GEODESIGN INCORPORATED

GEOTECHNICAL | CONSTRUCTION | ENVIRONMENTAL
ENGINEERS and SCIENTISTS

GEOTECHNICAL EVALUATION REPORT

PROPOSED 16 STORY BUILDING
2461 BROADWAY
MANHATTAN, NEW YORK

DEPT BLDGS Job No. 121275707
Scan Code ESHS9040465

Prepared for:
Adam America Real Estate
850 3rd Avenue
Suite 13D
New York, New York 10022

Prepared By:
Geo**Design**, Inc.
241 West 30th Street, 5th Floor
New York, NY 10001

Geo**Design** File No. 3816-003
August 2017

STATE OF NEW YORK
JONATHAN P CAMP
088192
LICENSED PROFESSIONAL ENGINEER

GEODESIGN
INCORPORATED

GEOTECHNICAL | CONSTRUCTION | ENVIRONMENTAL
ENGINEERS and SCIENTISTS

August 15, 2017
File No. 3816-003

Josh Zucker
Adam America Real Estate
850 3rd Avenue, Suite 13D
New York, NY 10022

Re: Geotechnical Evaluation Report
2461 Broadway, Manhattan, NY

Dear Mr. Zucker:

Geo**Design**, Inc. P.C. (GeoDesign) is pleased to submit this geotechnical evaluation report for the referenced project site.

We appreciate the opportunity to work with you. Please call if you have any questions.

Sincerely,

Geo**Design**, Inc. P.C.

Jonathan Ciampi, P.E.
Associate

Thomas G. Thomann, Ph.D., P.E.
Principal Engineer / Reviewer

TABLE OF CONTENTS

1.0 – INTRODUCTION AND OBJECTIVE 5
- 1.1 GENERAL 5
- 1.2 SITE CONDITIONS AND PROJECT UNDERSTANDING 5
- 1.3 OBJECTIVES AND SCOPE OF SERVICES 5
- 1.4 REPORT ORGANIZATION 6

2.0 – SUBSURFACE CONDITIONS 7
- 2.1 GENERAL 7
- 2.2 SUBSURFACE INVESTIGATION 7
  - 2.2.1 Test Boring Program 7
  - 2.2.2 Laboratory Testing 8
- 2.3 GENERALIZED SUBSURFACE CONDITIONS 8
- 2.4 GROUNDWATER LEVELS 8

3.0 – ANALYSES AND RECOMMENDATIONS 10
- 3.1 GENERAL 10
- 3.2 FOUNDATION DESIGN 10
  - 3.2.1 Seismic Recommendations 10
  - 3.2.2 Foundation Recommendations 10
    - 3.2.2.1 Columns and Walls 10
    - 3.2.2.2 Ground Floor Slab 11
  - 3.2.3 Lateral Earth Pressures 11
  - 3.2.4 Permanent Groundwater Control 11
- 3.3 CONSTRUCTION RECOMMENDATIONS 12
  - 3.3.1 Excavation Considerations 12
    - 3.3.1.1 Rock 12
    - 3.3.1.2 Soil 13
  - 3.3.2 Adjacent Building Support 13
  - 3.3.3 Temporary Groundwater Control 14
  - 3.3.4 Subgrade Preparation 14
  - 3.3.5 Backfill and Compaction Requirements 14

TABLE OF CONTENTS

3.3.6 Pre-Construction Condition Survey and Monitoring........................ 15
3.3.7 Construction Monitoring.. 15
4.0 – SUMMARY AND CONCLUSIONS 16
5.0 - LIMITATIONS 17

List of Figures

Figure 1 – Site Location Map
Figure 2 – As Drilled Boring Location Plan
Figure 3 – TA Structure Influence Line

List of Appendices

Appendix A –Test Boring Logs
Appendix B – Laboratory Test Results
Appendix C – Rock Core Photographs

1.0 INTRODUCTION AND OBJECTIVES

1.1 GENERAL

This report provides geotechnical recommendations for the design and construction of a proposed building at 2461 Broadway, Manhattan, New York (see Figure 1). Authorization to proceed was obtained in the form of an agreement between Adam America Real Estate and GeoDesign, dated June 12, 2017.

The geotechnical evaluations and recommendations presented herein are in general accordance with the 2014 NYC Building Code (Code).

1.2 SITE CONDITIONS AND PROJECT UNDERSTANDING

The project site is located at 2461 Broadway (Block 1239, Lots 10 and 110), in Manhattan, NY. The total lot area is approximately 5,370 sq. ft. Currently, lot 10 is occupied by a 5 to 6-story building and lot 110 is occupied by a 2 story building. The lots are bound by Broadway to the east, West 91st Street to the south, a 3-story building to the north, and 1 to 5-story buildings to the west. The adjacent buildings west of the site are in the Riverside-West End Historic District. The sidewalk varies from approximately el. +90 to +94 feet[1].

The New York City Transit Authority (TA) "1", "2", and "3" subways line are located below Broadway, just east of the site.

It is proposed to construct a new 16-story residential building with a cellar. The footprint for the proposed building is approximately 5,320 sq. ft.

1.3 OBJECTIVES AND SCOPE OF SERVICES

The objectives of this investigation were to evaluate the subsurface conditions at the site and provide geotechnical recommendations for the design and construction of the proposed building. The following scope of services was performed to achieve these objectives:

1. Retained a subcontractor to drill test borings;
2. Provided full-time special inspection of the test boring operations;
3. Performed engineering evaluations and prepared this report that includes the following:
    a. A description of the subsurface investigations performed for this project;
    b. A plan drawing showing the locations of the as-drilled test borings;
    c. An overview of general site and geologic conditions;
    d. The results of engineering evaluations and recommendations regarding the foundation design, including:
        - Foundation type, estimated capacity, bearing elevation, and settlement estimate;
        - Seismic site classification and liquefaction potential;

[1] All elevations in this report are referenced to NAVD 1988.

- Floor slab support;
- Permanent below grade wall lateral pressures;
- Permanent groundwater control measures, if necessary;

e. Recommendations regarding construction related issues, including:
   - Excavation and temporary support of excavation considerations;
   - Backfill and compaction requirements;
   - Pre-construction condition surveys;
   - Construction monitoring recommendations;

f. Appendices that include the test boring logs and laboratory testing results.

1.4 REPORT ORGANIZATION

This report is divided into five sections. Section 1 presents an introduction and the objectives of the study. Section 2 includes a description of the subsurface investigation methods and results. Section 3 provides engineering evaluation results and the foundation design and construction recommendations. A summary and conclusions are included in Section 4. Limitations of the subsurface explorations, analyses, and recommendations are included in Section 5. Tables and Figures are provided at the end of the text.

2.0 SUBSURFACE CONDITIONS

2.1 GENERAL

The subsurface investigation included a field investigation and laboratory testing. The field investigation included drilling test borings and installing a groundwater observation well. Laboratory testing included the performance of physical index tests to characterize samples obtained from the field investigation. Details of the subsurface investigation and conditions encountered are described in the following sections.

2.2 SUBSURFACE INVESTIGATION

2.2.1 Test Boring and Probe Program

Four test borings, designated B-1 through B-4, were drilled between July 26 and August 2, 2017. The locations of all explorations are shown in Figure 2. Special inspection of the test borings were performed on a continuous basis by a geotechnical engineer or geologist under the direction of Mr. Jonathan Ciampi, PE of GeoDesign.

The test borings were performed by Aquifer Drilling and Testing, Inc. of Mineola, New York using a hand-assembled Forida Explo 220 drilling rig and a track-mounted Acker RAD drilling rig. The boreholes were advanced using mud rotary drilling techniques with a 2-7/8 inch diameter tri-cone roller bit and a 3-inch diameter flush joint casing.

Soil samples were obtained using techniques and equipment in general accordance with the American Society for Testing and Materials (ASTM) Standard Specification D1586-Standard Penetration Test (SPT). The SPT consists of driving a 2 inch O.D. split spoon sampler for a distance of 24 inches, with repeated blows of a 140 lb. hammer free falling a distance of 30 inches. The standard penetration, or N-value, is determined as the number of blows required to advance the sampler 12 inches after the initial 6 inches of penetration. The recovered split-spoon samples were placed in jars, labeled with the project name and number, boring number, sample, depth, SPT blow counts and the amount of recovery.

Rock coring was performed using a five-foot long NX (2-1/8 in. O.D.) core barrel. The top of rock was estimated based on the drilling operations (e.g., excessive rig chatter, difficult penetration) and practical spoon refusal, as indicated by blow counts greater than 100 for a 6 inch interval. Rock coring was performed to verify the presence of rock (and discern bedrock from cobbles/boulders), and assess its relative quality, as indicated by Core Recovery[2] and the Rock Quality Designation (RQD)[3].

Upon completion of Boring B-4, a groundwater observation well was installed. The well was constructed of nominal 2-inch diameter Schedule 25 PVC pipe with a 15-foot screen between

[2] The Core Recovery is defined as the ratio (expressed as a percent) of the total length of recovered core to the length cored.

[3] The Rock Quality Designation (RQD) is defined as the ratio (expressed as a percentage) of the total length of recovered core samples having a length of at least twice the core diameter (e.g., about 4 in for NX-core) to the total length of core.

depths of approximately 10 and 25 feet, and 10 feet of riser pipe. The annulus between the pipe and the borehole wall was backfilled with filter sand to two feet above the top of the screen. The remainder of the annulus was backfilled with drill cuttings. A flush-mount cap was installed at the top of the completed borehole.

The test boring logs are included in Appendix A.

2.2.2 Laboratory Testing

Geotechnical laboratory testing was conducted on representative soil samples to verify the field classifications and assist in engineering evaluations. The laboratory test results, which include sieve analyses, are included in Appendix B.

2.3 GENERALIZED SUBSURFACE CONDITIONS

The following generalized strata descriptions are based on interpretations of the GeoDesign subsurface investigation results:

Stratum 1 – Uncontrolled Fill [7][4]: This stratum generally consisted of fill, which includes sand and gravel with varying amounts of debris including brick and asphalt fragments, concrete obstructions, cinder, and soft rock. N-values in this stratum varied from 3 to 29 blows per foot (bpf). The thickness of this stratum varied from approximately 2 to 7 feet.

Stratum 2 – Silt and Sand [5b/3b]: This stratum consisted of gray and brown stiff silt and medium to fine grained sand, with trace amounts of clay and soft rock. The N-values varied from 10 to 30 bpf. The thickness of this stratum varied from approximately 2 to 8 feet.

Stratum 3 – Soft rock [1d]: This stratum generally consisted of highly weathered soft rock. The N-values were typically split spoon refusal (i.e., more than 50 blows per 6 inches). The thickness of this stratum, where it was encountered, varied from approximately 2 to 5 feet.

Stratum 4 – Intermediate to Medium Rock [1c to 1b]: This stratum consisted of gray medium grained schist that was highly to slightly fractured with highly to slightly weathered joints. The Core Recovery ranged from 58% to 100% and the RQD ranged from 44% to 83%. The top of intermediate rock varied from approximately el. +74 to +71 feet. Photographs of the rock core are included in Appendix C.

2.4 GROUNDWATER LEVELS

A groundwater observation well was installed in boring B-4 on August 2. On August 10, 2017, groundwater was measured at a depth of approximately 17.5 feet, corresponding to about el. +73.5 feet. The measured groundwater is approximately at the same elevation as the top of the soft rock. Rock has a relatively low permeability, which reduces the flow of water through it, and results in

[4] Numbers in parentheses refer to the NYC Building Code material classification.

groundwater being "trapped" on top of it. Therefore, it is believed that the measured value represents a trapped groundwater condition.

Groundwater measurements were not taken over an extended period of time; therefore, the measurements do not adequately reflect seasonal or other time dependent variations that may occur. See limitations in Section 5.

3.0 – ANALYSES AND RECOMMENDATIONS

3.1 GENERAL

This section presents engineering analyses, evaluations, and recommendations related to the design and construction of the foundations and below grade structures. The evaluations and recommendations are based on the available subsurface information, our experience on other projects, and the design requirements provided herein for the proposed structure.

3.2 FOUNDATION DESIGN

3.2.1 Seismic Recommendations

Considering that the building will be supported on footings bearing on rock, as recommended in the next section, we recommend a seismic site classification of Site Class "B". In accordance with the Code, if the Risk Category is I&II, or III, the Seismic Design Category is "B". The appropriate Risk Category should be determined by the Architect or Structural Engineer.

Liquefaction is considered unlikely for this site.

3.2.2 Foundation Recommendations

3.2.2.1 Columns and Walls

Based on a top of cellar slab elevation of +78 feet and assuming a 4 foot thick slab and foundation, the bottom of the cellar level foundations will be at el. +74 feet. It is anticipated that soft rock (Class 1d) to intermediate rock (Class 1c) will be encountered at the foundation bearing level.

The thickness of the soft rock, at most locations, is estimated to range from 2 to 5 feet. The allowable bearing capacity of Class 1d and Class 1c rock is 8 and 20 tsf, respectively. A higher bearing capacity results in smaller foundations, which means less concrete; however, additional excavations are required to reach the better rock conditions. Considering that the Class 1d rock thickness is relatively thin and that bearing the foundations on Class 1c rock will likely be more cost effective, we recommend that the foundations be designed to bear on Class 1c rock having a maximum allowable bearing capacity of 20 tsf.

If Class 1c rock is not encountered at the foundation level, the unsuitable rock should be removed until Class 1c rock is encountered. It may be necessary to construct "piers to rock" at some locations where Class 1c rock is significantly below the proposed bearing elevation.

The TA will require that footings be located outside, or below, the subway influence zone. The influence zone is defined by an influence line, which varies based on the quality of the soil and rock and the groundwater level. Based on the site conditions and typical TA influence lines, it is estimated that the foundations will be outside the subway influence zone, as shown in Figure 3. The TA will review the proposed influence line, and will make the final determination based on the groundwater and soil conditions.

3.2.2.2 Ground Floor Slabs

The cellar slab will bear on either silt and sand (Stratum 2), or soft rock (Stratum 3) and can be designed as a slab-on-grade.

3.2.3 Lateral Earth Pressures

The design lateral pressures for permanent below grade walls consist of static and seismic pressures that are influenced by the thickness and type of overburden material, and wall bracing conditions. We recommend that the below grade walls above and below the design groundwater level be designed for a static equivalent hydrostatic lateral soil pressure of 45 pcf and 85 pcf, respectively (i.e., soil wall pressure is a triangular pressure).

In addition, a seismic lateral soil force of $6H^2$ (lb./ft. of wall), where H is the total vertical height of the wall, in feet, should be included. This force should be applied at a distance of H/3 from the top of the wall (i.e., seismic wall pressure is an inverted triangle).

The recommended lateral pressures do not include any surcharge loads adjacent to the walls or at the ground surface. We recommend that a uniform (i.e., rectangular) lateral pressure distribution of 0.40 times the design surcharge be added to the lateral soil pressure distribution. The structural engineer should determine the magnitude of the design surcharge loads (i.e., live loads).

3.2.4 Permanent Groundwater Control

The low permeability of rock results in a low groundwater seepage rate. This results in the water being "trapped" on top of the rock. This groundwater condition is typically less problematic during construction than other groundwater conditions; however, since it is a permanent condition, it should be considered in the permanent building design.

Considering that there was very little water on top of the rock, it is estimated that the amount of groundwater will be relatively small. Therefore, we recommend that the foundations around the cellar perimeter be continuous and poured directly on rock and that the foundation walls be waterproofed and poured directly against the rock and support of excavation system. This system will reduce the amount of water that might be present underneath the cellar slab. However, since some water might still be present, we recommend that an underslab drainage (i.e., underdrain) system also be installed.

The underdrain system should include crushed stone (minimum 12 inch thick) and a network of drainage pipes. The ¾" crushed stone should be placed over the entire cellar area. We recommend installing 6-in. diameter corrugated perforated plastic pipes (Advanced Drainage System N-12, or approved equal) under the slab on 30 foot maximum centers and along the base of the perimeter walls. The pipes should be encased with a minimum 6 inch thick envelope of 3/4 inch crushed stone. The pipes should be placed with a positive slope of about 1/32 to 1/16 inch per foot of pipe and connected to a sump pit.

It is estimated that the pumping rate will be less than 50 gpm. We recommend installing a duplex pump with an alarm and a backup generator.

At a minimum, dampproofing material (Grace Construction Products Florprufe, or approved equal) should be installed directly beneath the cellar floor slab. The surface of the crushed stone of the underdrain system should be prepared in accordance with the dampproofing manufacturers recommendations.

Waterproofing materials for the foundation walls should be installed on the outside of the perimeter walls and directly against the rock and SOE system (Grace Construction Products Preprufe 160R, or approved equivalent). The membrane should be properly protected against damage; however, the use of drainage board or any other drainage material should not be used. The waterproofing material should be installed to the ground surface.

Waterstops should be installed at applicable locations.

The installation of all waterproofing elements should be inspected on a full time basis to confirm that the waterproofing is being applied as per the manufacturer's specifications and details.

3.3 CONSTRUCTION

3.3.1 Excavation Considerations

It is anticipated that soil and rock excavations will be required at this site. The following sections provide recommendations for the excavation of soil and rock.

3.3.1.1 Rock

The effort required to excavate rock is dependent on many factors, including the extent of rock fracturing, the rock hardness and strength, and the abrasiveness of the rock. Blasting is not likely to be cost effective because of the relatively small amount of rock to be removed. The contractor may use a ho-ram mounted on an excavator and other conventional methods to excavate rock.

The measured rock core recoveries and RQD values are indicative of rock that is typically moderately fractured and weathered. For these conditions, the use of a ho-ram may be applicable for the majority of the rock. At locations where the rock fracturing is limited, expansive chemicals or hydraulic fracturing tools may be needed to assist in fracturing the rock and making conventional rock excavation equipment more practical.

Special attention should be given to the excavation of rock along the limits of the excavation. It is recommended that line drilling be performed to reduce the amount of overbreak and to reduce vibrations. The line drilling should be performed so that it creates a minimum of 50% rock removal (e.g., drill 3 inch diameter holes at 6 inch spacing). Proper line drilling will also assist in limiting the extent of the rock support that will be needed. At locations close to any adjacent buildings, the use of mechanical or hydraulic splitters or chemicals may be required to reduce the amount of rock overbreak and to limit the vibrations.

Excavated rock faces should be inspected by the geotechnical engineer to determine if rock stabilization measures are required. The need for rock stabilization will depend on the nature, location, extent, and orientation of discontinuities such as joints, shears, and foliation surfaces. These discontinuities, together with the orientation of the excavation face, could form unstable rock wedges and slabs on the rock walls. The use of rock bolts, prestressed rock anchors, concrete buttresses, and/or shotcrete may be required to stabilize potentially unstable rock blocks. The type, number, and location of rock stabilization are determined in the field after the rock face is exposed. The location and installation of the rock stabilization measures should be approved and inspected by the geotechnical engineer.

3.3.1.2 Soil

Local temporary soil excavations above the natural groundwater level can have cut slopes as steep as 1H:1V (horizontal to vertical). Temporary soil excavations below the natural groundwater level should be no steeper than 2H:1V. The slopes of any excavations adjacent to the existing structures should be no steeper than 2H:1V, unless approved by the SOE engineer.

All vertical soil faces will require temporary support until the new cellar walls and foundations are constructed and the area is properly backfilled. Considering the subsurface conditions and the proposed excavation depths, a feasible support system could consist of soldier piles and timber lagging with sufficient lateral restraint (e.g., anchors, rakers, bracing, etc.), as required. Design of the lateral bracing must also consider the protection of surrounding subsurface utilities and other adjacent infrastructure.

Vibration measurements should be made at selected adjacent structures (preferably on the ground surface next to the building) during installation of the support system and during excavation activities. The maximum allowable vibration levels should be established as part of the pre-construction condition survey of the adjacent structures. It is likely that the TA will require that vibration measurements be performed inside the subway tunnel.

The design and construction of any slopes and/or temporary excavation support systems should be the responsibility of a licensed New York Professional Engineer. All excavations and temporary support systems should conform to pertinent OSHA and local safety regulations.

3.3.2 Adjacent Building Support

Adjacent building support (e.g., underpinning or secant pile walls), will be required at locations where the new foundations will be placed within the influence zone of the adjacent building foundations.

We recommend that the drawings for the adjacent buildings be obtained and/or the adjacent structures be visited for the purpose of determining the cellar extents and depths and any other features (e.g., elevator pits, ejector pits, etc.) that may affect the design and construction of the proposed building. Test pits should be performed to document the size, depth, and type of adjacent building foundations, and below-grade encroachments that may be present. This information should then be used to develop final design methods and procedures for performing construction close to the adjacent buildings.

The analysis and design of any adjacent building support systems should be performed by a licensed New York Professional Engineer. Underpinning operations should be inspected full time during construction by a qualified engineer.

3.3.3 Temporary Groundwater Control

The groundwater level should be maintained at least 2 feet below the bottom of the excavation. The extent of the dewatering system will depend on the groundwater level at the time of construction, the lowest excavation depth, and the bedrock conditions.

It should be anticipated that trapped groundwater, rain water, and surface runoff will be encountered during excavation operations. As such, the contractor should be prepared to collect and discharge this water so that the subgrade can be properly prepared and concrete for the foundations can be poured. At a minimum, sump pits and pumps will be needed for dewatering.

3.3.4 Subgrade Preparation

Special inspection of all building foundation subgrades should be performed.

Subgrade surfaces for the foundations and slabs should be level and cleaned of loose soil, mud, and other material (such as concrete, brick, wood, debris, etc.) that can have a negative impact on the performance of the foundation or slab. Excavations to reach final soil subgrades should use a smooth edged bucket and/or hand tools.

If directed by the Special Inspector, the soil subgrade should be proof-rolled with a minimum of 6 passes of a smooth drum roller with a minimum 1,500 lb. static weight and minimum centrifugal force of 4,000 lbs., or similar approved equipment. Any unstable areas which cannot be stabilized by additional compaction should be excavated to competent material and the area backfilled with compacted structural fill or ¾" stone. The proof-rolling should not be performed when the subgrade is wet, muddy, or frozen.

If the foundation is constructed in the winter, the soil subgrade should be protected from frost to limit possible subgrade deterioration resulting from freezing and thawing cycles. Concrete should not be poured if the subgrade is wet, muddy, or frozen.

A 6-inch thick layer of compacted coarse aggregate, commonly known as ¾" gravel or crushed stone, or a "mud-slab" (i.e., 2 inches of lean concrete), should be placed on the approved soil subgrade to protect the subgrade from disturbance. A level working surface on the rock subgrade can be constructed by limited rock removal with a ho-ram (or similar equipment), or by placing a mud slab over the approved rock subgrade.

3.3.5 Backfill and Compaction Requirements

Select backfill or structural backfill should consist of granular soils free of cinder, brick, asphalt, ash, and other unsuitable materials. Such material should not contain any boulders or cobbles larger than about 4 inches across, and should have a fines content (material passing the No. 200 sieve) of less than 15 percent. The subgrade underneath the backfill shall be satisfactorily proof rolled prior to the placement of backfill.

All backfill should be placed in lifts not exceeding 8-in. in loose thickness. Backfill placed beneath slabs-on-grade, behind below-grade walls, and underneath sidewalks should be compacted to a minimum of 90% of the maximum dry density.

3.3.6 Pre-construction Condition Survey and Monitoring

A pre-construction condition survey of the adjacent structures should be performed for the protection of the new building owner in the event of a future damage claim and is required by the NYC Building Department. The report should include detailed documentation and photographs of the existing condition of the structures.

Based on the survey results, a monitoring program should be developed for the purpose of checking the performance of the adjacent structures and for monitoring construction procedures. The monitoring program should include, at a minimum, recommendations for the location of survey points to monitor vertical and horizontal movements, locations for crack gauges, and locations for monitoring vibrations during key construction activities. The monitoring program should also include threshold levels for allowable movements and vibrations, and the procedures to be implemented if the threshold levels are exceeded during construction.

3.3.7 Construction Monitoring

We recommend that a geotechnical engineer familiar with the subsurface conditions and foundation design criteria, review and approve the foundation contractors procedures and provide inspection services during excavation and foundation construction. Geotechnical related inspection services must include:

- Review and approval of contractor submittals related to foundation construction;
- Observation and documentation of all phases of excavation and foundation construction.
- Special inspection of the foundation subgrade.
- Special inspection of the support of excavation.
- Special inspection of underpinning, if required.
- Monitoring of adjacent buildings and interpretation of monitoring data.

4.0 – SUMMARY AND CONCLUSIONS

This report provides geotechnical recommendations for the design and construction of a 16 story building at 2461 Broadway, Manhattan, New York. The building will have a cellar level with the top of the cellar slab at el. +78 feet.

Based on the performance of four test borings, the subsurface conditions generally consisted of 2 to 7 feet of uncontrolled fill (Stratum 1), 2 to 8 feet of silt and sand (Stratum 2), 2 to 5 feet of soft rock (Stratum 3), and intermediate to medium hard schist rock (Stratum 4). Groundwater was measured at the same elevation as the top of the soft rock; therefore, it is believed that the measured value represents a trapped water condition.

The recommended seismic site classification is Site Class "B". If the proposed building is in Risk Category I&II or III, the Seismic Design Category (SDC) is "B". Liquefaction is considered unlikely for this site.

Based on an assumed bottom of foundation elevation of +74 feet, it is anticipated that soft (Class 1d) and intermediate (Class 1c) rock will be encountered at the foundation bearing level. We recommend that the foundations be designed as spread footings bearing on Class 1c rock having a maximum allowable bearing capacity of 20 tsf. It may be necessary to remove the soft rock at various locations to achieve the required intermediate rock. It may also be necessary to construct "piers to rock" at some locations where Class 1c rock is significantly below the proposed bearing elevation.

Soil and rock excavations may be required at this site. The measured rock core recoveries and RQD values are indicative of rock that is typically moderately fractured and weathered. For these conditions, the use of a ho-ram may be applicable for the majority of the rock. At locations where the rock fracturing is limited, expansive chemicals or hydraulic fracturing tools may be needed to assist in fracturing the rock and making conventional rock excavation equipment more practical.

Considering that there was very little water on top of the rock, it is estimated that the amount of groundwater will be relatively small. Therefore, we recommend that the foundations around the cellar perimeter be continuous and poured directly on rock and that the foundation walls be waterproofed and poured directly against the rock and support of excavation system. We also recommend that an underdrain system also be installed.

The report includes additional information regarding the subsurface conditions and foundation design recommendations and additional recommendations regarding excavation considerations, underpinning, subgrade preparation, temporary groundwater control, backfill and compaction requirements, pre-construction condition surveys and monitoring, and construction inspection and monitoring.

5.0 – LIMITATIONS

Explorations

1. The analysis and recommendations submitted in this report are based in part upon the data obtained from widely spaced subsurface explorations. The nature and extent of variations between these explorations may not become evident until construction. If variations then appear evident, it will be necessary to reevaluate the recommendations of this report.
2. The generalized soil profile described in the text is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretations of widely spaced explorations and samples; actual soil transitions are probably more erratic. For specific information, refer to the boring logs.
3. Water level readings have been made in the drill holes at times and under conditions stated on the logs. These data have been reviewed and interpretations made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature and other factors occurring since the time measurements were made.

Review

4. In the event that any changes in the nature, design or location of the proposed structures are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing by GeoDesign, Inc. It is recommended that this firm be provided the opportunity for a general review of final design and specifications in order that earthwork and foundation recommendations may be properly interpreted and implemented in the design and specifications.

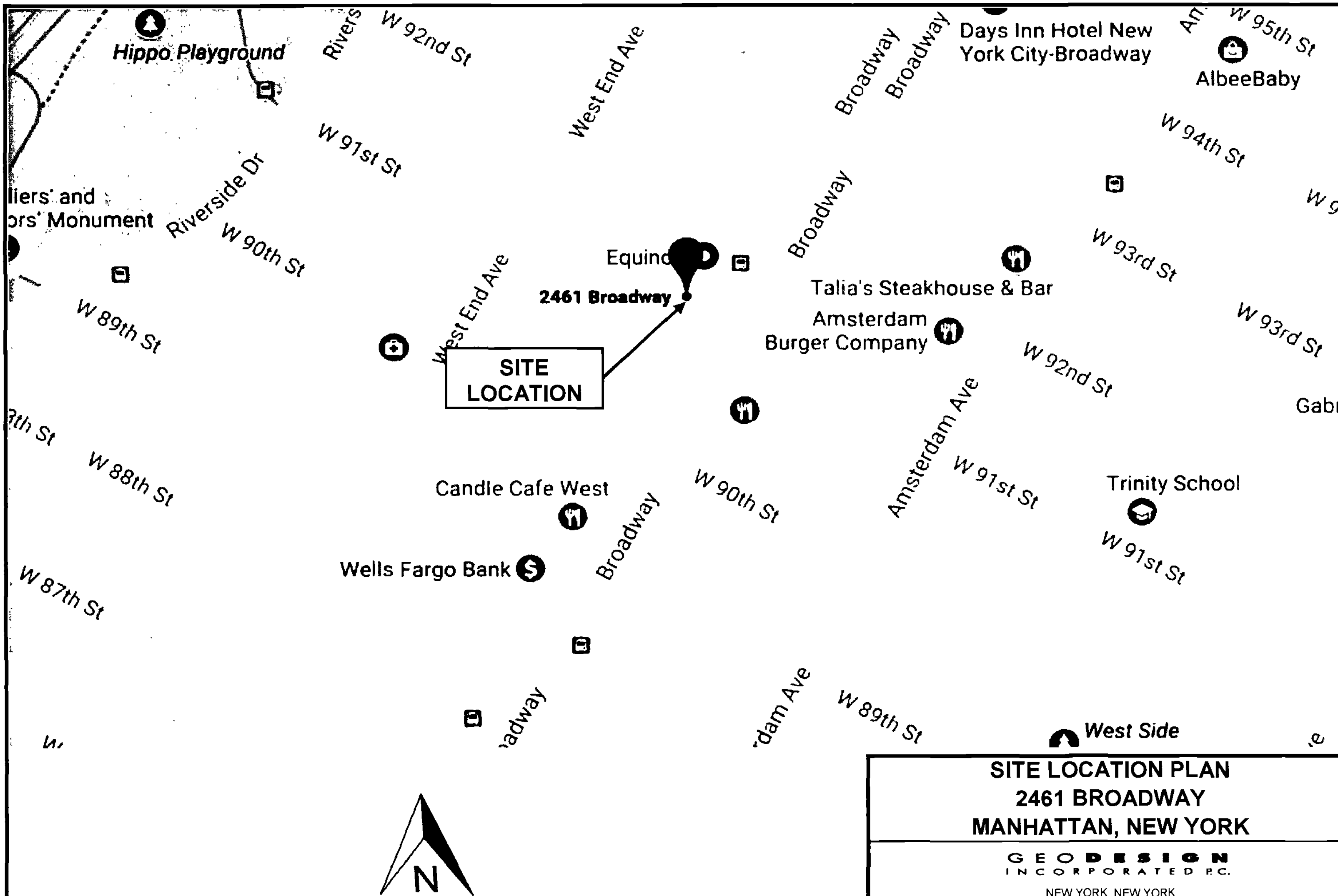
Construction

5. It is recommended that this firm be retained to provide soil engineering services during construction of the excavation and foundation phases of the work. This is to observe compliance with the design concepts, specifications, and recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to start of construction.

Uses of Report

6. This report has been prepared for the exclusive use of Adam America Real Estate for specific application to the proposed structures at 2461 Broadway, New York, NY in accordance with generally accepted soil and foundation engineering practices. No other warranty, express or implied, is made.

FIGURES



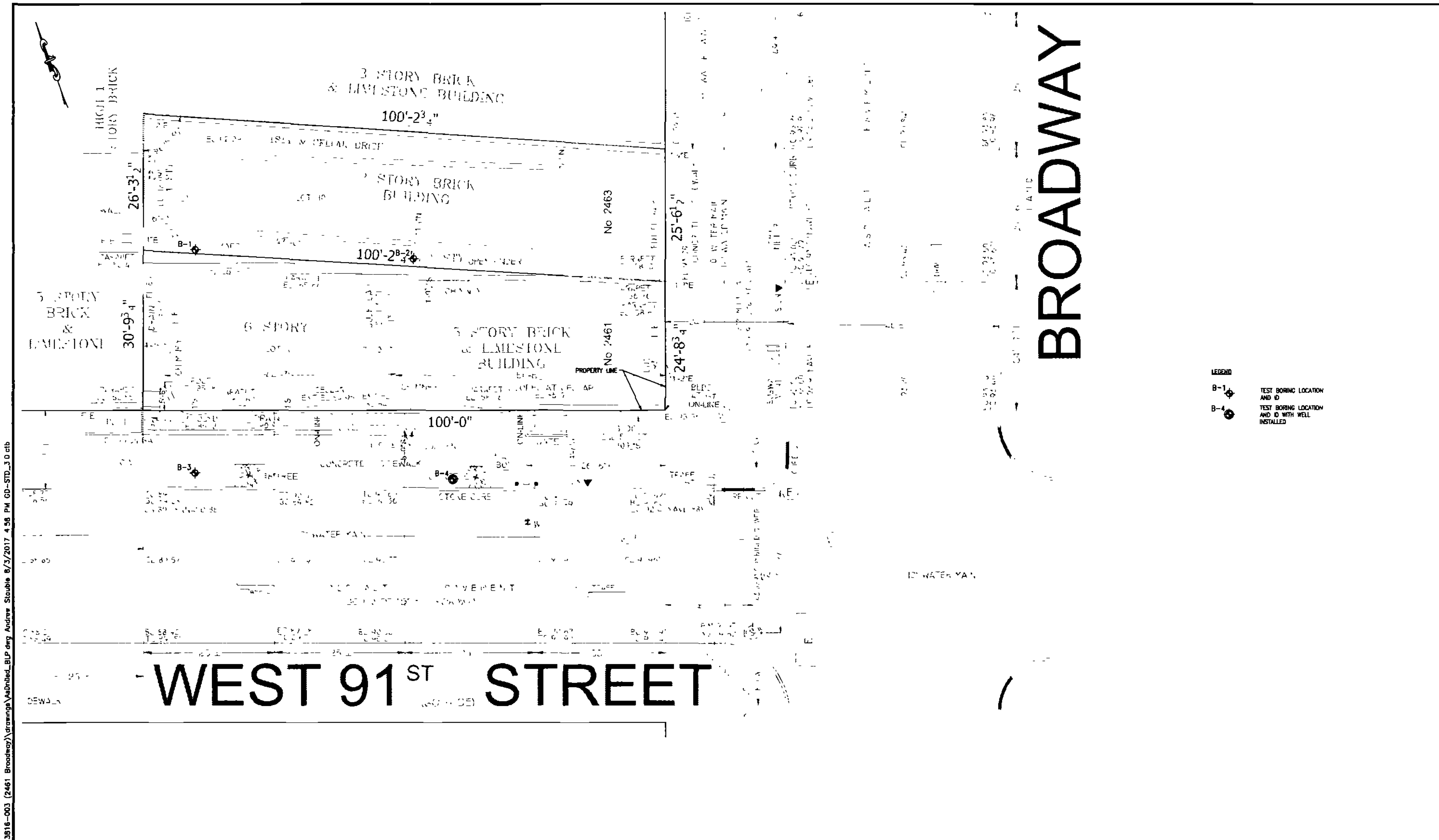
SOURCE: www.google.com/maps

SITE LOCATION PLAN
2461 BROADWAY
MANHATTAN, NEW YORK

GEODESIGN
INCORPORATED P.C.
NEW YORK, NEW YORK

DR. BY: AJS	SCALE: NTS	PROJ: 3816-003
	DATE: 08/03/2017	FIG NO 1

M:\CL\3816 Adam America\3816-003 (2461 Broadway)\Report\Figure_1



DESIGNED BY	JC
DRAWN BY	AJS
CHECKED BY	TGT
APPROVED BY	JC

NO	DATE	REVISIONS	DRWN	CHKD	APPVD

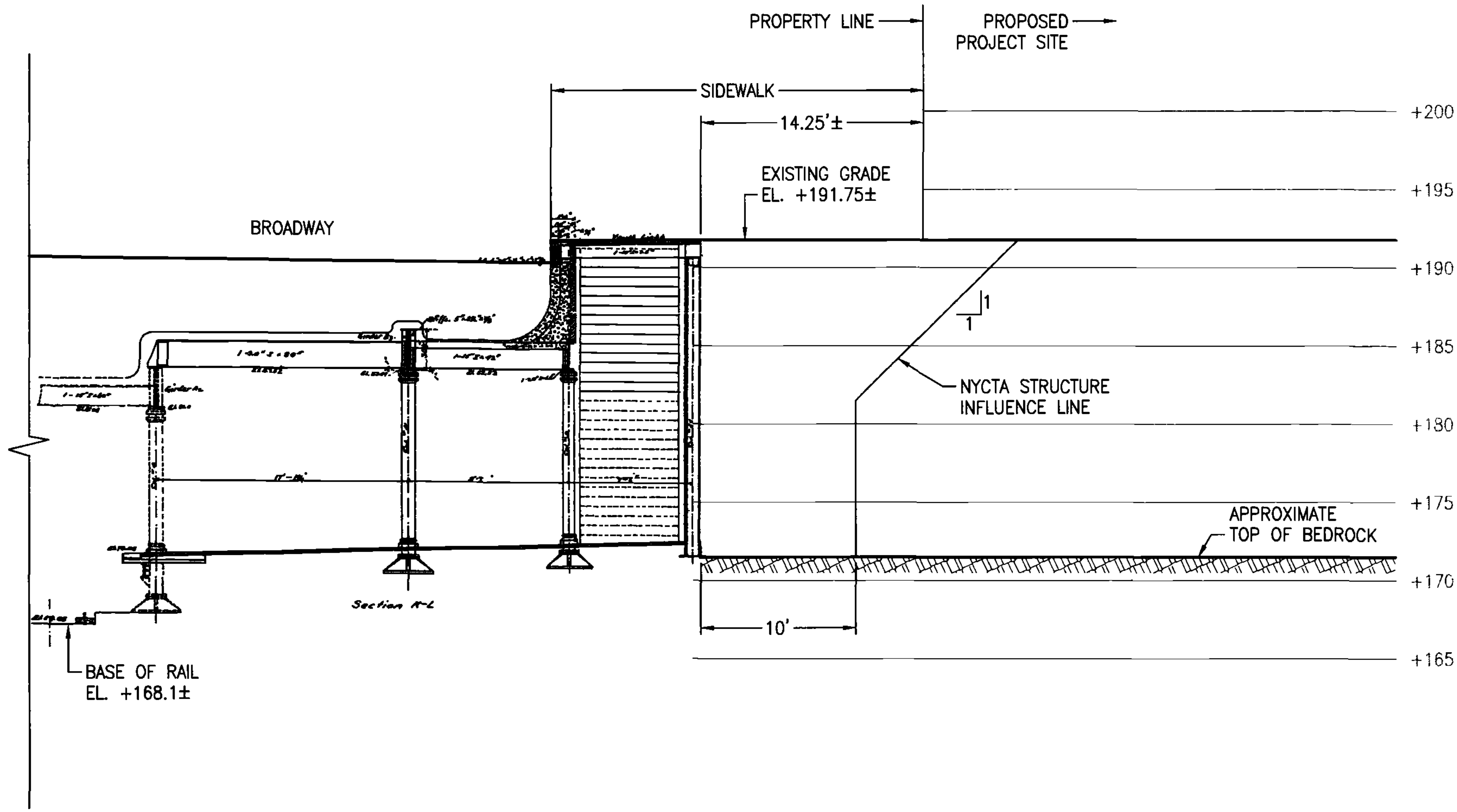
SCALE 1" = 8'
0 4 8 16

ADAM AMERICA REAL ESTATE
850 3RD AVENUE, SUITE 13D
NEW YORK, NY 10022

GEODESIGN INCORPORATED
Geotechnical | Construction | Environmental
Engineers and Scientists
60 PARK PLACE, SUITE 302 • NEWARK, NJ 07102
TELEPHONE 973 803 4515
www.geodesign.net

PROJECT	PROJECT NO
2461 BROADWAY NEW YORK, NY	3816-003
	SCALE: AS SHOWN; DATE: 08/03/2017
DWG TITLE: AS DRILLED BORING LOCATION PLAN	FIGURE NO: 2

M:\CL\3816 Adam America\3816-003 (2461 Broadway)\drawings\AsDrilled_BLP.dwg Andrew Staube 8/3/2017 4:58 PM GD-STD_3.0.ctb



NOTE:
ELEVATIONS SHOWN ON THIS FIGURE REFER TO THE BOARD OF TRANSPORTATION DATUM. ELEVATION 100 OF THE BOARD OF TRANSPORTATION DATUM IS 2.653 FEET ABOVE MEAN SEA LEVEL AT SANDY HOOK, NJ.

SCALE 1" = 10'
0 5 10 20

DRAWN BY: RH	REVIEWED BY: JC	GEODESIGN INCORPORATED Geotechnical | Construction | Environmental Engineers and Scientists 60 PARK PLACE, SUITE 302 • NEWARK, NJ 07102 TELEPHONE 973 803 4515 www.geodesign.net	PROJECT: 2461 BROADWAY NEW YORK, NY DWG. TITLE: TA STRUCTURE INFLUENCE LINE
PROJECT NO. 3816-003.00	DATE AUGUST 2017	DRAWING NO. FIGURE 3	

M:\CL\3816 Adam America\3816-003 (2461 Broadway)\drawings\TA Influence\TA-Influence.dwg Robert Hoffmann 8/11/2017 3:40 PM GD-STD_3.0.ctb

APPENDIX A
TEST BORING LOGS

GEODESIGN INCORPORATED
D/B/A GeoDesign, Inc P.C.
Geotechnical | Construction | Environmental
Engineers and Scientists
241 West 30th St., 5th Fl.
New York, NY 10001
Tel: 212.221.6651
Fax: 212.221.6799

BORING LOG

Project Name: 2461 Broadway, Manhattan, NY

Boring No.: B-1
Page No.: 1 of 1
File No.: 3816-003
Checked By:

Boring Company	Aquifer Drilling
Foreman	Matt G
GeoDesign Rep	Andrew Stauble
Date Started	July 27, 2017
Date Finished	July 27, 2017
N Coordinate	
E Coordinate	
Ground Surface Elevation (feet)	90.0
Station	
Offset	ft

	Casing	Sampler
Type	FJ	SS
I.D.	3.0 in	2.0 in
Hammer Wt	140 lbs	140 lbs
Hammer Fall	30 in	30 in
Rig Type	ExPlo	
Hammer Type	Donut - Cathead	

Groundwater Observations

Date	Depth (ft)	Elev (ft)	Notes

Depth (ft)	Casing Blows/ft	Number	Type	Penetration (inches)	Recovery (inches)	Depth (ft)	Blows / 6 inch Interval 0-6	6-12	12-18	18-24	Coring Time (min/ft)	Moisture Content (%)	Strata Description (Depth & Elevation (feet))	Sample Description (Classification System: Modified Burmister)
													Existing Partial Cellar Level	
5													5.0 Concrete 85.0	
													6.0 Fill 84.0	
		1	SS	24	10	6.0	3	6	5	7				[FILL] Brown and black c-f SAND and SILT, trace brick fragments. (7)
10													10.0 Silt 80.0	
		2	SS	24	15	10.0	6	8	12	15				[ML] Grayish-brown clayey SILT, two large pieces of soft rock. (5b)
													12.0 Boulder/Soft Rock 78.0	
		1	C	24	16	12.0	[REC= 67%; RQD= 0%]							[BOULDER/SOFT ROCK] Reddish-pink QUARTZITE, some highly weathered schist. (1d)
15														
													16.0 Medium Hard Rock 74.0	
		2	C	60	60	16.0	[REC= 100%; RQD= 83%]				7			[BEDROCK] Dark gray, moderately weathered/fractured, fairly hard SCHIST, some veins of quartz. (1b) [REC. = 100%, RQD = 83%]
											5			
											6			
20											7			
											5		21.0 Bottom of Exploration at 21.0 ft 69.0	
25														
30														

Remarks

1. Drilled 3" OD casing through 1' thick concrete slab.
2. High resistance drilling at 12' depth. Decided to take 1st core run. Water loss while coring C-1; apparent boulder or soft rock.
3. Soft rock noticed from ease of drilling of C-1 and cuttings.

Notes
1) Stratification lines represent approximate boundary between material types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made. AC = After coring, NR = Not Recorded.
3) Abbreviations: A = Auger, C = Core, MC=Macrocore, D = Driven, G = Grab, PS = Piston Sample, SS = Split Spoon, SSL = 3.5 Inch ID Split Spoon; ST = Shelby Tube, V = Vane, WOR/H = Weight of Rod/Hammer
4) Proportions Used: Trace = 1-10%, Little = 10-20%, Some = 20-35%, And = 35-50%

GEODESIGN INCORPORATED
D/B/A GeoDesign, Inc P C
Geotechnical | Construction | Environmental
Engineers and Scientists
241 West 30th St., 5th Fl.
New York, NY 10001
Tel: 212.221.6651
Fax: 212.221.6799

BORING LOG

Project Name: 2461 Broadway, Manhattan, NY

Boring No.: B-2
Page No.: 1 of 1
File No.: 3816-003
Checked By:

Boring Company	Aquifer Drilling
Foreman	Matt G
GeoDesign Rep	Andrew Stauble
Date Started	July 26, 2017
Date Finished	July 26, 2017
N Coordinate	
E Coordinate	
Ground Surface Elevation (feet)	90.0
Station	
Offset	ft

	Casing	Sampler
Type	FJ	SS
I D	3 0 in	2 0 in
Hammer Wt	140 lbs	140 lbs
Hammer Fall	30 in	30 in
Rig Type	ExPlo	
Hammer Type	Donut - Cathead	

Groundwater Observations

Date	Depth (ft)	Elev (ft)	Notes

Depth (ft)	Casing Blows/ft	Number	Type	Penetration (inches)	Recovery (inches)	Depth (ft)	Blows / 6 inch Interval 0 - 6	6 - 12	12 - 18	18 - 24	Coring Time (min/ft)	Moisture Content (%)	Strata Description (Depth & Elevation (feet))	Sample Description (Classification System Modified Burmister)
													Existing Partial Cellar Level	
5														
		1	SS	24	13	6.0	4	2	1	2			6.0 Concrete 84.0; Fill 83.8	[FILL] Black fine GRAVEL and brown SILT, trace brick fragments. (7)
		2	SS	24	14	8.0	4	4	6	6			8.0 Silt 82.0	[ML] Brown and reddish-brown SILT, trace gravel. (5b)
10														
		3	SS	24	14	11 0	9	9	11	26			12.0 Sand 78.0	1st 10": [ML] Gray and brown SILT, trace clay. (5b) Last 4": [SM] Reddish-brown fine SAND, some silt, little coarse gravel. (3a)
15														
		4	SS	15	10	16.0	54	51	50/3"	-			16.0 Soft Rock/Sand 74.0	[SOFT ROCK] Gray, highly weathered SCHIST, some brown fine sand. (1d/3a)
20		1	C	48	34	19.0	[REC= 71%, RQD= 48%]				8		19.0 Intermediate Rock 71.0	[BEDROCK] Gray and brown, moderately weathered/fractured, fairly hard SCHIST and GRANITE. (1c) [REC. = 71%, RQD = 48%]
											16			
											20			
											20		23.0	
													Bottom of Exploration at 23.0 ft 67.0	
25														
30														

Remarks
1. Drilled 3" OD casing through 2" thick concrete slab.
2. High resistance drilling at 19' depth; decided to take core run.
3. Core run stopped after 4' due to core barrel not advancing.

Notes
1) Stratification lines represent approximate boundary between material types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made AC = After coring, NR = Not Recorded.
3) Abbreviations A = Auger, C = Core, MC=Macrocore, D = Driven, G = Grab, PS = Piston Sample, SS = Split Spoon, SSL = 3 5 Inch ID Split Spoon, ST = Shelby Tube, V = Vane; WOR/H = Weight of Rod/Hammer
4) Proportions Used Trace = 1-10%, Little = 10-20%, Some = 20-35%, And = 35-50%

8 - NYC BORING LOG MC 3816-003 LOGS.GPJ GEODESIGN STANDARD GDT 8/11/17

GEODESIGN INCORPORATED
D/B/A GeoDesign, Inc P C
Geotechnical | Construction | Environmental
Engineers and Scientists

241 West 30th St., 5th Fl.
New York, NY 10001
Tel: 212.221 6651
Fax: 212.221.6799

BORING LOG

Project Name: 2461 Broadway, Manhattan, NY

Boring No: B-3
Page No.: 1 of 1
File No.: 3816-003
Checked By:

Boring Company	Aquifer Drilling
Foreman	Matt G
GeoDesign Rep	Andrew Stauble
Date Started	July 31, 2017
Date Finished	August 1, 2017
N Coordinate	
E Coordinate	
Ground Surface Elevation (feet)	90.0
Station	
Offset	ft

	Casing	Sampler
Type	FJ	SS
I D	3.0 in	2 0 in
Hammer Wt	140 lbs	140 lbs
Hammer Fall	30 in	30 in
Rig Type	Acker RAD	
Hammer Type	Donut - Cathead	

Groundwater Observations

Date	Depth (ft)	Elev (ft)	Notes

Depth (ft)	Casing Blows/ft	Number	Type	Penetration (inches)	Recovery (inches)	Depth (ft)	0 - 6	6 - 12	12 - 18	18 - 24	Coring Time (min/ft)	Moisture Content (%)	Strata Description (Depth & Elevation (feet))	Sample Description (Classification System Modified Burmister)
		1	SS	24	6	0 0	21	22	7	4			Sidewalk 89.7 / Fill	[FILL] Large pieces of CONCRETE FRAGMENTS. (7)
5		2	SS	24	7	5.0	6	5	3	2			5.0 Silt 85.0	[FILL] Brown/black SILT and CONCRETE FRAGMENTS. (7)
10		3	SS	24	12	10.0	25	20	100/5"	-			10.0 Soft Rock 80.0	[SOFT ROCK] Dark gray, highly weathered, soft SCHIST, some gray silt. (1d)
15		1	C	60	35	15 0	[REC= 58%; RQD= 44%]				0.5			[BEDROCK] Gray, some brown, moderately weathered/fractured, fairly hard SCHIST, little quartz. (1c)
											0.5			
											4		17.0 73.0 Intermediate Rock	
											2.5			
											5			
20		2	C	60	60	20.0	[REC= 100%, RQD= 76%]				3		20.0 70.0 Medium Hard Rock	[BEDROCK] Gray, some brown, moderately weathered/fractured, fairly hard SCHIST, little quartz. (1b)
											2.5			
											2 5			
											2.5			
											4			
25													25.0 65.0 Bottom of Exploration at 25.0 ft	
30														

Remarks
1. Sidewalk app. 4" thick.
2. First 2' of core run C-1 went very rapidly; possible soft rock (confirmed from core run).

Notes
1) Stratification lines represent approximate boundary between material types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made AC = After coring; NR = Not Recorded.
3) Abbreviations A = Auger; C = Core, MC=Macrocore; D = Driven, G = Grab, PS = Piston Sample, SS = Split Spoon, SSL = 3 5 Inch ID Split Spoon, ST = Shelby Tube, V = Vane, WOR/H = Weight of Rod/Hammer
4) Proportions Used Trace = 1-10%, Little = 10-20%, Some = 20-35%, And = 35-50%

Boring No.: B-3

GEODESIGN INCORPORATED
D/B/A GeoDesign, Inc P C
Geotechnical | Construction | Environmental
Engineers and Scientists

241 West 30th St., 5th Fl.
New York, NY 10001
Tel: 212.221.6651
Fax: 212.221.6799

BORING LOG

Project Name

2461 Broadway

Manhattan, NY

Boring No : B-4
Page No.: 1 of 1
File No : 3816-003
Checked By:

Boring Company	Aquifer Drilling
Foreman	Matt G
GeoDesign Rep	Andrew Stauble
Date Started	August 1, 2017
Date Finished	August 2, 2017
N Coordinate	
E Coordinate	
Ground Surface Elevation (feet)	91 0
Station	
Offset	ft

	Casing	Sampler
Type	FJ	SS
I D	3 0 in	2 0 in
Hammer Wt	140 lbs	140 lbs
Hammer Fall	30 in	30 in
Rig Type	Acker RAD	
Hammer Type	Donut - Cathead	

Groundwater Observations

	Date	Depth (ft)	Elev (ft)	Notes
▼	8/10/17	17 5	73.5	
▼				
▼				
▼				

Depth (ft)	Casing Blows/ft	Number	Type	Penetration (inches)	Recovery (inches)	Depth (ft)	Blows 0 - 6	Blows 6 - 12	Blows 12 - 18	Blows 18 - 24	Coring Time (min/ft)	Moisture Content (%)	Strata Description (Depth & Elevation (feet))	Sample Description (Classification System Modified Burmister)
													Sidewalk 90.7; Fill/Boulder	
		1	SS	24	0	2.0	100/1"	-	-	-				[FILL] Dark gray, highly weathered SCHIST, some concrete fragments (from cuttings, 0" recovery). (7)
5														
		1	C	24	24	5 0					3 5			[FILL] Dark gray, fairly hard SCHIST, some embedded concrete. (7)
											5			
													8.0 Void 83.0	
10														
													11.0 Silt/Sand 80.0	
		2	SS	24	24	11 0	10	10	11	13				1st 17": [ML] Brownish-gray, stiff SILT. (5b) Last 7": [SM] Dark gray m-f SAND, little soft rock fragments. (3b)
15														
		3	SS	24	17	15 0	7	10	20	33				[ML] Brownish-gray SILT, some fine sand, trace soft rock. (5a)
													18.0 ▼ Soft Rock 73.0	
20													20.0 Medium Hard Rock 71.0	
		2	C	60	60	20 0	[REC= 100%; RQD= 67%]				2			[BEDROCK] Gray, some brown, moderately weathered/fractured, fairly hard SCHIST. (1b)
											6			
											2			
											2			
25											2.5		25.0 Bottom 66.0 of Exploration at 25.0 ft	
30														

Well Log

Remarks

1. Sidewalk app. 4" thick. Hand auger used up to 2' to clear any possible utilities.
2. No recovery in S-1; assumed rock or boulder from cuttings.
3. Core run C-1 dropped rapidly after 2'; possible boulder then void due to loss of water return.
4. Spoon sample taken at 20' depth with no penetration/refusal; possible top of rock.
5. Groundwater well installed; 15' screen, 10' riser.

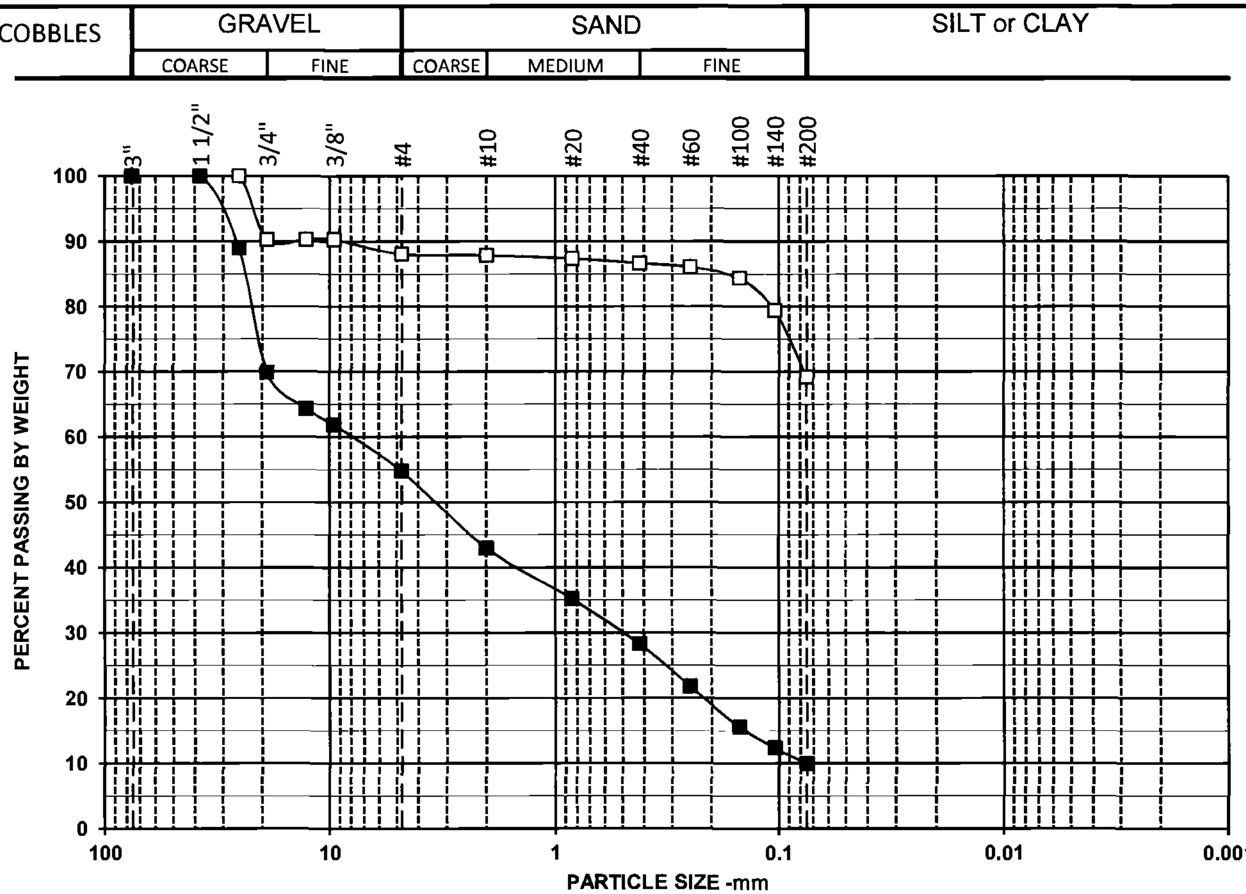
Notes
1) Stratification lines represent approximate boundary between material types, transitions may be gradual
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made AC = After coring, NR = Not Recorded
3) Abbreviations A = Auger, C = Core, MC=Macrocore, D = Driven, G = Grab, PS = Piston Sample, SS = Split Spoon, SSL = 3 5 Inch ID Split Spoon, ST = Shelby Tube, V = Vane, WOR/H = Weight of Rod/Hammer
4) Proportions Used Trace = 1-10%, Little = 10-20%, Some = 20-35%, And = 35-50%

Boring No.: B-4

GeoDesign Inc. #3816-003
2461 Broadway
LABORATORY TESTING DATA SUMMARY

BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS			REMARKS
			WATER CONTENT (%)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	
B-1	S-2	5-7	18.4	ML	69.2	
B-2	S-4	10-12	8.8	GP-GM	10.0	
B-3	S-3	10-12	14.0	SM	25.6	
B-4	S-2	11-13	20.7	ML	67.2	

Note: (1) USCS symbol based on visual observation and Sieve reported.



Symbol	□	■	○
Boring	B-1	B-2	
Sample	S-2	S-4	
Depth	5-7	10-12	
% +3"	0.0	0.0	
% Gravel	11.9	45.2	
% SAND	18.9	44.8	
%C SAND	0.2	11.8	
%M SAND	1.2	14.7	
%F SAND	17.5	18.3	
% FINES	69.2	10.0	
D_{100} (mm)	25.400	38.100	
D_{60} (mm)		7.907	
D_{30} (mm)		0.498	
D_{10} (mm)		0.075	
Cc		0.400	
Cu		105.4	

Sieve Size/ID #	Percent Finer Data		
6"	100.0	100.0	
4"	100.0	100.0	
3"	100.0	100.0	
1 1/2"	100.0	100.0	
1"	100.0	89.0	
3/4"	90.3	69.9	
1/2"	90.3	64.4	
3/8"	90.3	61.9	
#4	88.1	54.8	
#10	87.9	43.0	
#20	87.4	35.2	
#40	86.7	28.3	
#60	86.1	21.8	
#100	84.4	15.6	
#140	79.4	12.4	
#200	69.2	10.0	
5μ m			
2μ m			
1μ m			

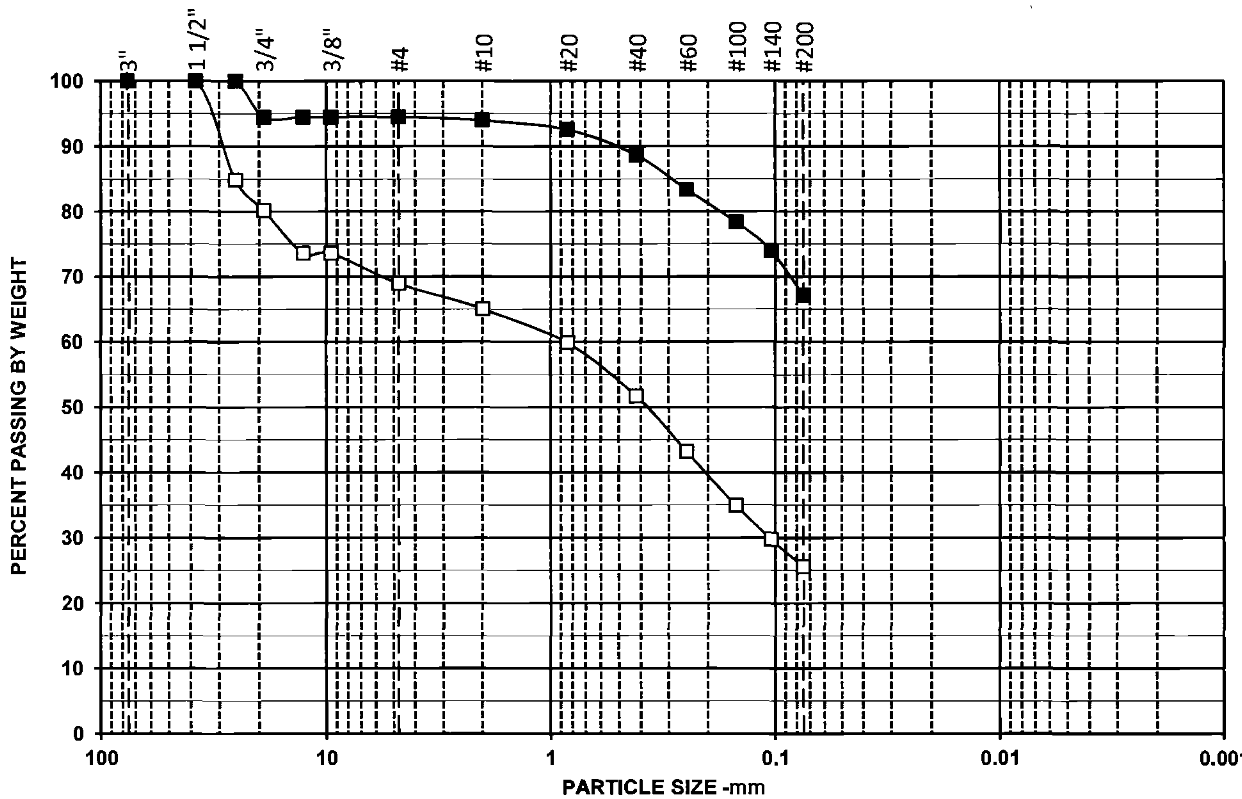
SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	18.4				ML		Brownish gray, Sandy silt	08/08/17
■	8.8				GP-GM		Brown, Poorly graded gravel with silt and sand	08/08/17
○								

GeoDesign Inc.	#3816-003	2461 Broadway	**PARTICLE SIZE DISTRIBUTION**
TerraSense, LLC	#8110-17008		

TerraSense Analysis File. GrainSizeV4R2f(6/17)

Siev1a.xlsx 8/11/2017

COBBLES	GRAVEL		SAND			SILT or CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



Symbol	□	■	○
Boring	B-3	B-4	
Sample	S-3	S-2	
Depth	10-12	11-13	
% +3"	0.0	0.0	
% Gravel	31.0	5.5	
% SAND	43.4	27.3	
%C SAND	3.9	0.5	
%M SAND	13.4	5.3	
%F SAND	26.1	21.5	
% FINES	25.6	67.2	
D_{100} (mm)	38.100	25.400	
D_{60} (mm)	0.855		
D_{30} (mm)	0.106		
D_{10} (mm)			
Cc			
Cu			

Sieve Size/ID #	Percent Finer Data		
6"	100.0	100.0	
4"	100.0	100.0	
3"	100.0	100.0	
1 1/2"	100.0	100.0	
1"	84.9	100.0	
3/4"	80.2	94.5	
1/2"	73.6	94.5	
3/8"	73.6	94.5	
#4	69.0	94.5	
#10	65.1	94.0	
#20	59.9	92.6	
#40	51.7	88.7	
#60	43.2	83.4	
#100	34.9	78.4	
#140	29.8	74.0	
#200	25.6	67.2	
5µ m			
2µ m			
1µ m			

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	14.0				SM		Brown, Silty sand with gravel	08/08/17
■	20.7				ML		Light brownish gray, Sandy silt	08/08/17
○								

GeoDesign Inc.	#3816-003	2461 Broadway	**PARTICLE SIZE DISTRIBUTION**
TerraSense, LLC	#8110-17008		

Project Name:	Site Location:	File No.
2461 Broadway	New York, NY	3816-003

Photo No.	Date:
1	8/2/2017

Description:

Rock core from borings B-1 through B-3.

From top to bottom.
B-2, C-1
B-1, C-2
B-3, C-1
B-3, C-2

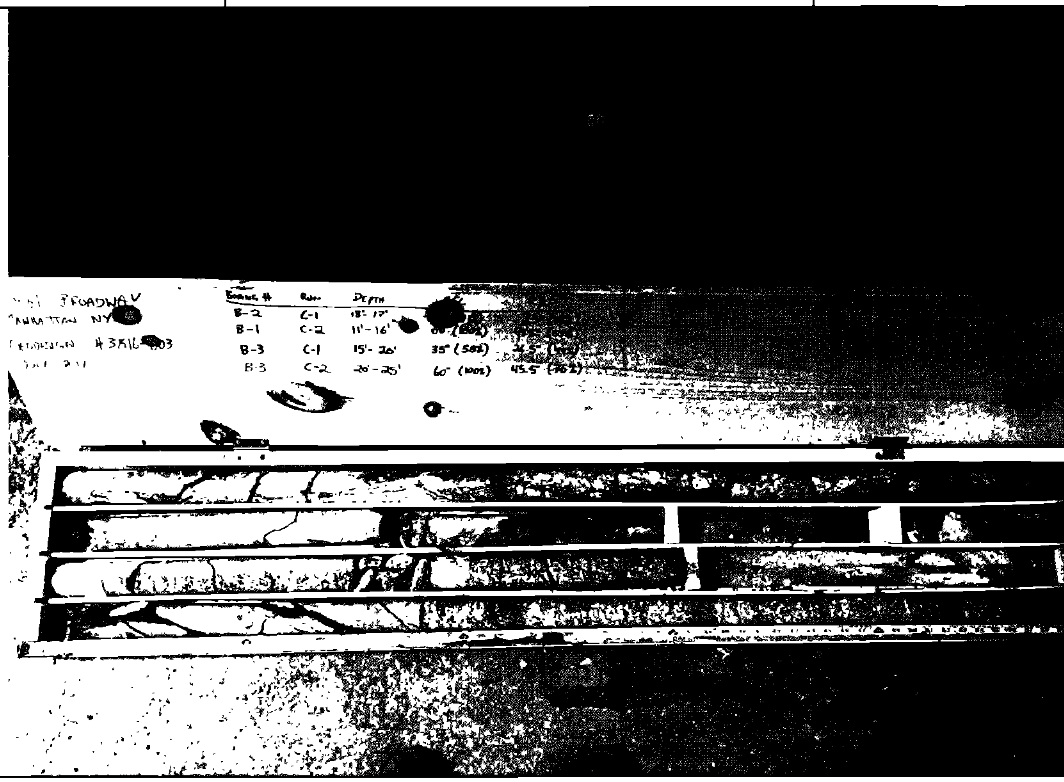


Photo No.	Date:
2	8/2/2017

Description:

Rock core from boring B-4