NUMMELIN TESTING SERVICES, INC.
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September 17, 2019

Westbrook Associated Engineers
619 E Hoxie Street, PO Box 429
Spring Green, WI 53588

NTS Project No. 17648_SBR

Attention: **Aaron Palmer, PE**
apalmer@westbrookeng.com

Subject: **Subsurface Soil Investigation Report**
Great Sauk Trail – Walking Iron Trail Recreational Bridge
(Wisconsin River Crossing)
Water Street, Sauk City, WI

As requested, Nummelin Testing Services, Inc. has conducted a Geotechnical Engineering Subsurface Exploration and Report for the above-named project. We enclose our report "Subsurface Soil Investigation, Great Sauk Trail – Walking Iron Trail Recreational Bridge (Wisconsin River Crossing), Water Street, Sauk City, WI – NTS 176.48" which discusses our conclusions and recommendations.

If additional information or clarification is needed, or if we may be of further service during the construction phase of the project, please do not hesitate to contact our office.

The soil samples will be discarded after November 1, 2019.

Respectfully,

Benjamin K. Nummelin, P.E.
Nummelin Testing Services, Inc.

Matthew B. Williams, EIT
Nummelin Testing Services, Inc.

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location map (1)
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abandonment form (1)
scour gradation results (1)

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SUBSURFACE SOIL INVESTIGATION

GREAT SAUK TRAIL – WALKING IRON TRAIL
RECREATIONAL BRIDGE
(WISCONSIN RIVER CROSSING)
WATER STREET, SAUK CITY
WISCONSIN

NTS 176.48

PREPARED FOR:

WESTBROOK ASSOCIATED ENGINEERS, INC
619 E HOXIE ST, PO BOX 429
SPRING GREEN, WI 53588

ATTENTION: AARON PALMER, PE

FIELD INVESTIGATION BY:

NUMMELIN TESTING SERVICES, INC.
STEVENS POINT/WAUNAKEE, WI

SEPTEMBER 17, 2019

SUBSURFACE SOIL INVESTIGATION

GREAT SAUK TRAIL – WALKING IRON TRAIL
RECREATIONAL BRIDGE
(WISCONSIN RIVER CROSSING)
WATER STREET, SAUK CITY
WISCONSIN

1. INTRODUCTION

Nummelin Testing Services, Inc. (NTS) performed this investigation to provide design information for the new recreational bridge over the Wisconsin River that will span from the Great Sauk Trail on Water Street in Sauk City, Sauk County, Wisconsin to the Walking Iron Trail in the Town of Mazomanie, Dane County, Wisconsin. The results and recommendations reported are based upon information obtained during a field investigation with a soil boring, and the geotechnical analysis of that information.

The conclusions and recommendations reported are based on our interpretation of available subsurface and project information. The report may not represent variations that occur away from the boring location.

Should the scope of this project be altered, or if subsurface variations become evident during construction, it may be necessary to modify our recommendations. See the attached Geotechnical Engineering Report Information Sheet for general information on NTS's geotechnical reports.

2. PROJECT DESCRIPTION

The proposed project is the construction of a new bridge that will span the Wisconsin River and connect the Great Sauk Tail in Sauk County to the Walking Iron Trail. The bridge is expected to be approximately 500 feet long and be used for pedestrian, bicycle, and snowmobile traffic. The original bridge in this location was a freight railroad bridge that was demolished in 2018. The new bridge is expected to be supported by deep foundations consisting of driven piling, or possibly drilled shafts. The foundations are expected to support freight rail traffic loading as additional piers may be constructed in the future if the freight rail is restored. Pavement approaches are expected to be constructed on the east and west sides of the bridge.

At the time of the investigation, the site was located near the proposed west abutment in the shoulder of the road on the east side of Water Street, just north of the original railroad bridge.

3. FIELD INVESTIGATION

One standard penetration boring (Boring 1) was performed on September 6, 2019, at the location shown on the attached map. Westbrook Associated Engineers, Inc determined the proposed boring location and depth, and located the boring in the field. NTS moved the boring roughly 45 feet northeast of the proposed location to avoid traffic and to be outside of the railroad right-of-way. The boring was drilled to the scheduled depth of 80 feet. At the first drilling location, the lead auger was damaged while drilling through a significant amount of cobbles and rubble, leaving a part of the auger in the ground at a depth of 17 feet. The drilling crew then moved 4 feet to the northeast and blind-drilled to 18.5 feet, where sampling continued to the proposed depth of 80 feet and the boring was ended.

Representative soil samples were obtained during boring using the Standard Penetration Test (SPT) method according to ASTM Test Procedure D1586 at the depths indicated on the boring log. Drilling between samples was by the hollow-stem-auger technique to a depth of 35 feet, then by the mud-rotary technique to 80 feet. The soils were visually/manually classified by a technician at the time the borings were performed. Soil samples taken from the site have also been examined in the laboratory by the authors for verification of descriptions which appear on the logs and to classify the soils according to the USCS and AASHTO classification systems. A mechanical sieve analysis was performed on Sample 9 to determine scour parameters. No other lab testing has been performed.

The ground elevation at the boring location was determined by NTS. The manhole located on the west side of Water Street, roughly 40 feet south of the Great Sauk Trail, was used as a benchmark. An elevation of 200.0 was chosen for this benchmark.

An automatic-trip hammer that is assumed to have an efficiency rating of 80 percent was used to drive the split-spoon sampler. However, the program used by NTS called ‘Driven,’ which uses LRFD acceptable methods to estimate pile skin friction and end bearing, is based on standard penetration values obtained with a 60 percent efficient hammer. To estimate pile skin friction and end bearing resistances for the bridge, the automatic-trip hammer penetration values (N_{80}) have been corrected to the standard 60 percent efficiency (N_{60}) values. These N_{60} standard penetration values are shown on the boring log.

After completion of the boring, the boring was backfilled with bentonite chips to comply with Wisconsin DNR requirements, then topped off with auger cuttings.

Copies of the soil boring log, location map, and gradation test are appended to this report.

4. SUBSURFACE CONDITIONS

4. 1. Area Geology

The subsoils in this area are mapped as glacial outwash deposits, which typically consist of stratified sand and/or stratified sand with gravel. The underlying bedrock is mapped as sandstone with some dolomite and shale that is present at depths greater than 150 feet below the average surface terrain. The online NRCS web soil survey maps the near-surface soils around the west abutment as Dakota loam, and wet Alluvial land and Kickapoo fine sandy loam on the east side of the Wisconsin River near the expected location of the east abutment.

Note that mapped soil and bedrock conditions are provided for supplemental information only. Designs based only on mapped or assumed conditions are not recommended.

4. 2. Soils at the Boring Locations

A summary of soil conditions encountered in the borings is shown in Table 4.2.

Table 4.2. Summary of soil conditions encountered in the borings.

Boring	*Surface Elevation*	*Water Depth*	*Base Course*	*Loose to Med. Dense Sand (Fill)*	*Med. Dense Silty Sand (Possible Fill)*	*Medium Dense to Dense Sand (Native)*
1 (W Abut)	199.7	23.5’	16.0”	1.3’- 19’⁑	19’- 27.5’‡	27.5’- 80’*

⁑Cobbles and concrete rubble in this depth range.
‡Organic odor in this depth range.
*Dense below 32 feet. Cobble encountered at 79 feet.

At the surface, the boring found 16 inches of brown sand and gravel with little silt (base course). Below the base course, fill was found to a depth of 19 feet that consisted of loose silty sand with trace gravel in the top 3.5 feet, and medium dense sand with some gravel, little silt, and cobbles/concrete rubble from 3.5 to 19 feet. Hard drilling occurred from 3.5 to 19 feet and sampler refusal occurred at 13.5 feet, likely on a cobble or concrete rubble. Below the fill, possible fill was found to a depth of 27.5 feet that primarily consisted of medium dense silty sand with little gravel that was saturated and had an organic odor. Below the possible fill, poorly-graded native sand was found to the terminal boring depth of 80 feet, which was medium-dense from 27.5 to 32 feet and dense below 32 feet. A cobble was encountered in the native sand at a depth of 79 feet.

See individual boring logs for more detailed soil descriptions.

4. 3. Water Level and Creek Bed Measurements

Groundwater was encountered at a depth of 23.5 feet in the boring. This water level should be considered as representative of site conditions at the time of boring only. Expect seasonal fluctuations in the water table of more than several feet, and that the groundwater table elevation will roughly follow that of the water elevation in the Wisconsin River.

5. DISCUSSION AND RECOMMENDATIONS

5. 1. General

Considering the bridge spans a river, a driven pile foundation is expected to be the foundation type of choice for support of the new bridge. However, we understand that drilled shafts are also being considered. The native sand explored to an 80-foot depth is expected to provide some support for Cast-in-Place (CIP) piling and drilled shafts but little support for H piling.

Should 10.75-inch CIP piles be used, a CIP pile shell thickness of at least 0.365 inches is recommended to avoid overstressing the piles during driving. Cobbles and concrete rubble were encountered in the existing fill, which may damage the piles during driving. It is recommended that the designer consider removing the existing fill prior to foundation construction. If the piles are driven through the existing fill, pile points are recommended on the ends of the piles to help protect the piles and to allow the piles to be driven in straighter alignments when driving through the rubble.

Silty sand occurred in the frost zone at the boring location, and this lean clay is a poor soil type for pavement support because of its high frost susceptibility.

See below for further recommendations.

5. 2. Driven Piles

Driven CIP piles are expected to be the foundation type of choice for bridge support at the site, and it is expected that 10.75-inch CIP piles will be the most economical pile size to support the new bridge. For maximum structural capacity, 10.75-inch CIP piles with a shell thickness of 0.365 inches should be driven to a nominal axial resistance of 150 tons using the FHWA modified Gates dynamic formula. However, this driving resistance is not expected to occur within the explored depth of 80 feet. At the location of Boring 1 (West Abutment), a driving resistance of 140 tons for 10.75-inch is expected to occur when the piles are driven to the maximum explored depth of 80 feet (elevation 119.7).

Relatively little driving resistance and axial capacity are expected to occur within the explored depth of 80 feet, and it is expected that H piling will not be cost efficient at this site.

Unit skin friction and end bearing values shown in Table 5.2 may be used to estimate pile penetrations for 10.75-inch CIP piles driven to other resistances. Skin friction and end bearing values shown in Table

5.2 were estimated using the Nordlund method presented in the 4th edition of the AASHTO LRFD Bridge Design Specifications. The estimations were made with the aid of the FHWA computer software program 'Driven'. Note that unit skin friction of CIP piles in cohesionless soils increases with pile diameter. Piles of larger diameter will experience significantly larger skin friction in cohesionless soils, and shorter pile penetrations may occur.

Table 5.2. Soil Parameters, Skin Frictions, and End Bearings for Pile Design.

WEST ABUTMENT (Boring 1)

Soil Description	*Friction Angle (Deg)*	*Cohesion (psf)*	*Unit Weight (pcf)*	*Nominal Skin Friction† (psf)*	*Nominal End Bearing† (psf)*
SAND (Fill) (Elevation 199.7 to 180.7)	0	0	125	180	Low
SAND, Med. Dense (Water @ El 176.2) (Elevation 180.7 to 167.7)	31	0	125	400	19,000
SAND, Med. Dense / Dense (Elevation 167.7 to 119.7)	35	0	130	1,360	89,000 - 115,000‡

†Skin friction and end bearing values are nominal (ultimate) values and have not been modified by a resistance factor.
‡End bearing increases linearly with depth in this range.

5. 3. Pile Drivability

Drivability evaluations were performed for a 10.75-inch CIP pile for maximum axial capacity at the boring location using a Delmag D-16-32 diesel hammer. Evaluation results indicate that a shell thickness of at least 0.365 inches will be needed for 10.75-inch CIP piling driven at this site to avoid exceeding the 35 ksi compressive stress limit during driving. Should CIP piles be driven through the existing fill with rubble, pile points are recommended on the ends of the piles to help protect the piles and to allow the piles to be driven in straighter alignments when driving through the rubble.

5. 4. Drilled Shafts

Drilled shafts may be considered for bridge support as an alternative to driven piling. The recommended minimum drilled shaft diameter is 2.5 feet.

5. 4. 1. Drilled Shaft Axial Capacity

Considering the 2.5-foot minimum drilled shaft diameter, the factored (or allowable) unit skin friction and end bearing values in kips per square foot (ksf) of soils encountered by the boring shown in Table 5.4.1 may be used in design of drilled reinforced concrete shafts. The skin frictions in the table may be used for both bearing resistance and uplift calculations.

It is recommended that skin friction contributions and end bearing of the fill soils in the top 19 feet be neglected in the design, as shown in Table 5.4.1, and skin frictions of native soils were calculated assuming the sand fill in the top 19 feet may not provide any significant contribution to overburden pressure. In addition, it is recommended that skin friction contributions of soils within the frost zone and scour zone also be neglected. According to the Wisconsin Administrative Code, this site is in Zone ‘B’, where the mapped frost protection depth in the soil type at the site is approximately 5 feet. Be aware that frost can occur to depths significantly deeper than 5 feet in areas where snow cover is frequently removed and/or traffic occurs, such as below roadways.

Table 5.4.1. Factored Unit Skin Friction & End Bearing Values for Drilled Shaft Design.

Material Type	**Depth Found in the Boring**	**Factored Unit Skin Friction***	**Factored Unit End Bearing****
Sand Fill	0’- 19’	Little	Little
Medium Dense Sand (submerged)	19’- 32’	200 psf	4,000 psf
Dense Sand (submerged)	32’- 80’	600 psf	12,000 psf

*Unit skin friction was estimated using the Beta Method, and includes the corresponding resistance factor of 0.55.
**Unit end bearing of the sand was estimated using the O’Neill & Reese Method (1999), and includes the corresponding resistance factor of 0.5.

To consider skin friction as a resistance, the shaft concrete must be cast-in-place and be allowed to adequately bond to the sidewalls of the drilled shaft. If the concrete cannot bond with the sidewalls of the shaft, such as if the shaft walls are underwater, if the shaft is cased, or other reason, consider the skin friction to be zero. To consider the end bearing as a resistance, the base of the drilled shaft must be inspected prior to concrete placement to verify it is clean and free of loose soil and/or rubble.

Using the recommendations in this report, settlement of the drilled shaft is not expected to exceed one inch. If the drilled shaft diameter will exceed about 5 feet, the recommended skin frictions and end bearings shown in Table 5.4.1 will need to be reduced to limit settlement. Contact the writers if a drilled shaft diameter larger than 5 feet will be used.

For uplift resistance of the drilled shaft, the uplift resistance should be taken as the lesser of two quantities. The first quantity is the sum of the total soil skin friction along the shaft. The second quantity is the weight of the soil within an inverted cone with tip at the base of the shaft. The angle of the sides of this cone should be considered as 20 degrees from the vertical. If soils around the shaft may be saturated, even temporarily, consider using the submerged unit weight of the soil in this calculation. Refer to Table 5.4.2 of this report for unit weights of soils at the site.

At the time of the investigation, the water table occurred at a depth of 23.5 feet and the native sands were saturated. Installation of the drilled shaft will likely take place below the water table, which may make installation and inspection of the drilled shaft difficult. Belled shafts are not recommended given all soils encountered were cohesionless.

To verify capacity of the drilled shaft, at least one static load test is recommended in the field after installation.

5. 4. 2. Drilled Shaft Lateral Capacity

For estimation of drilled shaft lateral capacity with a program such as L-Pile, the data shown in Table 5.4.2 may be used, including effective unit weight in pounds per cubic foot (pcf), internal angle of friction in degrees (deg), and lateral soil modulus ‘k’ in pounds per cubic inch (pci).

Table 5.4.2. Soil Parameters for Lateral Drilled Shaft Capacity.

Material Type	Depth Found in the Boring	Effective Unit Weight	Internal Angle of Friction	Lateral Soil Modulus ‘k’
Sand Fill	0’- 19’	120 pcf	30 deg	25 pci
Med Dense Sand (Submerged)	19’- 32’	65 pcf	31 deg	60 pci
Dense Sand (Submerged)	32’- 80’	70 pcf	35 deg	125 pci

5. 5. Approach Pavement Design Parameters

The pavement construction should meet the requirements of the Wisconsin DOT Standard Specifications for Road and Bridge Construction.

A prime requirement for successful pavement is preparation of the subgrade soil. At the time of base course placement, the subgrade should be firm when proof-rolled. An acceptable proof-roller for silty and clayey soils would be a fully-loaded, tandem-axle dump truck. An acceptable proof-roller for granular soil (sand and/or gravel) would be a smooth-drum vibratory roller weighing at least 25,000 pounds. The subgrade may yield slightly to the proof-roller, but after base course placement, the base grade should be unyielding to fully-loaded, quad-axle, dump trucks. This requirement also applies after the completion of any undercut. Any soft soils disclosed by the proof-rolling should be replaced with drier soil or stabilized with crushed rock or breaker run. Should undercutting or excavation below subgrade (EBS) be done, this applies after undercut locations are backfilled. Any breaker run or crushed rock used to stabilize a soft subgrade should not be considered as part of the base course thickness.

Assuming a stable subgrade is established prior to paving, pavement design will be controlled by the frost susceptibility of the near surface soils within the frost zone. Most soils in the frost zone consisted of silty sand, which is a poor soil type for pavement support because of its high frost susceptibility.

According to the Attachment 15.1 of Chapter 11-5 of the Facilities Design Manual (FDM), this area is mapped in the Wisconsin DOT's Standard Inclusion Area for Select Materials to improve pavement subgrade. The subgrade improvement consists of an undercut which is then filled with Select Materials. The depth of undercut depends on the type of Select Materials used to backfill the undercut. For example, if breaker run stone is used as the Select Material, the required depth of undercut is 16 inches. More guidance can be found in Attachment 15.2 of FDM Chapter 11-5. Select Materials were not observed below the pavement in the boring.

The recommended soil parameters are shown in Table 5.5 for pavement design over a subgrade of the on-site soils and over a subgrade of the on-site soils that have been improved with Select Materials. The table includes Frost Group Designation (FGD), Design Group Index (DGI), Soil Support Value (SSV), California Bearing Ratio (CBR), modulus of subgrade reaction (k), USCS Classification, and AASHTO Classification.

It is recommended that soil parameters for the on-site soils be used for approach pavement design unless the soils are improved with Select Materials.

Table 5.5. Recommended soil parameters for pavement design for the approaches.

Subgrade	***FGD***	***DGI***	***SSV***	***CBR***	***k (pci)***	***USCS***	***AASHTO***
On-Site Soils	F-4	16	3.6	4	125	SM	A-4
Select Materials	F-4	16	4.2	6	175	-	-

5. 6. Lab Test Results and Scour Parameters

A mechanical sieve analysis was performed according to ASTM D422 on Sample 9 recovered from the soil boring. Sample 9 was obtained at a depth of 33.5 to 35 feet and is expected to be representative of the soil type that exists near the river bed. A summary of the D_{50} and D_{90} parameters ranges from the sieve are:

$$D_{50} = 2.7 \times 10^{-1} \text{ mm } (1.1 \times 10^{-2} \text{ in}) \qquad D_{90} = 5.6 \times 10^{-1} \text{ mm } (2.2 \times 10^{-2} \text{ in})$$

Detailed sieve results are appended.

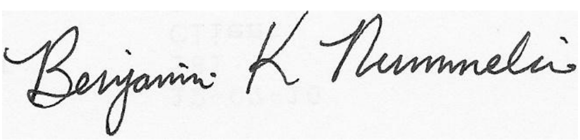
5. 7. Earthwork

Excavations should follow OSHA regulations.

The recommended compaction control method for the fill work is the D.O.T. standard compaction method. If the compaction of any fill is questionable, compaction tests may be performed on that fill. Tests for compaction should be performed on every 1,000 cubic yards of compacted fill, or a fraction thereof, to be at least equal to D.O.T. requirements for special compaction.

The compaction check should include one laboratory compaction test per field density determination. All nuclear testing should be calibrated to site soils by ASTM Methods D6938 and D3017. However, no work should be accepted that does not meet the requirements for standard compaction, regardless of test results.

Respectfully,



Benjamin K. Nummelin, P.E.
Nummelin Testing Services, Inc.

Matthew B. Williams, EIT
Nummelin Testing Services, Inc

NUMMELIN TESTING SERVICES, INC

GEOTECHNICAL ENGINEERING REPORT INFORMATION SHEET

Subsurface soil conditions are responsible for many of the construction problems encountered at building sites. In order to help you, our client, manage your risks, we offer you the following information and suggestions.

Geotechnical engineering reports are based on observations of specific soil conditions existing at the time of the subsurface soil investigation. As these conditions may change over time, construction decisions should be made with the timeliness of the report in mind. Further testing may be advisable if subsurface soil conditions are affected by natural events (flooding, spring thaws, etc.) and construction (drilling, blasting, surcharges, etc.) on-site or adjacent to it. Talking to your geotechnical professional before construction begins will help keep one informed if further tests are recommended.

The recommendations included in your geotechnical engineering report are based on a limited number of samples/tests. These recommendations assume that subsurface conditions throughout the site will be similar to those observed. As all recommendations are preliminary when based on limited testing, it is important to have your geotechnical professional observe the actual conditions during construction. This allows him/her to note any differences that may not have been revealed by the limited samples/tests and/or that are more abrupt than reported in the preliminary report. It is this geotechnical professional, using his/her knowledge and familiarity of site history, as well as construction observations, who will be able to determine if there is adequate and appropriate support to consider these recommendations final. He/she will also be able to document that the contractor is following these recommendations. Be aware that this geotechnical professional can not assume responsibility and/or liability for his/her recommendations based on observations and determinations by others.

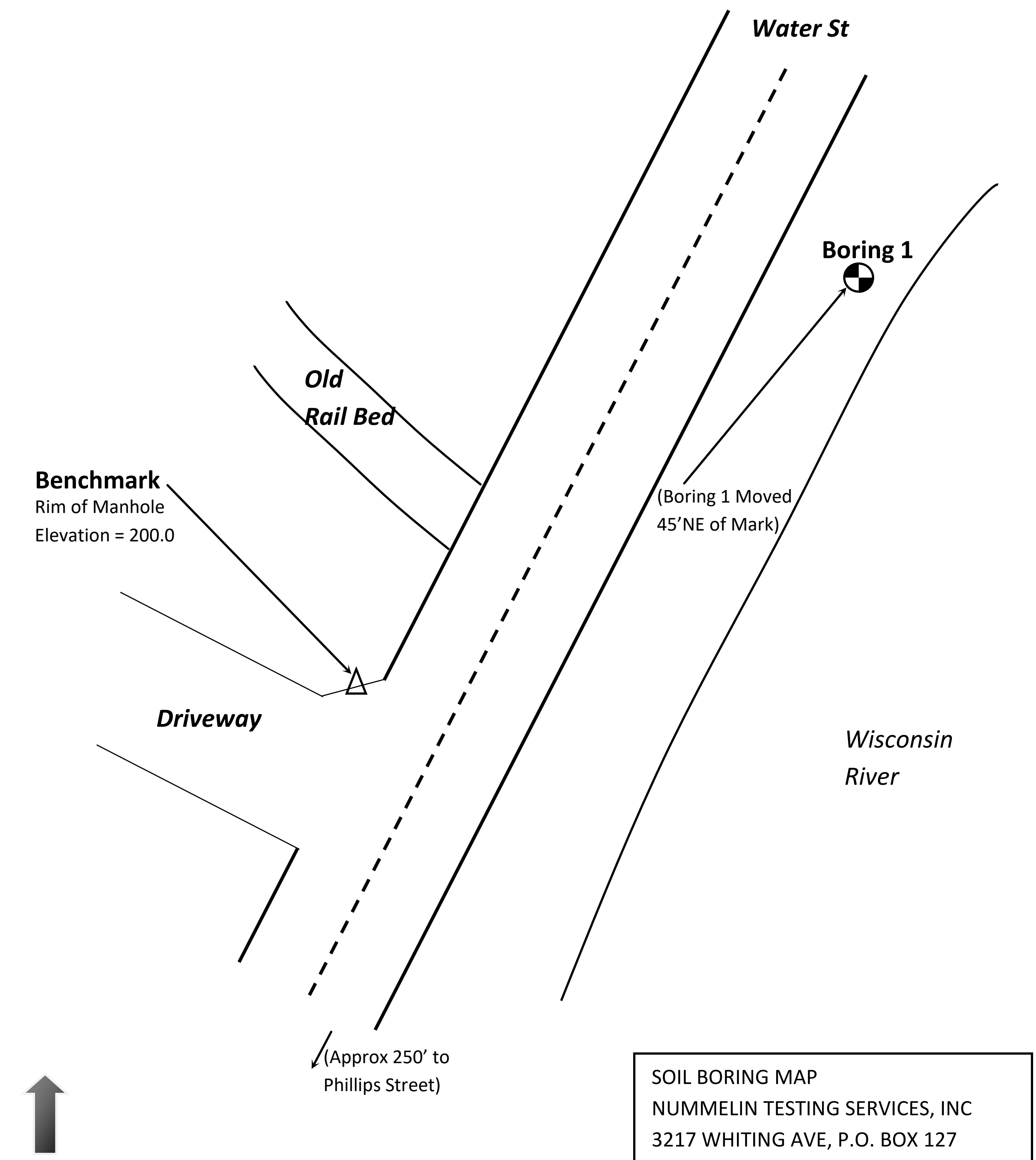
Professional judgement, based on experience and observations, is at the heart of our geotechnical recommendations. Geotechnical reports use information from a limited number of samples/tests to predict conditions regarding your overall site. No one may say with certainty what subsurface conditions really exist without actual observation. The conditions away from sample/test areas may vary from what is predicted. It is important to identify variations as early as possible. This is why we encourage you to take advantage of our knowledge and experience during the construction phase of your project. Working together we can help minimize the impact when unexpected variations occur.

Geotechnical reports are written for a specific client, purpose, project and set of conditions. They are not intended to be a generalized, generic report for a proposed site. They are for the sole use of our client for the express purpose indicated to us. Should the scope of the project be altered, or if subsurface variations become evident during construction, it may be necessary to modify our recommendations. Early communication with your geotechnical professional can help you avoid expensive problems that may occur when changes to a project's purpose, structure, size, usage, site orientation, elevation, etc. are made after a report is written.

Following these guidelines, your geotechnical subsurface report should provide informed and accurate information to assist in the planning and construction of your project.

Project: Great Sauk Trail Bridge (Wisconsin River Crossing)
Client: Westbrook Associated Engineers
NTS Project #: 176.48
Date: 09/13/19

SOIL BORING LOCATION MAP



LOCATIONS APPROXIMATE
NOT TO SCALE

SOIL BORING MAP
NUMMELIN TESTING SERVICES, INC
3217 WHITING AVE, P.O. BOX 127
STEVENS POINT, WI

NUMMELIN TESTING SERVICES, INC.

BORING LOG NOTES

DESCRIPTIVE TERM, GRANULAR SOIL (% BY DRY WEIGHT)

Trace	0% - 5%
Little	5% - 12%
Some	12% - 35%
And	35% - 50%

Q_P = Estimated Unconfined Compressive Strength (by pocket penetrometer) Expressed in tons per square foot (t/sf).

Q_U = Estimated Unconfined Compressive Strength (by ASTM 2166) Expressed in tons per square foot (t/sf).

NM = Natural Moisture

M = MOISTURE

D = Dry	F = Frozen
M = Moist	W = Wet
S = Saturated	

LOI = Loss on Ignition (Organic Content)

N (Standard Blow Count) = blows per foot, as shown. Performed in general accordance with Standard Penetration Test Specifications (ASTM 1586).

NR = No Recovery **WOH** = Weight of Hammer **#** = Sample Number

SOIL CLASSIFICATION

F = Fine	LL = Liquid Limit, percent
M = Medium	PL = Plastic Limit, percent
C = Coarse	PI = Plasticity Index (LL - PL)
W.L. = Water Level	

SOIL STRENGTH CHARACTERISTICS

CONSISTENCY (Cohesive Soils)

Term	Q_U tons/sq ft
Very Soft	0.0 to 0.25
Soft	0.25 to 0.50
Firm	0.50 to 1.0
Stiff	1.0 to 2.0
Very Stiff	2.0 to 4.0
Hard	Over 4.0

RELATIVE DENSITY (Granular Soils)

Term	"N" Value
Very Loose	0 - 4
Loose	4 – 10
Medium-Dense	10 – 30
Dense	30 - 50
Very Dense	Over 50

ORGANIC CONTENT BY COMBUSTION METHOD

Soil Description	Loss on Ignition
Non Organic	Less than 4%
Organic Silt / Clay	4 - 12%
Sedimentary Peat	12 - 50%
Fibrous & Woody Peat	More than 50%

PLASTICITY

Term	Plastic Index
None to Slight	0 - 4
Slight	5 - 7
Medium	8 - 22
High to Very High	Over 22

geotechborenotes.bor

SOIL BORING LOG

Boring By: Nummelin Testing Services, Inc.

Project: Great Sauk Trail - Walking Iron Trail Recreational Bridge
Location: Moved 45' NE of Mark to Avoid Traffic - See Map
(Wisconsin River Crossing) Water Street, Sauk City, Sauk County, WI

Boring: 1
Auger: HSA / Mud
Page: 1 of 4
Drillers: DC / RS
Date: 9/6/2019
Elevation: 199.7

Depth (ft.)		Classification/Description	#	Sample Depth (ft.)	N_{60}	Rec (in.)	M	Qp (tsf)	Notes
	-	16.0" of Brn SAND & GRAVEL (Base Course)							
1	-		1	1 - 2.5	8	6	M		Hard
	-	Brown Silty SAND							Drilling
2	-	Trace Gravel							3.5'- 19'
	-	(Fill) (USCS: SM, AASHTO: A-4)							
3	-								
	-	------ 3.5' ------	2	3.5 - 5	13	4	M		
4	-								
	-								
5	-								
	-								
6	-		3	6 - 7.5	17	9	M		
	-								
7	-								
	-								
8	-								Cobble
	-		4	8.5 - 10	75	7	M		@ 8.5'
9	-								
	-								
10	-	Brown F-M SAND							
	-	Some Gravel, Little Silt							
11	-	Occasional Cobbles, Concrete Rubble							
	-	(Fill) (USCS: SP-SM, AASHTO: A-3)							
12	-								
	-								
13	-								Cobble
	-		5	13.5 - 15	67/3	6	M		@ 13.5'
14	-								
	-								
15	-								
	-								
16	-								
	-								
17	-								
	-	Moved 4' NE and Blind-Drilled to 18.5' after							
18	-	Auger Broke Off in Concrete Rubble @ 17'							
	-		6	18.5 - 20	7	5	M		
19	-	------ 19.0' ------							
	-	Light Brown Fine SAND							
20	-	Trace Gravel, Trace Silt							
	-	(Possible Fill) (USCS: SP, AASHTO: A-3)							
21	-								
	-	------ 21.5' ------							
22	-	Gray / Brown Silty SAND							
	-	Little Gravel, Organic Odor							
23	-	(Possible Fill) (USCS: SM, AASHTO: A-4)							
	-	(Water @ 23.5')	7	23.5 - 25	12	8	S		
24	-	(continued)							

SOIL BORING LOG

Boring By: Nummelin Testing Services, Inc.

Project: Great Sauk Trail - Walking Iron Trail Recreational Bridge
Location: Moved 45' NE of Mark to Avoid Traffic - See Map
(Wisconsin River Crossing) Water Street, Sauk City, Sauk County, WI

Boring: 1
Auger: HSA / Mud

Drillers: DC / RS
Date: 9/6/2019
Elevation: 199.7

Depth (ft.)		Classification/Description	#	Sample Depth (ft.)	N_{60}	Rec (in.)	M	Qp (tsf)	Notes
	-	(continued)							
25	-								
	-	Gray / Brown Silty SAND							
26	-	Little Gravel, Organic Odor							
	-	(Possible Fill) (USCS: SM, AASHTO: A-4)							
27	-								
	-	------ 27.5' ------							
28	-								
	-		8	28.5 - 30	12	9	S		
29	-								
	-								
30	-								
	-								
31	-								
	-								
32	-								
	-								Sieve
33	-								Test
	-		9	33.5 - 35	28	9	S		Performed
34	-								
	-								Mud
35	-								Rotary
	-								Drilling
36	-								Below 35'
	-	Light Brown Fine SAND							
37	-	Trace Gravel, Trace Silt							
	-	(USCS: SP, AASHTO: A-3)							
38	-								
	-		10	38.5 - 40	24	13	S		
39	-								
	-								
40	-								
	-								
41	-								
	-								
42	-								
	-								
43	-								
	-		11	43.5 - 45	44	13	S		
44	-								
	-								
45	-								
	-								
46	-								
	-								
47	-								
	-								
48	-	(continued)							

SOIL BORING LOG

Boring By: Nummelin Testing Services, Inc.

Project: Great Sauk Trail - Walking Iron Trail Recreational Bridge
Location: Moved 45' NE of Mark to Avoid Traffic - See Map
(Wisconsin River Crossing) Water Street, Sauk City, Sauk County, WI

Boring: 1
Auger: HSA / Mud

Drillers: DC / RS
Date: 9/6/2019
Elevation: 199.7

Depth (ft.)		Classification/Description	#	Sample Depth (ft.)	N_{60}	Rec (in.)	M	Qp (tsf)	Notes
	-	(continued)	12	48.5 - 50	60	14	S		
49	-								
	-	Light Brown Fine SAND							
50	-	Trace Gravel, Trace Silt							
	-	(USCS: SP, AASHTO: A-3)							
51	-								
	-								
52	-	------ 52.0' ------							
	-								
53	-								
	-		13	53.5 - 55	35	10	S		
54	-								
	-								
55	-								
	-								
56	-								
	-								
57	-								
	-								
58	-								
	-		14	58.5 - 60	55	12	S		
59	-	Light Brown F-M SAND							
	-	Trace Gravel, Trace Silt							
60	-	(USCS: SP, AASHTO: A-3)							
	-								
61	-								
	-								
62	-								
	-								
63	-								
	-		15	63.5 - 65	29	11	S		
64	-								
	-								
65	-								
	-								
66	-								
	-								
67	-								
	-								
68	-	------ 68.0' ------							
	-		16	68.5 - 70	29	12	S		
69	-								
	-	Light Brown Fine SAND							
70	-	Trace Gravel, Trace Silt							
	-	(USCS: SP, AASHTO: A-3)							
71	-								
	-								
72	-	(continued)							

SOIL BORING LOG

Boring By: Nummelin Testing Services, Inc.

Project: Great Sauk Trail - Walking Iron Trail Recreational Bridge
Location: Moved 45' NE of Mark to Avoid Traffic - See Map
(Wisconsin River Crossing) Water Street, Sauk City, Sauk County, WI

Boring: 1
Auger: HSA / Mud

Drillers: DC / RS
Date: 9/6/2019
Elevation: 199.7

Depth (ft.)		Classification/Description	#	Sample Depth (ft.)	N_{60}	Rec (in.)	M	Qp (tsf)	Notes
	-	(continued)							
73	-								
	-	Light Brown Fine SAND	17	73.5 - 75	28	12	S		
74	-	Trace Gravel, Trace Silt							
	-	(USCS: SP, AASHTO: A-3)							
75	-								
	-								
76	-	------ 76.0' ------							
	-								
77	-								
	-	Light Brown F-M SAND							
78	-	Trace Silt, Little Gravel, Occasional Cobbles							Cobble
	-	(USCS: SP, AASHTO: A-3)	18	78.5 - 80	56	12	S		@ 79'
79	-								
	-								
80	-	----- E.O.B. 80.0' -----							
	-	----- Backfilled w/ Bentonite Chips -----							
81	-								
	-								
82	-								
	-								
83	-								
	-								
84	-								
	-								
85	-								
	-								
86	-								
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88	-								
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93	-								
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94	-								
	-								
95	-								
	-								
96	-								

State of Wisconsin- Dept of Natural Resources
P.O. Box 7921, Madison WI 53707-7921

Well / Drillhole / Borehole Abandonment
Form 3300-005 (R 10/03) Page 1

Notice: Completion of this report is required by chs. 160, 281, 283, 289, 291-293, 295 and 299, Wis Stats., and ch. NR 141, Wis. Adm. Code. In accordance with chs. 281, 289, 291-293, 295, and 299, Wis. Stats., failure to file this form may result in a forfeiture of between $10-25,000, or imprisonment for up to one year, depending on the program and conduct involved. Personally identifiable information on this form is not intended to be used for any other purpose. Return form to the appropriate DNR office and bureau. See instructions for more information.

Route To:
☐ Drinking Water ☐ Watershed Water ☐ Waste Management ☐ Remediation/Redevelopment ☐ Other: ________

1. General Information

Boring Number	DNR Well ID No.	County
1		Sauk

Common Well Name:
Gov't Lot # (if applic.):
1/4 / 1/4: 1/4: Section: Township: N Range: ☐ E ☐ W
Grid Location: Feet ☐ N ☐ E ☐ S ☐ W
☐ Local Grid Origin ☐ (estimated) OR ☐ Well Location
Latitude: DEG MIN SEC N
Longitude: DEG MIN SEC W
Reason For Abandonment: Borehole Termination
WI Unique Well No. of Replacement Well: ___ ___ ___ ___ ___

2. Facility / Owner Information

Facility Name: Great Sauk Trail - Walking Iron Trail Recreational Bridge

Facility ID	License/Permit No.	City, Village, or Town
176.48		Sauk City

Street Address of Well: Wisconsin River Crossing, Water Street
Present Well Owner:
Original Well Owner:
Street Address or Route of Owner:
City: State: ZIP Code:

3. Well / Drillhole / Borehole Information

☐ Monitoring Well
☐ Water Well
☑ Borehole / Drillhole

Original Construction Date: 9/6/2019
If a Well Construction Report is available, please attach.

Construction Type:
☑ Drilled ☐ Driven (sandpoint) ☐ Dug
☐ Other (specify): ________________

Formation Type:
☑ Unconsolidated Formation ☐ Bedrock

Total Well Depth From Groundsurface (ft.):
Casing Diameter (in.):
Lower Drillhole Diameter (in.):
Casing Depth (ft.):
Was Well Annular Space Grouted? ☐ Yes ☐ No ☐ Unknown
If yes, to what depth (feet)?
Depth to water (feet): 23.5

4. Pump, Liner, Screen, Casing & Sealing Material

	Yes	No	N/A
Pump and piping removed?	☐	☐	☑
Liner(s) removed?	☐	☐	☑
Screen removed?	☐	☐	☑
Casing left in place?	☐	☐	☑
Casing cut off below surface?	☐	☐	☑
Sealing material rise to surface?	☑	☐	☐
Material settle after 24 hrs?	☐	☐	☑
If yes, was hole retopped?	☐	☐	☑
If bentonite chips were used, were they hydrated with water from a known safe source?	☐	☐	☑

Required Method of Placing Sealing Material
☐ Conductor Pipe-Gravity ☐ Conductor Pipe-Pumped
☐ Screened and Poured (Bentonite Chips) ☐ Other (explain): ________

Sealing Materials
☐ Neat Cement Grout ☐ Clay Sand Slurry (11lb/gal wt.)
☐ Sand Cement (concrete) Grout ☐ Bentonite-Sand Slurry
☐ Concrete ☑ Bentonite Chips
For Monitoring Wells and Monitoring Well Boreholes Only:
☐ Bentonite Chips ☐ Bentonite-Cement Grout
☐ Granular Bentonite ☐ Bentonite-Sand Slurry

5. Material Used to Fill Well / Drillhole	From (ft.)	To (ft.)	No. Yards, Sacks Sealant or Volume (circle one)	Mix Ratio or Mud Weight
3/8" Bentonite Chips	Surface	80		

6. Comments

7. Supervision of Work

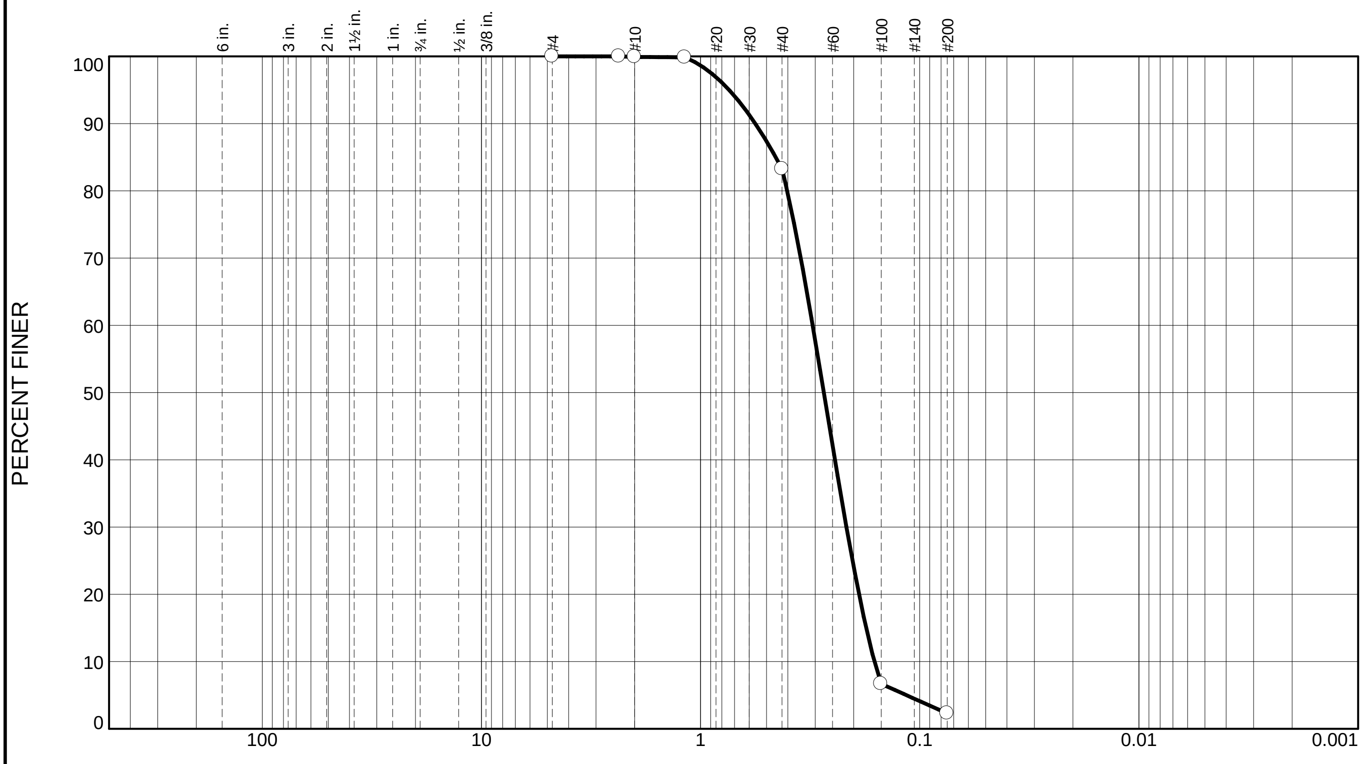
Name of Person or Firm Doing Sealing Work	Date of Abandonment
NTS, Inc.	09/06/19
Street or Route: P.O. Box 127	Telephone Number: (715) 341-7974

City	State	ZIP Code
Stevens Point	WI	54481

Signature of Person Doing Work:
Date Signed:

DNR Use Only
Date Received: Noted By:
Comments:

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.1	16.6	81.0	2.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#8	100.0		
#10	99.9		
#16	99.9		
#40	83.3		
#100	6.7		
#200	2.3		

* (no specification provided)

Material Description

Light Brown SAND, Mostly Fine Grained, Some Medium Grained, Trace silt.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.5630 D_{85}= 0.4542 D_{60}= 0.3082
D_{50}= 0.2739 D_{30}= 0.2160 D_{15}= 0.1756
D_{10}= 0.1610 C_u= 1.91 C_c= 0.94

Classification

USCS= SP AASHTO= A-3

Remarks

Source of Sample: Boring 1 **Depth:** 33.5' - 35'
Sample Number: 9 **Date:** 9/11/19

NUMMELIN TESTING SERVICES, INC.
Stevens Point, Wisconsin

Client: Westbrook
Project: Great Sauk Trail

Project No: 176.48 **Figure**

Tested By: BG **Checked By:** MW