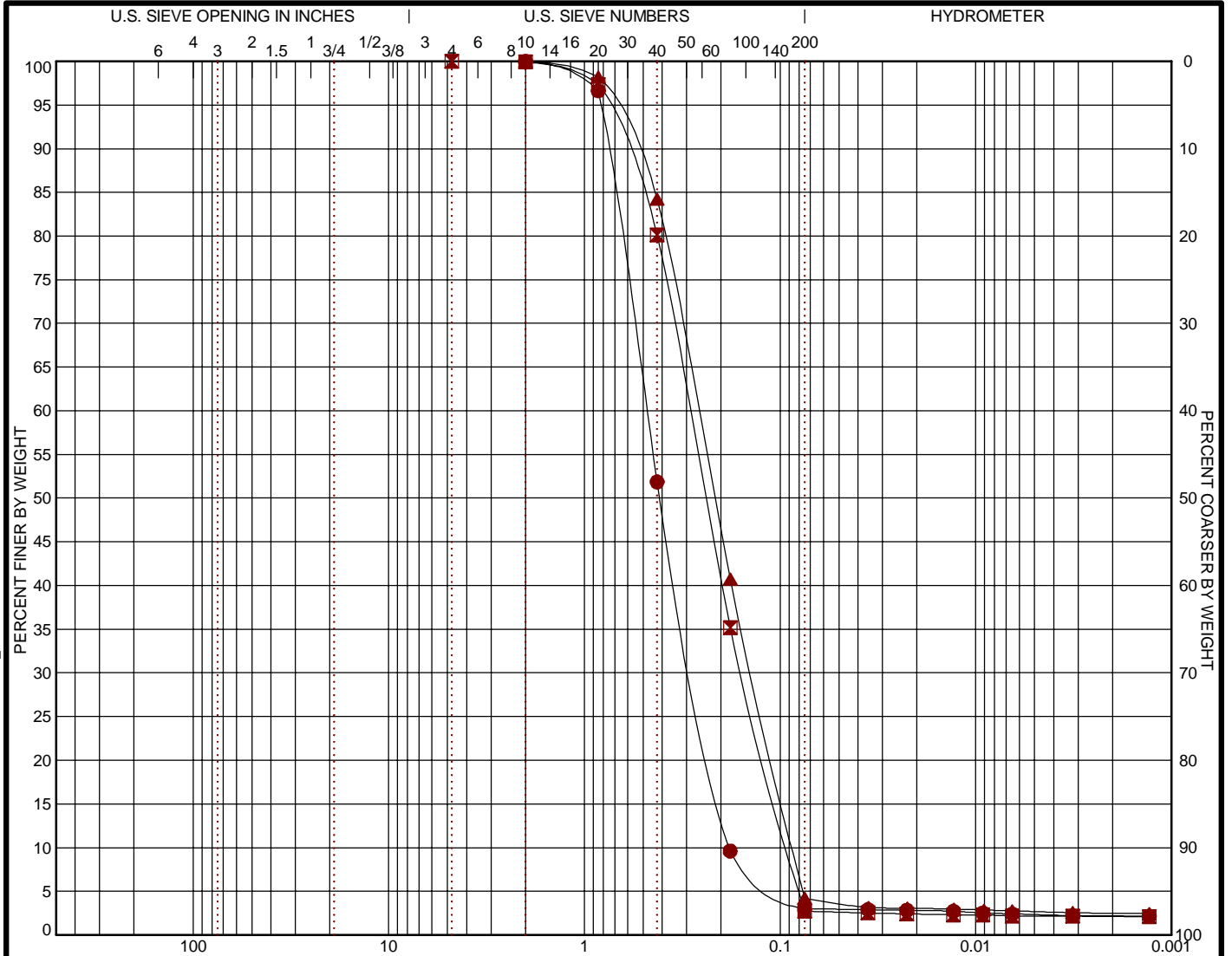
CLIENT: US Army Corps of Engineers (USACE)
Omaha, NE

EXHIBIT: B-7

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 05215156 BIG BEND RW COLLE.GPJ TERRACON_DATATEMPLATE.GDT 7/28/21

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	PH21-03	38 - 39.5	0.0	0.0	97.0	0.6		2.3	SP
☒	PH21-04	18 - 19.5	0.0	0.0	97.3	0.6		2.2	SP
▲	PH21-04	28 - 29.5	0.0	0.0	95.8	1.5		2.7	SP

	GRAIN SIZE		
	●	☒	▲
D ₆₀	0.482	0.289	0.263
D ₃₀	0.273	0.156	0.139
D ₁₀	0.181	0.091	0.086
	COEFFICIENTS		
	C _c	C _u	
C _c	0.85	0.93	0.85
C _u	2.66	3.17	3.06

Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
#10	100.0	#4	100.0	#10	100.0
#20	96.62	#10	99.92	#20	98.17
#40	51.85	#20	97.32	#40	84.23
#80	9.6	#40	80.1	#80	40.75
#200	2.97	#80	35.19	#200	4.21
		#200	2.74		

SOIL DESCRIPTION	
●	Poorly Graded Sand (SP)
☒	Poorly Graded Sand (SP)
▲	Poorly Graded Sand (SP)
REMARKS	
●	10YR 5/2 Grayish Brown
☒	2.5Y 6/1 Gray
▲	2.5Y 6/1 Gray

PROJECT: Big Bend RW Collector Pipe Replacement FFP Pilot Hole
 SITE: BIA Rd 4 and Native American Scenic Byway
 Fort Thompson, SD



PROJECT NUMBER: 05215156

CLIENT: US Army Corps of Engineers (USACE)
 Omaha, NE

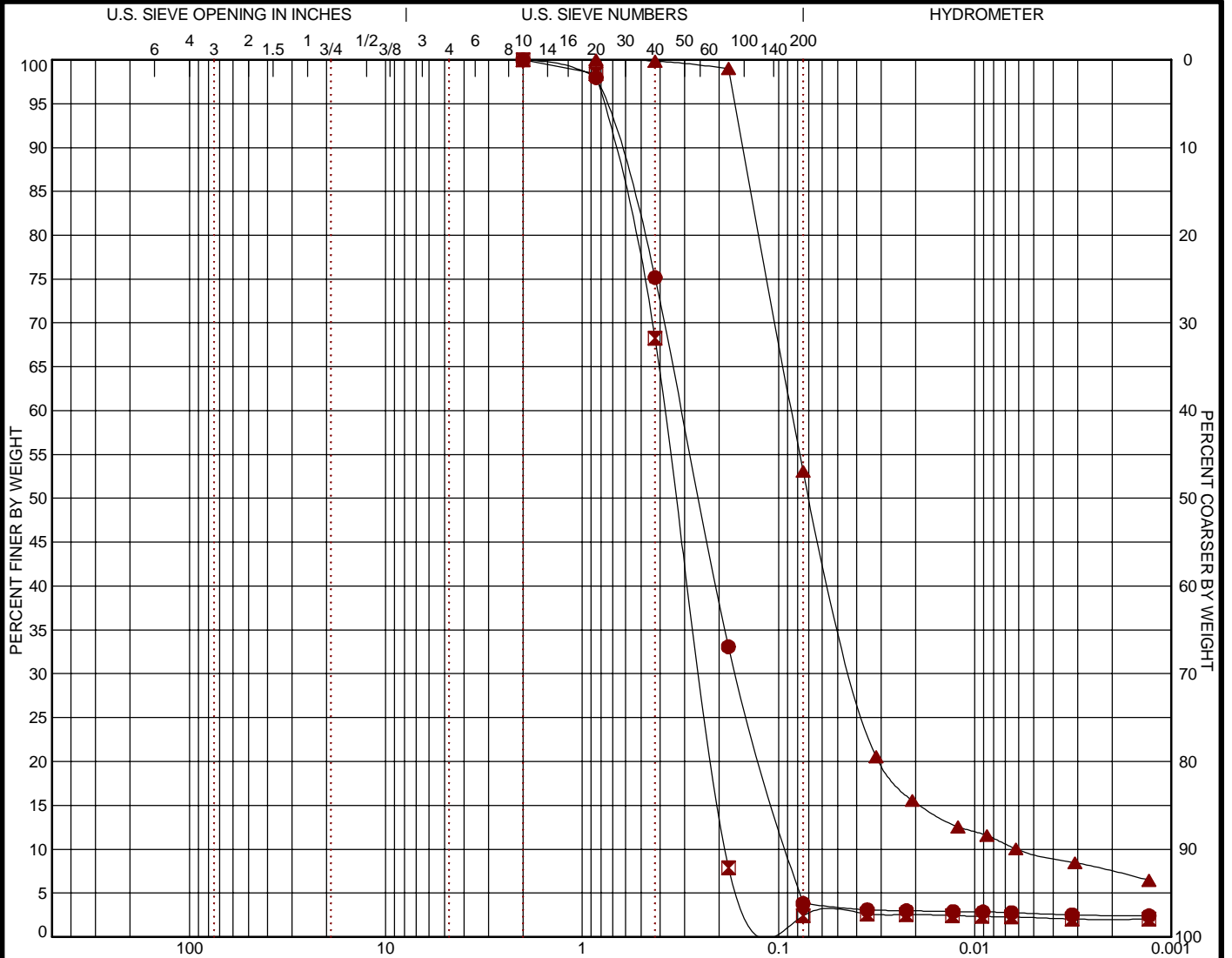
EXHIBIT: B-8

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 05215156 BIG BEND RW COLLE.GPJ TERRACON_DATATEMPLATE.GDT 7/28/21

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 05215156 BIG BEND RW COLLE.GPJ TERRACON_DATATEMPLATE.GDT 7/28/21



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	PH21-05	18 - 19.5	0.0	0.0	96.2	1.2		2.7	SP
⊠	PH21-05	23 - 24.5	0.0	0.0	97.6	0.2		2.2	SP
▲	PH21-05	63 - 64.5	0.0	0.0	46.9	43.5		9.5	ML

	GRAIN SIZE		
	●	⊠	▲
D ₆₀	0.312	0.378	0.086
D ₃₀	0.164	0.247	0.041
D ₁₀	0.09	0.185	0.006
	COEFFICIENTS		
	C _c	C _u	
	0.96	0.87	3.20
	3.46	2.04	14.01

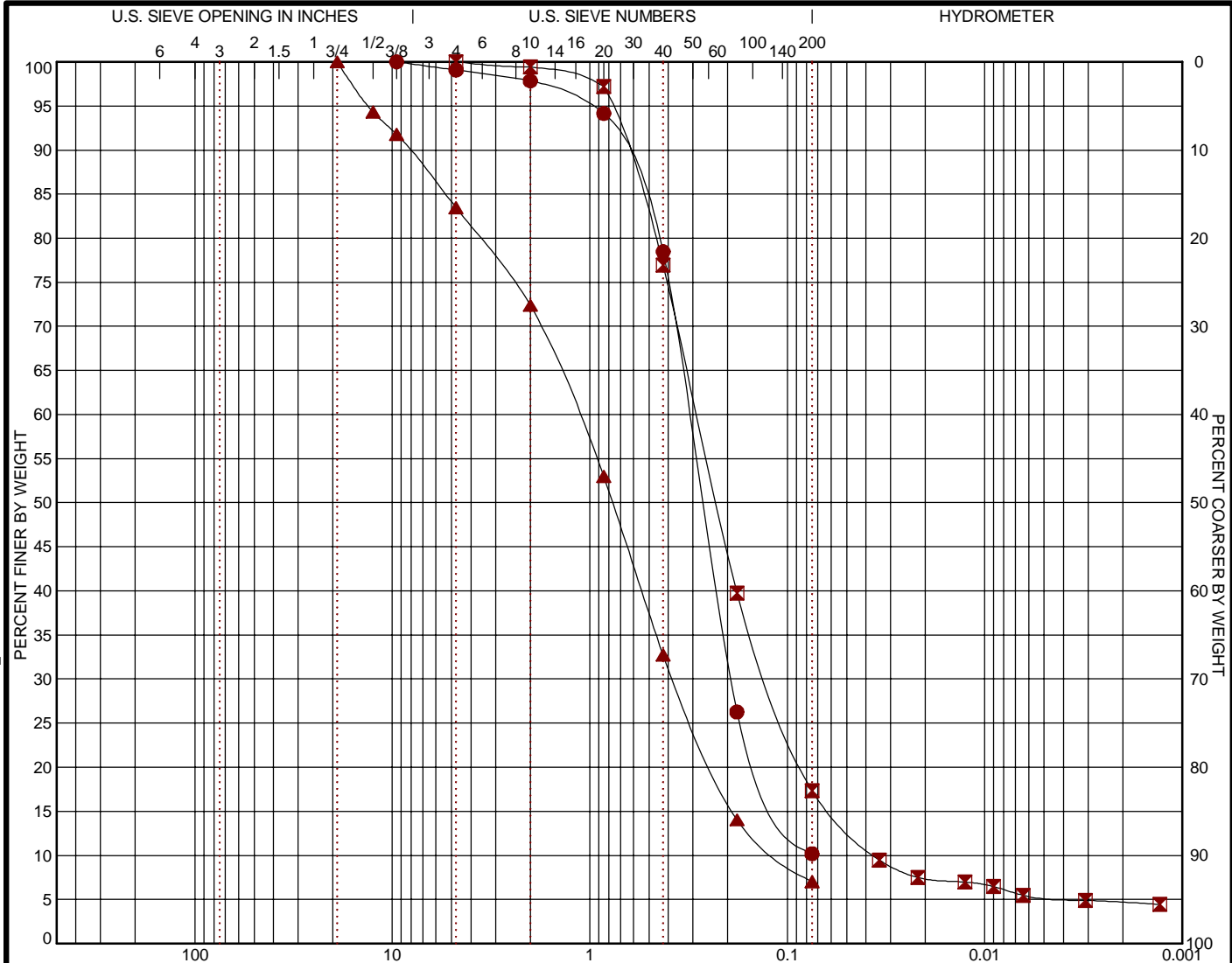
Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
#10	100.0	#10	100.0	#20	100.0
#20	97.96	#20	98.43	#40	99.86
#40	75.17	#40	68.23	#80	99.01
#80	33.08	#80	7.89	#200	53.08
#200	3.82	#200	2.41		

SOIL DESCRIPTION
● Poorly Graded Sand (SP)
⊠ Poorly Graded Sand (SP)
▲ Sandy Silt (ML)
REMARKS
● 2.5Y 5/1 Gray
⊠ 2.5Y 5/1 Gray
▲ Gley 1 4/N Dark Gray

PROJECT: Big Bend RW Collector Pipe Replacement FFP Pilot Hole	<p>15080 A Cir Omaha, NE</p>	PROJECT NUMBER: 05215156
SITE: BIA Rd 4 and Native American Scenic Byway Fort Thompson, SD		CLIENT: US Army Corps of Engineers (USACE) Omaha, NE
		EXHIBIT: B-9

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	PH21-05	74.5 - 76	0.0	0.9	88.9		10.2		SP-SM
⊠	PH21-05	78 - 79.5	0.0	0.0	82.7	12.1		5.3	SM
▲	PH21-05	84.1 - 84.5	0.0	16.5	76.4		7.0		SW-SM

	GRAIN SIZE		
	●	⊠	▲
D ₆₀	0.314	0.287	1.158
D ₃₀	0.191	0.123	0.375
D ₁₀		0.036	0.109
	COEFFICIENTS		
	C _c	C _u	
C _c	1.57	1.46	1.12
C _u	4.22	7.98	10.63

Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
3/8"	100.0	#4	100.0	3/4"	100.0
#4	99.08	#10	99.42	1/2"	94.3
#10	97.84	#20	97.18	3/8"	91.79
#20	94.15	#40	76.94	#4	83.46
#40	78.46	#80	39.77	#10	72.38
#80	26.26	#200	17.34	#20	53.0
#200	10.19			#40	32.71
				#80	14.03
				#200	7.01

SOIL DESCRIPTION	
●	Poorly Graded Sand with Silt (SP-SM)
⊠	Silty Sand (SM)
▲	Well Graded Sand with Silt and Gravel (SW-SM)
REMARKS	
●	Gley 1 5/N Gray
⊠	2.5Y 5/1 Gray
▲	2.5Y 4/1 Dark Gray

PROJECT: Big Bend RW Collector Pipe Replacement FFP Pilot Hole
 SITE: BIA Rd 4 and Native American Scenic Byway
 Fort Thompson, SD



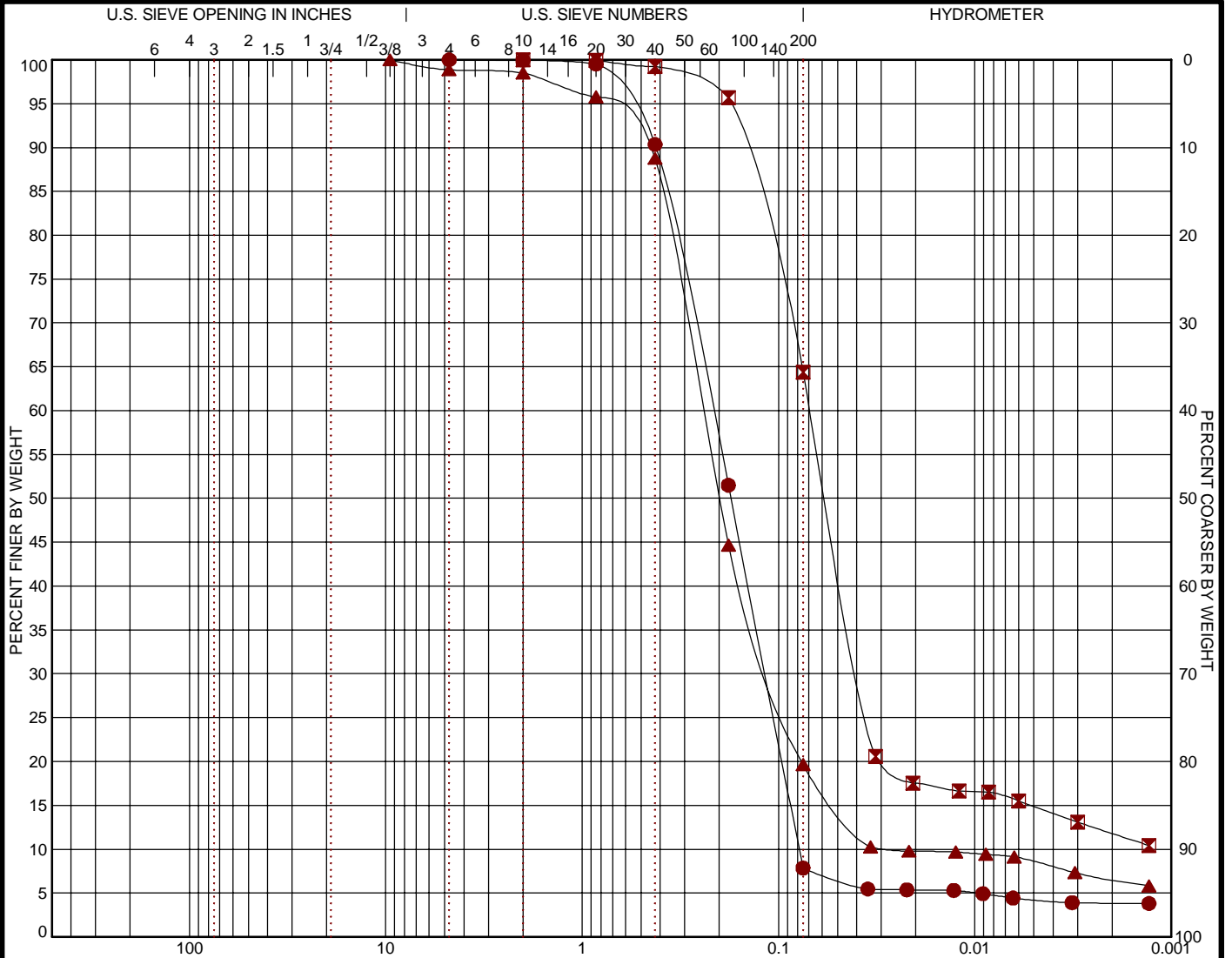
PROJECT NUMBER: 05215156
 CLIENT: US Army Corps of Engineers (USACE)
 Omaha, NE
 EXHIBIT: B-10

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 05215156 BIG BEND RW COLLE.GPJ TERRACON_DATATEMPLATE.GDT 7/28/21

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 05215156 BIG BEND RW COLLE.GPJ TERRACON_DATATEMPLATE.GDT 7/28/21



COBBLES	GRAVEL		SAND			SILT OR CLAY			
	coarse	fine	coarse	medium	fine				

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	PH21-06	23 - 24.5	0.0	0.0	92.2	3.6		4.2	SP-SC
⊠	PH21-06	48 - 49.5	0.0	0.0	35.6	49.5		14.9	ML
▲	PH21-06	53 - 53.7	0.0	1.1	79.2	11.1		8.5	SM

	GRAIN SIZE		
	●	⊠	▲
D ₆₀	0.217	0.069	0.243
D ₃₀	0.117	0.038	0.108
D ₁₀	0.078		0.027
	COEFFICIENTS		
	C _c		C _u
	0.80		1.80
	2.77		9.12

Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
#4	100.0	#10	100.0	3/8"	100.0
#10	99.96	#20	99.92	#4	98.85
#20	99.52	#40	99.22	#10	98.51
#40	90.36	#80	95.67	#20	95.77
#80	51.5	#200	64.4	#40	88.76
#200	7.85			#80	44.68
				#200	19.64

SOIL DESCRIPTION	
●	Poorly Graded Sand with Clay (SP-SC)
⊠	Sandy Silt (ML)
▲	Silty Sand (SM)
REMARKS	
●	2.5Y 4/3 Olive Brown
⊠	2.5Y 5/1 Gray
▲	2.5Y 3/1 Very Dark Gray

PROJECT: Big Bend RW Collector Pipe Replacement FFP Pilot Hole
SITE: BIA Rd 4 and Native American Scenic Byway
Fort Thompson, SD



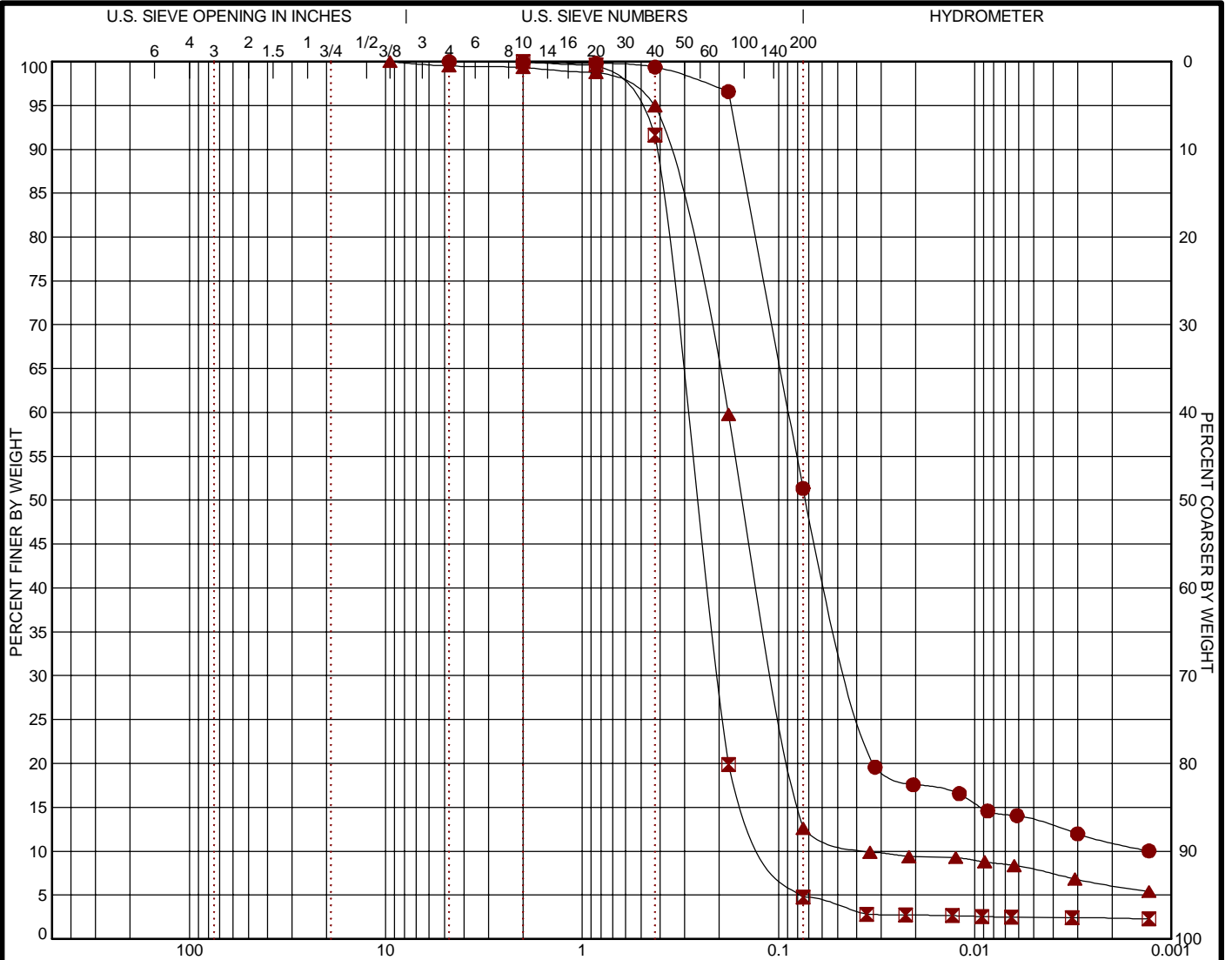
PROJECT NUMBER: 05215156

CLIENT: US Army Corps of Engineers (USACE)
Omaha, NE

EXHIBIT: B-11

GRAIN SIZE DISTRIBUTION

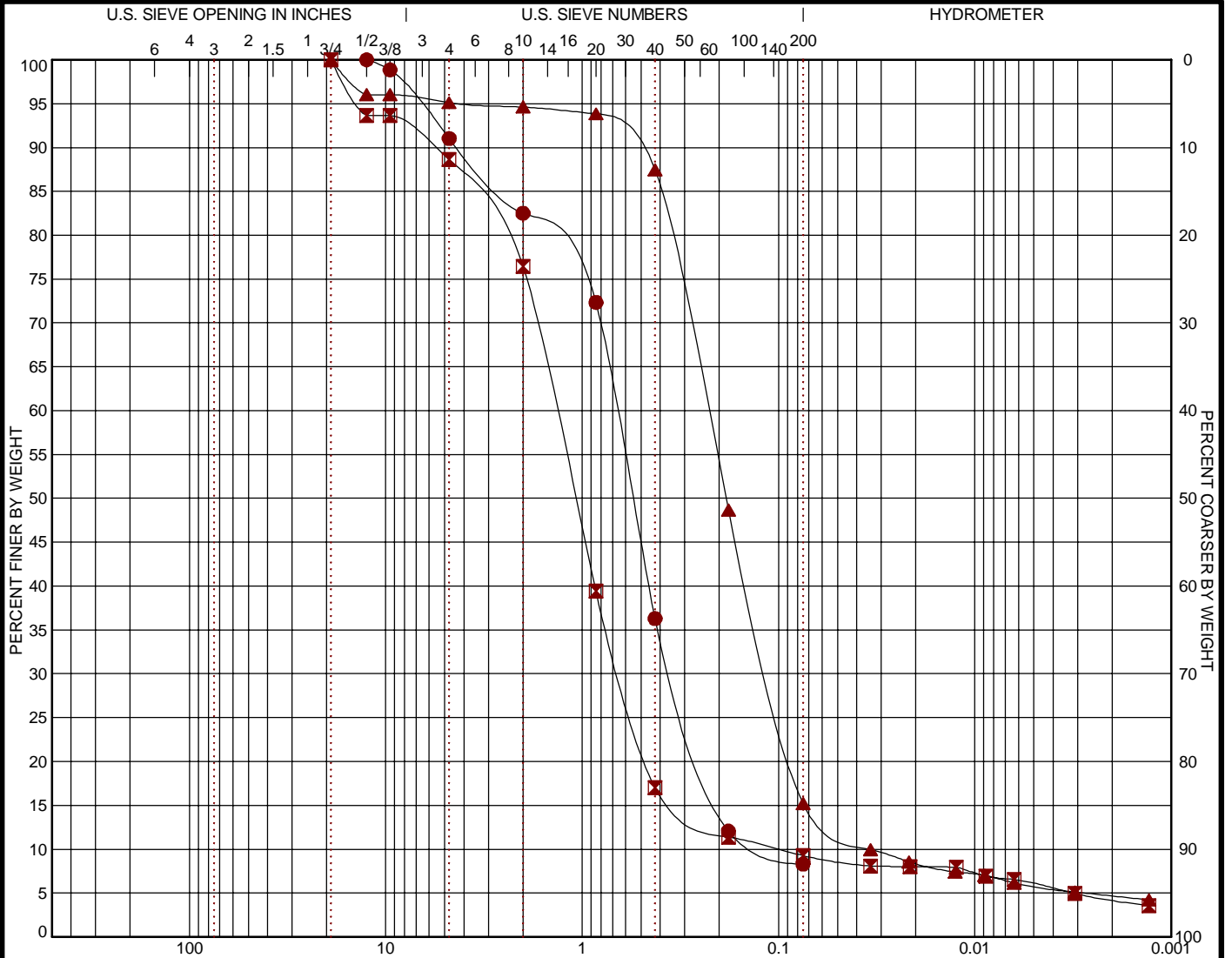
ASTM D422 / ASTM C136



GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 05215156 BIG BEND RW COLLE.GPJ TERRACON_DATATEMPLATE.GDT 7/28/21



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	PH21-06	69 - 69.5	0.0	9.0	82.7		8.3		SW-SM
☒	PH21-06	73 - 73.8	0.0	11.4	79.4	3.2		6.0	SW-SC
▲	PH21-06	73.8 - 74.5	0.0	4.9	79.9	9.4		5.8	SM

	GRAIN SIZE		
	●	☒	▲
D ₆₀	0.67	1.368	0.231
D ₃₀	0.34	0.635	0.11
D ₁₀	0.112	0.102	0.034
	COEFFICIENTS		
	C _c	C _u	
C _c	1.55	2.90	1.54
C _u	6.01	13.43	6.78

Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
1/2"	100.0	3/4"	100.0	3/4"	100.0
3/8"	98.85	1/2"	93.62	1/2"	96.02
#4	91.02	3/8"	93.62	3/8"	96.02
#10	82.5	#4	88.62	#4	95.12
#20	72.34	#10	76.44	#10	94.61
#40	36.29	#20	39.41	#20	93.85
#80	12.05	#40	17.01	#40	87.47
#200	8.3	#80	11.38	#80	48.69
		#200	9.26	#200	15.21

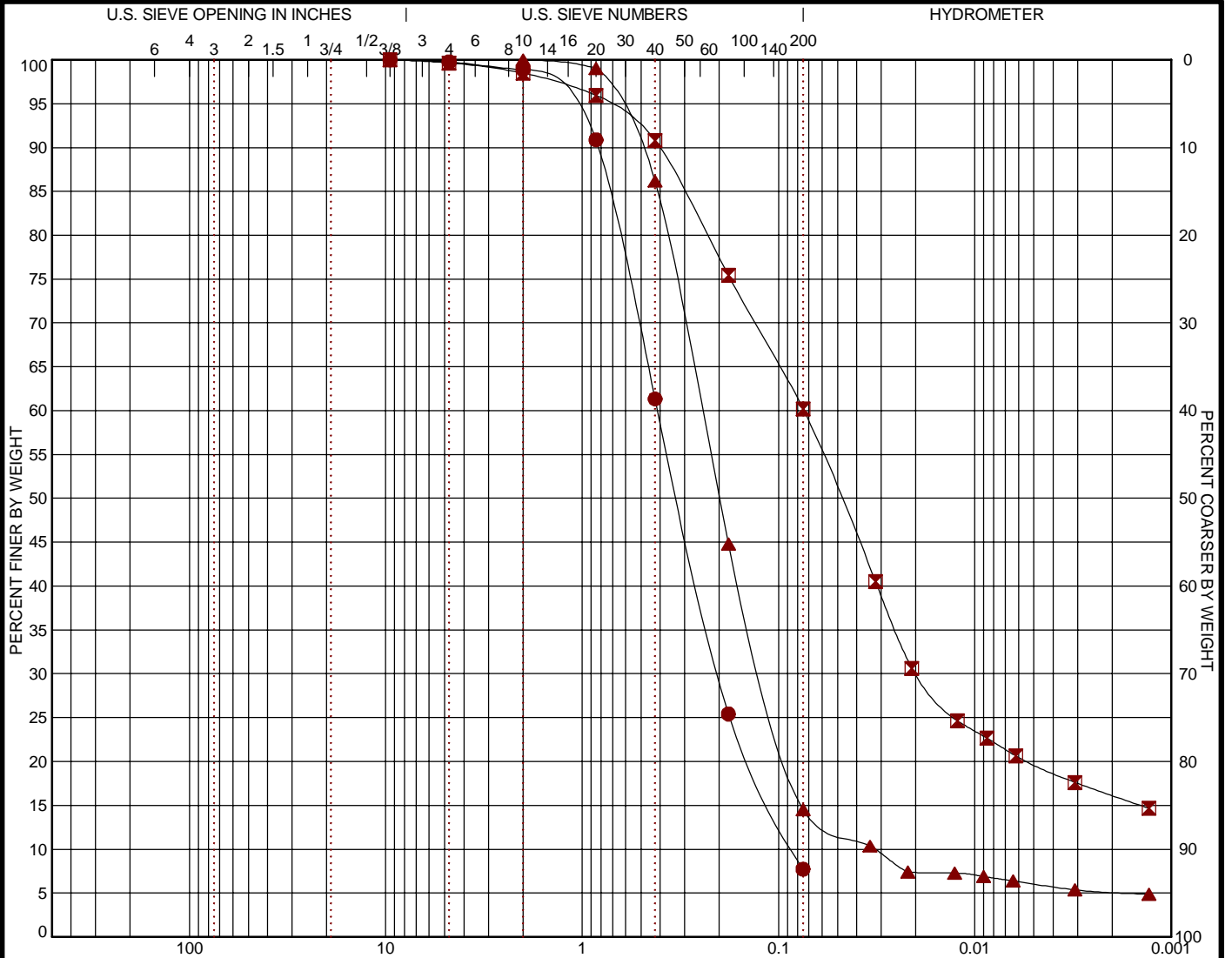
SOIL DESCRIPTION	
●	Well Graded Sand with Silt (SW-SM)
☒	Well Graded Sand with Clay (SW-SC)
▲	Silty Sand (SM)
REMARKS	
●	10YR 5/2 Grayish Brown
☒	10YR 5/2 Grayish Brown
▲	2.5Y 4/2 Dark Grayish Brown

PROJECT: Big Bend RW Collector Pipe Replacement FFP Pilot Hole	 <p>15080 A Cir Omaha, NE</p>	PROJECT NUMBER: 05215156
SITE: BIA Rd 4 and Native American Scenic Byway Fort Thompson, SD		CLIENT: US Army Corps of Engineers (USACE) Omaha, NE
		EXHIBIT: B-13

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 05215156 BIG BEND RW COLLE.GPJ TERRACON_DATATEMPLATE.GDT 7/28/21



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
●	PH21-06	78 - 79.5	0.0	0.2	92.0		7.7		SP-SM
☒	PH21-06B	4 - 4.5	0.0	0.4	39.4	40.5		19.7	CL
▲	PH21-06B	8 - 9.5	0.0	0.0	85.5	8.5		6.0	SM

				●		☒		▲		SOIL DESCRIPTION	
				Sieve	% Finer	Sieve	% Finer	Sieve	% Finer	● Poorly Graded Sand with Silt (SP-SM)	
				3/8"	100.0	3/8"	100.0	#10	100.0	☒ Sandy Lean Clay (CL) ▲ Silty Sand (SM)	
				#4	99.76	#4	99.65	#20	99.02		
				#10	98.89	#10	98.48	#40	86.16		
				#20	90.88	#20	95.96	#80	44.78		
				#40	61.34	#40	90.82	#200	14.5		
				#80	25.41	#80	75.41				
				#200	7.72	#200	60.21			REMARKS ● 10YR 5/2 Grayish Brown ☒ 2.5Y 5/1 Gray ▲ 2.5Y 5/2 Grayish Brown	

PROJECT: Big Bend RW Collector Pipe Replacement FFP Pilot Hole
 SITE: BIA Rd 4 and Native American Scenic Byway
 Fort Thompson, SD

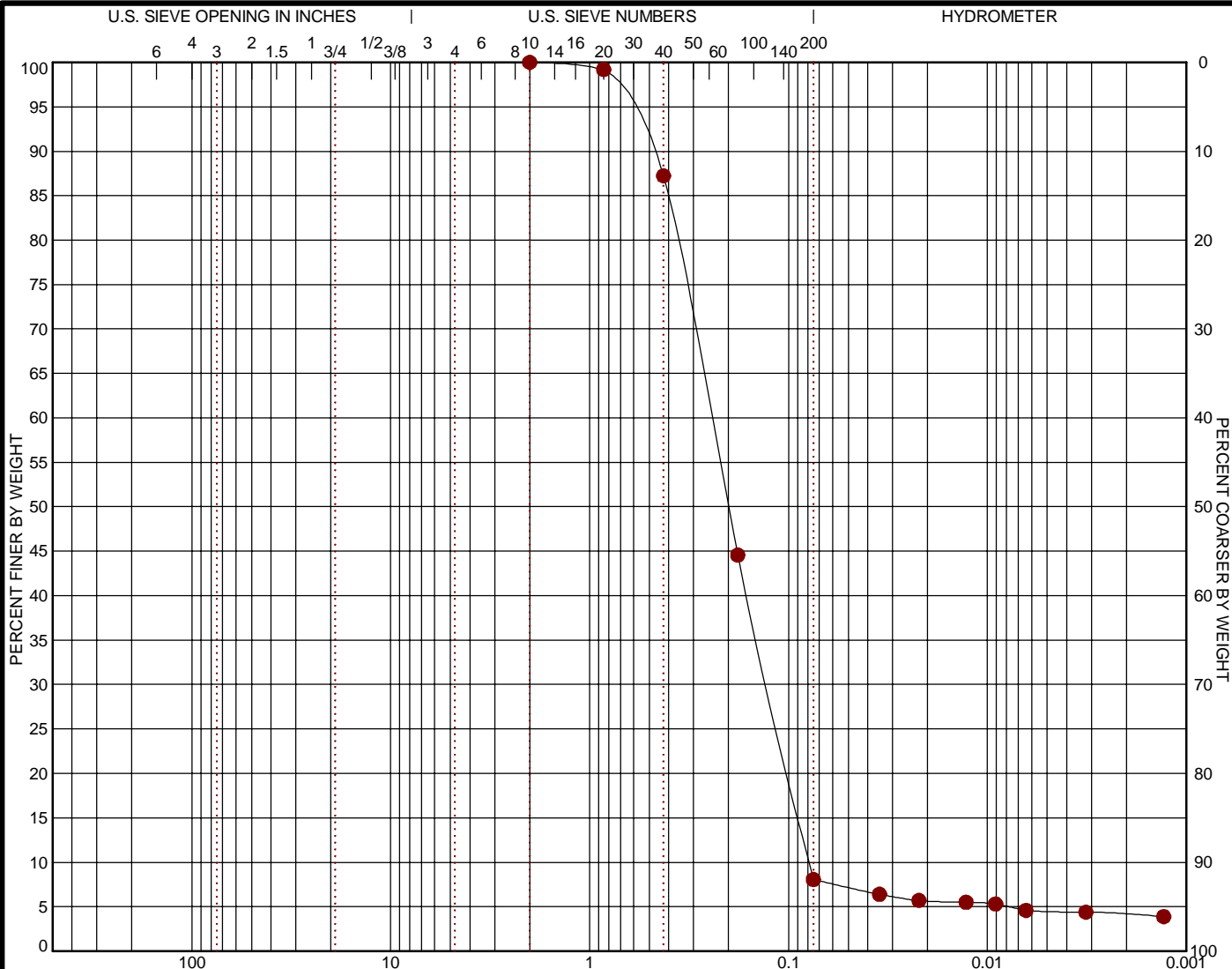


PROJECT NUMBER: 05215156
 CLIENT: US Army Corps of Engineers (USACE)
 Omaha, NE
 EXHIBIT: B-14

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 05215156 BIG BEND RW COLLE.GPJ TERRACON_DATATEMPLATE.GDT 7/28/21



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
PH21-06B	13 - 14.5	0.0	0.0	91.9	3.5		4.5	SP-SC

GRAIN SIZE			
D ₆₀	0.246		
D ₃₀	0.127		
D ₁₀	0.079		
COEFFICIENTS			
C _c	0.83		
C _u	3.13		

Sieve	% Finer	Sieve	% Finer	Sieve	% Finer
#10	100.0				
#20	99.2				
#40	87.24				
#80	44.56				
#200	8.06				

SOIL DESCRIPTION
● Poorly Graded Sand with Clay (SP-SC)
REMARKS
● 2.5Y 5/2 Grayish Brown

PROJECT: Big Bend RW Collector Pipe Replacement FFP Pilot Hole
 SITE: BIA Rd 4 and Native American Scenic Byway
 Fort Thompson, SD



PROJECT NUMBER: 05215156
 CLIENT: US Army Corps of Engineers (USACE)
 Omaha, NE
 EXHIBIT: B-15

Appendix D: HTRW Report



REPLY TO
ATTENTION OF

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA NE
1616 CAPITOL AVENUE
OMAHA NE 68102-4901

CENWO-EDG-S

2 July 2021

MEMORANDUM FOR RECORD

SUBJECT: Big Bend Dam, Fort Thompson, South Dakota, Soil, Groundwater and Investigative Derived Waste (IDW) Sampling.

1. Introduction. Past use of diesel fuel in piezometers to prohibit freezing during winter months has caused concern about the condition of the groundwater and soil in the vicinity of the wells.

2. Scope of Work. This environmental sampling event is to test the soil and groundwater for total petroleum hydrocarbons with diesel range organics (TPH-DRO) from 12 soil borings located near piezometers and relief wells at the site. Testing will be required if contamination is suspected. Sampling will be taken from IDW samples and tested.

3. Sampling Activities. The sampling team included the three man drill crew and a geologist. Soil samples were collected during 1-18 June 2020 and the locations of these samples are in Enclosure 1.

- a. Soil samples were collected from each boring at the upper limit of the groundwater. The sampling list is in Enclosure 2.
- b. Groundwater was collected as a grab sample from the bottom of the boring.
- c. IDW samples were taken at boring location BBSD-11A and BBSD-12A these were tested 10 May 2021 .The laboratory report is Enclosure 5.

4. Analytical Data. Soil, groundwater, and IDW was analyzed using EPA SW-846 methods for TPH-DRO (8015C). CT Laboratories in Baraboo, Wisconsin provided the sample analysis.

- a. A manual stage 2A validation of the laboratory data was performed in accordance with the DoD General Data Validation Guidelines and Quality Systems Manual V5.1. Results of the data validation are found in Enclosure 4. Based on the results of the validation, data are usable for the purpose of making a decision regarding the presence or absence of contamination and concentrations where special handling is required at the site. IDW data were not validated.

CENWO-EDG-S

SUBJECT: Big Bend Dam, Fort Thompson, South Dakota, Soil, Groundwater and Investigative Derived Waste (IDW) Sampling.

b. A detection above the Regional Screening Level (RSL) for TPH-DRO was noted at boring location BBSD-11A and BBSD-12A. The cuttings from these borings were collected in drums as IDW. Refer to Enclosure 3 for the combined laboratory analytical report.

Detected Analyte Table
Derived from the Laboratory Analytical Report
Sampling Completed 18 June 2020

Sample ID	DRO	Matrix	Method	Container
BBSD-01A	9.70 mg/kg J ⁶	Soil	SW846 8015C	4 ounce glass jar No preservatives 14 day hold time
BBSD-02A	6.93 J			
BBSD-00A ¹	<17 U ⁵			
BBSD-03A	7.05 J			
BBSD-04A	<18 U			
BBSD-05A	<18 U			
BBSD-05A-MS	224			
BBSD-05A-MSD	209			
BBSD-06A	<19 U			
BBSD-07A	<19 U			
BBSD-08A	<18 U			
BBSD-XXA ²	<18 U			
BBSD-09A	7.50 J			
BBSD-10A	7.24 J			
BBSD-11A	96.9			
BBSD-12A	2830			
BBSD-01B	110 ug/L J	Water		1 liter amber glass jar No preservatives 7 day hold time
BBSD-02B	480			
BBSD-00B ³	440			
BBSD-03B	270			
BBSD-04B	200 J			
BBSD-05B	1200			
BBSD-05B-MS	3890			
BBSD-05B-MSD	3860			
BBSD-06B	260 J			
BBSD-07B	520 J			
BBSD-08B	74 J			
BBSD-XXB ⁴	67 J			
BBSD-09B	290 J			
BBSD-10B	420			
BBSD-11B	300			
BBSD-12B	27,000			

¹ – Duplicate sample for BBSD-02A

² – Duplicate sample for BBSD-08A

³ – Duplicate sample for BBSD-02B

⁴ – Duplicate sample for BBSD-08B

⁵ - Analyte concentration was below detection limit

⁶ – Estimated value

5. Interpretation and Evaluation.

- a. The soil sample taken at BBSD-12A was analyzed at 2830 mg/kg and the groundwater from the same location was analyzed at 27,000 ug/L. The soil sample taken at BBSD-11A was analyzed at 96.9 mg/kg. This sampling event occurred during the June 2020 borings. Excavated soils with TPH concentrations greater than 10 mg/kg must be disposed of in accordance with the permitting requirements of the SDDNR Waste Management Program.
- b. The groundwater sample taken from the BBSD- 12B location was analyzed at 27,000 ug/L. If dewatering is required during construction, groundwater in this area must be containerized and sampled for disposal procedures.
- c. During construction, excavated contaminated soil must be stockpiled and tested for contamination of TPH-DRO, BTEX and Naphthalene prior to disposition for acceptance to landfills.
- d. IDW cuttings were sampled 10 May 2021 The Laboratory report shows concentrations of TPH-DRO above the RSL (see Enclosure 5). This waste will require disposal in accordance with the permitting requirements of the SDDNR Waste Management Program. Undisturbed contaminated soil requires no special handling instructions. Tier I action levels* for soils are as follows:

Chemical of Concern	Action Level	IDW Chemical Concentrations
Benzene	0.2 ppm	U*
Toluene	15 ppm	U
Ethylbenzene	10 ppm	U
Xylenes	300 ppm	U
Naphthalene	25 ppm	U
TPH-DRO	10 ppm	17.9 J*

* Taken from SDDNR Petroleum Assessment and Cleanup Handbook (Chapter 4)

*U- Analyte concentration was below detection limit.

*J- Estimated Value

6. Point of contact for this memorandum is the undersigned at (402) 995-2285.

5 Enclosures

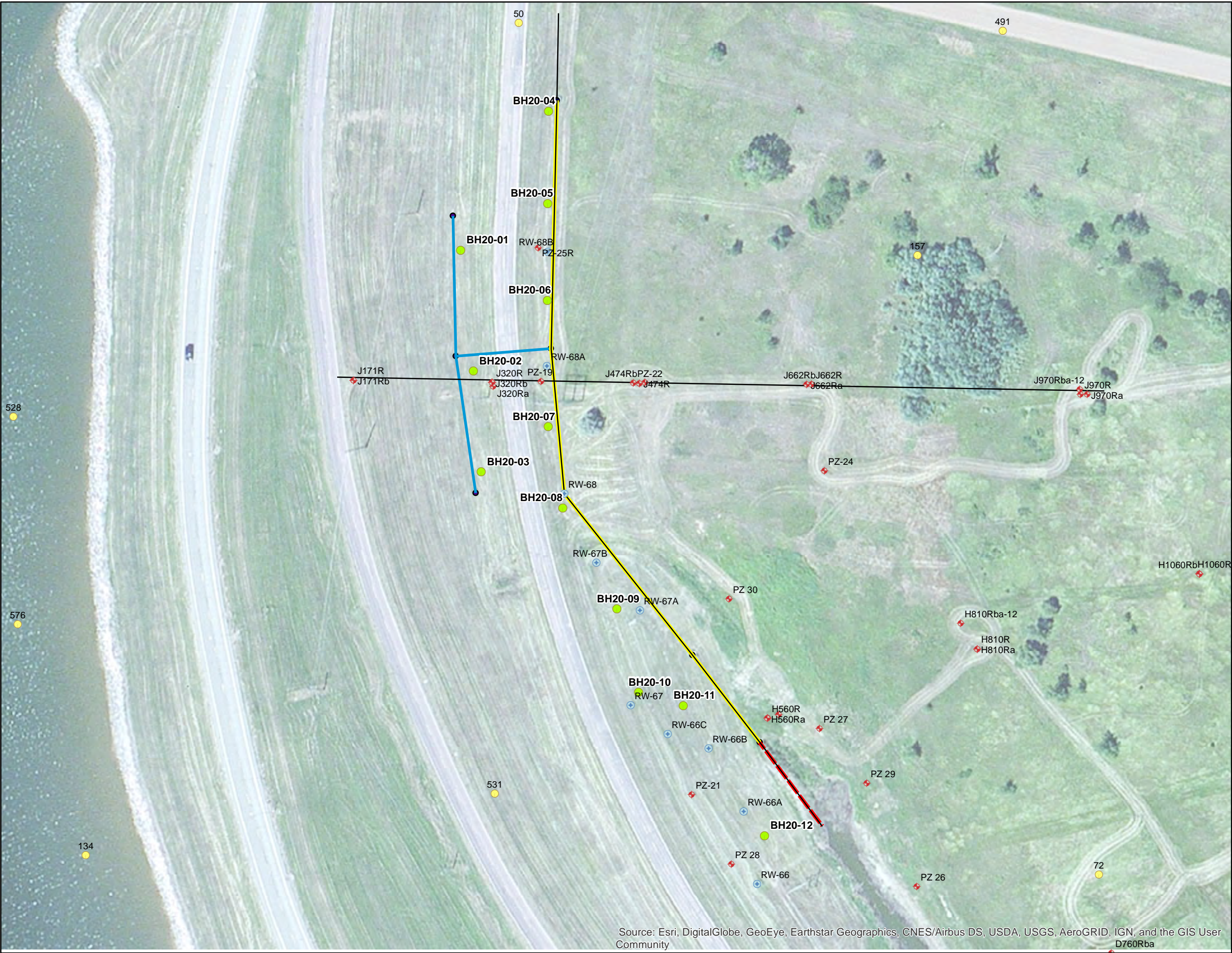
1. Sampling Location Map
2. Sampling List
3. Laboratory Report June 2020 sampling
4. Laboratory Data Validation June 2020
5. Laboratory Report IDW Sample May 2021

Marc Anderson
Environmental Scientist
Military Munitions and Environmental Science

ENCLOSURE 1

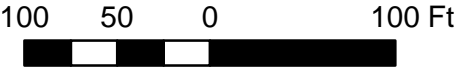
SAMPLING LOCATION MAP


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LEGEND

- Soil Boring (As-Drilled)
- ⊕ Existing Relief Well
- ⬢ Existing Piezometer
- Historical Soil Boring
- Relief Well Collector Pipe
- - - Proposed Extension
- Toe Drain
- Connector Pipe



 U.S. Army Corps of Engineers Omaha District	
Big Bend Dam Fort Thompson, SD	
Soil Boring Location Map	
July 2020	FIGURE 1

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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ENCLOSURE 2

SAMPLING LIST

JUNE 2020

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Sample ID	DRO	Matrix	Method	Container
BBSD-01A	9.70 mg/kg	Soil	SW846 8015C	4 ounce glass jar No preservatives 14 day hold time
BBSD-02A	6.93			
BBSD-00A ¹	<17			
BBSD-03A	7.05			
BBSD-04A	<18			
BBSD-05A	<18			
BBSD-05A-MS	224			
BBSD-05A-MSD	209			
BBSD-06A	<19			
BBSD-07A	<19			
BBSD-08A	<18			
BBSD-XXA ²	<18			
BBSD-09A	7.50			
BBSD-10A	7.24			
BBSD-11A	96.9			
BBSD-12A	2830			
BBSD-01B	110 ug/L	Water	1 liter amber glass jar No preservatives 7 day hold time	
BBSD-02B	480			
BBSD-00B ³	440			
BBSD-03B	270			
BBSD-04B	200			
BBSD-05B	1200			
BBSD-05B-MS	3890			
BBSD-05B-MSD	3860			
BBSD-06B	260			
BBSD-07B	520			
BBSD-08B	74			
BBSD-XXB ⁴	67			
BBSD-09B	290			
BBSD-10B	420			
BBSD-11B	300			
BBSD-12B	27,000			

*Sampling event occurred June 2020

¹ – Duplicate sample for BBSD-02A

² – Duplicate sample for BBSD-08A

³ – Duplicate sample for BBSD-02B

⁴ – Duplicate sample for BBSD-08B

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ENCLOSURE 3

LABORATORY REPORT

JUNE 2020

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ANALYTICAL SUMMARY REPORT

This report at a minimum contains the following information:

- Analytical Report of Test Results
- Description of QC Qualifiers
- Chain of Custody (copy)
- Quality Control Summary (if applicable)
- Case Narrative (if applicable)
- Correspondence with Client (if applicable)

This report has been specifically prepared to satisfy project or program requirements. These results are in compliance with NELAC requirements for parameters where accreditation is required or available, unless otherwise noted in the case narrative.

ANALYTICAL SAMPLE DATA

USACE - OMAHA
 TOM WEIRAUCH
 1616 CAPITOL AVE
 SUITE 9000
 OMAHA, NE 68102-9000

Project Name: BIG BEND DAM TOE DRAIN REPLACEMENT
 Project Phase: FORT THOMPSON, SD
 Project #:
 Folder #: 153747
 Purchase Order #:
 Contract #: 3357

Arrival Temperature: 3.2
 Report Date: 06/18/2020
 Date Received: 06/04/2020
 Reprint Date: 06/19/2020

CT LAB#: 427712	Sample Description: BBSD-01B	Client Sample #:	Sampled: 06/02/2020 1105
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Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Organic Results												
Diesel Range Organics	110	ug/L	34	100	200	200	1.00	J	06/08/2020 10:30	6/9/20 13:49	JJY	EPA 8015C
SURR: Octacosane	71	% Recovery	60			142	1.00		06/08/2020 10:30	6/9/20 13:49	JJY	EPA 8015C
Surr: Triacotane	63	% Recovery	29			140	1.00		06/08/2020 10:30	6/9/20 13:49	JJY	EPA 8015C

CT LAB#: 427714	Sample Description: BBSD-03B	Client Sample #:	Sampled: 06/03/2020 0845
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Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Organic Results												
Diesel Range Organics	270	ug/L	34	100	200	200	1.00		06/08/2020 10:30	6/9/20 14:17	JJY	EPA 8015C
SURR: Octacosane	81	% Recovery	60			142	1.00		06/08/2020 10:30	6/9/20 14:17	JJY	EPA 8015C
Surr: Triacotane	74	% Recovery	29			140	1.00		06/08/2020 10:30	6/9/20 14:17	JJY	EPA 8015C

CT LAB#: 427715	Sample Description: BBSD-12B	Client Sample #:	Sampled: 06/03/2020 1023
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Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Organic Results												
Diesel Range Organics	27000	ug/L	180	530	1100	1100	5.00		06/08/2020 10:30	6/9/20 16:09	JJY	EPA 8015C
SURR: Octacosane	26	% Recovery	60			142	1.00	S	06/08/2020 10:30	6/9/20 14:45	JJY	EPA 8015C
Surr: Triacotane	19	% Recovery	29			140	1.00	S	06/08/2020 10:30	6/9/20 14:45	JJY	EPA 8015C

CT LAB#: 427716	Sample Description: BBSD-02B	Client Sample #:	Sampled: 06/02/2020 1244
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Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Organic Results												
Diesel Range Organics	480	ug/L	42	130	250	250	1.00		06/08/2020 10:30	6/9/20 15:13	JJY	EPA 8015C
SURR: Octacosane	25	% Recovery	60			142	1.00	S	06/08/2020 10:30	6/9/20 15:13	JJY	EPA 8015C
Surr: Triacotane	20	% Recovery	29			140	1.00	S	06/08/2020 10:30	6/9/20 15:13	JJY	EPA 8015C

CT LAB#: 427717	Sample Description: BBSD-00B	Client Sample #:	Sampled: 06/02/2020 1244
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Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Organic Results												
Diesel Range Organics	440	ug/L	42	130	250	250	1.00		06/08/2020 10:30	6/9/20 18:02	JJY	EPA 8015C
SURR: Octacosane	29	% Recovery	60			142	1.00	S	06/08/2020 10:30	6/9/20 18:02	JJY	EPA 8015C
Surr: Triacotane	21	% Recovery	29			140	1.00	S	06/08/2020 10:30	6/9/20 18:02	JJY	EPA 8015C

CT LAB#: 427718	Sample Description: BBSD-00A	Client Sample #:	Sampled: 06/02/2020 1225
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Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
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Inorganic Results

Solids, Percent	82.7	%	0.1	0.1	0.1	0.1	1.00			6/15/20 13:57 BMM	EPA 8000C
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Organic Results

Diesel Range Organics	<17	mg/kg	5.8	17	46	46	1.00	U	06/16/2020 10:30	6/16/20 18:56 JJY	EPA 8015C
SURR: Octacosane	50	% Recovery	44			125	1.00		06/16/2020 10:30	6/16/20 18:56 JJY	EPA 8015C
Surr: Triacotane	40	% Recovery	35			136	1.00		06/16/2020 10:30	6/16/20 18:56 JJY	EPA 8015C

CT LAB#: 427719	Sample Description: BBSD-12A	Client Sample #:	Sampled: 06/03/2020 0941
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Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
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Inorganic Results

Solids, Percent	83.6	%	0.1	0.1	0.1	0.1	1.00			6/15/20 13:57 BMM	EPA 8000C
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Organic Results

Diesel Range Organics	2830	mg/kg	29	88	230	230	5.00		06/16/2020 10:30	6/17/20 11:56 JJY	EPA 8015C
SURR: Octacosane	81	% Recovery	44			125	5.00		06/16/2020 10:30	6/17/20 11:56 JJY	EPA 8015C
Surr: Triacotane	69	% Recovery	35			136	5.00		06/16/2020 10:30	6/17/20 11:56 JJY	EPA 8015C

CT LAB#: 427720	Sample Description: BBSD-02A	Client Sample #:	Sampled: 06/02/2020 1225
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Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
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Inorganic Results

Solids, Percent	88.3	%	0.1	0.1	0.1	0.1	1.00			6/15/20 13:57 BMM	EPA 8000C
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CT LAB#: 427720	Sample Description: BBSD-02A	Client Sample #:	Sampled: 06/02/2020 1225
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Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
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Organic Results

Diesel Range Organics	6.93	mg/kg	5.5	16	44	44	1.00	J	06/16/2020 10:30	6/16/20 19:52	JJY	EPA 8015C
SURR: Octacosane	55	% Recovery	44			125	1.00		06/16/2020 10:30	6/16/20 19:52	JJY	EPA 8015C
Surr: Triacotane	43	% Recovery	35			136	1.00		06/16/2020 10:30	6/16/20 19:52	JJY	EPA 8015C

CT LAB#: 427721	Sample Description: BBSD-01A	Client Sample #:	Sampled: 06/02/2020 1025
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Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
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Inorganic Results

Solids, Percent	78.9	%	0.1	0.1	0.1	0.1	1.00			6/15/20 13:57	BMM	EPA 8000C
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Organic Results

Diesel Range Organics	9.70	mg/kg	6.3	19	51	51	1.00	J	06/16/2020 10:30	6/16/20 20:19	JJY	EPA 8015C
SURR: Octacosane	53	% Recovery	44			125	1.00		06/16/2020 10:30	6/16/20 20:19	JJY	EPA 8015C
Surr: Triacotane	45	% Recovery	35			136	1.00		06/16/2020 10:30	6/16/20 20:19	JJY	EPA 8015C

CT LAB#: 427722	Sample Description: BBSD-03A	Client Sample #:	Sampled: 06/02/2020 1418
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Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
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Inorganic Results

Solids, Percent	80.0	%	0.1	0.1	0.1	0.1	1.00			6/15/20 13:57	BMM	EPA 8000C
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Organic Results

CT LAB#: 427722

Sample Description: BBSD-03A

Client Sample #:

Sampled: 06/02/2020 1418

Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Diesel Range Organics	7.05	mg/kg	6.2	19	50	50	1.00	J	06/16/2020 10:30	6/16/20 20:47	JJY	EPA 8015C
SURR: Octacosane	54	% Recovery	44			125	1.00		06/16/2020 10:30	6/16/20 20:47	JJY	EPA 8015C
Surr: Triacotane	45	% Recovery	35			136	1.00		06/16/2020 10:30	6/16/20 20:47	JJY	EPA 8015C

Notes:

^ Indicates the laboratory is NELAP accredited for this analyte by the indicated matrix and method. DL (detection limit), LOD (limit of detection), loq (limit of quantitation) as defined by most recent DOD QSM version.

All samples were received intact and properly preserved unless otherwise noted. The results reported relate only to the samples tested. This report shall not be reproduced, except in full, without written approval of this laboratory. The Chain of Custody is attached.

This report has been specifically prepared to satisfy project or program requirements. These results are in compliance with NELAC requirements for the parameters where accreditation is required or available, unless noted in the case narrative.

Submitted by: Brett M. Szymanski
Project Manager
608-356-2760

QC Qualifiers	
Code	Description
B	Analyte detected in the associated Method Blank.
C	Toxicity present in BOD sample.
D	Diluted Out.
E	Safe, No Total Coliform detected.
F	Unsafe, Total Coliform detected, no E. Coli detected.
G	Unsafe, Total Coliform detected and E. Coli detected.
H	Holding time exceeded.
I	Incubator temperature was outside acceptance limits during test period.
J	Estimated value.
L	Significant peaks were detected outside the chromatographic window.
M	Matrix spike and/or Matrix Spike Duplicate recovery outside acceptance limits.
N	Insufficient BOD oxygen depletion.
O	Complete BOD oxygen depletion.
P	Concentration of analyte differs more than 40% between primary and confirmation analysis.
Q	Laboratory Control Sample outside acceptance limits.
R	See Narrative at end of report.
S	Surrogate standard recovery outside acceptance limits due to apparent matrix effects.
T	Sample received with improper preservation or temperature.
U	Analyte concentration was below detection limit.
V	Raised Quantitation or Reporting Limit due to limited sample amount or dilution for matrix background interference.
W	Sample amount received was below program minimum.
X	Analyte exceeded calibration range.
Y	Replicate/Duplicate precision outside acceptance limits.
Z	Specified calibration criteria was not met.

Current CT Laboratories Certifications

Wisconsin (WDNR) Chemistry ID# 157066030
Wisconsin (DATCP) Bacteriology ID# 289
Louisiana NELAP (primary) ID# ACC20190002
Illinois NELAP Lab ID# 200073
Kansas NELAP Lab ID# E-10368
Virginia NELAP Lab ID# 460203
ISO/IEC 17025-2005 A2LA Cert # 3806.01
DoD-ELAP A2LA 3806.01
GA EPD Stipulation ID ACC20190002

QC SUMMARY REPORT

USACE - OMAHA

SDG #: 0

Folder #: 153747

Project Name: BIG BEND DAM TOE DRAIN
 REPLACEMENT
 Project #:

Duplicate

Analytical Run #:	171971	Analysis Date:	06/15/2020	Prep Batch #:	Matrix:	SOIL
CTLab #:	432147	Analysis Time:	13:57	Prep Date/Time:	Method:	SW8000C
Parent Sample #:	427718	Analyst:	BMM	Prep Analyst:		

Analyte	QC sample result	Units	Parent sample result	Qualifier(s)	Spike Amount Added	% Recovery	Control Limits	RPD	RPD Limit
Solids, Percent	83.0	%	82.7					0	8

USACE - OMAHA

SDG #: 0

Folder #: 153747

Project Name: BIG BEND DAM TOE DRAIN
REPLACEMENT
Project #:

Lab Control Spike Duplicate Water

Analytical Run #:	171977	Analysis Date:	06/09/2020	Prep Batch #:	76713	Matrix:	LIQUID
CTLab #:	427836	Analysis Time:	16:38	Prep Date/Time:	06/08/2020 10:30	Method:	SW8015
Parent Sample #:	427835	Analyst:	JJY	Prep Analyst:	JLH		

Analyte	QC sample result	Units	Parent sample result	Qualifier(s)	Spike Amount Added	% Recovery	Control Limits	RPD	RPD Limit
Diesel Range Organics	1980	ug/L			2500	79	36 --- 132	4	30

USACE - OMAHA

SDG #: 0

Folder #: 153747

Project Name: BIG BEND DAM TOE DRAIN
REPLACEMENT
Project #:

Lab Control Spike Water

Analytical Run #:	171977	Analysis Date:	06/09/2020	Prep Batch #:	76713	Matrix:	LIQUID
CTLab #:	427835	Analysis Time:	13:21	Prep Date/Time:	06/08/2020 10:30	Method:	SW8015
Parent Sample #:		Analyst:	JJY	Prep Analyst:	JLH		

Analyte	QC sample result	Units	Parent sample result	Qualifier(s)	Spike Amount Added	% Recovery	Control Limits	RPD	RPD Limit
Diesel Range Organics	1900	ug/L			2500	76	36 --- 132		30

USACE - OMAHA

SDG #: 0

Folder #: 153747

Project Name: BIG BEND DAM TOE DRAIN
REPLACEMENT
Project #:

Method Blank Water

Analytical Run #:	171977	Analysis Date:	06/09/2020	Prep Batch #:	76713	Matrix:	LIQUID
CTLab #:	427834	Analysis Time:	12:52	Prep Date/Time:	06/08/2020 10:30	Method:	SW8015
Parent Sample #:		Analyst:	JJY	Prep Analyst:	JLH		

Analyte	QC sample result	Units	Parent sample result	Qualifier(s)	Spike Amount Added	% Recovery	Control Limits	RPD	RPD Limit
Diesel Range Organics	33	ug/L		U	0		100		

USACE - OMAHA

SDG #: 0

Folder #: 153747

Project Name: BIG BEND DAM TOE DRAIN
REPLACEMENT
Project #:

Lab Control Spike Soil

Analytical Run #:	172235	Analysis Date:	06/16/2020	Prep Batch #:	76752	Matrix:	SOLID
CTLab #:	428336	Analysis Time:	18:27	Prep Date/Time:	06/16/2020 10:30	Method:	SW8015
Parent Sample #:		Analyst:	JJY	Prep Analyst:	JLH		

Analyte	QC sample result	Units	Parent sample result	Qualifier(s)	Spike Amount Added	% Recovery	Control Limits	RPD	RPD Limit
Diesel Range Organics	192	mg/kg			250	77	38 --- 132		30

USACE - OMAHA

SDG #: 0

Folder #: 153747

Project Name: BIG BEND DAM TOE DRAIN
REPLACEMENT
Project #:

Method Blank Soil

Analytical Run #:	172235	Analysis Date:	06/16/2020	Prep Batch #:	76752	Matrix:	SOLID
CTLab #:	428335	Analysis Time:	17:59	Prep Date/Time:	06/16/2020 10:30	Method:	SW8015
Parent Sample #:		Analyst:	JJY	Prep Analyst:	JLH		

Analyte	QC sample result	Units	Parent sample result	Qualifier(s)	Spike Amount Added	% Recovery	Control Limits	RPD	RPD Limit
Diesel Range Organics	5	mg/kg		U	0		20		

Sample Condition Report

Folder #: 153747
Client: USACE - OMAHA

Print Date / Time: 06/04/2020 12:37
Received Date / Time / By: 06/04/2020 11:30 CHB

Project Name: BIG BEND DAM TOE DRAIN REPLACEMENT
Project Phase: FORT THOMPSON, SD

Log-In Date / Time / By: 06/04/2020 12:08 JLS
Project #: PM: BMS

Coolers: 6380
Custody Seals Present : Y

Temperature: 3.2 C
COC Present?: Y Complete? Y On Ice: Y

Seal Intact? Y
Ship Method: FEDEX EXPRESS
Adequate Packaging: Y

Numbers: DATED AND SIGNED
Tracking Number: 806531978900
Temp Blank Enclosed? Y

Notes: THE SAMPLES WERE RECEIVED IN GOOD CONDITION ON ICE.

TWO CUSTODY SEALS WERE PRESENT AND INTACT UPON RECEIPT - BOTH WERE DATED 6/3/20 AND SIGNED.

Sample ID / Description	Container Type	Cond. Code	pH OK?/Filtered?	Tests
427712 BBSD-01B	AMBER GL	1	/	DRO
Total # of Containers of Type (AMBER GL) = 1				
Sample ID / Description	Container Type	Cond. Code	pH OK?/Filtered?	Tests
427714 BBSD-03B	AMBER GL	1	/	DRO
Total # of Containers of Type (AMBER GL) = 1				
Sample ID / Description	Container Type	Cond. Code	pH OK?/Filtered?	Tests
427715 BBSD-12B	AMBER GL	1	/	DRO
Total # of Containers of Type (AMBER GL) = 1				
Sample ID / Description	Container Type	Cond. Code	pH OK?/Filtered?	Tests
427716 BBSD-02B	AMBER GL	1	/	DRO
Total # of Containers of Type (AMBER GL) = 1				
Sample ID / Description	Container Type	Cond. Code	pH OK?/Filtered?	Tests
427717 BBSD-00B	AMBER GL	1	/	DRO
Total # of Containers of Type (AMBER GL) = 1				
Sample ID / Description	Container Type	Cond. Code	pH OK?/Filtered?	Tests
427718 BBSD-00A	UNPRES GL	1	/	DRO,%SOL
Total # of Containers of Type (UNPRES GL) = 1				

153747

Sample ID / Description	Container Type	Cond. Code	pH OK?/Filtered?	Tests
427719 BBSD-12A	UNPRES GL	1	/	DRO,%SOL
Total # of Containers of Type (UNPRES GL) = 1				
Sample ID / Description	Container Type	Cond. Code	pH OK?/Filtered?	Tests
427720 BBSD-02A	UNPRES GL	1	/	DRO,%SOL
Total # of Containers of Type (UNPRES GL) = 1				
Sample ID / Description	Container Type	Cond. Code	pH OK?/Filtered?	Tests
427721 BBSD-01A	UNPRES GL	1	/	DRO,%SOL
Total # of Containers of Type (UNPRES GL) = 1				
Sample ID / Description	Container Type	Cond. Code	pH OK?/Filtered?	Tests
427722 BBSD-03A	UNPRES GL	1	/	DRO,%SOL
Total # of Containers of Type (UNPRES GL) = 1				

<u>Condition Code</u>	<u>Condition Description</u>
1	Sample Received OK

Company: USACE - Omaha

Project Contact: Tom Weirauch

Telephone: 402 995 2289

Project Name: Big Bend Dam

Project #: Toe Drain Replacement

Location: Big Bend Dam S.D.

Sampled By: George Filpovich

CT LABORATORIES

Folder # 153747

Company: USACE - OMAHA

Project: BIG BEND DAM

Logged By: JLS PM: BM

1230 Lange Court, Baraboo, WI 53913

608-356-2760 Fax 608-356-2766

www.ctlaboratories.com

Program:

QSM RCRA SDWA NPDES

Solid Waste Other

PO #

Report To:

EMAIL: thomas.a.weirauch@

Company: USACE, ARMY, MIL

Address: USACE - Omaha Dist Hq

Invoice To:

EMAIL: NE 68102

Company:

Address: Same as above

*Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions

Client Special Instructions

ANALYSES REQUESTED

Turnaround Time

Normal RUSH*

Date Needed:

Rush analysis requires prior
CT Laboratories' approval

Surcharges:

24 hr 200%

2-3 days 100%

4-9 days 50%

Matrix:

GW - groundwater SW - surface water WW - wastewater DW - drinking water

S - soil/sediment SL - sludge A - air M - misc/waste

Filtered? Y/N

TPH DRD

Total # Containers

Designated MS/MSD

Collection		Matrix	Grab/Comp	Sample #	Sample ID Description	Filtered?	Fill in Spaces with Bottles per Test												CT Lab ID # Lab use only
Date	Time																		
6/2/20	1105	GW	G	1	BBSD-01B	N	1											427712	
6/3/20	0845	GW	G	1	BBSD-03B	N	1											427714	
6/3/20	1023	GW	G	1	BBSD-12B	N	1											427715	
6/2/20	1244	GW	G	1	BBSD-02B	N	1											427716	
6/2/20	1244	GW	G	1	BBSD-00B	N	1											427717	
6/2/20	1225	S	G	1	BBSD-00A		1											427718	
6/3/20	0941	S	G	1	BBSD-12A		1											427719	
6/2/20	1225	S	G	1	BBSD-02A		1											427720	
6/2/20	1025	S	G	1	BBSD-01A		1											427721	
6/2/20	1418	S	G	1	BBSP-03A		1											427722	

Relinquished By:

Date/Time

6/3/20 1430

Received By:

Date/Time

6/4/2020 1205

Lab Use Only

Ice Present Yes No

Temp 32 IR Gun 24

Cooler # G380

Received by:

Date/Time

Received for Laboratory by:

Date/Time

6/4/2020 11:30

CT Laboratories Terms and Conditions

Where a purchaser (Client) places an order for laboratory, consulting or sampling services from CT Laboratories (CTL), CTL shall provide the ordered services pursuant to these Terms and Conditions, and the related Quotation, or as agreed in a negotiated contract. In the absence of a written agreement to the contrary, the Order constitutes an acceptance by the Client of CTL's offer to do business under these Terms and Conditions, and an agreement to be bound by these Terms and Conditions. No contrary or additional terms and conditions expressed in a Client's document shall be deemed to become a part of the contract created upon acceptance of these Terms and Conditions, unless accepted by CTL in advance of the start of the project and in writing.

1. ORDERS AND RECEIPT OF SAMPLES (Sample Acceptance Policy)

- 1.1 The Client may place the Order (i.e., specify a Scope of Work) either by submitting a purchase order to CTL in writing, by telephone (confirmed in writing) or by negotiated contract. Whichever option the Client selects for placing the Order, the Order shall not be valid unless it contains sufficient information to enable CTL to carry out the Client's requirements. It is the policy of CTL that samples not meeting the acceptance criteria, outlined in the NELAC standards and Section 5.8.3.2 of the DOD QSM, will not be accepted by the laboratory or will be qualified on the final report. All samples submitted to the laboratory must: (a) be accompanied by proper, full and complete documentation, including sample identification, location, date and time of collection, the collector's name, type of preservation (if any), type of sample, any special comments concerning the sample and any additional pertinent fields on the chain-of-custody. In the absence of any of the required information, the laboratory will attempt to contact the client to obtain the information; if unable to obtain the necessary information, the final report will be qualified.
- (b) samples must be labeled appropriately with a unique sample identification written with indelible ink on water resistant labels. If the laboratory cannot determine the identity of a sample, it may be rejected and the client will be contacted for further instructions or resampling. (c) samples must be in an appropriate sample container. If the container is inappropriate, the client will be contacted for further instructions or resampling. If analysis is possible, the final report will be qualified. CTL can provide a sampling guide containing approved containers and preservations for analytical methods requested. (d) adhere to method specified holding times. If samples are received with less than 1/2 the holding time remaining for the requested test, CTL will make its best effort to analyze the samples and notify the client. If holding times are exceeded, the final report will be qualified. (e) contain adequate sample volume to perform the necessary testing. If sufficient volume is not present, the sample may be rejected and the client will be contacted for further instructions or resampling. If samples show signs of damage, contamination or inadequate preservation, the client will be notified. If analysis can be performed, the final report will be qualified. If not, the samples will be rejected and the client notified for further instructions or resampling. It is the Client's responsibility to understand and package samples correctly and provide the proper amount of temperature control (ice) suitable to current weather conditions.
- 1.2 CTL must be supplied with complete written disclosure of the known or suspected presence of any hazardous substances, as defined by applicable federal or state law. Where any samples which were not accompanied by the required disclosure, cause interruptions in the lab's ability to process work due to contamination of instruments or work areas, the Client will be responsible for the costs of clean up and recovery.
- 1.3 Prior to Sample Acceptance, the entire risk of loss or damage to samples remains with the Client. In no event will CTL have any responsibility or liability for the action or inaction of any carrier shipping or delivering any sample to or from CTL's premises. Client is responsible to assure that any sample containing any hazardous substance which is to be delivered to CTL's premises will be packaged, labeled, transported and delivered properly and in accordance with applicable laws.
- 1.4 Clients using CTL's shipping account(s) do so at their own risk and must purchase separate insurance if they do not wish to assume risk of loss. CTL will not assume any risk whatsoever for any samples outside of CTL's control and not successfully delivered to the laboratory within specified hold times.
- 1.5 CTL will not accept liability for any sample(s), except sample(s) damaged or broken by log-in staff prior to successful log-in of the sample(s) into the CTL- LIMS system. This includes, but may not be limited to: complete, valid COC documentation, all sample receiving issues being resolved from a delay caused by the Client in CTL's ability to log-in samples, including missed turnaround and hold times, delay in processing and, ultimately, additional charges to the Client.
- 1.6 CTL will only reject samples per directions from the Client. CTL's sole liability is to inform the Client of any sample receipt issues, and may provide an indication how proceeding with the analysis may affect results and final acceptance by the regulating agency. Ultimately, suitability for use is between the Client and the regulating agency(s).
- 1.7 Signing of this COC by the Client or Client's representative, or directions to CTL via email or Fax constitutes acceptance of these Terms and Conditions, and guarantees payment by the Client to CTL.

2. PAYMENT TERMS

2.1 Services performed by CTL will be in accordance with prices quoted and later confirmed in writing or as stated in the Price Schedule. Invoices may be submitted to Client upon completion of any sample delivery group. Payment in advance is required for all Clients except those whose credit has been established with CTL. For Clients with approved credit, payment terms are net 30 days from the date of invoice by CTL. All overdue payments are subject to an additional interest and service charge of one and one-half percent (1.5%) or the maximum rate permissible by law, per month or portion thereof from the due date until the date of payment. All fees are charged or billed directly to the Client. The billing of a third party will not be accepted without a statement, signed by the third party that acknowledges and accepts payment responsibility. CTL may suspend work and withhold delivery of data under this order at any time in the event Client fails to make timely payment of its invoices. Client shall be responsible for all costs and expenses of collection including reasonable attorney's fees. CTL reserves the right to refuse to proceed with work at any time based upon an unfavorable Client credit report.

3. CHANGE ORDERS, TERMINATION

- 3.1 Changes to the Scope of Work, price, or result delivery date may be initiated by CTL after Sample Acceptance due to any condition which conflicts with analytical, QA or other protocols warranted in these Terms and Conditions. CTL will not proceed with such changes until an agreement with the Client is reached on the amount of any cost, schedule change or technical change to the Scope of Work, and such agreement is documented in writing.
- 3.2 Changes to the Scope of Work, including but not limited to increasing or decreasing the work, changing test and analysis specification or acceleration in the performance of the work may be initiated by the Client after sample acceptance. Such a change will be documented in writing and may result in a change in cost and turnaround time commitment. CTL's acceptance of such changes is contingent upon technical feasibility and operational capacity.
- 3.3 Suspension or termination of all or any part of the work may be initiated by the Client. CTL will be compensated consistent with Section 2 of these Terms and Conditions. CTL will complete all work in progress and be paid in full for all work completed.

4. WARRANTIES AND LIABILITY

- 4.1 Where applicable, CTL will use analytical methodologies which are in substantial conformity with published test methods. CTL has implemented these methods in its Laboratory Quality Manuals and referenced Standard Operating Procedures and where the nature or composition of the sample requires it, CTL reserves the right to deviate from these methodologies as necessary or appropriate, based on the reasonable judgment of CTL, which deviations, if any, will be made on a basis consistent with recognized standards of the industry and/or CTL's Laboratory Quality Manuals. Client may request that CTL perform according to a mutually agreed Quality Assurance Project Plan (QAPP). In the event that samples arrive prior to agreement on a QAPP, CTL will proceed with analyses under its standard Quality Manuals then in effect, and CTL will not be responsible for any resampling or other charges if work must be repeated to comply with a subsequently finalized QAPP.
- 4.2 CTL shall start preparation and/or analysis within holding times provided that Sample Acceptance occurs within 48 hours of sampling or 1/2 of the holding time for the test, whichever is less. Samples received that do not meet this provision will be charged as expedited samples and the appropriate rate will be added accordingly. Where resolution of inconsistencies leading to Sample Acceptance does not occur within this period, CTL will use its best efforts to meet holding times and will proceed with the work provided that, in CTL's judgment, the chain-of-custody or definition of the Scope of Work provide sufficient guidance. Reanalysis of samples to comply with CTL's Quality Manuals will be deemed to have met holding times provided the initial analysis was performed within the applicable holding time. Where reanalysis demonstrates that sample matrix interference is the cause of failure to meet any Quality Manual requirements, the warranty will be deemed to have been met.
- 4.3 CTL warrants that it possesses and maintains all licenses and certifications which are required to perform services under these Terms and Conditions provided that such requirements are specified in writing to CTL prior to Sample Acceptance. CTL will notify the Client in writing of any decertification or revocation of any license, or notice of either, which affects work in progress.
- 4.4 The warranty obligations set forth in Sections 4.1, 4.2 and 4.3 are the sole and exclusive warranties given by CTL in connection with any services performed by CTL or any Results generated from such services, and CTL gives and makes NO OTHER REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESS OR IMPLIED. No representative of CTL is authorized to give or make any other representation or warranty or modify this warranty in any way.
- 4.5 Client's sole and exclusive remedy for the breach of warranty in connection with any services performed by CTL, will be limited to repeating any services performed, contingent on the Client's providing, at the request of CTL and at the Client's expense, additional sample(s) if necessary. Any reanalysis requested by the Client generating Results consistent with the original Results will be at the Client's expense. If resampling is necessary, CTL's liability for resampling costs will be limited to actual cost or one hundred or one hundred fifty dollars (\$150) per sample, whichever is less.
- 4.6 CTL's liability for any and all causes of action arising hereunder, whether based in contract, tort, warranty, negligence or otherwise, shall be limited to the lesser amount of compensation for the services performed or \$100,000. All claims, including those for negligence, shall be deemed waived unless suit thereon is filed within one year after CTL's completion of the services. Under no circumstances, whether arising in contract, tort (including negligence), or otherwise, shall CTL be responsible for loss of use, loss of profits, or for any special, indirect, incidental or consequential damages occasioned by the services performed or by application or use of the reports prepared.
- 4.7 In no event shall CTL have any responsibility or liability to the Client for any failure or delay in performance by CTL which results, directly or indirectly, in whole or in part, from any cause or circumstance beyond the reasonable control of CTL. Such causes and circumstances shall include, but not be limited to, acts of God, acts of God, acts or orders of any governmental authority, strikes or other labor disputes, natural disasters, accidents, wars, civil disturbances, equipment breakdown, matrix interference or unknown highly contaminated samples that impact instrument operation, unavailability of supplies from usual suppliers, difficulties or delays in transportation, mail or delivery services, or any other cause beyond CTL's reasonable control.

5. RESULTS, WORK PRODUCT

- 5.1 Data or information provided to CTL or generated by services performed under this agreement shall only become the property of the Client upon receipt in full by CTL of payment for the whole Order. Ownership of any analytical method, QA/QC protocols, software programs or equipment developed by CTL for performance of work will be retained by CTL, and Client shall not disclose such information to any third party.
- 5.2 Data and sample materials provided by Client or at Client's request, and the result obtained by CTL shall be held in confidence (unless such information is generally available to the public or is in the public domain or Client has failed to pay CTL for all services rendered or is otherwise in breach of these Terms and Conditions), subject to any disclosure required by law or legal process.
- 5.3 Should the Results delivered by CTL be used by the Client or Client's client, even though subsequently determined not to meet the warranties described in these Terms and Conditions, then the compensation will be adjusted based upon mutual agreement. In no case shall the Client unreasonably withhold CTL's right to independently defend its data.
- 5.4 CTL reserves the right to subcontract services ordered by the Client to another laboratory or laboratories, if, in CTL's sole judgment, it is reasonably necessary, appropriate or advisable to do so, and with the Client's permission. CTL will in no way be liable for any subcontracted services and all applicable warranties, guarantees and insurance are those of the subcontracted laboratory.
- 5.5 CTL shall dispose of the Client's samples and extracts 30 days after the analytical report is issued, unless instructed to store them for an alternate period of time or to return such samples to the Client, in a manner consistent with U.S. Environmental Protection Agency regulations or other applicable Federal, state or local requirements. Additional charges will apply for samples or extracts stored longer than 30 days at the Client's request. Any samples for projects that are canceled or not accepted, or for which return was requested, will be returned to the Client at Client expense. CTL reserves the right to return to the Client any sample or unused portion of a sample that is not within CTL's permitted capability or the capabilities of CTL's designated waste disposal vendor(s), or will make arrangements to dispose of these samples at Client direction and expense.
- 5.6 Unless a different time period is agreed to in any order under these Terms and Conditions, CTL agrees to retain all records for five (5) years.
- 5.7 In the event that CTL is required to respond to legal process related to services for Client, Client agrees to reimburse CTL for hourly charges for personnel involved in the response and attorney fees reasonably incurred in obtaining advice concerning the response, preparation to testify, and appearances related to the legal process, travel and all reasonable expenses associated with the litigation.

6. INSURANCE

6.1 CTL shall maintain in force during the performance of services under these Terms and Conditions, Workers' Compensation and Employer's Liability Insurance in accordance with the laws of the states having jurisdiction over CTL's employees who are engaged in the performance of the work. CTL shall also maintain during such period, Comprehensive General and Contractual Liability (limit of \$2,000,000 per occurrence/aggregate), Comprehensive Automobile Liability, owned and hired, (\$1,000,000 combined single limit), and Professional/Pollution Liability Insurance (limit of \$5,000,000 per occurrence/aggregate). Any Client required changes to these limits or conditions will result in a change in cost to the Client.

7. AUDIT

7.1 Upon prior notice to CTL, the Client may audit and inspect CTL's records and accounts covering reimbursable costs related to work done for the Client for a period of one (1) year after completion of the work. The purpose of any such audit shall be only for verification of such costs, and CTL shall not be required to provide access to cost records where prices are expressed as fixed fees or published unit prices.

FedEx
Express

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FedEx®		Package		Tracking Number	
Express		US Airbill		8065 31 7 8900	
1 From		Date		6/3/2	
Sender's Name		US ARMY CORP OF ENG		402	
Address		1516 CAPITOL AVE		402	
City		OMAHA		402	
State		NE		402	
ZIP		68102-4908		995-2217	
2 Your Internal Billing Reference		3 To		4 Recipient's Name	
Company		C-1 Laboratories		Phone	
Address		1230 Lange Court		608	
City		Omaha		608	
State		NE		608	
ZIP		68102-4908		608	

Form
and No. **0215**

Recipient's Copy

4 Express Package Service *To meet deadlines

NOTE: Service order has changed. Please select carefully.

Next Business Day

☐ **FeDEX First Overnight**
Earliest next-business morning delivery to select locations. Service order has changed. Monday unless SATURDAY Delivery is selected.

☐ **FeDEX Priority Overnight**
Second-business morning delivery. Service will be delivered on Monday unless SATURDAY Delivery is selected.

☐ **FeDEX Standard Overnight**
Third-business morning delivery. Service will be delivered on Monday unless SATURDAY Delivery is selected.

5 Packaging *Declared value limit \$500

☐ **FeDEX Envelope*** ☐ **FeDEX Pak***

6 Special Handling and Delivery Signature Options

☐ **SATURDAY Delivery**
Most available for select Standard Overnight, FeDEX 2Day A.M., or FeDEX Express Service.

No Signature Required

Packaging may be left unopened.

Does this shipment contain dangerous goods?
One box must be checked.

☐ **No** ☐ **Yes**
As per attached
Shipping Declaration

Dangerous goods (including oil and gas) cannot be shipped in FeDEX Envelope or packaged in a FeDEX Express Drop Box.

Direct Signature

Someone at the consignee address may sign for delivery. *Fee applies.*

☐ **Yes**

Signature required

7 Payment Bill to:

Enter FeDEX Account No. or Credit Card No. below.

☐ **Sender**
Billing to be sent to:
Name, No. and City

☐ **Recipient**

☐ **Third Party**

☐ **Cash/Check**

Deductions:
Account No. ☐

2 or 3 Business Days

☐ **FeDEX 2Day A.M.**
Second-business morning *
Standard Delivery NOT available

☐ **FeDEX 2Day**
Second-business afternoon * Thursday shipments will be delivered on Monday unless SATURDAY Delivery is selected.

☐ **FeDEX Express Saver**
Third-business morning *
Standard Delivery NOT available

☐ **FeDEX Box**

☐ **FeDEX Tube**

☒ **Other**

Packages up to 150 lbs.
For packages over 150 lbs.,
FeDEX Express freight to Mobile.

Total Packages

Total Weight

Total Cost/Chg.

fedex.com 1.800.GoFedEx 1.800.463.3339

100-443887-100

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ANALYTICAL SUMMARY REPORT

This report at a minimum contains the following information:

- Analytical Report of Test Results
- Description of QC Qualifiers
- Chain of Custody (copy)
- Quality Control Summary (if applicable)
- Case Narrative (if applicable)
- Correspondence with Client (if applicable)

This report has been specifically prepared to satisfy project or program requirements. These results are in compliance with NELAC requirements for parameters where accreditation is required or available, unless otherwise noted in the case narrative.

ANALYTICAL SAMPLE DATA

USACE - OMAHA
 TOM WEIRAUCH
 1616 CAPITOL AVE
 SUITE 9000
 OMAHA, NE 68102-9000

Project Name: BIG BEND DAM TOE DRAIN REPLACEMENT
 Project Phase: FORT THOMPSON, SD
 Project #:
 Folder #: 153810
 Purchase Order #:
 Contract #: 3357

Arrival Temperature: 3.0
 Report Date: 06/18/2020
 Date Received: 06/06/2020
 Reprint Date: 06/19/2020

CT LAB#: 428379	Sample Description: BBSD-11B	Client Sample #:	Sampled: 06/04/2020 1323
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Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Organic Results												
Diesel Range Organics	300	ug/L	44	130	270	270	1.00		06/11/2020 13:00	6/12/20 13:16	JJY	EPA 8015C
SURR: Octacosane	67	% Recovery	60			142	1.00		06/11/2020 13:00	6/12/20 13:16	JJY	EPA 8015C
Surr: Triacotane	59	% Recovery	29			140	1.00		06/11/2020 13:00	6/12/20 13:16	JJY	EPA 8015C

CT LAB#: 428380	Sample Description: BBSD-10B	Client Sample #:	Sampled: 06/04/2020 1500
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Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Organic Results												
Diesel Range Organics	420	ug/L	42	130	260	260	1.00		06/11/2020 13:00	6/12/20 13:44	JJY	EPA 8015C
SURR: Octacosane	72	% Recovery	60			142	1.00		06/11/2020 13:00	6/12/20 13:44	JJY	EPA 8015C
Surr: Triacotane	64	% Recovery	29			140	1.00		06/11/2020 13:00	6/12/20 13:44	JJY	EPA 8015C

CT LAB#: 428381	Sample Description: BBSD-07B	Client Sample #:	Sampled: 06/05/2020 1144
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Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Organic Results												
Diesel Range Organics	520	ug/L	87	260	530	530	1.00	J	06/11/2020 13:00	6/12/20 14:12	JJY	EPA 8015C
SURR: Octacosane	83	% Recovery	60			142	1.00		06/11/2020 13:00	6/12/20 14:12	JJY	EPA 8015C
Surr: Triacotane	74	% Recovery	29			140	1.00		06/11/2020 13:00	6/12/20 14:12	JJY	EPA 8015C

CT LAB#: 428382	Sample Description: BBSD-09B	Client Sample #:	Sampled: 06/09/2020 0920
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Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Organic Results												
Diesel Range Organics	290	ug/L	61	190	370	370	1.00	J	06/11/2020 13:00	6/12/20 14:40	JJY	EPA 8015C
SURR: Octacosane	82	% Recovery	60			142	1.00		06/11/2020 13:00	6/12/20 14:40	JJY	EPA 8015C
Surr: Triacotane	75	% Recovery	29			140	1.00		06/11/2020 13:00	6/12/20 14:40	JJY	EPA 8015C

CT LAB#: 428383	Sample Description: BBSD-11A	Client Sample #:	Sampled: 06/04/2020 1235
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Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Inorganic Results												
Solids, Percent	90.0	%	0.1	0.1	0.1	0.1	1.00			6/15/20 13:57	BMM	EPA 8000C
Organic Results												
Diesel Range Organics	96.9	mg/kg	5.5	17	44	44	1.00		06/16/2020 10:30	6/16/20 21:15	JJY	EPA 8015C
SURR: Octacosane	66	% Recovery	44			125	1.00		06/16/2020 10:30	6/16/20 21:15	JJY	EPA 8015C
Surr: Triacotane	56	% Recovery	35			136	1.00		06/16/2020 10:30	6/16/20 21:15	JJY	EPA 8015C

CT LAB#: 428384	Sample Description: BBSD-10A	Client Sample #:	Sampled: 06/04/2020 1408
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Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
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Inorganic Results

Solids, Percent	79.8	%	0.1	0.1	0.1	0.1	1.00			6/15/20 13:57 BMM	EPA 8000C
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Organic Results

Diesel Range Organics	7.24	mg/kg	6.3	19	50	50	1.00	J	06/16/2020 10:30	6/16/20 21:43 JJY	EPA 8015C
SURR: Octacosane	54	% Recovery	44			125	1.00		06/16/2020 10:30	6/16/20 21:43 JJY	EPA 8015C
Surr: Triacotane	46	% Recovery	35			136	1.00		06/16/2020 10:30	6/16/20 21:43 JJY	EPA 8015C

CT LAB#: 428385	Sample Description: BBSD-XXA	Client Sample #:	Sampled: 06/05/2020 1345
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Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
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Inorganic Results

Solids, Percent	83.5	%	0.1	0.1	0.1	0.1	1.00			6/15/20 13:57 BMM	EPA 8000C
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Organic Results

Diesel Range Organics	<18	mg/kg	5.8	18	47	47	1.00	U	06/16/2020 10:30	6/16/20 22:39 JJY	EPA 8015C
SURR: Octacosane	68	% Recovery	44			125	1.00		06/16/2020 10:30	6/16/20 22:39 JJY	EPA 8015C
Surr: Triacotane	58	% Recovery	35			136	1.00		06/16/2020 10:30	6/16/20 22:39 JJY	EPA 8015C

CT LAB#: 428386	Sample Description: BBSD-08A	Client Sample #:	Sampled: 06/05/2020 1345
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Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
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Inorganic Results

Solids, Percent	83.7	%	0.1	0.1	0.1	0.1	1.00			6/15/20 13:57 BMM	EPA 8000C
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CT LAB#: 428386	Sample Description: BBSD-08A	Client Sample #:	Sampled: 06/05/2020 1345
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Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
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Organic Results

Diesel Range Organics	<18	mg/kg	5.8	18	47	47	1.00	U	06/16/2020 10:30	6/16/20 23:06	JJY	EPA 8015C
SURR: Octacosane	65	% Recovery	44			125	1.00		06/16/2020 10:30	6/16/20 23:06	JJY	EPA 8015C
Surr: Triacontane	56	% Recovery	35			136	1.00		06/16/2020 10:30	6/16/20 23:06	JJY	EPA 8015C

CT LAB#: 428387	Sample Description: BBSD-09A	Client Sample #:	Sampled: 06/05/2020 0821
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Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
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Inorganic Results

Solids, Percent	80.8	%	0.1	0.1	0.1	0.1	1.00			6/15/20 13:57	BMM	EPA 8000C
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Organic Results

Diesel Range Organics	7.50	mg/kg	6.2	19	49	49	1.00	J	06/16/2020 10:30	6/16/20 23:34	JJY	EPA 8015C
SURR: Octacosane	49	% Recovery	44			125	1.00		06/16/2020 10:30	6/16/20 23:34	JJY	EPA 8015C
Surr: Triacontane	40	% Recovery	35			136	1.00		06/16/2020 10:30	6/16/20 23:34	JJY	EPA 8015C

CT LAB#: 428388	Sample Description: BBSD-07A	Client Sample #:	Sampled: 06/05/2020 1018
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Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
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Inorganic Results

Solids, Percent	79.7	%	0.1	0.1	0.1	0.1	1.00			6/15/20 13:57	BMM	EPA 8000C
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Organic Results

CT LAB#: 428388

Sample Description: BBSD-07A

Client Sample #:

Sampled: 06/05/2020 1018

Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Diesel Range Organics	<19	mg/kg	6.2	19	50	50	1.00	U	06/16/2020 10:30	6/17/20 00:02	JJY	EPA 8015C
SURR: Octacosane	53	% Recovery	44			125	1.00		06/16/2020 10:30	6/17/20 00:02	JJY	EPA 8015C
Surr: Triacotane	45	% Recovery	35			136	1.00		06/16/2020 10:30	6/17/20 00:02	JJY	EPA 8015C

Notes:

^ Indicates the laboratory is NELAP accredited for this analyte by the indicated matrix and method. DL (detection limit), LOD (limit of detection), loq (limit of quantitation) as defined by most recent DOD QSM version.

All samples were received intact and properly preserved unless otherwise noted. The results reported relate only to the samples tested. This report shall not be reproduced, except in full, without written approval of this laboratory. The Chain of Custody is attached.

This report has been specifically prepared to satisfy project or program requirements. These results are in compliance with NELAC requirements for the parameters where accreditation is required or available, unless noted in the case narrative.

Submitted by: Brett M. Szymanski
Project Manager
608-356-2760

QC Qualifiers		Current CT Laboratories Certifications
Code	Description	
B	Analyte detected in the associated Method Blank.	Wisconsin (WDNR) Chemistry ID# 157066030 Wisconsin (DATCP) Bacteriology ID# 289 Louisiana NELAP (primary) ID# ACC20190002 Illinois NELAP Lab ID# 200073 Kansas NELAP Lab ID# E-10368 Virginia NELAP Lab ID# 460203 ISO/IEC 17025-2005 A2LA Cert # 3806.01 DoD-ELAP A2LA 3806.01 GA EPD Stipulation ID ACC20190002
C	Toxicity present in BOD sample.	
D	Diluted Out.	
E	Safe, No Total Coliform detected.	
F	Unsafe, Total Coliform detected, no E. Coli detected.	
G	Unsafe, Total Coliform detected and E. Coli detected.	
H	Holding time exceeded.	
I	Incubator temperature was outside acceptance limits during test period.	
J	Estimated value.	
L	Significant peaks were detected outside the chromatographic window.	
M	Matrix spike and/or Matrix Spike Duplicate recovery outside acceptance limits.	
N	Insufficient BOD oxygen depletion.	
O	Complete BOD oxygen depletion.	
P	Concentration of analyte differs more than 40% between primary and confirmation analysis.	
Q	Laboratory Control Sample outside acceptance limits.	
R	See Narrative at end of report.	
S	Surrogate standard recovery outside acceptance limits due to apparent matrix effects.	
T	Sample received with improper preservation or temperature.	
U	Analyte concentration was below detection limit.	
V	Raised Quantitation or Reporting Limit due to limited sample amount or dilution for matrix background interference.	
W	Sample amount received was below program minimum.	
X	Analyte exceeded calibration range.	
Y	Replicate/Duplicate precision outside acceptance limits.	
Z	Specified calibration criteria was not met.	

QC SUMMARY REPORT

USACE - OMAHA

SDG #: 0

Folder #: 153810

Project Name: BIG BEND DAM TOE DRAIN
 REPLACEMENT
 Project #:

Lab Control Spike Water

Analytical Run #:	172130	Analysis Date:	06/12/2020	Prep Batch #:	76788	Matrix:	LIQUID
CTLab #:	429624	Analysis Time:	12:48	Prep Date/Time:	06/11/2020 13:00	Method:	SW8015
Parent Sample #:		Analyst:	JJY	Prep Analyst:	JLH		

Analyte	QC sample result	Units	Parent sample result	Qualifier(s)	Spike Amount Added	% Recovery	Control Limits	RPD	RPD Limit
Diesel Range Organics	2060	ug/L			2500	82	36 --- 132		30

USACE - OMAHA

SDG #: 0

Folder #: 153810

Project Name: BIG BEND DAM TOE DRAIN
REPLACEMENT
Project #:

Method Blank Water

Analytical Run #:	172130	Analysis Date:	06/12/2020	Prep Batch #:	76788	Matrix:	LIQUID
CTLab #:	429623	Analysis Time:	12:20	Prep Date/Time:	06/11/2020 13:00	Method:	SW8015
Parent Sample #:		Analyst:	JJY	Prep Analyst:	JLH		

Analyte	QC sample result	Units	Parent sample result	Qualifier(s)	Spike Amount Added	% Recovery	Control Limits	RPD	RPD Limit
Diesel Range Organics	33	ug/L		U	0		100		

USACE - OMAHA

SDG #: 0

Folder #: 153810

Project Name: BIG BEND DAM TOE DRAIN
REPLACEMENT
Project #:

Lab Control Spike Soil

Analytical Run #:	172235	Analysis Date:	06/16/2020	Prep Batch #:	76752	Matrix:	SOLID
CTLab #:	428336	Analysis Time:	18:27	Prep Date/Time:	06/16/2020 10:30	Method:	SW8015
Parent Sample #:		Analyst:	JJY	Prep Analyst:	JLH		

Analyte	QC sample result	Units	Parent sample result	Qualifier(s)	Spike Amount Added	% Recovery	Control Limits	RPD	RPD Limit
Diesel Range Organics	192	mg/kg			250	77	38 --- 132		30

USACE - OMAHA

SDG #: 0

Folder #: 153810

Project Name: BIG BEND DAM TOE DRAIN
REPLACEMENT
Project #:

Method Blank Soil

Analytical Run #:	172235	Analysis Date:	06/16/2020	Prep Batch #:	76752	Matrix:	SOLID
CTLab #:	428335	Analysis Time:	17:59	Prep Date/Time:	06/16/2020 10:30	Method:	SW8015
Parent Sample #:		Analyst:	JJY	Prep Analyst:	JLH		

Analyte	QC sample result	Units	Parent sample result	Qualifier(s)	Spike Amount Added	% Recovery	Control Limits	RPD	RPD Limit
Diesel Range Organics	5	mg/kg		U	0		20		

Sample Condition Report

Folder #: 153810
 Client: USACE - OMAHA

Print Date / Time: 06/08/2020 08:59
 Received Date / Time / By: 06/06/2020 10:30 JLS

Project Name: BIG BEND DAM TOE DRAIN REPLACEMENT
 Project Phase: FORT THOMPSON, SD

Log-In Date / Time / By: 06/08/2020 08:58 EKB
 Project #: PM: BMS

Coolers: 5425
 Custody Seals Present : Y

Temperature: 3.0 C
 COC Present?: Y Complete? Y On Ice: Y

Seal Intact? Y
 Ship Method: FEDEX EXPRESS
 Adequate Packaging: Y

Numbers: DATED AND SIGNED
 Tracking Number: 806531978884
 Temp Blank Enclosed? Y

Notes: THE SAMPLES WERE RECEIVED IN GOOD CONDITION ON ICE.

TWO CUSTODY SEALS WERE PRESENT AND INTACT UPON RECEIPT - BOTH WERE DATED 6/5/20 AND SIGNED.

Sample ID / Description	Container Type	Cond. Code	pH OK?/Filtered?	Tests
428379 BBSD-11B	AMBER GL	1	/	DRO
Total # of Containers of Type (AMBER GL) = 1				
Sample ID / Description	Container Type	Cond. Code	pH OK?/Filtered?	Tests
428380 BBSD-10B	AMBER GL	1	/	DRO
Total # of Containers of Type (AMBER GL) = 1				
Sample ID / Description	Container Type	Cond. Code	pH OK?/Filtered?	Tests
428381 BBSD-07B	AMBER GL	1	/	DRO
Total # of Containers of Type (AMBER GL) = 1				
Sample ID / Description	Container Type	Cond. Code	pH OK?/Filtered?	Tests
428382 BBSD-09B	AMBER GL	1	/	DRO
Total # of Containers of Type (AMBER GL) = 1				
Sample ID / Description	Container Type	Cond. Code	pH OK?/Filtered?	Tests
428383 BBSD-11A	UNPRES GL	1	/	DRO,%SOL
Total # of Containers of Type (UNPRES GL) = 1				
Sample ID / Description	Container Type	Cond. Code	pH OK?/Filtered?	Tests
428384 BBSD-10A	UNPRES GL	1	/	DRO,%SOL
Total # of Containers of Type (UNPRES GL) = 1				

Sample ID / Description	Container Type	Cond. Code	pH OK?/Filtered?	Tests
428385 BBSD-XXA	UNPRES GL	1	/	DRO,%SOL
Total # of Containers of Type (UNPRES GL) = 1				
Sample ID / Description	Container Type	Cond. Code	pH OK?/Filtered?	Tests
428386 BBSD-08A	UNPRES GL	1	/	DRO,%SOL
Total # of Containers of Type (UNPRES GL) = 1				
Sample ID / Description	Container Type	Cond. Code	pH OK?/Filtered?	Tests
428387 BBSD-09A	UNPRES GL	1	/	DRO,%SOL
Total # of Containers of Type (UNPRES GL) = 1				
Sample ID / Description	Container Type	Cond. Code	pH OK?/Filtered?	Tests
428388 BBSD-07A	UNPRES GL	1	/	DRO,%SOL
Total # of Containers of Type (UNPRES GL) = 1				

<u>Condition Code</u>	<u>Condition Description</u>
1	Sample Received OK

CHAIN OF CUSTODY

Company: USACE - Omaha
 Project Contact: Tom Weirauch
 Telephone: 402 995 2289
 Project Name: Big Bend Dam Toe Drain Replacement
 Project #:
 Location: Big Bend Dam SO
 Sampled By: George Filipovich

CT LABORATORIES

1230 Lange Court, Baraboo, WI 53913
 608-356-2760 Fax 608-356-2766
 www.ctlaboratories.com

Folder # 153810
 Company: USACE - OMAHA
 Project: BIG BEND DAM TO DRA
 Logged By: EKB PM: BM

Program:
 QSM RCRA SDWA NPDES
 Solid Waste Other _____
 PO #

Report To: thomas.g. weirauch@
 EMAIL: USACE, ARMY, MIL
 Company: USACE - Omaha District
 Address: 1616 Capitol Ave.
 Invoice To: Omaha NE 68102
 EMAIL:
 Company: Same as above
 Address:

*Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions

Client Special Instructions

ANALYSES REQUESTED

Turnaround Time

☒ Normal ☐ RUSH*

Date Needed: _____

Rush analysis requires prior
 CT Laboratories' approval

Surcharges:

24 hr 200%

2-3 days 100%

4-9 days 50%

Matrix:

GW - groundwater SW - surface water WW - wastewater DW - drinking water
 S - soil/sediment SL - sludge A - air M - misc/waste

Filtered? Y/N

TPH DRO

Total # Containers

Designated MS/MSD

Collection		Matrix	Grab/Comp	Sample #	Sample ID Description		Fill in Spaces with Bottles per Test																CT Lab ID # Lab use only
Date	Time																						
6/4/20	1323	GW	G	1	BBSD-11B	N	1																428379
6/4/20	1500	GW	G	1	BBSD-10B	N	1																428380
6/5/20	1144	GW	G	1	BBSD-07B	N	1																428381
6/5/20	0920	GW	G	1	BBSD-09B	N	1																428382
6/4/20	1235	S	G	1	BBSD-11A		1																428383
6/4/20	1400	S	G	1	BBSD-10A		1																428384
6/5/20	1345	S	G	1	BBSD-XXA		1																428385
6/5/20	1345	S	G	1	BBSD-08A		1																428386
6/5/20	0821	S	G	1	BBSD-09A		1																428387
6/5/20	1018	S	G	1	BBSD-07A		1																428388

Relinquished By:

Date/Time

6/5/20 1455

Received By:

Date/Time

6/8/2020 1030

Lab Use Only

Ice Present ☒ Yes ☐ No

Received by:

Date/Time

Received for Laboratory by:

Date/Time

6-8-2020 0858

Temp 3.0 IR Gun 24Cooler # 5425

CT Laboratories Terms and Conditions

When a purchaser (Client) places an order for laboratory, consulting or sampling services from CT Laboratories (CTL), CTL shall provide the ordered services pursuant to these Terms and Conditions, and the related Quotation, or as agreed in a negotiated contract. In the absence of a written agreement to the contrary, the Order constitutes an acceptance by the Client of CTL's offer to do business under these Terms and Conditions, and an agreement to be bound by these Terms and Conditions. No contrary or additional terms and conditions expressed in a Client's document shall be deemed to become a part of the contract created upon acceptance of these Terms and Conditions, unless accepted by CTL in advance of the start of the project and in writing.

1. ORDERS AND RECEIPT OF SAMPLES (Simple Acceptance Policy)

- 1.1 The Client may place the Order (i.e., specify a Scope of Work) either by submitting a purchase order to CTL in writing, by telephone (confirmed in writing) or by negotiated contract. Whichever option the Client selects for placing the Order, the Order shall not be valid unless it contains sufficient information to enable CTL to carry out the Client's requirements. It is the policy of CTL that samples not meeting the acceptance criteria, outlined in the NELAP standards and Section 5.8.3.2 of the DOD QSM, will not be accepted by the laboratory or will be qualified on the final report. All samples submitted to the laboratory must: (a) be accompanied by proper, full and complete documentation, including sample identification, location, date and time of collection, the collector's name, type of preservation (if any), type of sample, any special comments concerning the sample and any additional pertinent fields on the chain-of-custody. In the absence of any of the required information, the laboratory will attempt to contact the client to obtain the information; if unable to obtain the necessary information, the final report will be qualified. (b) samples must be labeled appropriately with a unique sample identification written with indelible ink on water resistant labels. If the laboratory cannot determine the identity of a sample, it may be rejected and the client will be contacted for further instructions or resampling. (c) samples must be in an appropriate sample container. If the container is inappropriate, the client will be contacted for further instructions or resampling. If analysis is possible, the final report will be qualified. CTL can provide a sampling guide containing approved containers and preservations for analytical methods requested. (d) adhere to method specified holding times. If samples are received with less than 1/2 the holding time remaining for the requested test, CTL will make its best effort to analyze the samples and notify the client. If holding times are exceeded, the final report will be qualified. (e) contain adequate sample volume to perform the necessary testing. If sufficient volume is not present, the sample may be rejected and the client will be contacted for further instructions or resampling. If samples show signs of damage, contamination or inadequate preservation, the client will be notified. If analysis can be performed, the final report will be qualified. If not, the samples will be rejected and the client notified for further instructions or resampling. It is the Client's responsibility to understand and package samples correctly and provide the proper amount of temperature control (ice) suitable to current weather conditions.
- 1.2 CTL must be supplied with complete written disclosure of the known or suspected presence of any hazardous substances, as defined by applicable federal or state law. Where any samples which were not accompanied by the required disclosure, cause interruptions in the lab's ability to process work due to contamination of instruments or work areas, the Client will be responsible for the costs of clean up and recovery.
- 1.3 Prior to Sample Acceptance, the entire risk of loss or damage to samples remains with the Client. In no event will CTL have any responsibility or liability for the action or inaction of any carrier shipping or delivering any sample to or from CTL's premises. Client is responsible to assure that any sample containing any hazardous substance which is to be delivered to CTL's premises will be packaged, labeled, transported and delivered properly and in accordance with applicable laws.
- 1.4 Clients using CTL's shipping account(s) do so at their own risk and must purchase separate insurance if they do not wish to assume risk of loss. CTL will not assume any risk whatsoever for any samples outside of CTL's control and not successfully delivered to the laboratory within specified hold times.
- 1.5 CTL will not accept liability for any sample(s), except sample(s) damaged or broken by log-in staff prior to successful log-in of the sample(s) into the CTL LIMS system. This includes, but may not be limited to: complete, valid COC documentation; all sample receiving issues being resolved from a delay caused by the Client in CTL's ability to log-in samples, including missed turnaround and hold times, delay in processing and, ultimately, additional charges to the Client.
- 1.6 CTL will only reject samples per directions from the Client. CTL's sole liability is to inform the Client of any sample receipt issues, and may provide an indication how proceeding with the analysis may affect results and final acceptance by the regulating agency. Ultimately, suitability for use is between the Client and the regulating agency(s).
- 1.7 Signing of this COC by the Client or Client's representative, or directions to CTL via email or Fax constitutes acceptance of these Terms and Conditions, and guarantees payment by the Client to CTL.

2. PAYMENT TERMS

2.1 Services performed by CTL will be in accordance with prices quoted and later confirmed in writing or as stated in the Price Schedule. Invoices may be submitted to Client upon completion of any sample delivery group. Payment in advance is required for all Clients except those whose credit has been established with CTL. For Clients with approved credit, payment terms are net 30 days from the date of invoice by CTL. All overdue payments are subject to an additional interest and service charge of one and one-half percent (1.5%) or the maximum rate permissible by law, per month or portion thereof from the due date until the date of payment. All fees are charged or billed directly to the Client. The billing of a third party will not be accepted without a statement, signed by the third party that acknowledges and accepts payment responsibility. CTL may suspend work and withhold delivery of data under this order at any time in the event Client fails to make timely payment of its invoices. Client shall be responsible for all costs and expenses of collection including reasonable attorney's fees. CTL reserves the right to refuse to proceed with work at any time based upon an unfavorable Client credit report.

3. CHANGE ORDERS, TERMINATION

- 3.1 Changes to the Scope of Work, price, or result delivery date may be initiated by CTL after Sample Acceptance due to any condition which conflicts with analytical, QA or other protocols warranted in these Terms and Conditions. CTL will not proceed with such changes until an agreement with the Client is reached on the amount of any cost, schedule change or technical change to the Scope of Work, and such agreement is documented in writing.
- 3.2 Changes to the Scope of Work, including but not limited to increasing or decreasing the work, changing test and analysis specification or acceleration in the performance of the work may be initiated by the Client after sample acceptance. Such a change will be documented in writing and may result in a change in cost and turnaround time commitment. CTL's acceptance of such changes is contingent upon technical feasibility and operational capacity.
- 3.3 Suspension or termination of all or any part of the work may be initiated by the Client. CTL will be compensated consistent with Section 2 of these Terms and Conditions. CTL will complete all work in progress and be paid in full for all work completed.

4. WARRANTIES AND LIABILITY

- 4.1 Where applicable, CTL will use analytical methodologies which are in substantial conformity with published test methods. CTL has implemented these methods in its Laboratory Quality Manuals and referenced Standard Operating Procedures and where the nature or composition of the sample requires it, CTL reserves the right to deviate from these methodologies as necessary or appropriate, based on the reasonable judgment of CTL, which deviations, if any, will be made on a basis consistent with recognized standards of the industry and/or CTL's Laboratory Quality Manuals. Client may request that CTL perform according to a mutually agreed Quality Assurance Project Plan (QAPP). In the event that samples arrive prior to agreement on a QAPP, CTL will proceed with analyses under its standard Quality Manuals then in effect, and CTL will not be responsible for any resampling or other charges if work must be repeated to comply with a subsequently finalized QAPP.
- 4.2 CTL shall start preparation and/or analysis within holding times provided that Sample Acceptance occurs within 48 hours of sampling or 1/2 of the holding time for the test, whichever is less. Samples received that do not meet this provision will be charged as expedited samples and the appropriate rate will be added accordingly. Where resolution of inconsistencies leading to Sample Acceptance does not occur within this period, CTL will use its best efforts to meet holding times and will proceed with the work provided that, in CTL's judgment, the chain-of-custody or definition of the Scope of Work provide sufficient guidance. Reanalysis of samples to comply with CTL's Quality Manuals will be deemed to have met holding times provided the initial analysis was performed within the applicable holding time. Where reanalysis demonstrates that sample matrix interference is the cause of failure to meet any Quality Manual requirements, the warranty will be deemed to have been met.
- 4.3 CTL warrants that it possesses and maintains all licenses and certifications which are required to perform services under these Terms and Conditions provided that such requirements are specified in writing to CTL prior to Sample Acceptance. CTL will notify the Client in writing of any decertification or revocation of any license, or notice of either, which affects work in progress.
- 4.4 The warranty obligations set forth in Sections 4.1, 4.2 and 4.3 are the sole and exclusive warranties given by CTL in connection with any services performed by CTL, or any Results generated from such services, and CTL gives and makes NO OTHER REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESS OR IMPLIED. No representative of CTL is authorized to give or make any other representation or warranty or modify this warranty in any way.
- 4.5 Client's sole and exclusive remedy for the breach of warranty in connection with any services performed by CTL, will be limited to repeating any services performed, contingent on the Client's providing, at the request of CTL and at the Client's expense, additional sample(s) if necessary. Any reanalysis requested by the Client generating Results consistent with the original Results will be at the Client's expense. If resampling is necessary, CTL's liability for resampling costs will be limited to actual cost or one hundred or one hundred fifty dollars (\$150) per sample, whichever is less.
- 4.6 CTL's liability for any and all causes of action arising hereunder, whether based in contract, tort, warranty, negligence or otherwise, shall be limited to the lesser amount of compensation for the services performed or \$100,000. All claims, including those for negligence, shall be deemed waived unless suit thereon is filed within one year after CTL's completion of the services. Under no circumstances, whether arising in contract, tort (including negligence), or otherwise, shall CTL be responsible for loss of use, loss of profits, or for any special, indirect, incidental or consequential damages occasioned by the services performed or by application or use of the reports prepared.
- 4.7 In no event shall CTL have any responsibility or liability to the Client for any failure or delay in performance by CTL which results, directly or indirectly, in whole or in part, from any cause or circumstance beyond the reasonable control of CTL. Such causes and circumstances shall include, but not be limited to, acts of God, acts of Client, acts or orders of any governmental authority, strikes or other labor disputes, natural disasters, accidents, wars, civil disturbances, equipment breakdown, matrix interference or unknown highly contaminated samples that impact instrument operation, unavailability of supplies from usual suppliers, difficulties or delays in transportation, mail or delivery services, or any other cause beyond CTL's reasonable control.

5. RESULTS, WORK PRODUCT

- 5.1 Data or information provided to CTL or generated by services performed under this agreement shall only become the property of the Client upon receipt in full by CTL of payment for the whole Order. Ownership of any analytical method, QA/QC protocols, software programs or equipment developed by CTL for performance of work will be retained by CTL, and Client shall not disclose such information to any third party.
- 5.2 Data and sample materials provided by Client or at Client's request, and the result obtained by CTL shall be held in confidence (unless such information is generally available to the public or is in the public domain or Client has failed to pay CTL for all services rendered or is otherwise in breach of these Terms and Conditions), subject to any disclosure required by law or legal process.
- 5.3 Should the Results delivered by CTL be used by the Client or Client's client, even though subsequently determined not to meet the warranties described in these Terms and Conditions, then the compensation will be adjusted based upon mutual agreement. In no case shall the Client unreasonably withhold CTL's right to independently defend its data.
- 5.4 CTL reserves the right to subcontract services ordered by the Client to another laboratory or laboratories, if, in CTL's sole judgment, it is reasonably necessary, appropriate or advisable to do so, and with the Client's permission. CTL will in no way be liable for any subcontracted services and all applicable warranties, guarantees and insurance are those of the subcontracted laboratory.
- 5.5 CTL shall dispose of the Client's samples and extracts 30 days after the analytical report is issued, unless instructed to store them for an alternate period of time or to return such samples to the Client, in a manner consistent with U.S. Environmental Protection Agency regulations or other applicable Federal, state or local requirements. Additional charges will apply for samples or extracts stored longer than 30 days at the Client's request. Any samples for projects that are canceled or not accepted, or for which return was requested, will be returned to the Client at Client expense. CTL reserves the right to return to the Client any sample or unused portion of a sample that is not within CTL's permitted capability or the capabilities of CTL's designated waste disposal vendor(s), or will make arrangements to dispose of these samples at Client direction and expense.
- 5.6 Unless a different time period is agreed to in any order under these Terms and Conditions, CTL agrees to retain all records for five (5) years.
- 5.7 In the event that CTL is required to respond to legal process related to services for Client, Client agrees to reimburse CTL for hourly charges for personnel involved in the response and attorney fees reasonably incurred in obtaining advice concerning the response, preparation to testify, and appearances related to the legal process, travel and all reasonable expenses associated with the litigation.

6. INSURANCE

6.1 CTL shall maintain in force during the performance of services under these Terms and Conditions, Workers' Compensation and Employer's Liability Insurance in accordance with the laws of the states having jurisdiction over CTL's employees who are engaged in the performance of the work. CTL shall also maintain during such period, Comprehensive General and Contractual Liability (limit of \$2,000,000 per occurrence/aggregate), Comprehensive Automobile Liability, owned and hired, (\$1,000,000 combined single limit), and Professional/Pollution Liability Insurance (limit of \$5,000,000 per occurrence/aggregate). Any Client required changes to these limits or conditions will result in a change in cost to the Client.

7. AUDIT

7.1 Upon prior notice to CTL, the Client may audit and inspect CTL's records and accounts covering reimbursable costs related to work done for the Client, for a period of one (1) year after completion of the work. The purpose of any such audit shall be only for verification of such costs, and CTL shall not be required to provide access to cost records where prices are expressed as fixed fees or published unit prices.

Recipient's Copy

1 From _____
Date _____
Sender's Name _____ Phone 404 55 481
Company _____
Address _____
City LIMA, OH State OH ZIP 45005-1705

2 Your Internal Billing Reference

3 To Recipient's Name _____ Phone _____

Company _____

Address _____

We cannot deliver to P.O. boxes or P.O. ZIP codes. _____ Dept./Room/Suite/Room _____

Address _____

Use this line for the HOLD location address or for continuation of your shipping address. _____

City _____ State _____ ZIP _____

HOLD Weekday
 FedEx location address
☐ REQUIRED **NOT** available for
 FedEx First Overnight

HOLD Saturday
 FedEx location address
☐ REQUIRED **Available ONLY for**
 FedEx Priority Overnight and
 FedEx 2Day to select locations

4 Express Package Service * To most locations.
NOTE: Service order has changed. Please select carefully.

Next Business Day

- ☐ **FedEx First Overnight**
Earliest next business morning delivery to select locations. Friday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
- ☐ **FedEx Priority Overnight**
Next business morning.* Friday shipments will be delivered on Monday unless SATURDAY Delivery is selected.
- ☐ **FedEx Standard Overnight**
Next business afternoon.* Saturday Delivery NOT available.

2 or 3 Business Days

- ☐ **FedEx 2Day A.M.**
Second business morning.
Saturday Delivery NOT available
- ☐ **FedEx 2Day**
Second business afternoon.* Thursday shipments
will be delivered on Monday unless SATURDAY
Delivery is selected.
- ☐ **FedEx Express Saver**
Third business day.*
Saturday Delivery NOT available

5 Packaging * Declared value limit \$500

- ☐
- FedEx Envelope*
- ☐
- FedEx Pak*
- ☐
- FedEx Box
- ☐
- FedEx Tube
- ☒
- Other

6 Special Handling and Delivery Signature Options

-  **SATURDAY Delivery**
NOT available for FedEx Standard Overnight, FedEx 2Day A.M., or FedEx Express Saver

- ☐ **No Signature Required**
Package may be left without obtaining a signature for delivery.
- ☐ **Direct Signature**
Someone at recipient's address may sign for delivery. **Fee applies.**

Indirect Signature
If no one is available at recipient's address, someone at a neighboring address may sign for delivery. For residential deliveries only. **Fee applies.**

Does this shipment contain dangerous goods?

- One box must be checked.
- ☐ No ☐ Yes As per attached Shipper's Declaration ☐ Yes Shipper's Declaration not required
- ☐ Dry Ice, 6 UN 1845 ☐ Dry Ice, 9 Only
- Dangerous goods (including dry ice) cannot be shipped in FedEx packaging, or placed in a FedEx Express Drop Box.

7 Payment Bill to:

Enter FedEx Acct. No. or Credit Card No. below.

- ☐ **Sender**
Acct. No. in Section
1 will be billed.
- ☐ **Recipient**
- ☐ **Third Party**
- ☐ **Cash**

Total Packages	Total Weight
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Up to US\$100, unless you declare a higher value. See the current...

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SDR

RT 909
EZ B97
1 12:00 D
8884
06.0



SATURDAY 12:00P
PRIORITY OVERNIGHT
AHS
53913
WI-US MSN

TRK# 8065 3197 8884
0215

XO LNRA



Cooler Receipt Form

Ice Present YES NO

Temperature 3.0

IR Gun # 24

Initials jes

Date 6/6/2020 Time 1030

Cooler #: 5425

CUSTODY SEAL

DATE

SIGNATURE

QEC

Quality Environmental Containers
800-255-3950

CUSTODY SEAL

DATE

SIGNATURE

QEC

Quality Environmental Containers
800-255-3950 • www.qecusa.com

ANALYTICAL SUMMARY REPORT

This report at a minimum contains the following information:

- Analytical Report of Test Results
- Description of QC Qualifiers
- Chain of Custody (copy)
- Quality Control Summary (if applicable)
- Case Narrative (if applicable)
- Correspondence with Client (if applicable)

This report has been specifically prepared to satisfy project or program requirements. These results are in compliance with NELAC requirements for parameters where accreditation is required or available, unless otherwise noted in the case narrative.

ANALYTICAL SAMPLE DATA

USACE - OMAHA
TOM WEIRAUCH
1616 CAPITOL AVE
SUITE 9000
OMAHA, NE 68102-9000

Project Name: BIG BEND DAM TOE DRAIN REPLACEMENT
Project Phase: FORT THOMPSON, SD
Project #:
Folder #: 153902
Purchase Order #:
Contract #: 3357

Arrival Temperature: 3.8
Report Date: 06/23/2020
Date Received: 06/10/2020
Reprint Date: 06/23/2020

CT LAB#: 429900	Sample Description: BBSD-06A	Client Sample #:	Sampled: 06/08/2020 0902
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Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Inorganic Results												
Solids, Percent	78.2	%	0.1	0.1	0.1	0.1	1.00			6/22/20 16:10 BMS		EPA 8000C
Organic Results												
Diesel Range Organics	<19	mg/kg	6.3	19	50	50	1.00	U	06/16/2020 10:30	6/17/20 00:30	JJY	EPA 8015C
SURR: Octacosane	51	% Recovery	44			125	1.00		06/16/2020 10:30	6/17/20 00:30	JJY	EPA 8015C
Surr: Triacotane	43	% Recovery	35			136	1.00		06/16/2020 10:30	6/17/20 00:30	JJY	EPA 8015C

CT LAB#: 429901	Sample Description: BBSD-08B	Client Sample #:	Sampled: 06/08/2020 0818
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Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Organic Results												
Diesel Range Organics	74	ug/L	34	100	200	200	1.00	J	06/11/2020 13:00	6/12/20 15:35	JJY	EPA 8015C
SURR: Octacosane	76	% Recovery	60			142	1.00		06/11/2020 13:00	6/12/20 15:35	JJY	EPA 8015C
Surr: Triacotane	67	% Recovery	29			140	1.00		06/11/2020 13:00	6/12/20 15:35	JJY	EPA 8015C

Unless specifically stated to the contrary, soil/sediment/sludge sample results reported on a Dry Weight Basis

CT LAB#: 429902	Sample Description: BBSD-XXB	Client Sample #:	Sampled: 06/08/2020 0818
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Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Organic Results												
Diesel Range Organics	67	ug/L	34	100	210	210	1.00	J	06/11/2020 13:00	6/12/20 16:03	JJY	EPA 8015C
SURR: Octacosane	53	% Recovery	60			142	1.00	S	06/11/2020 13:00	6/12/20 16:03	JJY	EPA 8015C
Surr: Triacotane	35	% Recovery	29			140	1.00		06/11/2020 13:00	6/12/20 16:03	JJY	EPA 8015C

CT LAB#: 429903	Sample Description: BBSD-06B	Client Sample #:	Sampled: 06/08/2020 1017
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Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Organic Results												
Diesel Range Organics	260	ug/L	94	290	570	570	1.00	J	06/11/2020 13:00	6/12/20 16:31	JJY	EPA 8015C
SURR: Octacosane	99	% Recovery	60			142	1.00		06/11/2020 13:00	6/12/20 16:31	JJY	EPA 8015C
Surr: Triacotane	120	% Recovery	29			140	1.00		06/11/2020 13:00	6/12/20 16:31	JJY	EPA 8015C

CT LAB#: 429904	Sample Description: BBSD-05A	Client Sample #:	Sampled: 06/08/2020 1112
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Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Inorganic Results												
Solids, Percent	79.8	%	0.1	0.1	0.1	0.1	1.00			6/22/20 16:10	BMS	EPA 8000C
Organic Results												
Diesel Range Organics	<18	mg/kg	6.1	18	49	49	1.00	U	06/16/2020 10:30	6/17/20 01:25	JJY	EPA 8015C
SURR: Octacosane	57	% Recovery	44			125	1.00		06/16/2020 10:30	6/17/20 01:25	JJY	EPA 8015C
Surr: Triacotane	47	% Recovery	35			136	1.00		06/16/2020 10:30	6/17/20 01:25	JJY	EPA 8015C

CT LAB#: 429905	Sample Description: BBSD-05B	Client Sample #:	Sampled: 06/08/2020 1235
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Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Organic Results												
Diesel Range Organics	1200	ug/L	75	230	450	450	1.00		06/11/2020 13:00	6/12/20 17:27	JJY	EPA 8015C
SURR: Octacosane	88	% Recovery	60			142	1.00		06/11/2020 13:00	6/12/20 17:27	JJY	EPA 8015C
Surr: Triacotane	80	% Recovery	29			140	1.00		06/11/2020 13:00	6/12/20 17:27	JJY	EPA 8015C

CT LAB#: 429906	Sample Description: BBSD-04A	Client Sample #:	Sampled: 06/08/2020 1342
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Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Inorganic Results												
Solids, Percent	85.1	%	0.1	0.1	0.1	0.1	1.00			6/22/20 16:10	BMS	EPA 8000C
Organic Results												
Diesel Range Organics	<18	mg/kg	5.9	18	47	47	1.00	U	06/16/2020 10:30	6/17/20 00:58	JJY	EPA 8015C
SURR: Octacosane	54	% Recovery	44			125	1.00		06/16/2020 10:30	6/17/20 00:58	JJY	EPA 8015C
Surr: Triacotane	44	% Recovery	35			136	1.00		06/16/2020 10:30	6/17/20 00:58	JJY	EPA 8015C

CT LAB#: 429907	Sample Description: BBSD-04B	Client Sample #:	Sampled: 06/08/2020 1450
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Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Organic Results												
Diesel Range Organics	200	ug/L	80	240	490	490	1.00	J	06/11/2020 13:00	6/12/20 16:59	JJY	EPA 8015C
SURR: Octacosane	120	% Recovery	60			142	1.00		06/11/2020 13:00	6/12/20 16:59	JJY	EPA 8015C
Surr: Triacotane	120	% Recovery	29			140	1.00		06/11/2020 13:00	6/12/20 16:59	JJY	EPA 8015C

Notes:

^ Indicates the laboratory is NELAP accredited for this analyte by the indicated matrix and method. DL (detection limit), LOD (limit of detection), loq (limit of quantitation) as defined by most recent DOD QSM version.

All samples were received intact and properly preserved unless otherwise noted. The results reported relate only to the samples tested. This report shall not be reproduced, except in full, without written approval of this laboratory. The Chain of Custody is attached.

This report has been specifically prepared to satisfy project or program requirements. These results are in compliance with NELAC requirements for the parameters where accreditation is required or available, unless noted in the case narrative.

Submitted by: Brett M. Szymanski
Project Manager
608-356-2760

QC Qualifiers	
Code	Description
B	Analyte detected in the associated Method Blank.
C	Toxicity present in BOD sample.
D	Diluted Out.
E	Safe, No Total Coliform detected.
F	Unsafe, Total Coliform detected, no E. Coli detected.
G	Unsafe, Total Coliform detected and E. Coli detected.
H	Holding time exceeded.
I	Incubator temperature was outside acceptance limits during test period.
J	Estimated value.
L	Significant peaks were detected outside the chromatographic window.
M	Matrix spike and/or Matrix Spike Duplicate recovery outside acceptance limits.
N	Insufficient BOD oxygen depletion.
O	Complete BOD oxygen depletion.
P	Concentration of analyte differs more than 40% between primary and confirmation analysis.
Q	Laboratory Control Sample outside acceptance limits.
R	See Narrative at end of report.
S	Surrogate standard recovery outside acceptance limits due to apparent matrix effects.
T	Sample received with improper preservation or temperature.
U	Analyte concentration was below detection limit.
V	Raised Quantitation or Reporting Limit due to limited sample amount or dilution for matrix background interference.
W	Sample amount received was below program minimum.
X	Analyte exceeded calibration range.
Y	Replicate/Duplicate precision outside acceptance limits.
Z	Specified calibration criteria was not met.

Current CT Laboratories Certifications

Wisconsin (WDNR) Chemistry ID# 157066030
Wisconsin (DATCP) Bacteriology ID# 289
Louisiana NELAP (primary) ID# ACC20190002
Illinois NELAP Lab ID# 200073
Kansas NELAP Lab ID# E-10368
Virginia NELAP Lab ID# 460203
ISO/IEC 17025-2005 A2LA Cert # 3806.01
DoD-ELAP A2LA 3806.01
GA EPD Stipulation ID ACC20190002

QC SUMMARY REPORT

USACE - OMAHA

SDG #: 0

Folder #: 153902

Project Name: BIG BEND DAM TOE DRAIN
 REPLACEMENT
 Project #:

Duplicate

Analytical Run #:	172222	Analysis Date:	06/22/2020	Prep Batch #:	Matrix:	SOIL
CTLab #:	436059	Analysis Time:	16:10	Prep Date/Time:	Method:	SW8000C
Parent Sample #:	429904	Analyst:	BMS	Prep Analyst:		

Analyte	QC sample result	Units	Parent sample result	Qualifier(s)	Spike Amount Added	% Recovery	Control Limits	RPD	RPD Limit
Solids, Percent	79.4	%	79.8					1	8

USACE - OMAHA

SDG #: 0

Folder #: 153902

Project Name: BIG BEND DAM TOE DRAIN
REPLACEMENT
Project #:

Lab Control Spike Water

Analytical Run #:	172130	Analysis Date:	06/12/2020	Prep Batch #:	76788	Matrix:	LIQUID
CTLab #:	429624	Analysis Time:	12:48	Prep Date/Time:	06/11/2020 13:00	Method:	SW8015
Parent Sample #:		Analyst:	JJY	Prep Analyst:	JLH		

Analyte	QC sample result	Units	Parent sample result	Qualifier(s)	Spike Amount Added	% Recovery	Control Limits	RPD	RPD Limit
Diesel Range Organics	2060	ug/L			2500	82	36 --- 132		30

USACE - OMAHA

SDG #: 0

Folder #: 153902

Project Name: BIG BEND DAM TOE DRAIN
REPLACEMENT
Project #:

Method Blank Water

Analytical Run #:	172130	Analysis Date:	06/12/2020	Prep Batch #:	76788	Matrix:	LIQUID
CTLab #:	429623	Analysis Time:	12:20	Prep Date/Time:	06/11/2020 13:00	Method:	SW8015
Parent Sample #:		Analyst:	JJY	Prep Analyst:	JLH		

Analyte	QC sample result	Units	Parent sample result	Qualifier(s)	Spike Amount Added	% Recovery	Control Limits	RPD	RPD Limit
Diesel Range Organics	33	ug/L		U	0		100		

USACE - OMAHA

SDG #: 0

Folder #: 153902

Project Name: BIG BEND DAM TOE DRAIN
REPLACEMENT
Project #:

Matrix Spike Duplicate Water

Analytical Run #:	172130	Analysis Date:	06/12/2020	Prep Batch #:	76788	Matrix:	GROUND WATER
CTLab #:	430508	Analysis Time:	18:23	Prep Date/Time:	06/11/2020 13:00	Method:	SW8015
Parent Sample #:	430506	Analyst:	JJY	Prep Analyst:	JLH		

Analyte	QC sample result	Units	Parent sample result	Qualifier(s)	Spike Amount Added	% Recovery	Control Limits	RPD	RPD Limit
Diesel Range Organics	3860	ug/L	1200		3680	72	36 --- 132	2	30
SURR: Octacosane	96.0	% Recovery			100	96.0	60 --- 142		
Surr: Triacontane	91.5	% Recovery			100	91.5	29 --- 140		

USACE - OMAHA

SDG #: 0

Folder #: 153902

Project Name: BIG BEND DAM TOE DRAIN
REPLACEMENT
Project #:

Matrix Spike Water

Analytical Run #:	172130	Analysis Date:	06/12/2020	Prep Batch #:	76788	Matrix:	GROUND WATER
CTLab #:	430506	Analysis Time:	17:55	Prep Date/Time:	06/11/2020 13:00	Method:	SW8015
Parent Sample #:	429905	Analyst:	JJY	Prep Analyst:	JLH		

Analyte	QC sample result	Units	Parent sample result	Qualifier(s)	Spike Amount Added	% Recovery	Control Limits	RPD	RPD Limit
Diesel Range Organics	3890	ug/L	1200		3620	74	36 --- 132		
SURR: Octacosane	80.7	% Recovery			100	80.7	60 --- 142		
Surr: Triacontane	66.1	% Recovery			100	66.1	29 --- 140		

USACE - OMAHA

SDG #: 0

Folder #: 153902

Project Name: BIG BEND DAM TOE DRAIN
REPLACEMENT
Project #:

Lab Control Spike Soil

Analytical Run #:	172235	Analysis Date:	06/16/2020	Prep Batch #:	76752	Matrix:	SOLID
CTLab #:	428336	Analysis Time:	18:27	Prep Date/Time:	06/16/2020 10:30	Method:	SW8015
Parent Sample #:		Analyst:	JJY	Prep Analyst:	JLH		

Analyte	QC sample result	Units	Parent sample result	Qualifier(s)	Spike Amount Added	% Recovery	Control Limits	RPD	RPD Limit
Diesel Range Organics	192	mg/kg			250	77	38 --- 132		30

USACE - OMAHA

SDG #: 0

Folder #: 153902

Project Name: BIG BEND DAM TOE DRAIN
REPLACEMENT
Project #:

Method Blank Soil

Analytical Run #:	172235	Analysis Date:	06/16/2020	Prep Batch #:	76752	Matrix:	SOLID
CTLab #:	428335	Analysis Time:	17:59	Prep Date/Time:	06/16/2020 10:30	Method:	SW8015
Parent Sample #:		Analyst:	JJY	Prep Analyst:	JLH		

Analyte	QC sample result	Units	Parent sample result	Qualifier(s)	Spike Amount Added	% Recovery	Control Limits	RPD	RPD Limit
Diesel Range Organics	5	mg/kg		U	0		20		

USACE - OMAHA

SDG #: 0

Folder #: 153902

Project Name: BIG BEND DAM TOE DRAIN
REPLACEMENT
Project #:

Matrix Spike Duplicate Soil

Analytical Run #:	172235	Analysis Date:	06/17/2020	Prep Batch #:	76752	Matrix:	SOIL
CTLab #:	431750	Analysis Time:	02:21	Prep Date/Time:	06/16/2020 10:30	Method:	SW8015
Parent Sample #:	431749	Analyst:	JJY	Prep Analyst:	JLH		

Analyte	QC sample result	Units	Parent sample result	Qualifier(s)	Spike Amount Added	% Recovery	Control Limits	RPD	RPD Limit
Diesel Range Organics	209	mg/kg	BDL		310	67	38 --- 132	5	30
SURR: Octacosane	61.4	% Recovery			100	61.4	44 --- 125		
Surr: Triacontane	50.2	% Recovery			100	50.2	35 --- 136		

USACE - OMAHA

SDG #: 0

Folder #: 153902

Project Name: BIG BEND DAM TOE DRAIN
REPLACEMENT
Project #:**Matrix Spike Soil**

Analytical Run #:	172235	Analysis Date:	06/17/2020	Prep Batch #:	76752	Matrix:	SOIL
CTLab #:	431749	Analysis Time:	01:53	Prep Date/Time:	06/16/2020 10:30	Method:	SW8015
Parent Sample #:	429904	Analyst:	JJY	Prep Analyst:	JLH		

Analyte	QC sample result	Units	Parent sample result	Qualifier(s)	Spike Amount Added	% Recovery	Control Limits	RPD	RPD Limit
Diesel Range Organics	224	mg/kg	BDL		315	71	38 --- 132		
SURR: Octacosane	65.3	% Recovery			100	65.3	44 --- 125		
Surr: Triacontane	56.0	% Recovery			100	56.0	35 --- 136		

Sample Condition Report

Folder #: 153902 Print Date / Time: 06/10/2020 12:30
 Client: USACE - OMAHA Received Date / Time / By: 06/10/2020 10:30 CHB

Project Name: BIG BEND DAM TOE DRAIN REPLACEMENT Log-In Date / Time / By: 06/10/2020 12:30 JLS
 Project Phase: FORT THOMPSON, SD Project #: PM: BMS

Coolers: 5654 Temperature: 3.8 C On Ice: Y
 Custody Seals Present : Y COC Present?: Y Complete?: Y

Seal Intact? Y Numbers: DATED AND SIGNED
 Ship Method: FEDEX EXPRESS Tracking Number: 806531978895
 Adequate Packaging: Y Temp Blank Enclosed? Y

Notes: THE SAMPLES WERE RECEIVED IN GOOD CONDITION ON ICE.

TWO CUSTODY SEALS WERE PRESENT AND INTACT UPON RECEIPT - BOTH WERE DATED 6/9/20 AND SIGNED.

Sample ID / Description	Container Type	Cond. Code	pH OK?/Filtered?	Tests
429900 BBSD-06A	UNPRES GL	1	/	DRO,%SOL
Total # of Containers of Type (UNPRES GL) = 1				
Sample ID / Description	Container Type	Cond. Code	pH OK?/Filtered?	Tests
429901 BBSD-08B	AMBER GL	1	/	DRO
Total # of Containers of Type (AMBER GL) = 1				
Sample ID / Description	Container Type	Cond. Code	pH OK?/Filtered?	Tests
429902 BBSD-XXB	AMBER GL	1	/	DRO
Total # of Containers of Type (AMBER GL) = 1				
Sample ID / Description	Container Type	Cond. Code	pH OK?/Filtered?	Tests
429903 BBSD-06B	AMBER GL	1	/	DRO
Total # of Containers of Type (AMBER GL) = 1				
Sample ID / Description	Container Type	Cond. Code	pH OK?/Filtered?	Tests
429904 BBSD-05A	UNPRES GL	1	/	DRO,%SOL
	UNPRES GL	1	/	DRO,%SOL
Total # of Containers of Type (UNPRES GL) = 2				
Sample ID / Description	Container Type	Cond. Code	pH OK?/Filtered?	Tests
429905 BBSD-05B	AMBER GL	1	/	DRO

153902

AMBER GL	1	/	DRO
AMBER GL	1	/	DRO
Total # of Containers of Type (AMBER GL) = 3			

Sample ID / Description	Container Type	Cond. Code	pH OK?/Filtered?	Tests
429906 BBSD-04A	UNPRES GL	1	/	DRO,%SOL
Total # of Containers of Type (UNPRES GL) = 1				

Sample ID / Description	Container Type	Cond. Code	pH OK?/Filtered?	Tests
429907 BBSD-04B	AMBER GL	1	/	DRO
Total # of Containers of Type (AMBER GL) = 1				

<u>Condition Code</u>	<u>Condition Description</u>
1	Sample Received OK

Company: USACE - Omaha
 Project Contact: Tom Weiranch
 Telephone: 402 995 2289
 Project Name: Big Bend Dam Toe Drain Replacement
 Project #:
 Location: Big Bend Dam SD
 Sampled By: George Filpovich

CT LABORATORIES

1230 Lange Court, Baraboo, WI 53913
 608-356-2760 Fax 608-356-2766
 www.ctlaboratories.com

Folder # 153902
 Company: USACE - OMAHA
 Project: BIG BEND DAM
 Logged By JLS PM: BM

Program:
 QSM RCRA SDWA NPDES
 Solid Waste Other _____
 PO # _____

Report To: Thomas A. Weiranch
 EMAIL: USACE.ATL@MIL
 Company: USACE - Omaha District
 Address: 1616 Capitol Ave
 Invoice To: Omaha NE 68102
 EMAIL:
 Company: Same as above
 Address:

*Party listed is responsible for payment of invoice as per CT Laboratories' terms and conditions

Client Special Instructions

ANALYSES REQUESTED

Turnaround Time

Normal RUSH*

Date Needed: _____

Rush analysis requires prior
 CT Laboratories' approval

Surcharges:

24 hr 200%

2-3 days 100%

4-9 days 50%

Matrix:

GW - groundwater SW - surface water WW - wastewater DW - drinking water
 S - soil/sediment SL - sludge A - air M - misc/waste

Filtered? Y/N

T/H - DRO

Total # Containers

Designated MS/MSD

Collection		Matrix	Grab/Comp	Sample #	Sample ID Description	Fill in Spaces with Bottles per Test																CT Lab ID #	
Date	Time																					Lab use only	
6/8/20	0902	S	G	1	BBSD-06A	N	1															429900	
6/8/20	0818	GW	G	1	BBSD-08B	N	1															429901	
6/8/20	0819	FW	G	1	BBSD-XXB	N	1															429902	
6/8/20	1017	GW	G	1	BBSD-06B	N	1															429903	
6/8/20	1112	S	G	1	BBSD-05A		1															429904	
6/8/20	1112	S	G	1	BBSD-05A-MS/MSD		1													Y		429904	
6/8/20	1235	GW	G	1	BBSD-05B	N	1															429905	
6/8/20	1235	GW	G	1	BBSD-05B-MS	N	1													Y		429905	
6/8/20	1235	GW	G	1	BBSD-05B-MSD	N	1													Y		429905	
6/8/20	1342	SL	G	1	BBSD-04A		1															429906	
6/8/20	1450	GW	G	1	BBSD-04B	N	1															429907	

Relinquished By:

Date/Time

6/9/20/1015

Received By:

Date/Time

6/10/2020 1230

Received by:

Date/Time

Received for Laboratory by:

Date/Time

6/10/2020 10:30

Lab Use Only

Ice Present Yes No

Temp 38 IR Gun 27

Cooler # 565A

CT Laboratories Terms and Conditions

Where a purchaser (Client) places an order for laboratory, consulting or sampling services from CT Laboratories (CTL), CTL shall provide the ordered services pursuant to these Terms and Conditions, and the related Quotation, or as agreed in a negotiated contract. In the absence of a written agreement to the contrary, the Order constitutes an acceptance by the Client of CTL's offer to do business under these Terms and Conditions, and an agreement to be bound by these Terms and Conditions. No contrary or additional terms and conditions expressed in a Client's document shall be deemed to become a part of the contract created upon acceptance of these Terms and Conditions, unless accepted by CTL in advance of the start of the project and in writing.

1. ORDERS AND RECEIPT OF SAMPLES (Sample Acceptance Policy)

- 1.1 The Client may place the Order (i.e., specify a Scope of Work) either by submitting a purchase order to CTL in writing, by telephone (confirmed in writing) or by negotiated contract. Whichever option the Client selects for placing the Order, the Order shall not be valid unless it contains sufficient information to enable CTL to carry out the Client's requirements. It is the policy of CTL that samples not meeting the acceptance criteria, outlined in the NELAP standards and Section 5.8.3.2 of the DOD QSM, will not be accepted by the laboratory or will be qualified on the final report. All samples submitted to the laboratory must: (a) be accompanied by proper, full and complete documentation, including sample identification, location, date and time of collection, the collector's name, type of preservation (if any), type of sample, any special comments concerning the sample and any additional pertinent fields on the chain-of-custody. In the absence of any of the required information, the laboratory will attempt to contact the client to obtain the information; if unable to obtain the necessary information, the final report will be qualified. (b) samples must be labeled appropriately with a unique sample identification written with indelible ink on water resistant labels. If the laboratory cannot determine the identity of a sample, it may be rejected and the client will be contacted for further instructions or resampling. (c) samples must be in an appropriate sample container. If the container is inappropriate, the client will be contacted for further instructions or resampling. If analysis is possible, the final report will be qualified. CTL can provide a sampling guide containing approved containers and preservations for analytical methods requested. (d) adhere to method specified holding times. If samples are received with less than 1/2 the holding time remaining for the requested test, CTL will make its best effort to analyze the samples and notify the client. If holding times are exceeded, the final report will be qualified. (e) contain adequate sample volume to perform the necessary testing. If sufficient volume is not present, the sample may be rejected and the client will be contacted for further instructions or resampling. If samples show signs of damage, contamination or inadequate preservation, the client will be notified. If analysis can be performed, the final report will be qualified. If not, the samples will be rejected and the client notified for further instructions or resampling. It is the Client's responsibility to understand and package samples correctly and provide the proper amount of temperature control (ice) suitable to current weather conditions.
- 1.2 CTL must be supplied with complete written disclosure of the known or suspected presence of any hazardous substances, as defined by applicable federal or state law. Where any samples which were not accompanied by the required disclosure, cause interruptions in the lab's ability to process work due to contamination of instruments or work areas, the Client will be responsible for the costs of clean up and recovery.
- 1.3 Prior to Sample Acceptance, the entire risk of loss or damage to samples remains with the Client. In no event will CTL have any responsibility or liability for the action or inaction of any carrier shipping or delivering any sample to or from CTL's premises. Client is responsible to assure that any sample containing any hazardous substance which is to be delivered to CTL's premises will be packaged, labeled, transported and delivered properly and in accordance with applicable laws.
- 1.4 Clients using CTL's shipping account(s) do so at their own risk and must purchase separate insurance if they do not wish to assume risk of loss. CTL will not assume any risk whatsoever for any samples outside of CTL's control and not successfully delivered to the laboratory within specified hold times.
- 1.5 CTL will not accept liability for any sample(s), except sample(s) damaged or broken by log-in staff prior to successful log-in of the sample(s) into the CTL- LIMS system. This includes, but may not be limited to: complete, valid COC documentation, all sample receiving issues being resolved from a delay caused by the Client in CTL's ability to log-in samples, including missed turnaround and hold times, delay in processing and, ultimately, additional charges to the Client.
- 1.6 CTL will only reject samples per directions from the Client. CTL's sole liability is to inform the Client of any sample receipt issues, and may provide an indication how proceeding with the analysis may affect results and final acceptance by the regulating agency. Ultimately, suitability for use is between the Client and the regulating agency(s).
- 1.7 Signing of this COC by the Client or Client's representative, or directions to CTL via email or Fax constitutes acceptance of these Terms and Conditions, and guarantees payment by the Client to CTL.

2. PAYMENT TERMS

- 2.1 Services performed by CTL will be in accordance with prices quoted and later confirmed in writing or as stated in the Price Schedule. Invoices may be submitted to Client upon completion of any sample delivery group. Payment in advance is required for all Clients except those whose credit has been established with CTL. For Clients with approved credit, payment terms are net 30 days from the date of invoice by CTL. All overdue payments are subject to an additional interest and service charge of one and one-half percent (1.5%) or the maximum rate permissible by law, per month or portion thereof from the due date until the date of payment. All fees are charged or billed directly to the Client. The billing of a third party will not be accepted without a statement, signed by the third party that acknowledges and accepts payment responsibility. CTL may suspend work and withhold delivery of data under this order at any time in the event Client fails to make timely payment of its invoices. Client shall be responsible for all costs and expenses of collection including reasonable attorney's fees. CTL reserves the right to refuse to proceed with work at any time based upon an unfavorable Client credit report.

3. CHANGE ORDERS, TERMINATION

- 3.1 Changes to the Scope of Work, price, or result delivery date may be initiated by CTL after Sample Acceptance due to any condition which conflicts with analytical, QA or other protocols warranted in these Terms and Conditions. CTL will not proceed with such changes until an agreement with the Client is reached on the amount of any cost, schedule change or technical change to the Scope of Work, and such agreement is documented in writing.
- 3.2 Changes to the Scope of Work, including but not limited to increasing or decreasing the work, changing test and analysis specification or acceleration in the performance of the work may be initiated by the Client after sample acceptance. Such a change will be documented in writing and may result in a change in cost and turnaround time commitment. CTL's acceptance of such changes is contingent upon technical feasibility and operational capacity.
- 3.3 Suspension or termination of all or any part of the work may be initiated by the Client. CTL will be compensated consistent with Section 2 of these Terms and Conditions. CTL will complete all work in progress and be paid in full for all work completed.

4. WARRANTIES AND LIABILITY

- 4.1 Where applicable, CTL will use analytical methodologies which are in substantial conformity with published test methods. CTL has implemented these methods in its Laboratory Quality Manuals and referenced Standard Operating Procedures and where the nature or composition of the sample requires it, CTL reserves the right to deviate from these methodologies as necessary or appropriate, based on the reasonable judgment of CTL, which deviations, if any, will be made on a basis consistent with recognized standards of the industry and/or CTL's Laboratory Quality Manuals. Client may request that CTL perform according to a mutually agreed Quality Assurance Project Plan (QAPP). In the event that samples arrive prior to agreement on a QAPP, CTL will proceed with analyses under its standard Quality Manuals then in effect, and CTL will not be responsible for any resampling or other charges if work must be repeated to comply with a subsequently finalized QAPP.
- 4.2 CTL shall start preparation and/or analysis within holding times provided that Sample Acceptance occurs within 48 hours of sampling or 1/2 of the holding time for the test, whichever is less. Samples received that do not meet this provision will be charged as expedited samples and the appropriate rate will be added accordingly. Where resolution of inconsistencies leading to Sample Acceptance does not occur within this period, CTL will use its best efforts to meet holding times and will proceed with the work provided that, in CTL's judgment, the chain-of-custody or definition of the Scope of Work provide sufficient guidance. Reanalysis of samples to comply with CTL's Quality Manuals will be deemed to have met holding times provided the initial analysis was performed within the applicable holding time. Where reanalysis demonstrates that sample matrix interference is the cause of failure to meet any Quality Manual requirements, the warranty will be deemed to have been met.
- 4.3 CTL warrants that it possesses and maintains all licenses and certifications which are required to perform services under these Terms and Conditions provided that such requirements are specified in writing to CTL prior to Sample Acceptance. CTL will notify the Client in writing of any decertification or revocation of any license, or notice of either, which affects work in progress.
- 4.4 The warranty obligations set forth in Sections 4.1, 4.2 and 4.3 are the sole and exclusive warranties given by CTL in connection with any services performed by CTL or any Results generated from such services, and CTL gives and makes NO OTHER REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESS OR IMPLIED. No representative of CTL is authorized to give or make any other representation or warranty or modify this warranty in any way.
- 4.5 Client's sole and exclusive remedy for the breach of warranty in connection with any services performed by CTL, will be limited to repeating any services performed, contingent on the Client's providing, at the request of CTL and at the Client's expense, additional sample(s) if necessary. Any reanalysis requested by the Client generating Results consistent with the original Results will be at the Client's expense. If resampling is necessary, CTL's liability for resampling costs will be limited to actual cost or one hundred or one hundred fifty dollars (\$150) per sample, whichever is less.
- 4.6 CTL's liability for any and all causes of action arising hereunder, whether based in contract, tort, warranty, negligence or otherwise, shall be limited to the lesser amount of compensation for the services performed or \$100,000. All claims, including those for negligence, shall be deemed waived unless suit thereon is filed within one year after CTL's completion of the services. Under no circumstances, whether arising in contract, tort (including negligence), or otherwise, shall CTL be responsible for loss of use, loss of profits, or for any special, indirect, incidental or consequential damages occasioned by the services performed or by application or use of the reports prepared.
- 4.7 In no event shall CTL have any responsibility or liability to the Client for any failure or delay in performance by CTL which results, directly or indirectly, in whole or in part, from any cause or circumstance beyond the reasonable control of CTL. Such causes and circumstances shall include, but not be limited to: acts of God, acts of Client, acts or orders of any governmental authority, strikes or other labor disputes, natural disasters, accidents, wars, civil disturbances, equipment breakdown, matrix interference or unknown highly contaminated samples that impact instrument operation, unavailability of supplies from usual suppliers, difficulties or delays in transportation, mail or delivery services, or any other cause beyond CTL's reasonable control.

5. RESULTS, WORK PRODUCT

- 5.1 Data or information provided to CTL or generated by services performed under this agreement shall only become the property of the Client upon receipt in full by CTL of payment for the whole Order. Ownership of any analytical method, QA/QC protocols, software programs or equipment developed by CTL for performance of work will be retained by CTL, and Client shall not disclose such information to any third party.
- 5.2 Data and sample materials provided by Client or at Client's request, and the result obtained by CTL shall be held in confidence (unless such information is generally available to the public or is in the public domain or Client has failed to pay CTL for all services rendered or is otherwise in breach of these Terms and Conditions), subject to any disclosure required by law or legal process.
- 5.3 Should the Results delivered by CTL be used by the Client or Client's client, even though subsequently determined not to meet the warranties described in these Terms and Conditions, then the compensation will be adjusted based upon mutual agreement. In no case shall the Client unreasonably withhold CTL's right to independently defend its data.
- 5.4 CTL reserves the right to subcontract services ordered by the Client to another laboratory or laboratories, if, in CTL's sole judgment, it is reasonably necessary, appropriate or advisable to do so, and with the Client's permission. CTL will in no way be liable for any subcontracted services and all applicable warranties, guarantees and insurance are those of the subcontracted laboratory.
- 5.5 CTL shall dispose of the Client's samples and extracts 30 days after the analytical report is issued, unless instructed to store them for an alternate period of time or to return such samples to the Client, in a manner consistent with U.S. Environmental Protection Agency regulations or other applicable Federal, state or local requirements. Additional charges will apply for samples or extracts stored longer than 30 days at the Client's request. Any samples for projects that are canceled or not accepted, or for which return was requested, will be returned to the Client at Client expense. CTL reserves the right to return to the Client any sample or unused portion of a sample that is not within CTL's permitted capability or the capabilities of CTL's designated waste disposal vendor(s), or will make arrangements to dispose of these samples at Client direction and expense.
- 5.6 Unless a different time period is agreed to in any order under these Terms and Conditions, CTL agrees to retain all records for five (5) years.
- 5.7 In the event that CTL is required to respond to legal process related to services for Client, Client agrees to reimburse CTL for hourly charges for personnel involved in the response and attorney fees reasonably incurred in obtaining advice concerning the response, preparation to testify, and appearances related to the legal process, travel and all reasonable expenses associated with the litigation.

6. INSURANCE

- 6.1 CTL shall maintain in force during the performance of services under these Terms and Conditions, Workers' Compensation and Employer's Liability Insurance in accordance with the laws of the states having jurisdiction over CTL's employees who are engaged in the performance of the work. CTL shall also maintain during such period, Comprehensive General and Contractual Liability (limit of \$2,000,000 per occurrence/aggregate), Comprehensive Automobile Liability, owned and hired, (\$1,000,000 combined single limit), and Professional/Pollution Liability Insurance (limit of \$5,000,000 per occurrence/aggregate). Any Client required changes to these limits or conditions will result in a change in cost to the Client.

7. AUDIT

- 7.1 Upon prior notice to CTL, the Client may audit and inspect CTL's records and accounts covering reimbursable costs related to work done for the Client for a period of one (1) year after completion of the work. The purpose of any such audit shall be only for verification of such costs, and CTL shall not be required to provide access to cost records where prices are expressed as fixed fees or published unit prices.

Ice Present YES NOTemperature 3.8IR Gun # 27Initials CMBDate 6/10/2020 Time 10:30Cooler #: 5654

Cooler Receipt Form

FedEx Package
Express US AirbillFedEx
Tracking
Number

8065 3197 8895

1 From

Date

Sender's
Name

Phone

Company

Address

City

State

ZIP

2 Your Internal Billing Reference

3 To

Recipient's
Name

Phone

Company

Address

We cannot deliver to P.O. boxes or P.O. ZIP codes.

Drop From/Ship From

Address

Use this line for the HOD location address or for confirmation of your shipping address.

City

State

ZIP

4 Express Package Service

NOTE: Service order has changed. Please select carefully.

Next Business Day

FedEx First Overnight

FedEx Priority Overnight

FedEx Standard Overnight

FedEx 2Day A.M.

FedEx 2Day

FedEx Express Saver

FedEx 2Day A.M.

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Recipient's

2 or 3 Business Days

FedEx 2Day A.M.

FedEx 2Day

FedEx Express Saver

FedEx 2Day A.M.

FedEx 2Day

FedEx Express Saver

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CUSTODY SEAL

DATE

SIGNATURE

CUSTODY SEAL

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QEC
Quality Environmental Containers
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ENCLOSURE 4

LABORATORY DATA VALIDATION

JUNE 2020

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Big Bend Dam Data Validation Report

Laboratory SDG: 153747
Associated Batches: 76713, 76752
Date Verified: June 26, 2020
Validation stage: Stage 2A
Client: In house
Laboratory: CT Laboratories
Guidance: DoD QSM, Version 5.3
Applicable QAPP: N/A

Chemist/Verifier: Tony Sedlacek
Contractor Program Chemist (CPC): In house
Date QC review: June 26, 2020

Project Title: Big Bend Dam Toe Drain

Description of soil and groundwater samples received by the laboratory for analysis:

Sample ID #	Sample Date	Date Lab Received	Lab ID
BBSD-01B	6/2/20	6/4/20	427712
BBSD-03B	6/3/20	6/4/20	727714
BBSD-12B	6/3/20	6/4/20	427715
BBSD-02B	6/2/20	6/4/20	427716
BBSD-00B	6/2/20	6/4/20	427717
BBSD-00A	6/2/20	6/4/20	427718
BBSD-12A	6/3/20	6/4/20	427719
BBSD-02A	6/2/20	6/4/20	427720
BBSD-01A	6/2/20	6/4/20	427721
BBSD-03A	6/2/20	6/4/20	427722

Note: “Yes/No” answers that indicate a possible data quality issue are shaded. If answer falls in the shaded area, an explanation must be provided below each applicable question box. Also include if any discussion occurred with USACE project chemist for discussion or concurrence.

1.0 Laboratory Case Narrative (*Manual / ~~Electronic~~*)

Verification Criteria	Yes	No	N/A	Page #
Were any DoD-QSM deviations noted in the laboratory case narrative?		X		
Were DoD-QSM corrective actions followed if deviations were noted?		X		

2.0 Sample Documentation (*Cooler receipt*)

Verification Criteria	Yes	No	Page #
Were all samples documented correctly on the chain-of-custody (COC) and samples labels?	X		
Were samples relinquished properly on the COC?	X		
Were any issues noted in the cooler receipt form?		X	
Were samples received in the required temperature range?	X		

3.0 Method Blank (Manual / ~~Electronic~~)

Verification Criteria	Yes	No	Page #
Was one method blank run per method batch?	X		
Were analytes detected >1/2 the LOQ and either > 1/10 the amount measured in any sample or 1/10 the regulatory limit?		X	
Common laboratory contaminants (methylene chloride, 2-butanone, and acetone were less than 2X the LOQ?		X	

4.0 LCS (Manual / ~~Electronic~~)

Verification Criteria	Yes	No	Page #
Was a complete list of analytes including surrogates reported?	X		
Was one LCS run per preparatory batch?	X		
All detections were within DoD LCS criteria or if in-house criteria were used they were not greater than $\pm 3X$ s the standard deviation of the mean LCS?	X		

Surrogates were not reported for LCS/LCSD samples. However, all LCS/LCSD recoveries were within evaluation criteria.

5.0 Matrix Spike and Matrix Spike Duplicate (Manual / ~~Electronic~~)

Verification Criteria	Yes	No	N/A	Page #
Was one MS and MSD run per preparatory batch per matrix?			X	
All detections were within DoD LCS criteria or if in-house criteria were used they were not greater than $\pm 3X$ s the standard deviation of the mean LCS?			X	
MSD RPD was within control limits?			X	

6.0 Surrogates (Manual / ~~Electronic~~)

Verification Criteria	Yes	No	Page #
Surrogates were added to all samples, standards, blanks, field and lab QC samples?		X	
Surrogates were within the upper and lower control limits?		X	3

Surrogate recoveries for octacosane and triacontane were below evaluation criteria in samples BBSD-12B, BBSD-02B and BBSD-00B. TPH-DRO was detected in all associated samples and qualified, estimated "J". In addition, surrogate recoveries were not reported for LCS/LCSD or method blank samples. However, all LCS/LCSD recoveries were within evaluation criteria and all method blanks were nondetect.

Sample ID	Analyte	Qualification
BBSD-12B	TPH-DRO	J
BBSD-02B	TPH-DRO	J
BBSD-00B	TPH-DRO	J

7.0 Duplicate Precision (*Manual / ~~Electronic~~*)

Verification Criteria	Yes	No	N/A	Page #
Were laboratory duplicate samples within 20% RPD?	X			
Were LCS/LCSD PRD within 20% RPD?	X			
Were MS/MSD PRD within 20%?			X	

8.0 Additional Qualifications

Were additional qualifications applied or professional judgment used?

Field ID	Analyte	New RL	Qualification

9.0 Completeness

Verification Criteria	Yes	No	N/A	Page #
Were any data recommended for exclusion during the verification process?		X		
Were any samples lost, broken, or in any other manner in not verified?		X		
Were all sample analyses requested performed, the correct analyte lists used and correct sample preparation and analyses methods and units utilized?	X			

No data is recommended for exclusion. All samples arrived at the laboratory intact and within the specified preservation temperature range. The analytical laboratory performed all analyses requested.

Big Bend Dam Data Validation Report

Laboratory SDG: 153810
Associated Batches: 76788, 76752
Date Verified: June 29, 2020
Validation stage: Stage 2A
Client: In house
Laboratory: CT Laboratories
Guidance: DoD QSM, Version 5.3
Applicable QAPP: N/A

Chemist/Verifier: Tony Sedlacek
Contractor Program Chemist (CPC): In house
Date QC review: June 29, 2020

Project Title: Big Bend Dam Toe Drain

Description of soil and groundwater samples received by the laboratory for analysis:

Sample ID #	Sample Date	Date Lab Received	Lab ID
BBSD-11B	6/4/2020	6/8/2020	428379
BBSD-10B	6/4/2020	6/8/2020	428380
BBSD-07B	6/5/2020	6/8/2020	428381
BBSD-09B	6/5/2020	6/8/2020	428382
BBSD-11A	6/4/2020	6/8/2020	428383
BBSD-10A	6/4/2020	6/8/2020	428384
BBSD-XXA	6/5/2020	6/8/2020	428385
BBSD-08A	6/5/2020	6/8/2020	428386
BBSD-09A	6/5/2020	6/8/2020	428387
BBSD-07A	6/5/2020	6/8/2020	428388

Note: “Yes/No” answers that indicate a possible data quality issue are shaded. If answer falls in the shaded area, an explanation must be provided below each applicable question box. Also include if any discussion occurred with USACE project chemist for discussion or concurrence.

1.0 Laboratory Case Narrative (*Manual / Electronic*)

Verification Criteria	Yes	No	N/A	Page #
Were any DoD-QSM deviations noted in the laboratory case narrative?		X		
Were DoD-QSM corrective actions followed if deviations were noted?		X		

2.0 Sample Documentation (*Cooler receipt*)

Verification Criteria	Yes	No	Page #
Were all samples documented correctly on the chain-of-custody (COC) and samples labels?	X		
Were samples relinquished properly on the COC?	X		
Were any issues noted in the cooler receipt form?		X	
Were samples received in the required temperature range?	X		

3.0 Method Blank (Manual / ~~Electronic~~)

Verification Criteria	Yes	No	Page #
Was one method blank run per method batch?	X		
Were analytes detected >1/2 the LOQ and either > 1/10 the amount measured in any sample or 1/10 the regulatory limit?		X	
Common laboratory contaminants (methylene chloride, 2-butanone, and acetone were less than 2X the LOQ?		X	

4.0 LCS (Manual / ~~Electronic~~)

Verification Criteria	Yes	No	Page #
Was a complete list of analytes including surrogates reported?		X	
Was one LCS run per preparatory batch?	X		
All detections were within DoD LCS criteria or if in-house criteria were used they were not greater than $\pm 3X$ s the standard deviation of the mean LCS?	X		

Surrogates were not reported for LCS/LCSD samples. However, all LCS/LCSD recoveries were within evaluation criteria.

5.0 Matrix Spike and Matrix Spike Duplicate (Manual / ~~Electronic~~)

Verification Criteria	Yes	No	N/A	Page #
Was one MS and MSD run per preparatory batch per matrix?			X	
All detections were within DoD LCS criteria or if in-house criteria were used they were not greater than $\pm 3X$ s the standard deviation of the mean LCS?			X	
MSD RPD was within control limits?			X	

6.0 Surrogates (Manual / ~~Electronic~~)

Verification Criteria	Yes	No	Page #
Surrogates were added to all samples, standards, blanks, field and lab QC samples?	X		
Surrogates were within the upper and lower control limits?	X		

Surrogate recoveries were not reported for LCS/LCSD or method blank samples. However, all LCS/LCSD recoveries were within evaluation criteria and all method blanks were nondetect.

Sample ID	Analyte	Qualification
		N/A

7.0 Duplicate Precision (Manual / ~~Electronic~~)

Verification Criteria	Yes	No	N/A	Page #
Were laboratory duplicate samples within 20% RPD?	X			
Were LCS/LCSD PRD within 20% RPD?	X			
Were MS/MSD PRD within 20%?			X	

8.0 Additional Qualifications

Were additional qualifications applied or professional judgment used?

Field ID	Analyte	New RL	Qualification

9.0 Completeness

Verification Criteria	Yes	No	N/A	Page #
Were any data recommended for exclusion during the verification process?		X		
Were any samples lost, broken, or in any other manner in not verified?		X		
Were all sample analyses requested performed, the correct analyte lists used and correct sample preparation and analyses methods and units utilized?	X			

No data is recommended for exclusion. All samples arrived at the laboratory intact and within the specified preservation temperature range. The analytical laboratory performed all analyses requested.

Big Bend Dam Data Validation Report

Laboratory SDG: 153902
Associated Batches: 76788, 76752
Date Verified: June 29, 2020
Validation stage: Stage 2A
Client: In house
Laboratory: CT Laboratories
Guidance: DoD QSM, Version 5.3
Applicable QAPP: N/A

Chemist/Verifier: Tony Sedlacek
Contractor Program Chemist (CPC): In house
Date QC review: June 29, 2020

Project Title: Big Bend Dam Toe Drain

Description of soil and groundwater samples received by the laboratory for analysis:

Sample ID #	Sample Date	Date Lab Received	Lab ID
BBSD-06A	6/8/2020	6/10/2020	429900
BBSD-08B	6/8/2020	6/10/2020	429901
BBSD-XXB	6/8/2020	6/10/2020	429902
BBSD-06B	6/8/2020	6/10/2020	429903
BBSD-05A	6/8/2020	6/10/2020	429904
BBSD-05B	6/8/2020	6/10/2020	429905
BBSD-04A	6/8/2020	6/10/2020	429906
BBSD-04B	6/8/2020	6/10/2020	429907

Note: “Yes/No” answers that indicate a possible data quality issue are shaded. If answer falls in the shaded area, an explanation must be provided below each applicable question box. Also include if any discussion occurred with USACE project chemist for discussion or concurrence.

1.0 Laboratory Case Narrative (*Manual / Electronic*)

Verification Criteria	Yes	No	N/A	Page #
Were any DoD-QSM deviations noted in the laboratory case narrative?		X		
Were DoD-QSM corrective actions followed if deviations were noted?		X		

2.0 Sample Documentation (*Cooler receipt*)

Verification Criteria	Yes	No	Page #
Were all samples documented correctly on the chain-of-custody (COC) and samples labels?	X		
Were samples relinquished properly on the COC?	X		
Were any issues noted in the cooler receipt form?		X	
Were samples received in the required temperature range?	X		

3.0 Method Blank (Manual / ~~Electronic~~)

Verification Criteria	Yes	No	Page #
Was one method blank run per method batch?	X		
Were analytes detected >1/2 the LOQ and either > 1/10 the amount measured in any sample or 1/10 the regulatory limit?		X	
Common laboratory contaminants (methylene chloride, 2-butanone, and acetone were less than 2X the LOQ?		X	

4.0 LCS (Manual / ~~Electronic~~)

Verification Criteria	Yes	No	Page #
Was a complete list of analytes including surrogates reported?	X		
Was one LCS run per preparatory batch?	X		
All detections were within DoD LCS criteria or if in-house criteria were used they were not greater than $\pm 3X$ s the standard deviation of the mean LCS?	X		

Surrogates were not reported for LCS/LCSD samples. However, all LCS/LCSD recoveries were within evaluation criteria.

5.0 Matrix Spike and Matrix Spike Duplicate (Manual / ~~Electronic~~)

Verification Criteria	Yes	No	N/A	Page #
Was one MS and MSD run per preparatory batch per matrix?	X			
All detections were within DoD LCS criteria or if in-house criteria were used they were not greater than $\pm 3X$ s the standard deviation of the mean LCS?	X			
MSD RPD was within control limits?	X			

Samples BBSD-05A and BBSD-05B were spiked and analyzed for TPH-DRO. All MS/MSD recoveries and RPDs were within evaluation criteria. No qualifications were necessary.

6.0 Surrogates (Manual / ~~Electronic~~)

Verification Criteria	Yes	No	Page #
Surrogates were added to all samples, standards, blanks, field and lab QC samples?		X	
Surrogates were within the upper and lower control limits?		X	3

Surrogate recovery for octacosane was below evaluation criteria in sample BBSD-XXB. TPH-DRO was detected in sample BBSD-XXB and qualified, estimated "J". In addition, surrogate recoveries were not reported for LCS/LCSD or method blank samples. However, all LCS/LCSD recoveries were within evaluation criteria and all method blanks were nondetect.

Sample ID	Analyte	Qualification
BBSD-XXB	TPH-DRO	J

7.0 Duplicate Precision (Manual / ~~Electronic~~)

Verification Criteria	Yes	No	N/A	Page #
Were laboratory duplicate samples within 20% RPD?	X			
Were LCS/LCSD PRD within 20% RPD?	X			
Were MS/MSD PRD within 20%?	X			

8.0 Additional Qualifications

Were additional qualifications applied or professional judgment used?

Field ID	Analyte	New RL	Qualification

9.0 Completeness

Verification Criteria	Yes	No	N/A	Page #
Were any data recommended for exclusion during the verification process?		X		
Were any samples lost, broken, or in any other manner in not verified?		X		
Were all sample analyses requested performed, the correct analyte lists used and correct sample preparation and analyses methods and units utilized?	X			

No data is recommended for exclusion. All samples arrived at the laboratory intact and within the specified preservation temperature range. The analytical laboratory performed all analyses requested.

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ENCLOSURE 5

LABORATORY REPORT FROM IDW

MAY 2021

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ANALYTICAL SUMMARY REPORT

This report at a minimum contains the following information:

- Analytical Report of Test Results
- Description of QC Qualifiers
- Chain of Custody (copy)
- Quality Control Summary (if applicable)
- Case Narrative (if applicable)
- Correspondence with Client (if applicable)

This report has been specifically prepared to satisfy project or program requirements. These results are in compliance with NELAC requirements for parameters where accreditation is required or available, unless otherwise noted in the case narrative.

ANALYTICAL SAMPLE DATA

USACE - OMAHA
 JENNIFER MUSILEK
 1616 CAPITOL AVE
 SUITE 9000
 OMAHA, NE 68102-9000

Project Name: BIG BEND DAM
 Project Phase: BIG BEND DAM, SD
 Project #: FY 21 PHS + BABS
 Folder #: 161697
 Purchase Order #:
 Contract #: 3357

Arrival Temperature: 0.9
 Report Date: 5/27/2021
 Date Received: 5/11/2021
 Reprint Date: 5/27/2021

CT LAB#: 1004242	Sample Description: BBD-IDW	Client Sample #:	Sampled: 5/10/2021 12:58
------------------	-----------------------------	------------------	--------------------------

Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Inorganic Results												
Solids, Percent	81.3	%					1.00			5/18/21 11:00	KMT	EPA 8000C
Organic Results												
Diesel Range Organics	17.9	mg/kg	12	24	49	49	1.00	J	5/13/2021 10:45	5/13/21 19:07	AJZ	EPA 8015C
SURR: Octacosane	11.1	% Recovery	44			125	1.00	S	5/13/2021 10:45	5/13/21 19:07	AJZ	EPA 8015C
Surr: Triacontane	13.3	% Recovery	35			136	1.00	S	5/13/2021 10:45	5/13/21 19:07	AJZ	EPA 8015C

CT LAB#: 1004243	Sample Description: BBD-IDW	Client Sample #:	Sampled: 5/10/2021 13:03
------------------	-----------------------------	------------------	--------------------------

Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Inorganic Results												
Solids, Percent	81.5	%					1.00			5/18/21 11:00	KMT	EPA 8000C
Organic Results												

CT LAB#: 1004243

Sample Description: BBD-IDW

Client Sample #:

Sampled: 5/10/2021 13:03

Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Benzene	<99	ug/kg	28	99	200	200	1.00	U	5/12/2021 10:30	5/13/21	12:03 RLD	EPA 8260C
Ethylbenzene	<50	ug/kg	13	50	99	99	1.00	U	5/12/2021 10:30	5/13/21	12:03 RLD	EPA 8260C
m & p-Xylene	<50	ug/kg	15	50	200	200	1.00	U	5/12/2021 10:30	5/13/21	12:03 RLD	EPA 8260C
Naphthalene	<50	ug/kg	14	50	99	99	1.00	U	5/12/2021 10:30	5/13/21	12:03 RLD	EPA 8260C
o-Xylene	<50	ug/kg	13	50	99	99	1.00	U	5/12/2021 10:30	5/13/21	12:03 RLD	EPA 8260C
Toluene	<99	ug/kg	28	99	200	200	1.00	U	5/12/2021 10:30	5/13/21	12:03 RLD	EPA 8260C
1,2 Dichloroethane-d4	97.0	% Recovery	71			136	1.00		5/12/2021 10:30	5/13/21	12:03 RLD	EPA 8260C
Bromofluorobenzene	101	% Recovery	79			119	1.00		5/12/2021 10:30	5/13/21	12:03 RLD	EPA 8260C
d8-Toluene	100	% Recovery	85			116	1.00		5/12/2021 10:30	5/13/21	12:03 RLD	EPA 8260C
Dibromofluoromethane	96.0	% Recovery	78			119	1.00		5/12/2021 10:30	5/13/21	12:03 RLD	EPA 8260C

CT LAB#: 1004246

Sample Description: METHANOL BLANK

Client Sample #:

Sampled: 5/10/2021

Analyte	Result	Units	DL	DOD LOD	DOD LOQ	RL	DF	Qualifier	Prep Date/Time	Analysis Date/Time	Analyst	Method
Organic Results												
Benzene	<25	ug/kg	11	25	50	50	1.00	U	5/12/2021 10:30	5/13/21	11:35 RLD	EPA 8260C
Ethylbenzene	<25	ug/kg	11	25	50	50	1.00	U	5/12/2021 10:30	5/13/21	11:35 RLD	EPA 8260C
m & p-Xylene	<50	ug/kg	25	50	100	100	1.00	U	5/12/2021 10:30	5/13/21	11:35 RLD	EPA 8260C
Naphthalene	<50	ug/kg	15	50	100	100	1.00	U	5/12/2021 10:30	5/13/21	11:35 RLD	EPA 8260C
o-Xylene	<25	ug/kg	7.0	25	50	50	1.00	U	5/12/2021 10:30	5/13/21	11:35 RLD	EPA 8260C
Toluene	<50	ug/kg	16	50	100	100	1.00	U	5/12/2021 10:30	5/13/21	11:35 RLD	EPA 8260C
1,2 Dichloroethane-d4	102	% Recovery	71			136	1.00		5/12/2021 10:30	5/13/21	11:35 RLD	EPA 8260C
Bromofluorobenzene	101	% Recovery	79			119	1.00		5/12/2021 10:30	5/13/21	11:35 RLD	EPA 8260C
d8-Toluene	101	% Recovery	85			116	1.00		5/12/2021 10:30	5/13/21	11:35 RLD	EPA 8260C
Dibromofluoromethane	97.0	% Recovery	78			119	1.00		5/12/2021 10:30	5/13/21	11:35 RLD	EPA 8260C

Notes:

^ Indicates the laboratory is NELAP accredited for this analyte by the indicated matrix and method . DL (detection limit), LOD (limit of detection), loq (limit of quantitation) as defined by most recent DOD QSM version.

All samples were received intact and properly preserved unless otherwise noted . The results reported relate only to the samples tested. This report shall not be reproduced, except in full, without written approval of this laboratory. The Chain of Custody is attached.

This report has been specifically prepared to satisfy project or program requirements. These results are in compliance with NELAC requirements for the parameters where accreditation is required or available, unless noted in the case narrative.

Submitted by: Brett M. Szymanski
Project Manager
608-356-2760

QC Qualifiers

<u>Code</u>	<u>Description</u>
B	Analyte detected in the associated Method Blank.
C	Toxicity present in BOD sample.
D	Diluted Out.
E	Safe, No Total Coliform detected.
F	Unsafe, Total Coliform detected, no E. Coli detected.
G	Unsafe, Total Coliform detected and E. Coli detected.
H	Holding time exceeded.
I	Incubator temperature was outside acceptance limits during test period.
J	Estimated value.
L	Significant peaks were detected outside the chromatographic window.
M	Matrix spike and/or Matrix Spike Duplicate recovery outside acceptance limits.
N	Insufficient BOD oxygen depletion.
O	Complete BOD oxygen depletion.
P	Concentration of analyte differs more than 40% between primary and confirmation analysis.
Q	Laboratory Control Sample outside acceptance limits.
R	See Narrative at end of report.
S	Surrogate standard recovery outside acceptance limits due to apparent matrix effects.
T	Sample received with improper preservation or temperature.
U	Analyte concentration was below detection limit.
V	Raised Quantitation or Reporting Limit due to limited sample amount or dilution for matrix background interference.
W	Sample amount received was below program minimum.
X	Analyte exceeded calibration range.
Y	Replicate/Duplicate precision outside acceptance limits.
Z	Specified calibration criteria was not met.

Current CT Laboratories Certifications

Wisconsin (WDNR) Chemistry ID# 157066030
Wisconsin (DATCP) Bacteriology ID# 289
Louisiana NELAP (primary) ID# ACC20190002
Illinois NELAP Lab ID# 200073
Kansas NELAP Lab ID# E-10368
Virginia NELAP Lab ID# 460203
ISO/IEC 17025-2005 A2LA Cert # 3806.01
DoD-ELAP A2LA 3806.01
GA EPD Stipulation ID ACC20190002

QC SUMMARY REPORT

USACE - OMAHA

Project Name: BIG BEND DAM

SDG #: 0

Folder #: 161697

Project #: FY 21 PHS + BABS

Lab Control Spike Soil

Analytical Run #:	191838	Analysis Date:	5/13/2021	Prep Batch #:	80994	Matrix:	SOLID
CTLab #:	1004653	Analysis Time:	08:47	Prep Date/Time:	05/12/2021 13:00	Method:	SW8260C
Parent Sample #:		Analyst:	RLD	Prep Analyst:	RLD		

Analyte	QC sample result	Units	Parent sample result	Qualifier(s)	Spike Amount Added	% Recovery	Control Limits	RPD	RPD Limit
Benzene	506	ug/kg			500	101	77 --- 121		20
Ethylbenzene	500	ug/kg			500	100	76 --- 122		20
m & p-Xylene	1010	ug/kg			1000	101	77 --- 124		20
Naphthalene	535	ug/kg			500	107	62 --- 129		20
o-Xylene	497	ug/kg			500	99.4	77 --- 123		20
Toluene	500	ug/kg			500	100	77 --- 121		20

Method Blank Soil

Analytical Run #:	191838	Analysis Date:	5/13/2021	Prep Batch #:	80994	Matrix:	SOLID
CTLab #:	1004652	Analysis Time:	09:43	Prep Date/Time:	05/12/2021 13:00	Method:	SW8260C
Parent Sample #:		Analyst:	RLD	Prep Analyst:	RLD		

Analyte	QC sample result	Units	Parent sample result	Qualifier(s)	Spike Amount Added	% Recovery	Control Limits	RPD	RPD Limit
Benzene	28	ug/kg			0		100		
Ethylbenzene	13	ug/kg			0		50		
m & p-Xylene	15	ug/kg			0		100		
Naphthalene	14	ug/kg			0		50		
o-Xylene	13	ug/kg			0		50		
Toluene	28	ug/kg			0		100		

Matrix Spike Duplicate Soil

Analytical Run #:	191838	Analysis Date:	5/13/2021	Prep Batch #:	80994	Matrix:	SOIL
CTLab #:	1004656	Analysis Time:	17:38	Prep Date/Time:	05/12/2021 13:00	Method:	SW8260C
Parent Sample #:	1004655	Analyst:	RLD	Prep Analyst:	RLD		

Analyte	QC sample result	Units	Parent sample result	Qualifier(s)	Spike Amount Added	% Recovery	Control Limits	RPD	RPD Limit
1,2 Dichloroethane-d4	100	% Recovery			100	100	71 --- 136	0	
Benzene	800	ug/kg	BDL		742	108	77 --- 121	3.28	20
Bromofluorobenzene	101	% Recovery			100	101	79 --- 119	0	
d8-Toluene	102	% Recovery			100	102	85 --- 116	0	
Dibromofluoromethane	98.0	% Recovery			100	98.0	78 --- 119	0	
Ethylbenzene	795	ug/kg	BDL		742	107	76 --- 122	2.09	20
m & p-Xylene	1590	ug/kg	BDL		1480	107	77 --- 124	2.49	20
Naphthalene	869	ug/kg	BDL		742	117	62 --- 129	6.86	20
o-Xylene	787	ug/kg	BDL		742	106	77 --- 123	1.54	20
Toluene	793	ug/kg	BDL		742	107	77 --- 121	3.16	20

Matrix Spike Soil

Analytical Run #:	191838	Analysis Date:	5/13/2021	Prep Batch #:	80994	Matrix:	SOIL
CTLab #:	1004655	Analysis Time:	17:10	Prep Date/Time:	05/12/2021 13:00	Method:	SW8260C
Parent Sample #:	1004243	Analyst:	RLD	Prep Analyst:	RLD		

Analyte	QC sample result	Units	Parent sample result	Qualifier(s)	Spike Amount Added	% Recovery	Control Limits	RPD	RPD Limit
1,2 Dichloroethane-d4	102	% Recovery			100	102	71 --- 136		
Benzene	774	ug/kg	BDL		742	104	77 --- 121		20
Bromofluorobenzene	101	% Recovery			100	101	79 --- 119		
d8-Toluene	101	% Recovery			100	101	85 --- 116		
Dibromofluoromethane	99.0	% Recovery			100	99.0	78 --- 119		
Ethylbenzene	779	ug/kg	BDL		742	105	76 --- 122		20
m & p-Xylene	1550	ug/kg	BDL		1480	105	77 --- 124		20
Naphthalene	811	ug/kg	BDL		742	109	62 --- 129		20
o-Xylene	775	ug/kg	BDL		742	104	77 --- 123		20
Toluene	768	ug/kg	BDL		742	104	77 --- 121		20

USACE - OMAHA

Project Name: BIG BEND DAM

SDG #: 0

Folder #: 161697

Project #: FY 21 PHS + BABS

Lab Control Spike Soil

Analytical Run #:	191943	Analysis Date:	5/13/2021	Prep Batch #:	81007	Matrix:	SOLID
CTLab #:	1004709	Analysis Time:	18:11	Prep Date/Time:	05/13/2021 10:45	Method:	SW8015
Parent Sample #:		Analyst:	AJZ	Prep Analyst:	WMB		

Analyte	QC sample result	Units	Parent sample result	Qualifier(s)	Spike Amount Added	% Recovery	Control Limits	RPD	RPD Limit
Diesel Range Organics	218	mg/kg			250	87.2	38 --- 132		30

USACE - OMAHA

Project Name: BIG BEND DAM

SDG #: 0

Folder #: 161697

Project #: FY 21 PHS + BABS

Method Blank Soil

Analytical Run #:	191943	Analysis Date:	5/13/2021	Prep Batch #:	81007	Matrix:	SOLID
CTLab #:	1004708	Analysis Time:	17:41	Prep Date/Time:	05/13/2021 10:45	Method:	SW8015
Parent Sample #:		Analyst:	AJZ	Prep Analyst:	WMB		

Analyte	QC sample result	Units	Parent sample result	Qualifier(s)	Spike Amount Added	% Recovery	Control Limits	RPD	RPD Limit
Diesel Range Organics	10	mg/kg			0		20		

Matrix Spike Duplicate Soil

Analytical Run #:	191943	Analysis Date:	5/13/2021	Prep Batch #:	81007	Matrix:	SOIL
CTLab #:	1004712	Analysis Time:	20:04	Prep Date/Time:	05/13/2021 10:45	Method:	SW8015
Parent Sample #:	1004711	Analyst:	AJZ	Prep Analyst:	WMB		

Analyte	QC sample result	Units	Parent sample result	Qualifier(s)	Spike Amount Added	% Recovery	Control Limits	RPD	RPD Limit
Diesel Range Organics	245	mg/kg	17.9		288	78.9	38 --- 132	19.3	30
SURR: Octacosane	34.0	% Recovery		S	100	34.0	44 --- 125	0	
Surr: Triacontane	41.0	% Recovery			100	41.0	35 --- 136	0	

Matrix Spike Soil

Analytical Run #:	191943	Analysis Date:	5/13/2021	Prep Batch #:	81007	Matrix:	SOIL
CTLab #:	1004711	Analysis Time:	19:36	Prep Date/Time:	05/13/2021 10:45	Method:	SW8015
Parent Sample #:	1004242	Analyst:	AJZ	Prep Analyst:	WMB		

Analyte	QC sample result	Units	Parent sample result	Qualifier(s)	Spike Amount Added	% Recovery	Control Limits	RPD	RPD Limit
Diesel Range Organics	313	mg/kg	17.9		303	97.4	38 --- 132		30
SURR: Octacosane	39.3	% Recovery		S	100	39.3	44 --- 125		
Surr: Triacotane	36.4	% Recovery			100	36.4	35 --- 136		

Sample Condition Report

Folder #:	161697	Print Date / Time:	05/11/2021	10:24
Client:	USACE - OMAHA	Received Date / Time / By:	05/11/2021	10:16 erc
Project Name:	BIG BEND DAM	Log-In Date / Time / By:	05/11/2021	10:24 erc
Project Phase:	BIG BEND DAM, SD	Project #:	FY 21 PHS + BABS	PM: BMS
Coolers:	5619	Temperature:	0.9 C	On Ice: Y
Custody Seals Present :	Y	COC Present:?	Y	Complete? Y
Seal Intact?	Y	Numbers:	DATED AND SIGNED	
Ship Method:	FEDEX EXPRESS	Tracking Number:	808104808791	
Adequate Packaging:	Y	Temp Blank Enclosed?	Y	

Notes: THE SAMPLES WERE RECEIVED IN GOOD CONDITION ON ICE.

TWO CUSTODY SEALS WERE PRESENT AND INTACT UPON RECEIPT - BOTH WERE DATED 5/10/21 AND SIGNED.

Sample ID / Description	Container Type	Cond. Code	pH OK?/Filtered?	Tests
1004242 BBD-IDW	UNPRES GL	1	N / N	DRO,%SOL
Total # of Containers of Type (UNPRES GL) = 1				
Sample ID / Description	Container Type	Cond. Code	pH OK?/Filtered?	Tests
1004243 BBD-IDW	SOLIDS	1	/	%SOL
Total # of Containers of Type (SOLIDS) = 1				
1004243 BBD-IDW	TERRA CORE	1	/	VOC
	TERRA CORE	1	N / N	VOC
Total # of Containers of Type (TERRA CORE) = 2				
Sample ID / Description	Container Type	Cond. Code	pH OK?/Filtered?	Tests
1004246 METHANOL BLANK	MEOH	1	N / N	VOC
	MEOH	1	/	VOC
Total # of Containers of Type (MEOH) = 2				

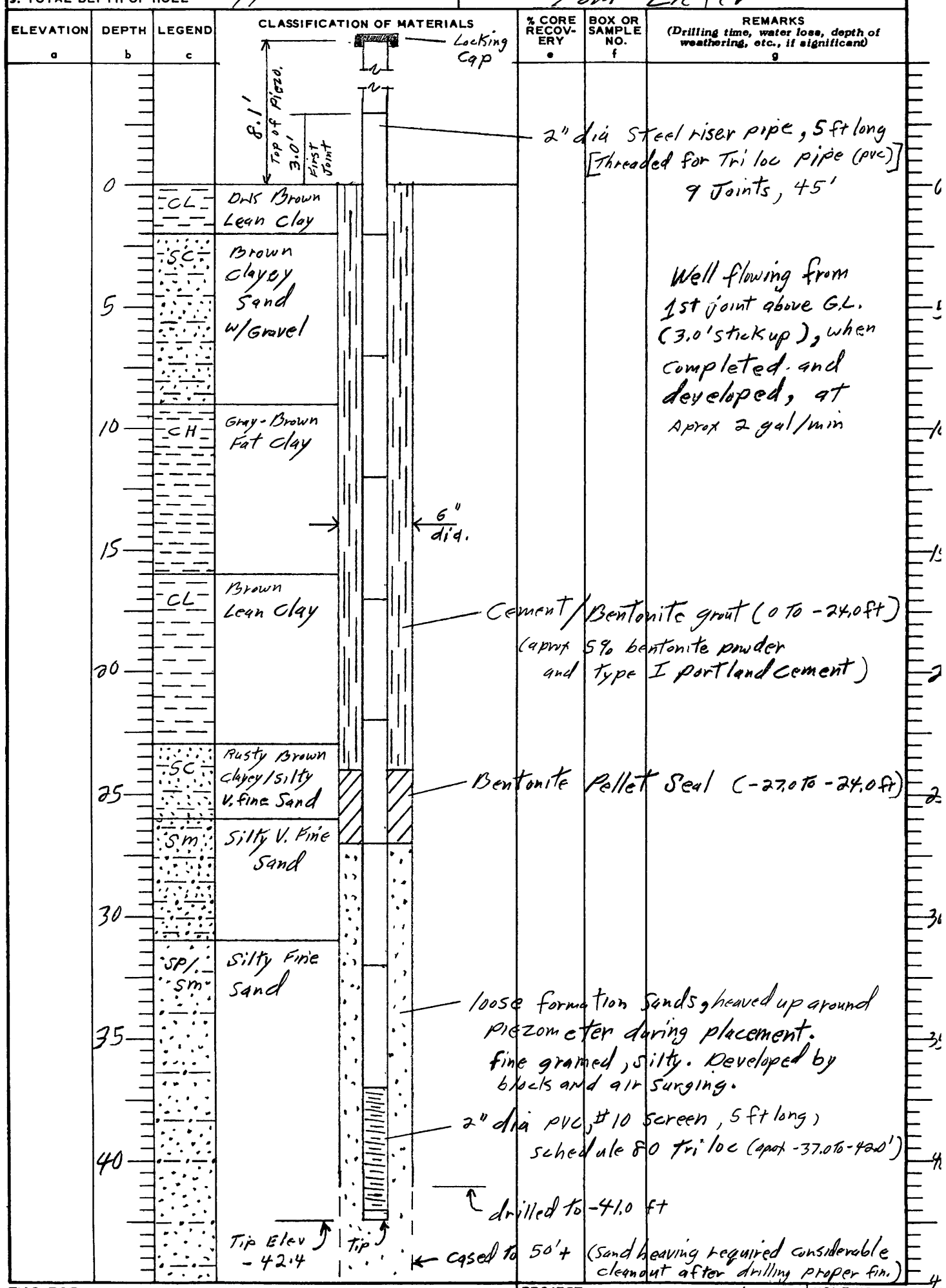
<u>Condition Code</u>	<u>Condition Description</u>
1	Sample Received OK

fedex.com 1.800.GoFedEx

8081 0480 8791

PIEZOMETERS

DRILLING LOG		DIVISION MRD	INSTALLATION Omaha Dist		SHEET OF 1 SHEETS
1. PROJECT Aczo Install. Big Bend Dam			10. SIZE AND TYPE OF BIT		
2. LOCATION (Coordinates or Station)			11. DATUM FOR ELEVATION SHOWN (TBM or MSL)		
3. DRILLING AGENCY CEMRO-ED-GC			12. MANUFACTURER'S DESIGNATION OF DRILL Churn		
4. HOLE NO. (As shown on drawing title and file number) PZ-18R			13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN 11		UNDISTURBED
5. NAME OF DRILLER A. Oakes			14. TOTAL NUMBER CORE BOXES		
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.			15. ELEVATION GROUND WATER approx 6.7' above GL		
7. THICKNESS OF OVERBURDEN 41' +			16. DATE HOLE STARTED 14 Aug 89 COMPLETED 16 Aug 89		17. ELEVATION TOP OF HOLE approx same as PZ-18
8. DEPTH DRILLED INTO ROCK 0			18. TOTAL CORE RECOVERY FOR BORING %		
9. TOTAL DEPTH OF HOLE 41'			19. SIGNATURE OF INSPECTOR Tom Liefer		



DRILLING LOG		DIVISION MRD	INSTALLATION Omaha Dist	SHEET 1 OF 4 SHEETS
1. PROJECT Piezo. Install., Big Bend Dam		10. SIZE AND TYPE OF BIT 6" dia Drive Bbl.		
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)		
3. DRILLING AGENCY CEMRO-ED-GC		12. MANUFACTURER'S DESIGNATION OF DRILL Churn (Bucyrus Erie 22W)		
4. HOLE NO. (As shown on drawing title and file number) PZ-18R		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED 11 UNDISTURBED —		
5. NAME OF DRILLER AI OAKS		14. TOTAL NUMBER CORE BOXES —		
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 6.7' above GL		
7. THICKNESS OF OVERBURDEN 41' +		16. DATE HOLE STARTED 14 Aug 89 COMPLETED 16 Aug 89		
8. DEPTH DRILLED INTO ROCK 0		17. ELEVATION TOP OF HOLE approx Same as PZ-18		
9. TOTAL DEPTH OF HOLE 41'		18. TOTAL CORE RECOVERY FOR BORING — %		
		19. SIGNATURE OF INSPECTOR <i>Lon J. [unclear]</i>		

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
		CL		D-2		10:30 - Start Drilling
			W/L 10:35 8/4 after 2nd drive, hole filled to -0.5'			
	1	D-1 	Low plastic clay med stiff (Mucky) wet to saturated Ork Brown Trace Sand - to med grain	S 63	D-1 0.5 to 1.0 Rep. 0 to 2'	Description from Ruts adjacent to drill site (20' away) also source of sample D-1
	2			R-0		← compressed ahead of bit (6" straight bit)
		SL	clayey Sand w/ gravel SC (stop) plasticity - slight	D-2		
	3		loose to med dense fines (silt & clay) ~ 20% gravels ~ 5% to almost cob size	S 153		set casing @ -6' No length Total 1 - 5.1 = 5.1 2 - 4.8 = 9.9 (switch to 5" Drive bbl w/ straight bit)
	4		Brown	R-0 D-2		← compressing ahead of bit
	5			S 60	D-2 7.0 to 7.5	Distance and Direction from PZ-18 = 11.4 ft, S 42° E Elevation approx Same as PZ-18
	6			R-0.5 D-2		— Represents 2.0 to 9.0 ← mostly grass/roots (top ft compressed) Too poor to save
	7	 D-2 		S 45		
	8			R-0.5 D-2		— stop (clayey Sand-Grav.)
	9	 CH D-3 	High plastic clay (CH) stiff wet (Probably no Sand) gray-brown	S 29 D-0.5	D-3 9.0 to 9.5	add casing @ 10.0' 5.3 - 4.9' = 14.8 represents 9.0 to 10.0 — stop, some clay

DRILLING LOG (Cont Sheet)			ELEVATION TOP OF HOLE		Hole No. PZ-18 R	
PROJECT Piezometer Installation			INSTALLATION P-14 Bend Dam		SHEET 2 OF 2 SHEETS	
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV- ERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
		CH	Fat Clay (CH) high plasticity stiff to V. stiff moist (below water table) Trace of sand (med to fine) gray-brown; somewhat mottled (Same as above)	D-2		
	11			S 27	D-4 11.5 To 12.0	Represents 10.0 To 16.0 ft
	12	D-4		R-2		
				D-2		
	13		Same as above (CH)	S 51		
	14			R-2		Add casing @ 18'
				D-2		#4 - 4.9 = 19.7
	15		Same as above (CH)	S 24		
	16			R-2		
		CL	Low plastic clay soft to med stiff wet silty Brown	D-2	D-5 17.5 To 18.0	Represents 16.0 To 20.0 ft
	17			S 32		
	18	D-5		R-2		
				D-2		
	19		stiff/med to low plastic →	S 41		
	20			R-2		
			med to low plastic clay (CL)	D-2	D-6 21.5 To 22.0	Represents 20.0 To 23.0
	21		stiff to V stiff wet silty grayish brown, slight mottling	S 30		add casing @ 22'
		D-6		R-2		#5 - 4.9 = 24.6

DRILLING LOG (Cont Sheet)			ELEVATION TOP OF HOLE		Hole No. PZ-18R	
PROJECT		INSTALLATION		SHEET		
Piezometer Installation		Big Bend Dam		3 OF 3 SHEETS		
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
				D-2		
				S		
	23	SC	clayey/silty v. fine sand (SC)	25		
			slightly plastic		D-7	
			Dense To med Dense		23.5	
	24		wet to moist	R-2	To 24.0	Represents 23.0 To
			v. fine grained - v. poorly graded	D-2		
			rusty brown			
			Some what layered (more or less fines)	S		
	25		(same as above, fewer fines, some coarser)	27		
				R-2		
	25	Sm	silty sand (Sm)	D-2		
			v. slightly to non plastic			
			Dense	S		
	27		wet to saturated	47		Add casing @ 28'
			v. fine grained			#6 - 4.9 = 29.5'
			dk gray w/ some iron staining in layers	R-0		
	28			D-2		← (clean cut 0.5' - ?) bar bit
				S		
	29			36		
					D-8	
					29.5	
	30			R-2	To 30.0	Represents (approx) 26.0 To 31.0
				D-2		
				S		
	31	SP/Sm	poorly graded silty sand (SP/Sm)	63		
			non plastic			
			v. Dense			
	32		saturated	R-2		
			fine grained	D-2		
			gray-brown			Add casing @ 34'
						#7 - 4.9 = 34.4'
	33			S		
				64		
					D-9	
		D-9			33.5	
				R-2	To 34.0	Represents 31.0 To 35.0

PZ-18R

VW Piezometer Calibration Certificate

Serial #: 12-6522
Range : 350 kPa
Cable Length: 60 ft
Date of Calibration: 6/19/2012

Part #: 52611020
Cable Part #: 50613524
Calibrated by: KB
Note:

ABC Calibration Factors

	A	B	C
kPa	-1.148088E-4	-3.027966E-2	1.018696E+3
psi	-1.665161E-5	-4.391694E-3	1.477494E+2

Pressure in kPa/psi = (A x Hz²) + (B x Hz) + C, where Hz is frequency in Hertz.

TI Calibration Factors

	C0	C1	C2	C3	C4	C5
kPa	1.015815E+3	-3.066860E-2	1.812745E-1	-1.148425E-4	4.081219E-5	-4.344694E-4
psi	1.473263E+2	-4.447948E-3	2.629072E-2	-1.665591E-5	5.919099E-6	-6.301224E-5

Pressure in kPa/psi = C0 + (C1 x Hz) + (C2 x T) + (C3 x Hz²) + (C4 x Hz x T) + (C5 x T²)

Where Hz is the frequency reading in Hertz and T is the Thermistor reading in degrees C.

TI factors are calculated from temperatures at 5.0, 15.0 and 25.0 degrees C.

Applied pressure and temperature are NIST traceable.

Summary of Test Results at 15°C

Thermistor reading is 14.7 °C.

Applied Pressure is referenced to 1 atm. Calculated Pressure uses ABC Calibration factors.

Applied (kPa)	Equivalent (psi)	Frequency (Hz)	Calculated (kPa)	Calculated (psi)	Error (%FS)
0.0	0.00	2849.8	0.0	0.00	0.00
35.0	5.08	2798.2	35.0	5.08	-0.01
70.0	10.15	2745.8	70.0	10.15	0.01
105.0	15.23	2692.3	105.0	15.23	0.00
140.0	20.31	2637.7	140.1	20.31	-0.01
175.0	25.38	2582.2	175.0	25.38	0.00
210.0	30.46	2525.4	210.0	30.46	-0.01
245.0	35.53	2467.5	245.0	35.53	0.01
280.0	40.61	2408.2	279.9	40.60	0.01
315.0	45.69	2347.3	315.1	45.69	-0.01
350.0	50.76	2285.1	350.0	50.76	0.00

DRILLING LOG		DIVISION CENWO	INSTALLATION Big Bend Dam	HOLE NUMBER PZ18R-12
1. PROJECT Big Bend Piezometer Abandon, Rehab, Replace		10. SIZE AND TYPE OF BIT 4-1/4 inches HSA		SHEET 1 OF 1 SHEETS
2. LOCATION (Coordinates or Station) Ft. Thompson, SD		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)		
3. DRILLING AGENCY CENWO-ED-GG		12. MANUFACTURER'S DESIGNATION OF DRILL Bus Pech 1300c		
4. HOLE NO. (As shown on drawing title and file number)	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN		DISTURBED none	UNDISTURBED none
5. NAME OF DRILLER <i>S. Carroll</i>		14. TOTAL NUMBER CORE BOXES <i>N/A</i>		
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER <i>7' N/A</i>		
7. THICKNESS OF OVERBURDEN <i>51</i>	16. DATE HOLE		STARTED <i>6/28/13</i>	COMPLETED <i>6/28/13</i>
8. DEPTH DRILLED INTO ROCK		17. ELEVATION TOP OF HOLE		
9. TOTAL DEPTH OF HOLE <i>51</i>		18. TOTAL CORE RECOVERY FOR BORING		
19. SIGNATURE OF INSPECTOR <i>G. Filpovich</i> <i>Steve A. [Signature]</i>				
LOCATION SKETCH/COMMENTS			SCALE	
<div style="font-size: 14pt; font-weight: bold;">Materials:</div> <ul style="list-style-type: none"> 1. Porous Ap 1. VW wire 1. 10 ft riser with a 1/2" hole every foot 4. 60 ft risers 1. 2 ft riser 5 bags Portland 15 lbs bentonite 1. top cap <div style="margin-top: 20px;"> <div style="float: right; text-align: right;"> <i>Initial Instilled Reading</i> <i>2603.3 Hz</i> <i>11.1 °C</i> </div> <div style="clear: both;"></div> <div style="display: flex; justify-content: space-between; margin-top: 20px;"> <div style="width: 30%;"> <i>Initial bucket surface reading</i> <i>2856.1 Hz</i> <i>20.1 °C</i> </div> <div style="width: 30%;"> <i>S/N</i> <i>12-6522</i> <i>P/N</i> <i>52611020</i> </div> <div style="width: 30%; text-align: right;"> <i>24 hour reading</i> <i>2601.7 Hz</i> <i>10.9 °C</i> </div> </div> </div>				

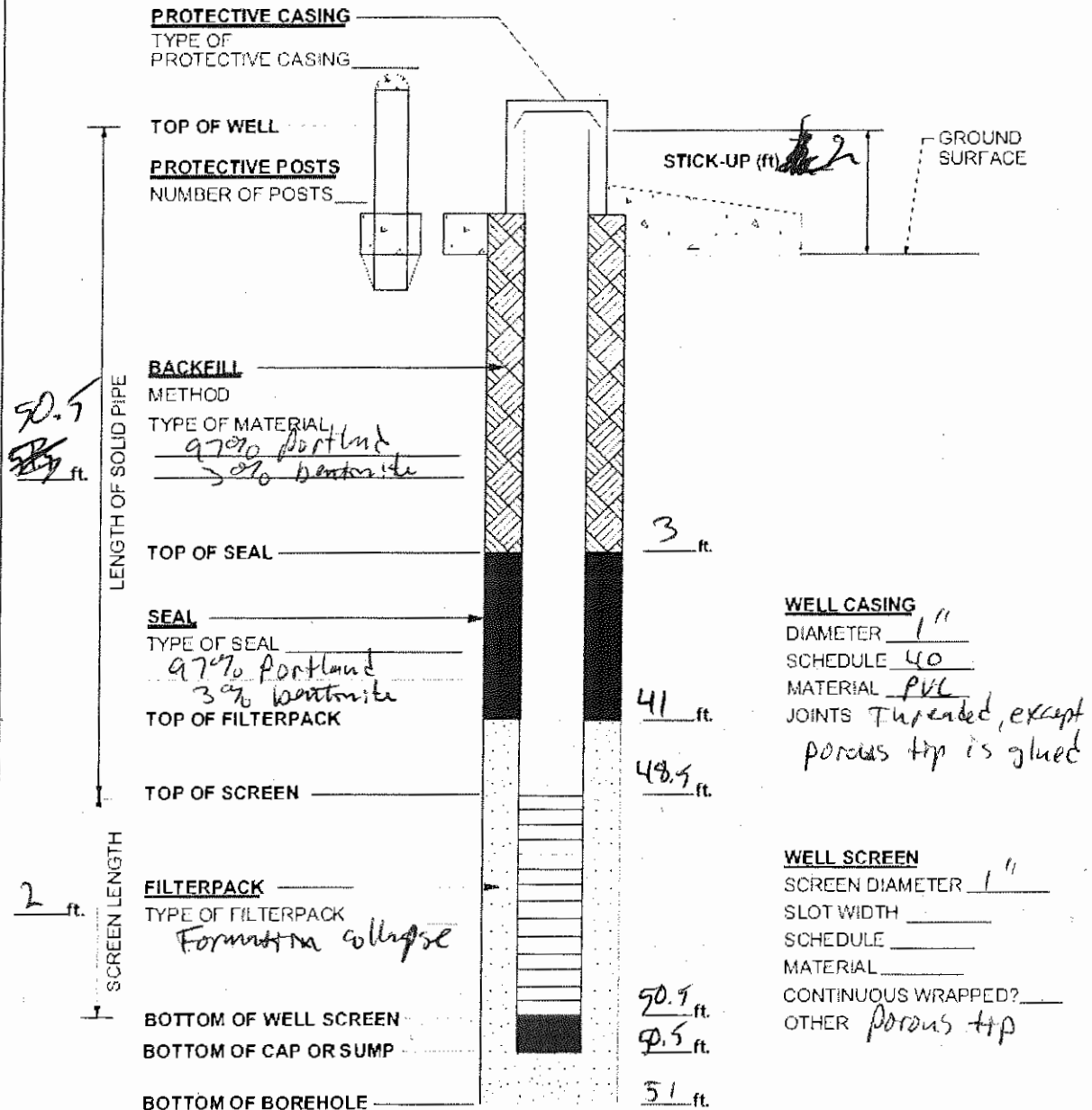
ENG FORM 1836
PROJECT *Big Bend PZ*
HOLE NO. *PZ-18R-12*

DRILLING LOG (CONT SHEET)				ELEVATION TOP OF HOLE		HOLE NUMBER PZ18R-12	
PROJECT Big Bend Piezometer Abandon, Rehab, Replace			INSTALLATION Big Bend Dam, SD			SHEET 2 OF 2 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	
	0	GC	GRAVEL, no plasticity, loose, light brown, dry, clayey			4 1/4" ID HSA Knock out plug	
	5						
	10	SC	SAND, no plasticity, loose light brown, wet, clayey sand is fine				
	15						
	20						
	25						
	30						
	35						
	40						
	45			45.0			
	45	CH	CLAY, high plasticity, soft, wet, olive gray				
	50			51.0			
	50		End of boring at 51 ft				
	55						
	60						
	65						
	70						
	75						
	80						
	85						
	90						
	95						
	100						

PROJECT NAME <i>Big Bend Piezometer, Rehab, Abilene, Texas</i>			WELL NUMBER <i>PZ18R-12</i>
LOCATION <i>Ft. Thompson SD</i>			WELL LOCATION (Coordinates or Station)
DATE INSTALLED <i>6/28/13</i>	STARTED <i>6/29/13</i>	COMPLETED <i>6/28/13</i>	TOP OF CASING ELEVATION
TOTAL DEPTH OF BOREHOLE <i>51 ft</i>		BORING DIAMETER <i>8"</i>	SIGNATURE OF INSPECTOR/INSTALLER <i>G. Filpovich</i>

PIEZOMETER CONSTRUCTION DIAGRAM

NO SCALE
(ALL MEASUREMENTS FROM GROUND SURFACE)



DRILLING LOG		DIVISION CENWO	INSTALLATION Big Bend Dam	HOLE NUMBER PZ18R-12
1. PROJECT Big Bend Piezometer Abandon, Rehab, Replace		10. SIZE AND TYPE OF BIT 4-1/4 inches HSA		SHEET 1 OF SHEETS
2. LOCATION (Coordinates or Station) Ft. Thompson, SD		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)		
3. DRILLING AGENCY CENWO-ED-GG		12. MANUFACTURER'S DESIGNATION OF DRILL Bus Pech 1300c		
4. HOLE NO. (As shown on drawing title and file number)	PZ18R-12		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED none
5. NAME OF DRILLER S Carroll		14. TOTAL NUMBER CORE BOXES 11/4		
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 7		
7. THICKNESS OF OVERBURDEN 51		16. DATE HOLE	STARTED 6/23/13	COMPLETED 6/23/13
8. DEPTH DRILLED INTO ROCK		17. ELEVATION TOP OF HOLE		
9. TOTAL DEPTH OF HOLE 51		18. TOTAL CORE RECOVERY FOR BORING		
19. SIGNATURE OF INSPECTOR G. Folpovich		Steve A. F...		
LOCATION SKETCH/COMMENTS			SCALE	
<p>Materials:</p> <ul style="list-style-type: none"> 1. Pious Ap. 1. V.W. wire 1. 10 ft riser with a 1/2" hole every foot 4 10 ft risers 1. 2 ft riser 5 bags Portland 15 lbs. bentonite 1. top cap <div style="text-align: right; margin-top: 20px;"> Initial Instilled Reading 2603.3 Hz 11.1 °C </div> <div style="display: flex; justify-content: space-between; margin-top: 20px;"> <div style="width: 30%;"> Initial bucket surface reading 2856.1 Hz 20.1 °C </div> <div style="width: 30%;"> S/N 12-6522 P/N 52611020 </div> <div style="width: 30%;"> 24 hour reading 2601.7 Hz 10.9 °C </div> </div>				
ENG FORM 1836		PROJECT Big Bend PZ,		HOLE NO. PZ-18R-12

DRILLING LOG (CONT SHEET)

ELEVATION TOP OF HOLE

HOLE NUMBER

PZ18R-12

PROJECT

Big Bend Piezometer Abandon, Rehab, Replace

INSTALLATION

Big Bend Dam, SD

SHEET 2

OF 2 SHEETS

ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
	0	GC	GRAVEL, no plasticity, loose, light brown, dry, clayed			4 1/4" ID HSA Knock out plug
	5					
	10	SC	SAND, no plasticity, loose light brown, wet, clayey sand is fine			
	15					
	20					
	25					
	30					
	35					
	40					
	45	CH	CLAY, high plasticity, soft, wet, olive gray	45.0		
	50		End of boring at 51 ft	51.0		
	55					
	60					
	65					
	70					
	75					
	80					
	85					
	90					
	95					
	100					

PROJECT NAME Br Bend PZs			WELL NUMBER PZ-20-12		
LOCATION Ft. Thompson			WELL LOCATION (Coordinates or Station)		
DATE INSTALLED 6/29/13	STARTED 6/29/13	COMPLETED 6/29/13	TOP OF CASING ELEVATION		
TOTAL DEPTH OF BOREHOLE 54.5		BORING DIAMETER 8"	SIGNATURE OF INSPECTOR/INSTALLER <i>G. Filpovich</i> <i>Angel A. [Signature]</i>		

PIEZOMETER CONSTRUCTION DIAGRAM

NO SCALE
(ALL MEASUREMENTS FROM GROUND SURFACE)

PROTECTIVE CASING
TYPE OF PROTECTIVE CASING _____

TOP OF WELL _____

PROTECTIVE POSTS
NUMBER OF POSTS _____

BACKFILL
METHOD **Tremie**
TYPE OF MATERIAL
97% Portland
3% Bentonite

TOP OF SEAL _____

SEAL
TYPE OF SEAL **97% Portland**
3% bentonite

TOP OF FILTERPACK _____

TOP OF SCREEN _____

FILTERPACK
TYPE OF FILTERPACK **Formation collapse**

BOTTOM OF WELL SCREEN _____

BOTTOM OF CAP OR SUMP _____

BOTTOM OF BOREHOLE _____

GROUND SURFACE

STICK-UP (ft) = **3**

53 ft. LENGTH OF SOLID PIPE

30 ft.

48 ft.

50 ft.

2 ft. SCREEN LENGTH

52 ft.

52 ft.

54.5 ft.

NOTES
TOTAL VOLUME OF WATER ADDED DURING CONSTRUCTION (IF ANY)
while removing tremie pipe - piezometer lifted 2 ft higher

MISC. INFORMATION

WELL CASING
DIAMETER **1"**
SCHEDULE **40**
MATERIAL **PVC**
JOINTS **flared, except glued, slip coupling**

WELL SCREEN
SCREEN DIAMETER **1"**
SLOT WIDTH _____
SCHEDULE _____
MATERIAL _____
CONTINUOUS WRAPPED? _____
OTHER **porous tip**

Revised Mar 2011 to a bottom depth of 52 ft
 Sand was measured at 48 ft
 prior to adding grout. Porous
 tip is below the grout, in the
 sand

DRILLING LOG		DIVISION CENWO	INSTALLATION Big Bend Dam	HOLE NUMBER PZ-20-12
1. PROJECT Big Bend Piezometer Abandon, Rehab, Replace		10. SIZE AND TYPE OF BIT 4-1/4 inches HSA		SHEET 1 OF 2
2. LOCATION (Coordinates or Station) Ft. Thompson, SD		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)		
3. DRILLING AGENCY CENWO-ED-GG		12. MANUFACTURER'S DESIGNATION OF DRILL Bus Pech 1300c		
4. HOLE NO. (As shown on drawing title and file number) PZ-20-12	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN		DISTURBED none	UNDISTURBED none
5. NAME OF DRILLER S. Calhoun		14. TOTAL NUMBER CORE BOXES		
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 8 ft		
7. THICKNESS OF OVERBURDEN 54	16. DATE HOLE 6/29/13		STARTED 6/29/13	
8. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE		COMPLETED 6/29/13	
9. TOTAL DEPTH OF HOLE 54	18. TOTAL CORE RECOVERY FOR BORING		19. SIGNATURE OF INSPECTOR G. Filpovich	
LOCATION SKETCH/COMMENTS			SCALE	
<p>Materials:</p> <ul style="list-style-type: none"> 1 Porous Tip 1 RW wire transducer 1 10 ft MSR with 1/2" holes drilled every foot 4 10 ft MSRs 1 5 ft MSR 6 bags Portland 20 lbs Bentonite 1 top cap <p>Notes: While pulling the frame pipe out of the augers, the piezometer lifted up approximately 2 ft. Could not be pushed back to the original 54 ft depth. Prior to grouting sand was measured at 48 ft. The tip of the porous tip is at 50 ft (bottom is at 52) leaving 2 ft of sand between the top of the tip and the grout.</p> <div style="display: flex; justify-content: space-between; margin-top: 20px;"> <div> <p>Initial Surface bucket reading</p> <p>2800.0 Hz</p> <p>21.2 °C</p> </div> <div> <p>P/N 526-11020</p> <p>S/N 12-6524</p> <p>60 ft</p> <p>Initial Install reading</p> <p>2557.0 Hz 14.2 °C</p> </div> <div> <p>24 hour reading</p> <p>2556.6 Hz 14.4</p> </div> </div>				
ENG FORM 1836		PROJECT Big Bend PZ		HOLE NO. PZ-20-12

DRILLING LOG (CONT SHEET)

ELEVATION TOP OF HOLE

HOLE NUMBER
PZ-20-12

PROJECT

Big Bend Piezometer Abandon, Rehab, Replace

INSTALLATION

Big Bend Dam, SD

SHEET **2**
OF **2** SHEETS

ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
	0	CH	CLAY, high plasticity, medium dense, moist, olive gray, some sand, sand is fine			4 1/4" ID HSA Knock out plug
	5					
	10					
	15					
	20					
	25					
	30					
	35					
	40					
	45	SC	SAND, clayey, low plasticity, loose, wet, olive gray			
	50					
	55		End of boring at 54 ft			
	60					
	65					
	70					
	75					
	80					
	85					
	90					
	95					
	100					



Vibrating Wire Pressure Transducer Calibration

Model Number: 4500ALX-10

Pressure Range: 10 psi

Serial Number: 37097

Mfg. Number: 5-5057

Customer: U.S.A.C.E.

Temp: 24.6 °C

Cust. I.D. Number: n/a

Baro: 1004 mbar.

Job No.: 9608

Date: 9/30/96

Test Gage: 336

Technician:

8

Shawn P. Edson

First Cycle

Applied Pressure	Reading	Change
0.0154	10632	
2.0004	9921	711
3.9998	9205	716
5.9996	8488	717
8.0008	7770	718
10.0090	7046	724

Second Cycle

Calibration Factor (C): 0.002788 (PSI/Digit)

Thermal Factor (K): -0.003943 (PSI/°C Rise)

Calculated Pressure = $C(R0-R1) + K(T1-T0)$

GK-401 Reading at Shipment:

Date: 10/3/96

Position "B":* 10642

Temperature: 24.9 °C

or

Position "F":*

Baro: 999.4 mbar**

* Users are advised to establish their own zero conditions.

** Factory elevation 580 ft. above sea level.

Wiring Code:

Red and Black: Gage

White and Green: Thermistor

DEPARTMENT OF THE ARMY				HOLE NO. <u>PIEZ. 25</u>		
DIVISION <u>MISSOURI RIVER</u>				1. PROJECT <u>BIG BEND DAM</u>		
INSTALLATION <u>OMAHA DIST.</u>				2. LOCATION (Coordinates or Station)		
DRILLING LOG				3. DRILLING AGENCY <u>US-CE-C</u>		
4. HOLE NO. (As shown on drawing title and file No.) <u>PIEZ. 25</u>				5. NAME OF DRILLER <u>STERLING</u>		
6. DIRECTION OF HOLE				7. THICKNESS OF OVER-BURDEN <u>54.7</u>	8. DEPTH DRILLED INTO ROCK <u>5.3</u>	
<input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED DEGREES WITH VERTICAL <u> </u>				9. TOTAL DEPTH OF HOLE <u>60.0</u>		
10. SIZE AND TYPE OF BIT <u>6" drive bbl.</u>		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)		12. MANUFACTURER'S DESIGNATION OF DRILL		
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN		14. TOTAL NO. CORE BOXES		15. ELEVATION GROUND WATER <u>1381.5</u>		
DISTURBED		UNDISTURBED		16. DATE HOLE STARTED <u>7-23-64</u> COMPLETED <u>7-23-64</u>		
17. ELEVATION TOP OF HOLE <u>1381.9</u>		18. TOTAL CORE RECOVERY FOR BORING (%) <u>100%</u>		19. SIGNATURE OF INSPECTOR <u>Millard E. Wik</u>		
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
						2" cap w/vent hole
1381.9	0.0					GROUND LEVEL
1376.9	5.0		IMPERVIOUS			2" BLACK PIPE EXTENDED 2.1' ABOVE GROUND LEVEL
			2.1'			TOP SAND BACKFILL AND BOTTOM OF IMPERVIOUS backfill
						Backfilled around sand point with a clean fine-med. Sand.
						Well point is a No. 60 2" x 36" x 24"
1341.6	40.3					TOP OF SCREEN
1339.1	42.8					BOTTOM OF SCREEN
1336.9	45.0					TOP CRUSHED ROCK
			FINE CRUSHED ROCK			
1321.9	50.0					BOTTOM 8" DRILL HOLE

DEPARTMENT OF THE ARMY DIVISION <u>MISSOURI RIVER</u> INSTALLATION <u>OMAHA DIST.</u>			1. PROJECT <u>BIG BEND DAM</u>		SHEET <u>1</u> OF <u>6</u>	
2. LOCATION (Coordinates or Station)			3. DRILLING AGENCY <u>US-CE-C</u>			
4. HOLE NO. (As shown on drawing title and file No.) <u>PIEZ. 25</u>			5. NAME OF DRILLER <u>STERLING</u>			
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED DEGREES WITH VERTICAL <u> </u>			7. THICKNESS OF OVER-BURDEN <u>54.7</u>		8. DEPTH DRILLED INTO ROCK <u>5.3</u>	
9. TOTAL DEPTH OF HOLE <u>60.0</u>			10. SIZE AND TYPE OF BIT <u>6" drive bbl.</u>			
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)			12. MANUFACTURER'S DESIGNATION OF DRILL <u>71 SPEED STAR</u>			
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED <u> </u> UNDISTURBED <u> </u>			14. TOTAL NO. CORE BOXES <u> </u>		15. ELEVATION GROUND WATER <u>1381.5</u>	
16. DATE HOLE STARTED <u>7-23-64</u> COMPLETED <u>7-23-64</u>			17. ELEVATION TOP OF HOLE <u>1381.9</u>			
18. TOTAL CORE RECOVERY FOR BORING (%) <u>100%</u>			19. SIGNATURE OF INSPECTOR <u>Miller & S. Wik</u>			
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
1381.9	0.0		SILTY CLAY (CL) LOW PLASTICITY MED. STIFF MOIST BLACK 30% silt 70% clay.	2.00		Figure in Core Recovery column is the number of blows required to drive a sample barrel, of the diameter indicated, one or two feet, as shown, using a <u>945</u> pound weight falling <u>30</u> inches. (S) indicates blows.
	1.0			5		
	2.0			29		
	2.0		w/shale mixed in from 2.5' - 3.5'	2.00		Hole is located on lower spillway, access road, 150' N. of PZ. 19 on D.S. side of road.
	3.0			2.00		
	3.0			5		
1378.4	3.5		SANDY CLAY (CL) LOW PLASTICITY MED. STIFF MOIST BROWN 35% fine sand 65% clay	2.00		depth of Hole 6.0' set 5.7 casing
	4.0			2.00		
	5.0			5		
	6.0			2.00		Depth of Hole 10.0' Added 5.0 casing total 10.4'
	7.0			2.00		
	8.0			5		
	9.0			12		
	9.0			2.00		
	10.0			2.00		
1372.5	9.4		CLAYEY SAND (SC) MED. DENSE WET-SAT. BROWN	2.00		
	10.0			2.00		

DEPARTMENT OF THE ARMY				HOLE NO. <u>PIEZ. 25</u>		
DIVISION <u>MISSOURI RIVER</u>				1. PROJECT <u>BIG BEND DAM</u>		
INSTALLATION <u>OMAHA DIST.</u>				SHEET <u>2</u> OF <u>6</u>		
DRILLING LOG				2. LOCATION (Coordinates or Station)		
4. HOLE NO. (As shown on drawing title and file No.)				3. DRILLING AGENCY		
<u>PIEZ. 25</u>				5. NAME OF DRILLER		
6. DIRECTION OF HOLE				7. THICKNESS OF OVER-BURDEN		
<input type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED DEGREES WITH VERTICAL				8. DEPTH DRILLED INTO ROCK		
10. SIZE AND TYPE OF BIT				9. TOTAL DEPTH OF HOLE		
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)				12. MANUFACTURER'S DESIGNATION OF DRILL		
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN				14. TOTAL NO. CORE BOXES		
DISTURBED UNDISTURBED				15. ELEVATION GROUND WATER		
17. ELEVATION TOP OF HOLE				16. DATE HOLE		
<u>1381.9</u>				STARTED COMPLETED		
18. TOTAL CORE RECOVERY FOR BORING (%)				19. SIGNATURE OF INSPECTOR		
1381.9						
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
1374.9	19.0		CLAYEY SAND (SC)	2.00		
			MED. DENSE			
			SATURATED			
			BROWN			
			5% clay			
			95% fine sand			
	11.0			5	10	
	12.0			2.00		
				2.00		
	13.0			5	18	
	14.0			2.00		Depth of Hole 14.0'
				2.00		Added 4.6 casing
						Total 15.3 "
	15.0			5	18	
	16.0			2.00		Depth of Hole 16.0'
				2.00		Added 5.0 casing
						Total 20.3 "
	17.0			5	21	
	18.0			2.00		
				2.00		
	19.0			5	30	
	20.0			2.00		

DEPARTMENT OF THE ARMY
DIVISION MISSOURI RIVER
INSTALLATION QUINCY DIST.

1. PROJECT
BIG FEND DAM
2. LOCATION (Coordinates or Station)

3. DRILLING AGENCY

4. HOLE NO. (As shown on drawing title and file No.)
PIEZ. 25
5. NAME OF DRILLER

6. DIRECTION OF HOLE
☐ VERTICAL ☐ INCLINED DEGREES WITH VERTICAL
7. THICKNESS OF OVER-BURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN
DISTURBED
UNDISTURBED
14. TOTAL NO. CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE
STARTED
COMPLETED
17. ELEVATION TOP OF HOLE
1381.9
18. TOTAL CORE RECOVERY FOR BORING (%)
19. SIGNATURE OF INSPECTOR

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
1381.9	30.0		CLAYEY SAND (SL) MED. DENSE SATURATED BROWN 2% CLAY 1% FINE SAND	2.00		Depth of Hole 30.0 Added 5.6 casing Total 36.5 "
	31.0			5	21	
	32.0			2.08	2.00	
	33.0					
1384.35	34.0		FINE SAND (SL) MED. DENSE SATURATED BROWN 1% FINE SAND	2.08	2.00	Depth of Hole 34.0 Added 4.7 casing Total 41.2 "
	35.0			5	31	
	36.0			2.08	2.00	
	37.0				37	
	38.0			2.08	2.00	
	39.0			5	25	
	40.0			2.08		

DATE TIME

DIVISION MISSOURI RIVER
INSTALLATION OMAHA DIST.

DRILLING LOG

4. HOLE NO. (As shown on drawing title and file No.)

PIEZ. 25

6. DIRECTION OF HOLE

☐ VERTICAL

☐ INCLINED

DEGREES WITH
VERTICAL

10. SIZE AND TYPE OF BIT

11. DATUM FOR ELEVATION SHOWN
(TBM or MSL)

12. MANUFACTURER'S DESIGNATION OF DRILL

13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN

DISTURBED

UNDISTURBED

14. TOTAL NO. CORE
BOXES

15. ELEVATION
GROUND WATER

16. DATE HOLE

STARTED

COMPLETED

17. ELEVATION TOP OF HOLE

1381.9

18. TOTAL CORE RECOVERY FOR BORING (%)

19. SIGNATURE OF INSPECTOR

ELEVATION

DEPTH

LEGEND

CLASSIFICATION OF MATERIALS
(Description)

% CORE
RECOV-
ERY

BOX OR
SAMPLE
NO.

REMARKS
(Drilling time, water loss, depth of
weathering, etc., if significant)

FINE SAND (SP)
MED. DENSE
SATURATED
BROWN
100% Fine sand

2.00

5
50

2.00
2.00

5
42

2.00
2.00

5
47

SILTY SANDY CLAY (CL)
MED. PLASTICITY
MED. STIFF
SATURATED
GRAY
15% silt
30% fine sand
55% clay

2.00

2.00

CLAYEY SAND (SC)
MED. DENSE
SATURATED
BROWN
5% clay
95% fine sand

5
45

2.00
2.00

5
37

Color changes to gray

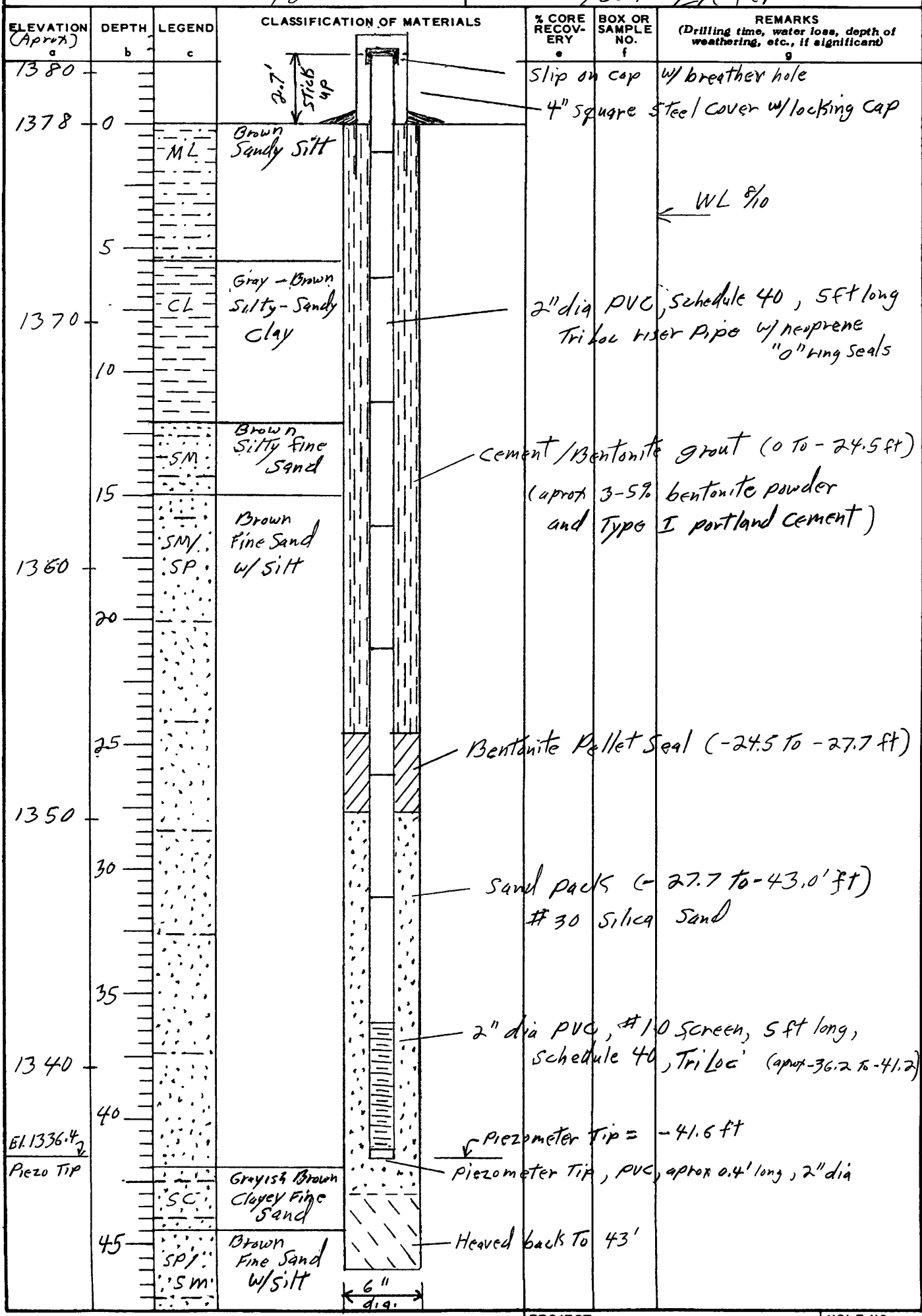
2.00

Depth of Hole 42.0'
Added 5.0 casing
Total 46.2 "

Depth of Hole 48.0'
Added 4.8 casing
Total 51.0 "

DEPARTMENT OF THE ARMY			1. PROJECT <u>BIG BEND DAM</u>		SHEET <u>6</u> OF <u>6</u>	
DIVISION <u>MISSOURI</u>			2. LOCATION (Coordinates or Station)			
INSTALLATION <u>SAIAHU DIST.</u>			3. DRILLING AGENCY			
4. HOLE NO. (As shown on drawing title and file No.) <u>P1 25</u>			5. NAME OF DRILLER			
6. DIRECTION OF HOLE			7. THICKNESS OF OVERBURDEN		8. DEPTH DRILLED INTO ROCK	
<input type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED DEGREES WITH VERTICAL					9. TOTAL DEPTH OF HOLE	
10. SIZE AND TYPE OF BIT			11. DATUM FOR ELEVATION SHOWN (TBM or MSL)		12. MANUFACTURER'S DESIGNATION OF DRILL	
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN			14. TOTAL NO. CORE BOXES		15. ELEVATION GROUND WATER	
DISTURBED			UNDISTURBED		16. DATE HOLE	
					STARTED	
17. ELEVATION TOP OF HOLE <u>1381.9</u>			18. TOTAL CORE RECOVERY FOR BORING (%)		19. SIGNATURE OF INSPECTOR	
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
1336.9	50.0		CLAYEY SAND (SC) MED. DENSE SATURATED GRAY 5% CLAY 95% FINE SAND	2.00		
1329.7	52.2		CLAYEY SILT (ML) LOW-MED. PLASTICITY SOFT-MED. STIFF SATURATED GRAY 20% CLAY 80% SILT	5 35		Depth of Hole 52.0' Added 4.6 casing Total 55.6 "
1327.2	54.7		SANDY CLAY (CL) LOW-MED. PLASTICITY MED. STIFF WET GRAY 15% FINE SAND 85% CLAY	2.00 2.00		Bailed hole dry @ 52.0
			NIOBRARA CHALK THIN BEDDED SANDY SOFT WET GRAY (CALCAREOUS)	5 45		
				2.00 2.00		
				5 46		
				2.00 2.00		
				5 34		
1321.9						BOTTOM OF HOLE

DRILLING LOG		DIVISION Missouri River	INSTALLATION Omaha District	SHEET 1 OF 1 SHEETS
1. PROJECT Piezo. Install. Big Bend Dam, S.D.		10. SIZE AND TYPE OF BIT 6" Drive B61		
2. LOCATION (Coordinates or Station) Approx Dam Sta 129+00, Range 285' DS		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL		
3. DRILLING AGENCY CEMRO - ED - GC		12. MANUFACTURER'S DESIGNATION OF DRILL Churn		
4. HOLE NO. (As shown on drawing title and file number) PZ-25R		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN 11		UNDISTURBED —
5. NAME OF DRILLER A1 OAKS		14. TOTAL NUMBER CORE BOXES —		
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER (-6.4 below Top of Piezo g/o)		
7. THICKNESS OF OVERBURDEN 46' ±		16. DATE HOLE 8 Aug 89		COMPLETED 10 Aug 89
8. DEPTH DRILLED INTO ROCK 0		17. ELEVATION TOP OF HOLE 1378 (approx)		
9. TOTAL DEPTH OF HOLE 46'		18. TOTAL CORE RECOVERY FOR BORING — %		
		19. SIGNATURE OF INSPECTOR Tom Liefer		



DRILLING LOG		DIVISION MRD	INSTALLATION Omaha Dist.	SHEET 1 OF 4 SHEETS
1. PROJECT Piezo. Install., Big Bend Dam			10. SIZE AND TYPE OF BIT 6" Drive Bbl	
2. LOCATION (Coordinates or Station) Approx Dam Sta 129+00, Range 285'D.S.			11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL	
3. DRILLING AGENCY CEMRO-ED-GC			12. MANUFACTURER'S DESIGNATION OF DRILL Chytrn (Bucyrus Erie 22W)	
4. HOLE NO. (As shown on drawing title and file number) PZ-25 R			13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED 11 UNDISTURBED -	
5. NAME OF DRILLER A Oaks			14. TOTAL NUMBER CORE BOXES -	
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.			15. ELEVATION GROUND WATER (approx 3' below PZ-25)	
7. THICKNESS OF OVERBURDEN 46' +			16. DATE HOLE STARTED 8 Aug 89 COMPLETED 10 Aug 89	
8. DEPTH DRILLED INTO ROCK 0			17. ELEVATION TOP OF HOLE (approx) 1378	
9. TOTAL DEPTH OF HOLE 46'			18. TOTAL CORE RECOVERY FOR BORING - %	
			19. SIGNATURE OF INSPECTOR Tom Liefer	

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
a	b	c	d	e	f	g
		ML	Sandy/clayey silt (ML)	D-2	D-1	Start Drilling
			low plastic		0.5	w/ 6" straight bit
		//////	v stiff		1.0	- Represents 0 to 5.5
	1	D-1	Slightly moist	S		
		//////	Brown	22		Distance and Direction
			10% fine sand			from PZ-25 =
			w/ clay balls - drk brn			15.5ft; N. 80° E
			med plastic (CL)			Elevation of new
	2			R-2		Piezometer =
				D-2		Elev of change, New
						PZ-25 of Elev Piezo
						1381.5 - 3.4 = 1378.1
	3		(Fill?)	S		
				28		
	4			R-2		
				D-2		
	5			S		
				25	D-2	
					7.0	
					7.5	- Represents 5.5 to 10.0
	6	CL	Silty-Sandy clay (CL)	R-2		
			low plastic			
			med. stiff	D-2		
			wet to saturated			
			gray brown			
	7	//////	10% fine sand	S		
		D-2	w/ high organic zones	16		
		//////	(Drk gray to Black)			
			up to 10% of sample			
	8			R-2		
				D-2		
	9			S		
				22		
				R-2		

DRILLING LOG (Cont Sheet)			ELEVATION TOP OF HOLE		Hole No. PZ-25R	
PROJECT <i>Piezometer Installation</i>			INSTALLATION <i>Big Bend Dam</i>		SHEET OF 4 SHEETS	
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
		CL	Silty-Sandy clay (CL) low plastic, med stiff to soft v. wet, gray to black - w/ high organic zones, sand = 10% (similar to above)	D-2	D-3 10.5 11.0	Represents 10.0 to 12.0 ft
		D-3	WC during drilling Saturated sandy clay	S 23		
	12	Sm	Silty med-fn Sand low to non plastic dense wet/saturated approx 15% silt/clay Brown	R-2		change bits & case @ 12 ft 5" drive bbl w/ straight shoe Casing No added Total 1 - 5.1 = 5.1 2 - 4.8 = 9.9 3 - 4.9 = 14.8
	14	R-4	(Note - mostly qtz sands w/ approx 20% other minerals or lithic frags mineral/Rx fragments, also fine grain sand size)	R-2	D-4 13.5 To 14.0	Represents 12.0 to 15.0
	15	Sm/sp	Very Similar to above (Sm/sp) Less silt silty fine Sand non plastic dense Saturated approx 10% fines (silt/clay) Brown	S 32	D-5 17.5 To 18.0	- Represents 15.0 to 20.0 ft
	17	D-5		R-2		Add casing #4 - 4.9 = 19.7
	19			D-2		
	21		Same as above fine to v. fine Silty Sand approx 5 to 10% silt & clay (Sp/Sm)	S 48	D-6 21.5 To 22.0	Represents 20.0 to 25.0
	23	D-6		R-2		Add ed Casing @ 22 ft #5 - 4.9 = 24.5

DRILLING LOG (Cont Sheet)			ELEVATION TOP OF HOLE		Hole No. PZ-25R	
PROJECT Piezometer Installation			INSTALLATION Big Bend Dam		SHEET OF 4 SHEETS	
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
		SP/SM	Silty sand (SP/SM) Same as above	R-2		
	23		dense saturated nonplastic fine to V fine grained approx 5-10% silt/clay Brown	S 73		
	24			R-2 D-2		
	25		Same as above (SP/SM) (almost all SP)	S 58	D-7 25.5 To 26.0	Add casing @ 28' #6 - 4.9 = 29.5' - Represents 25.0 To 30.0
	26	D-7	approx 7% silt/clay	R-2		
	27			D-2		
	28			S 49		couple cleanout runs Required af ter driving casing #6 @ 28 ft, before drilling to 30 ft
	29			R-2 D-2		
	30		(Prob. lost to clean outs before - pos. Heaving)	S 20		
	31		Same as above (SP/SM, almost SP) approx 7% silt/clay	R-1		Add casing @ 32.0 ft #7 - 4.9 = 34.4
	32	D-8		D-2 D-8 31.5 To 32.0		Represents 30.0 To 35.0
	33			S 47		
	34			R-2		
	35			D-2		← Re start drilling 8/9 after several cleanouts
	36			S 13		
	37			R-2		

DRILLING LOG (Cont Sheet)			ELEVATION TOP OF HOLE		Hole No. PZ-25 R	
PROJECT		INSTALLATION			SHEET	
Piezometer Installation		Big Bend Dam			OF 4 SHEETS	
ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
a	b	c	d	e	f	g
		sp/sm	Fine Sand w/silt (sp/sm) (almost sp) mod. dense non plastic saturated fine to v fine grained approx 7% silt & clay Brown	D-2		
	35			S 25	D-9 37.5 to 38.0	Add casing @ 36.0 ft #8 - 4.9 = 39.3
	36		(Same as above)	R-2 D-2		- Represents 35.0 to 42.0
	37			S 72		- heaving sand, high blow count prob. due to drive Barrel being over filled by heaving sands/sloughing in casing
	38	D-9 	(heaving sands)	R-2 D-2		
	39			S 37		Add casing @ 42.0 ft #9 - 4.9 = 44.2
	40		Same as above (sp/sm)	R-2 D-2		
	41			S 42		- Severe sand heaving below 38 ft
	42	sp/sm		R-2		
	43	SC	increased clay content clayey sand (SC) slightly plastic v. dense saturated fine sand approx 15% clay grayish Brown	D-2 S 70	D-10 43.5 to 44.0 Rep's 42.0 to 44.5	Should be related to sandy clay @ 45-46' in log of PZ-25
	44	D-10 		R-2 D-2		(Ground Surface approx 3 ft lower at this location!)
	45	sp/sm	Fine Sand w/silt sp/sm mod dense non plastic saturated (heaving) fine to v. fine grained approx 7% silt/clay Brown (Same as sp/sm above)	S 55	D-11 45.5 to 46.0	Finish drilling & sampling 8/9/89 - 13:15 - Represents 44.5 to 46'
		D-11 		R-2		TD = 46 ft

PROJECT <u>Big Bend Piezometer Installation</u>		WELL NUMBER <u>PZ-26</u>	
DATE INSTALLED <u>10/13/2010</u>	STARTED <u>10/13/2010</u>	COMPLETED <u>10/14/2010</u>	LOCATION (Coordinates or Station) <u>Omaha Akheer Proj</u> <u>LAT 44.055713 LONG -99.452699 NAD 27 datum</u>
SIGNATURE OF INSPECTOR/INSTALLER <u>[Signature]</u>		ELEVATION OF HOLE <u>1366 ft</u>	
TOTAL DEPTH OF BOREHOLE <u>41.4 ft</u>	BORING DIAMETER <u>8 in</u>	ELEVATION OF GROUND WATER IN WELL (DATE) <u>1358.1 ft 10/13/2010 1215 hrs</u>	

PIEZOMETER (PORE-FLUID) CONSTRUCTION DIAGRAM

NO SCALE

(ALL MEASUREMENTS FROM GROUND SURFACE)

PROTECTIVE CASING ☐ NO ☒ YES
 SIZE AND TYPE OF 4 inch square by
 PROTECTIVE CASING: 5 ft feet

TOP OF WELL

PROTECTIVE POSTS ☒ YES ☐ NO
 NO. OF POSTS 2 T-posts

STICK-UP= 3 ft.

GROUND SURFACE

CONCRETE PAD YES ☐ NO ☒

BACKFILL/ METHOD
☐ GRAVITY
☒ TREMIE
☐ OTHER (DESCRIBE)

BACKFILL/ GROUT
 MIX, ETC. (DESCRIBE)
5-7% bentonite by weight

LENGTH OF SOLID PIPE 37.8 ft.

TOP OF SEAL
 TYPE OF SEAL: bentonite

PELLET DIAMETER 3/8"

TOP OF FILTERPACK

TOP OF SCREEN

WELL SCREEN LENGTH 2 ft.

FILTERPACK

GRADATION:

BOTTOM OF WELL SCREEN

BOTTOM OF CAP OR SUMP

BOTTOM OF BORING

WELL CASING
 DIAMETER: 1" ☒ I.D. ☐ O.D.
 SCHEDULE: 40
 MATERIAL: ☒ PVC ☐ STAINLESS STEEL
☐ OTHER (DESCRIBE)

TYPE OF JOINTS
☒ FLUSH THREADED
☐ GLUE/SLIP JOINT
☐ OTHER

SCREEN INFORMATION
 SCREEN DIAMETER: 1" ☒ I.D. ☐ O.D.
 SLOT WIDTH:
 SCHEDULE:
 MATERIAL: ☐ PVC ☐ STAINLESS STEEL
☒ OTHER (DESCRIBE)
porous tip
 CONTINUOUS WRAPPED YES ☐ NO ☐

37.8 ft.
 29 ft.
 34 ft.
 35.8 ft.
 37.8 ft.
 37.8 ft.
 42 ft.

WATER LEVEL SUMMARY

(DATE/TIME/LEVEL)

OPEN BOREHOLE: 7.9 ft 10/13/2010 1215 hrs
 AFTER INSTALLATION:

NOTES:

TOTAL VOLUME OF WATER
 ADDED DURING CONSTRUCTION
 (IF ANY): NA

MISC. INFO:

VW piezometer tip @ 37.7' bgs
S/N 10-5253

REVISED 09-2009

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DRILLING LOG		DIVISION <i>NW0</i>	INSTALLATION <i>Big Bend Dam</i>	HOLE NUMBER <i>PZ-26</i>
1. PROJECT <i>Piezometer Installation</i>		10. SIZE AND TYPE OF BIT <i>4 1/4" HSA</i>		SHEET <i>1</i> OF <i>6</i>
2. LOCATION (Coordinates or Station) <i>N 44.05542° W 99.48328°</i>		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) <i>MSL</i>		
3. DRILLING AGENCY <i>CENVO-ED-GC</i>		12. MANUFACTURER'S DESIGNATION OF DRILL <i>Cas Rock 1300C</i>		
4. HOLE NO. (As shown on drawing title and file number) <i>PZ-26</i>	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN <i>-</i>		DISTURBED <i>-</i>	UNDISTURBED <i>-</i>
5. NAME OF DRILLER <i>Don Morrissey</i>		14. TOTAL NUMBER CORE BOXES <i>-</i>		
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER <i>1358</i>		
7. THICKNESS OF OVERBURDEN <i>NA</i>		16. DATE HOLE STARTED <i>10/13/2010</i>		
8. DEPTH DRILLED INTO ROCK <i>NA</i>		COMPLETED <i>10/14/2010</i>		
9. TOTAL DEPTH OF HOLE <i>41.4 ft</i>		17. ELEVATION TOP OF HOLE <i>1366</i>		
		18. TOTAL CORE RECOVERY FOR BORING <i>NA</i>		
		19. SIGNATURE OF INSPECTOR <i>Paul Dow</i>		

LOCATION SKETCH/COMMENTS	SCALE
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ENG FORM 1836	PROJECT <i>Piezometer Installation</i>	HOLE NO. <i>PZ-26</i>
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DRILLING LOG (CONT SHEET)			ELEVATION TOP OF HOLE		HOLE NUMBER	
PROJECT			INSTALLATION		SHEET	
			Bis Bend Dam		2 OF 6 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
	1		Clayey Sand (SC) Low plasticity, med grained, med brown, traces of fine gravel, moist			Started drilling @ 1025 hrs 3' auger stickage 1013/2010 Lugging from cuttings
	2					
	3					
	4					
	5		Silty Clay (CL) Med low plasticity, dark gray, moist			Soft drilling augers can be pushed down easily
	6					
	7					
	8					
	9					
	10					

DRILLING LOG (CONT SHEET)			ELEVATION TOP OF HOLE		HOLE NUMBER PZ-26		
PROJECT			INSTALLATION Big Bend Dam			SHEET 7 OF 6 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	
			Silty clay (CL) red plasticity, dark gray, moist				
	11						
	12						
	13	#3	Changes to wet			stopped for lunch cuttings coming up former to augers Drilling slitter	
	14						
	15						
	16						
	17	#4				Water mud mix coming up outside of augers	
	18						
	19						
	20						

DRILLING LOG (CONT SHEET)			ELEVATION TOP OF HOLE		HOLE NUMBER PZ-26	
PROJECT			INSTALLATION Big Bend Dam			SHEET 4 OF 6 SHEETS
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
			Silty clay (CL) Med plasticity, dark gray, wet,			
	21					
	22					
	23	#5				
	24					
	25					
	26					
	27					
	28	#6				
	29					
	30					

DRILLING LOG (CONT SHEET)				ELEVATION TOP OF HOLE		HOLE NUMBER PZ-26	
PROJECT			INSTALLATION Big Bend Dam			SHEET 5 OF 6 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	
31							
32		#7 SD #4	Well graded sand with silt (SW-SC) Non plastic, med graded, wet, med gray	32'		Logging from sampler Switched to cont. sampler S' water level reading 1215 @ 7.9' h ₂ O Run #1 ST 1223 ET 1224 Recovery 1.5' Think the drillers punched through the contact when they switched to sampler	
33							
34							
35							
36							
37			Same as above	37'		Sand here 5' Run #2 ST 1246 ET 1246 Recovery 1.8'	
38							
39							
40							

DRILLING LOG (CONT SHEET)			ELEVATION TOP OF HOLE		HOLE NUMBER	
PROJECT			INSTALLATION		SHEET	
			Big Bend Dam		36	
					OF 6 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
			Well Graded Sand w/ silt (SW-SC) no plasticity, med grained, wet, med gray			
	41		Bottom of hole ^{UD} 41.6' 41.4'			
	42			42' ^{UD}		Water level 6' bgs @ 1255 hrs
	43					Bottom of hole 41.4' bgs
	44					End of day 11/13/2010
	45					
	46					
	47					
	48					
	49					
	50					

VW Piezometer Calibration Certificate

Serial #: 10-5253
 Range : 50 psi
 Cable Length: 30 m
 Date of Calibration: 9/7/2010

Part #: 52611024
 Cable Part # : 50613524
 Calibrated by: KB
 Note:

ABC Calibration Factors

	A	B	C
kPa	-1.369458E-4	5.333046E-3	1.055221E+3
psi	-1.986231E-5	7.734929E-4	1.530469E+2

Pressure in kPa/psi = $(A \times \text{Hz}^2) + (B \times \text{Hz}) + C$, where Hz is frequency in Hertz.

TI Calibration Factors

	C0	C1	C2	C3	C4	C5
kPa	1.061967E+3	-1.332622E-3	1.369798E-1	-1.357220E-4	1.930639E-5	-1.983729E-3
psi	1.540198E+2	-1.932737E-4	1.986654E-2	-1.968412E-5	2.800056E-6	-2.877054E-4

Pressure in kPa/psi = $C0 + (C1 \times \text{Hz}) + (C2 \times T) + (C3 \times \text{Hz}^2) + (C4 \times \text{Hz} \times T) + (C5 \times T^2)$

Where Hz is the frequency reading in Hertz and T is the Thermistor reading in degrees C.

TI factors are calculated from temperatures at 5.0, 15.0 and 25.0 degrees C.

Applied pressure and temperature are NIST traceable.

Summary of Test Results at 15°C

Thermistor reading is 14.4 °C.

Applied Pressure is referenced to 1 atm. Calculated Pressure uses ABC Calibration factors.

Applied (psi)	Equivalent (kPa)	Frequency (Hz)	Calculated (psi)	Calculated (kPa)	Error (%FS)
0.00	0.0	2795.4	0.00	0.0	0.00
5.00	34.5	2749.7	5.00	34.5	0.00
10.00	68.9	2703.2	10.00	68.9	0.00
15.00	103.4	2655.9	15.00	103.4	0.01
20.00	137.9	2607.7	20.00	137.9	0.00
25.00	172.4	2558.6	25.00	172.4	0.00
30.00	206.8	2508.6	29.99	206.8	0.02
35.00	241.3	2457.4	35.00	241.3	-0.01
40.00	275.8	2405.1	40.01	275.9	-0.03
45.00	310.3	2351.8	45.01	310.3	-0.02
50.00	344.7	2297.4	49.99	344.7	0.02

DRILLING LOG		DIVISION CENWU		INSTALLATION Big Bend Dam		HOLE NUMBER PZ-27	
1. PROJECT Piezometer Installation		10. SIZE AND TYPE OF BIT 4 1/4" HSA		SHEET 1		SHEETS OF 5	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL					
3. DRILLING AGENCY CENWU-FD-66		12. MANUFACTURER'S DESIGNATION OF DRILL Gus Peck 1300C					
4. HOLE NO. (As shown on drawing title and file number) PZ-27		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN		DISTURBED NA		UNDISTURBED NA	
5. NAME OF DRILLER Don Morrissey		14. TOTAL NUMBER CORE BOXES -					
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 1356 ft					
7. THICKNESS OF OVERBURDEN NA		16. DATE HOLE 10/19/2010		STARTED 10/20/2010		COMPLETED	
8. DEPTH DRILLED INTO ROCK NA		17. ELEVATION TOP OF HOLE 1366 ft					
9. TOTAL DEPTH OF HOLE 38.2 ft		18. TOTAL CORE RECOVERY FOR BORING NA					
		19. SIGNATURE OF INSPECTOR [Signature]					
LOCATION SKETCH/COMMENTS						SCALE	
ENG FORM 1836		PROJECT				HOLE NO. PZ-27	

DRILLING LOG (CONT SHEET)

ELEVATION TOP OF HOLE

HOLE NUMBER

P2-27

PROJECT

INSTALLATION

Big Bend Dam

SHEET

2 OF 5 SHEETS

ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
	1		Well Graded Sand with silt SW-S.M Non plastic, med brown, med stained, traces of fine gravel			Lossing from cuttings 10/19/2010
	2					
	3					end of day Stop 10/20/2010
	4					
	5		Well Graded Sand w/clay (SW-SC) Non plastic, no plasticity, med stained med brown, wet			
	6					
	7					
	8					
	9					
	10					

10/20/10
0425



DRILLING LOG (CONT SHEET)

ELEVATION TOP OF HOLE

HOLE NUMBER
PZ-27

PROJECT

INSTALLATION

Big Bend Dam

SHEET 3

OF 5 SHEETS

ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
	11		Well Graded sand w/clay (SW-SC) no plasticity, med grained, med brown, wet			
	12		Clay content increasing			
	13					
	14					
	15					
	16					
	17					
	17.5			17.5		Logging from sampler
	18		Well graded sand (SW) no plasticity, loose, med brown, med grained, traces of fines			
	19					5' cut sampler Run #1 ST 0836 ET 0837 Recovery 4.5'
	20					

DRILLING LOG (CONT SHEET)				ELEVATION TOP OF HOLE		HOLE NUMBER PZ-27	
PROJECT			INSTALLATION Big Bend Dam			SHEET 4 OF 5 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	
			Well Graded Sand (SW) no plasticity, loose, med brown, med grained, traces of fines				
	21						
	22						
	23			22.5'		Sand heave approx 6'	
						Run #2 ST 0914 ET 0915 Recovery 0.0'	
	24						
				24.5'			
	25						
	26					Skipped due to sand heave boreal would have already been fill	
	27						
				27.5		Sand heave 1'	
	28					Run #3 ST 0927 ET 0927 Recovery 0.0'	
	29						
	30						

DRILLING LOG (CONT SHEET)			ELEVATION TOP OF HOLE		HOLE NUMBER	
PROJECT			INSTALLATION		SHEET 5 OF 5 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
71						
72						
73			Well Grained Sand w/ clay (SW-SC) no plasticity, loose, wet, med grained, med brown	72.5		Run # 4 SF 0958 ET 0959 Recovery 4.5'
74			Clay with silt (CL) med plasticity, stiff, moist, med gray and light olive green			
75						
76						
77						
78			Bottom of Hole 38.2'	77.5'		
79						End of day 10/20/2010
80						

PZ-27

VW Piezometer Calibration Certificate

Serial #: 10-5560
Range : 50 psi
Cable Length: 30 m
Date of Calibration: 9/29/2010

Part #: 52611024
Cable Part # : 50613524
Calibrated by: KB
Note:

ABC Calibration Factors

	A	B	C
kPa	-1.331785E-4	2.597979E-2	9.851498E+2
psi	-1.931591E-5	3.768050E-3	1.428839E+2

Pressure in kPa/psi = $(A \times \text{Hz}^2) + (B \times \text{Hz}) + C$, where Hz is frequency in Hertz.

TI Calibration Factors

	C0	C1	C2	C3	C4	C5
kPa	9.838324E+2	2.566194E-2	1.045885E-1	-1.331985E-4	2.932346E-5	-1.576969E-3
psi	1.426878E+2	3.721818E-3	1.516874E-2	-1.931813E-5	4.252859E-6	-2.287120E-4

Pressure in kPa/psi = $C0 + (C1 \times \text{Hz}) + (C2 \times T) + (C3 \times \text{Hz}^2) + (C4 \times \text{Hz} \times T) + (C5 \times T^2)$

Where Hz is the frequency reading in Hertz and T is the Thermistor reading in degrees C.

TI factors are calculated from temperatures at 5.0, 15.0 and 25.0 degrees C.

Applied pressure and temperature are NIST traceable.

Summary of Test Results at 15°C

Thermistor reading is 14.5 °C.

Applied Pressure is referenced to 1 atm. Calculated Pressure uses ABC Calibration factors.

Applied (psi)	Equivalent (kPa)	Frequency (Hz)	Calculated (psi)	Calculated (kPa)	Error (%FS)
0.00	0.0	2819.0	0.01	0.1	-0.01
5.00	34.5	2771.0	5.01	34.5	-0.02
10.00	68.9	2722.3	9.99	68.9	0.01
15.00	103.4	2672.5	14.99	103.4	0.01
20.00	137.9	2621.9	19.98	137.8	0.04
25.00	172.4	2569.8	25.01	172.4	-0.01
30.00	206.8	2516.8	30.01	206.9	-0.03
35.00	241.3	2462.8	35.01	241.4	-0.01
40.00	275.8	2407.5	40.00	275.8	0.00
45.00	310.3	2350.8	45.00	310.3	0.01
50.00	344.7	2292.6	50.00	344.7	0.00

PROJECT <u>Big Bend Piezometer Installation</u>			WELL NUMBER <u>PZ-28</u>	
DATE INSTALLED	STARTED	COMPLETED	LOCATION (Coordinates or Station) <u>Orin Albers Proj</u>	
	<u>10/22/2010</u>	<u>10/25/2010</u>	<u>LAT 44.055867 LONG -99.453494 NAD 27 Datum</u>	
SIGNATURE OF INSPECTOR/INSTALLER <u>[Signature]</u>			ELEVATION OF HOLE <u>1366 ft MSL</u>	
TOTAL DEPTH OF BOREHOLE <u>32.5 ft</u>		BORING DIAMETER <u>8 inch</u>	ELEVATION OF GROUND WATER IN WELL (DATE) <u>NA</u>	

PIEZOMETER (PORE-FLUID) CONSTRUCTION DIAGRAM

NO SCALE

(ALL MEASUREMENTS FROM GROUND SURFACE)

PROTECTIVE CASING ☐ NO ☒ YES
 SIZE AND TYPE OF 4 inch square by
 PROTECTIVE CASING: 5 feet

TOP OF WELL

PROTECTIVE POSTS ☒ YES ☐ NO
 NO. OF POSTS 3

STICK-UP= 3.3 ft.

GROUND SURFACE

CONCRETE PAD YES ☐ NO ☒

BACKFILL/ METHOD
☐ GRAVITY
☒ TREMIE
☐ OTHER (DESCRIBE)

BACKFILL/ GROUT
 MIX, ETC. (DESCRIBE)
3-5 1/2 bentonite by weight

25 ft.

LENGTH OF SOLID PIPE

TOP OF SEAL
 TYPE OF SEAL: Bentonite pellets

PELLET DIAMETER 3/8"

TOP OF FILTERPACK

11.4 ft.

WELL CASING
 DIAMETER: 1" ☒ I.D. ☐ O.D.
 SCHEDULE: 40
 MATERIAL: ☒ PVC ☐ STAINLESS STEEL
☐ OTHER (DESCRIBE)

18.5 ft.

TYPE OF JOINTS
☒ FLUSH THREADED
☐ GLUE/SLIP JOINT
☐ OTHER

21.8 ft.

SCREEN INFORMATION
 SCREEN DIAMETER: 1" ☒ I.D. ☐ O.D.
 SLOT WIDTH: _____
 SCHEDULE: _____
 MATERIAL: ☐ PVC ☐ STAINLESS STEEL
☒ OTHER (DESCRIBE)
perforated tip
 CONTINUOUS WRAPPED YES ☐ NO ☐

2 ft.

WELL SCREEN LENGTH

23.8 ft.

TOP OF SCREEN

23.8 ft.

FILTERPACK

32.5 ft.

GRADATION: _____

BOTTOM OF WELL SCREEN

BOTTOM OF CAP OR SUMP

BOTTOM OF BORING

NOTES:

TOTAL VOLUME OF WATER
 ADDED DURING CONSTRUCTION
 (IF ANY): >100 gal

MISC. INFO:

VW SIN 10-5251 tip located
@ 22.7 ft bgs

OPEN BOREHOLE: None taken
 AFTER INSTALLATION: _____

WATER LEVEL SUMMARY

(DATE/TIME/LEVEL)

DRILLING LOG		DIVISION	INSTALLATION	HOLE NUMBER
		NW0	Big Bend Dam	PZ-28
1. PROJECT		10. SIZE AND TYPE OF BIT		SHEET OF SHEETS
Piezometer Installation		4 1/4" HSA		1 OF 5
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)		
		MSL		
3. DRILLING AGENCY		12. MANUFACTURER'S DESIGNATION OF DRILL		
CENW0-ED-66		Gus Peck 1300C		
4. HOLE NO. (As shown on drawing title and file number)		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED	UNDISTURBED
PZ-28			-	-
5. NAME OF DRILLER		14. TOTAL NUMBER CORE BOXES		
Don Morrissey		NA		
6. DIRECTION OF HOLE		15. ELEVATION GROUND WATER		
<input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.		NA		
7. THICKNESS OF OVERBURDEN		16. DATE HOLE	STARTED	COMPLETED
		10/22/2016	10/22/2016	10/25/2016
8. DEPTH DRILLED INTO ROCK		17. ELEVATION TOP OF HOLE		
NA		1766 feet		
9. TOTAL DEPTH OF HOLE		18. TOTAL CORE RECOVERY FOR BORING		
32.5 feet		NA		
		19. SIGNATURE OF INSPECTOR		
		Zach Dow		
LOCATION SKETCH/COMMENTS				SCALE
<div style="font-size: 24pt; font-weight: bold; margin-bottom: 20px;">No water level reading due to adding water to counter heavily sands</div> <div style="font-size: 24pt; font-weight: bold;">VW Piezometer S/N 10-5251</div>				
ENG FORM 1836		PROJECT		HOLE NO. PZ-28

DRILLING LOG (CONT SHEET)				ELEVATION TOP OF HOLE		HOLE NUMBER PZ-28	
PROJECT			INSTALLATION			SHEET 2 OF 5 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	
	1					Start drilling 10/22/10 @ 1025 hrs	
	2		silty clay (CL) Med plasticity, med stiff, moist, dark brown, traces of fine grained sand				
	3						
	4						
	5						
	6		Gravelly Clay with Sand (CL) Med plasticity, med stiff, moist, dark brown, coarse grained gravel med grained sand.				
	7						
	8						
	9						
	10						

DRILLING LOG (CONT SHEET)				ELEVATION TOP OF HOLE		HOLE NUMBER PZ-28	
PROJECT			INSTALLATION			SHEET 3 OF 5 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	
	11		Silty Clay (CL) Med plasticity, wet, soft, dark gray fine grained sand/silt				
	12						
	13						
	14						
	15						
	16						
	17		Top 0.5' sluff Well Graded Sand w/clay (SW-SC) no plasticity, loose, wet, med grained, med brown	17'		Sand Leave 1' 5' cont. sampler Rm #1 SF 1204 ET 1205 Recovery 1.5'	
	18						
	19						
	20						

DRILLING LOG (CONT SHEET)				ELEVATION TOP OF HOLE		HOLE NUMBER PZ-28	
PROJECT			INSTALLATION			SHEET 4 OF 5 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	
	21		Well Graded Sand w/clay (SW-sc) no plasticity, loose, wet, med grained red brown				
	22		Top 0.5' sluff	22'		2.5' sand heave ST 1213 Run #2 ET 124 Recovery 0.0	
	23						
	24						
	25						
	26						
	27			27.5'		no heave Run #3 ST 1227 ET 1228 Recovery 4.8'	
	28		Clay (CL) red plasticity, stiff, moist, red brown patches of gray				
	29						
	30						

DRILLING LOG (CONT SHEET)				ELEVATION TOP OF HOLE		HOLE NUMBER PZ-28.	
PROJECT			INSTALLATION			SHEET 5 OF 5 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	
			See above				
	31		Sandy Clay (CL) med-low plasticity, variations in sand content, soft, wet, med greenish sand, med gray				
	32						
			Bottom of hole	32.5			
	33					End of day 10/22/2010	
	34						
	35						
	36						
	37						
	38						
	39						
	40						

VW Piezometer Calibration Certificate

Serial #: 10-5251
 Range : 50 psi
 Cable Length: 30 m
 Date of Calibration: 9/7/2010

Part #: 52611024
 Cable Part # : 50613524
 Calibrated by: KB
 Note:

ABC Calibration Factors

	A	B	C
kPa	-1.270981E-4	-7.160467E-2	1.226910E+3
psi	-1.843402E-5	-1.038538E-2	1.779482E+2

Pressure in kPa/psi = $(A \times \text{Hz}^2) + (B \times \text{Hz}) + C$, where Hz is frequency in Hertz.

TI Calibration Factors

	C0	C1	C2	C3	C4	C5
kPa	1.237222E+3	-8.073921E-2	1.128461E-1	-1.254625E-4	2.892948E-5	-1.801938E-3
psi	1.794375E+2	-1.170982E-2	1.636637E-2	-1.819615E-5	4.195718E-6	-2.613398E-4

Pressure in kPa/psi = $C0 + (C1 \times \text{Hz}) + (C2 \times T) + (C3 \times \text{Hz}^2) + (C4 \times \text{Hz} \times T) + (C5 \times T^2)$

Where Hz is the frequency reading in Hertz and T is the Thermistor reading in degrees C.

TI factors are calculated from temperatures at 5.0, 15.0 and 25.0 degrees C.

Applied pressure and temperature are NIST traceable.

Summary of Test Results at 15°C

Thermistor reading is 14.5 °C.

Applied Pressure is referenced to 1 atm. Calculated Pressure uses ABC Calibration factors.

Applied (psi)	Equivalent (kPa)	Frequency (Hz)	Calculated (psi)	Calculated (kPa)	Error (%FS)
0.00	0.0	2838.0	0.00	0.0	0.00
5.00	34.5	2794.2	5.00	34.5	-0.01
10.00	68.9	2749.8	10.00	68.9	-0.01
15.00	103.4	2704.7	15.01	103.5	-0.01
20.00	137.9	2659.0	20.00	137.9	0.00
25.00	172.4	2612.6	24.99	172.3	0.02
30.00	206.8	2565.3	30.00	206.8	0.01
35.00	241.3	2517.2	35.00	241.3	-0.01
40.00	275.8	2468.2	40.01	275.9	-0.03
45.00	310.3	2418.5	45.01	310.3	-0.02
50.00	344.7	2368.0	49.99	344.7	0.02

DRILLING LOG		DIVISION NW10		INSTALLATION Big Bend Dam		HOLE NUMBER PZ-29	
1. PROJECT Piezometer Installation		10. SIZE AND TYPE OF BIT 4 1/4" HSA				SHEET 1 OF 7	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) MSL					
3. DRILLING AGENCY CENW0-ED-CX		12. MANUFACTURER'S DESIGNATION OF DRILL Geo Rich 1300C					
4. HOLE NO. (As shown on drawing title and file number) PZ-29		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN NA		DISTURBED NA		UNDISTURBED NA	
5. NAME OF DRILLER Don Morrissey		14. TOTAL NUMBER CORE BOXES -					
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER NA					
7. THICKNESS OF OVERBURDEN NA		16. DATE HOLE 10/14/2010		STARTED 10/14/2010		COMPLETED 10/14/2010	
8. DEPTH DRILLED INTO ROCK NA		17. ELEVATION TOP OF HOLE 1366 ft					
9. TOTAL DEPTH OF HOLE 57.5 feet		18. TOTAL CORE RECOVERY FOR BORING NA					
		19. SIGNATURE OF INSPECTOR Fred Bow					
LOCATION SKETCH/COMMENTS						SCALE	
<p>PZ-29: (as stated)</p> <p>No water level readings taken due to water being added down hole.</p>							
ENG FORM 1836		PROJECT Piezometer Installation				HOLE NO. PZ-29	

DRILLING LOG (CONT SHEET)

ELEVATION TOP OF HOLE

HOLE NUMBER

PZ-29

PROJECT

INSTALLATION

Big Bend Dam

SHEET 2

OF 7 SHEETS

ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
	1		Silty Sand (SM) Med brown, med grained, dry			Logging from cuttings 10/14/2010
	2					
	3					
	4		Clayey Sand (SC) Color change to med gray med grained, wet			Wet
	5					
	6					
	7					
	8					
	9					
	10					

DRILLING LOG (CONT SHEET)				ELEVATION TOP OF HOLE		HOLE NUMBER PZ-29	
PROJECT			INSTALLATION Big Bend Dam			SHEET 3 OF 7 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	
	11		Clayey Sand (SC) Low plasticity, med gray, med grained, wet				
	12						
	13	#3					
	14						
	15						
	16						
	17						
	18	#4					
	19						
	20						

DRILLING LOG (CONT SHEET)				ELEVATION TOP OF HOLE		HOLE NUMBER PZ-29	
PROJECT			INSTALLATION Big Bend Dam			SHEET 9 OF 7 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	
			Clayey Sand (SC) Low plasticity, med gray, med grained, wet				
	21						
	22						
	23	#5					
	24						
	25						
	26						
	27						
	28	#6					
	29						
	30						

DRILLING LOG (CONT SHEET)				ELEVATION TOP OF HOLE		HOLE NUMBER PZ-29	
PROJECT			INSTALLATION Big Bend Dam			SHEET 5 OF 7 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	
	31		Clayey Sand (SC) Low plasticity, med gray, med grained, wet				
	32						
	33	#7					
	34						
	35						
	36						
	37						
	38	#8	Well graded sand (SW) Low plasticity, med brown, med to fine grained wet	37.5'		Logging from split spm 24" split spm Blow count 20 Recovery 24"	
	39		Clay (CL) Med plasticity, med stiff, moist, med gray, traces of med grained sand	39.5'			
	40						

DRILLING LOG (CONT SHEET)				ELEVATION TOP OF HOLE		HOLE NUMBER PZ-29	
PROJECT			INSTALLATION Big Bend Dam			SHEET 6 OF 7 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	
	41						
	42						
	42.5'	#9	Clayey Sand (SC) Low plasticity, med gray, fine grained, wet			24" split spoon blow count 2 Recovery 1.8'	
	43						
	44						
	44.5'						
	45						
	45.5'					@ 45.5 drilling became very easy (soft)	
	46						
	47						
	47.5'	#10	Silty Sand Low plasticity, loose, med gray, wet			24" split spoon pushed in recovery 1.5'	
	48						
	49						
	49.5'						
	50						

DRILLING LOG (CONT SHEET)				ELEVATION TOP OF HOLE		HOLE NUMBER PZ-29	
PROJECT			INSTALLATION Big Bend Dam			SHEET 7 OF 7 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	
	51						
	52						
	53	#11	Silty Clay med plasticity, med gray, med stiff, wet	57.5'			Split spm Blow count 11 recovery 2'
	54		Silty Sand N plasticity, med gray, loose, wet, fine grained	54.5'			
	55						
	56						
	57						
	58	#12	Bottom of hole (with auger)	57.5'			Split spm
	59		Well graded sand (SW) Non plastic, loose, med gray, med graded, wet				Blow count 8
	60		Changes to Silty Sand (SM) Non plastic, loose, med gray, fine grained wet	59.5'			End of log 10/14/2010

PROJECT <u>Big Bend Piezometer Installation</u>			WELL NUMBER <u>PZ-29</u>	
DATE INSTALLED <u>10/14/2010</u>	STARTED <u>10/14/2010</u>	COMPLETED <u>10/14/2010</u>	LOCATION (Coordinates or Station) <u>Onche Albers Pond</u> <u>LAT 44.560890 LONG -99.452914 NAD 27 datum</u>	
SIGNATURE OF INSPECTOR/INSTALLER <u>Paul Don</u>			ELEVATION OF HOLE <u>1366 ft</u>	
TOTAL DEPTH OF BOREHOLE <u>57.5 ft</u>		BORING DIAMETER <u>8 in</u>	ELEVATION OF GROUND WATER IN WELL (DATE) <u>NA</u>	

PIEZOMETER (PORE-FLUID) CONSTRUCTION DIAGRAM

NO SCALE

(ALL MEASUREMENTS FROM GROUND SURFACE)

PROTECTIVE CASING ☐ NO ☒ YES
 SIZE AND TYPE OF 4 inch square by
 PROTECTIVE CASING: 5 feet

TOP OF WELL

PROTECTIVE POSTS ☒ YES ☐ NO
 NO. OF POSTS 3

STICK-UP= 3 ft.

GROUND SURFACE

CONCRETE PAD YES ☐ NO ☒

BACKFILL/ METHOD
☐ GRAVITY
☒ TREMIE
☐ OTHER (DESCRIBE) _____

BACKFILL/ GROUT
 MIX, ETC. (DESCRIBE) 3-5% bentonite by weight

LENGTH OF SOLID PIPE 57.75 ft.

TOP OF SEAL
 TYPE OF SEAL: bentonite

PELLET DIAMETER 3/8

TOP OF FILTERPACK

TOP OF SCREEN

WELL SCREEN LENGTH 2 ft.

FILTERPACK

GRADATION: _____

BOTTOM OF WELL SCREEN

BOTTOM OF CAP OR SUMP

BOTTOM OF BORING

WELL CASING
 DIAMETER: 1" ☒ I.D. ☐ O.D.
 SCHEDULE: 40
 MATERIAL: ☒ PVC ☐ STAINLESS STEEL
☐ OTHER (DESCRIBE) _____

TYPE OF JOINTS
☒ FLUSH THREADED
☐ GLUE/SLIP JOINT
☐ OTHER

SCREEN INFORMATION
 SCREEN DIAMETER: 1" ☒ I.D. ☐ O.D.
 SLOT WIDTH: _____
 SCHEDULE: _____
 MATERIAL: ☐ PVC ☐ STAINLESS STEEL
☒ OTHER (DESCRIBE) perforated tip
 CONTINUOUS WRAPPED YES ☐ NO ☐

48 ft.

53 ft.

54.75 ft.

56.75 ft.

56.75 ft.

57.5 ft.

WATER LEVEL SUMMARY

(DATE/TIME/LEVEL)

OPEN BOREHOLE: None taken

AFTER INSTALLATION: _____

NOTES:

TOTAL VOLUME OF WATER
 ADDED DURING CONSTRUCTION
 (IF ANY): > 100 gal

MISC. INFO:

Wb piezometer tip @ 55.65 ft bgs

SN 10-5252

REVISED 09-2009

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VW Piezometer Calibration Certificate

Serial #: 10-5252
Range : 50 psi
Cable Length: 30 m
Date of Calibration: 9/7/2010

Part #: 52611024
Cable Part # : 50613524
Calibrated by: KB
Note:

ABC Calibration Factors

	A	B	C
kPa	-1.460729E-4	7.688206E-3	1.148114E+3
psi	-2.118609E-5	1.115080E-3	1.665199E+2

Pressure in kPa/psi = $(A \times \text{Hz}^2) + (B \times \text{Hz}) + C$, where Hz is frequency in Hertz.

TI Calibration Factors

	C0	C1	C2	C3	C4	C5
kPa	1.161128E+3	-3.641397E-3	1.363410E-1	-1.439535E-4	1.532628E-5	-2.287608E-3
psi	1.684014E+2	-5.281214E-4	1.977389E-2	-2.087796E-5	2.222811E-6	-3.317778E-4

Pressure in kPa/psi = $C0 + (C1 \times \text{Hz}) + (C2 \times T) + (C3 \times \text{Hz}^2) + (C4 \times \text{Hz} \times T) + (C5 \times T^2)$

Where Hz is the frequency reading in Hertz and T is the Thermistor reading in degrees C.

TI factors are calculated from temperatures at 5.0, 15.0 and 25.0 degrees C.

Applied pressure and temperature are NIST traceable.

Summary of Test Results at 15°C

Thermistor reading is 14.5 °C.

Applied Pressure is referenced to 1 atm. Calculated Pressure uses ABC Calibration factors.

Applied (psi)	Equivalent (kPa)	Frequency (Hz)	Calculated (psi)	Calculated (kPa)	Error (%FS)
0.00	0.0	2830.0	0.00	0.0	0.00
5.00	34.5	2787.5	5.01	34.5	-0.02
10.00	68.9	2744.5	10.00	68.9	0.00
15.00	103.4	2700.8	14.99	103.4	0.01
20.00	137.9	2656.4	19.98	137.8	0.03
25.00	172.4	2611.1	24.99	172.3	0.02
30.00	206.8	2564.8	30.01	206.9	-0.03
35.00	241.3	2517.9	35.01	241.4	-0.02
40.00	275.8	2470.1	40.01	275.9	-0.02
45.00	310.3	2421.4	45.00	310.3	0.00
50.00	344.7	2371.7	49.99	344.7	0.01

PROJECT <u>Big Bend Piezometer Installation</u>		WELL NUMBER <u>PZ-30</u>	
DATE INSTALLED <u>10/21/2010</u>	STARTED <u>10/21/2010</u>	COMPLETED <u>10/25/2010</u>	LOCATION (Coordinates or Station) <u>Omaha Albers Proj</u> <u>LAT 44.056642 LONG -99.453487 NAD 27 datum</u>
SIGNATURE OF INSPECTOR/INSTALLER <u>Paul Dow</u>		ELEVATION OF HOLE <u>1366 ft MSL</u>	
TOTAL DEPTH OF BOREHOLE <u>37.5 ft</u>	BORING DIAMETER <u>8 in</u>	ELEVATION OF GROUND WATER IN WELL (DATE) <u>1359 ft MSL</u>	

PIEZOMETER (PORE-FLUID) CONSTRUCTION DIAGRAM

NO SCALE
(ALL MEASUREMENTS FROM GROUND SURFACE)

PROTECTIVE CASING ☐ NO ☒ YES
 SIZE AND TYPE OF 4 inch square by
 PROTECTIVE CASING: 5 feet

TOP OF WELL

PROTECTIVE POSTS ☒ YES ☐ NO
 NO. OF POSTS 3

STICK-UP= 3 ft.

GROUND SURFACE

CONCRETE PAD YES ☐ NO ☒

BACKFILL/ METHOD
☐ GRAVITY
☒ TREMIE
☐ OTHER (DESCRIBE)

BACKFILL/ GROUT
 MIX, ETC. (DESCRIBE)
3-5% bentonite by weight

LENGTH OF SOLID PIPE 28.2 ft.

TOP OF SEAL
 TYPE OF SEAL: Bentonite pellets

PELLET DIAMETER 3/8"

TOP OF FILTERPACK

TOP OF SCREEN

WELL SCREEN LENGTH 2 ft.

FILTERPACK

GRADATION:

BOTTOM OF WELL SCREEN

BOTTOM OF CAP OR SUMP

BOTTOM OF BORING

WELL CASING
 DIAMETER: 1" ☒ I.D. ☐ O.D.
 SCHEDULE: 40
 MATERIAL: ☒ PVC ☐ STAINLESS STEEL
☐ OTHER (DESCRIBE)

TYPE OF JOINTS
☒ FLUSH THREADED
☐ GLUE/SLIP JOINT
☐ OTHER

SCREEN INFORMATION
 SCREEN DIAMETER: 1" ☒ I.D. ☐ O.D.
 SLOT WIDTH:
 SCHEDULE:
 MATERIAL: ☐ PVC ☐ STAINLESS STEEL
☒ OTHER (DESCRIBE)
perfor tip
 CONTINUOUS WRAPPED YES ☐ NO ☐

16.2 ft.

21.5 ft.

25.2 ft.

27.2 ft.

27.2 ft.

37.5 ft.

WATER LEVEL SUMMARY
 (DATE/TIME/LEVEL)
 OPEN BOREHOLE: 10/21 0934 7.0 ft bgs
 AFTER INSTALLATION:

NOTES:

TOTAL VOLUME OF WATER
 ADDED DURING CONSTRUCTION
 (IF ANY): > 100 gal

MISC. INFO:

VW S/N 10-5561 tip @
26.1 ft bgs

REVISED 09-2009

DRILLING LOG		DIVISION <i>NW0</i>		INSTALLATION <i>Big Bend Dam</i>		HOLE NUMBER <i>PZ-30</i>	
1. PROJECT <i>Piezometer Installation</i>		10. SIZE AND TYPE OF BIT <i>4 1/4" HSA</i>		SHEET <i>1</i> OF <i>5</i>			
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) <i>MSL</i>					
3. DRILLING AGENCY <i>USACE LEMNO-ED-66</i>		12. MANUFACTURER'S DESIGNATION OF DRILL <i>Gas Peck 1300C</i>					
4. HOLE NO. (As shown on drawing title and file number) <i>PZ-30</i>		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN		DISTURBED		UNDISTURBED	
5. NAME OF DRILLER <i>Dan Morrissey</i>		14. TOTAL NUMBER CORE BOXES					
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER <i>1359 ft</i>					
7. THICKNESS OF OVERBURDEN		16. DATE HOLE		STARTED		COMPLETED	
8. DEPTH DRILLED INTO ROCK <i>NA</i>		10/21/2010		10/22/2010			
9. TOTAL DEPTH OF HOLE <i>37.5'</i>		17. ELEVATION TOP OF HOLE <i>1366 ft</i>					
		18. TOTAL CORE RECOVERY FOR BORING					
		19. SIGNATURE OF INSPECTOR <i>John Dow</i>					
LOCATION SKETCH/COMMENTS						SCALE	
<div style="text-align: center;"> <i>VH Piezometer</i> <i>55-6 S/N 10-5561</i> </div>							
ENG FORM 1836		PROJECT			HOLE NO. <i>PZ-30</i>		

DRILLING LOG (CONT SHEET)				ELEVATION TOP OF HOLE		HOLE NUMBER PZ-30	
PROJECT			INSTALLATION			SHEET 2 OF 5 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	
	1		Organic soil with sand (OL) Med plasticity, moist, dark brown, med-coarse grained sand			Start drilling 0425 hrs 10/21/2010	
	2						
	3						
	4		Organic soil (OL) Med plasticity, moist, black				
	5		Color changes to black < 5% sand				
	6						
	7						
	8						
	9						
	10						

DRILLING LOG (CONT SHEET)				ELEVATION TOP OF HOLE		HOLE NUMBER PZ-30	
PROJECT			INSTALLATION			SHEET 3 OF 5 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	
	11		Organic soil (UC/OH) med plasticity, moist, black				
	12		Clayey Sand (SC) no plasticity, wet, med grained, med grained				
	13						
	14						
	15						
	16						
	17		Well Graded Sand (SW) no plasticity, wet, med grained, med brown	16.5'		sand heave 4-5 ft	
	18					5' cont. sampler ST 1003 ET 1004 Recovery 3.5'	
	19						
	20						

DRILLING LOG (CONT SHEET)				ELEVATION TOP OF HOLE		HOLE NUMBER PZ-30	
PROJECT			INSTALLATION			SHEET 4 OF 5 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	
	21		Well Graded Sand ^W (SW) no plasticity, med. med grained, med brown				
	22			21.5'		Run #2 SI 1026 ET 1027 Recovery 0.0'	
	23					3' sand heave	
	24						
	25						
	26			26.5'			
	27					Run #3 SI 1038 ET 1039 Recovery 0.0'	
	28					6 ft run	
	29						
	30						

DRILLING LOG (CONT SHEET)				ELEVATION TOP OF HOLE		HOLE NUMBER PZ-30	
PROJECT			INSTALLATION			SHEET 5 OF 5 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BDX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	
	31						
	32						
	33		Well Graded Sand with clay (SW-SC) no plasticity, loose, wet, med gray, med grained	32.5'		Run #4 ST 1044 ET 1050 Recovery 5.0	
	34		Sandy Clay (CL) Med plasticity, med stiff, moist to wet, med gray, fine grained sand/silt, Variations in sand content				
	35						
	36						
	37						
	38		Bottom of hole 37.5'				
	39					End of day 10/21/2010	
	40						

PZ -30

VW Piezometer Calibration Certificate

Serial #: 10-5561
Range : 50 psi
Cable Length: 30 m
Date of Calibration: 9/29/2010

Part #: 52611024
Cable Part # : 50613524
Calibrated by: KB
Note:

ABC Calibration Factors

	A	B	C
kPa	-1.459065E-4	4.672633E-2	1.060272E+3
psi	-2.116195E-5	6.777081E-3	1.537795E+2

Pressure in kPa/psi = $(A \times \text{Hz}^2) + (B \times \text{Hz}) + C$, where Hz is frequency in Hertz.

TI Calibration Factors

	C0	C1	C2	C3	C4	C5
kPa	1.061485E+3	4.396256E-2	2.012939E-1	-1.452583E-4	-2.821426E-5	-1.336743E-3
psi	1.539500E+2	6.376006E-3	2.919419E-2	-2.106719E-5	-4.091989E-6	-1.938713E-4

Pressure in kPa/psi = $C0 + (C1 \times \text{Hz}) + (C2 \times T) + (C3 \times \text{Hz}^2) + (C4 \times \text{Hz} \times T) + (C5 \times T^2)$

Where Hz is the frequency reading in Hertz and T is the Thermistor reading in degrees C.

TI factors are calculated from temperatures at 5.0, 15.0 and 25.0 degrees C.

Applied pressure and temperature are NIST traceable.

Summary of Test Results at 15°C

Thermistor reading is 14.5 °C.

Applied Pressure is referenced to 1 atm. Calculated Pressure uses ABC Calibration factors.

Applied (psi)	Equivalent (kPa)	Frequency (Hz)	Calculated (psi)	Calculated (kPa)	Error (%FS)
0.00	0.0	2860.7	-0.01	-0.1	0.03
5.00	34.5	2816.4	5.01	34.5	-0.02
10.00	68.9	2771.5	10.01	69.0	-0.03
15.00	103.4	2725.9	15.01	103.5	-0.02
20.00	137.9	2679.5	20.00	137.9	0.00
25.00	172.4	2632.2	25.00	172.4	0.00
30.00	206.8	2583.9	30.00	206.8	0.00
35.00	241.3	2534.8	34.99	241.2	0.02
40.00	275.8	2484.6	39.98	275.7	0.04
45.00	310.3	2433.1	44.99	310.2	0.02
50.00	344.7	2380.2	50.02	344.9	-0.04

RELIEF WELLS

DRILLING LOG		DIVISION	INSTALLATION	HOLE NUMBER
1. PROJECT <i>Big Bend Relief Well Installation</i>		10. SIZE AND TYPE OF BIT <i>10 1/4" HSA</i>		SHEET <i>1</i> OF <i>60</i>
2. LOCATION (Coordinates or Station) <i>44° 03' 21.592" N 49° 27' 13.899" W WGS 1984</i>		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) <i>MSL</i>		
3. DRILLING AGENCY <i>CENWU-ED-GG</i>		12. MANUFACTURER'S DESIGNATION OF DRILL <i>Coe Tech 1300C</i>		
4. HOLE NO. (As shown on drawing title and file number)	<i>RW66A</i>	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED <i>—</i>	UNDISTURBED <i>—</i>
5. NAME OF DRILLER <i>Dan Murrisey</i>		14. TOTAL NUMBER CORE BOXES <i>NA</i>		
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER <i>1374 feet</i> <i>11/04/2010</i>		
7. THICKNESS OF OVERBURDEN		16. DATE HOLE	STARTED <i>11/03/2010</i>	COMPLETED <i>11/04/2010</i>
8. DEPTH DRILLED INTO ROCK <i>NA</i>		17. ELEVATION TOP OF HOLE <i>1367</i>		
9. TOTAL DEPTH OF HOLE <i>82.3 feet</i>		18. TOTAL CORE RECOVERY FOR BORING <i>NA</i>		
		19. SIGNATURE OF INSPECTOR <i>Paul Dow</i>		
LOCATION SKETCH/COMMENTS			SCALE	
<div style="border: 1px dashed black; width: 100%; height: 100%;"></div>				
ENG FORM 1836		PROJECT		HOLE NO. <i>RW66A</i>

DRILLING LOG (CONT SHEET)				ELEVATION TOP OF HOLE		HOLE NUMBER RW66A	
PROJECT			INSTALLATION			SHEET 2 OF 12 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	
	1		Clay w/sand (CL) red plasticity, moist, fine grained sand/silt, traces of red grained sand, dark brown			Started drilling @ 0840 hrs lossing from cuttings	
	2						
	3						
	4						
	5		Sandy Clay (CL) Sand/silt content increase Color change to red gray red plasticity, moist, fine grained sand/silt				
	6						
	7						
	8		moisture content increasing				
	9						
	10						

DRILLING LOG (CONT SHEET)				ELEVATION TOP OF HOLE		HOLE NUMBER RW66A		
PROJECT			INSTALLATION				SHEET 3 OF 10 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)		
			Clayey Sand (SC) no plasticity, wet, med gray, med grained, flows at surface					
	11							
	12							
	13							
	14							
	15							
	16							
	17							
	18							
	19							
	20							

ENG FORM 1836	PROJECT	HOLE NO. RW66A
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DRILLING LOG (CONT SHEET)				ELEVATION TOP OF HOLE		HOLE NUMBER RW66A	
PROJECT			INSTALLATION			SHEET 4 OF 10 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	
	21		Clayey Sand (Sc) no plasticity, wet, red gray, red grained.				
	22						
	23						
	24						
	25						
	26						
	27		Drilling hard probably clay			Cuttings no longer reliable for logging due to mixing in hole, clay cuttings didn't surface	
	28					cuttings appearance remained similar to above to bottom depth	
	29						
	30						

DRILLING LOG (CONT SHEET)				ELEVATION TOP OF HOLE		HOLE NUMBER RW66A	
PROJECT			INSTALLATION			SHEET 5 OF 10 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	
	31		Clayey Sand (SC) no plasticity, wet, med gray, med grained				
	32						
	33						
	34		Drilling easier				
	35						
	36						
	37						
	38						
	39						
	40		Drilling hard				

DRILLING LOG (CONT SHEET)				ELEVATION TOP OF HOLE		HOLE NUMBER RW66A	
PROJECT			INSTALLATION			SHEET 6 OF 10 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	
	41 42 43 44 45 46 47 48 49 50		Clayey Sand (Sc) no plasticity, wet, med gray, med grained				
ENG FORM 1836				PROJECT		HOLE NO. RW66A	

DRILLING LOG (CONT SHEET)				ELEVATION TOP OF HOLE		HOLE NUMBER	
PROJECT			INSTALLATION			SHEET 7 OF 10 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	
	51		Clayey Sand (sc) no plasticity, wet, red gray, med grained				
	52						
	53						
	54						
	55						
	56						
	57						
	58						
	59						
	60						

ENG FORM 1836	PROJECT	HOLE NO. RLW66A
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DRILLING LOG (CONT SHEET)				ELEVATION TOP OF HOLE		HOLE NUMBER RW66A	
PROJECT			INSTALLATION			SHEET 8 OF 10 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	
	61		Clayey Sand (Sc) no plasticity, wet, med gray. med grained				
	62						
	63						
	64						
	65						
	66						
	67						
	68						
	69						
	70						

ENG FORM 1836

PROJECT

HOLE NO. RW66A

DRILLING LOG (CONT SHEET)			ELEVATION TOP OF HOLE		HOLE NUMBER	
PROJECT			INSTALLATION		SHEET 9 OF 10 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
			Clayey Sand (SC) no plasticity, wet, med gray, med grained			
	71					
	72					
	73					
	74					
	75					
	76					
	77					
	78					
	79					
	80					

ENG FORM 1836	PROJECT	HOLE NO. RW66A
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DRILLING LOG (CONT SHEET)			ELEVATION TOP OF HOLE		HOLE NUMBER RW66A	
PROJECT		INSTALLATION			SHEET 10 OF 10 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
	81		Clayey sand (Sc) no plasticity, wet, red gray, red grained Drilling hard			
	82		82.5' bottom of boring			
	83					
	84					
	85					
	86					
	87					
	88					
	89					
	90					

PROJECT <u>Big Bend Retest Well Installation</u>			WELL NUMBER <u>RW66A</u>		
DATE INSTALLED <u>11/03/2010</u>	STARTED <u>11/03/2010</u>	COMPLETED <u>11/04/2010</u>	LOCATION (Coordinates or Station)		
SIGNATURE OF INSPECTOR/INSTALLER <u>[Signature]</u>			ELEVATION OF HOLE <u>1367 feet</u>		
TOTAL DEPTH OF BOREHOLE <u>82.3 feet</u>		BORING DIAMETER <u>14 inches</u>	ELEVATION OF GROUND WATER IN WELL (DATE) <u>11/04/2010 1374 feet</u>		

PIEZOMETER (PORE-FLUID) CONSTRUCTION DIAGRAM

NO SCALE
(ALL MEASUREMENTS FROM GROUND SURFACE)

PROTECTIVE CASING ☒ NO ☐ YES

SIZE AND TYPE OF PROTECTIVE CASING: _____

TOP OF WELL _____

PROTECTIVE POSTS ☐ YES ☒ NO

NO. OF POSTS _____

BACKFILL/ METHOD

☐ GRAVITY

☒ TREMIE

☐ OTHER (DESCRIBE) _____

BACKFILL/ GROUT

MIX, ETC. (DESCRIBE) CETCO 20% solids

TOP OF SEAL _____

TYPE OF SEAL: Bentonite pellets

PELLET DIAMETER 1/2"

TOP OF FILTERPACK _____

TOP OF SCREEN _____

WELL SCREEN LENGTH 50 ft.

FILTERPACK _____

GRADATION: _____

BOTTOM OF WELL SCREEN _____

BOTTOM OF CAP OR SUMP _____

BOTTOM OF BORING _____

GROUND SURFACE

STICK-UP= 7.6 ft.

CONCRETE PAD YES ☐ NO ☒

22.3 ft.

28.2 ft.

31.4 ft.

81.1 ft.

81.4 ft.

82.3 ft.

WELL CASING

DIAMETER: 5" ☒ I.D. ☐ O.D.

SCHEDULE: 40

MATERIAL: ☒ PVC ☐ STAINLESS STEEL

☐ OTHER (DESCRIBE) _____

TYPE OF JOINTS

☒ FLUSH THREADED

☐ GLUE/SLIP JOINT

☐ OTHER

SCREEN INFORMATION

SCREEN DIAMETER: 5" ☒ I.D. ☐ O.D.

SLOT WIDTH: _____

SCHEDULE: _____

MATERIAL: ☐ PVC ☒ STAINLESS STEEL

☐ OTHER (DESCRIBE) _____

CONTINUOUS WRAPPED YES ☐ NO ☒

WATER LEVEL SUMMARY

(DATE/TIME/LEVEL)

OPEN BOREHOLE: _____

AFTER INSTALLATION: 11/04/2010 0825 hrs 6.5 ft above ground surface

NOTES:

TOTAL VOLUME OF WATER
ADDED DURING CONSTRUCTION
(IF ANY): Approx 350 gal

MISC. INFO:

CETCO Grout was too thick to pump above 20% solids

REVISED 09-2009

RELIEF WELL CAPACITY/DRAWDOWN TEST DATA FORM

Project: Big Bend Relief Well Installation	Date: 11/23/2010
Location: Fort Thompson, SD	Well ID: RW 66A
Monitoring Instrument: WL Indicator	Initial Depth of Well:
Static Water Level ² : 4.9 ft	Weather: Overcast, high of 24°F
	Measured By: Jacob Daly

Time	Depth To Water ¹	Elevation	Water Level Change ¹	Pumping Rate (gpm)	Comments
0				60 0	Unable to get initial readings due to fast drawdown
15 sec					
30 sec					
45 sec					
1 min					
2 min	12.20			60	
3 min	12.70			60	
4 min	13.88			61	
5 min	14.12			61.6	
10 min	14.45			60	
15 min	14.65			60	
20 min	14.82			60	
25 min	14.91			61	
30 min	14.97			61	
35 min	15.01			61	
40 min	15.06			61	
45 min	15.11			61	
50 min	15.16			61	
55 min	15.20			61	
1 hr 0 min	15.21			62	

¹ All measurements in 0.01 feet.

² Static water level recorded prior to capacity/drawdown test.

Additional Comments:

Turbidity 2020 Turbidimeter LaMotte 1.23 NTU tube code 0286
0.92 NTU

Static water level measured from the top of the 36" surface casing to water level as it was flowing out the outfall pipe

RELIEF-WELL CAPACITY/DRAWDOWN TEST DATA FORM (Cont. Page)

Project: <i>Big Bend Relief Well Installation</i>	Date: <i>11/23/2010</i>
Location: <i>Fort Thompson SD</i>	Well ID: <i>RW 66A</i>

Time	Depth To Water ¹	Elevation	Water Level Change ¹	Pumping Rate (gpm)	Comments
1 hr 5 min					
1 hr 10 min					
1 hr 15 min					
1 hr 20 min					
1 hr 25 min					
1 hr 30 min					
1 hr 35 min					
1 hr 40 min					
1 hr 45 min					
1 hr 50 min					
1 hr 55 min					
2 hr 0 min					
Recovery					
0 min	<i>15.21</i>				
5 min					<i>Recovery less than 10 sec</i>
10 min					
15 min					
20 min					
25 min					
30 min					
35 min					
40 min					
45 min					
50 min					
55 min					
1 hr 0 min					

15
30

Additional Comments:

SITE INFORMATION SHEET

(To be completed by the Field Geologist)

PROJECT NAME:	Big Bend Relief Well Installation RW664
LOCATION:	Big Bend Dam Fort Thompson, South Dakota
Date(s) of Field Work:	11/03/2010 - 11/04/2010

Boring Layout:

Who staked locations?	USACE Personnel
How were they located?	—
Were locations moved? (explain which ones, where, and why)	No

Sample Shipment:

Total Numbers and Types of Samples:	NA
Sample Preparation for Shipment:	NA
Method and Date of Shipment	NA
Final Destination:	NA

Site Description:

Current Uses, Buildings, Pavement, Utilities:	Dam toe, overhead power lines nearby as well as relief well drainage channel
Vegetation, Topography, Drainage:	Grass, mowed, sloping slightly to relief well drainage channel
Presence of Fill, Rubble, Debris, or Evidence of Contamination:	Fill
Disposition of Borehole, i.e., how backfilled, cuttings disposal, site restoration?	Backfilled with CETCO high solids bentonite 20% solids Heavy grout mix injected 20' bgs 2 1/4 batches (40 gal). Batch mix 3 bags portland cement 3 bags bentonite 1/2 gal high yield bentonite dose on 11/16/2010
Deviations from Drill Instructions:	Grout not 30% solids

DRILLING LOG		DIVISION <i>NWU</i>	INSTALLATION <i>Big Bend Dam</i>	HOLE NUMBER <i>RU66B</i>
1. PROJECT <i>Big Bend Relief Well Installation</i>		10. SIZE AND TYPE OF BIT <i>10 1/4" HSA</i>		SHEET <i>1</i> OF <i>10</i>
2. LOCATION (Coordinates or Station) <i>44° 03' 22.219" N 94° 27' 14.371" W UGS 1484</i>		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) <i>MSL</i>		
3. DRILLING AGENCY <i>CENWU-ED-GG</i>		12. MANUFACTURER'S DESIGNATION OF DRILL <i>Gus Peck 1300C</i>		
4. HOLE NO. (As shown on drawing title and file number) <i>RU66B</i>		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED —	UNDISTURBED —
5. NAME OF DRILLER <i>Dan Morrissey</i>		14. TOTAL NUMBER CORE BOXES <i>NA</i>		
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER <i>1373 feet 11/02/2010</i>		
7. THICKNESS OF OVERBURDEN		16. DATE HOLE STARTED <i>11/01/2010</i> COMPLETED <i>11/02/2010</i>		
8. DEPTH DRILLED INTO ROCK <i>NA</i>		17. ELEVATION TOP OF HOLE <i>1367 feet</i>		
9. TOTAL DEPTH OF HOLE <i>83.0ft</i>		18. TOTAL CORE RECOVERY FOR BORING <i>NA</i>		
		19. SIGNATURE OF INSPECTOR <i>Paul Dow</i>		
LOCATION SKETCH/COMMENTS			SCALE	
ENG FORM 1836		PROJECT		HOLE NO. <i>RU66B</i>

DRILLING LOG (CONT SHEET)				ELEVATION TOP OF HOLE		HOLE NUMBER RW66B	
PROJECT			INSTALLATION			SHEET 2 OF 10 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	
	1		Sandy Clay (CL) Med plasticity, moist, dark brown, fine grained sand/silt			Start drilling 11/01/2010 @ 0930 hrs Logging from cuttings	
	2						
	3						
	4						
	5						
	6						
	7		Color change to red gray Sand content increasing				
	8						
	9						
	10		UD Clayey Sand (SC) no plasticity, wet, red gray, red silt				

DRILLING LOG (CONT SHEET)				ELEVATION TOP OF HOLE		HOLE NUMBER RW66B		
PROJECT			INSTALLATION				SHEET 3 OF 10 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)		
	11		Sandy Clay (CL) red plasticity, moist, dark brown, fine grained sand/silt					
	12							
	13							
	14							
	15		Clayey Sand (SC) no plasticity, wet, med gray, med grained, flows					
	16							
	17							
	18							
	19							
	20							

DRILLING LOG (CONT SHEET)				ELEVATION TOP OF HOLE		HOLE NUMBER RW66B		
PROJECT			INSTALLATION			SHEET 4 OF 10 SHEETS		
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)		
	21		Clayey Sand (SC) no plasticity, wet, med strong, med stained, flows					
	22							
	23							
	24							
	25							
	26							
	27							
	28							
	29							
	30							

DRILLING LOG (CONT SHEET)			ELEVATION TOP OF HOLE		HOLE NUMBER RW66B	
PROJECT			INSTALLATION		SHEET 5 OF 10 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
	71		Clayey Sand (SL) no plasticity, wet red gray med grained			Cuttings no longer reliable for logging due to mixing in hole, no clay cutting surfaced
	72		clay layer (drilling harder) not from cuttings			Cuttings remained the same appearance to bottom depth
	73					
	74					
	75					
	76					
	77		Same as above			Could not tell where bottom of clay was
	78					
	79					
	46					

DRILLING LOG (CONT SHEET)				ELEVATION TOP OF HOLE		HOLE NUMBER RW66B		
PROJECT			INSTALLATION				SHEET OF 10 7 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)		
	51 52 53 54 55 56 57 58 59 60		Clayey Sand (Sc) no plasticity, wet, red gray, red grained					
ENG FORM 1836				PROJECT		HOLE NO. RW66B		

DRILLING LOG (CONT SHEET)			ELEVATION TOP OF HOLE		HOLE NUMBER	
PROJECT			INSTALLATION		SHEET 8 OF 10 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
	61		Clayey Sand (SC) no plasticity, wet, med gray, med grained			
	62		softer drilling			
	63					
	64					
	65					
	66					
	67					
	68					
	69					
	70					

ENG FORM 1836	PROJECT	HOLE NO. RW66B
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DRILLING LOG (CONT SHEET)				ELEVATION TOP OF HOLE		HOLE NUMBER	
PROJECT			INSTALLATION			SHEET 9 OF 10 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	
	71		Clayey Sand (SC) no plasticity, wet, med gray, med grained				
	72						
	73						
	74						
	75						
	76						
	77						
	78						
	79						
	80						

ENG FORM 1836	PROJECT	HOLE NO. RW66B
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DRILLING LOG (CONT SHEET)			ELEVATION TOP OF HOLE		HOLE NUMBER	
PROJECT			INSTALLATION		SHEET 10 OF 10 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
	81		Clayey Sand (SC) no plasticity, wet, red gray, med grained			
	82		Drilling hard $\approx 82'$			
	83		Bottom of hole 83.0'			
	84					
	85					
	86					
	87					
	88					
	89					
	90					

PROJECT <u>Big Bend Relief Well Installation</u>		WELL NUMBER <u>RW66B</u>	
DATE INSTALLED <u>11/01/2010</u>	STARTED <u>11/01/2010</u>	COMPLETED <u>11/02/2010</u>	LOCATION (Coordinates or Station)
SIGNATURE OF INSPECTOR/INSTALLER <u>[Signature]</u>		ELEVATION OF HOLE <u>1367 feet MSL</u>	
TOTAL DEPTH OF BOREHOLE <u>83 feet</u>	BORING DIAMETER <u>14 inches</u>	ELEVATION OF GROUND WATER IN WELL (DATE) <u>1373 feet 11/02/2010</u>	

PIEZOMETER (PORE-FLUID) CONSTRUCTION DIAGRAM

NO SCALE
(ALL MEASUREMENTS FROM GROUND SURFACE)

<p>PROTECTIVE CASING <input checked="" type="checkbox"/> NO <input type="checkbox"/> YES</p> <p>SIZE AND TYPE OF PROTECTIVE CASING: _____</p> <p>TOP OF WELL _____</p> <p>PROTECTIVE POSTS <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO NO. OF POSTS _____</p> <p>BACKFILL/ METHOD <input type="checkbox"/> GRAVITY <input checked="" type="checkbox"/> TREMIE <input type="checkbox"/> OTHER (DESCRIBE) _____</p> <p>BACKFILL/ GROUT MIX, ETC. (DESCRIBE) <u>CETCO high solids grout 20% solids</u></p> <p>TOP OF SEAL TYPE OF SEAL: <u>Bentonite extra balls</u></p> <p>PELLET DIAMETER <u>1/2"</u></p> <p>TOP OF FILTERPACK _____</p> <p>TOP OF SCREEN _____</p> <p>WELL SCREEN LENGTH <u>50</u> ft.</p> <p>FILTERPACK _____</p> <p>GRADATION: _____</p> <p>BOTTOM OF WELL SCREEN _____</p> <p>BOTTOM OF CAP OR SUMP _____</p> <p>BOTTOM OF BORING _____</p>	<p>GROUND SURFACE</p> <p>STICK-UP= <u>6.6</u> ft.</p> <p>CONCRETE PAD YES <input type="checkbox"/> NO <input checked="" type="checkbox"/></p> <p>WELL CASING DIAMETER: <u>5"</u> <input checked="" type="checkbox"/> I.D. <input type="checkbox"/> O.D. SCHEDULE: <u>40</u> MATERIAL: <input checked="" type="checkbox"/> PVC <input type="checkbox"/> STAINLESS STEEL <input type="checkbox"/> OTHER (DESCRIBE) _____</p> <p>TYPE OF JOINTS <input checked="" type="checkbox"/> FLUSH THREADED <input type="checkbox"/> GLUE/SLIP JOINT <input type="checkbox"/> OTHER _____</p> <p>SCREEN INFORMATION SCREEN DIAMETER: <u>5"</u> <input checked="" type="checkbox"/> I.D. <input type="checkbox"/> O.D. SLOT WIDTH: _____ SCHEDULE: _____ MATERIAL: <input type="checkbox"/> PVC <input checked="" type="checkbox"/> STAINLESS STEEL <input type="checkbox"/> OTHER (DESCRIBE) _____ CONTINUOUS WRAPPED YES <input type="checkbox"/> NO <input type="checkbox"/></p> <p>WATER LEVEL SUMMARY (DATE/TIME/LEVEL)</p>
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NOTES:

TOTAL VOLUME OF WATER
ADDED DURING CONSTRUCTION
(IF ANY): Approx 350 gal

MISC. INFO:

CETCO high solids grout is too thick to pump @ greater than 20% solids

OPEN BOREHOLE:

AFTER INSTALLATION: 11/02/2010/1432/5.85'
above ground surface

REVISED 09-2009

RELIEF WELL CAPACITY/DRAWDOWN TEST DATA FORM

Project: Big Bend Relief Well Installation	Date: 11/23/2010
	Well ID: RW 66 B
Location: Fort Thompson SD	Initial Depth of Well:
Monitoring Instrument: WL Indicator	Weather: Overcast, high at 24°F
Static Water Level²: 4.8 ft below TX	Measured By: Joe Morrissey

Time	Depth To Water ¹	Elevation	Water Level Change ¹	Pumping Rate (gpm)	Comments
0					Drawdown too fast to get beginning readings
15 sec					
30 sec					
45 sec					
1 min	23.70			≈ 24	
2 min					
3 min					
4 min					
5 min					
10 min					
15 min	22.45			≈ 24	
20 min					
25 min					
30 min					
35 min					
40 min	22.65				
45 min					
50 min					
55 min					
1 hr 0 min					

¹ All measurements in 0.01 feet.

² Static water level recorded prior to capacity/drawdown test.

Additional Comments:

Flow meter not working due to lower end at limits. Pumping rate done with 5 gal bucket and stop watch.

Turbidity Meter 22-2020 Turbidimeter LaMotte Code 17994 Reading { 9.0 NTU
2020 Tube code 0286 9.65 NTU

Static water level measured from top of 36" surface casing to water level as it was flowing out outfall pipe

Generator killed during capacity test, recovery data then collected

RELIEF-WELL CAPACITY/DRAWDOWN TEST DATA FORM (Cont. Page)

Project: Big Bend Relief Well Installation	Date: 11/23/2016
Location: Fort Thompson, SD	Well ID: RW 6613

Time	Depth To Water ¹	Elevation	Water Level Change ¹	Pumping Rate (gpm)	Comments
1 hr 5 min					
1 hr 10 min					
1 hr 15 min					
1 hr 20 min					
1 hr 25 min					
1 hr 30 min					
1 hr 35 min					
1 hr 40 min					
1 hr 45 min					
1 hr 50 min					
1 hr 55 min					
2 hr 0 min					
Recovery					
0 min	22.65'				Generator Quit
5 min	9'				
10 min	4.8'				Flowing out TOL
15 min					
20 min					
25 min					
30 min					
35 min					
40 min					
45 min					
50 min					
55 min					
1 hr 0 min					

112.5
15 sec
45 sec

Additional Comments:

SITE INFORMATION SHEET

(To be completed by the Field Geologist)

PROJECT NAME:	Big Bend Relief Well Installation RLJ66B
LOCATION:	Big Bend Dam Fort Thompson, South Dakota
Date(s) of Field Work:	11/01/2010 - 11/02/2010

Boring Layout:

Who staked locations?	USACE Personnel
How were they located?	—
Were locations moved? (explain which ones, where, and why)	No

Sample Shipment:

Total Numbers and Types of Samples:	NA
Sample Preparation for Shipment:	NA
Method and Date of Shipment	NA
Final Destination:	NA


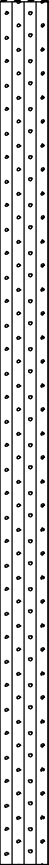
Site Description:

Current Uses, Buildings, Pavement, Utilities:	Dam toe in between road and relief well drainage channel
Vegetation, Topography, Drainage:	Grass, mowed, sloping slightly to drainage channel
Presence of Fill, Rubble, Debris, or Evidence of Contamination:	Fill
Disposition of Borehole, i.e., how backfilled, cuttings disposal, site restoration?	Backfilled with CETCO high solids bentonite grout 20% solids Heavy grout injected 20 bags 1 1/4 buckets (70 gal) Batch mix 3 bags portland cement 3 bags bwrte 1/2 bag high yield bentonite, done on 11/16/2010
Deviations from Drill Instructions:	Grout couldn't be pumped when mixture was 30% solids

Boring Designation RW-66C



DRILLING LOG		DIVISION NWD	INSTALLATION Big Bend Dam		SHEET 1 OF 10 SHEETS
1. PROJECT 2012 Relief Well Installation			9. COORDINATE SYSTEM State Plane		HORIZONTAL NAD83 VERTICAL NAVD88
2. HOLE NUMBER RW-66C			10. SIZE AND TYPE OF BIT 8.25 ID HSA		
3. DRILLING AGENCY USACE, Omaha District			11. MANUFACTURER'S DESIGNATION OF DRILL Gus Pech 1300C		
4. NAME OF DRILLER Sam Thomas			12. TOTAL SAMPLES DISTURBED 0 UNDISTURBED 0		
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED			13. TOTAL NUMBER CORE BOXES		
DEG FROM VERTICAL ---			14. ELEVATION GROUND WATER		
BEARING			15. DATE BORING STARTED 4/12/12 COMPLETED 4/12/12		
6. THICKNESS OF OVERBURDEN 82 ft			16. ELEVATION TOP OF BORING		
7. DEPTH DRILLED INTO ROCK 0 ft			17. TOTAL CORE RECOVERY FOR BORING N/A		
8. TOTAL DEPTH OF BORING 82 ft			18. SIGNATURE AND TITLE OF INSPECTOR Charles Klaus Geologist		
LOCATION SKETCH/COMMENTS					SCALE:
<p>Soil descriptions from auger cuttings:</p> <p>Top 5.0 ft. drilled with center bit, then auger was pulled and a center plug was installed</p> <p>There were no cuttings brought to the surface from 32' to 47' and from 58.5' to 82'.</p> <p>Soil classification was based upon ease of drilling, rig sounds, and cross section provided as well as what was seen in nearby wells.</p>					
PROJECT 2012 Relief Well Installation Fort Thompson, SD					HOLE NO RW-66C



DRILLING LOG (Cont Sheet)				INSTALLATION Big Bend Dam		SHEET 2 OF 10 SHEETS		
PROJECT 2012 Relief Well Installation				COORDINATE SYSTEM State Plane		HORIZONTAL NAD83	VERTICAL NAVD88	
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	Blows/ 0.5 ft	N _r	% REC	Sample Number	REMARKS
			<u>Clayey gravel with sand</u> (GC) medium stiff, loose, moist, dark brown.					Start drilling on 4/12/2012
			<u>Fat clay</u> (CH) very soft to soft, moist to wet, light gray.					Water in hole at 5.3 ft. under little head



DRILLING LOG (Cont Sheet)				INSTALLATION Big Bend Dam			SHEET 3 OF 10 SHEETS	
PROJECT 2012 Relief Well Installation				COORDINATE SYSTEM State Plane		HORIZONTAL NAD83	VERTICAL NAVD88	
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	Blows/ 0.5 ft	N _r	% REC	Sample Number	REMARKS
			<u>Fat clay</u> (CH) very soft to soft, moist to wet, light gray, (con't.).					
	15.0							
			<u>Silty sand</u> (SM) very loose to loose, saturated, light gray.					
	20.0							

Boring Designation RW-66C

[illegible]

DRILLING LOG (Cont Sheet)				INSTALLATION Big Bend Dam			SHEET 5 OF 10 SHEETS		
PROJECT 2012 Relief Well Installation				COORDINATE SYSTEM State Plane		HORIZONTAL NAD83		VERTICAL NAVD88	
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	Blows/ 0.5 ft	N _r	% REC	Sample Number	REMARKS	
			Poorly graded sand (SP) very loose to loose, saturated, light gray, (con't.).						
	32.0		Fat clay (CH).					Moderate drilling No cuttings Soil classification based upon ease of drilling Rig sounds and cross section provided as well as what was seen in nearby wells	


DRILLING LOG (Cont Sheet)				INSTALLATION Big Bend Dam			SHEET 6 OF 10 SHEETS		
PROJECT 2012 Relief Well Installation				COORDINATE SYSTEM State Plane		HORIZONTAL NAD83		VERTICAL NAVD88	
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	Blows/ 0.5 ft	N _r	% REC	Sample Number	REMARKS	
			Fat clay (CH) (con't.).						
	47.0		Poorly graded sand (SP) loose, saturated, light gray.					Easy drilling, cuttings	

DRILLING LOG (Cont Sheet)				INSTALLATION Big Bend Dam			SHEET 7 OF 10 SHEETS		
PROJECT 2012 Relief Well Installation				COORDINATE SYSTEM State Plane		HORIZONTAL NAD83		VERTICAL NAVD88	
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	Blows/ 0.5 ft	N _r	% REC	Sample Number	REMARKS	
			Poorly graded sand (SP) loose, saturated, light gray, (con't.).					Easy drilling	
	58.5		Fat clay (CH).					Moderate drilling	

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DRILLING LOG (Cont Sheet)				INSTALLATION Big Bend Dam				SHEET 8 OF 10 SHEETS	
PROJECT 2012 Relief Well Installation				COORDINATE SYSTEM State Plane		HORIZONTAL NAD83		VERTICAL NAVD88	
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	Blows/ 0.5 ft	N _r	% REC	Sample Number	REMARKS	
			Fat clay (CH) (con't.).					No cuttings	
			Sandy fat clay (CH).					No cuttings, easy drilling	
								Soil classification based upon ease of drilling Rig sounds and cross section provided as well as what was seen in nearby wells	

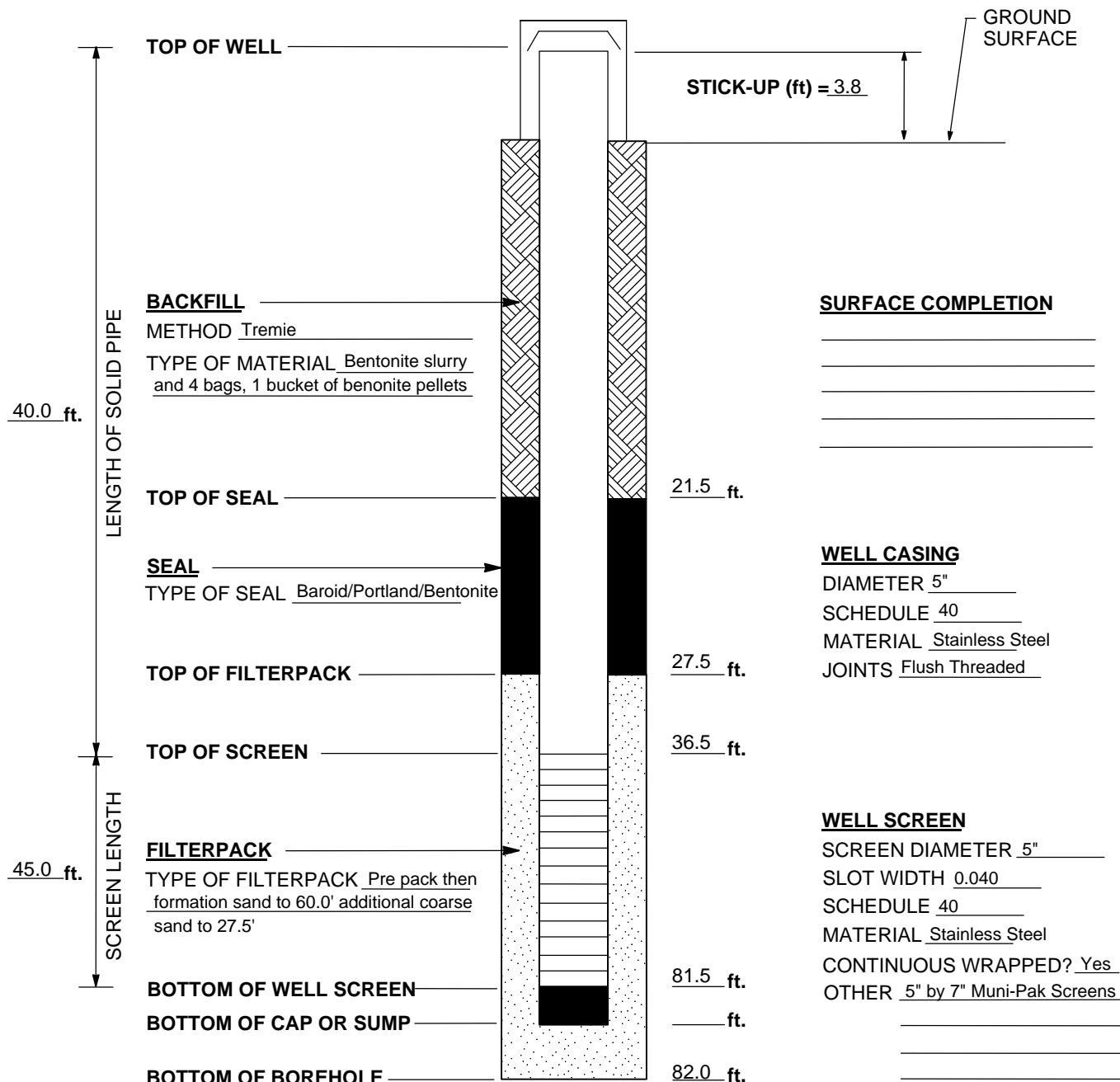
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DRILLING LOG (Cont Sheet)				INSTALLATION Big Bend Dam				SHEET 10 OF 10 SHEETS	
PROJECT 2012 Relief Well Installation				COORDINATE SYSTEM State Plane			HORIZONTAL NAD83	VERTICAL NAVD88	
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	Blows/ 0.5 ft	N _r	% REC	Sample Number	REMARKS	
			Sandy fat clay (CH) (con't.).						
	82.0		Bottom of boring at 82 ft bgs						
<p>Boring terminated at 82.0 ft. Well set with 45.0 ft. stainless steel 0.040 slot screen and 40 ft. of screen, stainless steel riser Sand collapsed to 60.0 ft. and coarse sand was added to 27.5 ft. 3 batches of Baroid/Portland/Bentonite mix and 4 bags of bentonite slurry mix to surface Had to pump well while placing seal Added 1 bucket pellets to top off Stick-Up = 3.8 ft. Total depth = 85.30 ft. Water Level = 0.64 ft. Below top of riser, 3.16 ft. above ground surface Well set at = 81.50 ft.</p>									

PROJECT NAME 2012 Relief Well Installation			WELL NUMBER RW-66C
LOCATION Big Bend Dam Fort Thompson, SD			WELL LOCATION (Coordinates or Station)
DATE INSTALLED	STARTED 4/12/2012	COMPLETED 4/12/2012	TOP OF CASING ELEVATION
TOTAL DEPTH OF BOREHOLE 82.0 ft bgs	BORING DIAMETER 10 1/4 in.		SIGNATURE OF INSPECTOR/INSTALLER Charles Klaus

RELIEF WELL CONSTRUCTION DIAGRAM

NO SCALE
(ALL MEASUREMENTS FROM GROUND SURFACE)



NOTES

TOTAL VOLUME OF WATER ADDED
DURING CONSTRUCTION (IF ANY)
150 gallons

MISC. INFORMATION

Pumped well while placing seal and
slurry

WATER LEVEL SUMMARY

OPEN BOREHOLE 3.16 ft bgs
AFTER INSTALLATION 0.64 ft TOC
4/12/2012

RELIEF WELL CAPACITY/DRAWDOWN TEST DATA FORM

Project: <u>Big Bend</u>		Date: <u>6/26/13</u>
Location: <u>Fort Thompson</u>		Well ID: <u>66C</u>
Monitoring Instrument: <u>Test well w/ meter</u>		Initial Depth of Well: <u>81.5</u> 81.70
Static Water Level: <u>4.92 i.o.g.</u>		Weather:
		Measured By: <u>Sam</u>

	Step #1 Pumping Rate (gpm)	Step #2 Pumping Rate (gpm)	Step #3 Pumping Rate (gpm)	Step #4 Pumping Rate (gpm)	Step #5 Pumping Rate (gpm)
	<u>23</u>	<u>33</u>	<u>49</u>		
Time	Depth To Water ²	Depth To Water ²	Depth To Water ²	Depth To Water ²	Depth To Water ²
0	<u>6.94</u>				
15 sec	<u>11.40</u>	<u>17.92</u>			
30 sec	<u>11.44</u>	<u>18.80</u>			
45 sec	<u>11.69</u>	<u>19.0</u>			
1 min	<u>11.9</u>	<u>19.22</u>	<u>27.42</u>		
2 min	<u>12.96</u>	<u>19.39</u>	<u>28.00</u>		
3 min	<u>13.14</u>	<u>19.46</u>	<u>28.12</u>		
4 min	<u>13.24</u>	<u>19.49</u>	<u>28.26</u>		
5 min	<u>13.56</u>	<u>19.66</u>	<u>28.31</u>		
10 min	<u>12.29</u>	<u>19.76</u>	<u>28.58</u>		
15 min	<u>13.34</u>	<u>19.80</u>	<u>28.68</u>		
20 min	<u>13.34</u>	<u>19.80</u>	<u>28.78</u>		
25 min	<u>13.34</u>	<u>19.80</u>	<u>28.79</u>		
30 min	<u>13.34</u>	<u>19.80</u>	<u>28.79</u>		
35 min			<u>28.85</u>		
40 min			<u>28.90</u>		
45 min					
50 min					
55 min					
1 hr 0 min					
Bottom Depth ³					
Sand in Outflow ⁴					

¹ Static water level recorded prior to capacity/drawdown test. ² All measurements in 0.01 feet. ³ Well Depth after pumping step.

⁴ Amount and relative grain size of sand captured from outfall during test.

Comments: Subtract 2' For ground Level
Stopped pump For 3rd stage added 10 more Feet
of pipe

DRILLING LOG		DIVISION <i>NWU</i>	INSTALLATION <i>Big Bend</i>	HOLE NUMBER <i>RW 67A</i>
1. PROJECT <i>Big Bend Relief Well</i>		10. SIZE AND TYPE OF BIT <i>10 1/4" ID HSA</i>		SHEET <i>1</i> OF <i>10</i> SHEETS
2. LOCATION (Coordinates or Station) <i>44° 03' 23.665" N 99° 27' 15.353" W UGS 1984</i>		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) <i>MSL</i>		
3. DRILLING AGENCY <i>CEMWU-EID-GG</i>		12. MANUFACTURER'S DESIGNATION OF DRILL <i>Gus Peck 1300C</i>		
4. HOLE NO. (As shown on drawing title and file number) <i>RW 67A</i>		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN <i>—</i>	DISTURBED <i>—</i> UNDISTURBED <i>—</i>	
5. NAME OF DRILLER <i>Dan Morrissey</i>		14. TOTAL NUMBER CORE BOXES <i>—</i>		
6. DIRECTION OF HOLE <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER <i>1370 feet 10/29/2010</i>		
7. THICKNESS OF OVERBURDEN		16. DATE HOLE <i>10/26/2010</i>	STARTED <i>10/26/2010</i> COMPLETED <i>11/01/2010</i>	
8. DEPTH DRILLED INTO ROCK <i>NA</i>		17. ELEVATION TOP OF HOLE <i>1370 ft</i>		
9. TOTAL DEPTH OF HOLE <i>84.8 ft</i>		18. TOTAL CORE RECOVERY FOR BORING <i>NA</i>		
		19. SIGNATURE OF INSPECTOR <i>Paul Bow</i>		
LOCATION SKETCH/COMMENTS				SCALE

DRILLING LOG (CONT SHEET)				ELEVATION TOP OF HOLE		HOLE NUMBER RW67A	
PROJECT			INSTALLATION Big Bend Dam			SHEET 2 OF 10 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	
	1		Gravelly Clay w/sand (CL) med plasticity, moist, fine grained gravel, med grained sand, dark brown			Started drilling 10/26/00 0930 hrs Lossing from cuttings	
	2						
	3						
	4						
	5		Organic Soil (OL/OH) Med plasticity, black, spongy, moist				
	6						
	7		Silty Sand Silty Clay (CL) Med plasticity, moist, med brown				
	8						
	9						
	10						

DRILLING LOG (CONT SHEET)				ELEVATION TOP OF HOLE		HOLE NUMBER RW67A	
PROJECT			INSTALLATION Big Bend Dam			SHEET 3 OF 10 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	
	11		Clayey Sand (SC) no plasticity, wet, med gray, med grained sand				
	12						
	13						
	14						
	15						
	16						
	17						
	18						
	19						
	20						

DRILLING LOG (CONT SHEET)			ELEVATION TOP OF HOLE		HOLE NUMBER	
PROJECT			INSTALLATION		SHEET	
			Big Bend Dam		4	
					OF 10 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
	21		Clayey Sand (Sc) no plasticity, wet, med gray, med grained sand			
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30		Clay (drilling harder not firm cuttings)			

End of day approx 22'
Begin at 10/28/10
Did not work 90/27 due
to high winds

DRILLING LOG (CONT SHEET)			ELEVATION TOP OF HOLE		HOLE NUMBER	
PROJECT			INSTALLATION		SHEET 5 OF 10 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
	31		Clayey Sand (SC) no plasticity, wet, red gray, red grained sand			Cuttings no longer reliable for logging due to mixing in hole, no clay cuttings surfaced
	32					
	33					
	34					
	35		Break through clay (told by driller)			
	36					
	37		Drilling hard again			
	38					
	39		Drilling easier			
	40					

DRILLING LOG (CONT SHEET)			ELEVATION TOP OF HOLE		HOLE NUMBER		
PROJECT			INSTALLATION			SHEET 6 OF 10 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	
			Clayey Sand (SC) no plasticity. Wet, med gray, med grained sand				
	41						
	42						
	43						
	44						
	45						
	46						
	47						
	48						
	49						
	50						

DRILLING LOG (CONT SHEET)			ELEVATION TOP OF HOLE		HOLE NUMBER	
PROJECT			INSTALLATION		SHEET OF 10 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
	51		Clayey Sand (SC) no plasticity, wet, red gray, med grained sand			
	52					
	53					
	54					
	55					
	56					
	57					
	58					
	59					
	60					

DRILLING LOG (CONT SHEET)				ELEVATION TOP OF HOLE		HOLE NUMBER RW67A	
PROJECT			INSTALLATION Big Bend Dam			SHEET 8 OF 10 SHEETS	
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)	
	61		Clayey Sand (SC) no plasticity, wet, red gray, med grained sand				
	62						
	63						
	64						
	65						
	66						
	67						
	68						
	69						
	70						
ENG FORM 1836				PROJECT		HOLE NO. RW67A	

DRILLING LOG (CONT SHEET)			ELEVATION TOP OF HOLE		HOLE NUMBER RW67A	
PROJECT			INSTALLATION Big Bend Dam			SHEET 9 OF 10 SHEETS
ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
	71 72 73 74 75 76 77 78 79 80		Clayey Sand, (SC) no plasticity, wet, med gray, med grained sand			
ENG FORM 1836			PROJECT		HOLE NO. RW67A	

DRILLING LOG (CONT SHEET)

ELEVATION TOP OF HOLE

HOLE NUMBER

PROJECT

INSTALLATION

Big Bend Dam

R067A

SHEET 16

OF 10 SHEETS

ELEV. (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (DESCRIPTION) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
	81		Clayey Sand (SC) no plasticity, wet, red grey, red grained sand			
	82					
	83		Drilling hard (Probably clay) or shale			
	84					
	85		Bottom of hole 84.8'			
	86					
	87					
	88					
	89					
	90					

PROJECT <u>Big Bend Relief Well Installation</u>		WELL NUMBER <u>RW 67A</u>	
DATE INSTALLED <u>10/26/2010</u>	STARTED <u>10/26/2010</u>	COMPLETED <u>11/01/2010</u>	LOCATION (Coordinates or Station)
SIGNATURE OF INSPECTOR/INSTALLER <u>Paul Dow</u>		ELEVATION OF HOLE <u>1370</u>	
TOTAL DEPTH OF BOREHOLE <u>84.8 feet</u>	BORING DIAMETER <u>14 inches</u>	ELEVATION OF GROUND WATER IN WELL (DATE)	

PIEZOMETER (PORE-FLUID) CONSTRUCTION DIAGRAM

NO SCALE
(ALL MEASUREMENTS FROM GROUND SURFACE)

<p>PROTECTIVE CASING <input checked="" type="checkbox"/> NO <input type="checkbox"/> YES</p> <p>SIZE AND TYPE OF PROTECTIVE CASING: _____</p> <p>TOP OF WELL _____</p> <p>PROTECTIVE POSTS <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO NO. OF POSTS _____</p> <p>BACKFILL/ METHOD <input type="checkbox"/> GRAVITY <input checked="" type="checkbox"/> TREMIE <input type="checkbox"/> OTHER (DESCRIBE) _____</p> <p>BACKFILL/ GROUT MIX, ETC. (DESCRIBE) <u>BH 20 Grout</u> <u>mixed at 25% solids</u></p> <p>TOP OF SEAL _____ TYPE OF SEAL: <u>Confed bentonite pellets</u></p> <p>PELLET DIAMETER <u>1/2 inch</u></p> <p>TOP OF FILTERPACK _____</p> <p>TOP OF SCREEN _____</p> <p>WELL SCREEN LENGTH <u>50</u> ft.</p> <p>FILTERPACK _____</p> <p>GRADATION: _____</p> <p>BOTTOM OF WELL SCREEN _____</p> <p>BOTTOM OF CAP OR SUMP _____</p> <p>BOTTOM OF BORING _____</p>	<p>GROUND SURFACE</p> <p>STICK-UP= <u>6.7</u> ft.</p> <p>CONCRETE PAD YES <input type="checkbox"/> NO <input checked="" type="checkbox"/></p> <p>23 ft.</p> <p>27.2 ft.</p> <p>32.3 ft.</p> <p>82 ft.</p> <p>82.3 ft.</p> <p>84.8 ft.</p>
---	---

WELL CASING

DIAMETER: 5 in ☒ I.D. ☐ O.D.
SCHEDULE: 40
MATERIAL: ☒ PVC ☐ STAINLESS STEEL
☐ OTHER (DESCRIBE) _____

TYPE OF JOINTS

☒ FLUSH THREADED
☐ GLUE/SLIP JOINT
☐ OTHER _____

SCREEN INFORMATION

SCREEN DIAMETER: ☐ I.D. ☐ O.D.
SLOT WIDTH: _____
SCHEDULE: _____
MATERIAL: ☐ PVC ☒ STAINLESS STEEL
☐ OTHER (DESCRIBE) _____

CONTINUOUS WRAPPED YES ☐ NO ☐

WATER LEVEL SUMMARY

(DATE/TIME/LEVEL)

NOTES:

TOTAL VOLUME OF WATER
ADDED DURING CONSTRUCTION
(IF ANY): approx 350 gal

MISC. INFO:

OPEN BOREHOLE: _____
AFTER INSTALLATION:
10/29/2010 1000 hrs @ ground surface

REVISED 09-2009

RELIEF WELL CAPACITY/DRAWDOWN TEST DATA FORM

Project: Big Bend Relief Well Installation	Date: 11/23/2010
Location: Fort Thompson, SD	Well ID: RW67A
Monitoring Instrument: WL Indicator	Initial Depth of Well:
Static Water Level²: 4.78' below TOC up	Weather: Overcast, high of 24°F
	Measured By: Joe Morrissey

Time	Depth To Water ¹	Elevation	Water Level Change ¹	Pumping Rate (gpm)	Comments
0	4.78'				
15 sec					
30 sec					
45 sec					
1 min					
2 min					
3 min					
4 min					
5 min					
10 min					
15 min					
20 min					
25 min					
30 min					
35 min					
40 min					
45 min					
50 min					
55 min					
1 hr 0 min					

¹ All measurements in 0.01 feet.

² Static water level recorded prior to capacity/drawdown test.

Additional Comments:

Pump 23' below TOC pumped dry in 1 min @ Max 65 GPM
Water dirty

Unable to perform capacity test due to low production from well

Static water level measured from the top of the 36" surface casing to the water level flowing out of the well pipe

SITE INFORMATION SHEET

(To be completed by the Field Geologist)

PROJECT NAME:	Big Bend Relief Well RW 67A
LOCATION:	
Date(s) of Field Work:	10/26/2010 - 11/01/2010

Boring Layout:

Who staked locations?	USACE Personnel
How were they located?	
Were locations moved? (explain which ones, where, and why)	No

Sample Shipment:

Total Numbers and Types of Samples:	NA
Sample Preparation for Shipment:	NA
Method and Date of Shipment	NA
Final Destination:	NA

Site Description:



Current Uses, Buildings, Pavement, Utilities:	Toe of dam overhead powerlines nearby
Vegetation, Topography, Drainage:	Grassy flat lying area, mowed
Presence of Fill, Rubble, Debris, or Evidence of Contamination:	Fill
Disposition of Borehole, i.e., how backfilled, cuttings disposal, site restoration?	Backfilled with BH20 grout mixed @ 25% solids
Deviations from Drill Instructions:	Grout not 30% solids

Boring Designation RW-67B



DRILLING LOG		DIVISION NWD	INSTALLATION Big Bend Dam	SHEET 1 OF 10 SHEETS
1. PROJECT 2012 Relief Well Installation		9. COORDINATE SYSTEM State Plane		HORIZONTAL NAD83
		10. SIZE AND TYPE OF BIT 8.25 ID HSA		VERTICAL NAVD88
2. HOLE NUMBER RW-67B	LOCATION COORDINATES		11. MANUFACTURER'S DESIGNATION OF DRILL Gus Pech 1300C	
3. DRILLING AGENCY USACE, Omaha District		12. TOTAL SAMPLES		DISTURBED 0
				UNDISTURBED 0
4. NAME OF DRILLER Sam Thomas		13. TOTAL NUMBER CORE BOXES		
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG FROM VERTICAL ---	14. ELEVATION GROUND WATER	
		BEARING	15. DATE BORING 4/16/12	
6. THICKNESS OF OVERBURDEN 83 ft		16. ELEVATION TOP OF BORING		
7. DEPTH DRILLED INTO ROCK 0 ft		17. TOTAL CORE RECOVERY FOR BORING N/A		
8. TOTAL DEPTH OF BORING 83 ft		18. SIGNATURE AND TITLE OF INSPECTOR Charles Klaus Geologist		
LOCATION SKETCH/COMMENTS			SCALE:	
<p>Soil descriptions from auger cuttings:</p> <p>Top 5.0 ft. drilled with center bit, then auger was pulled and a center plug was installed</p>				
<p>PROJECT 2012 Relief Well Installation Fort Thompson, SD</p>				
			HOLE NO RW-67B	

[illegible]

- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9

DRILLING LOG (Cont Sheet)				INSTALLATION Big Bend Dam			SHEET 4 OF 10 SHEETS		
PROJECT 2012 Relief Well Installation				COORDINATE SYSTEM State Plane		HORIZONTAL NAD83		VERTICAL NAVD88	
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	Blows/ 0.5 ft	N _r	% REC	Sample Number	REMARKS	
			<u>Clayey sand</u> (SC) very loose, wet to saturated, light gray, (con't.).						
	22.0		<u>Poorly graded sand</u> (SP) very loose, saturated, greenish gray.						

[illegible]

DRILLING LOG (Cont Sheet)				INSTALLATION Big Bend Dam			SHEET 6 OF 10 SHEETS		
PROJECT 2012 Relief Well Installation				COORDINATE SYSTEM State Plane		HORIZONTAL NAD83		VERTICAL NAVD88	
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	Blows/ 0.5 ft	N _r	% REC	Sample Number	REMARKS	
			Poorly graded sand (SP) very loose, saturated, greenish gray, (con't.).						
	45.0		Fat clay (CH) very stiff, moist to wet, light gray.					Moderate drilling	

Boring Designation RW-67B

[illegible]

DRILLING LOG (Cont Sheet)				INSTALLATION Big Bend Dam				SHEET 8 OF 10 SHEETS	
PROJECT 2012 Relief Well Installation				COORDINATE SYSTEM State Plane		HORIZONTAL NAD83		VERTICAL NAVD88	
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	Blows/ 0.5 ft	N _r	% REC	Sample Number	REMARKS	
			Fat clay (CH) very stiff, moist to wet, light gray, (con't.).						
	67.5		Poorly graded sand with silt (SP-SM) loose, saturated, light gray.						

Boring Designation RW-67B

DRILLING LOG (Cont Sheet)				INSTALLATION Big Bend Dam			SHEET 9 OF 10 SHEETS	
PROJECT 2012 Relief Well Installation				COORDINATE SYSTEM State Plane		HORIZONTAL NAD83	VERTICAL NAVD88	
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	Blows/ 0.5 ft	N _i	% REC	Sample Number	REMARKS
			Poorly graded sand with silt (SP-SM) loose, saturated, light gray, (con't.).					

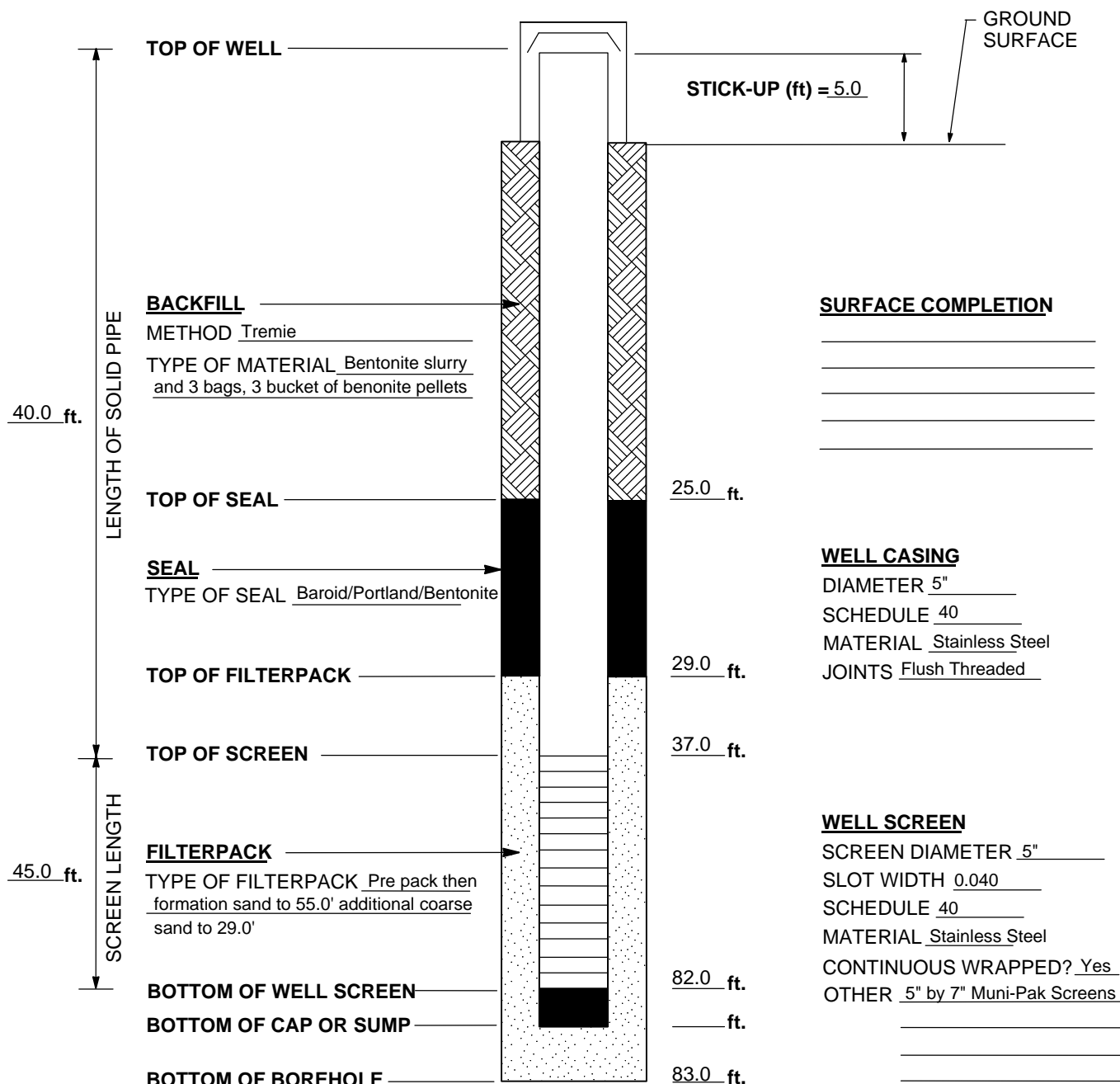
Boring Designation RW-67B

DRILLING LOG (Cont Sheet)				INSTALLATION Big Bend Dam				SHEET 10 OF 10 SHEETS	
PROJECT 2012 Relief Well Installation				COORDINATE SYSTEM State Plane			HORIZONTAL NAD83	VERTICAL NAVD88	
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	Blows/ 0.5 ft	N _r	% REC	Sample Number	REMARKS	
			Poorly graded sand with silt (SP-SM) loose, saturated, light gray, (con't.).						
	83.0		Bottom of boring at 83 ft bgs						
<p>Boring terminated at 83.0 ft.</p> <p>Well set with 45.0 ft. stainless steel 0.040 slot screen and 40 ft. of screen, stainless steel riser</p> <p>Sand collapsed to 55.0 ft. and coarse sand was added to 29.0 ft.</p> <p>2 batches of Baroid/Portland/Bentonite mix and 3 bags of bentonite slurry mix to surface</p> <p>Added 3 bucket pellets to top off</p> <p>Stick-Up = 5.0 ft.</p> <p>Water Level = 2.0 ft. Below top of riser, 3.0 ft. above ground surface</p>									

PROJECT NAME 2012 Relief Well Installation			WELL NUMBER RW-67B
LOCATION Big Bend Dam Fort Thompson, SD			WELL LOCATION (Coordinates or Station)
DATE INSTALLED	STARTED 4/16/2012	COMPLETED 4/16/2012	TOP OF CASING ELEVATION
TOTAL DEPTH OF BOREHOLE 83.0 ft bgs		BORING DIAMETER 10 1/4 in.	SIGNATURE OF INSPECTOR/INSTALLER Charles Klaus

RELIEF WELL CONSTRUCTION DIAGRAM

NO SCALE
(ALL MEASUREMENTS FROM GROUND SURFACE)



SURFACE COMPLETION

WELL CASING

DIAMETER 5"
SCHEDULE 40
MATERIAL Stainless Steel
JOINTS Flush Threaded

WELL SCREEN

SCREEN DIAMETER 5"
SLOT WIDTH 0.040
SCHEDULE 40
MATERIAL Stainless Steel
CONTINUOUS WRAPPED? Yes
OTHER 5" by 7" Muni-Pak Screens

NOTES

TOTAL VOLUME OF WATER ADDED
DURING CONSTRUCTION (IF ANY)
150 gallons

MISC. INFORMATION


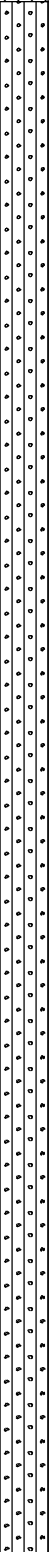
Pumped well while placing seal and
slurry

WATER LEVEL SUMMARY

OPEN BOREHOLE 3 ft bgs
AFTER INSTALLATION 2.00 ft TOC
4/17/2012

Boring Designation RW-68A



DRILLING LOG		DIVISION NWD	INSTALLATION Big Bend Dam		SHEET 1 OF 10 SHEETS
1. PROJECT 2012 Relief Well Installation			9. COORDINATE SYSTEM State Plane		HORIZONTAL NAD83 VERTICAL NAVD88
2. HOLE NUMBER RW-68A			10. SIZE AND TYPE OF BIT 8.25 ID HSA		
3. DRILLING AGENCY USACE, Omaha District			11. MANUFACTURER'S DESIGNATION OF DRILL Gus Pech 1300C		
4. NAME OF DRILLER Sam Thomas			12. TOTAL SAMPLES DISTURBED 0 UNDISTURBED 0		
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED			13. TOTAL NUMBER CORE BOXES		
DEG FROM VERTICAL ---			14. ELEVATION GROUND WATER		
BEARING			15. DATE BORING STARTED 4/17/12 COMPLETED 4/18/12		
6. THICKNESS OF OVERBURDEN 89 ft			16. ELEVATION TOP OF BORING		
7. DEPTH DRILLED INTO ROCK 0 ft			17. TOTAL CORE RECOVERY FOR BORING N/A		
8. TOTAL DEPTH OF BORING 89 ft			18. SIGNATURE AND TITLE OF INSPECTOR Charles Klaus Geologist		
LOCATION SKETCH/COMMENTS				SCALE:	
<p>Soil descriptions from auger cuttings:</p> <p>Top 5.0 ft. drilled with center bit, then auger was pulled and a center plug was installed</p> <p>There were no representative cuttings brought to the surface from 37.5' to 72.5' and no cuttings at all from 72.5' to 89'.</p> <p>Soil classification was based upon ease of drilling, rig sounds, cross section provided and what was seen in nearby wells.</p>					
PROJECT 2012 Relief Well Installation Fort Thompson, SD				HOLE NO RW-68A	

DRILLING LOG (Cont Sheet)				INSTALLATION Big Bend Dam			SHEET 2 OF 10 SHEETS		
PROJECT 2012 Relief Well Installation				COORDINATE SYSTEM State Plane		HORIZONTAL NAD83		VERTICAL NAVD88	
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	Blows/ 0.5 ft	N _r	% REC	Sample Number	REMARKS	
	1.0		<u>Lean clay (CL)</u> Clayey topsoil.					Start drilling on 4/17/2012 Easy drilling	
			<u>Silty sand (SM)</u> loose to medium dense, wet to saturated, greenish gray.						



DRILLING LOG (Cont Sheet)				INSTALLATION Big Bend Dam			SHEET 3 OF 10 SHEETS		
PROJECT 2012 Relief Well Installation				COORDINATE SYSTEM State Plane		HORIZONTAL NAD83		VERTICAL NAVD88	
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	Blows/ 0.5 ft	N _r	% REC	Sample Number	REMARKS	
			Silty sand (SM) loose to medium dense, wet to saturated, greenish gray, (con't.).						



DRILLING LOG (Cont Sheet)				INSTALLATION Big Bend Dam			SHEET 4 OF 10 SHEETS	
PROJECT 2012 Relief Well Installation				COORDINATE SYSTEM State Plane			HORIZONTAL NAD83	VERTICAL NAVD88
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	Blows/ 0.5 ft	N _r	% REC	Sample Number	REMARKS
			Silty sand (SM) loose to medium dense, wet to saturated, greenish gray, (con't.).					

[illegible]


DRILLING LOG (Cont Sheet)				INSTALLATION Big Bend Dam		SHEET 7 OF 10 SHEETS		
PROJECT 2012 Relief Well Installation				COORDINATE SYSTEM State Plane		HORIZONTAL NAD83	VERTICAL NAVD88	
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	Blows/ 0.5 ft	N _r	% REC	Sample Number	REMARKS
			Fat clay (CH) stiff to very stiff, wet, dark gray, (con't.).					Moderate drilling No clay in cuttings
	57.0		Poorly graded sand (SP) medium dense, saturated, dark gray.					Easier drilling

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DRILLING LOG (Cont Sheet)				INSTALLATION Big Bend Dam			SHEET 8 OF 10 SHEETS		
PROJECT 2012 Relief Well Installation				COORDINATE SYSTEM State Plane		HORIZONTAL NAD83		VERTICAL NAVD88	
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	Blows/ 0.5 ft	N _r	% REC	Sample Number	REMARKS	
			Poorly graded sand (SP) medium dense, saturated, dark gray, (con't.).						
	63.0		Fat clay (CH).					Moderate drilling No clay in cuttings	

DRILLING LOG (Cont Sheet)				INSTALLATION Big Bend Dam			SHEET 9 OF 10 SHEETS		
PROJECT 2012 Relief Well Installation				COORDINATE SYSTEM State Plane		HORIZONTAL NAD83		VERTICAL NAVD88	
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	Blows/ 0.5 ft	N _r	% REC	Sample Number	REMARKS	
			Fat clay (CH) (con't.).						
	72.5								
			Poorly graded sand (SP).					Easy drilling No cuttings	

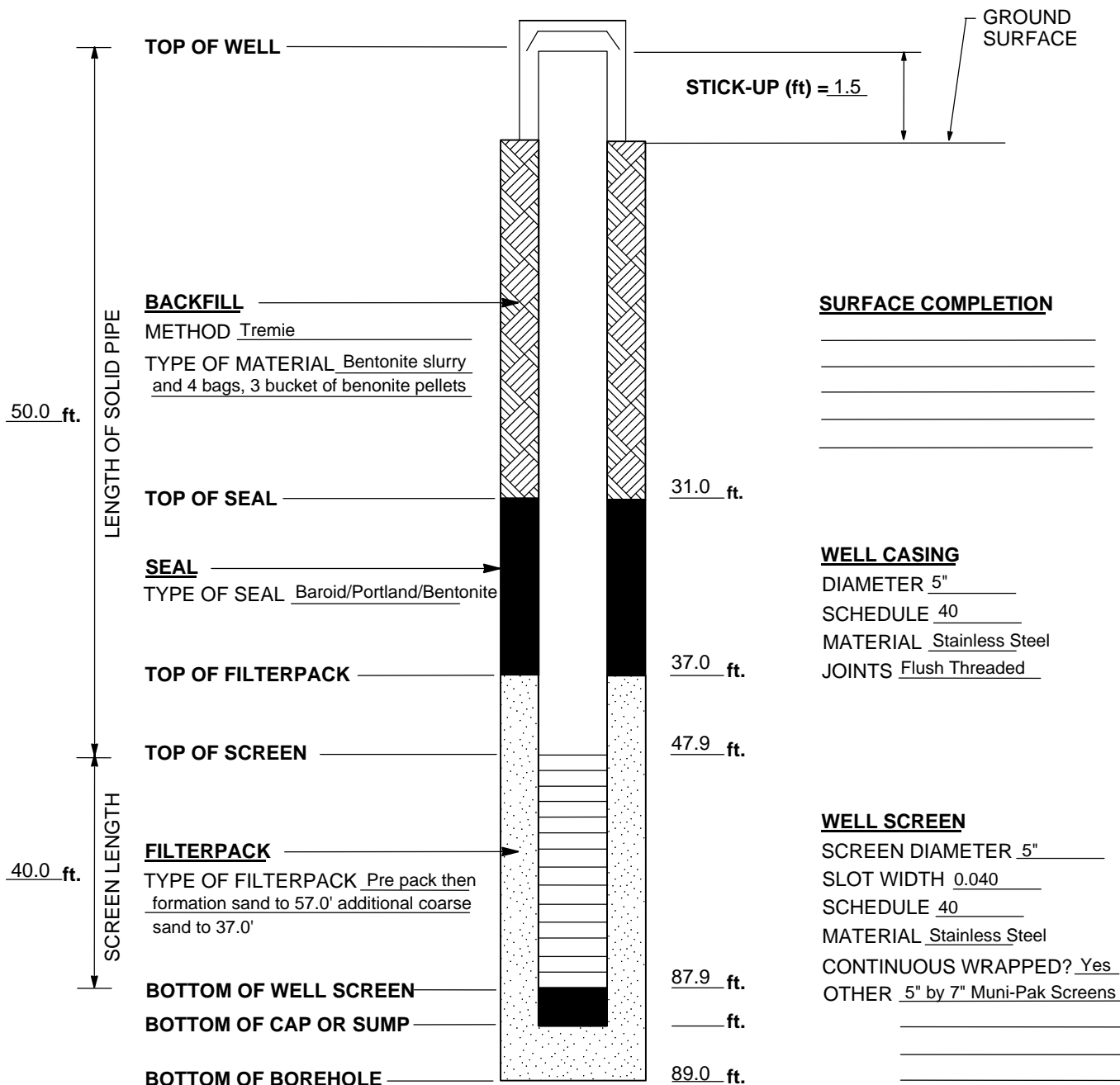
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DRILLING LOG (Cont Sheet)				INSTALLATION Big Bend Dam				SHEET 10 OF 10 SHEETS		
PROJECT 2012 Relief Well Installation				COORDINATE SYSTEM State Plane		HORIZONTAL NAD83		VERTICAL NAVD88		
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	Blows/ 0.5 ft	N _r	% REC	Sample Number	REMARKS		
			Poorly graded sand (SP) (con't.).							
	89.0		Bottom of boring at 89 ft bgs					Boring terminated at 89.0 ft. Well set with 40.0 ft. stainless steel 0.040 slot screen and 50 ft. of screen, stainless steel riser Sand collapsed to 57.0 ft. and coarse sand was added to 37.0 ft. 3 batches of Baroid/Portland/Bentonite mix and 4 bags of bentonite slurry mix to 3 ft. below ground surface Stick-Up = 1.47 ft. Water Level = 1.29ft. Below top of riser		

PROJECT NAME 2012 Relief Well Installation			WELL NUMBER RW-68A
LOCATION Big Bend Dam Fort Thompson, SD			WELL LOCATION (Coordinates or Station)
DATE INSTALLED	STARTED 4/17/2012	COMPLETED 4/18/2012	TOP OF CASING ELEVATION
TOTAL DEPTH OF BOREHOLE 89.0 ft bgs		BORING DIAMETER 10 1/4 in.	SIGNATURE OF INSPECTOR/INSTALLER Charles Klaus

RELIEF WELL CONSTRUCTION DIAGRAM

NO SCALE
(ALL MEASUREMENTS FROM GROUND SURFACE)



NOTES

TOTAL VOLUME OF WATER ADDED
DURING CONSTRUCTION (IF ANY)
150 gallons

MISC. INFORMATION

Pumped well while placing seal and
slurry

WATER LEVEL SUMMARY

OPEN BOREHOLE ---
AFTER INSTALLATION 1.29 ft TOC
4/19/2012

Boring Designation RW-68B

DRILLING LOG		DIVISION NWD	INSTALLATION Big Bend Dam	SHEET 1 OF 11 SHEETS
1. PROJECT 2012 Relief Well Installation		9. COORDINATE SYSTEM State Plane		HORIZONTAL NAD83
		10. SIZE AND TYPE OF BIT 8.25 ID HSA		VERTICAL NAVD88
2. HOLE NUMBER RW-68B	LOCATION COORDINATES		11. MANUFACTURER'S DESIGNATION OF DRILL Gus Pech 1300C	
3. DRILLING AGENCY USACE, Omaha District		12. TOTAL SAMPLES		DISTURBED 0
				UNDISTURBED 0
4. NAME OF DRILLER Sam Thomas		13. TOTAL NUMBER CORE BOXES		
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG FROM VERTICAL ---	14. ELEVATION GROUND WATER	
		BEARING	15. DATE BORING	
			STARTED 4/18/12	
			COMPLETED 4/19/12	
6. THICKNESS OF OVERBURDEN 90 ft		16. ELEVATION TOP OF BORING		
7. DEPTH DRILLED INTO ROCK 0 ft		17. TOTAL CORE RECOVERY FOR BORING N/A		
8. TOTAL DEPTH OF BORING 90 ft		18. SIGNATURE AND TITLE OF INSPECTOR Charles Klaus Geologist		
LOCATION SKETCH/COMMENTS			SCALE:	
<p>Relocated well approximately 25.0 ft north near PZ-25R.</p> <p>There were no cuttings brought to the surface from 65' to 90'.</p> <p>Soil classification was based upon ease of drilling, rig sounds, cross section provided, and what was seen in nearby wells.</p> <p>Original boring was drilled on 2/16/2012, and was abandoned and redrilled on 4/18/2012.</p>				
PROJECT 2012 Relief Well Installation Fort Thompson, SD			HOLE NO RW-68B	

[illegible]



DRILLING LOG (Cont Sheet)				INSTALLATION Big Bend Dam				SHEET 3 OF 11 SHEETS	
PROJECT 2012 Relief Well Installation				COORDINATE SYSTEM State Plane		HORIZONTAL NAD83		VERTICAL NAVD88	
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	Blows/ 0.5 ft	N _r	% REC	Sample Number	REMARKS	
			Silt (ML) very soft, wet, black, some organics, (con't.).						
	13.0		Poorly graded sand (SP) very loose to loose, saturated, light gray.					Easy drilling	

Boring Designation RW-68B



DRILLING LOG (Cont Sheet)				INSTALLATION Big Bend Dam			SHEET 4 OF 11 SHEETS	
PROJECT 2012 Relief Well Installation				COORDINATE SYSTEM State Plane		HORIZONTAL NAD83	VERTICAL NAVD88	
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	Blows/ 0.5 ft	N _i	% REC	Sample Number	REMARKS
			Poorly graded sand (SP) very loose to loose, saturated, light gray, (con't.).					

Boring Designation RW-68B

[illegible]

DRILLING LOG (Cont Sheet)				INSTALLATION Big Bend Dam				SHEET 6 OF 11 SHEETS	
PROJECT 2012 Relief Well Installation				COORDINATE SYSTEM State Plane		HORIZONTAL NAD83		VERTICAL NAVD88	
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	Blows/ 0.5 ft	N _r	% REC	Sample Number	REMARKS	
			Poorly graded sand (SP) very loose to loose, saturated, light gray, (con't.).						
	49.0		Lean clay (CL-ML) very stiff, moist, gray.						

[illegible]

DRILLING LOG (Cont Sheet)				INSTALLATION Big Bend Dam			SHEET 8 OF 11 SHEETS	
PROJECT 2012 Relief Well Installation				COORDINATE SYSTEM State Plane			HORIZONTAL NAD83	VERTICAL NAVD88
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	Blows/ 0.5 ft	N _r	% REC	Sample Number	REMARKS
			<u>Lean clay</u> (CL-ML) very stiff, moist, gray, (con't.).					
	65.0		<u>Poorly graded sand</u> (SP).					Easy drilling, no cuttings

[illegible]

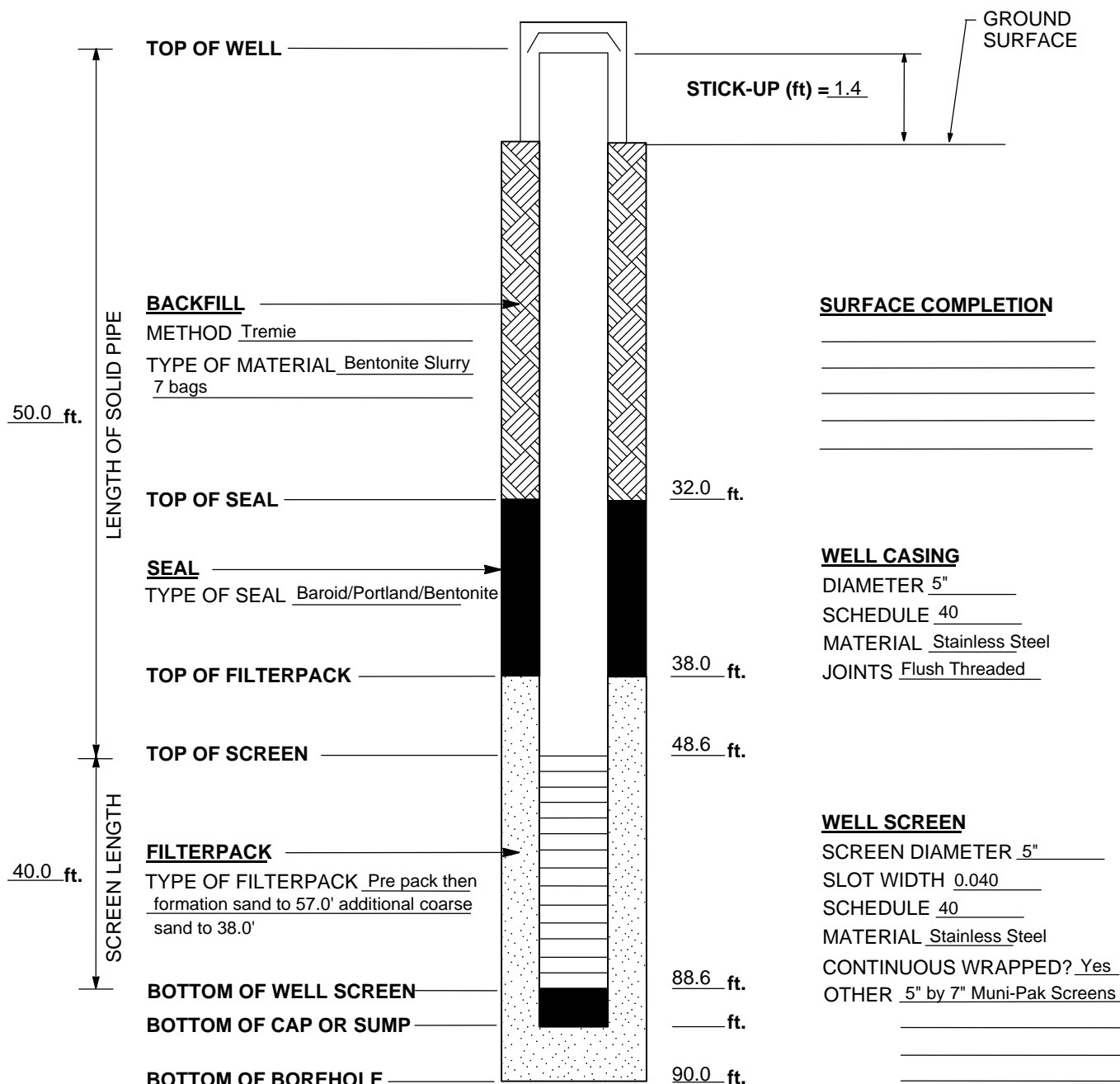
Boring Designation RW-68B

DRILLING LOG (Cont Sheet)				INSTALLATION Big Bend Dam				SHEET 11 OF 11 SHEETS	
PROJECT 2012 Relief Well Installation				COORDINATE SYSTEM State Plane		HORIZONTAL NAD83		VERTICAL NAVD88	
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)		Blows/ 0.5 ft	N _r	% REC	Sample Number	REMARKS
									<p>Boring terminated at 90.0 ft.</p> <p>Well set with 40.0 ft. stainless steel 0.040 slot screen and 50 ft. of screen, stainless steel riser</p> <p>Sand collapsed to 57.0 ft. and coarse sand was added to 38.0 ft.</p> <p>3 batches of Baroid/Portland/Bentonite mix and 7 bags of bentonite slurry</p> <p>Stick-Up = 1.4 ft.</p> <p>Water Level = 3.3 ft. Below top of riser</p> <p>Total depth = 90.0 ft.</p> <p>W.S. = 88.6 ft.</p>

PROJECT NAME 2012 Relief Well Installation			WELL NUMBER RW-68B
LOCATION Big Bend Dam Fort Thompson, SD			WELL LOCATION (Coordinates or Station)
DATE INSTALLED	STARTED 4/18/2012	COMPLETED 4/19/2012	TOP OF CASING ELEVATION
TOTAL DEPTH OF BOREHOLE 90.0 ft bgs		BORING DIAMETER 10 1/4 in.	SIGNATURE OF INSPECTOR/INSTALLER Charles Klaus

RELIEF WELL CONSTRUCTION DIAGRAM

NO SCALE
(ALL MEASUREMENTS FROM GROUND SURFACE)



NOTES

TOTAL VOLUME OF WATER ADDED
DURING CONSTRUCTION (IF ANY)
150 gallons

MISC. INFORMATION



Pumped well while placing seal and
slurry

WATER LEVEL SUMMARY

OPEN BOREHOLE ---
AFTER INSTALLATION 3.30 ft TOC
4/19/2012

Boring Designation RW-68A

DRILLING LOG		DIVISION NWD		INSTALLATION Big Bend Dam		SHEET 1 OF 10 SHEETS	
1. PROJECT 2012 Relief Well Installation				9. COORDINATE SYSTEM State Plane		HORIZONTAL NAD83	
				10. SIZE AND TYPE OF BIT 8.25 ID HSA		VERTICAL NAVD88	
2. HOLE NUMBER RW-68A		LOCATION COORDINATES		11. MANUFACTURER'S DESIGNATION OF DRILL Gus Pech 1300C			
3. DRILLING AGENCY USACE, Omaha District				12. TOTAL SAMPLES		DISTURBED 0	
				13. TOTAL NUMBER CORE BOXES		UNDISTURBED 0	
4. NAME OF DRILLER Sam Thomas				14. ELEVATION GROUND WATER			
5. DIRECTION OF BORING <input checked="" type="checkbox"/> VERTICAL <input type="checkbox"/> INCLINED		DEG FROM VERTICAL ---		BEARING		15. DATE BORING STARTED 4/17/12	
						COMPLETED 4/18/12	
6. THICKNESS OF OVERBURDEN		89 ft		16. ELEVATION TOP OF BORING			
7. DEPTH DRILLED INTO ROCK		0 ft		17. TOTAL CORE RECOVERY FOR BORING N/A			
8. TOTAL DEPTH OF BORING		89 ft		18. SIGNATURE AND TITLE OF INSPECTOR Charles Klaus Geologist			
LOCATION SKETCH/COMMENTS						SCALE:	
<p>▼ Static Water Level ▴ Depth Groundwater Encountered</p> <p>Soil descriptions from auger cuttings: Top 5.0 ft. drilled with center bit, then auger was pulled and a center plug was installed. There were no representative cuttings brought to the surface from 37.5' to 72.5' and no cuttings at all from 72.5' to 89'. Soil classification was based upon ease of drilling, rig sounds, cross section provided and what was seen in nearby wells.</p>							
PROJECT 2012 Relief Well Installation Fort Thompson, SD						HOLE NO RW-68A	

DRILLING LOG (Cont Sheet)				INSTALLATION Big Bend Dam			SHEET 2 OF 10 SHEETS	
PROJECT 2012 Relief Well Installation				COORDINATE SYSTEM State Plane		HORIZONTAL NAD83	VERTICAL NAVD88	
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	Blows/ 0.5 ft	N _i	% REC	Sample Number	REMARKS
	1.0		<u>Lean clay (CL)</u> Clayey topsoil.					Start drilling on 4/17/2012 Easy drilling
		<u>Silty sand (SM)</u> loose to medium dense, wet to saturated, greenish gray.						



[illegible]



DRILLING LOG (Cont Sheet)				INSTALLATION Big Bend Dam			SHEET 4 OF 10 SHEETS	
PROJECT 2012 Relief Well Installation				COORDINATE SYSTEM State Plane		HORIZONTAL NAD83		VERTICAL NAVD88
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	Blows/ 0.5 ft	N _i	% REC	Sample Number	REMARKS
			Silty sand (SM) loose to medium dense, wet to saturated, greenish gray, (con't.).					

DRILLING LOG (Cont Sheet)				INSTALLATION Big Bend Dam			SHEET 5 OF 10 SHEETS	
PROJECT 2012 Relief Well Installation				COORDINATE SYSTEM State Plane		HORIZONTAL NAD83	VERTICAL NAVD88	
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	Blows/ 0.5 ft	N _r	% REC	Sample Number	REMARKS
			Silty sand (SM) loose to medium dense, wet to saturated, greenish gray, (con't.).					
	37.5		Fat clay (CH) stiff to very stiff, wet, dark gray.					Moderate drilling No clay in cuttings

[illegible]

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DRILLING LOG (Cont Sheet)				INSTALLATION Big Bend Dam			SHEET 7 OF 10 SHEETS		
PROJECT 2012 Relief Well Installation				COORDINATE SYSTEM State Plane		HORIZONTAL NAD83		VERTICAL NAVD88	
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	Blows/ 0.5 ft	N _r	% REC	Sample Number	REMARKS	
			Fat clay (CH) stiff to very stiff, wet, dark gray, (con't.).					Moderate drilling No clay in cuttings	50
									51
									52
									53
									54
									55
	57.0		Poorly graded sand (SP) medium dense, saturated, dark gray.					Easier drilling	57
									58
									59
									60

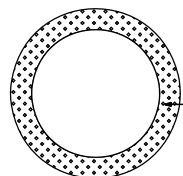
DRILLING LOG (Cont Sheet)				INSTALLATION Big Bend Dam			SHEET 8 OF 10 SHEETS		
PROJECT 2012 Relief Well Installation				COORDINATE SYSTEM State Plane		HORIZONTAL NAD83		VERTICAL NAVD88	
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	Blows/ 0.5 ft	N _r	% REC	Sample Number	REMARKS	
			Poorly graded sand (SP) medium dense, saturated, dark gray, (con't.).						
	63.0		Fat clay (CH).					Moderate drilling No clay in cuttings	

DRILLING LOG (Cont Sheet)				INSTALLATION Big Bend Dam		SHEET 9 OF 10 SHEETS		
PROJECT 2012 Relief Well Installation				COORDINATE SYSTEM State Plane		HORIZONTAL NAD83	VERTICAL NAVD88	
ELEV	DEPTH	LEGEND	FIELD CLASSIFICATION OF MATERIALS (Description)	Blows/ 0.5 ft	N _r	% REC	Sample Number	REMARKS
			Fat clay (CH) (con't.).					
	72.5							
			Poorly graded sand (SP).					Easy drilling No cuttings

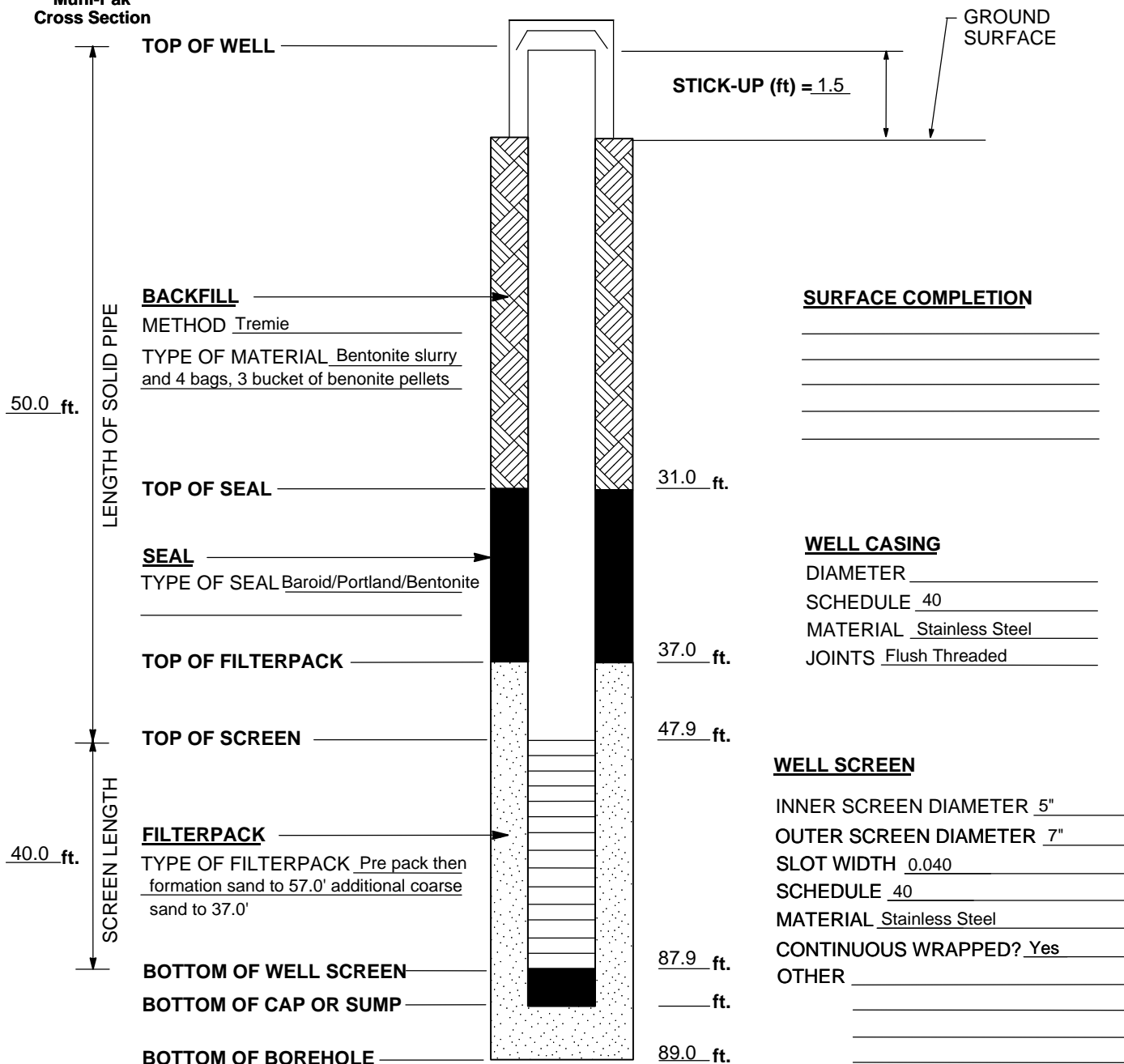
PROJECT NAME 2012 Relief Well Installation			WELL NUMBER RW-68A
LOCATION Big Bend Dam Fort Thompson, SD			WELL LOCATION (Coordinates or Station) 629568.373N 2199481.649E NAD83
DATE INSTALLED	STARTED 4/17/2012	COMPLETED 4/18/2012	TOP OF CASING ELEVATION 1381.70 ft NAVD88
TOTAL DEPTH OF BOREHOLE 89.0 ft bgs		BORING DIAMETER 10 1/4 in.	SIGNATURE OF INSPECTOR/INSTALLER Charles Klaus

RELIEF WELL CONSTRUCTION DIAGRAM MUNI-PAK

NO SCALE
(ALL MEASUREMENTS FROM GROUND SURFACE)



**Muni-Pak
Cross Section**



NOTES

TOTAL VOLUME OF WATER ADDED
DURING CONSTRUCTION (IF ANY)
150 gallons

MISC. INFORMATION

Pumped well while placing seal and
slurry

WATER LEVEL SUMMARY

OPEN BOREHOLE ---
AFTER INSTALLATION 1.29 ft TOC
4/19/2012

RELIEF WELL CAPACITY/DRAWDOWN TEST DATA FORM

Project: <u>Big Bend</u>	Date: <u>7/1/13</u>
Location: <u>Ft. Thompson</u>	Well ID: <u>68 A</u>
Monitoring Instrument: <u>Water level meter</u>	Initial Depth of Well: <u>88.9</u>
Static Water Level ¹ : <u>water is flowing at top of casing</u>	Weather: <u>80's, light west breeze, sunny</u>
	Measured By: <u>George Filipovich</u>

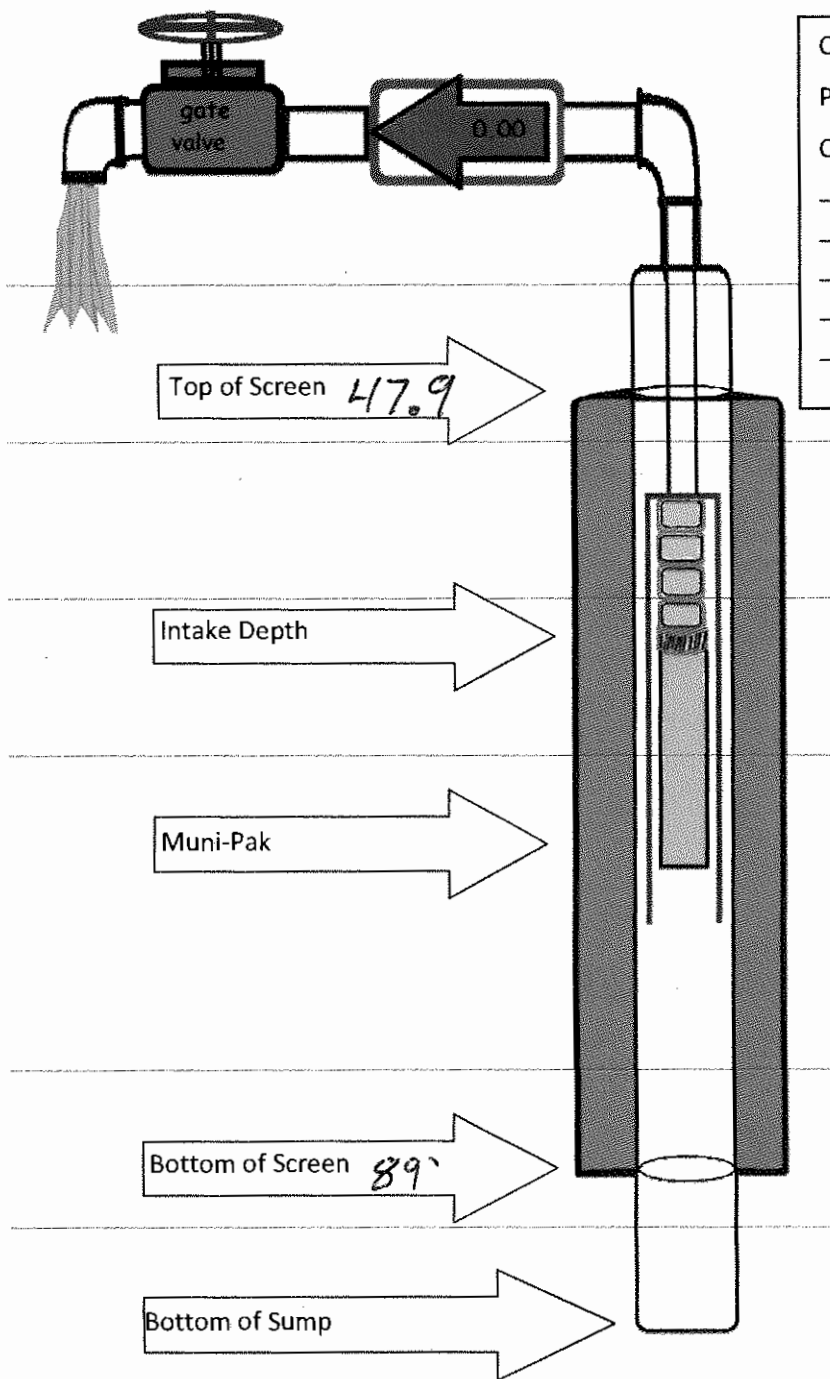
	Step #1 Pumping Rate (gpm)	Step #2 Pumping Rate (gpm)	Step #3 Pumping Rate (gpm)	Step #4 Pumping Rate (gpm)	Step #5 Pumping Rate (gpm)
	23.46	33.62	45.71		
Time	Depth To Water ²	Depth To Water ²	Depth To Water ²	Depth To Water ²	Depth To Water ²
0	0	1.73	4.03		
15 sec		3.59	4.78		
30 sec		3.65	6.22		
45 sec		3.75	6.46		
1 min	1.23	3.82	6.64		
2 min	1.44	3.86	6.74		
3 min	1.57	3.92	6.86		
4 min	1.59	3.97	6.87		
5 min	1.64	3.99	6.92		
10 min	1.73	4.03	7.10		
15 min	1.73	4.04	7.25		
20 min	1.73	4.03	7.30		
25 min		4.03	7.37		
30 min		4.03	7.40		
35 min			7.44		
40 min			7.43		
45 min			7.44		
50 min			7.44		
55 min			* (5)		
1 hr 0 min					
Bottom Depth ³					
Sand in Outflow ⁴					

¹ Static water level recorded prior to capacity/drawdown test. ² All measurements in 0.01 feet. ³ Well Depth after pumping step.

⁴ Amount and relative grain size of sand captured from outfall during test. (5) after shutting off pump water returned to static after 1 minute 36 seconds (1.36)

Comments:

water was clear, top of casing is 8.55 ft below Manhole cover



Capacity Pump Test Diagram _____ Date 6/27/13
 Project Big Bend Hole # G8A
 Comments _____

Pump Information
Grundfos 60520 230
2 Hp w/ 2" discharge
Single Phase & Shrouded

Power Source
Coleman Powermate 5500

Flow Meter
Test w.

