SOIL EXPLORATION;
PROPOSED WATER TRANSMISSION LINE
COUNTY ROAD 9
DELTA, FULTON COUNTY, OHIO

SUBMITTED TO:

JONES & HENRY ENGINEERS, LTD.
ATTENTION: Mr. Michael L. Karafa
3101 Executive Parkway, Suite 300
Toledo, Ohio 43606

BMI REPORT No. 202201-1021-9102

October 12, 2021

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Report To: Jones & Henry Engineers, Ltd.
Attention: Mr. Michael L. Karafa
3101 Executive Parkway, Suite 300
Toledo, Ohio 43606

Date: October 12, 2021
Laboratory Job No.: 202201
BMI Report No.: 202201-1021-9102
Report Consists of 24 Pages

Report On: SOIL EXPLORATION
Proposed Water Transmission Line, County Road 9,
Delta, Fulton County, Ohio

Dear Mr. Karafa:

Bowser-Morner, Inc. (BMI) has completed the authorized subsurface exploration and geotechnical engineering evaluation at the above-referenced project. The following report briefly reviews our exploration procedures, describes existing site and subsurface conditions, and presents our evaluations, conclusions, and recommendations.

1.0 AUTHORIZATION

The purpose of this subsurface exploration and geotechnical engineering evaluation was to determine the subsurface conditions at the project site and to analyze these conditions as they relate to the water transmission line design and construction. All work was performed in accordance with BMI technical proposal No. T-27316 dated September 9, 2021 and its attached *Proposal Acceptance Sheet* between Jones & Henry Engineers, Ltd. (Jones and Henry) and BMI. Authorization to proceed with the necessary work was given by Mr. Mike Karafa on September 7, 2021. The scope of the exploration included subsurface drilling and sampling, limited laboratory testing, engineering evaluation of the field and laboratory data, and the preparation of this report.

2.0 WORK PERFORMED

2.1 Field Exploration

During this exploration, four soil test borings were drilled at the approximate locations shown on the attached *Boring Location Plan*. The borings were drilled to a depth of 15 feet. Boring locations were established in the field by Jones and Henry. The boring elevations were interpolated from the plan and profile drawings provided by Jones and Henry. The elevations on the *Boring Logs* should be considered approximate.

All soil sampling and standard penetration testing was conducted in general accordance with American Society for Testing and Materials (ASTM) Standard D1586. The borings were advanced by an all-terrain vehicle (ATV)-mounted drilling rig by mechanically twisting hollow-stem augers into the soil. At regular intervals, soil samples were obtained with a standard 2-inch outside diameter (O.D.) split spoon sampler driven 18 inches into the soil with blows of a 140-pound hammer falling 30 inches. The number of hammer blows required to drive the sampler the final foot was recorded and designated the "standard penetration resistance." The standard penetration resistance, or "N" value, when properly evaluated, is an index of the soil's strength, density, and ability to support foundations. The disturbed samples recovered by the split spoon sampler were visually classified in the field, logged, sealed in glass jars, and returned to the laboratory for testing and evaluation by a geotechnical engineer.

Boring Logs indicating soil descriptions, penetration resistances, and observed groundwater levels are attached.

2.2 Laboratory Testing

In the laboratory, each of the samples recovered from the borings was examined and visually classified by a geotechnical engineer. In addition, samples of cohesive soils from the split spoon samplers were tested to determine the soil's approximate strength using a hand-held, calibrated spring penetrometer. These values were used by the geotechnical engineer to assist in the evaluation of the relative strengths of the subsurface soils and to aid in classification of the samples.

Five unconfined compressive strength tests were performed on the disturbed samples recovered by the liner samplers. These tests were performed on a constant rate of strain apparatus with a deformation rate adjusted to cause failure of the sample in less than 10 minutes. Note that care should be utilized in applying these test values due to the method of sampling. The results of these tests have been summarized and tabulated below.

Boring No.	Sample No.	Sample Depth (ft)	Moisture Content (%)	Dry Unit Weight (pcf)	Unconfined Compressive Strength (psf)	Strain at Failure (%)
1	SS-3	13.5-15.0	14.0	121.2	10,526	15.0
2	SS-1	3.5-5.0	22.0	111.3	4,113	15.0
	SS-3	13.5-15.0	15.2	120.9	8,625	15.0
3	SS-3	13.5-15.0	14.3	122.4	9,781	15.0
4	SS-3	13.5-15.0	15.4	119.0	12,481	14.0

pcf = pounds per cubic foot psf = pounds per square foot

Chloride ion concentration, Sulfate ion concentration and pH testing have been performed on representative combined soil samples taken from boring locations 1, 2, 3, and 4 between the depth of 3.5 and 10 feet. Laboratory test results are summarized below:

Chloride Ion Concentration, and
And Sulfate Ion Concentration

Test Parameter	Borings 1, 2, 3 & 4 (3.5'-10.0')
Water Soluble Sulfate Ion, ppm	220.0
Water Soluble Chloride Ion, ppm	554.0
pH	7.3

A soil resistivity test was performed on a combined samples recovered from boring locations 1, 2, 3, and 4 in accordance with ASTM D2216 and ASTM G187 specifications. The results of the soil resistivity tests are tabulated below:

Electrical Resistivity

Test Method	Borings 1, 2, 3 & 4 (3.5'-10.0')
Moisture Content, As Received, %:	14.8
Resistivity (As Received), Ohm-cm:	9,900
Resistivity (100% Saturation), Ohm-cm:	990

cm= centimeters ppm= parts per million

The soil resistivity indicated mildly corrosive soils at the as-received moisture content. The table below shows the relative corrosivity as a function of soil resistivity. It should be noted that the relationships given in the table below are approximate and intended as a general reference. Actual field performance can vary based on location specific conditions.

Soil Corrosivity as a Function of Soil Resistivity

Resistivity	Corrosivity
0 to 1,000 ohm-cm	Very corrosive
1,000 to 2,000 ohm-cm	Corrosive
2,000 to 10,000 ohm-cm	Mildly Corrosive
10,000 ohm-cm and above	Progressively Less Corrosive

Natural moisture content determinations were made on 12 split spoon samples recovered from the soil test borings. The results of the moisture content determination tests are shown on the attached *Moisture Content Summary Sheet*.

Soil samples are normally retained in our laboratory for a period of 60 days before they are discarded. To view the samples or arrange for longer storage of samples, please contact us.

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 Site Description

The project site is located along County Road 9 between U.S. 20 and the Indiana and Ohio Railroad tracks in Delta, Fulton County, Ohio.

3.2 Soil Profile

Data from the soil test borings are shown on the attached *Boring Logs*. The subsurface conditions discussed in the following paragraphs and those shown on the *Boring Logs* represent an estimate of the subsurface conditions based on interpretation of the boring data using normally accepted geotechnical engineering judgments. Although individual test borings are representative of the subsurface conditions at the boring locations on the dates shown, they are not necessarily indicative of subsurface conditions at other locations or at other times.

Geologically, the project site is situated in a glacial ground moraine consisting of till containing an unsorted, unstratified mixture of clay, silt, sand, and coarser fragments deposited discontinuously by advancing ice.

Asphalt concrete covered the ground surface of boring 1 and was recorded by the drillers as 3 inches in thickness. Below the asphalt was crushed stone that extended to a depth of 12 inches. Crushed stone covered the ground surface of boring 2 and was recorded by the drillers as 12 inches in thickness. Brown silt with some clay covered the ground surface of borings 3 and 4 and extended to depths of 2.5 to 3.5 feet. Beneath the crushed stone in borings 1 and 2 was brown sand with some silt. The sandy soil extended to depths between3.5 and 6 feet. The consistency of the sandy soil was between loose and medium dense.

Below the sand and silty clay in all of the borings was glacial till consisting of brown and gray silt and clay with some sand and a trace of gravel. The glacial till became gray at a depth of 13.5 feet and extended to the bottom of the borings. The estimated undrained shear strength of the glacial till ranged from 4,000 to greater than 4,500 psf.

3.3 Groundwater Observations

During the field exploration, the drilling rods and sampling equipment were continuously checked by the drillers for indications of groundwater or seepage. The *Boring Logs* list our driller's observations of groundwater or seepage. Three readings are recorded on the logs. The initial groundwater level indicates the depth(s) at which groundwater or seepage was initially noted by the drillers as the boring was being advanced and the intensity of the seepage. The completion groundwater level represents the depth groundwater was observed in the borehole immediately after the completion of the hole. The last reading on the *Boring Logs* represents the depth groundwater was observed in the borehole after an increment of time has passed. In this case, both the depth and time are listed.

Groundwater was not encountered in any of the borings.

Groundwater levels fluctuate with seasonal and climatic variations and may be different at other times. More specific information regarding groundwater levels, standard penetration resistances, and soil descriptions is detailed on the attached *Boring Logs*.

4.0 PROPOSED CONSTRUCTION

It is our understanding that the proposed construction is to consist of a new water transmission line along County Road 9 between U.S. Route 20A and the Railroad Tracks in Delta, Fulton County, Ohio.

5.0 EVALUATIONS AND CONCLUSIONS

The following evaluations and conclusions are based on our interpretation of the field and laboratory data obtained during the exploration and our experience with similar subsurface conditions. Soil penetration data and laboratory data have been used to estimate allowable bearing pressures using commonly accepted geotechnical engineering practices. Subsurface conditions in uninvestigated locations between borings may vary considerably from those encountered in the borings. If structure location, loadings, or levels are changed, we request we be advised so we may re-evaluate our recommendations.

5.1 Water Transmission Line Construction

As previously described, the soil profile at this site consists of silty clay soil with varying amounts of sand and gravel. We anticipate that excavations for the sewer line will stand open and that water intrusion into the excavations will be relatively minor. In order to provide protection for workers, a trenchbox or similar device will be needed. As an alternate, the excavations could be laid back at a slope of about 1:1. The dewatering requirements during construction will depend upon the weather and groundwater conditions at the time of construction. It does not appear, however, that much groundwater will be encountered. In general, the soil materials encountered at the invert elevation are stiff to hard clays that will provide adequate support for the sewer pipe.

The near surface soils at locations 1 and 2 consists of silty sand. Seepage, caving, and running sands will be encountered during the water line construction, some inflows of water should be expected and dewatering prior to excavation may be required. The amount of groundwater that will be encountered is difficult to determine from the borings, but will likely be light to moderate. It may be necessary to use ODOT size 57 or 67 crushed stone as a bedding material for the pipe to facilitate groundwater removal and provide a stable working base.

5.2 Slopes and Temporary Excavation

The owner and the contractor should make themselves aware of and become familiar with applicable local, state, and federal safety regulations, including current Occupational Safety and Health Administration (OSHA) excavation and trench safety standards. Construction site safety generally is the sole responsibility of the contractor. The contractor shall also be solely responsible for the means, methods, techniques, sequences, and operations of construction operations. BMI is providing the following information solely as a service to the client. Under no circumstances should BMI's provision of the following information be construed to mean BMI is assuming responsibility for construction site safety or the contractor's activities; such responsibility is not implied and should not be inferred.

The contractor should be aware that slope height, slope inclination, and excavation depths (including utility trench excavations) should in no case exceed those specified in local, state, or federal safety regulations, such as OSHA Health and Safety Standards for Excavations, Chapter 29 of the Code of Federal Regulations (CFR) Part 1926, or successor regulations. Such regulations are strictly enforced and, if not followed, the owner, the contractor, or earthwork or utility subcontractors could be liable for substantial penalties.

For this site, the overburden soil encountered in our exploration is silty clays and silty sands. We anticipate OSHA will classify the naturally occurring undisturbed clay soils as Type B. The sandy soil encountered would be classified as Type C.

Note: Soils encountered in the construction excavations may vary significantly across the site. Our preliminary soil classifications are based solely on the materials encountered in widely spaced borings. The contractor should verify similar conditions exist throughout the proposed area of excavation. If different subsurface conditions are encountered at the time of construction, BMI recommends we be contacted immediately to evaluate the conditions encountered.

If any excavation, including a utility trench, is extended to a depth of more than 20 feet, OSHA requires the side slopes of such excavation be designed by a Professional Engineer.

6.0 QUALIFICATIONS

The evaluations, conclusions, and recommendations in this report are based on our interpretation of the field and laboratory data obtained during the exploration, our understanding of the project, and our experience with similar sites and subsurface conditions. Data used during this exploration included, but was not necessarily limited to:

- Four exploratory borings performed during this study;
- observations of the project site by our staff;
- results of limited laboratory soil testing;
- preliminary site plans and drawings furnished by Jones and Henry;
- limited interaction with Mr. Mike Karafa of Jones and Henry; and
- published soil or geologic data of this area.

In the event changes in the project characteristics are planned, or if additional information or differences from the conditions anticipated in this report become apparent, BMI should be notified so the conclusions and recommendations contained in this report can be reviewed and, if necessary, modified or verified in writing.

The subsurface conditions discussed in this report and those shown on the *Boring Logs* represent an estimate of the subsurface conditions based on interpretation of the boring data using normally accepted geotechnical engineering judgments. Although individual test borings are representative of the subsurface conditions at the boring locations on the dates shown, they are not necessarily indicative of subsurface conditions at other locations or at other times.

Regardless of the thoroughness of a subsurface exploration, there is the possibility conditions between borings will differ from those at the boring locations, conditions are not as anticipated by designers, or the construction process has altered the soil conditions. As variations in the soil profile are encountered, additional subsurface sampling and testing may be necessary to provide data required to re-evaluate the recommendations of this report. Consequently, after submission of this report, it is recommended BMI be authorized to perform additional services to work with the designer(s) to minimize errors and/or omissions regarding the interpretation and implementation of this report.

Prior to construction, we recommend that BMI:

- work with the designers to implement the recommended geotechnical design parameters into plans and specifications;
- consult with the design team regarding interpretation of this report;
- establish criteria for the construction observation and testing for the soil conditions encountered at this site; and
- review final plans and specifications pertaining to geotechnical aspects of design.

During construction, we recommend that BMI:

- observe the construction, particularly site preparation, fill placement, and foundation excavation or installation;
- perform in-place density testing of all compacted fill;
- perform materials testing of soil and other materials as required; and
- consult with the design team to make design changes in the event differing subsurface conditions are encountered.

If BMI is not retained for these services, we shall assume no responsibility for construction compliance with the design concepts, specifications, or recommendations.

Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. No other warranty, expressed or implied, is made.

The scope of our services did not include an environmental site assessment for the presence or absence of hazardous substances in the soil, surface water, groundwater, or air, on, within, or beyond the site studied. Our scope of services also did not include an evaluation for the presence or absence of mold, wetlands, or protected species. Any statements in the report or on the *Boring Logs* regarding odors, staining of soils, or other unusual items or conditions observed are strictly for the information of our client.

This report has been prepared for the exclusive use of Jones and Henry for specific application to the proposed water transmission line located along County Road 9 in Delta, Fulton County, Ohio. Specific design and construction recommendations have been provided in the various sections of the report. The report should, therefore, be used in its entirety. This report is not a bidding document and shall not be used for that purpose. Anyone reviewing this report must interpret and draw their own conclusions regarding specific construction techniques and methods chosen. BMI is not responsible for the independent conclusions, opinions, or recommendations made by others based on the field exploration and laboratory test data presented in this report.

Respectfully submitted,

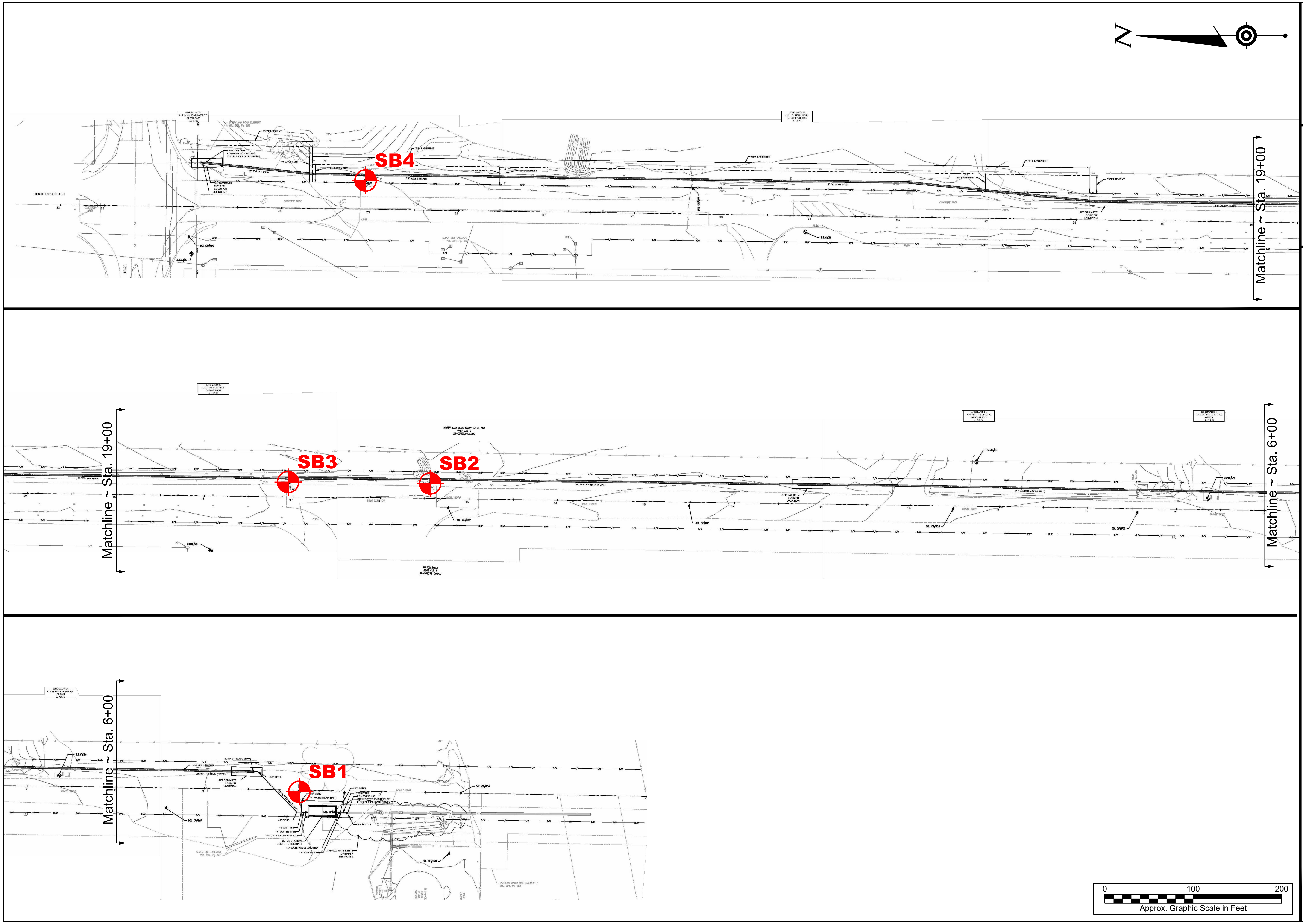
BOWSER-MORNER. INC.

Nicole Redinger
Ahmad Rashid

Nicole S. Redinger, E.I.
Geotechnical Engineer

Ahmad K. Rashid, P.E.
Chief Geotechnical Engineer
Manager, Toledo Engineering and Environmental Services

NSR/AKR:kko
Attachments: *Boring Location Plan*
Boring Log Terminology
Boring Logs
Moisture Content Summary Sheets
1-Client (via email to mkarafa@jheng.com)



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PROJECT NO.
202201

SCALE
Graphic

10-2021/SR

BORING LOCATION PLAN

Soil Exploration for Proposed Water Transmission Line
County Road 9,
Delta, Fulton Conty, Ohio

BORING LOG TERMINOLOGY

Stratum Depth:

Distance in feet and/or inches below ground surface.

Description of Materials:

When the color of the soil is uniform throughout, the color recorded will be such as brown, gray, or black and may be modified by adjectives such as light and dark. If the soil's predominant color is shaded by a secondary color, the secondary color precedes the primary color, such as gray and brown, yellow and brown. If two major and distinct colors are swirled throughout the soil, the colors will be modified by the term mottled, such as mottled brown and gray.

There are two types of visual classification methods currently used by Bowser-Morner, Inc. The first is ASTM D2488. This method results in classifications such as "lean clay". The second method is the ASEE system or Burmister system. This system results in classifications such as "silt and clay, with traces of sand" and is described below.

Particle Size		Visual
Boulders		Larger than 8"
Cobbles		8" to 3"
Gravel:	Coarse	3" to 3/4"
	Fine	3/4" to 2 mm
Sand:	Coarse	2 mm to 0.6 mm (pencil size)
	Medium	0.6 mm to 0.2 mm (table sugar & salt size)
	Fine	0.2 mm to 0.06 mm (powdered sugar size)
Silt		0.06 mm to 0.002 mm
Clay		0.002 mm and smaller (particles of silt and clay size are not visible to the naked eye)

Soil Components	
Major Components	**Minor Component Term**
Gravel	Trace…………..1 - 10%
Sand	Some………...11 - 35%
Silt	And…………36 - 50%
Clay	

Moisture Content	
Term	**Relative Moisture**
Dry	Powdery
Damp	Moisture content below plastic limit
Moist	Moisture content above plastic limit, but below liquid limit
Wet	Moisture content above liquid limit

Condition of Soil Relative to Compactness (Granular Material)	
Condition	**N**
Very Loose	5 blows/ft or less
Loose	6 to 10 blows/ft
Medium Dense	11 to 30 blows/ft
Dense	31 to 50 blows/ft
Very Dense	51 blows/ft of more

Condition of Soil Relative to Consistency (Cohesive Material)	
Condition	**Approximate Undrained Shear Strength**
Very Soft	Less than 250 psf
Soft	250 to 500 psf
Medium Stiff	500 to 1,000 psf
Stiff	1,000 to 2,000 psf
Very Stiff	2,000 to 4,000 psf
Hard	Greater than 4,000 psf

Sample Number:

Sample numbers are designated consecutively, increasing with depth for each boring.

Sample Type:

"A"	Split spoon, 2-inch O.D., 1-3/8-inch I.D., 18 inches in length.
"B"	One of the following: Power Auger Sample Piston Sample Liner Sample Denison Sample Sonic Sample
"C"	Shelby Tube 3-inch O.D., except where noted.

Sample Depth:

The depth below top of ground at which the sample was taken.

Blows per 6 inches on Sampler:

The number of blows required to drive a 2-inch O.D., 1-3/8-inch I.D., split spoon sampler, using a 140-pound hammer with a 30-inch free fall, is recorded for 6 inch drive increments. (Example: 3/8/9)

"N" Blows/Feet:

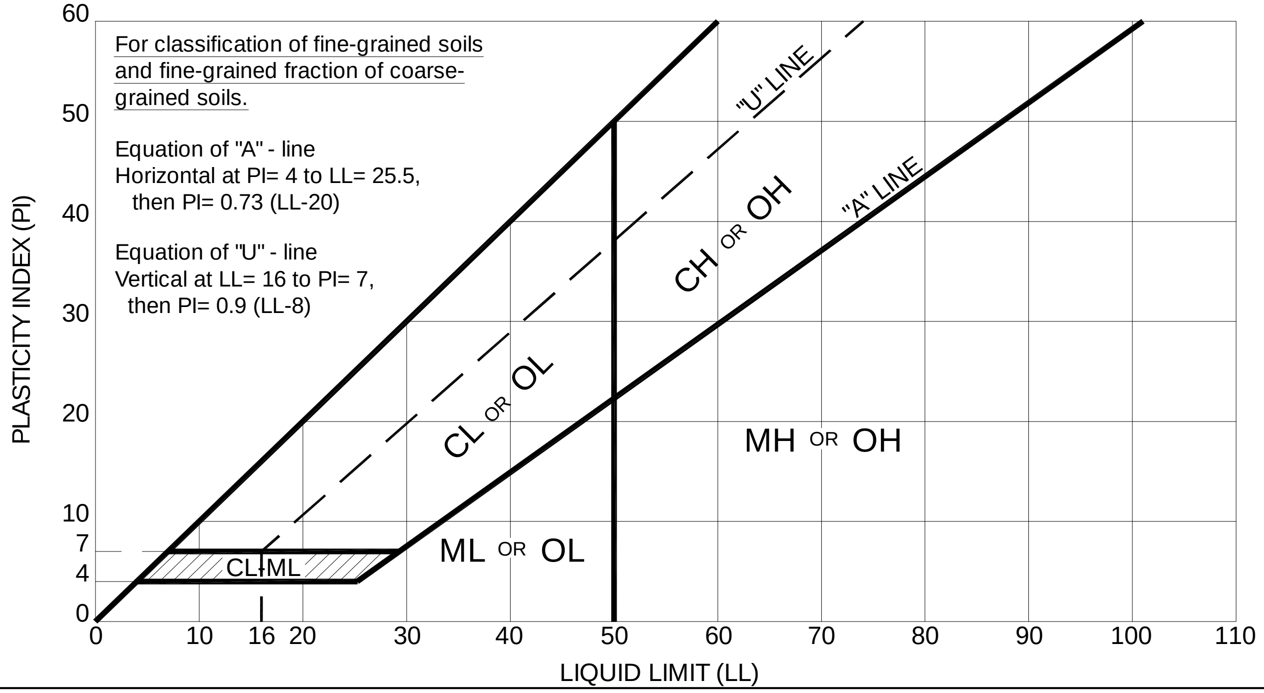
Standard penetration resistance. This value is based on the total number of blows required for the last 12 inches of penetration. (Example: 3/8/9 : N = 8 + 9 = 17)

Water Observations:

The depth of water recorded in the test boring is measured from the top of ground to the top of the water level. Initial depth indicates the water level during boring, completion depth indicates the water level immediately after boring, and depth after "X" number of hours indicates the water level after letting the water rise or fall over a time period. Water observations in pervious (sand and gravel) soils are considered reliable ground water levels for that date, Water observations in impervious (silt and clay) soils cannot be considered accurate unless records are made over a time period of several days to a month. Factors such as weather, soil porosity, etc. will cause the ground water level to fluctuate for both pervious and impervious soils.

UNIFIED CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GRAPH SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)	○	GW	WELL-GRADED GRAVEL WELL-GRADED GRAVEL WITH SAND
			●	GP	POORLY GRADED GRAVEL POORLY GRADED GRAVEL WITH SAND
		GRAVELS WITH FINES APPRECIABLE AMT. OF FINES)	●	GM	SILTY GRAVEL SILTY GRAVEL WITH SAND
			▨	GC	CLAYEY GRAVEL CLAYEY GRAVEL WITH SAND
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	CLEAN SAND (LITTLE OR NO FINES)	⁘	SW	WELL-GRADED SAND WELL-GRADED SAND WITH GRAVEL
			⁘	SP	POORLY GRADED SAND POORLY GRADED SAND WITH GRAVEL
		SANDS WITH FINES (APPRECIABLE AMT. OF FINES)	▥	SM	SILTY SAND SILTY SAND WITH GRAVEL
			▧	SC	CLAYEY SAND CLAYEY SAND WITH GRAVEL
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILT AND CLAYS	LIQUID LIMIT LESS THAN 50	▥	ML	SILT, SILT WITH SAND, SANDY SILT GRAVELLY SILT, GRAVELLY SILT WITH SAND
			▨	CL	LEAN CLAY WITH SAND, SANDY LEAN CLAY GRAVELLY LEAN CLAY WITH SAND
			┄	OL	ORGANIC CLAY, SANDY ORGANIC CLAY ORGANIC SILT, SANDY ORGANIC SILT WITH GRAVEL
	SILT AND CLAYS	LIQUID LIMIT GREATER THAN 50	▥	MH	ELASTIC SILT WITH SAND, SANDY ELASTIC SILT GRAVELLY ELASTIC SILT WITH SAND
			▨	CH	FAT CLAY WITH SAND, SANDY FAT CLAY GRAVELLY FAT CLAY WITH SAND
			▨	OH	ORGANIC CLAY WITH SAND, SANDY ORGANIC CLAY, ORGANIC SILT, SANDY ORGANIC SILT
	HIGHLY ORGANIC SOILS		≈	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

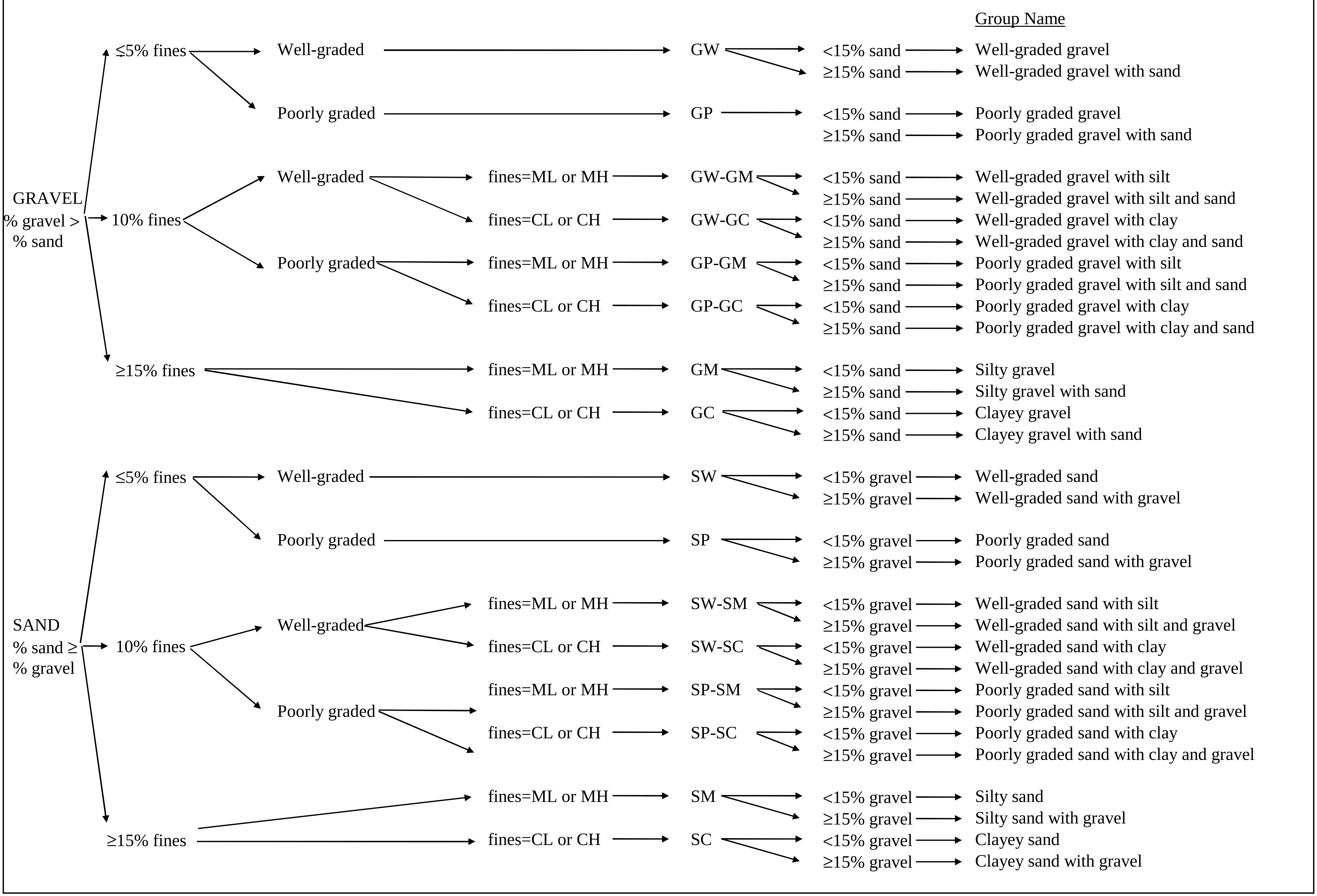


For classification of fine-grained soils and fine-grained fraction of coarse-grained soils.

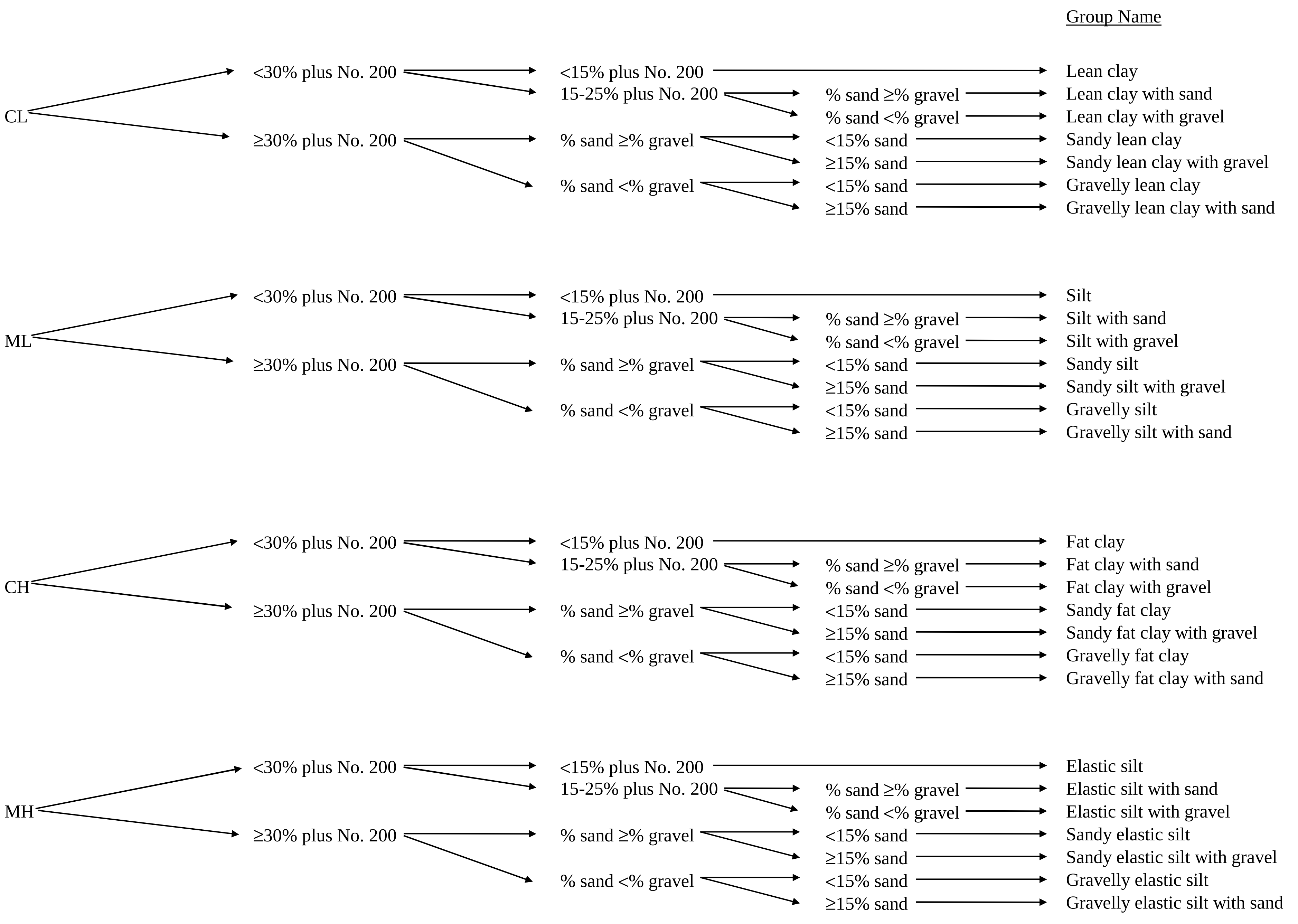
Equation of "A" - line
Horizontal at PI= 4 to LL= 25.5,
then PI= 0.73 (LL-20)

Equation of "U" - line
Vertical at LL= 16 to PI= 7,
then PI= 0.9 (LL-8)

Flow Chart for Visually Identifying Soils Based on ASTM D-2488



Flow Chart for Visually Identifying Soils Based on ASTM D-2488



STANDARD PENETRATION RESISTANCE (ASTM D1586)

The purpose of this test is to determine the relative consistency of the soils in a boring, or from boring over the site. This method consists of making a hole in the ground and driving a 2-inch O.D. split spoon sampler into the soil with a 140-pound hammer dropped from a height of 30 inches. The sampler is driven 18 inches and the number of blows recorded for each 6 inches of penetration. Values of standard penetration (N) are determined in blows per foot, summarizing the flows required for the last two 6-inche increments of penetration.

Example : 2-6-8; N = 14

THIN-WALLED SAMPLER (ASTM D1587)

The purpose of the thin-walled sampler is to recover a relatively undisturbed soil sample for laboratory tests. The sampler is a thin-walled seamless tube with a 3-inch outside diameter, which is hydraulically pressed into the ground, at a constant rate. The ends are then sealed to prevent soil moisture loss, and the tube is returned to the laboratory for tests.

UNCONFINED COMPRESSION OR TRIAXIAL TESTS (ASTM D 2166)

The unconfined compression test and the triaxial tests are performed to determine the shearing strength of the soil, to use in establishing its safe bearing capacity. In order to perform the unconfined compression test, it is necessary that the soil exhibit sufficient cohesion to stand in an unsupported cylinder. These tests are normally performed on samples which are 6.0 inches in height and 2.85 inches in diameter. In the triaxial test, various lateral stresses can be applied to more closely simulate the actual field conditions. There are several different types of triaxial tests. These are, however, normally performed on constant strain apparatus with a deformation rate of 0.05 inches per minute.

CONSOLIDATION TEST (ASTM D 2435)

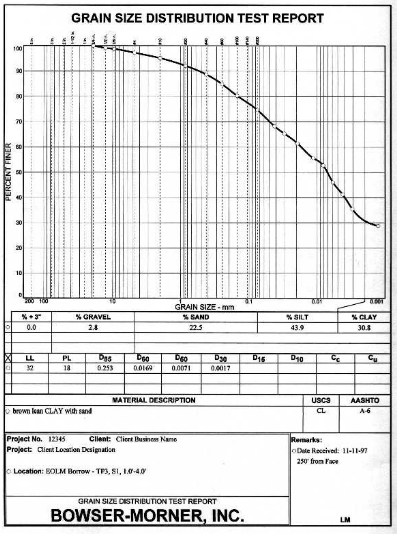
The purpose of this test is to determine the compressibility of the soil. This test is performed on a sample of soil which is 2.5 inches in diameter and 1.0 inch in height, and has been trimmed from relatively "undisturbed" samples. The test is performed with a lever system or an air activated piston for applying load. The loads are applied in increments and allowed to remain on the sample for a period of 24 hours. The consolidation of the sample under each individual load is measured and a curve of void ratio vs. Pressure is obtained. From the information obtained in this manner and the column loads of the structure, it is possible to calculate the settlement of each individual building column. This information, together with the shearing strength of the soil, is used to determine the safe bearing capacity for a particular structure.

REVISED TO ASTM D4318
ATTERBERG LIMITS (ASTM D423 AND D424)

These tests determine the liquid and plastic limits of soils having a predominant percentage of fine particle (silt and clay) sizes. The liquid limit of a soil is the moisture content expressed as a percent at which the soil changes from a liquid to a plastic state, and the plastic limit is the moisture content at which the soil changes from a plastic to a semi-solid state. Their difference is defined as the plasticity index (P.I. = L.L. - P.L.), which is the change in moisture content required to change the soil from a "semi-solid" to a liquid. These tests furnish information about the soil properties which is important in determining their relative swelling potential and their classifications.

MECHANICAL ANALYSIS (ASTM D422)

This test determines the percent of each particle size of a soil. A sieve analysis is conducted on particle sizes greater than a No. 200 sieve (0.074 mm), and a hydrometer test on particles smaller than the No.200 sieve. The gradation curve is drawn through the points of cumulative percent of particle size, and plotted on semi-logarithmic paper for the combined sieve and hydrometer analysis. This test, together with the Atterberg Limits tests, is used to classify a soil.



GRAIN SIZE DISTRIBUTION TEST REPORT

	% + 3"	% GRAVEL	% SAND	% SILT	% CLAY
○	0.0	2.8	22.5	43.9	30.8

☒	LL	PL	D_{85}	D_{60}	D_{60}	D_{30}	D_{15}	D_{10}	C_c	C_u
○	32	18	0.253	0.0169	0.0071	0.0017				

MATERIAL DESCRIPTION	USCS	AASHTO
○ brown lean CLAY with sand	CL	A-6

Project No. 12345 **Client:** Client Business Name
Project: Client Location Designation

○ **Location:** EOLM Borrow - TP3, S1, 1.0'-4.0'

Remarks:
○Date Received: 11-11-97
250' from Face

GRAIN SIZE DISTRIBUTION TEST REPORT
BOWSER-MORNER, INC.

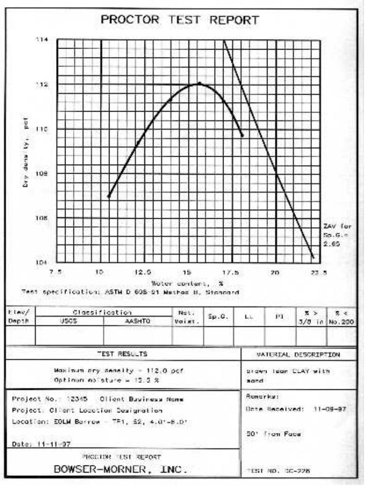
LM

NATURAL MOISTURE CONTENT (ASTM D2216)

The purpose of this test is to indicate the range of moisture contents present in the soil. A wet sample is weighed, placed in the constant temperature oven at 105° for 24 hours, and re-weighed. The moisture content is the change in weight divided by the dry weight.

PROCTOR TESTS

The purpose of these tests is to determine the maximum density and optimum moisture content of a soil. The Modified Proctor test is performed in accordance with ASTM D1557. The test is performed by dropping a 10-pound hammer 25 times from an 18-inch height on each of 5 equal layers of soil in a 1/30 cubic foot mold, which represents a compaction effort of 56,250 foot pounds per cubic foot. The moisture content is then raised, and this procedure is repeated. A moisture density curve is then plotted, with the density on the ordinate axis and the moisture on the abscissa axis. The moisture content at which the maximum density requirement can be achieved with a minimum compactive effort is designated as the optimum moisture content (O.M.C.). The Standard Proctor test is performed in accordance with ASTM D698. This test is similar to the Modified Proctor test and is performed by dropping a 5.5 pound hammer 25 times from a height of 12 inches on 3 equal layers of soil in a 1/30 cubic foot mold, which represents a compaction effort of 12,375 foot pounds per cubic foot. This test gives proportionately lower results than the Modified Proctor test.



PROCTOR TEST REPORT

Test specification: ASTM D 698-91 Method B, Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > 3/8 in	% < No.200
	USCS	AASHTO						

TEST RESULTS

Maximum dry density = 112.0 pcf
Optimum moisture = 15.5 %

MATERIAL DESCRIPTION

Brown lean CLAY with sand

Project No.: 12345 Client Business Name
Project: Client Location Designation
Location: EOLM Borrow - TP1, S2, 4.0'-8.0'

Date: 11-11-97

Remarks:
Date Received: 11-08-97

20' from Face

PROCTOR TEST REPORT
BOWSER-MORNER, INC.

TEST NO. SC-226

CLIENT
Jones & Henry Engineers, Ltd.

PROJECT
Proposed Water Transmission Line, County Road 9, Delta, Fulton County, Ohio

JOB NO. **202201**

BORING STARTED **9/24/21**
BORING COMPLETED **9/24/21**
DRILLER **BK JA**
METHOD **2 1/4" HSA**
TYPED BY **NSR**

B1
Boring No.
Sheet 1 of 1

PROJECT LOCATION
LAT. LONG.
SURFACE ELEVATION **741.0'**
BORING LOCATION
As shown on Boring Location Plan.
It has been necessary to interpolate between samples. Therefore, the contacts between the various soil strata should not be taken as absolute.

COMMENTS

N VALUE, blows/ft. ◇

DEPTH	SAMPLE NO.	SAMPLER TYPE	RECOVERY	VISUAL CLASSIFICATION OF THE MATERIAL	BLOW COUNTS	N VALUE, blows/ft.	REMARKS
0.0–0.25				Asphalt (3")			
0.25–1.0				Crushed Stone (9")			
1.0–6.0				Medium dense brown sand, some silt, moist			
3.5–5.0	SS-1	SS	■		4 4 7	11	
6.0–15.0				Hard brown and gray silt and clay, some sand, trace of gravel, moist			
8.5–10.0	SS-2	SS	■		8 10 11	21	
13.5–15.0	SS-3	SS	■	(Becomes gray at 13.5')	10 12 13	25	
15.0				Bottom of boring at 15.0 feet			

WATER LEVEL MEASUREMENTS

	DEPTH		DATE
INITIAL	NONE	⊽	9/24/2021
AT COMPLETION	NONE	▼	9/24/2021
OTHER		▼	

▩ SS — SPLIT SPOON
▥ SL — SPLIT SPOON W/SOIL LINER
▮ NQ— ROCK CORE
☒ ST — SHELBY TUBE
▮ AS — AUGER CUTTINGS
░ SC— SONIC

BOWSER MORNER.

GINT Report Used: NEWLOGIN Report No.: 202201-XXXX-XXXX.GPJ GINT Template Used: NATALIE_EDITS.GDT Date Printed: 9/30/21

CLIENT
Jones & Henry Engineers, Ltd.

PROJECT
Proposed Water Transmission Line, County Road 9, Delta, Fulton County, Ohio

JOB NO. **202201**

BORING STARTED **9/24/21**

BORING COMPLETED **9/24/21**

DRILLER **BK JA**

METHOD **2 1/4" HSA**

TYPED BY **NSR**

B2
Boring No.

Sheet 1 of 1

PROJECT LOCATION
LAT. LONG.

SURFACE ELEVATION **741.0'**

BORING LOCATION
As shown on Boring Location Plan.

It has been necessary to interpolate between samples. Therefore, the contacts between the various soil strata should not be taken as absolute.

COMMENTS

REMARKS

DEPTH	SAMPLE NO.	VISUAL CLASSIFICATION OF THE MATERIAL	BLOW COUNTS	N VALUE, blows/ft.
		Crushed Stone (12")		
1.0		Brown sand, some silt, moist		
2.0				
3.0				
4.0	SS-1	Hard brown and gray silt and clay, some sand, trace of gravel, moist	3 4 5	9
5.0				
6.0				
7.0				
8.0				
9.0	SS-2		7 8 13	21
10.0				
11.0				
12.0				
13.0				
14.0	SS-3	(Becomes gray at 13.5')	4 5 6	11
15.0		Bottom of boring at 15.0 feet		
16.0				
17.0				
18.0				
19.0				
20.0				

N VALUE scale: 10 20 30 40 50 60 70 80 90

WATER LEVEL MEASUREMENTS

	DEPTH		DATE
INITIAL	NONE	∇	9/24/2021
AT COMPLETION	NONE	▼	9/24/2021
OTHER		▼	

- ▩ SS — SPLIT SPOON
- ▥ SL — SPLIT SPOON W/SOIL LINER
- ◧ NQ— ROCK CORE
- ☒ ST — SHELBY TUBE
- ◨ AS — AUGER CUTTINGS
- ⬚ SC— SONIC

BOWSER MORNER.

CLIENT	**Jones & Henry Engineers, Ltd.**
PROJECT	**Proposed Water Transmission Line, County Road 9, Delta, Fulton County, Ohio**
JOB NO.	**202201**
BORING STARTED	**9/24/21**
BORING COMPLETED	**9/24/21**
DRILLER	**BK JA**
METHOD	**2 1/4" HSA**
TYPED BY	**NSR**

B3
Boring No.
Sheet 1 of 1

PROJECT LOCATION
LAT. LONG.
SURFACE ELEVATION **741.0'**
BORING LOCATION
As shown on Boring Location Plan.

It has been necessary to interpolate between samples. Therefore, the contacts between the various soil strata should not be taken as absolute.

DEPTH	SAMPLE NO.	SAMPLER TYPE	RECOVERY	VISUAL CLASSIFICATION OF THE MATERIAL	BLOW COUNTS	N VALUE, blows/ft.	COMMENTS	REMARKS
0.0–3.5				Stiff brown silt with some clay				
3.5–5.0	SS-1	SS		Hard brown and gray silt and clay, some sand, trace of gravel, moist	5 6 7	13		
8.5–10.0	SS-2	SS			5 8 11	19		
13.5–15.0	SS-3	SS		(Becomes gray at 13.5')	4 6 8	14		
15.0				Bottom of boring at 15.0 feet				

WATER LEVEL MEASUREMENTS

	DEPTH		DATE
INITIAL	NONE	▽	9/24/2021
AT COMPLETION	NONE	▼	9/24/2021
OTHER		▼	

- ▩ SS — SPLIT SPOON
- ▥ SL — SPLIT SPOON W/SOIL LINER
- ◧ NQ— ROCK CORE
- ☒ ST — SHELBY TUBE
- ◨ AS — AUGER CUTTINGS
- ⬚ SC— SONIC

BOWSER MORNER.

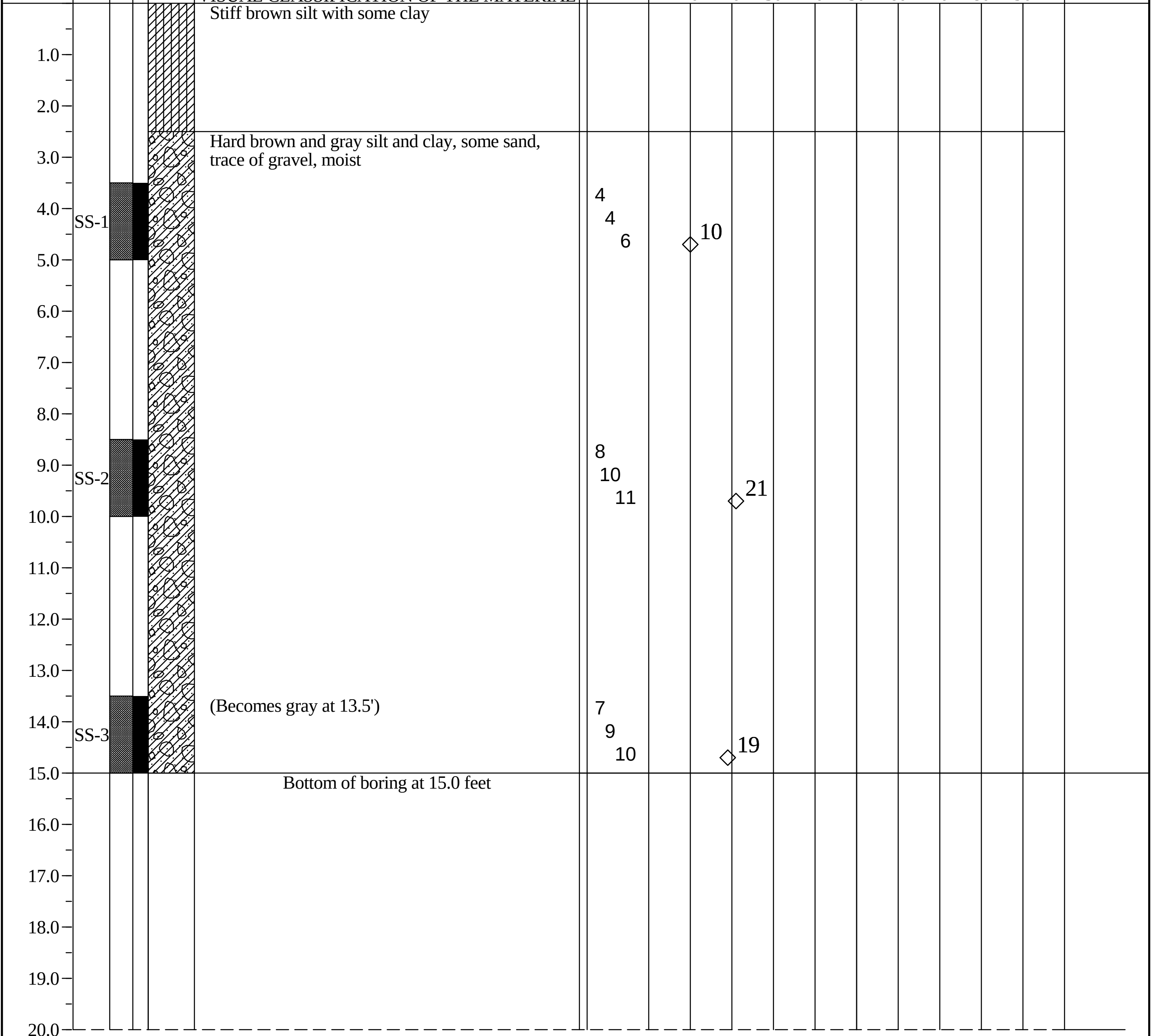
CLIENT **Jones & Henry Engineers, Ltd.**	JOB NO. **202201**		
PROJECT **Proposed Water Transmission Line, County Road 9, Delta, Fulton County, Ohio**	BORING STARTED **9/24/21**	BORING COMPLETED **9/24/21**	**B4** Boring No.
	DRILLER **BK JA**	METHOD **2 1/4" HSA**	
	TYPED BY **NSR**		**Sheet 1 of 1**

PROJECT LOCATION
LAT. LONG.
SURFACE ELEVATION **741.0'**

BORING LOCATION
As shown on Boring Location Plan.

It has been necessary to interpolate between samples. Therefore, the contacts between the various soil strata should not be taken as absolute.

COMMENTS



DEPTH	SAMPLE NO.	VISUAL CLASSIFICATION OF THE MATERIAL	BLOW COUNTS	N VALUE, blows/ft.
0.0–2.5		Stiff brown silt with some clay		
2.5–15.0		Hard brown and gray silt and clay, some sand, trace of gravel, moist		
3.5–5.0	SS-1		4 4 6	10
8.5–10.0	SS-2		8 10 11	21
13.5–15.0	SS-3	(Becomes gray at 13.5')	7 9 10	19
15.0		Bottom of boring at 15.0 feet		

WATER LEVEL MEASUREMENTS

	DEPTH		DATE
INITIAL	NONE	▽	9/24/2021
AT COMPLETION	NONE	▼	9/24/2021
OTHER		▼	

▩ SS — SPLIT SPOON
▥ SL — SPLIT SPOON W/SOIL LINER
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BOWSER MORNER.

MOISTURE CONTENT SUMMARY SHEET

Job No. 202201

Boring No.	Sample No.	Depth (Feet)	Moisture (%)
1	SS-1	3.5 - 5.0	9.9
	SS-2	8.5 - 10.0	13.8
	SS-3	13.5 - 15.0	14.0
2	SS-1	3.5 - 5.0	22.0
	SS-2	8.5 - 10.0	18.3
	SS-3	13.5 - 15.0	15.2
3	SS-1	3.5 - 5.0	16.8
	SS-2	8.5 - 10.0	14.6
	SS-3	13.5 - 15.0	14.3
4	SS-1	3.5 - 5.0	26.0
	SS-2	8.5 - 10.0	14.0
	SS-3	13.5 - 15.0	15.4