ENGINEERING INVESTIGATION & ANALYSIS
GEOTECHNICAL & STRUCTURAL
ASSESSMENT REPORT

59 CLINTON ROAD
FAIRFIELD, NEW JERSEY 07004

MATRIXNEWORLD
Engineering Progress

Prepared for:

State of New Jersey
Department of Community Affairs
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TABLE OF CONTENTS

FIGURES

APPENDICES

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 59 Clinton 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. One test pit (TP-1) was completed to a depth of 67 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 59 Clinton Road in Fairfield, New Jersey. The property consists of a one-story timber-framed ranch-style house with an approximately 1,560 square foot footprint. The L-shaped front and middle of the house is situated atop concrete foundation walls with assumed cast-in-place concrete footings, while the rear addition of the house contains concrete masonry unit (CMU) foundation walls on assumed cast-in-place concrete foundations. The residence contains a basement and two separate crawl space areas. The front and south timber-framed exterior walls of the structure are covered in a decorative stucco façade, while the rest of the building exterior contains vinyl siding.

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 1 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 entirely 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 Sand was underlain by deeper layers of Silt and Clay. Groundwater was encountered in the borings at approximately 6 feet bgs. Bedrock was not encountered during this subsurface program.

5.0 SUBSURFACE FIELD PROGRAM

The subsurface investigation was completed by generally accepted practices in the Geotechnical Engineering field and consisted of the advancement of 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 9, 2021, Boring Brothers completed a foundation survey which included a test pit to a depth of 67 inches below the ground surface. Each test pit was dug using a Kubota KX057-5 excavator and shovel to prevent any damage to the existing building foundations. The exterior edge of the building footing was exposed at the test pit location 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. Test Pit TP-1 was conducted at the northeast corner of the building. The test pit was backfilled with the original soils upon completion of the test pit log. No test pit samples were collected at the site for further analysis.

5.2 SPT Borings

On August 10, 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: 8-10’, 15-17’, 25-27’ B-2: 4-6’, 15-17’, 20-22’
Sieve Analysis	ASTM D422	2	B-1: 8-10’ B-2: 4-6’
Atterberg Limits	ASTM D4318	4	B-1: 15-17’, 25-27’ B-2: 15-17’, 20-22’
Percent Fines	ASTM D1140	1	B-1: 15-17’

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 Pit

Test pit TP-1 was completed along the front basement wall, in the northeast corner of the building. The top of concrete was uncovered in TP-1 at 63" bgs. The test pit revealed the concrete footing protrudes 3" from the wall and extends 4" deep at this location.

Surface Cover

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

Stratum 1: Sand (SM, SW-SM)

Beneath the surface cover in each boring, a soil layer was encountered consisting of mostly brown coarse-to-fine Sand with varying amounts of Silt and trace amounts of fine Gravel. The coarseness of the Sand within this layer increased with depth, while the Silt content decreased with depth. This Sand layer extended from the bottom of the surface cover to approximately 13.5 feet below the ground surface (bgs) in both borings.

The SPT-N values in this layer typically ranged from 5 to 12 blows per foot (bpf), which is indicative of loose to medium-dense Sand. In boring B-2, an N-value of 3 bpf was recorded at the 0.5-to-2-foot sampling interval, signifying very loose granular material. 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	SM SW-SM	0-2' 8-10'	6 10
B-2	SM SW-SM	0-4' 6-13.5'	3-5 6-8

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, SW-SM SW-SM	2-8' 10-13.5'	11-12 12
B-2	SW-SM	4-6'	11

Stratum 2: Silt (ML, CL-ML)

Beneath the granular material of Stratum 1 in both borings, a soil layer was encountered consisting predominantly of grey Silt with varying amounts of Clay. This layer was encountered at approximately 13.5 feet bgs and extended to approximately 18.5 feet bgs in both borings.

The SPT N-values in this layer were recorded at 11 bpf in both borings, which is indicative of medium Silt material and stiff cohesive soil. The SPT N-values for Stratum 2 are summarized in the tables below.

Table 6.0-3: Medium/Stiff SPT N-Values for Stratum 2

Soil Boring Location	USCS Group Symbol	Depth Below Ground Surface	SPT N-Values
B-1	CL-ML	13.5-18.5'	11
B-2	ML	13.5-18.5'	11

Stratum 3: Clay (CL)

Beneath the Silt soils (Stratum 2) in both borings, a more cohesive soil layer was encountered consisting predominantly of grey Clay with varying amounts of Silt. This layer was encountered at approximately 18.5 feet bgs, and both borings were terminated within this layer at 27 feet bgs.

The SPT N-values in this layer ranged from 4-7, which is indicative of medium-soft cohesive soil. The SPT N-values for Stratum 3 are summarized in the tables below.

Table 6.0-4: Medium-Soft 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'	5-7
B-2	CL	18.5-27'	4-6

Groundwater

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

7.0 GEOTECHNICAL SUBSURFACE PARAMETERS

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

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

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

Table 7.0-1: Geotechnical Design Parameters

Stratum	Unit Weight	Friction Angle (Φ)	Cohesive Strength, c_u	Earth Pressure Coefficient		Net Allowable Foundation Pressure*	Lateral Bearing
				Active	Passive		
	(pcf)	(deg)	(psf)	(Ka)	(Kp)	(psf)	(psf/ft. bgs)
Native Medium-Dense to Dense Granular Soil (SM, SW-SM) [SPT N > 10]	$\gamma = 125$ $\gamma' = 63$	32°	0	0.31	3.26	4,000	200
Native Loose Granular Soil (SM, SW-SM) [SPT N ≤ 10]	$\gamma = 120$ $\gamma' = 58$	30°	0	0.33	3.00	2,500	150
Native Silt (ML) Medium [10 ≤ SPT N ≤ 30]	$\gamma = 115$ $\gamma' = 43$	28°	400	0.36	2.77	2,000*	100
Native Clay Material (CL) Stiff [8 < SPT N ≤ 30]	$\gamma = 110$ $\gamma' = 48$	-	1,500	-	-	2,000*	100
Native Clay Material (CL) Medium-Soft [4 ≤ SPT N ≤ 8]	$\gamma = 100$ $\gamma' = 38$	-	1,000	-	-	1,500*	75

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

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

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

- Coefficient of earth pressure at rest may be computed using Jaky's equation, $K_o = 1 - \text{Sin } \phi'$.

8.0 STRUCTURAL INSPECTION

The following sections present the results of the structural inspection of the residential building at 59 Clinton 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 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 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 59 Clinton Road is supported by both cast-in-place concrete and concrete masonry unit (CMU) walls throughout its foundation. The structure is broken up into three separate foundation sections (basement, central crawl space, and rear crawl space), each with a different finished floor elevation. An elevated concrete walkway wraps around the rear addition of the building, with a floor elevation matching that of the rear addition.

The basement area of the building encompasses the front L-shaped section of the structural footprint, measuring approximately 24'-8" long (maximum) x 38'-9" wide. The basement walls appear to consist of painted cast-in-place concrete and extend 63 to 65 inches in height (measured from the main basement floor). The basement measures approximately 6'-1" in height from the main floor (north side of building) to the bottom of the first-floor floorboards. The concrete floor of the basement consists of three separate areas with differing elevations. The main basement floor encompasses the entire north half of the basement along with much of the southwest corner of the area. The floor in the southeast corner of the basement is 4" lower than the main floor, and the southwest edge (approximately 3' wide) is 7" lower than the main floor. This southwest edge also ramps down along the south wall to a sump pit in the southwest corner, which is an open hole containing two pumps that convey water out of the pit and into the south yard of the property. No girders were observed in the basement on the north side; nominal 2x10 timber floor joists, spaced 16" on center, span the full length of the basement (front to rear) in this area, and are supported at either end by the concrete foundation walls. On the south side, spanning the width of the extended portion of the L-shaped basement, the joists change direction and run north to south (side to side of building). These joists are supported on the south edge by the concrete foundation wall and on the north edge by a timber girder consisting of (2) nominal 2x10 members. The girder is supported at its ends by the concrete foundation walls, and a 2.5" diameter steel jack post has been installed at midspan, bearing on a 5" high concrete pedestal, to provide additional support.

Adjacent to the basement, along the northwest wall, a crawl space comprises the central area of the residential building. This area also appears to contain cast-in-place concrete walls, though the concrete floor is approximately 33" higher than the basement floor. The central crawl space could not be accessed at the time of the inspection, as the only opening was a small hatch within the basement's west wall. From the basement hatch opening, it was observed that the concrete walls of this crawl space were not uniform in thickness. Throughout the visible portions of the walls, protrusions and depressions were noted at multiple locations and at multiple heights within the walls. The subfloor above the foundation walls consisted of nominal 2x10 timber floor joists, spaced 16" on center, running side to side of the building (north to south). These joists are supported at either end by the concrete foundation walls and at midspan by a timber girder consisting of (2) nominal 2x10 members. The girder is situated atop (3) pedestals made up of CMU and brick. An additional girder or support beam for the floor joists was observed in the southeast corner of the central crawl space, consisting of an estimated 4x4 timber beam supported by a combination of timber studs, CMU blocks, and bricks. It could not be confirmed at the time of the inspection, but this girder does not appear to span the full length of the crawl space, and its purpose is not explicitly known.

Adjacent to the central crawl space, along the west wall, a second, rear crawl space serves as the foundation for the rear addition of the house. The foundation walls of this crawl space consist of 8x8x18 CMU block units. The walls support a two-way concrete slab that spans the full length and width of the crawl space (11'-3" long x 13'-5" wide). The slab includes approximately 8" deep turndowns along the edges that sit atop the CMU foundation walls of the space. No additional columns or support posts were observed within the crawl space to support the first-floor concrete slab. The floor of the rear crawl space, which appeared to be unfinished (soil), is approximately 36” below the bottom of the first-floor slab.

Wrapping around the west and south exterior edges of the rear crawl space, an elevated concrete patio/walkway has been constructed. This patio is elevated to the same height as the rear addition first floor, and contains wood and brick façade along the exterior face of the edge walls. The walls supporting the patio are assumed to be cast-in-place concrete, though this could not be confirmed at the time of the inspection.

A test pit excavation was performed in the northeast corner of the basement to determine the type and size of the building’s wall footings. The test pit revealed a concrete footing approximately 4” thick and with a bottom approximately 67” bgs. Based on our findings within the test pit and from conventional foundation construction, Matrix assumed a 16” wide footing as a minimum value for analysis, but expects the footings for the building to range between 16” and 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

Various pieces of equipment and machinery were observed within the front basement at the time of the inspection. Two sump pumps were observed in the basement, both within the lowered southwest corner. Located in the center of the south wall, a water flow meter was elevated approximately 13.5” above the lowered southeast floor (9.5” above the main basement floor). On the east wall (near the turn in the L-shape wall), a gas meter was elevated 43” above the main floor. The north wall contained an electrical panel and security system panel, elevated 46.5” and 45.5” above the main floor, respectively. Within the center of the basement, a hot water heater was observed atop a concrete pad, which raised the bottom of the unit approximately 8.5” above the main floor. Also in the center of the basement, a large air conditioner unit was suspended approximately 34” above the main floor using metal rods and struts attached to the first-floor subfloor. Multiple air ducts run from this unit to various areas of the house. Two CMU block chimneys were also observed within the basement – one directly behind the hot water heater and a second along the west wall, next to the central crawl space hatch opening. All piping, including PVC sanitary lines and metal water conduits, runs either along the top of the basement (connected to the first-floor joists) or along the walls of the basement.

The central and rear crawl spaces did not contain any equipment or machinery at the time of the inspection. In the central crawl space, (3) relatively large PVC vertical pipes were observed running from the bottom of the crawl space and into the first floor of the house. The function of these pipes is unknown. In the rear crawl space, various metal water and electrical conduits were seen running along the walls and ceiling.

Outside the building, two air conditioning units were observed; one was located on the rear patio and the other was located along the north wall on a concrete ground pad.

8.3 Site Observations

The front basement walls and visible floor joists were in good condition at the time of the inspection. No notable damages or abnormalities were observed. The thickness of the foundation walls in the basement could not be determined at the time of the inspection, but are assumed to be 8" thick.

In the central crawl space, the pedestal supported for the main girder and additional 4x4 beam appeared to be unstable. They consisted of different types and sizes of CMU block, brick, and even wood studs stacked together to support the building's structural members. Regardless, no damage to the building's foundation walls or subfloor was noted within this central crawl space area at the time of the inspection.

Observed from the attic, the CMU exhaust chimney located along the west wall of the front basement was leaning significantly as it extended through the attic and out to the roof. The displacement of the chimney has resulted in loss of mortar between joints, dislocation between adjacent CMU blocks, and creation of large openings in the chimney.

In the rear crawl space, two large holes were observed in the south CMU wall and in the west turndown of the concrete first-floor slab. These holes could only be observed from a distance, but the hole in the south wall was seen to span the full thickness of the wall. The hole in the south wall appeared to be about 12" wide and 4" deep, while the turndown hole was significantly smaller (estimated 3" wide x 2" deep).

Two timber-framed entrance vestibules were added to the house in the rear of the building, both with the same vinyl siding as the rest of the rear exterior. The first vestibule attaches to the southwest corner of the building's central area, and consists of concrete walls and concrete floor that butt up against the wraparound concrete patio surrounding the rear crawl space. The second vestibule, located at the southwest corner of the main basement area, is much smaller than the other (approximately 4'x4') and does not contain concrete foundation walls. This vestibule is supported by timber posts embedded in concrete that extends into the ground. These posts are assumed to support timber floor joists which run front to rear and bear on the west basement wall of the building.

A concrete chimney was observed along the north wall of the building. Its base measured approximately 61” wide x 24” deep, but changed to a narrower column near mid-height of the structure.

The property also contains a small tool shed and a separate two-car garage in the southwest corner of the site. These two structures are expected to be kept at ground level, since they contain no living space, and were not included in the structural inspection of the property.

8.4 Elevation Requirements

The FEMA 100-year flood elevation at 59 Clinton Road is El. +174.4 (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. +177.4 or higher to meet the requirements set forth in the program.

The current lowest first-floor elevation at the Site is at El. +171.66. To achieve the elevation requirements, the existing building would need to be raised approximately 5.8 feet.

8.5 Recommendations for Building Elevation

Matrix recommends that the existing foundation system of the residential building at 59 Clinton Road be kept and extended to achieve the required design flood elevation. The existing basement and crawl space foundation walls 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 or cast-in-place concrete would remain under an allowable bearing capacity as low as 1,500 psf (design capacity of loose Silt/medium-soft Clay at the Site) for the shallow concrete strip footings at the Site.

In accordance with NFIP requirements, it is required that the existing basement and crawl spaces be filled in to match the lowest adjacent exterior grade following raising. The newly raised house will have at least

7.25 feet of space beneath (down to existing finished grade), which is enough vertical height for a ground-level floor. This additional space beneath the raised building can be used for storage at the resident's discretion.

The most feasible method of elevation for the building consists of jacking up the entire residential structure from below using steel beams and jack posts. The building will then sit atop temporary cribbing while the existing CMU and concrete basement/crawl space walls are heightened with additional courses of masonry block units or additional poured concrete. Additional vertical reinforcement would need to be installed in ungrouted masonry cells to properly transfer loads through the new heightened wall to the existing wall, and horizontal ladder reinforcement should be installed at a minimum of every other course. For the concrete basement and central crawl space walls, additional rebar should be doweled into the existing walls to form a connection between the existing and new cast-in-place basement walls of the building.

Additionally, the existing steel posts or brick/concrete block pedestals intermittently supporting the existing building's girders must be removed and replaced by new steel, concrete, or masonry block columns. These new columns will need to include a spread footing beneath to sufficiently support the building loads. The existing concrete chimney along the north wall of the house, and the two exhaust chimneys in the basement, will also require extending during raising of the house to keep the tops of the chimneys above the roof level.

It is also recommended that new concrete or CMU walls be built, or additional height added to the existing walls, to support the newly raised rear entrance vestibules and rear concrete patio. The groundwater table was observed at approximately 6 feet bgs during the subsurface investigation, and no groundwater was encountered during the test pit excavation completed along the front basement wall. For these reasons, dewatering is not expected to be a concern for this project but may be required during construction of the new foundation walls within the vestibule and rear patio areas if new walls are necessary. 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 stucco façade covering the timber frame. If the façade is kept in place during raising, the process is liable to lead to some cracking in the existing façade. Alternatively, the stucco 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 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 10.83 square feet of total flood openings in the building's new foundation walls. Additionally, a minimum of two openings must be provided for each enclosed area of the new ground floor. These openings must be located no higher than one foot above the adjacent finished exterior grade along the building perimeter. Matrix recommends the use of engineered openings in lieu of non-engineered openings to maximize efficiency and minimize the quantity of openings required.

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

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 59 Clinton 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. 59 Clinton Road (Front of Building)

Photo 2. 59 Clinton Road (South Wall)

Photo 3. 59 Clinton Road (Rear Addition)

Photo 4. Basement Concrete Floors with Differing Elevations

Photo 5. Basement Concrete Walls & Timber First-Floor Subfloor (Southeast Corner)

Photo 6. Water Heater on Concrete Platform (Center of Basement)

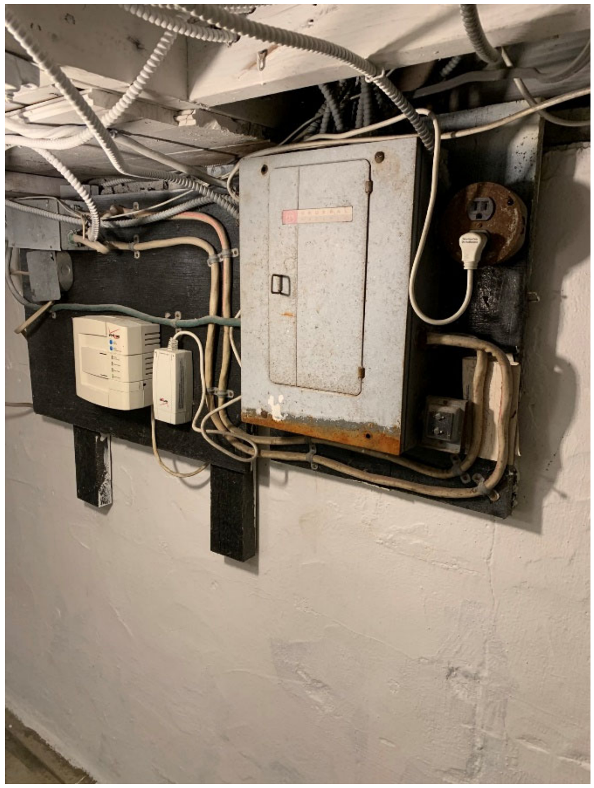


Photo 7. Electrical & Security Panel (North Wall of Basement)

Photo 8. Central Crawl Space Concrete Walls & Timber First-Floor Subfloor (Looking West)

Photo 9. Additional Timber Beam in Central Crawl Space (Looking South)

Photo 10. Rear Crawl Space CMU Walls & First-Floor Concrete Slab (Looking South)

Photo 11. Rear Southwest Entrance Vestibule (Looking North)

Photo 12. Rear South Entrance Vestibule (Looking Southeast)

Photo 13. Concrete Chimney Along North Wall (Looking West)

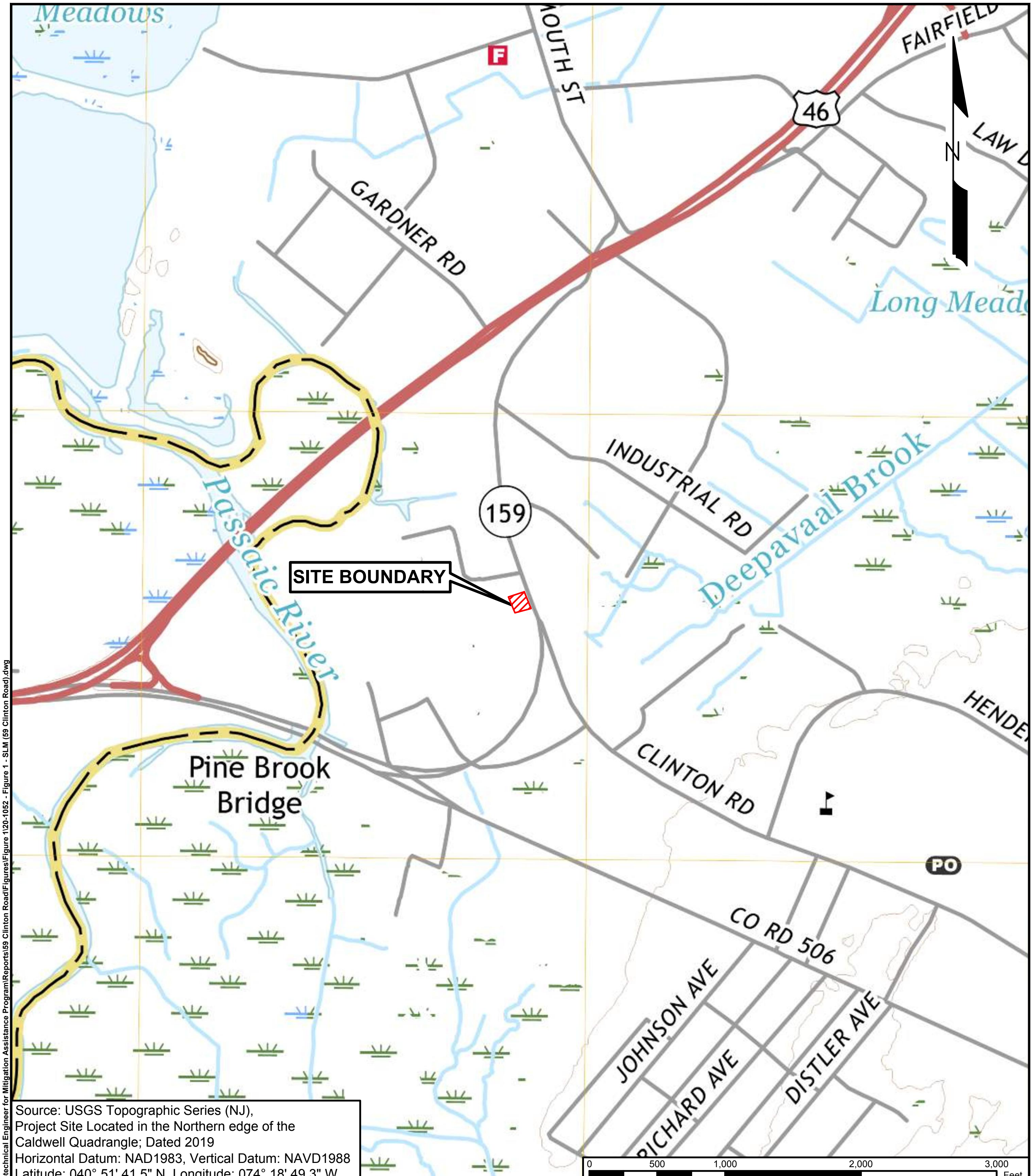
Photo 14. Damaged Exhaust Chimney Extending Through Attic (Looking Northwest)

Test Pit Photos

Photo 15. Test Pit TP-1 Location (Front of Building – Basement, Northwest Corner)

Photo 16. Test Pit TP-1 Foundation Conditions

FIGURES



Source: USGS Topographic Series (NJ),
Project Site Located in the Northern edge of the Caldwell Quadrangle; Dated 2019
Horizontal Datum: NAD1983, Vertical Datum: NAVD1988
Latitude: 040° 51' 41.5" N, Longitude: 074° 18' 49.3" W

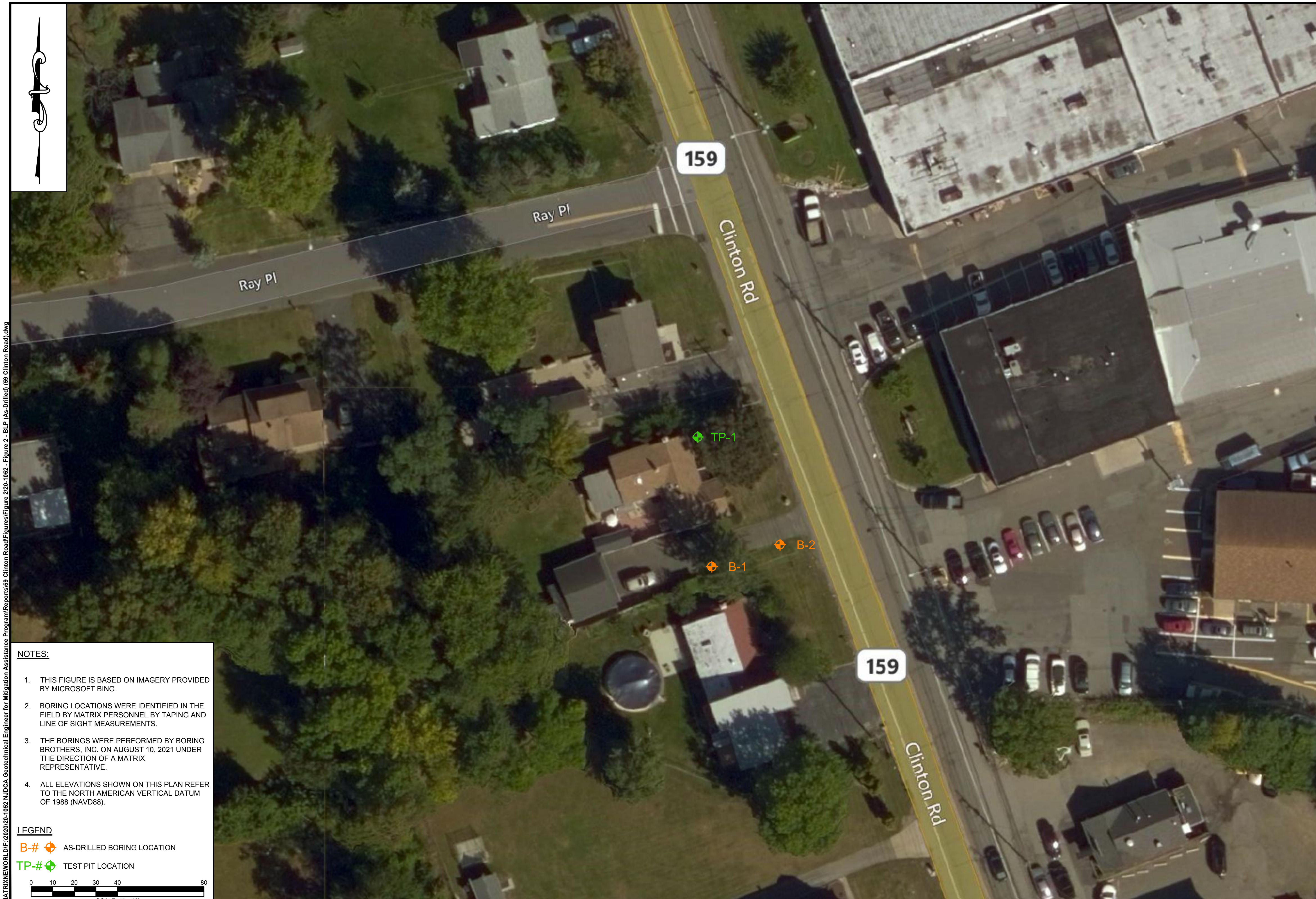
SITE LOCATION MAP

MATRIXNEWORLD
Engineering Progress

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

NJ DEPARTMENT OF COMMUNITY AFFAIRS
GEOTECHNICAL AND STRUCTURAL ASSESSMENT REPORT
59 CLINTON ROAD
FAIRFIELD, NEW JERSEY 07004

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



NOTES:

1. THIS FIGURE IS BASED ON IMAGERY PROVIDED BY MICROSOFT BING.
2. BORING LOCATIONS WERE IDENTIFIED IN THE FIELD BY MATRIX PERSONNEL BY TAPING AND LINE OF SIGHT MEASUREMENTS.
3. THE BORINGS WERE PERFORMED BY BORING BROTHERS, INC. ON AUGUST 10, 2021 UNDER THE DIRECTION OF A MATRIX REPRESENTATIVE.
4. ALL ELEVATIONS SHOWN ON THIS PLAN REFER TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).

LEGEND

B-# AS-DRILLED BORING LOCATION

TP-# TEST PIT LOCATION

0 10 20 30 40 80

SCALE: 1" = 40'

NO.	DESCRIPTION	DATE:	BY:	APR:

REVISIONS

DESIGNED BY: SF
REVIEWED BY: MS
RELEASED BY: MS

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AS-DRILLED BORING LOCATION PLAN

NJDCA GEOTECHNICAL ENGINEER FOR MITIGATION ASSISTANCE PROGRAM

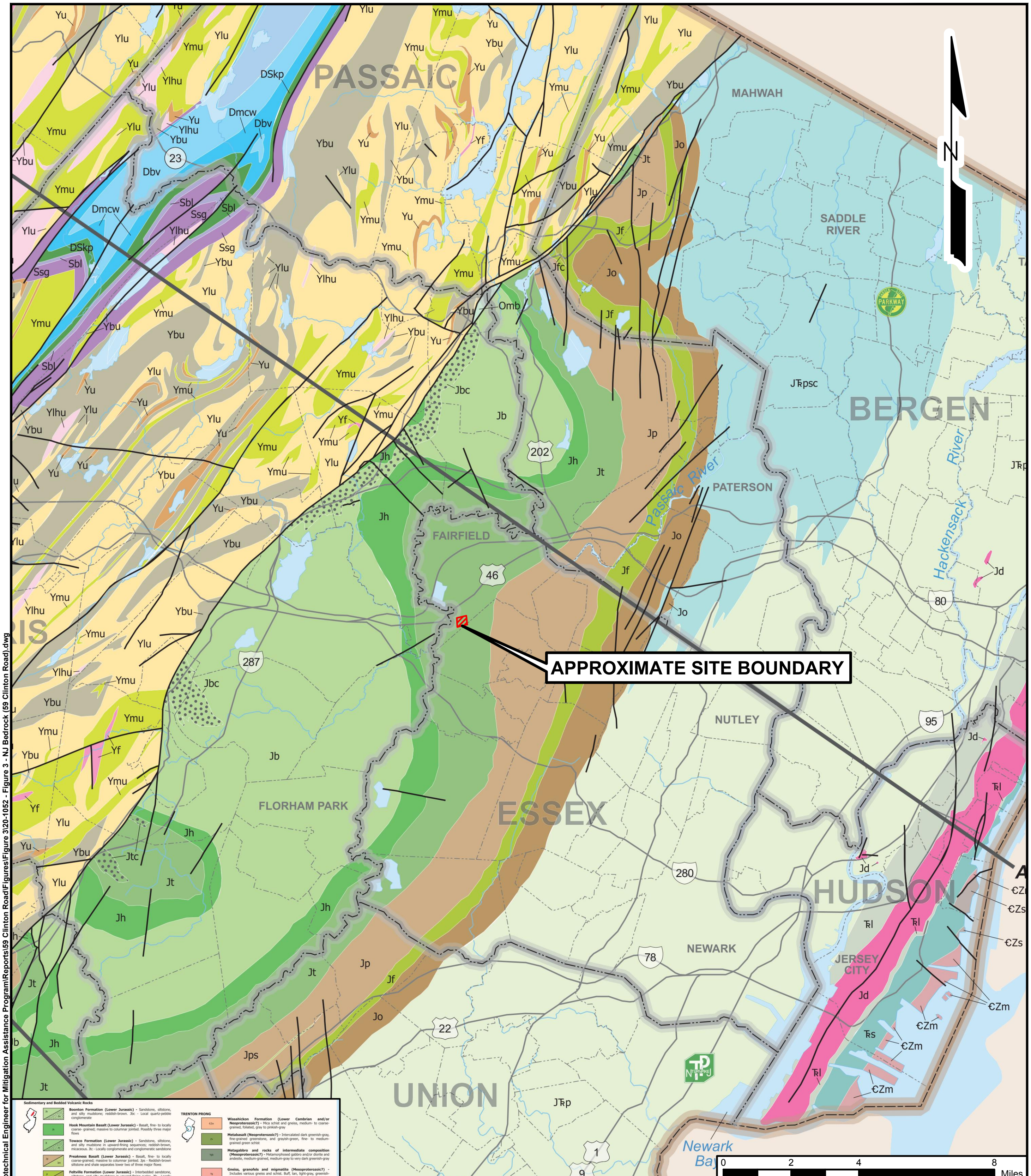
59 CLINTON ROAD
FAIRFIELD, NJ 07004

PROJECT NUMBER: 20-1052

SCALE: AS NOTED

DATE: SEPTEMBER 2021

2



BEDROCK GEOLOGY LOCATION MAP

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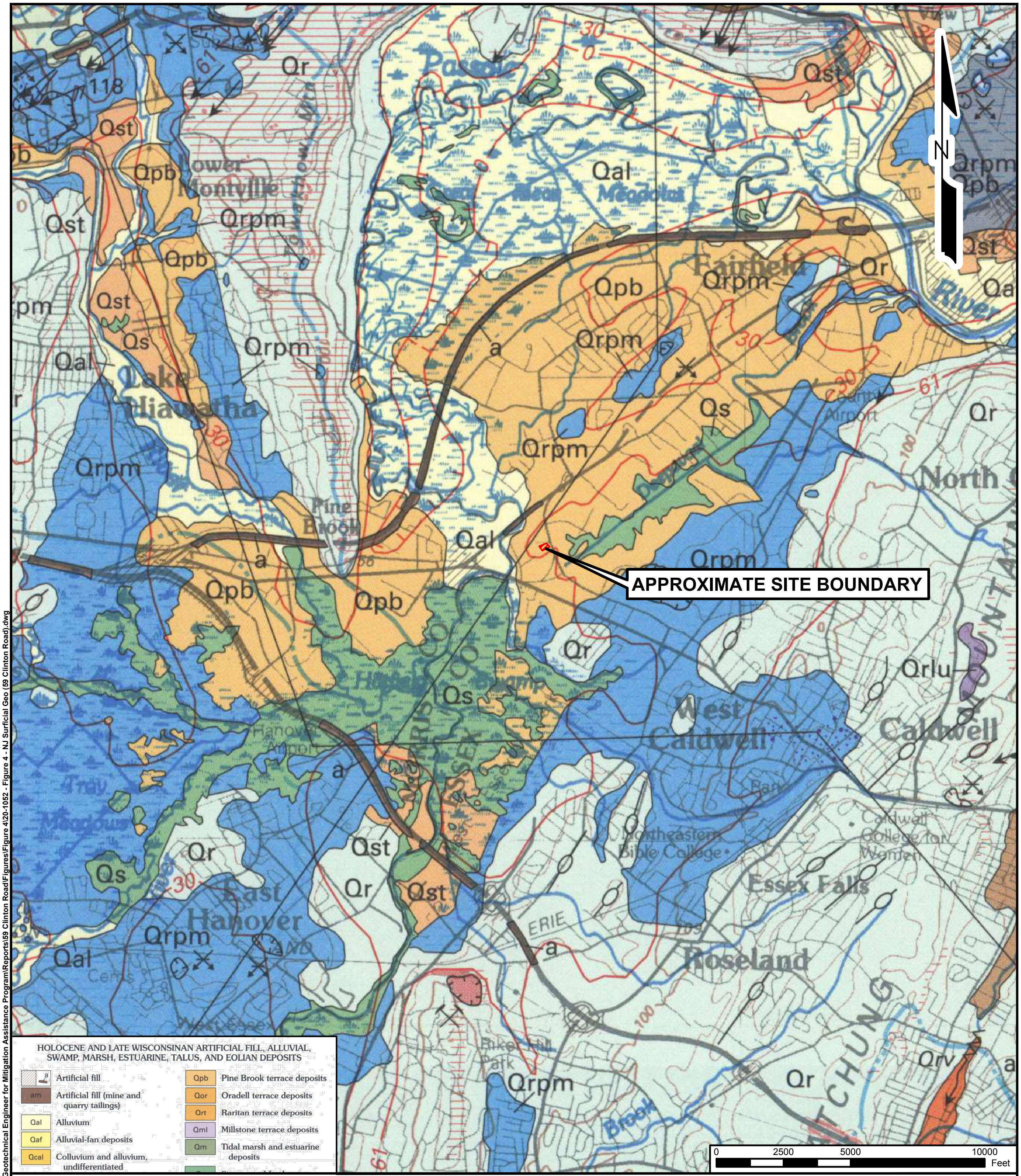
59 CLINTON ROAD
FAIRFIELD, NEW JERSEY 07004

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



SURFICIAL GEOLOGY LOCATION MAP

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NJ DEPARTMENT OF COMMUNITY AFFAIRS
GEOTECHNICAL AND STRUCTURAL ASSESSMENT REPORT
59 CLINTON ROAD
FAIRFIELD, NEW JERSEY 07004

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

APPENDIX A

SOIL BORING & TEST PIT LOGS

MATRIXNEWORLD
Engineering Progress

BORING LOG

BORING NO.: **B-1**

PROJECT NO.: **20-1052** PROJECT: **NJDCA Geotechnical Engineer for Mitigation Assistance Program** DATE: **8/10/21**
PROJECT LOCATION: **Fairfield, NJ** BORING LOCATION: **59 Clinton Road, Southeast Side of House**
DRILLING EQUIPMENT: **CME 55** ANGLE: **-90.0** DIR.: **------** ELEV.: DATUM: **NAVD88**
DRILLING CONTRACTOR: **Boring Brothers, Inc.** DRILLER: **D. Osuch** INSPECTOR: **A. Radiola**

CASING and HAMMER				SAMPLER and HAMMER				GROUNDWATER LEVELS			
Type	I.D.	Weight	Drop	Type	I.D.	Weight	Drop	Date	Time	Depth	Casing Depth
Auto		**140 lbs**	**30"**	**AUTO**		**140 lbs**	**30"**	**8/10/21**		**6.0**	**5**
FJ Steel	**4"**			**SS**	**1 3/8"**						

Depth Feet (Elev.)	CASING Blows/ Foot	SAMPLE No.	Type	Depth Feet	Blows/6" (REC. %) [RQD %]	Graphic Symbol	Description Of Material	Laboratory Tests
							6" Grass/Topsoil	
		S-1	SS	0.5-2	2-3-3 (33%)		S-1: Brown fine SAND, some Silt, trace fine Gravel, dry (SM)	
		S-2	SS	2-4	3-4-7-13 (92%)		S-2: Brown-Orange mf SAND, some Silt, trace fine Gravel, trace wood, dry (SM)	
5	4" Casing	S-3	SS	4-6	9-5-7-6 (83%)		S-3: Brown mf SAND, some Silt, trace fine Gravel, moist (SM)	
▼		S-4	SS	6-8	8-6-5-4 (79%)		S-4: Brown m*f SAND, little Silt, trace fine Gravel, wet (SW-SM)	
		S-5	SS	8-10	4-5-5-6 (100%)		S-5: Same as Above, wet (SW-SM) WC: 15.7%, Gravel: 4%, Sand: 84%, Fines: 12%	Sieve
10		S-6	SS	10-12	7-7-5-8 (100%)		S-6: Brown-Grey cmf SAND, little Silt, trace fine Gravel, wet (SW-SM)	
15		S-7	SS	15-17	4-6-5-6 (46%)		S-7: Grey SILT & CLAY, trace fine Sand, trace fine Gravel, wet (CL-ML) WC: 27.0%, Fines: 97.7%, LL: 22, PL: 17, PI: 5	Atterberg Limits; Pass No 200
20		S-8	SS	20-22	2-2-3-4 (75%)		S-8: Grey Silty CLAY, wet (CL)	
25		S-9	SS	25-27	2-3-4-6 (75%)		S-9: Grey CLAY & Silt, wet (CL) WC: 25.4%, LL: 30, PL: 20, PI: 10	Atterberg Limits
							Bottom of Borehole @ 27 ft.	

BORING NO.: **B-1**

MATRIXNEWORLD
Engineering Progress

BORING LOG

BORING NO.: **B-2**

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

PROJECT NO.: **20-1052** PROJECT: **NJDCA Geotechnical Engineer for Mitigation Assistance Program** DATE: **8/10/21**
PROJECT LOCATION: **Fairfield, NJ** BORING LOCATION: **59 Clinton Road, Southeast Corner of House**
DRILLING EQUIPMENT: **CME 55** ANGLE: **-90.0** DIR.: **------** ELEV.: DATUM: **NAVD88**
DRILLING CONTRACTOR: **Boring Brothers, Inc.** DRILLER: **D. Osuch** INSPECTOR: **A. Radiola**

CASING and HAMMER				SAMPLER and HAMMER				GROUNDWATER LEVELS			
Type	I.D.	Weight	Drop	Type	I.D.	Weight	Drop	Date	Time	Depth	Casing Depth
Auto		**140 lbs**	**30"**	**AUTO**		**140 lbs**	**30"**	**8/10/21**		**6.0**	**5**
FJ Steel	**4"**			**SS**	**1 3/8"**						

Depth Feet (Elev.)	CASING Blows/ Foot	SAMPLE No.	Type	Depth Feet	Blows/6" (REC. %) [RQD %]	Graphic Symbol	Description Of Material	Laboratory Tests
							6" Grass/Topsoil	
		S-1	SS	0.5-2	2-1-2 (94%)		S-1: Brown fine SAND, some Silt, trace fine Gravel, trace brick, dry (SM)	
		S-2	SS	2-4	2-2-3-4 (75%)		S-2: Brown mf SAND, little Silt, trace fine Gravel, moist (SM)	
5	4" Casing	S-3	SS	4-6	4-6-5-5 (58%)		S-3: Brown mf* SAND, little Silt, trace fine Gravel, moist (SW-SM) WC: 15.8%, Gravel: 9%, Sand: 81%, Fines: 10%	Sieve
▼		S-4	SS	6-8	3-4-3-3 (88%)		S-4: Red-Brown cmf SAND, little Silt, trace fine Gravel, wet (SW-SM)	
		S-5	SS	8-10	2-3-5-5 (100%)		S-5: Brown cmf SAND, little Silt, trace fine Gravel, wet (SW-SM)	
10		S-6	SS	10-12	4-3-3-7 (100%)		S-6: Grey-Brown cmf SAND, little Silt, trace fine Gravel, wet (SW-SM)	
15		S-7	SS	15-17	2-4-7-7 (75%)		S-7: Grey Clayey SILT, wet (ML) WC: 25.1%, LL: 27, PL: 22, PI: 5	Atterberg Limits
20		S-8	SS	20-22	2-2-2-4 (88%)		S-8: Grey Silty CLAY, wet (CL) WC: 33.4%, LL: 42, PL: 21, PI: 21	Atterberg Limits
25		S-9	SS	25-27	3-3-3-4 (100%)		S-9: Same as Above, wet (CL)	
							Bottom of Borehole @ 27 ft.	

MATRIXNEWORLD
Engineering Progress

TEST PIT LOG

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

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

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

PROJECT LOCATION: **Fairfield, NJ** ELEV.: ______ TIME STARTED: **1:30:00 PM**

TEST PIT LOCATION: **59 Clinton Road (Northeast Corner of Building - Basement)** DATUM: **NAVD88** TIME FINISHED: **2:45:00 PM**

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

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

Depth Inches (Elev)	No.	Depth Inches	Graphic Symbol	Description Of Material	Laboratory Tests
		0-3		Topsoil	
5		3-63		Brown fine SAND and Silt	
10					
15					
20					
25					
30					
35					
40					
45					
50					
55					
60					
65		63-67		Top of concrete encountered at 63" bgs, protrudes 3" from the face of the wall and extends 4" downward.	
				Bottom of Test pit @ 67 in. Test Pit Backfilled.	

LOG NOTATION

Sample Classifications

SS = Split Spoon

NR = No Recovery

NX = Rock Core

SH = Shelby Tube

REC = Soil Recovery

RQD = Rock Quality Designation

Sand Classifications

c = Coarse

m = Medium

f = Fine

* = Predominant Grain Size

Soil Properties

WC = Water Content

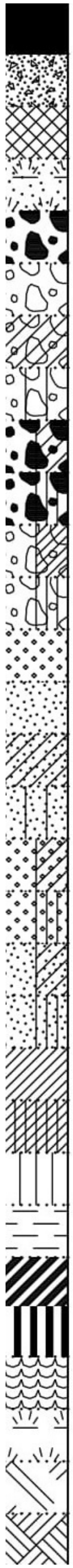
PL = Plastic Limit

LL = Liquid Limit

PI = Plasticity Index

OC = Organic Content

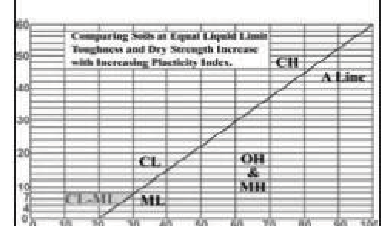
LOG GRAPHICAL LEGEND



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

APPENDIX B

SOIL CLASSIFICATION TABLES

<table>
<tr><th colspan="3">MAJOR DIVISIONS</th><th>GROUP SYMBOLS</th><th>TYPICAL NAMES</th><th colspan="3">FIELD IDENTIFICATION PROCEDURES (EXCLUDING PARTICLES LARGER THAN 3 IN. AND BASING FRACTIONS ON ESTIMATED WEIGHTS)</th><th>INFORMATION REQUIRED FOR DESCRIBING SOILS</th><th colspan="4">LABORATORY CLASSIFICATION CRITERIA</th></tr>
<tr><th>1</th><th colspan="2">2</th><th>3</th><th>4</th><th colspan="3">5</th><th>6</th><th colspan="4">7</th></tr>
<tr><td rowspan="8">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.</td><td rowspan="4">Gravels
More than half of coarse fraction is larger than No. 4 sieve size.</td><td rowspan="2">Clean Gravels (Little or no fines)</td><td>GW</td><td>Well-graded gravels, gravel-sand mixture, little or no fines.</td><td colspan="3">Wide range in grain size and substantial amounts of all intermediate particle sizes.</td><td rowspan="2">For undisturbed soils add information on stratification, degree of compactness, cementation, moisture condition, and drainage characteristics.</td><td rowspan="17">Use grain-size curve in identifying the fractions as given under field identification.</td><td rowspan="8">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.</td><td colspan="2">$C_u = \frac{D_{60}}{D_{10}}$ Greater than 4
$C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3</td></tr>
<tr><td>GP</td><td>Poorly graded gravels or gravel-sand mixture, little or no fines.</td><td colspan="3">Predominantly one size or a range of sizes with some intermediate sizes missing.</td><td colspan="2">Not meeting all gradation requirements for GW</td></tr>
<tr><td rowspan="2">Gravels with Fines (Appreciable amount of fines)</td><td>GM</td><td>Silty gravels, gravel and silt mixtures.</td><td colspan="3">Nonplastic fines or fines with low plasticity (for identification procedures see ML below).</td><td rowspan="3">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.</td><td>Atterberg limits below "A" line or P1 less than 4</td><td rowspan="2">Above "A" line with P1 between 4 and 7 are borderline cases requiring use of dual symbols.</td></tr>
<tr><td>GC</td><td>Clayey gravels, gravel and clay mixtures.</td><td colspan="3">Plastic fines
(for identification procedures see CL below).</td><td>Atterberg limits above "A" line with P1 greater than 7</td></tr>
<tr><td rowspan="4">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.)</td><td rowspan="2">Clean Sand (Little or no fines)</td><td>SW</td><td>Well-graded sands, gravelly sands, little or no fines.</td><td colspan="3">Wide range in grain size and substantial amounts of all intermediate particle sizes.</td><td colspan="2">$Cu = \frac{D_{60}}{D_{10}}$ Greater than 6
$C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3</td></tr>
<tr><td>SP</td><td>Poorly graded sands or gravelly sands, little or no fines.</td><td colspan="3">Predominantly one size or a range of sizes with some intermediate sizes missing.</td><td rowspan="3">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).</td><td colspan="2">Not meeting all gradation requirements for SW</td></tr>
<tr><td rowspan="2">Sands with Fines (Appreciable amount of fines)</td><td>SM</td><td>Silty sands, sand-silt mixtures.</td><td colspan="3">Nonplastic fines or fines with low plasticity (for identification procedures see ML below).</td><td>Atterberg limits above "A" line or P1 less than 4</td><td rowspan="2">Limits plotting in hatched zone with P1 between 4 and 7 are borderline cases requiring use of dual symbols.</td></tr>
<tr><td>SC</td><td>Clayey sands, sand-clay mixtures.</td><td colspan="3">Plastic fines
(for identification procedures see CL below).</td><td>Atterberg limits above "A" line with Pl greater than 7</td></tr>
<tr><td rowspan="8">Fine-grained Soils
More than half of material is smaller than No. 200 sieve size.</td><td colspan="4" rowspan="2"></td><td colspan="3">Identification Procedure on Fraction Smaller than No. 40 Sieve Size.</td><td rowspan="2"></td><td colspan="3" rowspan="2"></td></tr>
<tr><td>Dry Strength (Crushing Characteristics)</td><td>Dilatancy (Reaction to shaking)</td><td>Toughness (Consistency near PL)</td></tr>
<tr><td colspan="2" rowspan="2">Silts and Clays Liquid limit is less than 50</td><td>ML</td><td>Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.</td><td>None to slight</td><td>Quick to slow</td><td>None</td><td rowspan="2">For undisturbed soils add information on structure, stratification, consistency in undisturbed and remolded states, moisture and drainage conditions</td><td colspan="3" rowspan="7">LIQUID LIMIT PLASTICITY CHART
For laboratory classification of fine-grained soils
Plasticity Index
</td></tr>
<tr><td>CL</td><td>Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.</td><td>Medium to high</td><td>None to very slow</td><td>Medium</td></tr>
<tr><td colspan="2" rowspan="4">Silts and Clays Liquid limit is greater than 50</td><td>OL</td><td>Organic silts and organic silty clays of low plasticity.</td><td>Slight to medium</td><td>Slow</td><td>Slight</td><td rowspan="3">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.</td></tr>
<tr><td>MH</td><td>Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.</td><td>Slight to medium</td><td>Slow to none</td><td>Slight to medium</td></tr>
<tr><td>CH</td><td>Inorganic clays of high plasticity, fat clays.</td><td>High to very high</td><td>None</td><td>High</td></tr>
<tr><td>OH</td><td>Organic clays of medium to high plasticity, organic silts.</td><td>Medium to high</td><td>None to very slow</td><td>Slight to medium</td><td rowspan="2">Example:
Clayey silt, brown; slightly plastic; small percentage of fine sand; numerous vertical root holes; firm and dry in place; loess; (ML)</td></tr>
<tr><td colspan="3">Highly Organic Soils</td><td>Pt</td><td>Peat and other highly organic soils.</td><td colspan="3">Readily identified by color, odor, spongy feel and frequently by fibrous texture</td></tr>
</table>

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

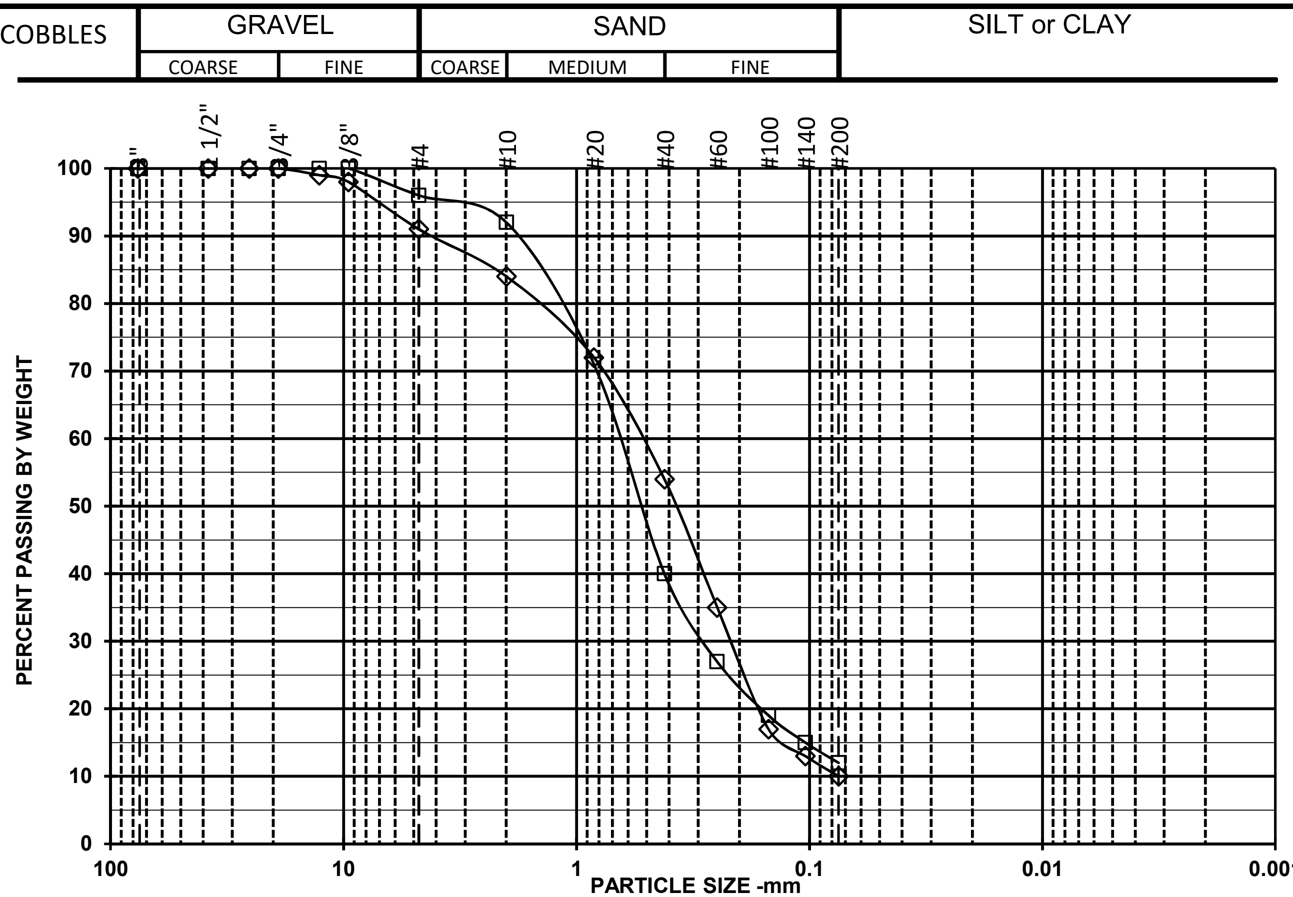
APPENDIX C

GEOTECHNICAL LABORATORY TESTING RESULTS

Matrix New World Engineering, P.C. #20-1052-016
NJDCA MAP - 59 Clinton 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 (%)	
B-1	S-5	8-10	15.7				SP-SM	12	
B-1	S-7	15-17	27.0	22	17	5	CL-ML	97.7	
B-1	S-9	25-27	25.4	30	20	10	CL		
B-2	S-3	4-6	15.8				SW-SM	10	
B-2	S-7	15-17	25.1	27	22	5	ML		
B-2	S-8	20-22	33.4	42	21	21	CL		

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



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

Symbol	□	◇	○
Boring	B-1	B-2	
Sample	S-5	S-3	
Depth	8-10	4-6	
% +3"	0	0	
% Gravel	4	9	
% SAND	84	81	
%C SAND	4	7	
%M SAND	52	30	
%F SAND	28	44	
% FINES	12	10	
D_{100} (mm)	12.7	19.1	
D_{60} (mm)	0.657	0.529	
D_{30} (mm)	0.28	0.22	
D_{10} (mm)		0.075	
Cc		1.2	
Cu		7.1	

Sieve Size/ID #	Percent Finer Data		
6"	100	100	
4"	100	100	
3"	100	100	
1 1/2"	100	100	
1"	100	100	
3/4"	100	100	
1/2"	100	99	
3/8"	100	98	
#4	96	91	
#10	92	84	
#20	71	72	
#40	40	54	
#60	27	35	
#100	19	17	
#140	15	13	
#200	12	10	
5μ m			
2μ m			
1μ m			

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	15.7				SP-SM		Brown, Poorly graded sand with silt	08/24/21
◇	15.8				SW-SM		Brown, Well-graded sand with silt	08/24/21
○								

Matrix New World Engineering, P.C. #20-1052-016

TerraSense #21004955A

NJDCA MAP
59 Clinton Road

PARTICLE SIZE DISTRIBUTION
ASTM D6913 & ASTM D7928

TerraSense Analysis File: GrainSizeV6Rev1a15

Siev1a.xlsx 9/1/2021

APPENDIX D

FEMA NFIP ELEVATION CERTIFICATE

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

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

ELEVATION CERTIFICATE

Important: Follow the instructions on pages 1–9.

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

SECTION A – PROPERTY INFORMATION

FOR INSURANCE COMPANY USE

A1. Building Owner's Name
[redacted]

Policy Number:

A2. Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.
59 Clinton Road

Company NAIC Number:

City	State	ZIP Code
Town of Fairfield	New Jersey	07004-1112

A3. Property Description (Lot and Block Numbers, Tax Parcel Number, Legal Description, etc.)
Block 401, Lot 10

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

A5. Latitude/Longitude: Lat. N40°51'41" Long. W74°18'49" 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 4

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

a) Square footage of crawlspace or enclosure(s) 1226.00 sq ft

b) Number of permanent flood openings in the crawlspace or enclosure(s) within 1.0 foot above adjacent grade 5

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

d) Engineered flood openings? ☐ Yes ☒ No

A9. For a building with an attached garage:

a) Square footage of attached garage N/A 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)
34013C0077	G	04-03-2020	04-03-2020	AE	174' (NAVD88')

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

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

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

Designation Date: ☐ CBRS ☐ OPA

ELEVATION CERTIFICATE

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

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

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

SECTION C – BUILDING ELEVATION INFORMATION (SURVEY REQUIRED)

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

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

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

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

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

☐ NGVD 1929 ☒ NAVD 1988 ☐ Other/Source:

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

Check the measurement used.

Item	Elevation	feet	meters
a) Top of bottom floor (including basement, crawlspace, or enclosure floor)	166.0	☒	☐
b) Top of the next higher floor	171.3	☒	☐
c) Bottom of the lowest horizontal structural member (V Zones only)	N/A	☐	☐
d) Attached garage (top of slab)	N/A	☐	☐
e) Lowest elevation of machinery or equipment servicing the building (Describe type of equipment and location in Comments)	166.9	☒	☐
f) Lowest adjacent (finished) grade next to building (LAG)	168.4	☒	☐
g) Highest adjacent (finished) grade next to building (HAG)	170.3	☒	☐
h) Lowest adjacent grade at lowest elevation of deck or stairs, including structural support	168.5	☒	☐

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): Base of hot water heater was in the basement at Elev=166.9'(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. 59 Clinton Road			Policy Number:
City Town of Fairfield	State New Jersey	ZIP Code 07004-1112	Company NAIC Number

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

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

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

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

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

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

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

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

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

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

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

Property Owner or Owner's Authorized Representative's Name			
Address	City	State	ZIP Code
Signature	Date	Telephone	

Comments

☐ Check here if attachments.

ELEVATION CERTIFICATE

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

IMPORTANT: In these spaces, copy the corresponding information from Section A.			FOR INSURANCE COMPANY USE
Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No. 59 Clinton Road			Policy Number:
City Town of Fairfield	State New Jersey	ZIP Code 07004-1112	Company NAIC Number

SECTION G – COMMUNITY INFORMATION (OPTIONAL)

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

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

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

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

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

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

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

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

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

Local Official's Name	Title
Community Name	Telephone
Signature	Date

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

☐ Check here if attachments.

ELEVATION CERTIFICATE

BUILDING PHOTOGRAPHS

See Instructions for Item A6.

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. 59 Clinton Road			Policy Number:
City Town of Fairfield	State New Jersey	ZIP Code 07004-1112	Company NAIC Number

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

Photo One

Photo One Caption Front View

Clear Photo One

Photo Two

Photo Two Caption Rear View

Clear Photo Two

BUILDING PHOTOGRAPHS

Continuation Page

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. 59 Clinton Road			Policy Number:
City Town of Fairfield	State New Jersey	ZIP Code 07004-1112	Company NAIC Number

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

Photo Three

Photo Three Caption Right Side View

Clear Photo Three

Photo Four

Photo Four Caption Left Side View

Clear Photo Four