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

**367 HORSENECK ROAD**
**FAIRFIELD, NEW JERSEY 08203**

MATRIXNEWORLD
Engineering Progress

**Prepared for:**

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

**Prepared by:**

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

Matrix No. 20-1052

August 2021

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

## 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 367 Horseneck Road in Fairfield, New Jersey (Site). Matrix provided geotechnical and structural engineering services and land surveying 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 31 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 367 Horseneck Road in Fairfield, New Jersey. The property consists of a one-story timber-framed raised ranch house with an approximately 1,420 square foot footprint. The house contains a half-buried basement level with concrete masonry unit (CMU) foundation walls, presumably on cast-in-place concrete foundations. From the first floor up, the timber frame of residential structure is covered with shingle siding throughout its exterior.

The residence contains a single rectangular area with two additions located at the rear and the east side of the building. The east side addition consists of a timber subfloor situated atop the basement walls and masonry columns along the east edge. The rear addition is built upon cast-in-place concrete walls and contains wooden steps which lead to the basement level. Adjacent to this rear addition, to the south, is an enclosed patio area composed of a concrete slab on grade with concrete steps leading to the residential building's rear entrance door.

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 situated atop approximately 90% Pompton-Urban land and 10% Pompton Sandy Loam. These two subsurface compositions are 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 Towaco Formation. Specifically, the subsurface consists of a reddish-brown micaceous sandstone, siltstone and silty mudstone.

The documented site conditions presented above are consistent with the findings from the subsurface investigation, in which Sand with varying amounts of silt was encountered throughout the length of the borings. 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. 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 14, 2021, Boring Brothers completed a foundation survey which included 1 test pit to a depth of 31 inches below the ground surface. Site constraints around the perimeter of the building allowed for only one test pit excavation to be completed at the Site. The test pit was 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 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 in the backyard. 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 18, 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. Boring B-1 was conducted on the Northern side of the building and boring B-2 was conducted on the northwestern side of the lot. 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: 15-17’, 20-27’<br>B-2: 4-6’, 25-27’ |
| Sieve Analysis | ASTM D422 | 2 | B-1: 15-17’<br>B-2: 4-6’ |
| Atterberg Limits | ASTM D4318 | 1 | B-2: 25-27’ |
| Combined Sieve & Hydrometer | ASTM D422 | 1 | B-1: 20-27’ |

## 6.0 SUBSURFACE CONDITIONS

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

### Test Pits

The top of concrete was uncovered in TP-1 at 28” bgs. The test pit revealed the concrete protrudes 2” from the wall and extends 7” deep.

### Surface Cover

The surface cover for boring B-1 and B-2 consisted of grass cover and topsoil. Present only in B-2 was an approximately 2-foot-thick lens of Silty topsoil.

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

Beneath the surface cover in each boring, a soil layer was encountered consisting of brown to grey coarse-to-fine Sand with varying amounts of Silt and fine Gravel. This Sand layer extended from the bottom of the surface cover to approximately 18.5 feet below the ground surface (bgs) in B-1 and approximately 23.5 feet bgs in boring B-2.

The SPT N-values in this layer ranged from 6 to 18 blows per foot (bpf), which is indicative of loose to medium-dense Sand. The SPT N-values for Stratum 1 are summarized in the tables below.

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

| Soil Boring Location | USCS Group Symbol | Depth Below Ground Surface | SPT N-Values |
|---|---|---|---|
| B-1 | SM | 0-4’ | 6-8 |
| B-2 | SM<br>SM, SP | 2-4’<br>13.5-23.5’ | 8<br>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, SP-SM | 4-18.5’ | 11-18 |
| B-2 | SM | 4-13.5’ | 14-16 |

**Stratum 2: Silt (ML)**

Beneath the granular material of Stratum 1, a layer of Silt was encountered that also included significant amounts of fine Sand and traces of fine Gravel (in boring B-2 only). This layer was encountered at approximately 18.5 feet bgs in boring B-1 and approximately 23.5 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 31 to 35 bpf, which is indicative of dense Silt material. In boring B-1, an N-value of 12 bpf was recorded for the 20-to-22-foot sampling interval, signifying medium Silt. The SPT N-values for Stratum 2 are summarized in the tables below.

**Table 6.0-3: Medium Silt SPT N-Values for Stratum 2**

| Soil Boring Location | USCS Group Symbol | Depth Below Ground Surface | SPT N-Values |
|---|---|---|---|
| B-1 | ML | 18.5-23.5’ | 12 |

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

| Soil Boring Location | USCS Group Symbol | Depth Below Ground Surface | SPT N-Values |
|---|---|---|---|
| B-1 | ML | 23.5-27’ | 31 |
| B-2 | ML | 23.5-27’ | 35 |

**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 and 6 feet bgs. It should be noted that the groundwater levels will vary with temperature, precipitation, and other climatic factors.

## 7.0 GEOTECHNICAL SUBSURFACE PARAMETERS

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

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

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

### Table 7.0-1: Geotechnical Design Parameters

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

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

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

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

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

## 8.0 STRUCTURAL INSPECTION

The following sections present the results of the structural inspection of the residential building at 367 Horseneck 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 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 Frame and Foundations

The building at 367 Horseneck Road is a rectangular structure built on concrete masonry unit (CMU) basement/foundation walls. Two additions have since been built adjacent to the original building foundation. The timber frame of the building is supported by nominal 2x8 timber girders spanning the CMU foundation walls.

The main basement of the building measures 25' x 35'. The CMU walls of the basement range from 69" to 71" in height (measured from the basement floor to the top of the block wall). The CMU blocks were observed to have a decorative finish on the exterior face, which was visible on the portion of the wall above exterior grade. A small trench was observed along the perimeter of the basement floor, creating a gap between the walls and the concrete floor slab. This trench measured 2" to 3.5" in width and ranged from 3" to 4" deep. The purpose of this trench is not explicitly known, but appears to serve as a drainage channel for the basement area.

Timber nominal 2x8 floor joists, spaced 16” on center, run north-to-south (front-to-rear of building) above the basement walls. These joists are supported on either end by the basement CMU walls, as well as a timber girder running perpendicular to the joists in the middle of the basement. The girder is made up of (2) connected nominal 2x8 timber beams and is supported along its length by seven 4x4 timber posts. The longest unsupported span of the girder measured approximately 9 feet, and a brick exhaust column (non-structural) was observed in the middle of that span.

Due to site constraints along the edges of the existing building, test pit excavation could be completed at only one location at the Site. The single test pit was located at the southeast corner of the basement area to obtain details of the building’s main foundation conditions. Based on our findings within the test pits and from conventional foundation construction, Matrix assumed 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 (typical footing size for residential homes). 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.

Adjacent to the main basement area to the south (rear), a recent addition had been constructed. This relatively narrow area, approximately 19’4” long x 6’-5” wide, consists of cast-in-place concrete foundation walls supporting a timber frame structure. A set of timber stairs lead from the basement level to the building’s first floor. The floor of the rear addition is a concrete slab with varying elevation – immediately adjacent to the basement, the stair landing is 5.5” higher than the basement floor. A second ledge in the concrete floor, south of the stair landing, raises the floor another 6.5”. The concrete foundation walls measured 21” in height from the highest floor elevation. Above these foundation walls, a timber platform has been constructed with nominal 2x6 timber beams running north to south to cover the remainder of the addition space. Timber 4x4 posts are spaced evenly along the length of the platform area to support the structure opposite the concrete foundation wall. This portion of the house was unfinished at the time of the inspection, as flood damage had halted further construction at the Site.

East of the basement area, a second addition was observed which added footage to the first floor of the building. This 14’-6” long x 6’-4” wide area is supported by the CMU basement wall along the west edge and a series of three concrete block columns along the east edge. The subfloor of the addition consists of nominal 2x6 timber beams running in both directions (north-to-south and east-to-west) and at equal elevation, with the transverse beams (east-to-west) sitting atop brick pedestals above the concrete block columns and bolted into a timber girder above the basement wall along the west edge. The area under this addition is open and only contains chain-link and lattice fencing for perimeter walls.

South of the rear addition, an enclosed patio area was observed. The patio consists of a concrete slab on grade with the top of slab 9” to 12” above the adjacent exterior grade. Concrete steps lead from the outside of the patio to a concrete landing approximately 13.5” above the patio floor surface. From the landing, a rear access door connects the patio to the rear addition of the residence.

### 8.2 Existing Equipment

All equipment and machinery for the Site were observed within the building interior, either in the basement or the rear addition.

Two sump pumps were observed within the basement area of the building, in opposite corners (southeast and northwest). Also observed in the basement, in the center of the area, was a water heater situated at the floor level and a boiler set atop three courses of stone block. A gas meter was mounted on the front (north) wall of the basement. Multiple PVC sewer lines run down from the rear of the building and across the basement to exit out of the front wall. The electrical panel for the building was located on the east wall of the basement, near the top of the wall.

Within the unfinished rear addition, appliances observed included a washer and dryer, a refrigerator, and a toilet (not in service at the time of the inspection). The toilet and refrigerator were at the floor level of the addition, while the stacked washer and dryer units were set atop a timber platform approximately 30” above the floor.

### 8.3 Site Observations

The property at 367 Horseneck Road was subject to standing water in the rear of the backyard at the time of the inspection. No signs of flooding were observed within the building at this time.

Within the basement, multiple cable trays and support channels were observed to be damaged and hanging, along with the electrical cables. Some water ponding was observed around the water heater located in the center of the basement, though the rest of the basement was dry.

Horizontal cracks were observed in the rear concrete stairwell landing in the rear addition, adjacent to the basement floor. As noted above, the rear addition was unfinished at the time of the inspection, and the timber frame of the building was visible throughout this area.

The east addition exhibited some differential settlement at the time of the inspection. The columns along the east edge of the addition had apparently settled, resulting in detachment of the addition from the original building frame (as evidenced by the gaps observed on either side of the addition between the two connecting frames).

The patio in the rear of the building exhibited notable weathering. Paint loss was observed throughout the area on the landing and patio floor. A large crack was also seen in the concrete slab surface spanning the width of the patio (east to west).

### 8.4 Elevation Requirements

The FEMA 100-year flood elevation at 367 Horseneck Road is El. +174 (NAVD88). According to the FEMA Flood Maps, the Site is located within a regulatory floodway. 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 sits at El. +173.65, with the adjacent rear addition floor at El. +168.48. To achieve the elevation requirements, the existing building would need to be raised at least 3.4 feet, and the rear addition brought to the same level as the rest of the building’s first floor. The rear patio area is expected to remain at ground level.

### 8.5 Recommendations for Building Elevation

Matrix recommends that the existing foundation system of the residential building at 367 Horseneck Road be kept and extended to achieve the required design flood elevation. 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 (foundation type to be verified in the field prior to construction).

In accordance with NFIP requirements, it is required that the existing basement and rear addition be filled in to match the lowest adjacent exterior grade following raising. The newly raised house will have over 8 feet of space beneath (down to existing finished grade), which is enough vertical height for a ground-floor level. This new level below 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 foundation 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 walls of the rear addition of the house, additional rebar should be doweled into the existing walls to form a connection between the existing and new cast-in-place foundation walls of the building. Also, the existing timber posts intermittently supporting the existing building's girder must be removed and replaced by new concrete or masonry block columns. These new columns will need to include a spread footing beneath to sufficiently support the building loads.

The rear addition of the house currently consists of an unfinished room located approximately 5 feet below the first-floor level, with a timber subfloor supported by timber posts. If kept at the same elevation following rising, the floor of this addition would be below the design flood elevation and rendered unusable. Matrix recommends that this area of the house be elevated to match the first floor following raising of the building, which will maintain the existing usable living space for the resident. A new timber subfloor will need to be constructed within the rear addition area to match the elevation of the newly raised first floor. Inclusion of a new timber subfloor will also create over 8 feet of space below, which can be used for storage at the resident's discretion.

The CMU block columns supporting the east addition appeared to have settled at the time of the inspection. Matrix recommends that these columns be removed and replaced with new concrete or CMU columns following raising. The new columns should be founded on a new concrete strip footing encompassing all three columns and appropriately sized to help prevent future differential settlement that was evident in the existing condition of the house's east addition at the time of the inspection. The groundwater table was observed between 4 and 6 feet bgs during the subsurface investigation, which may require the use of dewatering during construction of the new east addition footing. 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.

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 7.83 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, such as air conditioning, heat pump compressors, gas meters, electric meters, and hot water heaters, must be elevated 3 feet above the BFE. For interior elements, this may include relocation to an upper floor and thus less usable living space. For this residence, the hot water heater, boiler, gas meter, and electrical panel in the basement would require elevating 3 feet above the BFE.

## 9.0 CLOSURE

This report has been prepared to assist the State of New Jersey Department of Community Affairs with the structural evaluation of the residential building at 367 Horseneck 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. 367 Horseneck Road (Front of Building)**

**Photo 2. 367 Horseneck Road (East Addition)**

**Photo 3. Rear Enclosed Patio**

**Photo 4. Trench Along Basement Walls**

**Photo 5. Sump Pump in Basement (Southwest Corner)**

**Photo 6. Floor Joist Layout for First Floor**

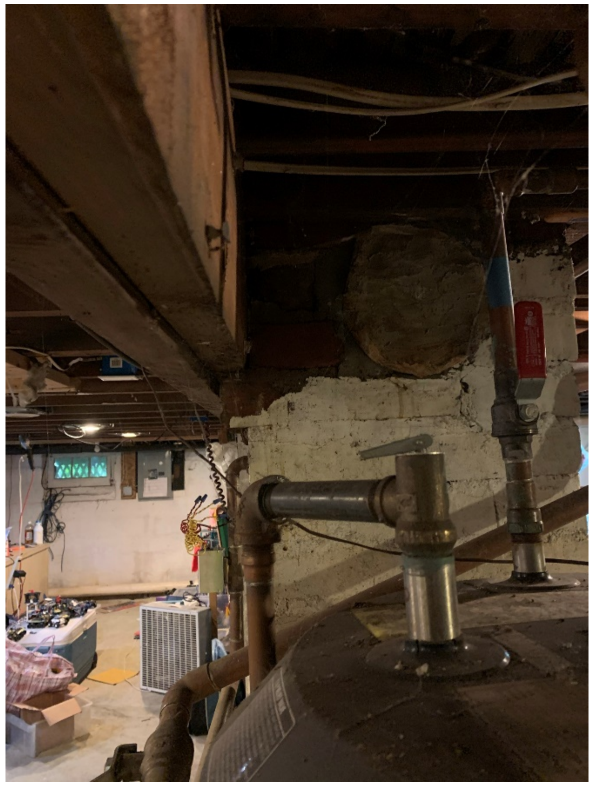


**Photo 7. (2) 2x8 Timber Girder in Basement**

**Photo 8. Timber 4x4 Girder Support Posts (Typ.)**

**Photo 9. Water Heater (Left) and Boiler (Right) in Basement**

**Photo 10. Rear Addition Foundation Wall**

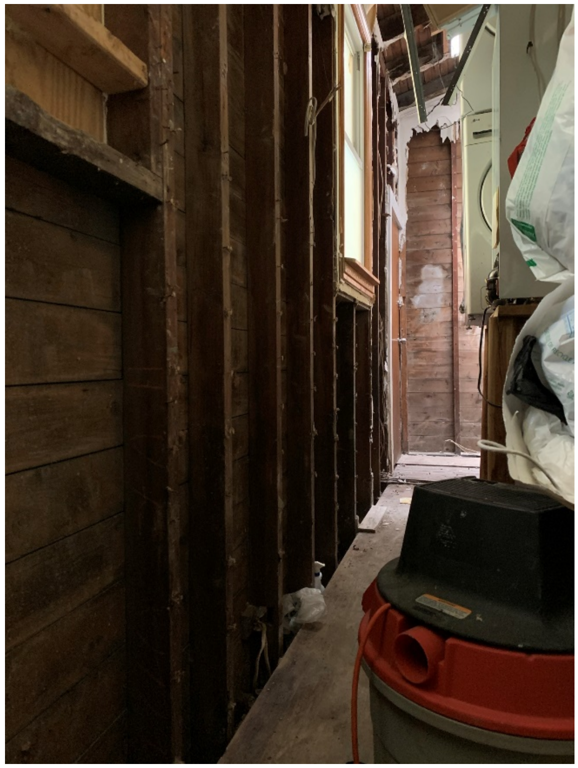


**Photo 11. Unfinished Rear Addition**

**Photo 12. East Addition Columns and Subfloor**

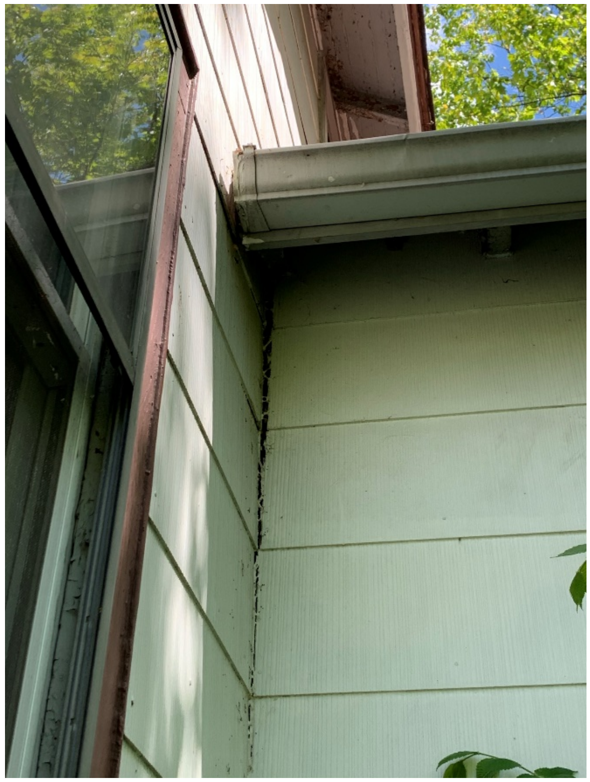


**Photo 13. Separation of East Addition from Main Building Frame**

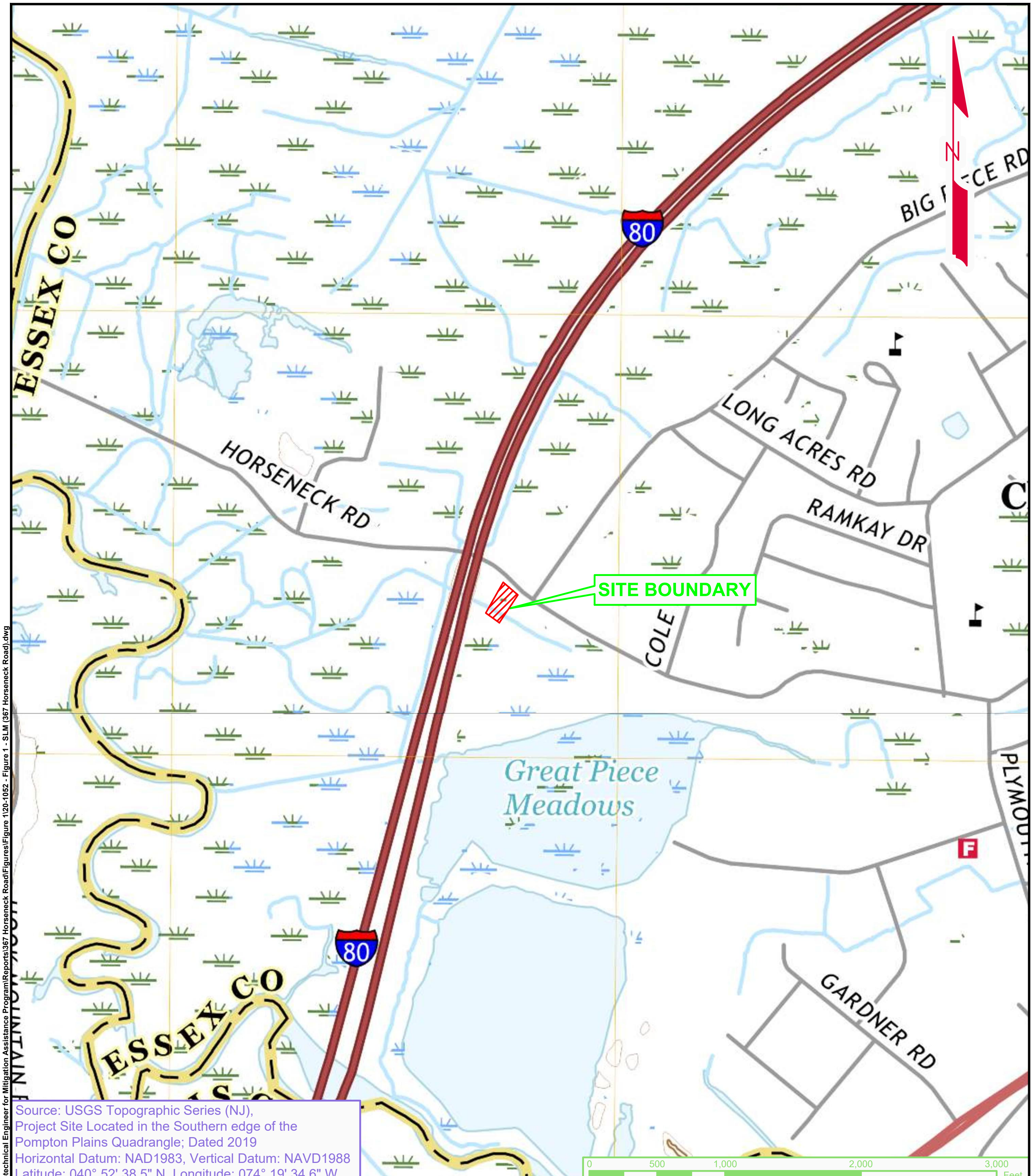
**Photo 14. Concrete Steps to Patio Landing**

**Test Pit Photos**

**Photo 15. Test Pit TP-1 Location (Southeast Corner of Building – Basement)**

**Photo 16. Test Pit TP-1 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' 38.5" N, Longitude: 074° 19' 34.6" 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 / DBE / SBE
Tel: 973-240-1800
Fax: 973-240-1818
www.matrixneworld.com

NJ DEPARTMENT OF COMMUNITY AFFAIRS
GEOTECHNICAL AND STRUCTURAL ASSESSMENT REPORT
367 HORSENECK 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 18, 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


MATRIXNEWORLD
Engineering Progress

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

Tel: 973-240-1800
Fax: 973-240-1818
www.matrixneworld.com


AS-DRILLED BORING LOCATION PLAN

**NJDCA GEOTECHNICAL ENGINEER FOR MITIGATION ASSISTANCE PROGRAM**

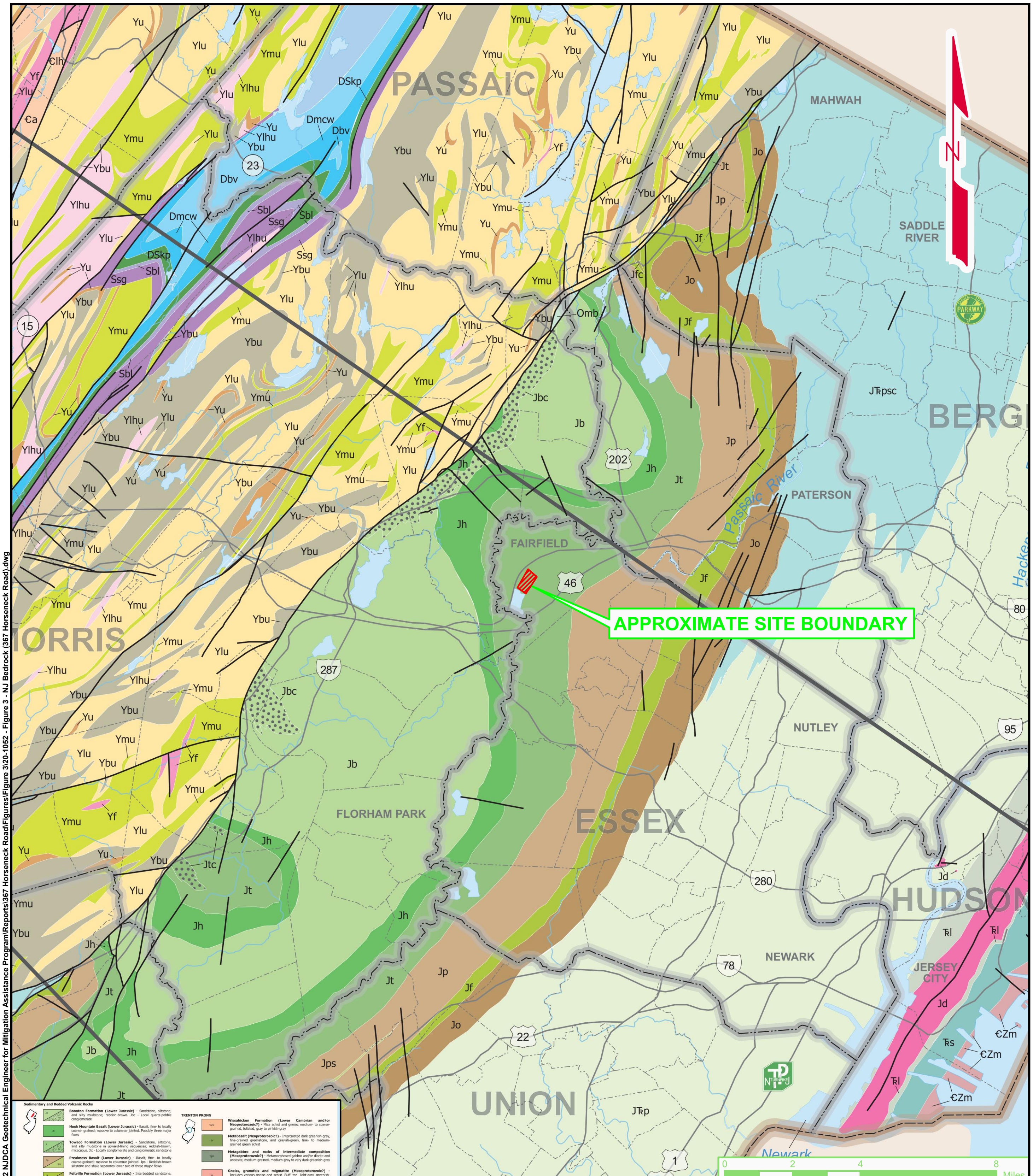
**367 HORSENECK ROAD FAIRFIELD, NJ 07004**

**PROJECT NUMBER: 20-1052**

**SCALE: AS NOTED**

**DATE: JUNE 2021**

**2**




# BEDROCK GEOLOGY LOCATION MAP

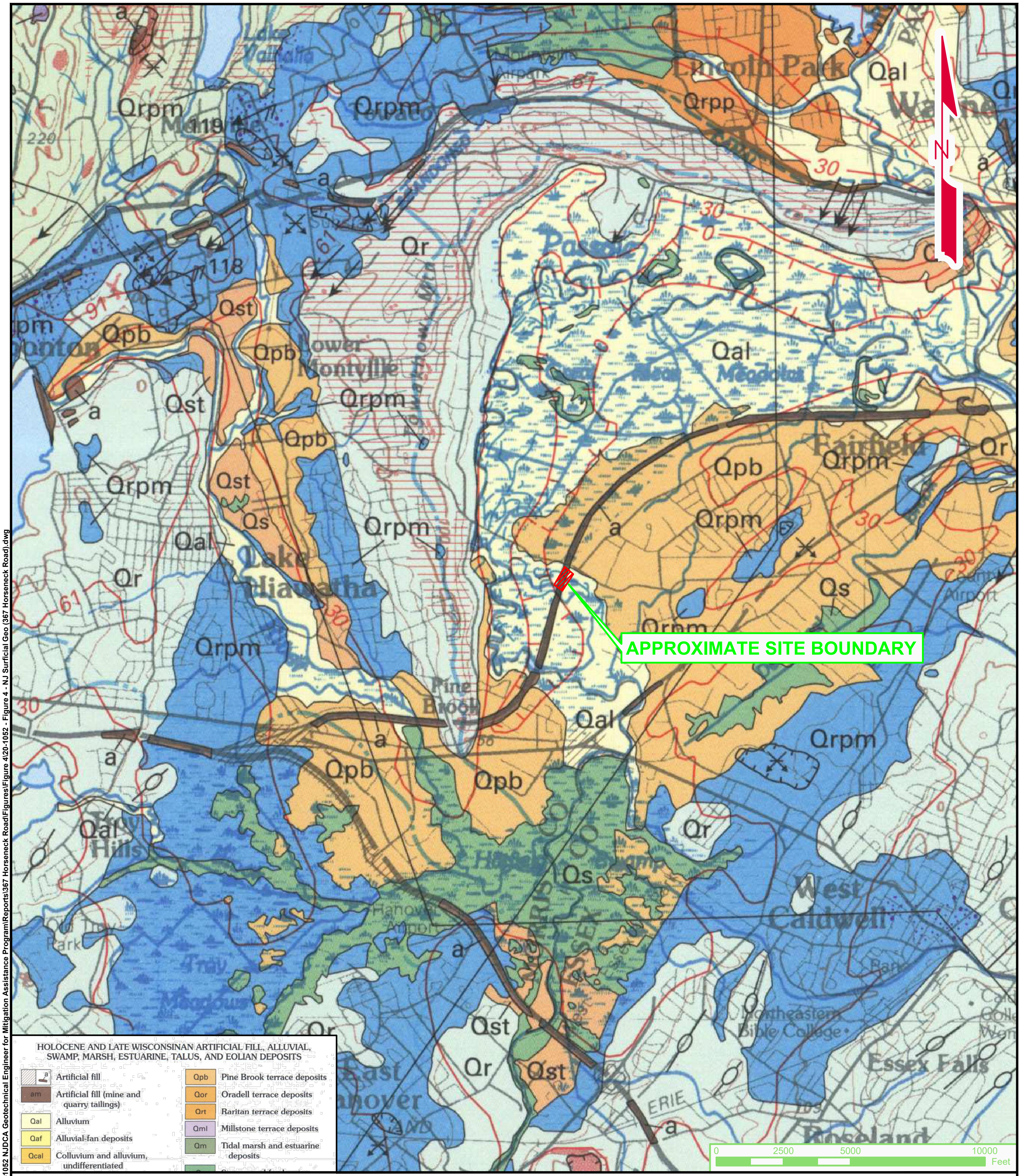

MATRIXNEWORLD
Engineering Progress

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

Tel: 973-240-1800
Fax: 973-240-1818
www.matrixneworld.com


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

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




# SURFICIAL GEOLOGY LOCATION MAP

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

NJ DEPARTMENT OF COMMUNITY AFFAIRS
GEOTECHNICAL AND STRUCTURAL ASSESSMENT REPORT
367 HORSENECK 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: **5/18/21**
PROJECT LOCATION: **Fairfield, NJ** BORING LOCATION: **367 Horseneck Road, North Side of House**
DRILLING EQUIPMENT: **CME 55** ANGLE: **-90.0** DIR.: **------** ELEV.: DATUM: **NAVD88**
DRILLING CONTRACTOR: **Boring Brothers, Inc.** DRILLER: **R. Dollar** 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"** | | | | |
| **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 | 2-4-2-1 (58%) | | S-1: Brown fine SAND and Silt, trace fine Gravel, trace roots, moist (SM) | |
| | | S-2 | SS | 2-4 | 5-3-5-7 (83%) | | S-2: Brown fine SAND, some Silt, trace fine Gravel, moist (SM) | |
| 5 | | S-3 | SS | 4-6 | 7-8-6-5 (17%) | | S-3: Brown fine SAND, some Silt, trace fine Gravel, moist (SM) | |
| | 4" Casing | S-4 | SS | 6-8 | 10-7-7-8 (100%) | | S-4: Orange-Brown cmf SAND, some Silt, trace fine Gravel, wet (SM) | |
| | | S-5 | SS | 8-10 | 10-8-10-5 (100%) | | S-5: Brown cmf SAND, little Silt, trace fine Gravel, wet (SM) | |
| 10 | 4" Casing | S-6 | SS | 10-12 | 9-8-9-10 (100%) | | S-6: Same as Above, wet (SM) | |
| 15 | | S-7 | SS | 15-17 | 5-5-6-8 (46%) | | S-7: Gray mf* SAND, trace Silt, wet (SP-SM)<br>WC: 22.8%, Gravel: 0.0%, Sand: 92%, Fines: 8% | Sieve |
| 20 | | S-8 | SS | 20-22 | 3-5-7-8 (100%) | | S-8: Brown SILT, some fine Sand, slight odor, wet (ML)<br>WC: 22.7%, Gravel: 0.0%, Sand: 34.1%, Fines: 65.9%, <2 μm: 13% | Sieve; Hydrometer |
| 25 | | S-9 | SS | 25-27 | 14-14-17-17 | | S-9: Same as Above, wet (ML) | |
| | | | | | | | 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: **5/18/21**
PROJECT LOCATION: **Fairfield, NJ** BORING LOCATION: **367 Horseneck Road, Northwest Side of Lot**
DRILLING EQUIPMENT: **CME 55** ANGLE: **-90.0** DIR.: **------** ELEV.: DATUM: **NAVD88**
DRILLING CONTRACTOR: **Boring Brothers, Inc.** DRILLER: **R. Dollar** 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"** | | | | |
| **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 | 6-10-10-6 (13%) | | S-1: Brown SILT, some fine Sand, trace of Gravel, moist (ML) | |
| | | S-2 | SS | 2-4 | 2-4-4-6 (54%) | | S-2: Brown-Grey fine SAND and Silt, trace fine Gravel, mottling, moist (SM) | |
| 5 | | S-3 | SS | 4-6 | 7-7-9-8 (100%) | | S-3: Brown fine SAND, some Silt, wet (SM)<br>WC: 22.9%, Gravel: 0.0%, Sand: 76.4%, Fines: 23.6% | Sieve |
| | 4" Casing | S-4 | SS | 6-8 | 11-7-7-7 (100%) | | S-4: Brown cmf SAND, little Silt, little fine Gravel, wet (SM) | |
| | | S-5 | SS | 8-10 | 9-7-8-9 (100%) | | S-5: Brown cmf SAND, little Silt, trace fine Gravel, wet (SM) | |
| 10 | 4" Casing | S-6 | SS | 10-12 | 6-7-8-10 (100%) | | S-6: Same as Above, wet (SM) | |
| 15 | | S-7 | SS | 15-17 | 5-3-5-6 (33%) | | S-7: Grey cmf SAND, trace Silt, trace fine Gravel, wet (SP) | |
| 20 | | S-8 | SS | 20-22 | 5-4-4-6 (54%) | | S-8: Grey fine SAND, little Silt, trace fine Gravel, wet (SM) | |
| 25 | | S-9 | SS | 25-27 | 21-18-17-18 (71%) | | S-9: Grey SILT and fine Sand, trace fine Gravel, wet (ML)<br>WC: 19%, LL: 19, PL: 18, PI: 1 | Atterberg Limits |
| | | | | | | | 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 for Mitigation Assistance Program** DATE: **5/14/2021**

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

TEST PIT LOCATION: **367 Horseneck Road (SE Corner of Building)** DATUM: **NAVD88** TIME FINISHED: **11:30:00 AM**

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 | | Black mf SAND and Silt, some fine Gravel (SM) | |
| | | 12-35 | | Brown medium SAND, some Silt, some fine Gravel (SM) | |
| | | 28-35 | | Top of concrete encountered at 28" bgs, protrudes 2" from the face of the wall and extends 7" downward. | |
| | | | | Bottom of Test pit @ 35 in.<br>Test Pit Backfilled. | |

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

TEST PIT NO.: **TP-16**

# 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

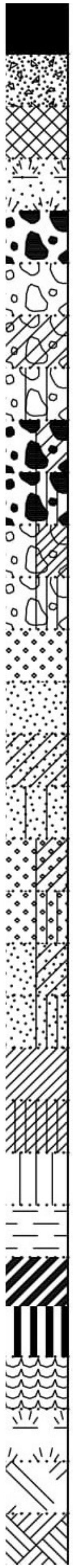
PL = Plastic Limit

LL = Liquid Limit

PI = Plasticity Index

OC = Organic Content

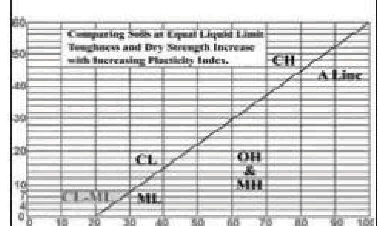
# LOG GRAPHICAL LEGEND



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<br>$C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ 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<br>$C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ 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:<br>Silty sand, gravelly; about 20% hard, angular gravel particles $^{1}/_{2}$-in. maximum size; rounded and subangular sand grains, coarse to fine; about 15% nonplastic fines with low dry strength; well compacted and moist in place; alluvial sand; (SM). | | Not meeting all gradation requirements for SW |
| | | Sands with Fines (Appreciable amount of fines) | SM | Silty sands, sand-silt mixtures. | Nonplastic fines or fines with low plasticity (for identification procedures see ML below). | | | | | Atterberg limits above "A" line or P1 less than 4 — Limits plotting in hatched zone with P1 between 4 and 7 are borderline cases requiring use of dual symbols. |
| | | | SC | Clayey sands, sand-clay mixtures. | Plastic fines (for identification procedures see CL below). | | | | | Atterberg limits above "A" line with Pl greater than 7 |
| Fine-grained Soils More than half of material is smaller than No. 200 sieve size. | | | | | Identification Procedure on Fraction Smaller than No. 40 Sieve Size. | | | | | |
| | | | | | Dry Strength (Crushing Characteristics) | Dilatancy (Reaction to shaking) | Toughness (Consistency near PL) | | | |
| | Silts and Clays Liquid limit is less than 50 | | ML | Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity. | None to slight | Quick to slow | None | For undisturbed soils add information on structure, stratification, consistency in undisturbed and remolded states, moisture and drainage conditions | Plasticity Index | LIQUID LIMIT PLASTICITY CHART<br>For laboratory classification of fine-grained soils<br> |
| | | | 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:<br>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<br>2 mm | No. 30 | No. 60 | No. 200<br>0.076 mm | 0.02 mm |
|---|---|---|---|---|---|---|---|---|
| Granular Component Fractions | GRAVEL: coarse | medium | fine | SAND: coarse | medium | fine | SILT: coarse | fine |
| Clay Soil Components | | | | | | | CLAY-SOIL<br>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 |

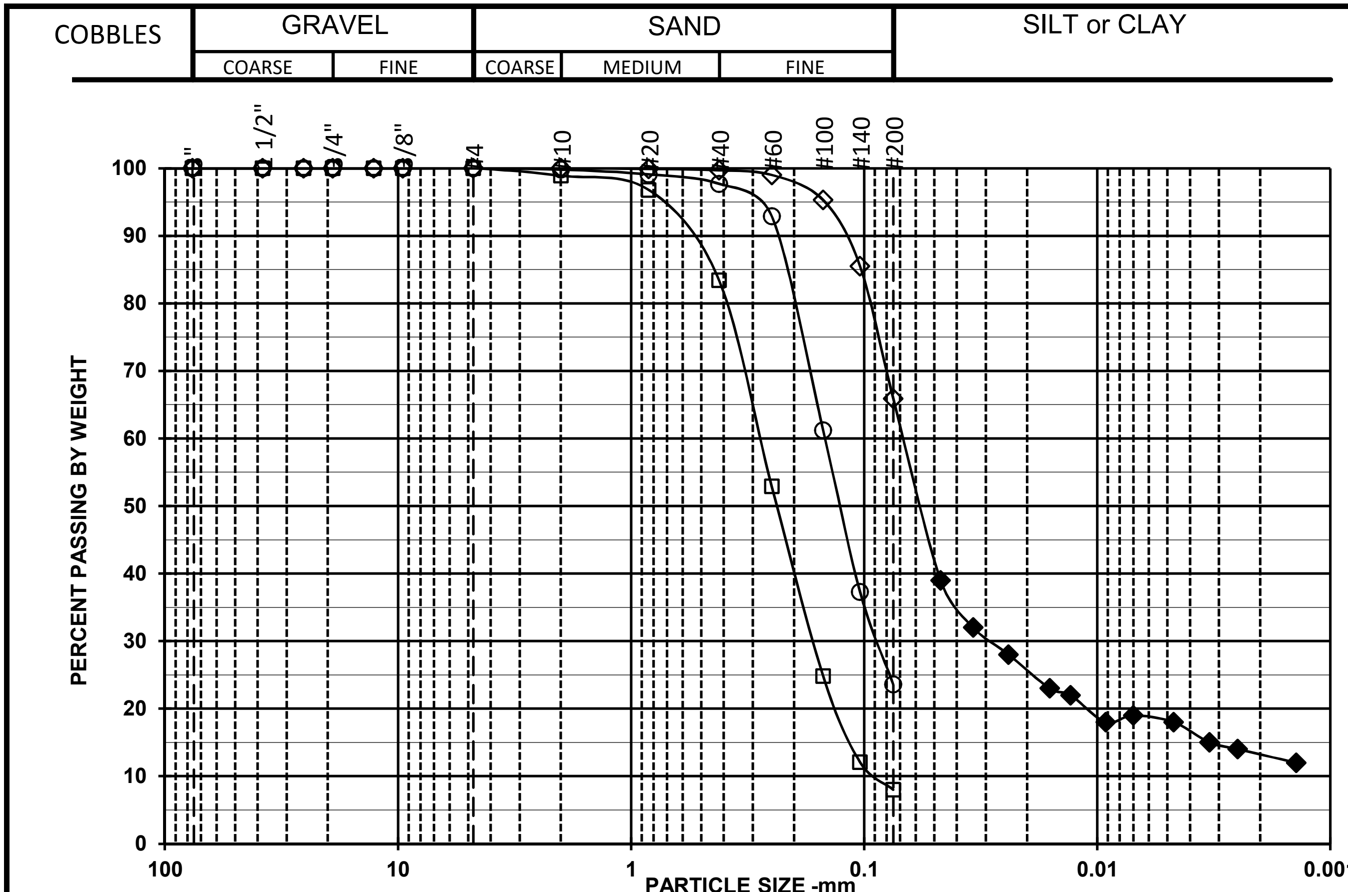
# APPENDIX C

## GEOTECHNICAL LABORATORY TESTING RESULTS

**Matrix New World Engineering, P.C. #20-1052-012**
**NJDCA MAP - 367 Horseneck 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-7 | 15-17 | 22.8 | | | | SP-SM | 8.0 | | |
| B-1 | S-8/S-9 | 20-27 | 22.7 | | | | ML | 65.9 | 13 | |
| B-2 | S-3 | 4-6 | 22.9 | | | | SM | 23.6 | | |
| B-2 | S-9 | 25-27 | 19.0 | 19 | 18 | 1 | ML | | | |
| | | | | | | | | | | |

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-1 | B-2 |
| Sample | S-7 | S-8/S-9 | S-3 |
| Depth | 15-17 | 20-27 | 4-6 |
| % +3" | 0 | 0 | 0 |
| % Gravel | 0 | 0 | 0 |
| % SAND | 92 | 34.1 | 76.4 |
| %C SAND | 1.1 | 0 | 0.2 |
| %M SAND | 15.5 | 0.3 | 2.1 |
| %F SAND | 75.4 | 33.8 | 74.1 |
| % FINES | 8 | 65.9 | 23.6 |
| $D_{100}$ (mm) | 4.75 | 4.75 | 4.75 |
| $D_{60}$ (mm) | 0.281 | 0.068 | 0.147 |
| $D_{30}$ (mm) | 0.16 | 0.029 | 0.087 |
| $D_{10}$ (mm) | 0.088 | | |
| Cc | 1 | | |
| Cu | 3.2 | | |

| Sieve Size/ID # | Percent Finer Data | | |
|---|---|---|---|
| 6" | 100.0 | 100.0 | 100.0 |
| 4" | 100.0 | 100.0 | 100.0 |
| 3" | 100.0 | 100.0 | 100.0 |
| 1 1/2" | 100.0 | 100.0 | 100.0 |
| 1" | 100.0 | 100.0 | 100.0 |
| 3/4" | 100.0 | 100.0 | 100.0 |
| 1/2" | 100.0 | 100.0 | 100.0 |
| 3/8" | 100.0 | 100.0 | 100.0 |
| #4 | 100.0 | 100.0 | 100.0 |
| #10 | 98.9 | 100.0 | 99.8 |
| #20 | 96.8 | 99.9 | 99.1 |
| #40 | 83.4 | 99.7 | 97.7 |
| #60 | 52.9 | 99.0 | 92.9 |
| #100 | 24.8 | 95.3 | 61.2 |
| #140 | 12.1 | 85.5 | 37.3 |
| #200 | 8.0 | 65.9 | 23.6 |
| 5µ m | | 18 | |
| 2µ m | | 13 | |
| 1µ m | | 11 | |

| SYMBOL | w (%) | LL | PL | PI | USCS | AASHTO | USCS DESCRIPTION AND REMARKS | DATE |
|---|---|---|---|---|---|---|---|---|
| □ | 22.8 | | | | SP-SM | | Gray, Poorly graded sand with silt | 06/29/21 |
| ◇ | 22.7 | | | | ML | | Brown, Sandy silt | 06/29/21 |
| ○ | 22.9 | | | | SM | | Brown, Silty sand | 06/29/21 |

**Matrix New World Engineering, P.C.** #20-1052-012

**TerraSense, LLC** #7783-21025

NJDCA MAP
367 Horseneck Road

**PARTICLE SIZE DISTRIBUTION**
**ASTM D6913 & ASTM D7928**

TerraSense Analysis File: GrainSizeV6Rev1a14

Siev1a.xlsx 7/8/2021

## 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<br>[redacted] | | | Policy Number: |
| A2. Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.<br>367 Horseneck Road | | | Company NAIC Number: |
| City<br>Town of Fairfield | State<br>New Jersey | ZIP Code<br>07004-1613 | |

A3. Property Description (Lot and Block Numbers, Tax Parcel Number, Legal Description, etc.)
Block 6001, Lot 2

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

A5. Latitude/Longitude: Lat. N40°52'39" Long. W74°19'34" Horizontal Datum: ☐ NAD 1927 ☒ NAD 1983

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

A7. Building Diagram Number 2A

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

a) Square footage of crawlspace or enclosure(s) 982.00 sq ft

b) Number of permanent flood openings in the crawlspace or enclosure(s) within 1.0 foot above adjacent grade 0

c) Total net area of flood openings in A8.b 0.00 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 N/A

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

d) Engineered flood openings? ☐ Yes ☒ No

## SECTION B – FLOOD INSURANCE RATE MAP (FIRM) INFORMATION

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

| B4. Map/Panel Number | B5. Suffix | B6. FIRM Index Date | B7. FIRM Panel Effective/ Revised Date | B8. Flood Zone(s) | B9. Base Flood Elevation(s) (Zone AO, use Base Flood Depth) |
|---|---|---|---|---|---|
| 34013C0014 | 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. | | | FOR INSURANCE COMPANY USE |
|---|---|---|---|
| Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.<br>367 Horseneck Road | | | Policy Number: |
| City<br>Town of Fairfield | State<br>New Jersey | ZIP Code<br>07004-1613 | 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) | 166.8 | ☒ | ☐ |
| b) Top of the next higher floor | 168.5 | ☒ | ☐ |
| 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) | 166.8 | ☒ | ☐ |
| f) Lowest adjacent (finished) grade next to building (LAG) | 167.3 | ☒ | ☐ |
| g) Highest adjacent (finished) grade next to building (HAG) | 168.6 | ☒ | ☐ |
| h) Lowest adjacent grade at lowest elevation of deck or stairs, including structural support | 167.3 | ☒ | ☐ |

## 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<br>Frank J. Barlowski | License Number<br>24GS03973500 | | Place Seal Here |
| Title<br>Professional Land Surveyor | | | |
| Company Name<br>Matrix New World Engineering, Land Surveying and Architecture, P.C. | | | |
| Address<br>442 State Route 35, Second Floor | | | |
| City<br>Eatontown | State<br>New Jersey | ZIP Code<br>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): Hot Water Heater was on basement floor at Elev = 166.8 (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.<br>367 Horseneck Road | | | Policy Number: |
| City<br>Town of Fairfield | State<br>New Jersey | ZIP Code<br>07004-1613 | 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.<br>367 Horseneck Road | | | Policy Number: |
| City<br>Town of Fairfield | State<br>New Jersey | ZIP Code<br>07004-1613 | 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.<br>367 Horseneck Road | | | Policy Number: |
| City<br>Town of Fairfield | State<br>New Jersey | ZIP Code<br>07004-1613 | Company NAIC Number |

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

Photo One

Photo One Caption Front View

Clear Photo One

Photo Two

Photo Two Caption Rear View

Clear Photo Two

| **IMPORTANT: In these spaces, copy the corresponding information from Section A.** | | | FOR INSURANCE COMPANY USE |
|---|---|---|---|
| Building Street Address (including Apt., Unit, Suite, and/or Bldg. No.) or P.O. Route and Box No.<br>367 Horseneck Road | | | Policy Number: |
| City<br>Town of Fairfield | State<br>New Jersey | ZIP Code<br>07004-1613 | 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 Left Side View

Clear Photo Three

Photo Four

Photo Four Caption Right Side View

Clear Photo Four