Geotechnical Subsurface Mentor Recreation Area Park Expansion

Mentor, OH

Prepared for:
The City of Mentor
8500 Civic Center Blvd.
Mentor, OH 44060

Prepared by:
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Verdantas Project No: 32272

April 2025

Mr. David A. Swiger, P.E.
City Engineer
8500 Civic Center Blvd.
Mentor, OH 44060

Geotechnical Subsurface Investigation
Mentor Recreation Area Park Expansion
Mentor, OH

Dear Mr. Swiger:

Following is the geotechnical subsurface investigation report of referenced site by Verdantas. This study was performed to support the design efforts associated with the proposed Mentor Recreation Area Park Expansion Project.

This report contains the results of our study, our engineering interpretation of the results with respect to the project characteristics, design and construction recommendations for foundations, floor slabs and pavements.

Soil and rock samples collected during this investigation will be stored at our laboratory for 90 days from the date of this report. The samples will be discarded after this time unless you request that they be saved or delivered to you.

Should you have any questions regarding this report or require additional information, please contact our office.

Sincerely,

Verdantas LLC

Imad El Hajjar, EI
Geotechnical Project Manager

Curtis Roupe, P.E.
Associate Vice President
Group Leader, Geotechnical Engineering

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APPENDICES

1. INTRODUCTION

This geotechnical subsurface investigation report has been prepared for the potential expansion of mentor civic center park. The proposed expansion consists of construction of parking areas, seven pickleball courts, two basketball courts, and a water retention basin near the newly proposed parking area. The Site Location Map is shown in Plate 1, attached to this report.

This report summarizes our understanding of the proposed construction, describes the investigative and testing procedures, presents the findings, discusses our evaluations and conclusions, and provides our design and construction recommendations for the proposed development.

The purpose of this investigation was to evaluate the subsurface conditions and laboratory data relative to the design and construction of foundations and pavements at the referenced site. This investigation included thirteen (13) test borings, field and laboratory soil testing, and a geotechnical engineering evaluation of the test results.

This report includes:

- A description of the existing subsurface soils, rock, and groundwater conditions encountered in the borings,
- A site reconnaissance summary of the observed conditions for the existing slope Marsh Creek,
- Laboratory test results of soils samples,
- Geotechnical recommendation for pavements, slabs, ponds and light tower foundations,
- Recommendations concerning soil and groundwater-related construction procedures such as site preparation, earthwork, pavement subgrade preparation, and related field testing.

2. INVESTIGATIVE PROCEDURES

This subsurface investigation included thirteen (13) test borings, designated as Borings B-1 through B-13, drilled by EnviroCore, Inc. on February 25 and 26, 2025. EnviroCore, Inc. was contracted by Verdantas for drilling services. The test borings were located in the field by Verdantas using a handheld Global Positioning System (GPS) device and are presented on the boring location plan attached as Plate 2.0. GPRS LLC, a private utility locate service, was contracted to delineate subsurface utilities within a 10-foot radius of each borehole location prior to the commencement of drilling operations. The job summary report from GPRS is attached as Appendix F.

The test borings were performed in general accordance with geotechnical investigative procedures outlined in ASTM Standards D 1452 and D 5434. The test boreholes performed during this investigation were drilled with a track mounted drilling rig utilizing 2¼-inch diameter hollow-stem augers. All borings surface elevations, termination depths, and surface cover thickness are presented in Table 1.

Table 1: Borehole Surface and Termination Elevations

Borehole No.	Surface Elevation (ft)	Termination Depth (ft)	Termination Elevation (ft)
B-1	629.7	20	609.7
B-2	629.9	5	624.9
B-3	629.4	20	609.4
B-4	629.4	5	624.4
B-5	629.1	5	624.1
B-6	620.7	20	600.7
B-7	629.4	5	624.4
B-8	627.3	20	607.3
B-9	627.8	5	622.8
B-10	627.5	5	622.5
B-11	627.1	5	622.1
B-12	626.2	5	621.2
B-13	626.1	20	606.1

During auger advancement, soil samples were collected at 2½-foot intervals to a depth of 10 feet and at 5-foot intervals thereafter. Split-spoon (SS) samples were obtained by the Standard Penetration Test (SPT) Method (ASTM D 1586), which consists of driving a 2-inch outside diameter split-barrel 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 soil 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 field logs of the encountered soils.

All samples of the subsoils were visually or manually classified using the Unified Soil Classification System (ASTM D 2487 and D 2488) and were tested in our laboratory for moisture content (ASTM D 2216). Atterberg limits tests (ASTM D 4318) and particle size analyses (ASTM D 422) were performed on selected samples to determine soil classification and index properties. These test results are presented on the Logs of Test Borings, Tabulation of Test Data sheets, and the Grain Size Distribution sheets attached to this report.

Experience indicates that the actual subsoil and rock conditions at a site could vary from those generalized on the basis of test borings made at specific locations. Therefore, it is essential that a geotechnical engineer be retained to provide soil engineering services during the site preparation, excavation, and foundation phases of the proposed project. This is to observe compliance with the design concepts, specifications, and recommendations, and to allow design changes in the event subsurface conditions differ from those anticipated prior to the start of construction.

3. PROPOSED CONSTRUCTION

It is our understanding that the project is related to the potential expansion of the Mentor Civic Center Park. The proposed expansion consists of the construction of parking areas, seven pickleball courts, two basketball courts, and a water retention basin near the newly proposed parking area. The site is accessible from Munson Road.

In the preparation of this report, we have addressed specific details regarding the structure type, treating the court structures, parking areas, and pavements uniformly. Additionally, the pavements are expected to consist of both flexible (asphalt) and rigid (concrete) sections.

Notably, no significant grade changes are expected as part of this construction. Therefore, we anticipate that final site elevations will approximate existing site elevations.

4. GENERAL SITE AND SUBSURFACE CONDITIONS

4.1 General Site Conditions

According to Google Earth imagery and site reconnaissance the project site is bounded by Hopkin Road to the north and east, wooded area to the south, and Munson Road to the south and west. The project site is located southeast of the Mentor Ice Arena.

The site is predominantly comprised recreational outdoor and indoor facilities, and the east of the site is lightly wooded. Marsh Creek flows in the north of the project site and water erosional features were significant along the creek flow. Apparently, the proposed structures are situated on stable slopes; however, the rate and size of marsh creek erosion is out of the scope of this report.

At the time of subsurface exploration, The surface materials encountered at all the boring locations consisted of topsoil ranging in thickness from 6 to 12 inches.

Undocumented Granular Fill materials were encountered in Boring B-6 underlying the surface material and extending to 6 feet below existing grades(Elev. 614.7±).. **The fill material** consisted of predominantly loose to medium dense silty clayey sand (SC-SM) and rock fragments. SPT N-values ranged from 9 to 15 bpf. Moisture contents were found on the order of 16%.

4.2 Regional Geology

According to the Ohio Department of Natural Resources (ODNR) online map repository, Mentor is part of the Central Lowland physiographic region, specifically within the Lake Erie Plain. This region features flat terrain influenced by glacial activity.

Mentor's surficial deposits are primarily from Wisconsian glacial activity, including glacial till, outwash plains, moraines, lacustrine, and alluvial deposits. The current site has late Wisconsinan Lacustrine silt, deposited in low-velocity waters of glacial lakes, which may contain fine sand or clay and are well-laminated in distal portions of deltas but poorly laminated elsewhere.

The bedrock here is predominantly Devonian Ohio Shale with carbonates/siderite concretions, dating back 359 to 419 million years old from the Paleozoic Era, known for rich marine life and extensive sedimentary rock layers.

As per ODNR, the bedrock typically lies at a depth of 75 to 80 feet below ground surface (bgs).

4.3 General Subsurface Conditions

Based on the results of our field and laboratory tests, the encountered subsoils predominantly consisted of stiff to very stiff cohesive soils, with isolated layers exhibiting medium stiff and hard consistencies. A surficial granular soil layer was encountered only in boring B-6. The surficial soils in Borings B-6, B-8 and B-13, were underlain by a localized stratum of granular soils (residual bedrock).

Additional descriptions of the soil stratigraphy encountered in the borings are presented in the Logs of Test Borings attached to the report in Appendix A.

Stratum I consisted of predominately medium stiff to stiff native cohesive soils, encountered underlying topsoil in all borings to the depths of 5 to 20 feet below ground surface (bgs) (Elev. 608.8± to Elev. 624.9±). Stratum I predominately consisted of lean clay (CL) and silty clay (CL-

ML), and silt (ML) mixed with varying potions of sand, gravel and rock fragments. Trace organics, generally indicative of an organic content less than 5%, were noted in SS-1 samples at intervals 1 to 2.5 feet bgs in Borings B-1, B-4, B-5, B-7, B-9, and B-13. Standard Penetration Test (SPT) N-values were on the order of 8 to 15 blows per foot (bpf). Unconfined compressive strength ranged from 2,750 to more than 4,500 pounds per square foot (psf). Moisture contents ranged from 13% to 21%.

Liquid limits of 34 and 35 percent and plasticity indices of 17 and 18 percent were determined for two samples in Stratum I. These values, along with gradation results, are indicative of lean clay (CL) in accordance with USCS designations.

Stratum II consisted of predominantly medium dense granular soil with angular rock fragments. Stratum II was encountered underlying the Stratum I in Borings B-6, B-8, and B-13 at the depths of 8.5, 18.5 and 13.5 feet bgs to the end of borings. This stratum predominately consisted of clayey gravel (GC) with significant amount of angular rock fragments. SPT N-values ranged from 18 to 30 bpf. Moisture contents ranged from 10% to 12%. The presence of significant amount of angular rock fragments and low moisture contents are indicative of severely weathered (decomposed) bedrock.

4.4 Groundwater Conditions

Groundwater was not encountered in any boring during or after the drilling activity. It should be noted that each borehole was drilled and backfilled within the same day and instrumentation was not installed to observe long-term groundwater levels.

Based on the soil characteristics and groundwater conditions encountered in the borings it is our opinion that the static, long-term groundwater table is approximately 10 to 14 feet below existing grades. Generally, groundwater elevations can fluctuate with seasonal and climatic influences. In particular, “perched” groundwater may be encountered within the pavement base materials, fill materials, and in the granular soils between less permeable cohesive strata or rock. Therefore, the groundwater conditions may vary at different times of the year from those encountered during this exploration.

4.5 Field Reconnaissance

VDT conducted a geotechnical field reconnaissance of the site on January 30, 2025. The assessment encompassed a detailed observation of the slopes on the west bank of Marsh Creek, covering approximately 1,200 feet to document surface soil conditions, exposed bedrock, and any evident slope instability features adjacent to the proposed development areas. Appendix E includes the site map highlighting photo locations and a detailed photo log.

During the site reconnaissance, it was noted that the southern portion of the site was predominantly wooded, while the northern section featured paved areas with a skating rink, pickleball courts, and basketball courts. A handrail was installed along the top of the western bank of the creek, primarily surrounding the playground and courts within the project location. The exposed soil mainly consisted of cohesive soils, with apparent bedrock exposed near the creek bed.

VDT's observations of the slopes adjacent to the proposed development areas revealed that the northern section of the slope, observed from the east bank of Marsh Creek, had gradients of approximately 3 horizontal to 1 vertical (3H:1V). Soil detachment in blocks was prevalent in this section, potentially indicative of erosional features from the creek and a loss of shear strength in

the soil (Photos 3 and 4). Additionally, partially exposed tree roots and utilities were observed (Photos 5 to 9).

The west bank of the creek exhibited slopes ranging from 2H:1V to 3H:1V in the southern section. This variation is depicted in photo 9. The southern portion of the west bank did not show any erosional features; however, a significant amount of broken tree trunks and drag-wood was observed. An abandoned structure was also noted in the southern section of the west bank.

The typical height of the west bank slope ranged from 20 to 25 feet in the northern section and 3 to 10 feet in the southern section along Marsh Creek adjacent to the proposed construction. Historic slope failure features such as head scarp, ground cracks, ground bulging, and geotropism were not observed at the proposed development location. However, block failures of soil were noticed in the northern section of the west bank. These features are visible only in the northern section of the west bank of Marsh Creek, and the proposed construction (proposed drop-off area and open lawn area) is approximately 30 to 40 feet away from them.

To mitigate these slope failures, it is recommended to construct a retaining wall if the proposed structure encroaches within 5 to 10 feet of the west bank. If a retaining structure is not feasible at this time, all development should be set back a minimum of one-third of the slope height (H/3) as per the International Building Code recommendations.

5. GEOTECHNICAL DESIGN RECOMMENDATIONS

The following conclusions and recommendations are based on the data obtained during the field investigation and our understanding of the proposed construction. If the project information or location as outlined is incorrect or should change significantly, a review of these recommendations should be made by VDT. Additionally, these recommendations are subject to additional geotechnical exploration and analysis for final design and are also contingent on satisfactory completion of the recommended site and subgrade preparation and fill placement operations described in Section 6.0, “Preliminary Construction Recommendations.”

5.1 Subgrades

5.1.1 Existing Subgrade

The subgrades that would result upon the satisfactory completion of the site preparation as described in Section 6.0 of this report are considered marginally suitable for support of the proposed pavements and floor slabs. Based on field and laboratory data developed during this investigation, the subgrade soils consist of cohesive soils. Laboratory analyses for Borings B-2 (SS-1) and B-7 (SS-2) as well as visual descriptions of the upper profile, indicate that the cohesive subgrade soils may be generally classified as A-6b in accordance with the Ohio Department of Transportation (ODOT) system of soil classification. These cohesive soils are considered fair to poor as subgrade materials because they have relatively low permeabilities and a high percentage of silt and clay particles, which makes them susceptible to moisture, frost penetration, and frost heave.

At the time of this investigation, moisture contents in the upper 5 feet of the cohesive subgrade soils ranged from approximately 15 to 21 percent for the A-6b soils. These moisture contents are estimated to vary from near to significantly above the expected optimum moisture content for these soils as per Ohio Geotechnical Design Manual Section 600. Remedial action should be anticipated to be required to adjust the moisture contents of the existing materials and achieve proper compaction of the subgrade.

5.1.2 Modified Subgrade

Although not anticipated to be prevalent, if soils are dry of optimum, water should be uniformly mixed into the subgrade. More likely to be encountered at this site are soils that are wet of optimum. Where soils wet of optimum are encountered, lowering the moisture content by scarification and aeration (discing and exposure to sun and wind) may be required. Very moist to wet soils will “pump” under the operation of heavy equipment, resulting in deep rutting and perhaps rendering the operation of grading and paving equipment difficult or impossible.

If the schedule does not allow for scarification and aeration of the soils, other methods of subgrade modification may be required in areas of high moisture content. Modification may be achieved by undercutting and replacement with granular subbase (possibly in combination with a geotextile separation layer or geogrid reinforcement), mixing stone into the subgrade, or treating the subgrade with lime or cement. The method of subgrade modification should be determined at the time of construction (See Section 6.1, “Construction Recommendations - Site and Subgrade Preparation”).

5.2 Floor Slabs for Outdoor Courts

It is recommended that all floor slabs be “floating,” that is, fully ground supported and not structurally connected to walls or foundations. This is to reduce the possibility of cracking and displacement of the floor slabs because of differential movements between the slab and the foundation. Such movements could be detrimental to slabs that are rigidly connected to the foundations. There may be certain areas where it will be difficult or impractical to make the slab floating. In such areas, it may be necessary to increase the slab thickness and reinforcement to prevent the foundation from cracking the slab and settling independently.

For properly prepared floor slab subgrade soils, a modulus of subgrade reaction (k) on the order of 135 pounds per cubic inch (pci) should be anticipated for design. It is recommended that the floor slab be supported on a minimum 6-inch layer of relatively clean granular material such as sand and gravel or crushed stone. This is to help distribute concentrated loads and provide more uniform subgrade support beneath the slab.

5.3 Flexible (Asphalt) Pavement

Based on the results of the gradation and Atterberg limits analyses, as well as visual classification for the cohesive subgrade soil samples, a subgrade CBR value on the order of 5 percent should be anticipated for the Group A-6b or better soils. This CBR value is based on subgrade compacted to at least 100 percent of the maximum dry density as determined by ASTM D 698 (Standard Proctor) or verified as stable through proof rolling.

It should be noted that we are not privy to the design traffic loads or intended design life. The subgrade support recommendations indicated herein should be reviewed by the site engineer in conjunction with the design traffic criteria to determine the required pavement sections. In any case, we recommend the light-duty pavement cross-section consist of at least 3 inches of asphalt underlain by 6 inches of aggregate base for even the lightest-duty pavements based on our experience regarding environmental exposure and reasonable serviceability. For the same reason, we recommend the heavy-duty pavement cross-section consist of at least 4 inches of asphalt underlain by 8 inches of aggregate base.

All paving operations should conform to Ohio Department of Transportation (ODOT) specifications. The pavement and subgrade preparation procedures outlined in this report should result in a reasonably workable and satisfactory pavement. It should be recognized, however, that all flexible pavements need repairs or overlays from time to time as a result of progressive yielding under repeated traffic loads for a prolonged period of time, as well as exposure to weather conditions.

5.4 Rigid (Concrete) Pavement

For properly prepared subgrade soils, a modulus of subgrade reaction (k) on the order of 135 pounds per cubic inch (pci) should be anticipated for rigid pavement design. A concrete pavement section is recommended in the loading-unloading areas, areas of repetitive turning, site exit and entrance aprons, and trash enclosure areas (including where the truck parks while servicing the container). This section should consist of a minimum of 6 inches of reinforced, air-entrained concrete with a minimum compressive strength of 3,500 pounds per square inch (psi) underlain by a minimum of 6 inches of a dense-graded granular base. Actual concrete design thickness will likely be thicker base on actual design traffic loads. The pavement section should be supported on a subgrade compacted to not less than 100 percent of the maximum dry density as

determined by ASTM D 698 (Standard Proctor) or verified as stable through proof rolling. All paving operations should conform to Ohio Department of Transportation (ODOT) specifications.

5.5 Pavement Drainage

Based on the poorly-drained nature of the cohesive subgrade soils, it is anticipated that surface water infiltration may collect in the aggregate base course. Without adequate drainage, water will remain in the base for extended periods of time, creating localized wet, soft pockets. The presence of these pockets will increase the likelihood that pavement distress (cracking, potholes, etc.) will develop. Drainage features may include grading the subgrade surface to slope downward to the outside edge of pavements and/or providing longitudinal edge drains connected to storm sewers or other outlets. A system of “finger drains” could also be installed near catch basins within the pavement areas to collect surface water, thus reducing the potential for freeze-thaw effects on the pavement.

5.6 Groundwater Control and Drainage

The groundwater conditions encountered in the borings during this investigation are summarized in Section 4.4. Based on the soil characteristics and groundwater conditions encountered during this investigation, it is our opinion that the “normal” groundwater table can generally be expected at nearby Marsh Creek or greater below existing grade.

It is our experience that adequate control of groundwater seepage or surface water run-off into excavations which do not extend more than a few feet below the ambient groundwater table should be achievable by minor dewatering systems, such as pumping from prepared sumps.

If excessive seepage is experienced during construction, VDT should be notified to evaluate other dewatering methods as per site conditions.

5.7 Detention Basin

Boring B-1 was performed within the proposed new detention basin area, located to the south of existing Mentor Skatepark in the proposed project site. The boring was extended to the depth of 20 feet bgs. The encountered subsoils within the anticipated depth of excavation predominantly consisted of medium stiff to stiff silty clays (CL-ML) with trace gravels. It is highly unlikely to encounter granular material at this location and native soils should be acceptable to construct the bottom of the pond and the associated berms.

However, Borings B-6, B-8, and B-13 encountered decomposed rock at shallow depths of 8.5 to 18.5 feet bgs. Therefore, if granular soils (i.e. sand/gravel or decomposed rock layer) are encountered on the bottom or sides of the pond, it will be necessary to add cohesive materials as a clay liner to reduce seepage losses and to allow for maintenance of a “normal” water level, if so desired. The clay liner should have a minimum thickness of 2 feet, measured perpendicular to the face of the slope or bottom of the pond. A 40 mils LLDPE impermeable geomembrane (or equivalent) could be utilized in-lieu of the clay liner. The geomembrane should be overlain with at least 6 inches of soil. Care should be taken during soil placement to prevent damaging the underlying geomembrane. Tracked equipment shouldn’t be allowed inside the pond area once the geomembrane is installed.

In order to facilitate construction and maintenance, it is recommended that permanent pond slopes be constructed no steeper than 3 horizontals to 1 vertical (3H:1V). All fill should be placed and compacted as outlined in Section 6, “Construction”. All slopes should have erosion protection,

such as vegetated topsoil, riprap, and/or man-made materials. Seeding of the exterior slopes should be completed as soon as possible after construction is complete.

It is anticipated that the soils excavated from the detention basin areas will be utilized to achieve design grades over the remainder of the site. The excavated soils from the detention basin areas may be utilized for engineered fill. If crushing and grading of the boulder/rock materials is required, care and diligence, including quality control density tests during placement and compaction, will be particularly important utilizing the rock fill soils for engineered fill.

5.8 Excavations and Slopes

The sides of temporary excavations for building foundations, utility installations, and other construction should be adequately sloped to provide stable sides and safe working conditions. Otherwise, the excavation must be properly braced against lateral movements. In any case, applicable Occupational Safety and Health Administration (OSHA) safety standards must be followed.

Based on the test borings, it is likely that excavations will encounter a range of soil conditions that include the following OSHA designations:

- Type A soils (cohesive soils with unconfined compressive strengths of 3,000 pounds per square foot (psf) or greater),
- Type B soils (cohesive soils with unconfined compressive strengths greater than 1,000 psf but less than 3,000 psf), and
- Type C soils (granular soils).

For temporary excavations in Type A, B, and C soils, side slopes must be no steeper than ¾ horizontal to 1 vertical (¾H:1V), 1H:1V, and 1½H:1V, respectively. For situations where a higher strength soil is underlain by a lower strength soil and the excavation extends into the lower strength soil, the slope of the entire excavation is governed by that required for the lower strength soil. In all cases, flatter slopes may be required if lower strength soils or adverse seepage conditions are encountered during construction.

For permanent excavations and slopes, we recommend that grades be no steeper than 3H:1V without a more extensive geotechnical evaluation of the proposed construction plans and site conditions.

5.9 Drilled Shaft Foundations

Drilled shaft (caisson) foundations are anticipated to be utilized for the proposed light towers at pickleball and basketball courts. Based on previous projects for similar light towers, we anticipate that the towers will be 20 to 25 feet high and will be supported on diameter drilled shafts extending approximately 8 to 10 feet below existing grades. Additionally, there are typically lateral load considerations with these foundations.

We have evaluated a drilled shaft foundation system with respect to the proposed construction and soil conditions encountered in Borings B-4, B-6, and B-9 to B-13 for light towers. Drilled shaft foundations will derive axial capacity from end-bearing and lateral resistance through soil-structure interactions which are dependent upon shaft material, diameter, soil properties, loading type, and bed slope of ground. The following table includes soil parameters for axial lateral design evaluations.

Table 2: Drilled Shaft Recommeded Design Parameters

Stratum	Approximate Elevation Range in Borings							Allowable End Bearing Pressure	Allowable Lateral Soil Pressure
Predominate Soils	B-4	B-6	B-9	B-10	B-11	B-12	B-13	ksf	psf per foot of depth
Granular Fill	-	621 to 615	-	-	-	-	-	Not Applicable	Not Applicable
Stratum I Cohesive Soils	629 to 624	615 to 612	628 to 623	628 to 623	627 to 622	626 to 621	626 to 613	4	300
Stratum III Decomposed Bedrock	-	612 to 601	-	-	-	-	613 to 606	10	400

1: Granular fill material is encountered only in Boring B-6.

The allowable lateral pressure in overburden soils becomes constant and does not increase linearly beyond the depth associated with the value at a depth equal to 10 times the drilled shaft diameter. We further recommend that the lateral pressure be neglected from the ground surface to a depth of 3 feet due to the potential for volume change and shrinkage resulting from moisture variation and freeze-thaw behavior. It is anticipated that the bearing depth of the drilled shaft foundation may be governed by the required lateral capacity.

We do not recommend diameters less than 2 feet (24 inches) for drilled shafts. Total settlement of drilled shafts which bear in Stratum III soils, and are fully loaded to the allowable capacity, is not expected to exceed ½ inch, including elastic compression of the shaft. Settlement of foundations bearing on sound bedrock is expected to be negligible. It should be noted that the actual capacity of drilled shafts is dependent on proper installation methods, and the allowable capacity is based on the assumption that a reasonable standard of care and quality control will be exercised during drilled shaft installation.

Drilled shaft installation in the upper profile cohesive soils is expected to experience only minor weeping if granular soil zones with perched water is encountered. Groundwater may be present below the soil/bedrock interface. Where granular soil zones (Decomposed Bedrock) are encountered, temporary steel casing may be required in order to support the shaft walls, as well as seal out water seepage prior to concrete placement. The drilled shafts should be clean and free of all loose material prior to the placement of concrete. A VDT representative should verify that the installation procedures meet specifications.

If tremie methods are utilized for concrete placement, sufficient concrete should be maintained above the bottom of the casing as the steel casing is withdrawn to counteract any hydrostatic head and prevent collapse or “necking” of the shaft. Care must be taken during concreting and removal of any temporary casing to prevent the possibility of soil intrusions. The contractor should submit procedures for shaft installation prior to the start of work.

6. CONSTRUCTION RECOMMENDATIONS

6.1 Site and Subgrade Preparation

Prior to proceeding with construction operations, all structures, pavements, vegetation, topsoil, root mat, and other deleterious non-soil materials should be removed from the proposed construction areas. Suitable topsoil may be stockpiled for later use in landscaped areas. Topsoil thicknesses are discussed in Section 4.1 and may vary across the site, and from the thickness indicated at the boring locations. Due to the agricultural use for much of the site, topsoil thickness may be greater in some areas of the site than what was encountered in the borings. Furthermore, severely weathered bedrock may encountered at shallower depths.

Dark soils having the appearance of topsoil but exhibiting only root “hairs” or trace organics less than approximately five percent, may not require stripping for the full depth of the darkly colored zone, provided the subgrade can be satisfactorily proof rolled as described below. The actual amount of required stripping should be determined in the field by a geotechnical engineer or qualified representative.

Upon completion of stripping and clearing, the areas intended to support floor slabs, pavements, and new fill should be carefully inspected by a geotechnical engineer. At that time, the engineer should observe proof rolling of the cohesive subgrade soils using a minimum 20-ton loaded truck or other pneumatic-tired vehicle of similar size and weight. The truck should make a minimum of two passes covering the proposed development area, with additional passes as necessary to achieve required compaction and/or subgrade stabilization.

The purpose of the proof-rolling operations for the cohesive soils is to locate any soft or excessively wet soils present at the time of construction. Any unsuitable materials observed during the inspection and proof-rolling operations should be undercut and replaced with compacted engineered fill or stabilized in place utilizing conventional remedial measures such as discing, aeration, and recompaction. Once the site has been proof rolled, inspected, and stabilized, the proof-rolled or inspected subgrades should not be exposed to wet conditions. It should be recognized that during periods of wet weather, the silty and clayey soils that will be exposed at design subgrades will tend to pond water for short periods of time, with the potential to deteriorate the prepared subgrade.

The results of the inspection and proof-rolling operations will be partially dependent on construction operations, the moisture content of the soil, and the weather conditions prevalent at the time. If pumping or rutting is encountered and difficulty is experienced in the operation of construction equipment, VDT should be notified in order to determine which method of subgrade modification may be best suited for the conditions encountered. Should such conditions be experienced, we may recommend that a small test area be used to determine the necessary depth of undercutting and stone replacement or other remedial action necessary to achieve a stable subgrade condition.

6.2 Fill

Material for engineered fill or backfill required to achieve design grades may consist of any non-organic soils having a maximum dry density as determined by the Standard Proctor (ASTM D 698) greater than 90 pounds per cubic foot (pcf) and exhibiting a liquid limit of less than 50 percent. On-site soils may be used as engineered fill materials provided that they are free of organic matter, debris, excessive moisture, and rock or stone fragments larger than 3 inches in

diameter and exhibit a liquid limit of less than 50 percent. Depending on seasonal conditions, the on-site soil may be wet of optimum. The soil could require scarification and aeration to achieve satisfactory compaction. If the construction schedule does not allow for scarification and aeration activities, it may be more practical or economical to utilize imported granular fill.

Fill should be placed in uniform layers no more than 8 inches thick (loose measure) and adequately keyed into stripped and scarified soils. All fill within the building areas and pavement subgrades should be compacted to not less than 100 percent of the maximum dry density as determined by ASTM D 698 (Standard Proctor).

Based on the preliminary investigation borings, the upper soil profile at the site consists of native cohesive soils. The contractor should be prepared to use a sheepsfoot roller to provide effective compaction of the cohesive soils. For new granular engineered fill, compaction of these materials should be performed using a vibratory, smooth-drum roller. In narrow utility or footing excavations, the on-site cohesive soils may be difficult to compact; therefore, a clean granular material may be required in these areas.

Scarified subgrade soils and all fill material should be within 3 percent of the optimum moisture content to facilitate compaction. Furthermore, fill material should not be frozen or placed on a frozen base. It is recommended that all earthwork and site preparation activities be conducted under adequate specifications and properly monitored in the field by a qualified geotechnical testing firm.

6.3 Detention Basin Excavations

The detention basin excavations should have a detailed inspection performed by a geotechnical engineer or qualified representative to verify that the exposed materials are similar to those encountered in the boring and are suitable for water storage system. It is highly unlikely to encounter weathered/decomposed bedrock at the proposed depth. However, care and diligence must be taken, and clay liner or geomembrane should be utilized as directed in section 5.7.

7. QUALIFICATION OF RECOMMENDATIONS

Our evaluation of foundation, floor slab, and pavement design and construction conditions 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. When the final structure locations become available, additional geotechnical exploration in the area of the proposed development should be performed. The findings of such an investigation will be presented in a supplemental report. Based on the results of the final design investigation, the recommendations of this report will be reviewed and modified, as necessary.

Regardless of the thoroughness of a subsurface investigation, there is the possibility that conditions between borings will differ from those 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 earthwork, excavation, and pavement construction to confirm that the conditions anticipated in design are noted. Otherwise, VDT assumes no responsibility for construction compliance with the design concepts, specifications, or recommendations.

The nature and extent of variations between the borings may not become evident until the course of construction. If such variations are encountered, it will be necessary to reevaluate the recommendations of this report and the final geotechnical subsurface investigation report after on-site observations of the conditions.

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. VDT is not responsible for the conclusions, opinions, or recommendations of others based on this data.

PLATES

SCALE IN FEET

0' 3,000' 6,000'

BASE PLAN "SITE AERIAL PLAN" DATED 04/06/2012 OBTAINED FROM GOOGLE EARTH.

SITE LOCATION MAP

MENTOR CIVIC RECREATION AREA EXPANSION
MENTOR, OHIO

PREPARED FOR

THE CITY OF MENTOR
MENTOR, OHIO

DRAWN:	MSI / 03/12/2025
REVISED:	---
PROJECT No:	32272

PLATE 1.0

verdantas

LEGEND:

B-1

APPROXIMATE TEST BORING LOCATION

SCALE IN FEET

0' 200' 400'

BASE PLAN "SITE AERIAL PLAN" DATED 04/06/2012 OBTAINED FROM GOOGLE EARTH.

TEST BORING LOCATION PLAN

MENTOR CIVIC RECREATION AREA EXPANSION
MENTOR, OHIO

PREPARED FOR

THE CITY OF MENTOR
MENTOR, OHIO

DRAWN:	MSI / 03/12/2025
REVISED:	---
PROJECT No:	32272

verdantas

PLATE 2.0

APPENDIX A

LOGS OF TEST BORINGS

Verdantas LLC
1915 N 12th Street
Toledo Ohio 43604
Telephone: (419)324-2222

BORING NUMBER B-1

CLIENT City of Mentor
PROJECT NAME Mentor Recreation Area Park Expansion
PROJECT NUMBER 32272
PROJECT LOCATION Mentor, OH
DRILLING CONTRACTOR EnviroCore, Inc. J. Clark Alan B.
RIG NO. 7822 DT
GROUND ELEVATION 629.68 ft
DRILLING METHOD 2-1/4 in. HSA
GROUND WATER LEVELS:
DATE STARTED 2/26/25 **COMPLETED** 2/26/25
AT TIME OF DRILLING None
LOGGED BY J. Hnida **CHECKED BY** MS Iqbal
AT END OF DRILLING None
NOTES
0hrs AFTER DRILLING Backfilled w/Cuttings

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	UNCONF. COMP. STR. (tsf)	DRY UNIT WT. (pcf)	PL MC LL / SPT N VALUE
	0		TOPSOIL - 6 Inches						
			0.5'						
			Moist Medium Stiff to Stiff Brown SILTY CLAY w/Sand, Trace Gravel, and Organics (CL-ML)	SS 1	100	3-3-5 (8)	2.75		18
			3.5'						
625	5		Moist Stiff Brown SILTY CLAY w/Sand and Trace Gravel (CL-ML)	SS 2	100	3-6-7 (13)	4.50		15
			6.0'						
			Moist Stiff Brown SANDY SILTY CLAY w/Trace Gravel (CL-ML)	SS 3	100	4-6-9 (15)	4.50		15
620	10		@8.5': Very Stiff, Brown/Gray	SS 4	100	4-8-12 (20)	>4.5		15
			13.5'						
			Moist Stiff Gray SILTY CLAY w/Sand and Trace Gravel (CL-ML)	SS 5	100	3-5-7 (12)	4.50		15
615	15		18.5'						
			Moist Stiff to Very Stiff Gray SANDY SILTY CLAY w/Trace Gravel (CL-ML)	SS 6	100	3-6-9 (15)	>4.5		13
610	20		20.0'						
			Bottom of hole at 20.0 feet.						

Verdantas LLC
1915 N 12th Street
Toledo Ohio 43604
Telephone: (419)324-2222

BORING NUMBER B-2

CLIENT City of Mentor
PROJECT NAME Mentor Recreation Area Park Expansion
PROJECT NUMBER 32272
PROJECT LOCATION Mentor, OH
DRILLING CONTRACTOR EnviroCore, Inc. J. Clark Alan B.
RIG NO. 7822 DT
GROUND ELEVATION 629.87 ft
DRILLING METHOD 2-1/4 in. HSA
GROUND WATER LEVELS:
DATE STARTED 2/25/25
COMPLETED 2/25/25
AT TIME OF DRILLING None
LOGGED BY J. Hnida
CHECKED BY MS Iqbal
AT END OF DRILLING None
NOTES
0hrs AFTER DRILLING Backfilled w/Cuttings

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	UNCONF. COMP. STR. (tsf)	DRY UNIT WT. (pcf)	PL MC LL / SPT N VALUE
	0		TOPSOIL - 6 Inches						
			0.5'						
			Moist Medium Stiff to Stiff Brown LEAN CLAY w/Sand and Trace Gravel (CL)	SS 1	100	2-3-5 (8)	4.25		17
			3.5'						
			Moist Stiff Brown SILTY CLAY w/Trace Gravel (CL-ML)	SS 2	100	3-4-6 (10)	4.50		15
625	5		5.0'						
			Bottom of hole at 5.0 feet.						

PL MC LL
20 40 60 80
▲ SPT N VALUE ▲
20 40 60 80

Verdantas LLC
1915 N 12th Street
Toledo Ohio 43604
Telephone: (419)324-2222

BORING NUMBER B-3

CLIENT City of Mentor
PROJECT NAME Mentor Recreation Area Park Expansion
PROJECT NUMBER 32272
PROJECT LOCATION Mentor, OH
DRILLING CONTRACTOR EnviroCore, Inc. J. Clark Alan B.
RIG NO. 7822 DT
GROUND ELEVATION 629.39 ft
DRILLING METHOD 2-1/4 in. HSA
GROUND WATER LEVELS:
DATE STARTED 2/26/25 **COMPLETED** 2/26/25
AT TIME OF DRILLING None
LOGGED BY J. Hnida **CHECKED BY** MS Iqbal
AT END OF DRILLING None
NOTES
0hrs AFTER DRILLING Backfilled w/Cuttings

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	UNCONF. COMP. STR. (tsf)	DRY UNIT WT. (pcf)	PL MC LL / SPT N VALUE
	0		TOPSOIL - 6 Inches						
			0.5'						
			Moist Stiff Gray/Brown SANDY SILTY CLAY w/Trace Gravel (CL-ML)	SS 1	100	2-5-7 (12)	4.50		17
			3.5'						
625	5		Moist Stiff Brown SILTY CLAY w/Sand and Trace Gravel (CL-ML)	SS 2	100	2-4-6 (10)	4.50		17
			6.0'						
			Moist Very Stiff Brown SANDY SILTY CLAY w/Trace Gravel (CL-ML)	SS 3	100	5-9-14 (23)	>4.5		15
			8.5'						
620	10		Moist Hard Brown/Gray SANDY SILTY CLAY w/Shale Fragments (CL-ML)	SS 4	100	8-14-21 (35)	4.50		16
			13.5'						
615	15		Moist Stiff to Very Stiff Gray SILTY CLAY w/Sand and Trace Gravel (CL-ML)	SS 5	89	3-6-8 (14)	4.50		15
610	20		20.0'	SS 6	89	4-6-9 (15)	4.50		13
			Bottom of hole at 20.0 feet.						

Verdantas LLC
1915 N 12th Street
Toledo Ohio 43604
Telephone: (419)324-2222

BORING NUMBER B-4

CLIENT City of Mentor
PROJECT NAME Mentor Recreation Area Park Expansion
PROJECT NUMBER 32272
PROJECT LOCATION Mentor, OH
DRILLING CONTRACTOR EnviroCore, Inc. J. Clark Alan B.
RIG NO. 7822 DT
GROUND ELEVATION 629.38 ft
DRILLING METHOD 2-1/4 in. HSA
GROUND WATER LEVELS:
DATE STARTED 2/25/25 **COMPLETED** 2/25/25
AT TIME OF DRILLING None
LOGGED BY J. Hnida **CHECKED BY** MS Iqbal
AT END OF DRILLING None
NOTES
0hrs AFTER DRILLING Backfilled w/Cuttings

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	UNCONF. COMP. STR. (tsf)	DRY UNIT WT. (pcf)	PL MC LL / SPT N VALUE
	0		TOPSOIL - 6 Inches 0.5'						
			Moist Medium Stiff to Stiff Brown SANDY SILTY CLAY w/Trace Gravel and Organics (CL-ML)	SS 1	100	3-3-5 (8)	4.00		17
			3.5'						
625			Moist Stiff Brown SILTY CLAY w/Sand, Trace Gravel, and Shale Fragments (CL-ML)	SS 2	100	3-3-8 (11)	4.50		16
	5		5.0'						
			Bottom of hole at 5.0 feet.						

PL MC LL
20 40 60 80
▲ SPT N VALUE ▲
20 40 60 80

Verdantas LLC
1915 N 12th Street
Toledo Ohio 43604
Telephone: (419)324-2222

BORING NUMBER B-5

CLIENT City of Mentor
PROJECT NAME Mentor Recreation Area Park Expansion
PROJECT NUMBER 32272
PROJECT LOCATION Mentor, OH
DRILLING CONTRACTOR EnviroCore, Inc. J. Clark Alan B.
RIG NO. 7822 DT
GROUND ELEVATION 629.05 ft
DRILLING METHOD 2-1/4 in. HSA
GROUND WATER LEVELS:
DATE STARTED 2/25/25
COMPLETED 2/25/25
AT TIME OF DRILLING None
LOGGED BY J. Hnida
CHECKED BY MS Iqbal
AT END OF DRILLING None
NOTES
0hrs AFTER DRILLING Backfilled w/Cuttings

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	UNCONF. COMP. STR. (tsf)	DRY UNIT WT. (pcf)	PL MC LL 20 40 60 80 ▲ SPT N VALUE ▲ 20 40 60 80
	0		TOPSOIL - 12 Inches 1.0'						
			Moist Stiff Brown SANDY SILTY CLAY w/Trace Gravel and Organics (CL-ML) 3.5'	SS 1	100	3-4-6 (10)	4.50		16
625	5		Moist Medium Stiff to Stiff Brown SILTY CLAY w/Sand and Trace Gravel (CL-ML) 5.0'	SS 2	100	2-3-5 (8)	4.25		18
			Bottom of hole at 5.0 feet.						

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Toledo Ohio 43604
Telephone: (419)324-2222

BORING NUMBER B-6

CLIENT City of Mentor
PROJECT NAME Mentor Recreation Area Park Expansion
PROJECT NUMBER 32272
PROJECT LOCATION Mentor, OH
DRILLING CONTRACTOR EnviroCore, Inc. J. Clark Alan B.
RIG NO. 7822 DT
GROUND ELEVATION 620.65 ft
DRILLING METHOD 2-1/4 in. HSA
GROUND WATER LEVELS:
DATE STARTED 2/26/25
COMPLETED 2/26/25
AT TIME OF DRILLING None
LOGGED BY J. Hnida
CHECKED BY MS Iqbal
AT END OF DRILLING None
NOTES
0hrs AFTER DRILLING Backfilled w/Cuttings

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	UNCONF. COMP. STR. (tsf)	DRY UNIT WT. (pcf)	PL MC LL / SPT N VALUE
620	0		TOPSOIL - 6 Inches						
			0.5'						
			Moist Loose Brown SILTY, CLAYEY SAND w/Trace Organics (SC-SM) - [FILL]	SS 1	67	2-3-6 (9)	NP		16
			3.5'						
			Moist Medium Dense Brown SILTY, CLAYEY SAND w/Trace Shale Fragments (SC-SM) - [FILL]	SS 2	33	3-6-9 (15)	NP		16
615	5		6.0'						
			Moist Very Stiff Gray SANDY SILTY CLAY w/Trace Gravel (CL-ML)	SS 3	100	4-9-11 (20)	4.50		16
			8.5'						
			Moist Medium Dense Gray CLAYEY GRAVEL (GC) [DECOMPOSED BEDROCK]	SS 4	100	5-7-11 (18)	NP		10
610	10								
				SS 5	89	5-8-11 (19)	NP		11
605	15								
				SS 6	100	6-8-12 (20)	NP		11
	20		20.0'						
			Bottom of hole at 20.0 feet.						

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1915 N 12th Street
Toledo Ohio 43604
Telephone: (419)324-2222

BORING NUMBER B-7

CLIENT City of Mentor
PROJECT NAME Mentor Recreation Area Park Expansion
PROJECT NUMBER 32272
PROJECT LOCATION Mentor, OH
DRILLING CONTRACTOR EnviroCore, Inc. J. Clark Alan B.
RIG NO. 7822 DT
GROUND ELEVATION 629.43 ft
DRILLING METHOD 2-1/4 in. HSA
GROUND WATER LEVELS:
DATE STARTED 2/25/25
COMPLETED 2/25/25
AT TIME OF DRILLING None
LOGGED BY J. Hnida
CHECKED BY MS Iqbal
AT END OF DRILLING None
NOTES
0hrs AFTER DRILLING Backfilled w/Cuttings

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	UNCONF. COMP. STR. (tsf)	DRY UNIT WT. (pcf)	PL MC LL / SPT N VALUE
	0		TOPSOIL - 6 Inches 0.5'						
			Moist Medium Stiff Brown SILTY CLAY w/Sand, Trace Gravel, and Organics (CL-ML) 3.5'	SS 1	100	2-3-4 (7)	4.00		17
625	5		Moist Stiff Brown LEAN CLAY w/Sand and Trace Gravel (CL) 5.0'	SS 2	100	3-4-6 (10)	4.00		17
			Bottom of hole at 5.0 feet.						

PL MC LL
20 40 60 80
▲ SPT N VALUE ▲
20 40 60 80

Verdantas LLC
1915 N 12th Street
Toledo Ohio 43604
Telephone: (419)324-2222

BORING NUMBER B-8

CLIENT City of Mentor
PROJECT NAME Mentor Recreation Area Park Expansion
PROJECT NUMBER 32272
PROJECT LOCATION Mentor, OH
DRILLING CONTRACTOR EnviroCore, Inc. J. Clark Alan B.
RIG NO. 7822 DT
GROUND ELEVATION 627.29 ft
DRILLING METHOD 2-1/4 in. HSA
GROUND WATER LEVELS:
DATE STARTED 2/26/25 **COMPLETED** 2/26/25
AT TIME OF DRILLING None
LOGGED BY J. Hnida **CHECKED BY** MS Iqbal
AT END OF DRILLING None
NOTES
0hrs AFTER DRILLING Backfilled w/Cuttings

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	UNCONF. COMP. STR. (tsf)	DRY UNIT WT. (pcf)	PL MC LL / SPT N VALUE
	0		TOPSOIL - 6 Inches 0.5'						
625			Moist Stiff Brown SILTY CLAY w/Sand and Trace Gravel (CL-ML)	SS 1	89	2-4-5 (9)	4.25		17
			3.5'						
	5		Moist Stiff Brown SANDY SILTY CLAY w/Trace Gravel (CL-ML)	SS 2	100	3-5-7 (12)	4.50		14
			6.0'						
620			Moist Very Stiff Brown SILTY CLAY w/Sand and Trace Gravel (CL-ML)	SS 3	100	5-7-11 (18)	4.25		16
			8.5'						
	10		Moist Very Stiff Gray/Brown SANDY SILTY CLAY w/Trace Gravel (CL-ML)	SS 4	100	5-8-13 (21)	>4.5		14
615			13.5'						
			Moist Stiff Gray SILTY CLAY w/Sand and Shale Fragments (CL-ML)	SS 5	100	2-4-6 (10)	4.50		15
	15								
610			18.5'						
			Moist Medium Dense Gray CLAYEY GRAVEL (GC) [DECOMPOSED BEDROCK]	SS 6	100	5-8-11 (19)	NP		12
	20		20.0'						
			Bottom of hole at 20.0 feet.						

Verdantas LLC
1915 N 12th Street
Toledo Ohio 43604
Telephone: (419)324-2222

BORING NUMBER B-9

CLIENT City of Mentor
PROJECT NAME Mentor Recreation Area Park Expansion
PROJECT NUMBER 32272
PROJECT LOCATION Mentor, OH
DRILLING CONTRACTOR Enviro Core J. Clark Alan B.
RIG NO. 7822 DT
GROUND ELEVATION 627.76 ft
DRILLING METHOD 2-1/4 in. HSA
GROUND WATER LEVELS:
DATE STARTED 2/25/25
COMPLETED 2/25/25
AT TIME OF DRILLING None
LOGGED BY J. Hnida
CHECKED BY MS Iqbal
AT END OF DRILLING None
NOTES
0hrs AFTER DRILLING Backfilled w/Cuttings

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	UNCONF. COMP. STR. (tsf)	DRY UNIT WT. (pcf)	PL MC LL / SPT N VALUE
	0		TOPSOIL - 6 Inches						
			0.5'						
625			Moist Medium Stiff Gray/Brown LEAN CLAY w/Sand, Trace Gravel, and Organics (CL)	SS 1	100	2-2-5 (7)	4.50		20
			3.5'						
	5		Moist Stiff Brown SILT w/Sand and Gravel (ML)	SS 2	100	3-5-6 (11)	4.50		15
			5.0'						
			Bottom of hole at 5.0 feet.						

PL MC LL
20 40 60 80
▲ SPT N VALUE ▲
20 40 60 80

Verdantas LLC
1915 N 12th Street
Toledo Ohio 43604
Telephone: (419)324-2222

BORING NUMBER B-10

CLIENT City of Mentor
PROJECT NAME Mentor Recreation Area Park Expansion
PROJECT NUMBER 32272
PROJECT LOCATION Mentor, OH
DRILLING CONTRACTOR EnviroCore, Inc. J. Clark Alan B.
RIG NO. 7822 DT
GROUND ELEVATION 627.48 ft
DRILLING METHOD 2-1/4 in. HSA
GROUND WATER LEVELS:
DATE STARTED 2/25/25
COMPLETED 2/25/25
AT TIME OF DRILLING None
LOGGED BY J. Hnida
CHECKED BY MS Iqbal
AT END OF DRILLING None
NOTES
0hrs AFTER DRILLING Backfilled w/Cuttings

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	UNCONF. COMP. STR. (tsf)	DRY UNIT WT. (pcf)	PL MC LL / SPT N VALUE
	0		TOPSOIL - 6 Inches						
			0.5'						
625			Moist Stiff Brown SILTY CLAY w/Sand and Trace Gravel (CL-ML)	SS 1	100	3-4-5 (9)	4.50		17
	5		5.0'	SS 2	100	3-4-5 (9)	4.50		16
			Bottom of hole at 5.0 feet.						

PL MC LL
20 40 60 80
▲ SPT N VALUE ▲
20 40 60 80

Verdantas LLC
1915 N 12th Street
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Telephone: (419)324-2222

BORING NUMBER B-11

CLIENT City of Mentor
PROJECT NAME Mentor Recreation Area Park Expansion
PROJECT NUMBER 32272
PROJECT LOCATION Mentor, OH
DRILLING CONTRACTOR EnviroCore, Inc. J. Clark Alan B.
RIG NO. 7822 DT
GROUND ELEVATION 627.09 ft
DRILLING METHOD 2-1/4 in. HSA
GROUND WATER LEVELS:
DATE STARTED 2/25/25 **COMPLETED** 2/25/25
AT TIME OF DRILLING None
LOGGED BY J. Hnida **CHECKED BY** MS Iqbal
AT END OF DRILLING None
NOTES
0hrs AFTER DRILLING Backfilled w/Cuttings

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	UNCONF. COMP. STR. (tsf)	DRY UNIT WT. (pcf)	PL MC LL / SPT N VALUE
	0		TOPSOIL - 6 Inches						
			0.5'						
625			Moist Soft to Medium Stiff Brown LEAN CLAY w/Sand and Trace Gravel (CL)	SS 1	100	2-1-3 (4)	3.25		19
			3.5'						
	5		Moist Medium Stiff Brown/Gray LEAN CLAY w/Sand and Trace Gravel (CL)	SS 2	100	2-3-3 (6)	3.75		21
			5.0'						
			Bottom of hole at 5.0 feet.						

PL MC LL
20 40 60 80
▲ SPT N VALUE ▲
20 40 60 80

Verdantas LLC
1915 N 12th Street
Toledo Ohio 43604
Telephone: (419)324-2222

BORING NUMBER B-12

CLIENT City of Mentor
PROJECT NAME Mentor Recreation Area Park Expansion
PROJECT NUMBER 32272
PROJECT LOCATION Mentor, OH
DRILLING CONTRACTOR EnviroCore, Inc. J. Clark Alan B.
RIG NO. 7822 DT
GROUND ELEVATION 626.21 ft
DRILLING METHOD 2-1/4 in. HSA
GROUND WATER LEVELS:
DATE STARTED 2/25/25
COMPLETED 2/25/25
AT TIME OF DRILLING None
LOGGED BY J. Hnida
CHECKED BY MS Iqbal
AT END OF DRILLING None
NOTES
0hrs AFTER DRILLING Backfilled w/Cuttings

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	UNCONF. COMP. STR. (tsf)	DRY UNIT WT. (pcf)	PL MC LL / SPT N VALUE
625	0		Moist Stiff Brown SANDY SILTY CLAY w/Trace Gravel (CL-ML)	SS 1	100	3-4-5 (9)	4.50		18
			3.5'						
	5		Moist Stiff Brown SILTY CLAY w/Sand, Trace Gravel, and Shale Fragments (CL-ML) 5.0'	SS 2	100	3-4-6 (10)	3.00		18
			Bottom of hole at 5.0 feet.						

PL MC LL
20 40 60 80
▲ SPT N VALUE ▲
20 40 60 80

Verdantas LLC
1915 N 12th Street
Toledo Ohio 43604
Telephone: (419)324-2222

BORING NUMBER B-13

CLIENT City of Mentor
PROJECT NAME Mentor Recreation Area Park Expansion
PROJECT NUMBER 32272
PROJECT LOCATION Mentor, OH
DRILLING CONTRACTOR EnviroCore, Inc. J. Clark Alan B.
RIG NO. 7822 DT
GROUND ELEVATION 626.12 ft
DRILLING METHOD 2-1/4 in. HSA
GROUND WATER LEVELS:
DATE STARTED 2/26/25 **COMPLETED** 2/26/25
AT TIME OF DRILLING None
LOGGED BY J. Hnida **CHECKED BY** MS Iqbal
AT END OF DRILLING None
NOTES
0hrs AFTER DRILLING Backfilled w/Cuttings

ELEVATION (ft)	DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	UNCONF. COMP. STR. (tsf)	DRY UNIT WT. (pcf)	PL MC LL / SPT N VALUE
	0		TOPSOIL - 6 Inches						
			0.5'						
625			Moist Stiff Brown SANDY SILTY CLAY w/Trace Gravel and Organics (CL-ML)	SS 1	100	2-5-8 (13)	4.50		15
				SS 2	100	3-5-7 (12)	4.50		15
	5								
620			@6': Very Stiff	SS 3	100	5-8-10 (18)	4.50		15
			8.5'						
			Moist Stiff Gray SILTY CLAY w/Sand and Trace Gravel (CL-ML)	SS 4	78	3-5-8 (13)	4.50		15
	10								
615									
			13.5'						
			Moist Medium Dense Gray CLAYEY GRAVEL (GC) [DECOMPOSED BEDROCK]	SS 5	100	5-14-16 (30)	NP		10 ▲
	15								
610									
				SS 6	83	11-12-15 (27)	NP		11 ▲
	20		20.0'						
			Bottom of hole at 20.0 feet.						

PL MC LL
20 40 60 80
▲ SPT N VALUE ▲
20 40 60 80

APPENDIX B

LEGEND KEY

LEGEND KEY

Unified Soil Classification System Soil Symbols


GW - WELL GRADED GRAVEL Includes Gravel-Sand mixtures, little or no fines.


GP - POORLY GRADED GRAVEL Includes Gravel-Sand mixtures, little or no fines.


GM - SILTY GRAVEL Includes Gravel-Sand-Silt mixtures.


GC - CLAYEY GRAVEL Includes Gravel-Sand-Clay mixtures.


SW - WELL GRADED SAND Includes Gravelly Sands, little or no fines.


SP - POORLY GRADED SAND Includes Gravelly Sands, little or no fines.


SM - SILTY SAND Includes Sand-Silt mixtures.


SC - CLAYEY SAND Includes Sand-Clay mixtures.


ML - SILT Includes Silt with Sand and Sandy Silt.


CL - LEAN CLAY Includes Sandy Lean Clay and Lean Clay with Sand and Gravel.


MH - ELASTIC SILT Includes Sandy Elastic Silt and Elastic Silt with Sand.


CH - FAT CLAY Includes Sandy Fat Clay and Fat Clay with Sand.


CL-ML - SILTY CLAY Includes Clayey Silt of low plasticity.


OL - ORGANIC SILT and ORGANIC CLAY of low plasticity.


OH - ORGANIC SILT and ORGANIC CLAY of medium to high plasticity.


Pt - PEAT Includes humus, swamp and other soils with high organic content.


FILL MATERIAL - Includes controlled and non-controlled soil and non-soil materials.


TOPSOIL


ASPHALT - Bituminous Asphalt


CONCRETE - Includes broken concrete rubble.

Sample Symbols


SS - Split Spoon


ST - Shelby Tube


RC - Rock Core


GS - Geoprobe Sleeve


AU - Auger Cuttings


GB - Grab

Notes:

1. Exploratory borings were drilled on February 25 and 26, 2025, using hollow stem augers.
2. The borings were located in the field by Verdantas and subsequently scanned for potential buried utilities within a 10-foot radius around each boring using Ground Penetrating Radar (GPR) by a private utility locating service.
3. Latitude, Longitude, and ground surface elevation for all borings were surveyed by Verdantas, LLC.
4. These logs are subject to the limitations, conclusions, and recommendations in the report and should not be interpreted separate from the report.
5. Unconfined Compressive Strength:
   NP = Non-Plastic

APPENDIX C

TABULATION OF LABORATORY TEST DATA

Verdantas LLC
1915 N 12th Street
Toledo Ohio 43604
Telephone: (419)324-2222

SUMMARY OF LABORATORY RESULTS

CLIENT City of Mentor **PROJECT NAME** Mentor Recreation Area Park Expansion

PROJECT NUMBER 32272 **PROJECT LOCATION** Mentor, OH

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
B-1	1.0							17.7			
B-1	3.5							14.7			
B-1	6.0							14.8			
B-1	8.5							14.8			
B-1	13.5							15.2			
B-1	18.5							12.8			
B-2	1.0	35	17	18	9.5	83	CL	17.3			
B-2	3.5							15.2			
B-3	1.0							17.0			
B-3	3.5							16.6			
B-3	6.0							14.6			
B-3	8.5							15.5			
B-3	13.5							14.8			
B-3	18.5							12.6			
B-4	1.0							16.7			
B-4	3.5							16.5			
B-5	1.0							15.8			
B-5	3.5							18.0			
B-6	1.0							16.2			
B-6	3.5							15.8			
B-6	6.0							16.0			
B-6	8.5							10.0			
B-6	13.5							11.1			
B-6	18.5							11.0			
B-7	1.0							17.2			
B-7	3.5	34	17	17	9.5	80	CL	17.2			
B-8	1.0							17.0			
B-8	3.5							14.1			
B-8	6.0							16.3			
B-8	8.5							13.9			
B-8	13.5							15.3			
B-8	18.5							11.8			
B-9	1.0							19.6			
B-9	3.5							14.8			
B-10	1.0							16.6			
B-10	3.5							16.2			
B-11	1.0							19.5			
B-11	3.5							21.4			
B-12	1.0							17.5			
B-12	3.5							18.4			
B-13	1.0							14.7			
B-13	3.5							14.7			
B-13	6.0							15.3			

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SUMMARY OF LABORATORY RESULTS

CLIENT City of Mentor **PROJECT NAME** Mentor Recreation Area Park Expansion

PROJECT NUMBER 32272 **PROJECT LOCATION** Mentor, OH

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
B-13	8.5							14.7			
B-13	13.5							10.3			
B-13	18.5							10.7			

APPENDIX D

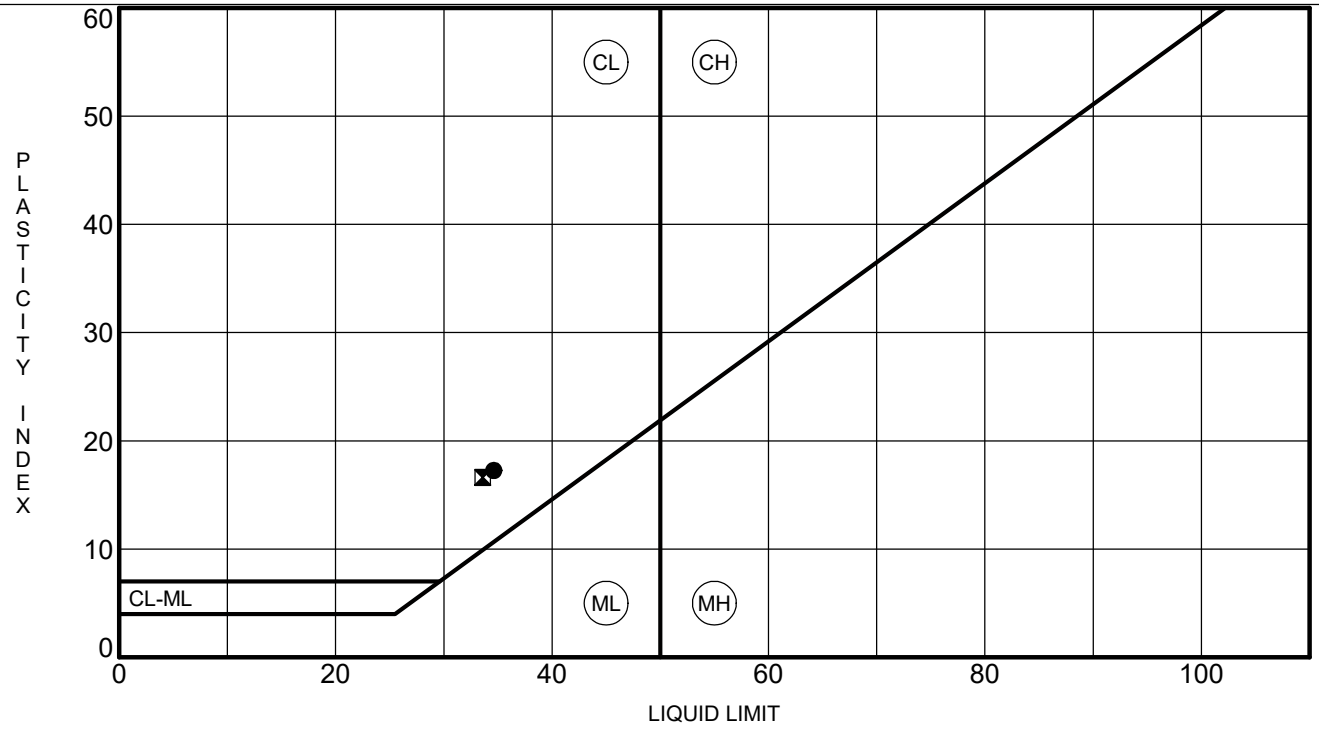
LABORATORY TEST RESULTS

Verdantas LLC
1915 N 12th Street
Toledo Ohio 43604
Telephone: (419)324-2222

ATTERBERG LIMITS' RESULTS

CLIENT City of Mentor **PROJECT NAME** Mentor Recreation Area Park Expansion

PROJECT NUMBER 32272 **PROJECT LOCATION** Mentor, OH



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**B-2**	**1.0**	**35**	**17**	**18**	**83**	**LEAN CLAY with SAND (CL)**
⧓	**B-7**	**3.5**	**34**	**17**	**17**	**80**	**LEAN CLAY with SAND (CL)**

Verdantas LLC
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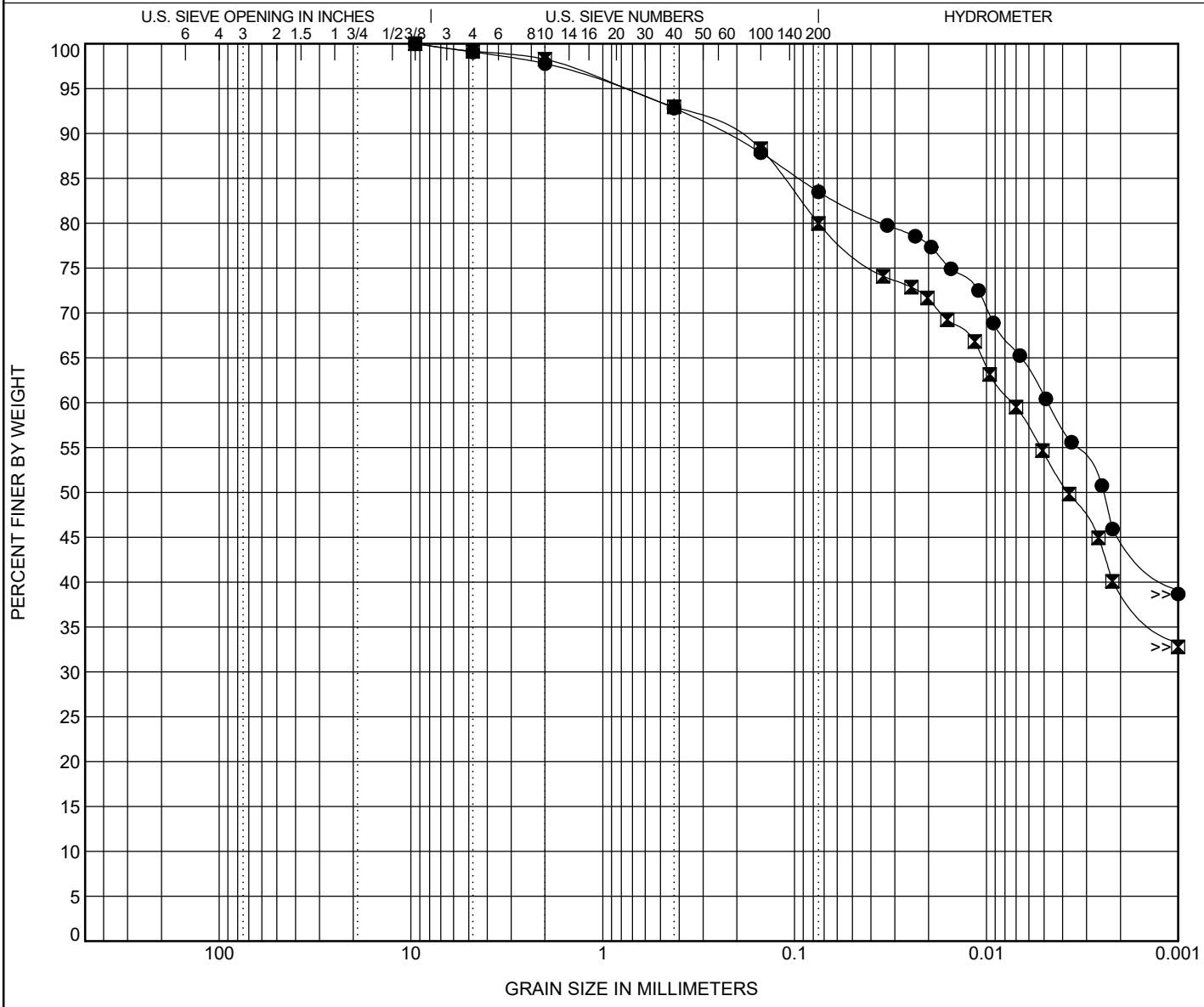
GRAIN SIZE DISTRIBUTION

CLIENT City of Mentor **PROJECT NAME** Mentor Recreation Area Park Expansion

PROJECT NUMBER 32272 **PROJECT LOCATION** Mentor, OH



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		USCS Classification	LL	PL	PI	Cc	Cu
●	B-2	1.0	**LEAN CLAY with SAND (CL)**	**35**	**17**	**18**		
⊠	B-7	3.5	**LEAN CLAY with SAND (CL)**	**34**	**17**	**17**		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-2	1.0	**9.5**	**0.005**			**0.9**	**15.6**	**22.8**	**60.7**
⊠	B-7	3.5	**9.5**	**0.007**			**0.8**	**19.2**	**25.6**	**54.4**

GRAIN SIZE 32272.GPJ GINT US LAB.GDT 3/24/25

APPENDIX E

FIELD RECONNAISSANCE

SITE RECONNAISSANCE PHOTOGRAPHS

Photo 1: Site reconnaissance map showing Marsh Creek at the project site, with marked photo locations.

Photo 2: Standing on the west bank of Mark Creek looking towards north, showing slope general conditions on the east and west sides of the creek.

Photo 3: View from the east bank of the creek, showing slope general condition on the west bank.

Photo 4: View from the east bank of the creek, looking northwest. The west bank shows material detachment likely caused by water flow and features a steep slope with horizontal.

Photo 5: View from the east bank of Marsh Creek, looking southwest. The slope general conditions, site guardrail, and exposed manhole on the west bank are visible.

Photo 6: This photo shows the view from the east bank of the creek, looking north, and presents the slope general condition on the west bank. The site guardrail is visible at the top of the slope.

Photo 7: This photo shows a closeup from the east bank of the creek, looking north, highlighting the slope condition on the west bank. A broken drainpipe is visible at the bottom of the slope.

Photo 8: This photo shows the slope condition on the west bank, viewed from the east bank looking northwest. Notice the water erosion features and exposed tree roots.

Photo 9: This photo depicts the slope condition on the west bank, as seen from the east bank looking southwest. Slope grade changes are noticeable compared to northwest slopes on the west banks.

Photo 10: This photo shows the slope condition on the west bank, viewed from the east bank looking southwest. The slope grade changes significantly compared to the northwest slopes on the west banks.

APPENDIX F

GPRS REPORT

JOB SUMMARY REPORT

Order Number:	Work Order #753816	**Job Date:**	Feb 25, 2025 10:19:00 AM
Customer:	80435 [CTN] VERDANTAS LLC : VERDANTAS LLC - WILMINGTON DE	**Billing Address:**	VERDANTAS LLC 5400 LIMESTONE ROAD WILMINGTON DE 19808 United States

JOB DETAILS

Jobsite Location	8500 Munson Road, Mentor, Ohio, 44060
Work Order Number	Work Order #753816
Job Number	
PO Number	362416

GPRS Project Manager: Jeremy Holder

Thank you for using GPRS on your project. We appreciate the opportunity to work with you. If you have questions regarding the results of this scanning, please contact the lead GPRS project manager on this project.

EQUIPMENT USED

The following equipment was used on this project:

- **Underground GPR Antenna:** This GPR Antenna uses frequencies ranging from 250 MHz to 450 MHz and is mounted in a stroller frame that rolls over the surface. Data is displayed on a screen and marked in the field in real time. The surface needs to be reasonably smooth and unobstructed to obtain readable scans. Obstructions such as curbs, landscaping, and vegetation will limit the efficacy of GPR. The total effective scan depth can be as much as 8’ or more with this antenna but can vary widely depending on the soil conditions and composition. Some soil types, such as clay, may limit maximum depths to 3’ or less. As depth increases, targets must be larger to be detected, and non-metallic targets can be challenging to locate. The depths provided should always be treated as estimates as their accuracy can be affected by multiple factors. For more information, please visit: Link
- **EM Pipe Locator:** Electromagnetic Pipe and Cable Locator. Detects electromagnetic fields. Used to actively trace conductive pipes and tracer wires, or passively detect power and radio signals traveling along conductive pipes and utilities. For more information, please visit: Link
- **GPS:** This handheld unit offers accuracy down to 4 inches; however, the accuracy achieved will depend on the satellite environment at the time of collection and is not considered survey-grade. Features can be collected as points, lines, or areas and then exported as a KML/KMZ or overlaid on a CAD drawing. For more information, please visit: Link

JOB SUMMARY REPORT

WORK PERFORMED

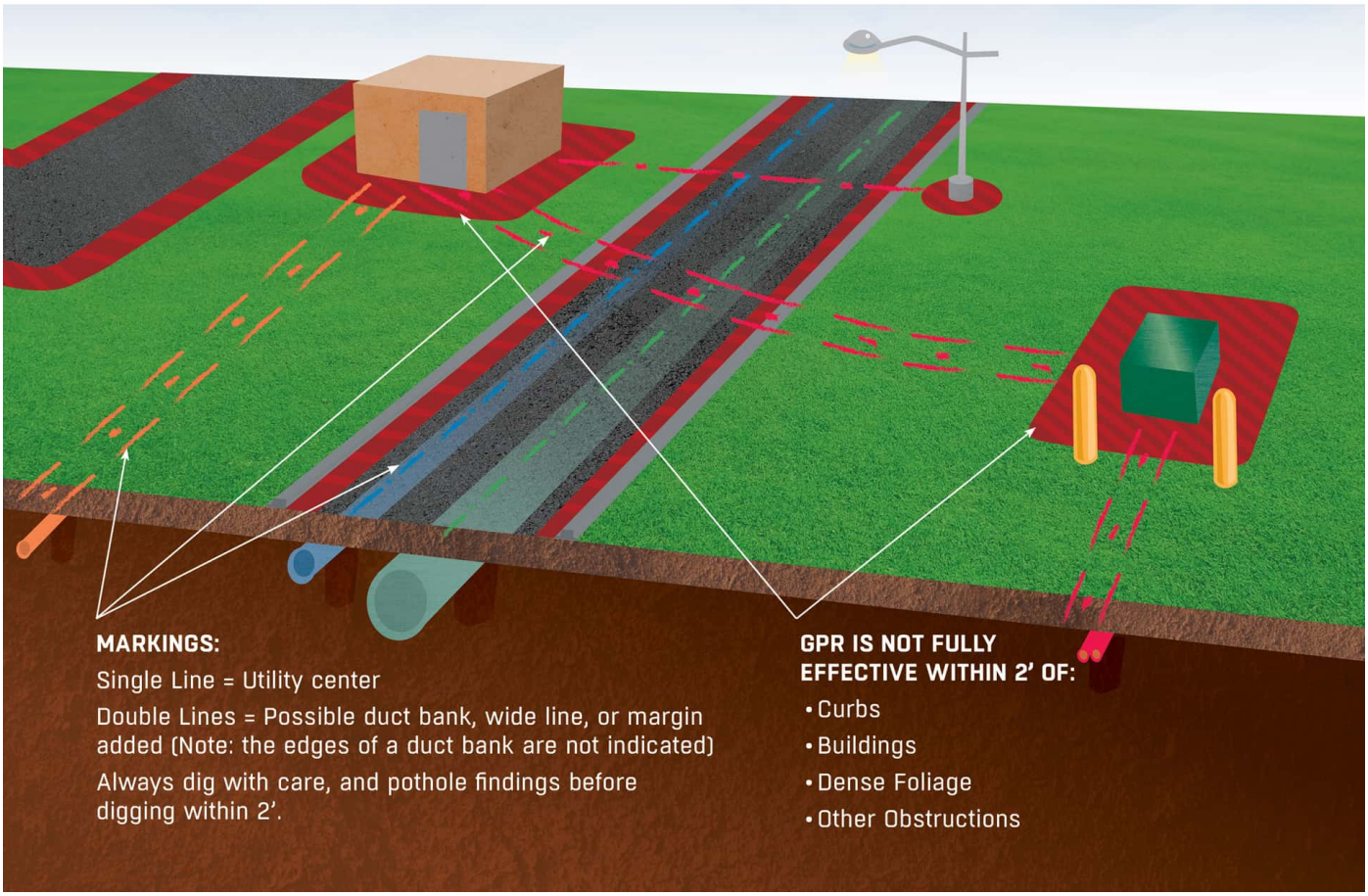
UNDERGROUND UTILITY	
Client Provided Drawings	No
Client completed 811 locate request	No
Scope of Work	12 soil boring locations.
Soil Borings (qty)	12
Approximate GPR Effective Depth (ft)	4
Marking Medium	- Spray Paint
Results Notes	Did not detect any utilities inside of locations for soil borings.

JOB SUMMARY REPORT

SUPPLEMENTAL INFORMATION

COMMON UTILITY LOCATING LIMITATIONS

There are many limitations to locating utilities, due to a variety of factors, with several more common examples illustrated here.



JOBSITE IMAGES

Jobsite Photo #1

Jobsite Photo #2

Jobsite Photo #3

Jobsite Photo #4

Jobsite Photo #5

Jobsite Photo #6

Jobsite Photo #7

Jobsite Photo #8

Jobsite Photo #9

Jobsite Photo #10

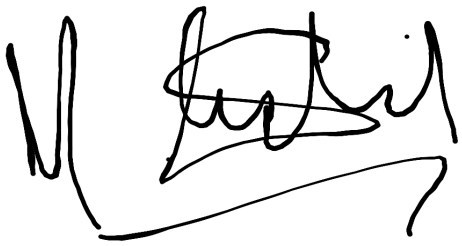
Jobsite Photo #11

Jobsite Photo #12

JOB SUMMARY REPORT

CONTACT / SIGNATURE INFORMATION

SIGNATURE



Contact Information

Contact Name	Muhammad iqbal	**Email**	muhammad.iqbal@verdantas.com

TERMS & CONDITIONS

http://www.gprsinc.com/termsandconditions.html