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January 18, 2018
Project No. BE-17-249-B

Ellicott Development
295 Main Street, Suite 210
Buffalo, New York
14203

Attn. Mr. Jeremy P. Wassel, Planning and Development Coordinator

Re: Geotechnical Engineering Report for
Proposed Elmwood Crossing Development
188 to 204 West Utica Street
Buffalo, New York

Dear Mr. Wassel:

Empire Geo-Services, Inc. is pleased to submit two copies of the enclosed Geotechnical Engineering Report to Ellicott Development for the above referenced project. A pdf file copy of the report has also been e-mailed to you for your use and distribution as appropriate.

Please contact me should you have any questions or wish to discuss this report. Thank you for considering Empire for this work and we look forward to working with you on this project, through its completion.

Sincerely,

EMPIRE GEO-SERVICES, INC.

Thomas R. Seider, P.E.
Geotechnical Engineer

Enc.: Geotechnical Engineering Report (2 copies)

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Geotechnical Engineering Report for Proposed Elmwood Crossing Development 188 to 204 West Utica Street Buffalo, New York

Prepared For:

Ellicott Development
295 Main Street, Suite 210
Buffalo, New York
14203

Prepared By:

Empire Geo-Services, Inc.
5167 South Park Avenue
Hamburg, New York
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STATE OF NEW YORK ★ THOMAS R. SEIDER ★ 079104 LICENSED PROFESSIONAL ENGINEER

1/18/2018

Project No.: BE-17-249-B
January 2018

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1.00 INTRODUCTION

1.10 GENERAL

This report presents the results of a subsurface exploration program and geotechnical engineering evaluation, completed by Empire Geo-Services, Inc. (Empire), for a portion of the proposed Elmwood Crossing Development, located at 188 to 204 West Utica Street, within the City of Buffalo, New York. The portion of the project addressed in this report includes: an addition to the parking ramp; a grocery store / apartment building; and three rows of townhouses. The overall Elmwood Crossing project, includes redevelopment of the former Women and Children's Hospital of Buffalo and several surrounding properties.

Ellicott Development retained Empire to complete this work, which was done in general accordance with our November 15th, 2017 proposal. SJB Services, Inc. (SJB), Empire's affiliated drilling company, completed the subsurface exploration program, which consisted of eight test borings. On this basis, Empire prepared this report, which summarizes the subsurface conditions encountered, and presents geotechnical recommendations for design and construction of the proposed structures.

1.20 SITE AND PROJECT DESCRIPTION

The project site is located along the south side of West Utica Street, extending from the existing parking ramp to near the intersection with Atlantic Avenue, within the City of Buffalo, New York. The approximate limits of the site are shown on Figure 1. The project site is about 250 feet wide and 500 feet long, consisting mostly of asphalt pavement parking lots, with one single story building centrally located within the project site. The ground surface at the site gradually slopes upward towards the east, with surface elevations at the test borings ranging from about 497 feet to 504 feet, based on the benchmark datum described below. Additional details about the current site conditions are shown on Figure 2.

The preliminary plans for the project include: a parking ramp addition off the east side of the existing parking ramp; a four story steel framed structure with a grocery store at the ground level and apartments above; and three rows of town houses. No below grade structures are planned, other than elevator pits. Maximum anticipated column loads are expected to range from about 300 to 600 kips.

2.00 SUBSURFACE EXPLORATIONS

The subsurface exploration program consisted of 8 test borings, completed by SJB between December 13th, 2017 and January 16th, 2018. The test borings are designated as B-1 through B-8. The test boring locations were initially selected and plotted on a site plan provided Ellicott Development. The test boring locations were then established in the field by SJB, and the locations were recorded using a hand held global positioning system (GPS) instrument. The approximate test boring locations are shown on Figure 2. Laser level survey techniques were utilized to determine the relative ground surface elevations at the test borings, using the floor at the entrance to the existing building on the site, as a benchmark. The approximate benchmark location is shown on Figure 2, and was assigned an arbitrary datum elevation of 500.0 feet by SJB.

The test borings were completed using a Central Mine Equipment (CME) model 550X, all terrain tire mounted drill rig, and a CME model 75, truck mounted drill rig. Hollow stem auger drilling and split spoon sampling techniques were used to advance the test borings. Test borings B-1 was advanced to a depth of 47 feet and test boring B-8 was completed to a depth of 50 feet. The remaining test borings were completed to depths of 23 to 27 feet.

An attempt was made to advance test boring B-1 to the top of bedrock, expected near a depth of 60 feet. However, running sands prevented advancement of the test boring using hollow stem auger drilling techniques. If it is necessary to determine the actual depth / elevation of the top of bedrock, for the installation of driven piles, advancement of a test boring(s) using flush joint casing will be necessary. At the time this report was issued, it appeared that spread foundations would be adequate for the proposed projects.

Split spoon samples and Standard Penetration Tests (SPTs) were taken continuously from the ground surface to a depth of 12 feet, and then in intervals of 5 feet or less for the remaining depth of the test borings. The split spoon samples and SPTs were completed in general accordance with *ASTM D1586 – "Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils"*.

A Geologist from SJB prepared the test boring logs based on visual observation of the recovered soil samples and a review of the driller's field notes. The soil samples were described based on a visual/manual estimation of the grain size distribution, along with characteristics such as color, relative density, consistency, moisture, etc. The test boring logs are presented in Appendix A, along with general information and a key of terms and symbols used to prepare the logs.

3.00 SUBSURFACE CONDITIONS

3.10 GENERAL SOIL STRATIGRAPHY

Beneath the asphalt pavement, fill soils were encountered which extended to depths of about 2 to 6 feet. Beneath the fill layer, the indigenous soils consisted predominately of non-cohesive sands and gravels with varying amounts of clayey silts. Lesser amounts of sandy silty clays and sandy clayey silts were also encountered. Bedrock was not encountered at the depths and locations explored. The soil stratigraphy encountered and the groundwater conditions observed are described in more detail in the following sections and on the test boring logs in Appendix A.

During the soil classification procedure completed at our office, an apparent petroleum odor was noted from two soil samples collected from test boring B-3, at 8 to 10 feet and 10 to 12 feet. These observations are noted on the test boring log and are an indication of potential environmental concern. However, no analytical screening or laboratory testing was completed by Empire to evaluate for contamination.

3.20 SURFACE CONDITIONS AND FILL SOILS

Beneath the asphalt pavement, fill soils were encountered which extended to depths of about 2 to 6 feet. The following table summarizes the fill depths and apparent bottom of fill elevations encountered at the test boring locations.

Approximate Fill Depths and Bottom of Fill Elevations

Test Boring	Ground Surface Elevation (feet)	Fill Depth / Bottom Elevation (feet)
B-1	496.5	2 / 494.5
B-2	497.4	2 / 495.4
B-3	498.4	2 / 496.4
B-4	496.9	4 / 492.9
B-5	499.5	4 / 495.5
B-6	500.9	6 / 494.9
B-7	502.7	2 / 500.7
B-8	504.0	4 / 500.0

It should be expected that the fill thickness will vary between and away from the test boring locations, and will extend at least to the bottom of existing or previous building foundations or utilities at the site.

The fill soils consisted mostly of gravels and sands with varying amounts of clayey silts. Slag and trace amounts of organics were observed within several of the fill samples. The Standard Penetration Test (SPT) "N" values obtained within the fill soils ranged from 3 to 25, indicating the fill soils have a "loose" to "firm" relative density.

3.30 INDIGENOUS SOILS

The indigenous soils encountered beneath the fill layer, consisted predominately of sands and gravels or gravels and sands with varying amounts of clayey silts. Lesser amounts of sandy clayey silts or sandy silty clays were also encountered, particularly within the western test borings. The non-cohesive sands and gravels are classified as a SM-SC, GM-GC, and GP group soil using the Unified Soil Classification System (USCS).

The cohesive sandy clays and silts, are classified as CL and ML group soils using the USCS, and were identified at the following locations and depths.

- Test boring B-1, from about 6 to 19 feet;
- Test boring B-2, from about 19 to 24 feet;
- Test boring B-3, from about 4 to 6 feet and 10 to 19 feet; and
- Test boring B-5, from about 19 to 23 feet.

At depths less than about 4 to 8 feet, the SPT "N" values obtained within the indigenous soils ranged from 3 to 14, indicating the shallower indigenous soils have a "loose" to "firm" relative density. Relatively higher SPT "N" values were obtained below these depths, with SPT "N" values typically exceeding 25. These higher values indicate the non-cohesive soils have a "firm", "compact", and "very compact" relative density, while the cohesive soils have a "very stiff" to "hard" consistency.

3.40 GROUNDWATER CONDITIONS

Based on the information summarized below, a general groundwater condition is expected about 10 feet to 15 feet below the ground surface.

Water level measurements made within the test borings at the completion of overburden drilling, typically encountered groundwater about 15 to 20 feet below the surface. At test boring B-5, the augers were left in the ground overnight. The next morning, the depth to water was measured at 16 feet. The water levels at the completion of drilling and the overnight water level at test boring B-5, generally correlate to the depth where the soil samples were described as “moist to wet” or “wet”. Exceptions include test boring B-6, where free standing water was observed at a depth of about 9 feet. The shallower groundwater at test boring B-6, however, could be the result of some perched groundwater, as described below.

In all cases, it is possible that the groundwater did not have sufficient time to stabilize in the boring holes within the time period that had elapsed from the completion of soil drilling and sampling operations and the time of the measurements.

Several shallower soils samples were described as “moist to wet” or “wet”, including: the soils from the surface to 6 feet at test boring B-2; and the soils from 6 to 10 feet at test boring B-6. These conditions could represent a perched or trapped groundwater condition within looser or more granular shallow soils. Perched groundwater conditions can be more prevalent following heavy or extended periods of precipitation and during seasonally wet periods. It should be expected that both perched and permanent groundwater conditions could vary with location and with changes in soil conditions, precipitation and seasonal conditions.

4.00 GEOTECHNICAL CONSIDERATIONS AND RECOMMENDATIONS

4.10 GENERAL

The following general considerations and recommendations are provided to assist with planning for the design and construction of the foundations and slab-on-grade floors for the proposed buildings. More detailed recommendations are presented in the subsequent sections of this report.

4.10.1 Foundation Support

The use of a conventional spread foundation system can be used to support the proposed structures, provided the recommended net allowable bearing capacity of 4,000 pounds per square foot is adequate, and the expected differential settlement due to the variable soil conditions is tolerable. For spread foundations to be used, all fill soils and any looser indigenous soils, will need to be completely removed. This will require excavations of about 5 to 9 feet deep.

Due to the variable relative density of the indigenous soils, we recommend the spread foundation bearing grades be compacted with a vibratory plate tamper weighing at least 500 pounds, prior to construction of the foundations or installation of Structural Fill. This will develop a firmer and more uniform subgrade condition for construction of the spread foundations.

The use of a driven pile foundation system, bearing on the Limestone bedrock, could be considered as an alternative to spread foundations. The top of bedrock was not identified within the test borings completed for this project. However, based on other investigations completed within this area of the city, the top of Limestone bedrock is expected at a depth of about 60 to 65 feet. If piles are selected, we recommend additional test borings, with rock coring, be completed to confirm the depth to the top of bedrock.

The use of piles would eliminate differential settlement concerns, limit the amount of excavation necessary to remove unsuitable soils, and provide for higher capacities than spread foundations. The expected 6o to 65 feet depth to bedrock, coupled with the groundwater conditions and non-cohesive sands would appear to preclude the use of a drilled pier foundation system.

4.10.2 Slab-on-Grade Floor Construction

For the slab-on-grade floor, it is common practice to recommend that all existing fill soils be removed and replaced with a properly controlled and compacted engineered fill layer. However, the fill soils encountered were relatively firm and appear to be generally absent of significant amounts of organics. Therefore, the Owner could consider an approach of removing a portion of the existing fill and providing some additional Subbase Stone, along with a heavy duty stabilization geotextile beneath the slab-on-grade construction. This will provide for a stiffer subgrade and reduce some of the differential settlement effects, if it were to occur. There are some uncertainties with this approach, such as the potential for some long-term differential settlement, resulting from unidentified zones of unsuitable fill soils or buried organics.

If the Owner is willing accept these risks, then we would recommend the following be implemented as minimum requirements for constructing the slab-on-grade over the existing fill soils.

- After removal of the asphalt pavement and excavation to the proposed subgrades, the existing fill subgrades should be thoroughly compacted and properly proof rolled, evaluated, and prepared in accordance with our recommendations provided in Section 4.90.4.
- Any existing structures (i.e. existing buried foundation walls, utilities, etc.), should be removed in order to effectively proof roll the subgrades and remove rigid locations from beneath the proposed slab-on-grade floor.
- Any deleterious materials, such as organics, very soft soils, debris, etc., which are present within the fill soils at the bottom of the subgrade excavation, should be further undercut, removed, and replaced with Suitable Granular Fill or additional Subbase Stone.
- A suitable stabilization/separation geotextile, such as Mirafi 600X or suitable equivalent, should be placed over the final exposed fill soil subgrades, prior to placing the first lift of the Subbase Stone.
- A minimum 15 inch thick layer of compacted Subbase Stone should be used beneath the floor slabs. Recommendations for the Subbase Stone are provided in Appendix B.

4.10.3 Groundwater Considerations

General groundwater conditions are not expected to be encountered within the upper 15 feet of the surface. However, some perched groundwater could be encountered within the fill soils or the upper, relatively looser, indigenous soils. Construction dewatering procedures should depress and maintain the groundwater levels at least 2 feet below the excavation bottom.

4.10.4 Seismic Site Conditions

The project site can be classified as Seismic Site Class “C” in accordance with ASCE 7, Table 20.3-1, as referenced in the Building Code of New York State (IBC 2015). Therefore, seismic design can be based on this seismic site classification.

4.20 SPREAD FOUNDATIONS

Spread foundations can be considered for use at the site, provided the estimated total and differential settlements beneath the foundations are acceptable. Spread foundations, if used to support the proposed buildings, should bear on suitable, relatively undisturbed, indigenous soil subgrades. Alternatively, they can bear on compacted Structural Fill, placed over suitable indigenous soil subgrades.

Suitable indigenous soil bearing grades should consist of the "firm" to "very compact" clayey silty sands and gravels or the "very stiff" sandy clayey silts. Suitable indigenous soil bearing grades should be free of all fill soils, loose, wet or otherwise deleterious conditions. The suitable bearing grade depths/elevations that were present in the test borings are presented on the following table.

Recommended Suitable Bearing Grade Depth / Elevation for Spread Foundations or Structural Fill		
Test Boring	Approximate Ground Surface Elevation (feet)	Suitable Bearing Grade Depth / Elevation (feet)
B-1	496.5	5.0 / 491.5
B-2	497.4	6.0 / 491.4
B-3	498.4	8.0 / 490.4
B-4	496.9	6.0 / 490.9
B-5	499.5	4.5 / 495.0
B-6	500.9	6.0 / 494.9
B-7	502.7	8.5 / 494.2
B-8	504.0	6.5 / 497.5

The exposed subgrades should be compacted with at least 4 passes of a minimum 500 pound vibratory plate tamper, prior to installation of the Structural Fill or construction of the foundations.

Foundations should bear at or below the suitable bearing grades noted above, or they may bear on Structural Fill, which is placed following excavation to or below these grades. Subsurface conditions away from the test boring locations, in some cases, may vary and require adjustments in the suitable subgrade elevation based on actual conditions encountered at the time of construction. Accordingly, close inspection of the foundation bearing grades by qualified geotechnical personnel is recommended at the time of construction.

Where new foundations for the parking ramp addition meet the existing structure foundations, the new foundations should meet the bearing grade of the existing spread foundations, which they will abut. This may require stepping the new foundations up or down away from the existing foundation to meet the design bearing grades for the addition. The existing foundations should also be protected from undermining or loss of lateral support during excavation and construction of the new adjacent foundations.

If Structural Fill is placed beneath the spread foundations, it must be placed beyond the foundation limits a horizontal distance equal to at least 0.5 times the thickness of the Structural Fill layer beneath the foundation. Excavations, therefore, will need to be planned and sized accordingly. In addition, a separation/stabilization geotextile should be installed between the indigenous soils and the Structural Fill layer. Recommendations for Structural Fill material along with its placement and compaction are presented in Appendix B.

It is recommended that continuous footings be at least 2.0 feet in width and column/individual footings should be at least 3.0 feet in width. Exterior foundations should be embedded a minimum of 4.0 feet below finished exterior grades for frost protection. Interior foundations should be embedded a minimum of 2.5 feet below the finished interior grades to develop adequate bearing capacity. All foundations, however, must bear at or below the suitable bearing grades summarized above, or on a layer of Structural Fill installed over the suitable bearing grades.

Spread foundations constructed on suitable indigenous soil bearing grades or on Structural Fill placed over the suitable bearing grades can be sized based on a maximum net allowable bearing pressure of 4,000 pounds per square foot (psf).

Based on the anticipated 300 to 600 kip column loads, it is estimated that spread foundations sized and properly constructed in accordance with our recommendations will undergo a total settlement of about 0.7 inches to 1.0 inches. Differential settlement, resulting from the variable column loads along with variable relative density of the soils between test borings in the area of the parking ramp addition and grocery store is expected to be about 0.3 inches. The bearing capacities and estimated settlements can be re-evaluated as the structure designs are developed, the column loads are refined, and the actual bearing grade elevations for the spread foundations are determined.

4.30 DRIVEN PILE FOUNDATIONS

4.30.1 General

The Limestone bedrock, expected about 60 to 65 feet below the existing ground surface, should provide a suitable bearing stratum for supporting the new structures, using end bearing piles driven to bedrock refusal. The piles should be equipped with a driving shoe to limit potential damage when driving into the top of bedrock. Due to the relatively compact soil conditions, pre-drilling could be considered to reduce the energy required to advance the piles to the top of bedrock.

4.30.2 Driven Pile Design Criteria

A steel pile, driven to absolute refusal at the top of the Limestone bedrock, can be designed for an allowable axial capacity equal to 35% of the pile yield strength or 17.5 kips per square inch (ksi), whichever is less, times the cross sectional area of the pile. During installation, the pile stresses should not exceed 85% of the pile yield stress.

Piles driven to absolute refusal at the top of the Limestone bedrock and in accordance with our recommendations should undergo insignificant total settlement. Piles should be spaced a minimum of 3 pile widths apart, or three feet, whichever is greater. At this spacing, no group reduction factor is considered necessary. All exterior pile caps and grade beams should be embedded a minimum of 4 feet for frost protection.

At least 4 random piles, of each type, should be dynamically tested to confirm the driving criteria and to evaluate that the pile capacity has been obtained with an adequate factor of safety (i.e. Factor of Safety of 2.0 or greater).

4.30.3 Axial Compressive Capacity of Driven H-Piles

Based on the above design criteria, an HP12 x 53 section (Grade 50 steel), with a cross sectional area of 15.5 in^2, would provide an allowable axial compressive capacity of about 135 tons per pile. The piles should be driven and tested for an ultimate capacity of 270 tons, using a Factor of Safety of 2.0, as required by the Building Code of New York State.

Other H-pile sections could also be used to obtain a different allowable axial capacity, using the same criteria outlined above. However, a lighter section is not recommended. The following table summarizes the allowable axial compressive capacity and required ultimate test capacity for three H-pile sections, based on the above design criteria. These capacities assume the use of Grade 50 Steel.

H-Pile Allowable Compressive Capacities			
Pile Section	**Cross Sectional Area**	**Allowable Axial Compressive Capacity**	**Required Ultimate Test Capacity**
HP 12 x 53	15.5 in^2	135 tons	270 tons
HP 12 x 74	21.8 in^2	190 tons	380 tons
HP 14 X 89	26.1 in^2	228 tons	456 tons

Open ended pipe piles could be considered as an alternative to H-piles, and can be sized using the same design criteria outlined above.

4.40 SLAB-ON-GRADE FLOORS

If the slab-on-grade floor is constructed over the existing fill soils, as discussed in Section 4.10.2, it is recommended that a minimum of 15 inches of Subbase Stone be placed beneath the slab-on-grade floors. A suitable stabilization/separation geotextile, such as Mirafi 600X or suitable equivalent, should be placed over the final exposed fill subgrades, prior to placing the first lift of Subbase Stone.

The slab-on-grade floor construction can proceed following the subgrade preparation, compaction, and proof-rolling, as outlined in Section 4.90.4. Subgrade proof-rolling and inspection, should also be performed just prior to the Subbase Stone layer placement.

Floor slabs constructed as a slab-on-grade can be designed using a modulus of subgrade reaction of 150 pounds per cubic inch at the top of the Subbase Stone layer. It is understood that the finished floor grade will be established above the surrounding exterior grades. Therefore, the use of a moisture barrier does not appear warranted, unless otherwise recommended by the finished flooring manufacturer.

It is recommended that the slab-on-grade be constructed such that it floats on the subbase and subgrades and is not structurally connected to, or resting directly on, perimeter walls or column footings in order to limit differential settlement effects.

4.50 LATERAL EARTH PRESSURES FOR ELEVATOR PIT WALLS

The design of below grade wall structures should be based on lateral earth pressures caused by the load of backfill against the wall and the surcharge effects from permanent or temporary loads. Earth retaining walls, which are designed for restrained or non-yielding conditions, should be designed using "at rest" lateral earth pressures. Walls, which are allowed to yield, can be designed on the basis of "active" lateral earth pressures.

The lateral earth pressures can be computed using the following soil parameters where the wall backfill is Suitable Granular Fill, as described in Appendix B, and contains a proper foundation drain(s) as discussed below.

Recommended Soil Parameters for Earth Retaining Wall Design

- Coefficient of At-Rest Lateral Earth Pressure – 0.49
- Coefficient of Active Lateral Earth Pressure – 0.32
- Coefficient of Passive Lateral Earth Pressure – 2.5
- Angle of Internal Friction – 31 Degrees
- Total Unit Weight of Soil – 140 pcf
- Submerged Unit Weight of Soil – 80 pcf
- Surcharge Load Coefficient – 0.50

4.60 SUBSURFACE DRAINAGE

The below grade walls should be constructed with perimeter foundation drains to intercept any perched groundwater that may tend to collect against the walls. It is recommended the below grade walls and floors be damp proofed where suitable foundation drainage is provided.

The drainage system must be properly designed, installed and maintained for long-term performance. The design should include such features as clean-outs to properly maintain the system. The foundation drainage system should drain to a sump(s) and pump system or a suitable gravity drainage system. The foundation drain pipes along the below grade walls should be set at a minimum depth of 1.0 foot below the elevator pit bottom slab grade or the lowest adjacent grade.

The foundation wall drainage system should include a geotextile, selected considering drainage and filtration, installed around drainage stone surrounding a slotted under-drain pipe. The drainage stone should be sized in accordance with the pipe slotting or perforations. A crushed aggregate conforming to NYSDOT Standard Specifications Section 703-02, Size Designation No. 1 (½-inch washed gravel or stone) is generally acceptable for slotted under-drain pipe. The foundation drainage stone and surrounding drainage geotextile (i.e. Mirafi 160N or suitable equivalent) should extend above the drainpipe a minimum of 2 feet.

A pervious granular backfill or a suitable geosynthetic drainage composite should be placed against the foundation wall, above the drainage system, to allow infiltration to the drainage system.

Concrete Sand, which meets the minimum requirements of NYSDOT Standard Specifications Section 703-07 (100 percent passing 3/8 inch sieve to maximum of 3 percent passing a No. 200 sieve), is generally acceptable as pervious granular backfill. Structural Fill, as described in Appendix B, is also acceptable provided the Structural Fill is well graded to prevent infiltration of the adjacent soils and has a permeability of $5x10^{-3}$ cm/sec or greater when placed and compacted to the requirements recommended in Appendix B.

The pervious granular backfill should be a nominal 2 feet in width. The drainage media against the wall should extend to about 1 to 2 feet below the finished grade surface, where it may be capped off with the foundation backfill material.

4.70 PROTECTION OF EXISTING STRUCTURES

The project will include earthwork excavations and heavy equipment operations near the existing roadways, buildings and underground utilities. In all cases, the excavations must be adequately sloped back and/or properly supported (i.e. sheeted, shored, braced, shielded etc.) in accordance with OSHA requirements as a minimum. We note that the explorations are widely spaced and that soil conditions may vary between test borings, therefore, the contractor must confirm the OSHA soil classification and excavation requirements at the time of construction based on soil conditions present. The contractor shall be solely responsible for all excavation safety.

Existing building foundations, foundation walls, and underground utilities should be protected during excavation and construction of the new adjacent foundations. The location and depth of all existing foundations, foundation walls and utilities should be determined and plans should be prepared to protect these structures, as appropriate. In addition, construction of the adjacent foundations should be planned and carried out such that any foundation drainage systems along the existing foundation walls are not adversely impacted, and can continue to function properly.

Should it be necessary to extend the excavation below the bearing grade of the existing foundations, the existing foundations must then be properly underpinned, sheeted, braced, etc. Proper bracing of existing foundation walls, which are exposed during excavation, must also be considered.

Properly braced tight steel sheeting should be required at locations where existing structures, utilities and roadways must be protected from potential detrimental soil movement as the result of soil relaxation/stress relief. It is noted that the use of cantilevered sheet piling (unbraced tight sheeting) or shields/trench boxes generally will not be sufficient to prevent soil relaxation/stress relief (i.e. soil deformation) as excavations takes place.

It is recommended in all cases that both temporary and permanent excavation support systems be properly designed by a registered Professional Engineer, who is experienced in the design of earth support systems. The design requirements at each location must consider the subsurface conditions, the potential for undercutting subgrades, utilities, structures, construction sequence, lateral earth pressures, hydrostatic conditions, trench bottom stability (potential bottom heave) and surcharge effects associated with trench wall and bottom stability. In addition, driving sheet piles can cause detrimental damage to nearby structures, surface features, and underground utilities and must be considered during design and construction.

Consideration should be given to completing a pre-construction and post-construction structural assessment to evaluate for potential damage from construction activities. In addition, it is also recommended that an appropriate vibration monitoring program be implemented during pile driving / removal of sheeting/soldier piles. Removal of excavation support systems should also be properly evaluated so as not to affect the integrity of the adjacent infrastructure.

4.80 SEISMIC DESIGN CONSIDERATIONS

Based on the subsurface conditions encountered in the test borings, and our knowledge of the regional geology, the project site can be classified as Seismic Site Class “C” in accordance with ASCE 7, Table 20.3-1, as referenced in the Building Code of New York State (IBC 2015). Therefore, seismic design can be based on this seismic site classification.

The spectral response accelerations in the area of the project site were obtained by Empire using the United States Geological Survey (USGS) web site application (https://geohazards.usgs.gov/secure/designmaps/us/). The accelerations are based on the 2008 USGS Seismic Hazard Data - Risk Targeted Maximum Considered Earthquake Ground Motion Response Acceleration Maps, as presented in the Building Code of New York State (IBC 2015).

The spectral response accelerations calculated from this application for Site Class "B" soils are 0.209g for the short period (0.2 second) response (S_S) and 0.060g for the one second response (S_1). For design purposes, these spectral response accelerations were then adjusted for the Seismic Site Class "C" soil profile determined for the project site.

Accordingly, the adjusted spectral response accelerations (S_{MS} and S_{M1}) for Site Class "C" are as follows:

- Short Period Response (S_{MS}) - 0.251g
- 1 Second Period Response (S_{M1}) - 0.102g

The corresponding five percent damped design spectral response accelerations (S_{DS} and S_{D1}) are as follows:

- S_{DS} - 0.167g
- S_{D1} - 0.068g

4.90 SITE PREPARATION AND CONSTRUCTION

4.90.1 Construction Dewatering

Construction dewatering will be necessary to control surface water and any perched groundwater that is encountered. Surface water should be diverted away from open excavations and prevented from accumulating on exposed subgrades. The exposed soil subgrades will be susceptible to strength degradation in the presence of excess moisture.

Dewatering of perched groundwater should be implemented in conjunction with excavation work such that the work proceeds in the dry. It is anticipated that diversion berms, proper site grading, and sump and pump methods of dewatering should generally be sufficient to control surface water and perched groundwater conditions. Construction dewatering procedures should depress and maintain the groundwater levels at least 2 feet below the excavation bottom. Dewatering systems should be operated on a continuous basis, until the foundations are constructed and backfilled.

It is recommended that the Contractor excavate some test pits in advance of the excavation work, particularly where deeper excavations are required, to ascertain potential groundwater conditions and plan the dewatering that will be necessary. Groundwater dewatering plans should include implementation of measures to control erosion, sedimentation and the migration of soil fines.

4.90.2 Excavation and Foundation Construction

Excavation to the proposed bearing grades for foundation construction should be performed using a method, which reduces disturbance to the bearing grade soils. All existing fill, loose soils and any otherwise deleterious soil material, beneath the proposed foundation bearing grades, should be removed. The indigenous soil bearing grades should be observed and evaluated by a representative of Empire, prior to placement of the Structural Fill or construction of the foundations. Placement and compaction of Structural Fill beneath foundations should also be observed and tested by a representative of Empire.

All soil bearing grades for foundation construction should be protected from precipitation and surface water. The indigenous soils will be sensitive to disturbance and strength degradation when in the presence of excess moisture. Where foundations are constructed directly on the indigenous soil bearing grades, and where construction of the foundations proceeds during seasonal wet periods and/or the foundations will not be constructed on the same day of the excavation, it may be desirable to place a 2 to 3 inch thick lean concrete mud mat in the excavation bottom to help protect the exposed subgrades and provide a suitable working surface for the foundation construction.

Water should not be allowed to accumulate on the soil bearing grades and the bearing grades should not be allowed to freeze, either prior to or after construction of foundations. If bearing grades are not protected and degrade, they must be undercut/removed accordingly.

Where new foundations for the additions meet the existing buildings, the new foundations should meet the bearing grade of the existing spread foundation, which it will abut. This may require stepping the new foundation up or down away from the existing foundation to meet the design bearing grades for the addition. The existing foundations should also be protected from undermining or loss of lateral support during excavation and construction of the new adjacent foundations.

Foundation excavations should be backfilled as soon as possible, and prior to construction of the superstructure. It is recommended that foundation excavations within slab-on-grade areas be backfilled with a Structural Fill or Suitable Granular Fill, as recommended in Appendix B.

4.90.3 Driven Pile Construction and Testing

The piles should be driven to absolute refusal, into the Limestone bedrock, using a pile hammer having a suitable energy rating. The pile driving criteria should be confirmed by the contractor through the use of the wave equation, based on the actual pile, pile hammer and cushions that will be used, to determine the final driving criteria and that adequate stresses can be developed in the pile to confirm its capacity through dynamic testing and to determine that the pile will not be overstressed during driving. Pile stresses should not exceed 85% of the pile yield stress. Plumbness of the piles should be maintained within 1% of the total length. Any misaligned or damage piles should be replaced.

Absolute refusal should be defined as when about 5 blows have been recorded for less than ¼ inch of pile penetration and the pile reaches the anticipated bedrock elevation. At least 4 random piles should be dynamically tested in accordance with *ASTM D 4945 – "Standard Test Method for High Strain Dynamic Testing of Piles"* to confirm the driving criteria and to evaluate that the pile capacity has been obtained with an adequate factor of safety (i.e. Factor of Safety of 2.0 or greater). A qualified individual should observe all pile driving and should prepare an individual pile driving report for each pile installed.

For driven piles subject to uplift loads, at least 1 pile should be tested in accordance with *ASTM D 3689 – "Standard Test Method for Individual Piles Under Static Axial Tensile Load"* to confirm the that the design uplift capacity has been obtained with an adequate factor of safety (i.e. Factor of Safety of 2.0 or greater).

4.90.4 Subgrade Preparation for Slab-On-Grade Construction

Following any required excavation to the proposed subgrade elevation, the exposed subgrades should be thoroughly compacted and proof-rolled. The compaction and proof-rolling should be performed prior to any fill placement, using a smooth drum roller weighing at least 10 tons. The roller should be operated in the vibratory mode for compacting the soil subgrades and in the static mode for the proof rolling.

The compaction should include at least four passes over the exposed subgrades. The proof rolling should include at least two passes over the exposed subgrades. The subgrade compaction and proof-rolling should be done under the guidance of, and observed/evaluated by a representative of Empire. Any areas, which appear wet, soft, unstable or otherwise exhibit unsuitable materials or conditions, should be further undercut and stabilized. Over excavation, which may be required as the result of the subgrade inspection and/or proof-rolling, should be performed based on guidance provided by Empire. Resulting over-excavations should be backfilled with Structural Fill as described in Appendix B.

The Subbase Stone placement can proceed following preparation and acceptance of the existing fill soil subgrades. A separation/stabilization geotextile (i.e. Mirafi 600X or suitable equivalent), should be placed over the undercut subgrade surface prior to placing the Subbase Stone. The Subbase Stone should be placed to a stable condition and should not "pump", "rut" or show signs of movement or significant deflection (i.e. unstable conditions) as it is being constructed. Any unsuitable conditions should be undercut and removed. The subgrades should also be properly graded, drained and protected from moisture and frost. Placement of Subbase Stone over wet, soft, snow covered or frozen subgrades is not acceptable.

It is recommended that utility trenches located within slab-on-grade areas be backfilled with controlled Structural Fill. During construction, the contractor should take precautions to limit construction traffic over the subgrades for slab-on-grade construction. Any subgrades, which become damaged, rutted or unstable should be undercut and repaired as necessary prior to placement of the overlying fill courses.

5.00 CONCLUDING REMARKS

This report was prepared to assist in planning the design and construction of a portion of the proposed Elmwood Crossing Development, located at 188 to 204 West Utica Street, within the City of Buffalo, New York, including an addition to the parking ramp; a grocery store / apartment building; and three rows of townhouses. The report has been prepared for the exclusive use of Ellicott Development, and other members of the design team, for specific application to this site and this project only.

The recommendations were prepared based on Empire Geo-Services, Inc.'s understanding of the proposed project, as described herein, and through the application of generally accepted soils and foundation engineering practices. No warranties, expressed or implied are made by the conclusions, opinions, recommendations or services provided.

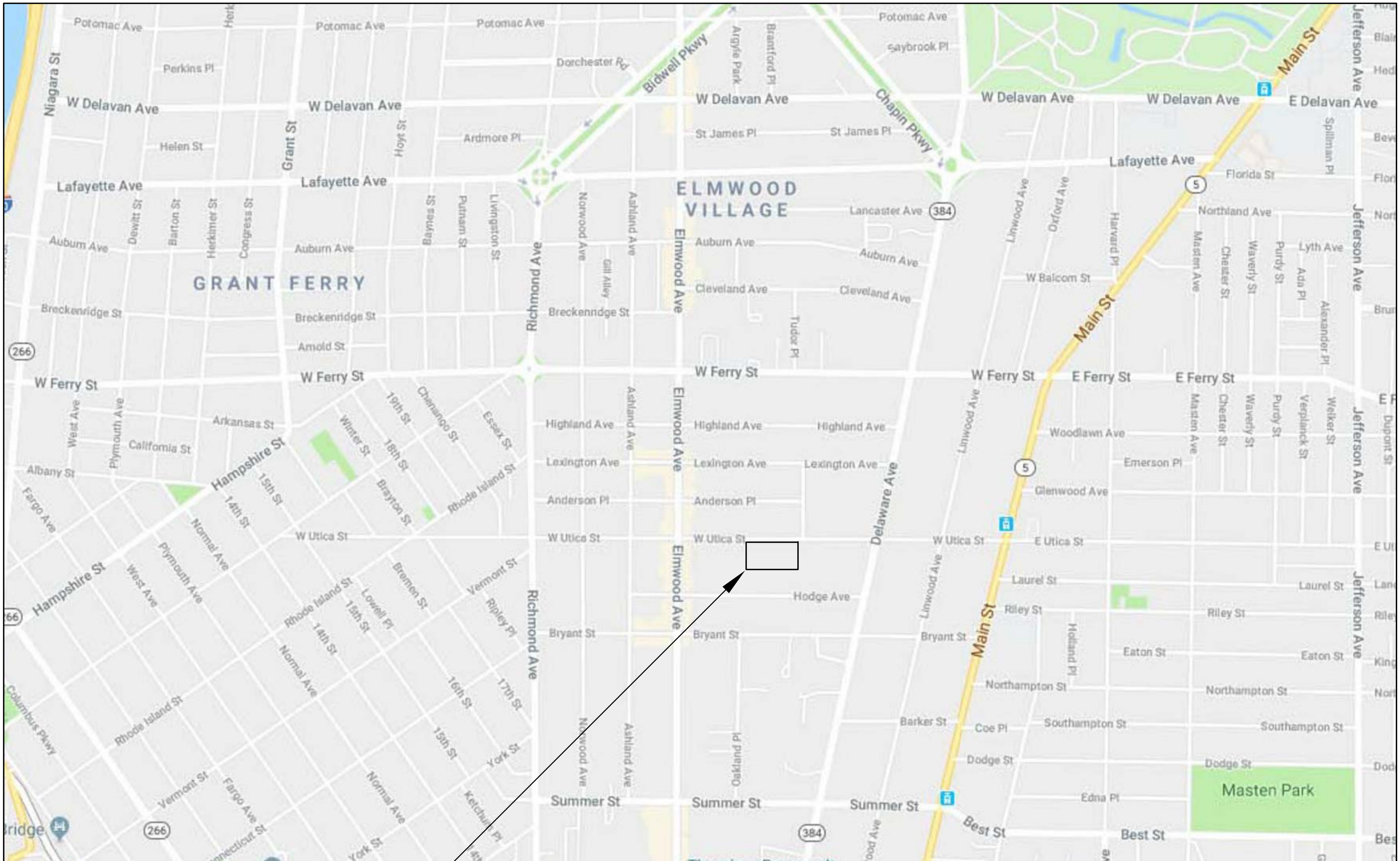
Empire Geo-Services, Inc. should be informed of any changes to the planned construction so that it may be determined if any changes to the recommendations presented in this report are necessary. Empire Geo-Services, Inc. should also review final plans and specifications to verify that the recommendations were properly interpreted and implemented. Important information regarding the use and interpretation of this report is presented in Appendix C.

Respectfully Submitted:

EMPIRE GEO-SERVICES, INC.

Thomas R. Seider, P.E.
Senior Geotechnical Engineer

FIGURES



APPROXIMATE PROJECT SITE LOCATION

N

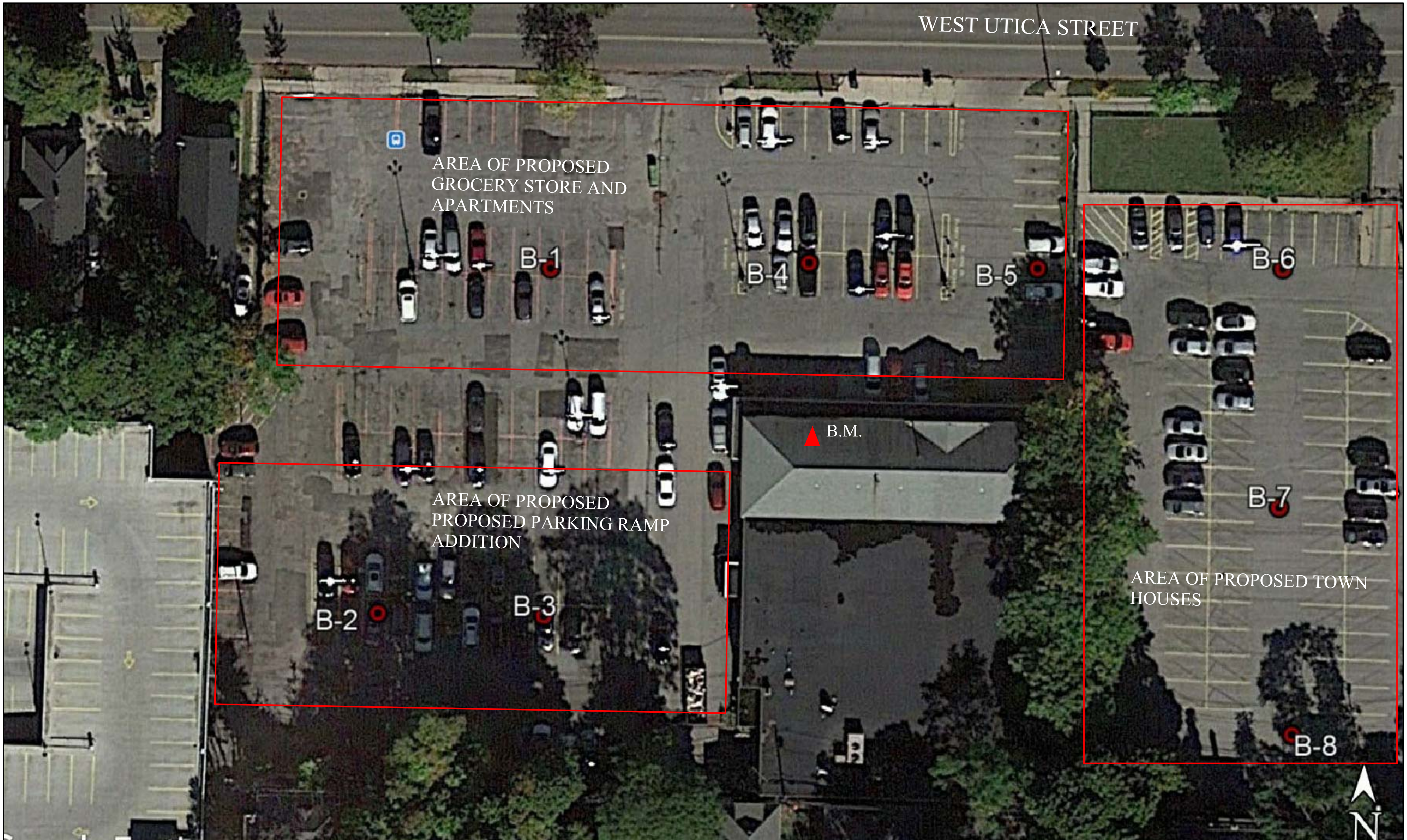
EMPIRE GEO
SERVICES INC
a subsidiary of SJB Services, Inc.

PROPOSED ELMWOOD CROSSING DEVELOPMENT
188 TO 204 WEST UTICA STREET
BUFFALO, NEW YORK

SITE LOCATION PLAN	DR BY: BVB	SCALE: NTS	PROJECT NO.: BE-17-249-B
	CHKD BY: TRS	DATE: 1/17/18	FIGURE NO: 1

NOTE:

SITE LOCATION PLAN DEVELOPED FROM GOOGLE MAPS



LEGEND:

B-1 INDICATES APPROXIMATE LOCATION AND DESIGNATION OF TEST BORING.

B.M. BENCHMARK: FLOOR AT ENTRANCE. ASSIGNED AN ARBITRARY ELEVATION OF 500.0 FEET BY SJB.

NOTE: AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH.

EMPIRE GEO SERVICES INC
a subsidiary of SJB Services, Inc.

PROPOSED ELMWOOD CROSSING DEVELOPMENT
188 TO 204 WEST UTICA STREET
BUFFALO, NEW YORK

SUBSURFACE EXPLORATION PLAN

DR BY: BVB	SCALE: NTS	PROJECT NO.: BE-17-249-B
CHKD BY: TRS	DATE: 1/17/18	FIGURE NO: 2

APPENDIX A

SUBSURFACE EXPLORATION LOGS

GENERAL INFORMATION & KEY TO SUBSURFACE LOGS

The Subsurface Logs attached to this report present the observations and mechanical data collected by the driller at the site, supplemented by classification of the material removed from the borings as determined through visual identification by technicians in the laboratory. It is cautioned that the materials removed from the borings represent only a fraction of the total volume of the deposits at the site and may not necessarily be representative of the subsurface condition between adjacent borings or between the sampled intervals. The data presented of the Subsurface Logs together with the recovered samples provide a basis for evaluating the character of the subsurface conditions relative to the project. The evaluation must consider all the recorded details and their procedures to more accurately evaluate the subsurface conditions. Any evaluation of the contents of this report and recovered samples must be performed by qualified professionals. The following information defines some of the procedures and terms used of the Subsurface Logs to describe the conditions encountered, consistent with the numbered identifiers shown on the Key opposite this page.

1. **The figures in the Depth column define the scale of the Subsurface Log.**

2. **The Samples column shows, graphically, the depth range from which a sample was recovered. See Table I for descriptions of the symbols used to represent the various types of samples.**

3. **The Sample No. is used for identification on sample containers and/or Laboratory Test Reports.**

4. **Blows on Sampler – shows the results of the "Penetration Test", recording the number of blows required to drive a split spoon sampler into the soil. The number of blows required for each six inches is recorded. The first 6 inches of penetration is considered a seating drive. The number of blows required for the second and third 6 inches of penetration is termed the penetration resistance, N.**

5. **Blows on Casing – Shows the number of blows required to advance the casing a distance of 12 inches. The casing size, hammer weight, and length of drop are noted at the bottom of the Subsurface Log. If the casing is advanced by means other than driving, the method of advancement will be indicated in the Notes column or under the Method of Investigation at the bottom of the Subsurface Log. Alternatively, sample recovery may be shown in this column or other data consistent with the column heading.**

6. **All recovered soil samples are reviewed in the laboratory by an engineering technician, geologist, or geotechnical engineer, unless noted otherwise. Visual descriptions are made on the basis of a combination of the driller's field descriptions and noted observations together with the sample as received in the laboratory. The method of visual classification is based primarily on the Unified Soil Classification System (ASTM D 2487) with regard to the particle size and plasticity (See Table No. II), and the Unified Soil Classification System group symbols for the soil types are sometimes included with the soil classification. Additionally, the relative portion, by weight, of two or more soil types is described for granular soils in accordance with "Suggested Methods of Test for Identification of Soils" by D.M. Burmister, ASTM Special Technical Publication 479, June 1970. (See Table No. III). Description of the relative soil density or consistency is based upon the penetration records as defined in Table No. IV. The description of the soil moisture is based upon the relative wetness of the soil as recovered and is described as dry, moist, wet, and saturated. Water introduced into the boring either naturally or during drilling may have affected the moisture condition of the recovered sample. Special terms are used as required to describe soil deposition in greater detail; several such terms are listed in Table V. When sampling gravelly soils with a standard two inch diameter split spoon, the true percentage of gravel is often not recovered due to the relatively small sampler diameter. The presence of boulders and large gravel is sometimes, but not necessarily, detected by an evaluation of the casing and sampler blows or through the "action" of the drill rig as reported by the driller.**

7. **Rock description is based on review of the recovered rock core and the driller's notes. Frequently used rock classification terms are included in Table VI.**

8. **The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Solid stratification lines delineate apparent changes in soil type, based upon review of recovered soil samples and the driller's notes. Dashed lines convey a lesser degree of certainty with respect to either a change in soil type or where such change may occur.**

9. **Miscellaneous observations and procedures noted by the driller are shown in this column, including water level observations. It is important to realize the reliability of the water level observations depends upon the soil type (water does not readily stabilize in a hole through fine grained soils), and that any drill water used to advance the boring may have influenced the observations. The ground water level will fluctuate seasonally, typically. One or more perched or trapped water levels may exist in the ground seasonally. All the available readings should be evaluated. If definite conclusions cannot be made, it is often prudent to examine the conditions more thoroughly through test pit excavations or groundwater observation wells.**

10. **The length of core run is defined as the length of penetration of the core barrel. Core recovery is the length of core recovered divided by the core run. The RQD (Rock Quality Designation) is the total length of pieces of NX core exceeding 4 inches divided by the core run. The size core barrel used is also noted in the Method of Investigation at the bottom of the Subsurface Log.**

DATE STARTED ______ FINISHED ______ SHEET ____ OF ____	SJB SERVICES, INC. **SJB SERVICES, INC. SUBSURFACE LOG**	PROJ. No. ______ HOLE No. ______ SURF. ELEV. ______ G.W. DEPTH ______

PROJECT ____________ LOCATION ____________

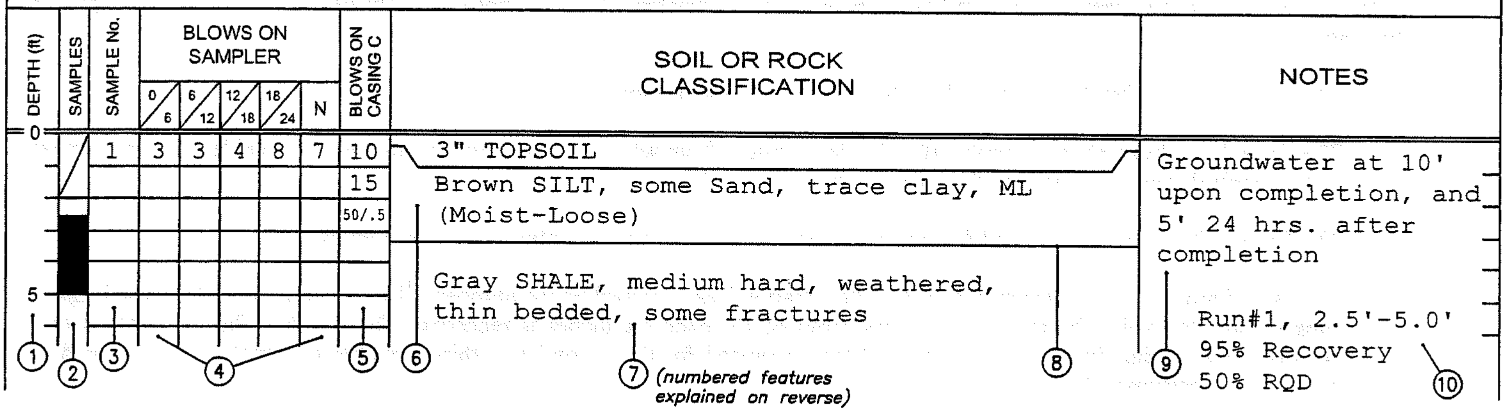


TABLE I

▯ (diagonal)	Split Spoon Sample
▮ (half filled)	Shelby Tube Sample
☒	Geoprobe Macro-Core
↕	Auger or Test Pit Sample
■	Rock Core

TABLE II

Identification of soil type is made on basis of an estimate of particle sizes, and in the case of fine grained soils also on basis of plasticity.

Soil Type	Soil Particle Size	
Boulder	>12"	Coarse Grained (Granular)
Cobble	3" - 12"	
Gravel - Coarse	3" - 3/4"	
- Fine	3/4" - #4	
Sand - Coarse	#4 - #10	
- Medium	#10 - #40	
- Fine	#40 - #200	
Silt - Non Plastic (Granular) Clay - Plastic (Cohesive)	<#200	Fine Grained

TABLE III

The following terms are used in classifying soils consisting of mixtures of two or more soil types. The estimate is based on weight of total sample.

Term	Percent of Total Sample
"and"	35 - 50
"some"	20 - 35
"little"	10 - 20
"trace"	less than 10

(When sampling gravelly soils with a standard split spoon, the true percentage of gravel is often not recovered due to the relatively small sampler diameter.)

TABLE IV

The relative compactness or consistency is described in accordance with the following terms:

Granular Soils Term	Blows per Foot, N	Cohesive Soils Term	Blows per Foot, N
Loose	0 - 4	Very Soft	0 - 2
Loose	4 - 10	Soft	2 - 4
Firm	10 - 30	Medium	4 - 8
Compact	30 - 50	Stiff	8 - 15
Very Compact	>50	Very Stiff	15 - 30
		Hard	>30

(Large particles in the soils will often significantly influence the blows per foot recorded during the penetration test)

TABLE V

Varved	Horizontal uniform layers or seams of soil(s).
Layer	Soil deposit more than 6" thick.
Seam	Soil deposit less than 6" thick.
Parting	Soil deposit less than 1/8" thick.
Laminated	Irregular, horizontal and angled seams and partings of soil(s).

TABLE VI

Rock Classification Term		Meaning
Hardness	- Soft	Scratched by fingernail
	- Medium Hard	Scratched easily by penknife
	- Hard	Scratched with difficulty by penknife
	- Very Hard	Cannot be scratched by penknife
Weathering	- Very Weathered	Judged from the relative amounts of disintegration, iron staining, core recovery, clay seams, etc.
	- Weathered	
	- Sound	

Rock Classification Term		Meaning	
Bedding	- Laminated	(<1")	Natural breaks in Rock Layers
	- Thin Bedded	(1" - 4")	
	- Bedded	(4" - 12")	
	- Thick Bedded	(12" - 36")	
	- Massive	(>36")	

(Fracturing refers to natural breaks in the rock oriented at some angle to the rock layers)

DATE:
START: 12/19/2017
FINISH: 1/16/2018
SHEET 1 OF 2

SJB SERVICES, INC.
SUBSURFACE LOG

HOLE NO. B-1
SURF. ELEV 496.5'
G.W. DEPTH See Notes

PROJECT: PROPOSED GROCERY STORE
LOCATION: FORMER WCHOB
PROJ. NO.: BE-17-249-B
188-204 WEST UTICA ST - BUFFALO, NY

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	–	7			ASPHALT	Driller noted Asphalt at
		9	7		16	Brown f-c SAND, little Clayey Silt, little fine Gravel,	the ground surface
	2	8	7			tr.organics (moist, FILL)	
		5	5		12	Brown f-c SAND, some Clayey Silt	
5	3	8	10			(moist, firm, SM-SC)	
		11	15		21		
	4	18	14			Brown Clayey SILT, some f-c Sand (moist, firm, ML)	
		10	20		24		
	5	8	12				
10		14	13		26		
	6	12	15			Becomes Gray-Brown	
		14	17		29		
15							
	7	18	24			Contains "and" f-c Sand (moist, v.compact)	
		27	39		51		
20							
	8	14	23			Gray f-m SAND, little Clayey Silt	
		27	30		50	(wet, v.compact, SM-SC)	
25							
	9	5	5			(firm)	
		5	8		10		
							Boring initially terminated
30							at 30' on 12/19/17 due
	10	4	7				to running sands.
		7	8		14		
							Test boring completed
							from 30' to 47' on 1/16/18.
35							Driller augered to 30 feet
	11	4	12				and continued sampling.
		14	28		26		
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW

CLASSIFIED BY: Geologist

DRILLER: K. FULLER / R. STEINER

DRILL RIG TYPE : CME-550X

METHOD OF INVESTIGATION: ASTM D-1586 USING HOLLOW STEM AUGERS

DATE:			
START	12/19/2017	**SJB SERVICES, INC.**	HOLE NO. B-1
FINISH	1/16/2018	**SUBSURFACE LOG**	SURF. ELEV 496.5'
SHEET	2 OF 2		G.W. DEPTH See Notes

PROJECT: PROPOSED GROCERY STORE — LOCATION: FORMER WCHOB, 188-204 WEST UTICA ST - BUFFALO, NY

PROJ. NO.: BE-17-249-B

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	12	8	9				
		9	14		18		
45							
	13	7	10			Contains tr.gravel	
		15	25		25		
						Boring Terminated at 47.0' due to running sands	Free Standing Water recorded at 10.4' after removing augers.
50							
55							
60							
65							
70							
75							
80							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW — CLASSIFIED BY: Geologist

DRILLER: K. FULLER / R. STEINER — DRILL RIG TYPE : CME-550X

METHOD OF INVESTIGATION: ASTM D-1586 USING HOLLOW STEM AUGERS

DATE:

START 12/14/2017

FINISH 12/14/2017

SHEET 1 OF 1

SJB SERVICES, INC.
SUBSURFACE LOG

HOLE NO. B-2

SURF. ELEV 497.4'

G.W. DEPTH See Notes

PROJECT: PROPOSED PARKING RAMP ADDITION

LOCATION: FORMER WCHOB, 188-204 WEST UTICA ST - BUFFALO, NY

PROJ. NO.: BE-17-249-B

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	38	10			ASPHALT	Driller noted Asphalt at
		3	3		13	Brown f-c GRAVEL, some Clayey Silt, little f-c Sand	the ground surface
	2	2	2			(moist-wet, FILL)	
		1	1		3	Brown f-c SAND, some Silty Clay, little fine Gravel	
5	3	1	3			(moist-wet, v.loose, SC-SM)	
		5	8		8	(loose)	
	4	10	15			Brown f-c SAND, little Clayey Silt	
		18	14		33	(moist, compact, SM-SC)	
	5	3	14			Contains little fine Gravel	
10		21	26		35		
	6	7	19			Brown fine SAND, some Clayey Silt	
		21	25		40	(moist, compact, SM-SC)	
15							
	7	10	14			Gray f-c SAND, some fine Gravel, little Clayey Silt	
		18	21		32	(moist-wet, compact, SM-SC)	
20							
	8	4	7			Brown Silty CLAY, little fine Sand (moist, v.stiff, CL)	
		11	12		18		
25							
	9	3	4			Gray f-m SAND, little Clayey Silt	
		6	6		10	(moist-wet, firm, SM-SC)	
						Boring Complete at 27.0'	Free Standing Water recorded at 17' at Boring Completion
30							
35							
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW

CLASSIFIED BY: Geologist

DRILLER: M. WARNER

DRILL RIG TYPE : CME-75

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE:
START 12/14/2017
FINISH 12/14/2017
SHEET 1 OF 1

SJB SERVICES, INC.
SUBSURFACE LOG

HOLE NO. B-3
SURF. ELEV 498.4'
G.W. DEPTH See Notes

PROJECT: PROPOSED PARKING RAMP ADDITION
LOCATION: FORMER WCHOB
188-204 WEST UTICA ST - BUFFALO, NY
PROJ. NO.: BE-17-249-B

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	5	7			ASPHALT	Driller noted Asphalt at the ground surface
		7	8		14	Gray-Brown f-c GRAVEL, some f-c Sand, little Clayey Silt (moist, FILL)	
	2	10	7				
		7	6		14	Gray f-c GRAVEL, some f-c Sand, tr.clayey Silt (moist, firm, GM-GC)	
5	3	2	3				
		3	4		6	Brown Clayey SILT, little f-c Sand (moist, loose, ML)	
	4	6	5			Brown f-c SAND, some f-c Gravel, little Clayey Silt (moist, firm, SM-SC)	
		8	10		13		
	5	10	14			Contains some Clayey Silt (compact)	Petroleum odor noted in Samples #5 & #6
10		18	20		32		
	6	8	8			Brown Silty CLAY, little f-c Sand, little fine Gravel (moist, firm, CL-ML)	
		12	17		20		
15							
	7	10	18			(compact)	
		17	21		35		
20							
	8	4	14			Gray f-m SAND, tr.clayey silt (moist-wet, compact, SP)	
		24	30		38		
25						Boring Terminated at 22.0' due to running sand	Free Standing Water recorded at 15' at Boring Completion
30							
35							
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW

CLASSIFIED BY: Geologist

DRILLER: M. WARNER

DRILL RIG TYPE : CME-75

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE:
START 12/13/2017
FINISH 12/13/2017
SHEET 1 OF 1

SJB SERVICES, INC.
SUBSURFACE LOG

HOLE NO. B-4
SURF. ELEV 496.9'
G.W. DEPTH See Notes

PROJECT: PROPOSED GROCERY STORE
PROJ. NO.: BE-17-249-B
LOCATION: FORMER WCHOB
188-204 WEST UTICA ST - BUFFALO, NY

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	5	4			ASPHALT	Driller noted Asphalt at the ground surface
		3	3		7	Brown f-c GRAVEL, some f-c Sand, little Clayey Silt, tr.organics (moist, FILL)	
	2	2	1				
		2	2		3		
5	3	1	2			Brown fine GRAVEL, some f-c Sand, little Clayey Silt (moist, loose, GM-GC)	
		5	8		7		
	4	18	24				
		30	36		54		
	5	15	44			Contains tr.clayey silt (v.compact, GP)	
10		41			85		
	6	7	35				
		41			76		
15							
	7	6	23			Brown f-c SAND, little Clayey Silt (moist, v.compact, SM-SC)	
		29	24		52		
20							
	8	WOH	6			Brown-Black f-c SAND, some fine Gravel, little Clayey Silt (moist-wet, firm, SM-SC)	WOH = Weight of Hammer and Rods
		17	23		23		
	9	9	37				
25						Boring Terminated at 24.0' due to running sand	Free Standing Water recorded at 16' at Boring Completion
30							
35							
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW

CLASSIFIED BY: Geologist

DRILLER: M. WARNER

DRILL RIG TYPE : CME-75

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

SJB SERVICES, INC.
SUBSURFACE LOG

DATE:
START 12/13/2017
FINISH 12/14/2017
SHEET 1 OF 1

HOLE NO. B-5
SURF. ELEV 499.5'
G.W. DEPTH See Notes

PROJECT: PROPOSED GROCERY STORE
PROJ. NO.: BE-17-249-B
LOCATION: FORMER WCHOB
188-204 WEST UTICA ST - BUFFALO, NY

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	5	21			ASPHALT	Driller noted Asphalt at
		10	8		31	Light-Dark Brown f-c GRAVEL, some f-c Sand,	the ground surface
	2	1	6			little Clayey Silt (moist, FILL)	
		4	9		10	Contains tr.organics	
5	3	9	23			Brown f-c SAND, some fine Gravel, little Clayey Silt	
		29	30		52	(moist, v.compact, SM-SC)	
	4	35	30				
		35	29		65		
	5	20	50			Light Brown f-c GRAVEL, some f-c Sand, little Clayey	
10		50/0.3			REF	Silt (moist, v.compact, GM-GC)	REF = Sample Spoon
	6	19	40			Light Brown f-c SAND, some f-c Gravel, little Clayey	Refusal
		51			91	Silt (moist, v.compact, SM-SC)	
15							
	7	8	13			Contains little Silty Clay (moist-wet, compact, SC-SM)	
		26	52		39		
20							
	8	3	8			Brown Silty CLAY, some f-c Sand (moist, v.stiff, CL)	
		16	18		24		
	9	3	7			Gray f-c SAND, some fine Gravel, tr.clayey silt	
25		16	16		23	(moist-wet, firm, SP)	
						Boring Complete at 25.0'	Free Standing Water recorded at 19' at Boring Completion
30							Free Standing Water recorded at 16' on 12/14/17 at 0800, with augers at 23'
35							
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW

CLASSIFIED BY: Geologist

DRILLER: M. WARNER

DRILL RIG TYPE : CME-75

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE:
START 12/15/2017
FINISH 12/18/2017
SHEET 1 OF 1

SJB SERVICES, INC.
SUBSURFACE LOG

HOLE NO. B-6
SURF. ELEV 500.9'
G.W. DEPTH See Notes

PROJECT: PROPOSED TOWN HOUSES
LOCATION: FORMER WCHOB
PROJ. NO.: BE-17-249-B
188-204 WEST UTICA ST - BUFFALO, NY

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	–	11			ASPHALT	Driller noted Asphalt at
		12	9		21	Brown-Gray f-c GRAVEL, some f-c Sand, little	the ground surface
	2	13	15			Clayey Silt, tr.slag (moist, FILL)	
		10	11		25		
5	3	5	7			Contains little Slag	
		12	19		19		
	4	19	18			Brown f-c SAND, some fine Gravel, little Clayey Silt	
		17	16		35	(moist-wet, compact, SM-SC)	
	5	12	13			(firm)	
10		13	22		26		No Free Standing Water
	6	10	14			Brown f-c GRAVEL, some f-c Sand, little Clayey	observed on 12/18/17 at
		15	17		29	Silt (moist, firm, GM-GC)	0800, with augers at 10'
15							
	7	26	42			Brown f-c SAND, some f-c Gravel, little Clayey Silt	
		45	50/0.3		87	(moist-wet, v.compact, SM-SC)	
20							
	8	10	19			Gray-Brown f-c GRAVEL, some f-c Sand, tr.clayey	
		22	20		41	silt (wet, compact, GP)	
	9	15	20				
25		21	28		41		
						Boring Complete at 25.0'	Free Standing Water recorded at 9' at Boring Completion
30							
35							
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW
CLASSIFIED BY: Geologist
DRILLER: K. FULLER
DRILL RIG TYPE : CME-550X
METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE:
START 12/15/2017
FINISH 12/15/2017
SHEET 1 OF 1

SJB SERVICES, INC.
SUBSURFACE LOG

HOLE NO. B-7
SURF. ELEV 502.7'
G.W. DEPTH See Notes

PROJECT: PROPOSED TOWN HOUSES
LOCATION: FORMER WCHOB
PROJ. NO.: BE-17-249-B
188-204 WEST UTICA ST - BUFFALO, NY

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	3	5			ASPHALT	Driller noted Asphalt at
		5	5		10	Brown-Gray f-c SAND, little fine Gravel, little Clayey	the ground surface
	2	4	5			Silt, tr.organics, tr.slag (moist, FILL)	
		6	6		11	Brown f-c SAND, some Clayey Silt	
5	3	3	2			(moist, firm, SM-SC)	
		2	2		4	Brown f-c SAND, some f-c Gravel, some Clayey	
	4	2	2			Silt (moist, loose, SM-SC)	
		3	6		5	Contains some fine Gravel, little Clayey Silt	
	5	4	10				
10		15	18		25	Becomes Gray-Brown (firm)	
	6	12	18			Gray-Brown f-c GRAVEL, some f-c Sand, little	
		30	30		48	Clayey Silt (moist, compact, GM-GC)	
15							
	7	15	27			(v.compact)	
		24	26		51		
20							
	8	6	13			Brown-Gray f-c GRAVEL, some f-c Sand, tr.clayey	
		17	17		30	silt (wet, firm, GP)	
	9	2	9				
25		11	12		20		
						Boring Complete at 25.0'	Free Standing Water recorded at 19' at Boring Completion
30							
35							
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW

CLASSIFIED BY: Geologist

DRILLER: M. WARNER

DRILL RIG TYPE : CME-75

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

SJB SERVICES, INC.
SUBSURFACE LOG

DATE:
START 12/18/2017
FINISH 12/18/2017
SHEET 1 OF 2

HOLE NO. B-8
SURF. ELEV 504.0'
G.W. DEPTH See Notes

PROJECT: PROPOSED TOWN HOUSES
PROJ. NO.: BE-17-249-B
LOCATION: FORMER WCHOB
188-204 WEST UTICA ST - BUFFALO, NY

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	1	–	6			ASPHALT	Driller noted Asphalt at
		12	20		18	Brown-Black f-c SAND, some f-c Gravel, little	the ground surface
	2	5	5			Clayey Silt (moist, FILL)	
		7	6		12	Brown f-c SAND, little Clayey Silt, tr.organics	
5	3	2	3			(moist, FILL)	
		2	2		5	Brown f-c SAND, tr.clayey silt (moist, loose, SP)	
	4	9	17			Brown f-c GRAVEL, some f-c Sand, tr.clayey silt	
		20	22		37	(moist, compact, GP)	
	5	40	15				
10		22	37		37		
	6	11	17				
		22	16		39		
15							
	7	12	18				
		23	17		41		
20							
	8	4	8			Brown f-c SAND, little fine Gravel, little Clayey Silt	
		11	7		19	(moist-wet, firm, SM-SC)	
25							
	9	14	19			Brown f-c GRAVEL, some f-c Sand, little Clayey	
		19	31		38	Silt (moist-wet, compact, GM-GC)	
30							
	10	17	24			(v.compact)	REF = Sample Spoon
		50/0.4			REF		Refusal
35							
	11	8	14			(wet, compact)	
		17	15		31		
40							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW

CLASSIFIED BY: Geologist

DRILLER: K. FULLER

DRILL RIG TYPE : CME-550X

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

DATE:
START 12/18/2017
FINISH 12/18/2017
SHEET 2 OF 2

SJB SERVICES, INC.
SUBSURFACE LOG

HOLE NO. B-8
SURF. ELEV 504.0'
G.W. DEPTH See Notes

PROJECT: PROPOSED TOWN HOUSES
LOCATION: FORMER WCHOB
188-204 WEST UTICA ST - BUFFALO, NY
PROJ. NO.: BE-17-249-B

DEPTH FT.	SMPL NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	SOIL OR ROCK CLASSIFICATION	NOTES
	12	18	32			(v.compact)	
		24	25		56		
45							
	13	15	18			(compact)	
		22	17		40		
	14	24	14				
50		17	18		31		
						Boring Complete at 50.0'	Free Standing Water recorded at 20' at Boring Completion
55							
60							
65							
70							
75							
80							

N = NO. BLOWS TO DRIVE 2-INCH SPOON 12-INCHES WITH A 140 LB. PIN WT. FALLING 30-INCHES PER BLOW

CLASSIFIED BY: Geologist

DRILLER: K. FULLER

DRILL RIG TYPE : CME-550X

METHOD OF INVESTIGATION ASTM D-1586 USING HOLLOW STEM AUGERS

APPENDIX B

FILL MATERIAL AND EARTHWORK RECOMMENDATIONS

APPENDIX B

FILL MATERIAL AND EARTHWORK RECOMMENDATIONS

I. Material Recommendations

A. Structural Fill

Structural Fill should consist of a crusher run quarried Limestone or Dolostone, free of clay, organics and friable or deleterious particles. As a minimum, the crusher stone should meet the requirements of New York State Department of Transportation, Standard Specifications, Item 304.12 – Type 2 Subbase, with the following gradation requirements.

Sieve Size Distribution	Percent Finer by Weight
2 inch	100
¼ inch	25-60
No. 40	5-40
No. 200	0-10

B. Subbase Stone

The subbase stone course placed as the aggregate course beneath slab-on-grade and pavement construction should conform to the same material requirements as Structural Fill, stated above.

C. Suitable Granular Fill

Suitable soil material, well graded from coarse to fine and classified as GW, GP, GM, SW, SP and SM soils using the Unified Soil Classification System (ASTM D-2487) and having no more than 85 percent by weight material passing the No. 4 sieve, no more than 20 percent by weight material passing the No. 200 sieve and which is generally free of particles greater than 6 inches, will be acceptable as Suitable Granular Fill. It should also be free of topsoil, asphalt, concrete rubble, wood, debris, clay and other deleterious materials. Suitable Granular Fill can be used as foundation backfill and as subgrade fill to raise site grades beneath slab-on-grade and pavement construction.

Material meeting the requirements of New York State Department of Transportation, Standard Specifications, Item 203.07 – Select Granular Fill or Item 203.20 Select Granular Subgrade is acceptable for use as Suitable Granular Fill.

II. Placement and Compaction Requirements

All controlled fill placed beneath foundations, slab-on-grade and pavement construction, and beneath utilities should be compacted to a minimum of 95 percent of the maximum dry density as measured by the modified Proctor test (ASTM D1557). Fill placed in non-loaded landscape areas can be compacted to a minimum of 90 percent of the maximum dry density (ASTM D1557).

Placement of fill should not exceed a maximum loose lift thickness of 6 to 9 inches with the exception of the Subbase Stone course directly beneath slab on grade and pavement construction, which can be placed in a single lift not exceeding 15 inches. In addition the first lift of Engineered Fill placed to backfill undercut excavations may also be placed in a single lift not exceeding 15 inches. All succeeding lifts, however, should not exceed a maximum loose lift thickness of 6 to 9 inches. The loose lift thicknesses recommended above should be reduced, as necessary, in conjunction with the type of compaction equipment used, so that the required density is attained.

Engineered fill should have a moisture content within two percent of the optimum moisture content at the time of its compaction and compaction testing. Subgrades should be properly drained and protected from moisture and frost. Placement of fill on frozen or snow covered subgrades is not acceptable. It is recommended that all fill placement and compaction be monitored and tested on a full time basis by a representative of Empire Geo-Services, Inc.

III. Quality Assurance Testing

The following minimum laboratory and field quality assurance testing frequencies are recommended to confirm fill material quality and post placement and compaction conditions. These minimum frequencies are based on generally uniform material properties and placement conditions. Should material properties vary or conditions at the time of placement vary (i.e. moisture content, placement and compaction, procedures or equipment, etc.) Then additional testing is recommended. Additional testing, which may be necessary, should be determined by qualified geotechnical personnel, based on evaluation of the actual fill material and construction conditions.

A. Laboratory Testing of Material Properties

- Moisture content (ASTM D-2216) - 1 test per 4,000 cubic yards or no less than 2 tests per each material type.
- Grain Size Analysis (ASTM D-422) - 1 test per 4,000 cubic yards or no less than 2 tests per each material type.
- Liquid and Plastic Limits (ASTM D-4318) 1 test per 4,000 cubic yards or no less than 2 tests per each material type. Liquid and Plastic Limit testing is necessary only if appropriate, based on material composition (i.e. clayey or silty soils).

- Modified Proctor Moisture Density Relationship (ASTM D-1557) 1 test per 4,000 cubic yards or no less than 1 test per each material type. A maximum/minimum density relationship (ASTM D-4253 and ASTM D-4254) may be an appropriate substitute for ASTM D-1557 depending on material gradation.

B. Field In-Place Moisture/Density Testing (ASTM D-3017 and ASTM D-2922)

- Backfilling along trenches and foundation walls - 1 test per 100 lineal feet per lift.
- Backfilling Isolated Excavations (i.e. column foundations, manholes, etc.) 1 test per lift.
- Filling in open areas for slab-on-grade and pavement construction - 1 test per 10,000 square feet per lift.

APPENDIX C

GEOTECHNICAL REPORT LIMITATIONS

GEOTECHNICAL REPORT LIMITATIONS

Empire Geo-Services, Inc. (Empire) has endeavored to meet the generally accepted standard of care for the services completed, and in doing so is obliged to advise the geotechnical report user of our report limitations. Empire believes that providing information about the report preparation and limitations is essential to help the user reduce geotechnical-related delays, cost over-runs, and other problems that can develop during the design and construction process. Empire would be pleased to answer any questions regarding the following limitations and use of our report to assist the user in assessing risks and planning for site development and construction.

PROJECT SPECIFIC FACTORS: The conclusions and recommendations provided in our geotechnical report were prepared based on project specific factors described in the report, such as size, loading, and intended use of structures; general configuration of structures, roadways, and parking lots; existing and proposed site grading; and any other pertinent project information. Changes to the project details may alter the factors considered in development of the report conclusions and recommendations. *Accordingly, Empire cannot accept responsibility for problems which may develop if we are not consulted regarding any changes to the project specific factors that were assumed during the report preparation.*

SUBSURFACE CONDITIONS: The site exploration investigated subsurface conditions only at discrete test locations. Empire has used judgement to infer subsurface conditions between the discrete test locations, and on this basis the conclusions and recommendations in our geotechnical report were developed. It should be understood that the overall subsurface conditions inferred by Empire may vary from those revealed during construction, and these variations may impact on the assumptions made in developing the report conclusions and recommendations. *For this reason, Empire should be retained during construction to confirm that conditions are as expected, and to refine our conclusions and recommendations in the event that conditions are encountered that were not disclosed during the site exploration program.*

USE OF GEOTECHNICAL REPORT: Unless indicated otherwise, our geotechnical report has been prepared for the use of our client for specific application to the site and project conditions described in the report. *Without consulting with Empire, our geotechnical report should not be applied by any party to other sites or for any uses other than those originally intended.*

CHANGES IN SITE CONDITIONS: Surface and subsurface conditions are subject to change at a project site subsequent to preparation of the geotechnical report. Changes may include, but are not limited to, floods, earthquakes, groundwater fluctuations, and construction activities at the site and/or adjoining properties. *Empire should be informed of any such changes to determine if additional investigative and/or evaluation work is warranted.*

MISINTERPRETATION OF REPORT: The conclusions and recommendations contained in our geotechnical report are subject to misinterpretation. *To limit this possibility, Empire should review project plans and specifications relative to geotechnical issues to confirm that the recommendations contained in our report have been properly interpreted and applied.*

Subsurface exploration logs and other report data are also subject to misinterpretation by others if they are separated from the geotechnical report. This often occurs when copies of logs are given to contractors during the bid preparation process. *To minimize the potential for misinterpretation, the subsurface logs should not be separated from our geotechnical report and the use of excerpted or incomplete portions of the report should be avoided.*

OTHER LIMITATIONS: Geotechnical engineering is less exact than other design disciplines, as it is based partly on judgement and opinion. For this reason, our geotechnical report may include clauses that identify the limits of Empire's responsibility, or that may describe other limitations specific to a project. These clauses are intended to help all parties recognize their responsibilities and to assist them in assessing risks and decision making. Empire would be pleased to discuss these clauses and to answer any questions that may arise.