

APPENDIX I
GEOTECHNICAL REPORT

Factual Geotechnical Report:

Proposed CREP Wetland MIT971516B
NW ¼ Sec. 16-T97N-R15W
East Lincoln Twp., Mitchell Co., Iowa
CVT# 15951.19.IAM

Prepared for:

Mr. Nathan Anderson, PE
WHKS & Co.

Certification:



	<p>I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.</p> <p></p> <p>_____ (signature) April 30, 2020 (date)</p> <p>Printed or typed name: <u>Matthew J. Reisdorfer, PE.</u> License number: <u>22234</u> My license renewal date is <u>December 31, 2021</u> Pages or sheets covered by this seal:</p>
---	--

TABLE OF CONTENTS

A. Introduction	2
A.1. Purpose	2
A.2. Scope	2
A.3. Boring Locations and Elevation.....	3
A.4. Geologic Background	3
B. Subsurface Data	3
B.1. Stratification.....	3
B.2. Penetration and Laboratory Test Data	4
B.3. Groundwater Data	5
C. Level of Care	5
Appendix.....	6

Soil Boring Location Sketch

Log of Boring # 1-7

Legend to Soil Description

Chosen Valley Testing, Inc.

Geotechnical Engineering and Testing • 421 North Georgia Avenue • Mason City, IA 50401 • Telephone (641) 201-1050 • masoncity@cvtesting.com

Mr. Nathan Anderson, PE
WHKS & Co
2905 South Broadway
Rochester, MN 55904
nanderson@whks.com

April 30, 2020

**Re: Proposal for Factual Geotechnical Evaluation
CREP Wetland MIT971516B
NW ¼ Sec. 16-T97N-R15W
East Lincoln Twp., Mitchell Co., Iowa
CVT Proposal Number: 15951.19.IAM**

Dear Mr. Anderson:

This factual report was prepared to assist planning for the proposed CREP Wetland near New Haven, Iowa. Our services were authorized by Mr. Nathan Anderson of WHKS.

A. Introduction

The intent of this report is to present our results to the client in the same logical sequence that led us to arrive at the opinions and recommendations expressed. Since our services must often be completed before the design, assumptions are sometimes needed to prepare a proper evaluation and to analyze the data. A complete and thorough review of this entire document, including the assumptions and the appendices, should be undertaken immediately upon receipt.

A.1. Purpose

This factual report was prepared to assist planning for the proposed CREP Wetland near New Haven, Iowa. Our services were authorized by Mr. Nathan Anderson of WHKS.

A.2. Scope

To obtain data for analysis, our services included a total of 7 penetration test borings. The borings were drilled to depths of about 10 feet below the surface. Our engineering scope consisted of providing a factual discussion of the soils and materials encountered during our exploration.

A.3. Boring Locations and Elevation

The desired borings locations were indicated to Chosen Valley Testing on site plans provided by the client. The Boring Location Sketch in the Appendix shows the approximate locations drilled. Elevations were estimated using LiDAR from the Iowa DNR. These elevations should be considered approximate.

A.4. Geologic Background

A geotechnical report is based on subsurface data collected for the specific structure or problem. Available geologic data from the region can help interpretation of the data and is briefly summarized in this section.

Area geologic maps indicate that the natural upper soils are primarily glacial outwash sands and gravels and glacial till deposits of clay, silt and sand mixtures. Bedrock is expected to be 100 to 150 feet below the surface and consist of dolomite and limestone of the Cedar Valley Group.

B. Subsurface Data

Methods: All of the borings were performed using penetration test procedures (Method of Test D1586 of the American Society for Testing and Materials). This procedure allows for the extraction of intact soil specimen from deep in the ground. With this method, a hollow-stem auger is drilled to the desired sampling depth. A 2-inch OD sampling tube is then screwed onto the end of a sampling rod, inserted through the hole in the auger's tip, and then driven into the soil with a 140-pound hammer dropped repeatedly from a height of 30 inches above the sampling rod. The sampler is driven 18-inches into the soil, unless the material is too hard. The samples are generally taken at 2½ to 5-foot intervals. The core of soil obtained is classified and logged by the driller and a representative portion is then sealed in a jar and delivered to the soils engineer for review.

B.1. Stratification

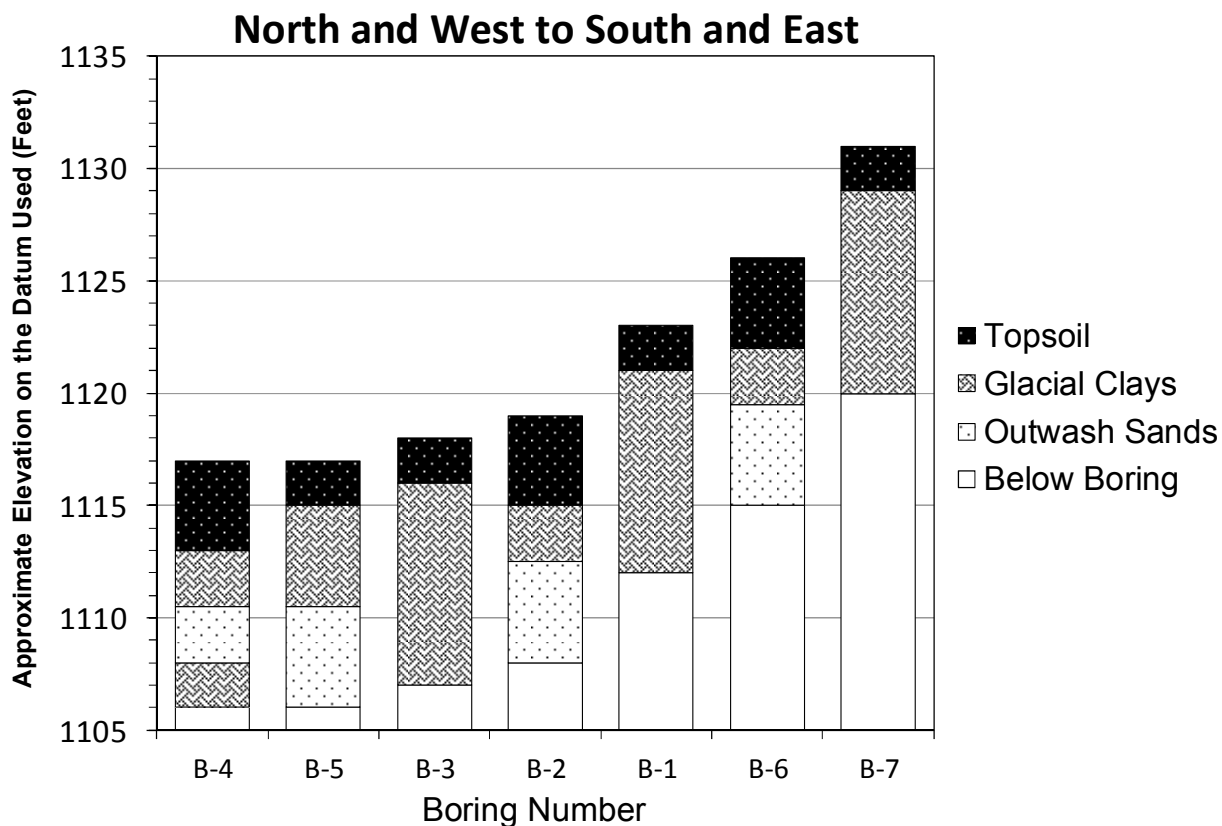
At the surface, the borings encountered about 2 to 4 feet of slightly organic lean clay topsoil.

Glacial till consisting mostly of lean clay with sand followed the topsoil in all of the borings, to depths of about 6 ½ to 11 feet.

Glacial outwash sands followed the glacial clay in Borings B-2 and B-4 through B-6, to depths of about 9 to 11 feet. Glacial clay was met below the sand in Boring B-4.

Borings B-2, B-5 and B-6 terminated in sands at depths of about 11 feet below the surface. The remaining borings terminated in glacial clays at depths of about 11 feet below the surface.

The following simplified cross-section summarizes the boring data. For more detailed information, please refer to the Log of Boring sheets in the Appendix.



B.2. Penetration and Laboratory Test Data

The number of blows needed for the hammer to advance the penetration test sampler is an indicator of soil characteristics. The number of blows to advance the sampler 1 foot is called the penetration resistance or “N”-value. The results tend to be more meaningful for natural mineral soils, than for fill soils. In fill soils, compaction tests are more meaningful.

Penetrations resistance values (“N” Values) of 2 to 15 blows per foot (BPF) were recorded in the topsoil and glacial clay, indicating they were soft to stiff, but were generally rather soft to medium. N-Values of 4 to 10 BPF were recorded in the sand, indicating they were very loose.

A key to the descriptors used to qualify the relative density of soil (such as *soft*, *stiff*, *loose*, and *dense*,) can be found on the Legend to Soil Description in the Appendix.

A pocket penetrometer was used to provide additional data on the compressive strength of cohesive soils. The clays returned values of ½ to 3 tons per square foot (tsf).

B.3. Groundwater Data

During the drilling operation, the drillers may note the presence of moisture on the sampling instrument, in the cuttings, or within the borehole. These observations are recorded on the boring logs. The water level may vary with weather; time of year and other factors and the presence or absence of water during the drilling is subject to interpretation and is not always conclusive.

Water was encountered in most of the borings during drilling, at depths of about 7 to 9 feet below the surface. Elevated moisture contents were noted in several of the clay samples. Groundwater levels at the site are expected to fluctuate seasonally with nearby creeks and rivers, as well as with local weather patterns.

C. Level of Care

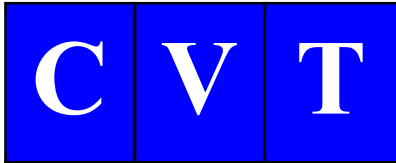
The services provided for this project have been conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in this area, under similar budget and time constraints. This is our professional responsibility. No other warranty, expressed or implied, is made.

Appendix

Soil Boring Location Sketch


Log of Boring 1-7

Legend to Soil Description



Chosen Valley Testing, Inc.

Legend

 Boring Locations

 Benchmark

N



Soil Boring Location Sketch

Proposed CREP Wetland MIT971516B

NW ¼ Sec. 16-T97N-R15W

East Lincoln Twp., Mitchell Co., Iowa

15951.19.IAM



LOG OF BORING

CHOSEN VALLEY TESTING



PROJECT: 15951.19.IAM Design Phase Geotechnical Evaluation CREP Wetland MIT971516B NW 1/4 Sec. 16 - T97N - R15W East Lincoln Twp., Mitchell Co., Iowa	BORING: B-1	
	LOCATION: See attached sketch	
	DATE: 4/20/2020	SCALE: 1" = 2'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
1123.0	0.0	CL OL	Slightly Organic LEAN CLAY black. (Topsoil)			Elevations estimated using Iowa DNR LiDAR.
1121.0	2.0	CL	LEAN CLAY with SAND trace gravel, brown, wet, rather soft to rather stiff. (Glacial Till)	5		PP = 0.75 tsf, MC = 21.2%
				5		PP = 0.75 tsf
			Seams of sand below 6.5'. Dark gray below 6.5'.			
			Water encountered around 7.5'.		▽	PP = 0.75 tsf
				8		
				11		PP = 0.5 tsf, MC = 25.8%
1112.0	11.0		End of boring. Water encountered during drilling around 7.5'. Boring sealed upon completion.			

CVT STANDARD 15951.19.IAM (MITCHELL COUNTY WETLAND).GP.J LOG A.GNNIN06.GDT 4/30/20

LOG OF BORING

CHOSEN VALLEY TESTING



PROJECT: 15951.19.IAM Design Phase Geotechnical Evaluation CREP Wetland MIT971516B NW 1/4 Sec. 16 - T97N - R15W East Lincoln Twp., Mitchell Co., Iowa	BORING: B-2	
	LOCATION: See attached sketch	
	DATE: 4/20/2020	SCALE: 1" = 2'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
1119.0	0.0	CL OL	Slightly Organic LEAN CLAY trace gravel, black, wet, rather soft. (Topsoil)			Elevations estimated using Iowa DNR LiDAR.
				4		PP = 1.5 tsf, MC = 25.9%
1115.0	4.0	CL	LEAN CLAY with SAND trace gravel, brown, wet, medium. (Glacial Till)			PP = 0.5 tsf, MC = 22.4%
				7		
1112.5	6.5	SP	POORLY GRADED SAND trace gravel, medium to coarse grained, brown, wet to water bearing, loose. (Glacial Outwash) Water bearing below 7'. Seams of lean clay below 9'.		▽	
				7		
				9		
1108.0	11.0		End of boring. Water encountered during drilling below around 7'. Boring sealed upon completion.			

CVT STANDARD 15951.19.IAM (MITCHELL COUNTY WETLAND).GP.J LOG A GNNIN06.GDT 4/30/20

LOG OF BORING

CHOSEN VALLEY TESTING



PROJECT: 15951.19.IAM Design Phase Geotechnical Evaluation CREP Wetland MIT971516B NW 1/4 Sec. 16 - T97N - R15W East Lincoln Twp., Mitchell Co., Iowa	BORING: B-3	
	LOCATION: See attached sketch	
	DATE: 4/20/2020	SCALE: 1" = 2'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
1118.0	0.0	CL OL	Slightly Organic LEAN CLAY black. (Topsoil)			Elevations estimated using Iowa DNR LiDAR.
1116.0	2.0	CL	LEAN CLAY with SAND trace gravel, brown, wet, soft to rather stiff. (Glacial Till)	2		PP = 1.5 tsf, MC = 19.4%
				4		Poor sample return.
			Dark gray below 6.5'.	9		PP = 2.0 tsf, MC = 21.0%
			Water encountered around 9'.		▽	
				11		PP = 1.0 tsf
1107.0	11.0		End of boring. Water encountered during drilling around 9'. Boring sealed upon completion.			

CVT STANDARD 15951.19.IAM (MITCHELL COUNTY WETLAND).GPJ LOG A GNNIN06.GDT 4/30/20

LOG OF BORING

CHOSEN VALLEY TESTING



PROJECT: 15951.19.IAM Design Phase Geotechnical Evaluation CREP Wetland MIT971516B NW 1/4 Sec. 16 - T97N - R15W East Lincoln Twp., Mitchell Co., Iowa	BORING: B-4	
	LOCATION: See attached sketch	
	DATE: 4/20/2020	SCALE: 1" = 2'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
1117.0	0.0	CL OL	Slightly Organic LEAN CLAY black. (Topsoil)			Elevations estimated using Iowa DNR LiDAR.
				2		PP = 2.0 sf, MC = 30.2%
1113.0	4.0	CL	LEAN CLAY with SAND seams of sand, brown, wet, rather soft. (Glacial Till)	5		
1110.5	6.5	SP SM	POORLY GRADED SAND with SILT fine to medium grained, brown, wet to water bearing, loose. (Glacial Outwash) Water bearing below 7.5'.	6	▽	
1108.0	9.0	CL	LEAN CLAY with SAND trace gravel, dark gray, wet, rather stiff. (Glacial Till)	11		PP = 1.75 tsf, MC = 21.4%
1106.0	11.0		End of boring. Water encountered during drilling around 7.5'. Boring sealed upon completion.			

CVT STANDARD 15951.19.IAM (MITCHELL COUNTY WETLAND).GP.J LOG A GNNIN06.GDT 4/30/20

LOG OF BORING

CHOSEN VALLEY TESTING



PROJECT: 15951.19.IAM Design Phase Geotechnical Evaluation CREP Wetland MIT971516B NW 1/4 Sec. 16 - T97N - R15W East Lincoln Twp., Mitchell Co., Iowa	BORING: B-5	
	LOCATION: See attached sketch	
	DATE: 4/20/2020	SCALE: 1" = 2'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
1117.0	0.0	CL OL	Slightly Organic LEAN CLAY black. (Topsoil)			Elevations estimated using Iowa DNR LiDAR.
1115.0	2.0	CL	LEAN CLAY with SAND brown, wet, soft to rather soft. (Glacial Till)	2		Poor sample return.
				4		Poor sample return.
1110.5	6.5	SP SM	POORLY GRADED SAND with SILT fine to medium grained, brown, wet to water bearing, loose. (Glacial Outwash) Water bearing below 7'. Medium to coarse grained below 9'. Seams of lean clay below 9'.	4	▽	
1106.0	11.0		End of boring. Water encountered during drilling below around 7'. Boring sealed upon completion.	9		

CVT STANDARD 15951.19.IAM (MITCHELL COUNTY WETLAND).GP.J LOG A GNNIN06.GDT 4/30/20

LOG OF BORING

CHOSEN VALLEY TESTING



PROJECT: 15951.19.IAM Design Phase Geotechnical Evaluation CREP Wetland MIT971516B NW 1/4 Sec. 16 - T97N - R15W East Lincoln Twp., Mitchell Co., Iowa	BORING: B-6	
	LOCATION: See attached sketch	
	DATE: 4/20/2020	SCALE: 1" = 2'

Elev. 1123.0	Depth 0.0	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
		CL OL	Slightly Organic LEAN CLAY black, wet, soft. (Topsoil)			Elevations estimated using Iowa DNR LiDAR.
				3		PP = 1.75 tsf, MC = 35.1%
1119.0	4.0	CL	LEAN CLAY with SAND trace gravel, brown, wet, rather soft. (Glacial Till)			PP = 2.0 tsf, MC = 20.3%
				5		
1116.5	6.5	SP SM	POORLY GRADED SAND with SILT fine to medium grained, brown, wet to water bearing, loose to medium dense. (Glacial Outwash)			
				6	▽	
						Water bearing below 8'.
				10		
1112.0	11.0		End of boring. Water encountered during drilling below around 8'. Boring sealed upon completion.			

CVT STANDARD 15951.19.IAM (MITCHELL COUNTY WETLAND).GP.J LOG A.GNIN06.GDT 4/30/20

LOG OF BORING

CHOSEN VALLEY TESTING


















PROJECT: 15951.19.IAM Design Phase Geotechnical Evaluation CREP Wetland MIT971516B NW 1/4 Sec. 16 - T97N - R15W East Lincoln Twp., Mitchell Co., Iowa	BORING: B-7	
	LOCATION: See attached sketch	
	DATE: 4/20/2020	SCALE: 1" = 2'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
1131.0	0.0	CL OL	<u>Slightly Organic LEAN CLAY</u> black. (Topsoil)			Elevations estimated using Iowa DNR LiDAR.
1129.0	2.0	CL	<u>LEAN CLAY with SAND</u> trace gravel, brown, wet, rather soft to stiff. (Glacial Till)	5		PP = 1.5 tsf, MC = 20.2%
			Dark gray below 6.5'.	9		PP = 1.75 tsf
				9		PP = 2.0 tsf, MC = 20.0%
				15		PP = 3.0 tsf
1120.0	11.0		End of boring. Boring sealed upon completion.			



CVT STANDARD 15951.19.IAM (MITCHELL COUNTY WETLAND).GP.J LOG A GNNIN06.GDT 4/30/20

UNIFIED SOIL CLASSIFICATION (ASTM D-2487/2488)

MATERIAL TYPES	CRITERIA FOR ASSIGNING SOIL GROUP NAMES			GROUP SYMBOL	SOIL GROUP NAMES & LEGEND	
COARSE-GRAINED SOILS >50% RETAINED ON NO. 200 SIEVE	GRAVELS >50% OF COARSE FRACTION RETAINED ON NO 4. SIEVE	CLEAN GRAVELS <5% FINES	$Cu > 4$ AND $1 < Cc < 3$	GW	WELL-GRADED GRAVEL	
		GRAVELS WITH FINES >12% FINES	$Cu > 4$ AND $1 > Cc > 3$	GP	POORLY-GRADED GRAVEL	
		FINES CLASSIFY AS ML OR CL		GM	SILTY GRAVEL	
		FINES CLASSIFY AS CL OR CH		GC	CLAYEY GRAVEL	
	SANDS >50% OF COARSE FRACTION PASSES ON NO 4. SIEVE	CLEAN SANDS <5% FINES	$Cu > 6$ AND $1 < Cc < 3$	SW	WELL-GRADED SAND	
		SANDS AND FINES >12% FINES	$Cu > 6$ AND $1 > Cc > 3$	SP	POORLY-GRADED SAND	
		FINES CLASSIFY AS ML OR CL		SM	SILTY SAND	
		FINES CLASSIFY AS CL OR CH		SC	CLAYEY SAND	
FINE-GRAINED SOILS >50% PASSES NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT < 50	INORGANIC	$PI > 7$ AND PLOTS > "A" LINE	CL	LEAN CLAY	
		INORGANIC	$PI > 4$ AND PLOTS < "A" LINE	ML	SILT	
		ORGANIC	LL (oven dried)/ LL (not dried) < 0.75	OL	ORGANIC CLAY OR SILT	
	SILTS AND CLAYS LIQUID LIMIT > 50	INORGANIC	PI PLOTS > "A" LINE	CH	FAT CLAY	
		INORGANIC	PI PLOTS < "A" LINE	MH	ELASTIC SILT	
		ORGANIC	LL (oven dried)/ LL (not dried) < 0.75	OH	ORGANIC CLAY OR SILT	
HIGHLY ORGANIC SOILS		PRIMARILY ORGANIC MATTER, DARK IN COLOR, AND ORGANIC ODOR		PT	PEAT	


Relative Proportions of Sand and Gravel	
TERM	PERCENT
Trace	< 15
With	15 - 29
Modifier	> 30
Relative Proportions of Fines	
TERM	PERCENT
Trace	< 5
With	5 - 12
Modifier	> 12
Grain Size Terminology	
TERM	SIZE
Boulder	< 12 in.
Cobble	3 in. - 12 in.
Gravel	#4 sieve to 3 in.
Sand	#200 sieve to #4 sieve
Silt or Clay	Passing #200 sieve

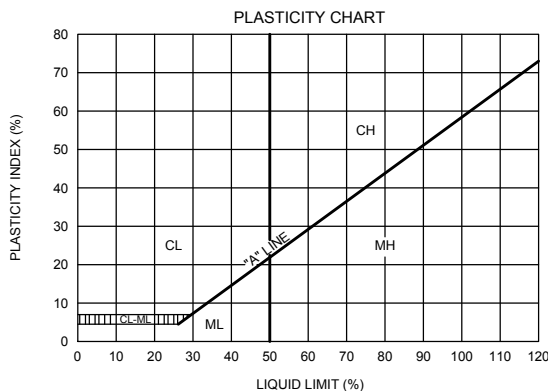
SAMPLE TYPES

-  Hollow Stem
-  Standard Penetration Test

TEST SYMBOLS

- | | |
|-----------------------------|--|
| MC - MOISTURE CONTENT | LL - LIQUID LIMIT |
| OC - ORGANIC CONTENT | PI - PLASTISITY INDEX |
| CN - CONSOLIDATION | SW - SWELL TEST |
| DD - DRY DENSITY | UU - Unconsolidated Undrained triaxial |
| PP - POCKET PENETROMETER | |
| RV - R-VALUE | |
| SA - SIEVE ANALYSIS | |
| P200 - % PASSING #200 SIEVE | |

-  WATER LEVEL (WITH TIME OF) MEASUREMENT



PENETRATION RESISTANCE (RECORDED AS BLOWS / 0.5 FT)				
SAND & GRAVEL		SILT & CLAY		
RELATIVE DENSITY	BLOWS/FOOT*	CONSISTENCY	BLOWS/FOOT*	COMPRESSIVE STRENGTH (TSF)
VERY LOOSE	0 - 4	VERY SOFT	0 - 1	0 - 0.25
LOOSE	4 - 10	SOFT	2 - 3	0.25 - 0.50
MEDIUM DENSE	10 - 30	RATHER SOFT	4 - 5	0.50 - 1.0
DENSE	30 - 50	MEDIUM	6 - 8	1.0 - 2.0
VERY DENSE	OVER 50	RATHER STIFF	9 - 12	1.0 - 2.0
		STIFF	13 - 16	2.0 - 4.0
		VERY STIFF	17 - 30	2.0 - 4.0
		HARD	OVER 30	OVER 4.0

* NUMBER OF BLOWS OF 140 LB HAMMER FALLING 30 INCHES TO DRIVE A 2 INCH O.D. (1-3/8 INCH I.D.) SPLIT-BARREL SAMPLER THE LAST 12 INCHES OF AN 18-INCH DRIVE (ASTM-1586 STANDARD PENETRATION TEST).

CVT- 15951.19.IAM (MITCHELL COUNTY WETLAND).GPJ 4/30/20

Chosen Valley Testing

Job No. 15951.19.IAM

LEGEND TO SOIL DESCRIPTIONS

