SUBSURFACE EXPLORATION AND RECOMMENDATIONS

PROPOSED NEW STREET DEPARTMENT BUILDING
Town of Hamilton
3540 West Railroad Street
Hamilton, IN

GME TESTING PROJECT NO.
G22-031140

PREPARED FOR:

Town of Hamilton
900 South Wayne Street
PO Box 249
Hamilton, IN 46742
Attn: Brent Shull, Town Manager
c/o: Jeffrey Weaver, P.E., Abonmarche Consultants

March 28, 2022

GME TESTING

March 28, 2022
G22-031140

Town of Hamilton
900 South Wayne Street
PO Box 249
Hamilton, IN 46742
Attn: Brent Shull, Town Manager
c/o: Jeffrey Weaver, P.E., Abonmarche Consultants

REF: SUBSURFACE EXPLORATION AND RECOMMENDATIONS
Proposed New Street Department Building
Town of Hamilton
3540 West Railroad Street
Hamilton, IN

Gentlemen:

In compliance with your request and authorization, ***GME Testing*** is pleased to submit this report of our subsurface exploration and recommendations for the above referenced project. Our work was performed in accordance with our proposal GMEP 22-020102 dated March 3, 2022. Our work was authorized on March 3, 2022.

We wish to remind you that we will store the samples for 30 days after which time they will be discarded unless you request otherwise.

We appreciate the opportunity to be of service on this project. Should you have any questions related to this report, please contact us at your convenience.

Sincerely,
GME Testing

S M Naziur Mahmud, E.I.T.
Project Engineer

No. 920294

Rami M. Anabtawi, P.E., D.GE
Principal Engineer

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Subsurface Exploration • Geotechnical Evaluation • Foundation Engineering • Construction Materials Testing & Monitoring Services
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1.0 INTRODUCTION

Geotechnical and Materials Engineers, Inc. (dba., ***GME Testing***) has performed a geotechnical engineering evaluation for proposed building that is planned for design and construction on the above-referenced site. The proposed construction will be located west of existing Town of Hamilton Street Department buildings at 3540 West Railroad Street in Hamilton, Indiana. This evaluation consisted of performing eight (8) vertical designated soil test boreholes, laboratory testing, geotechnical engineering analysis and preparation of this report.

2.0 PURPOSE OF WORK

The general purpose of this evaluation was to develop geotechnical recommendations for the foundations and slab design for this project. Our scope of services included:

- Performing eight (8) small-diameter, vertical soil test boreholes (i.e., B-1 through B-8) to observe the subsurface conditions at their respective locations;
- Evaluating the physical properties of the soils by performing field and laboratory tests;
- Summarizing the results of the subsurface exploratory program;
- Analyzing the data from the field and laboratory tests to provide geotechnical recommendations; and
- Preparing this engineering report that contains information on the subsurface conditions, conclusions and recommendations regarding:
    a) Foundation design recommendations;
    b) Floor slab evaluation; and
    c) General earthwork recommendations.

3.0 SITE CONDITIONS AND PROJECT DESCRIPTION

3.1 Project Coordination

GME Testing coordinated their field work logistics, site access, utilities markings and our geotechnical drilling program schedule with representatives of Town of Hamilton in conjunction with Abonmarche Consultants to complete this geotechnical engineering investigation.

3.2 Site Conditions

The site was previously disturbed. At the time of our field investigation, portions of the site were occupied by an existing steel-frame building to the east. The north, south and west sides of the proposed project was covered with overgrown brush and trees. Railroad tracks were located to the north of the property. Drainage is primarily along the existing ground surface and into low-lying areas of the site.

We observed scattered debris (i.e., chunks of concrete, stone etc.) and soil mounds on site as shown in Exhibit A below.

Exhibit A

The above description of site conditions is derived from our field investigation and our review of publicly available geologic and topographic maps.

3.3 Project Description

Based on preliminary information and conceptual plan presented to us by the client as part of our geotechnical scope of work, we understand that Town of Hamilton and Abonmarche Consultants are planning the design and construction of single-story, wood-frame or pre-engineered metal frame, slab-on-grade (i.e., no basement) building. The proposed building will have plan dimensions of about 60-feet by 110-feet.

No structural loading information for the proposed construction was available at this writing. For the purposes of this report, it is anticipated that the maximum building column, wall, and floor loadings will be light to moderate.

Neither the existing nor the final elevations and grading plans for the proposed project were available at this time. For the purposes of this report, it is anticipated that final grades will be established approximately at or slightly above the existing ground surface elevation.

All depths as referred to in this report are referenced from the ground surface existing at the time of this report, unless otherwise stated. The elevations presented on our borehole logs are considered accurate to ± one (1) foot.

As discussed, the site was previously disturbed and evidence of buried miscellaneous fill debris was observed during our field investigation as will be discussed later in this report. Prior to construction and placing any new fill within the construction limits of the project, **it is strongly recommended that the extent of existing buried debris be further investigated using test pits.**

GME Testing should be contacted to review design information that conflicts with our stated understanding of the project.

4.0 SUBSURFACE CONDITIONS

The subsurface conditions encountered at the eight (8) vertical test borings drilled for the project to depths of 15 to 20-feet below the existing ground surface as shown on the Borehole Logs.

The conceptual sketch for the proposed construction footprints provided to us by the client was projected onto aerials provided by the Google Earth website allowing for the correlation of the approximate latitude and longitude coordinates with each boring location. These coordinates were then assigned as waypoints and uploaded into a handheld GPS unit. Utilizing the handheld GPS unit, the locations referred to on our boring logs and presented on Figure 1, included in Appendix A of this report.

Additional details of field exploration, laboratory testing, and geologic conditions are provided in Appendix A of this report.

The lines of demarcation shown on the logs represent approximate boundaries between the various classifications. The stratification of soils, as shown on the accompanying test borehole logs, represents the soil conditions at the drilled borehole locations, and variations may occur between the boreholes. In-situ strata changes could occur gradually or at different levels. Also, it should be noted that the boreholes depict conditions at the particular locations and times indicated.

4.1 Generalized Soil Profile

The following discussions of subsurface conditions on this site represent generalized soil profiles at the test boring locations. A more detailed description and data for each test boring can be found on the individual Borehole Logs in Appendix B of this report.

The consistencies and relative densities of the encountered soils were based on the Standard Penetration Test, N-values, according to ASTM D-1586.

Surface Materials: In borings B-1 and B-7, about 2 to 5-inches of limestone products were disclosed on surface. Whereas, in borings B-2 and B-5, about 4 to 5-inches of sand and gravel products were disclosed on surface.

Approximately 1.5-inches of gravelly asphalt products (millings) were disclosed on surface in boring B-3.

Miscellaneous Fill: As previously discussed, miscellaneous fill debris were observed in test borings between depths of approximately 2 and 9-feet beneath the existing ground surface.

The existing miscellaneous fill materials consisted of sand, silty sand, gravel, topsoil, intermixed with wood, brick, steel and glass fragments, etc. SPT N-values were erratic in the field and may have been affected due to the mass of the existing fill debris rather than in these borings.

Test pits may be performed between the test borings to evaluate the extent and depth of unsuitable (old fill) materials that will require removal.

Native Soils: The native soils disclosed in borings below existing fills primarily consisted of cohesive soils. The cohesive soils consisted of stiff to very stiff and hard silty sandy clays. However, very soft, organic sandy clays were disclosed below the existing miscellaneous fill in boring B-5.

In borings B-7 and B-8, granular soils consisted of medium dense to dense, wet, silty sands, and silty sands and gravels were disclosed below depths of 11 to 12-feet beneath the existing ground surface elevation.

The consistencies of the clays ranged from very soft to stiff and very stiff. The relative densities of the granular soils ranged from very loose to medium dense.

The approximate depths of existing unsuitable soils including miscellaneous fill materials and compressible soils were encountered in borings to depths between 2 and 9-feet as approximately summarized in Table 1 shown below. Note that the shallow clayey fill disclosed in B-3 and B-7 was black and contained organics.

Table 1: Approximate Depths of Miscellaneous Fill in Borings

Boring No.	*Approximate Depth, feet	Boring No.	*Approximate Depth, feet
B-1	±6	B-5	±9
B-2	±8.5	B-6	±8.5
B-3	±2	B-7	±3.5
B-4	±8	B-8	±8.5

** Below existing ground surface. Actual depths must be evaluated by GME Testing at time of construction.*

4.2 Groundwater Conditions

Groundwater measurements were taken during our field operations by noting the depth of water on the rods and in open boreholes following withdrawal of the drilling augers after the completion of drilling activities in test borings.

Free groundwater was encountered during or following our drilling program in the test borings B-2, and B-5 through B-8 at depths ranging between approximately 2 and 15.5-feet as shown in Table 2 and on the boring logs included in Appendix B of this report. No groundwater was encountered in the remaining borings during or following our drilling program.

Table 2: Depth of Groundwater in Borings

Boring No.	*Groundwater Depth, ft		Boring No.	*Groundwater Depth, ft	
	During Drilling	At Completion of Drilling		During Drilling	At Completion of Drilling
B-1	†NO	NO	B-5	±2	NO
B-2	±8	±8	B-6	±15.5	±7.5
B-3	NO	NO	B-7	±11.5	±10.5
B-4	NO	NO	B-8	±12	±12

**Depths referenced below existing ground surface*
† *Not Observed (NO)*

The groundwater depths shown on the boring logs reflect groundwater levels only for the date which the borings were drilled.

It must be noted, however, that short term groundwater level observations made in test borings are not necessarily a reliable indication of the actual groundwater elevation. Based upon the engineering characteristics of the encountered soils, shallow trapped "perched" groundwater readings may also be present. Fluctuations in the level of groundwater typically occur due to variations in rainfall, water level and other factors. Shallow trapped water may become evident during wet periods of the year and within interbedded sands.

5.0 EVALUATION AND RECOMMENDATIONS

The following design recommendations have been developed in order to assist in the design and development of the proposed project. They are intended for use with regard to the specific project discussed herein and any substantial changes in the project description, location, or assumed grades should be brought to our attention so that we may evaluate how such changes may affect our evaluation.

The opinions and recommendations submitted in this report are based, in part, on our interpretation of the subsurface information revealed by the subsurface test borings shown on Figure 1 included in Appendix A of this report. Understandably, this report does not reflect variations in subsurface conditions between or beyond the extent of the test boring locations. Therefore, variations in these conditions can be expected, and fluctuation of the groundwater level will occur with time.

5.1 Foundation Design Concept

As previously discussed, miscellaneous fill debris materials composed generally of black mixtures of sands, glass, wood, and steel fragments including clayey sands were primarily disclosed in B-1, B-2, and B-4 through B-6, and B-8 to depths of approximately 6 and 9-feet. While organic clays were found in B-3 and B-7 to depths of 2 and 4-feet, respectively.

GME Testing recommends that existing miscellaneous fill and organic clay fill be removed in their entirety below the proposed building (foundations and slabs). Additionally, removal of these unsuitable materials must extend laterally a distance of 10 or more feet beyond the bottom edge of excavation. The new fill must be properly stepped, tied, and benched into suitable soil embankment in accordance with good construction practice.

Following this process, GME Testing strongly recommends that the bottom of the excavations be thoroughly evaluated, inspected and proofrolled to check that all unsuitable fill and any underlying compressible materials are removed prior to filling.

After satisfactory grade is reached and the excavation has been approved, new engineered fill can be placed and compacted to re-establish desired grade elevation. The new engineered fill to establish desired grade shall be evaluated and approved and may consist of clean granular soils and/or clay type soils posing suitable moisture contents. All new fill shall be compacted to a dry density of 95 or more percent as evaluated by ASTM D-1557.

Approved borrow fill or to replace unsuitable materials should be placed within approximately 2 percent (plus or minus) of the optimum moisture content as determined by ASTM D-1557.

Additionally, excavated spoil material must not be placed near the excavation slope. OSHA construction standards for excavation must be met as discussed in later section of this report.

Where fill material is placed on existing slopes, benches should be cut into the existing slopes before the fill placement so as to preclude a shear plane from developing at the interface. Benches having a minimum width of 4-feet should be cut into the natural slopes and existing embankment side slopes before new engineered fill is placed.

Provided that the above recommendations are followed, the proposed building can be supported on conventional footings bearing on approved engineered fill. Such footings can be designed for a maximum net allowable soil bearing pressures of **2,500 pounds per square foot (psf)** for column (square type) and **2,000 psf** for strip (wall type) footings.

In applying net allowable soil bearing pressure in the footing design, the weight of the footings and backfill over the footings, including the floor slab, need not be included in total loads for dimensioning footings.

A suitable hand penetration device (e.g., DCP, Housel or other approved method) should be used to check that the bearing soils at the base of the footings are consistent with the recommendations provided in this report.

We strongly recommend that GME Testing be retained to check that each fill lift is properly compacted, and that the foundation bearing are adequate for foundation support, as well as other earthwork related matters during construction.

All exterior footings and footings in unheated areas should be located at a depth of 3.5-feet below final exterior grade for frost protection. All footings should be adequately protected from frost penetration during and after construction and should bear on firm material.

Provided that our recommendations in this report and project specifications are followed, total foundation settlements are not expected to exceed about (1) inch with differential settlements of up to (½) inch. Under no condition should new construction be supported over existing miscellaneous fill or organic-containing (fill) materials and/or unsuitable soils. Field control and proper footing proportions will contribute substantially to minimizing total and differential settlements.

Water infiltration if encountered in the footing excavations should be removed by adequate sumps placed outside the limits of the main footing excavations. If significant groundwater is experienced, more aggressive dewatering system and methods should be considered.

Positive drainage of surface water, including downspout discharge, should be maintained away from structure foundations to avoid wetting and weakening of the foundation soils both during construction and after construction is complete. Water must not be allowed to pond on or adjacent to the structure.

5.2 Floor Slabs

The slab subgrade should be properly prepared in accordance with this report and applicable project specifications. It is anticipated that ground-supported slabs can either be supported over structural fill after unsuitable materials are removed and/or over properly prepared and approved native subgrade, following site preparation and successful filling operations.

The floor slabs should be designed by a qualified structural engineer for the anticipated loadings. Floor slabs-on-grade may be designed as floating slabs, which are structurally independent of any building footings or walls, and appropriately reinforced to support imposed loads.

We recommend that the top 6-inches of the slab subbase consist of an approved crushed limestone aggregate such as INDOT No. 53 to provide a leveling surface for construction of the slab and a moisture capillary break between the slab and the underlying soils.

The thickness of aggregate needed to provide a stable construction platform at the exposed subgrade elevation will depend on the condition of the subgrade during construction and the type and volume of construction equipment expected to traffic the prepared subgrade. Special attention should be made to the placement of backfill against the building foundations and walls as inadequate compaction of these locations may cause cracking of the slab edges and corners due to subsidence of the backfill.

Isolation joints should be provided at the junctions of the slab and foundation system so that a small amount of independent movement can occur without causing damage.

Depending on the choice of floor finishes, it may be appropriate to incorporate a moisture barrier below the floor slab. This decision should be evaluated by the architect and structural engineer based on the intended floor usage, planned finishes, and in accordance with ACI recommendations.

We recommend the slab-on-grade subgrade soils be protected from frost during winter construction. Frozen soils must be thawed and compacted or removed and replaced prior to slab-on-grade construction.

5.3 General Earthwork Recommendations

Wherever unsuitable native and fill soils are observed, they should be undercut and replaced as described in this report. We recommend that the materials used as engineered fill meet all criteria as discussed in **Engineered Fill**, Section 5.4 of this report.

Depending on weather conditions and the type of equipment and construction procedures used, surface instability may develop even after new engineered fill is restored on site. If this occurs, additional corrective procedures may be required.

Care must be exercised during grading and fill placement operations. Repeated heavy construction traffic over subgrade could cause the subgrade to pump, yield, and weak areas to develop and therefore should be avoided. Heavy construction traffic should use designated areas as directed by contractor.

Backfill placed in utility excavations, confined areas and against foundations should be non-organic and free of debris and consist of a clean granular material.

The earthwork recommendations may require modifications based on the field observations during construction. The appropriate course of action should be determined by the geotechnical engineer at the time of construction.

All earthwork operations must be performed under adequate specifications and be properly monitored by the geotechnical engineers' field representative.

5.4 Engineered Fill

All fill materials must be tested and approved by a GME Testing geotechnical engineer prior to placement.

If the fill is to provide non-frost susceptible characteristics, it must be classified as a clean (i.e., with a maximum of 10 percent passing No. 200 standard US sieve) “GW”, “GP”, “SW” or “SP” per the Unified Soil Classification System (ASTM D-2487). Engineered fill material must be free of significant organic matter or debris, must not contain rocks or hard lumps greater than 3-inches, and should have a low to moderate plasticity.

The fill should be placed in lifts of uniform thickness. Engineered fill should be placed in lifts no greater than 8-inches thick (loose). To reduce settlements and consolidation of fill, it is recommended that each lift be tested and documented as presented in this report. All structural fill supporting footings and placed over footings should be compacted to 95 or more percent of the maximum modified Proctor dry density in accordance with ASTM D-1557.

5.5 Excavations and Trenches

All excavating and trenching operations should comply with the requirements of OSHA 29CFR, Part 1926, Subpart P, “Excavations”, which deals with excavation and trench safety. Trenches and excavation for utilities and other construction activities are subject to caving sides and can expose workers to engulfment hazards. All excavations should be monitored by a “Competent Person”, as defined by the OSHA standard, and appropriate shoring or sloping techniques used to prevent cave-ins.

5.6 Foundation Excavations and Monitoring

Each foundation excavation should be evaluated by GME Testing to check that all unsuitable materials are removed, and that the foundation will bear on satisfactory material before forming and/or placing steel or concrete.

Concrete strength and consistency tests should also be carried out, in accordance with the project specifications.

As discussed previously, new fill replacing existing unsuitable fill debris will be required. In the event that pockets of unsuitable soils are encountered, the footings may be extended through any unsuitable pocket of soft soils to firm natural soils below Alternately, lean concrete (i.e., 2,000 or more psi mix) may be used to replace unsuitable materials below footing excavations to limit lateral undercut and expedite construction activities. Figure 2 in Appendix A of this report provide illustration of this and new structural fill.

If possible, all concrete for foundations should be poured the same day as the bearing surfaces are approved. If this is not practical, the foundation excavation should be adequately protected.

Soils exposed in the bases of all excavations must be protected against any detrimental change in conditions such as from disturbance, rain, and freezing.

Surface run-off water must be drained away and not allowed to pond in the excavations.

Care must be exercised when considering the placement of new foundations of proposed building and walls adjacent to existing foundations in order to avoid overlapping zones of influence and compromising existing foundations by excavating below their bearing elevations. Depending on the size of the excavation and the proximity and level of the excavation with respect to the existing structure and other factors, it may be necessary to provide bracing and support for the sides of the excavations. All footings should be located so that the clear distance between any two footings will be at least equal to the difference in their bearing elevations, as illustrated in Figure 3 included in Appendix A of this report. If this distance cannot be maintained, the lower footing should be designed to account for the load imparted by the upper footing.

5.7 Groundwater Control

Free water trapped within existing fill debris should be expected when making mass removal on site and extending any excavations to or below groundwater levels in borings. Depending on the excavation method to be selected for construction of underground structures, the means and methods of dewatering should be determined by the contractor during construction.

Proper site drainage is recommended to help minimize unwanted surface water runoff into excavations during the construction process. The scope of this evaluation was not to provide dewatering recommendations for contractor.

6.0 LIMITATIONS

This field evaluation, laboratory testing, and geotechnical analyses presented in this geotechnical report have been conducted in general accordance with current practice and the standard of care exercised by geotechnical consultants performing similar tasks in the project area. No other warranty, expressed or implied, is made regarding the conclusions, recommendations, and opinions presented in this report.

There is no evaluation detailed enough to reveal every subsurface condition. Variations may exist and conditions not observed or described in this report may be encountered during construction. Additional subsurface evaluation will be performed upon request.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. GME Testing should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document.

Our geotechnical recommendations and opinions are based on an analysis of the observed site conditions. If geotechnical conditions different from those described in this report are encountered, our office should be notified and additional recommendations, if warranted, will be provided upon request.

Although general constructability issues have been considered in this report, the means, methods, techniques, sequences and operations of construction, safety precautions, and all items incidental thereto and consequences of, are the responsibility of parties to the Project other than GME Testing. This office should be contacted if additional guidance is needed in these matters.

The scope of our services does not include any environmental assessments or investigations for the possible presence of toxic materials in the soil, groundwater, or surface water within or in the general vicinity of the site studied.

Any statements made in this report or shown on the test borehole logs regarding unusual subsurface conditions and/or composition, odor, staining, origin, or other characteristics of the surface and/or subsurface materials are strictly for the information of our client.

APPENDIX A

I. FIELD EXPLORATION

Drilling and Sampling Procedures

The test borings were drilled using conventional augers to advance the holes and representative samples of the soils were obtained employing split-barrel sampling techniques in accordance with ASTM procedures D-1586-84. After completion of the borings and water level readings, the auger holes were backfilled with auger cuttings.

The description and depths of soil strata encountered and levels at which samples were recovered are indicated on the accompanying borehole log sheets in the Appendix B. In the column "Soil/Material Description" on the drill borehole log, the horizontal lines represent stratum changes. A solid line represents an observed change, and a dashed line represents an estimated change. An explanation of the symbols and terms used on the boring log sheets is given in Appendix B of this report.

Field Tests and Measurements

Standard Penetration Test: During the sampling procedures, Standard Penetration Test (SPT) was performed at regular intervals through the depth of the borings. The SPT value ("N"-value) is defined as the number of blows required to advance a 2-inch O.D., split-barrel sampler a distance of one foot by a 140-pound hammer falling 30-inches. These values provide a useful preliminary indication of the consistency or relative density of most soil deposits and are included on the Borehole Logs in Appendix B.

Water Level Measurements: Groundwater level observations were made in the boring holes during and upon completion of the boring operations. The groundwater level measurements are noted on the boring logs presented herein.

All recovered samples were returned to GME Testing laboratory for visual examination and subsequent laboratory testing.

II. LABORATORY TESTING

Selected soil samples obtained from the drilling and sampling program were tested in the laboratory to evaluate additional pertinent engineering characteristics of the foundation materials necessary in estimating the engineering properties of these materials.

Soil Laboratory Tests and Measurements

Visual Classification: All samples were visually classified by a geotechnical engineer in general accordance with ASTM D-2488, and on the Borehole Logs, which are located in the Appendix B of this report.

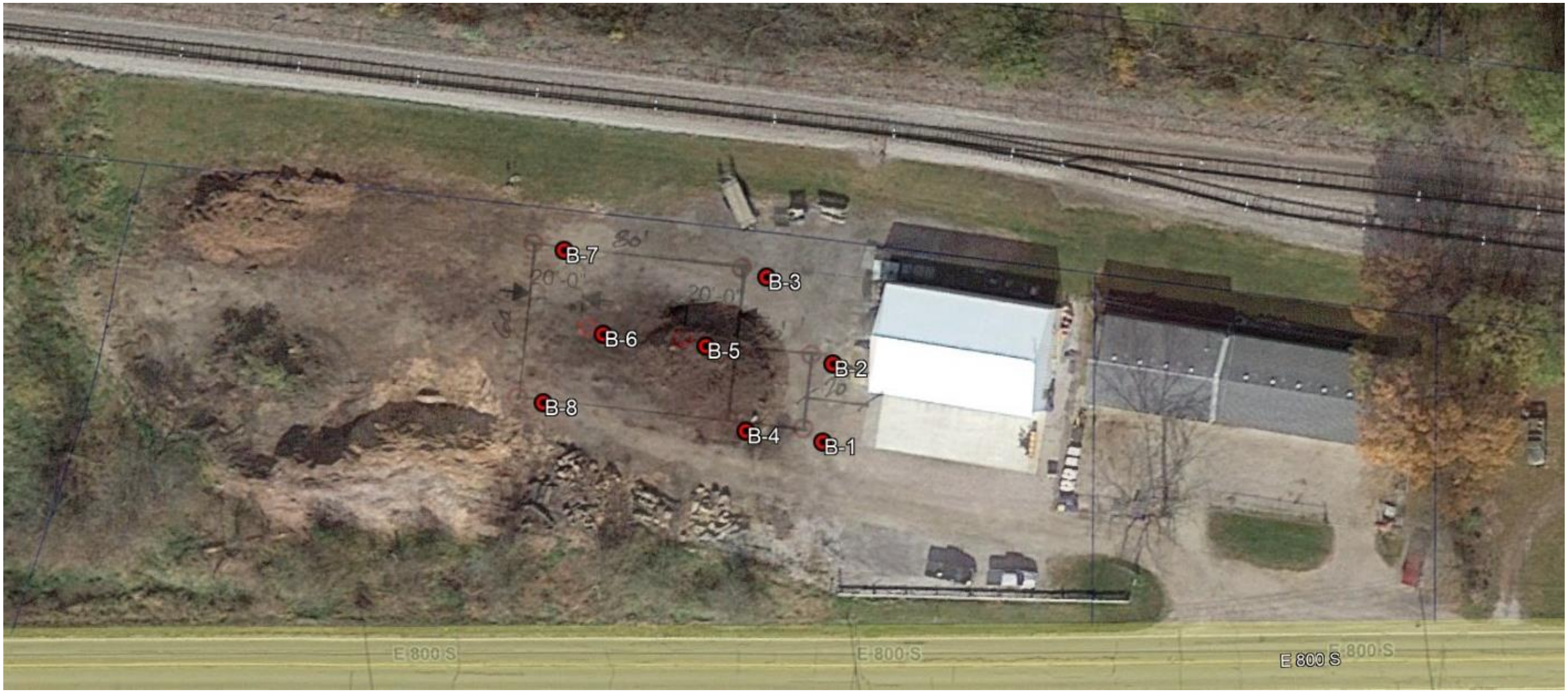
Moisture Content Tests: The natural moisture content of selected samples was determined by ASTM method D-2216 and is recorded on the Borehole Logs as a percentage of dry weight of soil under the “MC”.

Hand Penetration Tests: Samples of cohesive soils obtained from the split spoon sampler were tested with a calibrated hand penetrometer to aid in evaluating the soil strength characteristics. The results from this testing are tabulated on the Borehole Logs under the heading “Q_P”.

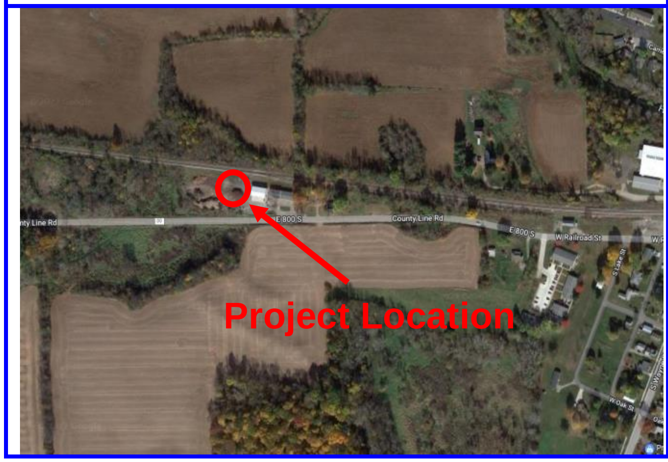
Unconfined Compressive Strength Tests: The undrained shear strengths of the cohesive soils were evaluated utilizing unconfined compressive tests on specimens obtained from the split-barrel and/or thin wall tube sampler. The values of strength tests performed on soil samples obtained from the split-barrel sampler are considered approximate recognizing that the sampler provides a representative but somewhat disturbed sample. The test results are tabulated on the Borehole Logs under the heading “Q_u”.

III. GEOLOGIC CONDITIONS

According to the *United States Department of Agriculture (USDA) Soil Survey and Natural Resources Conservation Service (NRCS),* the natural soils covering the majority of the site are classified as Miami loam (MhB), 2 to 6 percent slopes; Rensselaer loam (Rb), 0 to 1 percent slopes type soils. A copy of the *Custom Soil Resource Report for Steuben County, Indiana* has been included in Appendix B of this report.



VICINITY MAP (NOT TO SCALE)



NOTES

1. All boring locations are approximate.
2. Vicinity map generated using imagery from google.com/maps.

N

LEGEND

● B-1
Test Boring Location and Designation

FIGURE 1 – APPROXIMATE BORING LOCATION MAP

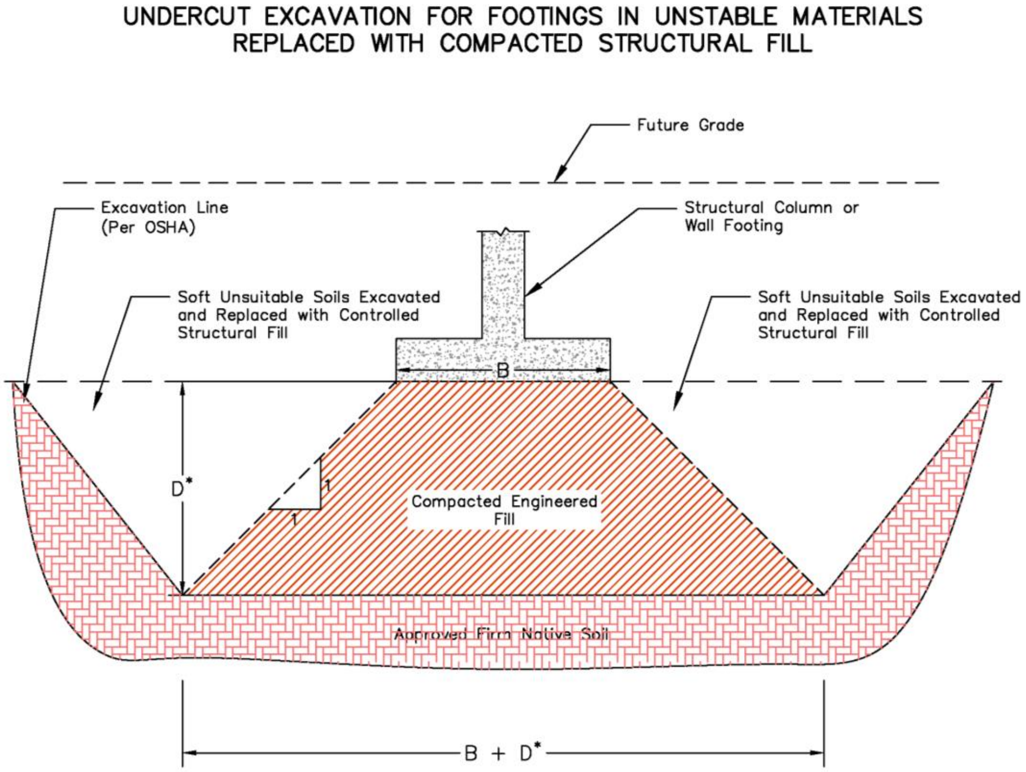
Project Name: Proposed New Street Department Building - Town of Hamilton

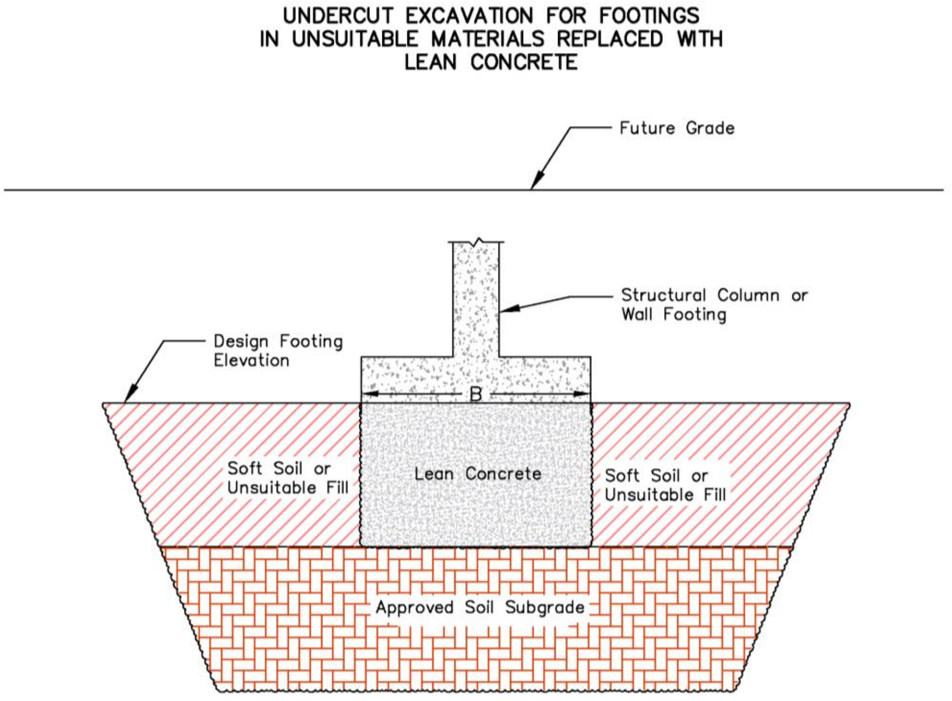
Location: 3540 West Railroad Street, Hamilton, IN

Client Name: Town of Hamilton; c/o: Abonmarche Consultants

GME Project Number: G22-031140

QUALITY SERVICE GME
GME TESTING





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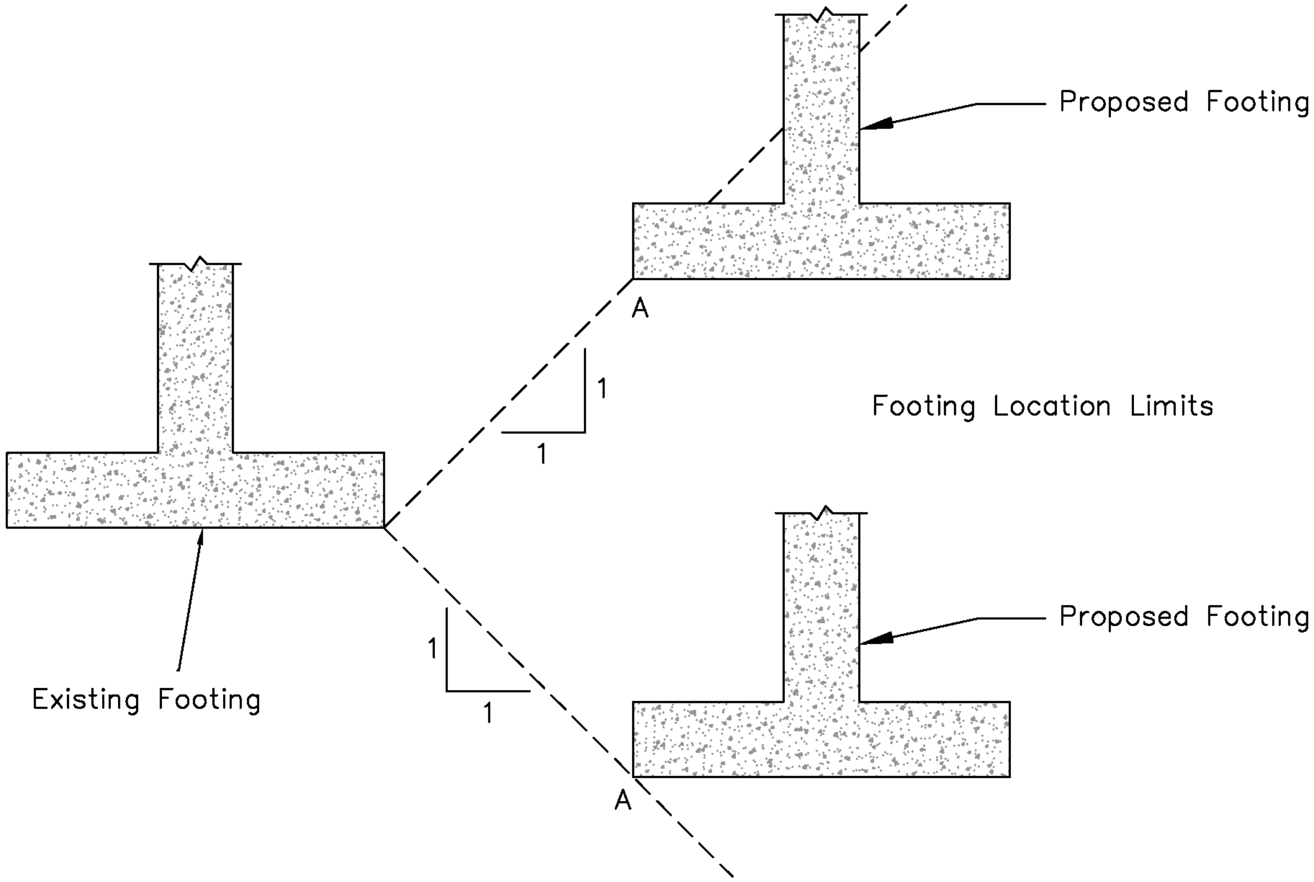
GME TESTING

FIGURE 2 - UNDERCUT EXCAVATION BELOW FOOTINGS

GME PROJECT NO.
G22-031140

PLACEMENT OF ADJACENT FOOTINGS



Note: Point 'A' of the proposed footing must be within the dashed lines showing the footing location limits

GME TESTING

FIGURE 3 – PLACEMENT OF ADJACENT FOOTINGS

GME PROJECT NO.
G22-031140

APPENDIX B

GME TESTING

TEST BORING LOG

BORING NO.: **B-1**
SHEET 1 OF 1
GME PROJECT NO: G22-031140
STRUCTURE
DATUM :
DATE STARTED : 03-16-22
DRILLER/INSP : RS/CW

CLIENT: Town of Hamilton; c/o: Abonmarche Consultants
PROJECT TYPE : Proposed New Street Department Building - Town of Hamilton
LOCATION : 3540 West Railroad Street, Hamilton, IN

ELEVATION :
STATION :
OFFSET :
LINE :
DEPTH : 15.0 ft

BORING METHOD : ASTM D-1586
RIG TYPE : Skid
CASING DIA. : 3.3 in
HAMMER : Auto

LATITUDE : 41.528692
LONGITUDE : -84.922989

GROUNDWATER: ▽ Encountered at Dry ▼ At completion Dry

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6" (N)	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., tsf	Qp (tsf)	REMARKS
		±5" LIMESTONE Product. 0.4							
	2.5	MISCELLANEOUS FILL: Brown, Sand and Gravel, with Brick and Glass Debris.	SS 1	5-3-2 (5)	100	9.2			
	5.0	6.0	SS 2	1-=-18" ()	100	14.7			
	7.5	Brown, SANDY SILTY CLAY, Trace Gravel. 8.0	SS 3	1-5-10 (15)	100	12.7		2.0	
	10.0	Brown and Gray, SILTY CLAY, Trace Gravel.	SS 4	11-12-16 (28)	100	11.0		4.5+	
	12.5								
	15.0	15.0	SS 5	8-8-11 (19)	100	11.1		4.5+	
		Bottom of Boring at 15.0 ft							
	17.5								
	20.0								
	22.5								
	25.0								

GME TESTING

TEST BORING LOG

BORING NO.: **B-2**
SHEET 1 OF 1
GME PROJECT NO: G22-031140
STRUCTURE
DATUM :
DATE STARTED : 03-16-22
DRILLER/INSP : RS/CW

CLIENT: Town of Hamilton; c/o: Abonmarche Consultants
PROJECT TYPE : Proposed New Street Department Building - Town of Hamilton
LOCATION : 3540 West Railroad Street, Hamilton, IN

ELEVATION :
STATION :
OFFSET :
LINE :
DEPTH : 15.0 ft

BORING METHOD : ASTM D-1586
RIG TYPE : Skid
CASING DIA. : 3.3 in
HAMMER : Auto

LATITUDE : 41.528775
LONGITUDE : -84.922975

GROUNDWATER: ▽ Encountered at 8.0 ft ▼ At completion 8.0 ft ☒ Caved in at 10.5 ft

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6" (N)	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., tsf	Qp (tsf)	REMARKS
		±4" GRAVEL Product. 0.3							
	2.5		SS 1	Rock-Cuttings- ()		17.4			
	5.0	MISCELLANEOUS FILL: Brown, Moist, Silty Sand and Gravel, Trace Brick and Glass Debris.	SS 2	2-=-18" ()	100	34.6			
	7.5		SS 3	1-=-18" ()	50	21.2			
▼		8.5							
	10.0		SS 4	1-3-8 (11)	100	12.8		2.5	
☒		Brown and Gray, Moist, SANDY CLAY.							
	12.5	12.5							
		Gray, SILTY CLAY, Trace Gravel.	SS 5	8-9-10 (19)	100	10.8	6.50	4.5+	
	15.0	15.0							
		Bottom of Boring at 15.0 ft							
	17.5								
	20.0								
	22.5								
	25.0								

GME TESTING

TEST BORING LOG

BORING NO.: **B-3**
SHEET 1 OF 1
GME PROJECT NO: G22-031140
STRUCTURE
DATUM :
DATE STARTED : 03-16-22
DRILLER/INSP : RS/CW

CLIENT: Town of Hamilton; c/o: Abonmarche Consultants
PROJECT TYPE : Proposed New Street Department Building - Town of Hamilton
LOCATION : 3540 West Railroad Street, Hamilton, IN

ELEVATION :
STATION :
OFFSET :
LINE :
DEPTH : 15.0 ft

BORING METHOD : ASTM D-1586
RIG TYPE : Skid
CASING DIA. : 3.3 in
HAMMER : Auto

LATITUDE : 41.528867
LONGITUDE : -84.923069

GROUNDWATER: ▽ Encountered at Dry ▼ At completion Dry

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION		SAMPLE NUMBER	SPT per 6" (N)	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., tsf	Qp (tsf)	REMARKS
		±1.5" Gravely ASPHALT Product.	0.1							
		FILL: Black, Moist, Sand and Gravel.	1.7							
	2.5			SS 1	5-5-5 (10)	100	17.8		3.0	
	5.0			SS 2	9-12-12 (24)	100	12.4		4.5	
	7.5	Brown, SANDY SILTY CLAY, Trace Gravel.		SS 3	9-11-12 (23)	100	21.2		3.5	
	10.0			SS 4	5-9-12 (21)	100	12.8		4.5+	
			12.0							
	12.5	Gray, SILTY CLAY, Trace Gravel.								
	15.0		15.0	SS 5	9-10-12 (22)	100	10.8		4.5	
		Bottom of Boring at 15.0 ft								
	17.5									
	20.0									
	22.5									
	25.0									

QUALITY SERVICE
GME
GME TESTING

TEST BORING LOG

BORING NO.: **B-4**
SHEET 1 OF 1
GME PROJECT NO: G22-031140
STRUCTURE
DATUM :
DATE STARTED : 03-16-22
DRILLER/INSP : RS/CW

CLIENT: Town of Hamilton; c/o: Abonmarche Consultants
PROJECT TYPE : Proposed New Street Department Building - Town of Hamilton
LOCATION : 3540 West Railroad Street, Hamilton, IN

ELEVATION :
STATION :
OFFSET :
LINE :
DEPTH : 15.0 ft

BORING METHOD : ASTM D-1586
RIG TYPE : Skid
CASING DIA. : 3.3 in
HAMMER : Auto

LATITUDE : 41.528703
LONGITUDE : -84.923097

GROUNDWATER: ▽ Encountered at Dry ▼ At completion Dry

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6" (N)	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., tsf	Qp (tsf)	REMARKS
	2.5	MISCELLANEOUS FILL: Brown, Silty Sand and Gravel, Trace Brick and Glass and Steel Fragments.	SS 1	10-6-2 (8)	100	20.2			
	5.0		SS 2	1-2-1 (3)	100	15.2			
	7.5	8.0	SS 3	1-=-18" ()	100	68.1			
	10.0	Brown and Gray, SILTY CLAY, Trace Gravel.	SS 4	8-10-12 (22)	100	11.0		4.5	
	12.5								
	15.0	15.0	SS 5	7-9-11 (20)	100	11.2	8.60	4.5+	
		Bottom of Boring at 15.0 ft							
	17.5								
	20.0								
	22.5								
	25.0								

TEST BORING LOG

BORING NO.: **B-5**
SHEET 1 OF 1
GME PROJECT NO: G22-031140
STRUCTURE
DATUM :
DATE STARTED : 03-16-22
DRILLER/INSP : RS/CW

CLIENT: Town of Hamilton; c/o: Abonmarche Consultants
PROJECT TYPE : Proposed New Street Department Building - Town of Hamilton
LOCATION : 3540 West Railroad Street, Hamilton, IN

ELEVATION :
STATION :
OFFSET :
LINE :
DEPTH : 15.0 ft

BORING METHOD : ASTM D-1586
RIG TYPE : Skid
CASING DIA. : 3.3 in
HAMMER : Auto

LATITUDE : 41.528794
LONGITUDE : -84.923156

GROUNDWATER: ▽ Encountered at 2.0 ft ▼ At completion Dry

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6" (N)	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., tsf	Qp (tsf)	REMARKS
		±5" Moist, Fine GRAVEL Product. 0.4							
▽	2.5	MISCELLANEOUS FILL: Brown, Silty Sand and Gravel, Trace Brick and Glass Debris.	SS 1	3-3-1 (4)	100	19.8			
	5.0	5.5	SS 2	1-2-1 (3)	50	16.1			
	7.5	Black, Very Moist, Organic SANDY CLAY, Trace Gravel. 9.0	SS 3	2-=-18" ()	100	23.6			
	10.0		SS 4	1-4-10 (14)	100	13.6		4.0	
	12.5	Brown and Gray, SANDY SILTY CLAY, Trace Gravel.							
	15.0	15.0	SS 5	7-12-13 (25)	100	11.7	8.40	4.5+	
		Bottom of Boring at 15.0 ft							
	17.5								
	20.0								
	22.5								
	25.0								

GME TESTING

TEST BORING LOG

BORING NO.: B-6
SHEET 1 OF 1
GME PROJECT NO: G22-031140
STRUCTURE
DATUM :
DATE STARTED : 03-16-22
DRILLER/INSP : RS/CW

CLIENT: Town of Hamilton; c/o: Abonmarche Consultants
PROJECT TYPE : Proposed New Street Department Building - Town of Hamilton
LOCATION : 3540 West Railroad Street, Hamilton, IN

ELEVATION :
STATION :
OFFSET :
LINE :
DEPTH : 20.0 ft

BORING METHOD : ASTM D-1586
RIG TYPE : Skid
CASING DIA. : 3.3 in
HAMMER : Auto

LATITUDE : 41.528806
LONGITUDE : -84.9233

GROUNDWATER: ▽ Encountered at 15.5 ft ▼ At completion 7.5 ft ⊠ Caved in at 11.0 ft

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6" (N)	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., tsf	Qp (tsf)	REMARKS
	2.5		SS 1	3-3-2 (5)	100	22.9			
	5.0	MISCELLANEOUS FILL: Balck , Silty Sand Mixed with Clay, Wood, Brick, Steel, and Glass Fragments.	SS 2	1-=-18" ()	100	16.1			
▼	7.5		SS 3	1-1-2 (3)	100	18.1			
		8.5							
	10.0	Brown, Very Moist, SANDY SILTY CLAY, Trace Gravel.	SS 4	2-6-12 (18)	100	11.9		3.0	
⊠									
		12.0							
	12.5								
	15.0		SS 5	8-11-14 (25)	100	11.0	7.30	4.5+	
▽		Gray, SANDY SILTY CLAY, Trace Gravel, Occassional Sand Seams.							
	17.5								
	20.0	20.0	SS 6	12-17-22 (39)	100	8.0		4.5+	
		Bottom of Boring at 20.0 ft							
	22.5								
	25.0								

GME
GME TESTING

TEST BORING LOG

BORING NO.: **B-7**
SHEET 1 OF 1
GME PROJECT NO: G22-031140
STRUCTURE
DATUM :
DATE STARTED : 03-16-22
DRILLER/INSP : RS/CW

CLIENT: Town of Hamilton; c/o: Abonmarche Consultants
PROJECT TYPE : Proposed New Street Department Building - Town of Hamilton
LOCATION : 3540 West Railroad Street, Hamilton, IN

ELEVATION :
STATION :
OFFSET :
LINE :
DEPTH : 15.0 ft

BORING METHOD : ASTM D-1586
RIG TYPE : Skid
CASING DIA. : 3.3 in
HAMMER : Auto

LATITUDE : 41.528894
LONGITUDE : -84.923356

GROUNDWATER: ▽ Encountered at 11.5 ft ▼ At completion 10.5 ft ☒ Caved in at 12.5 ft

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6" (N)	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., tsf	Qp (tsf)	REMARKS
		±2" Gray LIMESTONE Mix. 0.2							
	2.5	FILL: Black, Moist, Sandy Topsoil. 2.0	SS 1	4-3-6 (9)	100	17.9			
		FILL: Dark Brown, Moist, Sandy Silty Clay, Trace Gravel. 3.5							
	5.0	Brown, Very Moist, SANDY SILTY CLAY. 11.0	SS 2	7-8-9 (17)	100			2.0	
	7.5		SS 3	5-10-10 (20)	100	14.5	2.70	2.5	
	10.0		SS 4	10-19-35 (54)	100	12.2		4.5	
▼ ▽ ☒	12.5	Gray, Wet, Fine to Medium Coarse SILTY SAND and GRAVEL. 15.0							
	15.0		SS 5	10-11-8 (19)	100				
		Bottom of Boring at 15.0 ft							
	17.5								
	20.0								
	22.5								
	25.0								

GME TESTING

TEST BORING LOG

BORING NO.: **B-8**
SHEET 1 OF 1
GME PROJECT NO: G22-031140
STRUCTURE
DATUM :
DATE STARTED : 03-16-22
DRILLER/INSP : RS/CW

CLIENT: Town of Hamilton; c/o: Abonmarche Consultants
PROJECT TYPE : Proposed New Street Department Building - Town of Hamilton
LOCATION : 3540 West Railroad Street, Hamilton, IN

ELEVATION :
STATION :
OFFSET :
LINE :
DEPTH : 15.0 ft

BORING METHOD : ASTM D-1586
RIG TYPE : Skid
CASING DIA. : 3.3 in
HAMMER : Auto

LATITUDE : 41.528733
LONGITUDE : -84.923386

GROUNDWATER: ▽ Encountered at 12.0 ft ▼ At completion 12.0 ft ⊠ Caved in at 12.5 ft

STRATUM ELEVATION	SAMPLE DEPTH	SOIL/MATERIAL DESCRIPTION	SAMPLE NUMBER	SPT per 6" (N)	% RECOVERY	MOISTURE CONTENT	UNCONF. COMP., tsf	Qp (tsf)	REMARKS
	2.5		SS 1	8-4-2 (6)	100	12.5			
	5.0	MISCELLANEOUS FILL: Brown, Sandy Clay, Trace Gravel, Brick, Wood, and Glass Fragments.	SS 2	1-3-1 (4)	100				
	7.5		SS 3	1-5-1 (6)	100	12.8			
		8.5							
	10.0	Brown, SILTY CLAY, Trace Gravel.	SS 4	4-7-14 (21)	100	11.4		4.5+	
		12.0							
▼ ▽ ⊠	12.5	Brown, Wet, Fine to Medium Coarse SILTY SAND.							
	15.0	15.0	SS 5	15-18-15 (33)	100				
		Bottom of Boring at 15.0 ft							
	17.5								
	20.0								
	22.5								
	25.0								

GENERAL NOTES

SAMPLE IDENTIFICATION

Visual soil classifications are made in general accordance with the United States Soil Classification System on the basis of textural and particle size categorization, and various soil behavior and characteristics. Visual classifications should be made by appropriate laboratory testing when more exact soil identification is required to satisfy specific project applications criteria.

RELATIVE PROPORTIONS OF COHESIONLESS SOILS

Term	Defining Range by % of Weight
Trace	1-10 %
Little	11-20 %
Some	21-35 %
And	36-50 %

WATER LEVEL MEASUREMENT

NE	No Water Encountered
BF	Backfilled upon Completion

ORGANIC CONTENT BY COMBUSTION METHOD

Soil Description	LOI
w/ organic matter	4-15 %
Organic Soil (A-8)	16-30 %
Peat (A-8)	More than 30%

LABORATORY TESTS

Qp	Penetrometer Reading, tsf
Qu	Unconfined Strength, tsf
MC	Moisture Content, %
LL	Liquid Limit, %
PL	Plastic Limit, %
PI	Plastic Index
SL	Shrinkage Limit, %
pH	Measure of Soil Alkalinity/Acidity
γ	Dry Unit Weight, pcf
LOI	Loss of Ignition, %

DRILLING AND SAMPLING SYMBOLS

AS	Auger Sample
BS	Bag Sample
PID	Photo ionization Detector (Hnu meter) volatile vapor level,(PPM)
COA	Clean-Out Auger
CS	Continuous Sampling
FA	Flight Auger
HA	Hand Auger
HAS	Hollow Stem Auger
NR	No Recovery
PT	3" O.D. Piston Tube Sample
RB	Rock Bit
RC	Rock Coring
REC	Recovery
RQD	Rock Quality Designation
RS	Rock Sounding
S	Soil Sounding
SS	2"O.D. Split-Barrel Sample
2ST	2"O.D. Tin-Walled Tube Sample
3ST	3" O.D. Thin-Walled Tube Sample
VS	Vane Shear Test
DB	Diamond Bit
WS	Wash Sample
RB	Roller Bit
ST	Shelby Tube, 2" O.D. or 3" O.D.
CB	Carbide Bit
WOH	Weight of the Hammer

GRAIN SIZE TERMINOLOGY

Soil fraction	Particle size	Us standard sieve size
Boulders	larger than 75 mm	Larger than 3"
Gravel	2mm to 75 mm	#10 to 75 mm
Coarse Sand	0.425 mm to 2 mm	#40 to #10
Fine Sand	0.075mm to 0.425 mm	#200 to #40
Silt	0.002 mm to 0.075 mm	Smaller than #200
Clay	Smaller than 0.002 mm	Smaller than #200

RELATIVE DENSITY

Term	"N" Value
Very Loose	0-5
Loose	6-10
Medium Dense	11-30
Dense	31-50
Very Dense	51+

CONSISTENCY

Term	"N" Value
Very Soft	0-3
Soft	4-5
Medium Stiff	6-10
Stiff	11-15
Very Stiff	16-30
Hard	31+

PLASTICITY

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

Note(s):
The penetration resistance, "N" Value, is the summation of the number of blows required to effect two successive 6-inch penetrations of the 2-inch split-barrel sampler. The sampler is driven with a 140-lb. weight falling 30-inches and is seated to a depth of 6-inches before commencing the standard penetration test.
Water level measurements shown on the boring logs represent conditions at the time indicated and may not reflect static levels, especially in cohesive soils

GME TESTING
3517 Focus Drive
Fort Wayne, IN 46818
(260) 497- 8127▪ (877) 660-4GME• (260) 497- 0826 fax
Division of ***GEOTECHNICAL & MATERIALS ENGINEERS, INC.***
www.gmetesting.com

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
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 GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
			○	GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	○	GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
			▨	GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)	⁘	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			⁘	SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)	⁘	SM	SILTY SANDS, SAND - SILT MIXTURES
			▨	SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50	▥	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			▨	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			☰	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50	▥	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
			▨	CH	INORGANIC CLAYS OF HIGH PLASTICITY
			≈	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			⁂	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

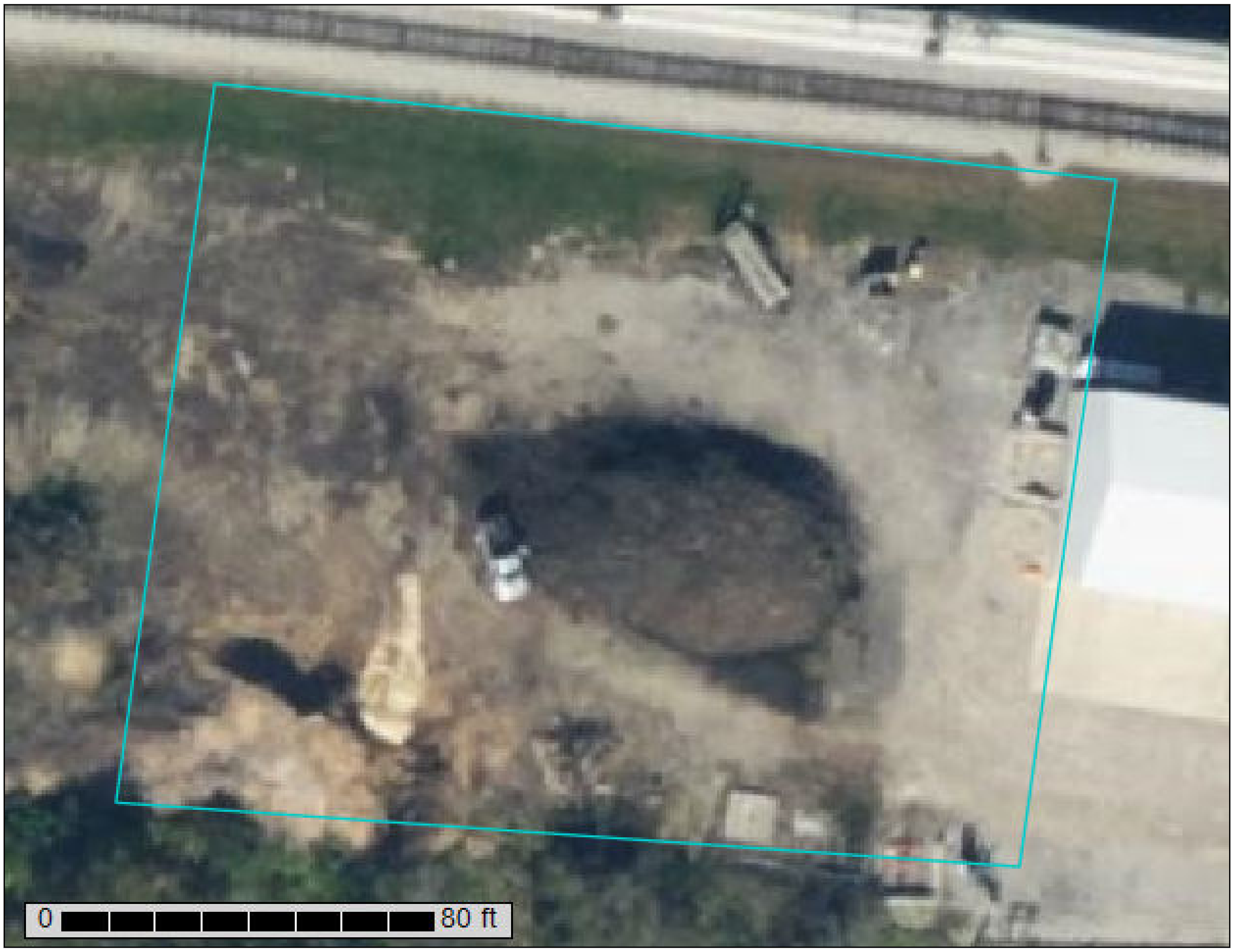
NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for
Steuben County, Indiana



March 24, 2022

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map

Map Scale: 1:433 if printed on A landscape (11" x 8.5") sheet.

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 16N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Steuben County, Indiana
Survey Area Data: Version 24, Sep 9, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 8, 2019—Oct 15, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
MhB	Miami loam, 2 to 6 percent slopes	0.6	86.6%
Rb	Rensselaer loam, 0 to 1 percent slopes	0.1	13.4%
Totals for Area of Interest		**0.7**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Steuben County, Indiana

MhB—Miami loam, 2 to 6 percent slopes

Map Unit Setting

National map unit symbol: 2wp1m
Elevation: 670 to 1,180 feet
Mean annual precipitation: 37 to 39 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 150 to 170 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Miami and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Miami

Setting

Landform: Moraines
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loamy till

Typical profile

Ap - 0 to 9 inches: loam
Bt1 - 9 to 13 inches: loam
Bt2 - 13 to 31 inches: clay loam
BCt - 31 to 36 inches: loam
Cd - 36 to 79 inches: loam

Properties and qualities

Slope: 2 to 6 percent
Depth to restrictive feature: 35 to 40 inches to densic material
Drainage class: Moderately well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately high (0.01 to 0.20 in/hr)
Depth to water table: About 24 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 35 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: C
Ecological site: F111BY503IN - Till Ridge
Hydric soil rating: No

Minor Components

Crosier

Percent of map unit: 9 percent
Landform: Moraines
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F111BY502IN - Wet Till Ridge
Hydric soil rating: No

Brookston

Percent of map unit: 6 percent
Landform: Drainageways, depressions
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, dip
Down-slope shape: Linear, concave
Across-slope shape: Concave
Ecological site: F111BY501IN - Till Depression
Hydric soil rating: Yes

Rb—Rensselaer loam, 0 to 1 percent slopes

Map Unit Setting

National map unit symbol: 2wp2b
Elevation: 600 to 1,010 feet
Mean annual precipitation: 34 to 40 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 150 to 185 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Rensselaer and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rensselaer

Setting

Landform: Depressions
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Loamy outwash

Typical profile

Ap - 0 to 15 inches: loam
Btg1 - 15 to 38 inches: clay loam
Btg2 - 38 to 42 inches: loam

Cg1 - 42 to 76 inches: stratified fine sand to silt loam
Cg2 - 76 to 79 inches: loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 0 to 6 inches
Frequency of flooding: None
Frequency of ponding: Frequent
Calcium carbonate, maximum content: 25 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 10.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: B/D
Ecological site: R111BY401IN - Wet Outwash Mollisol
Other vegetative classification: Mixed/Transitional (Mixed Native Vegetation)
Hydric soil rating: Yes

Minor Components

Whitaker

Percent of map unit: 7 percent
Landform: Outwash plains
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F111BY403IN - Outwash Upland
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Crosier

Percent of map unit: 5 percent
Landform: Moraines
Landform position (three-dimensional): Rise
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: F111BY502IN - Wet Till Ridge
Other vegetative classification: Trees/Timber (Woody Vegetation)
Hydric soil rating: No

Houghton, undrained

Percent of map unit: 3 percent
Landform: Depressions
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Ecological site: R111BY003IN - Deep Muck
Other vegetative classification: Mixed/Transitional (Mixed Native Vegetation)
Hydric soil rating: Yes

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