

**ENGINEERING INVESTIGATION & ANALYSIS
GEOTECHNICAL & STRUCTURAL
ASSESSMENT REPORT**

**28 ADDISON DRIVE
FAIRFIELD, NEW JERSEY 07004**

MATRIX **NEW** **WORLD**
Engineering Progress

Prepared for:

State of New Jersey
Department of Community Affairs
PO Box 800
Trenton, NJ 08625-0800

Prepared by:

Matrix New World Engineering, Land Surveying
and Landscape Architecture, PC
26 Columbia Turnpike
Florham Park, New Jersey 07932

Matrix No. 20-1052

October 2021



Michael J. Soltys, P.E.
Director of Structural & Geotechnical Engineering

TABLE OF CONTENTS

1.0 PROJECT BACKGROUND..... 1

2.0 PROJECT SCOPE 2

3.0 SITE LOCATION & PROJECT DESCRIPTION..... 3

4.0 GEOLOGIC SETTING 4

5.0 SUBSURFACE FIELD PROGRAM..... 5

 5.1 Test Pits..... 5

 5.2 SPT Borings..... 6

 5.3 Laboratory Testing..... 6

6.0 SUBSURFACE CONDITIONS 8

7.0 GEOTECHNICAL SUBSURFACE PARAMETERS..... 10

8.0 STRUCTURAL INSPECTION..... 12

 8.1 Existing Building Foundations..... 12

 8.2 Existing Equipment..... 14

 8.3 Site Observations 14

 8.4 Elevation Requirements 15

 8.5 Recommendations for Building Elevation..... 16

9.0 CLOSURE 19

10.0 REPRESENTATIVE SITE PHOTOS 20

FIGURES

1 Site Location Map

2 As-Drilled Boring & Test Pit Location Plan

3 Bedrock Geology Location Map

4 Surficial Geology Location Map

APPENDICES

A Soil Boring & Test Pit Logs

B Soil Classification Tables

C Geotechnical Laboratory Testing Results

D FEMA NFIP Elevation Certificate

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 28 Addison Drive 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. One test pit (TP-1) was completed to a depth of 24 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 47 Addison Drive in Fairfield, New Jersey. The property consists of a two-story timber-framed split-level house with an approximately 2,780 square foot footprint. The house is situated atop concrete masonry unit (CMU) foundation walls on cast-in-place concrete foundations or on concrete slabs on grade. The substructure of the house is comprised of a finished basement and ground-level area. The timber frame of the residential structure is mostly covered with a brick façade throughout most of its exterior, though the northeast corner of the building contains vinyl siding. A rear timber deck also spans the width of the southwest portion of the house.

To assist with the geotechnical and structural evaluation, a test pit and geotechnical borings were advanced in areas around the residence to obtain information regarding the soil's structural properties and the building's existing foundation. The test pit 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 situated atop Horseneck – Urban land. The subsurface composition is typically sandy loams from 2 to 22 inches bgs and loamy sands from 22 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 Silt. Groundwater was encountered in the borings at approximately 6.2 to 7.5 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 1 test pit 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 27, 2021, Boring Brothers completed a foundation survey which included 1 test pit, TP-1 (East Wall - Ground Level) to a depth of 24 inches below the ground surface. The test pit was dug using a Kubota KX033-4 and a shovel to prevent any damage to the existing building foundations. The exterior edge of the building foundation wall was exposed to attempt 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 footing. The test pit was 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 30, 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: 2-4', 4-6', 20-22' B-2: 4-6', 10-12', 25-27'
Sieve Analysis	ASTM D422	1	B-2: 4-6'
Atterberg Limits	ASTM D4318	3	B-1: 4-6', 20-22' B-2: 25-27'
Percent Fines	ASTM D1140	2	B-1: 2-4' B-2: 10-12'

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

The top of concrete was not uncovered in test pit TP-1. A 12” thick tree root was encountered at approximately 24” bgs and could not be broken through, so the excavation was terminated at this depth.

Surface Cover

The surface cover for boring B-1 and B-2 consisted of grass cover and topsoil, approximately 11 inches thick.

Stratum 1: Sand (SP, SP-SM)

Beneath the surface cover in each boring, a soil layer was encountered consisting of brown to grey coarse-to-fine-grained Sand with varying amounts of Silt and traces of fine Gravel. This Sand layer extended from the bottom of the surface cover to 18.5 feet below the ground surface (bgs) in both borings.

The SPT N-values in this layer ranged from 8 to 21 blows per foot (bpf), which is indicative of loose to medium-dense Sand. The SPT N-values for Stratum 1 are summarized in the tables 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	0.92-4'	8-9

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, SP-SM	4-18.5'	15-21
B-2	SM, SP-SM	0.92-18.5'	12-18

Stratum 2: Clay (CH)

Beneath the granular material of Stratum 1, a soil layer was encountered consisting of grey highly plastic Silty Clay. This Clay layer was encountered at approximately 18.5 feet in both borings, and each boring was terminated within this Clay layer at 27 feet bgs.

The SPT N-values in this layer ranged from 4 to 11 blows per foot (bpf), which is indicative of medium-soft to stiff Clay. The SPT N-values for Stratum 2 are summarized in the tables below.

Table 6.0-4: Medium-Soft SPT N-Values for Stratum 2

Soil Boring Location	USCS Group Symbol	Depth Below Ground Surface	SPT N-Values
B-1	CH	18.5-27'	4-7
B-2	CH	23.5-27'	5

Table 6.0-5: Stiff SPT N-Values for Stratum 2

Soil Boring Location	USCS Group Symbol	Depth Below Ground Surface	SPT N-Values
B-2	CH	18.5-23.5'	11

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 lies approximately between 6.2 and 7.5 feet bgs. Saturated soils were encountered in B-1 at 7.5 feet bgs at 11:15AM and in B-2 at 6.2 feet bgs at 12:25 AM. 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
	(pcf)	(deg)	(psf)	Active	Passive		
				(Ka)	(Kp)	(psf)	(psf/ft. bgs)
Native Medium-Dense to Dense Granular Soil (SP, SP-SM, SM) [SPT N > 10]	$\gamma = 125$ $\gamma' = 63$	32°	0	0.31	3.26	4,000	200
Native Loose Granular Soil (SP, SP-SM, SM) [SPT N ≤ 10]	$\gamma = 105$ $\gamma' = 43$	30°	0	0.33	3.00	2,500	150
Native Clay (CH) Stiff [8 < SPT N ≤ 30]	$\gamma = 110$ $\gamma' = 48$	-	1,500	-	-	2,000*	100
Native Clay (CH) 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, $K_0 = 1 - \sin \phi'$.

8.0 STRUCTURAL INSPECTION

The following sections present the results of the structural inspection of the residential building at 28 Addison Drive 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 a test pit and soil borings to obtain maximum pertinent information regarding the existing site conditions (refer to Section 6.0 of this report). The test pit performed at the site exposed the exterior portion of the building's foundation walls, allowing for 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 ground level 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 split-level building at 28 Addison Drive contains two separate foundation areas – a basement and finished ground-level living space. The entire west side of the building sits atop CMU basement foundation walls, while the timber frame of the rest of the building is situated on ground-level concrete floor slabs. The timber frame and subfloor of the house above the basement is supported by timber joists and girders spanning the CMU foundation walls.

The basement area of the building, measuring 24'-9" long x 21'-4" wide, encompasses the full area of the 1.5-floor of the building. The basement contains CMU (8x8x18 block) foundation walls measuring approximately 84" in height throughout most of the exterior walls of the room (measured from basement floor surface). Along the east wall, which is located inside the building, the height of the CMU block was only 52" – the remainder of this basement wall consisted of timber stud framing. A 4" bump out was observed on the north and west walls of the basement, located approximately 44.5" above the floor surface. The floor of the basement measured approximately 8'-1" below the bottom of the 1.5-floor floorboards,

and the ground-level first floor of the house is approximately 55” above the basement floor. Also, a gap was observed between the basement walls and floor slab along the entire perimeter of the basement. This gap was 1.5” to 2” wide and 2” to 3” deep throughout its length.

The floor above the basement is supported by nominal 2x10 timber floor joists, spaced 16” on center, running from front to rear of the building (north to south). A set of (3) connected nominal 2x10 timber members acts as a girder for the floor joists, located approximately 13’-6” off of the front wall of the basement. The girder is supported throughout its span, between the edge foundation walls, by (2) 4” diameter steel post columns that extend beneath the concrete floor (to presumed concrete spread footings). Since the south wall of the basement is shorter than the other walls, timber studs bridge the gap between the foundation wall and bottom of the girder. A timber stud member and 3” diameter steel jack post have been installed near the east edge of the girder, adjacent to each other, to provide additional support. The longest clear span of the girder measured 6’-10” along the westernmost span.

North of the rear basement wall, an additional CMU wall was observed through the basement window. This wall was located approximately 30” north of the basement’s rear wall, and extended about 11”-0” in width. This wall supports an apparent addition to the 1.5-floor of the house. The subfloor above the wall could not be observed at the time of the inspection, but the floor joists observed within the basement are expected to extend to this additional wall to support the 1.5-floor extension. The floor in this area consists of a concrete slab which is level with the exterior grade (approximately 49” above the basement floor).

East of the basement, the remainder of the house bears directly on a concrete slab on grade, as per the property owner. The perimeter walls of the house in this area consist of timber stud framing that extends down to the concrete floor at the ground level. The southeast area of the ground level, adjacent to the building front, was originally a two-car garage but has since been converted to a finished bedroom (garage doors have been removed and replaced with timber framing). The frame and ceiling of this front bedroom are covered in painted drywall, so the subfloor and support of the second floor above could not be observed. According to the resident, the original garage contained a support system similar to the basement – timber girder with steel post columns. Upon conversion of the garage to a bedroom, the existing girder/column system was replaced with a steel I-beam girder running north to south along the middle of the room, with columns moved further apart toward the edges of the space to create an open bedroom while maintaining support for the timber floor joists of the second floor. The support columns for the girder are located behind

the walls of the bedroom, so the type and size could not be determined at the time of the inspection. The clear span between edge walls along the girder measured 13'-8".

A test pit excavation along the east wall of the ground level was prematurely terminated at 24" bgs due to the presence of a tree root. Based on conventional foundation construction, Matrix utilized a 16" wide footing as a minimum value for analysis, but believes the actual footings for the building to likely 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 building's equipment and machinery were located in the basement, along the south foundation wall. Along this wall, a washer and dryer were observed atop a 7"-high concrete pad, and a sink was adjacent to the pad. In the southwest corner of the basement, a boiler and hot water heater were observed situated on stone/brick pavers, elevating the equipment 11" and 2.5" above the basement floor, respectively. Also in this corner, an electrical panel was mounted 40" above the floor on the west wall, a water meter was elevated 14" above the floor, a gas meter was elevated 50.5" above the floor on the south wall, and a sump pit was installed within the floor. In the southeast corner, a central vacuum cleaner unit was mounted to the wall, approximately 45" above the basement floor. In the northeast corner, a water filter system was installed onto the metal water conduits, elevated 48" above the floor. Various other PVC pipes and metal conduits were also observed running along the walls of the basement to feed the floors above.

Outside the building, to the east, two air conditioner units were observed atop a concrete slab on grade. On this slab, an additional concrete pedestal beneath one unit to raise it 2" off the exterior ground.

8.3 Site Observations

In the center of the front wall of the house, adjacent to the entrance doorway, the second floor overhangs the exterior grade in an approximately 5'8" x 9'-2" area. This area contains a ceiling, so the second-floor joists could not be observed at the time of the inspection. A brick-covered archway and columns provide support for the cantilevered floor members along the south edge of the overhang area. The remainder of the floor support is apparently provided by the perimeter timber frame walls of the house.

In the rear addition of the ground level, the east wall contains a decorative stone façade along the interior face, extending from the floor to the ceiling. An approximately 18” wide ledge spans the length of this wall, located about 12” above the floor surface. Within this wall, a fireplace has been constructed, and a brick chimney measuring approximately 21” deep x 82” wide was visible from the exterior of the house at the fireplace location.

Along the north wall of the 1.5-floor area, a rear timber deck was observed at the elevation of the interior floor (raised approximately 47” above the adjacent exterior grade. This deck consists of nominal 2x8 timber floor joists and girders, connected to each other with metal face mount hangers. The girders are supported along the perimeter by 4x4 timber posts which are expected to be embedded in concrete footings below grade. A set of timber stairs leads down from the deck to the concrete floor of the backyard.

A brick-covered exhaust chimney was observed along the west wall of the building, adjacent to the basement area and connected to the piping of the boiler and hot water heater. The chimney is expected to be made up of CMU block, and measured approximately 17.5” deep x 25.5” wide.

A few damaged areas were noted within the basement and along the exterior walls of the building. In the basement, near the center of the area, a horizontal crack was observed in the one of the floor joists for the 1.5-floor. The damaged joist was in the middle of a set of three joists; it is unclear if the crack is structurally significant. In the east wall of the rear addition, a crack was observed along the exterior brick façade. This crack originated from the lower left corner of a window, ran horizontally through the brick mortar joints (maximum 5/8” wide), then extended vertically downward beneath the adjacent ground surface. A similar crack was noted on the west wall of the rear addition, as well. In this location, two cracks were observed above and below a window, extending to the roof and into the ground, respectively.

8.4 Elevation Requirements

The FEMA 100-year flood elevation at 28 Addison Drive is El. +174 (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 (BFE). Therefore, the new first floor elevation must be at El. +177 or higher to meet the requirements set forth in the program.

The current 1.5-floor elevation at the Site is at El. +173.72, with the adjacent ground level floor at El. +169.88. To achieve the elevation requirements, the existing building would need to be raised at least 3.3 feet to elevate the existing 1.5-floor 3 feet above the BFE. Matrix recommends that the house be raised a minimum of 4.0 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 basement foundation wall system of the residential building at 28 Addison Drive be kept and extended to achieve the required design flood elevation. The bi-level nature of the existing building will require extra construction to bring the newly raised house to living condition. The east half of the house (ground level) bears on a concrete slab on grade, which cannot be easily raised with the house. In this area, new CMU walls with concrete strip footings are recommended beneath the existing timber-framed walls to provide sufficient support for the newly raised building. The existing CMU foundation walls of the basement are expected to provide sufficient support for the additional height of the newly raised building, while the new CMU walls and concrete footings for the house are to be designed with sufficient capacity to support the expected loads of the house. 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 would remain under an allowable bearing capacity of 2,000 psf for the existing shallow concrete strip footings at the Site.

In accordance with NFIP requirements, it is required that the existing basement be filled in to match the lowest adjacent exterior grade following raising. By elevating the house 4.0 feet, the newly raised building will have over 7 feet of space beneath (down to existing finished grade), which is enough vertical height for a ground-floor level. This additional space beneath the raised building can be used for storage at the resident's discretion. Raising the house in this manner will result in a loss of habitable area for the residence, as the existing ground-level can no longer be used for living space (below the design flood elevation).

Alternatively, the homeowner may elect to raise the existing house an additional 2.8 feet (6.8 feet total above current elevation) and construct a new elevated timber floor in the area of the existing ground level. The additional 2.8 feet of elevation will allow for the new first-floor ceiling height to be above the required limits for habitable space as per the 2018 International Residential Code, New Jersey Edition. Raising the house in this way will preserve the original square footage of the building's habitable space. The new timber subfloor will bear directly on the new CMU foundation walls of the building, which are proposed to be located along the exterior perimeter of the building and below the existing interior load-bearing walls.

Within the front bedroom and rear addition, new concrete or masonry columns are recommended with a new timber girder to provide additional support and to decrease the tributary area of the various new foundation walls. Support for the second floor is expected to remain the same as the existing support, which consists of a steel girder in the front bedroom area supported by steel, concrete, or masonry block columns (unable to identify column type at time of inspection).

Based on observations during the interior inspection, the existing ground level consists of a hallway, recreation area, living room, and a bedroom. No relocation of bathroom or kitchen utilities are expected to be required as part of the construction of a new first-floor subfloor, but all existing furniture/equipment and associated utilities on the ground level will need to be relocated to the new first floor.

The most feasible method of elevation for the building consists of jacking up the entire residential structure (except the concrete ground slabs) from below using steel beams and jack posts. The building will then sit atop temporary cribbing while the new CMU walls are built and the existing CMU foundation walls are heightened with additional courses of masonry block units. 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.

The existing steel post columns intermittently supporting the building's basement girder 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. The existing columns supporting the front bedroom girder are expected to remain, and are proposed to bear on the newly constructed CMU foundation walls. The existing chimneys located along the west and east walls of the house will also require extending during raising of the house to keep the top of the chimneys above the roof level.

The new CMU walls that are to be built within the east area of the house will require excavation into the ground to construct the concrete strip footings. Groundwater was observed approximately 6.2 feet bgs during the subsurface investigation, which is below the expected location of the concrete footings at the site. Dewatering is therefore not expected to be required for this project during construction of the new foundation walls. As previously noted, the groundwater table can be impacted by seasonal variations, precipitation, and other climatic factors. Presence of groundwater at foundation depths may severely impede the constructability of footings due to possible inflow of groundwater into the open excavation. The

appropriate measures to be taken for groundwater control during construction should be determined in the field at the time of excavation and are the responsibility of the Contractor.

Raising of the building should be undertaken with special attention to preserve the existing exterior brick façade covering the timber frame in the front and northeast side of the building, as well as the interior stone façade within the rear addition. If these façades are kept in place during raising, the process is liable to lead to some cracking in the existing façade. Alternatively, the brick and stone façades can be removed prior to raising, then replaced with a similar or more flexible finish after completion of the elevation process. The materials and labor involved in exterior and interior façade restoration of the house are not within the scope of this project.

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 19.3 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/garage, such as air conditioning, heat pump compressors, gas meters, electric meters, and hot water heaters, must be elevated 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, boiler, electrical panel, water meter, gas meter, central vacuum cleaner, and water filtration system in the building interior would require elevating 3 feet above the BFE onto the raised first or 1.5 floor. The two exterior air conditioning units 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 28 Addison Drive 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. 28 Addison Drive (Front of Building – 2-Story Area)



Photo 2. 28 Addison Drive (Front of Building – 1.5-Story Area)



Photo 3. 28 Addison Drive (Rear of Building – West Side)



Photo 4. 28 Addison Drive (Rear of Building – Rear Addition)



Photo 5. Basement Girder, Columns & Subfloor (Looking West)



Photo 6. Basement Foundation Wall with Boiler, Hot Water Heater & Elec. Panel (Looking West)



Photo 7. Crack in 1.5-Floor Joist (Looking North)



Photo 8. CMU Foundation Wall for 1.5-Floor Rear Extension (Looking Northwest)



Photo 9. Front Bedroom/Converted Garage Girder & Column (Covered - Looking Southeast)



Photo 10. Decorative Stone Façade on Interior Wall of Rear Addition (Looking North)



Photo 11. Rear Timber Deck Framing (Looking East)

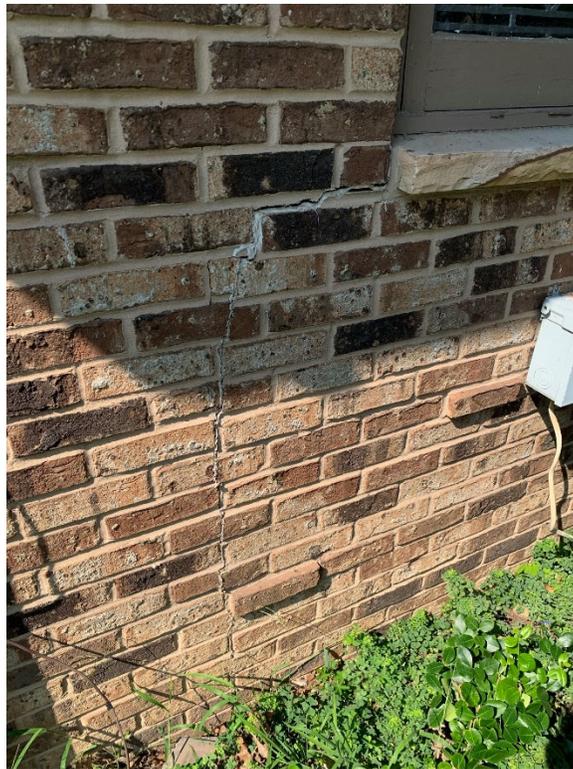


Photo 12. Crack in Brick Façade on East Wall of Rear Addition (Looking West)



Photo 13. Crack in Brick Façade Above Window on West Wall of Rear Addition (Looking East)



Photo 14. Crack in Brick Façade Below Window on West Wall of Rear Addition (Looking East)



Photo 15. Chimney Along East Wall of Rear Addition (Looking West)



Photo 16. Exhaust Chimney Along West Wall of Building (Looking Northeast)

Test Pit Photos

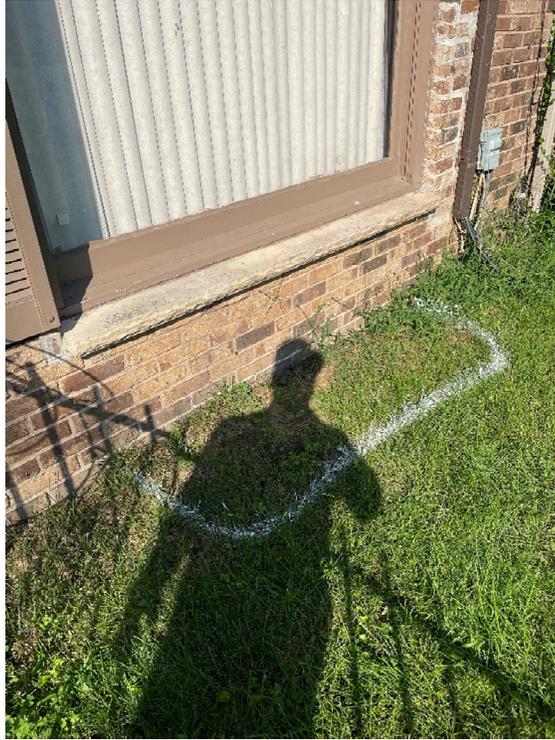


Photo 17. Test Pit TP-1 Location (East Wall – Ground Level)

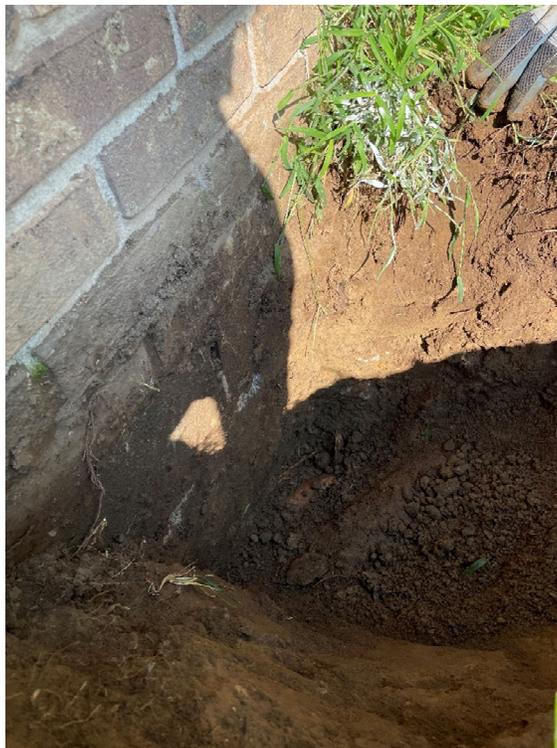
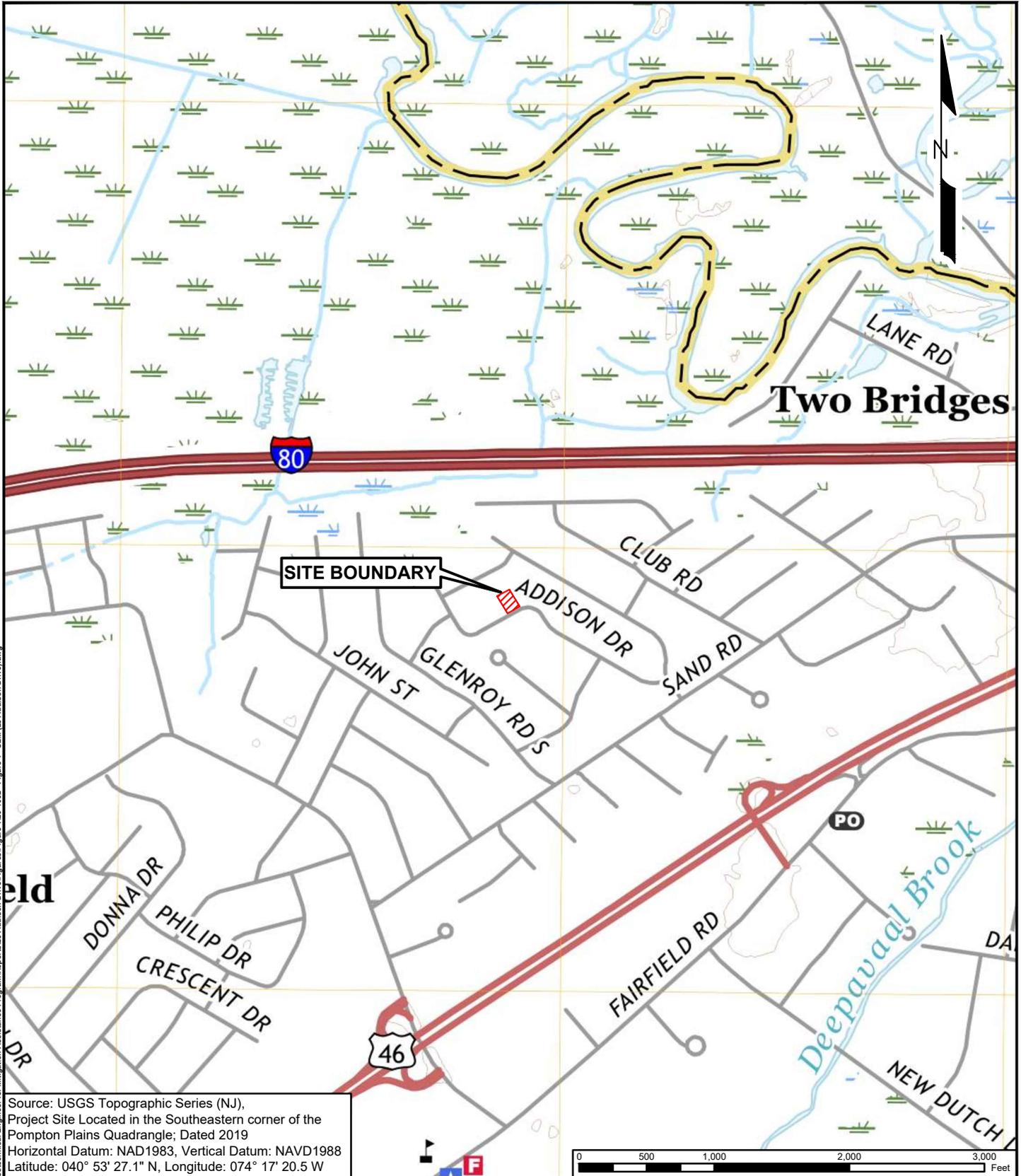


Photo 18. Test Pit TP-1 Conditions (Tree Root in Excavation)

FIGURES



Source: USGS Topographic Series (NJ),
 Project Site Located in the Southeastern corner of the
 Pompton Plains Quadrangle; Dated 2019
 Horizontal Datum: NAD1983, Vertical Datum: NAVD1988
 Latitude: 040° 53' 27.1" N, Longitude: 074° 17' 20.5 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.matrixnewworld.com

NJ DEPARTMENT OF COMMUNITY AFFAIRS
 GEOTECHNICAL AND STRUCTURAL ASSESSMENT REPORT
 28 ADDISON DRIVE
 FAIRFIELD, NEW JERSEY 07004

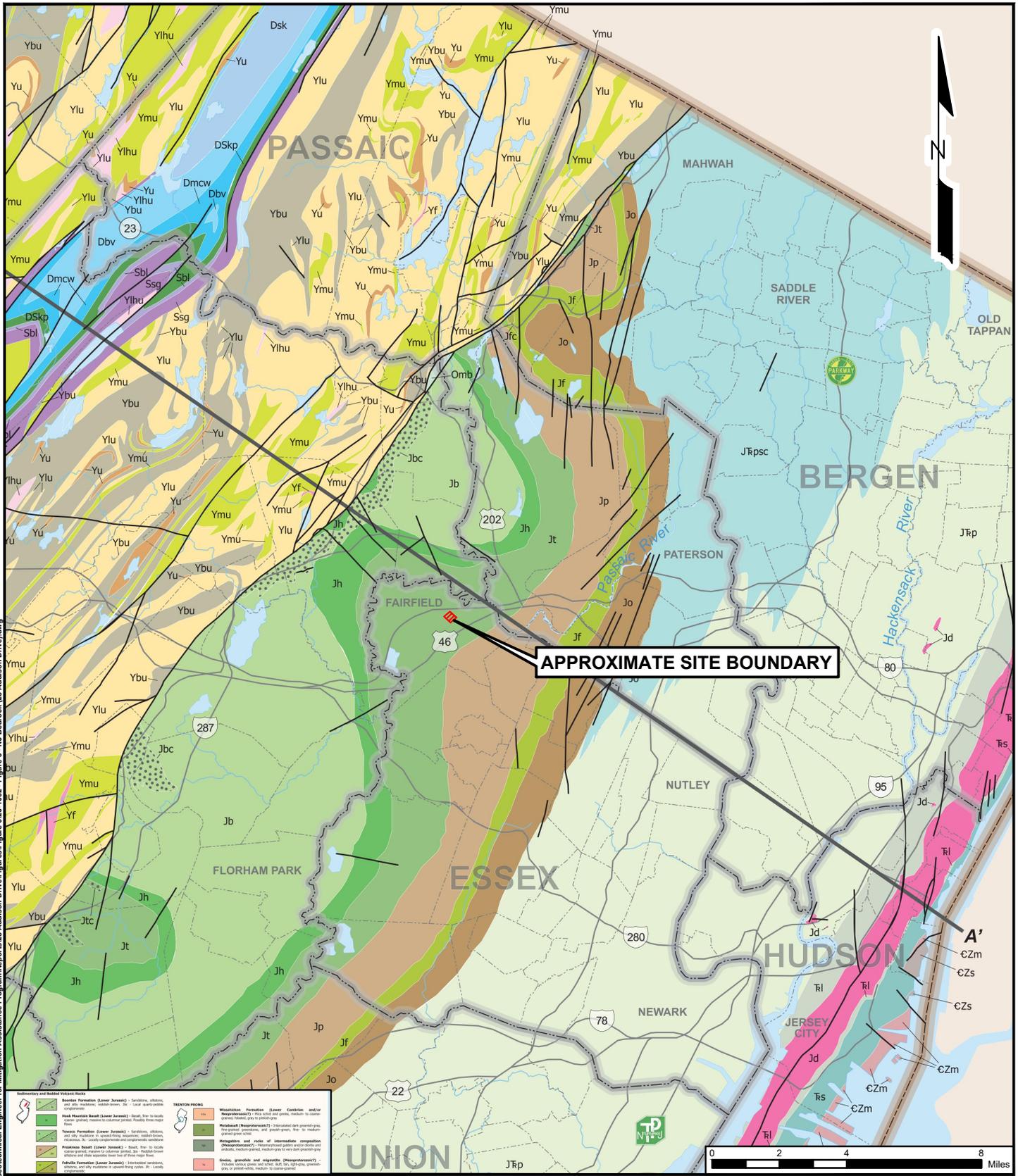
SCALE:
 1" = 1,000'

PROJECT NO.:
 20-1052

DATE:
 SEPTEMBER 2021

FIGURE NO.:
 1

© MATRIXNEWORLD, INC. 2020-09-10 10:52 NJDCA Geotechnical Engineer for Mitigation Assistance Program Reports 28 Addison Drive Figures 1 to 10 of 10 - Figure 1 - SLM (28 Addison Drive).dwg



APPROXIMATE SITE BOUNDARY

Subsidiary and Related Units

	Passaic River (Lower Jersey) - Sandstone, siltstone and clay matrix, medium to coarse grained, medium to coarse grained, medium to coarse grained, medium to coarse grained.
	Hackensack River (Lower Jersey) - Sandstone, siltstone and clay matrix, medium to coarse grained, medium to coarse grained, medium to coarse grained, medium to coarse grained.
	Passaic River (Upper Jersey) - Sandstone, siltstone and clay matrix, medium to coarse grained, medium to coarse grained, medium to coarse grained, medium to coarse grained.
	Passaic River (Lower Jersey) - Sandstone, siltstone and clay matrix, medium to coarse grained, medium to coarse grained, medium to coarse grained, medium to coarse grained.
	Hackensack River (Lower Jersey) - Sandstone, siltstone and clay matrix, medium to coarse grained, medium to coarse grained, medium to coarse grained, medium to coarse grained.
	Hackensack River (Upper Jersey) - Sandstone, siltstone and clay matrix, medium to coarse grained, medium to coarse grained, medium to coarse grained, medium to coarse grained.
	Hackensack River (Lower Jersey) - Sandstone, siltstone and clay matrix, medium to coarse grained, medium to coarse grained, medium to coarse grained, medium to coarse grained.

UNIT PROFILES

	Wachusett Formation (Lower Connecticut) - Sandstone, siltstone and clay matrix, medium to coarse grained, medium to coarse grained, medium to coarse grained, medium to coarse grained.
	Hackensack (Upper Connecticut) - Sandstone, siltstone and clay matrix, medium to coarse grained, medium to coarse grained, medium to coarse grained, medium to coarse grained.
	Hackensack (Lower Connecticut) - Sandstone, siltstone and clay matrix, medium to coarse grained, medium to coarse grained, medium to coarse grained, medium to coarse grained.
	Hackensack (Upper Connecticut) - Sandstone, siltstone and clay matrix, medium to coarse grained, medium to coarse grained, medium to coarse grained, medium to coarse grained.
	Hackensack (Lower Connecticut) - Sandstone, siltstone and clay matrix, medium to coarse grained, medium to coarse grained, medium to coarse grained, medium to coarse grained.
	Hackensack (Upper Connecticut) - Sandstone, siltstone and clay matrix, medium to coarse grained, medium to coarse grained, medium to coarse grained, medium to coarse grained.
	Hackensack (Lower Connecticut) - Sandstone, siltstone and clay matrix, medium to coarse grained, medium to coarse grained, medium to coarse grained, medium to coarse grained.

BEDROCK GEOLOGY LOCATION MAP

MATRIX NEW WORLD
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.matrixnewworld.com

NJ DEPARTMENT OF COMMUNITY AFFAIRS
GEOTECHNICAL AND STRUCTURAL ASSESSMENT REPORT
28 ADDISON DRIVE
FAIRFIELD, NEW JERSEY 07004

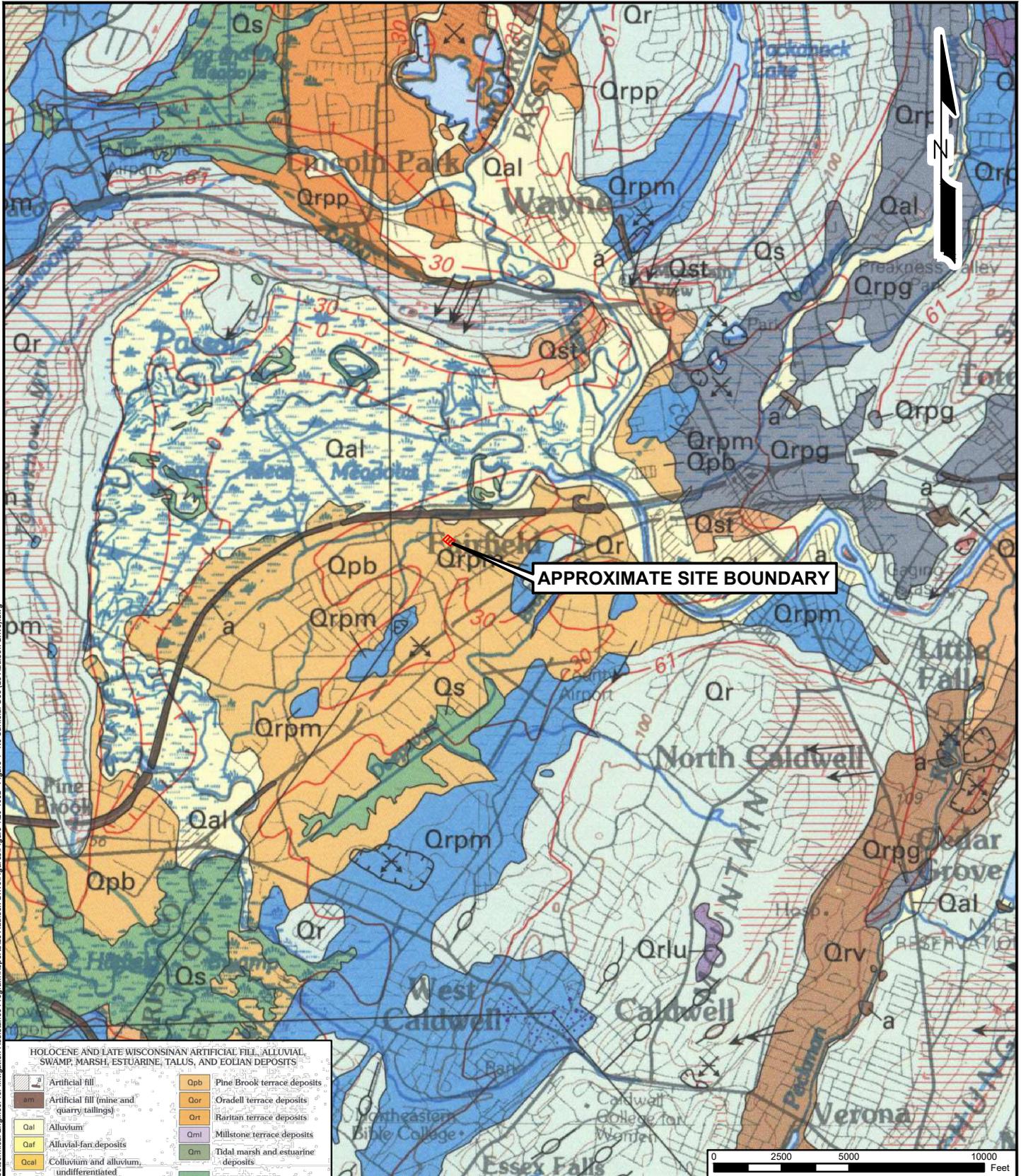
SCALE:
1" = 4 Miles

PROJECT NO.:
20-1052

DATE:
SEPTEMBER 2021

FIGURE NO.:
3

© MATRIXNEWORLD, 2020-09-10 052 NJDCA Geotechnical Engineer for Mitigation Assistance Program/Reports/28 Addison Drive/Figure 3/20-1052 - Figure 3 - NJ Bedrock (28 Addison Drive).dwg



© MATRIXNEWORLD,INC. 2020-20-1052 NJDCA Geotechnical Engineer for Mitigation Assistance Program/Reports/28 Addison Drive/Figure 4-20-1052 - Figure 4 - NJ Surficial Geo (28 Addison Drive).dwg

HOLOCENE AND LATE WISCONSINAN ARTIFICIAL FILL, ALLUVIAL, SWAMP, MARSH, ESTUARINE, TALUS, AND EOLIAN DEPOSITS

am	Artificial fill (mine and quarry tailings)	Qpb	Pine Brook terrace deposits
Qal	Alluvium	Qor	Oradell terrace deposits
Qaf	Alluvial fan deposits	Qrt	Raritan terrace deposits
Qcal	Colluvium and alluvium undifferentiated	Qml	Millstone terrace deposits
		Qm	Tidal marsh and estuarine deposits

SURFICIAL GEOLOGY 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.matrixnewworld.com

NJ DEPARTMENT OF COMMUNITY AFFAIRS
GEOTECHNICAL AND STRUCTURAL ASSESSMENT REPORT
28 ADDISON DRIVE
FAIRFIELD, NEW JERSEY 07004

SCALE:
1" = 5000'

PROJECT NO.:
20-1052

DATE:
SEPTEMBER 2021

FIGURE NO.:
4

APPENDIX A
SOIL BORING & TEST PIT LOGS

BORING LOG

BORING NO.: B-1

SHEET 1 OF 1

PROJECT NO.: 20-1052 PROJECT: NJDCA Geotechnical Engineer for Mitigation Assistance Program DATE: 8/30/21

PROJECT LOCATION: Fairfield, NJ BORING LOCATION: 28 Addison Drive, Front Lawn Near Street Curb

DRILLING EQUIPMENT: CME 55 ANGLE: -90.0 DIR.: ----- ELEV.: DATUM: NAVD88

DRILLING CONTRACTOR: Boring Brothers, Inc. DRILLER: R. Dollar INSPECTOR: T. Pace

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"	8/30/21	11:15 am	7.5	N/A
FJ Steel	4"			SS	1 3/8"						

Depth Feet (Elev.)	CASING		SAMPLE			Graphic Symbol	Description Of Material	Laboratory Tests
	Blows/ Foot	No.	Type	Depth Feet	Blows/6" (REC. %) [RQD %]			
		S-1	SS	0-2	2/12"-3-5 (63%)		11" Grass/Topsoil	Pass No 200 Atterberg Limits
	PUSH						S-1: Light Brown mf* SAND, little Silt, trace cf Gravel, trace asphalt, dry (SM)	
	10	S-2	SS	2-4	7-4-5-8 (88%)		S-2A (Top 7"): Same as Above, moist (SM)	
	20						S-2B (Bottom 14"): Light Brown fine SAND and Silt, moist (SM)	
	30	S-3	SS	4-6	8-8-8-8 (92%)		S-3A (Top 13"): Red-Brown to Dark Grey fine SAND, some Clayey Silt, moist (SM)	
5	30						WC: 18.9%, LL: 20, PL: 18, PI: 2	
	MUD	S-4	SS	6-8	7-9-8-14 (100%)		S-3B (Bottom 9"): Grey-Brown mf* SAND, little Silt, moist (SM)	
							S-4: Brown fine SAND, little Silt, trace fine Gravel, wet (SM)	
		S-5	SS	8-10	9-8-7-16 (100%)		S-5: Brown mf* SAND, little Silt, trace fine Gravel, wet (SM)	
		S-6	SS	10-12	8-10-8-12 (100%)		S-6: Same as Above, wet (SM)	Atterberg Limits
		S-7	SS	15-17	9-9-12-14 (67%)		S-7: Brown cm*f SAND, trace Silt, trace fine Gravel, wet (SP-SM)	
		S-8	SS	20-22	4-2-5-5 (100%)		S-8: Grey Silty CLAY, wet (CH)	Atterberg Limits
							WC: 39.5%, LL: 57, PL: 24, PI: 33	
		S-9	SS	25-27	2-2-2-3 (100%)		S-9: Same as Above, wet (CH)	
	MUD						Bottom of Borehole @ 27 ft.	

NEWORLD NO GROUT 20-1052 BORING LOGS.GPJ MATRIX.EGS.GDT 9/23/21

BORING NO.: B-1

BORING LOG

BORING NO.: **B-2**

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

PROJECT NO.: **20-1052** PROJECT: **NJDCA Geotechnical Engineer for Mitigation Assistance Program** DATE: **8/30/21**

PROJECT LOCATION: **Fairfield, NJ** BORING LOCATION: **28 Addison Drive, Front Lawn**

DRILLING EQUIPMENT: **CME 55** ANGLE: **-90.0** DIR.: **-----** ELEV.: **-----** DATUM: **NAVD88**

DRILLING CONTRACTOR: **Boring Brothers, Inc.** DRILLER: **R. Dollar** INSPECTOR: **T. Pace**

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"	8/30/21	12:25 pm	6.2	N/A
FJ Steel	4"			SS	1 3/8"						

Depth Feet (Elev.)	CASING		SAMPLE			Graphic Symbol	Description Of Material	Laboratory Tests
	Blows/Foot	No.	Type	Depth Feet	Blows/6" (REC. %) [RQD %]			
5	5	S-1	SS	0-2	1/12"-4-11 (67%)		11" Grass/Topsoil	Sieve
15	15	S-2	SS	2-4	6-5-7-5 (92%)		S-1: Grey-Brown mf* SAND, little Silt, trace of Gravel, dry (SM) S-2A (Top 10"): Dark Brown/Grey mf* SAND, some Silt, trace fine Gravel, trace asphalt, moist (SM) S-2B (Bottom 12"): Light Brown/Grey fine SAND, some Silt, moist (SM)	
25	25	S-3	SS	4-6	9-7-9-9 (100%)		S-3: Grey to Red-Brown mf* SAND, some Clayey Silt, moist (SM) WC: 20.3%, Gravel: 0.3%, Sand: 77.3%, Fines: 22.4%	
25	25	S-4	SS	6-8	9-7-10-8 (100%)		S-4: Same as Above, wet (SM)	
10	MUD	S-5	SS	8-10	13-9-9-12 (100%)		S-5: Grey-Brown fine SAND, some Silt, wet (SM) **Sand coarser (still fine) in bottom 4" of sample	
15		S-6	SS	10-12	8-7-8-10 (100%)		S-6: Grey-Brown mf* SAND, little Silt, trace fine Gravel, wet (SP-SM) WC: 17.6%, Fines: 11.3%	Pass No 200
15		S-7	SS	15-17	8-8-10-11 (71%)		S-7A (Top 13"): Grey-Brown fine SAND, little Silt, wet (SP-SM) S-7B (Bottom 4"): Red-Brown cmf SAND, trace Silt, trace of Gravel, wet (SP-SM)	
20		S-8	SS	20-22	9-5-6-8 (79%)		S-8: Grey Silty CLAY, wet (CH)	
25		S-9	SS	25-27	3-2-3-3 (100%)		S-9: Same as Above, wet (CH) WC: 41.2%, LL: 55, PL: 24, PI: 31	Atterberg Limits
	MUD						Bottom of Borehole @ 27 ft.	

BORING NO.: **B-2**

NEWORLD NO GROUT 20-1052 BORING LOGS:GFJ MATRIX EGS:GDT 9/23/21

TEST PIT LOG

TEST PIT NO.: TP-1

SHEET 1 OF 1

PROJECT NO.: 20-1052 PROJECT: NJDCA Geotechnical Engineer - Mitigation Assistance Program DATE: 8/27/2021

PROJECT LOCATION: Fairfield, NJ ELEV.: _____ TIME STARTED: 9:35:00 AM

TEST PIT LOCATION: 28 Addison Drive (East Wall - Ground Level) DATUM: NAVD88 TIME FINISHED: 10:00:00 AM

CONTRACTOR: Boring Brothers, Inc. GROUNDWATER LEVEL (IN): _____

EQUIPMENT: Kubota KX033-4 OPERATOR: Eladio Cruz INSPECTOR: J. Chon

Depth Inches (Elev)	No.	Depth Inches	Graphic Symbol	Description Of Material	Laboratory Tests
		0-6		Topsoil, Grass Cover	
		6-24		Brown mf* SAND, some Silt, trace of Gravel (SM)	
				12" thick tree root encountered approximately 24" bgs. Test pit excavation terminated at this depth - tree root could not be broken through. Wall footing not encountered at this location. Bottom of Test pit @ 24 in. Test Pit Backfilled.	

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

TEST PIT NO.: TP-1

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. Sands More than half of coarse fraction is smaller 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. 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. 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).	$C_u = \frac{D_{60}}{D_{10}}$ Greater than 4 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3 Not meeting all gradation requirements for GW 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. $C_u = \frac{D_{60}}{D_{10}}$ Greater than 6 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3 Not meeting all gradation requirements for SW 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. Atterberg limits above "A" line with P1 greater than 7					
			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.									
		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).									
			GC	Clayey gravels, gravel and clay mixtures.	Plastic fines (for identification procedures see CL below).									
		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.									
			SP	Poorly graded sands or gravelly sands, little or no fines.	Predominantly one size or a range of sizes with some intermediate sizes missing.									
		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).									
			SC	Clayey sands, sand-clay mixtures.	Plastic fines (for identification procedures see CL below).									
						Identification Procedure on Fraction Smaller than No. 40 Sieve Size.								
						Dry Strength (Crushing Characteristics)	Dilatancy (Reaction to shaking)				Toughness (Consistency near PL)			
Fine-grained Soils More than half of material is smaller than No. 200 sieve size.	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		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										

- 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.
- All sieve sizes on this chart are U.S. standard.
- Adopted by Corps of Engineers and Bureau of Reclamation, January 1952.

BURMISTER SOIL IDENTIFICATION METHOD

BURMISTER SOIL IDENTIFICATION METHOD

I. SOIL MATERIAL Composition, Gradation, and Plasticity Characteristics

a) Soil Components and Soil Fractions

Sieve	3"	1"	3/8"	No. 10	No. 30	No. 60	No. 200	
				2 mm			0.076 mm	0.02 mm
Granular Component	GRAVEL			SAND			SILT	
Fractions	coarse	medium	fine	coarse	medium	fine	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

<u>Component</u>	<u>Proportion Terms</u>	<u>Defining Range of Percentages</u>
Principal Components- GRAVEL, SAND, SILT (all Uppercase)		50% or more
Minor Components-	Gravel Sand Silt	and some little trace 35 to 50% 20 to 35% 10 to 20% 1 to 10%
<u>Gradation Terms for Granular Soils</u>		<u>ORGANIC SOILS</u>
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

<u>Overall Plasticity</u>	<u>Plasticity Index</u>	<u>Principal Component</u>	<u>Minor Component</u>
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	Specimen 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

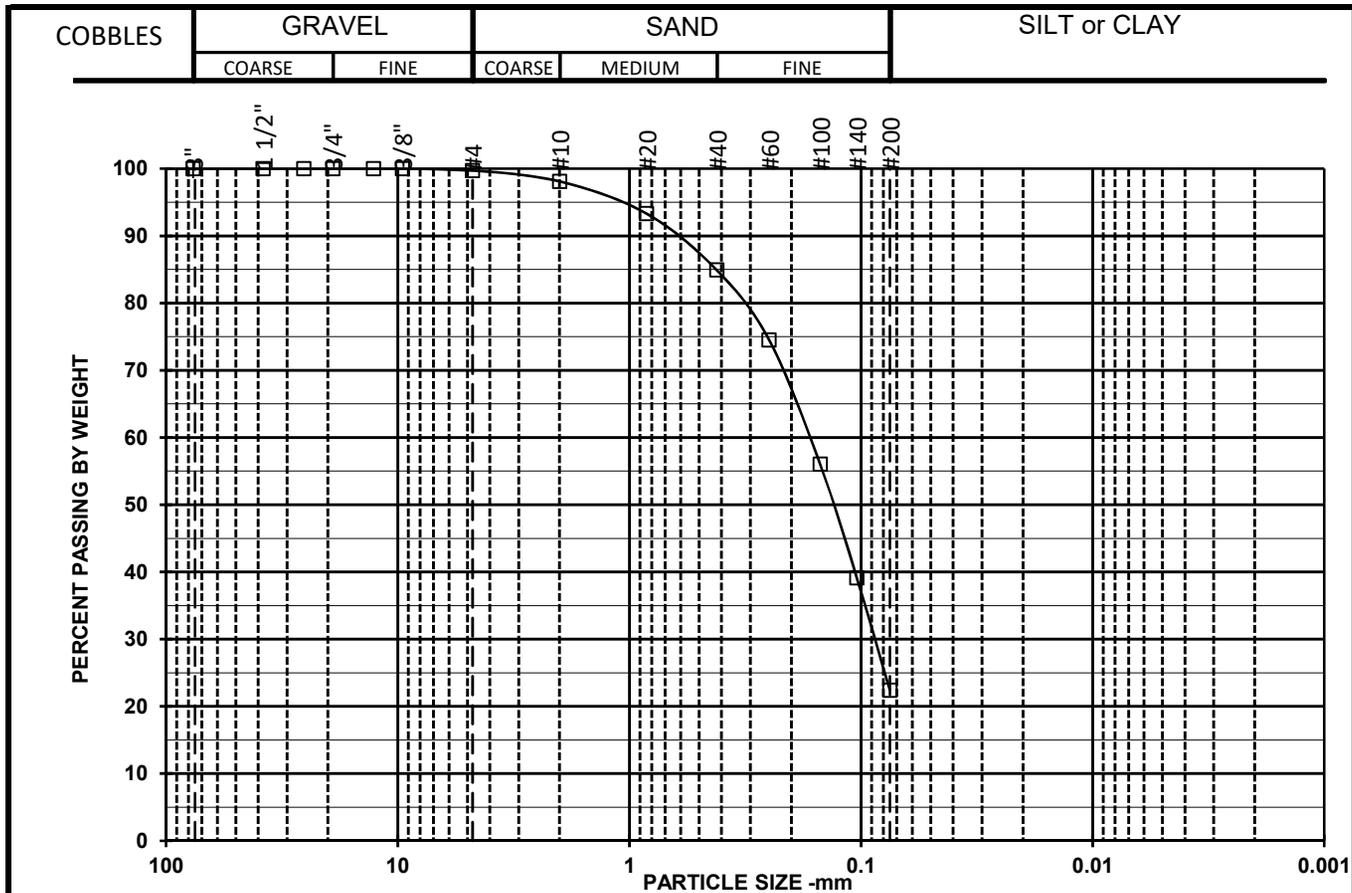
GEOTECHNICAL LABORATORY TESTING RESULTS

**Matrix New World Engineering, P.C. #20-1052-021
 NJDCA MAP - 28 Addison Drive**

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 (%)
B-1	S-2B	2-4	17.6				SM	37.3	
B-1	S-3A	4-6	18.9	20	18	2	SM		
B-1	S-8	20-22	39.5	57	24	33	CH		
B-2	S-3	4-6	20.3				SM	22.4	
B-2	S-6	10-12	17.6				SP-SM	11.3	
B-2	S-9	25-27	41.2	55	24	31	CH		

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



Symbol	□	◇	○
Boring	B-2		
Sample	S-3		
Depth	4-6		
% +3"	0		
% Gravel	0.3		
% SAND	77.3		
%C SAND	1.6		
%M SAND	13.2		
%F SAND	62.5		
% FINES	22.4		
D ₁₀₀ (mm)	9.53		
D ₆₀ (mm)	0.167		
D ₃₀ (mm)	0.087		
D ₁₀ (mm)			
Cc			
Cu			

Sieve	Percent Finer Data	
Size/ID #		
6"	100.0	
4"	100.0	
3"	100.0	
1 1/2"	100.0	
1"	100.0	
3/4"	100.0	
1/2"	100.0	
3/8"	100.0	
#4	99.7	
#10	98.1	
#20	93.3	
#40	84.9	
#60	74.5	
#100	56.0	
#140	39.1	
#200	22.4	
5μ m		
2μ m		
1μ m		

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

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	20.3				SM		Brown, Silty sand	09/10/21
◇								
○								

Matrix New World Engineering, P.C.	#20-1052-021	NJDCA MAP 28 Addison Drive
TerraSense	#21005323A	

PARTICLE SIZE DISTRIBUTION
ASTM D6913 & ASTM D7928

APPENDIX D

FEMA NFIP ELEVATION CERTIFICATE

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. 28 Addison Dr				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 3504, Lot 29					
A4. Building Use (e.g., Residential, Non-Residential, Addition, Accessory, etc.) <u>Residential</u>					
A5. Latitude/Longitude: Lat. <u>N40°53'27"</u> Long. <u>W74°17'20"</u> Horizontal Datum: <input type="checkbox"/> NAD 1927 <input checked="" type="checkbox"/> 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 <u>4</u>					
A8. For a building with a crawlspace or enclosure(s):					
a) Square footage of crawlspace or enclosure(s) <u>2596.00</u> sq ft					
b) Number of permanent flood openings in the crawlspace or enclosure(s) within 1.0 foot above adjacent grade <u>0</u>					
c) Total net area of flood openings in A8.b <u>N/A</u> sq in					
d) Engineered flood openings? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					
A9. For a building with an attached garage:					
a) Square footage of attached garage <u>0.00</u> sq ft					
b) Number of permanent flood openings in the attached garage within 1.0 foot above adjacent grade <u>0</u>					
c) Total net area of flood openings in A9.b <u>N/A</u> sq in					
d) Engineered flood openings? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No					
SECTION B – FLOOD INSURANCE RATE MAP (FIRM) INFORMATION					
B1. NFIP Community Name & Community Number Fairfield, Township of			B2. County Name Essex		B3. State New Jersey
B4. Map/Panel Number 34013C0018	B5. Suffix G	B6. FIRM Index Date 04-03-2020	B7. FIRM Panel Effective/ Revised Date 04-03-2020	B8. Flood Zone(s) AE	B9. Base Flood Elevation(s) (Zone AO, use Base Flood Depth) 174' (NAVD88')
B10. Indicate the source of the Base Flood Elevation (BFE) data or base flood depth entered in Item B9: <input type="checkbox"/> FIS Profile <input checked="" type="checkbox"/> FIRM <input type="checkbox"/> Community Determined <input type="checkbox"/> Other/Source: _____					
B11. Indicate elevation datum used for BFE in Item B9: <input type="checkbox"/> NGVD 1929 <input checked="" type="checkbox"/> NAVD 1988 <input type="checkbox"/> Other/Source: _____					
B12. Is the building located in a Coastal Barrier Resources System (CBRS) area or Otherwise Protected Area (OPA)? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Designation Date: _____ <input type="checkbox"/> CBRS <input type="checkbox"/> OPA					

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. 28 Addison Dr			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.

- | | | | |
|---|-------|--|---------------------------------|
| a) Top of bottom floor (including basement, crawlspace, or enclosure floor) _____ | 165.5 | <input checked="" type="checkbox"/> feet | <input type="checkbox"/> meters |
| b) Top of the next higher floor _____ | 169.9 | <input checked="" type="checkbox"/> feet | <input type="checkbox"/> meters |
| c) Bottom of the lowest horizontal structural member (V Zones only) _____ | N/A | <input type="checkbox"/> feet | <input type="checkbox"/> meters |
| d) Attached garage (top of slab) _____ | N/A | <input type="checkbox"/> feet | <input type="checkbox"/> meters |
| e) Lowest elevation of machinery or equipment servicing the building
(Describe type of equipment and location in Comments) _____ | 165.7 | <input checked="" type="checkbox"/> feet | <input type="checkbox"/> meters |
| f) Lowest adjacent (finished) grade next to building (LAG) _____ | 169.2 | <input checked="" type="checkbox"/> feet | <input type="checkbox"/> meters |
| g) Highest adjacent (finished) grade next to building (HAG) _____ | 169.7 | <input checked="" type="checkbox"/> feet | <input type="checkbox"/> meters |
| h) Lowest adjacent grade at lowest elevation of deck or stairs, including structural support _____ | 169.3 | <input checked="" type="checkbox"/> feet | <input type="checkbox"/> meters |

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	Place Seal Here
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	
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 located at Elev=165.7'(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. 28 Addison Dr			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. 28 Addison Dr			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.

BUILDING PHOTOGRAPHS

See Instructions for Item A6.

OMB No. 1660-0008

Expiration Date: November 30, 2022

ELEVATION CERTIFICATE

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. 28 Addison Dr			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

BUILDING PHOTOGRAPHS

Continuation Page

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

ELEVATION CERTIFICATE

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. 28 Addison Dr			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