LANGAN

Memorandum

Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C.
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To: NYC Board of Standards & Appeals

From: Michael Burke, P.G., CHMM, LEED AP
Saul Shapiro, P.E.

Info: Alexandros Washburn – Red Hook JV, LLC

Date: November 17, 2020

Re: Environmental and Geotechnical Engineering Hardships
145-165 Wolcott Street Property ("Project")
Brooklyn, New York
Langan Project No.: 170562201

This memorandum was prepared for the New York City Board of Standards and Appeals (BSA) by Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C. (Langan) to provide a summary of environmental challenges to development of the property at 145-165 Wolcott Street in Brooklyn, which is under the ownership of Red Hook JV LLC. Our evaluation is based on review of available data in and around the site, which includes the analytical results of multiple environmental investigations and soil data generated during a preliminary geotechnical investigation. The site contains unique subsurface conditions arising from a history of oil resin, chemical, and boiler manufacturing; vehicle maintenance and repair; bulk petroleum storage; and solid waste storage and transfer services. The site is one of only three among 146 properties in the surrounding area with environmental cleanup obligations; among those three lots, the site by far bears the greatest contaminant burden with 87% of the footprint requiring remediation. Adding to the site uniqueness, the bulk of contamination arising from these historical uses is located in an area that is outboard of the original East River high water line and contains uncontrolled fill. These environmental conditions, compounded by the geotechnical challenges, present construction hardships that differentiate the site from comparable nearby properties and result in premium construction costs of $8.8 million.

SITE DESCRIPTION AND LOCATION

The site is identified as Block 574, Lots 1, 23, and 24 and occupies approximately 1.84 acres (80,150 square feet) in the Red Hook neighborhood of Brooklyn. Lot 1 occupies the majority of the site (67,500 square feet), and Lot 23 (2,000 square feet) and Lot 24 (10,500 square feet) occupy the southeastern corner of the site. The site is vacant and improved by an asphalt-paved parking lot, a one-story light industrial building, and two trailers formerly used as office space. Grades within the site generally vary from about el 9.7 ft at the northeast to el 13.7 ft NAVD88 in the south-central part of the site. Grades generally slope down to the north. Grades along

Wolcott Street and Dikeman Street generally slope down to the east and west, respectively, from a crown that occurs roughly mid-block.

The site is bound by Ferris Street and a commercial development site to the northwest; Wolcott Street and warehouse and bus parking facilities to the northeast; and Conover Street, South Brooklyn Community High School and residential buildings to the southeast. Several properties, including residential buildings and a commercial storage building, directly adjoin the site to the southwest along Conover and Dikeman Streets. Other properties southwest of the site across Dikeman Street include multi-family residential buildings, and commercial storage, warehouse, and light manufacturing buildings. A Site Location Map is provided as Figure 1.

FEMA FLOOD ZONE

The site is located within flood zones AE and X as determined by the Federal Emergency Management Agency (FEMA) Preliminary Flood Insurance Rate Map (Panel 3604970192G, dated 5 December 2013). The controlling base flood elevation for the site is el 12 ft NAVD88. We note that the boundary between flood zone AE and X roughly mimics the location of the original high water line in the area of the site.

SITE HISTORY

The site has a protracted history of industrial and commercial usage, including oil resin manufacturing (1886), engine manufacturing and boiler repair (1904), transformer use (1915), commercial vehicle repair and petroleum bulk storage (1938-2016), lumber storage (1950-1992), and commercial waste recycling (1993-2012). Historical records indicate that the site contained 14 historical petroleum aboveground and underground storage tanks (ASTs and USTs). The site was also used as a vehicle disassembly facility in the early 1940s, during which military vehicles were coated with the petroleum-based wax sealant cosmoline prior to overseas shipment. Residences were located on Lots 23 and 24 between 1886 and 1969. The site was most recently used for school bus parking and maintenance, which occurred between 2002 and 2016, and is currently used for Tesla vehicle storage and a seasonal open-air beer garden. A concrete-encased, 4,000-gallon diesel AST is still located on the northeastern part of the site.

Based on the findings of a 2015 Environmental Assessment indicating petroleum- and tar-related soil and groundwater contamination, the New York State Department of Environmental Conservation (NYSDEC) accepted the site into the Brownfield Cleanup Program (BCP) in 2018. Site development will proceed in accordance with a Brownfield Cleanup Agreement (BCA). Under the terms of the BCA, NYSDEC will require cleanup of contaminated soil and historic fill with concentrations above the site-specific soil cleanup objectives (SCOs), remediation of any identified contaminated groundwater, and construction of a soil vapor mitigation system during development. A Limited Subsurface Investigation (LSI) and Remedial Investigation (RI) were completed on behalf of the BCP Volunteer in August 2018 and November 2019, respectively. The findings of the investigations reveal several environmental areas of concern (AOCs) for which NYSDEC will require remediation. The AOCs impacting soil, groundwater, and soil vapor are shown on Figures 2, 3, and 4, respectively.

LOCAL GEOLOGY

The Red Hook area was originally comprised of several small low-lying islands separated by tidal estuaries and ponds. Red Hook was filled incrementally between the mid-to-late 19th century to raise surface grades and extend the shoreline outward to the south and west. The site is located on the northern margins of a former island and straddles the original high water line. While the exact position of the original high water line varies slightly on historic maps, the southwestern half to one-third of Lot 1 is generally depicted to lie upland of the high water line, Lot 23 is generally depicted to lie outboard of the high water line, and Lot 24 is generally depicted largely outboard of the high water line.

General subsurface conditions in Red Hook consist of miscellaneous urban fill underlain by a heterogeneous layer of glacial till, which is in turn underlain by dense silt and clay deposits atop granular soil; alluvial deposits are present sporadically in areas located outboard of the original high water line. Metamorphic bedrock of the Hartland Formation underlies the granular soil at depths greater than 100 feet. Figure 5 shows the location of the historical shoreline in relation to the current lot configuration.

SUBSURFACE CONDITIONS

A preliminary geotechnical engineering study was performed to evaluate the subsurface soil and groundwater conditions within the project site. The preliminary study included drilling six borings, varying from 62 to 102 feet below the existing ground surface (bgs) and installation of two groundwater monitoring wells. Four northern borings were performed in areas located outboard of the original high water line and two southern borings were performed upland of the original high water line.

The general stratigraphy consists of uncontrolled fill, typically underlain by a layer of silty sand with varying amounts of silt, clay and fine gravel; however, a layer of clay and/or silt was generally observed below the fill in areas outboard of the original high water line. Uncontrolled fill extends to depths varying between about 6 and 15 feet bgs, and groundwater in the area is generally present at depths of about 8 to 13 feet bgs.

The results of the preliminary geotechnical investigation suggest that there are distinct differences in subsurface conditions in areas outboard of the original high water line versus those observed in the historical upland area. These differences include the following observations in historically outboard areas: 1) increased thickness of fill soil; 2) fill soil that is generally less dense; and 3) the presence of a layer of fine grained soil (silt and clay) immediately below the fill layer. The approximate location of the high water line was established via historic mapping (refer to Atlas of the Borough of Brooklyn, Belcher Hyde, 1857). The area outboard of the high water line is estimated to be about 52,000 square feet (about 65% of the total site footprint).

Additional details pertaining to the preliminary investigation and subsurface conditions are included in the Preliminary Geotechnical Engineering Study report, dated 26 August 2020, which is included as Attachment A.

ENVIRONMENTAL HARDSHIP

The following environmental areas of concern constitute a unique hardship that will present financial, administrative, constructability, and scheduling encumbrances to future site development. There are feasible geotechnical and environmental solutions necessary to prepare the site for as-of-right development, which if considered separately, are not economically viable. An integrated geotechnical and environmental approach, however, presents the most cost-effective solution. This derives from the fact that the areas that require ground improvement (i.e., outboard of the historical high water line) generally coincide with those that are the most environmentally impacted. The following environmental conditions create this hardship:

Free-Phase Tar-Like Material

Field observations and laboratory analytical results from environmental investigations conducted between 2015 and 2019 identified free-phase tar-like material on the northwestern portion of the site, which corresponds with the location of the historical oil resin manufacturing facility. Tar-like material was initially observed seeping through the asphalt pavement. Subsequent soil borings revealed that the material, which consists of tar mixed with black sand, exhibits organic vapor readings up to 1,500 parts per million (ppm) and extends from ground surface below the asphalt cover to a depth of at least 8 feet below grade surface (bgs). Fingerprint analysis of the material in 2015 indicated an affinity with coal tar and No. 6 fuel oil. The area impacted by the contaminated material measures at least 90 feet by 60 feet (at least 5,400 square feet).

Soil exhibiting tar-related impacts (i.e., staining and odors) extends below the free-phase material to a minimum depth of 16 feet bgs. Concentrations of semi-volatile organic compounds (SVOC) in soil in contact with the tar-like material were up to 1,240 times greater than the Title 6 of the

New York State Codes, Rules and Regulations (NYCRR) Part 375 Commercial Use (CU) SCOs, which are the applicable NYSDEC soil standards for development under the current zoning.

Petroleum- and/or Tar-related Groundwater Contamination

Ten (10) of 15 shallow groundwater samples collected from the northern and eastern portions of the site during the RI contained petroleum- and/or tar-related volatile organic compounds (VOC) at concentrations above the NYSDEC Technical & Operational Guidance Series (TOGS) Ambient Water Quality Standards (AWQS) and Guidance Values (SGV). The highest VOC concentrations were detected in the southeastern part of the commercial building, which was previously used for vehicle maintenance. Deeper groundwater samples contained VOCs above the SGV at concentrations increasing with depth to at least 80 feet bgs, which indicates contamination from another source (i.e., tar-related dense non-aqueous phase liquid [DNAPL]). The vertical extent of the DNAPL was not identified. Sources of the contamination likely include documented tar impacts in soil and releases from historical oil resin manufacturing, vehicle repair and petroleum bulk storage, which included approximately 15 gasoline, fuel oil, diesel, and waste oil ASTs and USTs.

VOC-, SVOC-, and Metals-Contaminated Soil

Petroleum-related VOCs were identified in soil between 6 and 8 feet bgs on the northeastern portion of the site and below the southeastern portion of the commercial building, which was previously used for vehicle maintenance. Soil between 6 and 8 feet bgs contained SVOCs exceeding 500 milligrams per kilogram (mg/kg) on the northern, central, and eastern portions of the site, with individual SVOCs up to 8 times the CU SCOs, and arsenic, lead, mercury, and/or copper were detected at concentrations above the CU SCOs throughout the site at depths up to 6 feet bgs.

The petroleum impacts are likely associated with releases from historical petroleum bulk storage on the northeastern portion of the site and from historical vehicle repair operations inside the commercial building. The SVOCs may originate from historical tar or petroleum releases or historical backfilling with contaminated materials, as the highest concentrations are outboard of the former shoreline on the eastern portion of the site. The source of metal impacts within the upper 6 feet may be related to localized releases of waste oil or other hazardous materials during former manufacturing activities.

Tar-Related DNAPL

Discrete sampling at incremental depths revealed that groundwater between 60 and 80 feet bgs on the northern and central portions of the site is heavily contaminated with petroleum- and tar-related VOCs. The concentrations abruptly increase by an order of magnitude below 60 feet bgs, and the tar-related VOC naphthalene was detected at a maximum concentration of 5,000 micrograms per liter (µg/L) between 76 and 80 feet bgs; by comparison, the SGV for naphthalene is 10 µg/L. The vertical extent of the contamination was not identified. The abrupt increase in contaminant levels at depth and the magnitude of concentrations indicate that tar-related DNAPL below 60 feet bgs is another likely source of contamination. The source of the impacts may be releases associated with historical manufacturing and the tar hot spot in the northwestern portion of the site.

Chlorinated VOC-impacted Soil Vapor

The chlorinated compounds tetrachloroethene (PCE), trichloroethene (TCE), and vinyl chloride (VC) were detected in soil vapor below the commercial building at concentrations above those for which the New York State Department of Health (NYSDOH) recommends soil vapor mitigation. The TCE concentration (1,260 micrograms per cubic meter [$\mu g/m^3$]) was three orders of magnitude above the minimum threshold for which NYSDOH recommends mitigation. The source of the compounds may be releases of chlorinated solvents used during historical vehicle repair operations.

Estimated Remediation Cost

Contamination resulting from the site's history of manufacturing, vehicle repair, petroleum bulk storage, and waste transfer will warrant engineering and construction measures beyond those customarily employed during construction projects. The presence of hazardous substances in soil, groundwater, and soil vapor will require regulatory submittals and approvals and construction measures that would not be applicable to comparable properties in the vicinity of the site. While the scope of the remediation has not yet been approved by the NYSDEC, it is certain that the as-of-right development project will incur additional expenses. NYSDEC will require removal and/or in situ treatment of the contaminant source material, hazardous material, and soil containing SVOCs at concentrations above 500 mg/kg (i.e., a Track 4 remedy). A Track 4 approach would involve a combination of in situ treatment and excavation below the as-of-right development depth to remove the above materials and in situ treatment and/or containment to address contaminated groundwater and tar-related DNAPL (if required).

Site remediation, ground stabilization, and deep foundation alternatives necessary for the as-of-right development plan were evaluated. The findings of this evaluation suggest that the most economical solution incorporates both ground improvement and environmental remediation under an all-encompassing in-situ stabilization approach (ISS). Addressing the environmental and geotechnical issues in isolation (e.g., applying an in situ environmental remedy while also constructing deep foundations or ground improvement remedies at the same locations) will lead to redundancies and an overall more expensive approach. ISS will address soil and dissolved-phase groundwater contamination and provide the necessary ground improvements to construct a shallow foundation system in the area that was historically outboard of the mean high water line. The most cost-effective remedy includes the following measures:

- Environmental engineering design, regulatory coordination, documentation, and oversight;
- Construction equipment decontamination;
- Decommissioning and removal of suspected petroleum USTs;
- Removal of free-phase tar material to depths of at least 7 feet bgs from the northwestern portion of the site, including support-of-excavation measures;
- ISS of tar-impacted soil and groundwater in the northwestern portion of the site to depths of approximately 16 feet bgs;
- Excavation of petroleum-, SVOC-, and metals-contaminated soil to depths of at least 7 feet bgs, including support-of-excavation measures, in the northeastern, eastern and southeastern portions of the site;
- ISS of petroleum-contaminated soil and groundwater to depths of up to approximately 30 feet bgs in the northeastern, eastern and southeastern portions of the site. This approach will also provide the necessary ground improvements required for the as-of-right development;
- Backfilling of contaminant removal areas to construction grade;
- Treatment, removal, and/or containment of tar-contaminated DNAPL at depths below 60 feet bgs (if required);
- Installation of soil vapor mitigation systems within occupied structures; and
- Post-remedial monitoring of groundwater and engineering controls.

As presented in the attached Table 1, premium environmental remediation costs (i.e., hardship costs) associated with the implementation of Track 4 remediation under an as-of-right, slab-on-grade scenario, inclusive of hard and soft costs, will increase the project cost by approximately **$8.8M**[1].

HARDSHIP AND UNIQUENESS

The site's prolonged history of manufacturing, commercial and military vehicle maintenance, petroleum bulk storage, and commercial waste storage has contributed to a unique combination of environmental contaminants and an extent of contamination far beyond that of nearby former industrial sites. About 87% of the site footprint is impacted with a unique combination of soil and groundwater contaminants. Environmental conditions characterized by (1) documented free-phase tar-like material; (2) widespread soil, groundwater, and soil vapor petroleum contamination; (3) chlorinated solvent groundwater and soil vapor contamination; and (4) deep (i.e., greater than 80 feet bgs) apparent tar-related DNAPL present unique site conditions and associated hardships for development. The site also has soil vapor impacts requiring design and integration of soil vapor mitigation systems into the construction of new buildings.

The presence of hazardous substances will require regulatory submittals and approvals and construction measures beyond what would be applicable to comparable sites nearby. Source contaminant removal, treatment, and containment will require excavation to depths greater than necessary for foundation construction and encapsulation of contaminated areas by mixing cement with soil to depths of up to 30 feet bgs. Alternative remedies require construction of a groundwater cut-off structure between the site and adjoining properties and treatment of contaminated soil and groundwater. These remedies will also require support-of-excavation measures beyond those necessary for as-of-right site development. The unique combination of soil and groundwater contamination extending to various depths with the presence of uncontrolled fill and organic silts and clays outboard of the former shoreline warrants an integrated remedy that addresses both environmental and geotechnical challenges.

Although individual nearby properties may have a similar history of commercial activities, none have experienced the breadth of manufacturing, vehicle maintenance, and petroleum and hazardous substance storage occurring at the site since the late 1800s. The resulting extent and magnitude of contamination in environmental media at multiple depths, in combination with the geotechnical challenges, has not been documented on surrounding properties. Of the 145 properties within a 400-foot radius of the site, only 11 (about 8%) have petroleum spills that have been reported to the NYSDEC. Of those properties, only one contains a spill that has not been closed and only two are also enrolled in the BCP. The current and historical uses of surrounding properties are shown on Figure 6, and surrounding properties with documented historical spills are shown on Figure 7.

The only two surrounding properties that are enrolled in the BCP are located directly north and northwest of the site across Ferris Street (44-62 Ferris Street [RH4 site] and 68-100 Ferris Street [RH3 site], respectively). Although these properties also exhibit tar-related impacts, neither contains free-phase tar material in shallow soil or exhibits the widespread shallow groundwater contamination documented at 145-165 Wolcott Street. Groundwater and tar-related contamination at the RH3 site is primarily contained to the southern part of the property and does not extend below 25 feet bgs. Deep tar-related DNAPL was observed in the southern corner of the RH4 site; however, the maximum depth was 75 feet bgs (compared with DNAPL extending greater than 80 feet bgs at 145-165 Wolcott Street).

The RH3 and RH4 sites are also larger properties than 145-165 Wolcott Street, and therefore bear a proportionally smaller relative contaminant burden. For example, petroleum and tar-related groundwater contamination impacts an estimated 80% of the 145-165 Wolcott Street footprint, as compared to about 15% and 40% of the RH3 site and RH4 site footprints, respectively. Similarly, areas containing petroleum, tar-related, and/or metals-impacted soil constitute about 80% of the 145-165 Wolcott Street footprint, as compared to about 12% and 40% of the RH3 site and RH4 site footprints, respectively.

In summary, about 87% of the subject site requires remediation, an extraordinary ratio considering its large size compared to most of the surrounding properties and more than twice the area requiring remediation at the two comparably large properties adjoining the site to the north (RH3 and RH4). The site is one of only three among 146 properties in the surrounding area with environmental cleanup obligations. Furthermore, the site is bisected by the historical high water line, creating a nexus of structurally compromised soil with contamination. The most cost-effective solution will address the environmental and geotechnical encumbrances. The site therefore has a unique hardship that requires approximately $8.8M in additional costs for as-of-right site development.

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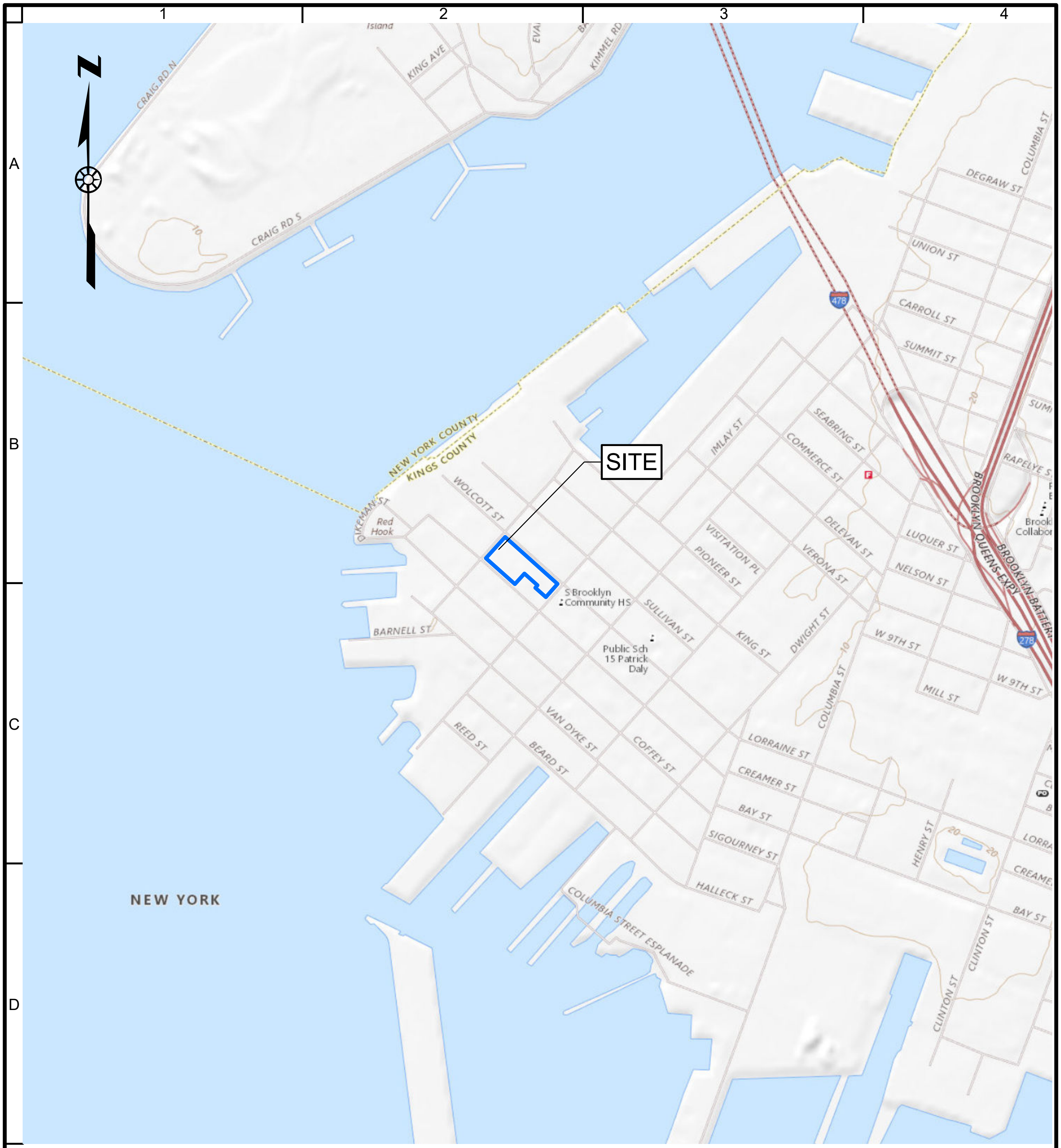
[1] In arriving at the minimum hardship cost, alternate approaches were evaluated. A containment and air sparge/soil vapor extraction (AS/SVE) approach with pile foundations was found to cost approximately $11.9 million dollars. A containment and AS/SVE approach with stone piers for ground improvement was found to cost approximately $9.7 million dollars.

FIGURES



▭ Approximate Site Boundary

1,000 0 1,000

SCALE IN FEET

NOTES:
1. BASEMAP ADAPTED FROM UNITED STATES GEOLOGICAL SURVEY (USGS) 7.5-MINUTE SERIES TOPOGRAPHICAL MAPS, JERSEY CITY, NEW JERSEY, QUADRANGLE, DATED 2016.

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Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C.
Langan International LLC

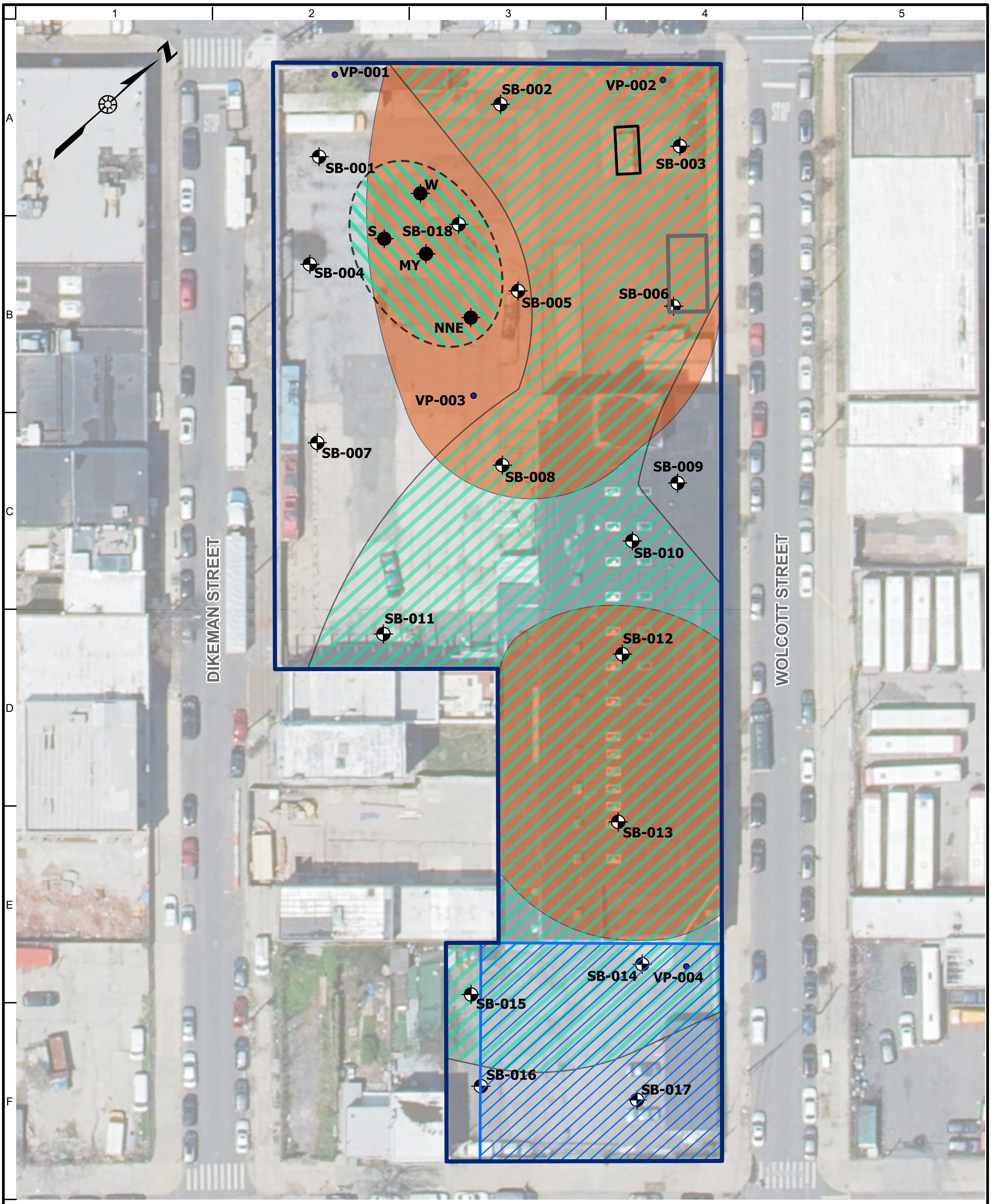
Collectively known as Langan

Project
145-165 WOLCOTT STREET
BLOCK No. 574, LOT No. 1, 23, & 24
BROOKLYN

KINGS NEW YORK

Figure Title
SITE LOCATION MAP

Project No. 170562201	Figure No. 1
Date 4/28/2020	
Scale 1"=1,000'	
Drawn By EMS	
Submission Date 4/28/2020	Sheet 1 of 6



LEGEND

▭	APPROXIMATE SITE BOUNDARY	▭	APPROXIMATE LOCATION OF 6,000 GAL DIESEL AST
●	HISTORIC SOIL BORING SAMPLE LOCATION	▭	APPROXIMATE FORMER UST AREA
⊕	SOIL BORING SAMPLE LOCATION	▨	FREE-PHASE TAR-LIKE MATERIAL
•	VERTICAL PROFILE WELL LOCATION	🟧	PETROLEUM-AND SVOC-CONTAMINATED SOIL
		▨	METAL CONTAMINATED HOTSPOTS

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NOTES:
1. WORLD AERIAL IMAGERY BASEMAP IS PROVIDED THROUGH LANGAN'S ESRI ARCGIS SOFTWARE LICENSING AND ARCGIS ONLINE.
2. SAMPLE LOCATIONS ARE APPROXIMATE AND WERE INTERPRETED FROM P.W. GROSSER REMEDIAL INVESTIGATION REPORT DATED NOVEMBER 2019
3. AOC = AREA OF CONCERN
4. AST = ABOVE GROUND STORAGE TANK
5. PAH = POLYCYCLIC AROMATIC HYDROCARBON
6. UST = UNDERGROUND STORAGE TANK
7. SVOC = SEMI-VOLATILE ORGANIC COMPOUND

WARNING: It is a violation of the NYS Education Law Article 145 for any person, unless he is acting under the direction of a licensed professional engineer, to alter this item in any way.

45 0 45

SCALE IN FEET

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Project

145-165 WOLCOTT STREET

BLOCK No. 574, LOT No. 1, 23, & 24
BROOKLYN

KINGS NEW YORK

Figure Title

AREA OF CONCERN MAP

SOIL IMPACTS

Project No.
170562201

Date
10/19/2020

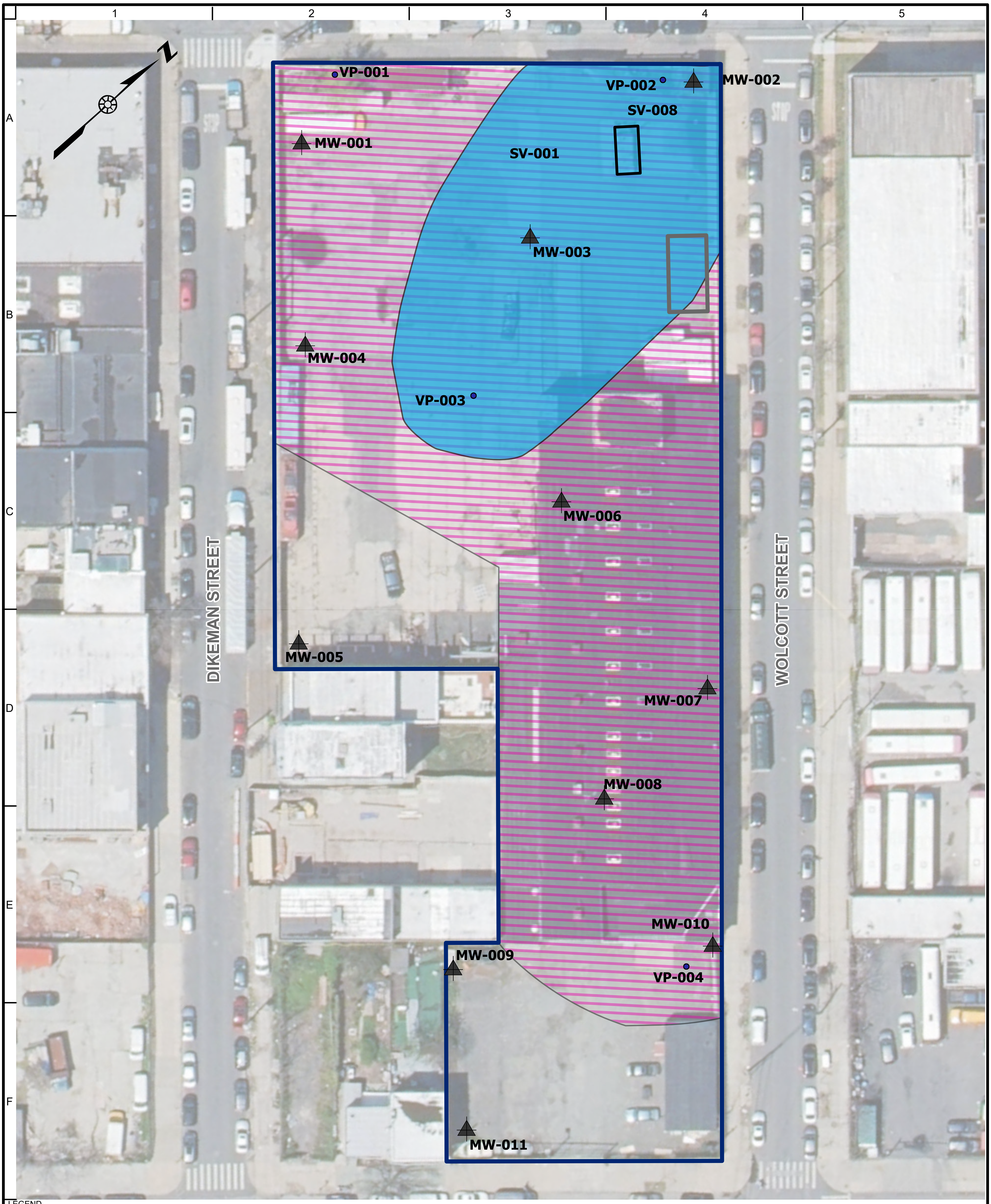
Scale
1"=45'

Drawn By
EMS

Figure No.
2

Sheet 2 of 6

Path: \\langan.com\data\NYC\data2\170562201\Project Data\ArcGIS\APRX\145 Wolcott Street\145 Wolcott Street.aprx Date: 10/19/2020 User: tzorn Time: 5:42 PM



LEGEND

▭	Approximate Site Boundary
▭	Approximate Location of 6,000 gal Diesel AST
▭	Approximate Former UST Area
▲	Monitoring Well Location
●	Vertical Profile Well Location
▤	Dissolved-Phase Petroleum-Contaminated Groundwater
🟦	Apparent Tar-Related DNAPL

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5. DNAPL = DENSE NON-AQUEOUS PHASE LIQUID
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BLOCK No. 574, LOT No. 1, 23, & 24
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Figure Title
AREA OF CONCERN MAP
GROUNDWATER IMPACTS

Project No. 170562201
Date 4/28/2020
Scale 1"=45'
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Figure No. 3
Sheet 3 of 6

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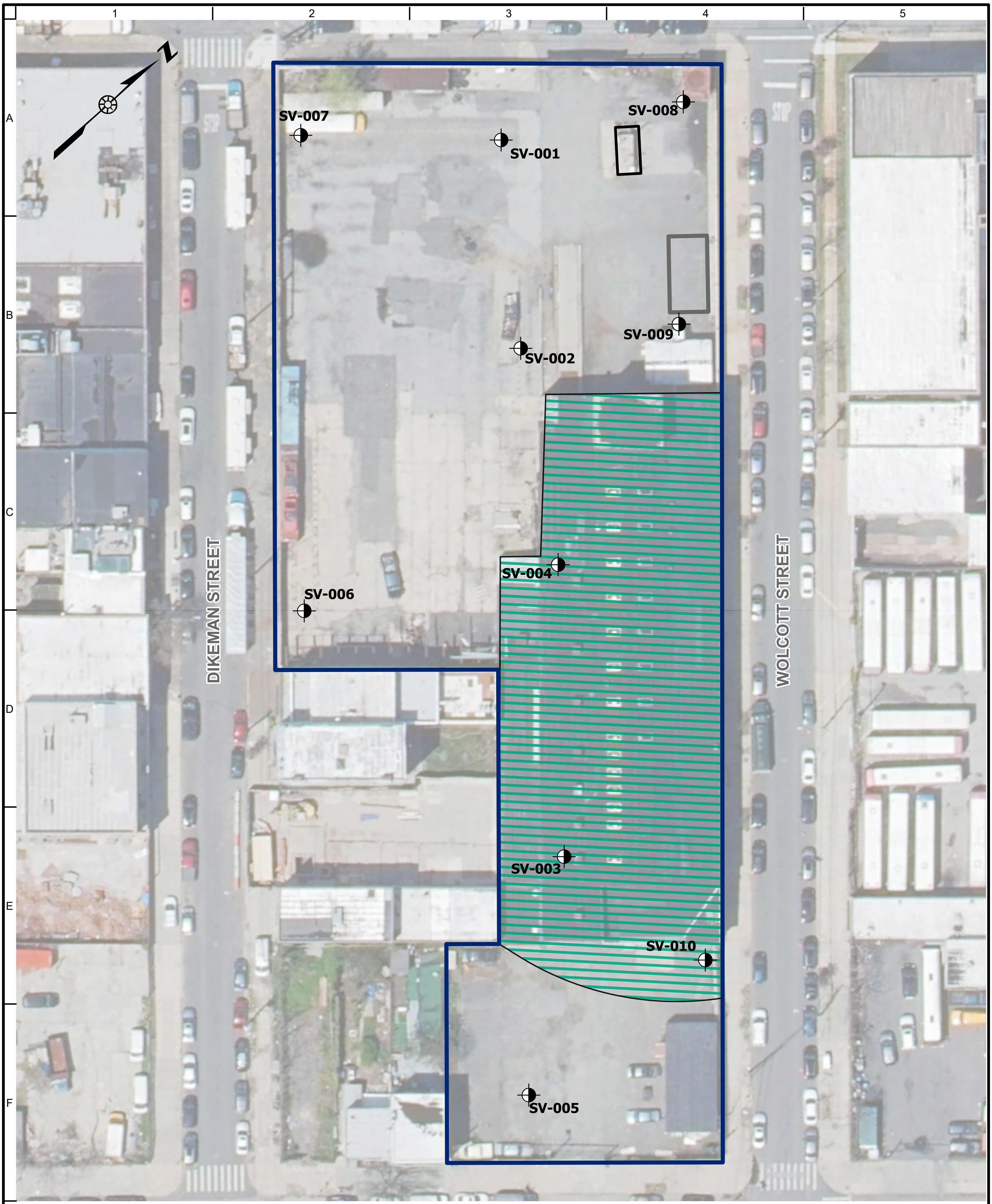

LEGEND

- 🟦 Approximate Site Boundary
- ☐ Approximate Location of 6,000 gal Diesel AST
- ☐ Approximate Former UST Area
- ⊕ Soil Vapor Sample Location
- ▤ Chlorinated VOC-Contaminated Soil Vapor

NOTES:
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4. AST = ABOVE GROUND STORAGE TANK
5. UST = UNDERGROUND STORAGE TANK
6. VOC = VOLATILE ORGANIC COMPOUND

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Project

145-165 WOLCOTT STREET

BLOCK No. 574, LOT No. 1, 23, & 24
BROOKLYN

KINGS NEW YORK

Figure Title

AREA OF CONCERN MAP

SOIL VAPOR IMPACTS

Project No.
170562201

Date
4/28/2020

Scale
1"=45'

Drawn By
EMS

Figure No.
4

Sheet 4 of 6

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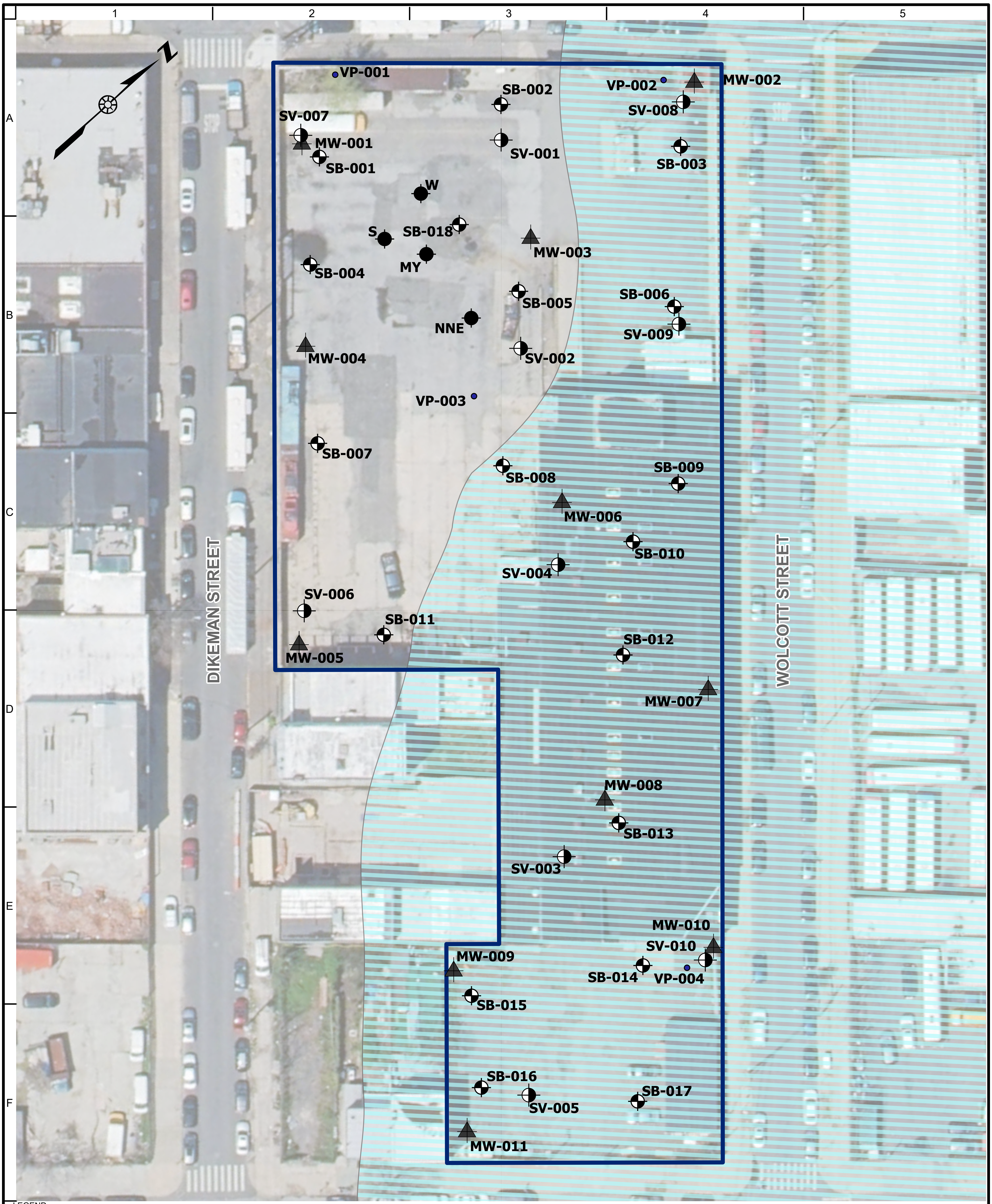

LEGEND

▨ Historical Area Below Sea Level

▭ Approximate Site Boundary

● Historic Soil Boring Sample Location

⊕ Soil Boring Sample Location

⊕ Soil Vapor Sample Location

▲ Monitoring Well Location

• Vertical Profile Well Location

G

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1. WORLD AERIAL IMAGERY BASEMAP IS PROVIDED THROUGH LANGAN'S ESRI ARCGIS SOFTWARE LICENSING AND ARCGIS ONLINE.
2. HISTORICAL SHORELINE INTERPRETED VIA GEOREFFERENCE OF "ORIGINAL HIGH AND LOW GROUNDS, SALT MARSH AND SHORE LINES IN THE CITY OF BROOKLYN" DATED 1875
3. SAMPLE LOCATIONS ARE APPROXIMATE AND WERE INTERPRETED FROM P.W. GROSSER RI DATED NOVEMBER 2019

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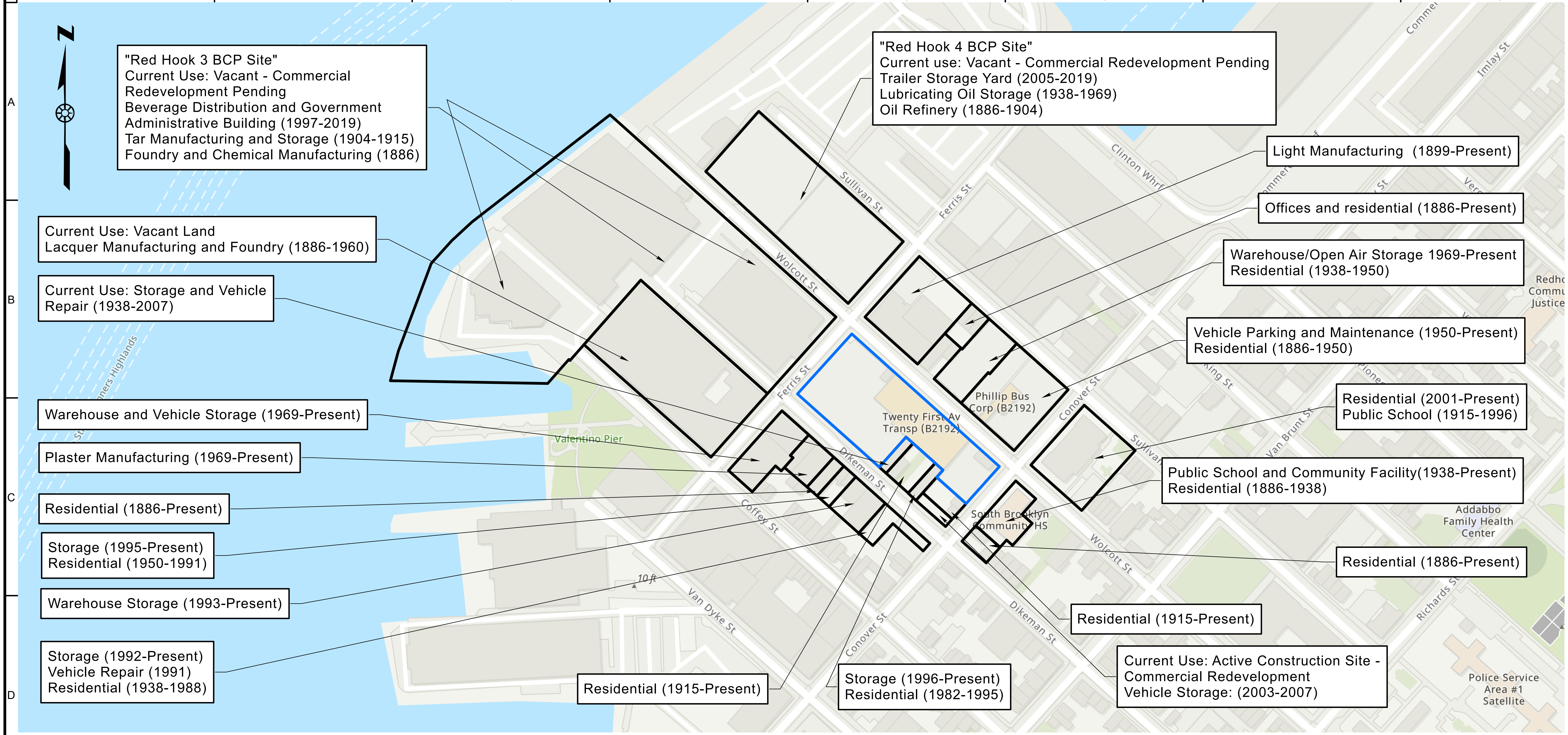
Figure Title
HISTORICAL AREA BELOW SEA LEVEL

Project No. 170562201
Date 10/19/2020
Scale 1"=45'
Drawn By EMS
Figure No. 5
Sheet 5 of 6



LEGEND

▭ APPROXIMATE SITE BOUNDARY

250 0 250
SCALE IN FEET

NOTES:
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2. HISTORIC USES OF PROPERTIES INFERRED FROM HISTORIC SANBORN FIRE INSURANCE MAPS
3. BCP = BROWNFIELD CLEANUP PROGRAM

WARNING: IT IS A VIOLATION OF THE NYS EDUCATION LAW ARTICLE 145 FOR ANY PERSON, UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER THIS ITEM IN ANY WAY.

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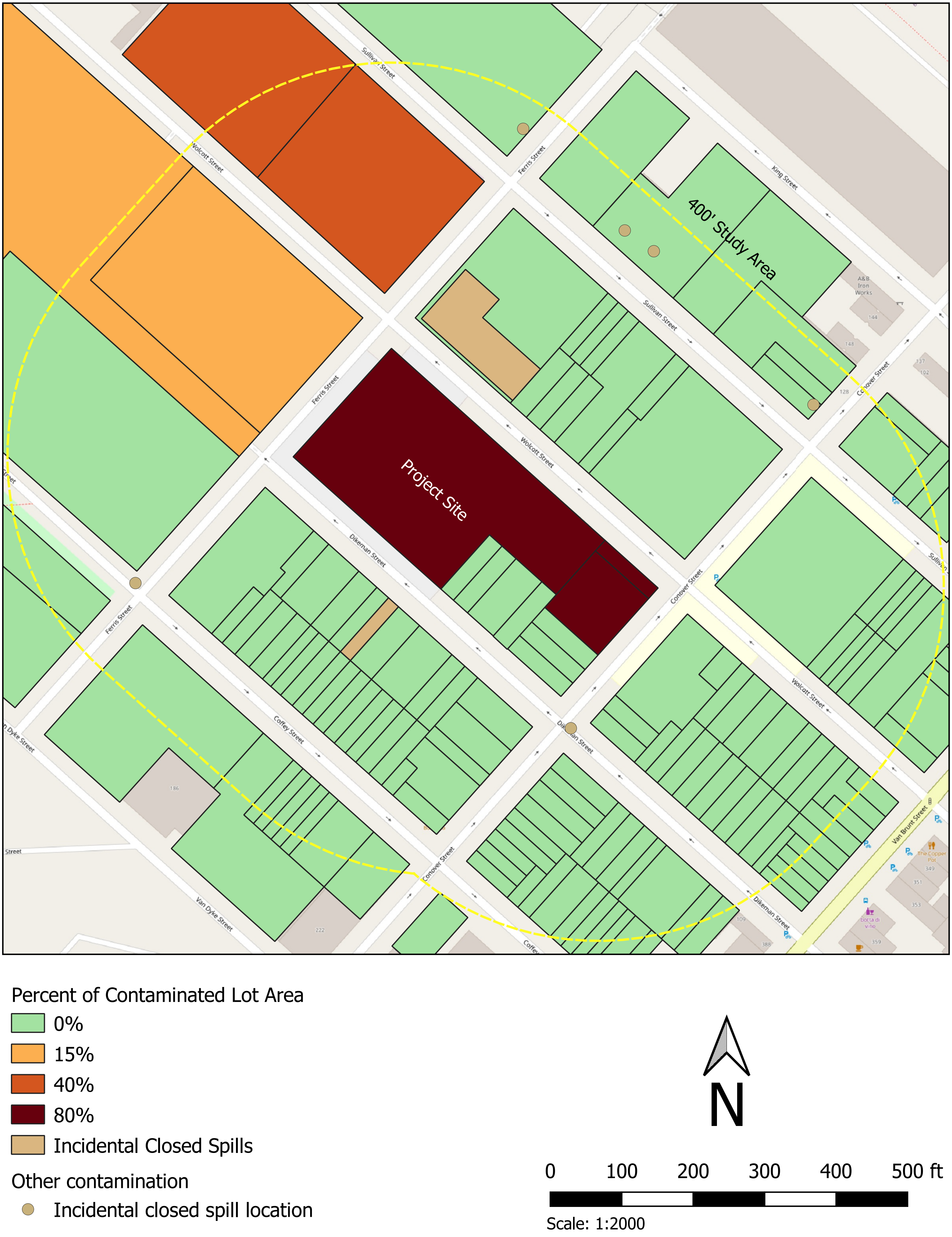
Project
145-165 WOLCOTT STREET
BLOCK No. 574, LOT No. 1, 23, & 24
BROOKLYN
KINGS NEW YORK

Figure Title
HISTORICAL SURROUNDING LAND USE MAP

Project No.
170562201
Date
5/14/2020
Scale
1"=250'
Drawn By
EMS

Figure No.
6
Sheet 6 of 6

Path: \\langan.com\data\NYC\data2\170562201\Project Data\ArcGIS\APRX\145 Wolcott Street\145 Wolcott Street.aprx Date: 5/14/2020 User: esmith Time: 4:53 PM



Project Site
400' Study Area
Sullivan Street
Wolcott Street
Ferris Street
King Street
Conover Street
Dikeman Street
Coffey Street
Van Dyke Street
Van Brunt Street
A&B Iron Works
Percent of Contaminated Lot Area
🟩 0%
🟧 15%
🟧 40%
🟥 80%
▨ Incidental Closed Spills
Other contamination
● Incidental closed spill location
N
0
100
200
300
400
500 ft
Scale: 1:2000

TABLE

Table 1
Premium Cost Estimate for Environmental Remediation during Site Development
145 Wolcott Street
Brooklyn, New York

Assumptions:

1 As-of-right development depth is 2 feet below grade for slab-on-grade foundation construction to lot lines.

2 In-Situ Stabilization (ISS) to be implemented across 55,000 square feet to address soil and groundwater contamination while constructing necessary ground improvements outboard of the historical high water line.

3 Bucket application of minimum 100-PSI ISS soil/cement mix to 13 ft bgs (35,000 SF); auger application to 30 ft bgs (20,000 SF).

4 Excavation to 7 ft bgs in ISS area to remove shallow soil contamination and create staging platform.

5 Support of excavation will consist of 1:1 sloping extending beneath the adjacent sidewalk.

6 Remedial excavation will also include treatment of tar hot spot via removal and ISS to 16 ft bgs and lead hot spot removal to 6 ft bgs.

7 The baseline transportation and disposal rate for historic fill material is $40/ton. All T&D unit rates reflect the incremental difference relative to the baseline rate.

8 Groundwater is between 8 and 13 ft bgs; no dewatering will be required.

9 Known or suspected tanks include five 275-gallon ASTs, one 4,000-gallon AST, one closed-in-place 6,000-gallon UST, four closed-in-place 550-gallon USTs, one cosmoline/waste oil UST, one 275-gallon UST identified in former auto shop, and two suspected tanks.

10 A sub-membrane depressurization system will be installed to address soil vapor impacts.

Revised: October 27, 2020

Item #	Description	Estimated Quantity	Unit	Unit Price	Estimated Cost
Environmental Engineering Fees					
1	Remedial Investigation and Reporting	1	LS	$290,000	$290,000
2	Remedial Action Work Plan	1	LS	$25,000	$25,000
3	Waste Classification Sampling and Reporting	1	LS	$100,000	$100,000
4	Remedial Specifications/Bid Support	1	LS	$20,000	$20,000
5	Engineering Oversight/Air Monitoring	170	Days	$1,760	$300,000
6	Management/DEC Coordination/Daily and Monthly Reporting	12	Month	$4,155	$50,000
7	Endpoint Sampling	95	Sample	$1,310	$125,000
8	Remedial Design	1	LS	$60,000	$60,000
9	Final Engineering Report and Site Management Plan	1	LS	$55,000	$55,000
10	SMP Monitoring (Site Inspection and Post-remediation Groundwater Monitoring)	8	Quarters	$20,000	$160,000
				Subtotal Engineering Costs	**$1,185,000**
Remediation Costs					
1	Construct and Maintain Decontamination Pad	1	LS	$25,000	$25,000
2	Tank Removal	15	Tank	$10,000	$150,000
3	Transportation and Disposal of lead hot spot (0-6 ft bgs)	1,167	Tons	$35	$41,000
4	Transportation and Disposal of Tar Material within ISS area (0-7 ft bgs)	2,352	Tons	$45	$106,000
5	Transportation and Disposal of Petroleum and Metals Impacted Material (70% of 2-foot cut across non-ISS area and 7-foot cut across ISS area)	15,232	Tons	$35	$534,000
6	Dust/Odor Control	6	Month	$20,000	$120,000
7	Soil backfill for Lead Hot Spot	519	CY	$40	$21,000
8	Sub-Slab Depressurization System	1	LS	$569,000	$569,000
9	ISS Batch Plant Mobilization	1	LS	$400,000	$400,000
10	Soil Excavation and Handling - 2 to 7 ft below grade across ISS Area	10,820	CY	$25	$271,000
11	Transportation and Disposal of Historic Fill - 2 to 7 ft below grade across ISS Area	16,231	Tons	$40	$650,000
12	Soil backfill (assumes ISS swelling - no 15% compaction required)	10,820	CY	$40	$433,000
13	ISS Installation - 13 ft bgs (6 ft below sub-grade)	7,778	CY	$65	$506,000
14	ISS Installation - 30 ft bgs (23 ft below sub-grade)	17,037	CY	$100	$1,704,000
				Subtotal Remediation Costs	**$5,530,000**
				Administration & Engineering (10%)	$553,000
				Construction Management (3%)	$166,000
				Insurance (8%)	$443,000
				Bond (2%)	$111,000
				General Conditions (10%)	$553,000
				Contingency (5%)	$277,000
				Estimated Soft and Capital Cost	**$2,103,000**
				Total Premium Remediation Cost	**$8,818,000**

ATTACHMENT A

Preliminary Geotechnical Engineering Study

PRELIMINARY GEOTECHNICAL ENGINEERING STUDY

for

145 Wolcott Street
Brooklyn, New York

Prepared For:

DRAW Brooklyn, LLC
373 Van Brunt Street
Brooklyn, NY 11231

Prepared By:

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26 August 2020
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New Jersey • New York • Connecticut • Pennsylvania • Washington, DC • Virginia • West Virginia • Ohio • Florida • Texas • Arizona • California
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INTRODUCTION

This report presents the results of our preliminary subsurface investigation and provides preliminary geotechnical recommendations for the design and construction of an as-of-right building at 145-165 Wolcott Street in Brooklyn, New York. Our understanding of the project requirements is based on review of documents provided, discussions with the project team, and our general experience in the area. All recommendations are in accordance with the New York City Building Code 2014 (NYCBC).

Elevations were estimated from 2010 Light Detection and Ranging (LiDAR) data publically available from the New York City Department of Information Technology and Telecommunications (DoITT). All elevations contained herein reference the North American Vertical Datum of 1988 (NAVD88)[1].

SITE DESCRIPTION

The project site is located at 145-165 Wolcott Street in the Red Hook neighborhood of Brooklyn, New York, on the city block bounded by Wolcott Street to the north, Conover Street to the east, Dikeman Street to the south, and Ferris Street to the west. The site is comprised of three lots, referenced as Block 574, Lots 1, 23, and 24, with a total footprint of approximately 80,150 square feet. Lot 1 occupies the majority of the project site (67,500 square feet), Lot 23 (2,000 square feet) and Lot 24 (10,500 square feet) occupy the northeast corner of the site. Several properties consisting of low-rise buildings adjoin the site on the southeast quadrant of the block. The project site has about 500 feet of frontage on Wolcott Street, about 125 feet of frontage on Conver Street, about 275 feet of frontage on Dikeman Street, and about 200 feet of frontage on Ferris Street. A site location map is presented in Figure 1.

Existing Conditions

The site is occupied by an asphalt-paved parking lot, a one-story light industrial building and two trailers formerly used as office space. The one-story building was recently used as a school bus maintenance and storage facility and contains two mezzanine levels. Grades within the site generally vary from about el 9.7 ft at the northeast to el 13.7 ft in the south-central. Grades generally slope down to the the north. Grades along Wolcott Street and Dikeman Street generally slope down to the east and west from a crown that occurs roughly mid-block.

LOCAL GEOLOGY

This site is underlain by bedrock of the Hartland Formation (middle Ordovician to lower Cambrian age) at depths greater than 100 feet. The bedrock in the area is generally composed of schistose and amphibolite rocks with variable levels of metamorphism. The surface geology is generally

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[1] Elevations are with respect to the North American Vertical Datum of 1988 (NAVD88), which is reported to be 1.1 feet above the Mean Sea Level at Sandy Hook, New Jersey, 1929 (NGVD 1929) and 1.447 feet below the Borough President of Brooklyn Highway Datum (BPBHD). (http://www.region2coastal.com/view-flood-maps-data/understanding-vertical-datums/)

comprised of manmade fill placed atop glacially derived soils; alluvial deposits are present sporadically in areas located outboard of the original high water line.

The Red Hook area was originally comprised largely of several small low lying islands separated by tidal estuaries and ponds. The Red Hook area was filled incrementally between the mid to late 19th century to both raise surface grades as well as to extend the shoreline outward to the south and west. The site is located on the northern margins of a former island and straddles the original high water line.

While the exact position of the original high water line varies slightly on historic mapping, the southern half to one-third of Lot 1 is generally depicted to lie upland of the high water line; Lot 23 is generally depicted to lie outboard of the high water line and Lot 24 is generally depicted as being largely outboard of the high water line. Areas outboard of the high water line are anticipated to contain alluvial deposits comprised of soft slightly organic silt and clay. Groundwater in the area is known to be shallow

Adjacent Strcutures

166 Dikeman Street (Block 574, Lot 38)

A two-story commercial building, identified as Block 574, Lot 38, adjoins the site's southeast border, and DOB records indicate the building was constructed circa 1931. Site personnel verbally indicated that the building does not contain a cellar based on our query. The type and extents of the foundations supporting the building are unknown.

164 Dikeman Street (Block 574, Lot 37)

A four-story residential building, identified as Block 574, Lot 37 is located adjacent to Lot 1's south property line. The northern edge of the building is offset about 38 feet from the property line. DOB records indicate the building was constructed circa 1931. The building has a basement level based on visual observations made along the Dikeman Street sidewalk. The exact location and extents of the below-grade space, as well as the type and extents of the foundations supporting the building are unknown.

160 Dikeman Street (Block 574, Lot 35)

A four-story commercial/industrial building, identified as Block 574, Lot 35 is located adjacent to Lot 1's south property line. Per discussions with site personnel the building was constructed circa 2018 and the building does not contain a cellar. The type and extents of the foundations supporting the building are unknown.

158 Dikeman Street (Block 574, Lot 34)

A two-story commercial building, identified as Block 574, Lot 34 is located adjacent to Lot 1's south property line and Lot 24's west property line. DOB records indicate the building was constructed circa 1990. Per discussions with site personnel the building does not contain a cellar. The type and extents of the foundations supporting the building are unknown.

198 Conover Street (Block 574, Lot 30)

A three-story residential building, identified as Block 574, Lot 30 is located adjacent to Lot 24's south property line. DOB records indicate the building was constructed circa 1901. An access hatch was observed along the east side of the building within the Conover Street sidewalk suggesting the presence of below-grade space. The exact location and extents of any below-grade space, as well as the type and extents of the foundations supporting the building are unknown.

Utilities

Numerous utilities were observed to be present along the sidewalks and streets fronting the site; however, the details of the such are unknown at this time. Notable utilities observed adjacent to the site include, but are not limited to, water mains, sewers, catch basins, and electrical and telecommunications infrastructure; above grade utilities front the site along Dikeman Street and Ferris Street. All active utilities, as well as utility infrastructure planned for re-use as part of the site development, must be protected during construction. A utility survey and utility agency records was not available at the time of this report.

PROPOSED DEVELOPMENT

We understand that the as-of-right development is anticipated to consist of an on-grade one- to three-story manufacturing building. The building is expected to include provisions for parking as as loading docks. Specific details pertaining to the proposed building loads were not available at the time of this report; however, given the industrial nature of the proposed space and the potential for it to be used for warehousing, we expect that column loads will likely vary from about 300 to 600 kips each and that potentially large ground floor uniform live loads will be present (on the order of 250 psf to 750 psf) from rack systems and other equipment.

PRELIMINARY SUBSURFACE INVESTIGATION

Our preliminary subsurface investigation included: (1) drilling six geotechnical test borings with in situ testing and soil sampling; (2) installing two groundwater observation wells; and (3) completing laboratory testing on representative soil samples. Langan provided full-time special inspection during the investigation in accordance with the NYCBC.

Geotechnical Test Borings

Six geotechnical test borings, identified as LB-01 through LB-06, were drilled within and adjacent to the site. The borings were drilled by Craig Geotechnical Drilling Co., Inc. (Craig) of Mays Landing, New Jersey between 27 July and 3 August 2020. All borings were drilled using a CME 55 track-mounted drill rig. The borings were advanced to depths varying between 62 and 102 feet below grade.

The borings were advanced through soil using mud-rotary drilling techniques with a tri-cone roller bits and drilling fluid. Temporary flush-joint steel casing was used to stabilize the boreholes and prevent fluid loss during drilling. The Standard Penetration Test (SPT)[2] was performed in general accordance with ASTM D1586. Soils were sampled using a standard split-spoon sampler driven by an automatic hammer. SPT N-values[3], visual soil classifications, and other field observations were recorded by Langan's inspecting engineer. All recovered soil samples were visually classified in the field in accordance with ASTM D2487 and the NYCBC.

Approximate locations of the borings are shown in Figure 3. Soil classifications, SPT N-values, and other field observations were recorded on the boring logs included in Appendix A.

Groundwater Observation Wells

Groundwater observation wells were installed in boreholes LB-04(OW) and LB-06(OW) and groundwater levels were measured periodically during the investigation. The wells in LB-04(OW) and LB-06(OW) were constructed using about a 10-ft section of a 2-inch-diameter Schedule 40 PVC, 0.02-inch slotted screen below a 10-foot section of solid riser pipe extending to grade. The annulus of the well was backfilled with No. 1 filter sand to a minimum of 2 feet above the well screen followed by a minimum 2-foot-thick bentonite-pellet seal. The remainder of the annulus was backfilled with soil cuttings. A protective steel flush-mounted cap was installed with grout at the ground surface to prevent surface water from influencing well readings. Following installation, the groundwater monitoring wells were developed by flushing with water until the water ran clear to establish the stabilized groundwater level. The observation well construction logs are included in Appendix B.

Laboratory Testing

Laboratory testing was performed on selected soil samples to evaluate engineering properties and verify visual classifications made in the field. Laboratory testing of soil samples included:

- Particle Size Analysis – ASTM D422 (20 tests)
- Atterberg Limits – ASTM D4318 (3 tests)

The laboratory test results are provided in Appendix C.

SUBSURFACE CONDITIONS

The general subsurface stratigraphy observed within the borings consists of uncontrolled fill, typically underlain by a layer of silty sand with varying amounts of silt, clay and fine gravel. However, in the four borings performed along the northern border of the site adjacent to the historic waterfront (LB-01 thru LB-04) a layer of clay and/or silt was observed either directly beneath the fill layer or within the start of the silty sand layer. Detailed descriptions of the observed subsurface conditions follow.

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[2] The Standard Penetration Test is a measure of soil density and consistency. The testing involves driving a 2-inch outer-diameter split-spoon sampler a distance of 2 feet, using a 140-lb hammer free falling from a height of 30 inches.

[3] N-value – The number of blows required to drive a 2-inch diameter split-spoon sampler 12 inches after an initial "seating" penetration of 6 inches, using a 140-lb hammer free falling from a height of 30 inches.

Stratum 1 – Uncontrolled Fill [NYCBC Class 7][4]

Uncontrolled fill was observed in all borings and generally consists of dark gray, light brown, or brown silty coarse to fine sand with variable concentrations of silt, clay, and fine gravel. The fill extended to depths varying from about 6 to 15 feet below grade, with the bottom of fill corresponding to between about el 6.5 ft and el -4 ft, respectively. The fill depths appear to increase moving north within the site which roughly correlates with areas increasingly outboard of the original highwater line. SPT N-values N-values varied from weight of rod (WOR) to 38 blows per foot (bpf) indicating density varying from very loose to dense. However, the higher recorded SPT N-values appear attributed to the presence of obstructions (i.e., construction debris, cobbles, etc.) and are generally not considered a representative indicator of in situ density. N-values were typically less than 10 bpf. The loosest materials appear to correlate with areas located outboard of the original highwater line and below the groundwater table. These fills were likely placed through water, resulting in lower density. The fill is generally considered to be in a loose to medium dense condition, often decreasing with depth.

Two particle size analyses were performed on samples of uncontrolled fill. The samples had fine contents (percent by weight passing a standard US No. 200 sieve) between about 16.3 and 25.7 percent.

The fill soil generally classifies as SM (silty sands and sand-silt mixtures) in accordance with USCS and Class 7 “Uncontrolled Fill” in accordance with the NYCBC.

Stratum 2a – Silt and Clay [Class 5b, 4a, 4b and 6]

A layer of dark brown to brown clay and silt was encountered below the fill in the four borings along the northern border of the site (areas outside the original highwater line). Variable amounts of the minor constituents (e.g., sand and gravel) were observed within this stratum. In addition, a discontinuous layer of slty sand was sometimes observed between the fill of Stratum 1 and the soils of Stratum 2a. The plasticity of the Stratum 2a material appeared to decrease somewhat moving east along the site and varies from silty clay to clayey silt. The thickness of the stratum varies between about 2 and 7 feet and the bottom of the layer was observed between about el -7 ft and about el -17 ft. SPT N-values varied from 1 bpf to 32 bpf and were typically around 10 bpf. The density within the upper margin of this material appears to be influenced somewhat by comingling with the overlying fill soils.

Three particle size analyses and three Atterberg Limits tests were perfomed on the samples from this layer. The samples had fines contents varying from 62 to 76.6 percent. Atterberg Limits results indicate a Liquid Limit ranging between 26 and 30; a Plastic Limit ranging between 18 and 21; and a Plasticity Index ranging between 8 and 9.

The soils of Stratum 2a classify as ML (non-plastic silt), CL (low-plasticity clay), and ML-CL inaccordance with the USCS, and Class 4a “Hard Clay,“ Class 4b “Stiff Clay,“ Class 4C “Medium Clay”, Class 5b “Medium Dense Silts”, and Class 6 “Loose Silts” in accordance with the NYCBC.

---

[4] Numbers in brackets indicate classification of soil and rock materials in accordance with the NYCBC.

Stratum 2b – Silty Sand [Class 3a, 3b, and 6]

Granular siols were observed in all borings, either directly below the uncontrolled fill layer of Stratum 1 or below the silt and clay soils of Stratum 2a. The granular soils varied in color from dark brown/brown to dark gray/gray and are generally comprised of medium to fine sand with variable concentrations of silt, clay, and gravel. In some instances silt constiutues a predominant portion of the soil sample. The sand layer was typically encountered between about 6 feet and 17.5 feet below existing grade, corresponding to about el 6.5 ft and el -7 ft, respectively. SPT N-values varied from 1 bpf to refusal (i.e., more than 50 blows over six inches of penetration) and were typically between about 15 and 50 bpf. The N-values also appeared to increase with depth. The soil is generally considered to be in a medium dense to dense condition.

Fifteen particle size analysis were performed on the upper sand layer. The samples had fines contents between about from 10.5 to 37.8 percent, with one sample having a fiens content of about 69.4 percent.

The sand layer generally classifies as SM (silty sands and sand-silt mixtures) in accordance with USCS, and typically classifies as Class 3a “Dense Granular Soils”and Class 3b “Medium Dense Granular Soils”, or Class 6 “Loose” or “Soft” materials in accordance with the NYCBC.

Groundwater

Groundwater levels were measured during and after the subsurface investigation at LB-04(OW) and LB-06(OW). Groundwater was observed to vary between about 7.7 feet and 12.7 feet below existing grade, corresponding to about el 1.1 ft and el 0.6 ft, respectively. Groundwater readings are summarized in Table 1 below. Please note that the groundwater level may vary seasonally, with changes in precipitation, and may be slightly tidally influenced.

Table 1 – Groundwater Observation Well Data

Well No.	Approximate Surface Elevation (feet, NAVD88)	Date	Depth Below Grade (feet)	Approximate Groundwater Elevation (feet, NAVD 88)
LB-04(OW)	± 8.8	7/29/2020	7.8±	±1.0
		7/30/2020	7.7±	±1.1
		7/30/2020	7.7±	±1.1
		7/31/2020	7.8±	±1.0
		8/3/2020	7.8±	±1.0
LB-06(OW)	± 13.3	7/31/2020	12.7±	±0.6
		7/31/2020	11.8±	±1.5
		8/3/2020	12.5±	±0.8
		8/3/2020	12.6±	±0.7

FEMA FLOOD ZONE

The site is located within flood zone AE and shaded zone X, as determined by the Federal Emergency Management Agency (FEMA) Preliminary Flood Insurance Rate Map (PFIRM), Panel 3604970192G, dated 5 December 2013. The AE designation corresponds to "Special Flood Hazard Areas Subject to Inundation by the 1% annual chance flood" (100-year flood). The base flood elevation (BFE) is located at el 11 ft. Figure 4 shows the FEMA PFIRM map flood boundaries as well as the approximate project site boundary.

A minimum of 1 foot of free board must be provided above the BFE for Structural Occupancy Category II (non-residential). Therefore, the minimum design flood elevation (DFE) is el 12 ft. All structures and utilities located below the DFE must be floodproofed in accordance with the requirements of the NYCBC and ASCE 24. Please note that forthcoming changes to the NYCBC are expected to increase the required free board by an additional 1-foot.

SEISMIC DESIGN PARAMETERS

Seismic design parameters presented herein are in accordance with Section 1613.5 of the 2014 NYCBC. The subsurface investigation indicates that medium dense granular soil is generally present throughout the site. Therefore, we recommend the building be assigned to Site Class D. Seismic design parameters are summarized in Table 2 below.

Table 2 – Seismic Design Parameters

Description	Parameter	Recommended Value	Building Code Reference
Mapped Spectral Acceleration for short periods:	S_s	0.281 g	Section 1613.5.1
Mapped Spectral Acceleration for 1-sec period:	S_1	0.073 g	
Site Class	-	**D**	Table 1613.5.2
Site Coefficient:	F_a	1.57	Table 1613.5.3
Site Coefficient:	F_v	2.40	
5 percent damped design spectral response acceleration at short periods:	S_{DS}	**0.294 g**	Section 1613.5.4
5 percent damped design spectral response acceleration at 1-sec period:	S_{D1}	**0.117 g**	
Structural Occupancy/Risk Category (to be confirmed by Project Structural Engineer)	-	**II (assumed)**	Table 1604.5
Seismic Design Category	-	B	Table 1613.5.6 (1) Table 1613.5.6 (2)
Site Adjusted Peak Ground Acceleration	PGA_M	0.24	Table 1813.2.1

Liquefaction Potential

The seismic provisions of the NYCBC require an evaluation of the liquefaction potential of non-cohesive soils below the groundwater table, and up to a depth of 50 feet below the ground surface. Liquefaction potential was evaluated using the procedures outlined by Youd et al. (2001). Our evalutation indicates that the potential for liquefaction, liquefaction-induced settlement, and other seismic ground failure at the site is unlikely. Therefore, liquefaction need not be considered in the design.

DESIGN AND CONSTRUCTION CONSIDERATIONS

The following section briefly summarizes significant design and construction considerations associated with foundations for the proposed development:

- The site lies within the FEMA mapped 1% annual chance flood zone (Zone AE) with a base flood elevation (BFE) or el 11 ft. A minimum design flood elevation (DFE) of el 12 ft must be used for the design. All structures and utilities located below the DFE must be floodproofed in accordance with the requirements of the NYCBC and ASCE 24.
- Measured groundwater levels varied from about el 0.6 ft and el 1.1 ft. To account for potential tidal fluctuation, extended precipitation events, and emergency utility breaks, we recommend a design groundwater elevation of el 2 ft for the design of any temporary support of excavation.
- The site should be designed assuming a seismic design category (***SDC***) of ***B*** for Structural Occupancy/Risk Category II. Liquefaction need not be considered in the design.
- Poor soils are present in the upper exposures of the site and are subject to potentially significant settlement. In addition, consideration must be made to address the environmentally contaminated conditions of soil and groundwater within the site.
- Soils upland of the original highwater line appear suitable to support the proposed bulding using a conventional shallow foundation system. However, areas outboard of the original highwater line would require shallow foundations to be paired with an appropriate ground improvement program that is capable of reducing total and differential settlements resulting from loose heterogeneneous fill soils.
- Deep foundation elements, such as driven or drilled pile foundations, are considered a feasible alternative the ground improvement option noted above for areas outboard of the original highwater line and could similarly be used on a discretionary basis upland of the original highwater line.
- If any below grade space is desired or if excavations are necessary for the purpose of environmental remediation, a support of excavation (SOE) system will be required where suitable OSHA compliant slopes or benches cannot be provided. Further, excavations that extend below the groundwater table will require temporary construction dewatering. Consideration should be given to providing a SOE system capable of providing groundwater cut-off. This may entail driving closed interlocking sheet piling at the perimeter of the excavation to decrease the dewatering demands and the potential for groundwater draw-down that could negatively impact adjoining buildings.

- Permission from the neighboring property owners will be required in order to install any support of excavation, underpinning, as well as any associated bracing elements (e.g. tiebacks) within the adjoining properties.
- Existing buildings and utilities adjacent to the excavation must be protected and monitored during construction activities.

PRELIMINARY DESIGN RECOMMENDATIONS

Foundation Options

Based on the results of our preliminary study, we recommend the proposed development be supported using either a shallow foundation system, paired with an appropriate ground improvement program or a deep foundation system.

Conventional shallow foundations are generally considered feasible upland of the original highwater line, but shallow foundations outboard of the original highwater line should not be used without an appropiate ground improvement program because of the potential for excessive settlements in these areas. Such settlements would likely be non-uniform across the site given the irregular nature of the existing subsurface conditions and the potential local changes to soil density resulting from environmental remediation work. Utlization of a conventional shallow foundation across the whole site without ground improvement would likely result in poor performance of building components such as ground floor slabs.

Shallow Foundations Paired with Ground Improvement

Shallow foundations are possible where an appropriate ground improvement program is implemented in areas outboard of the original highwater line. The ground improvement would likely consist of removal and replacement of poor near surface soils, above the groundwater table, along with soil-cement mixing techniques of deeper soils. Alternativelly, the ground improvement could consist of removal and remplacement of near surface soils paired with discrete inclusions (e.g. rammed aggregate piers, vibropiers, controlled modulus columns, etc) installed on defined grid below these areas of the building. Both options would improve bearing capabilities of the loose/soft poor soils noted outboard of the original highwater line.

Soil mixing may be preferable for the site because it also serves as an environmental remedy for the known contaminated ground conditions. The additional of cement stabilizes the soils in situ resulting in increased strength, reduced permeability, and decreased potential for contaminant transport.

Removal and replacement of near surface fill would based on a combination of geotechnical and environmental remediation requirements. The existing soils would be replaced with an approved fill such clean structural fill, recycled concrete aggregate, or crushed stone. Where necessary, the shallow fill replacement could be paired with geotextile reinforcement to aid load transfer. T discrete inclusions placed for the ground improvement program. The new fill would generally be installed in lifts of 12-inches or less and compacted to 95 percent of the maximum dry density determined in accordance with ASTM D1557.

The following sections provide recommendations for the design of shallow foundations. Note these design values assume that an appropriate ground improvement program is implemented where required.

Allowable Bearing Pressure

We recommend that footings be designed assuming a gross allowable bearing pressure of three (3) tons per square foot (tsf). Continuous footings should have a minimum width of 2 ft and isolated spread footings should have a minimum dimension of 3 ft. All perimeter footings should bear at least 4 ft below adjacent exterior grade for frost protection; interior footings should bear at least 2 ft below the floor slab. Footing subgrades should be prepared in accordance with the recommendations presented herein.

Settlement

The ground improvement program would be developed on a performance basis with an emphasis on controlling total and differential settlement. We believe total and differential settlements of new footings of less than 1 inch, and the angular distortion (Δ/L) of less than 1/600 can be achieved using the ground improvement methods discussed above.

Lateral Resistance

Lateral loads can be resisted by friction on the bottom of footings. We recommend an ultimate friction coefficient of 0.50 for mass concrete poured on compacted stone or RCA fill. A minimum factor of safety of 1.5 should be utilized when evaluating sliding. If additional resistance is needed, lateral loads can also be resisted by embedding footings deeper to develop passive resistance from the soil. The allowable passive resistance provided by the soil will be dictated by the depth of embedment, characteristics of the surrounding material, and the extent of backfill and compaction at a particular location. Alternatively, floor slabs can be used as diaphragms to transfer loads to the exterior walls.

Uplift Resistance

Uplift loads may be resisted by tiedown anchors where dead load resistance of the structure is insufficient. Tiedown anchors can be either post-tensioned or passive, but given the relatively deep rock in the area we recommend passive anchors.

Passive anchors are constructed similar to micropiles. The anchor is comprised of an open-ended steel casing drilled into place through the overburden soils and extending to the required bearing stratum. Once the tip elevation is reached, the entire shaft is filled with cement-grout and steel reinforcement. The steel casing is then partially extracted to create the bond zone. The grout is pressurized to help increase the bond strength. The cased zone must extend to a minimum depth of 5 feet, but may be extended as required to address adverse group effects.

We recommend an allowable peripheral bond strength of about 15 pounds per square inch (psi) for medium dense granular soil of Stratum 2b. The proportions of steel reinforcement can be adjusted to help control elongation that may occur during application of load. Anchor capacities up to about 100 tons are considered readily achievable for a 9.625-inch-diameter element. Final layout and design of the anchors should consider potential group effects.

A minimum of two successful load tests per anchor type will be required to verify tension capacities of the passive tiedown anchors. All testing should be performed in accordance with ASTM D3689. We recommend that load testing be performed on the first elements installed to verify that drilling techniques and design parameters are suitable to achieve the requisite design capacity.

Floor Slabs

Ground floor slabs elevated above the DFE can be designed as a slab-on-grade assuming a modulus of subgrade reaction equal to 100 psi per inch.. Slab-on-grade floors are assumed to be at least 8-inches thick and should bear atop a load transfer pad consisting of compacted lifts of stone fill or recycled concrete aggregate (RCA) in areas receiving ground improvement and a minimum 12-inch thick layer of compacted stone fill or recycled concrete aggregate (RCA) elsewhere. . Stone or RCA fill should be placed in loose lifts not exceeding 12 inches and per the recommendations provided herein.

Slabs located below the design flood elevation should be designed as framed pressure slabs suitable to accommodate hydrostatic pressures assuming a DFE of el 12 ft.

A vapor barrier or waterproofing membrane should be installed below all ground floor slabs.

We strongly recommend that the construction be sequenced such that slabs-on-grade be constructed following erection and enclosure of the building. Casting the a slab-on-grade following enclosure of the building is expected to result in less potential for differential settlement and improve performance of the building. Control joints should also be provided in the slab-on-grade at columns to reduce the potential for cracking.

Deep Foundations

Deep foundations may consist of drilled or driven piles bearing in the dense granular soils or stiff cohesive soils. Driven piles are expected to be more cost effective than drilled piles. Driven piles may consist of tapered friction piles, pipe piles, or H-piles. We estimate that driven steel piles are suitable for achieving allowable capacities of up to about 150 tons in compression and 50 tons in tension.

The presence of remnant foundations and/or rubble within the fill is likely to necessitate pre-drilling or spudding of piles at some locations. Pile driving operations may also cause previously installed piles to heave. Any pile that has heaved in excess of ¼ inch must be re-driven to the required level and resistance. We recommend that an allowance be carried to accommodate these tasks. Additionally, any pile type should be fitted with protective points or driving shoes.

The contractor should perform and submit a wave-equation analysis (WEAP), including driving stresses in the pile, once a final pile section and driving hammer are selected to ensure the pile is not overstressed during installation and to develop driving criteria. Furthermore, an index pile test program performed ahead of general foundation construction is recommended to optimize pile design. Details pertaining to the index piles and load testing are presented below.

The necessity for load testing will depend on the selected pile type and capacity.

Floor Slabs

We recommend that the floor slabs be designed as structural slabs capable of spanning between adjacent pile caps. Where possible, structural slabs should be keyed into the foundation walls and should be cast with integral water-stops at all joints. If the ground floor slabs are at or above the DFE a vapor barrier should be installed at a minimum below all ground floor slabs.

Below Grade Walls and Pits

All below grade walls and pits should be designed to resist static earth pressures, hydrostatic pressures, and foundation and surface surcharge loadings. We recommend the below grade walls and pits be designed using a triangular earth pressure distribution having an equivalent fluid weight of 60 pounds per square foot (psf) per ft of depth above the design groundwater level (DFE = el 12 ft) and 90 psf per ft of depth below the design groundwater table. Lateral pressures from surcharge loads should be added as a uniform soil pressure equal to one-half the vertical pressure. Lateral loads from seismic events need not be included (***SDC B***). All walls and pits should be waterproofed per the recommendations presented herein.

Permanent Groundwater Control

In the event the proposed structure extends below the DFE we recommend that waterproofing be installed on all below grade walls, slabs, and pits to account for flooding and for unforeseen conditions such as utility breaks, groundwater rise, etc. We recommend that all occupied spaces below the DFE be completely encapsulated using a membrane-type waterproofing system that is fully bonded to the concrete, such as those manufactured by GCP Applied Technologies (formerly Grace Construction Products), Carlisle Coatings and Waterproofing, and Sika. The selection of waterproofing membranes should be coordinated with any environmental design/regulatory requirements. The use of bentonite waterproofing or negative-side crystalline waterproofing is not recommended. Additionally, we recommend that waterstops also be installed at all concrete joints in conjunction with the waterproofing membrane.

Horizontally applied waterproofing membranes should be installed on a minimum 3-inch thick lean concrete mud slab placed over an approved subgrade to provide a smooth, uniform application surface. Vertically applied waterproofing membranes should extend up to the design flood elevation. Substrate preparation should be as per the manufacturer’s recommendations.

Quality control is critical to a successful waterproofing project. The waterproofing installation should be inspected daily, especially during placement of reinforcement for the floor slabs, caisson caps, and foundation walls. Any holes or tears should be repaired in accordance with the manufacturer’s recommendations and utility penetrations should be carefully sealed. All seams, including separations between wall and slab membranes should be checked for tightness. We recommend that the waterproofing manufacturer inspect the waterproofing operations during construction and approve all work prior to placement of concrete. We also suggest discussing waterproofing detailing with the selected manufacturer and recommend that a warrantee be obtained from both the manufacturer and installer to cover materials and workmanship.

CONSTRUCTION RECOMMENDATIONS

Excavation

For the purpose of this report the maximum general excavation is anticipated to typically extend to depths up to 15 feet below grade. We anticipate that excavation of soils can be accomplished with conventional earthmoving equipment (i.e. track-hoes, etc.). Obstructions such as remnant foundations, abandoned and live utilities, rubble, and other construction debris should be anticipated when excavating and may require larger demolition equipment.

All excavations should be benched or sloped in accordance with applicable OSHA standards. Where required, temporary excavation support should be installed as per the recommendations presented herein.

Temporary Support of Excavation

Temporary support of excavation (SOE) will be required to achieve the general excavation. Groundwater cut-off will also be desired during excavation and foundation construction. Based on the subsurface conditions, we expect that a sheet pile wall system with bracing is suitable for much of the site; soldier piles and lagging are not recommended given the anticipated need for dewatering and the potential for increased disturbance of loose silty soils during dewatering operations. Bracing may consist of external bracing (i.e., tiebacks) or internal bracing (i.e., rakers and heel blocks, corner braces, etc.).

The design of the SOE system should consider the following minimum design parameters and following minimum loading conditions:

- Braced Excavations – Free draining or dewatered walls should be designed using a uniform pressure distribution of 26H psf, where H is the total height of the wall.
- Walls that are not free draining or are not dewatered should also be designed using a uniform pressure of 26H psf, where H is the total height of the wall, plus a triangular hydrostatic pressure of 62.4 psf per foot below the temporary design groundwater table (el 2 ft).
- Lateral pressures from surface loads should assume roadway vehicular loading. Surface surcharges should be added as an inverted triangle having a maximum pressure at the ground surface equal to one-half of the vertical surface load (minimum 300 psf). Lateral surcharge pressure can be reduced to zero at a depth of 15 ft below ground surface.
- Lateral pressures resulting from any adjacent structures (applicable for areas exterior of the building) should be determined using elastic methods and should be added to the above loads.
- Temporary construction loads are not considered herein and must be assessed on a case-by-case basis.

- The SOE system must be designed by a professional engineer, licensed in the State of New York, and is subject to special inspection during construction. SOE systems should not be installed until adequate controls for survey monitoring of the existing and adjacent buildings are in place.

Temporary Construction Dewatering

Temporary construction dewatering will be required for excavations extending below about el 2 ft. In addition, dewatering may be required to address surface water accumulation that may occur during precipitation events or perched water that could occur sporadically in areas that contain higher concentrations of silt or clay.

Conventional sumps and pumps may be suitable for local dewatering operations where necessary draw-down is small. However a more robust dewatering system may be required where excavations extending more than 2 feet below the groundwater table. Such systems may include well points. Regardless the Contractor’s dewatering system should adequate for maintaining a “dry” subgrade during normal operating conditions. Typically to achieve this groundwater must be kept at least 2 feet below subgrade level to allow for proper subgrade preparation.

Any groundwater discharged into NYC sewers will require temporary dewatering permits from the NYCDEP. If implementing any existing outfall sewers, a permit from the NYSDEC will be required. Treatment may be required where the groundwater is found insufficient for meeting water quality standards dictated by the regulatory agencies having jurisdiction. A Long Island well permit may also be required. Permitting from the requisite agencies can often take three to four months.

Subgrade Preparation and Protection

Foundation bearing surfaces should be level and clear of debris, standing or frozen water and other deleterious materials. For soil subgrades, soils should be excavated with care to avoid disturbance below the bearing elevation. We recommend that the final 12 inches of excavation be performed with flat bladed buckets in open areas and by hand in confined areas. The subgrade should be protected from the effects of frost, precipitation, groundwater and surface water run-off and construction until concrete is cast. As such, we recommend that the Contractor limit the area of exposed subgrade to prevent deterioration of the bearing conditions; however, excavations should be made large enough to allow passage of a heavy compactor parallel to the major axis of the excavation line.

Soil subgrades should be proof-rolled using a smooth drum vibratory roller having a static weight of at least 8 tons. Areas inaccessible to the heavy equipment should be compacted using a vibratory trench roller having a static weight of at least 1.5 tons. Vibratory plate or jumping jack compactors should only be used where approved or directed by the inspecting Geotechnical Engineer.

Proof-rolling should consist of making a minimum of ten passes in two perpendicular directions (20 total). The resulting subgrade should be firm and unyielding under the weight of the compactor. Vibratory compaction shall not be performed on soils that are not within 2% of optimum moisture content. Proof-rolling should be discontinued in the event that soils are observed to "pump or heave" due to wet conditions. Areas which cannot be densified by proof-rolling and areas containing appreciable amounts of deleterious debris (i.e. wood, organics, etc.) should be removed as directed by the inspecting Geotechnical Engineer and replaced with structural fill, CLSM, or lean concrete. All proof-rolling must be performed in the presence of the inspecting Geotechnical Engineer.

Following compaction, we recommend all subgrades be capped with free draining gravel, crushed stone, or RCA fill as discussed previsouly herein. This material will help to protect the subgrade from degradation and can also be used to assist in conveyance of water during dewatering activities. A mud slab may also be cast to provide protection and may be required to provide a suitable substrate for waterproofing.

The NYCBC requires that a Professional Engineer licensed in the State of New York inspect and approve foundation subgrades prior to the placement of fill or concrete to verify that the subgrade material is adequate to provide the recommended allowable bearing pressure. We recommend foundation subgrades be inspected by Langan to verify bearing capacity and that foundation bottoms have been adequately prepared.

Fill Materials, Placement, and Compaction

Structural fill placed to establish the finished subgrade beneath foundations and floor slabs, or as backfill behind walls, should consist of a well-graded durable granular material having a maximum particle size of 4 inches in any dimension, and no more than 10 percent fines passing the No. 200 sieve. All fill materials should be free of trash, debris, roots, vegetation, peat, or other deleterious materials and should be approved by the Geotechnical Engineer prior to placement. Lean concrete or controlled low strength material (CLSM) may be substituted for structural fill.

All fill materials should be approved by the Geotechnical Engineer prior to placement.

Where wet subgrades are present below the groundwater table or from surface water runoff, we recommend that initial placement fill consist of free draining gravel or crushed stone in an effort to stabilize the subgrade prior to installation of structural fill soils. Free draining gravel or crushed stone should conform to the requirements of New York State Department of Transportation Item 605.0901, Underdrain Filter Type I or AASHTO No. 57 stone.

Fill should be placed in uniform loose lifts not exceeding 12-inches in thickness in open areas and 6-inches in thickness in confined areas. All fill placed below foundations should be compacted to at least 95% of its maximum dry density as determined by ASTM D1557. Compaction within 5 feet of foundation walls should be performed using hand operated equipment. The water content at the time of compaction should be within 2% of the optimum value determined by ASTM D1557. No fill should be placed on areas where free water is standing or on frozen subsoil areas.

Fill should not be placed on subgrades not inspected and approved by the Geotechnical Engineer.

ADDITIONAL RECOMMENDATIONS

Preconstruction Conditions Documentation

Preconstruction conditions documentation should be conducted for all adjacent structures located within 50 feet of the site as well as adjacent sidewalks, pavement, and utilities. The documentation should be performed within one month prior to commencing any construction activities. The purpose of these observations is to provide photographic and/or video documentation representative of general existing conditions, and to identify obvious visual deficiencies. The preconditions observations should also identify areas requiring specific monitoring during construction. Structural integrity is not addressed in such documentation. This baseline information is often critical in the event of future damage claims resulting from construction activities. The preconstruction conditions documentation should be used to inform an observational and instrumentation monitoring program that can be used to evaluate the performance of adjacent structures and construction procedures.

Monitoring Program

We recommend that a monitoring program be developed and incorporated into the Contract Documents to evaluate performance of adjacent buildings during construction. Monitoring should include means to measure structural and ground movement, fluctuations in the groundwater table (outside the limits of the excavation), and vibrations due to construction activities. The type and locations of specific monitoring equipment, threshold values, and durations should be developed based on review of the anticipated construction means and methods in conjunction with the proximity and type of existing structures and utilities with relation to the site. The purpose of performing monitoring is to provide reasonable feedback to the engineer as to performance of the contractor with respect to protecting existing structures and utilities, and to assess any necessary changes to means and methods of construction.

We recommend that a monitoring plan and project specifications be completed prior to construction and excavation. These would detail the methods and equipment required for monitoring vibration and movement, and would provide limits along with requirements for frequency of readings and reporting. The monitoring program would likely include optical surveying, seismographs (vibration monitoring), groundwater monitoring wells and crack gauges. The monitoring plan should address means and methods for measuring ground and structural deformation, and vibration levels. We recommend that all monitoring be performed by a third-party consultant independent of the contractor; however, the contractor should reserve the right to perform additional monitoring. Monitoring should be performed throughout excavation and foundation construction.

CONSTRUCTION DOCUMENTS

Technical specifications and design drawings should incorporate our recommendations to ensure that subsurface conditions and other geotechnical issues at the site are adequately addressed in the construction documents. Langan can prepare specification sections related to geotechnical issues such as earthwork, excavation support, tie-down anchors, monitoring, and groundwater control. Langan should also review foundation drawings and details, and all contractor submittals and construction procedures related to geotechnical work.

SPECIAL INSPECTIONS

Excavation and foundation work are subject to various Special Inspections as per the requirements outlined in Chapter 17 of the NYCBC and the Rules of the City of New York. Construction activities that require geotechnical quality control inspections generally include:

- Subgrade Inspection – BC 1704.7.1
- Subsurface Conditions –Fill Placement & In-Place Density – BC 1704.7.2 & BC 1704.7.3
- Deep Foundation Elements – BC 1704.8
- Excavations – Sheeting, Shoring, and Bracing - BC 1704.20.2 & 3304.4.1

This work must be performed under the inspection of a qualified Geotechnical Engineer and should be performed by Langan. The inspecting engineer should be familiar with the subsurface conditions, as well as the proposed and existing construction onsite. We recommend that all inspectors meet the requisite qualifications outlined in 1RCNY 101-06. In addition, while not required by the NYCBC, we recommend that regular inspections of waterproofing be made to mitigate the potential for leaks resulting from damaged or improperly installed materials.

LIMITATIONS

The conclusions and recommendations provided in this report are based on subsurface conditions inferred from a limited number of borings and in situ testing performed within and around the development parcel, and information provided by others.

This report has been prepared to assist the owner, architect, and structural engineer in the design process and is only applicable to the envisioned project discussed herein. Any proposed changes in structures or their locations should be brought to our attention so that we can determine whether such changes affect our recommendations. Langan cannot assume responsibility for use of this report for any areas beyond the limits of this study or for any projects not specifically discussed herein. This report shall not be used for the design of temporary works including scaffolding, construction hoists, and crane pads.

Information on subsurface strata and groundwater levels shown on the logs represents conditions encountered only at the locations indicated and at the time of investigation. If different conditions are encountered during construction, they should immediately be brought to our attention for evaluation as this may affect our recommendations.

Environmental issues (such as potentially contaminated soil and groundwater) are outside the scope of this study.

FIGURES

SOURCE: "JERSEY CITY QUADRANGLE, NEW YORK–NEW JERSEY 7.5–MINUTE SERIES", U.S. GEOLOGICAL SURVEY, 2019.

NOTE: ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).

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SCALE: 1 INCH = 2000 FEET

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Project

145 WOLCOTT STREET

BLOCK No. 574, LOT No.1
RED HOOK
BROOKLYN NEW YORK

Figure Title

SITE LOCATION PLAN

Project No.
170562201

Date
8/10/2020

Drawn By
AMH

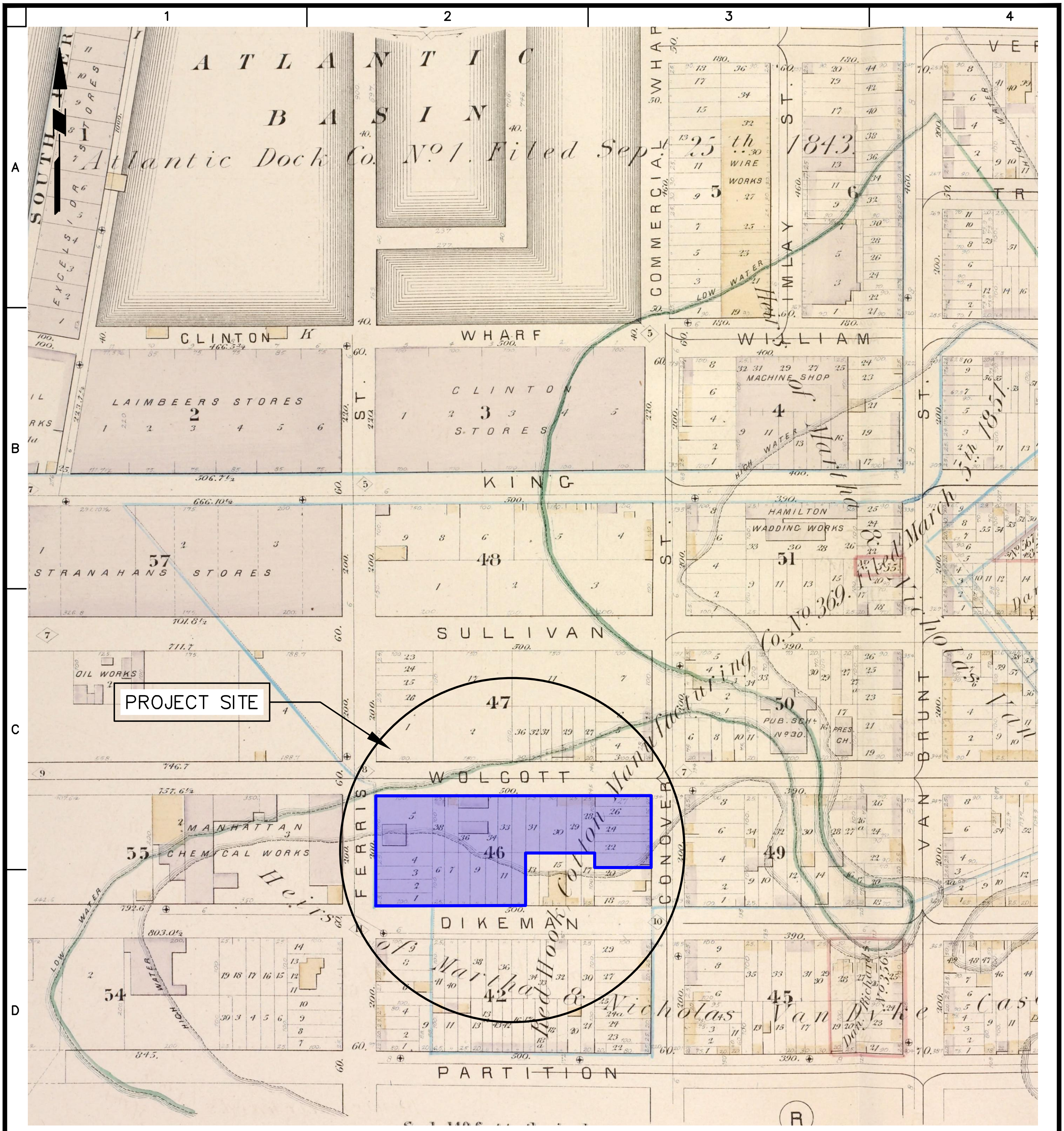
Checked By
AJC

Figure No.

1

Sheet 1 of 4

Filename: C:\Users\aherrera\Desktop\145 Wolcott\01\SheetFiles\Figures\FG01-170562201-BL101-0101.dwg Date: 8/20/2020 Time: 06:41 User: aherrera Style Table: Langan.stb Layout: 170562201_Figure 1 - Site Location Map



SOURCE: PORTION OF ATLAS OF THE BOROUGH OF BROOKLYN CITY OF NEW YORK BY E. BELCHERHYDE, 1857

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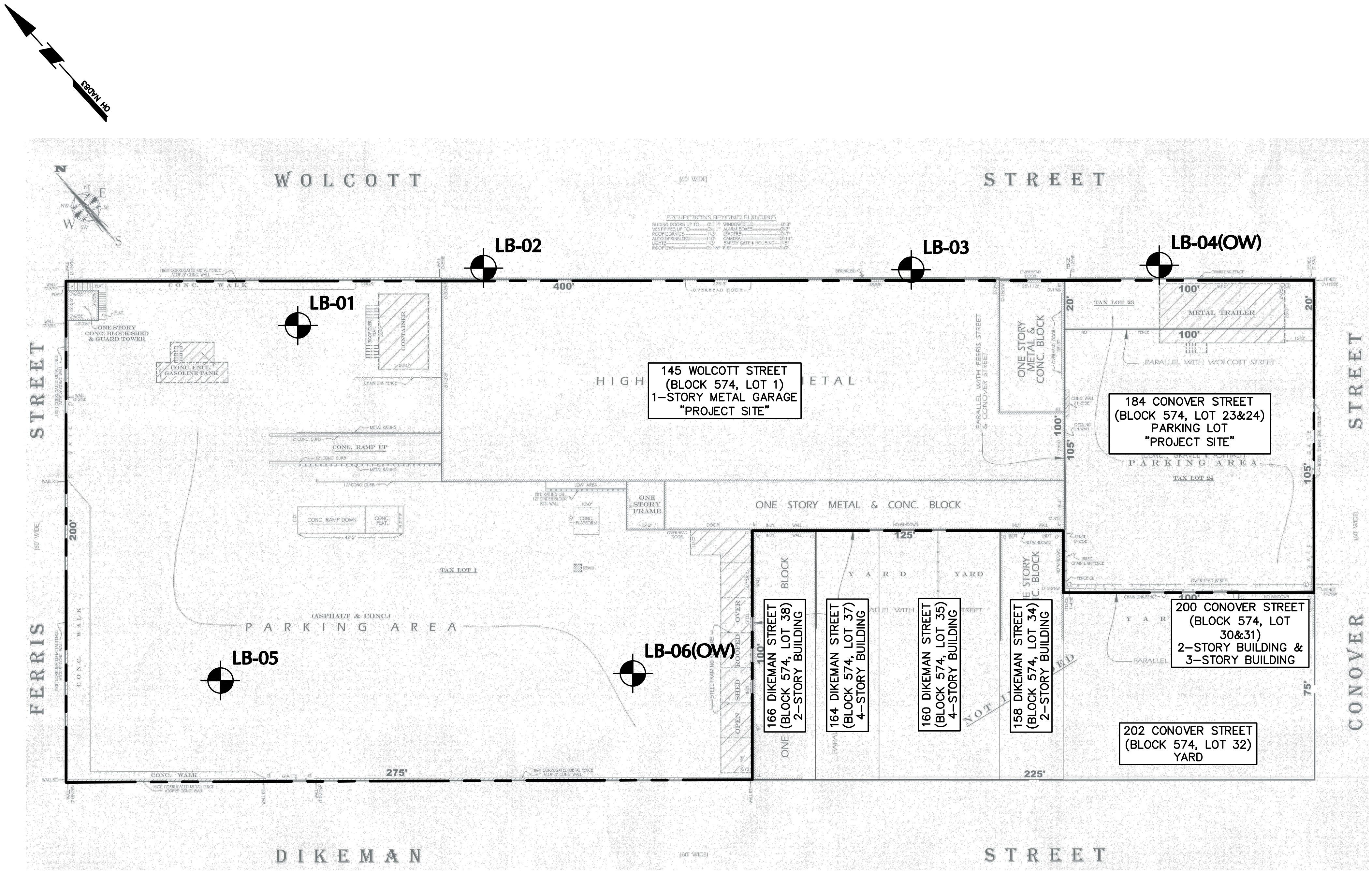
Project	**145 WOLCOTT STREET** BLOCK No. 574, LOT No.1 RED HOOK BROOKLYN NEW YORK
Figure Title	**HISTORIC MAP**
Project No.	170562201
Date	8/10/2020
Drawn By	AMH
Checked By	AJC
Figure No.	2
Sheet	2 of 4

Filename: C:\Users\aherrera\Desktop\145 Wolcott\01\SheetFiles\Figures\FG01-170562201-BL101-0101.dwg Date: 8/20/2020 Time: 06:41 User: aherrera Style Table: Langan.stb Layout: 170562201_Figure 2 - Historic Map



GENERAL NOTES:

1. BASE PLAN TAKEN FROM "SURVEY", PREPARED BY BORO SURVEYING, P.C., DATED 3 APRIL 2015.
2. ALL LANGAN BORING LOCATIONS WERE LAID OUT BY LANGAN REPRESENTATIVES BY MEASURING FROM EXISTING SITE FEATURES. ALL LOCATIONS SHOULD BE CONSIDERED APPROXIMATE.
3. ALL LANGAN GEOTECHNICAL BORINGS WERE DRILLED UNDER THE FULL-TIME OBSERVATION OF A LANGAN REPRESENTATIVE. DRILLING WAS PERFORMED BY CRAIG GEOTECHNICAL DRILLING CO., INC, NEW JERSEY BETWEEN 27 JULY AND 3 AUGUST 2020. ALL DRILLING WAS PERFORMED USING ROTARY DRILLING TECHNIQUES.
4. DISTURBED SOIL SAMPLES WERE OBTAINED USING A STANDARD 2-INCH-DIAMETER SPLIT-SPOON SAMPLER ADVANCED BY A 140-POUND HAMMER FREE-FALLING FROM A HEIGHT OF 30 INCHES.

LEGEND:

⊕ LB-#	GEOTECHNICAL BORING LOCATION
(OW)	OBSERVATION WELL
— — — —	PROPERTY LINE

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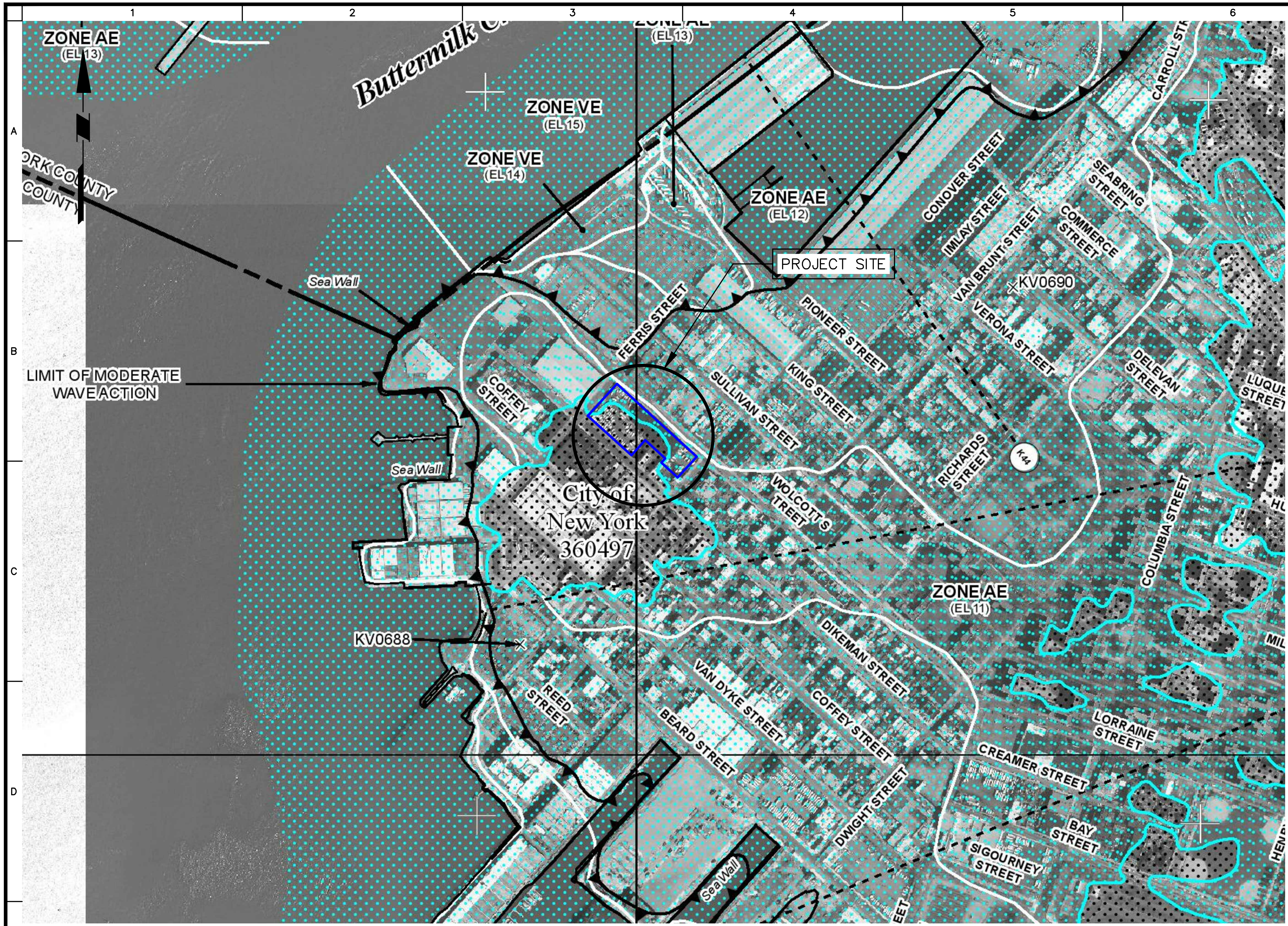
Figure Title
SUBSURFACE INVESTIGATION PLAN

Project No. 170562201
Date 08/06/2020
Drawn By AMH
Checked By AJC

Figure No.
3
Sheet 3 of 4

Filename: C:\Users\aherrera\Desktop\145 Wolcott\01\SheetFiles\Figures\FG01-170562201-BL101-0101.dwg Date: 8/20/2020 Time: 06:40 User: aherrera Style Table: Langan.stb Layout: 170562201_Figure 4 - Subsurface Investigation Plan



LEGEND

▨	SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

▨	FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

▨ **ZONE X**	OTHER FLOOD AREAS Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
☐	OTHER AREAS
ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.
▧	COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS
▧	OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

───	1% annual chance floodplain boundary
───	0.2% annual chance floodplain boundary
— — —	Floodway boundary
— —— —— —	Zone D boundary
•••••••••••••	CBRS and OPA boundary
▬	Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
▲──▲──▲	Limit of Moderate Wave Action
〰 513 〰	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

Ⓐ──Ⓐ	Cross section line
㉓- - -㉓	Transect line
— — —	Culvert, Flume, Penstock or Aqueduct
	Road or Railroad Bridge
	Footbridge
87° 07'45'', 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
$^{24}76^{000m}$N	1000-meter Universal Transverse Mercator grid values, zone 18
600000 FT	5000-foot grid values: New York State Plane coordinate system, Long Island zone (FIPSZONE 3104), Lambert Conformal Conic projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
● M1.5	River Mile

SOURCE: FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) FLOOD INSURANCE RATE MAP (FIRM), CITY OF NEW YORK, PANELS 192 OF 457 [3604970192G], MAP REVISED, PRELIMINARY, 5 DECEMBER, 2013

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Project
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BROOKLYN **NEW YORK**

Figure Title
PRELIMINARY FEMA FLOOD HAZARD MAP

Project No. 170562201	Figure No. 4
Date 8/10/2020	
Drawn By AMH	
Checked By AJC	Sheet 4 of 4

APPENDICES

APPENDIX A

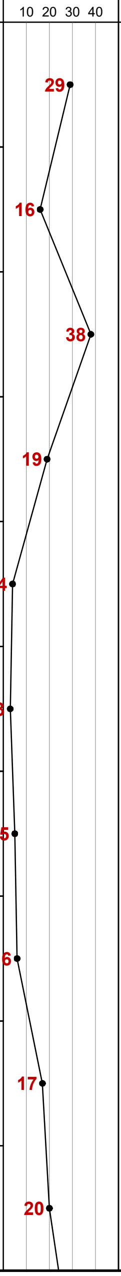
GEOTECHNICAL BORING LOGS

LANGAN

Log of Boring **LB-01** Sheet 1 of 3

Project 145 Wolcott Street		Project No. 170562201	
Location Brooklyn, NY		Elevation and Datum 10.4 ± (NAVD88)	
Drilling Company Craig Geotechnical Drilling		Date Started 8/3/20	Date Finished 8/3/20
Drilling Equipment CME55		Completion Depth 62 ft	Rock Depth -
Size and Type of Bit 3-7/8in Tricone Roller Bit		Number of Samples: Disturbed 19; Undisturbed -; Core -	
Casing Diameter (in) 4in Flush Joint Steel	Casing Depth (ft) 25	Water Level (ft.): First ▽ -; Completion ▼ -; 24 HR. ▼ -	
Casing Hammer Automatic; Weight (lbs) 140; Drop (in) 30		Drilling Foreman Nick Beehler	
Sampler 2in-diameter Split Spoon			
Sampler Hammer Automatic; Weight (lbs) 140; Drop (in) 30		Field Engineer Andrea Herrera	

Elev. (ft)	Sample Description	PID Reading (ppm)	Casng blws/ ft	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
+10.4 +10.2	2-in Asphalt Pavement Black coarse to fine SAND, some Silt, trace Clay (dry) [FILL] (Class 7)	0.2		0	S-1	SS	24	16 14 15 12	29	8/3/2020 Drill through 2-inch-thick asphalt Take S-1 from 0ft to 2ft
	Dark gray coarse to fine SAND, some Silt, trace Clay (dry) [FILL] (Class 7)	5.2	453	2	S-2	SS	24	7 8 8 12	16	Take S-2 from 2ft to 4ft Petroleum odor Drive casing to 5ft Drill to 4ft, smooth drilling, dark gray wash
	Dark gray coarse to fine SAND, some Silt, trace Clay (dry) [FILL] (Class 7)	8.2		4	S-3	SS	14	14 15 23 12	38	Take S-3 from 4ft to 6ft Petroleum odor
	Dark brown medium to fine SAND, some Silt, trace Clay (dry) [FILL] (Class 7)	117.6	Push	6	S-4	SS	13	8 11 8 6	19	Take S-4 from 6ft to 8ft Petroleum odor Drill to 8ft, smooth drilling, gray wash
	Dark brown medium to fine SAND, some Silt, trace Clay (wet) [FILL] (Class 7)	107.7		8	S-5	SS	8	2 2 2 2	4	Take S-5 from 8ft to 10ft Petroleum odor Push casing to 10ft
	Dark brown medium to fine SAND, some Silt, trace Clay (wet) [FILL] (Class 7)	90.5		10	S-6	SS	14	1 2 1 2	3	Take S-6 from 10ft to 12ft Petroleum odor Drill to 12ft, smooth drilling, brown wash
	Dark brown medium to fine SAND, some Silt, trace Clay, trace fine Gravel (wet) [FILL] (Class 7)	219.2	Push	12	S-7	SS	13	2 2 3 5	5	Take S-7 from 12ft to 14ft Petroleum odor Push casing to 15ft
-3.6	Dark brown Silty CLAY (wet) [CL] (Class 6)	2.4		14	S-8	SS	21	3 3 3 5	6	Take S-8 from 14ft to 16ft Drill to 16ft, smooth drilling, brown wash
	Dark brown Silty CLAY (wet) [CL] (Class 4b)	1.4		16	S-9A	SS	20	5 8 9 10	17	Take S-9 from 16ft to 18ft S-9: mc=28% LL=28, PL=21 ,PI=7
-7.0	Dark brown medium to fine SAND, some Silt, trace Clay (wet) [SM] (Class 3b)		123		S-9B					
	Dark brown coarse to fine SAND, some Silt, trace Clay (wet) [SM] (Class 3b)	0.8		18	S-10	SS	9	8 12 8 10	20	Take S-10 from 18ft to 20ft S-10: -#200=25% -#4=91% Pockets of clay
				20						



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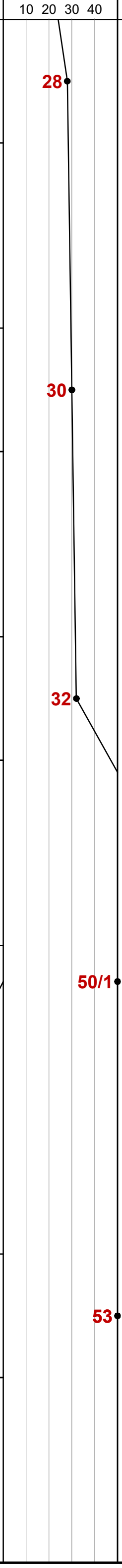
Log of Boring **LB-01** Sheet 2 of 3

Project	Project No.
145 Wolcott Street	170562201
Location	**Elevation and Datum**
Brooklyn, NY	10.4 ± (NAVD88)

Elev. (ft)	Sample Description	PID Reading (ppm)	Casng blws/ ft	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
-9.6	Dark brown medium to fine SAND, some Silt, trace Clay (wet) [SM] (Class 3b)	0.0		20	S-11	SS	14	9 9 19 21	28	Drill to 20ft, smooth drilling, brown wash Take S-11 from 20ft to 22ft Drill to 25ft, smooth drilling, brown wash
			224	22						
	No Recovery	0.0		25	S-12	SS	0	14 12 18 12	30	Take S-12 from 25ft to 27ft Drill to 30ft, smooth drilling, brown wash
	Dark brown medium to fine SAND, trace Silt (wet) [SP-SM] (Class 3a)	0.0		30	S-13	SS	7	12 14 18 12	32	Take S-13 from 30ft to 32ft S-13: -#200=8.1% Drill to 35ft, smooth drilling, brown wash
	Dark brown coarse to fine SAND, some Silt, some fine Gravel (wet) [SM] (Class 3a)	0.0		35	S-14	SS	7	28 50/1	50/1	Take S-14 from 35ft to 37ft Refusal encountered at 35.5ft, spoon bouncing Drive casing 25ft Drill to 40ft, smooth drilling, brown wash
	Brown medium to fine SAND, trace Silt (wet) [SP-SM] (Class 3a)	0.0		40	S-15	SS	14	21 22 31 35	53	Take S-15 from 40ft to 42ft S-15: -#200=12.5% Drill to 45ft, smooth drilling, brown wash
				45						



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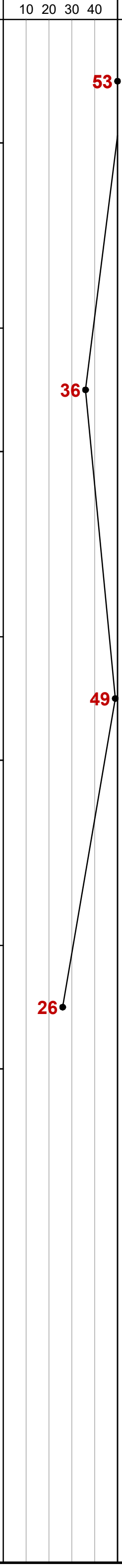
Log of Boring **LB-01** Sheet 3 of 3

Project 145 Wolcott Street	Project No. 170562201
Location Brooklyn, NY	Elevation and Datum 10.4 ± (NAVD88)

Elev. (ft)	Sample Description	PID Reading (ppm)	Casng blws/ ft	Depth Scale	Sample Data: Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
-34.6	Brown fine SAND, trace Silt (wet) [SP-SM] (Class 3a)	0.0		45	S-16	SS	12	22 21 32 37	53	Take S-16 from 45ft to 47ft Drill to 50ft, smooth drilling, brown wash
	Brown Silty fine SAND (wet) [SM] (Class 3a)	0.0		50	S-17	SS	16	12 15 21 19	36	Take S-17 from 50ft to 52ft Drill to 55ft, smooth drilling, brown wash
	Brown Silty fine SAND (wet) [SM] (Class 3a)	0.0		55	S-18	SS	20	22 24 25 21	49	Take S-18 from 55ft to 57ft Drill to 60ft, smooth drilling, brown wash
	Brown Silty fine SAND (wet) [SM] (Class 3b)	0.0		60	S-19	SS	15	12 13 13 12	26	Take S-19 from 60ft to 62ft
-51.6	End of boring at 62ft			62						Bottom of boring at 62 feet below ground surface Extract casing Grout to existing grade



Log of Boring **LB-02** Sheet 1 of 5

Project	145 Wolcott Street	Project No.	170562201
Location	Brooklyn, NY	Elevation and Datum	10.4 ± (NAVD88)
Drilling Company	Craig Geotechnical Drilling	Date Started	7/29/20
		Date Finished	7/29/20
Drilling Equipment	CME55	Completion Depth	102 ft
		Rock Depth	-
Size and Type of Bit	3-7/8in Tricone Roller Bit	Number of Samples	Disturbed 27; Undisturbed -; Core -
Casing Diameter (in)	4in Flush Joint Steel	Casing Depth (ft)	20
Water Level (ft.)	First ▽ -	Completion ▼ -	24 HR. ▼ -
Casing Hammer	Automatic	Weight (lbs) 140	Drop (in) 30
Sampler	2in-diameter Split Spoon	Drilling Foreman	Nick Beehler
Sampler Hammer	Automatic	Weight (lbs) 140	Drop (in) 30
Field Engineer	Andrea Herrera		

Elev. (ft)	Sample Description	PID Reading (ppm)	Casng blws/ ft	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
+10.4 +10.2	3-in Concrete Pavement			0						
	Light brown Silty fine SAND, trace Clay (dry) [FILL] (Class 7)	0.0		0–2	S-1	SS	24	2 2 3 3	5	7/29/2020 Drill through 3-inch-thick concrete Take S-1 from 0ft to 2ft
	Light brown Silty fine SAND, trace Clay (dry) [FILL] (Class 7)	0.0	Spin	2–4	S-2	SS	13	4 3 2 3	5	Take S-2 from 2ft to 4ft Spin casing to 5ft Drill to 4ft, smooth drilling, brown wash
	Light brown Silty fine SAND, trace Clay (dry) [FILL] (Class 7)	0.0		4–6	S-3	SS	12	4 3 3 4	6	Take S-3 from 4ft to 6ft
	Light brown Silty fine SAND, trace Clay (dry) [FILL] (Class 7)	0.0		6–8	S-4	SS	10	4 3 1 1	4	Take S-4 from 6ft to 8ft Sulfur and petroleum odor Drill to 8ft, smooth drilling, brown wash
	Light brown Silty fine SAND, trace Clay (dry) [FILL] (Class 7)	1.8		8–9	S-5A	SS	15	WOR WOR		Take S-5 from 8ft to 10ft Sulfur and petroleum odor
	Gray Silty fine SAND, trace Clay (dry) [FILL] (Class 7)			9–10	S-5B			WOR WOR		
	Dark brown Silty fine SAND (wet) [FILL] (Class 7)	2.3		10–12	S-6	SS	15	11 13 12 11	25	Take S-6 from 10ft to 12ft Pockets of clay Drill to 15ft, smooth drilling, brown wash
			Push	12–15						
-4.6	Brown Silty SAND (wet) [SM] (Class 3b)	0.0		15–17	S-7	SS	15	3 6 6 9	12	Take S-7 from 15ft to 17ft S-7: -#200=37.1%
	Brown Silty SAND (wet) [SM] (Class 3b)	0.0	47	17–19	S-8	SS	18	9 7 5 6	12	Take S-8 from 17ft to 19ft Pockets of clay Drill to 19ft, smooth drilling, brown wash
-8.6	Brown CLAY (wet) [CL] (Class 4b)	0.0		19–20	S-9	SS	21	2 4	10	Take S-9 from 19ft to 21ft S-9: mc=27% LL=30, PL=21 ,PI=9

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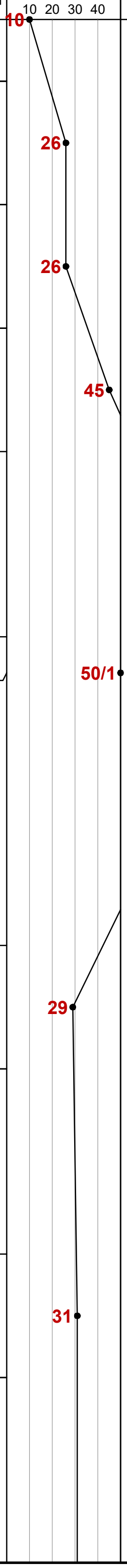
Log of Boring **LB-02** Sheet 2 of 5

Project 145 Wolcott Street	Project No. 170562201
Location Brooklyn, NY	Elevation and Datum 10.4 ± (NAVD88)

Elev. (ft)	Sample Description	PID Reading (ppm)	Casng blws/ ft	Depth Scale	Sample Data Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
-9.6				20	S-9	SS	21	6 8	10	
	No Recovery	0.0		21	S-10	SS	0	11 13 13 16	26	Take S-10 from 21ft to 23ft Drill to 23ft, smooth drilling, brown wash
	Brown CLAY (wet) [CL] (Class 4b)	0.0		23	S-11	SS	21	8 11 15 15	26	Take S-11 from 23ft to 25ft
	Brown CLAY (wet) [CL] (Class 4a)	0.0		25	S-12A S-12B	SS	24	11 20 25 44	45	Take S-12 from 25ft to 27ft S-12: mc=29% LL=26, PL=18 ,PI=8 Push casing to 15ft Drive casing to 20ft Drill to 30ft, smooth drilling, brown wash
-15.9	Dark brown to gray coarse to fine Silty SAND, trace fine Gravel (wet) [SM] (Class 3a)			26						
	Dark brown to gray coarse to fine Silty SAND, some fine Gravel (wet) [SM] (Class 3a)	0.0		30	S-13	SS	8	11 50/1	50/1	Take S-13 from 30ft to 32ft Refusal encountered at 30.5ft, spoon bouncing Switch to core barrel Recovered 8-inch cobble Drill to 35ft, smooth drilling, brown wash
	Brown medium to fine SAND, some Silt (wet) [SM] (Class 3b)	0.0		35	S-14	SS	13	9 14 15 15	29	Take S-14 from 35ft to 37ft S-14: -#200=14.9% Drill to 40ft, smooth drilling, brown wash
	Brown medium to fine SAND, some Silt (wet) [SM] (Class 3a)	0.0		40	S-15	SS	15	14 15 16 17	31	Take S-15 from 40ft to 42ft Drill to 45ft, smooth drilling, brown wash
				45						



Project 145 Wolcott Street	Project No. 170562201
Location Brooklyn, NY	Elevation and Datum 10.4 ± (NAVD88)

Elev. (ft)	Sample Description	PID Reading (ppm)	Casng blws/ ft	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
-34.6	Brown medium to fine SAND, some Silt (wet) [SM] (Class 3a)	0.0		45	S-16	SS	20	13 16 15 21	31	Take S-16 from 45ft to 47ft Drill to 50ft, smooth drilling, brown wash
	Brown medium to fine SAND, some Silt (wet) [SM] (Class 3a)	0.0		50	S-17	SS	15	15 22 28 30	50	Take S-17 from 50ft to 52ft Drill to 55ft, smooth drilling, brown wash
	Brown medium to fine SAND, some Silt (wet) [SM] (Class 3a)	0.0		55	S-18	SS	24	20 28 33 37	61	Take S-18 from 55ft to 57ft Drill to 60ft, smooth drilling, brown wash
	Brown fine SAND, some Silt (wet) [SM] (Class 3a)	0.0		60	S-19	SS	17	15 21 25 30	46	Take S-19 from 60ft to 62ft Drill to 65ft, smooth drilling, brown wash
	Brown fine SAND, some Silt (wet) [SM] (Class 3a)	0.0		65	S-20	SS	19	19 27 31 38	58	Take S-20 from 65ft to 67ft Drill to 70ft, smooth drilling, brown wash
				70						

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Log of Boring **LB-02** Sheet 4 of 5

Project	Project No.
145 Wolcott Street	170562201
Location	**Elevation and Datum**
Brooklyn, NY	10.4 ± (NAVD88)

Elev. (ft): -59.6

Depth Scale	Sample Description	PID Reading (ppm)	Casng blws/ ft	Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
70	Brown fine SAND, some Silt (wet) [SM] (Class 3a)	0.0		S-21	SS	18	19 29 40 40	69	Take S-21 from 70ft to 72ft Drill to 75ft, smooth drilling, brown wash
75	Brown fine SAND, some Silt (wet) [SM] (Class 3a)	0.0		S-22	SS	20	22 32 46 38	78	Take S-22 from 75ft to 77ft Drill to 80ft, smooth drilling, brown wash
80	Brown fine SAND, some Silt (wet) [SM] (Class 3a)	0.0		S-23	SS	22	24 34 40 41	74	Take S-23 from 80ft to 82ft Drill to 85ft, smooth drilling, brown wash
85	Brown fine SAND, some Silt, trace Clay, trace fine Gravel (wet) [SM] (Class 3a)	0.0		S-24	SS	18	26 37 40 31	77	Take S-24 from 85ft to 87ft Drill to 90ft, smooth drilling, brown wash
90	Reddish brown SAND, some Silt (wet) [SM] (Class 3a)	1.7		S-25	SS	18	27 33 40 40	73	Take S-25 from 90ft to 92ft Drill to 95ft, smooth drilling, brown wash
95									

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Log of Boring **LB-02** Sheet 5 of 5

Project 145 Wolcott Street	Project No. 170562201
Location Brooklyn, NY	Elevation and Datum 10.4 ± (NAVD88)

MATERIAL SYMBOL	Elev. (ft)	Sample Description	PID Reading (ppm)	Casng blws/ ft	Depth Scale	Sample Data Number	Sample Data Type	Sample Data Recov. (in)	Sample Data Penetr. resist BL/6in	N-Value (Blows/ft) 10 20 30 40	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	-84.6	Reddish brown Silty SAND (wet) [SM] (Class 3a)	0.0		95	S-26	SS	24	22 37 40 40	77	Take S-26 from 95ft to 97ft Drill to 100ft, smooth drilling, brown wash
					96						
					97						
					98						
					99						
		Reddish brown Silty SAND (wet) [SM] (Class 3a)	0.0		100	S-27	SS	18	18 28 37 30	65	Take S-27 from 100ft to 102ft
					101						
	-91.6	End of boring at 102ft			102						Bottom of boring at 102ft below ground surface Extract casing Grout to existing grade
					103						
					104						
					105						
					106						
					107						
					108						
					109						
					110						
					111						
					112						
					113						
					114						
					115						
					116						
					117						
					118						
					119						
					120						

Log of Boring **LB-03** Sheet 1 of 5

Project: 145 Wolcott Street
Project No.: 170562201
Location: Brooklyn, NY
Elevation and Datum: 9.8 ± (NAVD88)
Drilling Company: Craig Geotechnical Drilling
Date Started: 7/28/20
Date Finished: 7/28/20
Drilling Equipment: CME55
Completion Depth: 102 ft
Rock Depth: -
Size and Type of Bit: 3-7/8in Tricone Roller Bit
Number of Samples: Disturbed 26; Undisturbed -; Core -
Casing Diameter (in): 4in Flush Joint Steel
Casing Depth (ft): 20
Water Level (ft.): First ▽ -; Completion ▼ -; 24 HR. ▼ -
Casing Hammer: Automatic; Weight (lbs): 140; Drop (in): 30
Drilling Foreman: Nick Beehler
Sampler: 2in-diameter Split Spoon
Sampler Hammer: Automatic; Weight (lbs): 140; Drop (in): 30
Field Engineer: Andrea Herrera

Elev. (ft)	Sample Description	PID Reading (ppm)	Casng blws/ ft	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
+9.8 +9.6	3-in Concrete Pavement Brown SILT, trace fine Sand (dry) [FILL] (Class 7)	0.00		0	S-1	SS	14	5 5 3 3	8	7/28/2020 Drill through 3-inch concrete pavement Take S-1 from 0ft to 2ft
	Brown Silty SAND, trace Clay (dry) [FILL] (Class 7)	0.00	43	2	S-2	SS	12	3 4 4 3	8	Take S-2 from 2ft to 4ft Drill to 4ft, smooth drilling, dark gray wash
	Brown SAND, some Silt (dry) [FILL] (Class 7)	0.00		4	S-3	SS	8	2 4 4 3	8	Take S-3 from 4ft to 6ft Drive casing to 5ft
	Brown medium to fine SAND, some Silt, trace fine Gravel (dry) [FILL] (Class 7)	0.00	Push	6	S-4	SS	12	4 3 1 1	4	Take S-4 from 6ft to 8ft S-4: -#4=88.2% -#200=25.7% Drill to 8ft, smooth drilling, dark gray wash
	Dark gray Silty fine SAND (wet) [FILL] (Class 7)	27.0		8	S-5	SS	18	1 2 1 1	3	Tak S-5 from 8ft to 10ft Sulfur and petroleum odor
	No Recovery			10	S-6	SS	0	1 2 3 2	5	Take S-6 from 10ft to 12ft Sulfur and petroleum odor Push casing to 10ft Drill to 12ft, smooth drilling, dark gray wash
	Dark gray Silty fine SAND (wet) [FILL] (Class 7)	33.6	Push	12	S-7	SS	17	4 4 9 14	13	Take S-7 from 12ft to 14ft Sulfur and petroleum odor Drill to 15ft, smooth drilling, dark gray wash
-4.2				14						
	Dark brown Silty fine SAND, trace Clay (wet) [SM] (Class 3b)	0.2		15	S-8	SS	14	6 8 9 13	17	Take S-8 from 15ft to 17ft Push casing to 15ft Drive casing to 20ft Drill to 20ft, smooth drilling, dark gray wash
			34	17						
-10.2				20						

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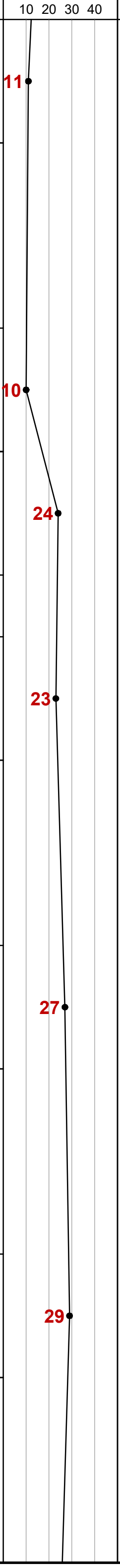
Log of Boring **LB-03** Sheet 2 of 5

Project	Project No.
145 Wolcott Street	170562201
Location	**Elevation and Datum**
Brooklyn, NY	9.8 ± (NAVD88)

Elev. (ft)	Sample Description	PID Reading (ppm)	Casng blws/ ft	Depth Scale	Sample Data Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
-10.2	Brown Sandy SILT, trace Clay (wet) [ML] (Class 5b)	0.2		20–22	S-9	SS	12	2 2 9 3	11	Take S-9 from 20ft to 22ft S-9: -#200=62.0% Change drilling fluid Drill to 25ft, smooth drilling, gray wash
	Brown Sandy SILT, trace Clay (wet) [ML] (Class 5b)	0.2		25–27	S-10	SS	21	3 4 6 5	10	Take S-10 from 25ft to 27ft S-10: -#200=63.2%
-17.2	Brown Silty SAND, some Clay (wet) [SM] (Class 3b)	0.0		27–28.5	S-11A	SS	24	9 12 12 13	24	Take S-11 from 27ft to 29ft Drill to 30ft, smooth drilling, gray wash
	Brown medium to fine SAND, some Silt, trace Clay (wet) [SM] (Class 3b)			28.5–29	S-11B					
	Brown medium to fine SAND, some Silt, trace Clay (wet) [SM] (Class 3b)	0.0		30–32	S-12	SS	14	9 11 12 17	23	Take S-12 from 30ft to 32ft Drill to 35ft, smoo th drilling, gray wash
	Brown fine SAND, some Silt (wet) [SM] (Class 3b)	0.0		35–37	S-13	SS	15	11 13 14 14	27	Take S-13 from 35ft to 37ft Drill to 40ft, smooth drilling, gray wash
	Brown fine SAND, some Silt (wet) [SM] (Class 3b)	0.1		40–42	S-14	SS	21	9 12 17 13	29	Take S-14 from 40ft to 42ft Drill to 45ft, smooth drilling, gray wash



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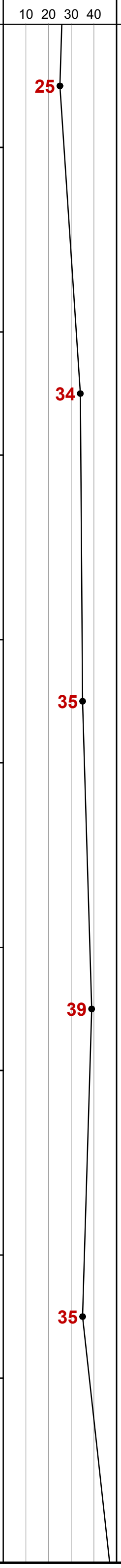
Log of Boring **LB-03** Sheet 3 of 5

Project	Project No.
145 Wolcott Street	170562201
Location	**Elevation and Datum**
Brooklyn, NY	9.8 ± (NAVD88)

Elev. (ft)	Sample Description	PID Reading (ppm)	Casng blws/ ft	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
-35.2	Brown fine SAND, some Silt (wet) [SM] (Class 3b)	0.1		45	S-15	SS	22	9 11 14 13	25	Take S-15 from 45ft to 47ft Drill to 50ft, smooth drilling, gray wash
	Brown Silty fine SAND (wet) [SM] (Class 3a)	0.0		50	S-16	SS	22	11 16 18 17	34	Take S-16 from 50ft to 52ft Drill to 55ft, smooth drilling, brown wash
	Brown Silty fine SAND (wet) [SM] (Class 3a)	0.0		55	S-17	SS	22	18 16 19 17	35	Take S-17 from 55ft to 57ft Drill to 60ft, smooth drilling, brown wash
	Brown Silty fine SAND (wet) [SM] (Class 3a)	0.1		60	S-18	SS	23	16 16 23 20	39	Take S-18 from 60ft to 62ft Drill to 65ft, smooth drilling, brown wash
	Brown Silty fine SAND (wet) [SM] (Class 3a)	0.0		65	S-19	SS	23	12 21 14 26	35	Take S-19 from 65ft to 67ft Drill to 70ft, smooth drilling, brown wash
				70						



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Log of Boring **LB-03** Sheet 4 of 5

Project	Project No.
145 Wolcott Street	170562201
Location	**Elevation and Datum**
Brooklyn, NY	9.8 ± (NAVD88)

MATERIAL SYMBOL	Elev. (ft)	Sample Description	PID Reading (ppm)	Casng blws/ ft	Depth Scale	Sample Data Number	Sample Data Type	Sample Data Recov. (in)	Sample Data Penetr. resist BL/6in	Sample Data N-Value (Blows/ft) 10 20 30 40	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	-60.2	Brown Silty fine SAND (wet) [SM] (Class 3a)	0.0		70	S-20	SS	22	20 24 26 20	50	Take S-20 from 70ft to 72ft Drill to 75ft, smooth drilling, brown wash
		Brown Silty fine SAND (wet) [SM] (Class 3a)	0.0		75	S-21	SS	24	16 17 19 21	36	Take S-21 from 75ft to 77ft Drill to 80ft, smooth drilling, brown wash
		Brown Silty fine SAND, trace Clay (wet) [SM] (Class 3a)	0.0		80	S-22	SS	20	22 29 30 30	59	Take S-22 from 80ft to 82ft Drill to 85ft, smooth drilling, brown wash
		Brown Silty fine SAND, trace Clay (wet) [SM] (Class 3a)	0.0		85	S-23	SS	24	23 28 32 30	60	Take S-23 from 85ft to 87ft Drill to 90ft, smooth drilling, brown wash
		Brown Silty fine SAND (wet) [SM] (Class 3a)	0.2		90	S-24	SS	22	16 25 31 32	56	Take S-24 from 90ft to 92ft Drill to 95ft, smooth drilling, brown wash
					95						

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Log of Boring **LB-03** Sheet 5 of 5

Project	Project No.
145 Wolcott Street	170562201
Location	**Elevation and Datum**
Brooklyn, NY	9.8 ± (NAVD88)

MATERIAL SYMBOL	Elev. (ft)	Sample Description	PID Reading (ppm)	Casng blws/ ft	Depth Scale	Sample Data Number	Sample Data Type	Sample Data Recov. (in)	Sample Data Penetr. resist BL/6in	Sample Data N-Value (Blows/ft) 10 20 30 40	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	-85.2	Brown Silty fine SAND (wet) [SM] (Class 3a)	0.0		95	S-25	SS	22	22 28 29 27	57	Take S-25 from 95ft to 97ft Drill to 100ft, smooth drilling, brown wash
					96						
					97						
					98						
					99						
		Brown Silty fine SAND, trace Clay (wet) [SM] (Class 3a)	0.0		100	S-26	SS	22	24 27 39 31	66	Take S-26 from 100ft to 102ft
					101						
	-92.2	End of boring at 102ft			102						Bottom of boring at 102ft Extract casing Grout to exisiting grade
					103						
					104						
					105						
					106						
					107						
					108						
					109						
					110						
					111						
					112						
					113						
					114						
					115						
					116						
					117						
					118						
					119						
					120						

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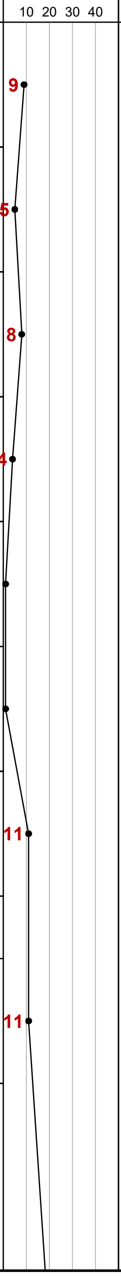
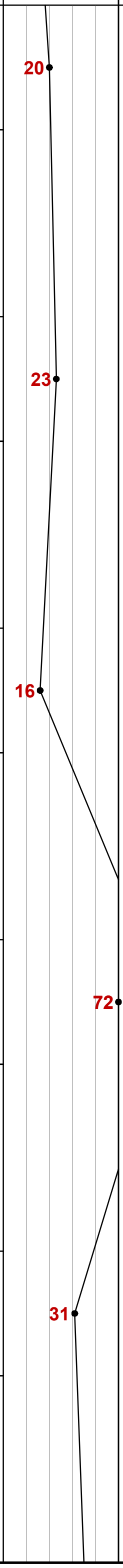
Log of Boring **LB-04(OW)** Sheet 1 of 3

Project 145 Wolcott Street		Project No. 170562201	
Location Brooklyn, NY		Elevation and Datum 8.8 ± (NAVD88)	
Drilling Company Craig Geotechnical Drilling		Date Started 7/27/20	Date Finished 7/27/20
Drilling Equipment CME55		Completion Depth 62 ft	Rock Depth -
Size and Type of Bit 3-7/8in Tricone Roller Bit		Number of Samples: Disturbed 17; Undisturbed -; Core -	
Casing Diameter (in) 4in Flush Joint Steel	Casing Depth (ft) 20	Water Level (ft.): First ▽ -; Completion ▼ -; 24 HR. ▼ -	
Casing Hammer Automatic; Weight (lbs) 140; Drop (in) 30		Drilling Foreman Nick Beehler	
Sampler 2in-diameter Split Spoon		Field Engineer Andrea Herrera	
Sampler Hammer Automatic; Weight (lbs) 140; Drop (in) 30			

Depth Scale	Elev. (ft)	Sample Description	PID Reading (ppm)	Casng blws/ ft	Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
0	+8.8 +8.6	3-in Concrete Pavement Brown Silty fine SAND (dry) [FILL] (Class 7)	0.0	Spin	S-1	SS	12	3 4 5 3	9	7/27/2020 Drill through 3-inch-thick concrete Take S-1 from 0ft to 2ft
2		Brown fine SAND, some Silt (dry) [FILL] (Class 7)	0.0		S-2	SS	8	2 3 2 2	5	Take S-2 from 2ft to 4ft Drill to 4ft, smooth drilling, brown wash
4		Brown fine SAND, some Silt (dry) [FILL] (Class 7)	0.0		S-3	SS	12	3 3 5 4	8	Take S-3 from 4ft to 6ft Spin casing to 5ft
6		Brown Silty fine SAND, trace Clay (wet) [FILL] (Class 7)	0.0	Spin	S-4	SS	12	2 2 2 2	4	Take S-4 from 6ft to 8ft Drill to 8ft, smooth drilling, brown wash
8		Brown fine SAND, some Silt, trace fine Gravel (wet) [FILL] (Class 7)	0.0		S-5	SS	12	1 1 WOR 1		Take S-5 from 8ft to 10ft S-5: -#4=95.6% -#200=16.3%
10	-1.2	Dark brown SILT, some medium to fine Sand, trace Clay (wet) [ML] (Class 6)	0.0	Spin	S-6	SS	13	1 WOR 1 1		Take S-6 from 10ft to 12ft S-6: -#200=76.6% Spin casing to 10ft Drill to 12ft, smoothing drilling, gray wash
12	-3.2	Dark brown fine SAND, trace Silt, trace fine Gravel (wet) [SP-SM] (Class 3b)	0.0		S-7	SS	16	4 9 2 7	11	Take S-7 from 12ft to 14ft S-7: -#4=97.0% -#200=10.5%
14			0.0	24						Spin casing to 14ft Drive casing to 15ft Drill to 15ft, smooth drilling, gray wash
15		Dark brown medium to fine SAND, some Silt (wet) [SM] (Class 3b)	0.0		S-8	SS	13	4 5 6 6	11	Take S-8 from 15ft to 17ft Drill to 20ft, smooth drilling, gray wash
18			0.0							
20										



Project 145 Wolcott Street	Project No. 170562201
Location Brooklyn, NY	Elevation and Datum 8.8 ± (NAVD88)



MATERIAL SYMBOL	Elev. (ft)	Sample Description	PID Reading (ppm)	Casng blws/ ft	Depth Scale	Sample Data Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	-11.2	Dark brown medium to fine SAND, some Silt (wet) [SM] (Class 3b)	0.0		20	S-9	SS	13	4 12 8 5	20	Take S-9 from 20ft to 22ft S-9: -#200=21.6% Drill to 25ft, smooth drilling, gray wash
		Dark brown fine SAND, some Clay, trace Silt (wet) [SC] (Class 3b)	0.0		25	S-10	SS	18	10 13 10 12	23	Take S-10 from 25ft to 27ft Drill to 30ft, smooth drilling, gray wash
		Dark brown coarse to medium SAND, trace Silt (wet) [SP-SM] (Class 3b)	0.0		30	S-11	SS	10	9 7 9 10	16	Take S-11 from 30ft to 32ft Drill to 35ft, smooth drilling, gray wash
		Dark brown Gravely coarse to fine SAND, some Silt (wet) [SM] (Class 3a)	0.0		35	S-12	SS	6	42 40 32 16	72	Take S-12 from 35ft to 37ft S-12: -#4=52.8% -#200=15.4% Drill to 40ft, smooth drilling, gray wash
		Dark brown fine SAND, some Silt (wet) [SM] (Class 3a)	0.0		40	S-13	SS	20	18 13 18 18	31	Take S-13 from 40ft to 42ft Drill to 45ft, smooth drilling, gray wash
					45						

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Log of Boring **LB-04(OW)** Sheet 3 of 3

Project	Project No.
145 Wolcott Street	170562201
Location	**Elevation and Datum**
Brooklyn, NY	8.8 ± (NAVD88)

						Sample Data					
MATERIAL SYMBOL	Elev. (ft)	Sample Description	PID Reading (ppm)	Casng blws/ ft	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft) 10 20 30 40	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	-36.2	Brown Silty SAND [SM] (Class 3a)	0.0		45	S-14	SS	14	13 18 18 17	36	Take S-14 from 45ft to 47ft Drill to 50ft, smooth drilling, gray wash
		Brown Silty SAND [SM] (Class 3a)	0.0		50	S-15	SS	25	20 20 24 21	44	Take S-15 from 50ft to 52ft Drill to 55ft, smooth drilling, gray wash
		Brown Silty SAND [SM] (Class 3a)	0.0		55	S-16	SS	18	20 21 33 24	54	Take S-16 from 55ft to 57ft Drill to 60ft, smooth drilling, gray wash
	-51.2	Brown Sandy SILT [SM] (Class 4a)	0.0		60	S-17	SS	24	23 27 35 24	62	Take S-17 from 60ft to 62ft S-17: -#200=69.4%
	-53.2	End of boring at 62ft			62						Bottom of boring at 62ft below ground surface Grout to 25ft below ground surface Install well, refer to Observation Well Construction Log Extract casing

Depth Scale: 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70

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Log of Boring **LB-05** Sheet 1 of 3

Project	145 Wolcott Street	Project No.	170562201
Location	Brooklyn, NY	Elevation and Datum	12.5 ± (NAVD88)
Drilling Company	Craig Geotechnical Drilling	Date Started / Date Finished	7/31/20 / 7/31/20
Drilling Equipment	CME55	Completion Depth / Rock Depth	62 ft / -
Size and Type of Bit	3-7/8in Tricone Roller Bit	Number of Samples	Disturbed 16 / Undisturbed - / Core -
Casing Diameter (in) / Casing Depth (ft)	4in Flush Joint Steel / 20	Water Level (ft.)	First ▽ - / Completion ▼ - / 24 HR. ▼ -
Casing Hammer / Weight (lbs) / Drop (in)	Automatic / 140 / 30	Drilling Foreman	Nick Beehler
Sampler	2in-diameter Split Spoon		
Sampler Hammer / Weight (lbs) / Drop (in)	Automatic / 140 / 30	Field Engineer	Andrea Herrera

MATERIAL SYMBOL	Elev. (ft) +12.5	Sample Description	PID Reading (ppm)	Casng blws/ ft	Depth Scale	Sample Data Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	+11.5	12-inch Asphalt Pavement			0						7/31/2020 Drill through 12-inch-thick asphalt
	+10.5	12-inch Concrete Pavement			1						Drill through 12-inch-thick concrete
		Dark gray coarse to fine Silty SAND, trace Clay (dry) [FILL] (Class 7)	0.0	Push	2	S-1	SS	9	4 3 5 4	8	Take S-1 from 2ft to 4ft Push casing to 5ft Drill to 4ft, smooth drilling, gray wash
	+6.5	Black coarse to fine Silty SAND, trace Clay (dry) [FILL] (Class 7)	1.7		4	S-2	SS	10	7 8 4 5	12	Take S-2 from 4ft to 6ft
		Brown fine SAND, trace Silt, trace fine Gravel (dry) [SP-SM] (Class 3b)	6.6		6	S-3	SS	18	10 10 15 16	25	Take S-3 from 6ft to 8ft Petroleum odor Drill to 8ft, smooth drilling, gray wash
		Brown fine SAND, trace Silt, trace fine Gravel (dry) [SP-SM] (Class 3b)	7.9		8	S-4	SS	13	6 6 7 8	13	Take S-4 from 8ft to 10ft Petroleum odor
		Brown fine SAND, trace Silt, trace fine Gravel (dry) [SP-SM] (Class 3b)	10.5	Push	10	S-5	SS	16	7 8 7 7	15	S-5 at 10ft Drill to 12ft, smooth drilling, brown wash
		Dark brown medium to fine SAND, some Silt (dry) [SM] (Class 3b) Brown fine Silty SAND, trace clay (wet) [SM] (Class 3b)	3.4		12	S-6A S-6B	SS	24	7 10 11 12	21	Take S-6 from 12ft to 14ft S-6: -#200=22.9% Push casing to 15ft Drill to 15ft, smooth drilling, brown wash
		Brown fine SAND, some Silt (wet) [SM] (Class 3b)	0.2		15	S-7	SS	14	10 13 16 14	29	Take S-7 from 15ft to 17ft Drive casing to 20ft Drill to 20ft, smooth drilling, brown wash
				165	17						
					20						

Project	Project No.
145 Wolcott Street	170562201
Location	**Elevation and Datum**
Brooklyn, NY	12.5 ± (NAVD88)

Depth Scale	Elev. (ft)	Sample Description	PID Reading (ppm)	Casng blws/ ft	Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
20	-7.5	Brown medium to fine SAND, some Silt (wet) [SM] (Class 3a)	0.1		S-8	SS	17	9 14 17 15	31	Take S-8 from 20ft to 22ft S-8: -#200=6.6% Drill to 25ft, smooth drilling, brown wash
25		Brown medium to fine SAND, some Silt (wet) [SM] (Class 3a)	0.0		S-9	SS	18	11 16 19 20	35	Take S-9 from 25ft to 27ft S-9: -#200=13.7% Drill to 30ft, smooth drilling, brown wash
30		Brown medium to fine SAND, some Silt (wet) [SM] (Class 3b)	0.0		S-10	SS	17	14 13 16 17	29	Take S-10 from 30ft to 32ft Drill to 35ft, smooth drilling, brown wash
35		Brown medium to fine SAND, some Silt (wet) [SM] (Class 3b)	0.0		S-11	SS	17	14 13 16 13	29	Take S-11 from 35ft to 37ft S-11: -#200=21.1% Drill to 40ft, smooth drilling, brown wash
40		Brown medium to fine SAND, some Silt (wet) [SM] (Class 3a)	0.0		S-12	SS	24	17 25 32 23	57	Take S-12 from 40ft to 42ft Drill to 45ft, smooth drilling, brown wash
45										

Log of Boring **LB-05** Sheet 3 of 3

Project	Project No.
145 Wolcott Street	170562201
Location	**Elevation and Datum**
Brooklyn, NY	12.5 ± (NAVD88)

MATERIAL SYMBOL	Elev. (ft)	Sample Description	PID Reading (ppm)	Casng blws/ ft	Depth Scale	Sample Data Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft) 10 20 30 40	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	-32.5	Brown medium to fine SAND, some Silt (wet) [SM] (Class 3a)	0.1		45	S-13	SS	22	17 19 25 20	44	Take S-13 from 45ft to 47ft Drill to 50ft, smooth drilling, brown wash
		Brown Silty medium to fine SAND (wet) [SM] (Class 3a)	0.1		50	S-14	SS	20	16 18 20 20	38	Take S-14 from 50ft to 52ft S-14: -#200=37.8% Drill to 55ft, smooth drilling, brown wash
		Brown Silty medium to fine SAND (wet) [SM] (Class 3a)	0.3		55	S-15	SS	21	16 16 18 17	34	Take S-15 from 55ft to 57ft Drill to 60ft, smooth drilling, brown wash
		Brown Silty medium to fine SAND (wet) [SM] (Class 3a)	0.1		60	S-16	SS	23	16 20 29 24	49	Take S-16 from 60ft to 62ft
	-49.5	End of boring at 62ft			62						Bottom of boring at 62ft below ground surface Extract casing Grout to exisiting grade

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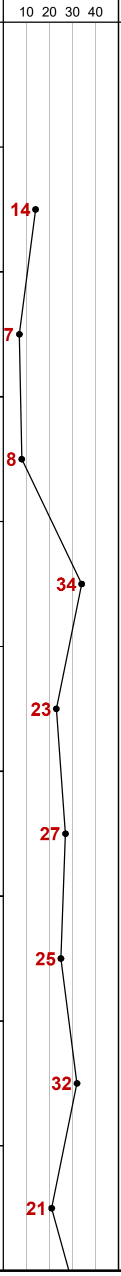
Log of Boring **LB-06(OW)** Sheet 1 of 5

Project	145 Wolcott Street	Project No.	170562201
Location	Brooklyn, NY	Elevation and Datum	13.3 ± (NAVD88)
Drilling Company	Craig Geotechnical Drilling	Date Started	7/30/20
		Date Finished	7/31/20
Drilling Equipment	CME55	Completion Depth	100.1 ft
		Rock Depth	-
Size and Type of Bit	3-7/8in Tricone Roller Bit	Number of Samples	Disturbed 28; Undisturbed -; Core -
Casing Diameter (in)	4in Flush Joint Steel	Water Level (ft.)	First ▽ -; Completion ▼ -; 24 HR. ▼ -
Casing Depth (ft)	55		
Casing Hammer	Automatic; Weight (lbs) 140; Drop (in) 30	Drilling Foreman	Nick Beehler
Sampler	2in-diameter Split Spoon		
Sampler Hammer	Automatic; Weight (lbs) 140; Drop (in) 30	Field Engineer	Andrea Herrera

Elev. (ft) +13.3	Sample Description	PID Reading (ppm)	Casng blws/ ft	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
+12.3	12-in Asphalt Pavement			0						7/30/2020 Drill through 12-inch-thick asphalt
+11.3	12-in Concrete Pavement			1						Drill through 12-inch-thick concrete
	Black Silty fine SAND, trace Clay (dry) [FILL] (Class 7)	0.0	43	2	S-1	SS	14	8 8 6 6	14	Take S-1 from 2ft to 4ft Drive casing to 5ft Push casing 8ft Drive cashing to 10ft Drill to 4ft, chattery drilling, black wash
	Black Silty fine SAND, trace Clay (dry) [FILL] (Class 7)	0.0		4	S-2	SS	9	2 4 3 4	7	Take S-2 from 4ft to 6ft
	Dark gray Clayey SILT, trace medium to fine Sand (dry) [FILL] (Class 7)	0.5	Push	6	S-3	SS	15	3 3 5 6	8	Take S-3 from 6ft to 8ft Drill to 8ft, smooth drilling, black wash
	No Recovery	0.0	54	8	S-4	SS	0	12 14 20 17	34	Take S-4 from 8ft to 10ft Push casing to 12ft Drive casing to 15ft Drill to 10ft, smooth drilling, grey wash
+3.3	Dark brown Silty fine SAND (wet) [SM] (Class 3b)	1.4	Push	10	S-5	SS	8	12 12 11 10	23	Take S-5 from 10ft to 12ff Drill to 12ft, smooth drilling, gray wash
	Dark brown Silty fine SAND, trace Clay (wet) [SM] (Class 3b)	2.0	45	12	S-6	SS	16	9 13 14 13	27	Take S-6 from 12ft to 14ft Drill to 14ft, smooth drilling, gray wash
	Dark brown Silty fine SAND, trace Clay (wet) [SM] (Class 3b)	13.8		14	S-7	SS	13	8 11 14 14	25	Take S-7 from 14ft to 16ft
	Dark brown Silty fine SAND, trace Clay (wet) [SM] (Class 3a)	71.9		16	S-8	SS	24	15 17 15 19	32	Take S-8 from 16ft to 18ft Push casing to 20ft Drill to 18ft, smooth drilling, gray wash
	Dark brown Silty fine SAND (wet) [SM] (Class 3b)	134.5		18	S-9	SS	20	5 9 12 12	21	Take S-9 from 18ft to 20ft Push casing to 25ft Drill to 20ft, smooth drilling,
				20						



Project 145 Wolcott Street	Project No. 170562201
Location Brooklyn, NY	Elevation and Datum 13.3 ± (NAVD88)

Elev. (ft)	Sample Description	PID Reading (ppm)	Casng blws/ ft	Depth Scale	Sample Data Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
-6.7	No Recovery	34.7		20	S-10	SS	0	16 18 18 16	36	Take S-10 from 20ft to 22ft
	Dark brown Silty fine SAND (wet) [SM] (Class 3a)		Push	22	S-12	SS	3	14 24 36 30	60	Take S-11 from 22ft to 24ft Encountered no recovery Switch to 3in-diameter spoon Take S-12 from 22ft to 24ft
	Dark brown Silty fine SAND (wet) [SM] (Class 3a)	0.2	Push	25	S-13	SS	17	12 16 18 17	34	Take S-13 from 25ft to 27ft Change drilling fluid Drill to 30ft, smooth drilling, dark brown wash
	Dark brown fine SAND, some Silt (wet) [SM] (Class 3a)	1.1		30	S-14	SS	18	20 31 31 51	62	Take S-14 from 30ft to 32ft Drill to 35ft, smooth drilling, no dark brown wash
	Dark brown medium to fine SAND, some Silt (wet) [SM] (Class 3a)	0.2	Push	35	S-15	SS	21	11 15 16 14	31	Take S-15 from 35ft to 37ft S-15: -#200=19.2% Drill to 40ft, smooth drilling brown wash
	Dark brown Silty fine SAND (wet) [SM] (Class 3b)	0.2		40	S-16	SS	19	8 12 13 15	25	Take S-16 from 40ft to 42ft Drill to 45ft, smooth drilling, brown wash
			72	42						
				45						

Project 145 Wolcott Street	Project No. 170562201
Location Brooklyn, NY	Elevation and Datum 13.3 ± (NAVD88)

MATERIAL SYMBOL	Elev. (ft)	Sample Description	PID Reading (ppm)	Casng blws/ ft	Depth Scale	Sample Data Number	Sample Data Type	Sample Data Recov. (in)	Sample Data Penetr. resist BL/6in	N-Value (Blows/ft) 10 20 30 40	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	-31.7	Dark brown fine SAND, some Silt (wet) [SM] (Class 3a)	0.2		45	S-17	SS	20	15 18 20 23	38	Take S-17 from 45ft to 47ft Drill to 50ft, smooth drilling, brown wash
				345	47						
		Brown fine SAND, some Silt (wet) [SM] (Class 3a)	0.2		50	S-18	SS	20	18 23 25 25	48	Take S-18 from 50ft to 52ft Drill to 55ft, smooth drilling, brown wash
				612	52						
		Brown fine SAND, some Silt (wet) [SM] (Class 3a)	0.2		55	S-19	SS	21	20 25 28 28	53	Take S-19 from 55ft to 57ft Drill to 60ft, smooth drilling, brown wash
		Brown fine SAND, some Silt (wet) [SM] (Class 3a)	0.0		60	S-20	SS	16	18 26 35 30	61	Take S-20 from 60ft to 62ft Drill to 65ft, smooth drilling, brown wash
		Brown fine SAND, some Silt (wet) [SM] (Class 3a)	0.2		65	S-21	SS	19	22 28 32 30	60	Take S-21 from 65ft to 67ft Drill to 70ft, smooth drilling, brown wash
					70						

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Log of Boring **LB-06(OW)** Sheet 4 of 5

Project	Project No.
145 Wolcott Street	170562201
Location	Elevation and Datum
Brooklyn, NY	13.3 ± (NAVD88)

Elev. (ft)	Sample Description	PID Reading (ppm)	Casng blws/ ft	Depth Scale	Number	Type	Recov. (in)	Penetr. resist BL/6in	N-Value (Blows/ft)	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
-56.7	Brown fine SAND, some Silt (wet) [SM] (Class 3a)	0.2		70	S-22	SS	21	22 28 28 32	56	Take S-22 from 70ft to 72ft Drill to 75ft, smooth drilling, brown wash
	Brown fine SAND, some Silt (wet) [SM] (Class 3a)	0.2		75	S-23	SS	18	27 33 42 41	75	Take S-23 from 75ft to 77ft Drill to 80ft, smooth drilling, brown wash
	Brown fine SAND, some Silt (wet) [SM] (Class 3a)	0.0		80	S-24	SS	20	18 36 48 51	84	Take S-24 from 80ft to 82ft Drill to 85ft, smooth drilling, brown wash
	Brown Silty fine SAND (wet) [SM] (Class 3a)	0.0		85	S-25	SS	24	19 27 30 26	57	Take S-25 from 85ft to 87ft Push casing to 40ft Drive casing to 55ft 7/31/2020 Drill to 90ft, smooth drilling, brown wash
	Brown Silty fine SAND (wet) [SM] (Class 3a)	0.0		90	S-26	SS	24	19 18 23 16	41	Take S-26 from 90ft to 92ft Drill to 95ft, smooth drilling, brown wash
				95						

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Log of Boring **LB-06(OW)** Sheet 5 of 5

Project	Project No.
145 Wolcott Street	170562201
Location	**Elevation and Datum**
Brooklyn, NY	13.3 ± (NAVD88)

MATERIAL SYMBOL	Elev. (ft)	Sample Description	PID Reading (ppm)	Casng blws/ ft	Depth Scale	Sample Data Number	Sample Data Type	Sample Data Recov. (in)	Sample Data Penetr. resist BL/6in	N-Value (Blows/ft) 10 20 30 40	Remarks (Drilling Fluid, Depth of Casing, Fluid Loss, Drilling Resistance, etc.)
	-81.7	Brown Silty fine SAND (wet) [SM] (Class 3a)	0.0		95	S-27	SS	20	85 41 36 31	77	Take S-27 from 95ft to 97ft Drill to 100ft, smooth drilling, brown wash Take S-28 from 100ft to 102ft
					96						
					97						
					98						
					99						
	-87.0	No Recovery End of boring at 100.1ft	0.1		100	S-28	SS	0	50/1	50/1	Bottom of boring at 100.1ft Grout to 25ft below ground surface Install well, refer to Observation Well Construction Log Extract casing
					101						
					102						
					103						
					104						
					105						
					106						
					107						
					108						
					109						
					110						
					111						
					112						
					113						
					114						
					115						
					116						
					117						
					118						
					119						
					120						

APPENDIX B

GROUNDWATER
WELL
CONSTRUCTION
LOGS

LANGAN
ENGINEERING & ENVIRONMENTAL SERVICES

WELL CONSTRUCTION SUMMARY
Well No. LB-4(OW)

PROJECT 145 Wolcott Street	**PROJECT NO.** 170562201
LOCATION Brooklyn, New York	**ELEVATION AND DATUM** el. 8.8 (NAVD 88)
DRILLING AGENCY Craig Geotechnical Drilling Co., Inc	**DATE STARTED** 7/27/2020 **DATE FINISHED** 7/27/2020
DRILLING EQUIPMENT CME 55	**FOREMAN** Nick Beehler
SIZE AND TYPE OF BIT 3 7/8" Tricone Roller Bit	**INSPECTORS** Andrea Herrera

METHOD OF INSTALLATION

The boring was advanced to 62 feet below the existing ground surface using mud rotary drilling techniques. The hole was grouted to a depth of 25 feet below ground surface. The well was installed to 20 feet below the ground surface. The well is made of 10 feet screen and 10 feet riser. A flush-mount well cap was installed to seal the well.

METHOD OF WELL DEVELOPMENT

The bore hole was developed by bailing approximately three times the well volume and sealed with bentonite.

TYPE OF CASING PVC	**DIAMETER** 2 inch	**TYPE OF BACKFILL MATERIAL** Soil Cuttings
TYPE OF SCREEN PVC	**DIAMETER** 2 inch	**TYPE OF SEAL MATERIAL** Bentonite
BOREHOLE DIAMETER 4 inch		**TYPE OF FILTER MATERIAL** Silica Sand

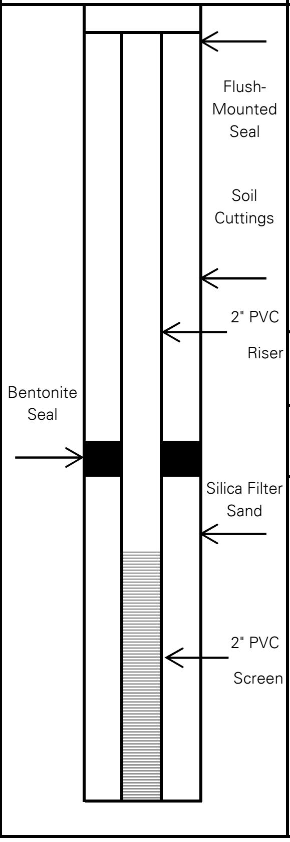
	ELEVATION (ft) (3)	DEPTH (ft)
TOP OF CASING	8.8	0
TOP OF SEAL	3.8	5
TOP OF FILTER	-0.2	9
TOP OF SCREEN	-1.2	10
BOTTOM OF SCREEN	-11.2	20

SCREEN LENGTH	**LENGTH (ft)** 10
SLOT SIZE	0.025 inch

GROUNDWATER ELEVATIONS

ELEVATION	DATE	DEPTH TO WATER (ft) (3)
1.0	7/29/2020	7.8
1.1	7/30/2020	7.7
1.1	7/30/2020	7.7
1.0	7/31/2020	7.8
1.0	8/3/2020	7.8

WELL DETAILS



SUMMARY SOIL CLASSIFICATION (1), NOTES	DEPTH (FT) (2)
	0.0
FILL	
	8.0
SAND	
	10.0
SILT	
	12.0
SAND	
	20.0

Langan Engineering & Environmental Services
21 Penn Plaza, 360 West 31st Street, 8th Floor, New York, New York 10001

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ENGINEERING & ENVIRONMENTAL SERVICES

WELL CONSTRUCTION SUMMARY
Well No. LB-6(OW)

PROJECT 145 Wolcott Street	**PROJECT NO.** 170562201
LOCATION Brooklyn, New York	**ELEVATION AND DATUM** el. 13.3 (NAVD 88)
DRILLING AGENCY Craig Geotechnical Drilling Co., Inc	**DATE STARTED** 7/30/2020 **DATE FINISHED** 7/31/2020
DRILLING EQUIPMENT CME 55	**FOREMAN** Nick Beehler
SIZE AND TYPE OF BIT 3 7/8" Tricone Roller Bit	**INSPECTORS** Andrea Herrera

METHOD OF INSTALLATION

The boring was advanced to 102 feet below the existing ground surface using mud rotary drilling techniques. The hole was grouted to a depth of 25 feet below ground surface. The well was installed to 20 feet below the ground surface. The well is made of 10 feet screen and 10 feet riser. A flush-mount well cap was installed to seal the well.

METHOD OF WELL DEVELOPMENT

The bore hole was developed by bailing approximately three times the well volume and sealed with bentonite.

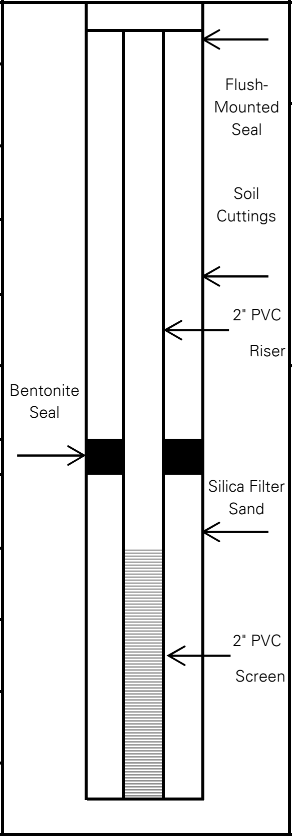
TYPE OF CASING PVC **DIAMETER** 2 inch	**TYPE OF BACKFILL MATERIAL** Soil Cuttings
TYPE OF SCREEN PVC **DIAMETER** 2 inch	**TYPE OF SEAL MATERIAL** Bentonite
BOREHOLE DIAMETER 4 inch	**TYPE OF FILTER MATERIAL** Silica Sand

	ELEVATION (ft) [3]	DEPTH (ft)
TOP OF CASING	13.3	0
TOP OF SEAL	8.3	5
TOP OF FILTER	4.3	9
TOP OF SCREEN	3.3	10
BOTTOM OF SCREEN	-6.7	20
SCREEN LENGTH	LENGTH (ft)	10
SLOT SIZE	0.025 inch	

GROUNDWATER ELEVATIONS

ELEVATION	DATE	DEPTH TO WATER (ft) [3]
0.6	7/31/2020	12.7
1.5	7/31/2020	11.8
0.8	8/3/2020	12.5
0.7	8/3/2020	12.6

WELL DETAILS



SUMMARY SOIL CLASSIFICATION [1], NOTES	DEPTH (FT) [2]
ASPHALT & CONCRETE	0.0
FILL	2.0
SILTY SAND	10.0
	20.0

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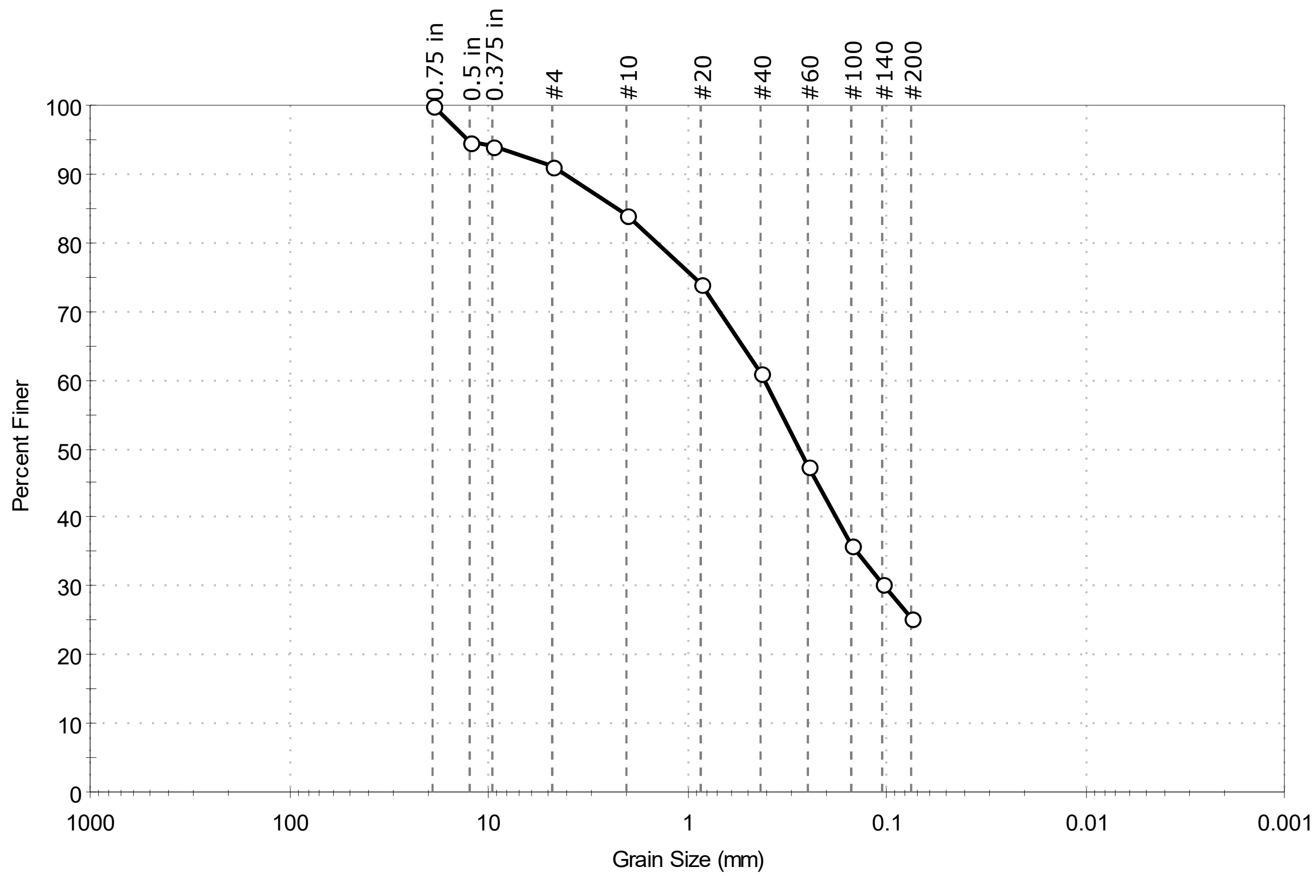
APPENDIX C
LABORATORY TEST RESULTS

GeoTesting
EXPRESS

Client: Langan Engineering
Project: 145 Wolcott Street
Location: Brooklyn, NY
Project No: GTX-312211
Boring ID: LB-1
Sample Type: jar
Tested By: ckg
Sample ID: S-10
Test Date: 08/13/20
Checked By: jdt
Depth : 18-20
Test Id: 571301
Test Comment: ---
Visual Description: Moist, dark olive gray silty sand
Sample Comment: ---

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	8.8	65.8	25.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	95		
0.375 in	9.50	94		
#4	4.75	91		
#10	2.00	84		
#20	0.85	74		
#40	0.42	61		
#60	0.25	48		
#100	0.15	36		
#140	0.11	30		
#200	0.075	25		

Coefficients

D_{85} =2.2564 mm	D_{30} =0.1039 mm
D_{60} =0.4088 mm	D_{15} =N/A
D_{50} =0.2753 mm	D_{10} =N/A
C_u =N/A	C_c =N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

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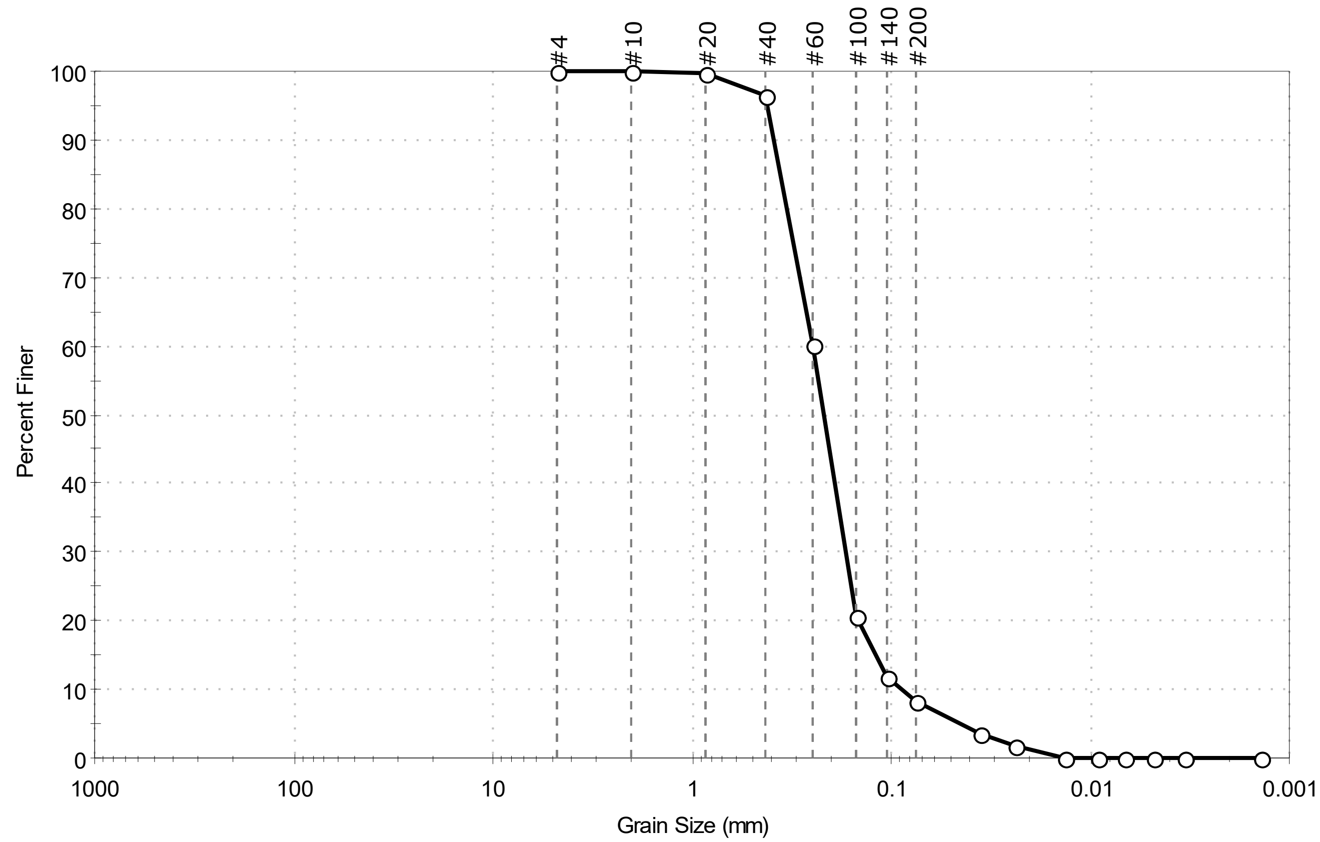
Client: Langan Engineering
Project: 145 Wolcott Street
Location: Brooklyn, NY
Project No: GTX-312211

Boring ID: LB-1
Sample Type: jar
Tested By: ckg
Sample ID: S-13
Test Date: 08/20/20
Checked By: jdt
Depth : 30-32
Test Id: 571303

Test Comment: ---
Visual Description: Moist, reddish brown sand with silt
Sample Comment: ---

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	91.9	8.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	96		
#60	0.25	60		
#100	0.15	21		
#140	0.11	12		
#200	0.075	8.1		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0360	3		
---	0.0237	2		
---	0.0133	0		
---	0.0091	0		
---	0.0068	0		
---	0.0048	0		
---	0.0034	0		
---	0.0014	0		

Coefficients

D_{85} =0.3600 mm
D_{30} =0.1692 mm
D_{60} =0.2498 mm
D_{15} =0.1200 mm
D_{50} =0.2194 mm
D_{10} =0.0893 mm
C_u =2.797
C_c =1.283

Classification

ASTM N/A

AASHTO Fine Sand (A-3 (1))

Sample/Test Description

Sand/Gravel Particle Shape : ---
Sand/Gravel Hardness : ---
Dispersion Device : Apparatus A - Mech Mixer
Dispersion Period : 1 minute
Est. Specific Gravity : 2.65
Separation of Sample: #200 Sieve

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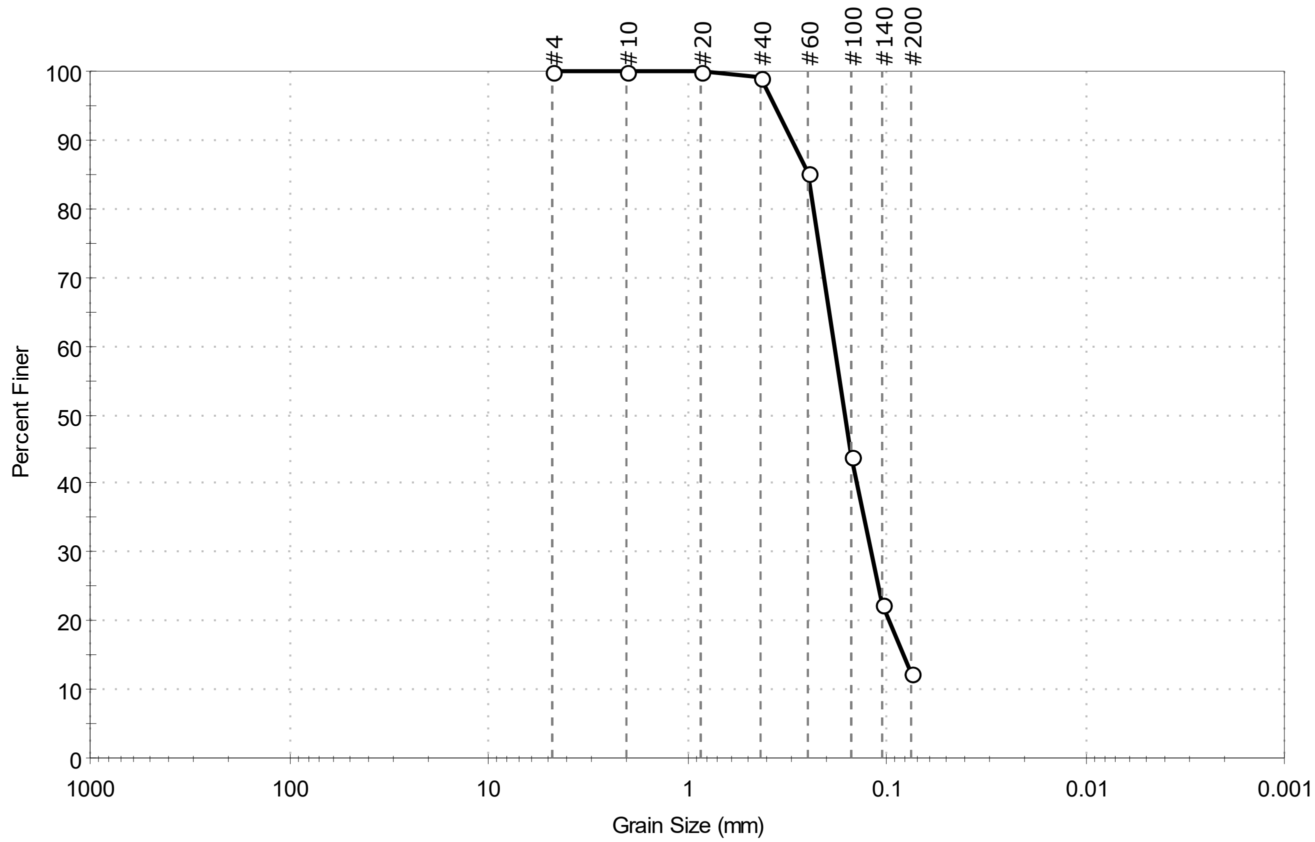
Client:	Langan Engineering				
Project:	145 Wolcott Street				
Location:	Brooklyn, NY			Project No:	GTX-312211
Boring ID:	LB-1	Sample Type:	jar	Tested By:	ckg
Sample ID:	S-15	Test Date:	08/17/20	Checked By:	jdt
Depth :	40-42	Test Id:	571300		

Test Comment: ---
Visual Description: Moist, brown silty sand
Sample Comment: ---

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	87.5	12.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	99		
#60	0.25	85		
#100	0.15	44		
#140	0.11	22		
#200	0.075	13		

Coefficients

D_{85} =0.2489 mm	D_{30} =0.1197 mm
D_{60} =0.1827 mm	D_{15} =0.0818 mm
D_{50} =0.1615 mm	D_{10} =N/A
C_u =N/A	C_c =N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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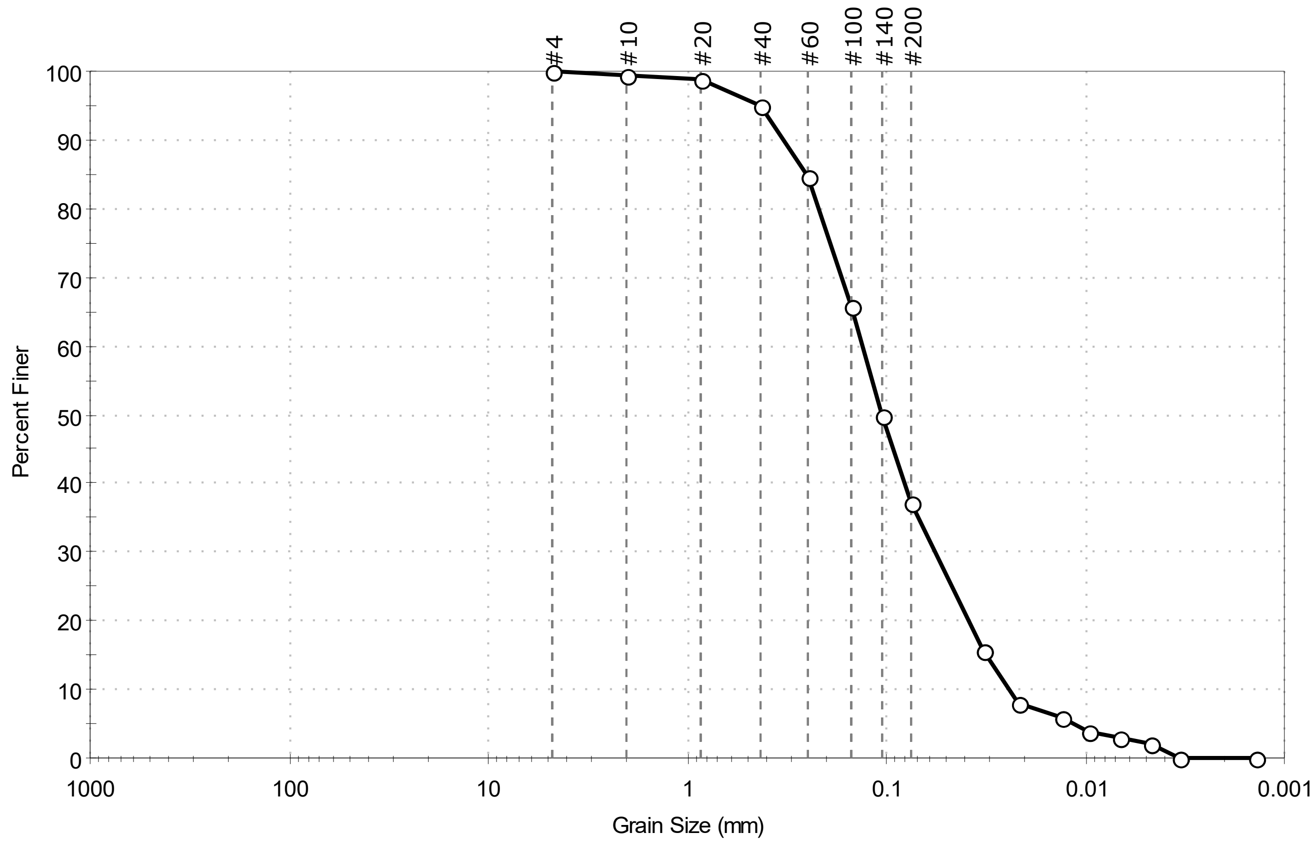
Client: Langan Engineering
Project: 145 Wolcott Street
Location: Brooklyn, NY
Project No: GTX-312211
Boring ID: LB-2
Sample Type: jar
Tested By: ckg
Sample ID: S-7
Test Date: 08/20/20
Checked By: jdt
Depth : 15-17
Test Id: 571302
Test Comment: ---
Visual Description: Moist, brown silty sand
Sample Comment: ---

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	62.9	37.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	99		
#40	0.42	95		
#60	0.25	85		
#100	0.15	66		
#140	0.11	50		
#200	0.075	37		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0325	16		
---	0.0218	8		
---	0.0132	6		
---	0.0096	4		
---	0.0068	3		
---	0.0048	2		
---	0.0034	0		
---	0.0014	0		

Coefficients

D_{85} =0.2555 mm
D_{30} =0.0569 mm
D_{60} =0.1320 mm
D_{15} =0.0314 mm
D_{50} =0.1063 mm
D_{10} =0.0243 mm
C_u =5.432
C_c =1.009

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---
Sand/Gravel Hardness : ---
Dispersion Device : Apparatus A - Mech Mixer
Dispersion Period : 1 minute
Est. Specific Gravity : 2.65
Separation of Sample: #200 Sieve

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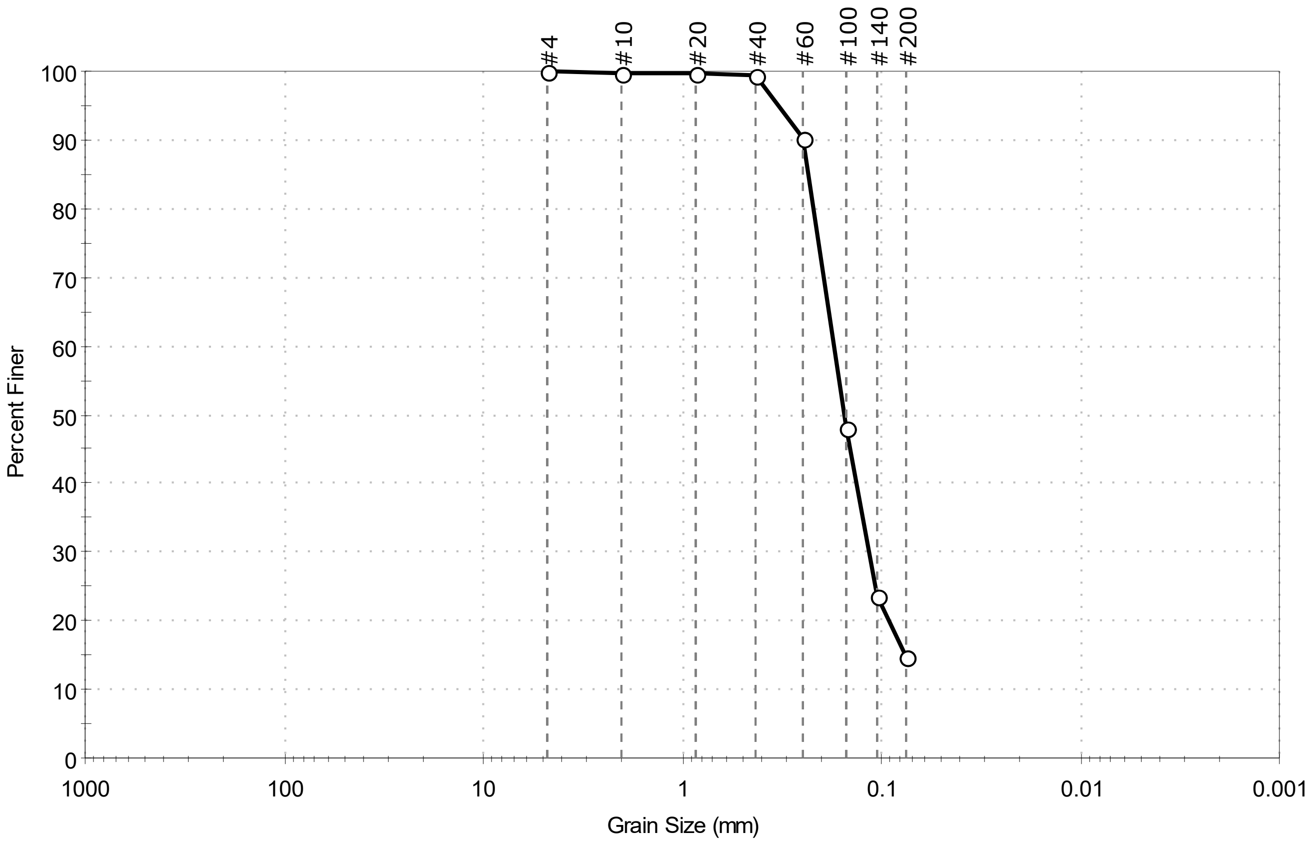
Client: Langan Engineering
Project: 145 Wolcott Street
Location: Brooklyn, NY
Project No: GTX-312211

Boring ID: LB-2
Sample ID: S-14
Depth : 35-37
Sample Type: jar
Test Date: 08/13/20
Test Id: 571306
Tested By: ckg
Checked By: jdt

Test Comment: ---
Visual Description: Moist, brown silty sand
Sample Comment: ---

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	85.1	14.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	99		
#60	0.25	90		
#100	0.15	48		
#140	0.11	24		
#200	0.075	15		

Coefficients

D_{85} =0.2346 mm
D_{30} =0.1160 mm
D_{60} =0.1733 mm
D_{15} =0.0754 mm
D_{50} =0.1536 mm
D_{10} =N/A
C_u =N/A
C_c =N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

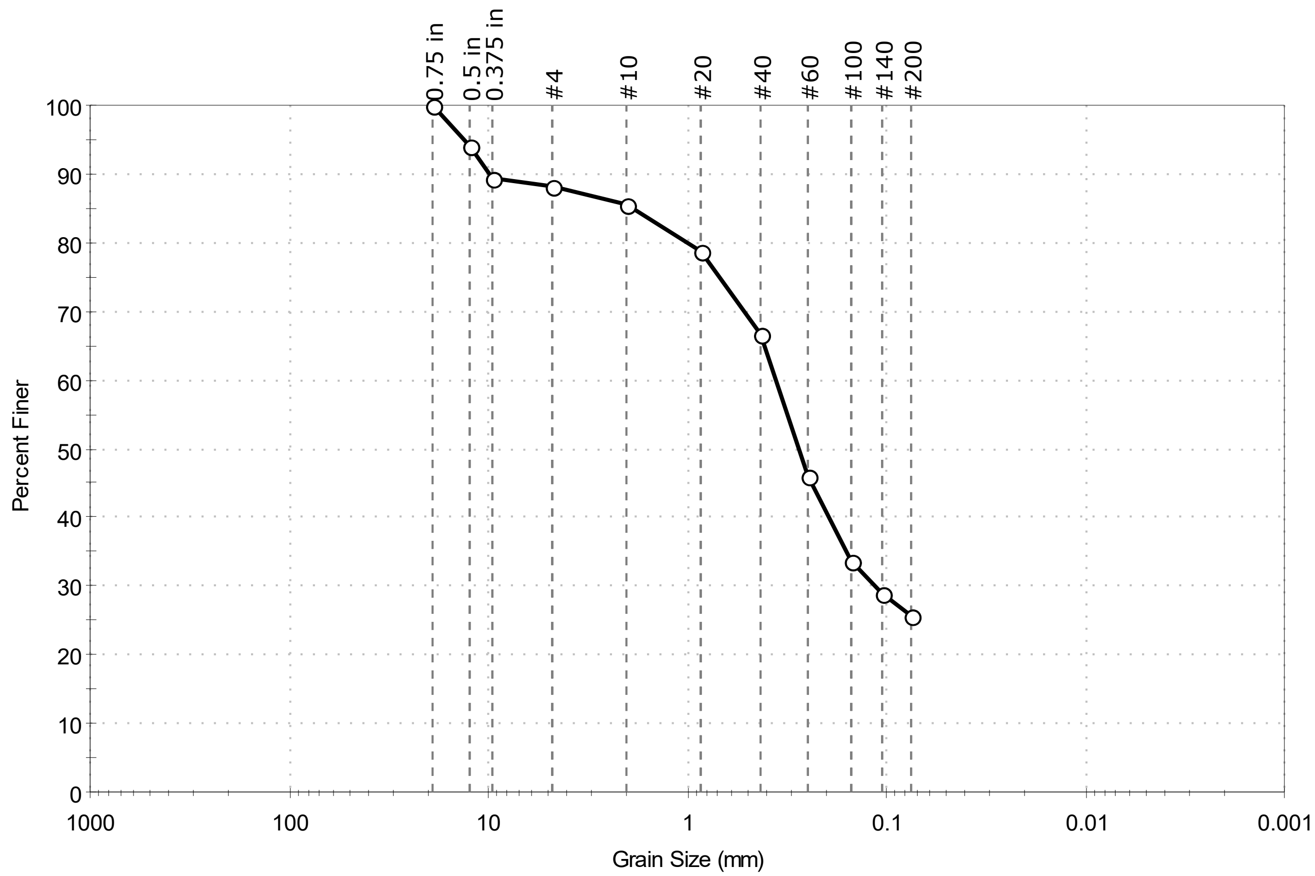
Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

GeoTesting
EXPRESS

Client: Langan Engineering
Project: 145 Wolcott Street
Location: Brooklyn, NY
Project No: GTX-312211
Boring ID: LB-3
Sample Type: jar
Tested By: ckg
Sample ID: S-4
Test Date: 08/17/20
Checked By: jdt
Depth : 6-8
Test Id: 571304
Test Comment: ---
Visual Description: Moist, brown silty sand
Sample Comment: ---

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	11.8	62.5	25.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	94		
0.375 in	9.50	89		
#4	4.75	88		
#10	2.00	85		
#20	0.85	79		
#40	0.42	67		
#60	0.25	46		
#100	0.15	34		
#140	0.11	29		
#200	0.075	26		

Coefficients

D_{85} =1.8886 mm
D_{30} =0.1141 mm
D_{60} =0.3573 mm
D_{15} =N/A
D_{50} =0.2760 mm
D_{10} =N/A
C_u =N/A
C_c =N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

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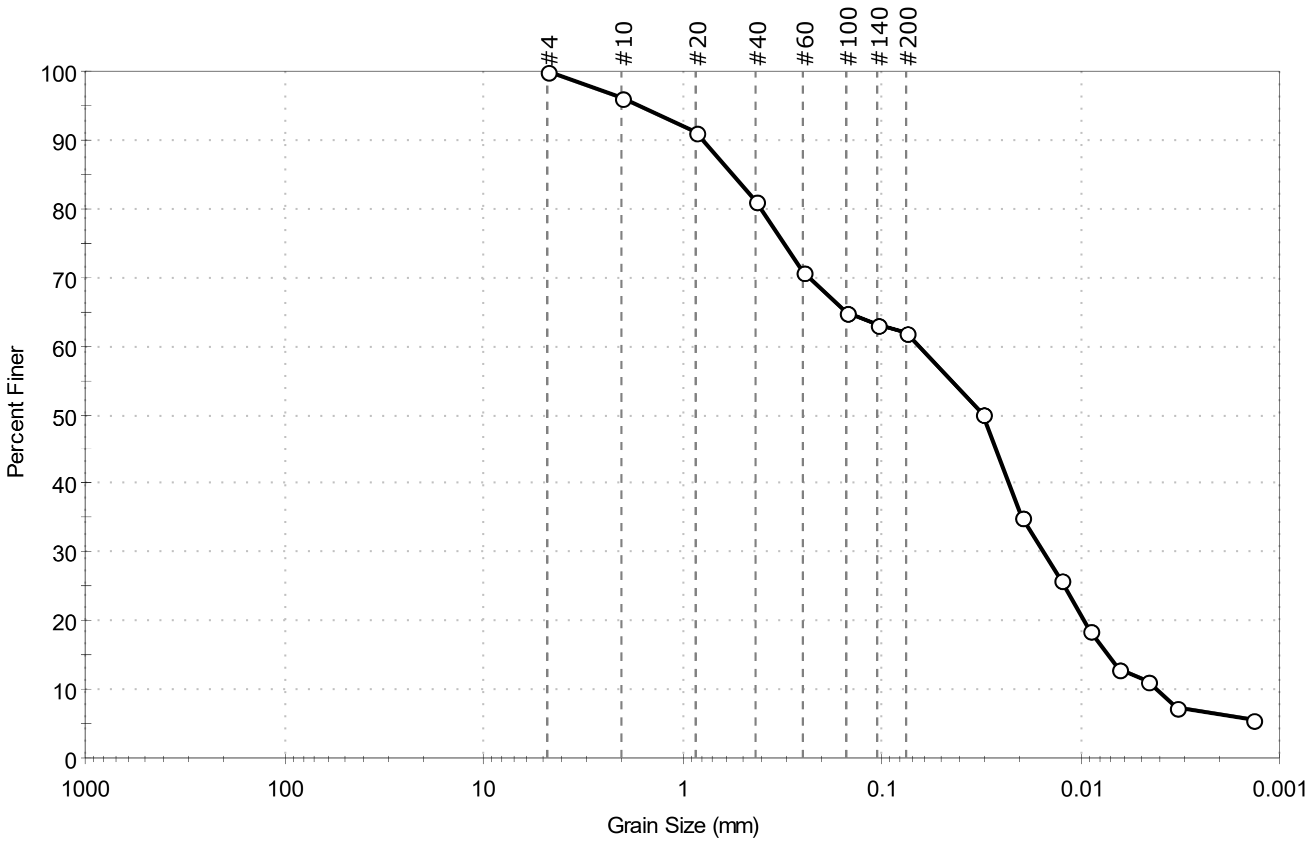
GeoTesting EXPRESS

Client: Langan Engineering
Project: 145 Wolcott Street
Location: Brooklyn, NY
Project No: GTX-312211

Boring ID: LB-3
Sample ID: S-9
Depth : 20-22
Sample Type: jar
Test Date: 08/20/20
Test Id: 571307
Tested By: ckg
Checked By: jdt

Test Comment: ---
Visual Description: Wet, brown sandy silt
Sample Comment: ---

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	38.0	62.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	96		
#20	0.85	91		
#40	0.42	81		
#60	0.25	71		
#100	0.15	65		
#140	0.11	63		
#200	0.075	62		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0314	50		
---	0.0196	35		
---	0.0126	26		
---	0.0089	19		
---	0.0065	13		
---	0.0046	11		
---	0.0033	7		
---	0.0014	6		

Coefficients

D_{85} =0.5577 mm	D_{30} =0.0153 mm
D_{60} =0.0650 mm	D_{15} =0.0073 mm
D_{50} =0.0314 mm	D_{10} =0.0042 mm
C_u =15.476	C_c =0.857

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

Dispersion Device : Apparatus A - Mech Mixer

Dispersion Period : 1 minute

Est. Specific Gravity : 2.65

Separation of Sample: #200 Sieve

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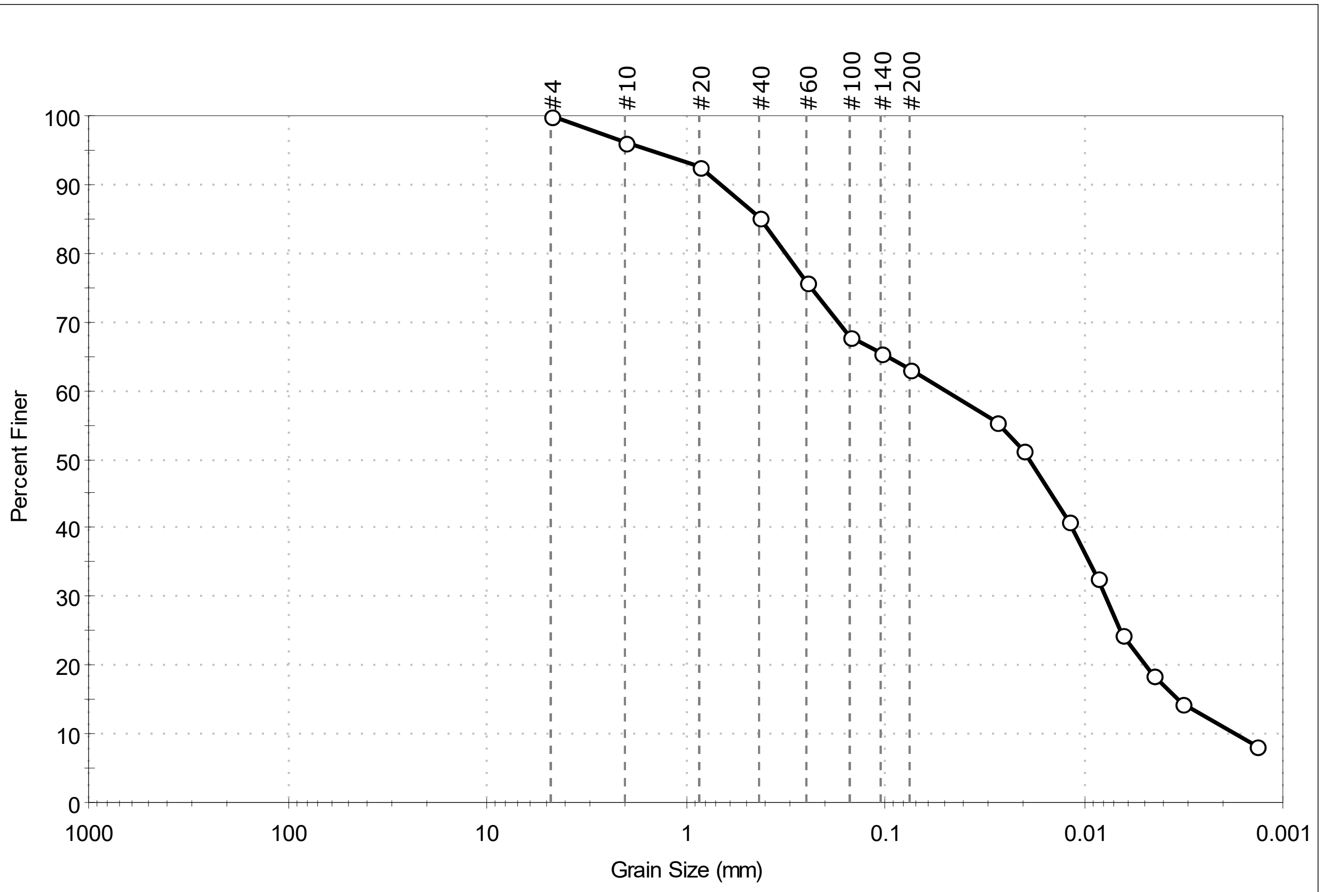
GeoTesting EXPRESS

Client:	Langan Engineering				
Project:	145 Wolcott Street				
Location:	Brooklyn, NY			Project No:	GTX-312211
Boring ID:	LB-3	Sample Type:	jar	Tested By:	ckg
Sample ID:	S-10	Test Date:	08/20/20	Checked By:	jdt
Depth :	25-27	Test Id:	571308		

Test Comment: ---
Visual Description: Moist, brown sandy silt
Sample Comment: ---

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	36.8	63.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	96		
#20	0.85	93		
#40	0.42	85		
#60	0.25	76		
#100	0.15	68		
#140	0.11	66		
#200	0.075	63		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0276	55		
---	0.0200	51		
---	0.0121	41		
---	0.0085	33		
---	0.0064	25		
---	0.0045	18		
---	0.0033	14		
---	0.0014	8		

Coefficients

D_{85} =0.4183 mm
D_{30} =0.0077 mm
D_{60} =0.0497 mm
D_{15} =0.0034 mm
D_{50} =0.0188 mm
D_{10} =0.0018 mm
C_u =27.611
C_c =0.663

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---
Sand/Gravel Hardness : ---
Dispersion Device : Apparatus A - Mech Mixer
Dispersion Period : 1 minute
Est. Specific Gravity : 2.65
Separation of Sample: #200 Sieve

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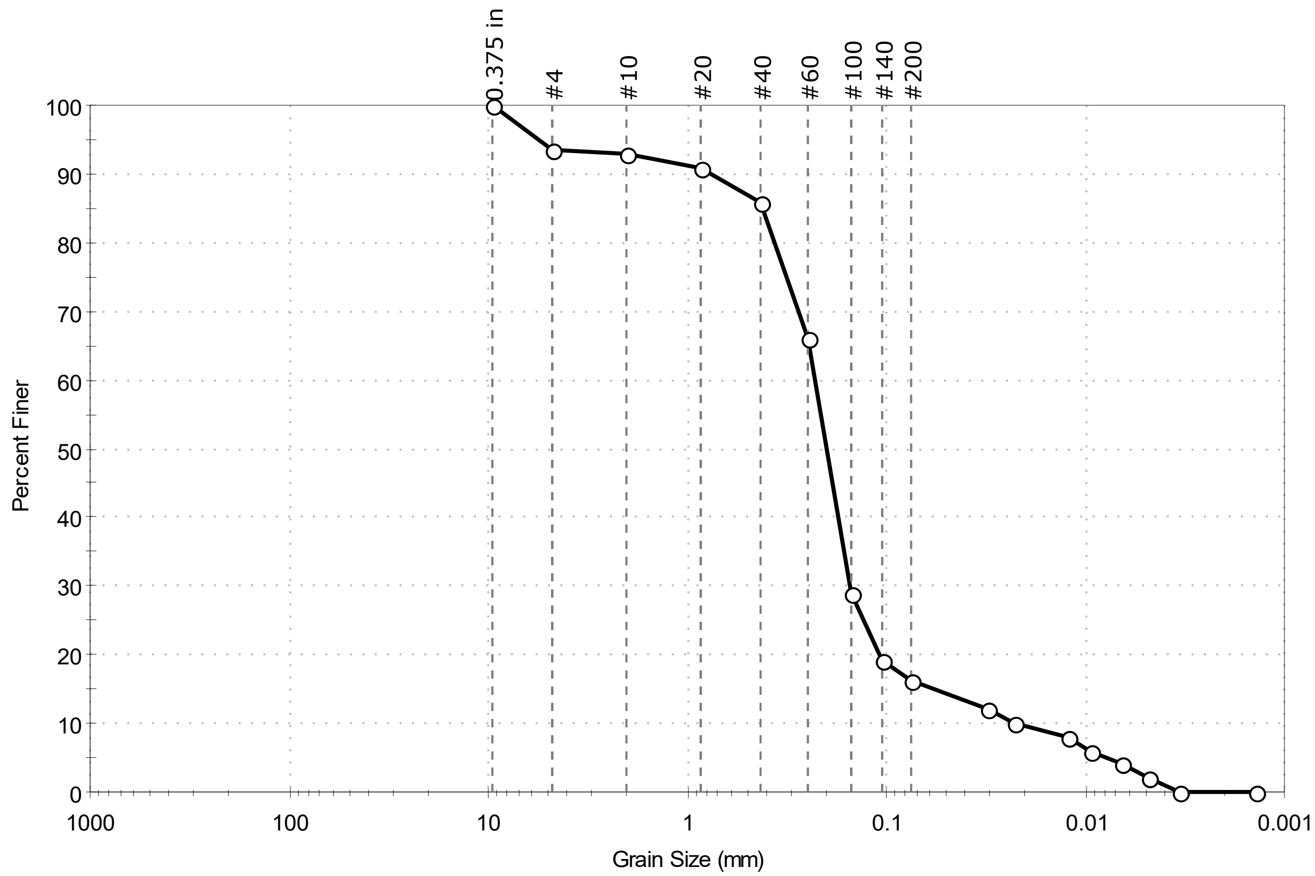
GeoTesting EXPRESS

Client: Langan Engineering
Project: 145 Wolcott Street
Location: Brooklyn, NY
Project No: GTX-312211

Boring ID: LB-4
Sample ID: S-5
Depth : 8-10
Sample Type: jar
Test Date: 08/20/20
Test Id: 571309
Tested By: ckg
Checked By: jdt

Test Comment: ---
Visual Description: Moist, brown silty sand
Sample Comment: ----

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	6.4	77.3	16.3

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.375 in	9.50	100		
#4	4.75	94		
#10	2.00	93		
#20	0.85	91		
#40	0.42	86		
#60	0.25	66		
#100	0.15	29		
#140	0.11	19		
#200	0.075	16		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0311	12		
---	0.0227	10		
---	0.0123	8		
---	0.0095	6		
---	0.0066	4		
---	0.0048	2		
---	0.0034	0		
---	0.0014	0		

Coefficients

D_{85} =0.4145 mm
D_{30} =0.1522 mm
D_{60} =0.2302 mm
D_{15} =0.0578 mm
D_{50} =0.2006 mm
D_{10} =0.0229 mm
C_u =10.052
C_c =4.394

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR
Sand/Gravel Hardness : HARD
Dispersion Device : Apparatus A - Mech Mixer
Dispersion Period : 1 minute
Est. Specific Gravity : 2.65
Separation of Sample: #200 Sieve

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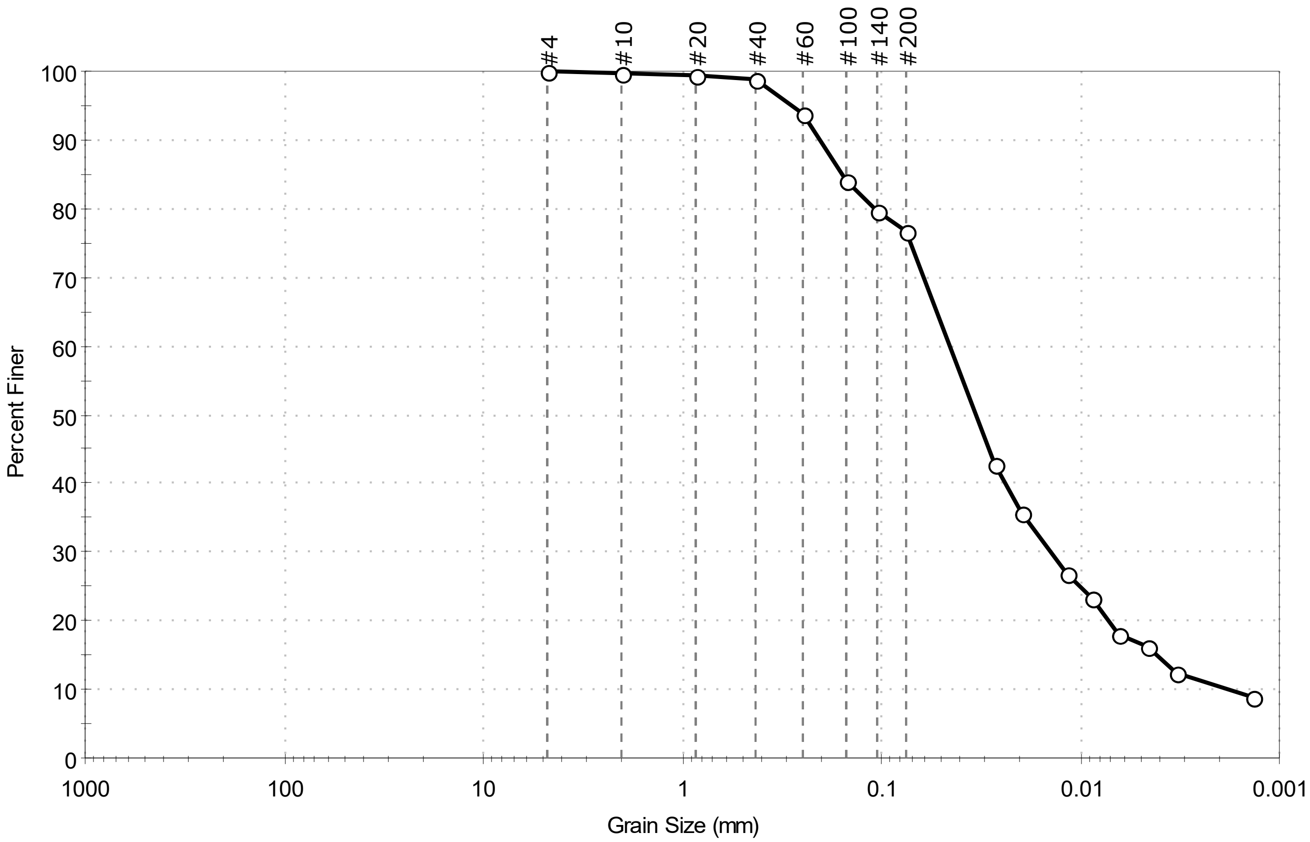
Client:	Langan Engineering				
Project:	145 Wolcott Street				
Location:	Brooklyn, NY			Project No:	GTX-312211
Boring ID:	LB-4	Sample Type:	jar	Tested By:	ckg
Sample ID:	S-6	Test Date:	08/20/20	Checked By:	jdt
Depth :	10-12	Test Id:	571310		

Test Comment: ---
Visual Description: Moist, dark brown silt with sand
Sample Comment: ----

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	23.4	76.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	99		
#40	0.42	99		
#60	0.25	94		
#100	0.15	84		
#140	0.11	80		
#200	0.075	77		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0270	43		
---	0.0199	36		
---	0.0118	27		
---	0.0087	23		
---	0.0064	18		
---	0.0046	16		
---	0.0033	13		
---	0.0014	9		

Coefficients

D_{85} =0.1581 mm	D_{30} =0.0142 mm
D_{60} =0.0453 mm	D_{15} =0.0041 mm
D_{50} =0.0335 mm	D_{10} =0.0018 mm
C_u =25.167	C_c =2.473

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---
Sand/Gravel Hardness : ---
Dispersion Device : Apparatus A - Mech Mixer
Dispersion Period : 1 minute
Est. Specific Gravity : 2.65
Separation of Sample: #200 Sieve

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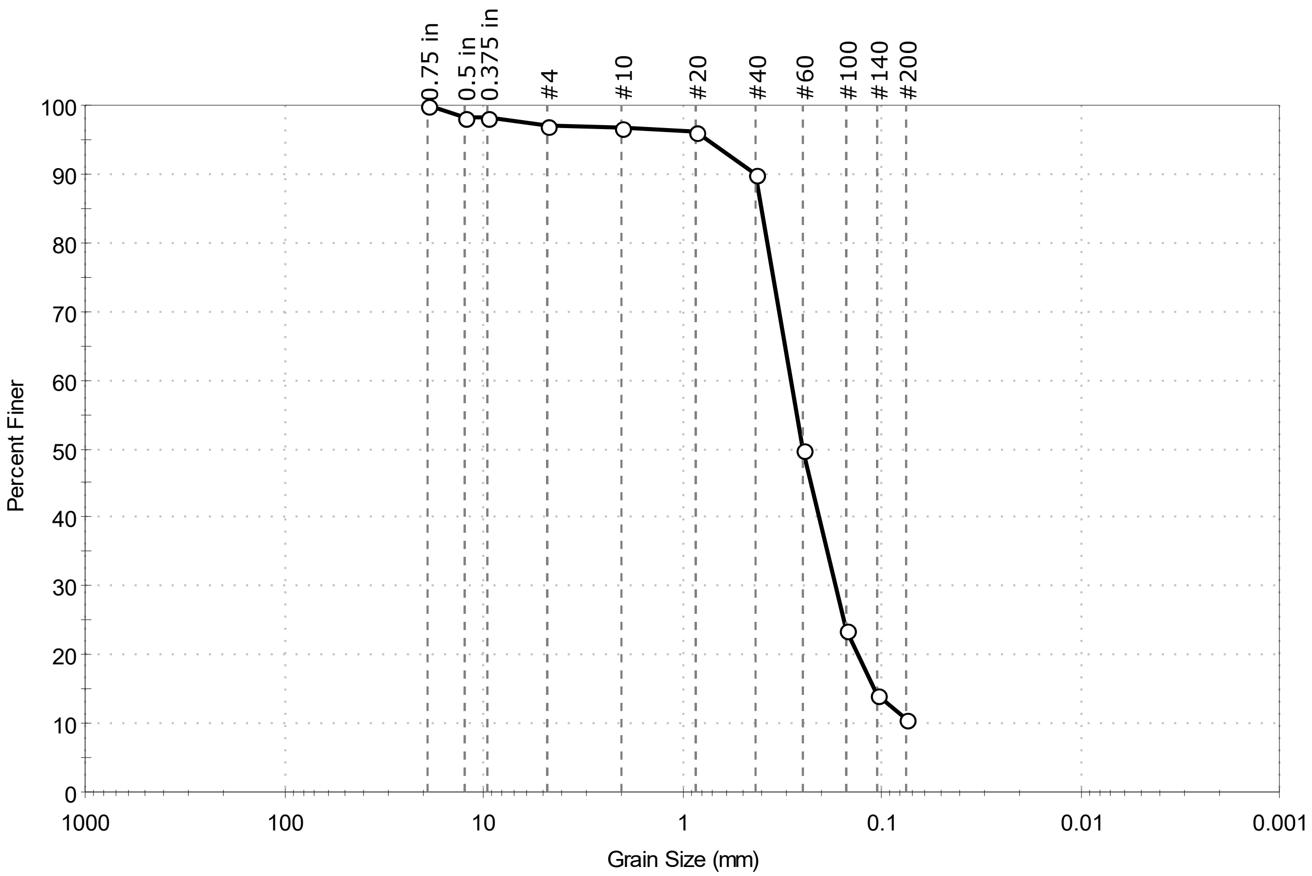
Client:	Langan Engineering				
Project:	145 Wolcott Street				
Location:	Brooklyn, NY			Project No:	GTX-312211
Boring ID:	LB-4	Sample Type:	tube	Tested By:	ckg
Sample ID:	S-7	Test Date:	08/17/20	Checked By:	jdt
Depth :	12-14	Test Id:	571311		

Test Comment: ---
Visual Description: Moist, brown sand with silt
Sample Comment: ---

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	3.0	86.5	10.5

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
0.75 in	19.00	100		
0.5 in	12.50	98		
0.375 in	9.50	98		
#4	4.75	97		
#10	2.00	97		
#20	0.85	96		
#40	0.42	90		
#60	0.25	50		
#100	0.15	24		
#140	0.11	14		
#200	0.075	10		

Coefficients

D_{85} =0.3976 mm	D_{30} =0.1701 mm
D_{60} =0.2861 mm	D_{15} =0.1090 mm
D_{50} =0.2508 mm	D_{10} =N/A
C_u =N/A	C_c =N/A

Classification

ASTM	N/A
AASHTO	Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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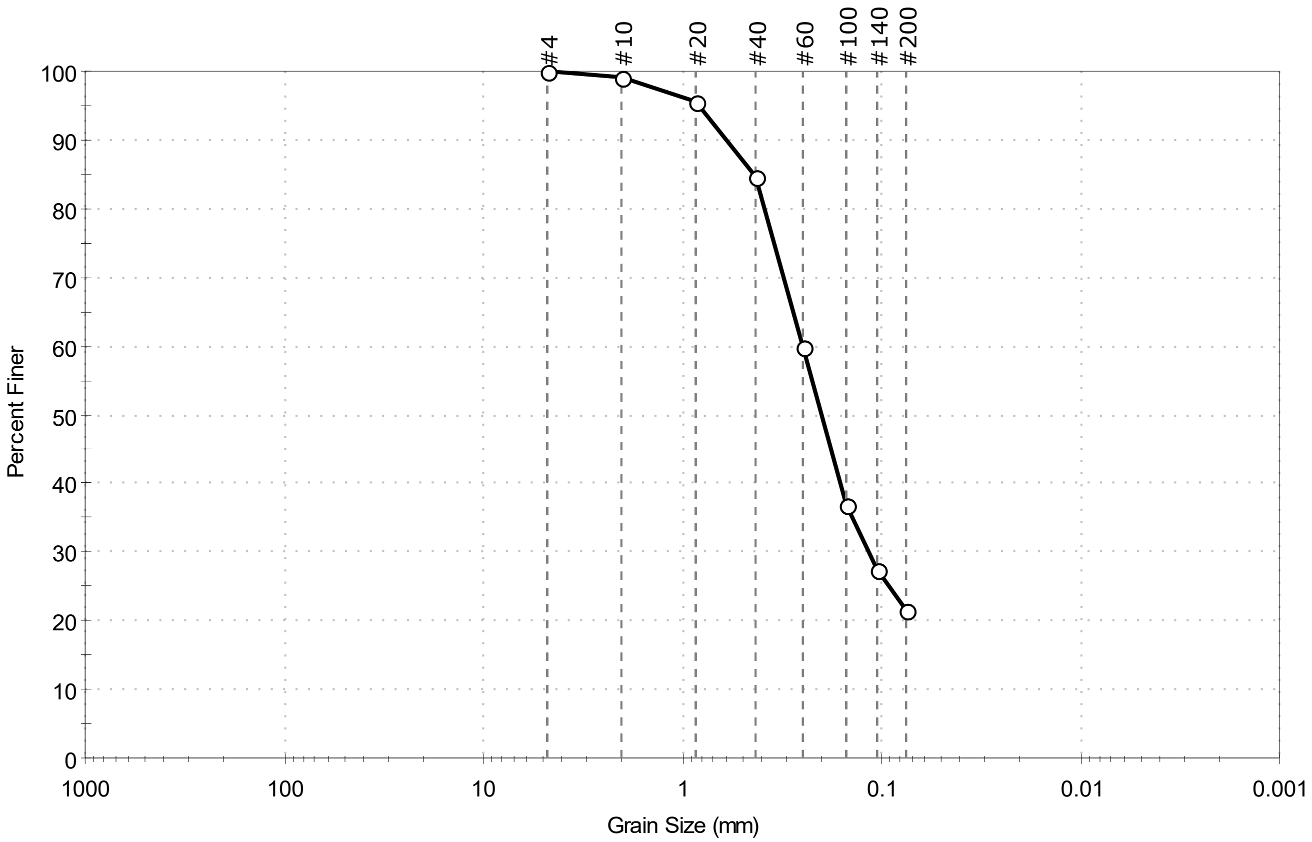
GeoTesting
EXPRESS

Client:	Langan Engineering				
Project:	145 Wolcott Street				
Location:	Brooklyn, NY			Project No:	GTX-312211
Boring ID:	LB-4	Sample Type:	jar	Tested By:	ckg
Sample ID:	S-9	Test Date:	08/17/20	Checked By:	jdt
Depth :	20-22	Test Id:	571319		

Test Comment: ---
Visual Description: Moist, grayish brown silty sand
Sample Comment: ---

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	78.4	21.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	99		
#20	0.85	96		
#40	0.42	85		
#60	0.25	60		
#100	0.15	37		
#140	0.11	27		
#200	0.075	22		

Coefficients

D_{85} =0.4338 mm
D_{30} =0.1168 mm
D_{60} =0.2507 mm
D_{15} =N/A
D_{50} =0.2008 mm
D_{10} =N/A
C_u =N/A
C_c =N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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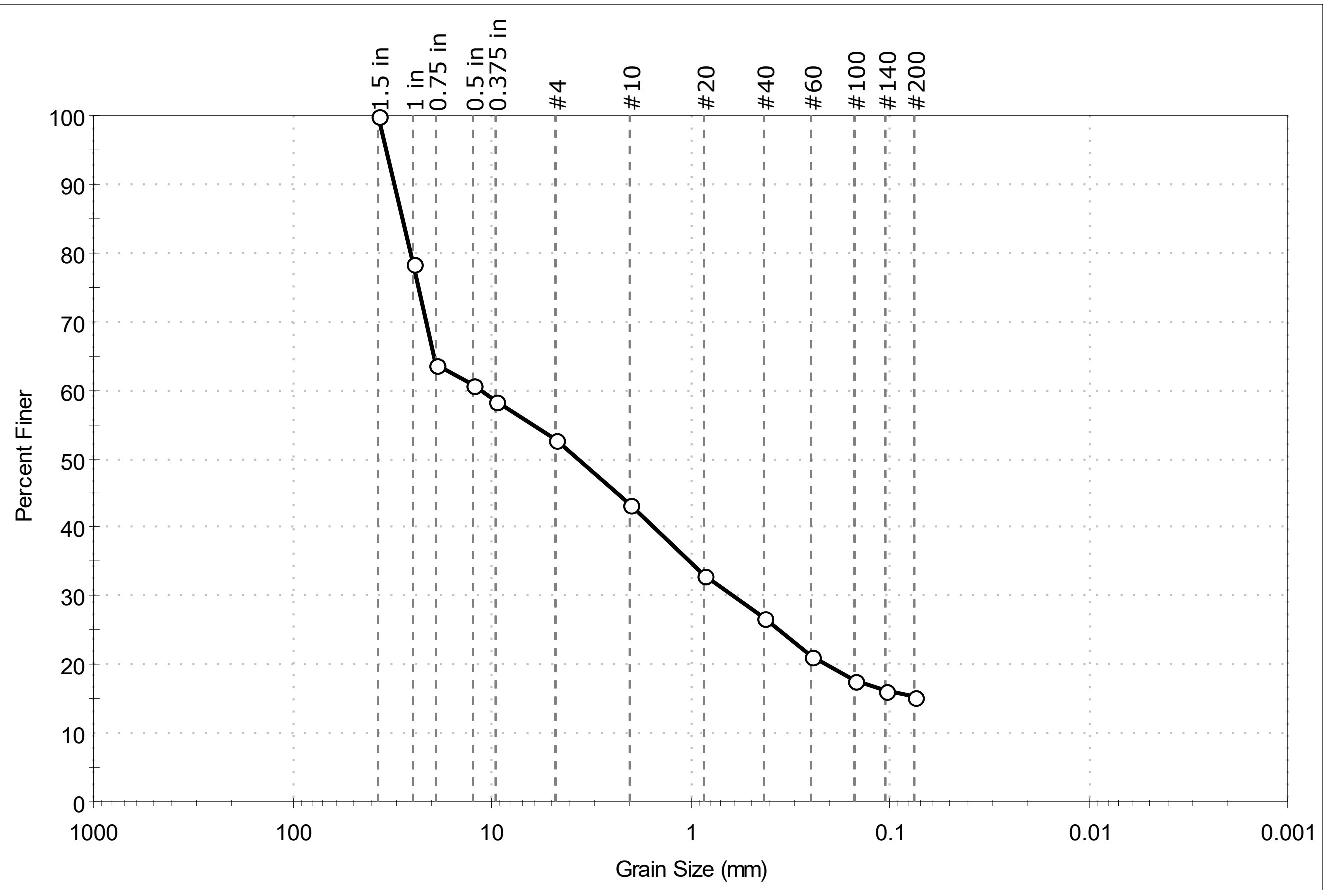
Client:	Langan Engineering				
Project:	145 Wolcott Street				
Location:	Brooklyn, NY			Project No:	GTX-312211
Boring ID:	LB-4	Sample Type:	tube	Tested By:	ckg
Sample ID:	S-12	Test Date:	08/13/20	Checked By:	jdt
Depth :	35-37	Test Id:	571312		

Test Comment: ---
Visual Description: Moist, brown silty gravel with sand
Sample Comment: ---

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	47.2	37.4	15.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	78		
0.75 in	19.00	64		
0.5 in	12.50	61		
0.375 in	9.50	58		
#4	4.75	53		
#10	2.00	43		
#20	0.85	33		
#40	0.42	27		
#60	0.25	21		
#100	0.15	18		
#140	0.11	16		
#200	0.075	15		

Coefficients

D_{85} =28.3203 mm
D_{30} =0.6074 mm
D_{60} =11.3620 mm
D_{15} =N/A
D_{50} =3.6982 mm
D_{10} =N/A
C_u =N/A
C_c =N/A

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (0))

Sample/Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

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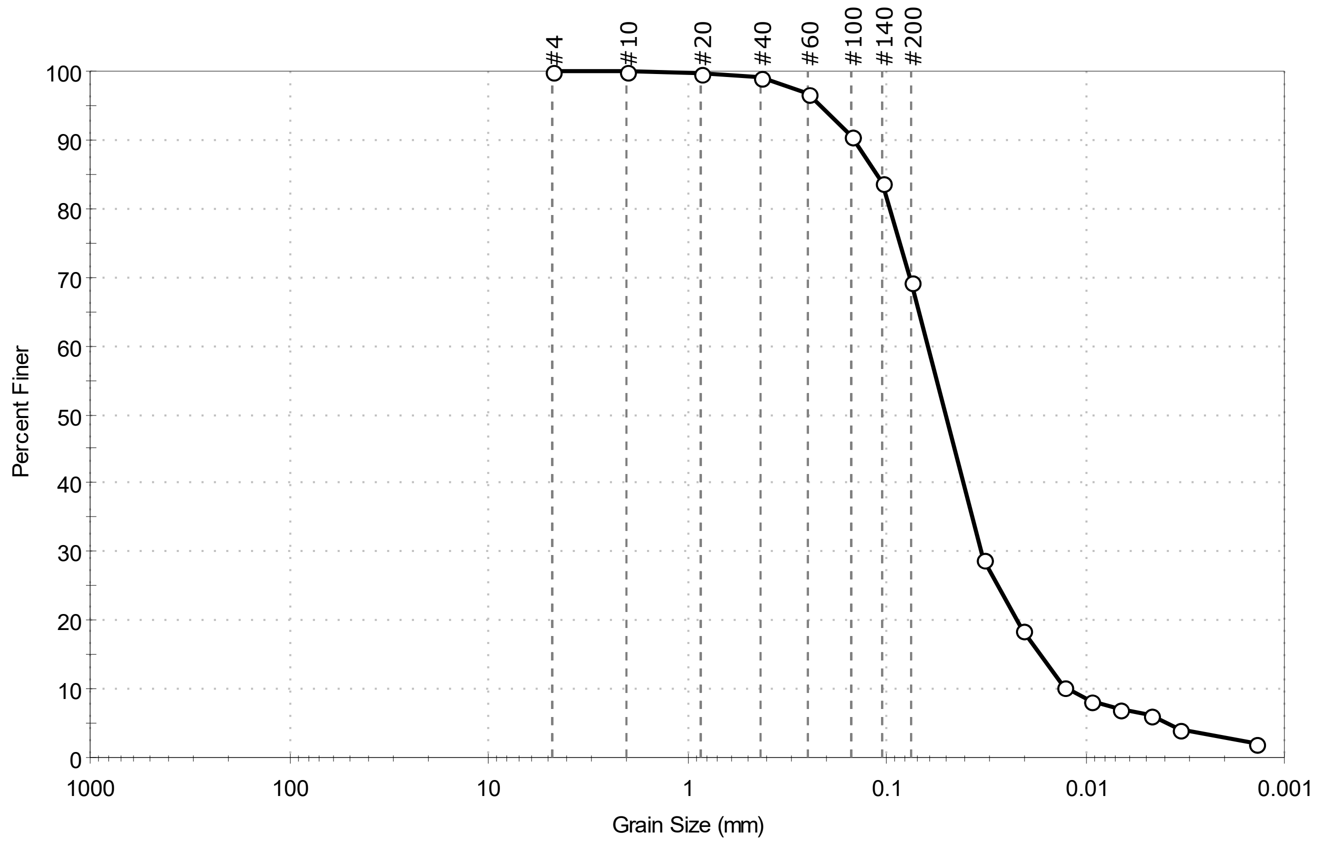
GeoTesting
EXPRESS

Client: Langan Engineering
Project: 145 Wolcott Street
Location: Brooklyn, NY
Project No: GTX-312211

Boring ID: LB-4
Sample ID: S-17
Depth : 60-62
Sample Type: tube
Test Date: 08/20/20
Test Id: 571316
Tested By: ckg
Checked By: jdt

Test Comment: ---
Visual Description: Moist, reddish brown sandy silt
Sample Comment: ---

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	30.6	69.4

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	99		
#60	0.25	97		
#100	0.15	90		
#140	0.11	84		
#200	0.075	69		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0324	29		
---	0.0206	19		
---	0.0129	10		
---	0.0094	8		
---	0.0067	7		
---	0.0047	6		
---	0.0034	4		
---	0.0014	2		

Coefficients

D_{85} =0.1131 mm
D_{30} =0.0332 mm
D_{60} =0.0618 mm
D_{15} =0.0169 mm
D_{50} =0.0502 mm
D_{10} =0.0123 mm
C_u =5.024
C_c =1.450

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

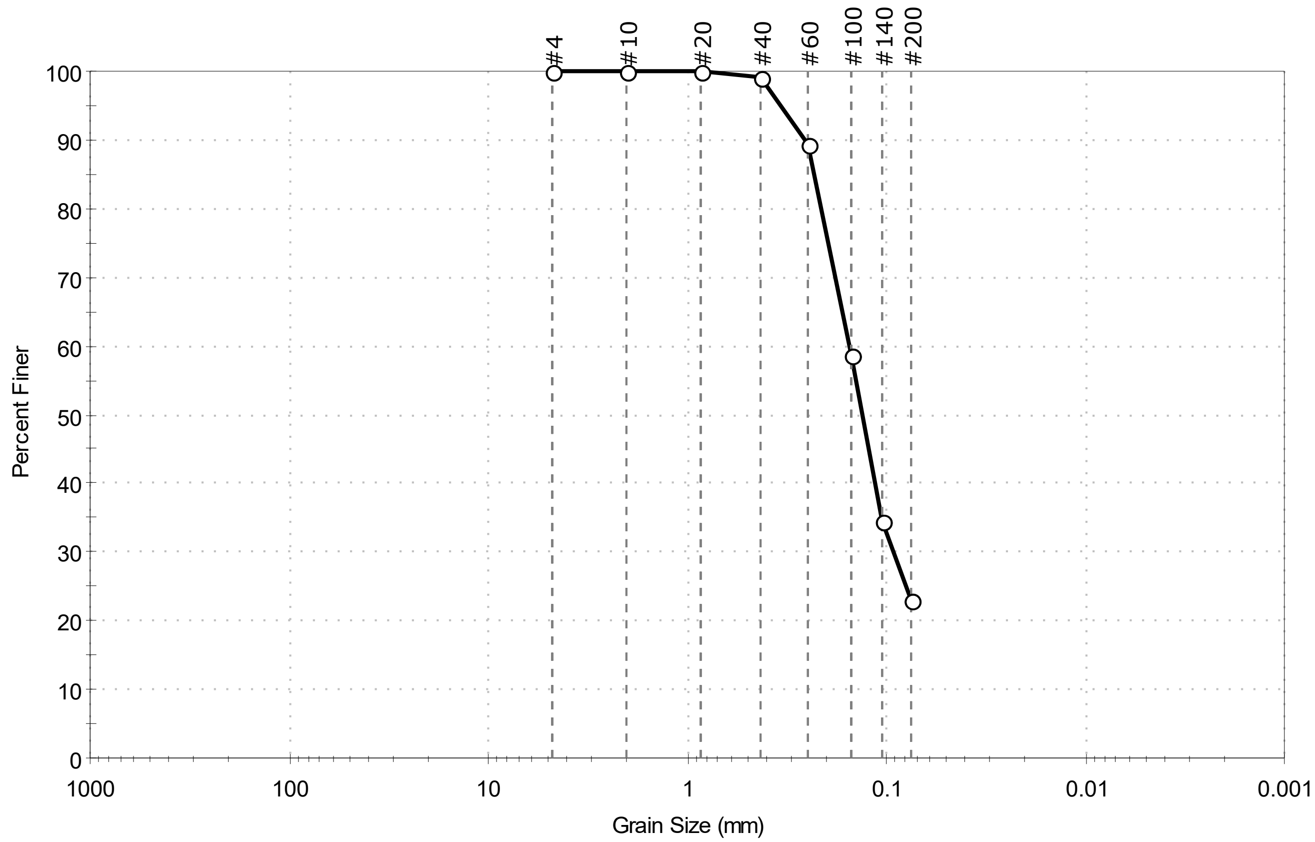
Sample/Test Description

Sand/Gravel Particle Shape : ---
Sand/Gravel Hardness : ---
Dispersion Device : Apparatus A - Mech Mixer
Dispersion Period : 1 minute
Est. Specific Gravity : 2.65
Separation of Sample: #200 Sieve

Client:	Langan Engineering				
Project:	145 Wolcott Street				
Location:	Brooklyn, NY			Project No:	GTX-312211
Boring ID:	LB-5	Sample Type:	tube	Tested By:	ckg
Sample ID:	S-6B	Test Date:	08/17/20	Checked By:	jdt
Depth :	12-14	Test Id:	571313		

Test Comment: ---
Visual Description: Moist, brown silty sand
Sample Comment: ---

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	77.1	22.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	99		
#60	0.25	89		
#100	0.15	59		
#140	0.11	35		
#200	0.075	23		

Coefficients

D_{85} =0.2325 mm
D_{30} =0.0926 mm
D_{60} =0.1529 mm
D_{15} =N/A
D_{50} =0.1322 mm
D_{10} =N/A
C_u =N/A
C_c =N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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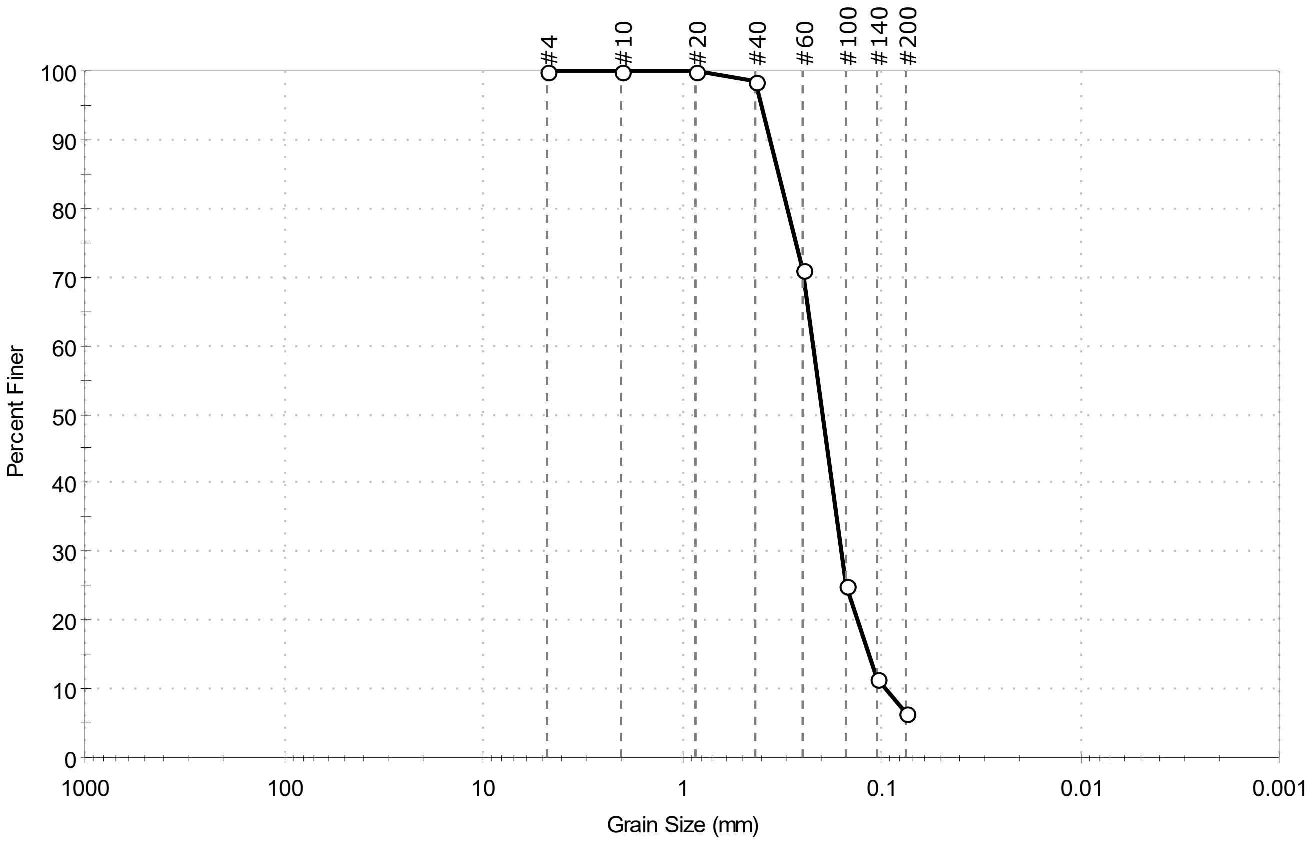
GeoTesting
EXPRESS

Client: Langan Engineering
Project: 145 Wolcott Street
Location: Brooklyn, NY
Project No: GTX-312211
Boring ID: LB-5
Sample Type: tube
Tested By: ckg
Sample ID: S-8
Test Date: 08/17/20
Checked By: jdt
Depth : 20-22
Test Id: 571314
Test Comment: ---
Visual Description: Moist, brown sand with silt
Sample Comment: ---

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	93.4	6.6

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	98		
#60	0.25	71		
#100	0.15	25		
#140	0.11	11		
#200	0.075	6.6		

Coefficients

D_{85} =0.3276 mm
D_{30} =0.1587 mm
D_{60} =0.2213 mm
D_{15} =0.1162 mm
D_{50} =0.1981 mm
D_{10} =0.0957 mm
C_u =2.312
C_c =1.189

Classification

ASTM N/A

AASHTO Fine Sand (A-3 (1))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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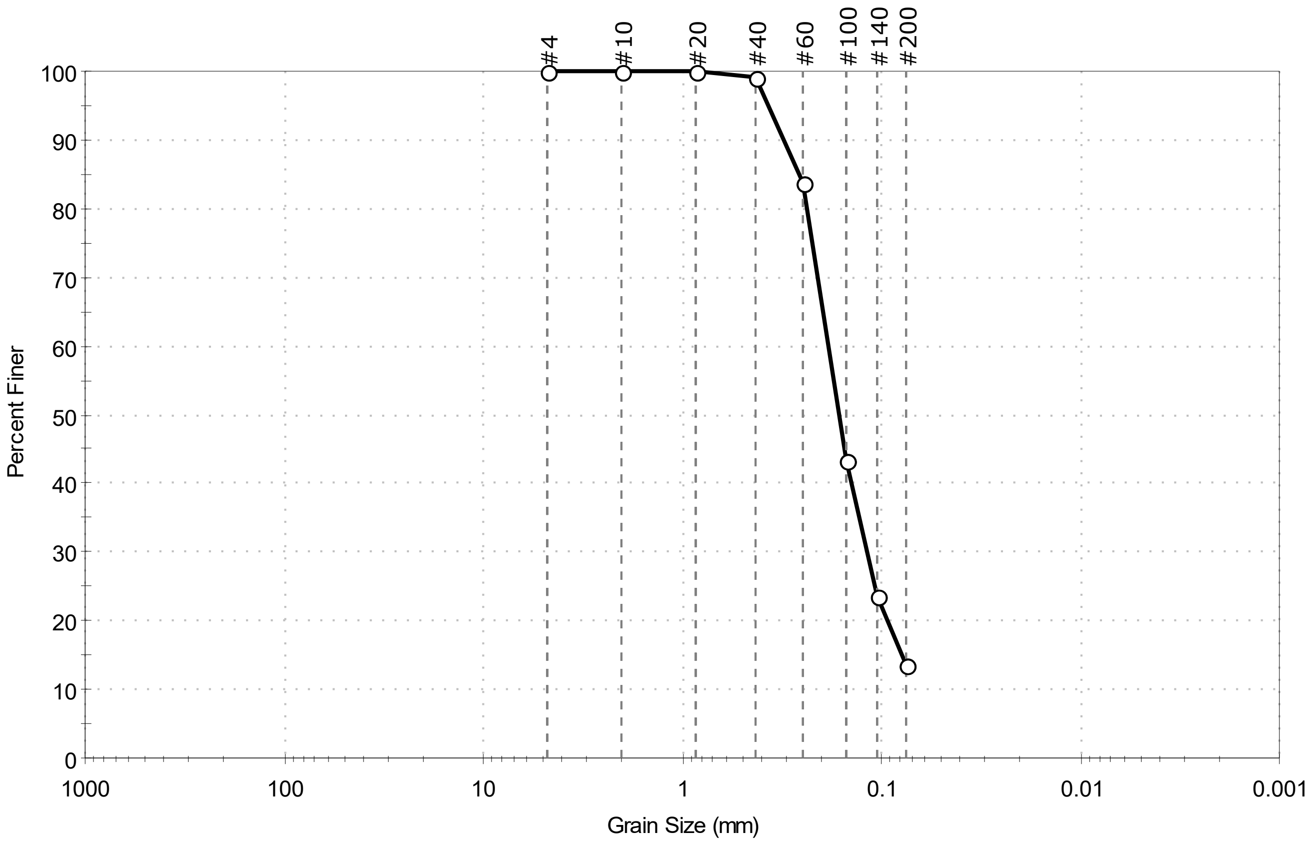
Client: Langan Engineering
Project: 145 Wolcott Street
Location: Brooklyn, NY
Project No: GTX-312211
Boring ID: LB-5
Sample Type: tube
Tested By: ckg
Sample ID: S-9
Test Date: 08/17/20
Checked By: jdt
Depth : 25-27
Test Id: 571315
Test Comment: ---
Visual Description: Moist, light reddish brown silty sand
Sample Comment: ---

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	86.3	13.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	99		
#60	0.25	84		
#100	0.15	43		
#140	0.11	23		
#200	0.075	14		

Coefficients

D_{85} =0.2600 mm
D_{30} =0.1187 mm
D_{60} =0.1849 mm
D_{15} =0.0786 mm
D_{50} =0.1630 mm
D_{10} =N/A
C_u =N/A
C_c =N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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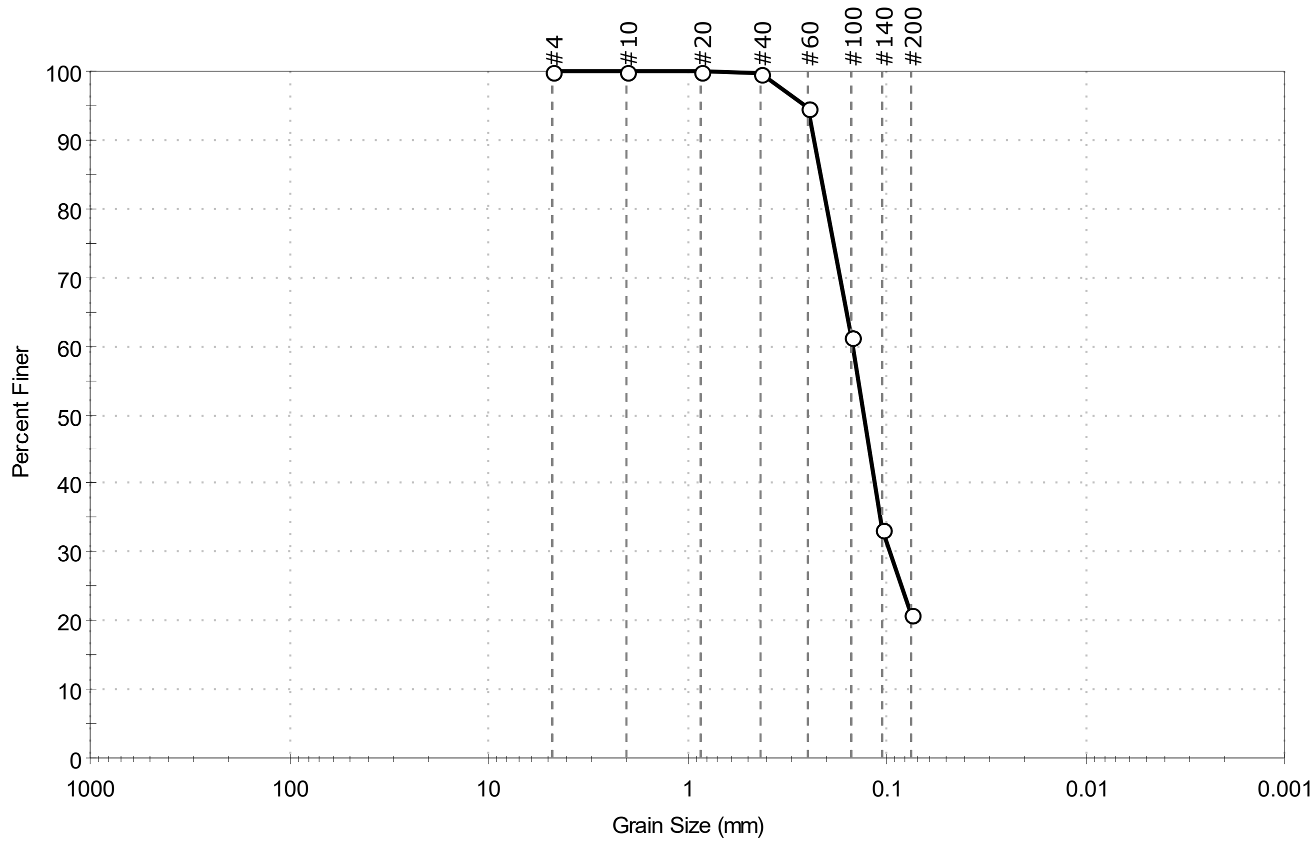
Client:	Langan Engineering				
Project:	145 Wolcott Street				
Location:	Brooklyn, NY			Project No:	GTX-312211
Boring ID:	LB-5	Sample Type:	tube	Tested By:	ckg
Sample ID:	S-11	Test Date:	08/13/20	Checked By:	jdt
Depth :	35-37	Test Id:	571509		

Test Comment: ---
Visual Description: Moist, reddish brown silty sand
Sample Comment: ---

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	78.9	21.1

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	100		
#60	0.25	95		
#100	0.15	61		
#140	0.11	33		
#200	0.075	21		

Coefficients

D_{85} =0.2156 mm
D_{30} =0.0967 mm
D_{60} =0.1476 mm
D_{15} =N/A
D_{50} =0.1304 mm
D_{10} =N/A
C_u =N/A
C_c =N/A

Classification

ASTM N/A

AASHTO Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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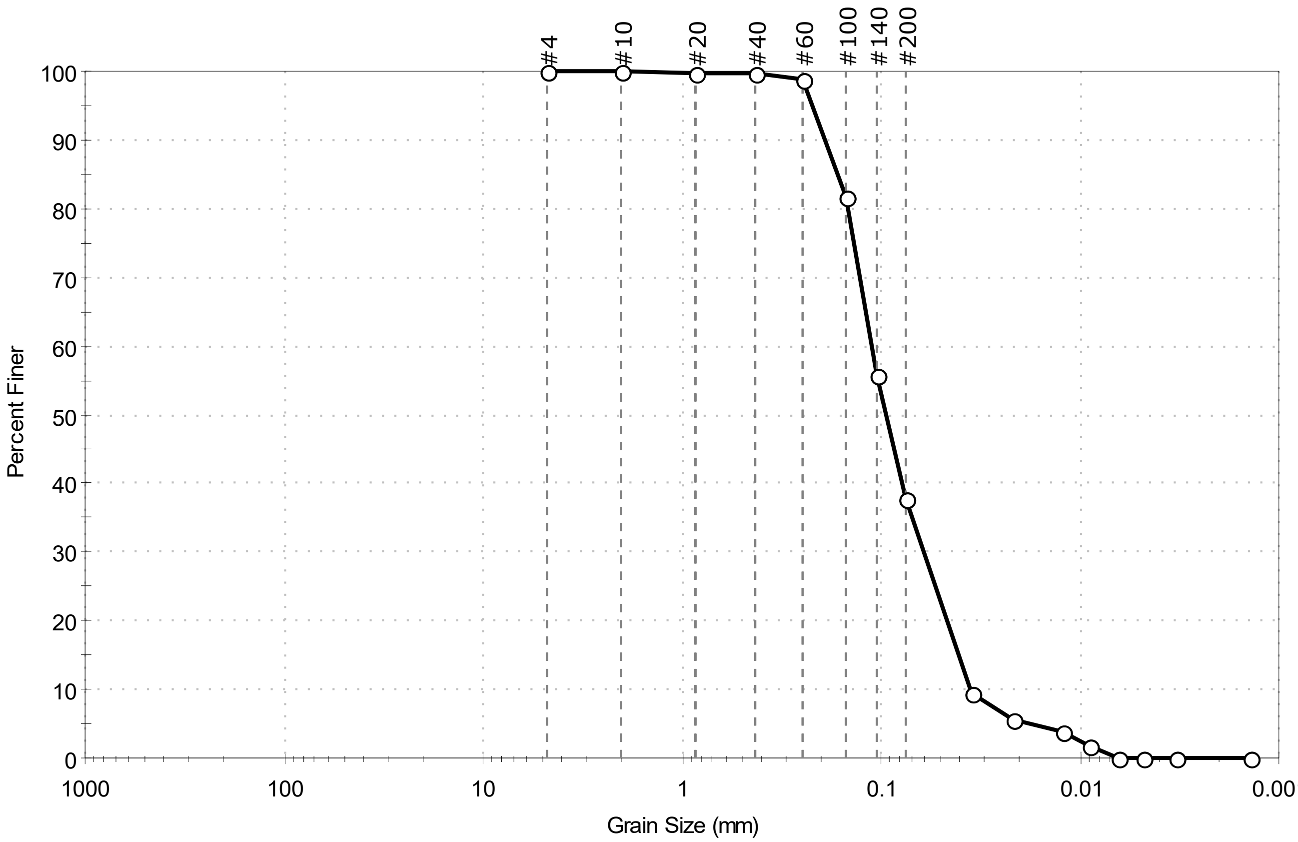
GeoTesting
EXPRESS

Client: Langan Engineering
Project: 145 Wolcott Street
Location: Brooklyn, NY
Project No: GTX-312211

Boring ID: LB-5
Sample ID: S-14
Depth : 50-52
Sample Type: jar
Test Date: 08/20/20
Test Id: 571317
Tested By: ckg
Checked By: jdt

Test Comment: ---
Visual Description: Moist, brown silty sand
Sample Comment: ---

Particle Size Analysis - ASTM D6913/D7928



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	62.2	37.8

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	100		
#60	0.25	99		
#100	0.15	82		
#140	0.11	56		
#200	0.075	38		
Hydrometer	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0346	9		
---	0.0218	6		
---	0.0124	4		
---	0.0090	2		
---	0.0065	0		
---	0.0048	0		
---	0.0033	0		
---	0.0014	0		

Coefficients

D_{85} =0.1659 mm
D_{30} =0.0607 mm
D_{60} =0.1120 mm
D_{15} =0.0404 mm
D_{50} =0.0947 mm
D_{10} =0.0352 mm
C_u =3.182
C_c =0.935

Classification

ASTM N/A

AASHTO Silty Soils (A-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---
Sand/Gravel Hardness : ---
Dispersion Device : Apparatus A - Mech Mixer
Dispersion Period : 1 minute
Est. Specific Gravity : 2.65
Separation of Sample: #200 Sieve

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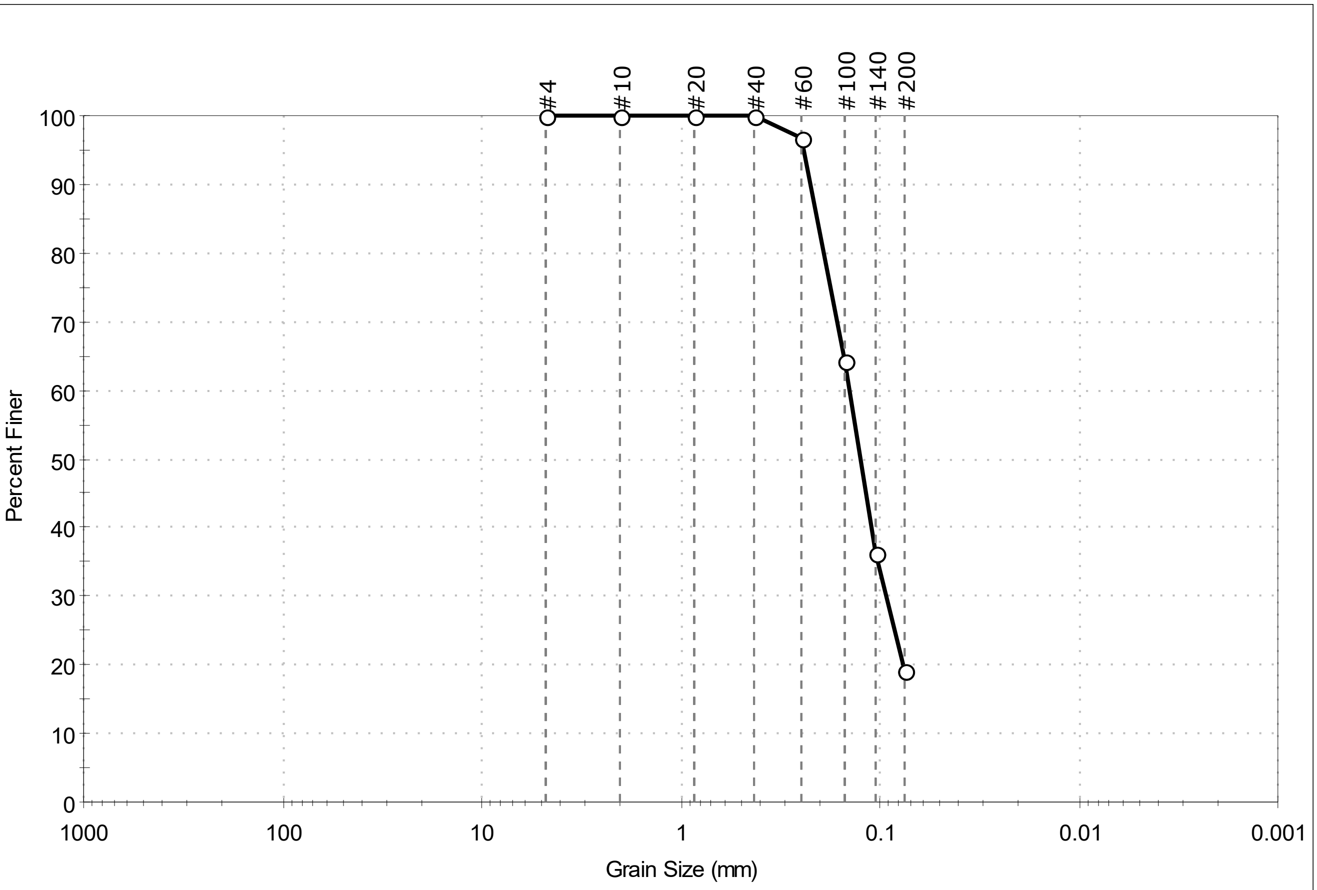
Client:	Langan Engineering				
Project:	145 Wolcott Street				
Location:	Brooklyn, NY			Project No:	GTX-312211
Boring ID:	LB-6	Sample Type:	jar	Tested By:	ckg
Sample ID:	S-15	Test Date:	08/17/20	Checked By:	jdt
Depth :	35-37	Test Id:	571320		

Test Comment: ---

Visual Description: Moist, brown silty sand

Sample Comment: ---

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	0.0	80.8	19.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
#4	4.75	100		
#10	2.00	100		
#20	0.85	100		
#40	0.42	100		
#60	0.25	97		
#100	0.15	64		
#140	0.11	36		
#200	0.075	19		

Coefficients

D_{85} =0.2078 mm	D_{30} =0.0933 mm
D_{60} =0.1422 mm	D_{15} =N/A
D_{50} =0.1256 mm	D_{10} =N/A
C_u =N/A	C_c =N/A

Classification

ASTM	N/A
AASHTO	Silty Gravel and Sand (A-2-4 (0))

Sample/Test Description

Sand/Gravel Particle Shape : ---

Sand/Gravel Hardness : ---

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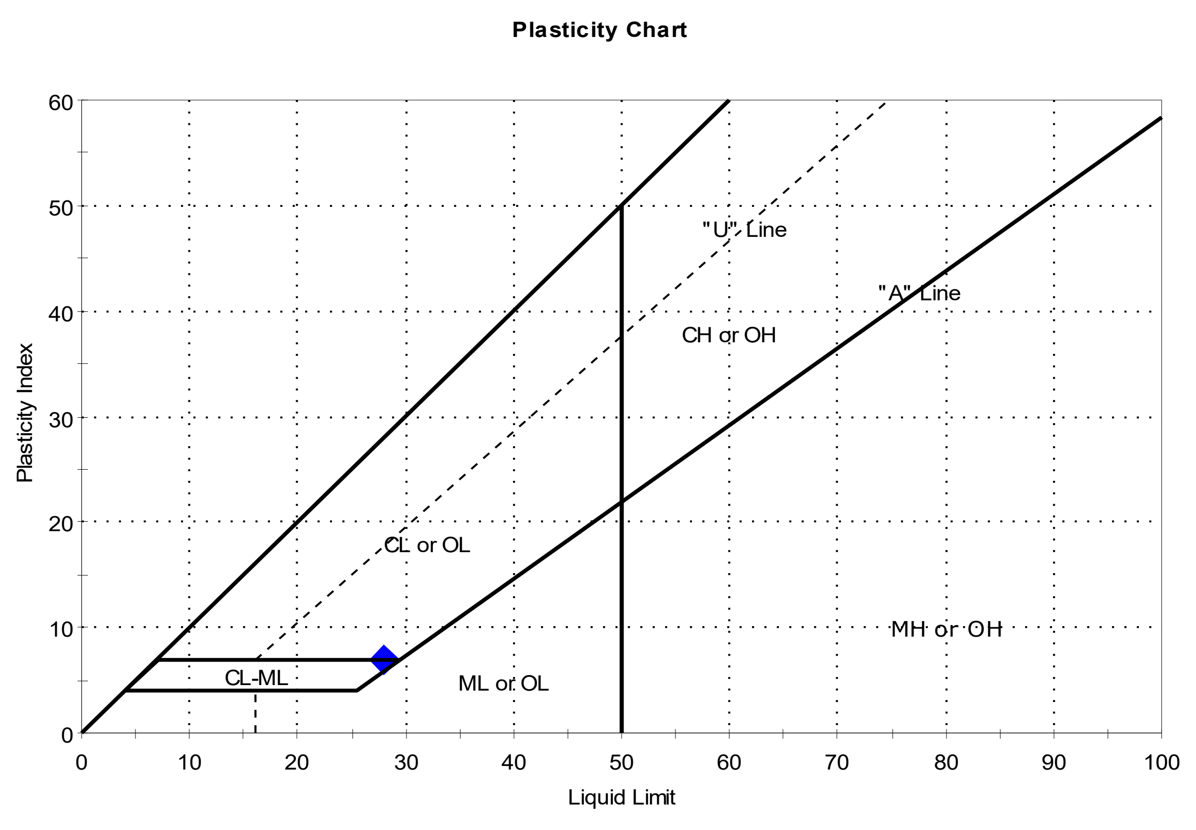
Client:	Langan Engineering				
Project:	145 Wolcott Street				
Location:	Brooklyn, NY			Project No:	GTX-312211
Boring ID:	LB-1	Sample Type:	jar	Tested By:	cam
Sample ID:	S-9A	Test Date:	08/19/20	Checked By:	jdt
Depth :	16-18	Test Id:	571299		

Test Comment: ---

Visual Description: Moist, grayish brown silty clay

Sample Comment: ---

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	S-9A	LB-1	16-18	28	28	21	7	1	

Sample Prepared using the WET method

Dry Strength: HIGH

Dilatancy: RAPID

Toughness: LOW

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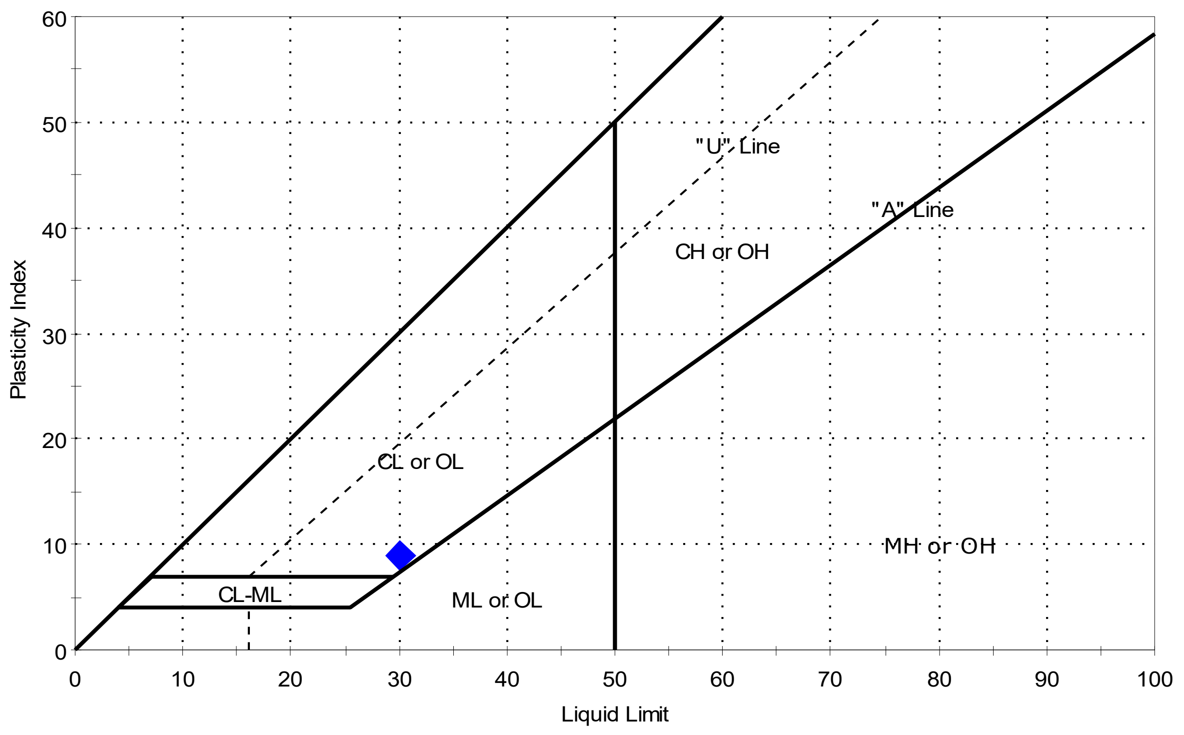
Client: Langan Engineering
Project: 145 Wolcott Street
Location: Brooklyn, NY
Project No: GTX-312211

Boring ID: LB-2
Sample ID: S-9
Depth : 19-21
Sample Type: jar
Test Date: 08/14/20
Test Id: 571298
Tested By: cam
Checked By: jdt

Test Comment: ---
Visual Description: Mosit, brown clay
Sample Comment: ---

Atterberg Limits - ASTM D4318

Plasticity Chart



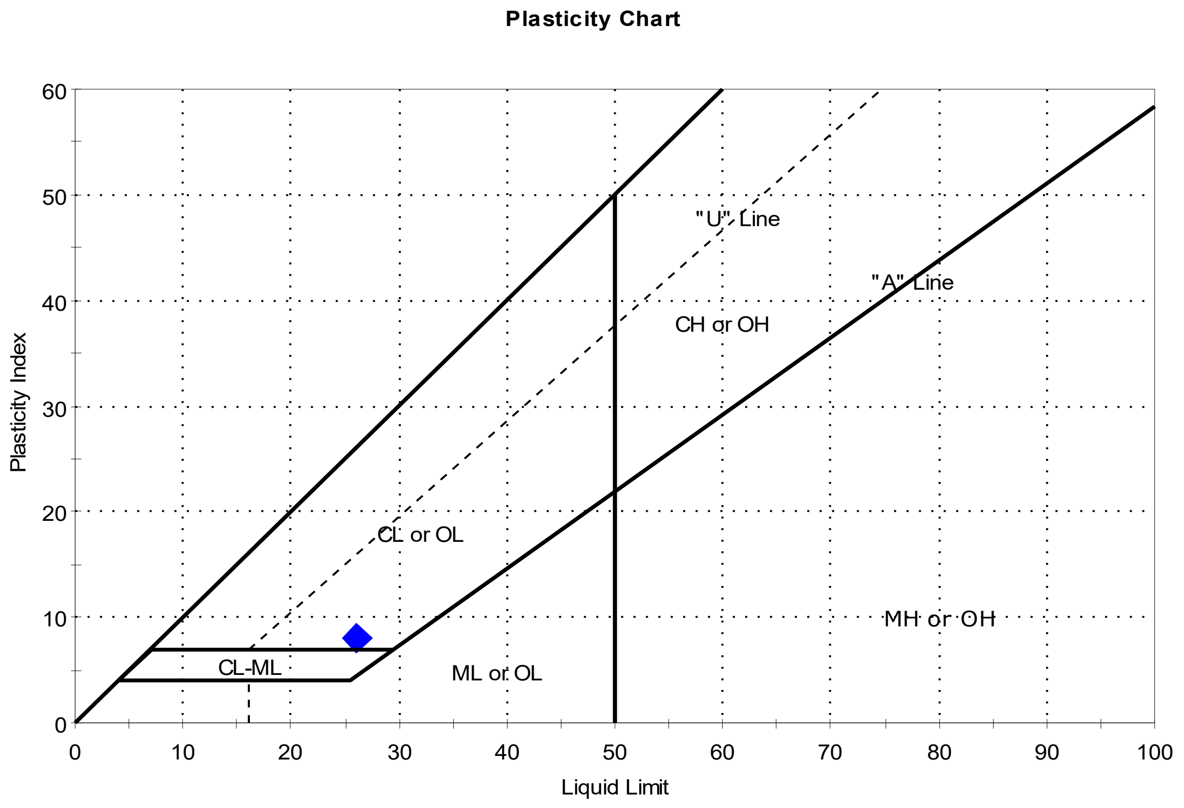
Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	S-9	LB-2	19-21	27	30	21	9	0.6	

Sample Prepared using the WET method

Dry Strength: HIGH
Dilatancy: RAPID
Toughness: LOW

Client: Langan Engineering
Project: 145 Wolcott Street
Location: Brooklyn, NY
Project No: GTX-312211
Boring ID: LB-2
Sample Type: jar
Tested By: cam
Sample ID: S-12
Test Date: 08/14/20
Checked By: jdt
Depth : 25-27
Test Id: 571297
Test Comment: ---
Visual Description: Moist, brown clay
Sample Comment: ---

Atterberg Limits - ASTM D4318



Symbol	Sample ID	Boring	Depth	Natural Moisture Content,%	Liquid Limit	Plastic Limit	Plasticity Index	Liquidity Index	Soil Classification
◆	S-12	LB-2	25-27	29	26	18	8	1.3	

Sample Prepared using the WET method

Dry Strength: HIGH
Dilatancy: RAPID
Toughness: LOW

Board of Standards and Appeals

250 Broadway, 29th Floor
New York, New York 10007
Phone: (212) 386-0009
Fax: (646) 500-6271
www.nyc.gov/bsa

APPLICATION DOCUMENT(S) CERTIFICATION

I, Michael Burke, am the [CHECK ALL APPLICABLE]
Printed Name

☐ APPLICANT

☐ PROPERTY OWNER ☐ CONTRACT VENDEE ☐ OTHER PERSON HAVING LEGAL OWNERSHIP OR COTROL OF THE PROPERTY IN ACCORDANCE WITH SECTION 202 OF THE NYC BUILDING CODE

☒ PREPARER OF Environmental + Geotechnical Hardships, dated Nov. 17, 2020
Document Title(s)

for an application relating to a variance, special permit and/or appeal filed on the Board of Standards and Appeals' BZ, SOC or A Calendar for [ADDRESS] 145 Wolcott St, Brooklyn, NY and certify, under penalty of perjury, that all of the factual information in this submission / the above referenced document(s), submitted on [DATE] November 17, 2020, is correct to the best of my knowledge and understanding.

I also understand that to "knowingly make or allow to be made a material false statement in any certificate, professional certification, form, signed statement, application or report that is either submitted directly to the board of standards and appeals or that is generated with the intent that the Board rely on its assertions" is a violation of New York City Charter § 670 and may subject me to a civil penalty of up to $15,000 for each such false statement and that the Board may dismiss any application in connection with a final determination of such violation.

Michael Burke
SIGNATURE

Nov. 24, 2020
DATE

Subscribed and sworn to before me this
24th day of November, 20 20

NOTARY PUBLIC

MELISSA J. WOLOWITZ
ID# 2423794
NOTARY PUBLIC OF NEW JERSEY
My Commission Expires Aug. 8, 2022