ENGINEERING INVESTIGATION & ANALYSIS
GEOTECHNICAL & STRUCTURAL
ASSESSMENT REPORT

140 LITTLE FALLS ROAD
FAIRFIELD, NEW JERSEY 07004

MATRIXNEWORLD
Engineering Progress

Prepared for:

State of New Jersey
Department of Community Affairs
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1.0 PROJECT BACKGROUND

The State of New Jersey Department of Community Affairs (DCA), Division of Disaster Recovery and Mitigation, anticipates receiving approval for grant funding through FEMA's Flood Mitigation Assistance (FMA) appropriation. This funding is provided through FMA to states and local communities to reduce or eliminate flood risk due to repetitive flood damage to buildings insured by the National Flood Insurance Program (NFIP). The DCA intends to use the funding for the State's Mitigation Assistance Program (MAP) to elevate residential properties located in a floodplain in the Township of Fairfield. The properties are to be elevated at least 3 feet above the base flood elevation (BFE). The DCA hosted a town hall meeting for homeowners in Fairfield, focused on homeowners with properties that experience Repetitive Losses or Severe Repetitive Losses.

In preparation of procuring a Design-Build firm to conduct the effort, the DCA has contracted Matrix New World Engineering, Land Surveying and Landscape Architecture, P.C. (Matrix) to conduct a geotechnical analysis, preliminary structural analysis, and elevation certificate for residences anticipated to be included in the program. It is understood that this document will serve as the basis for the development of a Request for Proposal (RFP) to procure Design-Build firms to do final structural design and perform the elevation of the properties.

2.0 PROJECT SCOPE

Matrix has completed a geotechnical and structural assessment and elevation certificate to evaluate the viability of elevating the residential building located at 140 Little Falls Road in Fairfield, New Jersey (Site). Matrix provided geotechnical and structural engineering and land surveying services as a consultant to the DCA. The project location is shown on the attached Site Location Map (Figure 1).

The purpose of the engineering study was to compile comprehensive data regarding the existing building's foundations and overall structural composition and condition at the Site. The information obtained will be further utilized to determine the feasibility and proposed design of raising the existing residence 3 feet above the base flood elevation (BFE) as determined by FEMA. A team of Matrix engineers and surveyors performed the evaluation, consisting of a geotechnical soil inspection, test pits to reveal the existing building foundations, an interior inspection of the building's visible foundation walls and frame, and topographic surveying for the development of a flood elevation certificate. A total of 2 test pits (TP-1 and TP-2) were completed to depths of 40 to 63 inches below the ground surface (bgs) and 2 geotechnical borings (B-1 and B-2) were completed to a depth of 27 feet bgs (see Figure 2).

Matrix's geotechnical characterization of the property is based on an engineering evaluation of the subsurface conditions as indicated by the field exploration data and geotechnical laboratory test results on representative soil samples.

3.0 SITE LOCATION & PROJECT DESCRIPTION

The project site is located at 140 Little Falls Road in Fairfield, New Jersey. The property consists of a one-story timber-framed cape cod-style house with an approximately 1,510 square foot footprint. The house is situated atop both concrete masonry unit (CMU) and cast-in-place concrete foundation walls on cast-in-place concrete foundations. The substructure of the house is comprised of a three-room basement as well as a crawl space. The timber frame of the residential structure is covered with a vinyl siding throughout its exterior. The property also contains a timber-framed painted timber deck in the rear of the house.

To assist with the geotechnical and structural evaluation, test pits and geotechnical borings were advanced in areas around the residence to obtain information regarding the soil's structural properties and building's existing foundation. The 2 test pits and 2 borings were located to provide the most useful information about the subsurface conditions. Refer to Figure 2 of this report for a map of the test pit and boring locations.

4.0 GEOLOGIC SETTING

According to the USDA Soil Survey of Essex County, the site is entirely situated atop Horseneck-Urban land. The subsurface composition is typically sandy loam and loamy sands down to 60 inches bgs.

According to the 2014 Bedrock Geologic Map of New Jersey, the Site is underlain by the Sedimentary and Bedded Volcanic Rocks Towaco Formation. Specifically, the subsurface consists of micaceous, reddish-brown sandstone, siltstone, and silty mudstone in upward-fining sequences. The Bedrock Geologic Map is shown in Figure 3.

From the Surficial Geologic Map of Northern New Jersey, compiled by and edited by Byron D. Stone, Scott D. Stanford, and Ron W. White in 2002, the natural surface material (beyond fill) is suggested to be in the Pine Brook terrace deposit, which contains sand and gravel, moderately to poorly sorted. The Surficial Geology map is shown in Figure 4.

The documented site conditions presented above are consistent with the findings from the subsurface investigation, in which Sand was encountered followed by a layer of Clay and Silt. Groundwater was encountered in the borings at approximately 6 feet bgs. Bedrock was not encountered during this subsurface program.

5.0 SUBSURFACE FIELD PROGRAM

The subsurface investigation was completed by generally accepted practices in the Geotechnical Engineering field and consisted of the advancement of 2 test pits and 2 Standard Penetration Test (SPT) borings using mud rotary drilling methods. Matrix retained Boring Brothers, Inc., located in Egg Harbor Township, NJ, to complete the subsurface field program.

A Matrix Geotechnical Engineer provided full-time drilling oversight, soil logging, and sample collection. Matrix prepared the field test pit and boring logs, which included sample depths, SPT-N blow counts, soil recovery, and soil descriptions based on the Burmister Soil Classification System followed by the Unified Soil Classification System (USCS) letter symbol. Test pit and soil boring logs are provided in Appendix A. Classification tables and charts used to determine the soil attributes are included in Appendix B.

Upon the completion of the field program, representative samples were subjected to geotechnical laboratory analyses. Laboratory results aided in soil classification and assessing the relevant engineering properties of the stratigraphic layers which were used in developing the revised geotechnical parameters outlined herein. Geotechnical laboratory reports are included in Appendix C.

5.1 Test Pits

On August 9, 2021, Boring Brothers completed a foundation survey which included 2 test pits to depths of 40 and 63 inches below the ground surface. Each test pit was dug using a Kubota KX057-5 excavator and shovel to prevent any damage to the existing building foundations. The exterior edges of the building's foundation walls and/or footings were exposed at both locations to analyze the conditions of the concrete foundation.

The Matrix Geotechnical Engineer also observed the subsurface soil conditions encountered within the test pits, noting the type and composition of the soils surrounding and beneath the existing footings. Test Pit TP-1 was conducted on the south face of the building, along Pier Lane, and TP-2 was conducted at the northeast corner of the building, along Little Falls Road. All test pits were backfilled with the original soils upon completion of the test pit logs. No test pit samples were collected at the site for further analysis.

5.2 SPT Borings

On August 9, 2021, Boring Brothers advanced 2 geotechnical borings with a Mobile CME 55 track-mounted drill rig using mud rotary drilling techniques.

Split spoon (SS) samples were collected in accordance with *ASTM D-1586*, *Standard Method for Penetration Test and Split-Barrel Sampling of Soils*. A standard 2-inch outer diameter split spoon, two feet in length, was used to collect the soil samples. An automatic 140-pound hammer having a 30-inch drop was used to drive the split spoon sampler. As a part of boring observation, the SPT blow counts were recorded for the 0- to 6-inch interval, the 6- to 12-inch interval, the 12- to 18-inch interval and the 18- to 24-inch interval. The SPT N-values for design purposes are reported as the sum of the SPT N values observed for the above referenced 6- to 12-inch interval and the 12- to 18-inch interval that the split spoon sampler was driven.

The Matrix Geotechnical Engineer observed the split spoon samples and collected representative samples in sealed containers for further examination. All borings were continuously sampled to 12 feet bgs and at every subsequent 5-foot interval thereafter. The 2 borings were each advanced to a depth of 27 feet bgs. The borings were backfilled with soil cuttings and bentonite hole plug (if necessary) upon completion of the borehole.

5.3 Laboratory Testing

In addition to the field investigation, a laboratory testing program was conducted to determine additional pertinent engineering characteristics of representative samples of on-site soils. The laboratory testing program was performed in general accordance with applicable ASTM standard test methods and included physical/textural testing of representative samples of various strata.

Upon review of the boring logs, Matrix selected representative samples for laboratory testing. Laboratory testing of selected samples was completed by TerraSense, LLC, located in Totowa, New Jersey. The following table presents a summary of the testing program.

The results of the laboratory testing program were utilized to assist in developing geotechnical design parameters and recommendations, and are provided in Appendix C.

Table 5.3-1: Laboratory Testing Program

Test	Testing Procedure	Quantity Performed	Sample Locations and Depth Intervals
Water Content	ASTM D2216	6	B-1: 6-8’, 10-12’, 15-17’, 20-22’ B-2: 4-6’, 20-22’
Sieve Analysis	ASTM D422	1	B-2: 4-6’
Atterberg Limits	ASTM D4318	3	B-1: 10-12’, 20-22 B-2: 20-22’
Percent Fines	ASTM D1140	1	B-1: 15-17’
Combined Sieve & Hydrometer	ASTM D422	1	B-1: 6-8’

6.0 SUBSURFACE CONDITIONS

The subsurface conditions beneath the site can be characterized by the following stratigraphy, proceeding from the surface materials downward, unless noted otherwise below. Classification tables and charts used to determine the soil attributes are included in Appendix B.

Test Pits

Test pit TP-1 was located in the southwest corner of the house, along the walls of the rear crawl space. At this location, the bottom of the CMU foundation wall was encountered at 36" bgs. There did not appear to be a spread footing beneath the wall.

Test pit TP-2 was completed along the front basement walls, in the northeast corner of the building. Due to limited access, the concrete footing could not be reached during test pit excavation. The excavation was terminated along the length of the foundation wall at 63" bgs.

Surface Cover

The surface cover for boring B-1 and B-2 consisted of grass cover and topsoil, approximately 6 inches thick.

Stratum 1: Upper Sand (SC, SM)

Beneath the surface cover in each boring, a soil layer was encountered consisting of typically brown medium-to-fine Sand with varying amounts of Silt and/or Clay and trace amounts of fine Gravel. This Sand layer extended from the bottom of the surface cover to 8 feet below the ground surface (bgs) in B-1 and approximately 13.5 feet bgs in B-2.

The SPT-N values in this layer ranged from 5 to 39 blows per foot (bpf), which is indicative of loose to dense Sand. The SPT N-values for Stratum 1 are summarized in the tables below.

Within this Upper Sand stratum in boring B-1, a thin, approximately 7-inch layer of Clay was observed from 5.42 to 6 feet bgs. This soil had a recorded N-value of 3 blows per 6 inches, which signifies medium-soft Clay material.

Table 6.0-1: Loose SPT N-Values for Stratum 1

Soil Boring Location	USCS Group Symbol	Depth Below Ground Surface	SPT N-Values
B-1	SM, SC	0-2' 4-5.42' 6-8'	6 5 5
B-2	SM, SC	0-2' 4-6'	5 5

Table 6.0-2: Medium-Dense SPT N-Values for Stratum 1

Soil Boring Location	USCS Group Symbol	Depth Below Ground Surface	SPT N-Values
B-1	SM	2-4'	23
B-2	SM	2-4' 6-10'	22 18-26

Table 6.0-3: Dense SPT N-Values for Stratum 1

Soil Boring Location	USCS Group Symbol	Depth Below Ground Surface	SPT N-Values
B-2	SM	10-13.5'	39

Table 6.0-4: Medium Soft SPT N-Values for Clay in Stratum 1

Soil Boring Location	USCS Group Symbol	Depth Below Ground Surface	SPT N-Values
B-1	CL	5.42-6'	3/6"

Stratum 2: Clay & Silt (CL, ML)

Beneath the granular material of Stratum 1 in both borings, a soil layer was encountered consisting of a mixture brown to grey Clay and Silt. This layer was encountered at 8 and approximately 13.5 feet bgs in borings B-1 and B-2, respectively. The layer extended to approximately 23.5 feet bgs in boring B-1, and boring B-2 was terminated within this layer at 27 feet bgs. In boring B-1, this layer also contained little to trace amounts of fine Sand and Gravel from 10 to 18.5 feet bgs.

In boring B-1, the soils within this layer were much harder at the top of the layer, from 8 to approximately 13.5 feet bgs. Within this depth range, the SPT N-values in this layer ranged from 31 to 37 bpf, which is indicative of hard Clay material. For the rest of this layer in both borings, the SPT N-values ranged from 5 to 12 bpf, signifying medium-soft to stiff Clay. The SPT N-values for Stratum 2 are summarized in the tables below.

Table 6.0-5: Hard Clay SPT N-Values for Stratum 2

Soil Boring Location	USCS Group Symbol	Depth Below Ground Surface	SPT N-Values
B-1	CL	8-13.5’	31-37

Table 6.0-6: Stiff Clay SPT N-Values for Stratum 2

Soil Boring Location	USCS Group Symbol	Depth Below Ground Surface	SPT N-Values
B-2	CL	13.5-18.5’	12

Table 6.0-7: Medium Soft Clay SPT N-Values for Stratum 2

Soil Boring Location	USCS Group Symbol	Depth Below Ground Surface	SPT N-Values
B-1	CL	18.5-23.5’	5
B-2	CL	18.5-27’	5-8

Table 6.0-8: Medium Silt SPT N-Values for Stratum 2

Soil Boring Location	USCS Group Symbol	Depth Below Ground Surface	SPT N-Values
B-1	ML	13.5-18.5’	12

Stratum 3: Lower Sand (SM)

Beneath the Clay & Silt layer (Stratum 2) in boring B-1, a second granular soil layer was encountered consisting of brown medium-to-fine Sand with some Silt and trace amounts of fine Gravel. This Lower Sand layer was encountered at approximately 23.5 feet bgs, and boring B-1 was terminated within this layer at 27 feet bgs.

The SPT-N value in this layer was recorded at 15 bpf, which is indicative of medium-dense Sand. The SPT N-values for Stratum 3 are summarized in the table below.

Table 6.0-1: Loose SPT N-Values for Stratum 1

Soil Boring Location	USCS Group Symbol	Depth Below Ground Surface	SPT N-Values
B-1	SM	23.5-27’	15

Groundwater

Groundwater levels could not be measured during drilling in either boring, due to the use of water and drilling mud to advance the borings. Based on soil saturation levels, the groundwater table was expected to lie approximately at 6 feet bgs during the drilling program. It should be noted that the groundwater levels will vary with temperature, precipitation, and other climatic factors.

7.0 GEOTECHNICAL SUBSURFACE PARAMETERS

The geotechnical design parameters in this report are derived from the field program and are based on accepted geotechnical standards and practices. At the time of the geotechnical assessment, loading conditions and the final proposed grading plans were not available. Therefore, certain assumptions were made for the recommendations provided in this report.

Table 7.0-1 summarizes the recommended geotechnical design parameters for the various soil strata encountered at the Site. The values are based on review and interpretation of the subsurface field program and laboratory test data results.

Table 1806.2 of the 2018 International Building Code provides allowable coefficients of friction to be used in the evaluation of resistance to sliding.

Table 7.0-1: Geotechnical Design Parameters

Stratum	Unit Weight	Friction Angle (Φ)	Cohesive Strength, c_u	Earth Pressure Coefficient		Net Allowable Foundation Pressure*	Lateral Bearing
				Active	Passive		
	(pcf)	(deg)	(psf)	(Ka)	(Kp)	(psf)	(psf/ft. bgs)
Native Medium-Dense to Dense Granular Soil (SP, SM, SC) [SPT N > 10]	$\gamma = 125$ $\gamma' = 63$	32°	0	0.31	3.26	4,000	200
Native Loose Granular Soil (SP, SM, SC) [SPT N ≤ 10]	$\gamma = 120$ $\gamma' = 58$	30°	0	0.33	3.00	2,500	150
Native Silt (ML) Medium [10 ≤ SPT N ≤ 30]	$\gamma = 115$ $\gamma' = 53$	28°	400	0.36	2.77	2,000*	100
Native Clay Material (CL) Very Stiff - Hard [SPT N > 30]	$\gamma = 120$ $\gamma' = 58$	-	2,000	-	-	3,000*	100
Native Clay Material (CL) Stiff [8 < SPT N ≤ 30]	$\gamma = 110$ $\gamma' = 48$	-	1,500	-	-	2,000*	100
Native Clay Material (CL) Medium-Soft [4 ≤ SPT N ≤ 8]	$\gamma = 100$ $\gamma' = 38$	-	1,000	-	-	1,500*	75

Notations: γ = moist unit weight, γ' = buoyant unit weight, and c_u = average undrained shear strength.

+ Allowable foundation pressure is contingent upon either replacement of at least two feet of existing fill below the bottom of footing by a Controlled Fill, or upon confirmation that the field density of the existing fill material down to four feet below the bottom of footing meets 95% of the maximum dry density of the existing fill material observed in Modified Proctor Tests.

* These values are based on the 2018 International Building Code, New Jersey Edition, and adjusted for field conditions encountered. To increase the allowable foundation pressure above the values recommended in the table given above, further testing of soil will be required. In Cohesive soils, it should be noted that the shallow footing may fail under the settlement criteria before the footing pressure approaches the anticipated allowable bearing capacity. Allowable Foundation Pressure values assume the water table is below the influence depth of the foundation.

● Coefficient of earth pressure at rest may be computed using Jaky's equation, $K_o = 1 - \sin \phi'$.

8.0 STRUCTURAL INSPECTION

The following sections present the results of the structural inspection of the residential building at 140 Little Falls Road in Fairfield, New Jersey. The conclusions presented herein are derived from Matrix's geotechnical and structural investigation of the existing soils and building foundations and framing configurations, along with pertinent survey data as compiled by Matrix's team of land surveyors.

Matrix conducted a subsurface investigation that included both test pits and soil borings to obtain maximum pertinent information regarding the existing site conditions (refer to Section 6.0 of this report). Each test pit performed at the site exposed the exterior portion of the building's foundation walls, allowing for measurement of dimensions of the structure and assessment of the construction methods utilized. Two geotechnical borings were also conducted to gain further information regarding the existing soils beneath the site.

In addition to the geotechnical investigation, Matrix also conducted a structural site inspection to observe the existing foundation walls and framing of the building. Matrix's structural engineer was granted access to the residence's basement and crawl space to observe the building's foundation structure. Substructure composition was recorded, including beam/girder type, building dimensions, and spacing of structural components. Structural defects, if any, were also noted during the inspection and have been included within Section 8.3.

8.1 Existing Building Foundations

The building at 140 Little Falls Road is supported by a combination of concrete masonry unit (CMU) and cast-in-place concrete walls throughout its foundation. The structure is broken up into four foundation sections (three basement rooms and a crawl space area), each with a different finished floor elevation. The rear of the building appears to consist of multiple additions, as the original house likely spanned the front basement area only.

The front basement area of the building encompasses the entire front of the residence and spans the full width of the house, measuring approximately 18'-7" long x 41'-5" wide. The basement walls consist of CMU blocks (assumed 8"x8"x16" units) atop concrete foundation walls. The concrete portion of the foundation walls was present along the entire perimeter of the front basement, but varied in height throughout. These concrete walls ranged from only 12" in height (above the basement floor surface) along the northwestern edge of the area to approximately 47" above the basement floor surface. CMU block units comprise the remainder of the foundation walls, bearing on the concrete walls below and extending approximately 36” to 38” to the top of the wall. The concrete portion of these walls was observed to be between 8” and 11” thicker than the CMU wall above, as the top of the concrete walls protruded into the basement. The basement floor elevation varies slightly throughout this area, as the bottom of the first-floor floorboards were measured between 7’-7” and 7’-9” above the basement floor surface.

In the front basement, the first floor is supported by nominal 2x8 timber joists, spaced 16” on center, spanning the length of the area from east to west (front to rear of the house). These joists are supported at either end by the foundation walls, and a nominal 6x8 timber girder provides added support. The girder is located approximately 7’ off the east (front) foundation wall, and is supported along its length by (2) 12”x16” CMU block columns and (2) 3” diameter steel jack posts. The longest clear span of this girder, located along the south-central portion of the basement, was measured at 11’-3” long. Immediately south of this clear span, an additional (4) nominal 2x8 timber members were observed next to the 6x8 girder to provide increased support for the southeastern corner of the of the first floor.

Adjacent to the front basement, in the northwest corner of the house, an additional basement room was observed with similar foundation wall construction. Along the north and south walls of this room, the concrete portion of the wall extended approximately 12” above the floor surface. No concrete lower wall was observed in the rear of the room (CMU blocks only from top to bottom). In the south and east wall (which is shared with the front basement), some CMU units had been removed in multiple places. The purpose of the removed blocks is unknown, but all removed CMU had been replaced with timber stud framing. The concrete floor of this room measured approximately 10” higher than the floor of the front basement. The bottom of the first-floor floorboards above this basement room measured approximately 6’-11” above the room’s floor surface. The first floor above is supported by nominal 2x8 timber joists, spaced 16” on center, running east to west. A nominal 3x8 timber girder spans the width of the room and supports the joists at midspan. This girder is supported by the foundation walls of the basement as well as a 3” diameter steel jack post located at midspan of the girder.

Immediately south of the northwest basement room detailed above, and adjacent to the front basement, a third basement room was observed with a set of concrete stairs leading to the backyard of the property. A hatch access door provides entrance to the basement from the backyard. The foundation walls of this basement room vary; along the south edge of the room, the walls appear to be constructed entirely with cast-in-place concrete, while the north wall (which is shared with the northwest basement room) consists of CMU block atop at 12” high concrete wall. The concrete floor of this room is approximately 5.5” higher than the front basement floor. The bottom of the first-floor floorboards above this basement room measured approximately 7’-3” above the room’s floor surface. The first floor above is supported by nominal 2x8 timber joists, spaced 16” on center, running east to west. Two steel girders, which span the width of the area (north to south) and bear on the foundation walls, support the floor joists above this room. The girders measured 6” deep x 3.5” wide, and have similar dimensions to the S6x17.25 steel section as per the American Institute of Steel Construction Manual.

To the south of the backyard access basement room, and adjacent to the front basement, a crawl space encompasses the remainder of the house in the southwest corner of the building footprint. This area appears to be the most recent addition of the house, as the first-floor roof above is asymmetrical with the rest of the house’s roof framing. The walls of the crawl space consist of unpainted CMU blocks. The floor of the crawl space is considerably higher than the adjacent basement floors, as the crawl space floor measured only approximately 29” below the first-floor surface. Nominal 2x8 timber joists span the length of the crawl space, spaced 16” on center and running east to west (front to rear of the house). No girder was observed in the crawl space, but additional 2x8 timber members were noted perpendicular to the floor joists at midspan to provide blocking for the subfloor.

A test pit excavation performed along the south crawl space wall revealed an approximately 36” deep concrete foundation beneath the CMU wall. The concrete foundation was encountered nearly at the exterior ground surface, and extended 36” into the ground. As per the resident, the construction of the crawl space foundation was completed internally by the homeowner. Exposed steel rebar was observed beneath the concrete foundation, within the 4” thick base of ¾” crushed stone. The concrete foundation appeared to be equal in thickness to the CMU block wall above. Although a typical spread footing was not observed beneath the CMU wall of the crawl space, from conventional foundation construction Matrix assumed a 16” wide footing as a minimum value for analysis of the building foundation’s structural capacity. Actual footings for the building are expected to range from 16” to 24” in width. Prior to raising the house, Matrix recommends that the contractor confirm the foundation size and bearing adequacy with multiple test pits around the building perimeter.

8.2 Existing Equipment

Most of the equipment for the house is located within the laundry room on the first floor. Within this room, a washer and dryer were observed on the floor, an electrical panel was built into the wall 45” above the floor, and a hot water heater was elevated 61” above the floor.

In the basement areas, three sump pits were observed – one near the east (front) wall of the front basement near the northeast corner, one near the rear wall of the front basement in the center of the area, and one in the backyard access room. No other equipment or machinery was observed in the basement or crawl space areas, but gas, electric and water conduits were observed throughout the areas along the perimeter walls and ceilings.

Outside the building, an air conditioning unit was observed on a concrete ground slab along the house’s north edge.

8.3 Site Observations

As detailed in Section 8.1 of this report, the foundation walls of the building at 140 Little Falls Road were not uniform, and varied notably throughout the building footprint. Sections of existing foundation walls appeared to have been demolished and replaced with timber stud framing. The lower, concrete portion of the foundation walls varied noticeably in height and thickness throughout the length of the walls.

Type and dimensions of the existing footings for the front basement walls could not be determined during the test pit excavation program. Prior to raising the house, the contractor is advised to perform multiple test pits around the building perimeter to verify the foundations at the site.

Along the perimeter of the three basement areas, French drains were observed with PVC conduits intermittently leading to the exterior of the building. The drains and conduits are believed to convey exterior groundwater and flood waters into the three sump pits within the basement, which then draw away the accumulated water from the house via pumps.

The property also contains an elevated timber deck in the backyard, spanning the southern half of the house (equal width of crawl space). The deck, which is set at the same elevation as the house’s first floor, is supported by timber girders atop concrete Sonotube footings. Two sets of timber stairs lead from the deck to the adjacent exterior ground surface.

8.4 Elevation Requirements

The FEMA 100-year flood elevation at 140 Little Falls Road is El. +171 (NAVD88). As per the New Jersey Department of Community Affairs (DCA), and in accordance with the New Jersey Flood Hazard Area Control Act, the lowest floor of newly elevated buildings must be at least 3 feet above the base flood elevation. Therefore, the new first floor elevation must be at El. +174 or higher to meet the requirements set forth in the program.

The current first-floor elevation at the Site is at El. +168.69. To achieve the elevation requirements, the existing building would need to be raised approximately 5.4 feet. Matrix recommends raising the building at least 5.8 feet to allow for the creation of a ground-level beneath the newly raised building.

8.5 Recommendations for Building Elevation

Matrix recommends that the existing foundation system of the residential building at 140 Little Falls Road be kept and extended to achieve the required design flood elevation. The presence of both basement and crawl space foundation walls is expected to provide sufficient support for the additional height of the newly raised building. Based on loading estimation and analysis for the existing building, Matrix estimates that the anticipated additional dead load of the required new courses of CMU or additional concrete wall would remain under an allowable bearing capacity as low as 2,500 psf (design capacity of loose Granular soil) for the shallow concrete strip footings at the Site.

In accordance with NFIP requirements, it is required that the existing basement and crawl space be filled in to match the lowest adjacent exterior grade following raising. The newly raised house will have approximately 7.8 feet of space beneath (down to existing finished grade), which is enough vertical height for a ground-level floor. This additional space beneath the raised building can be used for storage at the resident's discretion.

The most feasible method of elevation for the building consists of jacking up the entire residential structure from below using steel beams and jack posts. The building will then sit atop temporary cribbing while the existing CMU and concrete basement/crawl space walls are heightened with additional courses of masonry block units or additional poured concrete. Additional vertical reinforcement would need to be installed in ungrouted masonry cells to properly transfer loads through the new heightened wall to the existing wall, and horizontal ladder reinforcement should be installed at a minimum of every other course. For the concrete basement walls, additional rebar should be doweled into the existing walls to form a connection between the existing and new cast-in-place basement walls of the building. The existing concrete block pedestals and steel posts intermittently supporting the existing building's girders must be removed and replaced by new steel, concrete, or masonry block columns. These new columns will need to include a spread footing beneath to sufficiently support the building loads. Additionally, the rear deck is anticipated to require raising to match the current ingress/egress at heights of the main structure. This would require construction of new timber support posts for the timber deck substructure.

Within the new foundation walls, permanent openings are required to allow floodwater to enter the ground level and equalize the hydrostatic pressure during a flood event. As per the 2018 International Residential Code, New Jersey Edition, the total net area of non-engineered openings must comprise at least 1 square inch for every square foot of enclosed space within the building's ground floor. This equates to approximately 10.49 square feet of total flood openings in the building's new foundation walls. Additionally, a minimum of two openings must be provided for each enclosed area of the new ground floor. These openings must be located no higher than one foot above the adjacent finished exterior grade along the building perimeter. Matrix recommends the use of engineered openings in lieu of non-engineered openings to maximize efficiency and minimize the quantity of openings required.

Additionally, any service equipment, whether outside or in the basement/crawl space, such as air conditioning, heat pump compressors, gas meters, electric meters, and hot water heaters, must be elevated at least 3 feet above the BFE. For interior elements, this may include relocation to an upper floor and thus less usable living space. For this residence, the hot water heater and electrical panel on the first floor will be raised along with the house. The exterior air conditioning unit would also require elevating 3 feet above the BFE on a new exterior platform.

9.0 CLOSURE

This report has been prepared to assist the State of New Jersey Department of Community Affairs with the structural and geotechnical evaluation of the residential building at 140 Little Falls Road in Fairfield, New Jersey. The conclusions and recommendations provided within this report were prepared based on our understanding of the project and through the application of generally accepted engineering practices. No warranties, expressed or implied, are made. Matrix should be notified of any changes to the existing building foundation system or if subsurface conditions differing from those described herein are encountered, so the impact on the geotechnical and/or structural recommendations can be evaluated.

10.0 REPRESENTATIVE SITE PHOTOS

Structural Inspection Photos

Photo 1. 140 Little Falls Road (Front of Building)

Photo 2. 140 Little Falls Road (South Wall)

Photo 3. 140 Little Falls Road (Rear Addition with Timber Deck)

Photo 4. Basement CMU/Concrete Wall and Timber Subfloor (Southeast Corner)

Photo 5. Front Basement Girder with Additional (4) 2x8 Beams for Southeast Corner

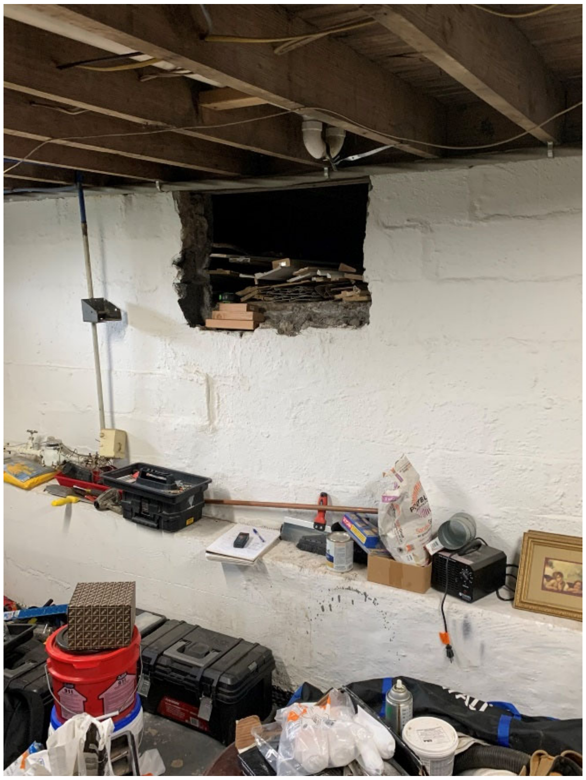


Photo 6. Front Basement Foundation Wall with Crawl Space Opening

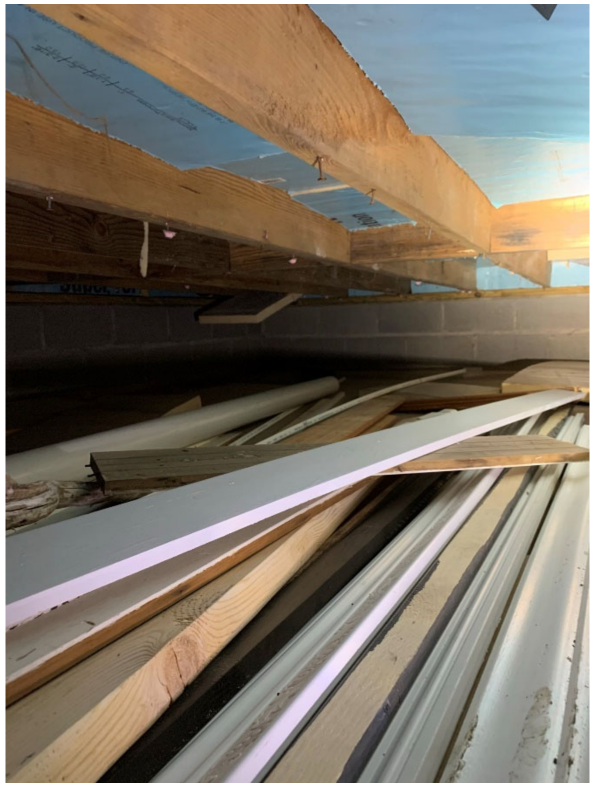


Photo 7. Southwest Crawl Space CMU Walls and Subfloor

Photo 8. Front Basement Northeast Corner

Photo 9. Northwest Basement Room (Looking West)

Photo 10. Backyard Access Basement Room (Looking at Building Rear)

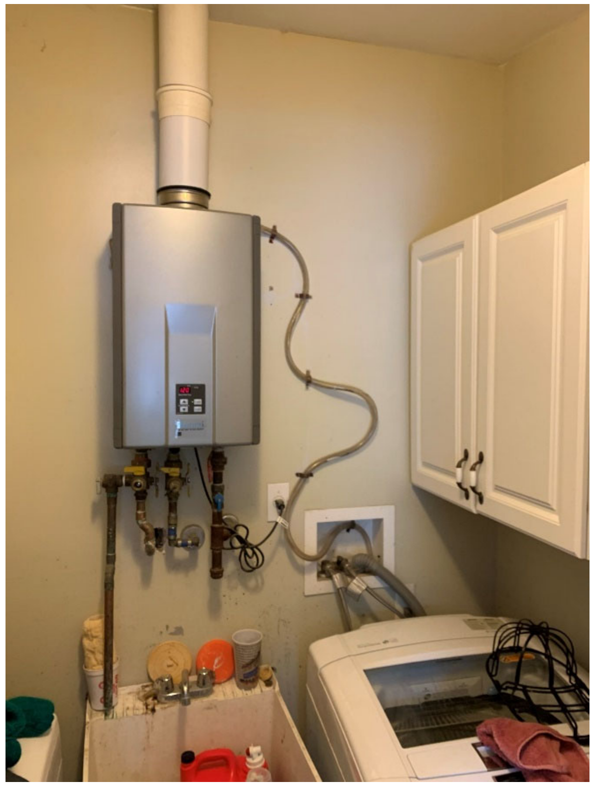


Photo 11. Hot Water Heater in First Floor Laundry Room

Photo 12. Electrical Panel in First Floor Laundry Room

Test Pit Photos

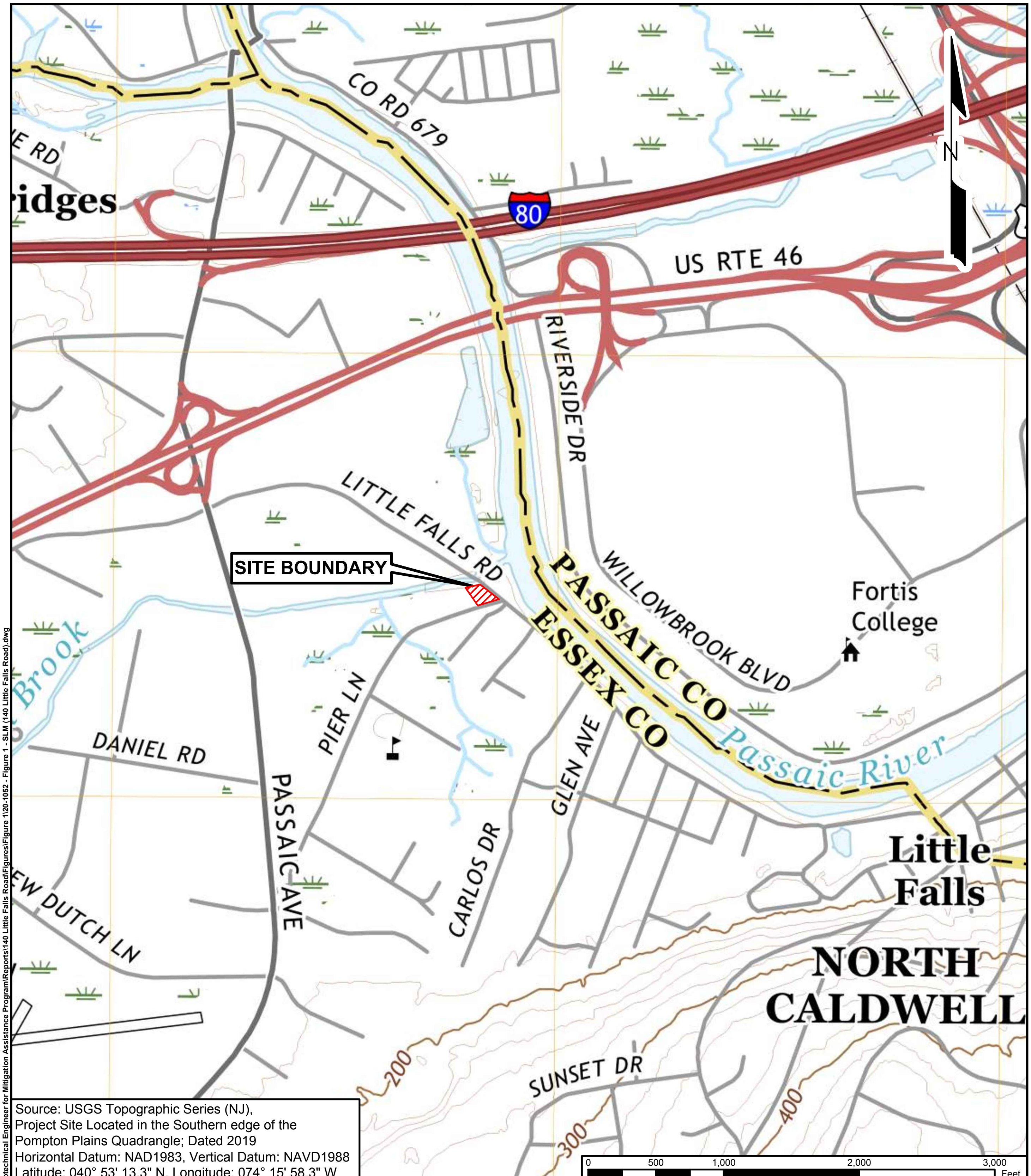
Photo 13. Test Pit TP-1 Location (South Wall of Building – Crawl Space)

Photo 14. Test Pit TP-1 Foundation Conditions

Photo 15. Test Pit TP-2 Location (Front Wall of Building – Northeast Corner)

Photo 16. Test Pit TP-2 Foundation Conditions

FIGURES



Source: USGS Topographic Series (NJ),
Project Site Located in the Southern edge of the Pompton Plains Quadrangle; Dated 2019
Horizontal Datum: NAD1983, Vertical Datum: NAVD1988
Latitude: 040° 53' 13.3" N, Longitude: 074° 15' 58.3" W

SITE LOCATION MAP

MATRIXNEWORLD
Engineering Progress

Matrix New World Engineering, Land Surveying and Landscape Architecture, P.C.
26 Columbia Turnpike
Florham Park, New Jersey 07932
WBE
Tel: 973-240-1800
Fax: 973-240-1818
www.matrixneworld.com

NJ DEPARTMENT OF COMMUNITY AFFAIRS
GEOTECHNICAL AND STRUCTURAL ASSESSMENT REPORT
140 LITTLE FALLS ROAD
FAIRFIELD, NEW JERSEY 07004

SCALE:	PROJECT NO.:	DATE:	FIGURE NO.:
1" = 1,000'	20-1052	SEPTEMBER 2021	1

NOTES:

1. THIS FIGURE IS BASED ON IMAGERY PROVIDED BY MICROSOFT BING.
2. BORING LOCATIONS WERE IDENTIFIED IN THE FIELD BY MATRIX PERSONNEL BY TAPING AND LINE OF SIGHT MEASUREMENTS.
3. THE BORINGS WERE PERFORMED BY BORING BROTHERS, INC. ON AUGUST 09, 2021 UNDER THE DIRECTION OF A MATRIX REPRESENTATIVE.
4. ALL ELEVATIONS SHOWN ON THIS PLAN REFER TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).

LEGEND

B-# — AS-DRILLED BORING LOCATION

TP-# — TEST PIT LOCATION

0 10 20 30 40 80

SCALE: 1" = 40'

NO.	DESCRIPTION	DATE:	BY:	APR:

REVISIONS

DESIGNED BY: SF

REVIEWED BY: MS

RELEASED BY: MS

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AS-DRILLED BORING LOCATION PLAN

NJDCA GEOTECHNICAL ENGINEER FOR MITIGATION ASSISTANCE PROGRAM

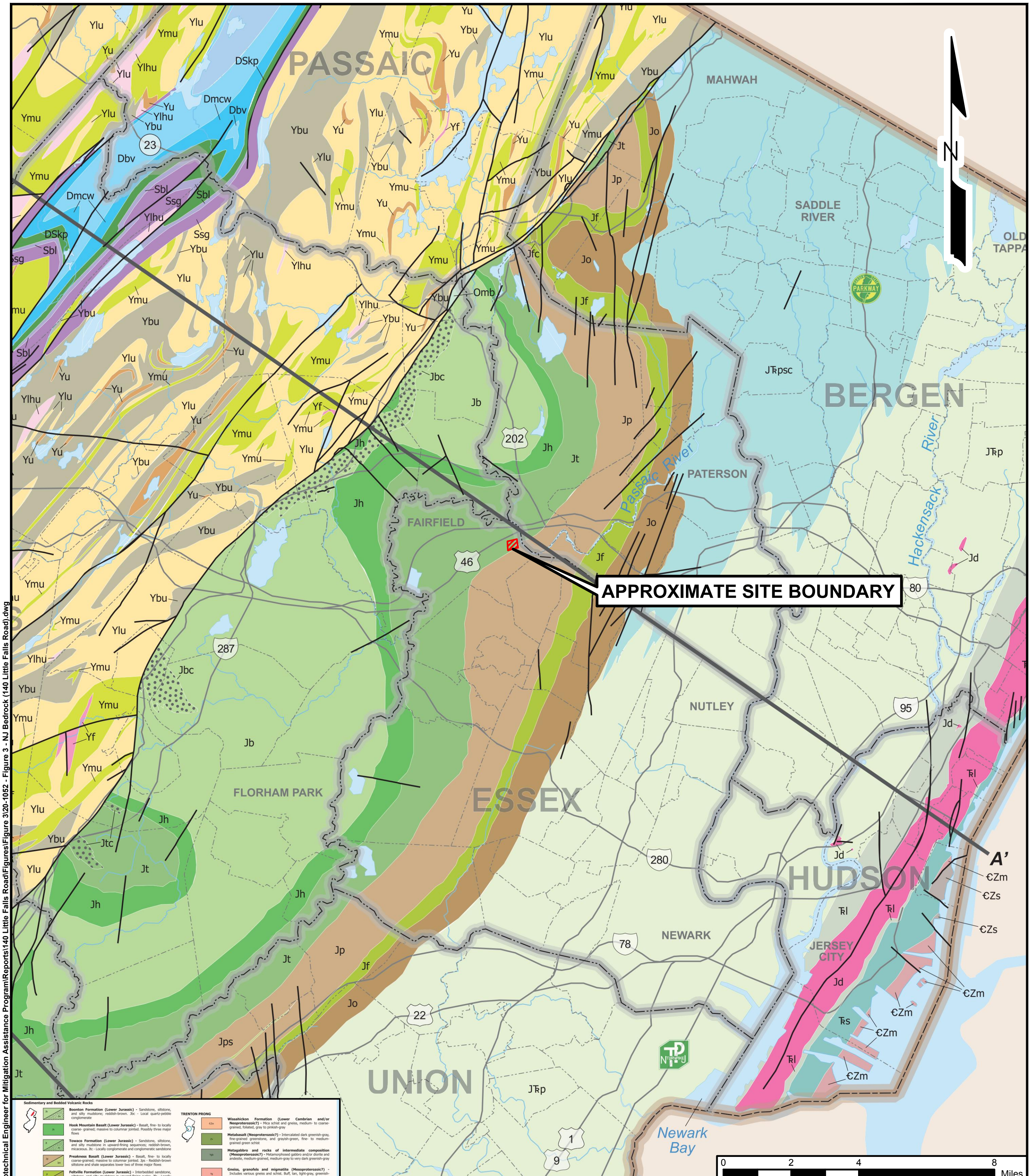
140 LITTLE FALLS ROAD
FAIRFIELD, NJ 07004

PROJECT NUMBER: 20-1052

SCALE: AS NOTED

DATE: SEPTEMBER 2021

2



BEDROCK GEOLOGY LOCATION MAP

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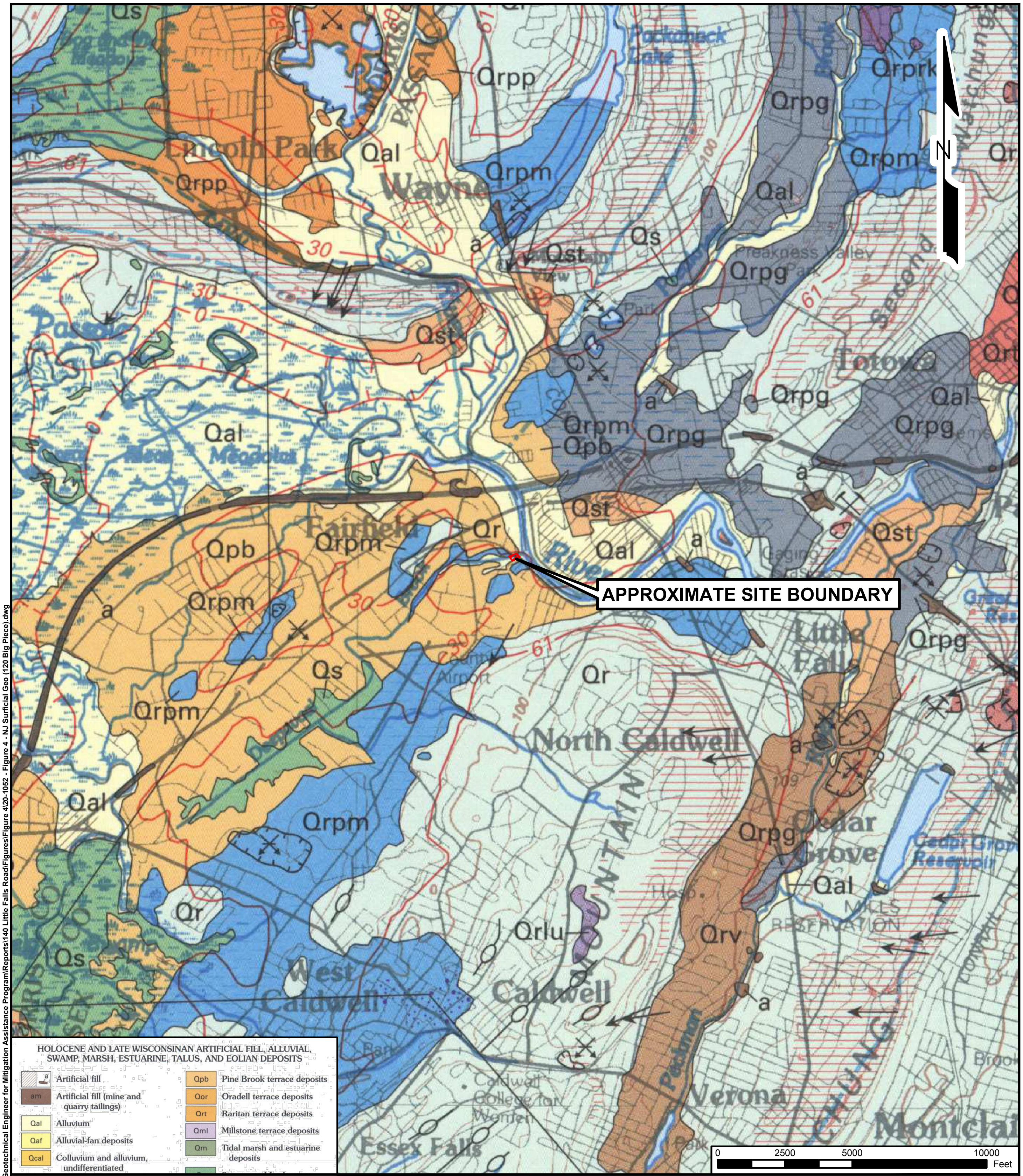
GEOTECHNICAL AND STRUCTURAL ASSESSMENT REPORT
140 LITTLE FALLS ROAD
FAIRFIELD, NEW JERSEY 07004

SCALE:	PROJECT NO.:	DATE:	FIGURE NO.:
1" = 4 Miles	20-1052	SEPTEMBER 2021	3



SURFICIAL GEOLOGY LOCATION MAP

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140 LITTLE FALLS ROAD
FAIRFIELD, NEW JERSEY 07004

SCALE:	PROJECT NO.:	DATE:	FIGURE NO.:
1" = 5000'	20-1052	SEPTEMBER 2021	4

APPENDIX A

SOIL BORING & TEST PIT LOGS

MATRIXNEWORLD
Engineering Progress

BORING LOG

BORING NO.: **B-1**

SHEET **1** OF **1**

PROJECT NO.: **20-1052** PROJECT: **NJDCA Geotechnical Engineer for Mitigation Assistance Program** DATE: **8/09/21**
PROJECT LOCATION: **Fairfield, NJ** BORING LOCATION: **140 Little Falls Road, Southeast Side of House**
DRILLING EQUIPMENT: **CME 55** ANGLE: **-90.0** DIR.: **------** ELEV.: DATUM: **NAVD88**
DRILLING CONTRACTOR: **Boring Brothers, Inc.** DRILLER: **D. Osuch** INSPECTOR: **A. Radiola**

CASING and HAMMER				SAMPLER and HAMMER				GROUNDWATER LEVELS			
Type	I.D.	Weight	Drop	Type	I.D.	Weight	Drop	Date	Time	Depth	Casing Depth
Auto		**140 lbs**	**30"**	**AUTO**		**140 lbs**	**30"**	**8/09/21**		**6.0**	**5**
FJ Steel	**4"**			**SS**	**1 3/8"**						

Depth Feet (Elev.)	CASING Blows/ Foot	SAMPLE No.	Type	Depth Feet	Blows/6" (REC. %) [RQD %]	Graphic Symbol	Description Of Material	Laboratory Tests
							6" Grass/Topsoil	
		S-1	SS	0.5-2	2-2-4 (56%)		S-1: Brown fine SAND, some Silt, trace fine Gravel, trace roots, trace wood, dry (SM)	
		S-2	SS	2-4	8-11-12-10 (71%)		S-2: Brown fine SAND, some Silt, trace fine Gravel, trace asphalt, dry (SM)	
5	4" Casing	S-3	SS	4-6	4-3-2-3 (58%)		S-3A (Top 7"): Brown mf SAND, some Silt, trace fine Gravel, dry (SM)	
▼							S-3B (Bottom 7"): Dark Grey-Green Silty CLAY, trace vegetation, moist (CL)	
		S-4	SS	6-8	3-2-3-3 (67%)		S-4: Grey-Green mf* SAND, some Silty Clay, trace fine Gravel, wet (SC) WC: 18.5%, Gravel: 2.9%, Sand: 58.1%, Fines: 39.0%, <2 μm: 15%	Sieve; Hydrometer
		S-5	SS	8-10	16-15-16-18 (100%)		S-5: Brown CLAY & Silt, wet (CL)	
10	End of Casing	S-6	SS	10-12	21-21-16-20 (100%)		S-6: Brown CLAY & Silt, little fine Sand, trace fine Gravel, wet (CL) WC: 19.5%, LL: 37, PL: 19, PI: 18	Atterberg Limits
15		S-7	SS	15-17	7-6-6-8 (46%)		S-7: Brown Clayey SILT, little fine Sand, trace fine Gravel, wet (ML) WC: 24.8%, Fines: 82.9%	Pass No 200
20		S-8	SS	20-22	1-2-3-5 (100%)		S-8: Grey CLAY & Silt, wet (CL) WC: 39.4%, LL: 35, PL: 19, PI:16	Atterberg Limits
25		S-9	SS	25-27	6-7-8-10 (58%)		S-9: Brown mf SAND, some Silt, trace fine Gravel, wet (SM)	
							Bottom of Borehole @ 27 ft.	

NEWORLD NO GROUT 20-1052 BORING LOGS.GPJ MATRIX EGS.GDT 9/13/21

MATRIXNEWORLD
Engineering Progress

BORING LOG

BORING NO.: **B-2**

SHEET **1** OF **1**

PROJECT NO.: **20-1052** PROJECT: **NJDCA Geotechnical Engineer for Mitigation Assistance Program** DATE: **8/09/21**
PROJECT LOCATION: **Fairfield, NJ** BORING LOCATION: **140 Little Falls Road, Southwest Side of House**
DRILLING EQUIPMENT: **CME 55** ANGLE: **-90.0** DIR.: **------** ELEV.: DATUM: **NAVD88**
DRILLING CONTRACTOR: **Boring Brothers, Inc.** DRILLER: **D. Osuch** INSPECTOR: **A. Radiola**

CASING and HAMMER				SAMPLER and HAMMER				GROUNDWATER LEVELS			
Type	I.D.	Weight	Drop	Type	I.D.	Weight	Drop	Date	Time	Depth	Casing Depth
Auto		**140 lbs**	**30"**	**AUTO**		**140 lbs**	**30"**	**8/09/21**		**6.0**	**5**
FJ Steel	**4"**			**SS**	**1 3/8"**						

Depth Feet (Elev.)	CASING Blows/ Foot	SAMPLE No.	Type	Depth Feet	Blows/6" (REC. %) [RQD %]	Graphic Symbol	Description Of Material	Laboratory Tests
	4" Casing	S-1	SS	0-2	4-2-3-5 (42%)		6" Grass/Topsoil S-1: Brown fine SAND, some Silt, trace fine Gravel, trace roots, trace wood, dry (SM)	
		S-2	SS	2-4	9-10-12-7 (58%)		S-2: Brown-Black mf SAND, some Silt, trace fine Gravel, trace oil staining, petroleum odor, dry (SM)	
5		S-3	SS	4-6	2-2-3-8 (75%)		S-3: Brown mf* SAND, little Silty Clay, little cf Gravel, trace roots, moist (SC) **Top 6" oil-stained WC: 18.4%, Gravel: 11%, Sand: 73%, Fines: 16%	Sieve
		S-4	SS	6-8	10-10-8-9 (83%)		S-4: Brown mf SAND, little Silt, trace fine Gravel, wet (SM)	
		S-5	SS	8-10	12-17-9-14 (100%)		S-5: Brown mf SAND, some Silt, trace fine Gravel, wet (SM)	
10		S-6	SS	10-12	14-19-20-24 (83%)		S-6: Brown mf SAND, little Silt, trace fine Gravel, wet (SM)	
15		S-7	SS	15-17	8-6-6-8 (79%)		S-7: Grey-Brown CLAY & Silt, wet (CL)	
20		S-8	SS	20-22	8-4-4-6 (63%)		S-8: Same as Above, wet (CL) WC: 29.4%, LL: 36, PL: 18, PI: 18	Atterberg Limits
25		S-9	SS	25-27	3-2-3-4 (100%)		S-9: Same as Above, wet (CL)	
							Bottom of Borehole @ 27 ft.	

NEWORLD NO GROUT 20-1052 BORING LOGS.GPJ MATRIX EGS.GDT 9/13/21

MATRIXNEWORLD
Engineering Progress

TEST PIT LOG

TEST PIT NO.: **TP-1**

SHEET **1** OF **1**

PROJECT NO.: **20-1052** PROJECT: **NJDCA Geotechnical Engineer - Mitigation Assistance Program** DATE: **8/9/2021**

PROJECT LOCATION: **Fairfield, NJ** ELEV.: TIME STARTED: **10:00:00 AM**

TEST PIT LOCATION: **140 Little Falls Road (South Wall - Crawl Space)** DATUM: **NAVD88** TIME FINISHED: **10:45:00 AM**

CONTRACTOR: **Boring Brothers, Inc.** GROUNDWATER LEVEL:

EQUIPMENT: **Kubota KX057-5** OPERATOR: **Eladio Cruz** INSPECTOR: **D. Brosseau**

Depth Inches (Elev)	No.	Depth Inches	Graphic Symbol	Description Of Material	Laboratory Tests
		0-5		Topsoil, Mulch Cover	
5		5-36		Brown fine SAND and Silt, little fine Gravel **Areas of Black Sand/asphalt pieces	
10					
15					
20					
25					
30					
35		36-40		Bottom of CMU wall encountered at 36" bgs - no footing observed beneath wall Steel Rebar exposed under foundation wall 3/4" Clean Crushed Stone Base beneath wall	
40				Bottom of Test pit @ 40 in. Test Pit Backfilled.	

TEST PIT INCH 20-1052 TEST PIT LOGS.GPJ MATRIX EGS.GDT 9/16/21

MATRIXNEWORLD
Engineering Progress

TEST PIT LOG

TEST PIT NO.: **TP-2**

SHEET **1** OF **1**

PROJECT NO.: **20-1052** PROJECT: **NJDCA Geotechnical Engineer - Mitigation Assistance Program** DATE: **8/9/2021**

PROJECT LOCATION: **Fairfield, NJ** ELEV.: TIME STARTED: **10:45:00 AM**

TEST PIT LOCATION: **140 Little Falls Road (East Wall - Basement)** DATUM: **NAVD88** TIME FINISHED: **11:15:00 AM**

CONTRACTOR: **Boring Brothers, Inc.** GROUNDWATER LEVEL:

EQUIPMENT: **Kubota KX057-5** OPERATOR: **Eladio Cruz** INSPECTOR: **D. Brosseau**

Depth Inches (Elev)	No.	Depth Inches	Graphic Symbol	Description Of Material	Laboratory Tests
		0-6		Topsoil, Mulch Cover	
5					
		6-60		Brown fine SAND and Silt, little fine Gravel	
10					
15					
20					
25					
30					
35					
40					
45					
50					
55					
60					
		60-63		Brown fine SAND and Silt, little cobbles (4"-5" River Stone)	
				Excavation terminated at 63" bgs due to limited access with utilities located on both sides of test pit. Wall footing not encountered. Bottom of Test pit @ 63 in. Test Pit Backfilled.	

LOG NOTATION

Sample Classifications

SS = Split Spoon

NR = No Recovery

NX = Rock Core

SH = Shelby Tube

REC = Soil Recovery

RQD = Rock Quality Designation

Sand Classifications

c = Coarse

m = Medium

f = Fine

* = Predominant Grain Size

Soil Properties

WC = Water Content

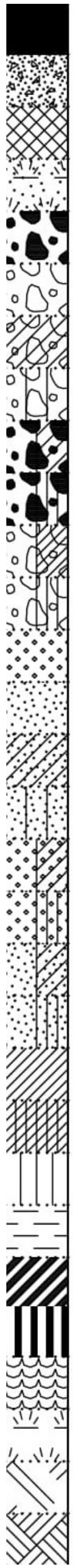
PL = Plastic Limit

LL = Liquid Limit

PI = Plasticity Index

OC = Organic Content

LOG GRAPHICAL LEGEND

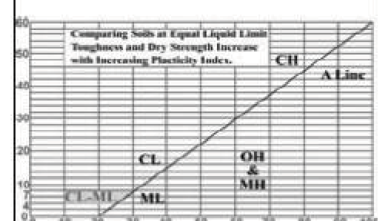


- Asphalt
- Concrete
- Fill
- Topsoil
- Well graded Gravel (GW)
- Poorly graded Gravel (GP)
- Clayey Gravel (GC)
- Silty Gravel (GM)
- Well graded Gravel with Clay (GW-GC)
- Well graded Gravel with Silt (GW-GM)
- Poorly graded Gravel with Clay (GP-GC)
- Poorly graded Gravel with Silt (GP-GM)
- Well graded Sand (SW)
- Poorly graded Sand (SP)
- Clayey Sand (SC)
- Silty Sand (SM)
- Well graded Sand with Clay (SW-SC)
- Well graded Sand with Silt (SW-SM)
- Poorly graded Sand with Clay (SP-SC)
- Poorly graded Sand with Silt (SP-SM)
- Lean Clay (CL)
- Silty Clay (CL-ML)
- Silt (ML)
- Organic Silt or Clay (Low Plasticity) (OL)
- Fat Clay (CH)
- Elastic Silt (MH)
- Organic Silt or Clay (High Plasticity) (OH)
- Peat (PT)
- Decomposed Bedrock
- Bedrock

APPENDIX B

SOIL CLASSIFICATION TABLES

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES	FIELD IDENTIFICATION PROCEDURES (EXCLUDING PARTICLES LARGER THAN 3 IN. AND BASING FRACTIONS ON ESTIMATED WEIGHTS)			INFORMATION REQUIRED FOR DESCRIBING SOILS	LABORATORY CLASSIFICATION CRITERIA			
1	2		3	4	5			6	7			
Coarse-grained Soils More than half of material is larger than No. 200 sieve size. The No. 200 sieve size is about the smallest visible to the naked eye.	Gravels More than half of coarse fraction is larger than No. 4 sieve size. (For visual classification. the 1/4-in. size may be used as equivalent to the No. 4 sieve size.)	Clean Gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixture, little or no fines.	Wide range in grain size and substantial amounts of all intermediate particle sizes.			For undisturbed soils add information on stratification, degree of compactness, cementation, moisture condition, and drainage characteristics.	Use grain-size curve in identifying the fractions as given under field identification.	Determine percentage of gravel and sand from grain-size curve. Depending on percentage of fine (fraction smaller than No. 200 sieve size) coarse-grained soils are classified as follows: Less than 5% GW, GP, SW, SP; More than 12% GM, GC, SM, SC; 5% to 12% Borderline cases requiring use of dual symbols.	$C_u = \frac{D_{60}}{D_{10}}$ Greater than 4 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			GP	Poorly graded gravels or gravel-sand mixture, little or no fines.	Predominantly one size or a range of sizes with some intermediate sizes missing.						Not meeting all gradation requirements for GW	
		Gravels with Fines (Appreciable amount of fines)	GM	Silty gravels, gravel and silt mixtures.	Nonplastic fines or fines with low plasticity (for identification procedures see ML below).			Give typical name; indicate approximate percentages of sand and gravel, maximum size; angularity, surface condition, and hardness of the coarse grains; local or geologic name and other pertinent descriptive information; and symbol in parentheses.			Atterberg limits below "A" line or P1 less than 4	Above "A" line with P1 between 4 and 7 are borderline cases requiring use of dual symbols.
			GC	Clayey gravels, gravel and clay mixtures.	Plastic fines (for identification procedures see CL below).						Atterberg limits above "A" line with P1 greater than 7	
	Sands More than half of coarse fraction is smaller than No .4 sieve size.	Clean Sand (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines.	Wide range in grain size and substantial amounts of all intermediate particle sizes.						$Cu = \frac{D_{60}}{D_{10}}$ Greater than 6 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			SP	Poorly graded sands or gravelly sands, little or no fines.	Predominantly one size or a range of sizes with some intermediate sizes missing.			Example: Silty sand, gravelly; about 20% hard, angular gravel particles 1/2-in. maximum size; rounded and subangular sand grains, coarse to fine; about 15% nonplastic fines with low dry strength; well compacted and moist in place; alluvial sand; (SM).			Not meeting all gradation requirements for SW	
		Sands with Fines (Appreciable amount of fines)	SM	Silty sands, sand-silt mixtures.	Nonplastic fines or fines with low plasticity (for identification procedures see ML below).						Atterberg limits above "A" line or P1 less than 4	Limits plotting in hatched zone with P1 between 4 and 7 are borderline cases requiring use of dual symbols.
			SC	Clayey sands, sand-clay mixtures.	Plastic fines (for identification procedures see CL below).						Atterberg limits above "A" line with Pl greater than 7	
Fine-grained Soils More than half of material is smaller than No. 200 sieve size.					Identification Procedure on Fraction Smaller than No. 40 Sieve Size.							
					Dry Strength (Crushing Characteristics)	Dilatancy (Reaction to shaking)	Toughness (Consistency near PL)					
	Silts and Clays Liquid limit is less than 50		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.	None to slight	Quick to slow	None	For undisturbed soils add information on structure, stratification, consistency in undisturbed and remolded states, moisture and drainage conditions		Plasticity Index	LIQUID LIMIT PLASTICITY CHART For laboratory classification of fine-grained soils	
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.	Medium to high	None to very slow	Medium					
	Silts and Clays Liquid limit is greater than 50		OL	Organic silts and organic silty clays of low plasticity.	Slight to medium	Slow	Slight	Give typical name; indicate degree and character of plasticity; amount and maximum size of coarse grains; color in wet condition; odor, if any; local or geologic name and other pertinent descriptive information; and symbol in parentheses.				
			MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.	Slight to medium	Slow to none	Slight to medium					
			CH	Inorganic clays of high plasticity, fat clays.	High to very high	None	High					
			OH	Organic clays of medium to high plasticity, organic silts.	Medium to high	None to very slow	Slight to medium	Example: Clayey silt, brown; slightly plastic; small percentage of fine sand; numerous vertical root holes; firm and dry in place; loess; (ML)				
Highly Organic Soils			Pt	Peat and other highly organic soils.	Readily identified by color, odor, spongy feel and frequently by fibrous texture							



1. Boundary classifications: Soils possessing characteristics of two groups are designed by combinations of group symbols. For example GM-GC, well-graded gravel-sand mixture with clay binder.
2. All sieve sizes on this chart are U.S. standard.
3. Adopted by Corps of Engineers and Bureau of Reclamation, January 1952.

032058C

BURMISTER SOIL IDENTIFICATION METHOD

BURMISTER SOIL IDENTIFICATION METHOD

1. SOIL MATERIAL Composition, Gradation, and Plasticity Characteristics

a) Soil Components and Soil Fractions

Sieve	3"	1"	3/8"	No. 10 2 mm	No. 30	No. 60	No. 200 0.076 mm	0.02 mm
Granular Component Fractions	GRAVEL coarse	medium	fine	SAND coarse	medium	fine	SILT coarse	fine
Clay Soil Components							CLAY-SOIL Defined and Named on a Plasticity Basis	

b) Identifying Terms for Granular Soils
Composition and Proportion Terms for Components

Component		Proportion Terms	Defining Range of Percentages
Principal Components- GRAVEL, SAND, SILT (all Uppercase)			50% or more
Minor Components-	Gravel	and	35 to 50%
	Sand	some	20 to 35%
	Silt	little	10 to 20%
		trace	1 to 10%

Gradation Terms for Granular Soils		ORGANIC SOILS
coarse to fine	all fractions more than 10%	Plasticity Basis, as
coarse to medium	fine less than 10%	
medium to fine	coarse less than 10%	Organic SILT, H. PI
medium	coarse and fine less than 10%	
fine	coarse and medium less than 10%	Organic SILT, L. PI
PLUS or MINUS signs used to indicate upper or lower limits.		

c) Identifying Terms for CLAY SOILS. Plasticity Basis for Combined Silt and Clay Components, Expressing the Relative Dominance of Clay

Overall Plasticity	Plasticity Index	Principal Component	Minor Component
Non-Plastic	0	SILT	Silt
Slight	1 to 5	Clayey SILT	Clayey Silt
Low	5 to 10	SILT & CLAY	Silt & Clay
Medium	10 to 20	CLAY & SILT	Clay & Silt
High	20 to 40	Silty CLAY	
Very High	more than 40	CLAY	

Example: Soil 60% coarse to fine Sand, 25% medium to fine Gravel, 15% Clayey Silt and color-brown.
Identification: Br. coarse to fine SAND, some medium to fine Gravel, little Clayey Silt.

References: 1) D. M. Burmister, "Principles and Techniques of Soil Identification" 29th Highway Research Board Proceedings, 1949.

2) "Identification and Classification of Soils – An appraisal and Statement of Principles", ASTM Special Technical Publication No. 113, 1951.

Field Classification of Soil Using the USCS

Apparent Density of Coarse-Grained Soils

SPT N-Value (corrected)	Apparent Density
0 - 4	Very loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
> 50	Very Dense

Consistency of Fine-Grained Soils

SPT N-Value (uncorrected)	Consistency	Compressive Strength (ksf)	Results of Manual Manipulation
< 2	Very Soft	< 0.5	Specimen (height = twice the diameter) sags under its own weight; extrudes between fingers when squeezed
3 - 4	Soft	> 0.5 - 1.0	Speciment can be pinched in to between the thumb and forefinger; remolded by light finger pressure
5 - 8	Medium stiff	> 1.0 - 2.0	Can be imprinted easily with fingers; remolded by strong finger pressure
9 - 15	Stiff	> 2.0 - 4.0	Can be imprinted with considerable pressure from fingers or indented by thumbnail
16 - 30	Very stiff	> 4.0 - 8.0	Can be barely imprinted by pressure from the fingers or indented by thumbnail
> 30	Hard	> 8.0	Cannot be imprinted by fingers or difficult to indent by thumbnail

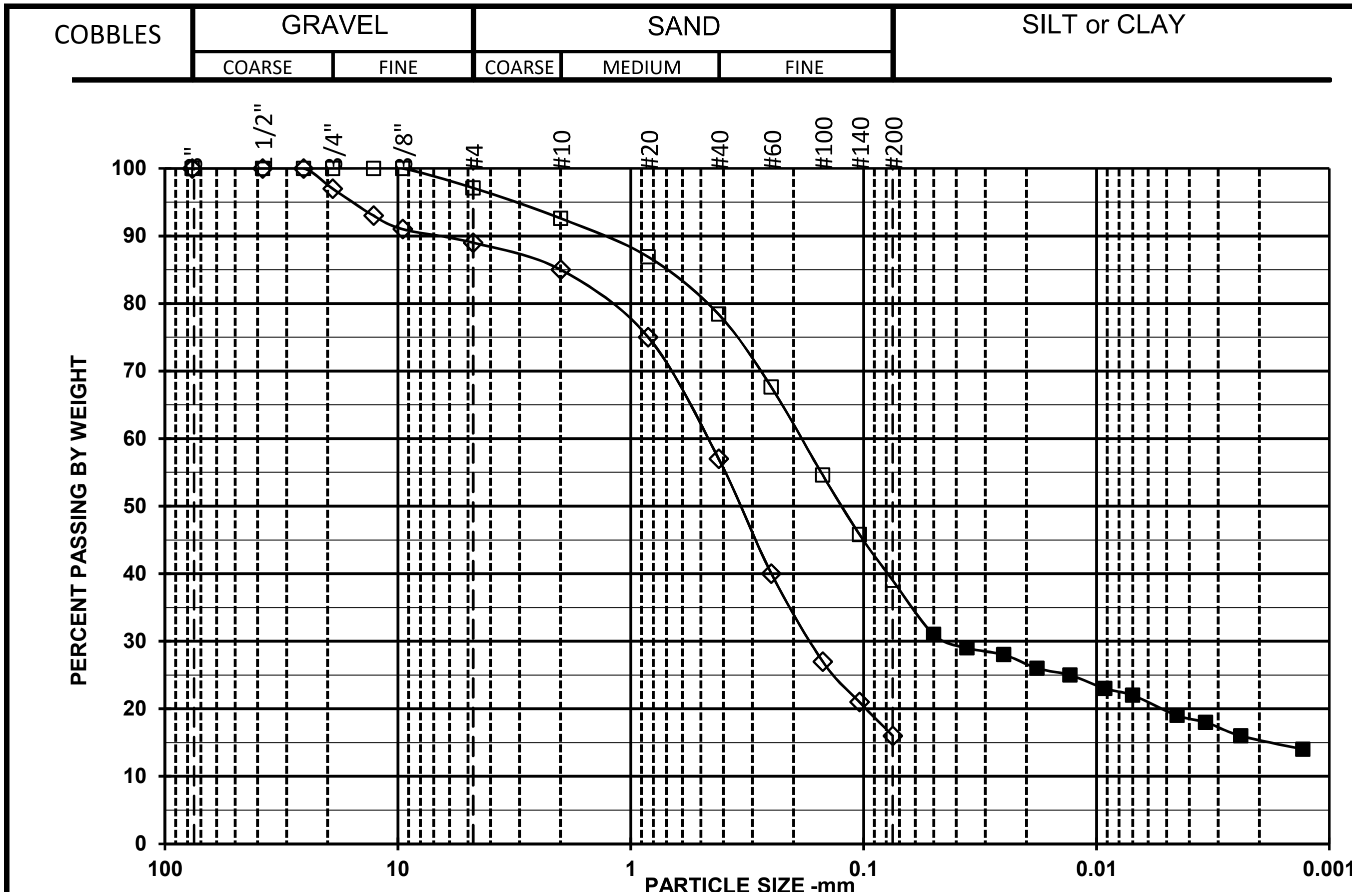
APPENDIX C

GEOTECHNICAL LABORATORY TESTING RESULTS

Matrix New World Engineering, P.C. #20-1052-014
NJDCA MAP - 140 Little Falls Road
LABORATORY TESTING DATA SUMMARY

BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS							REMARKS
			WATER CONTENT (%)	LIQUID LIMIT (-)	PLASTIC LIMIT (-)	PLAS. INDEX (-)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2 μm (%)	
B-1	S-4	6-8	18.5				SC	39	15	
B-1	S-6	10-12	19.5	37	19	18	CL			
B-1	S-7	15-17	24.8				ML	82.9		
B-1	S-8	20-22	39.4	35	19	16	CL			
B-2	S-3	4-6	18.4				SM	16		
B-2	S-8	20-22	29.4	36	18	18	CL			

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



Open Symbols: Sieve analysis by ASTM D6913
Filled symbols: Hydrometer analysis by ASTM D7928 corrected for complete sample

Symbol	□	◇	○
Boring	B-1	B-2	
Sample	S-4	S-3	
Depth	6-8	4-6	
% +3"	0	0	
% Gravel	2.9	11	
% SAND	58.1	73	
%C SAND	4.5	4	
%M SAND	14.2	28	
%F SAND	39.4	41	
% FINES	39	16	
D_{100} (mm)	9.53	25.4	
D_{60} (mm)	0.185	0.471	
D_{30} (mm)	0.042	0.17	
D_{10} (mm)			
Cc			
Cu			

Sieve Size/ID #	Percent Finer Data		
6"	100.0	100	
4"	100.0	100	
3"	100.0	100	
1 1/2"	100.0	100	
1"	100.0	100	
3/4"	100.0	97	
1/2"	100.0	93	
3/8"	100.0	91	
#4	97.1	89	
#10	92.6	85	
#20	86.9	75	
#40	78.4	57	
#60	67.6	40	
#100	54.6	27	
#140	45.8	21	
#200	39.0	16	
5µ m	20		
2µ m	15		
1µ m	13		

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	18.5				SC		Brown, Clayey sand	08/26/21
◇	18.4				SM		Brown, Silty sand, Insufficient sample size	08/24/21
○								

Matrix New World Engineering, P.C. #20-1052-014

TerraSense #21004954A

NJDCA MAP
140 Little Falls Road

PARTICLE SIZE DISTRIBUTION
ASTM D6913 & ASTM D7928

TerraSense Analysis File: GrainSizeV6Rev1a15

Siev1a.xlsx 9/1/2021

APPENDIX D

FEMA NFIP ELEVATION CERTIFICATE

U.S. DEPARTMENT OF HOMELAND SECURITY
Federal Emergency Management Agency
National Flood Insurance Program

OMB No. 1660-0008
Expiration Date: November 30, 2022

ELEVATION CERTIFICATE

Important: Follow the instructions on pages 1–9.

Copy all pages of this Elevation Certificate and all attachments for (1) community official, (2) insurance agent/company, and (3) building owner.

SECTION A – PROPERTY INFORMATION			FOR INSURANCE COMPANY USE
A1. Building Owner's Name [redacted]			Policy Number:
A2. Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No. 140 Little Falls Road			Company NAIC Number:
City Town of Fairfield	State New Jersey	ZIP Code 07004-1112	

A3. Property Description (Lot and Block Numbers, Tax Parcel Number, Legal Description, etc.)
Block 2801, Lot 18

A4. Building Use (e.g., Residential, Non-Residential, Addition, Accessory, etc.) Residential

A5. Latitude/Longitude: Lat. N40°53'13" Long. W74°15'58" Horizontal Datum: ☐ NAD 1927 ☒ NAD 1983

A6. Attach at least 2 photographs of the building if the Certificate is being used to obtain flood insurance.

A7. Building Diagram Number 2A

A8. For a building with a crawlspace or enclosure(s):

a) Square footage of crawlspace or enclosure(s) 1326.00 sq ft

b) Number of permanent flood openings in the crawlspace or enclosure(s) within 1.0 foot above adjacent grade 8

c) Total net area of flood openings in A8.b N/A sq in

d) Engineered flood openings? ☐ Yes ☒ No

A9. For a building with an attached garage:

a) Square footage of attached garage 0.00 sq ft

b) Number of permanent flood openings in the attached garage within 1.0 foot above adjacent grade 0

c) Total net area of flood openings in A9.b N/A sq in

d) Engineered flood openings? ☐ Yes ☒ No

SECTION B – FLOOD INSURANCE RATE MAP (FIRM) INFORMATION

B1. NFIP Community Name & Community Number	B2. County Name	B3. State
Fairfield, Township of	Essex	New Jersey

B4. Map/Panel Number	B5. Suffix	B6. FIRM Index Date	B7. FIRM Panel Effective/ Revised Date	B8. Flood Zone(s)	B9. Base Flood Elevation(s) (Zone AO, use Base Flood Depth)
34013C0019	G	04-03-2020	04-03-2020	AE	171' (NAVD88')

B10. Indicate the source of the Base Flood Elevation (BFE) data or base flood depth entered in Item B9:
☐ FIS Profile ☒ FIRM ☐ Community Determined ☐ Other/Source:

B11. Indicate elevation datum used for BFE in Item B9: ☐ NGVD 1929 ☒ NAVD 1988 ☐ Other/Source:

B12. Is the building located in a Coastal Barrier Resources System (CBRS) area or Otherwise Protected Area (OPA)? ☐ Yes ☒ No

Designation Date: ☐ CBRS ☐ OPA

ELEVATION CERTIFICATE

OMB No. 1660-0008
Expiration Date: November 30, 2022

IMPORTANT: In these spaces, copy the corresponding information from Section A.

Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.			FOR INSURANCE COMPANY USE
140 Little Falls Road			Policy Number:
City: Town of Fairfield	State: New Jersey	ZIP Code: 07004-1112	Company NAIC Number

SECTION C – BUILDING ELEVATION INFORMATION (SURVEY REQUIRED)

C1. Building elevations are based on: ☐ Construction Drawings* ☐ Building Under Construction* ☒ Finished Construction

*A new Elevation Certificate will be required when construction of the building is complete.

C2. Elevations – Zones A1–A30, AE, AH, A (with BFE), VE, V1–V30, V (with BFE), AR, AR/A, AR/AE, AR/A1–A30, AR/AH, AR/AO. Complete Items C2.a–h below according to the building diagram specified in Item A7. In Puerto Rico only, enter meters.

Benchmark Utilized: CORS Network NGS Monuments Vertical Datum: NAVD 1988

Indicate elevation datum used for the elevations in items a) through h) below.

☐ NGVD 1929 ☒ NAVD 1988 ☐ Other/Source:

Datum used for building elevations must be the same as that used for the BFE.

Check the measurement used.

Item	Elevation	feet	meters
a) Top of bottom floor (including basement, crawlspace, or enclosure floor)	160.9	☒	☐
b) Top of the next higher floor	168.7	☒	☐
c) Bottom of the lowest horizontal structural member (V Zones only)	N/A	☐	☐
d) Attached garage (top of slab)	N/A	☐	☐
e) Lowest elevation of machinery or equipment servicing the building (Describe type of equipment and location in Comments)	168.7	☒	☐
f) Lowest adjacent (finished) grade next to building (LAG)	166.2	☒	☐
g) Highest adjacent (finished) grade next to building (HAG)	166.9	☒	☐
h) Lowest adjacent grade at lowest elevation of deck or stairs, including structural support	166.1	☒	☐

SECTION D – SURVEYOR, ENGINEER, OR ARCHITECT CERTIFICATION

This certification is to be signed and sealed by a land surveyor, engineer, or architect authorized by law to certify elevation information. *I certify that the information on this Certificate represents my best efforts to interpret the data available. I understand that any false statement may be punishable by fine or imprisonment under 18 U.S. Code, Section 1001.*

Were latitude and longitude in Section A provided by a licensed land surveyor? ☒ Yes ☐ No ☐ Check here if attachments.

Certifier's Name: Frank J. Barlowski
License Number: 24GS03973500

Title: Professional Land Surveyor

Company Name: Matrix New World Engineering, Land Surveying and Architecture, P.C.

Address: 442 State Route 35, Second Floor

City: Eatontown State: New Jersey ZIP Code: 07724

Place Seal Here

Signature Date Telephone Ext.

Copy all pages of this Elevation Certificate and all attachments for (1) community official, (2) insurance agent/company, and (3) building owner.

Comments (including type of equipment and location, per C2(e), if applicable)

C2(e): Base of hot water heater was on the first floor at Elev=168.7'(NAVD88)

ELEVATION CERTIFICATE

OMB No. 1660-0008
Expiration Date: November 30, 2022

IMPORTANT: In these spaces, copy the corresponding information from Section A.			FOR INSURANCE COMPANY USE
Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No. 140 Little Falls Road			Policy Number:
City Town of Fairfield	State New Jersey	ZIP Code 07004-1112	Company NAIC Number

SECTION E – BUILDING ELEVATION INFORMATION (SURVEY NOT REQUIRED) FOR ZONE AO AND ZONE A (WITHOUT BFE)

For Zones AO and A (without BFE), complete Items E1–E5. If the Certificate is intended to support a LOMA or LOMR-F request, complete Sections A, B,and C. For Items E1–E4, use natural grade, if available. Check the measurement used. In Puerto Rico only, enter meters.

E1. Provide elevation information for the following and check the appropriate boxes to show whether the elevation is above or below the highest adjacent grade (HAG) and the lowest adjacent grade (LAG).

a) Top of bottom floor (including basement, crawlspace, or enclosure) is ________ ☐ feet ☐ meters ☐ above or ☐ below the HAG.

b) Top of bottom floor (including basement, crawlspace, or enclosure) is ________ ☐ feet ☐ meters ☐ above or ☐ below the LAG.

E2. For Building Diagrams 6–9 with permanent flood openings provided in Section A Items 8 and/or 9 (see pages 1–2 of Instructions), the next higher floor (elevation C2.b in the diagrams) of the building is ________ ☐ feet ☐ meters ☐ above or ☐ below the HAG.

E3. Attached garage (top of slab) is ________ ☐ feet ☐ meters ☐ above or ☐ below the HAG.

E4. Top of platform of machinery and/or equipment servicing the building is ________ ☐ feet ☐ meters ☐ above or ☐ below the HAG.

E5. Zone AO only: If no flood depth number is available, is the top of the bottom floor elevated in accordance with the community's floodplain management ordinance? ☐ Yes ☐ No ☐ Unknown. The local official must certify this information in Section G.

SECTION F – PROPERTY OWNER (OR OWNER'S REPRESENTATIVE) CERTIFICATION

The property owner or owner's authorized representative who completes Sections A, B, and E for Zone A (without a FEMA-issued or community-issued BFE) or Zone AO must sign here. The statements in Sections A, B, and E are correct to the best of my knowledge.

Property Owner or Owner's Authorized Representative's Name

Address	City	State	ZIP Code

Signature	Date	Telephone

Comments

☐ Check here if attachments.

ELEVATION CERTIFICATE

OMB No. 1660-0008
Expiration Date: November 30, 2022

IMPORTANT: In these spaces, copy the corresponding information from Section A.			FOR INSURANCE COMPANY USE
Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No. 140 Little Falls Road			Policy Number:
City Town of Fairfield	State New Jersey	ZIP Code 07004-1112	Company NAIC Number

SECTION G – COMMUNITY INFORMATION (OPTIONAL)

The local official who is authorized by law or ordinance to administer the community's floodplain management ordinance can complete Sections A, B, C (or E), and G of this Elevation Certificate. Complete the applicable item(s) and sign below. Check the measurement used in Items G8–G10. In Puerto Rico only, enter meters.

G1. ☐ The information in Section C was taken from other documentation that has been signed and sealed by a licensed surveyor, engineer, or architect who is authorized by law to certify elevation information. (Indicate the source and date of the elevation data in the Comments area below.)

G2. ☐ A community official completed Section E for a building located in Zone A (without a FEMA-issued or community-issued BFE) or Zone AO.

G3. ☐ The following information (Items G4–G10) is provided for community floodplain management purposes.

G4. Permit Number	G5. Date Permit Issued	G6. Date Certificate of Compliance/Occupancy Issued

G7. This permit has been issued for: ☐ New Construction ☐ Substantial Improvement

G8. Elevation of as-built lowest floor (including basement) of the building: ____________ ☐ feet ☐ meters Datum ____________

G9. BFE or (in Zone AO) depth of flooding at the building site: ____________ ☐ feet ☐ meters Datum ____________

G10. Community's design flood elevation: ____________ ☐ feet ☐ meters Datum ____________

Local Official's Name	Title
Community Name	Telephone
Signature	Date

Comments (including type of equipment and location, per C2(e), if applicable)

☐ Check here if attachments.

ELEVATION CERTIFICATE

BUILDING PHOTOGRAPHS

See Instructions for Item A6.

IMPORTANT: In these spaces, copy the corresponding information from Section A.			FOR INSURANCE COMPANY USE
Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No. 140 Little Falls Road			Policy Number:
City Town of Fairfield	State New Jersey	ZIP Code 07004-1112	Company NAIC Number

If using the Elevation Certificate to obtain NFIP flood insurance, affix at least 2 building photographs below according to the instructions for Item A6. Identify all photographs with date taken; "Front View" and "Rear View"; and, if required, "Right Side View" and "Left Side View." When applicable, photographs must show the foundation with representative examples of the flood openings or vents, as indicated in Section A8. If submitting more photographs than will fit on this page, use the Continuation Page.

Photo One

Photo One Caption Front View

Clear Photo One

Photo Two

Photo Two Caption Rear View

Clear Photo Two

IMPORTANT: In these spaces, copy the corresponding information from Section A.			FOR INSURANCE COMPANY USE
Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No. 140 Little Falls Road			Policy Number:
City Town of Fairfield	State New Jersey	ZIP Code 07004-1112	Company NAIC Number

If submitting more photographs than will fit on the preceding page, affix the additional photographs below. Identify all photographs with: date taken; "Front View" and "Rear View"; and, if required, "Right Side View" and "Left Side View." When applicable, photographs must show the foundation with representative examples of the flood openings or vents, as indicated in Section A8.

Photo Three

Photo Three Caption Right Side View

Clear Photo Three

Photo Four

Photo Four Caption Left Side View

Clear Photo Four