



**Soil Study for Subsurface Investigation  
Tomberg Street, Ansbury Drive, Hubbard Drive,  
Barnard Drive, and Hemingway Road, Huber Heights, Ohio**

**Submitted To:**

**City of Huber Heights  
Attn. Ms. Hanane Eisentraut  
6131 Taylorsville Road  
Huber Heights, Ohio 45424**

**Report No. 209619-0523-088  
May 05, 2023**

**BOWSER  
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May 05, 2023

City of Huber Heights  
6131 Taylorsville Road  
Huber Heights, Ohio 45424

Attention: Ms. Hanane Eisentraut  
Assistant City Engineer

Re: Report No. 209619-0523-088; Soil Study for  
Subsurface Investigation, Tomberg Street,  
Ansbury Drive, Hubbard Drive, Barnard  
Drive, and Hemingway Road, Huber Heights,  
Ohio

Dear Ms. Eisentraut:

Bowser-Morner, Inc. is pleased to submit our report of the soil study for the above-referenced project. The purpose of this study is to determine the physical characteristics of the soil strata and groundwater depths along the five streets.

The samples collected that were not used to perform the laboratory tests will be kept in our laboratory for 30 days unless you advise us otherwise. If you have any questions or if we can help you in any way on this project or future work, please call us.

Respectfully submitted,  
BOWSER-MORNER, INC.

**"This document was originally issued by Chris R. Ryan, M.S.C.E., P.E. and Daniel Otieno on May 05, 2023. This document is not considered a sealed document."**

Daniel M. Otieno  
Geotechnical Engineer

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3-Client  
2-File

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## Section I

Text

## 1.0 INTRODUCTION

We understand that you propose to determine the subgrade soil conditions along five streets in Huber Heights, Ohio. The five streets are: Tomberg Street, Ansbury Drive, Hubbard Drive, Barnard Drive, and Hemingway Road. A vicinity map (Figure 1) is included in Section III of this report. Our findings on the soil conditions and groundwater levels are given in this report.

Authorization to proceed with this soil study was given by City of Huber Heights in a signed proposal acceptance sheet dated March 27, 2023. The work was to proceed in accordance with our proposal and agreement, Quotation No. 23-2771-029 dated March 21, 2023.

## 2.0 WORK PERFORMED

### 2.1 Field Work

Five soil borings were made at the locations shown on the boring location plan, Figure 2 in Section III. The boring logs and boring location plan are included in Section III. The borings were made with a truck-mounted boring rig using hollow-stem augers and standard penetration resistance methods. The standard penetration tests were performed in accordance with ASTM D1586, which includes a 140-pound hammer, 30-inch drops, and two-inch-O.D. split-spoon samplers driven at maximum depth intervals of five feet or at major changes in stratum, whichever occurred first. The disturbed split-spoon samples were visually classified, logged, sealed in moisture-proof jars, and taken to the Bowser-Morner, Inc. laboratory for study. The depths where these "SS"-type split-spoon samples were collected are noted on the corresponding boring logs.

### 2.2 Laboratory Work

One Unified Soil Classification soil classification test was performed in accordance with ASTM D422, D2216, D2487, and D4318. The purpose of this type of test is to determine parameters that aid in the evaluation of the general behavior of the soils.

Five Atterberg limits tests were performed in accordance with ASTM D4318 to determine the liquid and plastic limits on the most visibly plastic cohesive soil or as needed for soil classification. In addition, 15 moisture content determinations were made in accordance with ASTM D2216. The moisture contents ranged from 11.8% to 12.0% for the brown silty sand, from 8.2% to 11.6% for the brown sandy lean clay, from 9.6% to 12.7% for the brown silty lean clay, from 9.3% to 13.4% for the gray sandy lea clay, and from 10.5% to 18.5% for the brown and gray silty lean clay. The moisture content for the gray clayey silt was 9.2%. The results of the laboratory tests are summarized in Table 2-1 and included in Section III of this report.

Table 2-1. Summary of Laboratory Test Results

Boring No.	Depth (ft.)	Moisture Content (%)	% Gravel	% Sand	% Fines	Atterberg Limits
						LL
						PL
1	3.5 – 5.0	12.0				
	6.0 – 7.5	11.8				
	8.5 – 10.0	11.6				
						21
						14
						7

**Table 2-1. Summary of Laboratory Test Results**

Boring No.	Depth (ft.)	Moisture Content (%)			% Gravel	% Sand	% Fines	Atterberg Limits		
		LL	PL	PI						
2	1.0 – 2.5	8.6								
	6.0 – 7.5	12.7						22	14	8
	8.5 – 10.0	13.4								
3	1.0 – 2.5	9.6								
	6.0 – 7.5	17.2						28	16	12
	8.5 – 10.0	10.5	11.3	36.5	52.2			18	13	5
4	1.0 – 2.5	12.1								
	6.0 – 7.5	18.5						29	16	13
	8.5 – 10.0	9.3								
5	3.5 – 5.0	16.3						18	16	2
	6.0 – 7.5	8.2								
	8.5 – 10.0	9.2								

Five sets of chemical tests were performed on soil samples from this site to determine the corrosivity potential. The soil pH was determined in accordance with ASTM D4972, the water-soluble sulfate content was determined in accordance with ASTM D516, and the water-soluble chloride content was determined in accordance with ASTM D512. The results of the chemical tests are summarized in Table 2-2 and included in Section III of this report.

**Table 2-2. Summary of Chemical Test Results**

Boring No.	Depth (ft)	Soil pH		Water-Soluble Sulfate Ion (ppm)	Water-Soluble Chloride Ion (ppm)
		In Distilled Water	In Calcium Chloride Solution		
1	1.0 – 2.5	9.0	8.2	30	43
2	3.5 – 5.0	8.9	8.1	61	120
3	3.5 – 5.0	8.7	8.0	54	5
4	3.5 – 5.0	8.5	8.0	50	120
5	1.0 – 2.5	9.1	8.3	43	130

Based on ACI Building Code 318, the water soluble sulfate of 60 mg/kg (ppm) and less can be considered negligible. Based on ACI Building Code 318, water-soluble-chloride of 0.06% (600 ppm) by weight or greater requires corrosion protection for any pre-stressed concrete members. The water-soluble-chloride of 130 mg/kg (ppm) is less than the maximum value of 0.06% (600 ppm) by weight. The pH levels were determined to be between 8.0 and 9.1. A pH level of 5 or below can lead to extreme corrosion rates and premature pitting of metallic objects.

## 3.0 SOIL AND GROUNDWATER CONDITIONS

### 3.1 Boring 1 – Hemingway Road

Based on the information from the boring made for this study along Hemingway Road, the subgrade soil conditions are described in descending order below:

- Fifteen inches of undocumented and uncontrolled fill consisting of 4.5 inches of asphalt and 10.5 inches of granular base.
- Below the fill layer, approximately 6.5 feet of very-loose-to-medium-dense brown silty sand with gravel.
- Below the silty sand layer, very stiff brown sandy lean clay extending to the bottom of this boring at a depth of ten feet.

### 3.2 Boring 2 – Hubbard Drive

Based on the information from the boring made for this study along Hubbard Drive, the subgrade soil conditions are described in descending order below:

- Seventeen inches of undocumented and uncontrolled fill consisting of 5 inches of asphalt and 12 inches of granular base.
- Below the fill layer, approximately 4.5 feet of very-soft-to- very-stiff brown sandy lean clay.
- Below the brown sandy lean clay layer, two feet of very soft brown silty lean clay.
- Below the brown silty lean clay layer, very soft gray sandy lean clay extending to the bottom of this boring at a depth of 10 feet.

### 3.3 Boring 3 – Ansbury Drive

Based on the information from the boring made for this study along Ansbury Drive, the subgrade soil conditions are described in descending order below:

- 14.5 inches of undocumented and uncontrolled fill consisting of 5 inches of asphalt and 9.5 inches of granular base.
- Below the fill layer, approximately 4.5 feet of medium-stiff-to-stiff brown silty lean clay.
- Below the silty lean clay layer, medium stiff brown and gray silty lean clay extending to the bottom of this boring at a depth of 10 feet.

### 3.4 Boring 4 – Tomberg Street

Based on the information from the boring made for this study along Tomberg Street, the subgrade soil conditions are described in descending order below:

- Seventeen inches of undocumented and uncontrolled fill consisting of 4 inches of asphalt and 13 inches of granular base.
- Below the fill layer, approximately 6.5 feet of medium-stiff-to-stiff brown and gray silty lean clay.
- Below the silty lean clay layer, stiff gray sandy lean clay extending to the bottom of this boring at a depth of 10 feet.

### 3.5 Boring 5 – Barnard Drive

Based on the information from the boring made for this study along Barnard Drive, the subgrade soil conditions are described in descending order below:

- 3.5 inches of undocumented and uncontrolled fill consisting of 3.5 inches of asphalt.
- Below the fill layer, approximately 5.5 feet of stiff-to-very-stiff brown and gray silty lean clay.
- Below the silty lean clay layer, two feet of very stiff brown sandy lean clay.
- Below the sandy lean clay layer, very stiff gray clayey silt extending to the bottom of this boring at a depth of 10 feet.

Free groundwater was encountered during the advancement of the borings at the depths and elevations summarized in Table 3-1.

**Table 3-1. Summary of Groundwater Observations**

Boring No.	Depth Groundwater First Observed (ft)		Groundwater Observations at Completion of Boring	
	Depth	Elevation	Depth	Elevation
1	3.0	993.0	No Water	
2		No Water	No Water	
3		No Water	No Water	
4		No Water	No Water	
5		No Water	No Water	

Free groundwater is defined as water that seeps into an open borehole before it is backfilled. Groundwater observations were made during the boring operations by noting the depth of water on the boring tools and in the open boreholes following withdrawal of the boring augers. However, it should be noted that short-term water level readings are not necessarily a reliable indication of the groundwater level and that significant fluctuations may occur due to variations in rainfall and other factors. For specific questions on the soil conditions, please refer to the individual boring logs in Section III.

## 4.0 DISCUSSION AND FINDINGS

### 4.1 Project Description

We understand that you propose to determine the subgrade soil conditions along five streets in Huber Heights, Ohio. The five streets are: Tomberg Street, Ansbury Drive, Hubbard Drive,

Barnard Drive, and Hemingway Road. The purpose of this study is determine the subgrade soil conditions, including the corrosiveness of the soils, and groundwater depths along the five streets.

The following recommendations are based on this information. If the above statements are incorrect or changes are made, Bowser-Morner, Inc. should be notified so that the new data can be reviewed and additional recommendations and services can be given if required to meet the needs of your project.

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## 4.2 FINDINGS

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Based on information from the five borings made for this study, the thicknesses of the asphalt pavement and granular base are tabulated in Table 4-1.

**Table 4-1. Thickness of Asphalt Pavement and Base**

Boring No.	Street	Thickness of Asphalt Pavement (inches)	Thickness of Granular Base (inches)
1	Hemingway Road	4.5	10.5
2	Hubbard Drive	5.0	12.0
3	Ansbury Drive	5.0	9.5
4	Tomberg Street	4.0	13.0
5	Barnard Drive	3.5	N/A

The subgrade soils encountered below the pavement and/or base consisted of silty sand with gravel, sandy lean clay, silty lean clay, and clayey silt. In the vicinity of Borings 1 and 2, the original soil is very soft or very loose with "N" values between 0 and 3 blows per foot. The very loose soil was encountered in Boring 1 at a depth of 3.5 feet. The very soft soil was encountered in Boring 2 at depths of 3.5 to 10 feet.

Based on the Soil Survey of Montgomery County, Ohio from the United States Department of Agriculture Soil Conservation Service, the soil are classified as outlined below in Table 4-2.

**Table 4-2. USDA Soil Classifications**

Boring No.	Street	USDA Classification
1	Hemingway Road	CsA (Crosby Silt Loam) & MIB (Miamian Silt Loam)
2	Hubbard Drive	MoB (Miamian – Urban Land Complex, Undulating)
3	Ansbury Drive	MoB (Miamian – Urban Land Complex, Undulating)
4	Tomberg Street	MoB (Miamian – Urban Land Complex, Undulating)
5	Barnard Drive	MoB (Miamian – Urban Land Complex, Undulating)

Based on the information provided in the Soil Survey of Montgomery County, Ohio from the United States Department of Agriculture Soil Conservation Service, the pH of the CsA soil can range from 5.1 to 7.3 within the top 28 inches and will range from 7.4 to 8.4 at a depth of 28 to 79 inches. The pH of the MIB soil can range from 5.6 to 7.8 within the top 36 inches and will range from 7.4 to 8.4 at a depth of 36 to 79 inches. The pH of the MoB soil can range from 5.1 to 6.5 within the top 24 inches and will range from 7.4 to 8.4 at a depth of 28 to 79 inches. A detailed summary report of the chemical soil properties from the Soil Survey of Montgomery County, Ohio at each boring location is included in Section III.

As outlined in Table 2-2, the pH levels of the soils from the samples collected for this study were determined to be between 8.0 and 9.1. Again, a pH level of 5 or below can lead to extreme corrosion rates and premature pitting of metallic objects.

Additionally, based on ACI Building Code 318, the water soluble sulfate of 60 mg/kg (ppm) and less can be considered negligible. Based on ACI Building Code 318, water-soluble-chloride of 0.06% (600 ppm) by weight or greater requires corrosion protection for any pre-stressed concrete members. The water-soluble-chloride of 130 mg/kg (ppm) is less than the maximum value of 0.06% (600 ppm) by weight.

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#### 4.4 Excavations

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During any excavations, the subsurface conditions should be verified. Changes in subsurface conditions other than what are shown on the boring logs warrant additional subsurface investigation.

Any excavations should be observed to ensure that the loose, soft, or otherwise undesirable materials are removed and that the subbase will be supported directly on an acceptable surface. At the time of this observation, it may be necessary to use a hand penetration device in the base of the excavation to ensure that the soils immediately below the base are satisfactorily prepared. Please note that such shallow observations do not replace an adequate deep-boring program and structural fill compaction QA/QC records. The overall performance of the prepared subgrade is governed by the soils below the bottom of the subbase.

If pockets of soft, loose, or otherwise unsuitable materials are encountered in the excavations and it is inconvenient to lower the subgrade, the proposed elevations may be reestablished by backfilling after the undesirable materials have been removed. The excavation should extend to suitable soils, and the base of the excavation should extend one lateral foot for every foot of excavation below the bottom of the subbase. The entire excavation should then be refilled with well-compacted, engineered fill. Special care should be taken to remove the sloughed, loose, or soft materials near the base of the excavation slopes. Extra care should also be taken to tie-in the compacted fill with the excavation slopes, with benches as necessary, to ensure that no pockets of loose or soft materials are left along the excavation slopes below the subgrade bearing level. The contractor should maintain temporary cut slopes in accordance with the current OSHA regulations governing trenching and slope stability.

Soils exposed at the bases of satisfactory excavations should be protected against any detrimental change in condition such as from construction disturbances, rain, and freezing. Surface runoff should be drained away from the excavation and not allowed to pond. The excavations should be adequately protected. Also, for this reason, proper drainage should be maintained after construction. It must be emphasized that all excavations must conform to all state, federal, and local regulations relative to slope geometry.

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#### 4.6 Dewatering

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At the time of our study, free groundwater was encountered in Boring 1 at a depth of 3 feet below the existing grade as outlined in Table 3-1. No groundwater was encountered in any of the remaining borings during the boring operations. Any groundwater and surface water encountered in any excavation should be lowered to the bottom of the maximum excavation

using sumps and pumps. Sumps can consist of perforated pipes or drums installed vertically in the relatively permeable granular soils and surrounded with free-draining sand and gravel. The perforations of the pipe should be covered with a layer of filter fabric to keep silt and fine sand from pumping through the sumps. Care must be exercised when pumping from sumps that extend into silts or other granular soils since general deterioration of the bearing soils and a localized "quick" condition could result. The groundwater should be kept at a level below the fill operation during the placement and compaction of the backfill materials during construction.

The amount and type of dewatering required during construction will depend on the weather and groundwater levels at the time of construction, and the effectiveness of the contractor's techniques in preventing surface runoff from entering open excavations. Typically, groundwater levels are highest during winter and spring, and lower in summer and early fall.

## 5.0 CLOSURE

### 5.1 Basis Of Recommendations

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 were not necessarily limited to:

- Five exploratory borings performed during this study.
- Observations of the project site by our staff.
- The results of the laboratory soil tests.
- Published soil or geologic data of this area.

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

### 5.2 Limitations And Additional Services

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.

Due to the wide spacing of the borings, additional borings and laboratory analyses can be performed to further define the soil subgrade conditions.

It must be emphasized that the excavation and compaction of soil fill are highly influenced by weather conditions. Performing the earthwork under wet and frozen conditions is generally very difficult. Hence, compaction of wet silty and clayey soil should be avoided during wet and frozen

conditions because the wet soil cannot be compacted to the required unit weight without drying or other soil stabilization methods.

Regardless of the thoroughness of a subsurface exploration, there is the possibility that conditions between borings will differ from those at the boring locations, that conditions are not as anticipated by designers, or that 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 reevaluate the recommendations of this report. Consequently, after submission of this report, it is recommended that Bowser-Morner, Inc. be authorized to perform additional services to work with the designer(s) to minimize errors and omissions regarding the interpretation and implementation of this report.

Before any construction begins, we recommend that Bowser-Morner, Inc.:

- 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.
- Review final plans and specifications pertaining to geotechnical aspects of design.

During any construction, we recommend that Bowser-Morner, Inc.:

- Observe the construction, particularly the site preparation, fill placement, and excavation.
- Perform in-place density testing of all compacted fill.
- Perform materials testing of soil and other materials as required.
- Consult with the design team to make design changes in the event that differing subsurface conditions are encountered.

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

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### 5.3 Warranty

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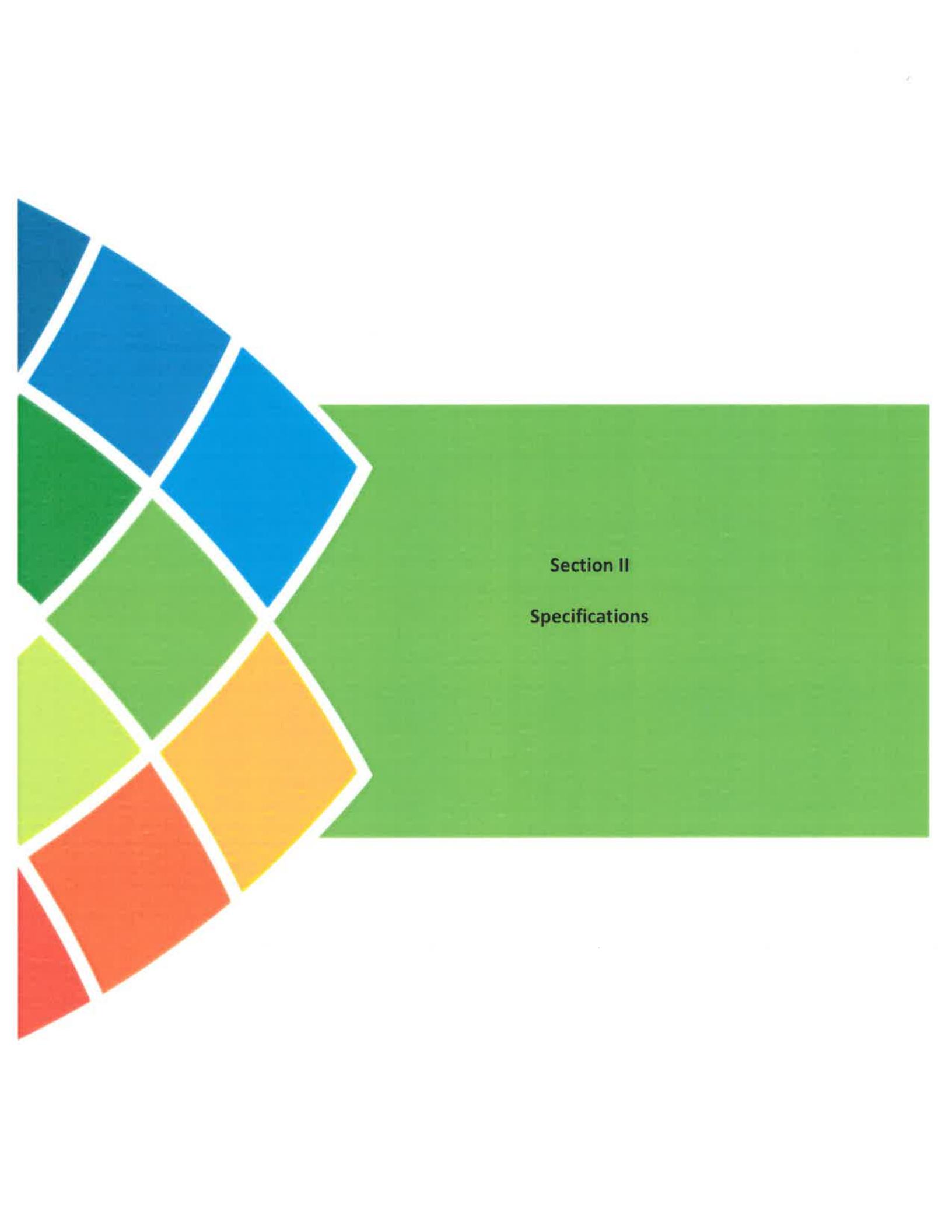
Our professional services have been performed, our findings obtained and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. No other warranty, express or implied, is made.

The scope of this study did not include an environmental assessment for the presence or absence of hazardous or toxic materials in the soil, surface water, groundwater or air, on, within or beyond the site studied. 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.

To evaluate the site for possible environmental liabilities, we recommend an environmental assessment, consisting of a detailed site reconnaissance, a record review, and report of findings. Additional subsurface drilling and sampling, including groundwater sampling, may be required.

Bowser-Morner, Inc. can provide this service and would be pleased to provide a cost proposal to perform such a study, if requested.

This report has been prepared for the exclusive use of City of Huber Heights for specific application to the subgrade investigation on Tomberg Street, Ansbury Drive, Hubbard Drive, Barnard Drive, and Hemingway Road in Huber Heights, Ohio (see Figure 1 in Section III of this report). Specific design and construction recommendations have been provided in the various sections of the report. The report shall 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. Bowser-Morner, Inc. 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.



## **Section II**

### **Specifications**

# **CLEARING AND GRADING SPECIFICATIONS**

## **I. GENERAL CONDITIONS**

The contractor shall furnish all labor, materials, and equipment, and perform all work and services necessary to complete in a satisfactory manner the site preparation, excavation, filling, compaction and grading as shown on the plans and as described therein.

This work shall consist of all clearing and grading, removal of existing structures unless otherwise stated, preparation of the land to be filled, filling of the land, spreading and compaction of the fill, and all subsidiary work necessary to complete the grading of the cut and fill areas to conform with the lines, grades, slopes, and specifications.

This work is to be accomplished under the constant and continuous supervision of the Owner or his designated representative.

In these specifications the terms "approved" and "as directed" shall refer to directions to the Contractor from the Owner or his designated representative.

## **II. SUBSURFACE CONDITIONS**

Prior to bidding the work, the Contractor shall examine, investigate and inspect the construction site as to the nature and location of the work, and the general and local conditions at the construction site, including, without limitation, the character of surface or subsurface conditions and obstacles to be encountered on and around the construction site; and shall make such additional investigation as he may deem necessary for the planning and proper execution of the work. Borings and/or soil investigations shall have been made. Results of these borings and studies will be made available by the Owner to the Contractor upon his request, but the Owner is not responsible for any interpretations or conclusions with respect thereto made by the Contractor on the basis of such information, and the Owner further has no responsibility for the accuracy of the borings and the soil investigations.

If conditions other than those indicated are discovered by the Contractor, the Owner should be notified immediately. The material which the Contractor believes to be a changed condition should not be disturbed so that the Owner can investigate the condition.

## **III. SITE PREPARATION**

Within the specified areas, all trees, brush, stumps, logs, tree roots, and structures scheduled for demolition shall be removed and disposed of.

All cut and fill areas shall be properly stripped. Topsoil will be removed to its full depth and stockpiled for use in finish grading. Any rubbish, organic and other objectionable soils, and other deleterious material, shall be disposed of off the site, or as directed by the Owner or his designated representative if on site disposal is provided. In no case shall such objectionable material be allowed in or under the fill unless specifically authorized in writing.

Prior to the addition of fill, the original ground shall be compacted to job specifications as outlined below. Special notice shall be given to the proposed fill area at this time. If wet spots, spongy conditions, or ground water seepage is found, corrective measures must be taken before the placement of fill.

#### **IV. FORMATION OF FILL AREAS**

Fills shall be formed of satisfactory materials placed in successive horizontal layers of not more than eight (8) inches in loose depth for the full width of the cross section. The depth of lift may be increased if the Contractor can demonstrate the ability to compact a larger lift. If compaction is accomplished using hand-tamping equipment, lifts will be limited to 4-inch loose lifts.

All material entering the fill shall be free of organic matter such as leaves, grass, roots, and other objectionable material.

The operations on earth work shall be suspended at any time when satisfactory results cannot be obtained because of rain, freezing weather, or other unsatisfactory conditions. The Contractor shall keep the work areas graded to provide the drainage at all times.

The fill material shall be of the proper moisture content before compaction efforts are started. Wetting or drying of the material and manipulation to secure a uniform moisture content throughout the layer shall be required. Should the material be too wet to permit proper compaction or rolling, all work on all portions of the embankment thus affected shall be delayed until the material has dried to the required moisture content. The moisture content of the fill material should be no more than two (2) percentage points higher or lower than optimum unless otherwise authorized. Sprinkling shall be done with equipment that will satisfactorily distribute the water over the disced area.

Compaction operations shall be continued until the fill is compacted to not less than 90% above foundation elevation and 95% below foundation elevation, of the maximum density as determined in accordance with the latest ASTM D-1557 (Modified). Any areas inaccessible to a roller shall be consolidated and compacted by mechanical tampers. The equipment shall be operated in such a manner that hardpan, cemented gravel, clay or other chunky soil material will be broken up into small particles and become incorporated with the other material in the layer.

In the construction of filled areas, starting layers shall be placed in the deepest portion of the fill, and as placement progresses, additional layers shall be constructed in horizontal planes. If directed, original slopes shall be continuously, vertically benched to provide horizontal fill planes. The size of the benches shall be formed so that the base of the bench is horizontal and the back of the bench is vertical. As many benches as are necessary to bring the site to final grade shall be constructed. Filling operations shall begin on the lowest bench, with the fill being placed in horizontal eight (8) inch loose lifts unless otherwise authorized. The filling shall progress in this manner until the entire first bench has been filled, before any fill is placed on the succeeding benches. Proper

drainage shall be maintained at all times during benching and filling of the benches, to insure that all water is drained away from the fill area.

When rock and other embankment material are excavated at approximately the same time, the rock shall be incorporated into the outer portion of the areas. Stones or fragmentary rock larger than four (4) inches in their greatest dimensions will not be allowed in the fill unless specifically authorized in writing. Rock fill shall be brought up in layers as specified or as directed, and every effort shall be exerted to fill the voids with the finer material to form a dense, compact mass. Rock or boulders shall be disposed of as deleterious material per Item III.

Frozen material shall not be placed in the fill nor shall the fill be placed upon frozen material.

The Contractor shall be responsible for the stability of all fills made under the contract, and shall replace any portion, which in the opinion of the Owner or his designated representative, has become displaced due to carelessness or negligence on the part of the Contractor. Fill damaged by inclement weather shall be repaired at the Contractor's expense.

#### **V. SLOPE RATIO AND STORM WATER RUN-OFF**

Slopes shall not be greater than 2 (horizontal) to 1 (vertical) in both cut and fill, and storm water shall not be drained over the slopes.

#### **VI. GRADING**

The Contractor shall furnish, operate, and maintain such equipment as is necessary to construct uniform layers, and control smoothness of grade for maximum compaction and drainage.

#### **VII. COMPACTING**

The compaction equipment shall be approved equipment of such design, weight, and quantity to obtain the required density in accordance with these specifications.

#### **VIII. TESTING AND INSPECTION SERVICES**

Testing and inspection services will be provided by the Owner.

#### **IX. SPECIAL CONDITIONS**



### Section III

#### Boring Log Terminology, Boring Logs, Laboratory Data, And Prints

## BORING LOG TERMINOLOGY

### **Stratum Depth:**

Distance in feet and/or inches below ground surface.

### **Stratum Elevation:**

Elevation in feet below ground surface elevation.

### **Description of Materials:**

Major types of soil material existing at boring location. Soil classification based on one of the following systems: Unified Soil Classification System., Ohio State Highway Classification System, Highway Research Board Classification System, Federal Aviation Authority Classification System, Visual Classification.

### **Sample No.:**

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

### **Sample Type:**

“A” Split spoon, 2” O.D., 1-3/8” I.D., 18” in length.

“B” Rock Core

“C” Shelby Tube 3” O.D. except where noted

“D” Soil Probe

“E” Auger Cuttings

“F” Sonic

### **Sample Depth:**

Depth below top of ground at which appropriate sample was taken.

### **Blows per 6” on Sampler:**

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

### **“N” Blows/Ft.:**

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

### Water Observations:

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

## SOIL DESCRIPTION

### Color:

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-brown, yellow-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.

Particle Size	Visual	Soil Components	
		Major Component:	Minor Component Term
Boulders	Larger than 8"	Gravel	Trace 1-10%
Cobbles	8" to 3"	Sand	Some 11-35%
Gravel - Coarse	3" to 3/4"	Silt	And 36-50%
- Fine	2 mm. To 3/4"	Clay	
Sand - Coarse	2 mm. - 0.6 mm. (Pencil lead size)		
- Medium	0.6 mm. - 0.2mm. Table sugar and salt size)		
- Fine	0.2 mm. - 0.06 mm. (Powdered sugar and human hair size)	Term	Moisture Content
Silt	0.06 mm. - 0.002 mm.	Dry	Relative Moisture
Clay	0.002 and smaller (Particle size of both Silt and Clay not visible To naked eye	Damp	Powdery
		Moist	Moisture content below plastic limit
		Wet	Moisture content above plastic limit but below liquid limit
			Moisture content Above liquid limit

### Condition of Soil Relative to Compactness Granular Material

Very Loose	5 blows/ft. or less
Loose	6 to 10 blows/ft.
Medium Dense	11 to 30 blows/ft.
Dense	30 to 50 blows/ft.
Very Dense	51 blows/ft. or more

### Condition of Soil Relative to Consistency Cohesive Material

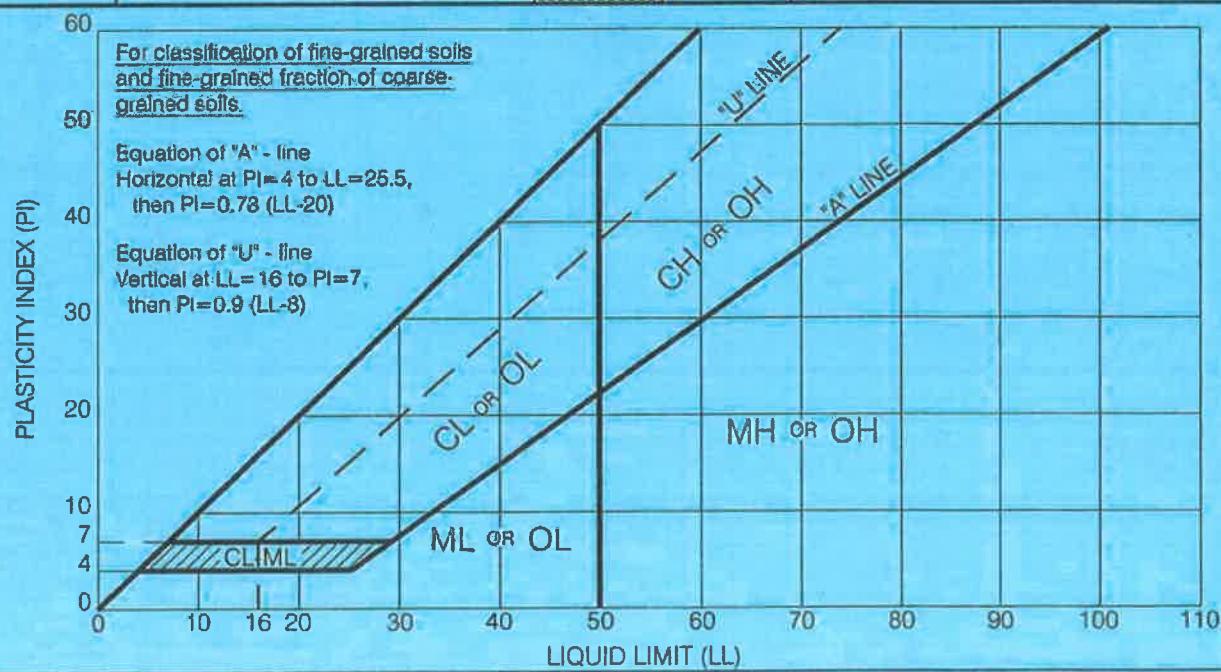
Very Soft	3 blows/ft. or less
Soft	4 to 5 blows/ft.
Medium Stiff	6 to 10 blows/ft.
Stiff	11 to 15 blows/ft.
Very stiff	16 to 30 blows/ft.
Hard	31 blows/ft. or more



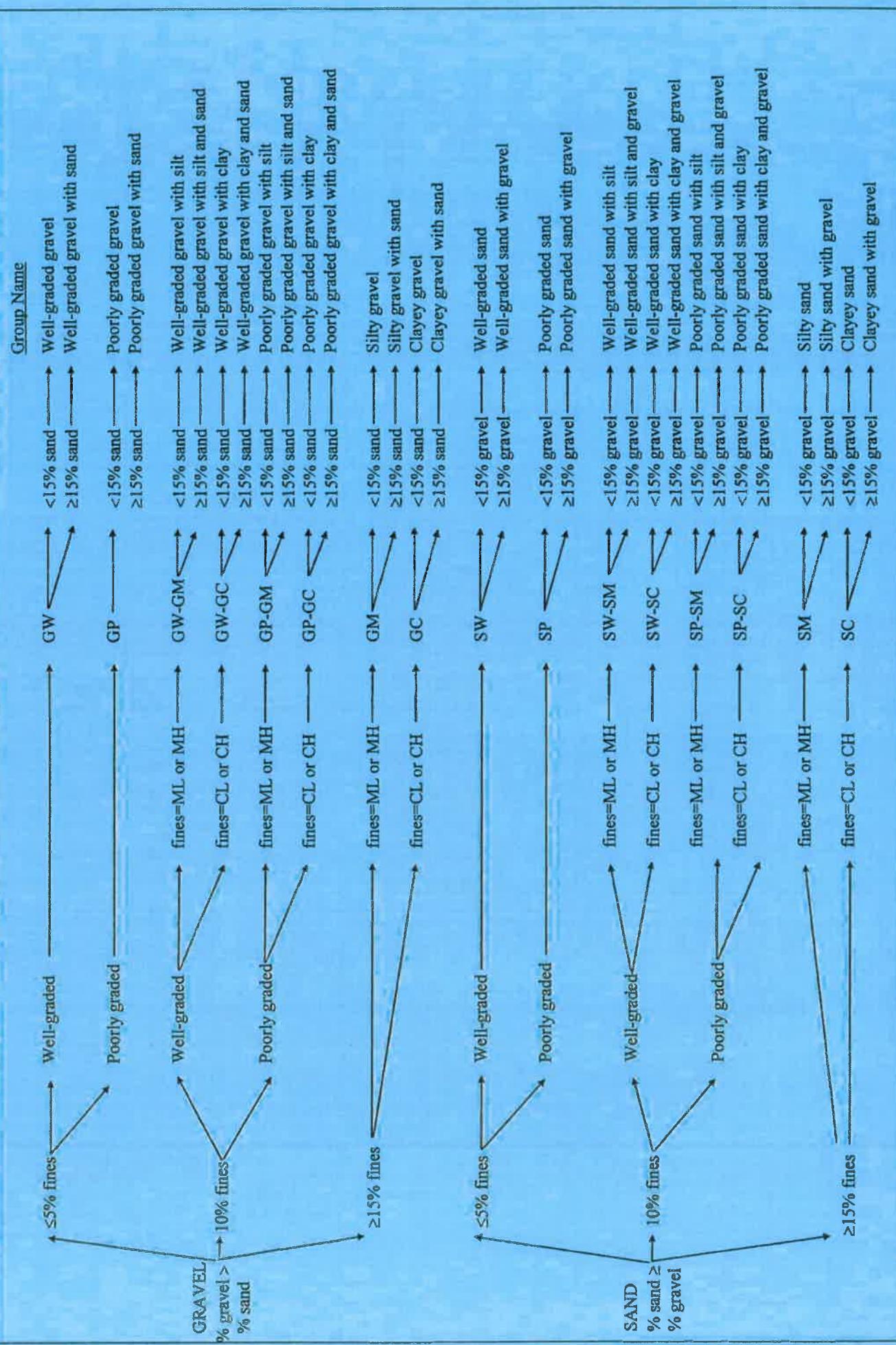
**BOWSER  
MORNER**

## UNIFIED CLASSIFICATION SYSTEM

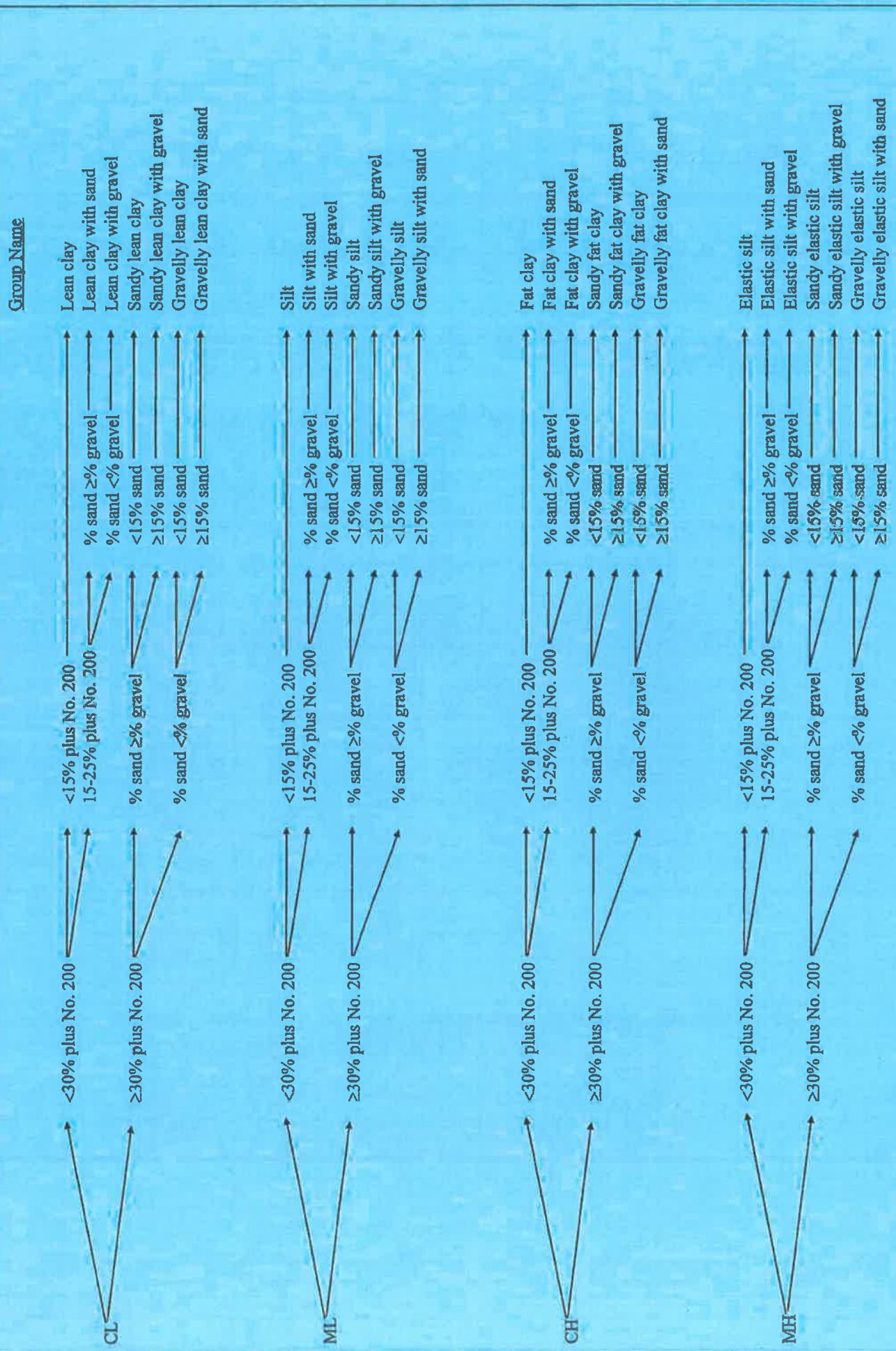
MAJOR DIVISIONS		GRAPH SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS  MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS  MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)	GW	WELL-GRADED GRAVEL WELL-GRADED GRAVEL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



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



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



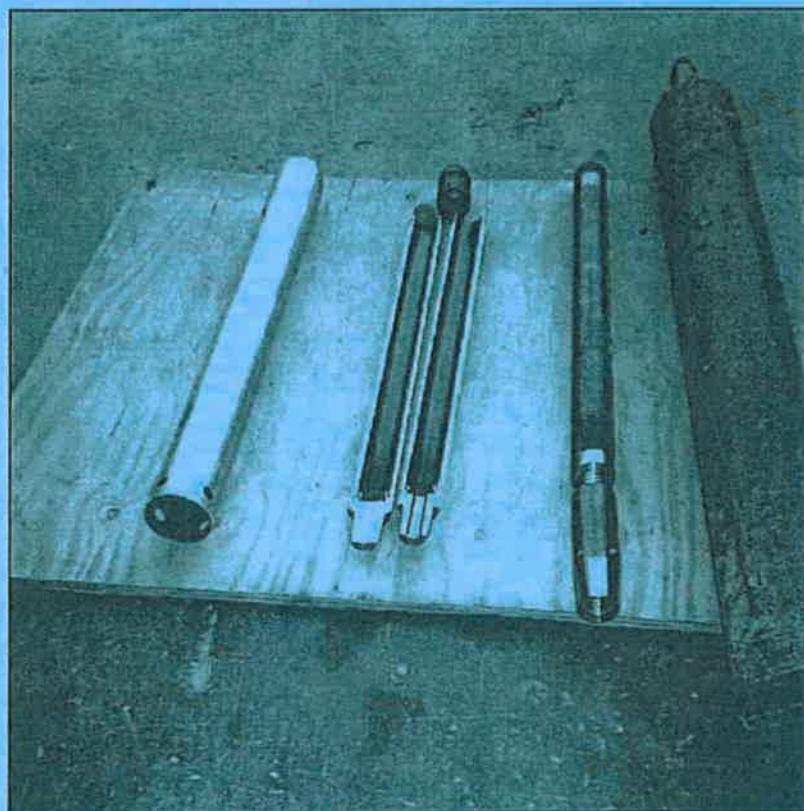
### **STANDARD PENETRATION RESISTANCE (ASTM D1586)**

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-inch increments of penetration.

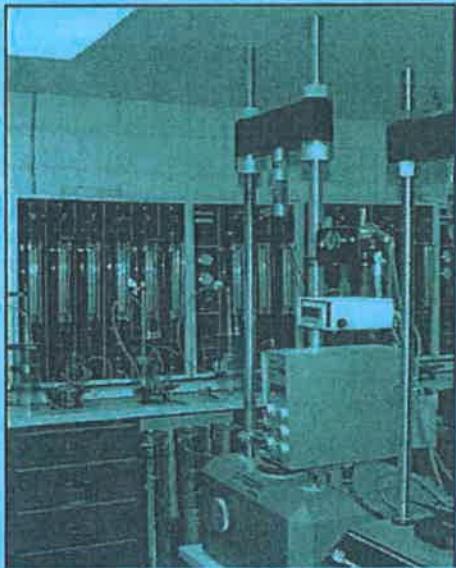
Example : 2-6-8; N = 14

### **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.

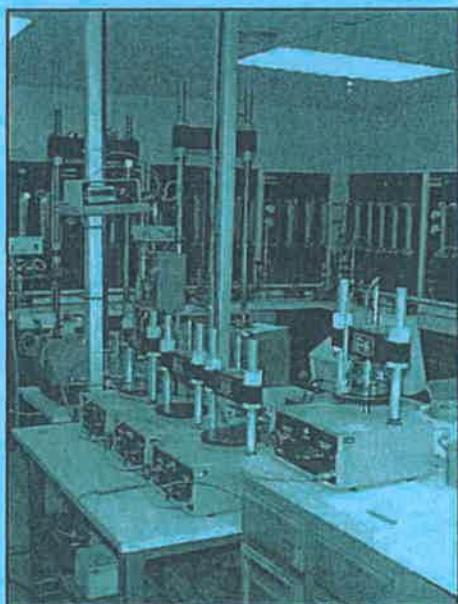


## UNCONFINED COMPRESSION OR TRIAXIAL TESTS (ASTM D 2166)



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.

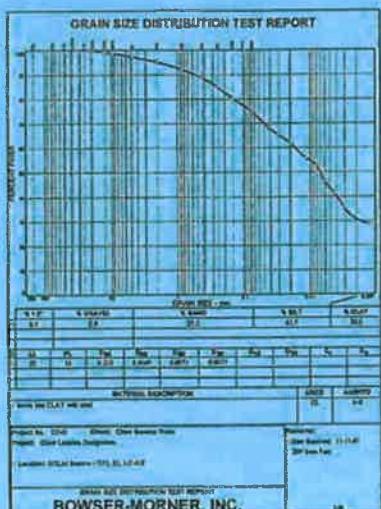
**REVISED TO ASTM D4318  
ATTERBERG LIMITS (ASTM D423 AND D424)**

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.



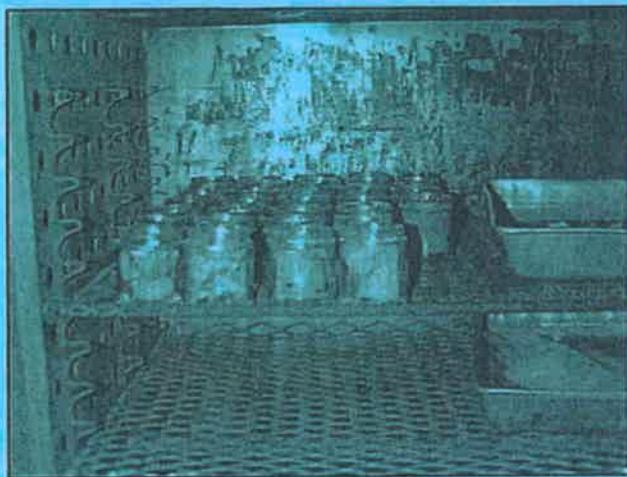
#### MECHANICAL ANALYSIS (ASTM D422)

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.



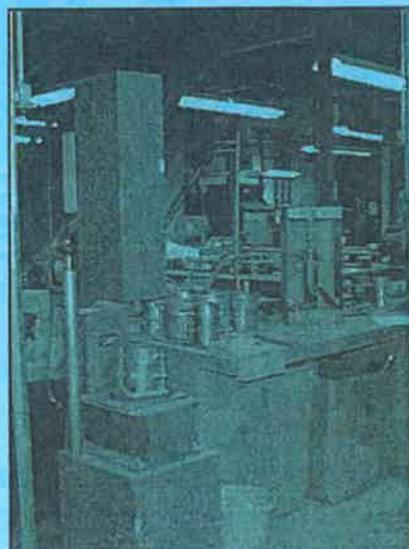
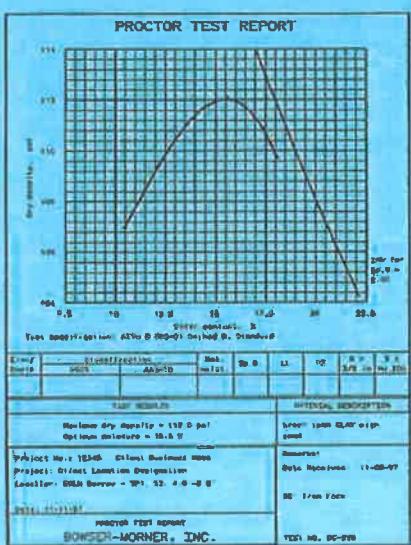
## NATURAL MOISTURE CONTENT (ASTM D2216)

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.

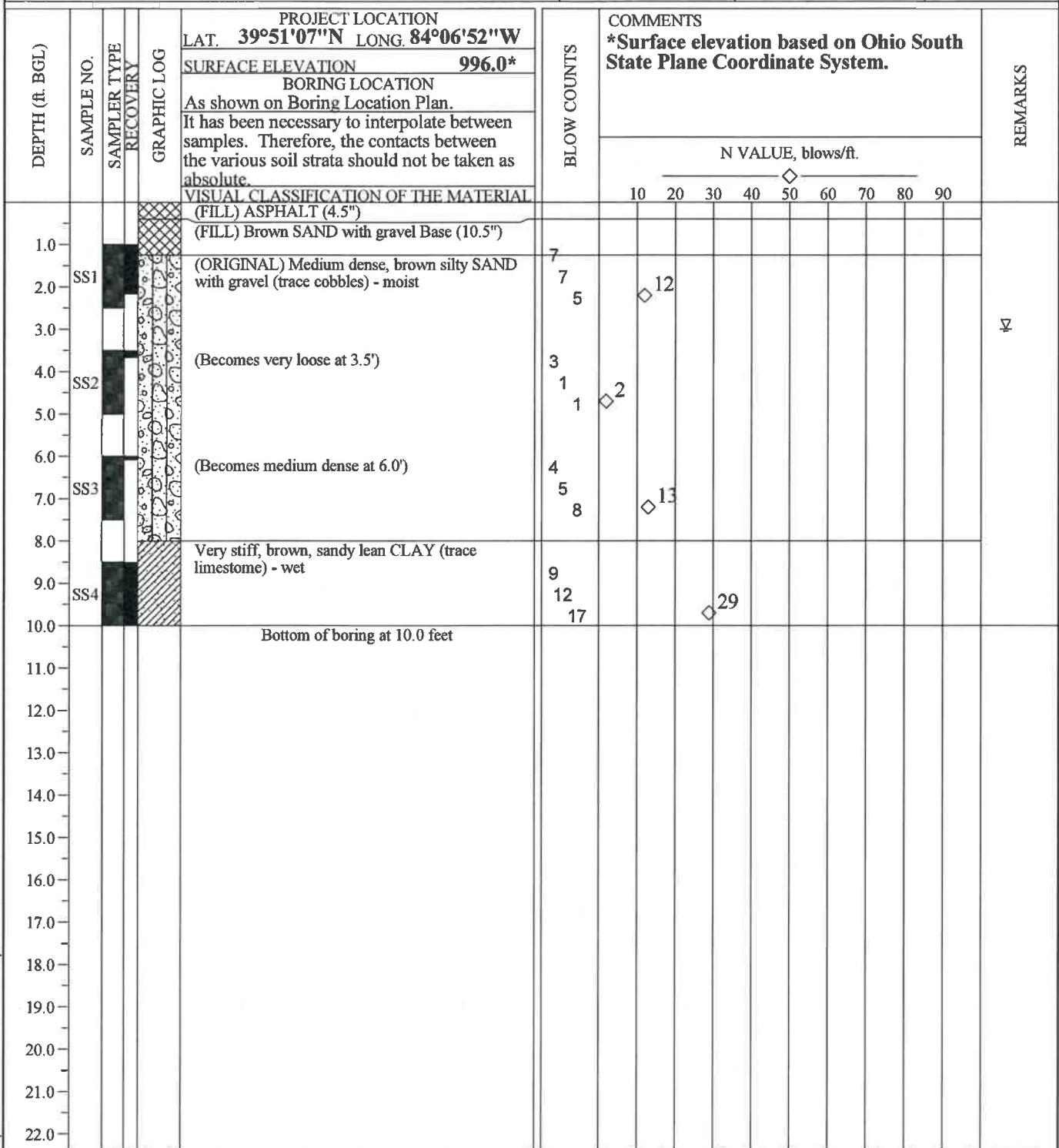


## PROCTOR TESTS

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.



CLIENT City of Huber Heights	JOB NO.		1 Boring No. Sheet 1 of 1
	209619		
	BORING STARTED	4/3/23	BORING COMPLETED 4/3/23
	DRILLER	Central Star	METHOD 2 1/4" HSA

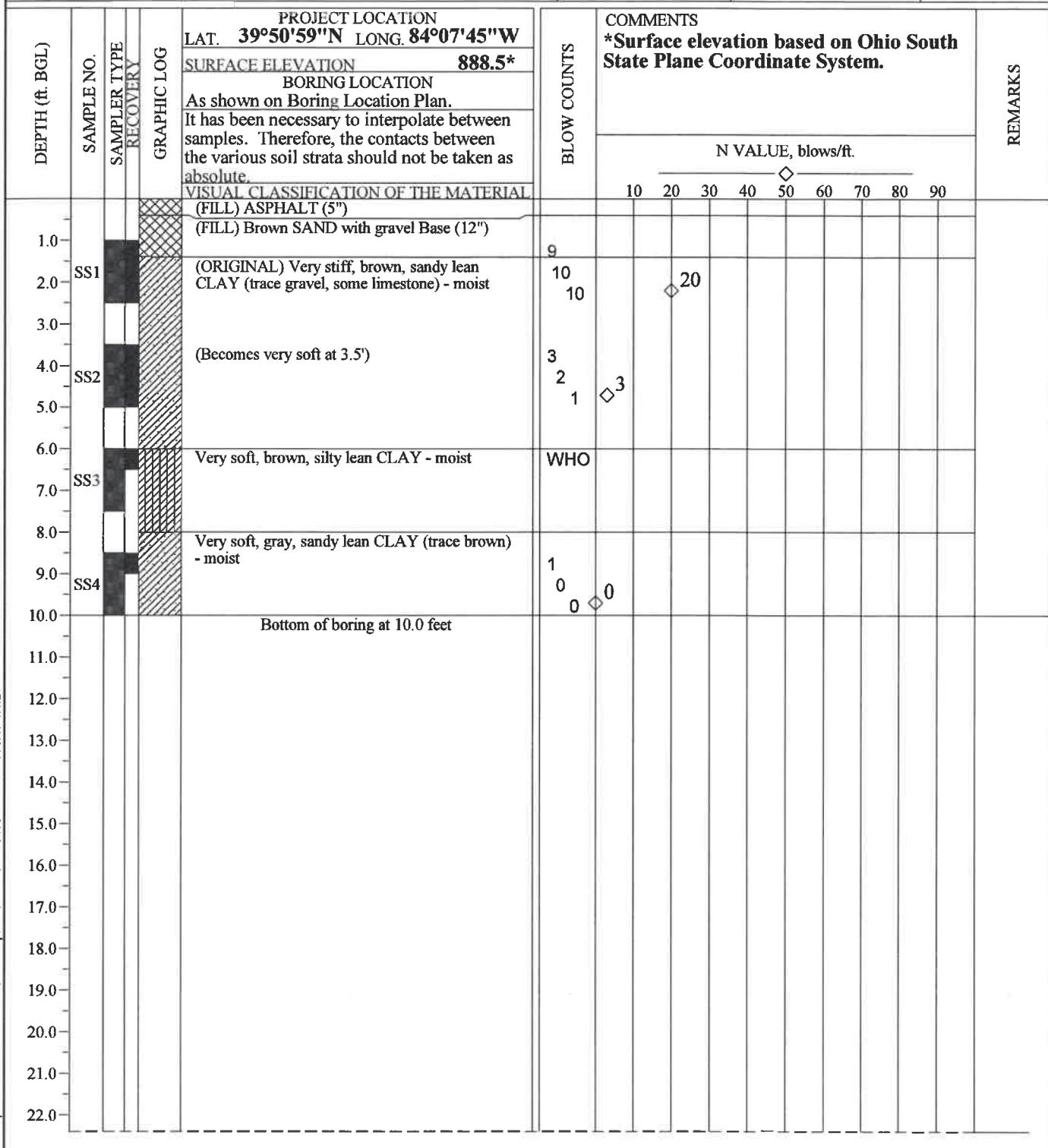


WATER LEVEL MEASUREMENTS

INITIAL	DEPTH	DATE
AT COMPLETION	3.0	4/3/2023
OTHER	NONE	4/3/2023
	N/A	N/A

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

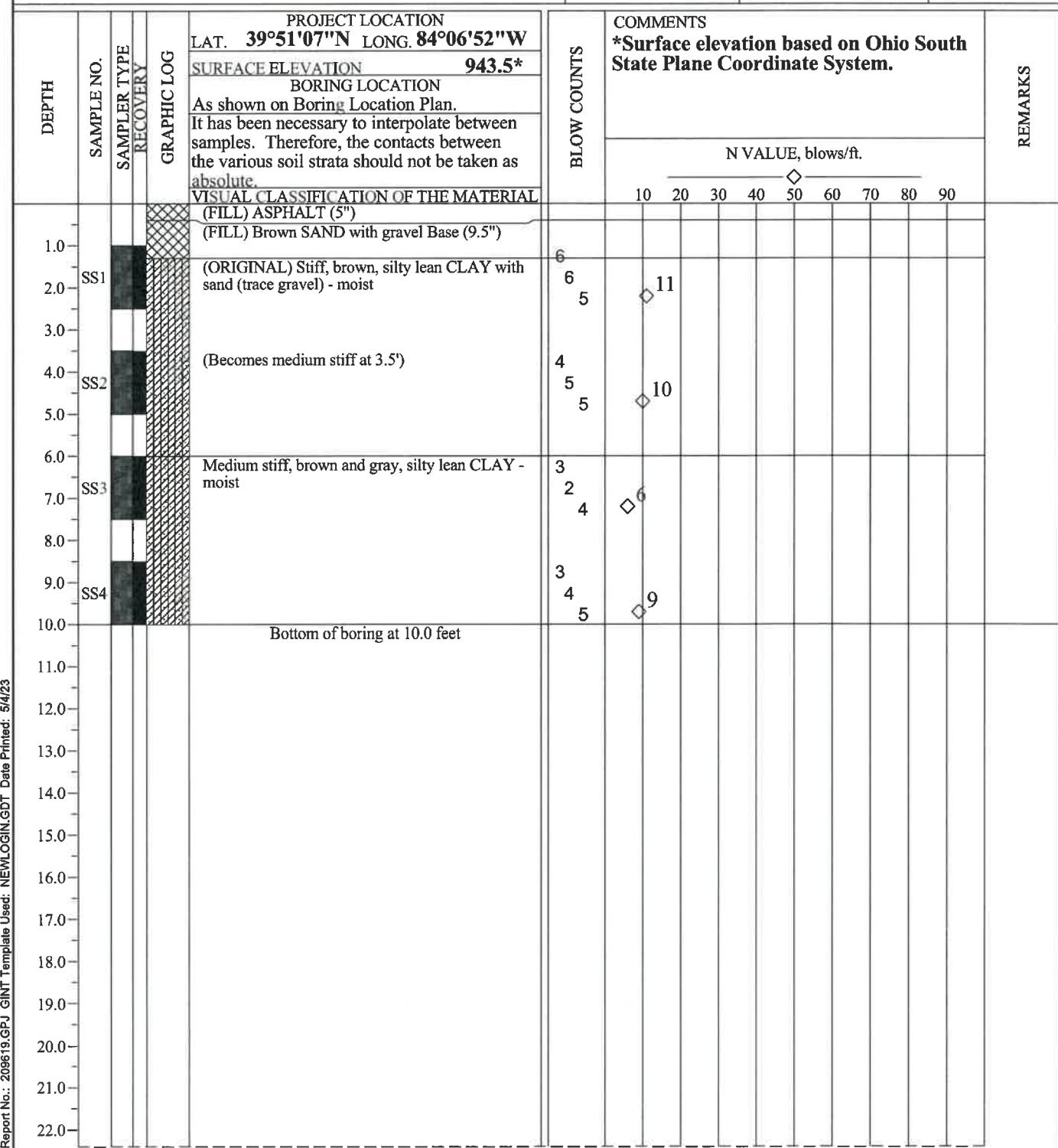
CLIENT <b>City of Huber Heights</b>	JOB NO. <b>209619</b>	2 Boring No. Sheet 1 of 1
PROJECT <b>Soil Study for Proposed Street Improvements, Huber Heights, Ohio.</b>	BORING STARTED <b>4/3/23</b>	
	BORING COMPLETED <b>4/3/23</b>	
	DRILLER <b>Central Star</b>	



WATER LEVEL MEASUREMENTS				SS — SPLIT SPOON
INITIAL	DEPTH <b>NONE</b>	DATE <b>4/3/2023</b>		SL — SPLIT SPOON W/SOIL LINER
AT COMPLETION	<b>NONE</b>	<b>4/3/2023</b>		NQ — ROCK CORE
OTHER	<b>N/A</b>	<b>N/A</b>		ST — SHELBY TUBE
				AS — AUGER CUTTINGS
				SC — SONIC

CLIENT City of Huber Heights	JOB NO.	
	209619	
	BORING STARTED 4/3/23	BORING COMPLETED 4/3/23
	DRILLER Central Star	METHOD 2 1/4" HSA
TYPED BY dmo		

3  
Boring No.  
Sheet 1 of 1



WATER LEVEL MEASUREMENTS

INITIAL	DEPTH NONE	DATE 4/3/2023
AT COMPLETION	NONE	4/3/2023
OTHER	N/A	N/A

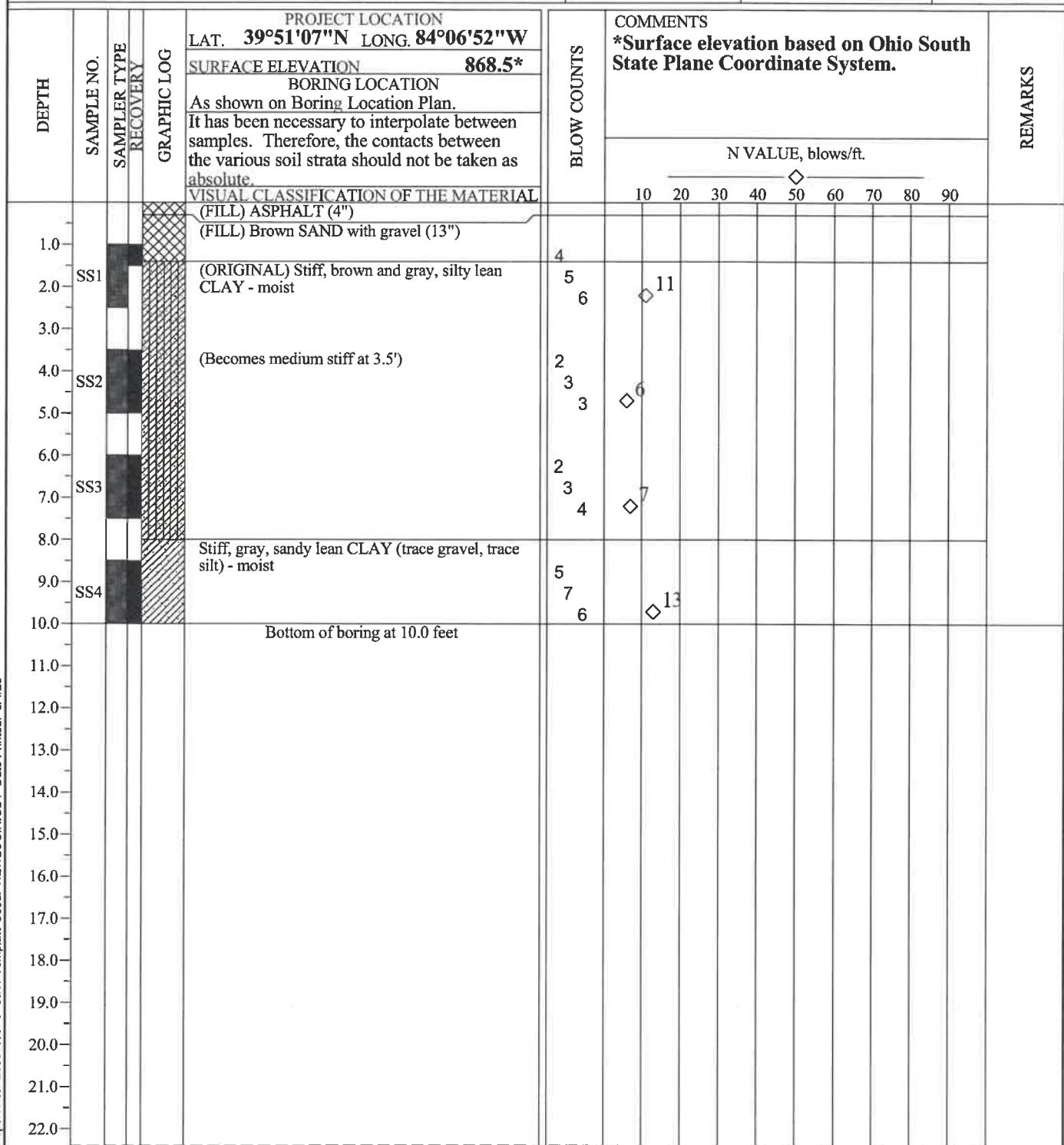
-  A - SPLIT SPOON
-  B - ROCK CORE
-  C - SHELBY TUBE
-  D - SOIL PROBE
-  E - AUGER CUTTINGS
-  F - SONIC

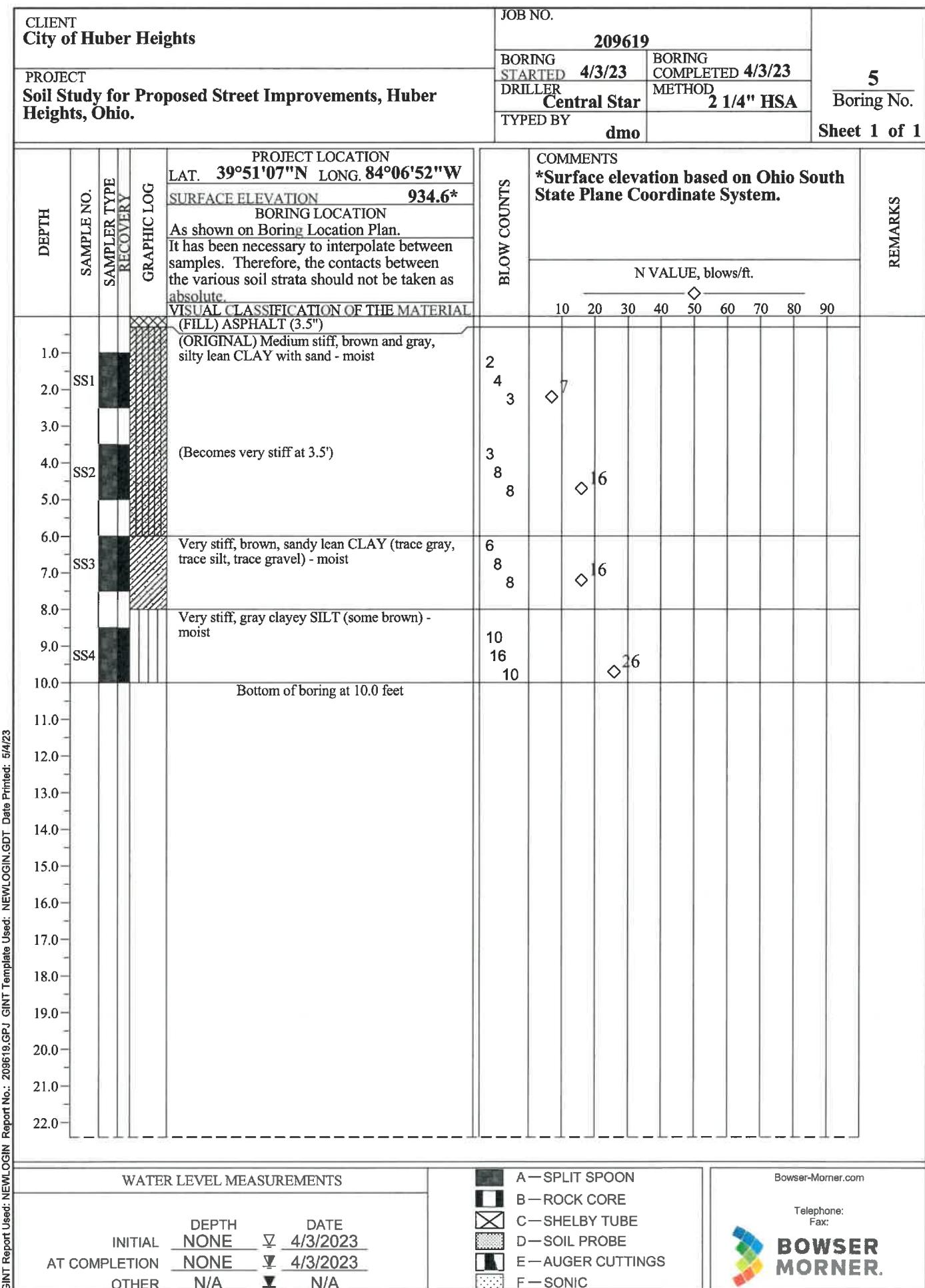
Bowser-Morner.com

Telephone:  
Fax:



CLIENT <b>City of Huber Heights</b>	JOB NO. <b>209619</b>	4 Boring No. Sheet 1 of 1
PROJECT <b>Soil Study for Proposed Street Improvements, Huber Heights, Ohio.</b>	BORING STARTED <b>4/3/23</b>	
	DRILLER <b>Central Star</b>	
	METHOD <b>2 1/4" HSA</b>	





GINT Report Used: NEWLOGIN Report No.: 209619.GPJ GINT Template Used: NEWLOGIN.GDT Date Printed: 5/4/23

**WATER LEVEL MEASUREMENTS**  
INITIAL DEPTH **NONE** DATE **4/3/2023**  
AT COMPLETION DEPTH **NONE** DATE **4/3/2023**  
OTHER DEPTH **N/A** DATE **N/A**

	A—SPLIT SPOON
	B—ROCK CORE
	C—SHELBY TUBE
	D—SOIL PROBE
	E—AUGER CUTTINGS
	F—SONIC

  
**BOWSER MORNER.**  
Telephone:  
Fax:

**DEPARTMENT 21**  
**Construction Materials and Geotechnical Laboratories**

**IN HOUSE REPORT**

Report Date: April 24, 2023  
Client: City of Huber Heights  
Project: Proposed Street Improvements  
Work Order No: 209619  
Owning Department: 27 – Chris Ryan  
Date Received: April 3, 2023

Testing was performed in accordance with the following procedures:

ASTM D 512, "Determining Water-Soluble Chloride Ion Content in Soil".

ASTM D 516, "Determining Water-Soluble Sulfate Ion Content in Soil".

ASTM D 4972, "Determining pH of Soil for Use in Corrosion Testing".

Results are detailed in the following table.

Test Method	B-1, SS 1	B-2, SS 2	B-3, SS2	B-4, SS 2	B-5, SS 1
Water Soluble Chloride Ion, mg/kg (ppm):	<b>&lt;3</b>	<b>120</b>	<b>5</b>	<b>120</b>	<b>130</b>
Water Soluble Sulfate Ion, mg/kg (ppm):	<b>30</b>	<b>61</b>	<b>54</b>	<b>50</b>	<b>43</b>
pH (in Distilled Water):	<b>9.0</b>	<b>8.9</b>	<b>8.7</b>	<b>8.5</b>	<b>9.1</b>
pH (in Calcium Chloride Solution):	<b>8.2</b>	<b>8.1</b>	<b>8.0</b>	<b>8.0</b>	<b>8.3</b>

## Moisture Content of Soil

ASTM (D-2216)



Client: City of Huber Heights

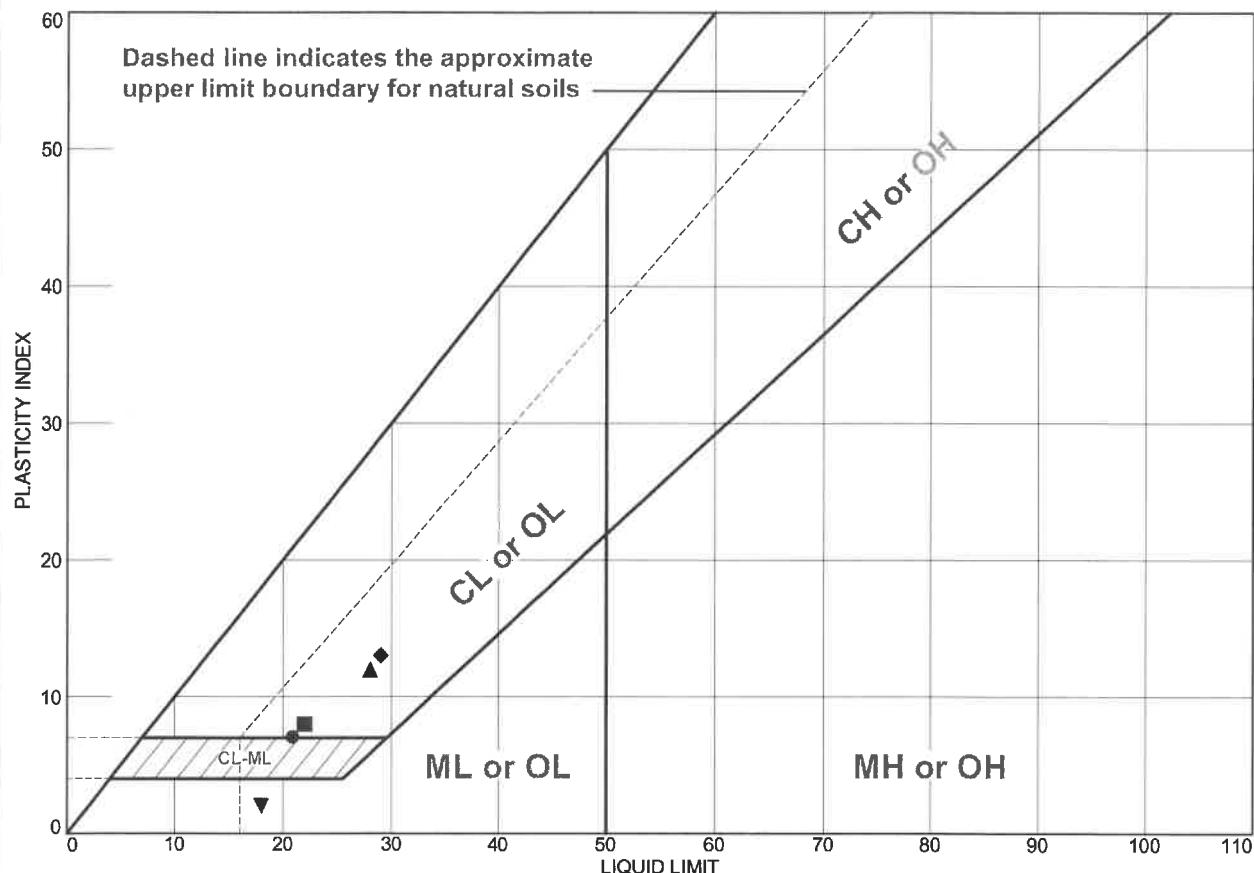
Project: Proposed Street Improvements

Work Order No.: 209619

Date: 04/24/23

Boring Number	Sample Number	Depth, (ft)	Depth, (m)	Moisture Content, (%)
B-1	SS 1	1.0 - 2.5	0.3 - 0.8	Not Tested
	SS 2	3.5 - 5.0	1.1 - 1.5	12.0
	SS 3	6.0 - 7.5	1.8 - 2.3	11.8
	SS 4	8.5 - 10.0	2.6 - 3.0	11.6
B-2	SS 1	1.0 - 2.5	0.3 - 0.8	8.6
	SS 2	3.5 - 5.0	1.1 - 1.5	Not Tested
	SS 3	6.0 - 7.5	1.8 - 2.3	12.7
	SS 4	8.5 - 10.0	2.6 - 3.0	13.4
B-3	SS 1	1.0 - 2.5	0.3 - 0.8	9.6
	SS 2	3.5 - 5.0	1.1 - 1.5	Not Tested
	SS 3	6.0 - 7.5	1.8 - 2.3	17.2
	SS 4	8.5 - 10.0	2.6 - 3.0	10.5
B-4	SS 1	1.0 - 2.5	0.3 - 0.8	12.1
	SS 2	3.5 - 5.0	1.1 - 1.5	Not Tested
	SS 3	6.0 - 7.5	1.8 - 2.3	18.5
	SS 4	8.5 - 10.0	2.6 - 3.0	9.3
B-5	SS 1	1.0 - 2.5	0.3 - 0.8	Not Tested
	SS 2	3.5 - 5.0	1.1 - 1.5	16.3
	SS 3	6.0 - 7.5	1.8 - 2.3	8.2
	SS 4	8.5 - 10.0	2.6 - 3.0	9.2

## LIQUID AND PLASTIC LIMITS TEST REPORT



MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
● B-1, SS 4	21	14	7			
■ B-2, SS 3	22	14	8			
▲ B-3, SS 3	28	16	12			
◆ B-4, SS 3	29	16	13			
▼ B-5, SS 2	18	16	2			

Project No. 209619 Client: City of Huber Heights

Project: Proposed Street Improvements

● Location: B-1	Depth: 8.5' - 10.0'	Sample Number: SS 4
■ Location: B-2	Depth: 6.0' - 7.5'	Sample Number: SS 3
▲ Location: B-3	Depth: 6.0' - 7.5'	Sample Number: SS 3
◆ Location: B-4	Depth: 6.0' - 7.5'	Sample Number: SS 3
▼ Location: B-5	Depth: 3.5' - 5.0'	Sample Number: SS 2

### Remarks:

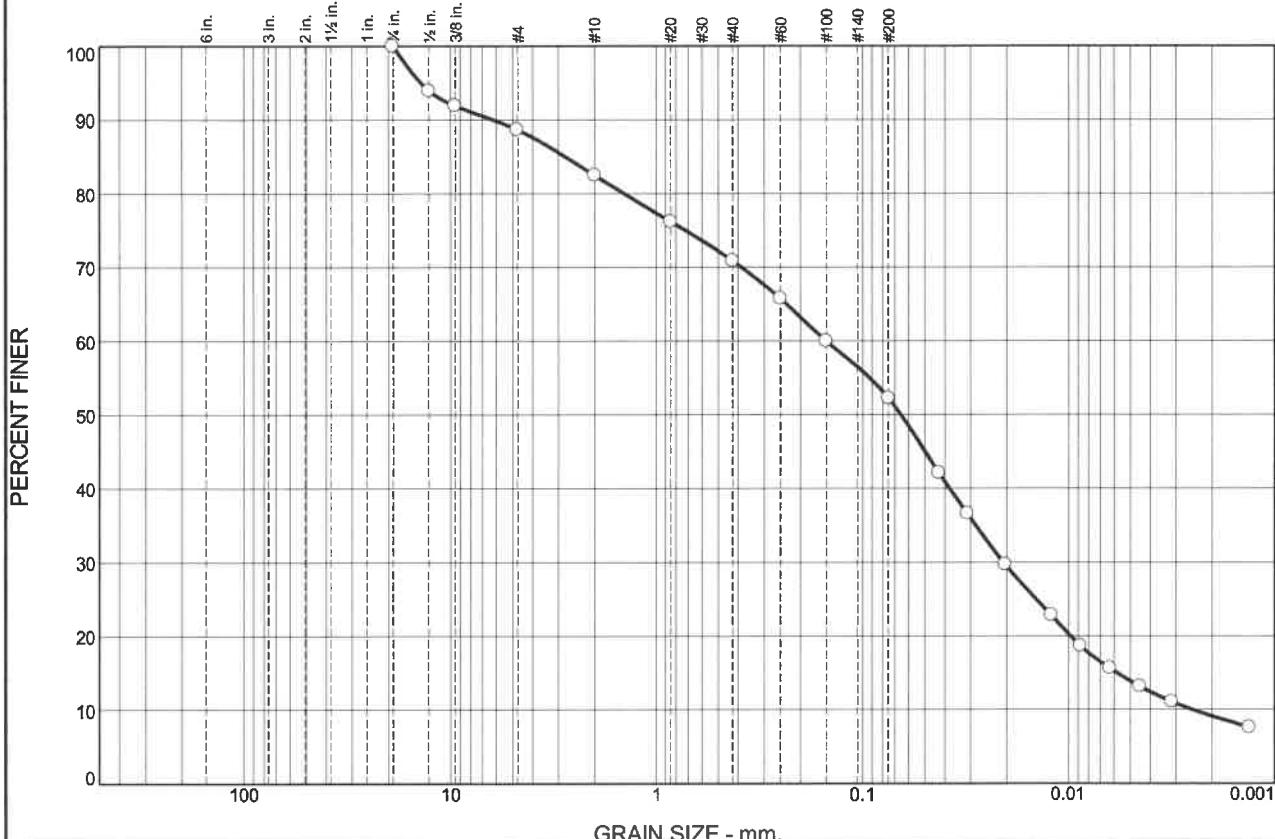
- As Received Moisture Content: 11.6%
- As Received Moisture Content: 12.7%
- ▲ As Received Moisture Content: 17.2%
- ◆ As Received Moisture Content: 18.5%
- ▼ As Received Moisture Content: 16.3%

BOWSER-MORNER, INC.

Dayton, Ohio

Tested By:  HMR  HMR  HMR  HMR  JW Checked By: BLC

## GRAIN SIZE DISTRIBUTION REPORT



% +3"	% Gravel		% Sand			% Fines		
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay	
○	0.0	0.0	11.3	6.2	11.6	18.7	43.1	9.1
○	LL	PL	D <sub>85</sub>	D <sub>60</sub>	D <sub>50</sub>	D <sub>30</sub>	D <sub>15</sub>	D <sub>10</sub>
○	18	13	2.7738	0.1502	0.0653	0.0208	0.0058	0.0025
○	Material Description							USCS      AASHTO
○	brown/gray sandy silty CLAY							CL-ML      A-4(0)

Project No. 209619      Client: City of Huber Heights

Project: Proposed Street Improvements

○ Location: B-3      Depth: 8.5' - 10.0'      Sample Number: SS 4

### Remarks:

○ As Received Moisture Content:  
10.5%

**BOWSER-MORNER, INC.**

Dayton, Ohio

Tested By: HMR

Checked By: BLC

## GRAIN SIZE DISTRIBUTION TEST DATA

4/24/2023

**Client:** City of Huber Heights

**Project:** Proposed Street Improvements

**Project Number:** 209619

**Location:** B-3

**Depth:** 8.5' - 10.0'

**Material Description:** brown/gray sandy silty CLAY

**Liquid Limit:** 18

**USCS Classification:** CL-ML

**Testing Remarks:** As Received Moisture Content: 10.5%

**Tested by:** HMR

**Sample Number:** SS 4

**Plastic Limit:** 13

**AASHTO Classification:** A-4(0)

**Checked by:** BLC

### Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer
314.25	119.10	0.00	.75	0.00	100.0
			.50	11.85	93.9
			.375	15.78	91.9
			#4	22.12	88.7
			#10	34.21	82.5
			#20	4.56	76.2
59.82	0.00	0.00	#40	8.42	70.9
			#60	12.15	65.7
			#100	16.31	60.0
			#200	21.93	52.2

### Hydrometer Test Data

Hydrometer test uses material passing #10

Percent passing #10 based upon complete sample = 82.5

Weight of hydrometer sample = 60.06

Hygroscopic moisture correction:

Moist weight and tare = 59.46

Dry weight and tare = 59.38

Tare weight = 39.44

Hygroscopic moisture = 0.4%

Automatic temperature correction

Composite correction (fluid density and meniscus height) at 20 deg. C = -6.0

Meniscus correction only = 0.0

Specific gravity of solids = 2.65

Hydrometer type = 152H

Hydrometer effective depth equation:  $L = 16.294964 - 0.164 - 0.164 \times Rm$

Elapsed Time (min.)	Temp. (deg. C.)	Actual Reading	Corrected Reading	K	Rm	Eff. Depth	Diameter (mm.)	Percent Finer
1.00	22.5	36.0	30.5	0.0132	36.0	10.4	0.0427	42.1
2.00	22.5	32.0	26.5	0.0132	32.0	11.0	0.0311	36.6
5.00	22.5	27.0	21.5	0.0132	27.0	11.9	0.0204	29.7
15.00	22.5	22.0	16.5	0.0132	22.0	12.7	0.0122	22.8
30.00	22.5	19.0	13.5	0.0132	19.0	13.2	0.0088	18.7
60.00	22.5	16.8	11.3	0.0132	16.8	13.5	0.0063	15.6
120.00	22.5	15.0	9.5	0.0132	15.0	13.8	0.0045	13.1
250.00	22.5	13.5	8.0	0.0132	13.5	14.1	0.0031	11.1

**BOWSER-MORNER, INC.**

**Hydrometer Test Data (continued)**

Elapsed Time (min.)	Temp. (deg. C.)	Actual Reading	Corrected Reading	K	Rm	Eff. Depth	Diameter (mm.)	Percent Finer
1440.00	22.5	11.0	5.5	0.0132	11.0	14.5	0.0013	7.6

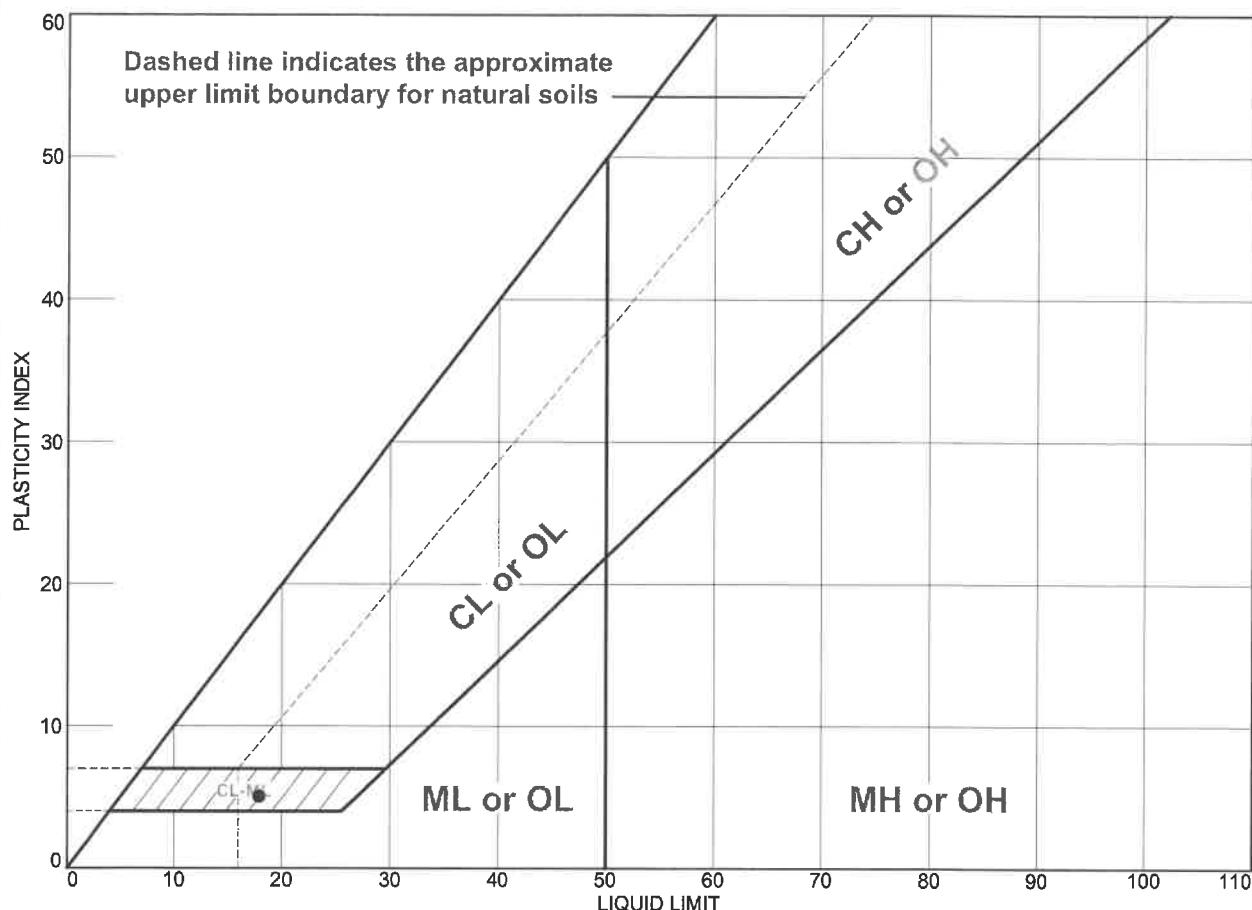
**Fractional Components**

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0.0	0.0	11.3	11.3	6.2	11.6	18.7	36.5	43.1	9.1	52.2

D <sub>5</sub>	D <sub>10</sub>	D <sub>15</sub>	D <sub>20</sub>	D <sub>30</sub>	D <sub>40</sub>	D <sub>50</sub>	D <sub>60</sub>	D <sub>80</sub>	D <sub>85</sub>	D <sub>90</sub>	D <sub>95</sub>
0.0025	0.0058	0.0098	0.0208	0.0379	0.0653	0.1502	1.4393	2.7738	6.2242	13.9037	

Fineness Modulus	C <sub>u</sub>	C <sub>c</sub>
1.56	60.28	1.16

## LIQUID AND PLASTIC LIMITS TEST REPORT



MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
● brown/gray sandy silty CLAY	18	13	5	70.9	52.2	CL-ML

Project No. 209619

Client: City of Huber Heights

Remarks:

Project: Proposed Street Improvements

● Location: B-3

Depth: 8.5' - 10.0'

Sample Number: SS 4

BOWSER-MORNER, INC.

Dayton, Ohio

## Chemical Soil Properties

This table shows estimates of some chemical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

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## Report—Chemical Soil Properties

Chemical Soil Properties—Montgomery County, Ohio								
Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	in	meq/100g	meq/100g	pH	Pct	Pct	mmhos/cm	
CsA—Crosby silt loam, Southern Ohio Till Plain, 0 to 2 percent slopes								
Crosby	0-8	5.4-13	—	5.1-7.3	0	0	0.0-2.0	0
	8-11	5.4-13	—	5.1-7.3	0	0	0.0-2.0	0
	11-14	11-14	—	5.1-7.3	0	0	0.0-2.0	0
	14-28	18-24	—	5.1-7.3	0	0	0.0-2.0	0
	28-36	5.6-17	—	7.4-8.4	5-40	0	0.0-2.0	0
	36-79	4.1-12	—	7.4-8.4	20-50	0	0.0-2.0	0
MIB—Miamian silt loam, 2 to 6 percent slopes								
Miamian	0-10	10-18	—	5.6-7.3	0	0	0.0-2.0	0
	10-14	12-22	—	5.1-7.3	0	0	0.0-2.0	0
	14-36	17-28	—	5.1-7.8	0-15	0	0.0-2.0	0
	36-79	7.0-16	—	7.4-8.4	25-45	0	0.0-2.0	0
MIB2—Miamian silt loam, 2 to 6 percent slopes, eroded								
Miamian, eroded	0-9	7.5-15	—	5.6-7.3	0	0	0.0-2.0	0
	9-12	11-21	—	5.1-7.3	0	0	0.0-2.0	0
	12-24	18-26	—	5.1-7.8	0-15	0	0.0-2.0	0
	24-33	8.1-17	—	6.6-7.8	0-25	0	0.0-2.0	0
	33-79	7.3-12	—	7.4-8.4	25-50	0	0.0-2.0	0



## Data Source Information

Soil Survey Area: Montgomery County, Ohio  
Survey Area Data: Version 21, Sep 9, 2022



**Natural Resources  
Conservation Service**

Web Soil Survey  
National Cooperative Soil Survey

5/2/2023  
Page 3 of 3

## Chemical Soil Properties

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MoB—Miamian-Urban land complex, undulating								
Miamian	0-7	10-18	—	5.1-6.5	0	0	0	0
	7-24	17-28	—	5.1-6.5	0-15	0	0	0
	24-60	7.0-16	—	7.4-8.4	25-45	0	0	0
Urban land	—	—	—	—	—	—	—	—

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Urban land	—	—	—	—	—	—	—	—

### Data Source Information

Soil Survey Area: Montgomery County, Ohio  
Survey Area Data: Version 21, Sep 9, 2022



Natural Resources  
Conservation Service

Web Soil Survey  
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5/2/2023  
Page 2 of 2

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Natural Resources  
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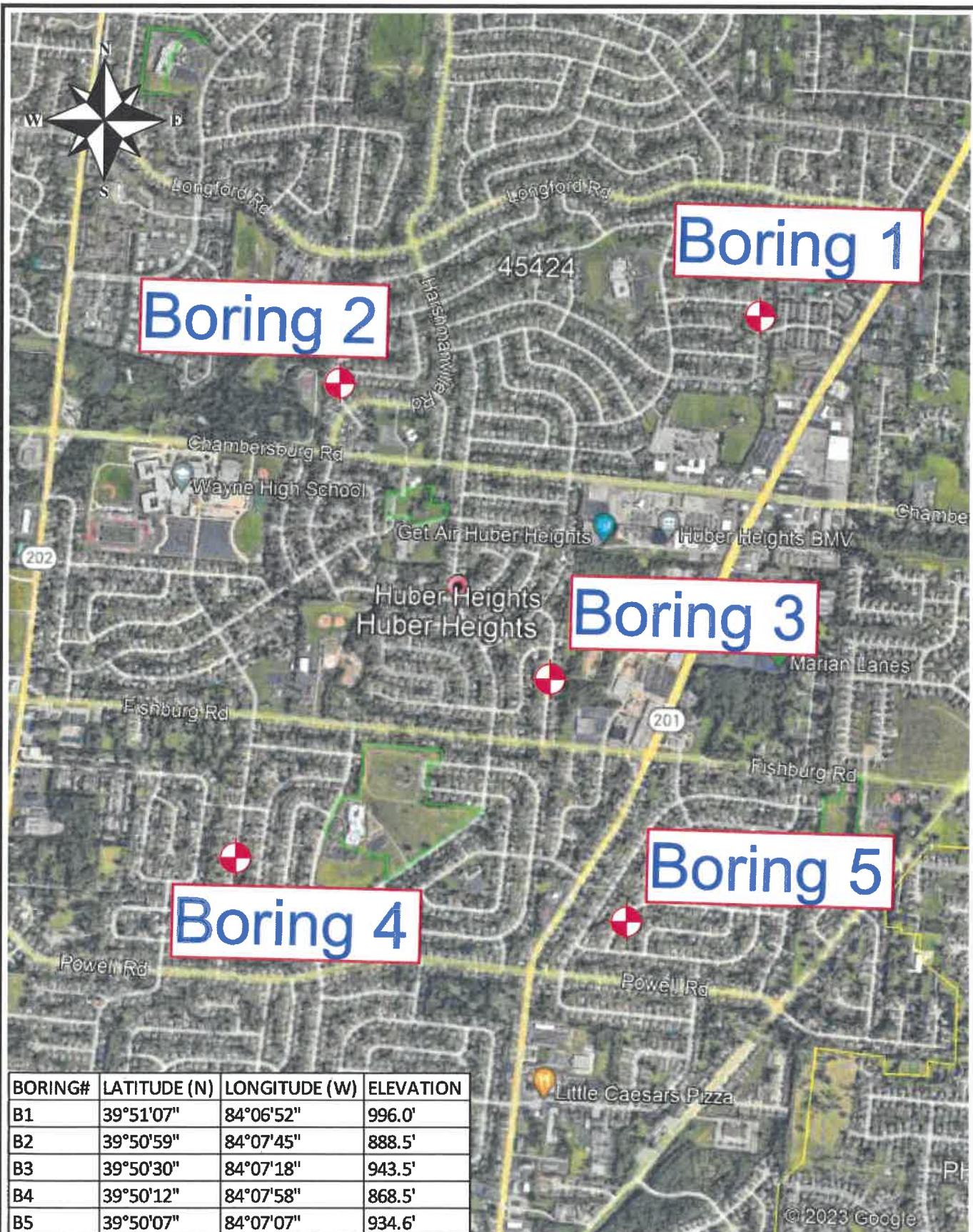
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Urban land	—	—	—	—	—	—	—	—

### Data Source Information

Soil Survey Area: Montgomery County, Ohio  
Survey Area Data: Version 21, Sep 9, 2022



#### VICINITY MAP

Soil Study for Proposed Street Improvements  
Huber Heights,  
Montgomery County, Ohio

Client: City of Huber Heights

PROJECT NO.  
209619

SCALE  
1" = 1/4 Mile

FIGURE NO.  
1

04-2023/EM



**BOWSER  
MORNER**



## BORING LOCATION PLAN

Soil Study for Proposed Street Improvements  
Huber Heights,  
Montgomery County, Ohio

Client: City of Huber Heights

PROJECT NO.  
209619

SCALE  
1" = 200'

FIGURE NO.  
2

04-2023/EM





**BORING LOCATION PLAN**  
Soil Study for Proposed Street Improvements  
Huber Heights,  
Montgomery County, Ohio  
Client: City of Huber Heights

PROJECT NO.  
209619  
SCALE  
1" = 200'  
FIGURE NO.  
3  
04-2023/EM



**BOWSER  
MORNER**



## BORING LOCATION PLAN

Soil Study for Proposed Street Improvements  
Huber Heights,  
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PROJECT NO.  
209619

SCALE  
1" = 200'

FIGURE NO.  
4

04-2023/EM



**BOWSER  
MORNER**



## BORING LOCATION PLAN

Soil Study for Proposed Street Improvements  
Huber Heights,  
Montgomery County, Ohio

Client: City of Huber Heights

PROJECT NO.  
209619

SCALE  
1" = 200'

FIGURE NO.  
5

04-2023/EM



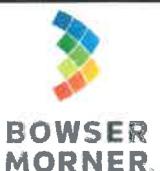
**BOWSER  
MORNER**



**BORING LOCATION PLAN**  
Soil Study for Proposed Street Improvements  
Huber Heights,  
Montgomery County, Ohio  
Client: City of Huber Heights

PROJECT NO.  
209619  
SCALE  
1" = 200'  
FIGURE NO.  
6

04-2023/EM



## ENGINEERING & ENVIRONMENTAL SERVICES:

Geotechnical Engineering  
Subsurface Exploration  
Civil Engineering  
Environmental Services  
Due Diligence  
Permitting

## LABORATORY SERVICES:

Geotechnical Laboratories  
Construction Materials Laboratories  
Mineral Aggregates  
Concrete  
Stone & Masonry  
Asphalt  
Analytical Services Laboratories  
Industrial Minerals  
Product Testing  
Mechanical/Metallurgical Testing  
Calibration Services  
Chemistry Laboratory  
Consulting Geology  
Radon Reference Laboratory

## CONSTRUCTION SUPPORT SERVICES:

General Construction  
Construction Quality Assurance  
Building Code Special Inspections  
Transportation Projects:  
- Contractor QA/QC  
- Material Supplier QA/QC  
- Owner Quality Assurance  
Materials Consulting:  
- Construction Engineering



