



August 21, 2020

Mr. Dan Mossing, P.E.
Emmons & Olivier Resources, Inc.
1919 University Avenue West, Suite 300
St. Paul, Minnesota 55104

RE: Contract Drilling Services
Stormwater Improvements
USH 63 / STH 48 at 3rd Avenue
Cumberland, Wisconsin
AET Project No. 31-20717

Dear Mr. Mossing:

We are pleased to present the results of our subsurface exploration program for your stormwater improvements project in the City of Cumberland, Wisconsin. These services were performed according to our proposal to you dated July 17, 2020.

We appreciate the opportunity to work with you on this phase of the project. Please contact us if you have questions about this report or require further assistance.

Sincerely,

American Engineering Testing, Inc.

A handwritten signature in blue ink that reads 'Blake Snyder' with a long, sweeping flourish extending to the right.

Blake E. Snyder, P.E.
Geotechnical Engineer

Attachments: Boring Log Notes, Unified Soil Classification System, Figure 1 – Boring Locations, Subsurface Boring Logs, SBD-10793 Stormwater form

BORING LOG NOTES

DRILLING AND SAMPLING SYMBOLS

Symbol	Definition
B, H, N:	Size of flush-joint casing
CA:	Crew Assistant (initials)
CAS:	Pipe casing, number indicates nominal diameter in inches
CC:	Crew Chief (initials)
COT:	Clean-out tube
DC:	Drive casing; number indicates diameter in inches
DM:	Drilling mud or bentonite slurry
DR:	Driller (initials)
DS:	Disturbed sample from auger flights
FA:	Flight auger; number indicates outside diameter in inches
HA:	Hand auger; number indicates outside diameter
HSA:	Hollow stem auger; number indicates inside diameter in inches
LG:	Field logger (initials)
MC:	Column used to describe moisture condition of samples and for the ground water level symbols
N (BPF):	Standard penetration resistance (N-value) in blows per foot (see notes)
NQ:	NQ wireline core barrel
PQ:	PQ wireline core barrel
RD:	Rotary drilling with fluid and roller or drag bit
REC:	In split-spoon (see notes) and thin-walled tube sampling, the recovered length (in inches) of sample. In rock coring, the length of core recovered (expressed as percent of the total core run). Zero indicates no sample recovered.
REV:	Revert drilling fluid
SS:	Standard split-spoon sampler (steel; 1" is inside diameter; 2" outside diameter); unless indicated otherwise
SU	Spin-up sample from hollow stem auger
TW:	Thin-walled tube; number indicates inside diameter in inches
WASH:	Sample of material obtained by screening returning rotary drilling fluid or by which has collected inside the borehole after "falling" through drilling fluid
WH:	Sampler advanced by static weight of drill rod and 140-pound hammer
WR:	Sampler advanced by static weight of drill rod
94mm:	94 millimeter wireline core barrel
▼:	Water level directly measured in boring
▽:	Estimated water level based solely on sample appearance

TEST SYMBOLS

Symbol	Definition
CONS:	One-dimensional consolidation test
DEN:	Dry density, pcf
DST:	Direct shear test
E:	Pressuremeter Modulus, tsf
HYD:	Hydrometer analysis
LL:	Liquid Limit, %
LP:	Pressuremeter Limit Pressure, tsf
OC:	Organic Content, %
PERM:	Coefficient of permeability (K) test; F - Field; L - Laboratory
PL:	Plastic Limit, %
q _p :	Pocket Penetrometer strength, tsf (<u>approximate</u>)
q _c :	Static cone bearing pressure, tsf
q _u :	Unconfined compressive strength, psf
R:	Electrical Resistivity, ohm-cms
RQD:	Rock Quality Designation of Rock Core, in percent (aggregate length of core pieces 4" or more in length as a percent of total core run)
SA:	Sieve analysis
TRX:	Triaxial compression test
VSR:	Vane shear strength, remolded (field), psf
VSU:	Vane shear strength, undisturbed (field), psf
WC:	Water content, as percent of dry weight
%-200:	Percent of material finer than #200 sieve

STANDARD PENETRATION TEST NOTES

The standard penetration test consists of driving the sampler with a 140 pound hammer and counting the number of blows applied in each of three 6" increments of penetration. If the sampler is driven less than 18" (usually in highly resistant material), permitted in ASTM: D1586, the blows for each complete 6" increment and for each partial increment is on the boring log. For partial increments, the number of blows is shown to the nearest 0.1' below the slash.

The length of sample recovered, as shown on the "REC" column, may be greater than the distance indicated in the N column. The disparity is because the N-value is recorded below the initial 6" set (unless partial penetration defined in ASTM: D1586 is encountered) whereas the length of sample recovered is for the entire sampler drive (which may even extend more than 18").

UNIFIED SOIL CLASSIFICATION SYSTEM
ASTM Designations: D 2487, D2488

**AMERICAN
ENGINEERING
TESTING, INC.**

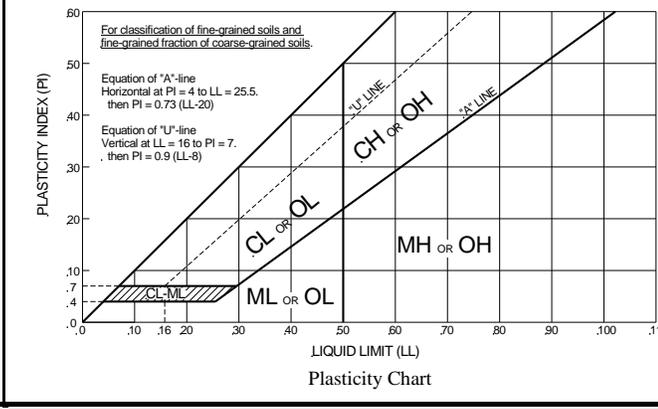
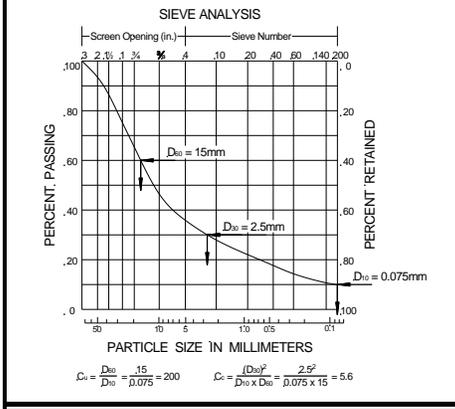


Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A				Soil Classification		
				Group Symbol	Group Name ^B	
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines ^C	$Cu \geq 4$ and $1 \leq Cc \leq 3$ ^E	GW	Well graded gravel ^F	
			$Cu < 4$ and/or $1 > Cc > 3$ ^E	GP	Poorly graded gravel ^F	
	Sands 50% or more of coarse fraction passes No. 4 sieve	Gravels with Fines more than 12% fines ^C	Fines classify as ML or MH		GM	Silty gravel ^{F,G,H}
			Fines classify as CL or CH		GC	Clayey gravel ^{F,G,H}
		Clean Sands Less than 5% fines ^D	$Cu \geq 6$ and $1 \leq Cc \leq 3$ ^E	SW	Well-graded sand ^I	
			$Cu < 6$ and/or $1 > Cc > 3$ ^E	SP	Poorly-graded sand ^I	
Fine-Grained Soils 50% or more passes the No. 200 sieve (see Plasticity Chart below)	Sils and Clays Liquid limit less than 50	inorganic	$PI > 7$ and plots on or above "A" line ^J	CL	Lean clay ^{K,L,M}	
			$PI < 4$ or plots below "A" line ^J	ML	Silt ^{K,L,M}	
		organic	Liquid limit—oven dried < 0.75 Liquid limit – not dried	OL	Organic clay ^{K,L,M,N} Organic silt ^{K,L,M,O}	
	Sils and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line	CH	Fat clay ^{K,L,M}	
			PI plots below "A" line	MH	Elastic silt ^{K,L,M}	
		organic	Liquid limit—oven dried < 0.75 Liquid limit – not dried	OH	Organic clay ^{K,L,M,P} Organic silt ^{K,L,M,Q}	
Highly organic soil		Primarily organic matter, dark in color, and organic in odor	PT	Peat ^R		

Notes
^ABased on the material passing the 3-in (75-mm) sieve.
^BIf field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
^CGravels with 5 to 12% fines require dual symbols:
 GW-GM well-graded gravel with silt
 GW-GC well-graded gravel with clay
 GP-GM poorly graded gravel with silt
 GP-GC poorly graded gravel with clay
^DSands with 5 to 12% fines require dual symbols:
 SW-SM well-graded sand with silt
 SW-SC well-graded sand with clay
 SP-SM poorly graded sand with silt
 SP-SC poorly graded sand with clay

$${}^E C_u = D_{60} / D_{10}, \quad C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

^FIf soil contains $\geq 15\%$ sand, add "with sand" to group name.
^GIf fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
^HIf fines are organic, add "with organic fines" to group name.
^IIf soil contains $\geq 15\%$ gravel, add "with gravel" to group name.
^JIf Atterberg limits plot is hatched area, soil is a CL-ML silty clay.
^KIf soil contains 15 to 29% plus No. 200 add "with sand" or "with gravel", whichever is predominant.
^LIf soil contains $\geq 30\%$ plus No. 200, predominantly sand, add "sandy" to group name.
^MIf soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name.
^N $PI \geq 4$ and plots on or above "A" line.
^O $PI < 4$ or plots below "A" line.
^P PI plots on or above "A" line.
^Q PI plots below "A" line.
^RFiber Content description shown below.

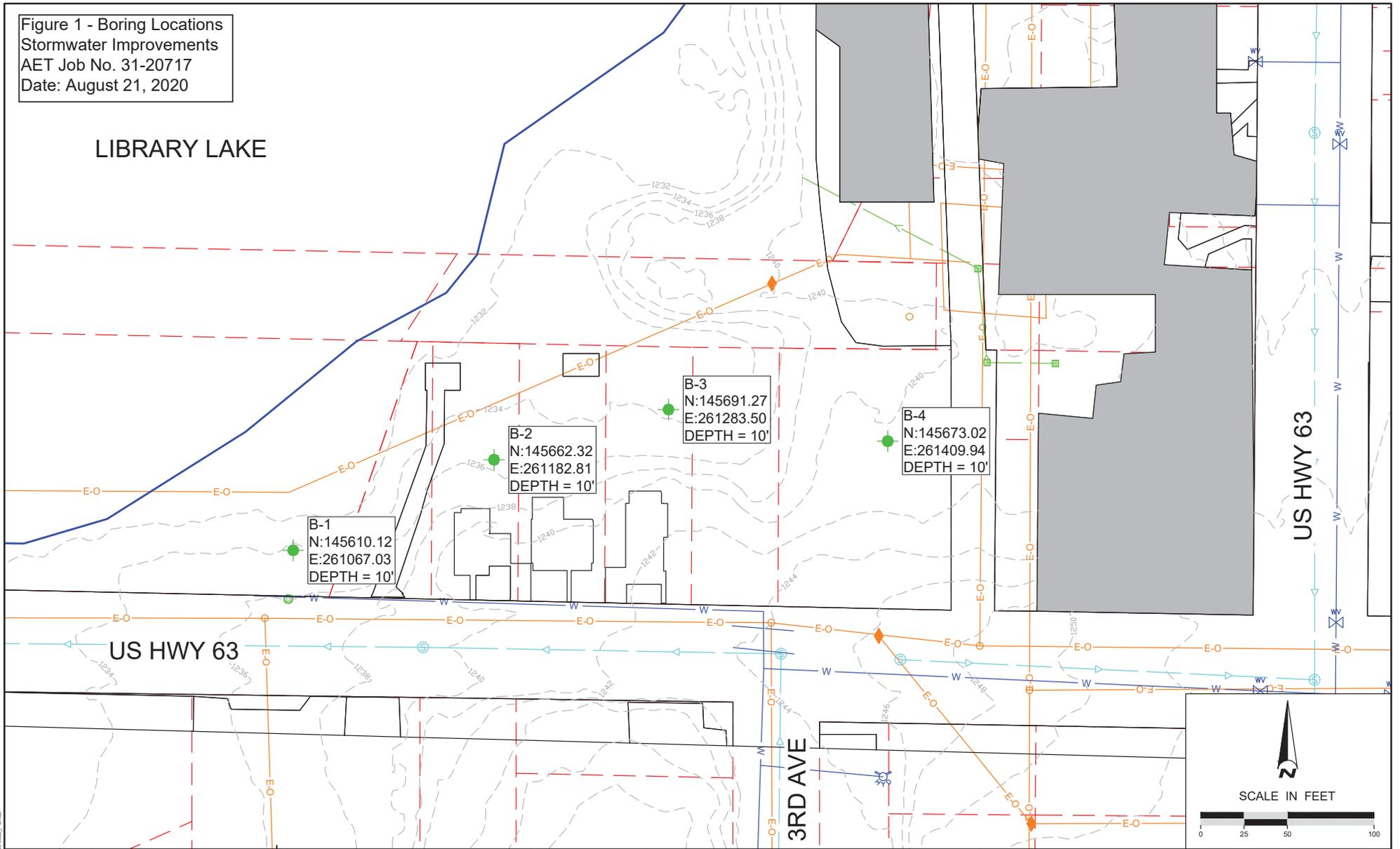


ADDITIONAL TERMINOLOGY NOTES USED BY AET FOR SOIL IDENTIFICATION AND DESCRIPTION

Grain Size		Gravel Percentages		Consistency of Plastic Soils		Relative Density of Non-Plastic Soils	
Term	Particle Size	Term	Percent	Term	N-Value, BPF	Term	N-Value, BPF
Boulders	Over 12"	A Little Gravel	3% - 14%	Very Soft	less than 2	Very Loose	0 - 4
Cobbles	3" to 12"	With Gravel	15% - 29%	Soft	2 - 4	Loose	5 - 10
Gravel	#4 sieve to 3"	Gravelly	30% - 50%	Firm	5 - 8	Medium Dense	11 - 30
Sand	#200 to #4 sieve			Stiff	9 - 15	Dense	31 - 50
Fines (silt & clay)	Pass #200 sieve			Very Stiff	16 - 30	Very Dense	Greater than 50
				Hard	Greater than 30		
Moisture/Frost Condition (MC Column)		Layering Notes		Peat Description		Organic Description (if no lab tests)	
D (Dry):	Absence of moisture, dusty, dry to touch.	Laminations: Layers less than 1/2" thick of differing material or color.		Term	Fiber Content (Visual Estimate)	Soils are described as <i>organic</i> , if soil is not peat and is judged to have sufficient organic fines content to influence the Liquid Limit properties. <i>Slightly organic</i> used for borderline cases.	
M (Moist):	Damp, although free water not visible. Soil may still have a high water content (over "optimum").					Fibric Peat: Greater than 67%	With roots: Judged to have sufficient quantity of roots to influence the soil properties.
W (Wet/Waterbearing):	Free water visible, intended to describe non-plastic soils. Waterbearing usually relates to sands and sand with silt.	Lenses: Pockets or layers greater than 1/2" thick of differing material or color.		Hemic Peat: 33 - 67%	Trace roots: Small roots present, but not judged to be in sufficient quantity to significantly affect soil properties.		
F (Frozen):	Soil frozen			Sapric Peat: Less than 33%			

Figure 1 - Boring Locations
 Stormwater Improvements
 AET Job No. 31-20717
 Date: August 21, 2020

LIBRARY LAKE



8/21/2020
 Drawing name: \\C:\Users\pfrank0009\Documents\Boring_Demo_Lake_Asc0202_1\mwy_Lake_BE_Plan\mwy00_GMS00000202_Soil_BORING.dwg
 User: pfrank0009
 Plot date: 8/21/2020 10:00:00 AM
 Plot scale: 1:1
 Plot device: HP DesignJet 2400

6			
5			
4			
3			
2			
1	07/14/2020	DEM	SOIL BORING PLAN
NO	DATE	BY	REVISION



SUBMISSION DATE:	XXXXXXXX
DESIGN BY	DEM
DRAWN BY	DEM
CHECKED BY	DRL
ECR PROJECT NO.	00909-0022

EO Emmons & Olivier
 Resources, Inc.
 1919 University Ave W
 St. Paul, MN 55104
 ecology water
 Tel: 651.770.8448
 community www.eorinc.com

BEAVER DAM LAKE
 MANAGEMENT DISTRICT
 PO BOX 232
 CUMBERLAND, WI 54829

LIBRARY LAKE SOUTHEAST
 STORMWATER IMPROVEMENTS
 CUMBERLAND, BARRON COUNTY,
 WISCONSIN

SOIL BORING PLAN
 SHEET 01 OF 01 SHEETS



SUBSURFACE BORING LOG

AET JOB NO: **31-20717**

LOG OF BORING NO. **B-1 (p. 1 of 1)**

PROJECT: **Contract Drilling - Stormwater Improvements; USH 63 / STH 48 at 3rd Avenue; Cumberland, WI**

DEPTH IN FEET	ELEV. FEET	SURFACE ELEVATION: <u>1234.5</u> MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
								WC	qp	LL	PL	%-#200
1		FILL, mixture of sand and silt with organics, dark brown, moist	FILL	3	M	SS	12					
2	1232.5											
3		SILT with organics, very dark brown, moist, very loose (OL)	FINE ALLUVIUM	WH	M	SS	16					
4	1230.5											
5	1229.5	SILT with sand and organics, very dark brown with dark gray mottling, moist, very loose, with possible lenses of peat (OL)		4	M	SS	18					
6	1228.5	SAND WITH SILT, fine to medium grained, grayish brown, moist, very loose (SP-SM)	COARSE ALLUVIUM									
7		LEAN CLAY with trace roots, gray, soft (CL)	FINE ALLUVIUM	3	M/W	SS	16					
8												
9	1225.0			5	W	SS	18					
10	1224.5	SAND WITH SILT, fine to medium grained, gray, waterbearing, loose (SP-SM) <i>End of boring at 10.0 feet</i>	COARSE ALLUVIUM									

AET_CORP-W-ELEV. 31-20717 - CUMBERLAND SW.GPJ - AET+CPT+WELL.GDT 8/21/20

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-8.0'	3.25" HSA	8/18/20	1753	10.0	8.0	7.9	None	7.6	
		8/18/20	1758	10.0	8.0	7.8	None	7.6	
BORING COMPLETED: 8/18/20									
DR: MH LG: AT Rig: 67									



SUBSURFACE BORING LOG

AET JOB NO: **31-20717**

LOG OF BORING NO. **B-2 (p. 1 of 1)**

PROJECT: **Contract Drilling - Stormwater Improvements; USH 63 / STH 48 at 3rd Avenue; Cumberland, WI**

DEPTH IN FEET	ELEV. FEET	SURFACE ELEVATION: <u>1235.8</u> MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
								WC	qp	LL	PL	%-#200
1	1234.8	SILT with sand and organics, dark brown, moist (OL)	TOPSOIL	5	M	SS	18					
2	1233.8	SILTY CLAY, brown, firm (CL-ML)	FINE ALLUVIUM									
3	1233.3	LEAN CLAY with sand, brown with yellowish brown mottling, firm (CL)										
4	1231.8	SAND, fine to medium grained, brown, moist, loose (SP)	COARSE ALLUVIUM	8	M	SS	20					
5		SAND, fine to medium grained, a little gravel, brown, moist to waterbearing, loose (SP)		7	M	SS	14					
6					▼							
7				7	W	SS	18					
8	1227.8											
9		SAND, fine to medium grained, brown, waterbearing, loose (SP)		5	W	SS	16					
10	1225.8	<i>End of boring at 10.0 feet</i>										

AET_CORP-W-ELEV. 31-20717 - CUMBERLAND SW.GPJ - AET+CPT+WELL.GDT 8/21/20

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-8.0'	3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		8/18/20	1639	10.0	8.0	8.2	None	6.1	
		8/18/20	1644	10.0	8.0	7.5	None	6.0	
BORING COMPLETED: 8/18/20									
DR: MH LG: AT Rig: 67									



SUBSURFACE BORING LOG

AET JOB NO: **31-20717**

LOG OF BORING NO. **B-3 (p. 1 of 1)**

PROJECT: **Contract Drilling - Stormwater Improvements; USH 63 / STH 48 at 3rd Avenue; Cumberland, WI**

DEPTH IN FEET	ELEV. FEET	SURFACE ELEVATION: <u>1233.9</u> MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
								WC	qp	LL	PL	%-#200
1	1232.4	SILT with organics, dark brown, moist, possible fill (OL)	TOPSOIL	2	M	SS	12					
2		LEAN CLAY, gary with brown mottling, soft to firm, possible fill (CL)	FINE ALLUVIUM									
3				5	M	SS	18					
4												
5				3	M/W	SS	18					
6	1227.9	LEAN CLAY with roots, gray with dark brown mottling, stiff, possible fill (CL)										
7	1227.4	SAND WITH SILT, fine to medium grained, brown, waterbearing, medium dense (SP-SM)	COARSE ALLUVIUM	11	W	SS	16					
8												
9				11	W	SS	18					
10	1223.9	<i>End of boring at 10.0 feet</i>										

AET_CORP-W-ELEV_31-20717 - CUMBERLAND SW.GPJ - AET+CPT+WELL.GDT 8/21/20

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-8.0'	3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		8/18/20	1712	10.0	8.0	9.6	None	6.6	
		8/18/20	1717	10.0	8.0	7.9	None	5.0	
BORING COMPLETED: 8/18/20		8/18/20	1722	10.0	8.0	7.1	None	4.9	
DR: MH LG: AT Rig: 67									



SUBSURFACE BORING LOG

AET JOB NO: **31-20717**

LOG OF BORING NO. **B-4 (p. 1 of 1)**

PROJECT: **Contract Drilling - Stormwater Improvements; USH 63 / STH 48 at 3rd Avenue; Cumberland, WI**

DEPTH IN FEET	ELEV. FEET	SURFACE ELEVATION: <u>1240.6</u> MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
								WC	qp	LL	PL	%-#200
1	1240.1	FILL, silty sand with organics, fine grained, dark brown, moist (SM) FILL, silty sand, fine to medium grained, a little gravel, brown, moist (SM)	FILL	13	M	SS	18					
2	1238.6	FILL, sand with silt, fine to medium grained, a little gravel, brown, moist (SP-SM)		13	M	SS	18					
3	1237.1	FILL, clayey sand, fine grained, a little gravel, gray with brown mottling, moist (SC)		11	M	SS	14					
4	1236.6	SILTY CLAY with organics, dark gray with slight gray mottling, soft to stiff, with lenses of sandy lean clay (CL-ML)	FINE ALLUVIUM	4	M	SS	18					
5	1234.1	LEAN CLAY, gray with brown mottling, soft to firm (CL)		5	M	SS	18					
6												
7												
8												
9												
10	1230.6	End of boring at 10.0 feet										

AET_CORP-W-ELEV. 31-20717 - CUMBERLAND SW.GPJ - AET+CPT+WELL.GDT 8/21/20

DEPTH: 0-8.0'	DRILLING METHOD: 3.25" HSA	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
		8/18/20	1605	10.0	8.0	9.9	None	None	
BORING COMPLETED: 8/18/20									
DR: MH LG: AT Rig: 67									

SOIL EVALUATION - STORM

in accordance with SPS 382.365 and 385, Wis. Adm. Code

Attach complete site plan on paper not less than 8 1/2 x 11 inches in size. Plan must include, but not limited to: vertical and horizontal reference point (BM), direction and percent slope, scale or dimensions, north arrow, and BM referenced to nearest road.

Please print all information.

Personal information you provide may be used for secondary purposes (Privacy Law, s. 15.04 (1) (m)).

County Barron	
Parcel I.D.	
Reviewed by	Date

Property Owner Emmons & Olivier Resources, Inc.				Property Location Govt. Lot SE 1/4 NW 1/4 S 07 T 35 N R 13 W E (or) W			
Property Owner's Mailing Address 1919 University Avenue West; Suite 300				Lot #	Block #	Subd. Name or CSM#	
City	State	Zip Code	Phone Number	<input checked="" type="checkbox"/> City <input type="checkbox"/> Village <input type="checkbox"/> Town		Nearest Road	
St. Paul	MN	55104	(651) 770-8448	Cumberland		USH63 / STH 48 at 3rd Ave	

Drainage area _____ <input type="checkbox"/> sq. ft. <input type="checkbox"/> acres Optional: Test Site Suitable for (check all that apply) <input type="checkbox"/> Irrigation <input type="checkbox"/> Bioretention trench <input type="checkbox"/> Trench(es) <input type="checkbox"/> Rain garden <input type="checkbox"/> Grassed swale <input type="checkbox"/> Reuse <input type="checkbox"/> Infiltration trench <input type="checkbox"/> SDS (> 15' wide) <input type="checkbox"/> Other _____	Hydraulic Application Test Method: <input checked="" type="checkbox"/> Morphological Evaluation <input type="checkbox"/> Double-Ring Infiltrometer <input type="checkbox"/> Other (specify) _____
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B-1 Obs. # Boring Ground surface elev. 1234.5 ft. Depth to limiting factor 48 in.

Pit

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate	
									Inches/Hr	
1	0-24	7.5YR 3/2	--- (FILL)	s / sil	0, sg / 0, m	m, lo	a, w	<5	3.60 / 0.13	
2	24-48	10YR 2/2	---	si	0, m	m, lo	g, w	<5	0.07	
3	48-60	10YR 2/2	C, 1-2, F, 10YR 4/1	sil	0, m	m, lo	a, w	<5	0.13	
4	60-72	10YR 4/2	---	s	0, sg	m, lo	a, w	<5	3.60	
5	72-114	10YR 4/1	---	c	0, m	m, fr	a, w	<5	0.07	
6	114-120	10YR 4/1	---	s	0, sg	m, lo	---	<5	3.60	
			GW at about 7.6'							

B-2 Obs. # Boring Ground surface elev. 1235.8 ft. Depth to limiting factor 24 in.

Pit

Horizon	Depth in.	Dominant Color Munsell	Redox Description Qu. Sz. Cont. Color	Texture	Structure Gr. Sz. Sh.	Consistence	Boundary	% Rock Frag.	Hydraulic App. Rate	
									Inches/Hr	
1	0-12	10YR 3/3	---	sil	0, m	m, fr	a, w	<5	0.13	
2	12-24	10YR 4/3	---	c	0, m	m, fr	g, w	<5	0.07	
3	24-30	10YR 4/3	C, 1-2, D, 10YR 4/6	c	0, m	m, fr	a, w	<5	0.07	
4	30-120	7.5YR 5/4	---	s	0, sg	m, lo	---	<5	3.60	
			GW at about 6.0'							

CST/PSS Name (Please Print) Blake E. Snyder	Signature 	CST/PSS Number 1323667
Address 1837 County Highway OO, Chippewa Falls WI 54729	Date Evaluation Conducted 08/18/2020	Telephone Number (715) 861-5045

