HULL
Environment / Energy / Infrastructure

February 11, 2021

Harrison County Commissioners
100 West Main Street
Cadiz, Ohio 43907
Attn: Misty Bailie

RE: Geotechnical Exploration Report for the Freeport Sanitary Improvements Project Located in the Village of Freeport, Harrison County, Ohio; HCY005.0055.

Dear Commissioners:

Hull & Associates, LLC (Hull) is pleased to provide this Geotechnical Engineering Report for the above referenced project. The report was prepared by Hull in general accordance with our Scope of Work dated April 2, 2020 (Hull Document HCY005.0001), and subsequent authorization of Task Order 001: Freeport Sanitary Improvement Project by the Board of Harrison County Commissioners on April 8, 2020.

The enclosed report presents the findings of the subsurface exploration and presents geotechnical engineering conclusions and recommendations related to the design and construction of the proposed sanitary sewer collection system, pump station, wastewater treatment plant, and associated improvements for the Village of Freeport.

A Professional Engineer registered in the State of Ohio has planned and supervised the performance of the geotechnical engineering services, evaluated the findings, and prepared this report in accordance with industry accepted geotechnical engineering practices.

If you have any questions concerning this report, or if we may be of further service, please contact either of the undersigned at (614) 793-8777 at your convenience.

Sincerely,

Cheryl L. Green, P.E.
Senior Project Manager

A.J. Smith, P.E.
Senior Project Manager/St. Clairsville Office Manager

Enclosure

6397 Emerald Pkwy, Suite 200
Dublin, Ohio 43016
614.793.8777 www.hullinc.com

GEOTECHNICAL EXPLORATION REPORT

FREEPORT SANITARY SYSTEM IMPROVEMENTS
VILLAGE OF FREEPORT
HARRISON COUNTY, OHIO

PREPARED FOR:
HARRISON COUNTY COMMISSIONERS
100 WEST MAIN STREET
CADIZ, OHIO 43907

PREPARED BY:
HULL & ASSOCIATES, LLC
6397 EMERALD PARKWAY, SUITE 200
DUBLIN, OHIO 43016

FEBRUARY 2021

HULL
Environment / Energy / Infrastructure

Geotechnical Exploration Report

FREEPORT SANITARY SYSTEM IMPROVEMENTS
VILLAGE OF FREEPORT
HARRISON COUNTY, OHIO

Hull Document No. HCY005.0055

Date of Report: February 11, 2021

Prepared for:

Harrison County Commissioners
100 West Main Street
Cadiz, OH 43907

Prepared by:

Hull & Associates, LLC
6397 Emerald Parkway, Suite 200
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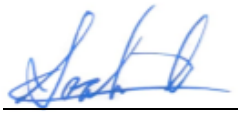
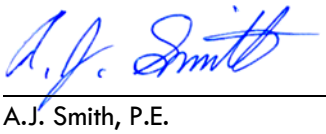
(614) 793-8777



Sarah A. Aboulhosn
Engineer II, EIT



A.J. Smith, P.E.
Senior Project Manager/St. Clairsville Office Manager

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1.0 INTRODUCTION AND PROJECT DESCRIPTION

1.1 Introduction

This report presents the results of Hull's geotechnical engineering services for the Freeport Sanitary System Improvements project in the Village of Freeport, Harrison County, Ohio. The project site is shown relative to the surrounding physical features on the Vicinity Map, Figure 1 and Site Plans, Figures 2 and 3.

The purpose of our services is to evaluate the subsurface conditions at the Site as a basis for developing geotechnical conclusions and recommendations for the design and construction of the proposed sanitary sewer collection system, pump station, wastewater treatment plant (WWTP), and associated improvements. Our geotechnical engineering services were performed in general accordance with our Scope of Work dated April 2, 2020 (Hull Document HCY005.0001), and subsequent authorization of Task Order 001: Freeport Sanitary Improvement Project by the Board of Harrison County Commissioners on April 8, 2020.

1.2 Project Description

As currently envisioned, the project will include a conventional gravity sanitary sewer collection system (with several areas served by low-pressure sewer) and a WWTP to convey and treat the Village's wastewater. The proposed gravity sewer collection system primarily consists of an 8-inch gravity sewer, one lift station serving the Eastern half of the Village, and several areas served by grinder stations and low-pressure sewer where elevations or constructability concerns restrict gravity sewer service. The gravity sewer ranges from about 4 feet deep (to crest of pipe) to about 25 feet deep near the intersection of East Main Street and Piedmont Road. The gravity sewer depths are typically about 10 to 12 feet deep throughout the proposed sewer system to provide service to basements. The gravity sewer terminates at the influent screen and pump station of the wastewater treatment plant at an invert elevation of 863.00 feet (i.e., 15 feet below existing grade).

The proposed WWTP will be located at the southern portion of the Site, situated West of Stillwater Creek and East of S. Philadelphia Street. The WWTP will include a package plant manufactured by Aeromod, Inc. with an enhanced biological phosphorous removal configuration; influent pumping and screening will be installed prior to the package plant. A tertiary filter, effluent metering, post aeration and UV disinfection systems are also proposed to be constructed as part of the WWTP. A small precast concrete building with a footprint of 12 feet by 20 feet is planned to store electrical and chemical feed equipment. These structures are anticipated to be mostly constructed at or near the existing site grades; however, excavations on the order of 25 feet may be needed to construct below grade portions of the influent station.

2.0 FIELD EXPLORATION AND LABORATORY TESTING

2.1 Field Exploration

The subsurface conditions at the Site were evaluated by drilling and sampling 37 borings; B20-01 through B20-30 in June 2020 and B21-31 through B21-35 in January 2021. The borings were drilled to depths ranging between 1.1 and 40 feet below the existing ground surface (bgs) using a track-mounted, continuous-flight hollow-stem auger and NQ-size rock core drill tooling. Rock coring was performed in borings B21-31, B21-34, and B21-34R.

The approximate locations of the borings are presented on the Site Plans, Figures 2 and 3. Details of the field exploration program, logs of the borings, and photos of the rock cores are presented in Appendix A.

2.2 Laboratory Testing

The soil samples obtained from the borings were sealed to reduce moisture loss, labeled for identification, and transported to the laboratory for further examination, testing, and classification. Representative soil and rock samples were tested for the determination of moisture content, grain size distribution (sieve analysis), plasticity characteristics (Atterberg limits), point load strength index, and unconfined compressive strength. The laboratory testing was performed in general accordance with test methods of the ASTM International or other applicable procedures. The laboratory test results are presented in Appendix B and presented on the boring logs in Appendix A at the respective sample depths.

3.0 SITE CONDITIONS

3.1 Geologic Setting

The Site locally lies within the Muskingum-Pittsburgh Plateau, an unglaciated physiographic region characterized as a moderately high to high relief (300 to 600 feet) dissected plateau having broad major valleys that contain outwash terraces, and tributaries with lacustrine terraces formed of medium-grained bedrock sequences (Ohio Division of Geological Survey, 1998). The underlying bedrock consists of the Conemaugh Group (Upper Pennsylvanian), which is predominately composed of shale, mudstone, siltstone, sandstone, and economically important coals and claystone (Bedrock Geologic Map of Ohio, 2006). Within this region, the bedrock generally dips to the southeast and periodically interrupted by gently anticlinal and synclinal folds (Soil Survey of Harrison County, Ohio, 1998). The surficial soil deposits at the Site, where present, are derived from siltstone, sandstone, and shale, and mapped as alluvial, colluvial, and residual deposits consisting mainly of silt and clay.

3.2 Geologic Hazards

3.2.1 Surface and Underground Mines

Based on review of the Ohio Department of Natural Resources (ODNR) Mine Locator GIS system, the nearest mapped active underground mine is the Vail coal mine, located approximately 1.2 miles west of the Site and covers the western half of Freeport Township and extends into Washington Township in Guernsey County. The nearest mapped abandoned underground mine is the Natress coal mine, located approximately 0.1 miles to the south of the Site.

3.2.2 USGS Mapped Landslides

The USGS "Landslides and Related Features of the Freeport, Ohio Quadrangle" (USGS 1978) indicates that the Site soils consists of soil and rock conditions that may be susceptible to landsliding, primarily areas underlain by claystone, mudstone, and shale.

3.2.3 Regional Seismicity

We evaluated the site for seismic hazards including liquefaction, lateral spreading, and fault rupture. Conditions favorable to liquefaction generally occur in loose to medium dense, clean to moderately silty sand that is below the groundwater level. Our analysis indicates that during the design MCE seismic event, the soil profile is generally not potentially susceptible to liquefaction and, therefore, not potentially susceptible to liquefaction-induced ground disturbance including lateral spreading. Additionally, based on the absence of any mapped faults that cross the site, our opinion is that there is a negligible risk of fault displacement resulting in ground rupture at the surface.

3.3 Surface Conditions

The Site lies primarily within a residential area in the Village of Freeport, covering an approximate area of 0.6 square miles. The elevations across the site range from about 877 feet in the southernmost portion to about 1141 feet in the northernmost portion of the Site (elevations are in NAVD88). The ground surface throughout the proposed sewer network, as observed in the borings, is mainly composed of 4 to 12 inches of asphalt or topsoil, and within the WWTP area, the ground surface is composed of gravel and sand in the form of processed aggregate. The southernmost portion of the site is within the mapped 100-year flood plan of the Stillwater Creek.

3.4 Subsurface Conditions

The subsurface conditions at the Site were evaluated by completing 37 borings in June 2020 and January 2021, designated B20-01 through B20-30 and B21-31 through B21-35. The logs of the borings are presented in Appendix A and the boring locations are presented on the Site Plans, Figure 2 and 3.

The borings from June 2020 ranged from 1.1 to 40 feet below the existing site grades, with 19 of the 30 borings encountering practical refusal of the drilling equipment on bedrock or other obstructions prior to reaching planned termination depths of the borings. In January 2021, Hull returned to the Site to complete 6 additional borings to confirm the subsurface conditions across the Site. These borings were advanced to depths ranging between 11.1 and 24 feet bgs, with rock coring completed in borings B21-31, B21-34, and B21-34R.

The borings generally encountered similar conditions across the site, with asphalt/topsoil thicknesses ranging between 4 and 12 inches, underlain by generally medium stiff to hard clay with variable amounts of sand, gravel, and claystone/sandstone rock fragments, underlain by sedimentary bedrock.

The following exceptions were noted in borings B20-18 and B20-27:

- Very soft to soft clay soils with variable amount of coal and fill material were encountered in boring B20-18 at depths ranging from 0.5 to 5.5 feet below the ground surface; and
- Very soft to soft lean clay with abundant organic material (i.e., tree root) was encountered in boring B20-27 at depths ranging from 5.5 to 15.3 feet below ground surface.

Table 1 summarizes the locations, boring depths, existing ground surface elevations, bedrock or boring refusal depths, and groundwater levels observed during drilling.

Table 1 – Summary of Borings

Boring	Location	Boring Depth (feet)	Ground Surface Elevation (feet, NAVD88)	Bedrock or Boring Refusal Depth (feet)	Groundwater Levels	
					Depth BGS (feet)	Observation Type
B20-01	Sewer	9.6	1141	9.6	--	--
B20-02	Sewer	15.0	1098	-	--	--
B20-03	Sewer	7.2	1011	7.2	--	--
B20-04	Sewer	13.2	1010	13.2	--	--
B20-05	Sewer	6.1	1004	6.1	--	--
B20-06	Sewer	1.1	999	1.1	--	--
B20-07	Sewer	9.0	941	9.0	--	--
B20-08	Sewer	2	884	2.0	--	--
B20-08A	Sewer	15	884	-	8.5	Time of drilling
B20-09	WWTP	25	882	-	18.5	Time of drilling
B20-10	WWTP	25	882	-	--	--
B20-11	WWTP	40	877	-	13.5	Time of drilling
B20-12	Sewer	10	1080	-	--	--
B20-13	Sewer	15	1043	-	--	--
B20-14	Sewer	14.3	1028	14.3	--	--
B20-15	Sewer	4.4	992	4.4	--	--
B20-16	Sewer	17.5	1031	-	16.0	Time of drilling
B20-17	Sewer	9.4	1006	9.4	--	--
B20-18	Sewer	7.4	995	7.4	--	--
B20-19	Sewer	8.2	989	8.2	--	--
B20-20	Sewer	15	1113	-	--	--
B20-21	Sewer	9.4	1047	9.4	--	--
B20-22	Sewer	15	1021	-	13.5	Time of drilling
B20-23	Sewer	11.6	1005	11.6	--	--
B20-24	Sewer	6.9	991	6.9	--	--
B20-25	Lift Station	6.6	982	6.6	--	--
B20-26	Sewer	13.2	1001	13.2	--	--
B20-27	Sewer	15.6	1008	15.6	8.0	End of drilling
B20-28	Sewer	15	1058	-	--	--
B20-29	Sewer	8.9	988	8.9	--	--
B20-30	Sewer	10	877	-	3.5	Time of drilling
B21-31	Sewer	20	1004	1.8	--	--
B21-32	Sewer	18.4	1007	5.5	--	--
B21-33	Sewer	18.9	1000	7.0	18.0	End of drilling
B21-34	Lift Station	24	983	3.0	7.0	End of drilling
B21-34R	Lift Station	11.1	983	3.0	--	--
B21-35	Sewer	20	1022	9.7	--	--

Notes: Elevations for borings are approximate and estimated based on publicly available topographic mapping.
-- Denotes parameter not observed.

3.4.1 Wastewater Treatment Plant

The borings completed in the general vicinity of the proposed WWTP (B20-09, B20-10, B20-11 and B20-30) encountered a 2 to 5½-foot thick layer of processed aggregate comprised of very loose to very dense sand and gravel, underlain by very soft to stiff clayey/silty soils down to termination depth of the borings (i.e., 10 to 40 feet deep). Borings B20-09, B20-10, and B20-11 encountered very soft to soft fat clay from 5.5 feet below ground surface down to about 26½ feet below ground surface. Bedrock was not encountered in the borings completed near the WWTP.

3.4.2 Lift Station

The subsurface conditions at the proposed lift station, encountered in borings B20-25, B21-34, and B21-34R, consisted of a 10- to 12-inch-thick layer of topsoil. Below this surficial layer, the borings generally encountered medium dense to very dense gravel or sand with variable silt and clay to depths ranging between 3 and 6.6 feet bgs underlain by strong, weathered sandstone to termination depth of the borings.

3.5 Rock Coring

Rock coring was performed in borings B21-31, B21-34, and B21-34R. The results of unconfined compressive strength (UCS) testing of intact rock core collected from the borings is summarized below in Table 2, along with the proposed 8" sanitary sewer details.

Table 2 – Summary of Rock Strength Testing and Proposed 8" Sewer Pipe Details

Boring	Sample	Depth (feet bgs)	UCS (psi)	Proposed 8" Sewer Pipe Details	
				Location	Invert Depth (feet) / Elevation (feet, NAVD88)
B21-31	RC-1	10.8-11.0	3,465	Easy Street & High Street (STA 17+24.32)	13.58 / 990.25
		11.0-11.5	2,310		
		12.9-13.3	3,900		
		14.3-14.9	4,680		
B21-31	RC-2	17.0-17.8	3,740	Easy Street & High Street (STA 17+24.32)	13.58 / 990.25
B21-34	RC-1	19.3-19.5	953	Lift Station (STA 0+00)	7.77 / 973.73
		21.0-21.7	15,875		
		22.5-23.0	17,786		
		23.0-23.3	7,095		
B21-34R	RC-1	10.3-10.4	2,418	Lift Station (STA 0+00)	7.77 / 973.73
		10.6-10.8	5,376		

Notes: Pipe invert depths and elevations noted refer to flow in the northern direction.

3.6 Groundwater Conditions

The presence and level of groundwater was observed in 9 of the 37 borings at depths ranging from 3½ to 18½ feet below ground surface. The groundwater observations encountered at the time or end of drilling are summarized in Table 1. Zones of groundwater seepage and/or notable moisture changes observed during drilling are noted on the boring logs in Appendix A.

The groundwater observations, or lack thereof, represent conditions observed during drilling and may not represent the true static groundwater level because it can take hours or even days for the groundwater level observed in a boring to reach equilibrium. Consequently, the groundwater levels shown on the boring logs represent conditions at the time the observations were made and may be different at the time of construction. Groundwater levels at the site should be expected to fluctuate due to seasonal variations in the amount of rainfall, runoff, and other factors not evident at the time the field exploration was performed.

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 Summary

Hull completed geotechnical a field investigation that included the drilling and sampling of 37 borings and laboratory testing. These results have been used as the basis for developing the geotechnical engineering recommendations and conclusions presented in this Report. We understand that this report will be used for the design and construction of the proposed Site development.

We conclude that the planned improvements can be successfully constructed from a geotechnical perspective, provided the considerations presented in this report are incorporated into the project planning, design, and construction phases. A summary of the primary geotechnical considerations for the project is provided below. This summary is presented for introductory purposes and should be used in conjunction with the complete recommendations presented in this report.

- Planned excavations range from about 4 to 25 feet below the existing site grades and are generally expected to be completed above the groundwater table; however, where deeper excavations are planned the likelihood of encountering groundwater increase. Accordingly, the contractor should plan for temporary shoring and construction dewatering to construct the new structures and pipelines.
- If practical, we recommend that site preparation, earthwork, and construction activities be completed in the generally drier summer to early fall months in order to reduce earthwork and construction dewatering costs associated with these activities.
- Practical refusal of the drilling equipment was met in 19 of the 30 borings in June 2020 using a Geoprobe 7800 track-mounted drill rig. Six additional borings were completed in January 2021 to further explore and confirm the rock type and quality at the Site. These borings were advanced to depths ranging between 11.1 and 24 feet bgs, with apparent rock encountered between 1.8 and 9.7 feet bgs. These borings were able to be advanced by auger through the upper 8.2 to 16.0 feet of apparent rock. Advancing of drilling equipment in borings is typically suggestive that conventional construction equipment would be effective at excavating/ripping these materials. Rock coring was completed in borings B21-31, B21-34, and B21-34R at depths between 10.0 to 24.0 bgs. The results of the UCS testing of intact rock cores collected from the borings is summarized in Section 3.5. In general, the rock becomes less weathered as depths increase and will become more difficult to excavate.
- The near surface soils at the site contain sufficient fines (silt and clay) such that they are moisture-sensitive soils that will become easily disturbed when wet. We recommend site development be accomplished during extended periods of dry weather when the site soils will be less susceptible to disturbance due to rain and runoff and when the groundwater seepage is less. If construction is completed during the wet season, additional excavation and replacement of portions of structure subgrades may be needed.
- The on-site soils generally contain a significant percentage of fines (silt/clay) and are anticipated to be highly moisture sensitive and susceptible to disturbance during construction, especially when wet.
- A design frost penetration depth of 40 inches is recommend for the Site.
- Pursuant to ASCE/SEI 7-10 and the International Building Code (IBC), Site Class E is recommended for seismic design at the Site.

These and other geotechnical considerations are discussed further, and recommendations pertaining to the geotechnical aspects of the project are presented in the following sections of this report.

4.2 Earthwork

Earthwork is most efficiently accomplished using large, heavy-duty equipment, unimpeded by obstacles. Consequently, it is preferable to complete as much of this work as is possible prior to initiating other phases of construction, such as footing excavation and installation of underground utilities. We anticipate that the clayey soils and sand/gravel observed in the field explorations can be excavated with conventional grading equipment, such as track excavators or dozers. Based on the borings completed at the Site, excavation of rock may be required. The results of rock coring and UCS testing are presented in Section 3.5 for consideration as to excavation methods. Although not encountered in the borings, the contractor should be prepared to deal with debris, cobbles, and boulders within the soils at the site during construction.

4.2.1 Stripping Clearing and Grubbing

We recommend that areas to receive fill or structures should be cleared of vegetation and stripped of topsoil. Stripping depths on the order of 1 foot are expected; however, stripping depths will be locally greater where large trees or shrubs are cleared and grubbed.

Within the designated clearing limits, clearing should consist of removal of all surface and subsurface deleterious matter, including debris, trees, brush, shrubs and associated stumps and root wads, and should be stripped of any sod and organic soil. Any remaining below-grade elements from previous site development should also be removed. Abandoned, below-grade utilities should be removed; alternatively, below-grade utilities can be abandoned in place by completely filling the pipes/conduits with lean concrete.

Depressions/excavations that result from removal of existing improvements that are present in earthwork, foundation, slab, or pavement areas should be filled (if located in areas where proposed grades are higher than the base of the depression/excavation) with properly compacted structural fill.

4.2.2 Erosions and Sedimentation Control

Potential sources or causes of erosion and sedimentation depend upon construction methods, slope length, and gradient, amount of soil exposed and/or disturbed, soil type, construction sequencing and weather. The project's impact on erosion-prone areas can be reduced by implementing an erosion and sedimentation control plan. The plan should be designed in accordance with applicable local and/or county standards. The plan should incorporate basic planning principles including:

- Scheduling grading and construction to reduce soil exposure;
- Retaining existing vegetation whenever feasible;
- Revegetating or mulching denuded areas;
- Directing runoff away from denuded areas;
- Minimizing the length and steepness of slopes with exposed soils;
- Decreasing runoff velocities;

- Confining sediment to the project site;
- Inspecting and maintaining control measures frequently;
- Covering soil stockpiles; and
- Implementing proper erosion control best management practices (BMPs).

Temporary erosion protection should be used and maintained in areas with exposed or disturbed soils to help reduce the potential for erosion and reduce transport of sediment to adjacent areas. Temporary erosion protection should include the construction of a silt fence around the perimeter of the work areas prior to the commencement of grading activities. Permanent erosion protection should be provided by reestablishing vegetation using hydroseeding and/or landscape planting.

Until the permanent erosion protection is established and the site is stabilized, site monitoring should be performed by qualified personnel to evaluate the effectiveness of the erosion control measures and repair and/or modify them as appropriate. Provisions for modifications to the erosion control system based on monitoring observations should be included in the erosion and sedimentation control plan.

4.2.3 Subgrade Preparation

Prior to placing new fills, pavement base course materials or gravel below on-grade floor slabs, subgrade areas should be proof-rolled to locate any soft, pumping, or otherwise unsuitable soils. This is particularly imperative in those areas with existing fill and/or soft soils as discussed previously in this Report. Proofrolling can be completed using heavy tire-mounted equipment such as a loaded dump truck. During wet weather, the exposed subgrade areas should be probed to determine the extent of soft soils. If soft, pumping, or otherwise unsuitable soils are observed, they should be removed and replaced with structural fill.

If deep pockets of soft or pumping soils are encountered outside the building area, it may be possible to limit the depth of over-excavation by placing a non-woven geotextile fabric such as Mirafi 500X (or similar material) on the over-excavated subgrade prior to placing structural fill. The geotextile will provide additional support by bridging over the soft material and will help reduce fines contamination into the structural fill. This may be performed under pavement and building floor slab areas depending on actual conditions observed during construction, but it should not occur under future building foundations.

After the proofrolling is completed, the subgrade areas should be recompacted to a firm and unyielding condition, if possible. We recommend that subgrade areas be recompacted to at least 98 percent of the maximum dry density (MDD) in general accordance with the ASTM D698 (Standard Proctor) test procedure. If construction occurs during extended periods of wet weather, routing of equipment on the subgrade soils will be difficult, and the subgrade will likely become disturbed and softened. In addition, a significant amount of mud can be produced. Therefore, to protect the subgrade soils and to provide an adequate working surface for the contractor's equipment and labor, consideration should be given to placing a working pad

layer over the exposed subgrade soils. The working pad layer thickness and material should be the contractor's choice, but typically is about 12 inches thick and consists of clean granular materials. A geotextile separator, such as Mirafi 160N, may also be placed on the subgrade prior to placing the working pad layer to prevent fines from pumping up into the material under equipment loads.

The geotechnical engineer, or their representative, should observe the subgrade preparation operations to help determine the depth of removal of soft or pumping soils, and to evaluate whether subgrade disturbance or progressive deterioration is occurring. Subgrade disturbance or deterioration could occur if the subgrade is wet and cannot be dried. If the subgrade deteriorates during proof-rolling or compaction, it may become necessary to modify the proof-rolling or compaction criteria or methods.

4.2.4 Controlled Fill

Materials used to construct building pads, support foundations, slabs, mats, structures and pavements, or to backfill around structures are classified as "structural fill" for the purpose of this Report. Structural fill material should be free of debris, organic contaminants, frozen material, and rock fragments larger than 6 inches. The workability of material for use as structural fill will depend on the gradation and moisture content of the soil. As the amount of fines (silt/clay) increases, soil becomes increasingly more sensitive to small changes in moisture content and adequate compaction becomes more difficult to achieve. Additionally, all structural fill material should be free from contamination with topsoil, organic matter, asphalt/concrete, rocks having a major dimension greater than 3 inches, and frozen soil. Materials maximum dry density of less than 100 pounds per cubic foot (ASTM ID698) and/or are not considered satisfactory for use as fill. Additionally, soils classified as "silt" (ML or MH per USCS designation) are not recommended for use as structural fill material.

Materials

Structural fill material quality varies depending upon its use, as described below:

- Structural fill considered satisfactory for general grading, in parking areas, or to backfill utility trenches includes low plasticity clay soils having a liquid limit (LL) less than 40 and plasticity index (PI) less than 22 and granular soils (i.e., sand, gravel), provided the material is at a suitable moisture content to be properly compacted.
- Structural fill used for the 2-foot thickness of crushed rock below structural mat foundations and capillary break material should consist of clean crushed free-draining granular material with negligible sand or silt (e.g. No. 57 aggregate or approved alternate).
- Structural fill placed within 6 inches of perimeter foundation drains (drainage aggregate) should meet the requirements of Type 57 aggregate or approved alternate.
- Crushed surfacing base course placed below sidewalks and pavements should meet the requirements of Section 300 of the ODOT Construction and Material Specifications.

On-Site Soils

On-site material, with the exception of any topsoil, organic contaminated soil or other deleterious materials,

may be satisfactory for use as controlled fill for support of building, equipment, and pavements, subject to compactive effort applied and possible adjustment of moisture as may be required to achieve specified density requirements. Much of the on-site soils are anticipated to be highly moisture-sensitive should be assumed to require moisture-conditioning in order to meet the required compaction criteria during dry weather conditions and may not be suitable for reuse during wet weather.

Placement and Compaction Criteria

All suitable fill as required to establish planned grades, should be uniformly compacted to a firm, non-yielding condition in lifts not exceeding 8 inches loose thickness to a density of not less than:

- 98 percent of maximum dry density as established by ASTM procedure D 698 (Standard Proctor), in all areas.
- 100 percent of maximum dry density as established by ASTM procedure D 698 in all areas subject to train or vehicular traffic loads.

Before compaction, the material should be moisture conditioned to within about 3 percent of optimum moisture content to facilitate compaction. Compaction must be achieved by mechanical means. No jetting, ponding, or flooding should be allowed for compaction.

During fill and backfill placement, a suitable number of in-place density tests should be performed concurrently with the filling to check that the required compaction is being achieved.

4.2.5 Site Drainage

Adequate drainage should be established at the site to minimize any increase in the moisture content of the subgrade material. Positive drainage of the site should be created by gently sloping the surface away from the active construction equipment and towards the drainage swales and/or appropriate discharge locations. It should be noted that the subgrade soils are subject to shrinking and swelling due to changes in moisture content.

4.3 Temporary Shoring Support and Excavations

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. All excavations and shoring must comply with applicable local, state, and federal safety regulations including the current Occupational Safety and Health Administration (OSHA) Excavation and Trench Safety Standards (29 CFR Part 1926).

4.3.1 Temporary Cut Slopes

In general, temporary cut slopes should be inclined no steeper than about 1½H:1V above the groundwater table; however, the appropriate inclination must be determined based on actual site conditions at the time

of construction. This guideline assumes that all surface loads are kept at a minimum distance of at least one half the depth of the cut away from the top of the slope and that significant seepage is not present on the slope face. In our opinion, any excavations below the water table will be unstable and will either require temporary shoring or dewatering, or both, to complete the excavations successfully. Even with dewatering, some sloughing and raveling of the temporary slopes should be expected. For open cuts at the site we recommend that:

- Construction traffic, equipment, stockpiles or building supplies not be allowed within a distance of 5 feet from the top of the cuts.
- Surface water should be diverted away from the open excavations to reduce surface erosion of exposed soil along the slopes and to reduce the amount of water entering the excavations.
- The general condition of the slopes be observed periodically by a geotechnical engineer to confirm adequate stability.

If temporary cut slopes experience excessive sloughing or raveling during construction, it may become necessary to modify the cut slopes to maintain safe working conditions and protect adjacent facilities or structures. Slopes experiencing excessive sloughing or raveling can be flattened, supported with shoring, or additional dewatering can be provided if the poor slope performance is related to groundwater seepage.

4.3.2 Shored Excavations

Excavations deeper than 4 feet should be shored or laid back at a stable slope if workers are required to enter. Because of the diversity of available shoring systems and construction techniques, the design of temporary shoring is most appropriately left up to the contractor proposing to complete the installation. However, we recommend that the shoring be designed by a Professional Engineer (PE) licensed in the State of Ohio, and that the PE-stamped shoring plans and calculations be submitted to the Harrison County Commissioners and Hull for review prior to construction. The following paragraphs present general recommendations for the type of shoring system and design parameters that we conclude are appropriate for the subsurface conditions at the project.

We anticipate that the excavations will be shored using trench boxes, conventional sheet piles, a braced system, or a slide rail system. It will be preferable to use an "active" system (sheet piles, braced system or slide rail system) over trench boxes because typical trench box shoring results in voids between the trench box and soil, resulting in increased risks of soil caving. The lateral soil pressures acting on temporary supports will depend on the type and density of the soil behind the wall, the inclination of the ground surface behind the wall, and groundwater. For walls that are free to yield at the top at least one thousandth of the height of the wall (i.e., wall height times 0.001), soil pressures will be less than if movement is restrained. The design of temporary shoring should allow for lateral pressures exerted by the adjacent soil, and for surcharge loads resulting from structures, traffic, construction equipment, temporary stockpiles adjacent to the excavation, etc. Lateral load resistance can be mobilized through the use of braces, tiebacks, anchor blocks,

and passive pressures on members that extend below the bottom of the excavation. Temporary shoring used to support trench excavations typically uses internal bracing such as hydraulic shoring or trench boxes.

We recommend that yielding walls retaining on-site soils be designed using active earth pressures. For non-yielding (i.e., braced) systems, we recommend that the shoring be designed using at-rest earth pressure. If the shoring system is not adequately drained then full hydrostatic conditions should be assumed by the shoring designer. Hull can provide recommend earth pressures for the design of temporary shoring upon request if requested.

The soil pressure available to resist lateral loads against shoring is a function of the passive resistance that can develop on the face of below-grade elements of the shoring as those elements move horizontally into the soil. We recommend that the allowable passive resistance used for shoring design includes a factor of safety of about 1.5.

Hull can provide recommend earth pressures for the design of temporary shoring if requested.

4.4 Temporary Construction Dewatering

Groundwater was observed in the borings at depths between 3½ to 18½ feet bgs and planned excavation depths for the sewer and WWTP range to a maximum depth of about 25 feet bgs. Where deeper excavations are planned the likelihood of encountering groundwater increases. Accordingly, the contractor should plan for temporary construction dewatering to construct the new structures and pipelines and be prepared to proactively deal with groundwater seepage and/or surface water that may accumulate in excavations during construction.

We recommend that the design of the dewatering system be performed by an experienced dewatering specialist who is a PE Licensed in the State of Ohio. The contractor should be required to submit the proposed dewatering system design and plan layout to the Harrison County Commissioners and Hull for review and comment prior to beginning construction. A general discussion of the dewatering methods anticipated for the project is presented below.

4.4.1 Open Pumping

This dewatering method involves removing water that has seeped into the excavation by pumping from a sump that has been excavated usually at one end of the excavation or trench. Drainage ditches that are connected to the sump are typically excavated along the sidewalls at the base of the excavation or trench. The excavation for the sump and the drainage ditches should be backfilled with gravel or crushed rock to reduce the amount of erosion and associated sediment in the water pumped from the sump. In our experience, a slotted casing or perforated 55-gallon drum that is installed in the sump backfill provides a suitable housing for a submersible pump.

The amount of water removed from the excavation by open pumping should be minimized because of the potential for high turbidity levels that may prevent direct discharge. Temporary storage of dewatering effluent from the sumps in a settlement tank or basin may be required to meet discharge permit requirements and reduce sediment content prior to discharging the water to surface water courses. In our opinion, open pumping will only be feasible in excavations that are adequately shored and extend no deeper than about 2 to 3 feet below the groundwater table.

4.4.2 Vacuum Wellpoints

Vacuum wellpoints are effective for dewatering all types of soils, whether pumping small amounts of water from silt or large quantities of water from sand and gravel. The volume of water generated by a wellpoint system is typically less than the volume generated by a corresponding system of pumped wells because the wellpoints are generally completed at a shallower depth. Because of the shallower completion depth, the volume of aquifer that contributes water to a wellpoint system is less than for a comparable deep well system.

Wellpoint systems are most suitable for dewatering shallow excavations where the water table must be lowered no more than about 20 feet bgs. Multiple well point stages are generally required beyond that depth because of the physical limitations of suction lift.

4.4.3 Pumped Wells

Individually pumped dewatering wells may be considered for dewatering the construction areas. Pumped wells that have been properly installed and developed are capable of producing the high discharge rates that are necessary to dewater highly permeable sand deposits. Pumped wells are generally the most effective dewatering method in areas where dewatering to deeper than about 20 feet bgs is necessary.

We recommend that all dewatering wells installed for this project be properly developed to remove fine sediment from the immediate vicinity of the well screens. Proper development is essential for producing efficient wells and greatly reduces the turbidity of the water discharged from the well. Filter packs consisting of graded sand, or sand and fine gravel should be installed around the well screens in areas where the aquifer contains a high percentage of fine sand and silt.

4.4.4 Other Considerations

An important issue for any significant dewatering project is the potential impact of lowering the groundwater table beneath adjacent structures and facilities. When the groundwater table is lowered in loose sands or soft silt, the increase in effective weight or reduction in buoyancy tends to cause these materials to settle. This settlement, if excessive, can cause damage to buried utilities or to shallow foundations. The potential off-site impacts from dewatering could be serious, with numerous possible sources for claims (e.g. broken utilities, damage to roads and utilities). Therefore, it is critical that the dewatering program be designed to

minimize off-site impacts. It is also critical for the owner and contractor's protection to initiate a monitoring program where groundwater impacts could occur.

4.5 Settlement and Vibration Potential during Construction

Peak particle velocity (PPV) is the generally accepted vibration component for assessing the potential for damaging vibrations produced by a wide variety of energy sources, including construction equipment. Empirical studies show that the PPV associated with ground vibrations is inversely and exponentially proportional to the distance for the source vibration. In other words, the PPV decreases very rapidly with distance from the source vibration. For example, the PPV measured at a distance of 100 feet from the source will be approximately 0.1 percent of the PPV measured at the source for typical construction-related vibrations. Because of the exponential rate of energy decay with distance from the source, variations in subsurface material type have only a minor effect on PPV, as compared to source distance.

A PPV of 2 inches per second is generally considered a threshold value for inducing damage to residential structures located near construction sites and quarry blasting operations (ISEE 1998). A PPV of 0.5 inches per second has been proposed as a threshold value of "old residential structures in very poor condition" (Wiss 1981). Similarly, Hudson and Harrison (1997) report the tolerable PPV limit of 0.5 to 2 inches per second for residential masonry buildings. By way of comparison, a PPV of 0.02 inches per second is considered the threshold for human perception of motion. ISEE (1998) reports that a PPF of 5.4 inches per second would be expected to cause minor damage to an average house subjected to quarry blasting vibrations and a PPV of 20 inches per second would be expected to cause damage to nearly all houses. It has been demonstrated that an upper PPV limit of 12 inches per second is adequate to protect buried steel pipelines in most circumstances (Oriard 2002).

For preliminary risk assessment purposes, we evaluated the distance expected to produce PPV values of 0.5 and 2 inches per second for the anticipated construction activities/equipment as summarized in Table 3 below.

Table 3 – Summary of Anticipated Construction Vibrations

Construction Equipment/Activity	Distance (feet)	
	PPV = 0.5 in/sec	PPV = 2.0 in/sec
Caisson Drilling and Large Bull Dozers	8	3
Trucks	7	< 3
Jack Hammering	4	< 2
Crane Idling	< 2	< 1

Using available published information, ground vibrations produced by the anticipated construction activities

are expected to be much less than damage threshold values at the nearby homes. However, human perception of vibration is very sensitive and is much lower than the level to damage residential structures. Therefore, we recommended the following be considered to manage the risk associated with potential homeowner claims of damage from the planned construction activities:

- Complete outreach to the community informing them of the construction activities and what to expect by way of vibrations in addition to schedule, noise, street closures, etc.
- Document the exiting conditions of the adjacent structures prior to construction with photographs and/or video. It is not uncommon for homeowners to notice preexisting cracks in their home's foundation, concrete finishes, and masonry until after a construction project is underway.
- Obtain seismographic test data early on during construction to record the real-time vibration intensity with distance for the various construction activities/equipment and to document that construction-included vibrations are below damage thresholds.

We do not anticipate measurable settlement of the near surface soils adjacent to the construction from construction vibrations at the site.

4.6 Sewer Design

4.6.1 Earth Pressures

We recommend that the sewer be designed considering the full weight of the overburden soils above the pipes. The overburden soil weight can be evaluated assuming a total unit weight of 125 pcf. Resistance to uplift below groundwater can be developed by the dead weight of the structure and friction along the sides of the structure. Frictional resistance can be computed using a coefficient of friction of 0.40 applied to the lateral soil pressures. This coefficient of friction is an allowable value and includes a factor of safety. We recommend that lateral soil pressures for uplift resistance be computed using an equivalent fluid density of 30 pcf.

4.6.2 Sewer Support

Based on information obtained from our subsurface explorations, the subsurface materials expected to be encountered at subgrade level will provide adequate support for the sewer throughout the entire alignment. If soft or otherwise unsuitable soils are encountered at subgrade depth, we recommend that the soft materials be overexcavated to firm subgrade, or to at least 12 inches below design subgrade. Thereafter, the overexcavations can be backfilled with on-site material that is of structural fill quality or imported structural fill. Based on the borings completed at the Site, excavation of rock may be required in areas along the sewer alignment. The confirmation borings completed in January 2021 indicate the existence of weathered rock in the borings that were able to be advanced by augering to their respective termination depths (i.e., B21-32, B21-33, B21-35). These borings near the sewer alignment suggest that weathered rock may be excavated using conventional construction equipment. The results of rock coring and UCS testing for borings

B21-31, B21-34, and B21-34R are presented in Section 3.5 for consideration as to excavation methods. In general, the rock becomes harder and less weathered with depth.

4.7 WWTP Design and Construction

4.7.1 Earth Pressures

We recommend that the WWTP's structural elements and pipelines be designed considering the full weight of the overburden soils above the structures and pipes, if applicable. The overburden soil weight can be evaluated assuming a total unit weight of 125 pounds per cubic foot (pcf). Resistance to uplift below groundwater can be developed by the dead weight of the structure and friction along the sides of the structure. Frictional resistance can be computed using a coefficient of friction of 0.40 applied to the lateral soil pressures. This coefficient of friction is an allowable value and includes a factor of safety. We recommend that lateral soil pressures for uplift resistance be computed using an equivalent fluid density of 30 pcf.

4.7.2 Structural Support

In the vicinity of the planned WWTP, borings B20-09, B20-10, and B20-11 encountered very soft to soft fat clay from 5.5 feet below ground surface down to about 26½ feet bgs.

Alternate foundation options considered feasible to mitigate settlement beneath WWTP structures include, but are not limited to; surcharge/preload, grade beams, piles, and ground improvement.

Hull will provide geotechnical design and construction recommendations for these alternatives, or others, based on the actual Site development plan and loading.

4.8 Underground Structure Design

The following recommendation are for preliminary design purposes and will be revised based on the actual Site development plan and loading

4.8.1 Lateral Loads

We anticipate that the walls of below grade structures will be restrained from movement and may be subjected to permanent pressures from groundwater. Therefore, the walls should be designed for lateral pressures corresponding to at-rest soil pressure and for full hydrostatic pressures below the design ground water level. For these conditions, we recommend using a design lateral pressure for static loading conditions based on an equivalent fluid density of 60 pcf above the groundwater level and 90 pcf below the groundwater level.

These lateral soil pressures do not include traffic or other surcharges that should be added separately, if appropriate. Typically, below grade walls are designed for a surcharge pressure for traffic loading. For traffic loading, we recommend that below grade walls be designed for a uniform surcharge pressure determined by increasing the apparent height of the backfill around the wall by 2 feet. Other surcharge

loads should be included as appropriate. The above recommendations for lateral pressures acting on below grade walls assume that the ground surface behind the walls is relatively level.

4.8.2 Structural Mat Foundations

Concrete structural mat foundations may have flat bottoms or may be thickened below the perimeter and interior walls or areas of concentrated loading.

For preliminary design purposes, structural mat foundations can be evaluated assuming a subgrade modulus of 150 pounds per cubic inch (pci). Local bearing pressures below concentrated loads can be evaluated assuming an allowable soil bearing pressure of 3,000 pounds per square foot (psf). This bearing value considers combined dead and long-term live loads, and may be increased by up to one-third to account for short-term live loads such as wind or seismic forces.

We recommend that the Geotechnical Engineer observe the final subgrade below structural mat foundations to evaluate if the subgrade conditions are as expected, and to provide recommendations for design changes should the conditions encountered during construction differ from those anticipated.

4.8.3 Settlement Potential

Provided all loose/soft soil is removed and the subgrade is prepared as recommended under "Construction Considerations" below, we estimate the total settlement of buried structure foundations will be on the order of 1 inch or less. The settlements will occur rapidly, essentially as loads are applied.

4.9 Shallow Foundations

Shallow foundations are considered suitable support for lightly loaded structures throughout the site. The site near-surface conditions generally consist of soft to stiff clay and we conclude that some portions of the site may require overexcavation or ground improvement for typical shallow foundations.

4.9.1 Design Considerations

Hull recommends that conventional strip or isolated spread foundations be founded on the undisturbed medium stiff or stiffer native clay/silt soils encountered in the borings completed at the site. Individual column footings and continuous wall footings should have minimum widths of 30 and 18 inches, respectively. We recommend that all exterior footings be founded a minimum of 40 inches below the lowest adjacent grade for frost protection, although, local building codes should be consulted for minimum footing depths below finished grade. Interior footings in heated areas may be placed at a convenient depth below building floor slab level, provided they bear on suitable material.

Footings bearing on native medium stiff or stiffer clay soils may be designed for a maximum net allowable bearing pressure of 2,500 pounds per square foot (psf), when the subgrade preparation and controlled fill

procedures outlined in other sections of this report are followed. This allowable bearing capacity may be increased by one-third to account for short-term live loads such as induced by wind or seismic forces.

Footings subgrades consisting of soft soils, as encountered near the ground surface in borings B20-04, B20-05, B20-8A, B20-12, B20-13, B20-14, B20-17, and B20-18, should be overexcavated to a suitable subgrade of medium stiff or stiffer soils and backfilled with controlled fill to support shallow foundations or otherwise designed using a reduced bearing capacity.

4.9.2 Settlement Potential

We estimate the total postconstruction settlement of footings founded on medium stiff or stiffer soils or on controlled fill extended to these soils, as recommended, should be less than 1 inch. Differential settlement between comparably loaded column footings or along a 25-foot section of continuous wall footing should be less than ½ inch. We expect that most the footing settlements will occur as loads are applied. Loose, soft, or disturbed soils not removed from footing excavations prior to placing concrete could result in additional settlement.

4.9.3 Construction Considerations

All foundation excavations should be cut to vertical side walls and flat bottoms with the bottoms being firm soil undisturbed by the method of excavation or softened by standing water and/or organic matter. Conventional backhoe type equipment may be used, except in the last few inches when hand excavation methods may be required. Before the placement of backfill or concrete, accumulated water, organics, loose/soft soil and/or debris should be removed from the excavations. Concrete placement should follow excavation and bearing surface examination as soon as practical.

A Geotechnical Engineer, or their representative, should examine footing excavation bottoms, prior to placement of reinforcing steel and concrete to confirm suitability of the subgrade soils. We recommend that the footing excavations extend beyond soft soils and bear on medium stiff or stiffer native undisturbed soils. If suitable bearing is not encountered at the proposed bottom of the excavation, the following should be performed as approved by the Geotechnical Engineer and concurred with by the Structural Engineer: 1) footings should be redesigned for the lower allowable bearing capacity encountered, 2) the footings should be extended until competent soil is encountered, or 3) the underlying unsuitable soils should be removed and replaced with acceptable engineered fill.

Relative to excavation and replacement of unsuitable soils, the following is recommended:

- The bottom plan area of the excavation should extend beyond the outer edge of the exterior footings by a distance equal to the depth of the excavation below the bottom of the footing plus 5 feet.

- The excavation should be performed using conventional backhoe type equipment to minimize disturbance to the soils at the bottom of the excavation.
- The bottom of the excavation should be examined and approved for fill placement by the Geotechnical Engineer.
- All fill should be placed and compacted under the continuous observation and testing by a technician under the general guidance of the Geotechnical Engineer.

4.10 On-Grade Slabs

Based on the subsurface conditions encountered in the borings, typical slab-on-grade construction is anticipated to be adequate for future Site development. For slabs designed as a beam on an elastic foundation, a modulus of subgrade reaction of 100 pounds per cubic inch (pci) may be used for subgrade soils prepared as recommended (i.e. founded on medium stiff or stiffer subgrade or controlled fill over medium stiff or stiffer subgrade). Where slab-on-grade construction is planned in areas with soft subgrade conditions, as encountered in some of the borings, overexcavation and replacement of unsuitable soils will likely be required. For planning purposes, a minimum 2-foot overexcavation and replacement with gravel should be considered for "settlement sensitive" on-grade slabs to mitigate settlement potential; however, these recommendations should be verified, and adjusted as appropriate, during final design.

4.11 Pavement Considerations

Where subgrades are prepared in accordance with the recommendations presented in this report, we recommend that an effective CBR value of 5 and a subgrade modulus of 100 pounds per cubic inch (pci) for the on-site clayey soils can be used for design of the design of flexible (asphalt) and rigid (Portland cement) pavements, respectively. At a minimum, we recommend that the upper 12 inches of the existing subgrade soils be compacted to at least 100 percent of the maximum dry density obtained using the ASTM D698 (Standard Proctor) test method prior to placing pavement section materials. If the subgrade soils are loose or soft, it may be necessary to locally excavate the soils and replace them with structural fill.

For planning purposes, we recommend that pavement in areas to be used exclusively for light vehicle parking (no heavy truck parking) consist of a minimum 3 inches of hot mix asphalt (HMA) asphalt over 8 inches of densely compacted crushed rock base course. For pavement in access drives and truck parking areas, we recommend a minimum section of 4 inches of HMA over 10 inches of densely compacted crushed rock base course. Portland cement concrete (PCC) pavement sections should be considered for loading dock aprons, trash dumpster areas, and where other concentrated heavy loads may occur. We recommend that these pavements consist of at least 8 inches of PCC.

The minimum pavement sections recommended above are based on our experience. Thicker pavement sections may be needed based on the actual traffic data and intended use. Final pavement design should consider the actual subgrade materials to support the planned pavements, site grading (e.g. cut, fill), pavement type selection, and the desired trafficability, serviceability, and future maintenance expectations.

We recommend that the pavement designer verify the CBR value used for final design by performing additional laboratory/field tests of the representative soil subgrade as the project progresses into final design and construction phases.

4.12 Seismic Site Class

Pursuant to ASCE/SEI 7-10 and the International Building Code (IBC), Site Class E is recommended for seismic design of structures at the WWTP having a fundamental period of vibration that is no more than 0.5 seconds. This recommendation is based on the soil conditions encountered to the limited depth of the borings complete in the vicinity of the WWTP.

4.13 Additional Geotechnical Services

The evaluations, conclusions, and recommendations presented in this report are based on information disclosed by the limited number of widely spaced borings at the site. The field exploration (i.e., borings) and laboratory testing identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Hull reviewed field and laboratory data and then applied our professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ, sometimes significantly, from those indicated in this report.

Our Report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions. The recommendations presented in this report are based in part on the assumption that certain natural conditions will actually be encountered and not altered during construction. Consequently, it is recommended that the construction observation and testing be performed under the direction of a qualified Geotechnical Engineer. The recommendations in this Report can be finalized only by observing actual subsurface conditions revealed during construction. Hull cannot assume responsibility or liability for this Report's recommendations if we do not perform construction observation. Therefore, sufficient monitoring, testing and consultation by Hull should be provided during construction to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated, and to evaluate whether or not earthwork activities are completed in accordance with our recommendations. Retaining Hull for construction observation for this project is the most effective method of managing the risks associated with unanticipated conditions.

Furthermore, any revision in the plans for the proposed Site from those enumerated in this report should be brought to the attention of Hull so it may be determined if changes in the earthwork recommendations are required. If additional data are needed for design purposes or if deviations from the noted subsurface conditions are encountered during construction, they should all be brought immediately to the attention of Hull. At that time, it may be necessary for Hull to submit modified or supplementary recommendations, if needed.

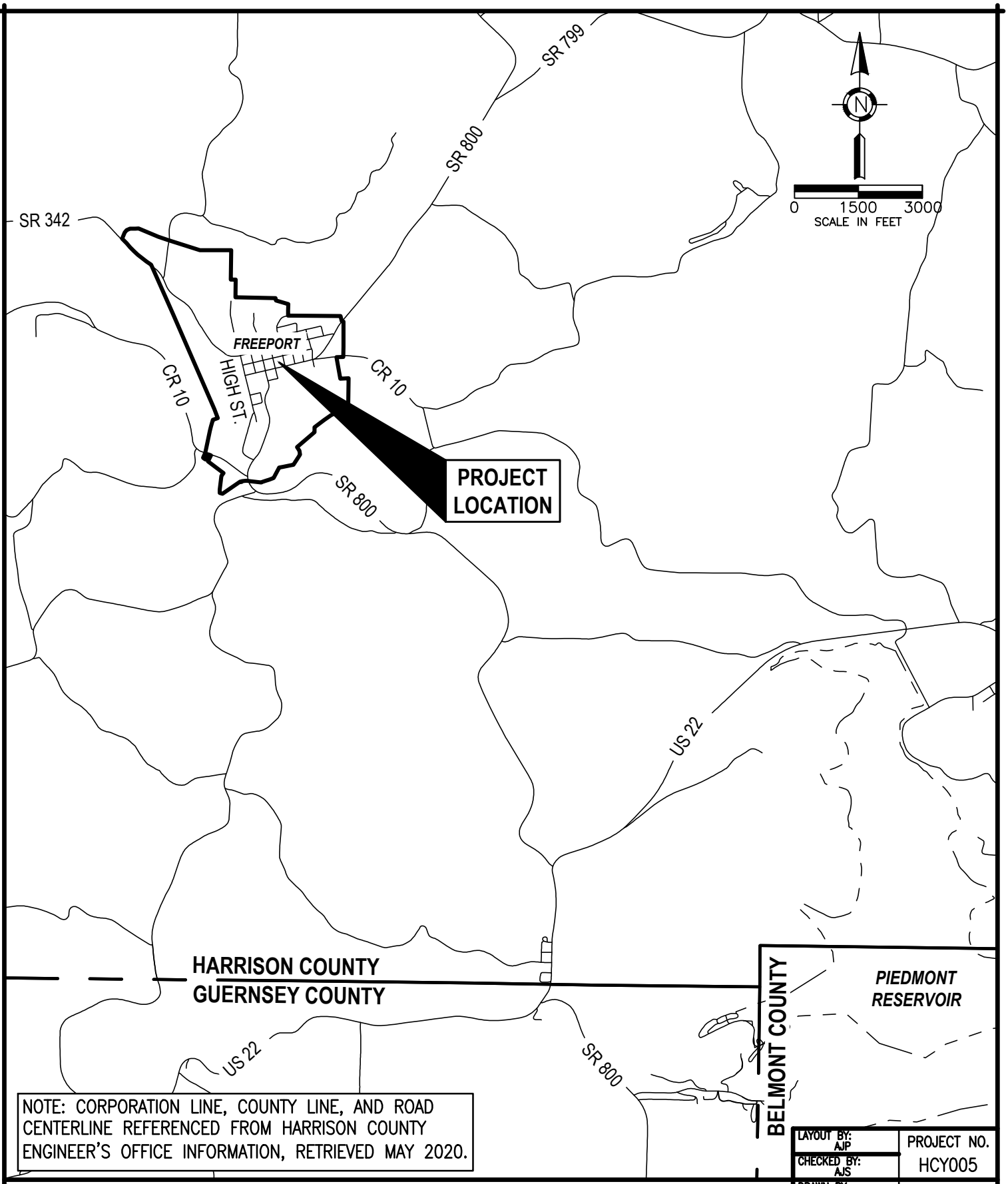
5.0 STANDARD OF CARE AND LIMITATIONS

Hull has prepared this Report for the sole use of the Harrison County Commissioners and their authorized agents for the proposed Freeport Sanitary System Improvements project in the Village of Freeport, Harrison County, Ohio. The contents thereof may not be used or relied upon by any other person or entity, without the express written consent and authorization of the Reagent and Hull.

The conclusions and recommendations presented herein are based on the level of effort and investigative techniques using that degree of care and skill ordinarily exercised under similar conditions by reputable members of the profession practicing in the same or similar locality at the time of service. No other warranties, expressed or implied, is made or intended by this report. An evaluation of past or present compliance with federal, state, or local environmental or land use laws or regulations has not been conducted. It should be noted that environmental studies were not performed as part of this scope of work, and, as such, no recommendations relative to environmental issues are included in the report. Conclusions presented by Hull regarding the site are consistent with the scope of work, level of effort specified, and investigative techniques employed. Reports, opinions, letters, and other documents do not evaluate the presence or absence of any compound or parameter not specifically analyzed and reported. Hull makes no guarantees regarding the completeness or accuracy of any information obtained from public or private files. In addition, Hull makes no guarantees on the condition of the Site or changes in Site records after the date reviewed as indicated in the Report.

Our geotechnical recommendations are not intended to direct the contractor's procedures, methods, schedule, or management of the work site. The contractor is solely responsible for job site safety and for managing construction operations to minimize risks to on-site personnel and to adjacent properties. Under no circumstance should the information provided be interpreted to imply Hull is assuming responsibility for job site safety.

FIGURES



NOTE: CORPORATION LINE, COUNTY LINE, AND ROAD CENTERLINE REFERENCED FROM HARRISON COUNTY ENGINEER'S OFFICE INFORMATION, RETRIEVED MAY 2020.

LAYOUT BY: AJP	PROJECT NO.
CHECKED BY: AJS	HCY005
DRAWN BY: AJP	FIGURE
DATE: 2/5/2021	1

FREEPORT SANITARY SYSTEM IMPROVEMENTS
HARRISON COUNTY WATER & SEWER DISTRICT

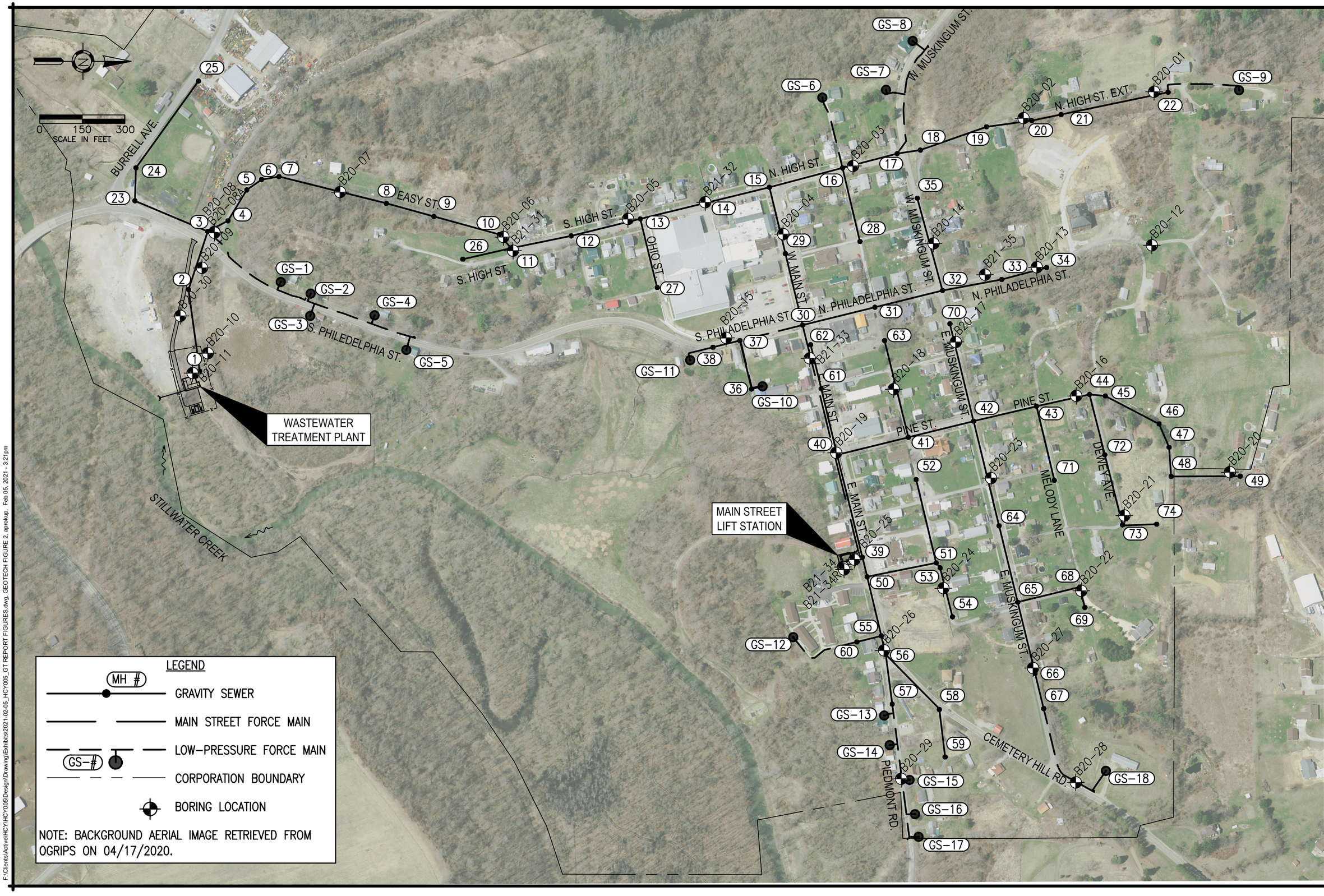
VILLAGE OF FREEPORT
HARRISON COUNTY
OHIO

VICINITY MAP

HULL
Environment / Energy / Infrastructure

6397 EMERALD PARKWAY
SUITE 200
DUBLIN, OHIO 43016
PHONE: (614) 793-8777
FAX: (614) 793-9070
www.hullinc.com

F:\Clients\Active\HCY\HCY005\Design\Drawing\Exhibits\2020-07-21_HCY005_GT REPORT VICINITY MAP.dwg, GEOTECH FIGURE 1, aprokup, Feb 05, 2021 - 3:32pm



F:\Clients\Active\HCY\HCY005\Design\Drawing\Exhibits\2021-02-05_HCY005_GT REPORT FIGURES.dwg, GEOTECH FIGURE 2, aprokup, Feb 05, 2021 - 3:21pm

HULL
Environment / Energy / Infrastructure
6397 EMERALD PARKWAY
SUITE 200
DUBLIN, OHIO 43016
PHONE: (614) 793-8777
FAX: (614) 793-9070
www.hullinc.com

SITE PLAN

FREEPORT SANITARY SYSTEM IMPROVEMENTS
HARRISON COUNTY WATER & SEWER DISTRICT

LAYOUT BY:	AJP
CHECKED BY:	AJS
DRAWN BY:	AJP
DATE:	2/5/2021
PROJECT NO.	HCY005
FIGURE	2

N

0 30 60
SCALE IN FEET

4

B20-08
B20-08A

3

B20-30

S. PHILADELPHIA STREET / SR 800

2

GRAVEL ACCESS DRIVE

B20-30

B20-10

FENCE

1

ELECTRICAL BUILDING

B20-11

WASTEWATER
TREATMENT PLANT

OUTFALL

STILLWATER CREEK

LEGEND

MH #

GRAVITY SEWER

LOW-PRESSURE FORCE MAIN

CORPORATION BOUNDARY

BORING LOCATION

NOTE: BACKGROUND AERIAL IMAGE RETRIEVED FROM OGRIPS ON 11/12/2020.

F:\Clients\Active\HCY\HCY005\Design\Drawing\Exhibits\2021-02-05_HCY005_GT REPORT FIGURES.dwg, GEOTECH FIGURE 3, aprokup, Feb 05, 2021 - 3:45pm

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6397 EMERALD PARKWAY
SUITE 200
DUBLIN, OHIO 43016
PHONE: (614) 793-8777
FAX: (614) 793-9070
www.hullinc.com

WASTEWATER TREATMENT PLANT
SITE PLAN

FREEPORT SANITARY
SYSTEM IMPROVEMENTS
HARRISON COUNTY WATER &
SEWER DISTRICT

LAYOUT BY: AJP
CHECKED BY: AJS
DRAWN BY: AJP
DATE: 2/5/2021
PROJECT NO. HCY005
FIGURE 3

APPENDIX A

FIELD EXPLORATION

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GENERAL INFORMATION, DRILLING PROCEDURES AND LOGS OF BORINGS

Subsurface conditions at the Site were explored by drilling and sampling 37 borings to depths ranging between 1.1 and 40 feet below the ground surface (bgs). The drilling was performed in June 2020 and January 2021 by Envirocore, Inc. under subcontract to Hull. The borings were drilled with a track-mounted Geoprobe 7800 or a Mobile B-57 drill rig utilizing 3¼-inch inside-diameter hollow-stem augers and NQ-size rock core drill tooling. The borings were continuously monitored by a geologist or engineer from our firm who examined and classified the soils encountered, obtained representative soil samples, observed groundwater conditions, and prepared a detailed field log of each exploration.

The soils encountered in the borings were sampled at 2½- or 5-foot vertical intervals with a 2-inch outside diameter split-barrel standard penetration test (SPT) sampler. The samples were obtained by driving the sampler 18 inches into the soil with a 140-pound hammer free-falling 30 inches. The number of blows required for each 6 inches of penetration was recorded. The blow count ("N-value") of the soil was calculated as the number of blows required for the final 12 inches of penetration. This resistance, or N-value, provides a measure of the relative density of granular soils and the relative consistency of cohesive soils. Where very dense or hard soil conditions precluded driving the full 18 inches, the penetration resistance for the partial penetration was entered on the logs. The blow counts are shown on the boring logs at the respective sample depths. It should be noted that the SPT blow counts reported on the boring logs are uncorrected, field-recorded blow counts and have not been adjusted/corrected for field procedures, hammer efficiency, etc. Additionally, the SPT sampler is limited to the collection of material that is smaller than its nominal 1.4-inch inside diameter. Therefore, the presence of larger gravels, cobbles, and boulders noted on the boring logs is generally inferred rather than through actual collection of these larger constituents by typical sampling procedures.

The boring logs included in this Appendix are based on our interpretation of the field and laboratory data and indicate the various types of soil or rock encountered and therefore contain both factual and interpretative information and are not an exact copy of the field log. In the field and/or laboratory, all samples were described based on the visual-manual examination soil classification system in general accordance with ASTM D2488 or based on the laboratory test results in general accordance with ASTM D2487. The logs also indicate the depths at which these soils or their characteristics change, although the change may actually be gradual. If the change occurred between samples, it was interpreted. The densities noted on the boring logs are based on the blow count data obtained in the borings and judgment based on the conditions encountered.

The depth of groundwater recorded on the boring logs was measured from the top of the existing ground surface to the top of the observed water level. The groundwater observations, or lack thereof, represent only conditions observed during or at the end of drilling, and may not represent the true static groundwater level because it can take hours or even days for the groundwater level observed in a borehole to reach equilibrium. Consequently, the groundwater observations shown on the boring logs only represent conditions at the time the readings were collected. Furthermore, the use of drilling fluids (e.g., mud) added to the boreholes can alter the observed groundwater levels or otherwise make observations of groundwater within the borehole not possible.

Although we believe that the borings have disclosed information generally representative of actual site conditions, it should be expected that between borings conditions may occur which are not precisely represented by any one of the borings. Soil deposition processes and natural geologic forces are such that soil and rock types and conditions may change in short vertical intervals and horizontal distances.

Soil and rock samples obtained from the borings will be stored for a period of 90 days. After this period of time, they will be discarded, unless notified to the contrary by the client.

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DEFINITION OF TERMS USED TO DESCRIBE SUBSURFACE MATERIALS ON BORING LOGS

DESCRIPTION OF SOILS

The material descriptions of the soils on the boring logs are based on visual-manual examination (ASTM D2488), Standard Penetration Test (ASTM D1586) results, and the results of laboratory testing on selected soil samples. Soils are described as to color, moisture condition, density or consistency, and other pertinent properties, in that order. SAA indicates material can be described as "Same as Above", with any differences noted. Soil descriptions are according to the following criteria, with the principal constituent, written in capital letters.

Standard Penetration Test (ASTM D1586)

In the Standard Penetration Test (SPT), a 2.0-inch outside diameter, 1.375-inch inside diameter split-spoon sampler is driven 18 inches into soil with a 140-pound hammer dropped 30 inches. The sampler is normally driven in three successive 6-inch increments. The total number of blows required to drive the split spoon sampler over 12 inches of penetration during the second and third successive increments is the SPT "N-Value". Where very dense or hard soil conditions precluded driving the full 18 inches, the penetration resistance for the partial penetration was entered on the logs (e.g., 50/3 indicates 50 blows were recorded for a 3-inch penetration).

Sampling Method Abbreviations

Methods by which soil samples are collected for analysis are abbreviated as follows:

AS	Auger Sample (sample collected directly from auger flight)
SPT	Standard Penetration Test (1.375-inch I.D. Split Spoon)
MC	Modified California Sampler (2.4-inch I.D. Split Spoon)
PS	Piston Sample (Shelby Tube Sample)
ST	Shelby Tube Sample
DP	Direct Push Sample
RC	Rock Core

Color

Soil color is described in basic terms, such as brown, black, red, grey, and yellow. If the soil is a uniform color throughout, the term is single, modified by adjectives such as light and dark. If the predominant color is shaded by a secondary color, the secondary color precedes the primary color. If two major and distinct colors are swirled throughout the soil, the colors are modified by the term "mottled".

Moisture Condition

Moisture condition may be written as dry, moist, or wet as described below:

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible moisture
Wet	Visible free water, usually soil below the water table

Density of Cohesionless Soils

Density of cohesionless soils (i.e., sand and gravel) is based upon SPT results as indicated below:

Density	**SPT N-Value** (blows per foot)
Very loose	0 to 4
Loose	4 to 10
Medium Dense	10 to 30
Dense	30 to 50
Very Dense	Over 50

Consistency of Cohesive Soils

Consistency of cohesive soils (i.e, silt and clay) is based on SPT results and unconfined compressive strength.

Consistency	**SPT N-Value** (blows per foot)	**Unconfined Compressive Strength** (tons per square foot)
Very soft	0 to 2	< 0.25
Soft	2 to 4	0.25 to 0.5
Medium stiff	4 to 8	0.5 to 1.0
Stiff	8 to 16	1.0 to 2.0
Very stiff	16 to 30	2.0 to4.0
Hard	Over 30	> 4.0

Component Definitions by Grain Size (ASTM D653)

Material	Definition		Size Range	
			Upper	Lower
Boulders	Material too large to pass through an opening 12 in. square.			12 inches
Cobbles	Material passing through a 12 in. square opening and retained on the 3-inch sieve.		12 inches	3 inches
Gravel	Material passing the 3 in. sieve and retained on ¼ in. (No. 4) sieve.	Coarse Fine	3 inches ¾ inch	¾ inches No. 4 (¼ inch)
Sand	Material passing the No. 4 sieve and retained on the No. 200 Sieve.	Coarse Medium Fine	No. 4 (¼ inch) No. 10 (⅛ inch) No. 40 (1/32 inch)	No. 10 (⅛ inch) No. 40 (1/32 inch) No. 200
Silt	Material passing the No. 200 sieve, which is usually non-plastic or very slightly plastic in character and exhibits little or no strength when air dried.		No. 200	
Clay	Material passing the No. 200 sieve, which can also be made to exhibit plasticity within a certain range of moisture contents and which exhibits considerable strength when air dried.		No. 200	

Soil Constituents

Soil constituents may be stated in terms of percentages (by weight) of gravel, sand, and fines, as follows:

Trace	particles of a given size range present, but present at <5%
Few	5 to 15%
Little	15 to 25%
Some	30 to 45%
Mostly	50 to 100%

Field/Laboratory Test Abbreviations

Methods by which soil samples are tested in the field/laboratory are abbreviated as follows:

PP	Pocket Penetrometer
MC	Moisture (Water) Content
LL	Liquid Limit
PL	Plastic Limit
PI	Plasticity Index
%F	Fines Content (% by Weight finer than the #200 sieve)

DESCRIPTION OF ROCK

Degree of Weathering

The following terms are used to describe the degree of weathering of the rock specimen relative to that of the comparable unweathered parent rock (relative strength/hardness should not be confused with degree of weathering.):

Unweathered	No evidence of any chemical or mechanical alternation of the rock mass. Mineral crystals have a bright appearance with no discoloration. Fractures show little or no staining on surfaces.
Slightly Weathered	<10% of rock volume altered. Slight discoloration of the surface w/minor alterations along open fractures.
Moderately Weathered	Portions of the rock mass are discolored as evident by a dull appearance. Surfaces may have a pitted appearance. Isolated zones of varying rock strengths due to alteration may be present. 10 to 15 percent of the rock volume presents alterations.
Highly Weathered	Entire rock mass appears discolored and dull. Some pockets of slightly to moderately weathered rock may be present and some areas of severely weathered materials may be present.
Severely Weathered	Majority of the rock mass reduced to a soil-like state with visible relict rock texture. Zones of more resistant rock may be present, but the material can generally be molded and crumbled by hand pressures.

Relative Strength/Hardness

The following terms are used to describe the relative strength/hardness of the bedrock:

Very Weak	Can be easily scratched by fingernail or knife. Pieces 1 inch (25 mm) or more in thickness can be broken by finger pressure.
Weak	Can be grooved or gouged readily by a knife or pick. Can be excavated in small fragments by moderate blows of a pick point. Small, thin pieces can be broken by finger pressure.
Moderately Strong	Can be scratched with a knife or pick. Grooves or gouges to ¼ inch (6 mm) deep can be excavated by hand blows of a geologist's pick. Requires moderate hammer blows to detach specimen.
Strong	Can be scratched with a knife or pick only with difficulty. Requires hard hammer blows to detach specimen.
Very Strong	Cannot be scratched by a knife or sharp pick. Breaking of hand specimens requires hard repeated blows of the geologist hammer.

Rock Quality Designation (RQD)

RQD is expressed in percent and is an indirect measure of rock soundness. It is obtained by summing the total length of all core pieces which are at least four inches long, and then dividing this sum by the total length of the core recovered.

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BORING NUMBER B20-01

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 6/5/20 **COMPLETED** 6/5/20
GROUND ELEVATION 1141 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Geoprobe 7800 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING --- none observed
LOGGED BY L. Flesher **CHECKED BY** S. Aboulhosn
AT END OF DRILLING --- none observed
COORDINATES 40.213568°, -81.269673°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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	1140		4 inches ASPHALT										
			SILTY SAND WITH GRAVEL, (SM) light brown, moist, medium stiff	SPT 1	78	0-0-7 (7)	0.75		17.4				
			LEAN CLAY WITH SAND, (CL) tan, moist, very stiff to hard, (weathered shale)	SPT 2	100	9-10-11 (21)			8.4				34
5	1135			SPT 3	100	6-13-14 (27)							
				SPT 4	100	15-19-50/1 (69/7)							

Auger refusal at 9.6 feet.
Bottom of borehole at 9.6 feet.
Borehole cave-in at 6.2 feet following auger removal.

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BORING NUMBER B20-02

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 6/5/20 **COMPLETED** 6/5/20
GROUND ELEVATION 1098 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Geoprobe 7800 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING --- none observed
LOGGED BY L. Flesher **CHECKED BY** S. Aboulhosn
AT END OF DRILLING --- none observed
COORDINATES 40.212297°, -81.269378°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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			6 inches ASPHALT										
			LEAN CLAY, SANDY, (CL) brown to tan, moist, medium stiff to stiff	SPT 1	56	2-2-4 (6)	2.5						
	1095												
				SPT 2	94	2-4-5 (9)	4.0		14.0				
5													
			LEAN CLAY, (CL) reddish brown to gray, moist, very stiff to hard, (weathered claystone)	SPT 3	100	4-8-12 (20)			17.0	40	24	16	63
	1090												
				SPT 4	100	8-10-14 (24)							
10													
	1085												
				SPT 5	100	14-15-19 (34)							
15													

Bottom of borehole at 15 feet.
Borehole cave-in at 9.3 feet following auger removal.

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BORING NUMBER B20-03

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 6/5/20 **COMPLETED** 6/5/20
GROUND ELEVATION 1011 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Geoprobe 7800 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING --- none observed
LOGGED BY L. Flesher **CHECKED BY** S. Aboulhosn
AT END OF DRILLING --- none observed
COORDINATES 40.210634°, -81.268825°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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	1010		6 inches ASPHALT										
			LEAN CLAY, (SC) dark gray and brown, moist, medium stiff	SPT 1	100	2-2-4 (6)	3.0		9.5				
			CLAYEY SAND, (CL) gray to tan, moist, very stiff to hard, weathered claystone/shale)	SPT 2	100	2-11-11 (22)			16.6	37	21	16	43
5	1005			SPT 3	100	9-22-50/2 (72/8)							

Auger refusal at 7.2 feet.
Bottom of borehole at 7.2 feet.
Borehole cave-in at 5 feet following auger removal.

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BORING NUMBER B20-04

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 6/8/20 **COMPLETED** 6/8/20
GROUND ELEVATION 1010 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Geoprobe 7800 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING --- none observed
LOGGED BY L. Flesher **CHECKED BY** S. Aboulhosn
AT END OF DRILLING --- none observed
COORDINATES 40.209942°, -81.267985°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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	1010		2 inches ASPHALT 8 inches CONCRETE 2 inches BASE COURSE LEAN CLAY, (CL) grayish brown to tan, moist, soft to stiff	SPT 1	72	2-2-2 (4)	3.25						
				SPT 2	100	2-1-9 (10)	1.25		15.4				
5	1005		SANDY LEAN CLAY, (CL) grayish tan and purple, moist, hard, (weathered claystone)	SPT 3	100	7-15-20 (35)			10.3	41	21	20	62
				SPT 4	100	12-20-30 (50)							
10	1000												
			Auger refusal at 13 feet. Bottom of borehole at 13.2 feet. Borehole cave-in at 9 feet following auger removal.	SPT 5	100	50/2 (50/2)							

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BORING NUMBER B20-05

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 6/4/20 **COMPLETED** 6/4/20
GROUND ELEVATION 1004 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Geoprobe 7800 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING --- none observed
LOGGED BY L. Flesher **CHECKED BY** S. Aboulhosn
AT END OF DRILLING --- none observed
COORDINATES 40.208442°, -81.268222°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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			12 inches ASPHALT and PROCESSED STONE										
			SANDY SILT, (ML) orangeish brown, moist, soft, trace gravel	SPT 1	94	2-2-2 (4)	1.5		19.0				68
	1000		LEAN CLAY, (CL) orangeish brown and gray, moist, very stiff, laminated, with silt, (decomposed shale)	SPT 2	100	6-18-11 (29)			10.2	27	20	7	
5			POORLY GRADED GRAVEL, (GP) tan, dry, very dense, (sandstone fragments)	SPT 3	100	50/1 (50/1)							

Auger refusal at 6.1 feet.
Bottom of borehole at 6.1 feet.
Borehole cave-in at 4 feet following auger removal.

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BORING NUMBER B20-06

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 6/4/20 **COMPLETED** 6/4/20
GROUND ELEVATION 999 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Geoprobe 7800 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING --- none observed
LOGGED BY L. Flesher **CHECKED BY** S. Aboulhosn
AT END OF DRILLING --- none observed
COORDINATES 40.207231°, -81.268031°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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			6 inches TOPSOIL										
			LEAN CLAY, (CL) orangeish brown, moist										
			POORLY GRADED GRAVEL, (GP) light tan, moist, very dense, (sandstone fragments)	SPT 1	100	50/1 (50/1)							
			Auger refusal at 1.1 feet.										
			Bottom of borehole at 1.1 feet.										

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BORING NUMBER B20-07

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 6/4/20 **COMPLETED** 6/4/20
GROUND ELEVATION 941 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Geoprobe 7800 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING --- none observed
LOGGED BY L. Flesher **CHECKED BY** S. Aboulhosn
AT END OF DRILLING --- none observed
COORDINATES 40.205659°, -81.268647°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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	940		6 inches PROCESSED AGGREGATE										
			LEAN CLAY WITH SAND, (CL) brown to orangeish brown, moist, stiff	SPT 1	67	4-4-5 (9)			15.3				
			LEAN CLAY, SILTY, (CL-ML) light tan to tan, moist, hard, laminated, and silt, (decomposed shale)										
5				SPT 2	100	9-24-30 (54)			5.8				
	935			SPT 3	100	12-24-33 (57)							
				SPT 4	83	50							

Auger refusal at 9 feet.
Bottom of borehole at 9 feet.
Borehole cave-in at 4 feet following auger removal.

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BORING NUMBER B20-08

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 6/4/20 **COMPLETED** 6/4/20
GROUND ELEVATION 884 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Geoprobe 7800 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING --- none observed
LOGGED BY L. Flesher **CHECKED BY** S. Aboulhosn
AT END OF DRILLING --- none observed
COORDINATES 40.204433°, -81.268181°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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			GRAVELLY SAND, (GW) dark gray to black, moist, very dense	SPT 1	100	50/5 (50/5)							
			Auger refusal at 2 feet. Bottom of borehole at 2 feet.										

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BORING NUMBER B20-08A

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 6/4/20 **COMPLETED** 6/4/20
GROUND ELEVATION 884 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Geoprobe 7800 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING 8.50 ft / Elev 875.50 ft
LOGGED BY L. Flesher **CHECKED BY** S. Aboulhosn
AT END OF DRILLING 10.00 ft / Elev 874.00 ft
COORDINATES 40.204433°, -81.268171°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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			LEAN CLAY, (CL) dark gray to black, moist to wet, soft to medium stiff, and gravel, gravel and sand are processed aggregate from driveway	SPT 1	56	3-3-3 (6)	2.0						
	880			SPT 2	78	1-1-2 (3)	0.75						
5			LEAN CLAY WITH SAND, SILTY, (CL-ML) gray to orangeish brown, wet, soft to medium stiff, with silt, some sand	SPT 3	100	1-1-1 (2)	1.0		22.8	25	20	5	78
	875		▽	SPT 4	100	1-2-3 (5)	1.0		21.9				
10			▼										
	870			SPT 5	100	3-4-6 (10)	1.0						
15													

Bottom of borehole at 15 feet.
Redrill of Boring B20-08 (translated 3 feet east).
Borehole cave-in at 13 feet following auger removal.

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BORING NUMBER B20-09

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 6/4/20 **COMPLETED** 6/4/20
GROUND ELEVATION 882 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Geoprobe 7800 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING 18.50 ft / Elev 863.50 ft
LOGGED BY L. Flesher **CHECKED BY** S. Aboulhosn
AT END OF DRILLING --- none observed
COORDINATES 40.204305°, -81.267731°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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	880		POORLY GRADED SAND WITH SILT AND GRAVEL, (SP-SC) black and tan, moist, loose to medium dense, gravel is processed aggregate	SPT 1	56	3-3-6 (9)			13.1				
5				SPT 2	61	3-6-5 (11)			9.8				8
	875		FAT CLAY, (CH) gray to dark gray, moist to wet, soft to medium stiff, with silt, and sand	SPT 3	100	4-1-3 (4)	2.0						
10				SPT 4	100	0-0-1 (1)	0.5						
	870												
15				SPT 5	100	0-1-1 (2)	1.0						
	865		▽										
20				SPT 6	100	0-0-0 (0)	0.0						
	860												
25				SPT 7	100	2-3-2 (5)	1.0						

Bottom of borehole at 25 feet.
Borehole cave-in at 22.5 feet following auger removal.

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BORING NUMBER B20-10

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 6/4/20 **COMPLETED** 6/4/20
GROUND ELEVATION 882 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Geoprobe 7800 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING --- none observed
LOGGED BY L. Flesher **CHECKED BY** S. Aboulhosn
AT END OF DRILLING --- none observed
COORDINATES 40.204341°, -81.266651°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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	880		POORLY GRADED GRAVEL WITH SAND, (GP) tannish gray to black, moist to wet, medium dense, gravel is processed aggregate	SPT 1	67	14-11-8 (19)			29.8				
				SPT 2	89	7-7-6 (13)							
5	875		FAT CLAY, (CH) gray to light brown, moist to wet, very soft to medium stiff, with silt, trace sand	SPT 3	100	4-2-3 (5)	3.5		14.6				
				SPT 4	100	0-2-2 (4)	1.75						
10	870												
				SPT 5	100	0-0-1 (1)	0.75						
15	865												
				SPT 6	100	0-1-1 (2)	0.0						
20	860												
				SPT 7	100	0-1-2 (3)	0.0						
25													

Bottom of borehole at 25 feet.
Borehole cave-in at 22.5 feet following auger removal.

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BORING NUMBER B20-11

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 6/9/20 **COMPLETED** 6/9/20
GROUND ELEVATION 877 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Geoprobe 7800 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING 13.50 ft / Elev 863.50 ft
LOGGED BY L. Flesher **CHECKED BY** S. Aboulhosn
AT END OF DRILLING 16.00 ft / Elev 861.00 ft
COORDINATES 40.204190°, -81.266405°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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			WELL GRADED SAND WITH SILT AND GRAVEL, (SW-SM) black, moist to wet, very loose, some clay, gravel is processed aggregate										
	875			SPT 1	100	3-2-1 (3)			19.8				9
5				SPT 2	33	5-0-0 (0)							
	870		FAT CLAY, (CH) light gray and orangeish brown, moist to wet, very soft to soft	SPT 3	89	0-2-2 (4)	1.5		34.4	57	27	30	86
				SPT 4	100	2-1-2 (3)	2.5						
10	865												
			▽	SPT 5	100	0-0-0 (0)	0.25						
15			▼										
	860		FAT CLAY WITH SAND, (CH) gray to dark gray, wet, very soft to soft	SPT 6	100	0-0-1 (1)	0.5						
20													
	855			SPT 7	100	1-1-1 (2)	0.0						
25													
	850		SILT WITH SAND, (ML) gray, wet, medium stiff										
30				SPT 8	100	2-2-4 (6)	1.5		24.5				85

(Continued Next Page)

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BORING NUMBER B20-11

CLIENT Harrison County Commissioners **PROJECT NAME** Freeport Sanitary System Improvements

PROJECT NUMBER HCY005 **PROJECT LOCATION** Village of Freeport, Harrison County, Ohio

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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 (%)
30			SILT WITH SAND, (ML) gray, wet, medium stiff *(continued)*										
	845												
				SPT 9	100	2-3-5 (8)	2.0						
35													
	840												
				SPT 10	100	2-3-4 (7)	2.0						
40													

Bottom of borehole at 40 feet.
Borehole cave-in at 18 feet following auger removal.

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BORING NUMBER B20-12

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 6/5/20 **COMPLETED** 6/5/20
GROUND ELEVATION 1080 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Geoprobe 7800 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING --- none observed
LOGGED BY L. Flesher **CHECKED BY** S. Aboulhosn
AT END OF DRILLING --- none observed
COORDINATES 40.213511°, -81.267733°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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	1080		12 inches TOPSOIL										
			LEAN CLAY, (CL) orangeish brown, moist to wet, soft to stiff, some sand, some gravel	SPT 1	100	0-1-1 (2)	0.5		23.6				
5	1075			SPT 2	100	2-2-3 (5)	2.25						
				SPT 3	89	2-5-5 (10)	3.0						
10	1070			SPT 4	100	2-1-3 (4)	1.0						

Bottom of borehole at 10 feet.
Borehole cave-in at 8 feet following auger removal.

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BORING NUMBER B20-13

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 6/5/20 **COMPLETED** 6/5/20
GROUND ELEVATION 1043 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Geoprobe 7800 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING --- none observed
LOGGED BY L. Flesher **CHECKED BY** S. Aboulhosn
AT END OF DRILLING --- none observed
COORDINATES 40.212392°, -81.267490°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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			12 inches TOPSOIL										
	1040		LEAN CLAY, (CL) orangeish brown to brown, moist, soft to very stiff, trace gravel, (WEATHERED SHALE)	SPT 1	78	1-1-2 (3)	2.0						
5				SPT 2	100	1-2-3 (5)	1.0		19.9				
				SPT 3	39	10-10-10 (20)	2.0						
	1035		SILT WITH SAND, (ML) tan and orangeish brown, moist, very stiff, laminated										
10				SPT 4	100	3-6-12 (18)			13.4				78
	1030												
15				SPT 5	100	8-10-14 (24)							

Bottom of borehole at 15 feet.
Borehole cave-in at 10.3 feet following auger removal.

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BORING NUMBER B20-14

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 6/9/20 **COMPLETED** 6/9/20
GROUND ELEVATION 1028 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Geoprobe 7800 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING --- none observed
LOGGED BY L. Flesher **CHECKED BY** S. Aboulhosn
AT END OF DRILLING --- none observed
COORDINATES 40.211396°, -81.267822°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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			6 inches ASPHALT										
			LEAN CLAY, (CL) orangeish brown to brown, moist, soft	SPT 1	89	1-1-3 (4)	2.5		24.8				
	1025		LEAN CLAY, (CL) orangeish brown to tan, moist, hard, trace sand, (weathered shale)										
5				SPT 2	89	9-26-39 (65)			10.3				
				SPT 3	100	19-30-20 (50)							
	1020			SPT 4	100	12-20-30 (50)							
10													
	1015			SPT 5	100	22-50/3 (50/3)							

Auger refusal at 14.3 feet.
Bottom of borehole at 14.3 feet.
Borehole cave-in at 10 feet following auger removal.

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BORING NUMBER B20-15

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 6/9/20 **COMPLETED** 6/9/20
GROUND ELEVATION 992 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Geoprobe 7800 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING --- none observed
LOGGED BY L. Flesher **CHECKED BY** S. Aboulhosn
AT END OF DRILLING --- none observed
COORDINATES 40.209366°, -81.266690°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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			12 inches ASPHALT and ROAD BASE AGGREGATE										
	990		SILTY SAND WITH GRAVEL, (SM) tan to orangeish brown, moist, medium dense to very dense	SPT 1	44	4-4-8 (12)			10.7				
				SPT 2	100	8-50/5 (50/5)			9.3				21

Auger refusal at 4.4 feet.
Bottom of borehole at 4.4 feet.
Borehole cave-in at 4 feet following auger removal.

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BORING NUMBER B20-16

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 6/9/20 **COMPLETED** 6/9/20
GROUND ELEVATION 1031 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Geoprobe 7800 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING 16.00 ft / Elev 1015.00 ft
LOGGED BY L. Flesher **CHECKED BY** S. Aboulhosn
AT END OF DRILLING 13.50 ft / Elev 1017.50 ft
COORDINATES 40.212745° -81.265854°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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	1030		6 inches TOPSOIL										
			FAT CLAY, (CH) brown to orangeish brown, moist, medium stiff, some gravel	SPT 1	67	0-3-4 (7)	1.0		18.9				
			LEAN CLAY, (CL) orangeish brown to grayish brown, moist to wet, stiff to hard, (completely weathered claystone)	SPT 2	100	2-6-9 (15)	2.0		21.8	51	28	23	
5	1025			SPT 3	100	10-14-17 (31)							
				SPT 4	100	14-26-35 (61)							
10	1020												
			(coal in sample)	SPT 5	100	9-31-19 (50)							
15	1015			SPT 6	100	16-28-32 (60)							

Bottom of borehole at 17.5 feet.
Borehole cave-in at 15 feet following auger removal.

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BORING NUMBER B20-17

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 6/5/20 **COMPLETED** 6/5/20
GROUND ELEVATION 1006 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Geoprobe 7800 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING --- none observed
LOGGED BY L. Flesher **CHECKED BY** S. Aboulhosn
AT END OF DRILLING --- none observed
COORDINATES 40.211589°, -81.266570°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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	1005		12 inches ASPHALT and PROCESSED STONE										
			LEAN CLAY WITH GRAVEL, (CL) orangeish brown to grayish brown, moist to wet, soft to stiff, trace sand	SPT 1	100	6-4-6 (10)	1.5		11.9				
5				SPT 2	100	0-2-1 (3)	1.0		20.3				
	1000		LEAN CLAY, (CL) blueish gray to dark gray, moist, stiff to hard (Limestone fragments observed in sample)	SPT 3	100	3-3-10 (13)	4.0						
				SPT 4	100	11-15-50/5 (65/11)							

Auger refusal at 9.4 feet.
Bottom of borehole at 9.4 feet.
Borehole cave-in 7 feet following auger removal.

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BORING NUMBER B20-18

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 6/8/20 **COMPLETED** 6/8/20
GROUND ELEVATION 995 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Geoprobe 7800 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING --- none observed
LOGGED BY L. Flesher **CHECKED BY** S. Aboulhosn
AT END OF DRILLING --- none observed
COORDINATES 40.210977°, -81.265992°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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	995		6 inches PROCESSED AGGREGATE										
			LEAN CLAY WITH GRAVEL, (CL) black, moist, very soft to soft, trace coal, (fill)	SPT 1	33	0-0-0 (0)							
5	990			SPT 2	89	0-0-2 (2)			41.3				
			LEAN CLAY WITH SAND, (CL) light brown and gray, moist, hard, (completely weathered shale)	SPT 3	100	2-19-50/5 (69/11)			12.7	27	18	9	

Auger refusal at 7.4 feet.
Bottom of borehole at 7.4 feet.
Borehole cave-in at 6 feet following auger removal.

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BORING NUMBER B20-19

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 6/8/20 **COMPLETED** 6/8/20
GROUND ELEVATION 989 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Geoprobe 7800 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING --- none observed
LOGGED BY L. Flesher **CHECKED BY** S. Aboulhosn
AT END OF DRILLING --- none observed
COORDINATES 40.210406°, -81.265207°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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			12 inches ASPHALT and ROAD BASE AGGREGATE										
			GRAVELLY LEAN CLAY WITH SAND, (CL) dark grayish brown to light brown, moist, stiff to very stiff, some gravel	SPT 1	78	16-7-6 (13)	3.5						
	985			SPT 2	100	8-10-13 (23)	1.5		8.2	NP	NP	NP	
5			LEAN CLAY WITH GRAVEL, (CL) light brown to orangeish brown, hard, some sand	SPT 3	100	14-18-50/5 (68/11)			8.6				
			Auger refusal at 8.2 feet.	SPT 4	100	50/2 (50/2)							

Bottom of borehole at 8.2 feet.
Borehole cave-in at 5.9 feet following auger removal.

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BORING NUMBER B20-20

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 6/9/20 **COMPLETED** 6/9/20
GROUND ELEVATION 1113 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Geoprobe 7800 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING --- none observed
LOGGED BY L. Flesher **CHECKED BY** S. Aboulhosn
AT END OF DRILLING --- none observed
COORDINATES 40.214215°, -81.264844°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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			6 inches ASPHALT										
			SILTY SAND WITH GRAVEL, (SM) orangeish brown, moist, loose to medium dense, some clay	SPT 1	100	7-11-13 (24)			9.7				
	1110		SAA, loose										
5				SPT 2	100	7-3-4 (7)			9.7				13
				SPT 3	100	3-4-3 (7)							
	1105												
10				SPT 4	100	2-2-4 (6)							
	1100		SAA, dense										
15				SPT 5	100	30-15-24 (39)							

Bottom of borehole at 15 feet.
Borehole cave-in at 13 feet following auger removal.

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BORING NUMBER B20-21

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 6/9/20 **COMPLETED** 6/9/20
GROUND ELEVATION 1047 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Geoprobe 7800 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING --- none observed
LOGGED BY L. Flesher **CHECKED BY** S. Aboulhosn
AT END OF DRILLING --- none observed
COORDINATES 40.213184°, -81.264328°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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			6 inches ASPHALT										
	1045		LEAN CLAY, (CL) orangeish brown to tan, moist, stiff to hard, (completely weathered claystone)	SPT 1	72	2-2-13 (15)	3.0		16.8				
5				SPT 2	100	16-22-26 (48)			9.6				
	1040			SPT 3	100	19-19-23 (42)							
				SPT 4	100	20-50/5 (50/5)							

Auger refusal at 9.4 feet.
Bottom of borehole at 9.4 feet.
Borehole cave-in at 6.5 feet following auger removal.

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BORING NUMBER B20-22

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 6/9/20 **COMPLETED** 6/9/20
GROUND ELEVATION 1021 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Geoprobe 7800 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING 13.50 ft / Elev 1007.50 ft
LOGGED BY L. Flesher **CHECKED BY** S. Aboulhosn
AT END OF DRILLING --- none observed
COORDINATES 40.212750°, -81.263389°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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	1020		12 inches TOPSOIL										
			LEAN CLAY, (CL) orangeish brown and gray, moist, medium stiff to stiff	SPT 1	11	1-4-7 (11)			21.1				
5	1015			SPT 2	94	2-3-5 (8)	3.0		28.1				
				SPT 3	100	2-4-9 (13)	2.75						
10	1010		LEAN CLAY, (CL) orangeish brown to purpleish brown, moist to wet, stiff to very stiff, trace sand, (completely weathered shale)	SPT 4	100	4-7-10 (17)							
15			▽	SPT 5	100	4-4-11 (15)							

Bottom of borehole at 15 feet.
Borehole cave-in at 12.7 feet following auger removal.

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BORING NUMBER B20-23

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 6/5/20 **COMPLETED** 6/5/20
GROUND ELEVATION 1005 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Geoprobe 7800 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING --- none observed
LOGGED BY L. Flesher **CHECKED BY** S. Aboulhosn
AT END OF DRILLING --- none observed
COORDINATES 40.211900°, -81.264840°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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	1005		12 inches ASPHALT and PROCESSED STONE										
			LEAN CLAY, (CL) tan to red, moist, soft to medium stiff	SPT 1	100	2-1-1 (2)	1.25		19.5	39	18	21	
5	1000			SPT 2	100	1-2-5 (7)	3.5		19.0				
				SPT 3	100	2-4-4 (8)	2.5						
			LEAN CLAY, (CL) tan, moist, stiff to hard, laminated, (completely weathered shale)	SPT 4	100	3-5-8 (13)							
10	995		SHALE, gray, very dense										
			Auger refusal at 11.6 feet. Bottom of borehole at 11.6 feet. Borehole cave-in at 9.3 feet following auger removal.	SPT 5	100	50/1 (50/1)							

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BORING NUMBER B20-24

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 6/8/20 **COMPLETED** 6/8/20
GROUND ELEVATION 991 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Geoprobe 7800 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING --- none observed
LOGGED BY L. Flesher **CHECKED BY** S. Aboulhosn
AT END OF DRILLING --- none observed
COORDINATES 40.211414°, -81.263463°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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	990		12 inches TOPSOIL										
			LEAN CLAY, (CL) tan to gray, moist, soft to stiff	SPT 1	33	2-1-2 (3)	0.5						
5				SPT 2	72	3-4-6 (10)	1.0		18.8	39	22	17	
	985		LEAN CLAY, (CL) orangeish brown, moist, (completely weathered claystone/shale)	SPT 3	100	7-50/5 (50/5)			13.1				

Auger refusal at 6.9 feet.
Bottom of borehole at 6.9 feet.

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BORING NUMBER B20-25

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 6/8/20 **COMPLETED** 6/8/20
GROUND ELEVATION 982 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Geoprobe 7800 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING --- none observed
LOGGED BY L. Flesher **CHECKED BY** S. Aboulhosn
AT END OF DRILLING --- none observed
COORDINATES 40.210559°, -81.263852°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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			12 inches TOPSOIL										
	980		POORLY GRADED GRAVEL WITH SILT AND SAND, (GP-GM) tan and gray, moist, medium dense to very dense, some clay	SPT 1	89	6-5-6 (11)			7.4				10
5				SPT 2	67	16-9-4 (13)							
				SPT 3	100	25-50/1 (50/1)							

Auger refusal at 6.6 feet.
Bottom of borehole at 6.6 feet.
Borehole cave-in at 5.5 feet following auger removal.

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BORING NUMBER B20-26

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 6/8/20 **COMPLETED** 6/8/20
GROUND ELEVATION 1001 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Geoprobe 7800 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING --- none observed
LOGGED BY L. Flesher **CHECKED BY** S. Aboulhosn
AT END OF DRILLING --- none observed
COORDINATES 40.210824°, -81.262695°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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	1000		12 inches ASPHALT and ROAD BASE AGGREGATE										
			LEAN CLAY, (CL) orangeish brown mottled gray, moist, medium stiff to stiff, some gravel	SPT 1	78	11-4-3 (7)	2.0		17.0				
				SPT 2	67	4-4-6 (10)	3.5						
5	995		LEAN CLAY, (CL) tan, moist, medium stiff to hard, (completely weathered claystone)	SPT 3	100	3-6-12 (18)	1.5		13.5	34	20	14	
				SPT 4	100	13-28-29 (57)							
10	990			SPT 5	100	50/2 (50/2)							

Auger refusal at 13.2 feet.
Bottom of borehole at 13.2 feet.
Borehole cave-in at 9.5 feet following auger removal.

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BORING NUMBER B20-27

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 6/5/20 **COMPLETED** 6/5/20
GROUND ELEVATION 1008 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Geoprobe 7800 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING --- none observed
LOGGED BY L. Flesher **CHECKED BY** S. Aboulhosn
AT END OF DRILLING 8.00 ft / Elev 1000.00 ft
COORDINATES 40.212264°, -81.262428°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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			12 inches ASPHALT and PROCESSED STONE										
	1005		LEAN CLAY WITH GRAVEL, (CL) orangeish brown to brown, moist, soft to medium stiff	SPT 1	89	1-2-3 (5)	1.75		13.0				
5				SPT 2	56	1-2-2 (4)	1.5						
	1000		LEAN CLAY, (CL) reddish brown to grayish brown, moist to wet, very soft to hard, abundant organic material (tree root)	SPT 3	100	0-1-1 (2)	1.25		92.4				
10				SPT 4	33	0-0-1 (1)	0.75						
	995												
15				SPT 5	44	2-2-2 (4)	0.0						
			Weathered SHALE, very dense	SPT 6	100	50/1 (50/1)							

Auger refusal at 15.5 feet.
Bottom of borehole at 15.6 feet.
Borehole cave-in at 10 feet following auger removal.

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BORING NUMBER B20-28

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 6/5/20 **COMPLETED** 6/5/20
GROUND ELEVATION 1058 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Geoprobe 7800 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING --- none observed
LOGGED BY L. Flesher **CHECKED BY** S. Aboulhosn
AT END OF DRILLING --- none observed
COORDINATES 40.212652°, -81.260969°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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			12 inches TOPSOIL										
			LEAN CLAY, (CL) orangeish brown to brown, moist, medium stiff, some gravel, little sand	SPT 1	94	3-3-2 (5)	2.75		17.3				
	1055												
5				SPT 2	100	1-1-3 (4)	2.5		18.6	31	20	11	
			SAA, stiff to very stiff	SPT 3	100	2-12-8 (20)	2.0						
	1050												
10				SPT 4	100	6-4-5 (9)	0.75						
			SAA, medium stiff										
	1045												
15				SPT 5	100	2-3-3 (6)	1.25						

Bottom of borehole at 15 feet.
Borehole cave-in at 11.3 feet following auger removal.

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BORING NUMBER B20-29

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 6/8/20 **COMPLETED** 6/8/20
GROUND ELEVATION 988 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Geoprobe 7800 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING --- none observed
LOGGED BY L. Flesher **CHECKED BY** S. Aboulhosn
AT END OF DRILLING --- none observed
COORDINATES 40.210962°, -81.261068°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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			12 inches ASPHALT and ROAD BASE AGGREGATE										
	985		SANDY SILT, (ML) light brown, moist, stiff	SPT 1	100	2-3-6 (9)	2.0		14.3				61
5			POORLY GRADED SAND WITH GRAVEL, (SP) orangeish brown to tan, moist, loose to medium dense, some clay, (sandstone fragments)	SPT 2	100	6-12-9 (21)			8.1				
	980			SPT 3	100	5-14-8 (22)							
				SPT 4	100	50/5 (50/5)							

Auger refusal at 8.9 feet.
Bottom of borehole at 8.9 feet.
Borehole cave-in at 6.8 feet following auger removal.

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BORING NUMBER B20-30

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 6/9/20 **COMPLETED** 6/9/20
GROUND ELEVATION 877 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Geoprobe 7800 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING 3.50 ft / Elev 873.50 ft
LOGGED BY L. Flesher **CHECKED BY** S. Aboulhosn
AT END OF DRILLING 4.00 ft / Elev 873.00 ft
COORDINATES 40.204083°, -81.267131°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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			12 inches PROCESSED AGGREGATE and SAND										
	875		POORLY GRADED SAND WITH GRAVEL, (SP) brown to orangeish brown, moist to wet, very loose to loose	SPT 1	72	2-5-5 (10)			18.1				
5				SPT 2	39	3-2-1 (3)							
	870		LEAN CLAY, (CL) orangeish brown, wet, medium stiff	SPT 3	100	2-2-3 (5)	2.5		27.4				
10				SPT 4	100	2-2-4 (6)	1.0						

Bottom of borehole at 10 feet.
Borehole cave-in at 5 feet following auger removal.

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BORING NUMBER B21-31

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 1/15/21 **COMPLETED** 1/15/21
GROUND ELEVATION 1004 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Mobile B-57 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING --- None observed.
LOGGED BY D. Sansone **CHECKED BY** A.J. Smith
AT END OF DRILLING --- None observed.
COORDINATES 40.207329°, -81.267859°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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			6 inches TOPSOIL										
			LEAN CLAY, (CL) light brown to dark brown, moist, very stiff	SPT 1	89	3-6-10 (16)	4.5+						
			SHALE, tan, severely weathered, moist										
	1000			SPT 2	72	6-16-16 (32)							
5													
			SAA, gray and tan, some clay	SPT 3	75	6-50/2 (50/2)							
			SANDSTONE, brown, severely weathered, moist										
	995			SPT 4	100	40-50/3 (50/3)							
10													
			SANDSTONE, gray, moderately weathered, fine, moderately strong, moist, few vertical fractures, numerous horizontal fractures	RC 1	95 (53)	UCS = 3,465 psi UCS = 2,310 psi UCS = 3,900 psi							
	990												
15						UCS = 4,680 psi							
			SAA, strong, vertical and horizontal fractures, few clay										
			SAA, slightly weathered	RC 2	95 (37)	UCS = 3,740 psi							
	985												
20													

Bottom of borehole at 20 feet.
Borehole cave-in at 16 feet following auger removal.

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BORING NUMBER B21-32

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 1/15/21 **COMPLETED** 1/15/21
GROUND ELEVATION 1007 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Mobile B-57 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING --- None observed.
LOGGED BY D. Sansone **CHECKED BY** A.J. Smith
AT END OF DRILLING --- None observed.
COORDINATES 40.209202°, -81.268414°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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			6 inches ASPHALT										
	1005		LEAN CLAY WITH GRAVEL, (CL) dark gray to dark brown, moist, stiff, (FILL)	SPT 1	89	4-3-6 (9)	4.5+						
5			LEAN CLAY, (CL) tan and brown, moist, stiff, trace shale rock fragments	SPT 2	61	3-4-8 (12)	3.5						
	1000		SHALE, light brown, severely weathered, weak, moist	SPT 3	100	13-36-50/5 (86/11)							
10				SPT 4	89	8-19-25 (44)							
	995		SAA, thinly laminated	SPT 5	100	7-23-35 (58)							
15			SAA, brown, moderately strong	SPT 6	78	14-18-18 (36)							
	990		SANDSTONE, tan to brown, severely weathered, moist	SPT 7	80	50/5 (50/5)							
				SPT 8	100	50/5 (50/5)							

Bottom of borehole at 18.4 feet.
Borehole collapse at 17.5 feet following auger removal.

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BORING NUMBER B21-33

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 1/14/21 **COMPLETED** 1/14/21
GROUND ELEVATION 1000 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Mobile B-57 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING --- None observed.
LOGGED BY D. Sansone **CHECKED BY** A.J. Smith
AT END OF DRILLING 18.00 ft / Elev 982.00 ft
COORDINATES 40.210179°, -81.266412°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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	1000		6 inches ASPHALT										
			LEAN CLAY WITH SAND, (CL) tan to dark brown, moist, medium stiff, (FILL)	SPT 1	50	3-2-3 (5)							
			SAA, trace gravel	SPT 2	6	2-2-3 (5)							
5	995			SPT 3	83	6-17-30 (47)							
			SANDSTONE, tan, severely weathered, very fine, strong, moist										
			SAA, moderately weathered	SPT 4	40	50/5 (50/5)							
10	990		SAA, moderately weathered, fine	SPT 5	83	50							
			SAA, gray, moist, few sand	SPT 6	100	11-50/1 (50/1)							
15	985		SAA, highly weathered, strong	SPT 7	75	6-50/2 (50/2)							
			SAA, tan and gray, severely weathered	SPT 8	100	50/5 (50/5)							

Bottom of borehole at 18.9 feet.

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BORING NUMBER B21-34

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 1/14/21 **COMPLETED** 1/14/21
GROUND ELEVATION 983 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Mobile B-57 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING --- None observed.
LOGGED BY D. Sansone **CHECKED BY** A.J. Smith
AT END OF DRILLING 7.00 ft / Elev 976.00 ft
COORDINATES 40.210453°, -81.263764°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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			10 inches TOPSOIL										
			POORLY GRADED SAND, (SP) brown, moist, medium dense, some clay, some shale rock fragments	SPT 1	89	3-7-7 (14)							
	980		SANDSTONE, brown to dark brown, severely weathered, moist	SPT 2	94	6-16-40 (56)							
5			SAA, tan and gray, moderately weathered	SPT 3	80	50/5 (50/5)							
	975			SPT 4	75	49-50/2 (50/2)							
10				SPT 5	78	55-50/3 (50/3)							
	970			SPT 6	100	36-50/1 (50/1)							
15				SPT 7	9	50							
	965		SAA, dark brown, severely weathered	SPT 8	56	11-50/3 (50/3)							
20			SANDSTONE, gray, moderately weathered, thickly, fine, strong, moist, moderately fractured			UCS = 953 psi							
				RC 1	90 (56)	UCS = 15,875 psi							
	960					UCS = 17,786 psi							
						UCS = 7,095 psi							

Auger refusal at 19 feet.
Bottom of borehole at 24 feet.
Borehole collapse at 17.5 feet following auger removal.

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BORING NUMBER B21-34R

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 1/14/21 **COMPLETED** 1/14/21
GROUND ELEVATION 983 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Mobile B-57 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING --- None observed.
LOGGED BY D. Sansone **CHECKED BY** A.J. Smith
AT END OF DRILLING --- None observed.
COORDINATES 40.210464°, -81.263734°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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	980		(borehole drilled to 10 feet before rock coring)										
5	975												
10			SANDSTONE, brown and gray, severely weathered, fine, moderately strong, moist, highly fractured	RC 1	92 (0)	UCS = 2,418 psi UCS = 5,376 psi							

Bottom of borehole at 11.1 feet.
Redrill of Boring B21-34 (translated 10 feet northeast).
Core barrel locked in at 11.1 feet.

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BORING NUMBER B21-35

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio
DATE STARTED 1/15/21 **COMPLETED** 1/15/21
GROUND ELEVATION 1022 ft NAVD88
DRILLING CONTRACTOR Envirocore, Inc.
GROUND WATER LEVELS:
RIG TYPE Mobile B-57 **DRILLING METHOD** 3¼-in ID HSA
AT TIME OF DRILLING --- None observed.
LOGGED BY D. Sansone **CHECKED BY** A.J. Smith
AT END OF DRILLING --- None observed.
COORDINATES 40.211897°, -81.267416°
AFTER DRILLING ---

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	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	1020		LEAN CLAY, (CL) brown to black, moist, medium stiff, little sand, (FILL)	SPT 1	89	2-2-2 (4)	2.5						
5	1015			SPT 2	83	2-3-2 (5)	1.5						
10	1010		SHALE, tan to gray, severely weathered, moist	SPT 3	67	2-3-4 (7)	4.5+						
15	1005		SAA, slightly weathered	SPT 4	100	4-4-7 (11)							
				SPT 5	56	7-12-15 (27)							
				SPT 6	89	6-12-24 (36)							
				SPT 7	67	6-16-17 (33)							
20				SPT 8	67	12-11-12 (23)							

Bottom of borehole at 20 feet.

PHOTO 1: Boring B21-31 RC-1 (10.0 - 15.0 feet)

PHOTO 2: Boring B21-31 RC-2 (15.0 - 20.0 feet)

HULL Environment / Energy / Infrastructure	Freeport Sanitary Improvements Rock Core Photographs Village of Freeport Harrison County, Ohio	Date: FEBRUARY 2021 Project Number: HCY005

PHOTO 3: Boring B21-34 RC-1 (19.0 - 24.0 feet)

PHOTO 4: Boring B21-34R RC-1 (10.0 - 11.1 feet)

HULL Environment / Energy / Infrastructure	Freeport Sanitary Improvements Site Photographs Village of Freeport Harrison County, Ohio	Date: FEBRUARY 2021 Project Number: HCY005

APPENDIX B

LABORATORY TESTING

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SUMMARY OF LABORATORY RESULTS (ASTM D2487 / D2488)

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio

BORING	DEPTH (ft)	MC%	LL	PL	PI	%F	USCS Classification
B20-01	1.0 - 2.5	17.4					
B20-01	3.5 - 5.0	8.4				34	SILTY SAND with GRAVEL (SM)
B20-02	3.5 - 5.0	14.0					
B20-02	6.0 - 7.5	17.0	40	24	16	63	SANDY LEAN CLAY (CL)
B20-03	1.0 - 2.5	9.5					
B20-03	3.5 - 5.0	16.6	37	21	16	43	CLAYEY SAND (SC)
B20-04	3.5 - 5.0	15.4					
B20-04	6.0 - 7.5	10.3	41	21	20	62	SANDY LEAN CLAY (CL)
B20-05	1.0 - 2.5	19.0				68	SANDY SILT (ML)
B20-05	3.5 - 5.0	10.2	27	20	7		LEAN CLAY (CL)
B20-07	1.0 - 2.5	15.3					
B20-07	3.5 - 5.0	5.8					
B20-08A	6.0 - 7.5	22.8	25	20	5	78	SILTY CLAY with SAND (CL-ML)
B20-08A	8.5 - 10.0	21.9					
B20-09	1.0 - 2.5	13.1					
B20-09	3.5 - 5.0	9.8				8	POORLY GRADED SAND with SILT and GRAVEL (SP-SM)
B20-10	1.0 - 2.5	29.8					
B20-10	6.0 - 7.5	14.6					
B20-11	1.0 - 2.5	19.8				9	WELL GRADED SAND with SILT and GRAVEL (SW-SM)
B20-11	6.0 - 7.5	34.4	57	27	30	86	FAT CLAY (CH)
B20-11	28.5 - 30.0	24.5				85	SILT with SAND (ML)
B20-12	1.0 - 2.5	23.6					
B20-13	3.5 - 5.0	19.9					
B20-13	8.5 - 10.0	13.4				78	SILT with SAND (ML)
B20-14	1.0 - 2.5	24.8					
B20-14	3.5 - 5.0	10.3					
B20-15	1.0 - 2.5	10.7					
B20-15	3.5 - 4.4	9.3				21	SILTY SAND with GRAVEL (SM)
B20-16	1.0 - 2.5	18.9					
B20-16	3.5 - 5.0	21.8	51	28	23		FAT CLAY (CH)
B20-17	1.0 - 2.5	11.9					
B20-17	3.5 - 5.0	20.3					
B20-18	3.5 - 5.0	41.3					
B20-18	6.0 - 7.4	12.7	27	18	9		LEAN CLAY with SAND (CL)
B20-19	3.5 - 5.0	8.2	NP	NP	NP		
B20-19	6.0 - 7.4	8.6					LEAN CLAY with SAND (CL)
B20-20	1.0 - 2.5	9.7					
B20-20	3.5 - 5.0	9.7				13	SILY SAND with GRAVEL (SM)
B20-21	1.0 - 2.5	16.8					
B20-21	3.5 - 5.0	9.6					
B20-22	1.0 - 2.5	21.1					
B20-22	3.5 - 5.0	28.1					
B20-23	1.0 - 2.5	19.5	39	18	21		LEAN CLAY (CL)

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SUMMARY OF LABORATORY RESULTS (ASTM D2487 / D2488)

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio

BORING	DEPTH (ft)	MC%	LL	PL	PI	%F	USCS Classification
B20-23	3.5 - 5.0	19.0					LEAN CLAY (CL)
B20-24	3.5 - 5.0	18.8	39	22	17		LEAN CLAY (CL)
B20-24	6.0 - 6.9	13.1					
B20-25	1.0 - 2.5	7.4				10	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)
B20-26	1.0 - 2.5	17.0					
B20-26	6.0 - 7.5	13.5	34	20	14		
B20-27	1.0 - 2.5	13.0					
B20-27	6.0 - 7.5	92.4					
B20-28	1.0 - 2.5	17.3					
B20-28	3.5 - 5.0	18.6	31	20	11		
B20-29	1.0 - 2.5	14.3				61	SANDY SILT (ML)
B20-29	3.5 - 5.0	8.1					
B20-30	1.0 - 2.5	18.1					
B20-30	6.0 - 7.5	27.4					

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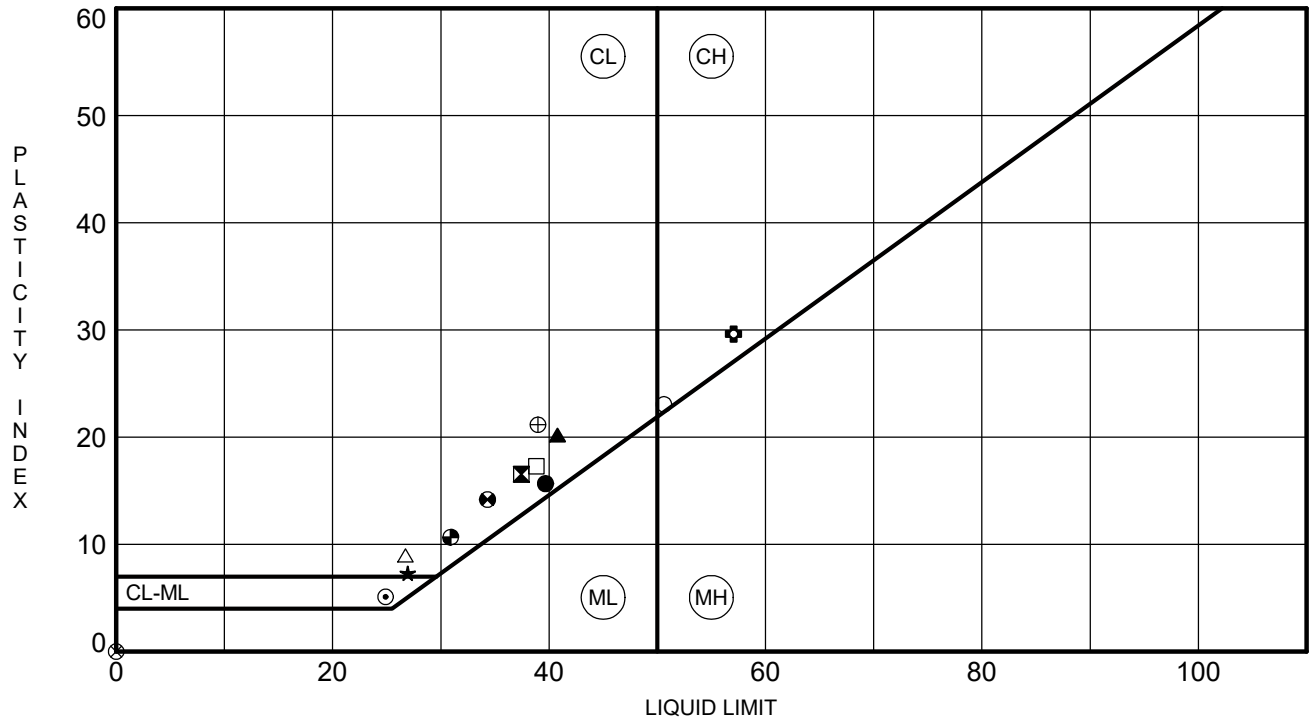
ATTERBERG LIMITS (ASTM D4318)

CLIENT Harrison County Commissioners
PROJECT NAME Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
PROJECT LOCATION Village of Freeport, Harrison County, Ohio



	BORING	DEPTH (ft)	LL	PL	PI	%F	USCS Classification
●	B20-02	6.0 - 7.5	40	24	16	63	SANDY LEAN CLAY (CL)
⊠	B20-03	3.5 - 5.0	37	21	16	43	CLAYEY SAND (SC)
▲	B20-04	6.0 - 7.5	41	21	20	62	SANDY LEAN CLAY (CL)
★	B20-05	3.5 - 5.0	27	20	7		LEAN CLAY (CL)
⊙	B20-08A	6.0 - 7.5	25	20	5	78	SILTY CLAY with SAND (CL-ML)
✿	B20-11	6.0 - 7.5	57	27	30	86	FAT CLAY (CH)
○	B20-16	3.5 - 5.0	51	28	23		FAT CLAY (CH)
△	B20-18	6.0 - 7.4	27	18	9		LEAN CLAY with SAND (CL)
⊗	B20-19	3.5 - 5.0	NP	NP	NP		GRAVELLY LEAN CLAY with SAND (CL)
⊕	B20-23	1.0 - 2.5	39	18	21		LEAN CLAY (CL)
□	B20-24	3.5 - 5.0	39	22	17		LEAN CLAY (CL)
⊗	B20-26	6.0 - 7.5	34	20	14		LEAN CLAY (CL)
◕	B20-28	3.5 - 5.0	31	20	11		LEAN CLAY (CL)

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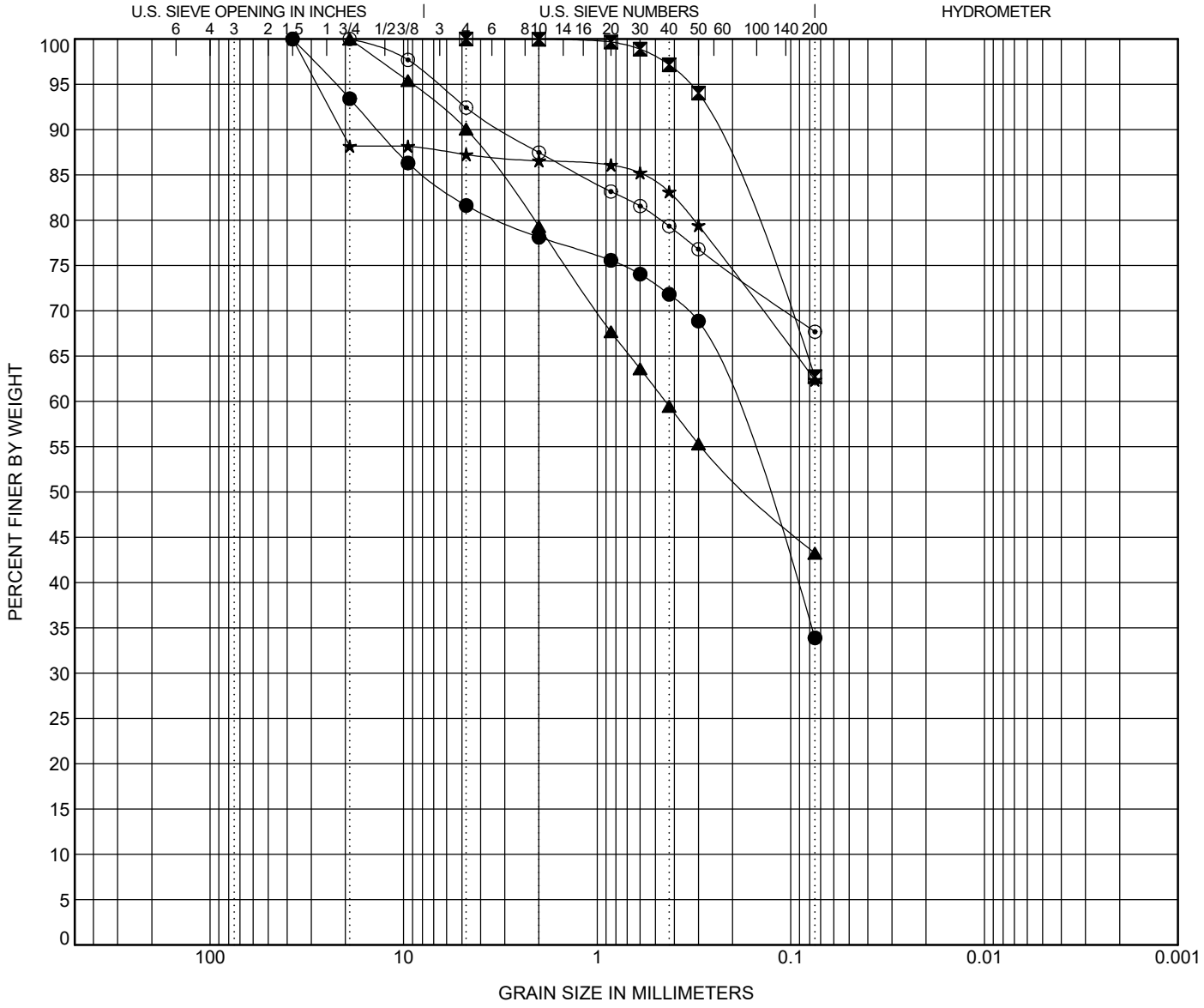
GRAIN SIZE DISTRIBUTION (ASTM D422 / D1140 / C136)

CLIENT Harrison County Commissioners **PROJECT** Freeport Sanitary System Improvements

PROJECT NUMBER HCY005 **LOCATION** Village of Freeport, Harrison County, Ohio



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING	DEPTH (ft)	USCS Classification	MC%	LL	PL	PI	Cc	Cu
●	B20-01	3.5 - 5.0	SILTY SAND with GRAVEL (SM)	8.4					
⊠	B20-02	6.0 - 7.5	SANDY LEAN CLAY (CL)	17.0	40	24	16		
▲	B20-03	3.5 - 5.0	CLAYEY SAND (SC)	16.6	37	21	16		
★	B20-04	6.0 - 7.5	SANDY LEAN CLAY (CL)	10.3	41	21	20		
⊙	B20-05	1.0 - 2.5	SANDY SILT (ML)	19.0					

	BORING	DEPTH (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B20-01	3.5 - 5.0	37.5	0.211			18.4	47.7	33.9	
⊠	B20-02	6.0 - 7.5	4.75				0.0	37.3	62.7	
▲	B20-03	3.5 - 5.0	19	0.445			9.9	46.8	43.2	
★	B20-04	6.0 - 7.5	37.5				12.8	24.9	62.4	
⊙	B20-05	1.0 - 2.5	19				7.6	24.7	67.7	

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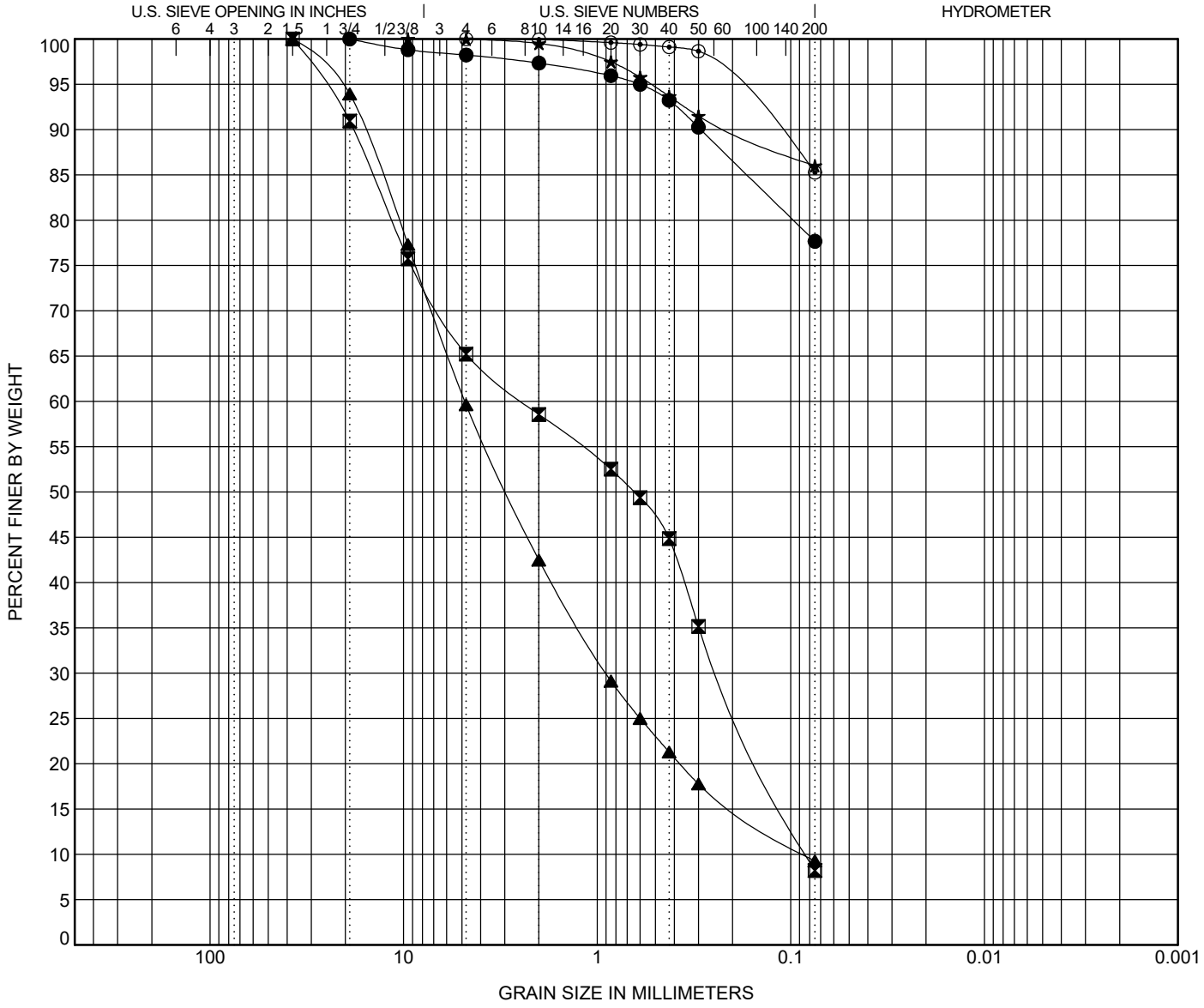
GRAIN SIZE DISTRIBUTION (ASTM D422 / D1140 / C136)

CLIENT Harrison County Commissioners
PROJECT Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
LOCATION Village of Freeport, Harrison County, Ohio



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING	DEPTH (ft)	USCS Classification	MC%	LL	PL	PI	Cc	Cu
●	B20-08A	6.0 - 7.5	SILTY CLAY with SAND (CL-ML)	22.8	25	20	5		
⊠	B20-09	3.5 - 5.0	POORLY GRADED SAND with SILT and GRAVEL (SP-SM)	9.8				0.27	29.36
▲	B20-11	1.0 - 2.5	WELL GRADED SAND with SILT and GRAVEL (SW-SM)	19.8				1.99	57.08
★	B20-11	6.0 - 7.5	FAT CLAY (CH)	34.4	57	27	30		
⊙	B20-11	28.5 - 30.0	SILT with SAND (ML)	24.5					

	BORING	DEPTH (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B20-08A	6.0 - 7.5	19				1.8	20.6	77.7	
⊠	B20-09	3.5 - 5.0	37.5	2.414	0.23	0.082	34.8	57.0	8.2	
▲	B20-11	1.0 - 2.5	37.5	4.82	0.899	0.084	40.4	50.4	9.3	
★	B20-11	6.0 - 7.5	9.5				0.0	13.9	86.0	
⊙	B20-11	28.5 - 30.0	4.75				0.0	14.7	85.3	

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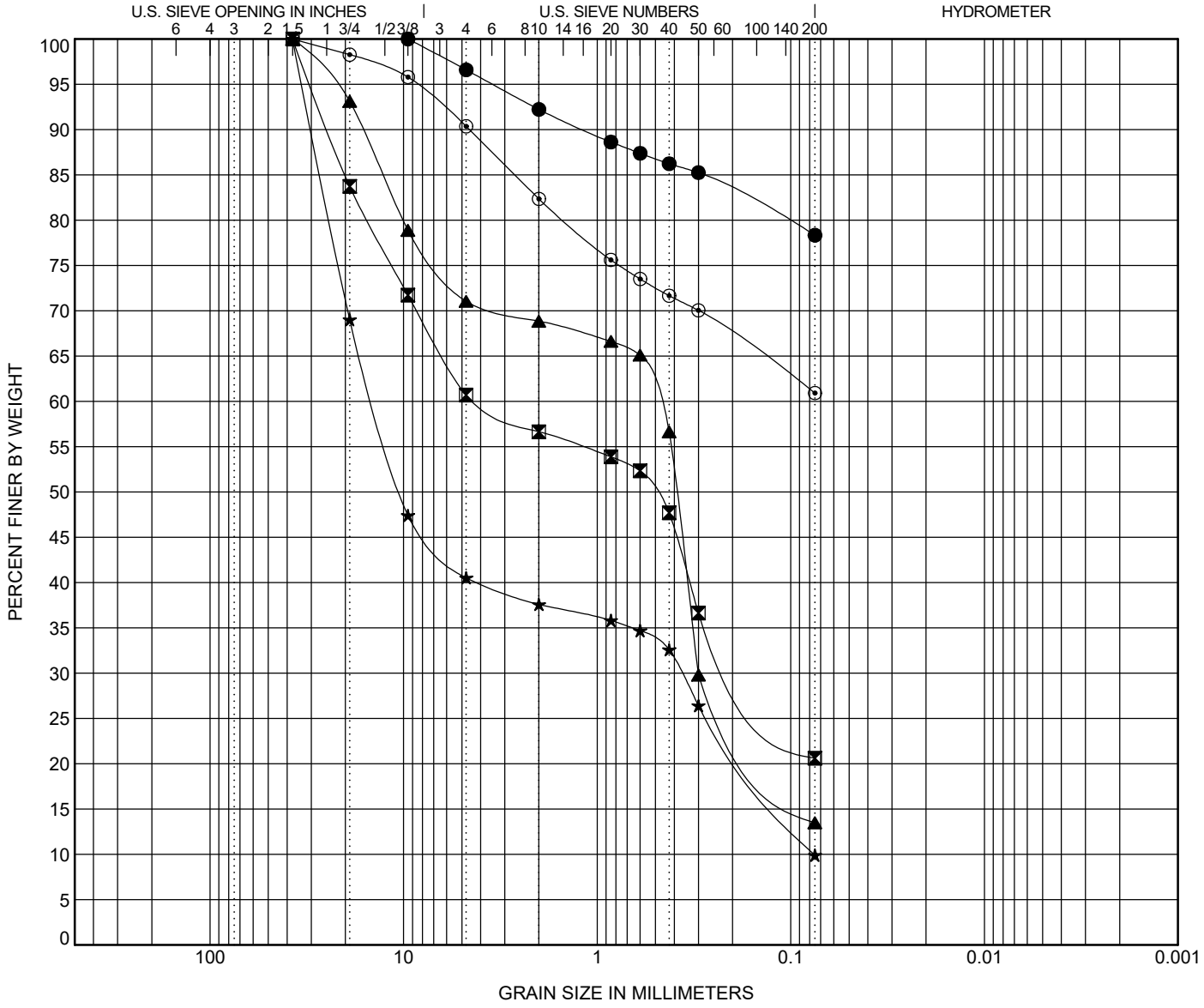
GRAIN SIZE DISTRIBUTION (ASTM D422 / D1140 / C136)

CLIENT Harrison County Commissioners
PROJECT Freeport Sanitary System Improvements
PROJECT NUMBER HCY005
LOCATION Village of Freeport, Harrison County, Ohio



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BORING	DEPTH (ft)	USCS Classification	MC%	LL	PL	PI	Cc	Cu
●	B20-13	8.5 - 10.0	SILT with SAND (ML)	13.4					
⊠	B20-15	3.5 - 4.4	SILTY SAND with GRAVEL (SM)	9.3					
▲	B20-20	3.5 - 5.0	SILY SAND with GRAVEL (SM)	9.7					
★	B20-25	1.0 - 2.5	POORLY GRADED GRAVEL with SILT and SAND (GP-GM)	7.4				0.13	188.27
⊙	B20-29	1.0 - 2.5	SANDY SILT (ML)	14.3					

	BORING	DEPTH (ft)	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B20-13	8.5 - 10.0	9.5				3.4	18.3	78.3	
⊠	B20-15	3.5 - 4.4	37.5	4.101	0.169		39.3	40.1	20.6	
▲	B20-20	3.5 - 5.0	37.5	0.487	0.301		29.0	57.6	13.5	
★	B20-25	1.0 - 2.5	37.5	14.225	0.367	0.076	59.5	30.6	9.9	
⊙	B20-29	1.0 - 2.5	37.5				9.6	29.4	60.9	

Point Load Strength Index of Rock

(ASTM D-5731)

Project Name: HCY005 - Freeport Sanitary Improvements Project Number: 2018820.02

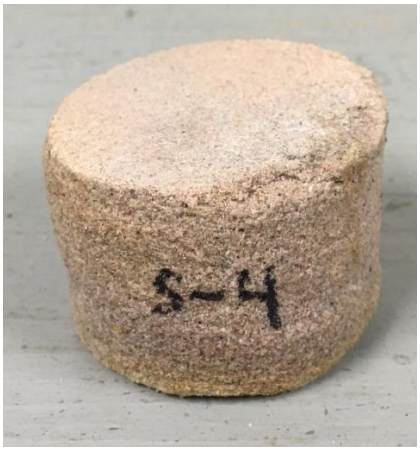
Technician: NC

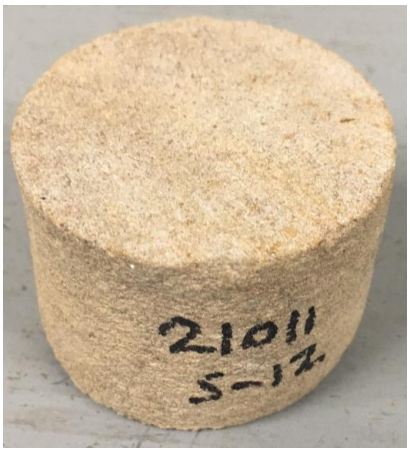
Moisture Condition at start of test: Test perform in as-received moisture condition.

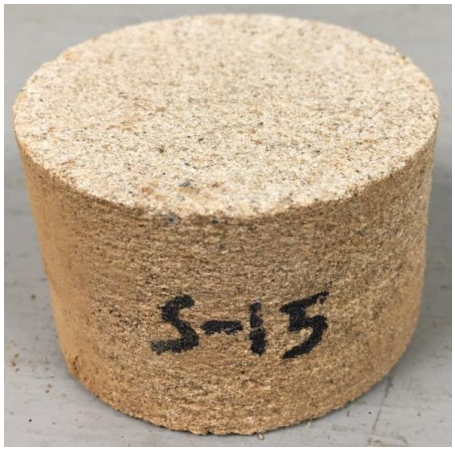
Sample	Sample Depth	Sample Description	Moisture Content	Point Load Index, $I_{s,50}$ (psi)	Corresponding Uniaxial Compressive Strength (psi)
B21-31 RC-1 S-4	10.8'-11.0'	Tan, Fine to Medium Grain Sandstone	6%	165	3,465
B21-34 RC-1 S-9	19.3'-19.5'	Dark Brown, Fine to Medium Grain Sandstone	9%	45	953
B21-34R RC-1 S-12	10.6'-10.8'	Tan, Fine to Medium Grain Sandstone	1%	256	5,376
B21-34R RC-1 S-14	10.3'-10.4'	Tan, Fine to Medium Grain Sandstone	1%	115	2,418
B21-34 RC-1 S-15	23.0'-23.3'	Tan, Fine to Medium Grain Sandstone	1%	338	7,095

Note: Single Samples provided for testing. As such, no statistical evaluation was performed.

Raw Data									
Specimen Number	Test Type	Diameter (W) In.	Post –Test Height (D') In.	Load (P) kips	De^2 In^2	De in	Is KSI	F	$I_{s,50}$ KSI
B21-31 RC-1 S-4	Axial	1.832	1.094	0.473	2.552	1.597	0.185	0.893	0.165
B21-34 RC-1 S-9	Axial	1.848	1.031	0.123	2.426	1.558	0.051	0.890	0.045
B21-34R RC-1 S-12	Axial	1.850	1.114	0.740	2.624	1.620	0.282	0.907	0.256
B21-34R RC-1 S-14	Axial	1.851	0.602	0.210	1.419	1.191	0.148	0.778	0.115
B21-34 RC-1 2-15	Axial	1.852	1.016	0.912	2.396	1.548	0.381	0.887	0.338

Sample Photos	
Before Testing	After Testing
B21-31 RC-1 S-4 (10.8'-11.0')	B21-31 RC-1 S-4 (10.8'-11.0')
	

B21-34 RC-1 S-9 (19.3’-19.5’) 	B21-34 RC-1 S-9 (19.3’-19.5’) 
B21-34R RC-1 S-12 (10.6’-10.8’) 	B21-34R RC-1 S-12 (10.6’-10.8’) 
B21-34R RC-1 S-14 (10.3’-10.4’) 	B21-34R RC-1 S-14 (10.3’-10.4’) 

B21-34 RC-1 S-15 (23.0’-23.3’)  	B21-34 RC-1 S-15 (23.0’-23.3’) 

Compressive Strength of Rock Core Specimen

(ASTM D-7012 Method C)

Project Name: Freeport Sanitary Improvements

Project Number: 2018820.02

Sample: B21-31 RC-1 S-1

Sample Depth: 14.3'-14.9'

Technician: N.C.

Rock Description: Tan, Fine to Medium Grain Sandstone

Moisture Condition at start of test: Damp

Specimen Diameter: 1.855"

Specimen Height: 4.230"

Height to Diameter Ratio: 2.28

Time to Failure: 2 minutes / 40 seconds at continuous strain rate.

Axial Compressive Strength: 4,680 psi (32.3 MPa)

Sample preparation occurred as follows: A rock core specimen is cut such that the length to diameter ratio is between 2:1 and 2.5:1. Any end protrusions are machined flat. All samples are then capped with a high strength gypsum cement. A bubble level is used to ensure the capped ends are parallel. Results may differ from results obtained from a test specimen prepared per the requirements of Practice D4543.

Sample After Testing:

Compressive Strength of Rock Core Specimen

(ASTM D-7012 Method C)

Project Name: Freeport Sanitary Improvements

Project Number: 2018820.02

Sample: B21-31 RC-1 S-2

Sample Depth: 12.9'-13.3'

Technician: N.C.

Rock Description: Tan, Fine to Medium Grain Sandstone

Moisture Condition at start of test: Damp

Specimen Diameter: 1.850"

Specimen Height: 3.700"

Height to Diameter Ratio: 2.00

Time to Failure: 2 minutes / 15 seconds at continuous strain rate.

Axial Compressive Strength: 3,900 psi (26.89 MPa)

Sample preparation occurred as follows: A rock core specimen is cut such that the length to diameter ratio is between 2:1 and 2.5:1. Any end protrusions are machined flat. All samples are then capped with a high strength gypsum cement. A bubble level is used to ensure the capped ends are parallel. Results may differ from results obtained from a test specimen prepared per the requirements of Practice D4543.

Sample After Testing:

Compressive Strength of Rock Core Specimen

(ASTM D-7012 Method C)

Project Name: Freeport Sanitary Improvements

Project Number: 2018820.02

Sample: B21-31 RC-1 S-3

Sample Depth: 11.0'-11.5'

Technician: N.C.

Rock Description: Tan, Fine to Medium Grain Sandstone

Moisture Condition at start of test: Damp

Specimen Diameter: 1.844"

Specimen Height: 4.196"

Height to Diameter Ratio: 2.28

Time to Failure: 3 minutes / 15 seconds at continuous strain rate.

Axial Compressive Strength: 2,310 psi (15.93 MPa)

Sample preparation occurred as follows: A rock core specimen is cut such that the length to diameter ratio is between 2:1 and 2.5:1. Any end protrusions are machined flat. All samples are then capped with a high strength gypsum cement. A bubble level is used to ensure the capped ends are parallel. Results may differ from results obtained from a test specimen prepared per the requirements of Practice D4543.

Sample After Testing:

Compressive Strength of Rock Core Specimen

(ASTM D-7012 Method C)

Project Name: Freeport Sanitary Improvements

Project Number: 2018820.02

Sample: B21-31 RC-2 S-6

Sample Depth: 17.0'-17.8'

Technician: N.C.

Rock Description: Brown, Fine to Coarse Grain Sandstone

Moisture Condition at start of test: Damp

Specimen Diameter: 1.858"

Specimen Height: 4.041"

Height to Diameter Ratio: 2.17

Time to Failure: 2 minutes / 11 seconds at continuous strain rate.

Axial Compressive Strength: 3,740 psi (25.79 MPa)

Sample preparation occurred as follows: A rock core specimen is cut such that the length to diameter ratio is between 2:1 and 2.5:1. Any end protrusions are machined flat. All samples are then capped with a high strength gypsum cement. A bubble level is used to ensure the capped ends are parallel. Results may differ from results obtained from a test specimen prepared per the requirements of Practice D4543.

Sample After Testing:

Compressive Strength of Rock Core Specimen

(ASTM D-7012 Method C)

Project Name: Freeport Sanitary Improvements

Project Number: 2018820.02

Sample: B21-34 RC-1 S-8

Sample Depth: 21.0'-21.7'

Technician: N.C.

Rock Description: Grey, Dense Limestone

Moisture Condition at start of test: Dry

Specimen Diameter: 1.869"

Specimen Height: 3.970"

Height to Diameter Ratio: 2.12

Time to Failure: 5 minutes / 3 seconds at continuous strain rate.

Axial Compressive Strength: 15,875 psi (109.45 MPa)

Sample preparation occurred as follows: A rock core specimen is cut such that the length to diameter ratio is between 2:1 and 2.5:1. Any end protrusions are machined flat. All samples are then capped with a high strength gypsum cement. A bubble level is used to ensure the capped ends are parallel. Results may differ from results obtained from a test specimen prepared per the requirements of Practice D4543.

Sample After Testing:

Compressive Strength of Rock Core Specimen

(ASTM D-7012 Method C)

Project Name: Freeport Sanitary Improvements

Project Number: 2018820.02

Sample: B21-34 RC-1 S-11

Sample Depth: 22.5'-23.0'

Technician: N.C.

Rock Description: Grey, Dense Limestone

Moisture Condition at start of test: Dry

Specimen Diameter: 1.874"

Specimen Height: 3.986"

Height to Diameter Ratio: 2.13

Time to Failure: 4 minutes / 23 seconds at continuous strain rate.

Axial Compressive Strength: 17,786 psi (122.63 MPa)

Sample preparation occurred as follows: A rock core specimen is cut such that the length to diameter ratio is between 2:1 and 2.5:1. Any end protrusions are machined flat. All samples are then capped with a high strength gypsum cement. A bubble level is used to ensure the capped ends are parallel. Results may differ from results obtained from a test specimen prepared per the requirements of Practice D4543.

Sample After Testing: