ENGINEERING INVESTIGATION & ANALYSIS
GEOTECHNICAL & STRUCTURAL
ASSESSMENT REPORT

112 BIG PIECE ROAD
FAIRFIELD, NEW JERSEY 08203

MATRIXNEWORLD
Engineering Progress

Prepared for:

State of New Jersey
Department of Community Affairs
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August 2021

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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 112 Big Piece 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 35 to 36 inches below ground surface (bgs), respectively, 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 112 Big Piece Road in Fairfield, New Jersey. The property consists of a 1.5-story timbe-framed split-level house with an approximately 1,430 square foot footprint. The building is situated atop concrete masonry unit (CMU) foundation walls on cast-in-place concrete foundations. The substructure of the house is comprised of two crawl spaces and a finished, partially underground basement area. The timber frame of the 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 situated atop Pompton – Urban land. The subsurface composition is typically sand and loamy sands from 8 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 loamy Sands were encountered followed by a layer of cohesive material. Groundwater was encountered in the borings at approximately 5 to 6 feet bgs based on soil saturation levels. 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 May 17, 2021, Boring Brothers completed a foundation survey which included 2 test pits, TP-1 (East Wall) and TP-2 (Rear Wall) were completed to depths of 35 and 36 inches below the ground surface, respectively. The test pits were dug using a Bobcat E55 and shovel to prevent any damage to the existing building foundations. The exterior edge of the building footing was exposed at both locations to accurately measure the structure's dimensions, as well as 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. 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 May 14, 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	4	B-1: 4-6', 25-27' B-2: 4-6', 20-22'
Sieve Analysis	ASTM D422	1	B-2: 4-6'
Atterberg Limits	ASTM D4318	2	B-1: 4-6,' 25-27'
Percent Fines	ASTM D1140	1	B-1: 4-6'
Combined Sieve & Hydrometer	ASTM D422	1	B-2: 20-22'

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 the concrete was uncovered in TP-1 (East Wall) at 21" bgs. The concrete protrudes 4" from the wall and extends 14" deep at this location.

In TP-2 (Rear Wall) the top of the concrete was uncovered at 30" bgs. The concrete protrudes 2" from the wall and extends 6" deep at this location.

Surface Cover

The surface cover for boring B-1 and B-2 consisted of grass cover and topsoil, approximately 4-6 inches thick.

Stratum 1: Sand (SP, SM, SC, SC-SM)

Beneath the surface cover, a soil layer was encountered consisting of brown to gray medium-to-fine Sand with varying amounts of Silt and/or Clay. This granular layer extended from the bottom of the surface cover to 11 feet below the ground surface (bgs) in B-1 and approximately 18.5 feet bgs in B-2.

The SPT N-value in this layer ranged from 1 to 20 blows per foot (bpf), which is indicative of very loose to medium-dense. The SPT N-values for Stratum 1 are summarized in the tables below.

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

Soil Boring Location	USCS Group Symbol	Depth Below Ground Surface	SPT N-Values
B-1	SP, SM	0-4'	1-4
B-2	SP, SM	0-4'	2-4

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	SP, SC-SM	4-11’	11-18
B-2	SC, SP	4-18.5’	13-20

Stratum 2: Silt (ML)

Beneath the granular material of Stratum 1, a layer of Clayey Silt was encountered. This Silt layer extended from 11 to approximately 18.5 feet bgs in boring B-1 and from approximately 18.5 to 20.67 feet bgs in boring B-2.

The SPT N-values in this layer ranged from 12 to 18 bpf, which is indicative of medium Silt material. The SPT N-values for Stratum 2 are summarized in the tables below.

Within this layer in boring B-1, from approximately 13.5 to 15.5 feet bgs, a lens of black-gray find Sand with traces of Silt was encountered. The SPT N-value for this material was recorded at 8 bpf, signifying loose Sand material.

Table 6.0-3: Loose Sand SPT N-Values for Stratum 2

Soil Boring Location	USCS Group Symbol	Depth Below Ground Surface	SPT N-Values
B-1	SM	13.5-15.5’	8

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

Soil Boring Location	USCS Group Symbol	Depth Below Ground Surface	SPT N-Values
B-1	ML	11-13.5’ 15.5-18.5’	15 18
B-2	ML	18.5-20.67’	12

Stratum 3: Clay (CL)

Beneath the Silt layer (Stratum 2), a cohesive layer was encountered consisting predominantly of Clay with significant amounts of Silt and traces of fine Sand. This Clay layer was encountered at approximately 18.5 feet bgs in boring B-1 and at 20.67 feet bgs in boring B-2. Both borings were terminated within this layer at 27 feet bgs.

The SPT N-values in this layer typically ranged from 4 to 6 bpf, which is indicative of medium-soft cohesive soil material. One outlying N-value of 12 bpf (signifying stiff Clay material) was recorded in boring B-2 at 21.25 feet bgs. The SPT N-values for Stratum 3 are summarized in the tables below.

Table 6.0-5: Medium-Soft Clay SPT N-Values for Stratum 3

Soil Boring Location	USCS Group Symbol	Depth Below Ground Surface	SPT N-Values
B-1	CL	18.5-27’	4-6
B-2	CL	23.5-27’	5

Table 6.0-6: Stiff Clay SPT N-Values for Stratum 3

Soil Boring Location	USCS Group Symbol	Depth Below Ground Surface	SPT N-Values
B-2	CL	20.67-23.5’	12

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 4 to 6 feet bgs. Saturated soils were first encountered in B-1 at 6 feet bgs at 10:50AM and in B-2 at 5 feet bgs at 11:50AM. 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 (pcf)	Friction Angle (Φ) (deg)	Cohesive Strength, c_u (psf)	Earth Pressure Coefficient: Active (Ka)	Earth Pressure Coefficient: Passive (Kp)	Net Allowable Foundation Pressure* (psf)	Lateral Bearing (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 Silt (ML) Medium [10 ≤ SPT N ≤ 30]	$\gamma = 115$ $\gamma' = 53$	28°	400	0.36	2.77	2,000*	100
Native Clay Material (CL) Medium-Soft [4 ≤ SPT N ≤ 8]	$\gamma = 100$ $\gamma' = 38$	-	1,000	-	-	1,500*	75
Native Clay Material (CL) Stiff [8 < SPT N ≤ 30]	$\gamma = 110$ $\gamma' = 48$	-	1,500	-	-	2,000*	1,000

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, $K_o = 1 - \text{Sin}\ \phi'$.

8.0 STRUCTURAL INSPECTION

The following sections present the results of the structural inspection of the residential building at 112 Big Piece 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 wall footings, 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 spaces 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 112 Big Piece Road sits atop two crawl space areas and a finished basement area. The timber frame and subfloor are supported by the CMU (8x8x18 block) foundation walls, as well as a nominal 2x8 timber girder in each of the two crawl space areas.

Encompassing the east portion of the house, beneath the first-floor level, is a rectangular crawl space with CMU foundation walls ranging from 35" to 37" in height. The first-floor surface above was measured at approximately 45" above the crawl space floor surface (surface is uneven). The CMU walls exhibited a 2" protrusion into the crawl space, approximately 12" above the crawl space floor. This likely signifies the use of 12" thick CMU blocks for the lower courses of the foundation walls. The subfloor of the level above is comprised of nominal 2x8 timber joists, spaced 16" on center, running north to south (front to rear of building). A support girder consisting of (3) nominal 2x8 timber beams runs perpendicular to the floor joists to provide additional support along the center of the crawl space. The girder bears on the CMU foundation walls at each end and is supported at its midspan by a CMU block column consisting of (4) stacked 8x8x18 blocks. In the southwest corner of the crawl space, next to the entrance opening, a small pit was observed that was approximately 15” lower than the rest of the crawl space. The purpose of this pit is unknown.

Adjacent to the front crawl space, to the south, is an addition to the house that connects the original building to the rear deck. This portion of the house sits atop a foundation system that could not be observed at the time of the inspection, as there is no crawl space or basement underneath. This area of the house is assumed to consist of a concrete floor slab supported by perimeter stem walls, with the space below the slab filled in with soil.

The rear southwest portion of the building, which appears to be another addition to the original building, is situated atop a second crawl space area with CMU foundation walls (same as front crawl space). The crawl space floor measured approximately 24” below the bottom of the insulted ceiling panels. This insulation covered the floor joists of the house, which could not be observed or measured. A girder consisting of (2) nominal 2x8 timber beams was observed running the length of the crawl space from, east to west, below the ceiling panels. This girder was supported at its end and at midspan by CMU block pedestals.

Test pits were conducted along the east wall of the southeast house addition and the rear wall of the rear crawl space. Below the foundation walls in the rear crawl space area, an approximately 12” wide concrete spread footing was revealed during the test pit excavation program. Based on our findings within the test pits and from 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.

The remainder of the CMU foundation walls are covered in a plaster coating, as the basement space of the split-level house consists of a furnished open area and a laundry room. The foundation walls can be differentiated from the timber house frame by their protrusion into the building (thinner walls above). The floor of the western half of the finished basement (including the laundry room in the southwest corner) measures approximately 3” higher than the adjacent eastern half. The floor of the western half of the basement is approximately 9” below the adjacent exterior grade along the west side of the house, and measures approximately 7’-6” below the basement ceiling. A 4” diameter steel post was observed in the center of the basement area, supporting the subfloor of the second floor above.

8.2 Existing Equipment

Various pieces of equipment and machinery were observed within the front crawl space of the building at the time of the inspection. The southwest pit within the crawl space floor contained a sump pump with PVC piping leading out the east side of the house. Also observed in the front crawl space was an electrical panel along the south wall (5” above the crawl space floor), a fuel storage tank on 4” high concrete blocks (currently out of service as per homeowner), and a water well pressure tank system in the northeast corner of the space. This system consisted of two storage tanks and a pump, with both tanks situated on 2” high stone/wood pedestals. Multiple PVC and metal pipes were also observed running through the front crawl space at varying elevations.

Within the laundry room in the southwest corner of the basement, a boiler, water heater, washer, and dryer were observed. The washer and dryer were located on the floor of the basement, while the water heater and boiler were raised approximately 11.5” and 7.5”, respectively, above the basement floor on CMU block pedestals.

An air conditioning unit and gas meter were observed outside the building along the west wall. The air conditioning unit was situated atop a concrete pad that raised the unit approximately 5” above the exterior grade.

8.3 Site Observations

The rear of the property at 112 Big Piece Road was subject to standing water at the time of the inspection. The western side of the backyard (between the two neighboring houses) was under water, as a stream running along the southern edge of the property appeared to have broken off its original pathway and created a marsh-like area within the property. No standing water was observed within the building at the time of the inspection.

Above the finished basement, the second floor was seen to extend approximately 25” further outward along the front of the building, creating a cantilevered overhang.

A block chimney was observed protruding from the west wall of the crawl space, near the southwest corner. This chimney can be seen to extend up and through the roof of the first-floor level of the house.

A timber deck was observed in the rear of the building, matching the width of the southeast addition of the house. The deck's timber subfloor is supported by timber posts embedded in concrete Sonotube footings. The deck floor, which is level with the first floor of the house, ranges from 35" to 52" above the adjacent exterior grade.

Some minor cracks or material loss in exterior stucco coating covering the CMU foundation walls was noted throughout the building exterior. These do not appear to be a structural concern.

The interior faces of the north and east walls in the rear crawl space are covered with a stucco coating, similar to the other visible exterior foundation walls of the building. This suggests that the southwest portion of the house is the newest addition to the building.

Along the south wall of the southeast house addition, brick stairs were observed beneath the rear timber deck leading up to the floor of the addition. These stairs are assumed to have once led to a rear entrance of the building, prior to construction of the rear deck.

A deep header beam was observed running east to west and spanning the width of the first floor, likely supporting the loading from the attic above.

8.4 Elevation Requirements

The FEMA 100-year flood elevation at 112 Big Piece Road 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. Therefore, the new first floor elevation must be at El. +177 or higher to meet the requirements set forth in the program.

The current first-floor elevation at the Site is at El. +172.39, with the lowest basement floor at El. +168.79. To achieve the elevation requirements, the existing building would need to be raised at least 4.7 feet to elevate the existing first floor 3 feet above the BFE.

8.5 Recommendations for Building Elevation

Matrix recommends that the existing foundation system of the residential building at 112 Big Piece Road be kept and extended to achieve the required design flood elevation. The existing CMU foundation walls and concrete footings are 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 would remain under an allowable bearing capacity of 2,500 psf for the shallow concrete strip footings at the Site.

In accordance with NFIP requirements, it is required that the existing crawl space and basement area be filled in to match the lowest adjacent exterior grade following raising. The newly raised house will have at least 7.5 feet of height throughout the ground-floor level, which 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 basement floor 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 (7.5 feet total above current elevation) and construct a new timber floor above the existing basement 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. This will preserve the original square footage of the building's habitable space while also providing a new ground level for storage. A new CMU foundation wall is likely to be required in the middle of the ground level, as well as a new timber load bearing wall above the foundation wall on the new first floor, to carry the loads from the second and first floors down to the foundation. The existing foundation system of the building is expected to sufficiently support the remaining additional loading from the raised walls and a new first floor, but footing size must be confirmed for these foundations prior to construction.

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 cellar/crawl space 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. Also, the existing concrete block pedestals supporting the building's crawl space girders, as well as the steel post supporting the second-floor subfloor, must be removed and replaced by new steel, concrete, or masonry block columns. The new columns will need to include spread footings beneath to sufficiently support the building loads.

The southeast addition of the building is assumed to currently contain a concrete floor slab above CMU stem walls. The existing floor of this area will need to be demolished and removed, along with the fill soil beneath. The perimeter foundation walls will then be raised as described above, and the area filled in to match the existing adjacent grade. Following raising of the foundation walls, a new timber subfloor will need to be constructed for the addition area to replace the removed concrete floor slab. Additionally, the rear timber deck is anticipated to require raising to match the current ingress/egress heights of the main structure. This would require replacement or extension of the timber support posts.

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 9.93 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 crawl space/ground floor rooms, 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 and boiler in the basement laundry room, as well as the electrical panel and water well pressure system in the front crawl space, would require elevating 3 feet above the BFE onto the raised first floor. The exterior air conditioning unit and gas meter would also require elevating 3 feet above the BFE on a new or extended 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 112 Big Piece 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. 112 Big Piece Road (Front of Building)

Photo 2. 112 Big Piece Road (Rear of Building)

Photo 3. Rear of Building with Timber Deck

Photo 4. Southeast House Addition (Looking Southwest)

Photo 5. Water Well Pressure Tank & Pump System in Front Crawl (Looking North)

Photo 6. Timber Floor Joists & Girder on CMU Pedestal (Front Crawl Space)

Photo 7. Pit with Sump Pump in Southwest Corner of Front Crawl Space (Looking South)

Photo 8. Steel Support Post in Basement (Looking West)

Photo 9. Boiler & Water Heater in Laundry Room (Looking Southeast)

Photo 10. Brick Stairs on South Wall of Southeast Addition (Below Rear Deck)

Photo 11. Timber Girder & CMU Pedestals in Rear Crawl Space (Looking Northeast)

Photo 12. West Side of Building

Test Pit Photos

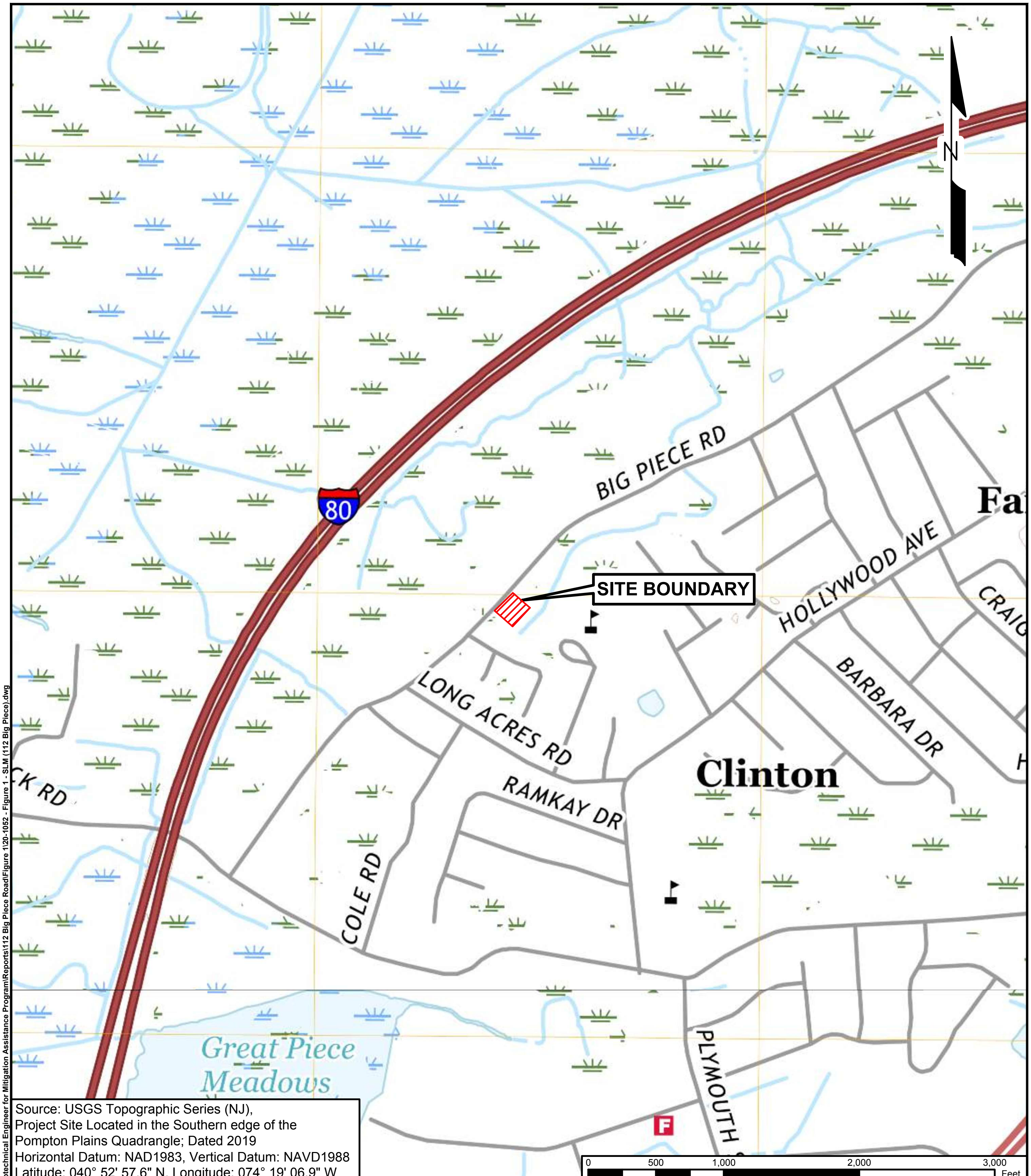
Photo 13. Test Pit TP-1 Location (Rear of Building – Rear Wall of Rear Crawl Space)

Photo 14. Test Pit TP-1 Foundation Conditions

Photo 15. Test Pit TP-2 Location (Front of Building – North Cellar)

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° 52' 57.6" N, Longitude: 074° 19' 06.9" W

SITE LOCATION MAP

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Engineering Progress

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NJ DEPARTMENT OF COMMUNITY AFFAIRS
GEOTECHNICAL AND STRUCTURAL ASSESSMENT REPORT
112 BIG PIECE ROAD
FAIRFIELD, NEW JERSEY 07004

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

NOTES:

1. THIS FIGURE IS BASED ON IMAGERY PROVIDED BY GOOGLE EARTH PRO
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 MAY 14 THROUGH 17, 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: JS
REVIEWED BY: MS
RELEASED BY: MS

MATRIXNEWWORLD
Engineering Progress

Matrix New World Engineering, Land Surveying and Landscape Architecture, P.C.
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Florham Park, New Jersey 07932
WBE / DBE / SBE

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AS-DRILLED BORING LOCATION PLAN

NJDCA GEOTECHNICAL ENGINEER FOR MITIGATION ASSISTANCE PROGRAM

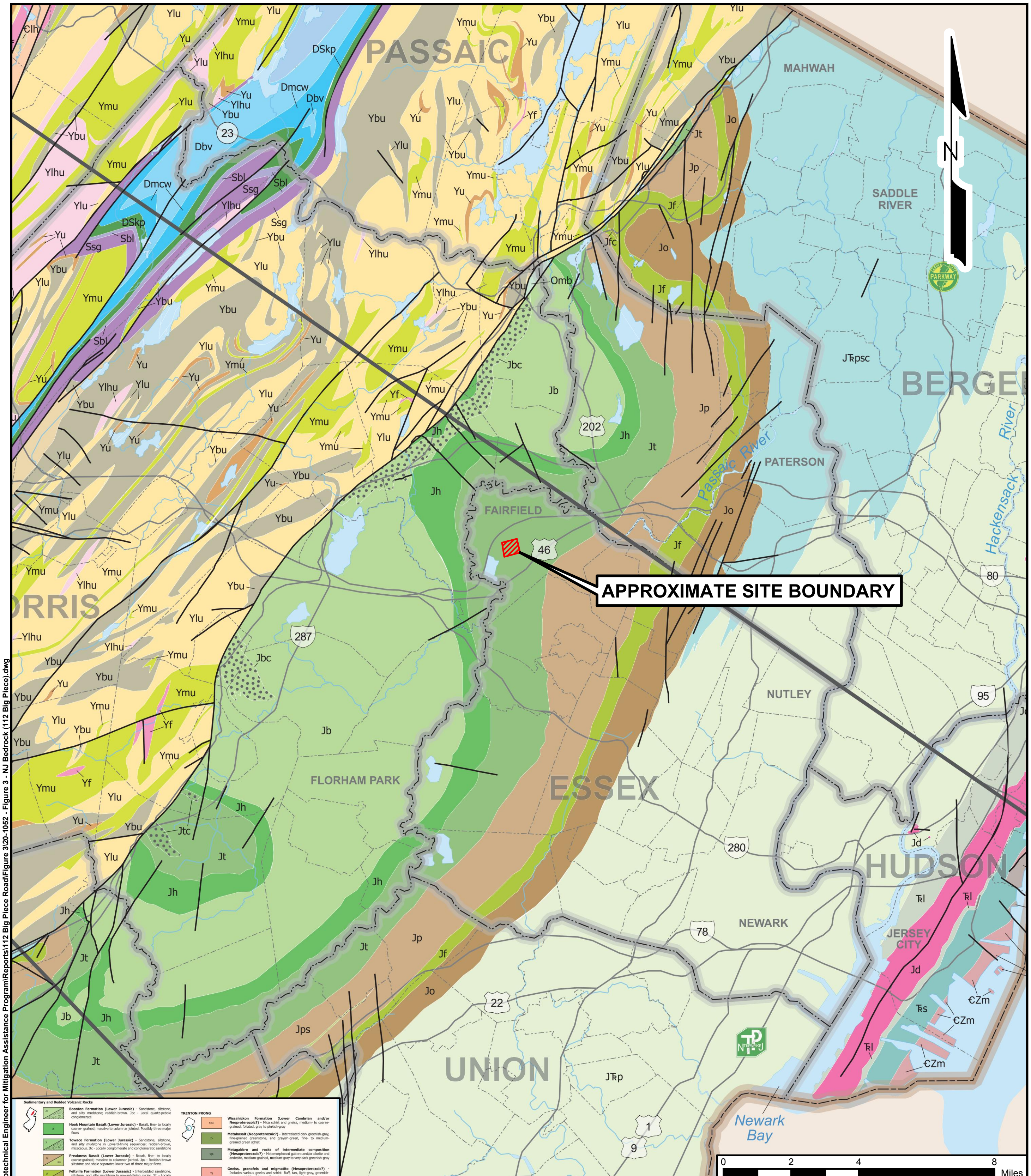
112 BIG PIECE ROAD
FAIRFIELD, NJ 07004

PROJECT NUMBER: 20-1052

SCALE: AS NOTED

DATE: JUNE 2021

2



BEDROCK GEOLOGY LOCATION MAP

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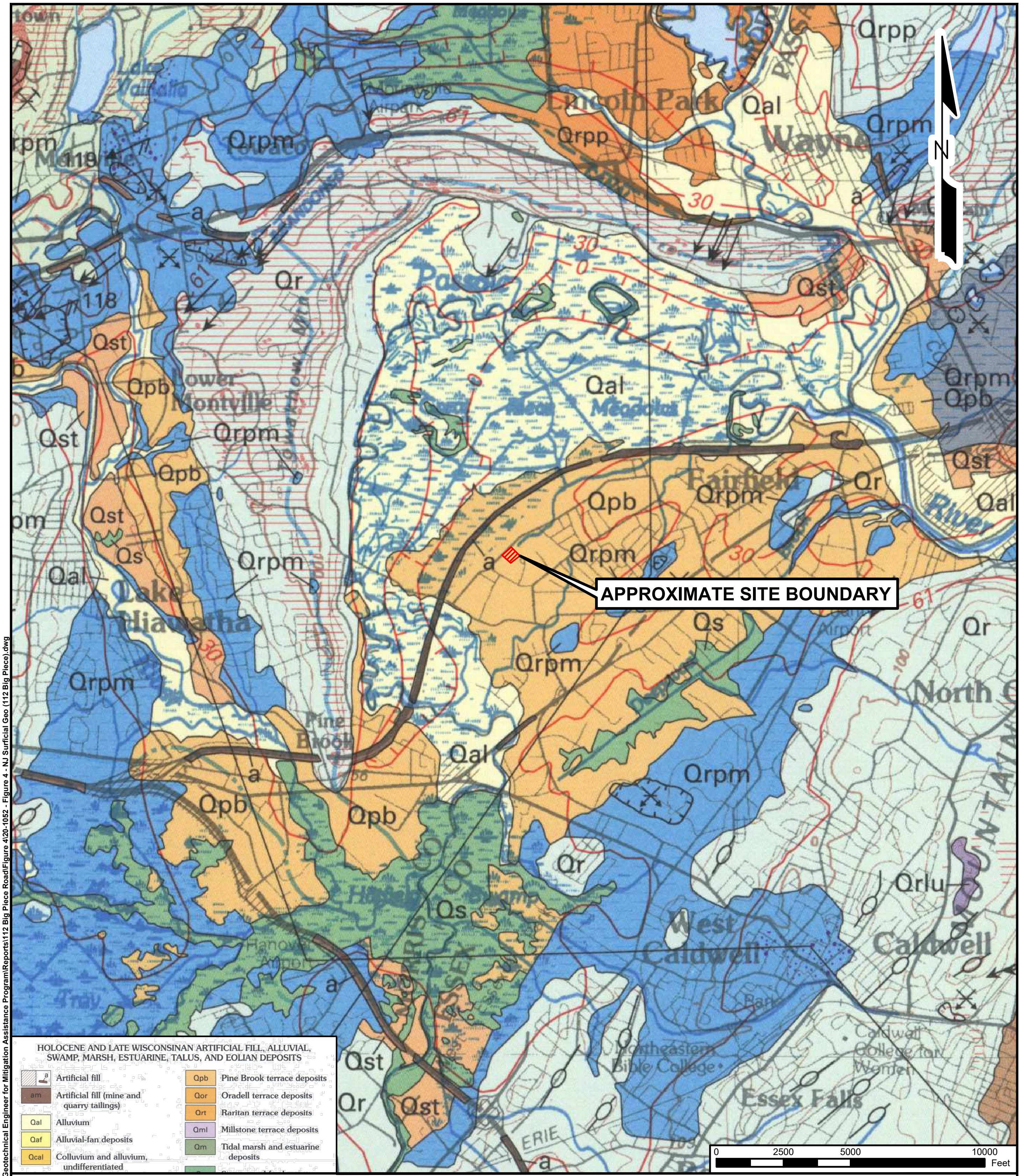
112 BIG PIECE ROAD
FAIRFIELD, NEW JERSEY 07004

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



SURFICIAL GEOLOGY LOCATION MAP

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GEOTECHNICAL AND STRUCTURAL ASSESSMENT REPORT
112 BIG PIECE ROAD
FAIRFIELD, NEW JERSEY 07004

SCALE:	PROJECT NO.:	DATE:	FIGURE NO.:
1" = 5000'	20-1052	JUNE 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: **5/14/21**
PROJECT LOCATION: **Fairfield, NJ** BORING LOCATION: **112 Big Piece Road**
DRILLING EQUIPMENT: **CME 55** ANGLE: **-90.0** DIR.: **------** ELEV.: DATUM: **NAVD88**
DRILLING CONTRACTOR: **Boring Brothers, Inc.** DRILLER: **R. Dollar** INSPECTOR: **S. Fung**

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"**	**5/14/21**	**10:50 am**	**6.0**	
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	1-1-WOH/24" (54%)		S-1: Brown fine SAND, trace Silt, moist (SP)	
		S-2	SS	2-4	2-2-2-1 (88%)		S-2: Brown fine SAND, little Silt, moist (SM)	
5		S-3	SS	4-6	7-5-6-5 (79%)		S-3A (Top 4"): Brown mf SAND, trace Silt, moist (SP) S-3B (Bottom 15"): Gray SAND and Silt & Clay, moist (SC-SM) WC: 20.2%, LL: 22, PL: 28, PI: 4, Gravel: 0.2%, Sand: 63.4%, Fines: 41%	Atterberg Limits; Pass No 200
▼		S-4	SS	6-8	5-4-7-7 (100%)		S-4: Gray-Brown mf SAND, trace Silt, wet (SP)	
		S-5	SS	8-10	9-8-10-10 (100%)		S-5: Gray-Brown mf SAND, trace Silt, wet (SP)	
10		S-6	SS	10-12	10-8-9-6 (100%)		S-6A (Top 12"): Gray-Brown mf SAND, trace Silt, wet (SP) S-6B (Bottom 12"): Brown SILT, moist (ML)	
15		S-7	SS	15-17	4-2-6-9 (50%)		S-7A (Top 6"): Gray-Black fine SAND, trace Silt, moist (SP) S-7B (Bottom 6"): Gray Clayey SILT, moist (ML)	
20		S-8	SS	20-22	2-3-3-5 (88%)		S-8: Gray CLAY & Silt, moist (CL)	
25		S-9	SS	25-27	2-2-2-2 (100%)		S-9: Gray CLAY & Silt, moist (CL) WC: 27.5%, LL: 29, PL: 19, PI: 10	Atterberg Limits
							Bottom of Borehole @ 27 ft.	

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: **5/14/21**
PROJECT LOCATION: **Fairfield, NJ** BORING LOCATION: **112 Big Piece Road**
DRILLING EQUIPMENT: **CME 55** ANGLE: **-90.0** DIR.: **------** ELEV.: DATUM: **NAVD88**
DRILLING CONTRACTOR: **Boring Brothers, Inc.** DRILLER: **R. Dollar** INSPECTOR: **S. Fung**

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"**	**5/14/21**	**11:50 am**	**5.0**	
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
		S-1	SS	0-2	1-1-1-2 (71%)		S-1: Brown-Gray fine SAND, little Silt, moist (SM)	
		S-2	SS	2-4	1-2-2-3 (50%)		S-2: Gray fine SAND, trace Silt, moist (SP)	
▼ 5		S-3	SS	4-6	7-7-8-8 (75%)		S-3: Gray fine SAND and Clay, moist-wet (SC) WC: 19.8%, Gravel: 0.2%, Sand: 63.4%, Fines: 36.4%	Sieve
	4" Casing	S-4	SS	6-8	9-7-9-10 (100%)		S-4: Same as Above, wet (SC)	
		S-5	SS	8-10	8-6-7-10 (100%)		S-5: Gray mf SAND, trace Silt, wet (SP)	
10		S-6	SS	10-12	11-10-9-12 (100%)		S-6: Gray mf SAND, trace Silt, wet (SP)	
15		S-7	SS	15-17	8-10-10-12 (42%)		S-7: Brown cf SAND, trace Silt, wet (SP)	
20		S-8	SS	20-22	5-7-5-9 (71%)		S-8A (Top 8"): Brown Clayey SILT, trace fine Sand, moist (ML) S-8B (Bottom 9"): Gray CLAY & Silt, trace fine Sand, moist (CL) WC: 25.1%, Gravel: 0.0%, Sand: 4.1%, Fines: 95.9%, <2 µm: 24%	Sieve; Hydrometer
25		S-9	SS	25-27	3-2-3-3 (83%)		S-9: Gray CLAY & Silt, moist (CL)	
							Bottom of Borehole @ 27 ft.	

NEWORLD NO GROUT 20-1052 BORING LOGS.GPJ MATRIX EGS.GDT 7/16/21

MATRIXNEWORLD
Engineering Progress

TEST PIT LOG

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

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

PROJECT NO.: **20-1052** PROJECT: **NJDCA Geotechnical Engineer for Mitigation Assistance Program** DATE: **5/17/2021**

PROJECT LOCATION: **Fairfield, NJ** ELEV.: TIME STARTED: **12:00:00 PM**

TEST PIT LOCATION: **112 Big Piece Road (East Wall - SE Corner of Building)** DATUM: **NAVD88** TIME FINISHED: **1:00:00 PM**

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

EQUIPMENT: **Bobcat E55** OPERATOR: **Steve** INSPECTOR: **A. Bangar**

Depth Inches (Elev)	No.	Depth Inches	Graphic Symbol	Description Of Material	Laboratory Tests
		0-12		Topsoil, grass surface cover	
5					
10					
15		12-35		Brown mf SAND and Silt, little fine Gravel (SM)	
20					
25		21-35		Top of concrete encountered at 21" bgs, protrudes 4" from the face of the wall and extends 14" downward.	
30					
35					
				Bottom of Test pit @ 35 in. Test Pit Backfilled.	

TEST PIT INCH 20-1052 TEST PIT LOGS.GPJ MATRIX EGS.GDT 7/9/21

MATRIXNEWORLD
Engineering Progress

TEST PIT LOG

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

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

PROJECT NO.: **20-1052** PROJECT: **NJDCA Geotechnical Engineer for Mitigation Assistance Program** DATE: **5/17/2021**

PROJECT LOCATION: **Fairfield, NJ** ELEV.: TIME STARTED: **1:00:00 PM**

TEST PIT LOCATION: **112 Big Piece Road (Rear Wall - Rear Crawl Space)** DATUM: **NAVD88** TIME FINISHED: **2:00:00 PM**

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

EQUIPMENT: **Bobcat E55** OPERATOR: **Steve** INSPECTOR: **A. Bangar**

Depth Inches (Elev)	No.	Depth Inches	Graphic Symbol	Description Of Material	Laboratory Tests
		0-6		Landscaped pebble, geotextile fabric, topsoil	
5					
		6-36		Brown mf SAND, some Silt, little fine Gravel (SM)	
10					
15					
20					
25					
30					
		30-36		Top of concrete encountered at 30" bgs, protrudes 2" from the face of the wall and extends 6" downward.	
35					
				Bottom of Test pit @ 36 in. Test Pit Backfilled.	

TEST PIT INCH 20-1052 TEST PIT LOGS.GPJ MATRIX EGS.GDT 7/9/21

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

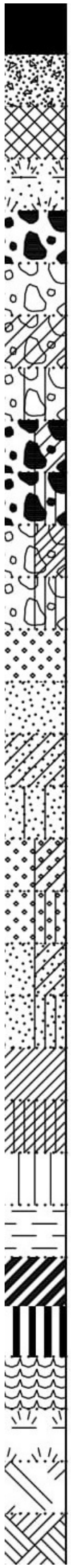
PL = Plastic Limit

LL = Liquid Limit

PI = Plasticity Index

OC = Organic Content

LOG GRAPHICAL LEGEND

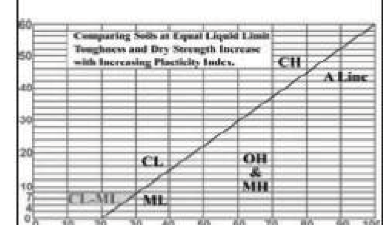


Asphalt
Concrete
Fill
Topsoil
Well graded Gravel (GW)
Poorly graded Gravel (GP)
Clayey Gravel (GC)
Silty Gravel (GM)
Well graded Gravel with Clay (GW-GC)
Well graded Gravel with Silt (GW-GM)
Poorly graded Gravel with Clay (GP-GC)
Poorly graded Gravel with Silt (GP-GM)
Well graded Sand (SW)
Poorly graded 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

MAJOR DIVISIONS		GROUP SYMBOLS	TYPICAL NAMES	Identification Procedure on Fraction Smaller than No. 40 Sieve Size.			INFORMATION REQUIRED FOR DESCRIBING SOILS	LABORATORY CLASSIFICATION CRITERIA
				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 Plasticity Index 
		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			SAND			SILT	
	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

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

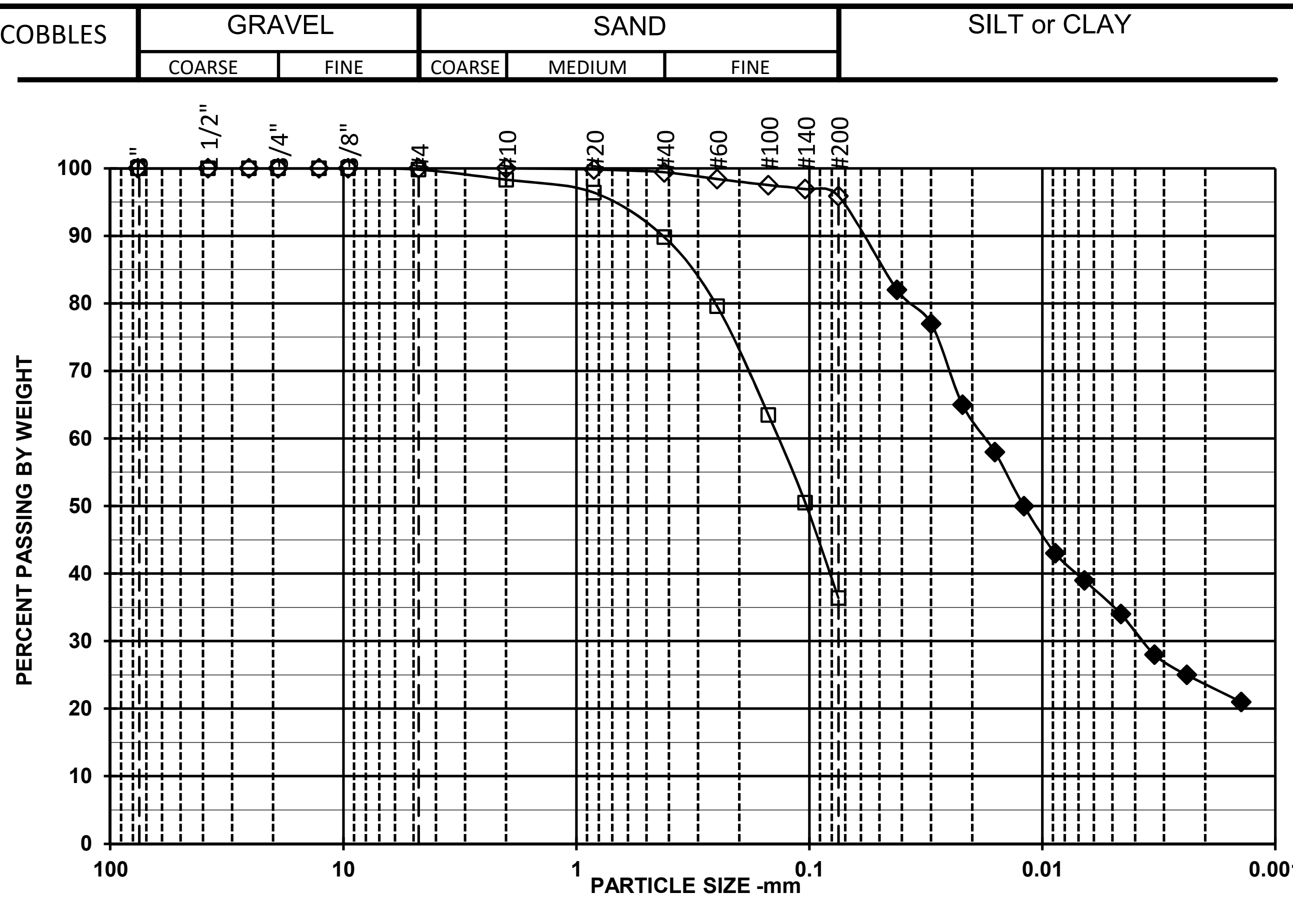
APPENDIX C

GEOTECHNICAL LABORATORY TESTING RESULTS

Matrix New World Engineering, P.C. #20-1052-004
NJDCA MAP - 112 Big Piece 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 (%)	HYDROMETER % MINUS 2 µm (%)	
B-1	S-3	4-6	20.2	22	18	4	SC-SM	41		
B-1	S-9	25-27	27.5	29	19	10	CL			
B-2	S-3	4-6	19.8				SC	36.4		
B-2	S-8	20-22	25.1				CL	95.9	24	

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-2	B-2	
Sample	S-3	S-8	
Depth	4-6	20-22	
% +3"	0	0	
% Gravel	0.2	0	
% SAND	63.4	4.1	
%C SAND	1.5	0	
%M SAND	8.5	0.6	
%F SAND	53.4	3.5	
% FINES	36.4	95.9	
D_{100} (mm)	9.53	4.75	
D_{60} (mm)	0.136	0.018	
D_{30} (mm)		0.004	
D_{10} (mm)			
Cc			
Cu			

Sieve Size/ID #	Percent Finer Data		
6"	100.0	100.0	
4"	100.0	100.0	
3"	100.0	100.0	
1 1/2"	100.0	100.0	
1"	100.0	100.0	
3/4"	100.0	100.0	
1/2"	100.0	100.0	
3/8"	100.0	100.0	
#4	99.8	100.0	
#10	98.3	100.0	
#20	96.4	99.8	
#40	89.8	99.4	
#60	79.6	98.4	
#100	63.5	97.5	
#140	50.5	96.9	
#200	36.4	95.9	
5μ m		35	
2μ m		24	
1μ m		19	

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	19.8				SC		Brown, Clayey sand	06/29/21
◇	25.1				CL		Brown, Lean clay	06/25/21
○								

Matrix New World Engineering, P.C. #20-1052-004

TerraSense, LLC #7783-21022

NJDCA MAP
112 Big Piece Road

PARTICLE SIZE DISTRIBUTION
ASTM D6913 & ASTM D7928

TerraSense Analysis File: GrainSizeV6Rev1a14

Siev1a.xlsx 7/9/2021

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.
112 Big Piece Road

Company NAIC Number:

City	State	ZIP Code
Town of Fairfield	New Jersey	07004-1210

A3. Property Description (Lot and Block Numbers, Tax Parcel Number, Legal Description, etc.)
Block 5101, Lot 32

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

A5. Latitude/Longitude: Lat. N40°52'57" Long. W74°19'07" 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 3

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

a) Square footage of crawlspace or enclosure(s) 626.00 sq ft

b) Number of permanent flood openings in the crawlspace or enclosure(s) within 1.0 foot above adjacent grade 3

c) Total net area of flood openings in A8.b 384.00 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 0.00 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)
34013C0014	G	04-03-2020	04-03-2020	AE	174 (NAVD)

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

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City Town of Fairfield	State New Jersey	ZIP Code 07004-1210	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)	168.7	☒ feet	☐ meters
b) Top of the next higher floor	172.4	☒ feet	☐ meters
c) Bottom of the lowest horizontal structural member (V Zones only)	N/A	☐ feet	☐ meters
d) Attached garage (top of slab)	N/A	☐ feet	☐ meters
e) Lowest elevation of machinery or equipment servicing the building (Describe type of equipment and location in Comments)	169.7	☒ feet	☐ meters
f) Lowest adjacent (finished) grade next to building (LAG)	169.1	☒ feet	☐ meters
g) Highest adjacent (finished) grade next to building (HAG)	170.0	☒ feet	☐ meters
h) Lowest adjacent grade at lowest elevation of deck or stairs, including structural support	167.9	☒ feet	☐ 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	ZIP Code 07724	
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): Boiler was on basement floor Elev=169.7 (NAVD88)

ELEVATION CERTIFICATE

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City Town of Fairfield	State New Jersey	ZIP Code 07004-1210	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.

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City Town of Fairfield	State New Jersey	ZIP Code 07004-1210	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.

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City Town of Fairfield	State New Jersey	ZIP Code 07004-1210	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

ELEVATION CERTIFICATE

BUILDING PHOTOGRAPHS
Continuation Page

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City Town of Fairfield	State New Jersey	ZIP Code 07004-1210	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