ECS Mid-Atlantic, LLC

Geotechnical Engineering Report

Proposed Burger King

Lot 8 of 7700 Derry Street Subdivision
Southwest Corner of Derry Street and Milroy Road
Swatara Township, Dauphin County, Pennsylvania

ECS Project Number 18:4914

May 8, 2020

ECS MID-ATLANTIC, LLC
"Setting the Standard for Service"
Geotechnical • Construction Materials • Environmental • Facilities

May 8, 2020

Mr. Ryan Solum, P.E
InSite Real Estate, LLC
1400 16th Street
Suite 300
Oak Brook, Illinois 60523

ECS Project No. 18:4914

Reference: Subsurface Exploration and Geotechnical Engineering Services
Proposed Burger King
Swatara Township, Dauphin County, Pennsylvania

Dear Mr. Solum:

ECS Mid-Atlantic, LLC (ECS) has completed the subsurface exploration and geotechnical engineering analyses for the above referenced project. Our services were performed in general accordance with our Proposal No. 18:7146-GP, dated December 11, 2019. This report presents our understanding of the geotechnical aspects of the project, results of the field exploration along with our design and construction recommendations.

It has been our pleasure to be of service to InSite Real Estate, LLC, during this phase of this project. We would appreciate the opportunity to remain involved during the continuation of the design phase and to provide our services during construction phase operations as well to verify the assumptions of subsurface conditions made for this report. Should you have any questions concerning the information contained in this report, or if we can be of further assistance to you, please contact us.

Respectfully submitted,

ECS Mid-Atlantic, LLC

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EXECUTIVE SUMMARY

The following provides a summary outline of the geotechnical engineering data and recommendations associated with the proposed Burger King to be located in Swatara Township, Dauphin County, Pennsylvania. This summary must be read in complete context with the following report for proper interpretation.

Our scope of work included drilling test borings across the proposed building footprint and parking areas along with conducting infiltration testing within the proposed stormwater management facility. The test borings extended to depths ranging from approximately 8 to 15 feet below existing grades.

Based on the test boring data gathered, the property is underlain by a layer of fill followed by the naturally-occurring soils. The bedrock surface, groundwater and evidence of the seasonal high water table, were not encountered at the termination depths of any test location completed.

Infiltration testing was conducted at 5 and 8 feet below site grades. The infiltration rates were found range from 0.00 to 1.53 in/hr when a factor of safety was applied. Based on the results of the infiltration testing, we recommend a design infiltration rate of 0.30 inch/hr be used.

The site is located within an area of karst limestone geology which is prone to dissolution and the formation of sinkholes. Although signs of existing or incipient sinkhole activity were not observed at the time of our exploration, repair of karst features during and immediately following construction should be budgeted for.

The building footprint is underlain by a layer of fill which extended to depths of up to 7.5 feet below existing site grades. Due to the unknowns associated with the placement of the existing fill, the foundation bearing elevation is **not** anticipated to be suitable for support of the proposed building. Therefore, it is recommended the existing fill be completely removed and replaced under engineering control within the building envelope.

The parking areas are also underlain by a layer of fill. Based on the presence of the existing fill, it is **imperative** the pavement subgrade be thoroughly compacted and proof-rolled with suitable construction equipment. The proof-rolling should be traversed in two perpendicular (orthogonal) directions with overlapping passes of the vehicle under the observation of the Geotechnical Engineer or authorized representative. In the event unstable or “pumping” subgrade is identified by the proof-rolling operation, these areas will need to be repaired.

The proposed building can be supported by conventional shallow foundations consisting of column and/or strip footings bearing on the improved existing fill or naturally-occurring soils. The foundations can be designed for an allowable soil bearing pressure of 3,000 psf based on anticipated design loads. The building should be designed based on a seismic site classification of D.

1.0 INTRODUCTION

1.1 GENERAL

The purpose of this study was to provide geotechnical information for a proposed Burger King to be located in Swatara Township, Dauphin County, Pennsylvania. The recommendations developed for this report are derived from the “Premises Plan” (Plan), prepared by InSite Real Estate, LLC, dated November 11, 2019. This report contains the results of our subsurface exploration and engineering analyses for site development.

1.2 SCOPE OF SERVICES

Characterization of the subsurface conditions is critical to the design process. The scope of work for this phase of the project included test borings and infiltration testing across the proposed development.

This report presents our findings and evaluations which includes the following:

- A review of surface topographical features and site conditions
- A review of area and site geologic conditions.
- A review of subsurface soil stratigraphy with pertinent available physical properties.
- A brief review and description of our field procedures conducted.
- Final copies of our boring logs.
- Infiltration testing results and recommendations for stormwater management.
- Recommendations for site preparation and construction of compacted fills, including an evaluation of on-site soils for use as compacted fills.
- Pavement design and construction recommendations.
- Recommended allowable bearing pressure(s) for foundation design.
- Recommendations for construction within karst areas.
- Discussion of parameters for slab on grade construction and modulus of subgrade reaction (k).
- SeismicSite Classification.
- Recommended pavement sections for concrete and bituminous sections.
- Design and construction recommendations for below-grade wall construction.
- Evaluation and recommendations relative to groundwater.

1.3 AUTHORIZATION

Our services were provided in accordance with our Proposal No. 18:7146-GP, dated December 11, 2019, as authorized by InSite Real Estate, LLC.

2.0 PROJECT INFORMATION

2.1 PROJECT LOCATION

The project site is located southwest of the intersection at Derry Street and Milroy Road in Swatara Township, Dauphin County, Pennsylvania. At the time of our exploration, the property was covered by grass with patches of old asphalt and stone. Topography across the property is relatively flat, sloping down gradient towards the east resulting in approximately 8 feet of relief across the proposed improvements. Refer to Figure 2.1.A and the Site Location Map in Appendix A for the extents of the project site.

Figure 2.1.A – Site Location

2.2 PROPOSED CONSTRUCTION

The following information explains our understanding of the structure and assumed loads:

Table 2.2.A – Design Values

SUBJECT	DESIGN INFORMATION / EXPECTATIONS
Building Footprint	2,775 square feet
# of Stories	1-story above grade
Usage	Commercial
Framing	Not Provided – Assume wood frame with concrete slab-on-grade
Column Loads	Not Provided – Assume 80 kips maximum
Wall Loads	Not Provided – Assume 3 kips per linear foot maximum
Finish Floor Elevation	Not Provided – Assume close to existing site grades

3.0 FIELD EXPLORATION

3.1 FIELD EXPLORATION PROGRAM

The field exploration was planned with the objective of characterizing the project site in general geotechnical and geological terms to provide recommendations for the design and construction of the Burger King restaurant.

3.1.1 Boring Data

The subsurface conditions were explored by drilling a total of six (6) test borings across the proposed building footprint, surrounding pavement areas, and stormwater management facilities. This subsurface exploration was completed under the general supervision of an ECS Field Specialist.

Boring locations were field located by an ECS Field Specialist utilizing a handheld GPS unit based on the previously referenced Plan. The approximate as-drilled boring locations are shown on the Exploration Location Plan found within Appendix A.

An experienced Field Specialist visually classified each soil sample on the basis of texture and plasticity in accordance with USCS and ASTM D-2488 (Description and Identification of Soils-Visual/Manual Procedures). After classification, the Field Specialist grouped the various soil types into the major zones noted on the boring logs within Appendix B. The group symbols for each soil type are indicated in parentheses following the soil descriptions on the boring logs. The stratification lines designating the interfaces between earth materials on the boring logs are approximate as the in-situ transitions may be gradual.

Standard penetration tests (SPTs) were conducted in the borings at regular intervals in general accordance with ASTM D 1586. Representative samples were obtained during these tests and used to classify the soils encountered. The standard penetration resistances obtained provide a general indication of soil shear strength and compressibility. A summary of the boring data is provided in the table below.

Table 3.1.1.A – Summary of Boring Data

Boring Location	Surface Elevation (Feet)	Drilled Depth	
		Depth (Feet)	Elev. (Feet)
Building Footprint			
B-1	±371	15	356
B-2	±370	15	355
Pavement Areas			
B-3	±371	10	361
B-4	±372	10	362
Stormwater Management Facilities			
B-5	±364	8	356
B-6	±365	10	355

The logs for the subsurface exploration along with the Exploration Location Plan are included within the Appendices of this report.

3.1.2 Stormwater Infiltration Testing

Cased borehole infiltration tests were conducted in general accordance with Appendix C of the Pennsylvania Stormwater Best Management Practices (PA BMP) Manual. The infiltration test results are provided in the following table.

Table 3.1.2.A – Infiltration Testing Results

Test Location	Surface Elevation (Feet)	Depth to Limiting Zone (Feet)	Limiting Layer Elevation (Feet)	Infiltration Test Depth (Feet)	Test Elevation (Feet)	Infiltration Rate (inches / hour) (Includes FS=2.0)
B-5	±366	>8	<358	5	361	0.00
B-6A	±363	>10	<353	5	358	0.30
B-6B	±363	>10	<353	8	355	1.53

3.2 REGIONAL/SITE GEOLOGY

Based on the *Geologic Map of Pennsylvania,* the project site is mapped as being underlain by the St. Paul Group (Osp). According to *Engineering Characteristics of the Rocks of Pennsylvania*, Second Edition, 1982, by Alan Geyer and Peter Wilshusen, the St. Paul Group consists of a buff-colored, finely crystalline, “birdseye” limestone at the top and base, and granular fossiliferrous limestone, chert, and dolomite in the middle. The bedrock is well-bedded in a fissile to flaggy manner with minor thick beds. Because the formation group is moderately resistant to weathering, it is only slightly weathered to a shallow depth. The surface drainage is good, but has poor subsurface drainage. This formation is susceptible to karst processes and sinkholes are common. The overlying soil mantle is often highly variable in thickness because the bedrock surface is often highly pinnacled making the soil-rock interface uneven. St. Paul Group rocks are difficult to excavate with bedrock pinnacles providing additional difficulty, but the drilling rate is moderate. The cut slope stability is good and the foundation stability provided by the bedrock is good provided excavation is performed to sound rock.

An overview of the general site geology is illustrated in Figure 3.2.A below.

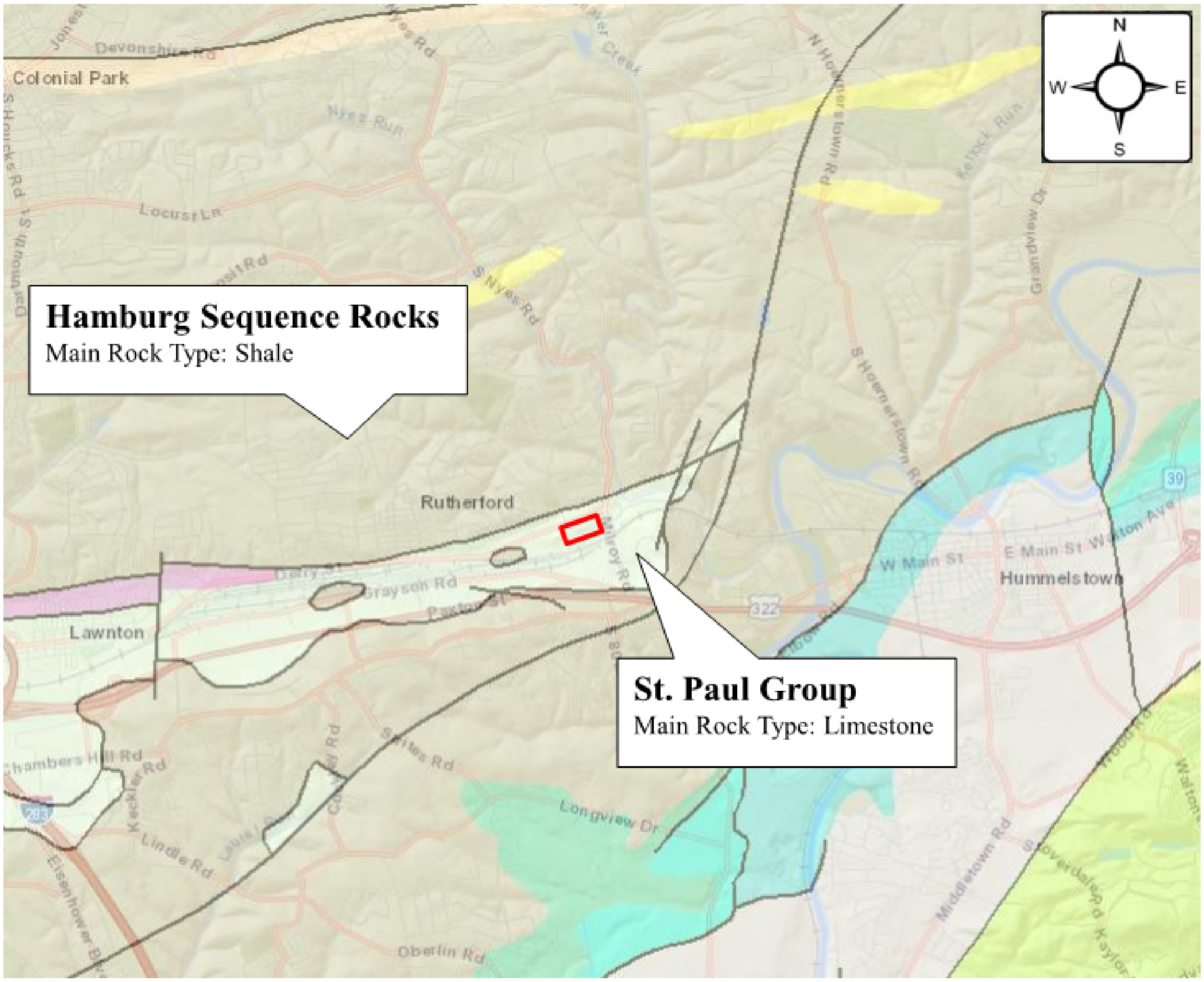


Figure 3.2.A

Geologic map for Figure 3.2.A obtained from the Commonwealth of Pennsylvania Department of Conservation and Natural Resources Interactive Geologic Map website, http://www.gis.dcnr.state.pa.us/geology/index.html

3.3 SITE PHYSIOGRAPHY

This site is situated in the Great Valley Section of the Ridge and Valley Physiographic Province in northwest Pennsylvania. This section consists of very broad valleys where dissected uplift is present in the northwestern half and low karst terrain is present in the southeast half. This section is primarily developed on shale and sandstone bedrock in the northwest, while limestone and dolomite bedrock are dominant in the southeast. Elevations in this section range from 140 to 1,100 feet, and local relief is low to moderate. The drainage pattern is dendritic and karst for this section.

3.4 SOIL SURVEY MAPPING

Our review of the Soil Survey (USDA - Natural Resources Conservation Service websoilsurvey.ncrs.usda.gov) revealed that the project site is mapped as Philo Silt Loam and Weikert Shaly Silt Loam (25-40% Slopes). These soil types are described as having the following properties.

Table 3.4.A – Soil Mapping Summary

Mapped Soil Unit	Soil Unit Symbol	Origin/Type	Depth to Restrictive Feature	Depth to Water Table	Hydrologic Soil Group	K_{Sat} (in/hr)
Philo Silt Loam	Ph	Recent coarse-loamy alluvium derived from sandstone and shale	>80 inches	>80 inches	B/D	0.60-2.00
Weikert Shaly Silt Loam (25-40% Slopes)	WeE2	Residuum weathered from shale and siltstone	10 to 20 inches to lithic bedrock	>80 inches	D	2.00-6.00

Soil mapping of the site vicinity is presented in Appendix A.

3.5 SUBSURFACE STRATIGRAPHY

The following section provides generalized characterizations of the soil strata encountered during our subsurface exploration. For subsurface information at a specific location, refer to the Boring Logs presented within Appendix B.

Table 3.5.A – Subsurface Stratigraphy

Stratum	Description
Surficial Material	2 to 3 inches of topsoil
I	Fill – Generally, (CL) Gravelly Lean Clay • Stiff to very stiff; loose to medium dense • Moist • Orange, brown, red, black, tan • Contains varying amounts of brick, asphalt, concrete, styrofoam and organics • Extend from below surficial materials to as deep as 7.5 feet
II	Generally, (SM) Silty Sand with Gravel • Medium dense to very dense • Moist • Tan to orange to reddish brown • Extended from below fill to as deep as 15 feet

3.6 GROUNDWATER OBSERVATIONS

Groundwater was not encountered at the termination depths at the time of our fieldwork. It should be noted the groundwater elevation will be highly affected by precipitation; therefore, higher or lower groundwater levels may be encountered depending on the time of year and recent precipitation events. However, small localized perched water conditions could be encountered during construction.

4.0 LABORATORY TESTING

The laboratory testing was performed by ECS on representative samples obtained during our field exploration. The following paragraph briefly discusses the laboratory testing program. Classification and index property tests were performed on representative soil samples obtained from the test borings in order to aid in classifying soils according to the Unified Soil Classification System (USCS) and to quantify and correlate engineering properties.

Laboratory testing performed specifically for this project included moisture content determination, grain size analysis, and Atterberg Limits. A summary of the laboratory testing is provided below.

Table 4.A – Summary of Soil Classification Testing Results

Boring	Depth (Feet)	USCS Classification	Water Content (%)	Atterberg Limits		Grain Size			
				Liquid Limit	Plastic Index	%Gravel	%Sand	%Silt	%Clay
B-1	6.0 – 8.0	GM	15.7	NP	NP	38.8	36.8	24.4	
B-4	2.0 - 4.0	SM	20.3	43	31	16.2	37.8	46.0	
B-5	6.0 – 8.0	GM	8.6	31	23	46.6	41.2	12.2	

5.0 DESIGN RECOMMENDATIONS

5.1 FOUNDATION DESIGN

Provided subgrades and structural fills are prepared as discussed herein, the proposed building can be supported utilizing conventional shallow foundations consisting of column and continuous wall footings. The design of the foundations shall utilize the following parameters:

Table 4.1.A Foundation Design Parameters

Design Parameter	Column Footing	Wall Footing
Net Allowable Bearing Pressure[1]	3,000 psf	3,000 psf
Acceptable Bearing Soil Material	Stratum II or Structural Fill	Stratum II or Structural Fill
Minimum Width	24 inches	24 inches
Minimum Footing Embedment Depth for Interior Foundations (below slab or finished grade)	24 inches	18 inches
Minimum Footing Embedment Depth for Exterior Foundations (below slab or finished grade)	36 inches	36 inches
Estimated Total Settlement (max.)	1 inch	1 inch
Estimated Differential Settlement	Less than 0.5 inches between columns	Less than 0.5 inches over 50 feet

Note[1]: Net allowable bearing pressure is the applied pressure in excess of the surrounding overburden soils above the base of the foundation.

Based on the data gathered, the building footprint is underlain by a layer of fill which extended to depths of approximately 5 and 7.5 feet below existing site grades. Due to the unknowns associated with the placement of the existing fill and the presence of deleterious materials, the foundation bearing elevation is **not** anticipated to be suitable for support of the proposed structure. Therefore, a ground improvement program is recommended to improve the existing ground conditions.

The existing fill, where encountered, should be completely excavated until the naturally-occurring soils are encountered. The lateral extent of the excavation should be widened 1 foot on each side for every foot of over-excavation (equivalent to a 1H:1V slope for improved bearing area) beyond 2 feet in depth. Upon completion of the excavation, the bottom of remediated area should be satisfactorily compacted utilizing appropriate equipment. If soft or unsuitable soils are observed, this material should be undercut and removed. Following review, the undercut area should be backfilled with structural fill (such as the previously excavated soils orother on-site soils if free of deleterious matter, or 2A aggregate) and compacted under engineering review until the designed bearing elevation has been reached.

5.2 FLOOR SLAB

Due to the necessary overexcavation and replacement within the building pad, the slab for the structure will bear on new structural fill. Areas of existing unsuitable fill, soft soils, or other unsuitable soils should be removed and replaced with compacted structural fill in accordance with the recommendations included in this report. The slab subgrade should be evaluated by proof-rolling in accordance with Section 6.1.3. The following graphic depicts our soil-supported slab recommendations:

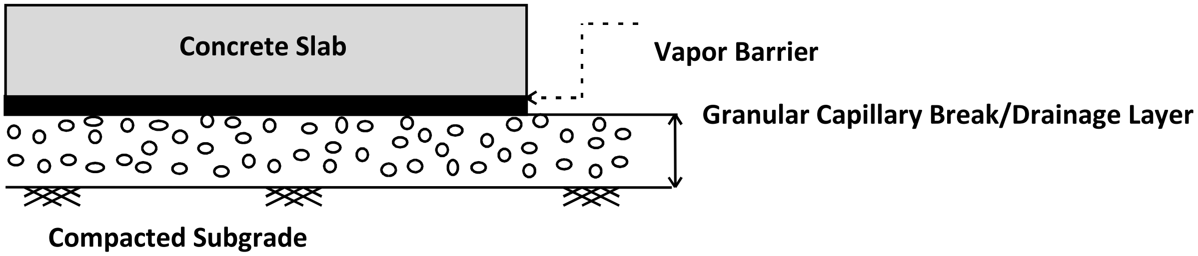


Figure 4.2.A

1. Drainage Layer Thickness: 6 inches minimum
2. Drainage Layer Material: AASHTO #57 Stone
3. Subgrade compacted to ***98%*** maximum dry density per ASTM D698

Subgrade Modulus: Provided the evaluation bearing stratum and Granular Drainage Layer are completed per the recommendations discussed herein, the slab may be designed assuming a modulus of subgrade reaction, k_1, of 150 pci. The modulus of subgrade reaction value is based on a 1 foot by 1 foot plate load test basis.

Slab Isolation: Ground-supported slabs should be isolated from the foundations and foundation-supported elements of the structure so that differential movement between the foundations and slab will not induce excessive shear and bending stresses in the floor slab. Where the structural configuration prevents the use of a free-floating slab, the slab should be designed with suitable reinforcement and load transfer devices to preclude overstressing of the slab.

Vapor Barrier: The granular layer below the slab will facilitate the fine grading of the subgrade and help prevent the rise of water through the floor slab. Before the placement of concrete, a vapor barrier may be placed on top of the granular material to provide additional moisture protection. However, special attention should be given to the surface curing of the slab in order to minimize uneven drying of the slab and associated cracking. Depending on flooring material types, the structural engineer and/or the architect may choose to eliminate the vapor barrier.

5.3 SITE RETAINING WALLS

We recommend that all below grade and site retaining walls be designed to withstand lateral earth pressures and surcharge loads from soil. To accomplish a drained condition, the walls will need to incorporate appropriate drainage materials including a foundation drain and clean stone (AASHTO #57). We recommend that walls that are restrained from movement at the top be designed for a linearly increasing lateral earth pressure.

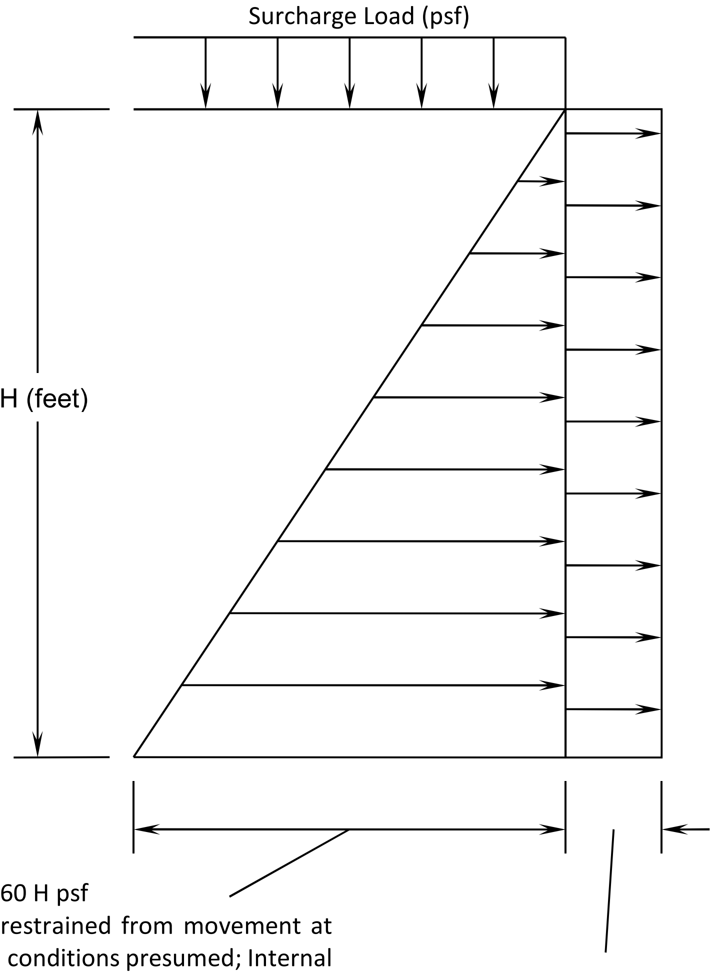
The engineering soil parameters below can be used for the design of these walls assuming positive foundation drainage is provided to prevent buildup of hydrostatic pressure. The table also assumes that the walls will be backfilled with Structural fill materials. The fills should be granular materials that classify as Silty SAND (SM) or more granular soil types having an internal angle of friction of 30 degrees and a unit weight of 120 pcf. Wall backfill should not consist of clayey soil types. The majority of the on-site soils should be suitable for wall backfill.

Table 5.3.A – Engineering Soil Parameters

Parameter	Structural Fill
Moist unit weight (pcf)	120
Friction angle (degrees)	30
Cohesion (psf)	0
Active Earth Pressure Coefficient, K_a	0.33
At-Rest Earth Pressure Coefficient, K_o	0.50
Passive Earth Pressure Coefficient, K_p	3.00
Coefficient of Friction for Sliding	0.30

The following Figure depicts the suggested lateral earth pressure condition for a “drained” wall condition with restrained wall tops (such as a loading dock wall):

This diagram is not suitable for the design of Support of Excavation or temporary shoring systems.



Lateral Earth Pressure = 60 H psf
(For below grade walls restrained from movement at top and bottom, drained conditions presumed; Internal angle of friction of 30 degrees and a unit weight of 120 pcf.

Horizontal Pressure from Surcharge
= 0.5 x Vertical Surcharge

Figure 5.3.A – Retained Earth Diagram

Backfill of foundation walls and retaining walls should consist of granular material. The backfill materials should be placed in 8-inch thick loose layers and compacted to 98 percent of the standard Proctor maximum dry density. We recommend that backfill directly behind the walls be compacted with hand-held compactors. Heavy compactors and grading equipment should not be allowed to operate within 10 feet of the wall during backfilling to avoid developing excessive temporary or long-term lateral soil pressures. We recommend that a representative of the geotechnical engineer be present to monitor foundation excavations and fill placement. Below grade walls should also be designed to resist adjoining surcharge loads from foundations, equipment, and/or vehicle traffic located in the zone of influence of the wall.

5.4 SEISMIC DESIGN CHARACTERISTICS

Seismic Site Classification: The International Building Code (IBC) requires site classification for seismic design based on the upper 100 feet of a soil profile. Where site specific data are not available to a depth of 100 feet, appropriate soil properties are permitted to be estimated by the registered design professional preparing the soils report based on known geologic conditions. Three (3) methods are utilized in classifying sites, namely the shear wave velocity (v_s) method; the undrained shear strength (s_u) method; and the Standard Penetration Resistance (N-value) method.

The seismic site class definitions for the weighted average of shear wave velocity or SPT N-value in the upper 100 feet of the soil profile are shown in the following table:

Table 4.4.A – Seismic Site Classification

Site Class	Soil Profile Name	Shear Wave Velocity, Vs, (ft./s)	N value (bpf)
A	Hard Rock	Vs > 5,000 fps	N/A
B	Rock	2,500 < Vs ≤ 5,000 fps	N/A
C	Very dense soil and soft rock	1,200 < Vs ≤ 2,500 fps	>50
D	Stiff Soil Profile	600 ≤ Vs ≤ 1,200 fps	15 to 60
E	Soft Soil Profile	Vs < 600 fps	<15

The subsurface exploration at this site included drilling borings to depths ranging from 2 to 11 feet below the existing site grades. The International Building Code (IBC) 2012/15 requires site classification for seismic design based on the upper 100 feet of a soil profile. Where site specific data are not available to a depth of 100 feet, appropriate soil properties are permitted to be estimated by the registered design professional preparing the soils report based on known geologic conditions.

Based on our interpretation of International Building Code, the site soils can be characterized as **Site Class D**. It is feasible that the site class may be able to achieve a higher classification if it is determined to be economically beneficial to the project. However, additional site testing could be required to measure actual shear wave velocities, such as ReMi test methods or equivalent, along with a site specific analysis. ECS can provide additional consultation upon request.

Liquefaction: The subsurface profile consists primarily of residual soils derived from the in-place weathering of the underlying bedrock. The subsurface conditions do not appear to exhibit liquefaction potential; therefore, it is our opinion that additional investigation regarding liquefaction potential is not necessary.

5.5 STORMWATER MANAGEMENT AREAS

5.5.1 Stormwater Management Facilities

General: A plan provided to ECS was used to locate the stormwater management facilities. The facilities are expected to consist of a surface basin as well as a subsurface stormwater management facility.

5.5.1.a Infiltration Characteristics

Based on the results of the infiltration testing, the infiltration rates were found to range from 0.0 to 1.5 inches per hour. If volume reduction cannot be met with this infiltration rate, stormwater management may also need to incorporate water quality and rate control measures. Water quality can be enhanced with the use of amended soils in BMP facilities for filtering of the water, while volume control can be provided with adequate sizing of facilities combined with an appropriate underdrain system.

ECS recommends that specific construction notes appear on the plans requiring full-time observation of the excavation of the basins by the authorized ECS representative to verify suitable conditions are present. Some over excavation of existing fill materials may be necessary. ECS can assist in developing these notes once plans become more final.

5.5.1.b Temporary Sediment Basin Fill Embankments

Soils used in temporary sediment basin fill embankments should satisfy the requirements for fill discussed above and should be placed and compacted to the specification requirements for Structural Fill. Care should be taken not to track heavy equipment over the basin bottom during construction.

5.5.2 Stormwater Management Considerations

In keeping with the guidelines and recommendations of the PA BMP Manual, we recommend the following design principles be incorporated:

- Use existing drainage patterns
- Avoid concentrating stormwater
- Reduce runoff volume and velocity
- Use broad shallow basins
- Maintain the facilities post construction
- Provide underdrains in all stormwater management facilities

5.5.3 Stormwater Management Facilities - Design Notes

It has been our experience that construction of stormwater management facilities may encounter conditions that were not anticipated as a result of the subsurface exploration. As a result, we have developed the following sequence of items for addressing construction related difficulties or discrepancies with the design assumptions. We recommend that these recommendations be included in the stormwater management feature construction notes on the plans.

A) If redoximorphic features (soil mottling and coloration patterns formed by the reduction of iron and/or manganese from saturated conditions in the soil) are encountered:

- A qualified professional should determine if the features observed are associated with a historic condition (associated with fill, previous site condition, or natural coloration) or are associated with conditions that could presently occur (seasonal variations in the water table).
- Evaluate the elevation of the features relative to the proposed design elevation of the SWM feature and determine if the size and elevation of the SWM feature can be adjusted to alleviate the conflict.
- Retain the Geotechnical Engineer and Civil Engineer to evaluate alternate design concepts. Alternate designs proposed by the Professional should be sealed and submitted to the Township for approval.

B) If the field verified infiltration rates are excessively high (greater than 6 inches per hour):

- Determine the extent of the materials exhibiting the high infiltration rates through a combination of visual-manual classification, hand probing, density testing, or other suitable methods as determined by the Geotechnical Engineer.
- Over-excavate the materials to the depth where the material type changes or a maximum depth of 2 feet, whichever is encountered first.
- If excessive rates are associated with weathered or broken rock, the rock surface should be examined by the Geotechnical Engineer, prior to replacement of suitable material.
- Replace the excavated material with finer grained materials approved by the Geotechnical Engineer. Suitable soil mixtures can consist of a blend of on-site and/or off-site materials available to the Contractor generally conforming to the table below, with field infiltration rates post placement determined and approved by the Geotechnical Engineer.

Table 5.5.3.A – Recommended Amended Soil Blend

Permissible Soil Types for Amended Soil, based on UDSA Classification	Ranges of USDA Particle Size Percentages						Typical Infiltration Rates for Permissible Soil Types (in/hr)*	
	Sand		Silt		Clay		Min	Max
	Min	Max	Min	Max	Min	Max		
Sand, Loamy Sand, Sandy Loam, Loam	50	100	0	50	0	20	0.5	6.0

- Materials should be lightly tracked into place in non-structural areas.
- If material replacement is required in structural areas (Ex: below-grade SWM facilities in paved areas), material placement specifications, including materials type, mix ratio, compactive effort and required density should be determined by the Geotechnical Engineer. Technical recommendations should be sealed by the Geotechnical Engineer and submitted to the Township for approval.

C) If the field verified infiltration rates are excessively low (less than 0.1 in/hr):

- Determine the extent of the materials exhibiting the low infiltration rates through a combination of visual-manual classification, hand probing, density testing, or other suitable methods as determined by the Geotechnical Engineer.
- Over-excavate the materials to the depth where the material type changes or a maximum depth of 2 feet, whichever is encountered first.

- If rock is encountered, the rock should be removed to a minimum depth of 2 feet below the bottom of basin and should be examined by the Geotechnical Engineer, prior to replacement of suitable material.
- Replace the excavated material with more coarsely grained materials approved by the Geotechnical Engineer. Suitable soil mixtures can consist of a blend of on-site and/or off-site materials available to the Contractor, and subject to testing and approval of the Geotechnical Engineer.
- Suitable soil mixtures may consist of materials blended by volume ratios as determined by the Geotechnical Engineer.
- Materials should be lightly tracked into place in non-structural areas.

If material replacement is required in structural areas (Ex: below-grade SWM facilities in paved areas), material placement specifications, including materials type, mix ratio, compactive effort and required density should be determined by the Geotechnical Engineer. Suitable soil mixtures can consist of a blend of on-site and/or off-site materials available to the Contractor generally conforming to the table below, with field infiltration rates post placement determined and approved by the Geotechnical Engineer.

5.6 SITE DESIGN CONSIDERATIONS

5.6.1 Pavement Sections

Subgrade Characteristics: Based on the results of our subsurface exploration, it appears that the soils which will comprise the pavement subgrade, will consist of localized areas of fill and the naturally-occurring soils. These soils should generally provide proper pavement support provided the subgrade is thoroughly proof-rolled and compacted with suitable equipment (minimum 15-ton roller) prior to paving. We did not perform CBR testing, but these soils typically demonstrate a minimum CBR value on the order of 3. For design purposes, a CBR value of 3 has been selected. The pavement design assumes subgrades consist of suitable materials evaluated by ECS and placed and compacted to at least 98 percent of the maximum dry density as determined by the Standard Proctor test (ASTM D 698) in accordance with the project specifications.

5.6.2 Flexible Pavement Design

The recommended pavement thicknesses presented in this report section are considered typical and minimum for the assumed parameters in the general site area. We understand that budgetary considerations sometimes warrant thinner pavement sections than those presented. However, the client, the owner, and the project designers should be aware that thinner pavement sections may result in increased maintenance costs and lower than anticipated pavement life.

Because of the anticipated use of the planned pavement areas associated with the new Burger King, we have assumed only a light duty pavement section will be required. However, a heavy duty pavement section can be provided at the request of the Client. The light duty pavement section can be utilized in parking areas that will support primarily passenger vehicle traffic and occasional light maintenance vehicle traffic. The pavement design for the light duty section was based on maximum traffic loads of 35,000 equivalent single axle loads (ESALs), respectively, initial serviceability of 4.2, terminal serviceability of 2.2, a reliability of 90 percent, a standard deviation of 0.45 for flexible pavements, and a design life of 20 years. The design analyses for pavements have been based on methodology from the American Association of State Highway and Transportation Officials' (AASHTO) *Guide of Design of Pavement Structures*, 1993 and guidelines established for SUPERPAVE as outlined in the Pavement Design Guide from the Pennsylvania

Asphalt Pavement Association. The following pavement design assumes a stable and yielding subgrade at the time of the subbase and asphalt placement.

Table 5.6.2.A – Asphalt Pavement Sections

Recommended Light Duty Pavement Section	
Pavement Materials	Thickness (inches)
Asphaltic Surface Course (SUPERPAVE 9.5mm)	1.5
Asphaltic Base Course (SUPERPAVE 19mm Base Course)	3.0
Crushed Stone Base	6.0

5.6.3 Rigid Pavement

Rigid concrete pavement may be used instead of flexible pavement. The typical rigid pavement section is listed below. Rigid pavement is recommended to be used where trash dumpsters or large trucks are to be parked on the pavement. This should provide better distribution of surface loads to the sub grade without causing surficial deformation.

Table 5.6.3.A – Concrete Pavement Sections

Rigid Pavement Recommended Thickness (Inches)	
Pavement Materials	Trash Pad
Reinforcement	WWF6x6-W6xW6
Dowels at Joints	7/8” diameter x 18” long @ 12” c-c
Portland Cement Concrete f’c=4000 psi	7
Crushed Stone Base	6

The above sections represent minimum thickness representative of typical local construction practices and periodic maintenance should be anticipated. Pavement may be placed after the subgrade has been properly compacted, fine graded and proof rolled as recommended earlier in this report. It should be noted that undercutting of some areas of soft soils or existing fill may be necessary, based on the results of the test borings. Actual pavement section thickness and joint spacing, if applicable, should be determined by the design civil engineer or geotechnical engineer based on traffic loads, volume, and the owner’s design life requirements.

An important consideration with the design and construction of pavements is surface and subsurface drainage. Where standing water develops, either on the pavement surface or within the base course layer, softening of the subgrade and other problems related to the deterioration of the pavement can be expected. Sealing of saw cut and construction joints will be critical to the long term success of the pavement. Failure to do so or to maintain this seal can result in failure of the concrete joint. Furthermore, good drainage should reduce the possibility of the subgrade materials becoming saturated over a long period of time. We would be pleased to be of further assistance to you in the design of the project pavements by providing additional recommendations during construction of the project.

Weather Restrictions: In this region, asphalt plants may close during the months of December, January, and/or February if particularly cold weather conditions prevail. However, this can change based on year to year temperature fluctuations. Daily temperatures from December to February will often stay below 40°F, limiting the days that asphalt placement can occur. Asphalt and concrete should not be placed on exposed subbase that has been exposed to freezing temperatures until it is confirmed that no frost is in the subbase or subgrade. Failure to do so can result in unacceptable frost heaving and settlement.

6.0 SITE CONSTRUCTION RECOMMENDATIONS

6.1 SUBGRADE PREPARATION

6.1.1 Stripping and Grubbing

The subgrade preparation should consist of stripping all topsoil and any other soft or unsuitable materials. Existing fill materials in the building pad should be removed in their entirety and subgrade reestablished with suitable structural fill. The suitability of any fill materials in the parking lot areas should be evaluated at the time of site preparation for its suitability for support of pavement areas. Select undercutting of soft, wet, or otherwise deleterious materials may be required. ECS should be called on to verify that unsuitable surficial and existing fill materials have been completely removed prior to the placement of Structural Fill or construction of structures.

6.1.2 Proof-rolling

After removing all unsuitable surface materials, cutting to the proposed grade, and prior to the placement of any structural fill or other construction materials, the exposed subgrade should be observed by the Geotechnical Engineer or authorized representative. The exposed subgrade should be thoroughly proof rolled with previously approved construction equipment having a minimum axle load of 10 tons (e.g. fully loaded tandem-axle dump truck). The areas subject to proof-rolling should be traversed by the equipment in two perpendicular (orthogonal) directions with overlapping passes of the vehicle under the observation of the Geotechnical Engineer or authorized representative. This procedure is intended to assist in identifying localized yielding materials or areas of incipient sinkhole activity. In the event that unstable or "pumping" subgrade is identified by the proof-rolling, those areas should be marked for repair prior to the placement of any subsequent structural fill or other construction materials. Methods of repair of unstable subgrade, such as undercutting, moisture conditioning, or chemical stabilization, should be discussed with the Geotechnical Engineer to determine the appropriate procedure with regard to the existing conditions causing the instability. Test pits may be excavated to explore the shallow subsurface materials in the area of the instability to help in determined the cause of the observed unstable materials and to assist in the evaluation of the appropriate remedial action to stabilize the subgrade.

6.1.3 Subgrade Stabilization

Subgrade Benching: Fill should not be placed on ground with a slope steeper than 5H:1V, unless the fill is confined by an opposing slope, such as in a ravine. Otherwise, where steeper slopes exist, the ground should be benched so as to allow for fill placement on a horizontal surface.

Subgrade Compaction: Upon completion of subgrade preparation the exposed subgrade within the 10-foot expanded building and 5-foot expanded pavement and embankment limits should be moisture conditioned to within -3 and +3 % of the soil's optimum moisture content and be compacted with suitable equipment (minimum 15-ton roller) to a depth of 10 inches. Subgrade compaction within the expanded building, pavement, and embankment limits should be to a dry density of at least 95% of the Standard Proctor maximum dry density (ASTM D698). ECS should be called on to document that proper subgrade compaction has been achieved.

Multiple orthogonal passes with a 15-ton roller in the parking lot areas to stiffen the pavement subgrade is required in lieu of overexcavation of existing fill materials. The number pf passes and an evaluation of stability will be determined at the time of construction. Some localized areas of overexcavation and replacement of materials should be anticipated.

Subgrade Compaction Control: The expanded limits of the proposed construction areas should be well defined, including the limits for buildings, pavements, fills, and slopes, etc. Field density testing of subgrades will be performed at frequencies in Table 6.2.1.A.

Subgrade Stabilization: Is some areas, particularly low-lying, wet areas of the site, undercutting of excessively soft materials may be considered inefficient. In such areas the use of a reinforcing geotextile or geogrid might be employed, under the advisement of ECS. Suitable stabilization materials may include medium duty woven geotextile fabrics or geogrids. The suitability and employment of reinforcing or stabilization products should be determined in the field by ECS, in accordance with project specifications.

6.2 EARTHWORK OPERATIONS

6.2.1 Structural Fill Materials

After subgrade preparation and observation has been completed and a stable subgrade exists, fill placement may begin. Structural fill materials should not be placed on frozen or frost-heaved soils or soils which have not been moisture conditioned to acceptable levels. Borrow fill materials, if necessary, should not contain wet or frozen materials at the time of placement. Wet or frost-heaved soils should be removed prior to the placement of engineered fill, granular sub-base materials, foundation/slab concrete, or paving materials. Excavated rock is generally suitable for use as backfill if the material meets the requirements of on-site manufactured structural fill (listed below), is not subject to degradation during compaction or weathering and is approved by the Geotechnical Engineer of Record.

Materials satisfactory for use as Structural Fill should consist of inorganic soils classified as CL, ML, SM, SC, SW, SP, GW, GP, GM and GC, or a combination of these group symbols, per ASTM D 2487. The materials should be free of organic matter, debris, and should contain no particle sizes greater than 4 inches in the largest dimension. Open graded materials, such as Gravels (GW and GP), which contain void space in their mass should not be used in structural fills unless properly encapsulated with filter fabric. Unsatisfactory structural fill materials include materials which do not satisfy the requirements for suitable materials, as well as topsoil and organic materials (OH, OL), elastic Silt (MH), and high plasticity Clay (CH).

Near surface materials, and more generally the silty and clayey soils across the site may have elevated moisture contents which would require moisture conditioning (drying) prior to their reuse as engineered fill. In some cases, the materials might not be suitable due to elevated moisture contents and/or the presence of deleterious materials, and should be placed in non-structural areas only. We recommend that evaluation and laboratory testing be performed prior to placement as fill, to further explore the site conditions. Prior to placement of structural fill, representative bulk samples should be submitted to the Geotechnical Engineer of Record for acceptance which will include Atterberg limits, natural moisture content, grain-size analysis, and moisture-density relationships (Proctor) for compaction. Import materials should be tested prior to being hauled to the site to determine if they meet project specifications.

Structural Fill within the expanded building and pavement limits should be placed in maximum 12-inch loose lifts, moisture conditioned as necessary to within ±3% of the soil's optimum moisture content, and be compacted with suitable equipment to a dry density of at least 95% of the Standard Proctor maximum dry density (ASTM D698). ECS should be called on to document that proper fill compaction has been achieved.

The expanded limits of the proposed construction areas should be well defined, including the limits of the fill zones for buildings, pavements, and slopes, etc., at the time of fill placement. Grade controls should be maintained throughout the filling operations. All filling operations should be observed on a full-time basis by a qualified representative of the construction testing laboratory to determine that the minimum compaction requirements are being achieved. Field density testing of fills should be performed at the approximate frequencies shown in Table 6.2.1.A, but not less than 1 test per lift.

Table 6.2.1.A – Frequency of Compaction Tests in Fill Areas Table

Location	Frequency of Tests
Expanded Building Limits	1 test per 2,500 sq. ft. per lift
Outparcels and SWM Facilities	1 test per 5,000 sq. ft. per lift
Pavement Areas	1 test per 10,000 sq. ft. per lift
All Other Non-Critical Areas	1 test per 10,000 sq. ft. per lift
Utility Trenches	1 test per 200 linear ft. per lift

Compaction equipment suitable to the soil type being compacted should be used to compact the subgrades and fill materials. Sheepsfoot compaction equipment should be suitable for the fine-grained soils (Clays and Silts). A vibratory smooth drum roller should be used for compaction of coarse-grained soils (Sands) as well as for sealing compacted surfaces. Smooth drum roller should not be used for the first pass of compaction of fine-grained soils. In confined areas such as utility trenches, portable compaction equipment and thin lifts of 3 inches to 4 inches may be required to achieve specified degrees of compaction.

It should be noted that some of the on-site soils are likely moisture and disturbance sensitive. Due to the nature of the soils on site, approved fills or prepared subgrades should be protected from construction traffic. Previously stable subgrades will quickly degrade if exposed to moisture or construction traffic. Furthermore, at the end of each work day, all fill areas should be graded to facilitate drainage of any precipitation and the surface should be sealed by use of a smooth-drum roller to limit infiltration of surface water. During placement and compaction of new fill at the beginning of each workday, the Contractor may need to scarify existing subgrades to a depth on the order of 4 inches so that a weak plane will not be formed between the new fill and the existing subgrade soils.

Because of the fine-grained and cohesive nature of the soils, it is recommended that the earthwork operations be performed during the warmer and dryer (i.e. late spring, summer, early fall) periods of the year, as drying and compaction of wet soils is typically difficult during the cold, winter months. We recommend that the grading contractor have equipment on site during earthwork for both drying and wetting fill soils. In the event that the earthwork operations are accomplished during the cooler and wetter periods of the year or even during the warmer periods where rainfall has occurred, delays, and/or additional costs should be anticipated. Proper drainage should be maintained during the earthwork phases of construction to prevent ponding of water which has a tendency to degrade subgrade soils. Alternatively, if these soils cannot be stabilized by conventional methods as previously discussed, additional modifications to the subgrade soils such as lime or cement stabilization may be utilized to adjust the moisture content. If lime or cement are utilized to control moisture contents and/or for stabilization, Quick Lime, Calciment® or regular Type I/II cement can be used. The construction testing laboratory should evaluate proposed lime or cement soil modification procedures, such as quantity of additive and mixing and curing procedures, before implementation. The contractor should be required to minimize dusting or implement dust control measures, as required. It should be noted that the application of agricultural lime would not be suitable for this application.

6.2.2 Proposed Fill Slopes

Slopes comprised of engineered fill may be constructed at a slope of 3:1 or flatter. Slopes steeper than 3:1 should be evaluated by the Geotechnical Engineer. All slopes should be properly vegetated to reduce the likelihood of surficial erosion and sloughing.

6.2.3 Existing Fill

Up to approximately 6.0 feet of existing fill was noted within the proposed building footprint during the subsurface exploration and up to 6.5 feet was noted at the project site. The existing fill will need remediation in the building footprint and the pavement footprint in accordance with the recommendations in Section 5.1 and Section 5.6.1, respectively.

6.3 SOLUTION ACTIVITY

It should be noted sinkholes generally develop during and immediately following construction as it is not possible to predict how construction activities will impact the existing karst conditions at the site. If an active sinkhole forms during construction activity, immediate remediation will be necessary to eliminate and/or minimize any subsequent subsidence in the same area. Remediation of the feature will most likely involve the excavation of a test pit to verify that the origin of the collapse feature is natural and not from previously buried debris. Once it has been verified the feature is natural, the sinkhole should be excavated and field probing should be accomplished to locate and determine the path of the collapse and location of the throat of the sinkhole. If the sinkhole is in a non-structural area, a crushed stone plug, or inverted filter may be suitable to seal the feature. The size of the crushed stone plug will be based on the actual size of the throat and will generally be 12 to 18-inches thick and extend 2 to 4 feet beyond the collapse path area. The size of the crushed stone will depend on the size of the throat, but will typically consist of 2 to 6-inch surge stone. In addition, the crushed stone should be wrapped with Mirafi 140N or equivalent Geotextile fabric to prevent migration of soil through the stone and into the throat. If a sinkhole occurs in a structural area, it may need to be remediated by the use of grout.

We recommend the following criteria be followed to minimize the potential for future development of sinkholes within the development area.

- Provide water-tight, gasketed joints for all utilities that carry fluids, or encase such utilities with flowable fill.
- Provide positive drainage away from structural areas (i.e., at least 3% slope for first 10 feet along building.
- Collection of all storm water from roof drains, sidewalks, parking lots, drive lanes, and other impervious surfaces directly into an approved SWM facility or into the storm drain system to minimize the infiltration of water into the subsurface soils and/or rock.
- Minimize stone bedding below utility pipes to minimize water flow.

- During construction, care must be taken to minimize and/or eliminate the ponding of surface water in and adjacent to the planned building and pavement areas.
- Provide joints in masonry/brick walls with a spacing not greater than 20 feet and reinforcement in all masonry walls.
- Construct buildings of well braced structural framework.

It is recommended in the areas where rock has been excavated, a Geotechnical Engineer and/or Engineering Geologist be permitted to examine the excavated surface for any existing solution features. After a complete examination of the exposed rock surface, in the excavated portion of the project site, for solution features, the predominantly fine-grained and cohesive on-site soils should be used to seal all exposed rock surfaces and return those portions of the project site to planned subgrade levels as discussed previously.

Consideration should be given to thoroughly compacting a 12-inch layer of fine-grained and cohesive on-site soils beneath any topsoil veneer within any planned pavement island and adjacent landscaped areas in order to minimize the infiltration of future precipitation into the underlying soils.

It should be noted the recommendations and measures outlined above will not completely eliminate the risk of sinkhole development, but by including these recommendations/measures in the overall design of the project, the probability of sinkholes in developed areas can be reduced. Consequently, it should be realized that development of this site will always involve some degree of sinkhole risk, but it is our opinion that inclusion of these recommendations/measures will significantly reduce the degree of risk to acceptable tolerance levels.

6.4 UTILITY INSTALLATIONS

Utility Subgrades: The soils encountered in our exploration are expected to be generally suitable for support of utility pipes. The pipe subgrade should be observed and probed for stability by ECS to evaluate the suitability of the materials encountered. Any loose or unsuitable materials encountered at the utility pipe subgrade elevation should be removed and replaced with suitable compacted Structural Fill or pipe bedding material. As noted in Section 5.2.3 above, some rock excavation will likely be required for utility installation.

Utility Backfilling: The granular bedding material should be at least 4 inches thick, but not less than that specified by the project drawings and specifications. Fill placed for support of the utilities, as well as backfill over the utilities, should satisfy the requirements for Structural Fill given in this report. Compacted backfill should be free of topsoil, roots, ice, or any other material designated by ECS as unsuitable. The backfill should be moisture conditioned, placed, and compacted in accordance with the recommendations of this report.

Utility Excavation Dewatering: It is possible that perched water may be encountered by utility excavations which extend below existing grades. It is expected that removal of perched water which seeps into excavations could be accomplished by pumping from sumps excavated in the trench bottom and which are backfilled with AASHTO No. 57 Stone or open graded bedding material. Should water conditions beyond the capability of sump pumping be encountered, the contractor should submit a Dewatering Plan in accordance with project specifications.

Excavation Safety: All excavations and slopes should be made and maintained in accordance with OSHA excavation safety standards. The contractor is solely responsible for designing and constructing stable, temporary excavations and slopes and should shore, slope, or bench the sides of the excavations and slopes as required to maintain stability of both the excavation sides and bottom. The contractor's responsible person, as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations. ECS is providing this information solely as a service to our client. ECS is not assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred.

6.5 GENERAL CONSTRUCTION CONSIDERATIONS

Moisture Conditioning: During the cooler and wetter periods of the year, delays and additional costs should be anticipated. At these times, reduction of soil moisture may need to be accomplished by a combination of mechanical manipulation and the use of chemical additives, such as lime or cement, in order to lower moisture contents to levels appropriate for compaction. Alternatively, during the drier times of the year, such as the summer months, moisture may need to be added to the soil to provide adequate moisture for successful compaction according to the project requirements.

Subgrade Protection: Measures should also be taken to limit site disturbance, especially from rubber-tired heavy construction equipment, and to control and remove surface water from development areas, including structural and pavement areas. It would be advisable to designate a haul road and construction staging area to limit the areas of disturbance and to prevent construction traffic from excessively degrading sensitive subgrade soils and existing pavement areas. Haul roads and construction staging areas could be covered with excess depths of aggregate to protect those subgrades. The aggregate can later be removed and used in pavement areas.

Surface Drainage: Surface drainage conditions should be properly maintained. Surface water should be directed away from the construction area, and the work area should be sloped away from the construction area at a gradient of 1 percent or greater to reduce the potential of ponding water and the subsequent saturation of the surface soils. At the end of each work day, the subgrade soils should be sealed by rolling the surface with a smooth drum roller to minimize infiltration of surface water.

Erosion Control: The surface soils may be erodible. Therefore, the Contractor should provide and maintain good site drainage during earthwork operations to maintain the integrity of the surface soils. All erosion and sedimentation controls should be in accordance with sound engineering practices and local requirements.

7.0 CLOSING

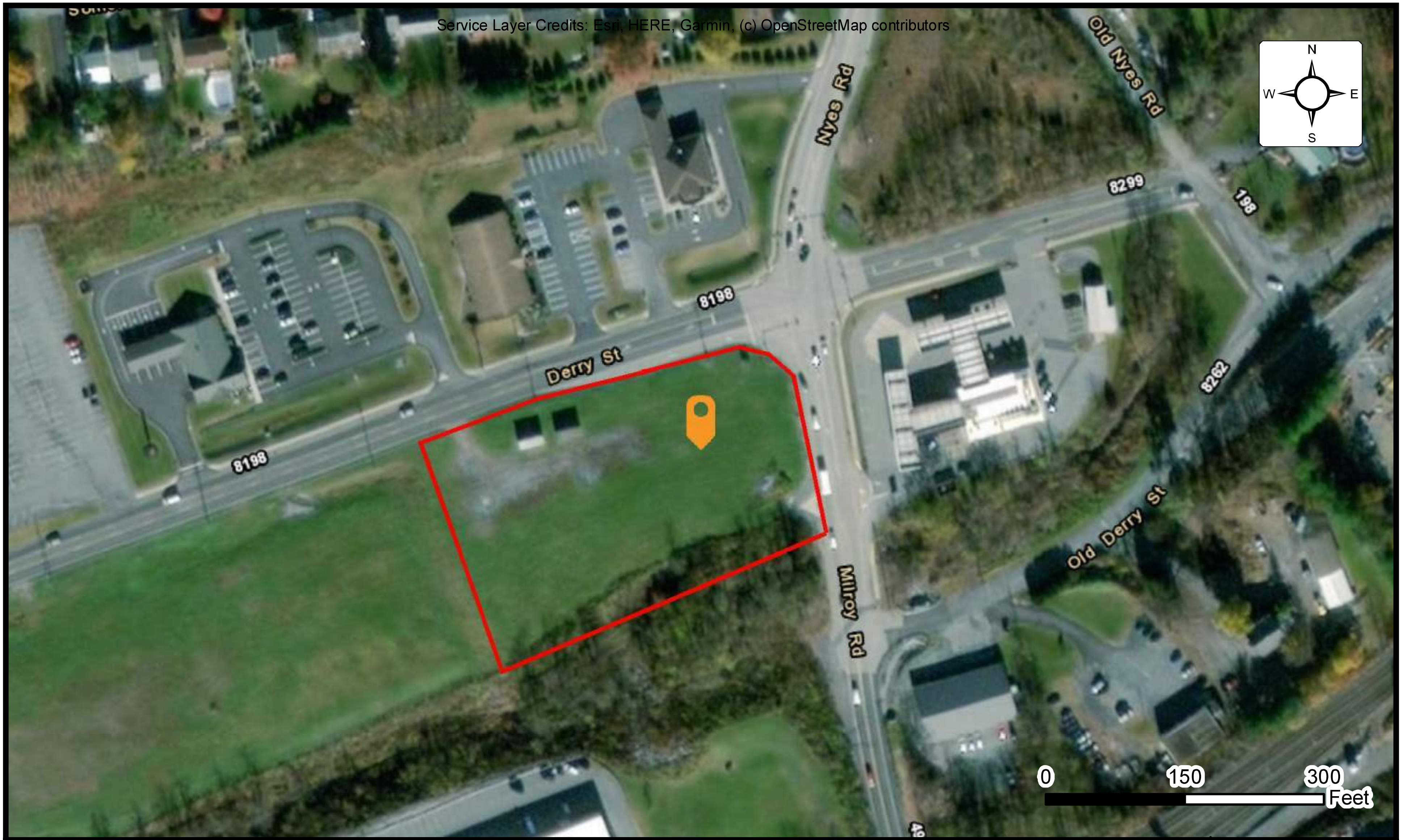
ECS has prepared this report of findings, evaluations, and recommendations to guide geotechnical-related design and construction aspects of the project.

The description of the proposed project is based on information provided to ECS by InSite Real Estate, LLC. If any of this information is inaccurate, either due to our interpretation of the documents provided or if the site’s design changed, ECS should be contacted immediately to review the report in light of the changes and provide additional or alternate recommendations as required to reflect the proposed addition.

We recommend that ECS be allowed to review project plans and specifications, so we may evaluate consistency of those plans/specifications with our geotechnical report.

Field observations, monitoring, and quality assurance testing during earthwork and foundation installation are an extension of and integral to the geotechnical design recommendation. We recommend that the owner retain these quality assurance services and that ECS be allowed to continue our involvement throughout these critical phases of construction to provide general consultation as issues arise. ECS is not responsible for the conclusions, opinions, or recommendations of others based on the data in this report.

APPENDIX A – Figures



Site Location Map
BURGER KING

MILROY RD, HARRISBURG, PENNSYLVANIA
INSITE REAL ESTATE DEVELOPMENT

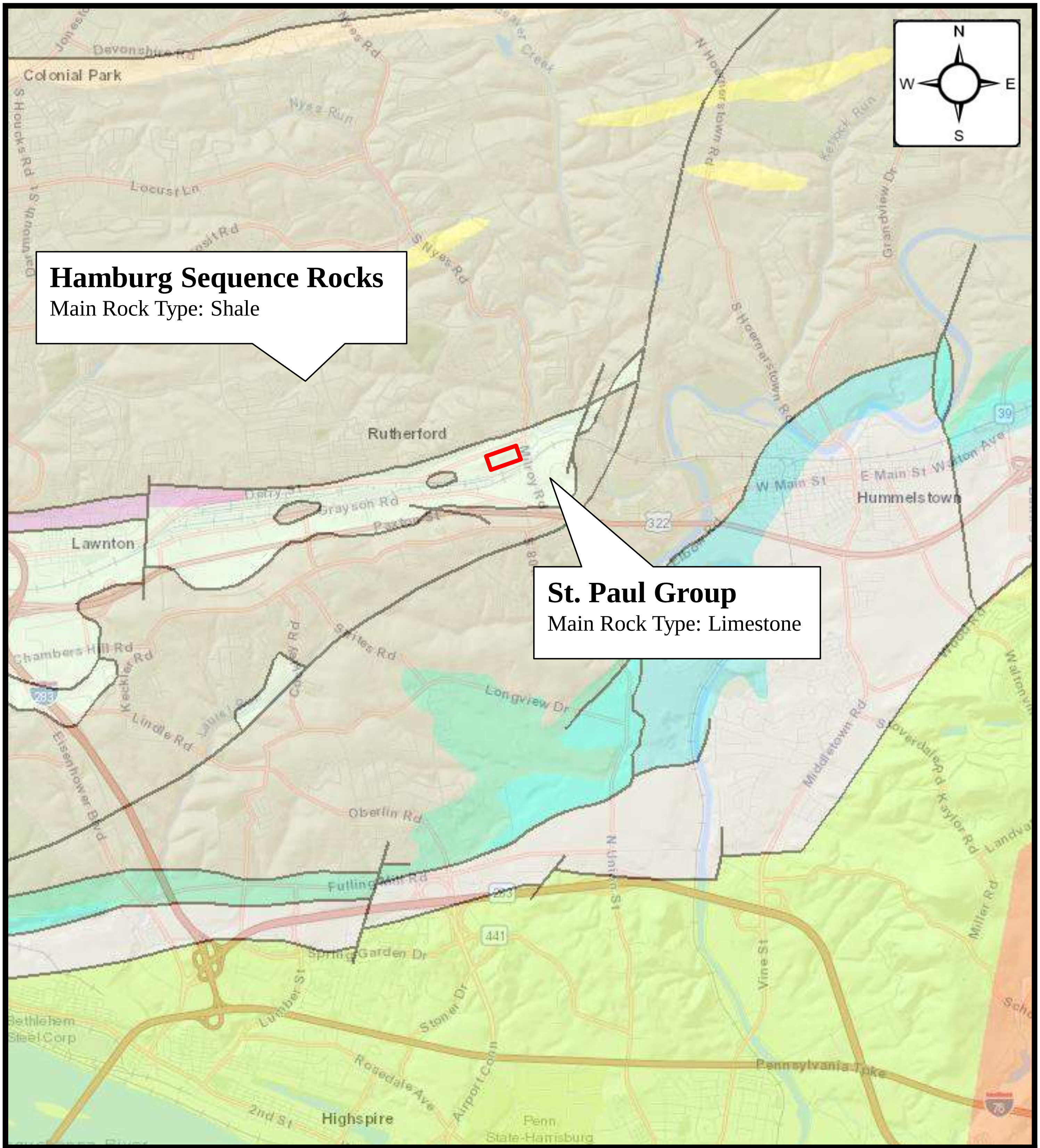
ENGINEER
JMC2

SCALE
1 " = 150 '

PROJECT NO.
18:4914

SHEET
1 OF 1

DATE
4/14/2020



Hamburg Sequence Rocks
Main Rock Type: Shale

St. Paul Group
Main Rock Type: Limestone

Geology Map
BURGER KING

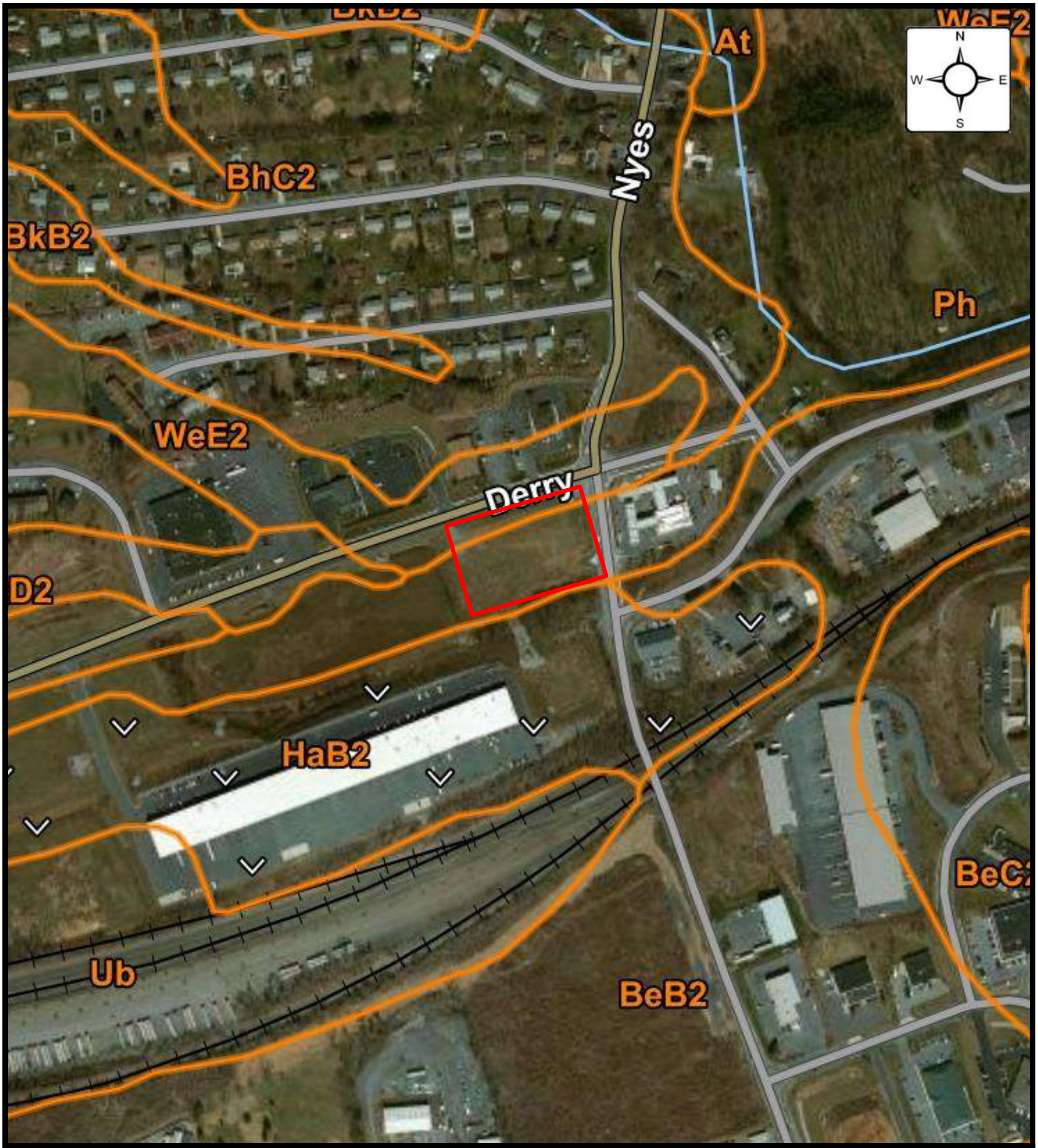
MILROY ROAD, HARRISBURG, PA
INSITE REAL ESTATE DEVELOPMENT

DRAFTER	GMW
SCALE	NTS
PROJECT NO.	18:4914
DATE	2/6/2020
SOURCE	PA DCNR Geologic Map http://www.gis.dcnr.state.pa.us

Exploration Location Plan
BURGER KING

MILROY ROAD, HARRISBURG, PA
INSITE REAL ESTATE DEVELOPMENT

DRAFTER	GMW
SCALE	NTS
PROJECT NO.	18:4914
DATE	3/16/2020
SOURCE	Google Earth



Soil Survey Map
BURGER KING

MILROY ROAD, HARRISBURG, PA
INSITE REAL ESTATE DEVELOPMENT

DRAFTER	GMW
SCALE	NTS
PROJECT NO.	18:4914
DATE	2/6/2020
SOURCE	Web Soil Survey https://websoilsurvey.nrcs.usda.gov

APPENDIX B – Field Operations

Boring Logs
Cased Borehole Infiltration Test Results
Boring Log Reference Notes

CLIENT	Job #:	BORING #	SHEET
InSite Real Estate Development	18:4914	B-1	1 OF 1

PROJECT NAME: Burger King

ARCHITECT-ENGINEER:

SITE LOCATION: Derry Street and Milroy Road, Harrisburg, Dauphin County, PA

NORTHING:

EASTING:

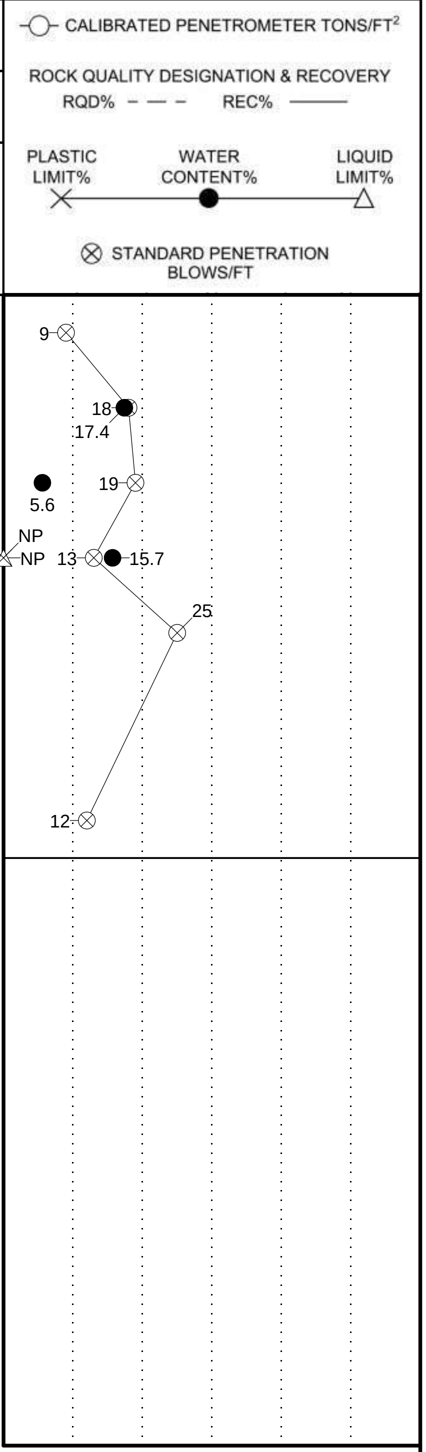
STATION:

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING ➤ LOSS OF CIRCULATION

SURFACE ELEVATION 371.0

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness [3.00"]			
	S-1	SS	24	24	(CL FILL) FILL, GRAVELLY LEAN CLAY, contains asphalt, brick, and rock fragments, orange, brown, red, and black, moist, stiff to very stiff		370	2 4 5 5
	S-2	SS	24	18				5 6 12 16
5	S-3	SS	24	2				12 7 12 9
	S-4	SS	24	20			365	5 8 5 8
	S-5	SS	24	0	(GM) SILTY GRAVEL WITH SAND, contains rock fragments, tan and reddish brown, moist, medium dense			10 11 14 22
10							360	
	S-6	SS	24	21				5 6 6 7
15					END OF BORING @ 15'		355	
20							350	
25							345	
30								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL N/E WS ☐ WD ☒	BORING STARTED 04/06/20	CAVE IN DEPTH 12.0'
WL(SHW) WL(ACR) N/E	BORING COMPLETED 04/06/20	HAMMER TYPE Auto
WL N/A	RIG Acker XLS FOREMAN Matt	DRILLING METHOD 3.25" HSA

CLIENT	Job #:	BORING #	SHEET
InSite Real Estate Development	18:4914	B-2	1 OF 1

PROJECT NAME: Burger King

ARCHITECT-ENGINEER:

SITE LOCATION: Derry Street and Milroy Road, Harrisburg, Dauphin County, PA

NORTHING:

EASTING:

STATION:

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING ➡ — LOSS OF CIRCULATION

SURFACE ELEVATION 370.0

-○- CALIBRATED PENETROMETER TONS/FT^2

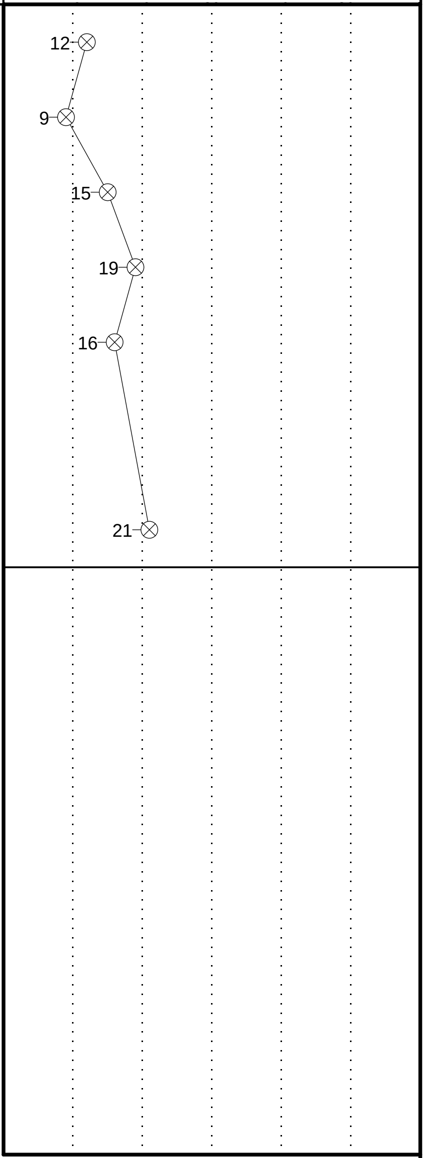
ROCK QUALITY DESIGNATION & RECOVERY

RQD% - — - REC% ———

PLASTIC LIMIT% ✕ — WATER CONTENT% ● — LIQUID LIMIT% △

⊗ STANDARD PENETRATION BLOWS/FT

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness [2.00"]		370	
	S-1	SS	24	18	(CL FILL) FILL, GRAVELLY LEAN CLAY, contains asphalt, brick, styrofoam, rock and quartz fragments, brown, orange, tan, red, and black, moist, stiff			2 4 8 4
	S-2	SS	24	17				5 5 4 5
5	S-3	SS	24	20	(SM) SILTY SAND WITH GRAVEL, rock fragments, tan and reddish brown, moist, medium dense		365	4 4 11 11
	S-4	SS	24	24				11 10 9 8
	S-5	SS	24	11				5 6 10 10
10							360	
	S-6	SS	24	4				10 10 11 13
15					END OF BORING @ 15'		355	
20							350	
25							345	
30							340	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL N/E WS ☐ WD ☒	BORING STARTED 04/06/20	CAVE IN DEPTH 12.0'
WL(SHW) WL(ACR) N/E	BORING COMPLETED 04/06/20	HAMMER TYPE Auto
WL N/A	RIG Acker XLS FOREMAN Matt	DRILLING METHOD 3.25" HSA

CLIENT InSite Real Estate Development	Job #: 18:4914	BORING # B-3	SHEET 1 OF 1
PROJECT NAME Burger King	ARCHITECT-ENGINEER		

SITE LOCATION
Derry Street and Milroy Road, Harrisburg, Dauphin County, PA

NORTHING
EASTING
STATION

-○- CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% – — – REC% ———

PLASTIC LIMIT% × WATER CONTENT% ● LIQUID LIMIT% △

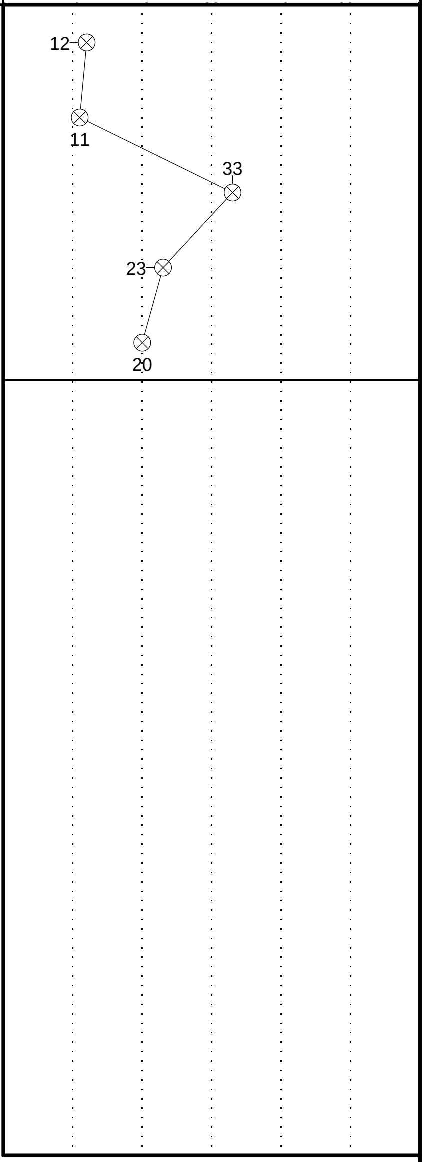
⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL ENGLISH UNITS

BOTTOM OF CASING LOSS OF CIRCULATION

SURFACE ELEVATION 371.0

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness [3.00"]			
	S-1	SS	24	24	(CL FILL) FILL, SANDY LEAN CLAY WITH GRAVEL, contains asphalt, brick, quartz, and slag fragments, brown, orange, and black, moist, stiff		370	3 6 6 5
	S-2	SS	24	24				5 6 5 9
5	S-3	SS	24	24	(SM) SILTY SAND WITH GRAVEL, tan to orange and reddish brown, moist, medium dense to dense			10 17 16 15
	S-4	SS	24	21			365	7 12 11 11
	S-5	SS	24	19				9 9 11 9
10					END OF BORING @ 10'			
							360	
15								
							355	
20								
							350	
25								
							345	
30								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL N/E WS ☐ WD ☒	BORING STARTED 04/06/20	CAVE IN DEPTH 4.0'
WL(SHW) WL(ACR) N/E	BORING COMPLETED 04/06/20	HAMMER TYPE Auto
WL N/A	RIG Acker XLS FOREMAN Matt	DRILLING METHOD 3.25" HSA

CLIENT	Job #:	BORING #	SHEET
InSite Real Estate Development	18:4914	B-4	1 OF 1

PROJECT NAME: Burger King

ARCHITECT-ENGINEER:

SITE LOCATION: Derry Street and Milroy Road, Harrisburg, Dauphin County, PA

NORTHING:

EASTING:

STATION:

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING ➧ LOSS OF CIRCULATION 100%

SURFACE ELEVATION 372.0

-○- CALIBRATED PENETROMETER TONS/FT^2

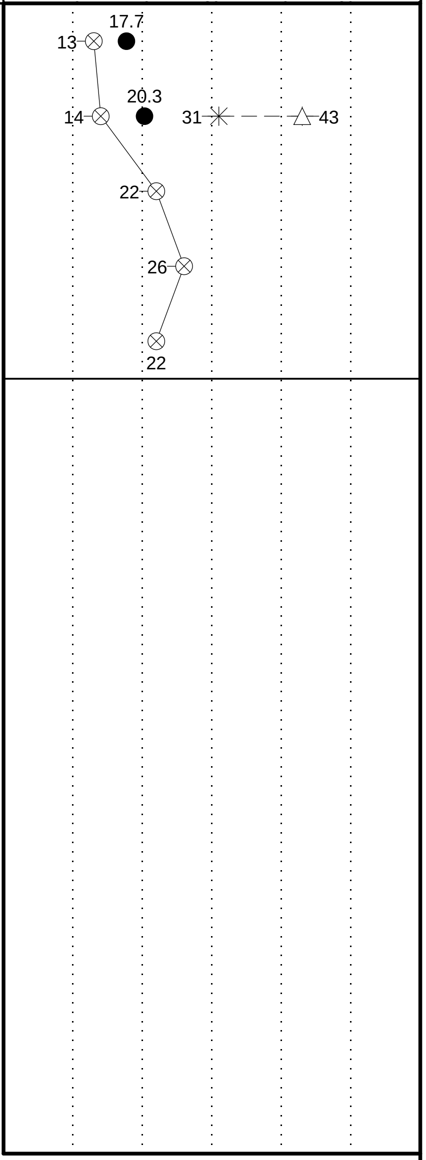
ROCK QUALITY DESIGNATION & RECOVERY

RQD% — — — REC% ———

PLASTIC LIMIT% ✕ — WATER CONTENT% ● — LIQUID LIMIT% △

⊗ STANDARD PENETRATION BLOWS/FT

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness [3.00"]		
	S-1	SS	24	24	(SM FILL) FILL, SILTY SAND WITH GRAVEL, contains organics, fiberglass material, and slag, asphalt, brick, quartz, and concrete fragments, orange, brown, black, red, and tan to light brown, reddish brown, and red, moist, medium dense	370	3 6 7 7
	S-2	SS	24	22			4 4 10 8
5	S-3	SS	24	21			5 13 9 10
	S-4	SS	24	22	(SM) SILTY SAND WITH GRAVEL, tan to reddish brown, moist, medium dense	365	11 13 13 11
	S-5	SS	24	22			9 11 11 9
10					END OF BORING @ 10'		
15						360	
20						355	
25						350	
30						345	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL N/E WS ☐ WD ☒	BORING STARTED 04/06/20	CAVE IN DEPTH 3.5'
WL(SHW) WL(ACR) N/E	BORING COMPLETED 04/06/20	HAMMER TYPE Auto
WL N/A	RIG Acker XLS FOREMAN Matt	DRILLING METHOD 3.25" HSA

CLIENT	Job #:	BORING #	SHEET
InSite Real Estate Development	18:4914	B-5	1 OF 1

PROJECT NAME: Burger King

ARCHITECT-ENGINEER:

SITE LOCATION: Derry Street and Milroy Road, Harrisburg, Dauphin County, PA

NORTHING: EASTING: STATION:

-○- CALIBRATED PENETROMETER TONS/FT²

ROCK QUALITY DESIGNATION & RECOVERY

RQD% – — – REC% ———

PLASTIC LIMIT% ✕ WATER CONTENT% ● LIQUID LIMIT% △

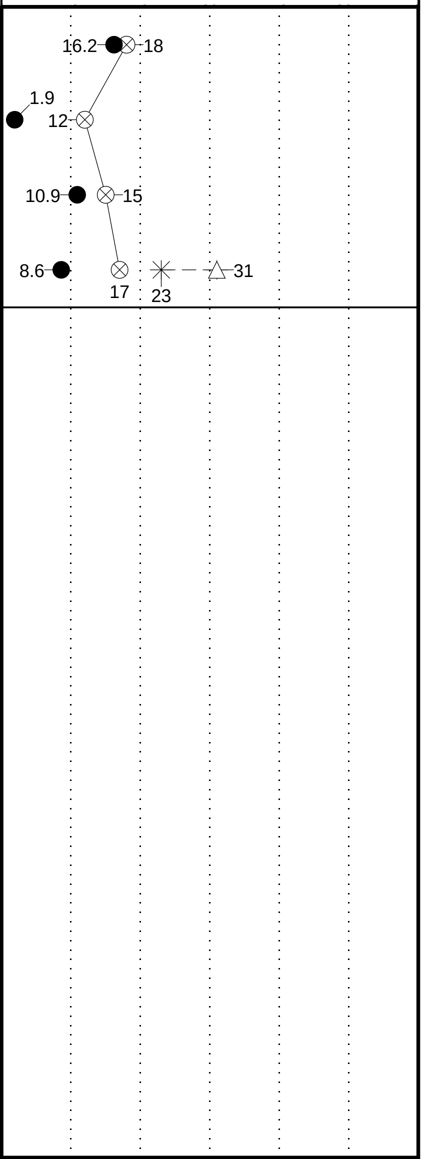
⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL ENGLISH UNITS

BOTTOM OF CASING LOSS OF CIRCULATION

SURFACE ELEVATION 364.0

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness [3.00"]			
	S-1	SS	24	18	(CL FILL) FILL, GRAVELLY LEAN CLAY, contains asphalt, brick, and rock fragments, brown, red, orange, and black, moist, stiff to very stiff			2 12 6 5
	S-2	SS	24	15			360	5 6 6 5
5	S-3	SS	24	24	(GM) SILTY GRAVEL WITH SAND, reddish brown and tan, moist, medium dense			5 7 8 7
	S-4	SS	24	24				5 7 10 10
					END OF BORING @ 8'		355	
10								
							350	
15								
							345	
20								
							340	
25								
							335	
30								



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL N/E WS ☐ WD ☒	BORING STARTED 04/06/20	CAVE IN DEPTH 3.0'
WL(SHW) WL(ACR) N/E	BORING COMPLETED 04/06/20	HAMMER TYPE Auto
WL N/A	RIG Acker XLS FOREMAN Matt	DRILLING METHOD 3.25" HSA

CLIENT	Job #:	BORING #	SHEET
InSite Real Estate Development	18:4914	B-6	1 OF 1

PROJECT NAME: Burger King

ARCHITECT-ENGINEER:

SITE LOCATION: Derry Street and Milroy Road, Harrisburg, Dauphin County, PA

NORTHING:

EASTING:

STATION:

-○- CALIBRATED PENETROMETER TONS/FT^2

ROCK QUALITY DESIGNATION & RECOVERY
RQD% - — - REC% ———

PLASTIC LIMIT% ✕ WATER CONTENT% ● LIQUID LIMIT% △

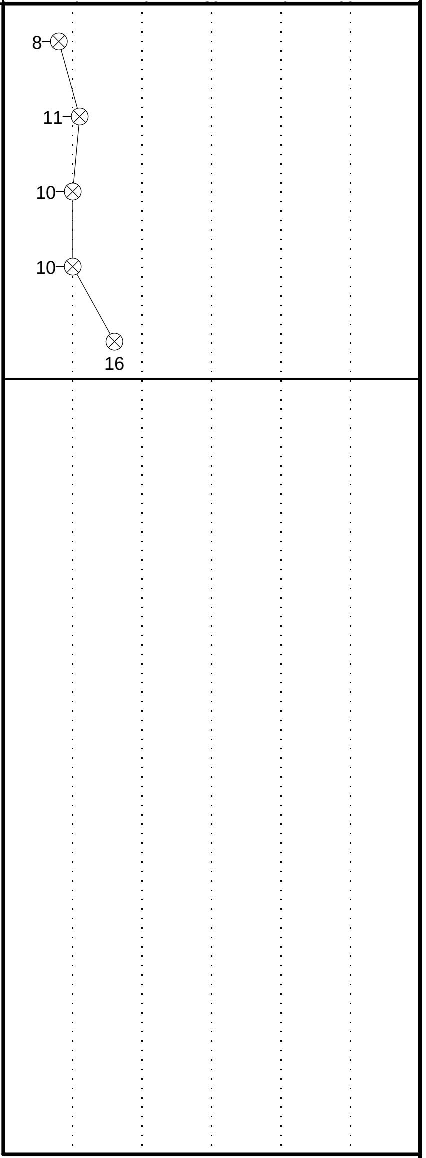
⊗ STANDARD PENETRATION BLOWS/FT

DESCRIPTION OF MATERIAL — ENGLISH UNITS

BOTTOM OF CASING — LOSS OF CIRCULATION

SURFACE ELEVATION 365.0

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness [2.00"]		365	
	S-1	SS	24	16	(CL FILL) FILL, GRAVELLY LEAN CLAY, contains asphalt, brick, and rock fragments, brown, orange, and black, moist, firm			5 4 4 12
	S-2	SS	24	18	(ML FILL) FILL, SANDY SILT WITH GRAVEL, contains asphalt, brick, and rock fragments, red, orange, and brown to dark brown, moist, loose to medium dense			7 6 5 5
5	S-3	SS	24	24			360	2 5 5 5
	S-4	SS	24	21	(SM) SILTY SAND WITH GRAVEL, tan to reddish brown, moist, loose to medium dense			6 3 7 9
	S-5	SS	24	19				7 8 8 7
10					END OF BORING @ 10'		355	
15							350	
20							345	
25							340	
30							335	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL.

WL N/E WS ☐ WD ☒	BORING STARTED 04/06/20	CAVE IN DEPTH N/A
WL(SHW) WL(ACR) N/E	BORING COMPLETED 04/06/20	HAMMER TYPE Auto
WL N/A	RIG Acker XLS FOREMAN Matt	DRILLING METHOD 3.25" HSA

ECS Project No. 18:4914

Burger King

Cased Borehole Infiltration Testing Results

Date Tested: 4/6/2020

Field Data	B-5		B-6A		B-6B					
Test Depth (ft)	5.0		5.0		8.0					
	Time	Drop	Time	Drop	Time	Drop	Time	Drop	Time	Drop
Initial Water Depth (ft)	8:30	0.00	8:09	0.00	11:01	0.00				
Presoak 30 Min	9:00	0.05	8:39	3.35	11:31	0.05				
Presoak 60 Min	9:30	0.00	9:09	0.00	12:01	0.20				
Reading Interval	30 min		30 min		10 min					
Reading # 1 (ft)	9:30	0.00	9:09	0.00	12:01	0.10				
Reading # 2 (ft)	10:00	0.00	9:39	0.02	12:11	0.05				
Reading # 3 (ft)	10:30	0.00	10:09	0.03	12:21	0.01				
Reading # 4 (ft)	11:00	0.00	10:39	0.03	12:31	0.08				
Reading # 5 (ft)			11:09	0.02	12:41	0.03				
Reading # 6 (ft)					12:51	0.05				
Reading # 7 (ft)					13:01	0.05				
Reading # 8 (ft)					13:11	0.04				
Diameter of Casing (in)	4.00		4.00		4.00					
Final Water Level Drop (ft)	0.00		0.02		0.04					
Average Reading (ft)	0.00		0.03		0.04					
Average Reading (in)	0.00		0.30		0.51					
Average Reading (in/hr)	0.00		0.60		3.06					
Safety Factor	2.00		2.00		2.00					
Infiltration Rate (in/hr)	0.00		0.30		1.53					

REFERENCE NOTES FOR BORING LOGS

MATERIAL[1,2]

■		**ASPHALT**
▨		**CONCRETE**
▨		**GRAVEL**
▨		**TOPSOIL**
□		**VOID**
▦		**BRICK**
▨		**AGGREGATE BASE COURSE**
▨	**FILL**[3]	**MAN-PLACED SOILS**
▨	**GW**	**WELL-GRADED GRAVEL** gravel-sand mixtures, little or no fines
▨	**GP**	**POORLY-GRADED GRAVEL** gravel-sand mixtures, little or no fines
▨	**GM**	**SILTY GRAVEL** gravel-sand-silt mixtures
▨	**GC**	**CLAYEY GRAVEL** gravel-sand-clay mixtures
▨	**SW**	**WELL-GRADED SAND** gravelly sand, little or no fines
▨	**SP**	**POORLY-GRADED SAND** gravelly sand, little or no fines
▨	**SM**	**SILTY SAND** sand-silt mixtures
▨	**SC**	**CLAYEY SAND** sand-clay mixtures
▥	**ML**	**SILT** non-plastic to medium plasticity
▥	**MH**	**ELASTIC SILT** high plasticity
▧	**CL**	**LEAN CLAY** low to medium plasticity
▧	**CH**	**FAT CLAY** high plasticity
▨	**OL**	**ORGANIC SILT or CLAY** non-plastic to low plasticity
▨	**OH**	**ORGANIC SILT or CLAY** high plasticity
▨	**PT**	**PEAT** highly organic soils

DRILLING SAMPLING SYMBOLS & ABBREVIATIONS

SS	Split Spoon Sampler	PM	Pressuremeter Test
ST	Shelby Tube Sampler	RD	Rock Bit Drilling
WS	Wash Sample	RC	Rock Core, NX, BX, AX
BS	Bulk Sample of Cuttings	REC	Rock Sample Recovery %
PA	Power Auger (no sample)	RQD	Rock Quality Designation %
HSA	Hollow Stem Auger		

PARTICLE SIZE IDENTIFICATION

DESIGNATION		PARTICLE SIZES
Boulders		12 inches (300 mm) or larger
Cobbles		3 inches to 12 inches (75 mm to 300 mm)
Gravel:	Coarse	¾ inch to 3 inches (19 mm to 75 mm)
	Fine	4.75 mm to 19 mm (No. 4 sieve to ¾ inch)
Sand:	Coarse	2.00 mm to 4.75 mm (No. 10 to No. 4 sieve)
	Medium	0.425 mm to 2.00 mm (No. 40 to No. 10 sieve)
	Fine	0.074 mm to 0.425 mm (No. 200 to No. 40 sieve)
Silt & Clay ("Fines")		<0.074 mm (smaller than a No. 200 sieve)

COHESIVE SILTS & CLAYS

UNCONFINED COMPRESSIVE STRENGTH, Q_P[4]	SPT[5] (BPF)	CONSISTENCY[7] (COHESIVE)
<0.25	<3	Very Soft
0.25 - <0.50	3 - 4	Soft
0.50 - <1.00	5 - 8	Firm
1.00 - <2.00	9 - 15	Stiff
2.00 - <4.00	16 - 30	Very Stiff
4.00 - 8.00	31 - 50	Hard
>8.00	>50	Very Hard

RELATIVE AMOUNT[7]	COARSE GRAINED (%)[8]	FINE GRAINED (%)[8]
Trace	≤5	≤5
Dual Symbol *(ex: SW-SM)*	10	10
With	15 - 20	15 - 25
Adjective *(ex: "Silty")*	≥25	≥30

GRAVELS, SANDS & NON-COHESIVE SILTS

SPT[5]	DENSITY
<5	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
>50	Very Dense

WATER LEVELS[6]

▽	WL	Water Level (WS)(WD)
		(WS) While Sampling
		(WD) While Drilling
▽	SHW	Seasonal High WT
▼	ACR	After Casing Removal
▽	SWT	Stabilized Water Table
	DCI	Dry Cave-In
	WCI	Wet Cave-In

---

[1] *Classifications and symbols per ASTM D 2488-09 (Visual-Manual Procedure) unless noted otherwise.*

[2] *To be consistent with general practice, "POORLY GRADED" has been removed from GP, GP-GM, GP-GC, SP, SP-SM, SP-SC soil types on the boring logs.*

[3] *Non-ASTM designations are included in soil descriptions and symbols along with ASTM symbol [Ex: (SM-**FILL**)].*

[4] *Typically estimated via pocket penetrometer or Torvane shear test and expressed in tons per square foot (tsf).*

[5] *Standard Penetration Test (SPT) refers to the number of hammer blows (blow count) of a 140 lb. hammer falling 30 inches on a 2 inch OD split spoon sampler required to drive the sampler 12 inches (ASTM D 1586). "N-value" is another term for "blow count" and is expressed in blows per foot (bpf).*

[6] *The water levels are those levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding fluids, in granular soils. In clay and cohesive silts, the determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally employed.*

[7] *Minor deviation from ASTM D 2488-09 Note 16.*

[8] *Percentages are estimated to the nearest 5% per ASTM D 2488-09.*

APPENDIX C – Laboratory Results

Laboratory Testing Summary
Atterberg Limits
Grain Size Analysis

Laboratory Testing Summary

Sample Source	Sample Number	Start Depth (feet)	End Depth (feet)	Sample Distance (feet)	MC[1] (%)	Soil Type[2]	Atterberg Limits[3] LL	Atterberg Limits[3] PL	Atterberg Limits[3] PI	Percent Passing No. 200 Sieve[4]	Moisture - Density (Corr.)[5] Maximum Density (pcf)	Moisture - Density (Corr.)[5] Optimum Moisture (%)	CBR Value[6]	Other
B-1														
	S-2	2.0	4.0	2.0	17.4									
	S-3	4.0	6.0	2.0	5.6									
	S-4	6.0	8.0	2.0	15.7	GM	NP	NP	NP	24.4				
B-4														
	S-1	0.0	2.0	2.0	17.7									
	S-2	2.0	4.0	2.0	20.3	SM FILL	43	31	12	46.0				
B-5														
	S-1	0.0	2.0	2.0	16.2									
	S-2	2.0	4.0	2.0	1.9									
	S-3	4.0	6.0	2.0	10.9									
	S-4	6.0	8.0	2.0	8.6	GM	31	23	8	12.2				

Notes: 1. ASTM D 2216, 2. ASTM D 2487, 3. ASTM D 4318, 4. ASTM D 1140, 5. See test reports for test method, 6. See test reports for test method

Definitions: MC: Moisture Content, Soil Type: USCS (Unified Soil Classification System), LL: Liquid Limit, PL: Plastic Limit, PI: Plasticity Index, CBR: California Bearing Ratio, OC: Organic Content (ASTM D 2974)

Project No.	**18:4914**
Project Name:	**Burger King**
PM:	**Meghan D. Hartman**
PE:	**J. Matthew Carroll**
Printed On:	**Tuesday, April 21, 2020**

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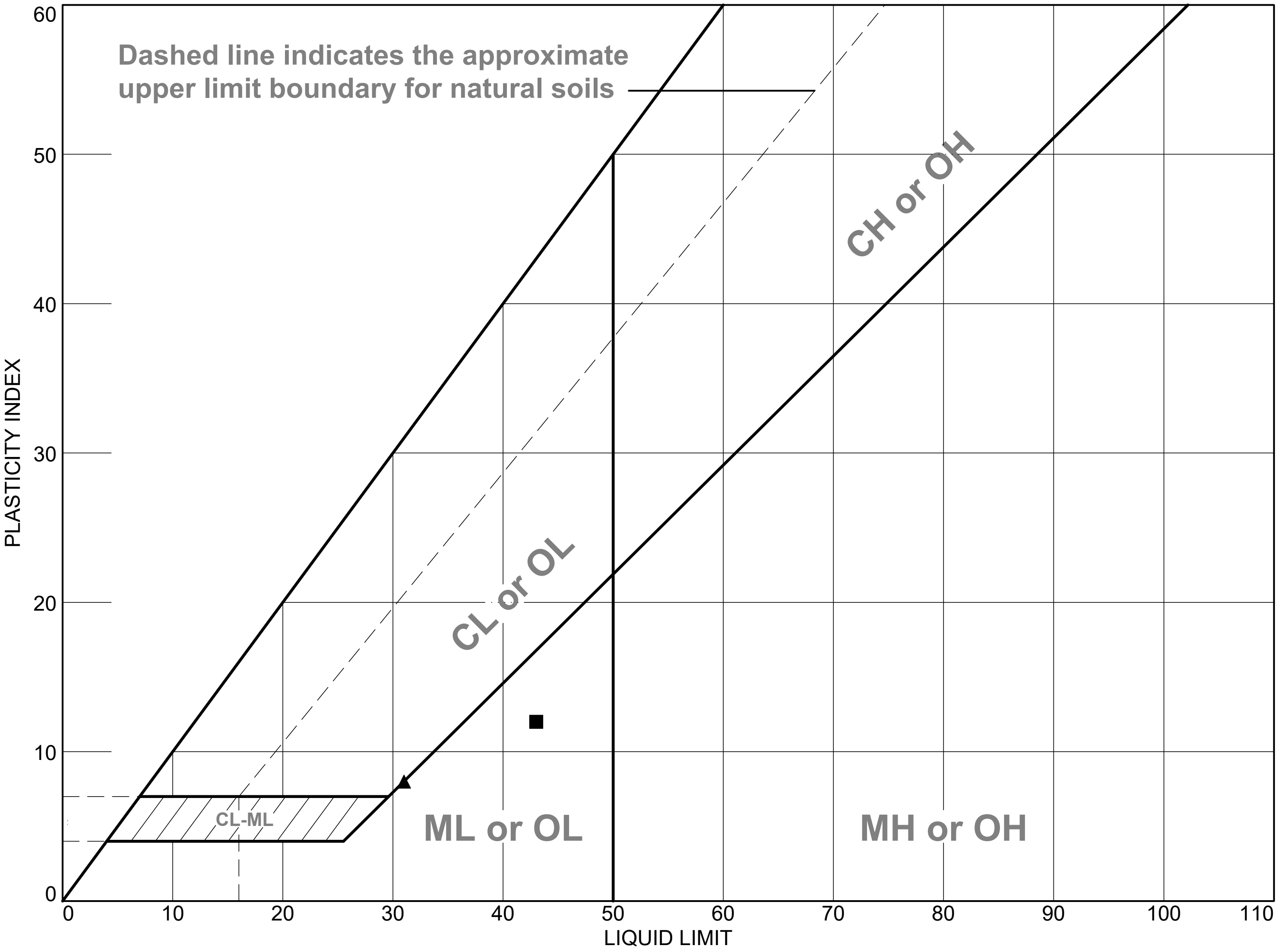
56 Grumbacher Road, Suite D
York, PA 17406
Phone: (717) 767-4788
Fax: (717) 767-5658

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Silty Gravel with Sand	NP	NP	NP	34.8	24.4	GM
■	Silty Sand with Gravel	43	31	12	57.9	46.0	SM
▲	Silty Gravel with Sand	31	23	8	22.2	12.2	GM

Project No. 4914 **Client:** InSite Real Estate Development

Project: Burger King

● **Source of Sample:** B-1 **Depth:** 6.00-8.00 **Sample Number:** S-4
■ **Source of Sample:** B-4 **Depth:** 2.00-4.00 **Sample Number:** S-2
▲ **Source of Sample:** B-5 **Depth:** 6.00-8.00 **Sample Number:** S-4

Remarks:

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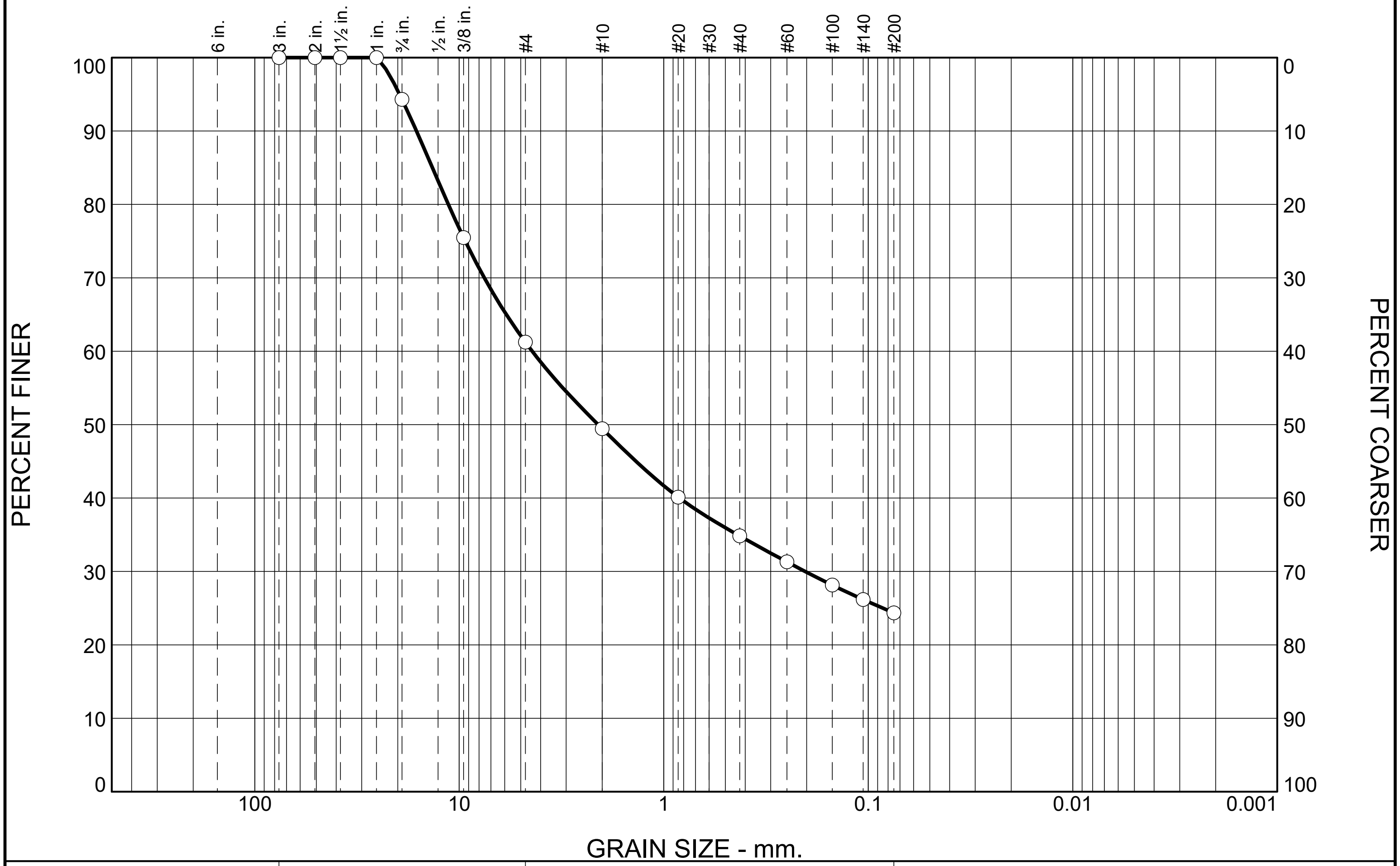
Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	5.7	33.1	11.7	14.7	10.4	24.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1 1/2	100.0		
1	100.0		
3/4	94.3		
3/8	75.5		
#4	61.2		
#10	49.5		
#20	40.1		
#40	34.8		
#60	31.3		
#100	28.1		
#140	26.2		
#200	24.4		

* (no specification provided)

Soil Description

Silty Gravel with Sand

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 16.2009 D_{85}= 13.5365 D_{60}= 4.3982
D_{50}= 2.0923 D_{30}= 0.2034 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= GM AASHTO= A-1-b

Remarks

Source of Sample: B-1 **Depth:** 6.00-8.00
Sample Number: S-4

Date: 4/15/2020

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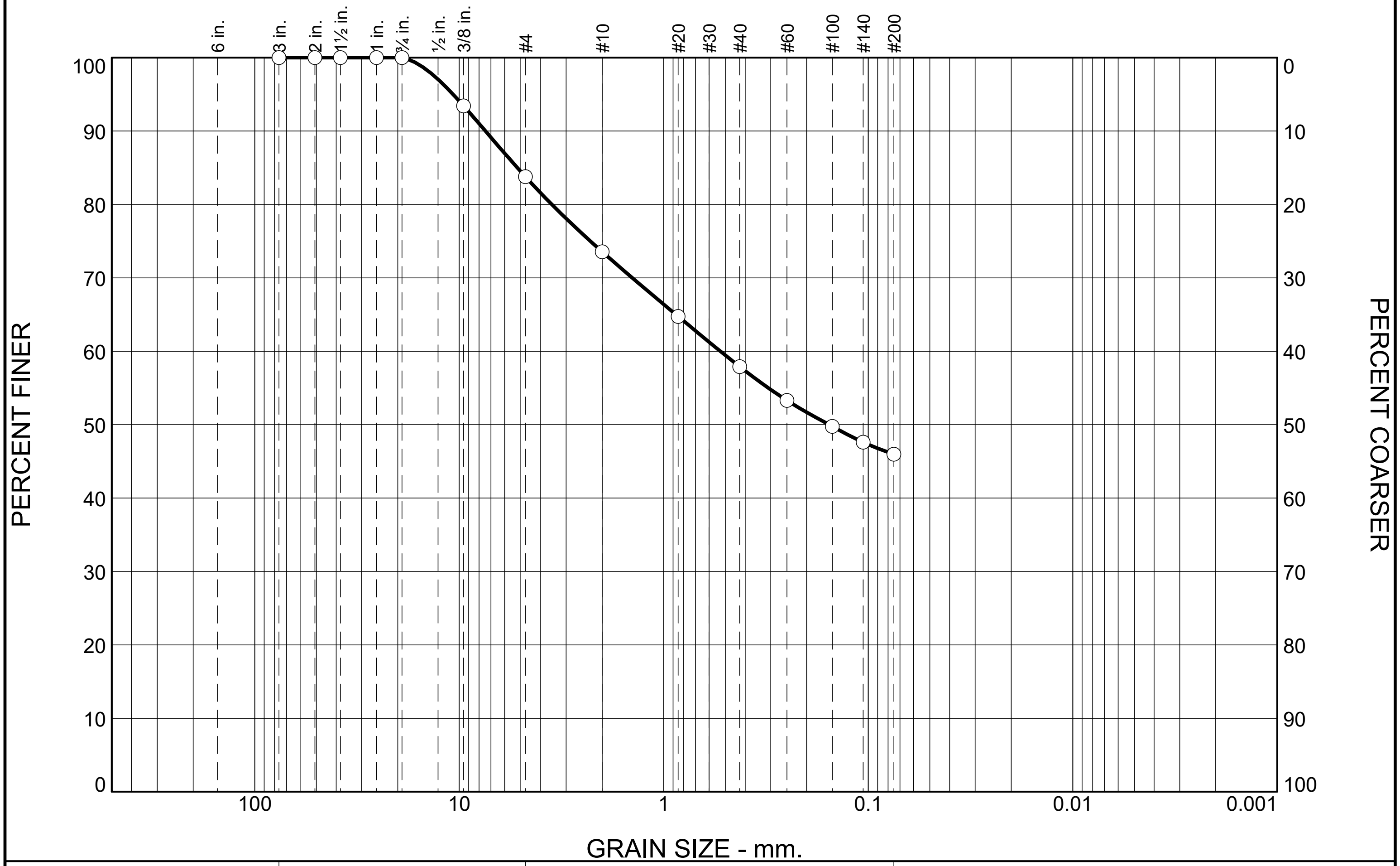
Client: InSite Real Estate Development
Project: Burger King

Project No: 4914 **Figure** 1 of 3

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	16.2	10.2	15.7	11.9	46.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1 1/2	100.0		
1	100.0		
3/4	100.0		
3/8	93.4		
#4	83.8		
#10	73.6		
#20	64.7		
#40	57.9		
#60	53.3		
#100	49.8		
#140	47.6		
#200	46.0		

* (no specification provided)

Soil Description

Silty Sand with Gravel

Atterberg Limits

PL= 31 LL= 43 PI= 12

Coefficients

D_{90}= 7.4465 D_{85}= 5.2023 D_{60}= 0.5286

D_{50}= 0.1554 D_{30}= D_{15}=

D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-7-5(3)

Remarks

Grainsize sample contained approximately 1.41 g of unknown fill materials to include fibers and organics; not inlcuded in test results.

Source of Sample: B-4 **Depth:** 2.00-4.00
Sample Number: S-2

Date: 4/15/2020

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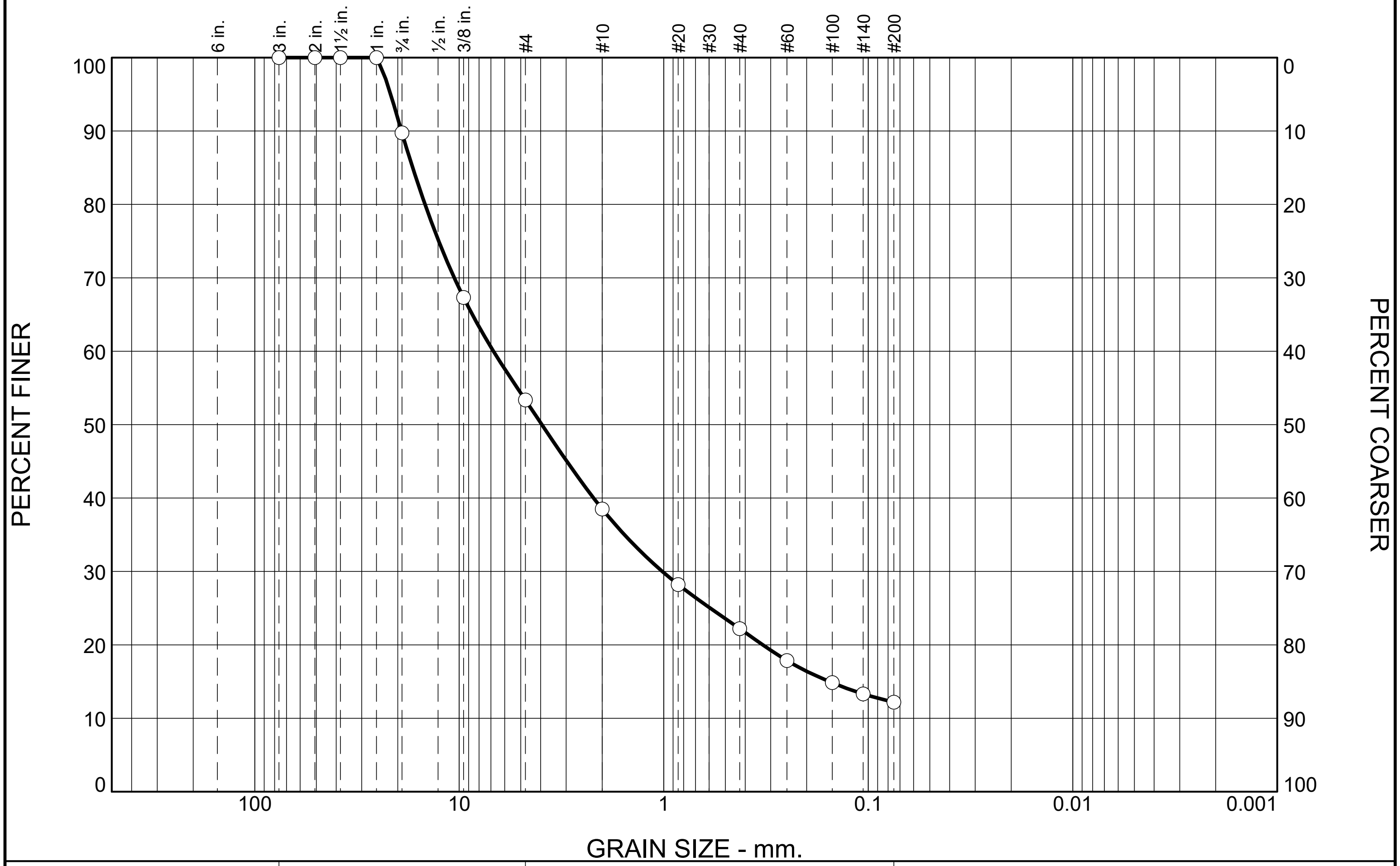
Client: InSite Real Estate Development
Project: Burger King

Project No: 4914 **Figure** 2 of 3

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	10.2	36.4	14.9	16.3	10.0	12.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3	100.0		
2	100.0		
1 1/2	100.0		
1	100.0		
3/4	89.8		
3/8	67.3		
#4	53.4		
#10	38.5		
#20	28.2		
#40	22.2		
#60	17.9		
#100	14.8		
#140	13.3		
#200	12.2		

* (no specification provided)

Soil Description

Silty Gravel with Sand

Atterberg Limits

PL= 23 LL= 31 PI= 8

Coefficients

D_{90}= 19.1643 D_{85}= 16.8948 D_{60}= 6.8024
D_{50}= 3.9447 D_{30}= 1.0160 D_{15}= 0.1546
D_{10}= C_u= C_c=

Classification

USCS= GM AASHTO= A-2-4(0)

Remarks

Source of Sample: B-5 **Depth:** 6.00-8.00
Sample Number: S-4

Date: 4/15/2020

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Client: InSite Real Estate Development
Project: Burger King

Project No: 4914 **Figure** 3 of 3