GEOTECHNICAL INVESTIGATION REPORT
JOINT FIRE AND POLICE STATION
SEC OF THE INTERSECTION OF ABBEY AVENUE & WEST THIRD STREET
DAYTON, MONTGOMERY COUNTY, OHIO
DHDC PROJECT NUMBER: C24-100

For:

App Architecture
615 Woodside Drive
Englewood, Ohio 45322

Submitted by:

DHDC Engineering Consulting Services, Inc.
2390 Advanced Business Center Drive
Columbus, Ohio 43228

Date:

July 16, 2024

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July 16, 2024

Timothy J. Bement, AIA
Principal
App Architecture
615 Woodside Drive
Englewood, Ohio 45322
O: 937.836.8898

RE: Geotechnical Investigation Report
Joint Fire and Police Station
Southeast Corner of the Intersection of Abbey Avenue & West Third Street
Dayton, Montgomery County, Ohio
DHDC Project Number: C24-100

Dear Mr. Bement:

In compliance with your request, DHDC Engineering Consulting Services, Inc. (DHDC) has completed a subsurface exploration and geotechnical evaluation for the above referenced project. We appreciate the opportunity to be of service to you on this project. If you have any questions regarding our report or if we may be of further service, please contact us at your earliest convenience.

Respectfully submitted,

DHDC Engineering Consulting Services, Inc.

STATE OF OHIO
MOHAMMED O. HAQUE
E-63310
REGISTERED
PROFESSIONAL ENGINEER

Mohammed O. Haque, P.E.
Geotechnical Engineer

Savvas P. Sophocleous
Project Manager

Attachment

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1.0 INTRODUCTION

The site of the proposed Joint Fire and Police Station building structure is located at the southeast corner of the intersection of Abbey Avenue and West Third Street in Dayton, Montgomery County, Ohio. The purpose of this investigation was to determine the general types of subsoils present at the proposed site, to make an evaluation of their likely impact on the proposed development, and to make comments and recommendations relative to the design and construction of earthwork and building foundations for this project.

The scope of this investigation included a review of available geologic and soils data for the project area, a subsurface investigation consisting of six (6) standard soil test borings, field and laboratory soil testing, and an engineering analysis and evaluation of the subsurface conditions encountered at this site.

2.0 PROJECT AND SITE CHARACTERISTICS

The proposed building will be a single-story tall slab-on-grade type of structure and will involve load-bearing masonry walls. The footprint of the proposed building will be about 9,000 square feet. It is DHDC's understanding that the proposed building will house equipment room and offices. Parking and paved areas will surround the proposed facility.

Structural loads have not been provided; however, it has been assumed that maximum column loads will not exceed 100 kips, the maximum wall loads will not exceed 5 kips per linear foot and the maximum floor slab loads will not exceed about 200 pounds per sq. ft.

The topography of the proposed site can be described as relatively flat. No site grading plan and finished floor elevation of the proposed structure is available at this time. However, based on the exposed grade it appears that very minimal cuts and/or fill will be required (no more than 2 to 3± feet) to bring the site to the desired finished subgrade elevation.

3.0 INVESTIGATIVE PROCEDURES

DHDC performed four (4) soil Borings B-1 through B-4 within the footprint of the proposed building structure and two (2) soil Borings P-1 and P-2 within the proposed pavement areas. Based on the site plan DHDC staked the boring locations. The building borings were advanced to a depth of about 25 feet and the pavement borings to a depth of 15.0 feet below the exposed grade. The test borings were performed in accordance with geotechnical investigative procedures outlined in American Society for Testing and Materials (ASTM) Standards D 1452 and D 5434. The test borings were performed utilizing 3¼-inch inside diameter hollow-stem augers. Soil samples were collected at 2.5-foot intervals to a depth of 10.0 feet and 5.0 feet thereafter to the maximum depth explored.

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Split-spoon samples were obtained by the Standard Penetration Test (SPT) Method (ASTM D 1586), which consists of driving a 2.5-inch outside diameter split-spoon sampler into the soil with a 140-pound weight falling freely through a distance of 30 inches. The sampler was driven in three successive 6-inch increments with the number of blows per increment being recorded. The sum of the number of blows required to advance the sampler the second and third 6-inch increments is termed the Standard Penetration Resistance (N-value) and is presented on the Logs of Test Borings attached to this report. The split-spoon samples were sealed in jars and transported to our laboratory for further classification and testing.

Soil conditions encountered in the test borings are presented in the Logs of Test Borings, along with information related to sample data, SPT results, water conditions observed in the borings, and laboratory test data. It should be noted that these logs have been prepared on the basis of laboratory classification and testing as well as on field logs of the encountered soils.

All samples of the subsoils were visually or manually classified using the Unified Group Soil Classification System (ASTM D-2487 and D-2488). All soil samples were tested in the laboratory for moisture content (ASTM-D 2216) and intact cohesive soil samples for Pocket Penetrometer tests. Atterberg Limit tests were performed on few selected soil samples. The results of these tests are presented on the soil boring logs attached to this report.

4.0 GENERAL SUBSURFACE CONDITIONS

4.1 Site Geologic Conditions

Various topographic, geologic and county soil and groundwater availability maps published by the Ohio Department of Natural Resources (ODNR) and the United States Department of Agriculture (USDA) were reviewed as part of this investigation. The results of the review are summarized in the paragraphs below.

The site is located in the Southern Ohio Loamy Till Plain regional physiographic province. The soils at the site are primarily fine-grained, low plasticity soils formed by weathering of the underlying loess and glacial till. Deep deposits of Late Wisconsinan-aged glacial till ground moraine cover the area to various depths. Glacial till soil consists of silts, silty clays, sandy clays, and clays with variable sand and gravel components. Interbedded thin to thick layers of sand and gravel are also encountered within the cohesive glacial till soil. These interbedded thick layers of cohesionless soils are mostly glacial outwash. The bedrock geology consists Ordovician-aged Drakes, Whitewater, and Liberty Formations. Geological and bedrock maps of Ohio are attached in Appendix of this report.

4.2 Soil Profile

<u>Fill</u>

Man-made fill material was encountered in all six (6) borings drilled for this investigation. Based on the soil borings information, it appears that the bottom of the man-made fill material at this site ranged from about 2.0 to 6.5 feet below the exposed grade. The man-made fill materials consisted of both cohesive and cohesionless soils. The upper layer of fill material in most of the borings consisted of a mixture of silty sand, gravel, and rock fragments. The thickness of this fill material ranged from about 2.0 to about 5.5 feet. The deeper depth fill material consisted of cohesive silty clay containing trace amounts of sand. The silty clay fill material in Boring B-2 contained organic odor.

The Standard Penetration Test N-values within the cohesionless fill material ranged from 10 to more than 50 blows per foot (bpf) and the moisture content ranged from 3 to 4 percent. The N-values within the cohesive fill material ranged from 8 to 11 bpf and the moisture content ranged from 10 to 27 percent.

<u>Possible Fill Material</u>

Below the man-made fill material, a thin layer of brown sandy clay possible fil material was encountered in Boring P-1. The bottom of the possible fill material is about 4.0 feet below the exposed grade.

<u>Naturally Occurring Soil</u>

<u>Cohesive Soil</u>

Below the fill material, naturally occurring native cohesive silty clay soil was encountered in most of the boring locations. The thickness of the silty clay soil ranged from about 1.5 to 4.0 feet. The silty clay soil is glacial till material. Trace amounts of sand and gravel were encountered within the cohesive silty clay soil. The N-values within the silty clay soils ranged from 3 to 7 bpf, indicating soft to medium stiff soil consistency. Natural moisture content of the silty clay cohesive soils ranged from 22 to 28 percent. Pocket Penetrometer value which is the approximate Unconfined Compressive Strength ranged from 1.0 to 2.5 tons per square foot (tsf). Atterberg Limit tests performed on representative samples from this stratum indicated Liquid Limits in the range of 38 to 39 percent and Plasticity Indices of 19 percent, indicating a classification of CL according to the Unified Soil Classification System (USCS).

The deeper depth cohesive soil consisted of silty sandy clay glacial till. All six (6) borings were discontinued in silty sandy clay soil to the maximum depth explored of 10.0 to 25.0 feet below the exposed grade. Coarse gravel and/or cobble were encountered within the silty sandy clay soil in silty sandy clay soil matrix in Boring B-3. Interbedded silty sand and gravel layers were observed within the silty sandy clay soil matrix in Boring B-2.

The N-values in silty sandy clay soil ranged from 8 to 49 bpf. It is most likely that the high N-values are due to the presence of coarse gravel or cobble within the soil matrix. Natural moisture content of the silty sandy clay soils ranged from 9 to 12 percent. Pocket Penetrometer values within these materials ranged from 2.0 to more than 4.5 tsf. Liquid Limit on representative samples from this stratum was 36 percent and the Plasticity Indices 15 to 16 percent, indicating a classification of CL according to the USCS.

Cohesionless Soil

Interbedded thin to thick layers of silty sand and sandy silt were encountered in glacial till soil matrix. The N-values within the cohesionless soils ranged from 4 to 33 bpf, indicating loose to dense relative density. The cohesionless soils sandwiched between less permeable glacial till soil usually hold perched or trapped groundwater.

4.3 Groundwater Conditions

Ground water observations were made during the drilling operations (by noting the depth of water on the drilling tools) and in the open holes following the withdrawal of the drilling augers. Groundwater was encountered in all but Boring P-2. The following table shows the depth of groundwater encountered in the soil borings:

Table - I

Boring No.	Boring Depth (ft.)	Groundwater at the Time of Drilling (ft.)	Groundwater at End of Drilling (ft.)
B-1	25.0	10.0	11.3
B-2	25.0	9.0	10.2
B-3	25.0	9.0	10.2
B-4	25.0	17.0	None
B-5	10.0	10.0	None
B-6	10.0	None	None

Groundwater was encountered in all building borings and in pavement Boring P-1. Groundwater will be encountered within the cohesionless soils sandwiched between less permeable cohesive soils. Upon withdrawal of the augers Boring B-4, P-1, and P-2 stayed open (not caved) and other borings caved at depths ranging from 19.7 to 22.7 feet below the exposed grade.

Based on the soil borings information it appears that groundwater can be encountered as high as 9.0 to 10.0 feet below the exposed grade. Although these groundwater depths are not the reliable groundwater depths, it is possible that some perched or trapped groundwater can be encountered at any depths within the sand and gravel seam or layers in the glacial till soil matrix.

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Seasonal influences typically cause a rise and fall in groundwater levels. Groundwater conditions should be anticipated to fluctuate depending on variations in precipitation, surface runoff, infiltration, site topography, and drainage. Fluctuation of the groundwater table can only be determined by installation of a monitoring well. Construction of monitoring well was beyond the scope of this investigation.

4.4 Seismic Site Classification

The Ohio Building Code (OBC) follows International Building Code (IBC) with regards to seismic guidelines. As part of the OBC code, the seismic properties of the overburden soils and bedrock are utilized to determine the site seismic classification. The Seismic Site Class is determined by evaluation of the shear wave velocities of the overburden soil and bedrock to a depth of 100 feeet.

Based on the boring findings, review of geological information, and in accordance with the Ohio Building Code – Site Class Definitions, we estimate the site as a Site Class D - stiff soil profile. Table 20.3-1 of the International Building Code shows the various Site Class.

TABLE 20.3-1 SITE CLASSIFICATION

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard rock	>5,000 ft/s	NA	NA
B. Rock	2,500 to 5,000 ft/s	NA	NA
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the following characteristics: - Plasticity index PI > 20, - Moisture content $w \geq 40\%$, and - Undrained shear strength $\bar{s}_u$ < 500 psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1 ft/s = 0.3048 m/s 1 lb/ft^2 = 0.0479 kN/m^2

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5.0 GEOTECHNICAL CONCLUSIONS AND RECOMMENDATIONS

Based upon our analysis of the soil conditions and the preliminary design details supplied for this project by the client as previously outlined, the following conclusions were reached, and the following recommendations were developed.

5.1 Important Information and Findings

- Building Borings B-1 through B-4 revealed approximately 5.5 to 6.5 feet of man-made fill material. The fill materials are not compacted engineered fill. The fill material contained various types of foreign materials.

- Below the man-made fill material, possible fill material was encountered in Boring P-1 to a depth of about 4.0 feet below the exposed grade.

- A thin layer of soft silty clay soil was encountered below the fill material in Boring B-2. Wet silty sand was encountered just below the soft silty clay soil. Loose silty sand was encountered below the silty clay soil in Boring P-2.

- Other than the soft and loose soil mentioned above in Boeings B-2 and P-2, the naturally occurring native soil encountered below the fill material consisted of medium stiff to very stiff silty to silty sandy clay glacial till soil.

- Groundwater can be encountered at about 9.0 to 10.0 feet below the exposed grade.

5.2 Building Foundation Recommendations

DHDC recommends complete removal of all existing fill material from the footprint of the proposed building structure footprint area and to a distance of at least 10.0 feet beyond the exterior building line and backfilling the undercut areas with compacted engineered fill. Based on the soil borings information it appears that the bottom of excavation will vary from about 5.5 to 6.5 feet below the exposed surface. However, the actual depth of undercut will be determined during the earth excavation. Provided all existing fill materials are removed as recommended above and the undercut areas backfilled with compacted engineered fill, the floor slab will rest on compacted engineered fill.

Once the foundation areas are prepared as recommended above, conventional shallow spread footing may be used to support the proposed building additions. Continuous (wall) footings, isolated (column) footings, or a combination of both may be utilized to transmit the structural loading to the bearing strata. DHDC recommends that the building footings be designed for a maximum net allowable bearing pressure of 3,000 pounds per square foot (psf) for both column (square) and wall (strip) footings.

This recommended soil bearing value should be considered the upper limit, and any value less than that listed above would be acceptable for the foundation system. It is strongly recommended that careful observation of the undercut excavation as well as all foundation excavations be carried out by a representative of DHDC to identify existing fill and other unsuitable materials and to recommend appropriate remedial actions as necessary.

In using net pressure, the weight of the footing and backfill over the footing including the weight of the floor slab need not be considered; hence, only loads applied at or above the finished floor need to be used for dimensioning the footings. Furthermore, wall footings and isolated column footings should be at least 18 inches wide and 24 inches square, respectively (or as per applicable building code requirements, whichever is larger) for protection against a punching shear type of failure.

Provided that the footings are designed as prescribed herein and inspected, it is estimated that the post construction total and differential foundation settlements will not exceed approximately 1 inch and ¾ inches, respectively. Careful field control will contribute substantially to minimizing the settlements.

Uplift forces on footings due to wind load can be resisted by the weight of the footings and the soil material that is placed over the footings. It is recommended that the soil weight be limited to that immediately above and within the perimeter of the footings (unless a much higher factor of safety is used). A total soil unit weight of 115 pounds/cubic foot can be used for the backfill material adjacent to and above the footings, provided it is compacted as recommended. It is also recommended that a factor of safety of at least 1.2 be used for calculating uplift resistance from the footings (provided only the weight of the footing and the soil immediately above it are used to resist uplift forces).

Lateral forces on a shallow spread footing can be resisted by the passive lateral earth pressure against the side of the footing and by friction between the subgrade soil and the base of the footing. A uniform allowable passive pressure of 500 pounds/square foot can be used for that portion of the footing that is below a depth of 3.0 feet below the final exterior grade (no portion of the footing above this depth should be used for lateral resistance). An allowable coefficient of friction (between the base of the footing and the underlying soil) of 0.20 can be used in conjunction with the minimum downward load on the base of the footing.

The footings should be taken to at least 3.0 feet below the final exterior grade for frost protection. All foundation bearing surfaces should be protected against freezing, surface water and undue disturbance as the cohesive soils will tend to soften and increase settlements in such cases. If possible, the footing concrete should be placed the same day that the excavation takes place. If this is not feasible, proper protection of the footing excavations should be provided. All footing excavations should be observed by a representative of DHDC to assure that adequate bearing is achieved before placing concrete for the foundations.

5.3 Floor Slab

Undercutting of existing fill materials and backfilling the undercut areas have been discussed in Sections 5.1 and 5.2 of this report. Since the site will be prepared as per the recommendations of Sections 5.1 and 5.2 of this report, the floor slab will rest on compacted engineered fill. DHDC recommends that the floor slab subgrade areas be proofrolled prior to the placement of the granular subbase material.

Particular attention should be paid to the placement of backfill against the foundation and beneath the slab as inadequate compaction at these locations may cause cracking of the slab edges and corners due to subsidence of the backfill. The slab should be "free floating", i.e., not structurally attached to adjacent walls or foundations.

It is DHDC's recommendation that the floor slabs be supported on a minimum six (6) inch thickness of clean, compacted granular material (ODOT Item No. 304 stone), to help distribute concentrated loads and to allow equalization of moisture conditions beneath the slab. Provided that the above granular cushion is in place, a modulus of subgrade reaction (k_{30}) of 120 pounds per sq. inch per inch can be used for design of the floor slabs.

A vapor barrier may not be required beneath the floor slabs unless the floors are covered with moisture sensitive flooring. It should be noted that vapor barrier can have adverse effects on concrete curing and performance. If used, the vapor barrier should be installed in accordance with the recommendations contained in the ACI Manual of Concrete Practice 302.1 R, Guide for Concrete Floor and Slab Construction, and should be placed below the crushed stone layer. If the vapor barrier is placed immediately below the concrete slab, a coefficient of friction between the slab-on-grade concrete floor and the vapor barrier of 0.15 should be used.

5.4 Pavement Design

The borings revealed 2.0 to as much as 6.5 feet of fill at this site. Provided that the existing fill material passes the proofroll test and there will be at least 2.0 feet of compacted engineered fill below the finish subgrade elevation, the existing fill material can stay in place. Failed proofrolled subgrade areas will require stabilization or undercutting.

Minimizing the infiltration of water into the subgrade and rapid removal of any subsurface water will be essential in assuring successful long-term performance of pavements. Both the subgrade and the pavement surface should have a minimum slope of one-quarter (1/4) inch per foot to promote drainage. A means of water outlet should be provided at the pavement edges by extending the aggregate base course through to daylight or to surface drainage features such as storm inlets.

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California Bearing Ratio (CBR) test was not performed for this project. DHDC recommends CBR value of 5 for design. The following paragraphs summarize pavement thicknesses for automobile parking areas (light-duty) and heavy truck loading and/or truck turnaround areas. It is important to note that the recommendations for the automobile parking areas assume that these areas will not be subject to any heavy truck traffic. Therefore, in areas where truck traffic cannot be controlled (such as driveways), it is suggested that the thicker pavement section be utilized. The thicknesses were determined by methods developed by the American Association of State Highway and Transportation Officials (AASHTO) based on a ten-year design period.

The following assumptions were made, and the coefficients were used in order to compute a design section:

Regional Factor:	1.5 Roadbed subject to frost, but fairly dry
Terminal Serviceability:	2.5 (2-3 fair)
Soil Support Value:	4 (for CBR value of 5.0)
Traffic Information:	Five (5) semi-trucks per week Two (2) garbage trucks per week 500 cars per day

Flexible Pavement Structural Coefficients:

Items 448 - AC Surface Course:	0.43
Items 302 - AC Base Course:	0.36

Rigid Pavement Design Parameters

Reliability:	90%
Overall Standard Deviation:	0.39
Terminal Serviceability:	2.5
Subgrade Resilient Modulus:	6,000 psi (Satisfactorily Proofrolled Subgrade Soil)

Based on the above traffic numbers and the assumptions, DHDC is recommending the following pavement sections:

Option 1: Flexible Section

Automobile Parking Areas
1.5” Asphalt Concrete Surface Course, Item 448, AC Surface Course
1.5” Asphalt Concrete base Course, Item 301
8” Aggregate Base, ODOT Item No. 304 Stone
Satisfactorily Proofrolled and Compacted Subgrade

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Driveway Areas and Truck Zones
1.5” Asphalt Concrete Surface Course, Item 448, AC Surface Course
3.0” Asphalt Concrete base Course, Item 301
10 Aggregate Base, ODOT Item No. 304 Stone
Satisfactorily Proofrolled and Compacted Subgrade

Option 2: Rigid Section (Driveway Areas and Truck Zones)
8” Non Reinforced Concrete Pavement
10” Aggregate Base, ODOT Item No. 304 Stone
Satisfactorily Proofrolled and Compacted Subgrade

DHDC recommends Tack Coat for Intermediate Course applied at a minimum of 0.05 gallons per square yard. The base aggregate should consist of well-graded crushed stone with a maximum of fourteen (14) percent by weight finer than the number 200 sieve (ODOT item 304 “Aggregate Base”). The pavement should be constructed in accordance with ODOT Standard Specifications.

5.5 Excavation

There will be minimal difficulty experienced in excavating the fill and naturally occurring overburden soil at this site with conventional equipment and methods. All permanent cut slopes shall be no steeper than 3 horizontal to 1 vertical. All temporary excavations for the installation of foundations, utilities, etc., should be properly laid back or braced in accordance with Occupational Safety and Health Administration (OSHA) requirements. For safety purposes, all federal, state, and local safety regulations should be strictly followed. Surface run-off water should be drained away from the excavation and not allowed to pond. The footing excavations should be adequately protected. Some groundwater will be encountered at a depth of about 9.0 to 10.0 feet below the exposed grade. Soft and loose naturally occurring soil can be encountered just below the man-made fill material and at the interface of saturated cohesionless soil.

5.6 Fill

The existing fill materials free of organics and deleterious can be reused as compacted engineered fill. As stated earlier, the upper layer of fill material contained asphalt fragments. Fill material containing asphaltic concrete fragments shouldn’t be used as compacted engineered fill. The on-site geotechnical engineer or technician should make the call regarding the usability of the existing man-made fill material as these fill materials are excavated from the site.

DHDC recommends that the structural fills supporting footings, floor slabs, and pavements be compacted to at least 100 percent of the maximum Standard Proctor dry density (ASTM D-698) or 95 percent of the maximum Modified Proctor dry density (ASTM D-11567).

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It is DHDC's recommendation that if the moisture content of the existing fill material is higher than the Optimum Moisture Content of such soils at the time of fill material compaction, then tilling, pulverization, and drying will be required to remove the excess moisture. If needed lime modification (about 5.0 percent of the dry weight of these materials) can be performed to bring the existing fill material to the workable condition.

The naturally occurring imported fill material should have a plasticity index value no higher than 25, a liquid limit no higher than 50, organic content less than 5 percent, and a maximum dry density of at least 100 pounds per cubic foot. ODOT Item No. 304 stone or well graded sand and gravel can also be used as compacted engineered fill.

The fill should contain no pieces whose greatest dimension is larger than the thickness of the lift being placed. If fill construction takes place during the winter months, care should be taken so as not to place fill over frozen soil nor should froze materials be used within the fill.

Excavations in excess of 4.0 feet in depth should be sloped or shored according to OSHA regulations. Excavation sidewalls should be inspected and approved by the Soils Engineer. Prior to the commencement of construction, all sheeting, shoring, and bracing of trenches, pits, and excavations should be made the responsibility of the contractor. The following back-slope recommendations are for temporary cut-slopes of 20 feet or less in height:

1. Existing Fill material and Medium Stiff Native Cohesive Soil – OSHA Type B Soil; 1H:1V
2. Granular soil including gravel, and/or stone fragments, submerged soil, or soil from which water is freely seeping soils - OSHA Type C Soil; 1.5H:1V (ø = 34°)

6.0 QUALIFICATION OF RECOMMENDATIONS

Our evaluation has been based on our understanding of the site and project information and the data obtained during our field investigation. The general subsurface conditions were based on interpretation of the subsurface data at specific boring locations. Regardless of the thoroughness of a subsurface investigation, there is the possibility that conditions will differ from those encountered at the boring locations, that conditions are not as anticipated by the designers, or that the construction process has altered the soil conditions. Therefore, experienced geotechnical engineers should observe construction to confirm that the conditions anticipated in design are noted. Otherwise, DHDC assumes no responsibility for construction compliance with the design concepts, specifications, or recommendations.

The design recommendations in this report have been developed on the basis of the previously described project characteristics and subsurface conditions. If project criteria or locations change, DHDC should be permitted to determine whether the recommendations must be modified. The findings of such a review will be presented in a supplemental report.

Our professional services have been performed, our findings derived, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. This warranty is in lieu of all other warranties either expressed or implied. DHDC is not responsible for the conclusions, opinions, or recommendations of others based on this data.

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APPENDIX: GEOLOGICAL MAPS

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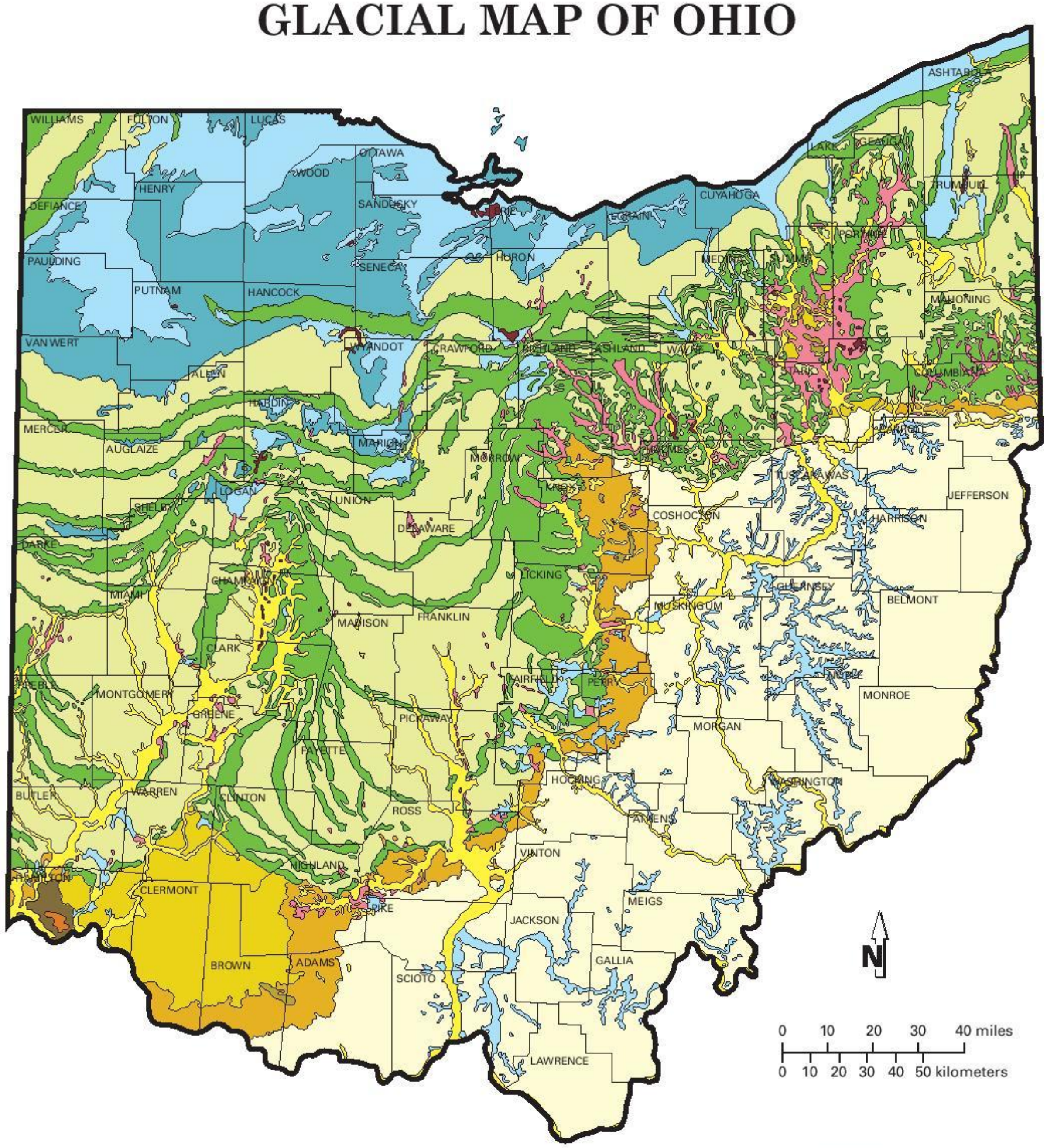
GLACIAL MAP OF OHIO



WISCONSINAN (14,000 to 24,000 years old)	ILLINOIAN (130,000 to 300,000 years old)	PRE-ILLINOIAN (older than 300,000 years)	
Ground moraine	Ground moraine	Ground moraine	Kames and eskers
Wave-planed ground moraine	Dissected ground moraine	Dissected ground moraine	Outwash
Ridge moraine	Hummocky moraine		Lake deposits
			Peat
			Colluvium

Recommended citation: Ohio Division of Geological Survey, 2005, Glacial map of Ohio: Ohio Department of Natural Resources, Division of Geological Survey, page-size map with text, 2 p., scale 1:2,000,000.

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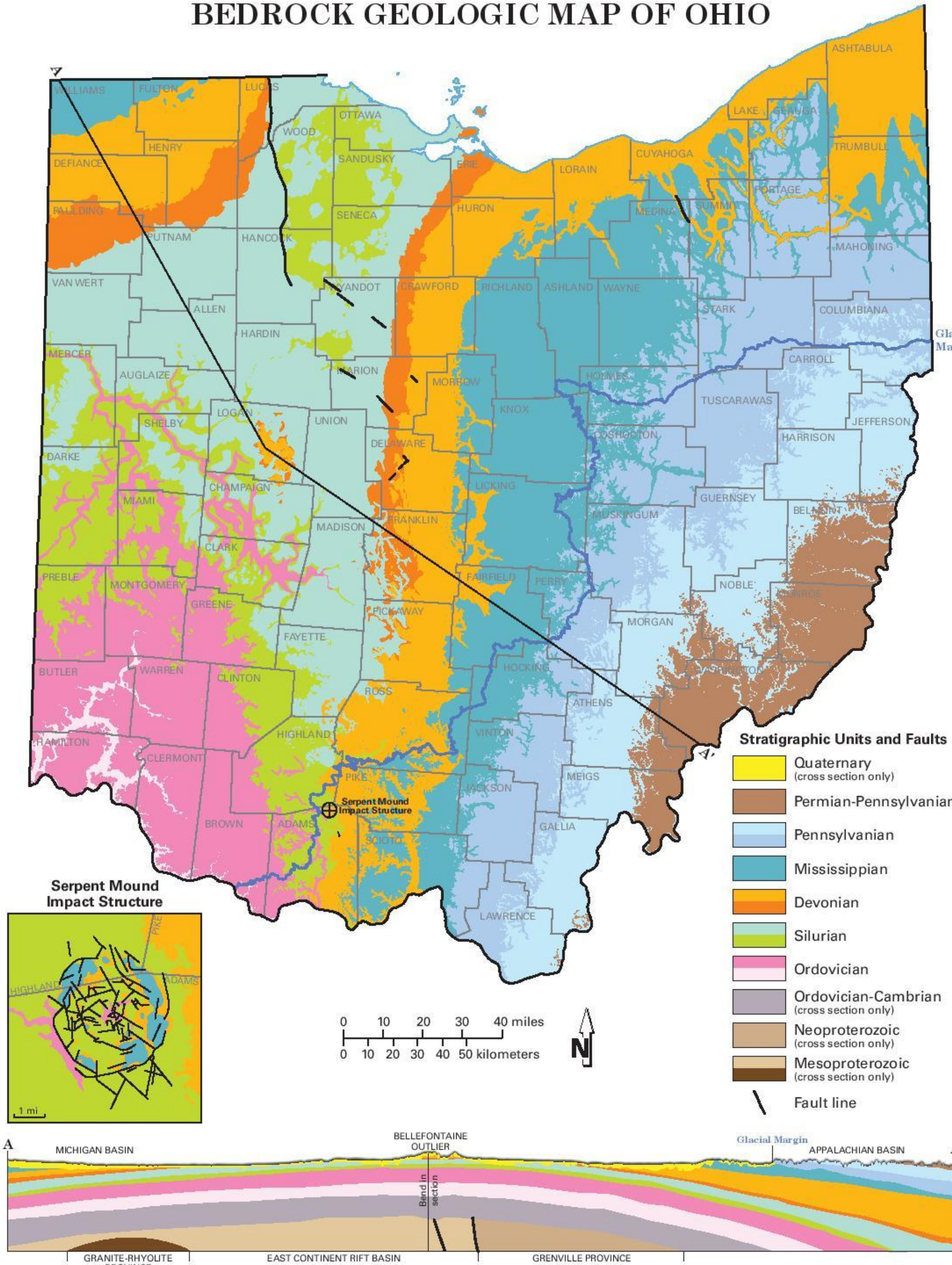
BEDROCK GEOLOGIC MAP OF OHIO



Recommended citation: Ohio Division of Geological Survey, 2006, Bedrock geologic map of Ohio: Ohio Department of Natural Resources, Division of Geological Survey Map BG-1, generalized page-size version with text, 2 p., scale 1:2,000,000. [Revised 2017.]

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APPENDIX: BORING LOCATION PLAN

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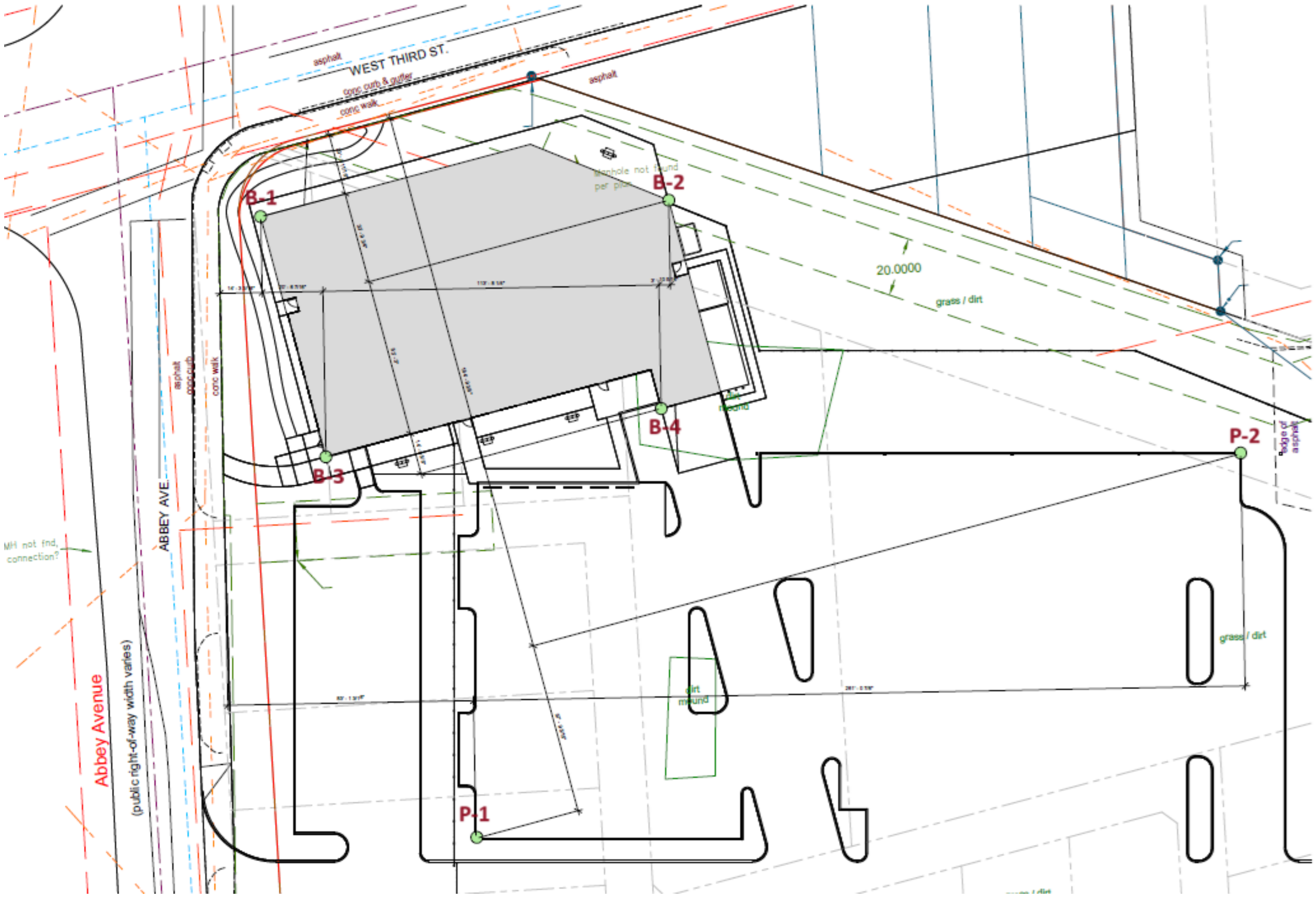

BORING LOCATION PLAN

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APPENDIX: SOIL TERMS

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DESCRIPTION OF SOIL TERMS

The following terminology was used to describe soils throughout this report and is generally adapted from ASTM 2487/2488 and ODOT Geotechnical Specifications.

GRANULAR SOILS – The relative compactness of granular soils is described as:

Description	Blows per foot – SPT (N)		
Very Loose	2	–	4
Loose	5	–	10
Medium Dense	11	–	30
Dense	31	–	50
Very Dense	Over	–	50

COHESIVE SOILS – The relative consistency of cohesive soils is described as:

Description	Blows per foot – SPT (N)			Unconfined UCS (ksf)		
Very Soft	Below	–	2	Less Than	–	0.50
Soft	2	–	5	0.50	–	1.00
Medium Stiff	6	–	10	1.00	–	2.00
Stiff	11	–	15	2.00	–	4.00
Very Stiff	16	–	30	4.00	–	8.00
Hard		–	Over 30	Over	–	8.00

GRADATION – The following size related denominations are used to describe soils:

Soil Fraction	USCS Size	ODOT Size
Boulders	Larger than 12”	Larger than 12”
Cobbles	12” to 3”	12” to 3”
Gravel – Coarse	3” to 3/4"	3” to 3/4"
Gravel – Fine	3/4" to 4.75 mm	3/4" to 2.0 mm (#10)
Sand – Coarse	4.77 mm to 2.0 mm	2.0 mm to 0.42 mm (#40)
Sand – Medium	2.0 mm to 0.42 mm	
Sand – Fine	0.42 mm to 0.074 mm	0.42 mm to 0.074 mm (#200)
Silt	0.074 mm to 0.005 mm	0.074 mm to 0.005 mm
Clay	< 0.005 mm	< 0.005 mm

MODIFIERS OF COMPONENTS – Modifiers of components are as follows:

Term	Range		
Trace	0%	–	10%
Little	11%	–	20%
Some	21%	–	35%
And	36%	–	50%

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APPENDIX: BORING LOGS (6)

BORING NUMBER B-1

DHDC Engineering Consulting Services, Inc.

CLIENT APP Architecture
PROJECT NAME Joint Fire & Police Station
PROJECT NUMBER C24-100
PROJECT LOCATION Dayton, Ohio
DATE STARTED 6/27/24 **COMPLETED** 6/27/24
GROUND ELEVATION ______ **HOLE SIZE** inches
DRILLING CONTRACTOR DHDC
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
▽ **AT TIME OF DRILLING** 10.00 ft
LOGGED BY Brian **CHECKED BY** M.O.H.
▼ **AT END OF DRILLING** 11.30 ft
NOTES
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		Fill: Brown to Blackish Brown, **SILTY CLAY**, little sand, trace gravel, Moist		SS 1	44	4-6-6 (12)			13				
5		Fill: Dark Brown, **SILTY CLAY**, trace to little sand, trace gravel, Moist		SS 2	67	4-5-5 (10)			10				
		Medium Stiff, Dark Brown and Gray, **SILTY CLAY** (CL), trace sand, trace gravel [Glacial Till], Moist		SS 3	72	3-3-4 (7)	2.5		24	39	20	19	
				SS 4	56	2-4-7 (11)			16				
10		▽ Medium Dense, Brown, **SILTY SAND** (SM), little gravel, Wet											
		▼ Medium Dense, Brown, fine **SANDY SILT** (ML), Wet											
15		Hard, Gray, **SILTY SANDY CLAY** (CL), little gravel [Glacial Till], Wet		SS 5	100	6-12-23 (35)	4.5+		9				
20		Medium Dense, Gray, **SILTY SAND** (SM), little gravel, Wet		SS 6	100	5-7-10 (17)			17				
25		Very Stiff, Gray, **SILTY SANDY CLAY** (CL), little gravel [Glacial Till], Wet		SS 7	33	4-7-10 (17)			11				

Boring discontinued at 25.0 feet depth
Boring caved at 21.6 feet

CLIENT APP Architecture
PROJECT NAME Joint Fire & Police Station
PROJECT NUMBER C24-100
PROJECT LOCATION Dayton, Ohio
DATE STARTED 6/27/24 **COMPLETED** 6/27/24
GROUND ELEVATION **HOLE SIZE** inches
DRILLING CONTRACTOR DHDC
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
∇ **AT TIME OF DRILLING** 9.00 ft
LOGGED BY Brian **CHECKED BY** M.O.H.
▼ **AT END OF DRILLING** 10.20 ft
NOTES
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	FINES CONTENT (%)
0		Fill: Black, A mixture of **SILTY SAND**, **GRAVEL**, **ASPHALT**, and **ROCK** fragments, Moist		SS 1	72	7-11-6 (17)			25				
		Fill: Black, **SILTY CLAY**, trace sand, Moist ---Organic odor---		SS 2	67	2-3-5 (8)			27				
5		Soft, Brown with trace Gray, **SILTY CLAY** (CL), trace sand, trace gravel, Moist		SS 3	22	1-1-2 (3)	1.0		28				
		Medium Dense, Brown, **SILTY SAND** (SM), little to some gravel, Wet ∇ ▼ ---Coarse GRAVEL/COBBLE within the soil matrix---		SS 4	44	3-9-10 (19)			12				
10													
		Medium Dense, Brown, **SILTY SAND** (SM), Wet		SS 5	78	9-9-12 (21)			15				
15		Very Stiff to Stiff, Gray, **SILTY SANDY CLAY** (CL), little gravel [Glacial Till], Wet ---Interbedded **SILTY SAND** and **GRAVEL** layers---		SS 6	100	7-12-12 (24)			12				
20				SS 7	83	3-6-9 (15)			11				
25													

Boring discontinued at 25.0 feet depth
Boring caved at 19.7 feet

BORING NUMBER B-3

DHDC Engineering Consulting Services, Inc.

CLIENT APP Architecture
PROJECT NAME Joint Fire & Police Station
PROJECT NUMBER C24-100
PROJECT LOCATION Dayton, Ohio
DATE STARTED 6/27/24 **COMPLETED** 6/27/24
GROUND ELEVATION ______ **HOLE SIZE** inches
DRILLING CONTRACTOR DHDC
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
▽ **AT TIME OF DRILLING** 9.00 ft
LOGGED BY Brian **CHECKED BY** M.O.H.
▼ **AT END OF DRILLING** 10.20 ft
NOTES
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION (ft)
0		Fill: A mixture of Brown, **SILTY SAND**, **GRAVEL**, and **ROCK** fragments, Moist	
		Fill: Blackish Brown, **SILTY CLAY**, trace sand, trace gravel, Moist	
		Possible Fill: Dark Brown, **SILTY CLLAY**, trace sand, trace gravel, Moist	
5		Medium Stiff, Mottled Brown and Gray, **SILTY CLAY** (CL), trace sand, trace gravel [Glacial Till], Moist	
		Dense, Brown and Gray, **SILTY SAND** (SM), little to some gravel, Wet ▽	
10		▼ ---Coarse GRAVEL/COBBLE within the soil matrix---	
		Very Stiff to Hard, Gray, **SILTY SANDY CLAY** (CL), little gravel [Glacial Till], Wet ---Coarse GRAVEL/COBBLE within the soil matrix---	
15			
20			
25			

SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	FINES CONTENT (%)
SS 1	44	4-6-6 (12)			18				
SS 2	39	5-5-6 (11)			23				
SS 3	39	2-2-3 (5)	1.5		22	38	19	19	
SS 4	83	10-13-20 (33)			23				
SS 5	89	7-12-17 (29)	4.0		10				
SS 6	100	6-7-10 (17)	3.5		9				
SS 7	100	8-16-33 (49)			10				

Boring discontinued at 25.0 feet depth
Boring caved at 22.7 feet

BORING NUMBER B-4

DHDC Engineering Consulting Services, Inc.

CLIENT APP Architecture
PROJECT NAME Joint Fire & Police Station
PROJECT NUMBER C24-100
PROJECT LOCATION Dayton, Ohio
DATE STARTED 6/27/24 **COMPLETED** 6/27/24
GROUND ELEVATION **HOLE SIZE** inches
DRILLING CONTRACTOR DHDC
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
▽ **AT TIME OF DRILLING** 17.00 ft
LOGGED BY Brian **CHECKED BY** M.O.H.
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	ATTERBERG LIMITS: PLASTIC LIMIT	ATTERBERG LIMITS: PLASTICITY INDEX	FINES CONTENT (%)
0		Fill: A mixture of Brown, **SILTY SAND**, **GRAVEL**, and **ROCK** fragments, Moist		SS 1	72	30-21-34 (55)			3				
				SS 2	60	50/5"			4				
5		Very Stiff, Mottled Brown and Gray, **SILTY SANDY CLAY** (CL), little gravel [Glacial Till], Moist		SS 3	100	9-9-11 (20)	4.0		11	36	21	15	
				SS 4	100	8-8-8 (16)	3.0		12				
10													
				SS 5	100	7-9-19 (28)	4.0		11				
15		Very Stiff, Gray, **SILTY SANDY CLAY** (CL), little gravel [Glacial Till], Wet ▽											
		Medium Stiff, Gray, **SILTY SANDY CLAY** (CL), little gravel [Glacial Till], Wet		SS 6	100	4-4-4 (8)			12				
20													
				SS 7	100	2-4-4 (8)			12				
25													

Boring discontinued at 25.0 feet depth
Boring didn't caved

BORING NUMBER P-1

DHDC Engineering Consulting Services, Inc.

CLIENT APP Architecture		**PROJECT NAME** Joint Fire & Police Station	
PROJECT NUMBER C24-100		**PROJECT LOCATION** Dayton, Ohio	
DATE STARTED 6/27/24	**COMPLETED** 6/27/24	**GROUND ELEVATION**	**HOLE SIZE** inches
DRILLING CONTRACTOR DHDC		**GROUND WATER LEVELS:**	
DRILLING METHOD Hollow Stem Auger		▽ **AT TIME OF DRILLING** 10.00 ft	
LOGGED BY Brian	**CHECKED BY** M.O.H.	**AT END OF DRILLING** ---	
NOTES		**AFTER DRILLING** ---	

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	FINES CONTENT (%)
0		Fill: A mixture of Brown, **SILTY SAND**, **GRAVEL**, and **ROCK** fragments, Moist		SS 1	17	8-12-8 (20)			4				
		Possible Fill: Brown, **SANDY CLAY** (CL), little gravel, Moist											
5		Medium Dense, Brown, **SILTY SAND** (SM), some gravel, Moist		SS 2	67	11-13-10 (23)			12				
		Stiff to Very Stiff, Mottled Brown and Gray, **SILTY SANDY CLAY** (CL), little gravel [Glacial Till], Moist		SS 3	67	6-4-6 (10)	3.0		8	36	20	16	
10	▽			SS 4	100	5-9-9 (18)	4.0		11				
15		Stiff, Gray, **SILTY SANDY CLAY** (CL), little gravel [Glacial Till], Wet		SS 5	100	3-4-7 (11)	2.0		11				

Boring discontinued at 15.0 feet depth
Boring didn't caved

GEOTECH BH COLUMNS - GINT STD US LAB.GDT - 7/15/24 20:53 - C:\USERS\SUNDE\DROPBOX\FAMILY ROOMS\SUNDEEP\GINT FILES\JOINT FIRE & POLICE STATION_C24-100.GPJ

BORING NUMBER P-2

DHDC Engineering Consulting Services, Inc.

CLIENT APP Architecture
PROJECT NAME Joint Fire & Police Station
PROJECT NUMBER C24-100
PROJECT LOCATION Dayton, Ohio
DATE STARTED 6/27/24 **COMPLETED** 6/27/24
GROUND ELEVATION **HOLE SIZE** inches
DRILLING CONTRACTOR DHDC
GROUND WATER LEVELS:
DRILLING METHOD Hollow Stem Auger
AT TIME OF DRILLING ---
LOGGED BY Brian **CHECKED BY** M.O.H.
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION (ft)	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	FINES CONTENT (%)
0		Fill: A mixture of Brown, **SILTY SAND**, **GRAVEL**, and **ROCK** fragments, Moist		SS 1	67	13-5-5 (10)	2.0		20				
		Stiff, Dark Brown, **SILTY CLAY**, trace sand, Moist											
		Loose, Brown, **SILTY SAND** (SM), some gravel, Moist ---Sample #3 is coarse GRAVEL/COBBLE fragments---		SS 2	44	5-2-2 (4)			13				
5				SS 3	17	5-8-7 (15)			10				
		Stiff, Brown, **SILTY SANDY CLAY** (CL), little gravel [Glacial Till], Moist		SS 4	100	2-4-6 (10)	2.5		12				
10													
		Very Stiff, Gray, **SILTY SANDY CLAY** (CL), little gravel [Glacial Till], Moist		SS 5	100	5-8-12 (20)	4.0		9				
15													

Boring discontinued at 15.0 feet depth
Boring didn't caved
No groundwater

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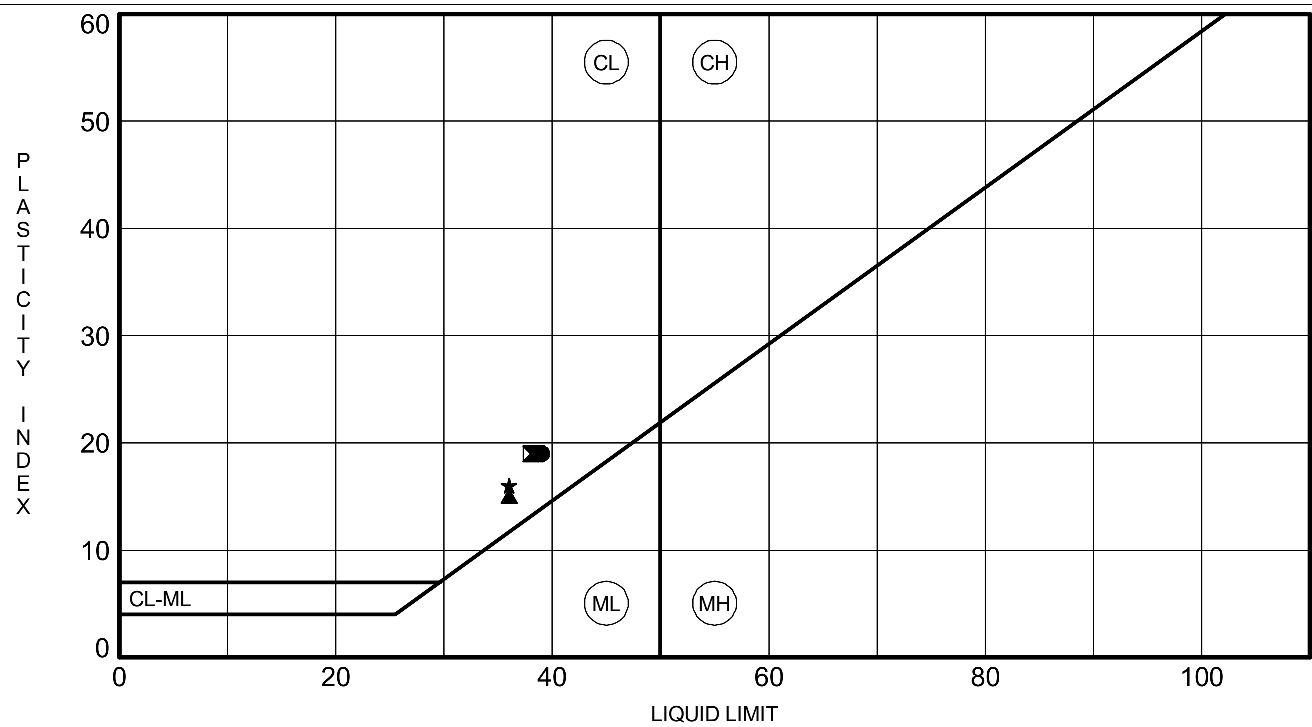
APPENDIX: LABORATORY TEST RESULTS

ATTERBERG LIMITS' RESULTS

DHDC Engineering Consulting Services, Inc.

CLIENT APP Architecture **PROJECT NAME** Joint Fire & Police Station

PROJECT NUMBER C24-100 **PROJECT LOCATION** Dayton, Ohio



	BOREHOLE	DEPTH	LL	PL	PI	Fines	Classification
●	**B-1**	**6.0**	**39**	**20**	**19**		**SILTY CLAY (CL)**
⧗	**B-3**	**6.0**	**38**	**19**	**19**		**SILTY CLAY (CL)**
▲	**B-4**	**6.0**	**36**	**21**	**15**		**SILTY SANDY CLAY (CL)**
★	**P-1**	**6.0**	**36**	**20**	**16**		**SILTY SANDY CLAY (CL)**