Geotechnical Engineering Report

Grove City Commercial Development
Grove City, Ohio
February 2, 2021
Terracon Project No. N4205433

Prepared for:
Ampler Development
Oklahoma City, OK

Prepared by:
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Columbus, Ohio

February 2, 2021

Ampler Development
PO Box 721888
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Attn: Mr. Dan Peyton
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E: dpeyton@amplergroup.com

Re: Geotechnical Engineering Report
Grove City Commercial Development
London Groveport Road
Grove City, Ohio
Terracon Project No. N4205433

Dear Mr. Peyton:

We have completed the Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with Terracon Proposal No. PN4205433 dated October 29, 2020 and signed Agreement of Services dated October 30, 2020. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations and pavements for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

Ganesh Vairavan
Senior Staff Engineer

Yogesh S. Rege, P.E.
Senior Principal, Department Manager

REPORT TOPICS

Note: This report was originally delivered in a web-based format. **Orange Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the ***GeoReport*** logo will bring you back to this page. For more interactive features, please view your project online at client.terracon.com.

ATTACHMENTS

Note: Refer to each individual Attachment for a listing of contents.

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INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed restaurant building to be located on London Groveport Road in Grove City, Ohio. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Site preparation and earthwork
- Foundation design and construction
- Seismic site classification per IBC
- Pavement design and construction

The geotechnical engineering Scope of Services for this project included the advancement of seven test borings to approximate depths ranging from 10 to 20 feet below existing site grade.

Maps showing the site and boring locations are shown in the **SITE LOCATION** and **EXPLORATION PLAN** sections, respectively. The results of the laboratory testing performed on selected soil samples obtained from the site during the field exploration are included on the boring logs and/or as separate graphs in the **EXPLORATION RESULTS** section.

SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Item	Description
Parcel Information	The project site is located approximately 300 feet west of the intersection of London Groveport Road and Summit Drive in Grove City, Ohio. The approximate coordinates of this parcel are 39.8390, -83.0794. See **Site Location.**
Existing Improvements	The subject site is currently undeveloped and is bordered by London Groveport Road to the North, existing Taco Bell restaurant to the west, existing ditch/small creek and Meijer Store's parking lot to the South, and an undeveloped land to the east.

Item	Description
Current Ground Cover	Topsoil and grass.
Existing Topography	Based on publicly available maps (Google Earth), the project site appears to be relatively level with approximate ground surface elevations ranging from 822 to 824 feet.

PROJECT DESCRIPTION

Our understanding of the project is as follows:

Item	Description
Information Provided	Site Plan - undated; provided via email dated October 27, 2020.
Project Description	Based on the provided information, the proposed improvements include the construction of a single-story restaurant building with a building footprint of approximately 2,300 square feet along with associated access driveways and parking lot.
Finished Floor Elevation	The proposed finished floor elevation was not available as of preparation of this report. It is assumed that the finished floor elevation will be within about 1 feet of the existing grade within the proposed building pad area.
Maximum Loads	Not provided. The following loads have been assumed based on previous similar projects: Column: 50 kips Wall: 1.5 KLF Slab: 100 psf
Grading	Based on the relatively level terrain, grading is anticipated to consist of up to 2 feet of fill within the proposed building pad area.
Below-Grade Structures	None.
Pavements	Not provided. We have assumed the following light duty traffic loading information: ■ Autos/light trucks: 1,000 vehicles per day ■ Delivery trucks: 2 vehicles per day ■ Trash collector trucks: 2 vehicles per week The pavement design period is 20 years.
Estimated Start of Construction	Not known.

If the project information presented above is not consistent with the proposed development, please inform us so that our recommendations can be reviewed and revised, if necessary.

GEOTECHNICAL CHARACTERIZATION

We have developed a general characterization of the subsurface conditions based upon our review of the subsurface exploration, laboratory data, and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of site preparation and foundation options. Conditions encountered at the exploration points are indicated on the individual logs. The individual logs can be found in the **EXPLORATION RESULTS** section and the GeoModel can be found in the **FIGURES** section of this report.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at the boring locations, please refer to the GeoModel.

Model Layer	Layer Name	General Description
1	**Topsoil**	About 6 inches of topsoil
2	**Existing Fill**	Fill that can be described as lean clay with sand, gravel, and brick fragments. Fill was encountered only in Boring B-3 to a depth of about 3.5 feet below existing site grade.
3	**Native cohesive soil**	Lean clay with varying amounts of sand and gravel; medium stiff to hard
4	**Discontinuous granular soil**	Clayey sand with varying amounts of gravel; medium dense

Groundwater Conditions

The borings were observed during drilling and immediately upon completion of drilling for the presence and level of groundwater as shown on the table below.

Boring ID	Approximate Depth of Groundwater (feet)	
	While Drilling	Upon Completion of Drilling
B-1	Not Encountered	Not Encountered
B-2	Not Encountered	Not Encountered
B-3	8.5	14
P-1	Not Encountered	Not Encountered
P-2	Not Encountered	8.5
P-3	Not Encountered	Not Encountered
P-4	Not Encountered	Not Encountered

Absence of groundwater in some of the borings does not necessarily mean that these borings were terminated above groundwater. Due to the low permeability of the soils encountered in some of the borings, a relatively long period of time may be necessary for a groundwater level to develop and stabilize in a borehole in these materials. Long term observations in piezometers or observation wells sealed from the influence of surface water are often required to define groundwater levels in materials of this type.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

GEOTECHNICAL OVERVIEW

Existing fill was encountered in Boring B-3 within the proposed building pad to a depth of about 3.5 feet below existing grade. This fill is not suitable for direct foundation and floor slab and should be entirely removed from within and 10 feet beyond the building footprint and replaced with structural fill consistent with recommendations provided in **EARTHWORK** section of this report. We recommend performing few test pits in the vicinity of Boring B-3 to determine the lateral extent of the existing fill soils.

Our subsurface findings indicate that the proposed building can be supported on shallow spread footings bearing on at least stiff native cohesive soils or on lean concrete and/or structural fill extending to such competent native soil.

Native cohesive soils generally appear suitable for floor slab and pavement support provided the subgrade is proofrolled and unstable areas remediated by stabilizing or undercutting of the unstable subgrade materials.

A proposed grading plan was not available at the time of this report preparation. Grading to prepare the proposed building pad is anticipated to consist of up to 2 feet of cut and/or fill. Proofrolling of areas anticipated to receive structural fill and exposed subgrades for floor slab and pavement areas during site preparation process is an important aspect of the earthwork operations to provide for suitable subgrade for pavement support. Proofrolling and remediation of any soft or unstable areas should be performed as outlined in the **EARTHWORK** section of this report.

Groundwater was observed in the borings at depths ranging from approximately 8.5 to 14 feet below existing site grade. Therefore, groundwater seepage is not anticipated in shallow excavations planned for this project. However, trapped water infiltration may be encountered in shallow excavations during construction, especially after a period of heavy precipitation and depending on when the construction is performed. In such an event, sump and pumping methods may be required for temporary dewatering. The contractor is responsible for employing appropriate temporary dewatering methods to control seepage and facilitate construction.

Close monitoring of the construction operations discussed herein will be critical in achieving the design subgrade support. We therefore recommend that Terracon be retained to monitor this portion of the work.

The **GENERAL COMMENTS** section provides an understanding of the report limitations.

EARTHWORK

Earthwork is anticipated to include topsoil removal, excavations, and fill placement. The following sections provide recommendations for use in the preparation of specifications for the work. Recommendations include critical quality criteria, as necessary, to render the site in the state considered in our geotechnical engineering evaluation for foundations, floor slabs, and pavements.

Site Preparation

As an initial measure of site preparation, topsoil, existing fill, or any other surficial deleterious material (e.g. debris, desiccated soil, high organic content soil, frozen soil, etc.) should be completely removed to expose the underlying native soils in areas that support the proposed building and associated pavements. Any materials consisting of vegetation and organic matter should be wasted off site or could be re-spread in landscaped areas after completion of grading operations. Stripping depths across the site could vary considerably. We recommend actual stripping depths be evaluated by a representative of Terracon during construction to aid in preventing removal of excess material.

As indicated previously, the existing fill soils encountered at the proposed building location (in Boring B-3) are not suitable for direct foundation and floor slab and should be entirely removed from within and 10 feet beyond the building footprint and replaced with structural fill consistent with recommendations provided in **EARTHWORK** section of this report. We recommend performing few test pits in the vicinity of Boring B-3 to determine the lateral extent of the existing fill soils.

Removal and/or relocation of any “to be abandoned” utilities should also be performed prior to rough site grading activities. We would anticipate removal and relocation, or re-routing, of any existing utilities and catch basins which may currently exist within the footprint of the proposed development area that would interfere with new construction. Any abandoned underground pipes, left in place, should be fully grouted. Excavations created due to utility relocations should be backfilled with granular structural fill material, placed and compacted in accordance with the recommendations provided in the following paragraphs or with lean concrete or flowable fill. If lean concrete is used as backfill, the contractor should refer to the project drawings to confirm that the concrete backfill materials will not conflict with any new item installations or construction. Backfill above utilities to be abandoned in place by grouting should be evaluated in area where these materials will provide subgrade support for new fill or structures. Unsuitable existing backfill should be undercut and replaced with structural fill.

After the removal of topsoil, the exposed subgrades within the limits of the proposed building and associated pavement areas should be proofrolled with heavy pneumatic tired construction equipment, such as a loaded dump truck weighing at least 20 tons. Densification of granular soils, if encountered, should be performed with a heavy drum vibratory compactor. A geotechnical engineer or their representative should observe the densification/proofrolling to aid in locating unstable subgrade materials and assessing the subgrade.

Any soft, medium stiff, loose or yielding areas encountered during proofrolling operations should be undercut to expose firm stable soils and replaced with structural fill or reworked in place to a stable acceptable condition. The actual amount of undercut would need to be determined in the field during construction and is dependent on weather conditions and equipment used in the construction.

Fill Material Types

Fill required to achieve design grade should be classified as structural fill. Structural fill is material used below, or within 10 feet of structures and pavements. Earthen materials used for structural fill should meet the following material property requirements:

Soil Type [1]	USCS Classification	Acceptable Parameters (for Structural Fill)
Lean clay	CL (LL<40 & PI<22)	All locations and elevations
Well graded granular	SW or GW[2]	All locations and elevations
Low Volume Change Material [3]	CL (LL<40 & PI<22) or SW or GW [2]	All locations and elevations
On-Site Native Soil	CL and SC	The use of on-site CL and SC soils as structural fill should meet the requirements for "acceptable location for placement" indicated above. Moisture conditioning of the onsite soils should be anticipated.
Existing fill	N/A	The existing fill can be used as structural fill after deleterious materials such as brick fragments, cobble fragments, etc. are completely removed. Moisture conditioning of the onsite soils should be anticipated.

Soil Type [1]	USCS Classification	Acceptable Parameters (for Structural Fill)

1. Structural fill should consist of approved materials free of organic matter, and particles larger than 3 inches in any dimension and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the Geotechnical Engineer for evaluation prior to use on this site.
2. Crushed limestone aggregate, limestone screenings, or granular material such as sand, gravel or crushed stone.
3. Low plasticity cohesive soil and well graded granular soil.

Fill Compaction Requirements

Structural fill should meet the following compaction requirements.

Item	Structural Fill
Maximum Lift Thickness	8 inches or less in loose thickness when heavy, self-propelled compaction equipment is used 4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or dry compactor) is used
Minimum Compaction Requirements [1, 2]	98% of maximum dry density (Standard proctor)
Water Content Range [2]	Low plasticity cohesive: -2% to +3% of optimum Granular: Workable moisture levels

1. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved. The compacted subgrade should also not indicate rutting and pumping under construction traffic.
2. Specifically, moisture levels should be maintained low enough to allow for satisfactory compaction to be achieved without the cohesionless fill material pumping when proofrolled. Soils removed which will be used as structural fill should be protected to aid in preventing an increase in moisture content due to rain.

Utility Trench Backfill

For low permeability subgrades, utility trenches are a common source of water infiltration and migration. Utility trenches installed beneath the building should be effectively sealed to restrict water intrusion and flow through the trenches, which could migrate below the building. The trench should provide an effective trench plug that extends at least 5 feet from the face of the building exterior. The plug material should consist of cementitious flowable fill or low permeability clay. The trench plug material should be placed to surround the utility line. If used, the clay trench plug material should be placed and compacted to comply with the water content and compaction recommendations for structural fill stated previously in this report.

Grading and Drainage

All grades must provide effective drainage away from the building during and after construction and should be maintained throughout the life of the structure. Water retained next to the building can result in soil movements greater than those discussed in this report. Greater movements can result in unacceptable differential foundation movements, cracked slabs and walls, and roof leaks. The roof should have gutters/drains with downspouts that discharge onto splash blocks at a distance of at least 10 feet from the building.

Based on our short-term observations, groundwater seepage/trapped infiltration may be encountered in shallow excavations during construction, especially if the construction is started after the period of heavy precipitation. In such an event, sump and pumping methods might be required for the temporary dewatering.

Earthwork Construction Considerations

Excavations for the proposed structure are anticipated to be accomplished with conventional construction equipment. Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of foundations and pavements. Construction traffic over the completed subgrades should be avoided to the extent possible. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Water collecting over or adjacent to construction areas should be removed. If the subgrade freezes, desiccates, saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted prior to pavement construction.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, “Excavations” and its appendices, and in accordance with any applicable local, and/or state regulations.

Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming responsibility for construction site safety, or the contractor's activities; such responsibility shall neither be implied nor inferred.

Construction Observation and Testing

The earthwork efforts should be monitored under the direction of the Geotechnical Engineer. Monitoring should include documentation of adequate removal of vegetation, topsoil and unsuitable/unstable soils, proofrolling, and mitigation of areas delineated by the proofroll to require mitigation.

Each lift of compacted fill should be tested, evaluated, and reworked as necessary until approved by the Geotechnical Engineer prior to placement of additional lifts.

In areas of foundation excavations, the bearing subgrade should be evaluated under the direction of the Geotechnical Engineer. In the event unanticipated conditions are encountered, the Geotechnical Engineer should recommend mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of engagement of the Geotechnical Engineer in the construction phase of the project, provides the continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions, including assessing variations and associated design changes.

SHALLOW FOUNDATIONS

It is recommended that the building footings bear on suitable native soils, or newly placed structural fill and/or lean concrete that extends to suitable native soils. Suitable native soils consist of native cohesive soils having at least stiff consistency. Where unsuitable conditions are encountered at the design footing bearing depths, the remedial methods recommended in section **Foundation Construction Considerations** below should be implemented.

Design Parameters

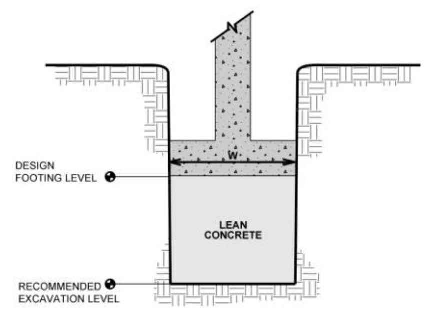
Item	Description
Maximum net allowable bearing pressure [1, 2]	2,500 psf
Required bearing stratum [3]	Native soils consisting of at least stiff consistency or structural fill and/or lean concrete extending to suitable at least stiff native soils.
Minimum allowable foundation dimensions	Columns: 30 inches Continuous: 18 inches
Ultimate coefficient of sliding friction [4]	0.30
Minimum embedment below finished grade [5]	Exterior footings in unheated areas: 32 inches Interior footings in heated areas: 24 inches
Estimated total settlement from structural loads [2]	Less than about 1 inch
Estimated differential settlement [2, 6]	About 2/3 of total settlement

1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. An appropriate factor of safety has been applied.
2. Values provided are for maximum loads noted in **PROJECT DESCRIPTION**.
3. Unsuitable or soft to medium stiff or loose soil, if encountered, should be over-excavated and replaced according to the recommendations presented in Foundation Construction Considerations section below.
4. Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Should be neglected for foundations subject to net uplift conditions.
5. Embedment necessary to reduce the effects of frost and/or seasonal water content variations.
6. Differential settlements are as measured over a span of 50 feet.

Foundation Construction Considerations

As noted in **EARTHWORK**, the footing excavations should be evaluated under the direction of the Geotechnical Engineer. The base of all foundation excavations should be free of water and existing fill, loose or very soft to medium stiff soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations should be removed/reconditioned before foundation concrete is placed.

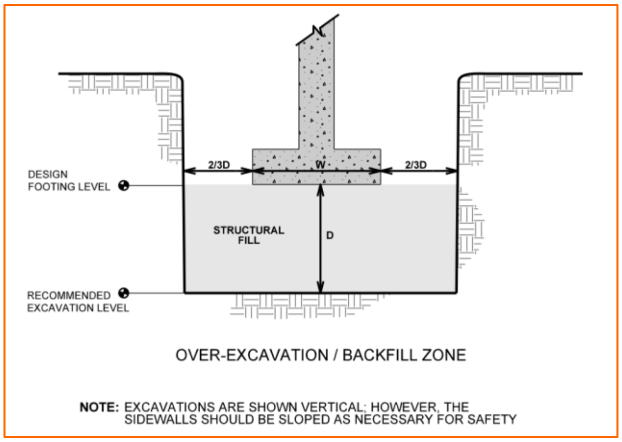
If existing fill or unsuitable bearing soils are encountered at the base of the planned footing excavation, the excavation should be extended deeper to suitable soils, and the footings could bear directly on these soils at the lower level or on lean concrete backfill placed in the excavations. This is illustrated on the sketch below.



LEAN CONCRETE BACKFILL

NOTE: EXCAVATIONS ARE SHOWN VERTICAL; HOWEVER, THE SIDEWALLS SHOULD BE SLOPED AS NECESSARY FOR SAFETY

Over-excavation for structural fill placement below footings should be conducted as shown below. Over-excavation for compacted engineered fill placement below footings should extend laterally beyond all edges of the footings at least 8 inches per foot of over-excavation depth below footing base elevation. The over-excavation should then be backfilled up to the footing base elevation with granular structural fill material placed in lifts of 8 inches or less in loose thickness (4 inches or less if using hand-guided compaction equipment) and compacted according to the recommendations provided in **EARTHWORK** section of this GeoReport. The over-excavation and backfill procedures are described in the following figure.



SEISMIC CONSIDERATIONS

The seismic design requirements for buildings and other structures are based on Seismic Design Category. Site Classification is required to determine the Seismic Design Category for a structure. The Site Classification is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7 and the International Building Code (IBC). Based on the soil properties encountered at the site and as described on the exploration logs and results, it is our professional opinion that the **Seismic Site Classification is D**. Subsurface explorations at this site were extended to a maximum depth of 20 feet. The site properties below the boring depth to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area. Additional deeper borings or geophysical testing may be performed to confirm the conditions below the current boring depth.

FLOOR SLABS

Design parameters for floor slabs assume the requirements for **EARTHWORK** have been followed. Specific attention should be given to positive drainage away from the structure and positive drainage of the aggregate base beneath the floor slab.

Floor Slab Design Parameters

Item	Description
Floor slab support [1]	Minimum 6 inches of free-draining (less than 6% passing the U.S. No. 200 sieve) crushed aggregate compacted to at least 98% of ASTM D 698 [2, 3]
Estimated modulus of subgrade reaction [2]	110 pounds per square inch per inch (psi/in) for point loads

Item	Description
1.	Floor slab areas should be structurally independent of any building footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation.
2.	Modulus of subgrade reaction is an estimated value based upon our experience with the subgrade condition, the requirements noted in **EARTHWORK**, and the floor slab support as noted in this table. It is provided for point loads. For large area loads the modulus of subgrade reaction would be lower.
3.	Free-draining granular material should have less than 6 percent fines (material passing the #200 sieve). Other design considerations such as cold temperatures and condensation development could warrant more extensive design provisions.

The use of a vapor retarder should be considered beneath concrete slabs on grade covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

Saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual. Joints or cracks should be sealed with a water-proof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing or other means.

Floor Slab Construction Considerations

Finished subgrade, within and for at least 10 feet beyond the floor slab, should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or desiccated prior to construction of floor slabs, the affected material should be removed, and structural fill should be added to replace the resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

The Geotechnical Engineer should approve the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel, and concrete. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

PAVEMENTS

General Pavement Comments

Pavement designs are provided for the traffic conditions and pavement life conditions as noted in **Project Description** and in the following sections of this report. A critical aspect of pavement performance is site preparation. Pavement designs noted in this section must be applied to the site which has been prepared as recommended in the **Earthwork** section.

Subgrade Preparation

On most project sites, the site grading is accomplished relatively early in the construction phase. However, as construction proceeds, excavations are made into these areas, rainfall and surface water saturates some areas, heavy construction traffic disturbs the subgrade and many surface irregularities are filled in with loose soils to improve trafficability temporarily. As a result, the pavement subgrades should be carefully evaluated as the time for pavement construction approaches.

We recommend the moisture content and density of the upper 12 inches of the subgrade be evaluated and the pavement subgrades be proof-rolled within two days prior to commencement of actual paving operations. Areas not in compliance with the required ranges of moisture or density should be moisture conditioned and recompacted. Particular attention should be paid to anticipated high traffic areas and to areas where backfilled trenches are located. Areas where unsuitable conditions are located should be repaired by removing and replacing the materials with properly compacted fills.

After proof-rolling and repairing deep subgrade deficiencies, the entire subgrade should be scarified and developed as recommended in **Site Preparation** to provide a uniform subgrade for pavement construction. Areas that appear severely desiccated following removal of topsoil may require further undercutting and moisture conditioning. If a significant precipitation event occurs after the evaluation or if the surface becomes disturbed, the subgrade should be reviewed by qualified personnel immediately prior to paving. The subgrade should be in its finished form at the time of the final review.

Pavement Design Parameters

Provided site preparation recommendations in this report are followed to prepare the pavement subgrade, a CBR value of 3 can be considered for preliminary pavement design. This value needs to be verified by performing laboratory tests (laboratory CBR tests) on the representative on-site soil subgrade samples as the project progresses into final design and construction phase.

The minimum pavement section thicknesses presented in the section **Estimates of Minimum Pavement Thickness** below are based on anticipated traffic loading information presented in the

PROJECT DESCRIPTION of this report. We have anticipated that the traffic loads will be produced primarily by automobile traffic, delivery trucks, and occasional trash removal trucks. The thickness of pavements subjected to heavy truck traffic should be determined using expected traffic volumes, vehicle types, and vehicle loads and should be in accordance with local, city or county ordinances.

For areas subject to concentrated and repetitive loading conditions such as dumpster pads or loading dock areas, we recommend the use of a Portland Cement Concrete (PCC) pavement. For areas where PCC pavements, a subgrade modulus of 110 pci may be used for pavement design purposes.

Pavement performance is affected by its surroundings. In addition to providing preventive maintenance, the civil engineer should consider the following recommendations in the design and layout of pavements:

- Final grade adjacent to parking lots and drives should slope down from pavement edges at a minimum 2%;
- The subgrade and the pavement surface should have a minimum ¼ inch per foot slope to promote proper surface drainage;
- Install pavement drainage surrounding areas anticipated for frequent wetting;
- Install joint sealant and seal cracks immediately;
- Seal all landscaped areas in, or adjacent to pavements to reduce moisture migration to subgrade soils;
- Place compacted, low permeability backfill against the exterior side of curb and gutter; and,
- Place curb, gutter and/or sidewalk directly on clay subgrade soils rather than on unbound granular base course materials

Estimates of Minimum Pavement Thickness

The following table provides options for Asphaltic Concrete and for Portland Cement Sections:

Typical Pavement Section Thickness (inches)						
Traffic Area	**Alternative**	**Asphalt Concrete Surface Course**	**Asphalt Concrete Base Course**	**Portland Cement Concrete** [1]	**Aggregate Base Course** [2]	**Total Thickness**
Light Duty [3] (automobiles and occasional delivery trucks)	PCC	--	--	6.0	6.0	12.0
	AC	2.0	2.0	--	6.0	10.0

1. 4,000 psi at 28 days, 4-inch maximum slump and 5 to 7 percent air entrained, 6-sack min. mix. At least 7.0-inch-thick PCC pavements are recommended for trash container pads and in any other areas subjected to heavy wheel loads and/or turning traffic.
2. ODOT 304 crushed limestone base material.
3. In accordance with assumed traffic information included in the **PROJECT DESCRIPTION** section of the report.

Pavement Drainage

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular base section. The subgrade and the pavement surface should have a minimum ¼ inch per foot slope to promote drainage. Appropriate sub-drainage or connection to a suitable daylight outlet should be provided to remove water from the base layer.

If not already in place, Spider or Finger Drains should be installed at all existing drainage structures within the pavement limits. Four (4) - inch diameter perforated drain tile should be installed with positive slope to extend 10 feet beyond each face of the structure with the invert 18 inches minimum below the pavement surface. The drains should be backfilled with free draining open graded granular material.

Pavement Maintenance

The pavement sections represent minimum recommended thicknesses and, as such, periodic maintenance should be anticipated. Therefore, preventive maintenance should be planned and provided for through an on-going pavement management program. Maintenance activities are intended to slow the rate of pavement deterioration and to preserve the pavement investment. Maintenance consists of both localized maintenance (e.g., crack and joint sealing and patching) and global maintenance (e.g., surface sealing). Preventive maintenance is usually the priority when implementing a pavement maintenance program. Additional engineering observation is recommended to determine the type and extent of a cost-effective program. Even with periodic maintenance, some movements and related cracking may still occur and repairs may be required.

GENERAL COMMENTS

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client, and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, and cost estimating including, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

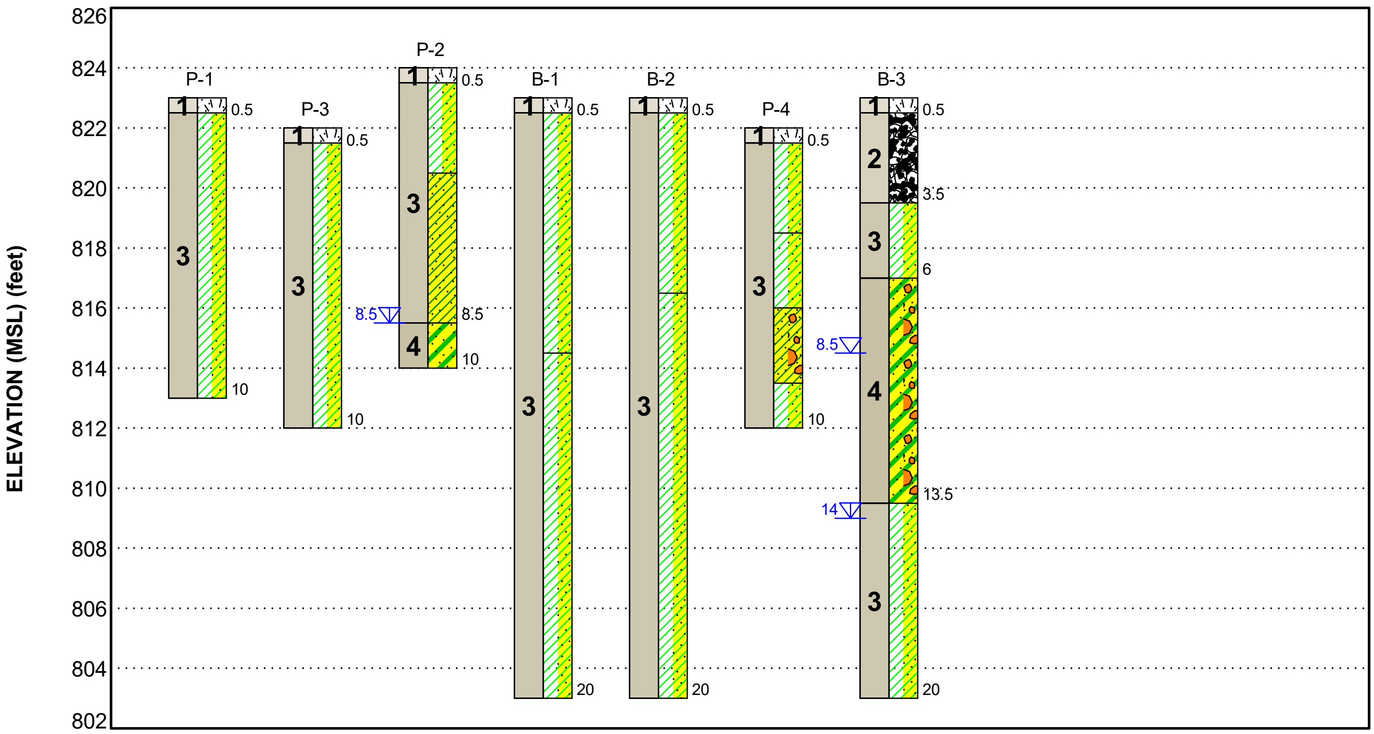
FIGURES

Contents:

GEOMODEL

Grove City Commercial Development ■ Grove City, OH
Terracon Project No. N4205433

Terracon GeoReport



This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	Topsoil	About 6 inches of topsoil
2	Existing fill	Fill that can be described as lean clay containing sand, gravel, and brick fragments
3	Native cohesive soil	Lean clay with varying amounts of sand and gravel; medium stiff to hard
4	Discontinuous granular soil	Clayey sand with varying amounts of gravel; medium dense

LEGEND

- Topsoil
- Lean Clay with Sand
- Fill
- Clayey Sand with Gravel
- Sandy Lean Clay
- Clayey Sand
- Sandy Lean Clay with Gravel

▽ First Water Observation
▽ Second Water Observation

Groundwater levels are temporal. The levels shown are representative of the date and time of our exploration. Significant changes are possible over time.
Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

NOTES:
Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project.
Numbers adjacent to soil column indicate depth below ground surface.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES

Field Exploration

Number of Boring(s)	Boring Depth (feet)	Planned Location
3	20	Building
4	10	Pavement

Boring Layout and Elevations: Terracon used a hand held GPS unit to locate the field exploration points. The ground surface elevation at the boring locations were obtained from Google Earth. The Location and elevation of the boring locations as presented on the boring logs should be considered approximate and accurate only to the degree implied by the means and methods used to define them.

Subsurface Exploration Procedures: We advanced the borings with a drill rig using continuous flight hollow-stem augers. Soil sampling was performed using split-barrel sampling procedures. The samples were placed in appropriate containers and taken to our soil laboratory for testing. In addition, we observed and recorded groundwater levels during drilling and sampling.

Our exploration team member prepared field boring logs as part of the drilling operations that includes sampling depths, penetration distances, and other relevant sampling information. Field logs also include visual classifications of materials encountered during drilling, and our interpretation of subsurface conditions between samples. Final boring logs, prepared from field logs, represent the geotechnical engineer's interpretation, and include modifications based on observations and laboratory tests.

Prior to subsurface exploration Terracon made a call to the Ohio811 services to clear the public utilities at the project site.

Property Disturbance: We backfilled the borings with auger cuttings after completion. Excess auger cuttings were dispersed in the general vicinity of the borehole. Because backfill material often settles below the surface after a period, we recommend that the boreholes be checked periodically and backfilled, if necessary.

Laboratory Testing

The project engineer reviewed the field data and assigned various laboratory tests to better understand the engineering properties of various soil strata. Our laboratory testing program included examination of soil samples by an engineer. Based on the material's texture and plasticity, we described and classified soil samples in accordance with the Unified Soil Classification System (USCS). The following tests were performed on selected soil samples:

- ASTM D2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- ASTM D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- ASTM D422 Standard Test Method for Particle-Size Analysis of Soils

SITE LOCATION AND EXPLORATION PLANS

Contents:

Note: All attachments are one page unless noted above.

SITE LOCATION

Grove City Commercial Development ■ Grove City, OH

February 2, 2021 ■ Terracon Project No. N4205433

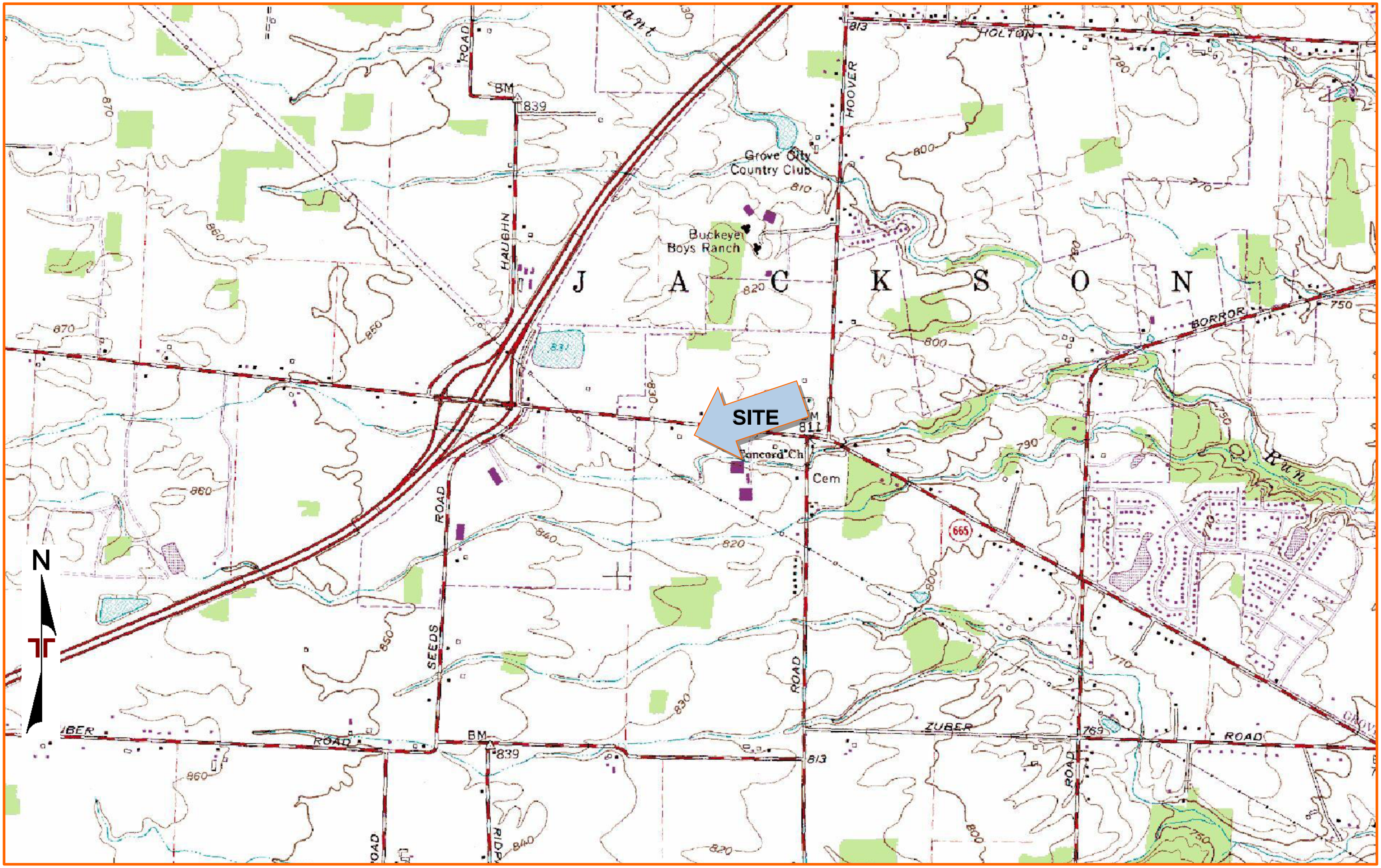


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGICAL SURVEY QUADRANGLES INCLUDE: COMMERCIAL POINT, OH (1/1/1988).

EXPLORATION PLAN

Grove City Commercial Development ■ Grove City, OH

February 2, 2021 ■ Terracon Project No. N4205433

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

EXPLORATION RESULTS

Contents:

Note: All attachments are one page unless noted above.

BORING LOG NO. B-1

PROJECT: Grove City Commercial Development

CLIENT: Ampler Development, LLC

SITE: London Groveport Road
Grove City, OH

LOCATION See Exploration Plan

Latitude: 39.8392° Longitude: -83.0793°

Approximate Surface Elev.: 823 (Ft.) +/-

MODEL LAYER	DEPTH	DESCRIPTION	ELEVATION (Ft.)
1	0.5	**TOPSOIL (6")**	822.5+/-
3	8.5	**LEAN CLAY WITH SAND (CL)**, brown, moist, medium stiff to stiff	814.5+/-
3	20.0	**LEAN CLAY WITH SAND (CL)**, trace gravel, brown, moist, very stiff to hard	803+/-
		Boring Terminated at 20 Feet	

SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI
X	6	4-8-4 N=12	4.5	16.0	29-13-16
X	12	4-4-3 N=7	3.0	16.0	
X	12	4-5-7 N=12	4.5	11.0	
X	2	6-16-13 N=29	4.5		
X	3	5-11-25 N=36	4.5		
X	12	6-14-12 N=26	4.5		

DEPTH (Ft.): 5, 10, 15, 20

WATER LEVEL OBSERVATIONS: Cave-in at 17.0'

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
2.25" HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Cave-in at 17.0'

Terracon
800 Morrison Rd
Gahanna, OH

Boring Started: 01-15-2021	Boring Completed: 01-15-2021
Drill Rig: 7822 (#13)	Driller: K. Langstaff
Project No.: N4205433	

BORING LOG NO. B-2

PROJECT: Grove City Commercial Development

CLIENT: Ampler Development, LLC

SITE: London Groveport Road Grove City, OH

LOCATION See Exploration Plan

Latitude: 39.8391° Longitude: -83.0793°

Approximate Surface Elev.: 823 (Ft.) +/-

MODEL LAYER	DEPTH	Description	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI
1	0.5	**TOPSOIL (6")**	822.5+/-								
		LEAN CLAY WITH SAND (CL), brown, moist, stiff contains roots and organics at 1.0' - 2.5'				X	6	4-8-7 N=15	4.5	16.0	
						X	6	2-4-5 N=9	3.5	19.0	
3	6.5	**LEAN CLAY WITH SAND (CL)**, trace gravel, brown, moist, very stiff to hard	816.5+/-	5		X	8	5-11-14 N=25	4.5	10.0	
				10		X	4	8-19-15 N=34	4.5		
				15		X	12	4-8-11 N=19	4.5		
					Cave-in (17.0')						
	20.0		803+/-	20		X	8	13-11-13 N=24	4.5		

Boring Terminated at 20 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
2.25" HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Cave-in at 17.0'

Terracon
800 Morrison Rd
Gahanna, OH

Boring Started: 01-15-2021	Boring Completed: 01-15-2021
Drill Rig: 7822 (#13)	Driller: K. Langstaff
Project No.: N4205433	

BORING LOG NO. B-3

PROJECT: Grove City Commercial Development

CLIENT: Ampler Development, LLC

SITE: London Groveport Road
Grove City, OH

LOCATION See Exploration Plan

Latitude: 39.8390° Longitude: -83.0792°

Approximate Surface Elev.: 823 (Ft.) +/-

MODEL LAYER	DEPTH	DESCRIPTION	ELEVATION (Ft.)
1	0.5	**TOPSOIL (6")**	822.5+/-
2	3.5	**FILL - LEAN CLAY WITH SAND**, brown, moist, contains brick fragments	819.5+/-
3	6.0	**LEAN CLAY WITH SAND (CL)**, brown, moist, medium stiff	817+/-
4	13.5	**CLAYEY SAND WITH GRAVEL (SC)**, brown, wet, medium dense	809.5+/-
3	20.0	**LEAN CLAY WITH SAND (CL)**, gray, wwet, stiff to very stiff	803+/-
		Boring Terminated at 20 Feet	

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI
1.0–2.5		X	6	3-5-7 N=12	3.5	16.0	
3.5–5.0		X	6	2-3-3 N=6	3.0	21.0	
6.0–7.5		X	10	1-4-6 N=10	-	17.0	
8.5	▽						
8.5–10.0		X	10	4-4-6 N=10	-		
14	▽						
13.5–15.0		X	18	2-4-6 N=10	2.5		
17	Cave-in						
18.5–20.0		X	18	13-12-11 N=23	4.5		

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3.25" HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *Water observed at 8.5' while drilling*

▽ *Water at 14' upon completion*

Cave-in at 17.0'

Terracon
800 Morrison Rd
Gahanna, OH

Boring Started: 01-15-2021	Boring Completed: 01-15-2021
Drill Rig: 7822 (#13)	Driller: K. Langstaff
Project No.: N4205433	

BORING LOG NO. P-1

PROJECT: Grove City Commercial Development | **CLIENT: Ampler Development, LLC**

SITE: London Groveport Road Grove City, OH

LOCATION See Exploration Plan

Latitude: 39.8392° Longitude: -83.0797°

Approximate Surface Elev.: 823 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI
1		0.5	**TOPSOIL (6")**	822.5+/-								
3			**LEAN CLAY WITH SAND (CL)**, brown, moist, medium stiff to stiff				X	10	2-3-4 N=7	3.0	25.0	
							X	12	5-4-5 N=9	4.5	11.0	
					5							
							X	12	2-3-11 N=14	4.5		
						Cave-in						
		10.0		813+/-	10		X	8	3-3-7 N=10	4.5		

Boring Terminated at 10 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3.25" HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Cave-in at 8.0'

Terracon
800 Morrison Rd
Gahanna, OH

Boring Started: 01-15-2021	Boring Completed: 01-15-2021
Drill Rig: 7822 (#13)	Driller: K. Langstaff
Project No.: N4205433	

BORING LOG NO. P-2

PROJECT: Grove City Commercial Development

CLIENT: Ampler Development, LLC

SITE: London Groveport Road Grove City, OH

LOCATION See Exploration Plan

Latitude: 39.8390° Longitude: -83.0795°

Approximate Surface Elev.: 824 (Ft.) +/-

MODEL LAYER	DEPTH	MATERIAL DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI
1	0.5	**TOPSOIL (6")**	823.5+/-								
	3.5	**LEAN CLAY WITH SAND (CL)**, brown, moist, medium stiff	820.5+/-			X	12	2-3-4 N=7	4.5	22.0	
3	8.5	**SANDY LEAN CLAY (CL)**, trace gravel, brown, moist, very stiff	815.5+/-	5		X	6	9-14-11 N=25	-	9.0	
						X	18	5-8-8 N=16	4.5		
4	10.0	**CLAYEY SAND (SC)**, brown, moist, medium dense	814+/-	10	Cave-in at 8.5'	X	18	8-9-12 N=21	-		

Boring Terminated at 10 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
3.25" HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Water at 8.5' upon completion

Cave-in at 8.5'

Terracon
800 Morrison Rd
Gahanna, OH

Boring Started: 01-15-2021	Boring Completed: 01-15-2021
Drill Rig: 7822 (#13)	Driller: K. Langstaff
Project No.: N4205433	

BORING LOG NO. P-3

PROJECT: Grove City Commercial Development

CLIENT: Ampler Development, LLC

SITE: London Groveport Road Grove City, OH

LOCATION See Exploration Plan

Latitude: 39.8388° Longitude: -83.0797°

Approximate Surface Elev.: 822 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI
1		0.5	**TOPSOIL (6")**	821.5+/-								
3			**LEAN CLAY WITH SAND (CL)**, brown, moist, stiff to very stiff				X	18	4-6-6 N=12	4.5	14.0	
							X	18	5-4-8 N=12	4.5	11.0	
					5		X	18	4-6-15 N=21	4.5		
						Cave-in	X	18	11-14 N=	4.5		
		10.0		812+/-	10							

Boring Terminated at 10 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
2.25" HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Cave-in at 8.5'

Terracon
800 Morrison Rd
Gahanna, OH

Boring Started: 01-15-2021	Boring Completed: 01-15-2021
Drill Rig: 7822 (#13)	Driller: K. Langstaff
Project No.: N4205433	

BORING LOG NO. P-4

PROJECT: Grove City Commercial Development | **CLIENT: Ampler Development, LLC**

SITE: London Groveport Road, Grove City, OH

LOCATION See Exploration Plan

Latitude: 39.8388° Longitude: -83.0792°

Approximate Surface Elev.: 822 (Ft.) +/-

MODEL LAYER	GRAPHIC LOG	DEPTH	MATERIAL DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (In.)	FIELD TEST RESULTS	HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI
1		0.5	**TOPSOIL (6")**	821.5+/-								
3		3.5	**LEAN CLAY WITH SAND (CL)**, brown, moist, hard, possible cobbles/boulder encountered; contains rootlets at 1.0' - 2.5'	818.5+/-			X	9	8-50/4"	4.5	16.0	
		6.0	**LEAN CLAY WITH SAND (CL)**, brown, moist, stiff	816+/-	5		X	9	2-3-6 N=9	3.0	20.0	
		8.5	**SANDY LEAN CLAY WITH GRAVEL (CL)**, brown, moist, stiff	813.5+/-			X	8	2-3-8 N=11	-		
		10.0	**LEAN CLAY WITH SAND (CL)**, trace gravel, brown, moist, very stiff	812+/-	10		X	8	5-8-10 N=18	-		

Boring Terminated at 10 Feet

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
2.25" HSA

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

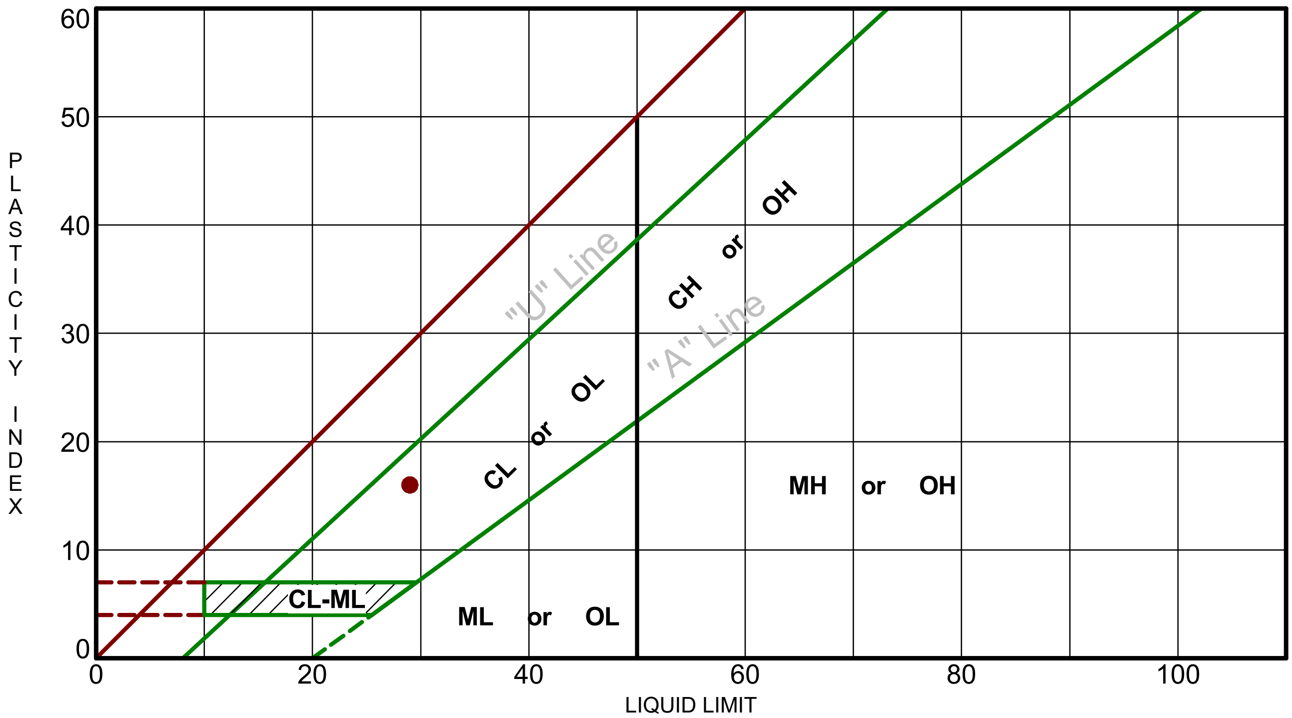
WATER LEVEL OBSERVATIONS

Terracon
800 Morrison Rd
Gahanna, OH

Boring Started: 01-15-2021	Boring Completed: 01-15-2021
Drill Rig: 7822 (#13)	Driller: K. Langstaff
Project No.: N4205433	

ATTERBERG LIMITS RESULTS

ASTM D4318



	Boring ID	Depth	LL	PL	PI	Fines	USCS	Description
●	B-1	1 - 2.5	29	13	16			LEAN CLAY

PROJECT: Grove City Commercial Development

SITE: London Groveport Road Grove City, OH

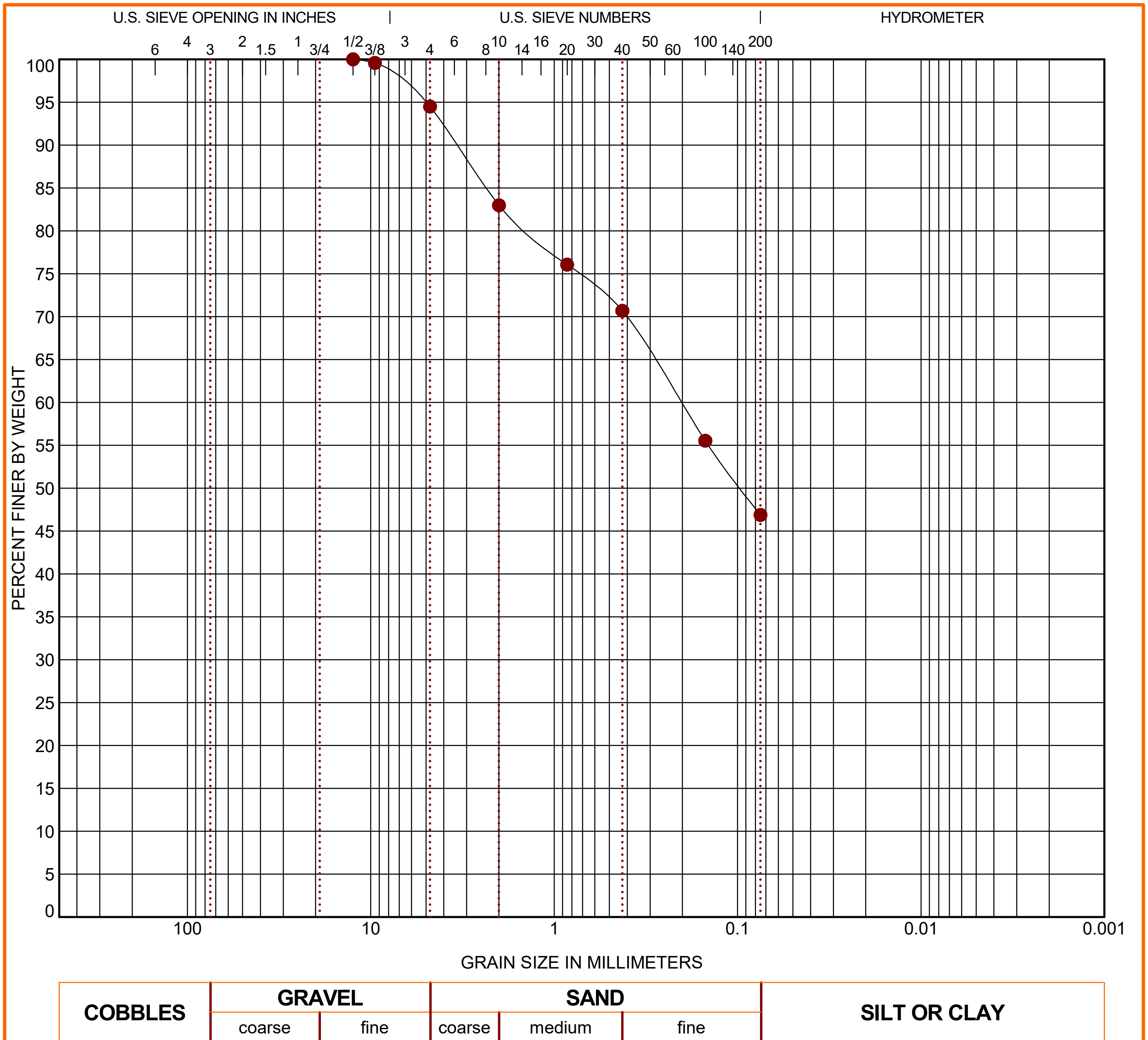
Terracon
800 Morrison Rd
Gahanna, OH

PROJECT NUMBER: N4205433

CLIENT: Ampler Development, LLC

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



Boring ID		Depth	USCS Classification	WC (%)	LL	PL	PI	Cc	Cu
●	B-3	6 - 7.5	CLAYEY SAND	17.0					

Boring ID		Depth	D_{100}	D_{60}	D_{30}	D_{10}	%Cobbles	%Gravel	%Sand	%Silt	%Fines	%Clay
●	B-3	6 - 7.5	12.5	0.204			0.0	5.5	47.6		46.9	

PROJECT: Grove City Commercial Development

SITE: London Groveport Road Grove City, OH

Terracon
800 Morrison Rd
Gahanna, OH

PROJECT NUMBER: N4205433

CLIENT: Ampler Development, LLC

SUPPORTING INFORMATION

Contents:

Note: All attachments are one page unless noted above.

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

Grove City Commercial Development ■ Grove City, OH

Terracon Project No. N4205433

Terracon GeoReport

SAMPLING	WATER LEVEL	FIELD TESTS
Standard Penetration Test	▽ Water Initially Encountered Water Level After a Specified Period of Time ▼ Water Level After a Specified Period of Time Cave In Encountered Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.	**N** Standard Penetration Test Resistance (Blows/Ft.) **(HP)** Hand Penetrometer **(T)** Torvane **(DCP)** Dynamic Cone Penetrometer **UC** Unconfined Compressive Strength **(PID)** Photo-Ionization Detector **(OVA)** Organic Vapor Analyzer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification as noted on the soil boring logs is based Unified Soil Classification System. Where sufficient laboratory data exist to classify the soils consistent with ASTM D2487 "Classification of Soils for Engineering Purposes" this procedure is used. ASTM D2488 "Description and Identification of Soils (Visual-Manual Procedure)" is also used to classify the soils, particularly where insufficient laboratory data exist to classify the soils in accordance with ASTM D2487. In addition to USCS classification, coarse grained soils are classified on the basis of their in-place relative density, and fine-grained soils are classified on the basis of their consistency. See "Strength Terms" table below for details. The ASTM standards noted above are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment.

LOCATION AND ELEVATION NOTES

Exploration point locations as shown on the Exploration Plan and as noted on the soil boring logs in the form of Latitude and Longitude are approximate. See Exploration and Testing Procedures in the report for the methods used to locate the exploration points for this project. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength Qu, (tsf)**	**Standard Penetration or N-Value Blows/Ft.**
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium Stiff	0.50 to 1.00	4 - 8
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 15
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	> 4.00	> 30

RELEVANCE OF SOIL BORING LOG

The soil boring logs contained within this document are intended for application to the project as described in this document. Use of these soil boring logs for any other purpose may not be appropriate.

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	**Group Name** [B]
Coarse Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	Cu ≥ 4 and 1 ≤ Cc ≤ 3 [E]		GW	Well-graded gravel [F]
			Cu < 4 and/or 1 > Cc > 3 [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F,G,H]
			Fines classify as CL or CH		GC	Clayey gravel [F,G,H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	Cu ≥ 6 and 1 ≤ Cc ≤ 3 [E]		SW	Well-graded sand [I]
			Cu < 6 and/or 1 > Cc > 3 [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G,H,I]
			Fines classify as CL or CH		SC	Clayey sand [G,H,I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	PI > 7 and plots on or above "A" line [J]		CL	Lean clay [K,L,M]
			PI < 4 or plots below "A" line [J]		ML	Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K,L,M,N]
			Liquid limit - not dried			Organic silt [K,L,M,O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line		CH	Fat clay [K,L,M]
			PI plots below "A" line		MH	Elastic Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K,L,M,P]
			Liquid limit - not dried			Organic silt [K,L,M,Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10} \qquad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.