

Consulting  
Engineers and  
Scientists

## Geotechnical Report Vessel Residential

446 Hopmeadow Street  
Simsbury, Connecticut

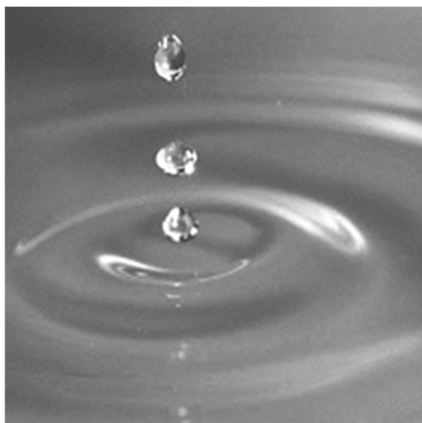
**Submitted to:**

Vessel Technologies, Inc.  
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New York, NY 10019

**Submitted by:**

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December 7, 2022  
Project No. 2203416



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# 1. Introduction

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## 1.1 Project Summary

We understand that the proposed development at 446 Hopmeadow Street will consist of a structure containing eighty (80) prefabricated residential units stacked across three floors. Appurtenant site features include parking areas, access drives, and storm water management basin(s).

This report was prepared to address foundation and site preparation recommendations for the proposed construction.

## 1.2 Scope of Services

Our scope of work included the following tasks:

- Engaged a subcontractor to drill three (3) test borings on the property to depths of 22 feet each.
- Observed soil samples recovered from the test borings and prepared test boring logs.
- Installation of two (2) temporary monitoring wells to depths of 8 feet each.
- Conducted downhole infiltration testing within the temporary wells.
- Engaged a testing laboratory to perform three (3) grain-size analyses on soil samples to verify visual classification and evaluate subsurface conditions regarding infiltration capacity.
- Developed recommendations for site preparation, pavement sections, excavation, backfill, seismic design, lateral wall pressures, foundation design, infiltration rate, and construction considerations.
- Prepared this *Geotechnical Report*.

## 1.3 Authorization

Our work was performed in general accordance with our proposal dated June 30, 2022, and the resulting Standard Professional Services agreement.

## **2. Site and Project Description**

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### **2.1 Site Description and History**

The property slated for development is an approximate 1.95-acre parcel known by Town records as 446 Hopmeadow Street in Simsbury, Connecticut. The site is bounded by Hopmeadow Street (Route 202) to the west, the Farmington River and wooded land to the east, and residential property to the north and south.

The west side of the site is occupied with a one-story residential dwelling. The remaining extents of the property consist of paved drives, maintained grass, or wooded areas. Based on provided conceptual information, the property slopes downward to the east towards the Farmington River by a total of about 10 feet.

### **2.2 Proposed Construction**

Our current understanding of the project is based on the limited information provided to GEI as shown on drawing “CSP-1” dated 8/23/2022, as detailed below, and information provided for previous similar Vessel buildings.

We understand that the project involves construction of a three-story residential building consisting of stacked prefabricated units with a footprint of 13,289-sf. We also understand that the structure will likely be founded on a series of grade beams supporting load bearing walls and an elevated cold-formed metal panel floor. Based on existing site grades, absent a grading plan, we expect cuts and fills of up to about 5 feet will be required.

Concept plans provided to GEI show construction of 96 parking spaces to support the development along the north side of the parcel, with a new entrance from Hopmeadow Street. Stormwater management basins are to be constructed to the east and/or west of the building.

## **3. Exploration Procedures**

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### **3.1 Test Borings**

The boring locations were laid out on the site from the provided conceptual plan using handheld GPS. Borings were located in accessible areas within the proposed building footprint. Approximate boring locations relative to the property boundary and conceptual site plan are shown on Figure 1.

Three (3) soil test borings (B-1 through B-3) were performed at the site on September 14, 2022, by New England Boring Contractors, under subcontract to GEI. The appropriate one-call utility location service (Call Before You Dig) was contacted prior to our arrival. All borings were advanced to depths of 22 feet using hollow-stem augering techniques and a track-mounted drilling rig. Boring logs are attached in Appendix A.

Standard Penetration Testing (SPT) and split-spoon sampling were performed continuously through the upper 8 feet of the borings and at 5-foot intervals thereafter using a 140-pound automatic hammer. Representative samples of the soils obtained by the sampler were classified by the on-site GEI engineer. The samples were placed in appropriately identified sealed glass jars and transported to our office for laboratory assignment. Borings were backfilled with drill cuttings upon completion.

### **3.2 Monitoring Well Installation**

Two (2) temporary PVC wells (MW-1 and MW-2) were installed within areas labeled as potential stormwater management areas on the concept plan. Well installation logs are attached in Appendix A for reference.

Falling-head infiltration measurements were conducted within the wells, the results of which are attached in Appendix D.

### **3.3 Laboratory Testing**

Laboratory testing was conducted on representative soil samples to confirm field identification of the soils and establish engineering characteristics for design. Tests performed by GeoTesting Express, under subcontract to GEI, included the following:

- Three (3) grain-size analysis with standard sieve set (ASTM D6913)
- Three (3) moisture content analyses (ASTM D2216)

Results of the laboratory testing program are included in Appendix B.

## 4. Subsurface Conditions

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### 4.1 Geologic Setting

Based on observations and published mapping, the eastern portion site appears to lie on an alluvial flood plain of the Farmington River underlain by interbedded silts and clays. Moving upland to the west, though data is limited, this part of the site is likely underlain by sand to gravelly sand.

### 4.2 Subsurface Conditions

The generalized subsurface conditions at the site are described below, in order of increasing depth. The subsurface conditions between boring locations may differ. The nature and extent of variations between the sampling points will not become evident until construction.

In particular, drill cuttings observed during installation of well MW-1 were significantly coarser than those observed elsewhere on site. Though no samples were obtained at this location, it appears that upland portions of the site, above about El. +178 feet, are likely underlain by sand to gravelly sand.

**Topsoil** – Topsoil thickness at the boring locations was measured as about 9 to 10 inches.

**Alluvial Clays** – Thinly layered deposits of fine-grained clays and silts were observed beneath the topsoil layer and continuing to termination depth of the borings. Samples were generally noted as having 90 to 95 percent non-plastic to low-plasticity cohesive fines. Evident of recent alluvial floodplain soils, minor to moderate proportions of organic fibers were noted in borings B-2 and B-3 to depths of up to 8 feet below current grade.

Below the near-surface soils, Standard Penetration Test (SPT) N-values typically ranged between 9 to 15 blows/foot, indicating stiff conditions, softening to between 4 and 9 blows/foot below groundwater.

### 4.3 Groundwater Conditions

Free groundwater was not observed in the borings or wells. However, wet samples were noted at depths of approximately 10 to 15 feet. We note that fine-grained deposits exhibit very slow infiltration and recharge rates. Therefore, groundwater may be present within these soils, that could be described as wet or saturated, but not observed as free water within boreholes until several hours after the hole is opened. The groundwater conditions during earthwork will be highly reflective of seasonal patterns. In addition, as is typical of alluvial



soils, we expect groundwater to be present largely within well-draining silty to sandy seams present within the overall soil formation.

Groundwater levels are subject to seasonal and weather-related variations. Groundwater measurements made at different times and different locations may be significantly different than the measurements taken as part of this investigation.

## 5. Design Recommendations

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### 5.1 General Suitability

The fine-grained clays and silts encountered beneath the primary development area are suitable for this scale of development, so long as they properly handled and addressed during construction, as discussed further below. The primary issue associated with these soils will be subgrade softening and general workability if they are allowed to become wet, as well as long-term susceptibility to frost heave and drainage issues. These soils also can be expected to exhibit poor long term drainage characteristics.

### 5.2 Foundation Design

The proposed structure may be supported on shallow foundations bearing on a subgrade consisting of fine-grained natural soils or compacted structural fill. We caution that these soils will be highly susceptible to moisture disturbance, so protection of exposed subgrades will be critical.

As shown on conceptual plans, we recommend that proposed grade beams bear on a minimum 6-inch working pad of crushed stone wrapped on the sides by a geotextile fabric, placed over a soil subgrade, soon after exposure, prepared in accordance with Section 6.1. This will serve to protect subgrades and improve expediency of foundation construction. Crushed Stone meeting the specifications in Appendix C may be considered non-frost susceptible. We recommend that all footing subgrades be evaluated by a GEI representative prior to concrete placement.

The maximum allowable bearing pressures for the design of footings are:

**Table 1: Allowable Bearing Pressure**

| <b>Bearing Stratum</b>                     | <b>Net Allowable Bearing Pressure</b> |
|--|---------------------------------------|
| Crushed Stone over Clay or Structural Fill | 2,500 lb/ft <sup>2</sup>              |

Minimum individual column footing and wall footing widths should be at least 36 and 18 inches, respectively. Exterior footings should bear at least 3½ feet below the adjacent exterior grade for frost protection. Interior footings should be founded at least 18 inches below the bottom of the floor slab. The tops of all footings should be at least 6 inches below the bottom of the overlying floor slab.

### 5.3 Settlement

We understand structure loads on the 18-inch-wide grade beams will be on the order of 3.5 kips/ft. Assuming the design and construction recommendations herein are followed, we estimate total settlement of the building will be less than 1 inch, and differential settlement will be less than ½ inch. We expect nearly all expected settlements will occur during construction or soon after.

### 5.4 Seismic Design

The 2022 edition of the Connecticut Building Code document mirrors the 2021 International Building Code, with exception of the revisions and supplemental information provided by state building officials.

Based on the criteria of Building Code Section 1613.3.2 and the SPT N-values measured on site, we recommend the use of Site Class D for seismic design. The Site Class was used in conjunction with the seismic hazard ( $S_s$ ,  $S_1$ ) for this location to determine spectral design values, as follows:

**Table 2: Seismic Design Values**

| <b>2022 Connecticut Building Code</b>                            |         |
|--|---------|
| $S_s$  | 0.177 g |
| $S_1$  | 0.054 g |
| $S_{Ds}$   | 0.189 g |
| $S_{D1}$   | 0.087 g |
| $PGAM$   | 0.150 g |
| <b>Seismic Design Category<br/>(Risk Category I, II, or III)</b> | B       |

We calculated the spectral response parameters for the site using general procedures outlined in Building Code Section 1613.3. Peak ground acceleration ( $PGAM$ ) is adjusted for Site Class effects, per ASCE 7-10 Section 11.8.3.

The soils below the foundation level at this site are not considered susceptible to liquefaction.

### 5.5 Lateral Earth Pressures

If required for the project, all earth retaining structures should be designed using the earth pressures shown in Table 3. Note that no factor of safety has been applied to these values. Below-grade walls that are restrained from movement should be designed for at-rest earth

pressures. Retaining walls free to rotate at the top should be designed for active earth pressures. In addition to the lateral loads exerted by the soil against the walls, allowance should be included for lateral stresses imposed by any temporary or long-term surcharge loads, such as cars or trucks adjacent to the walls or adjacent footing loads.

We caution that natural soils underlying most of the site can be considered poor-draining and must be replaced behind any retaining walls used on the project to, at minimum, within the active zone behind the wall and replaced with granular Structural Fill.

**Table 3: Wall Design Parameters**

| <b>Material</b> | <b>Total Unit Weight (<math>\gamma</math>, pcf)</b> | <b>Friction Angle (<math>\Phi</math>)</b> | <b>Cohesion (c)</b> | <b>At-Rest Earth Pressure Coeff (<math>K_o</math>)</b> | <b>Active Earth Pressure Coeff, (<math>K_a</math>)</b> | <b>Passive Earth Pressure Coeff, (<math>K_p</math>)</b> |
|-----------------|---|---|---------------------|--|--|---|
| Structural Fill | 125   | 34°                                       | 0                   | 0.44   | 0.28   | 3.00  |

We recommend limiting the passive pressure coefficient to 3.00 as shown above, due to the relatively high movement required to fully engage passive resistance. The minimum factors of safety for sliding and overturning under static loads should be 1.5 and 2.0, respectively. An allowable coefficient of friction of 0.40 between the grade beam and crushed stone over granular bearing soil may be assumed.

The recommended wall design parameters do not consider the development of hydrostatic pressure behind the walls. As such, positive wall drainage must be provided for all earth retaining structures. These drainage systems can be constructed of open-graded washed stone isolated from the soil backfill with a geosynthetic filter fabric and drained by perforated pipe, or several wall drainage products made specifically for this application. Where backfill soils are not drained using an appropriately designed drainage system, the lateral soil pressure on proposed retaining walls must consider hydrostatic forces and submerged soil unit weight.

The earth pressures given in Table 3 assume placement and compaction of the backfill in accordance with recommendations elsewhere in this report. Compact backfill directly behind walls with light, hand-operated compactors. Heavy compactors and grading equipment should not be allowed to operate within 10 feet of the walls during backfilling to avoid developing excessive temporary or long-term lateral soil pressures.

## **5.6 Pavement Design**

Native fine-grained soils similar to those encountered on the site are considered to be highly susceptible to frost heave and drainage issues. To mitigate this risk, we recommend including a relatively free-draining subbase course under the stone base and pavement

section, as noted below. Pavement subgrades should be prepared in accordance with Section 6.1.

The tenant parking area may be designed with light-duty pavements, while those areas expected to receive repeated truck traffic, such as dumpster pads, should be designed as a rigid pavement section. We recommend the following pavement sections for these areas:

Light-Duty Parking Area

3.0 inches bituminous concrete

- 1.5 inches wearing course (CTDOT Form 818 Class 2 or Superpave HMA S0.5)
- 1.5 inches binder course (CTDOT Form 818 Class 1 or Superpave HMA S1.0)

6.0 inches of processed aggregate base (CTDOT Form 818 M05.01)

6.0 inches of compacted gravel subbase (CTDOT Form 818 M.02.06, Grading B)

Heavy-Duty Rigid Concrete Section

6.0 inches of 4,000-psi jointed concrete (CTDOT M.03.01 Portland Cement)

6.0 inches of processed aggregate base (CTDOT Form 818 M05.01)

6.0 inches of compacted gravel subbase (CTDOT Form 818 M.02.06, Grading B)

Recommended pavement sections are based on AASHTO Guide for Design of Pavement Structures (1993) and ACI 330R. Pavement materials should conform with and be placed in accordance with the *Connecticut Department of Transportation (CTDOT) Standard Specifications for Road, Bridges, and Incidental Construction (Form 818), 2020*.

CTDOT Standard Specifications (form 818) allow for the use of recycled materials as Processed Aggregate Base under M.05.01. If recycled base is to be considered under pavement sections, we recommend that it be compliant with requirements of M.05.01-2 and that the material be tested for LA Abrasion. Subject to the results of this testing, recycled base may be suitable for use on this project.

Rigid pavement sections should be designed and constructed in accordance with appropriate American Concrete Institute (ACI) recommendations and with the applicable specifications of the CTDOT Standard Specifications. An adequate number of smooth steel dowels should be provided at all control and construction joints. All dowels should be coated and lubricated and affixed with metal or plastic caps. The size and spacing of dowels should conform to recommendations in ACI 330R. All joints should also be sealed with a flexible fuel resistant sealer to minimize surface water infiltration into the prepared base.

According to AASHTO design guidelines, the recommended pavement sections shown above are suitable for a 20-year design life. However, pavement maintenance such as sealing

of cracks and localized patching due to normal weathering should be expected within the first 5 to 10 years of life.

## 5.7 Subsurface Drainage Design

It is our understanding that stormwater will likely be managed using detention basins. Based on preliminary site plans provided to us, up to two detention basins will be constructed to the east and/or west of the building.

Based on the results of this investigation, the proposed east basin would be founded in moderately slow-draining clays and silts while the west basin would be founded in highly permeable sands. Though no samples were taken, drill cuttings during installation of well MW-1 were classified as fine to medium-grained sand with minor silt content.

Hydraulic conductivities at the monitoring well locations (MW-1 and MW-2) were estimated using downhole falling-head field measurements and published equations for borehole permeability, which are attached in Appendix D.

For the west basin, though the field-measured data indicate infiltration rates of over 100 inches/hour, we recommend assuming an infiltration rate of **40.0 inches/hour** for stormwater system design. For the east basin, we recommend assuming an infiltration rate of **4.0 inches/hour**.

Per CT DEEP regulations, a factor of safety of 2.0 must be applied to these values for design.

## 5.8 Site Slopes

We recommend that all cut and fill slopes on the project be constructed at grades no steeper than 2H:1V. Suitable erosion protection should be established as quickly as possible following construction of slopes.

## **6. Construction Considerations**

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### **6.1 Subgrade Preparation**

#### **6.1.1 General**

To prepare the site for grading operations, topsoil, organic matter, and other deleterious material should be stripped from the building and site improvement areas. Soft, wet, loose, or otherwise un-suitable soils should be removed and replaced, or potentially re-compacted in-place.

We caution that most existing in-place soils will be very sensitive to disturbance from construction equipment, especially during or immediately following periods of inclement weather. Conditions could temporarily become excessively muddy and unstable during these times.

#### **6.1.2 Demolition**

All existing structures should be removed in their entirety from within the building footprint and the area backfilled with compacted Structural Fill to finished grade. Where existing structures fall at least 10 feet from the exterior line of building footings, below-grade portions of these structures may remain in place. However, where this occurs below new pavements, below-grade structural features should be cut off at least 2 feet below the pavement base course, to reduce the potential for a hard spot developing.

Existing utilities to remain in use should be rerouted around the proposed building footprint. If not removed, any pipes over 3 inches in diameter should be filled with flowable fill or grout. Otherwise, these pipes may serve as conduits for subsurface erosion resulting in formation of voids below foundations or floor slabs. Where existing utilities are left in place and plugged in the building footprint, it may be necessary to undercut poorly compacted backfill to provide adequate support for footings or slabs.

#### **6.1.3 Pavements**

Following the required stripping, excavation to rough grade, and before placing new fill to achieve design grades, the resulting subgrade should be firm, stable, and unyielding. Stabilization, where required, may consist of removing unsuitable material and replacement with compacted structural fill, or where unsuitable soils are relatively thin, drying and compacting in place.

Fine-grained soil subgrades (silt and clay) should be protected with the subbase course soon after exposure, particularly if inclement weather is forecast. Stone compaction should be

conducted using small rollers without vibratory action. Use of large rollers or vibratory action is likely to soften the subgrade and necessitate re-placement of the stone. Excavation and compaction within these soils should not be performed during inclement weather.

Coarse-grained sand and gravelly subgrades, if/where encountered on the upland western portions of the site, should be proof-rolled with at least four (4) passes of a minimum 10-ton vibratory roller in open areas, or a 1-ton vibratory roller or large plate compactor, such as Wacker DPU4545 or equivalent, in trenches.

### **6.1.3 Foundations**

Footings should bear on a subgrade consisting of native fine-grained soils or compacted structural fill. Bearing surfaces should be free of standing water, frost, and loose soil before placement of reinforcing steel and concrete.

Final excavation to foundation subgrade should be conducted with a smooth-edged bucket to reduce soil disturbance. As shown on conceptual plans, we recommend that the grade beams bear on a minimum 6-inch working pad of crushed stone wrapped on the sides by a geotextile fabric, placed over an approved soil subgrade. This will serve to protect subgrades and improve expediency of foundation construction. Crushed Stone meeting the specifications in Appendix C may be considered non-frost susceptible.

## **6.2 Excavation and Dewatering**

Excavations can be accomplished with conventional earthmoving equipment. Excavations should be sloped or shored in accordance with the local, state, and federal regulations, including Occupational Safety and Health Agency (OSHA 29 CFR Part 1926) excavation trench safety standards.

Based on the investigation results, groundwater intrusion should not be a significant hindrance to most site construction. However, if encountered, dewatering for foundation and utility construction could likely be accomplished with filtered sumps and pumps located outside the footing or trench excavations.

## **6.3 Freezing Conditions**

The native soils that will form the subgrades for grade slabs, footings, and pavements can be expected to have a moderate to high susceptibility to frost.

All subgrades should be free of frost before placement of concrete. Frost-susceptible soils that have frozen should be removed and replaced with compacted Structural Fill. The footing and the soil adjacent to the footing should be insulated until they are backfilled. Soil placed as fill should be free of frost, as should the ground on which it is placed.



If slabs-on-grade or footings are built and left exposed during the winter, precautions should be taken to prevent freezing of the underlying soil.

## **6.4 Backfilling and Compaction**

Recommended specifications for gradation and compaction of backfill soils are provided in the attached recommended Material Specifications (Appendix C).

The natural fine-grained, brown clays and silts referenced in Section 5.1 are not suitable for re-use as Structural Fill on the project due to their high fines content. These soils, where excavated, should be “wasted” on non-structural areas of the project or removed from the site.

Though data is limited at this time, suitable granular soils might be obtained from upland areas of the site, including, potentially, the western stormwater basin shown on concept plans. If native sands and gravels are encountered and excavated as part of earthwork activities they can possibly be re-used on site as Structural Fill or Ordinary Fill, provided they do not contain oversize, organic, or otherwise deleterious material and can meet the appropriate compaction requirements.

Fill imported from off site should meet the attached gradation requirements. Fill placed within the building limits, within a 3-foot-wide zone outside foundation walls, under pavements, and behind retaining walls should meet the compaction requirements for Structural Fill. Backfill placed in non-structural areas should meet the compaction requirements for Ordinary Fill. Proposed borrow materials that fall slightly outside of these specifications may also be suitable for use, subject to review and approval by GEI.

## **7. Closure**

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### **7.1 Follow-on Services**

We recommend that GEI be kept on the project through the final design and construction phases for the following services:

- Review geotechnical-related contractor submittals and assist in developing responses to questions from the contractor (i.e. RFI's).
- Provide periodic site visits during construction to view subgrades and consult on geotechnical-related issues that occur.

### **7.2 Limitations**

This report was prepared for the use of the project team, exclusively. Our recommendations are based on the project information provided to us at the time of this report and may require modification if there are any changes in the nature, design, or location of the proposed building. We cannot accept responsibility for designs based on our recommendations unless we are engaged to review the final plans and specifications to determine whether any changes in the project affect the validity of our recommendations, and whether our recommendations have been properly implemented in the design.

Our professional services for this project have been performed in accordance with generally accepted engineering practices. No warranty, expressed or implied, is made.

## Figures

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# Appendix A

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## Boring and Monitoring Well Logs

# BORING

## B-1

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### BORING INFORMATION

LOCATION: See Boring Location Plan.

GROUND SURFACE EL. (ft): 173

VERTICAL DATUM:

TOTAL DEPTH (ft): 22.0

LOGGED BY: B. Akereyeni & R. Perryman

DATE START/END: 9/14/2022 - 9/14/2022

DRILLING COMPANY: New England Boring

DRILLER NAME: Anthony McKernan

RIG TYPE:

### DRILLING INFORMATION

HAMMER TYPE: Automatic

AUGER I.D./O.D.: 4.25 inch / NA

DRILLING METHOD: Hollow Stem Auger

WATER LEVEL DEPTHS (ft): 9/14/2022 Not encountered

CASING I.D./O.D.: NA / NA

DRILL ROD O.D.: NM

CORE BARREL TYPE:

CORE BARREL I.D./O.D. NA / NA

### ABBREVIATIONS:

Pen. = Penetration Length  
 Rec. = Recovery Length  
 RQD = Rock Quality Designation  
 = Length of Sound Cores > 4 in / Pen., %  
 WOR = Weight of Rods  
 WOH = Weight of Hammer

S = Split Spoon Sample  
 C = Core Sample  
 U = Undisturbed Sample  
 SC = Sonic Core  
 DP = Direct Push Sample  
 HSA = Hollow-Stem Auger

Qp = Pocket Penetrometer Strength  
 Sv = Pocket Torvane Shear Strength  
 LL = Liquid Limit  
 PI = Plasticity Index  
 PID = Photoionization Detector  
 I.D./O.D. = Inside Diameter/Outside Diameter

NA, NM = Not Applicable, Not Measured  
 Blows per 6 in.: 140-lb hammer falling  
 30 inches to drive a 2-inch-O.D.  
 split spoon sampler.

| Elev. (ft) | Depth (ft) | Sample Information |            |                |                        | Drilling Remarks/<br>Field Test Data | Layer Name | Soil and Rock Description   |  |
|------------|------------|--------------------|------------|----------------|------------------------|--------------------------------------|------------|---|--|
|            |            | Sample No.         | Depth (ft) | Pen./Rec. (in) | Blows per 6 in. or RQD |                                      |            |   |  |
| 170        | 5          | S1                 | 0 to 2     | 24/15          | 2-2-2-3                |                                      | CLAY       | S1A (0-10"): CLAYEY SAND WITH GRAVEL (SC); ~60% F sand, ~25% NP fines, ~15% F-C gravel, frequent organic fibers, brown, damp. TOPSOIL |  |
|            |            | S2                 | 2 to 4     | 24/14          | 5-6-5-7                |                                      |            | S1B (10-15"): LEAN CLAY (CL); ~95% NP-LP fines, ~5% F sand, brown, damp.  |  |
|            |            | S3                 | 4 to 6     | 24/24          | 5-6-7-7                |                                      |            | S2: LEAN CLAY WITH SAND (CL); 92.2% LP fines, 7.5% F-M sand, 0.3% F gravel, brown, moisture=32.3%.                                    |  |
|            |            | S4                 | 6 to 8     | 24/17          | 6-7-8-9                |                                      |            | S3: Similar to S1B .  |  |
| 160        | 10         | S5                 | 10 to 12   | 24/15          | 5-5-5-12               |                                      |            | S4: Similar to S1B, layer of silt and F-C sand from 2"-6", moist  | S5: SANDY LEAN CLAY (CL); ~70% NP-MP fines, ~30% v. F sand, wet at 5". |
|            |            | S6                 | 15 to 17   | 24/19          | 3-4-3-3                |                                      |            | S6: Similar to S1B, wet.  |  |
| 150        | 20         | S7                 | 20 to 22   | 24/20          | 2-2-2-4                |                                      |            | S7: Similar to S1B, wet.  | End of boring at 22'. Planned Extent. Backfilled with drill cuttings   |

### NOTES:

PROJECT NAME: Vessel - Simsbury

CITY/STATE: Simsbury, Connecticut

GEI PROJECT NUMBER: 2203416



GEI WOBURN STD 1-LOCATION-LAYER NAME\_VESSEL\_SIMSBURY.GPJ\_GEI DATA TEMPLATE 2013.GDT 12/6/22

# BORING

## B-2

PAGE 1 of 1

### BORING INFORMATION

LOCATION: See Boring Location Plan.

GROUND SURFACE EL. (ft): 175

DATE START/END: 9/14/2022 - 9/14/2022

VERTICAL DATUM:

DRILLING COMPANY: New England Boring

TOTAL DEPTH (ft): 22.0

DRILLER NAME: Anthony McKernan

LOGGED BY: B. Akereyeni & R. Perryman

RIG TYPE:

### DRILLING INFORMATION

HAMMER TYPE: Automatic

CASING I.D./O.D.: NA / NA

CORE BARREL TYPE:

AUGER I.D./O.D.: 4.25 inch / NA

DRILL ROD O.D.: NM

CORE BARREL I.D./O.D.: NA / NA

DRILLING METHOD: Hollow Stem Auger

WATER LEVEL DEPTHS (ft): 9/14/2022 Not encountered

### ABBREVIATIONS:

Pen. = Penetration Length  
 Rec. = Recovery Length  
 RQD = Rock Quality Designation  
 = Length of Sound Cores > 4 in / Pen., %  
 WOR = Weight of Rods  
 WOH = Weight of Hammer

S = Split Spoon Sample  
 C = Core Sample  
 U = Undisturbed Sample  
 SC = Sonic Core  
 DP = Direct Push Sample  
 HSA = Hollow-Stem Auger

Qp = Pocket Penetrometer Strength  
 Sv = Pocket Torvane Shear Strength  
 LL = Liquid Limit  
 PI = Plasticity Index  
 PID = Photoionization Detector  
 I.D./O.D. = Inside Diameter/Outside Diameter

NA, NM = Not Applicable, Not Measured  
 Blows per 6 in.: 140-lb hammer falling  
 30 inches to drive a 2-inch-O.D.  
 split spoon sampler.

| Elev. (ft)   | Depth (ft) | Sample Information |            |                |                        | Drilling Remarks/<br>Field Test Data | Layer Name | Soil and Rock Description  |
|--|------------|--------------------|------------|----------------|------------------------|--------------------------------------|------------|--|
|  |            | Sample No.         | Depth (ft) | Pen./Rec. (in) | Blows per 6 in. or RQD |                                      |            |  |
| 170  | 5          | S1                 | 0 to 2     | 24/19          | 1-1-1-1                |                                      | CLAY       | S1A (0-9"): CLAYEY SAND (SC); ~60% F-C sand, ~35% NP fines, ~5% F-C gravel, organic fibers, dark brown, damp. TOPSOIL<br>S1B (9-19"): LEAN CLAY WITH SAND (CL); ~85% NP-LP fines, ~10% F sand, ~5% F-C gravel, brown, damp.<br>S2: LEAN CLAY (CL); ~90% NP-LP fines, ~10% F-sand, lauer of F-M sand at 8-10", brown, damp. |
|  |            | S2                 | 2 to 4     | 24/17          | 3-5-6-6                |                                      |            | S3: LEAN CLAY (CL); 94.9% fines, 5.1% F sand, brown, moist.  |
|  |            | S3                 | 4 to 6     | 24/22          | 5-4-5-6                |                                      |            | S4: Similar to S3, few organic fibers.   |
|  |            | S4                 | 6 to 8     | 24/15          | 6-7-6-7                |                                      |            |  |
|  |            | S5                 | 10 to 12   | 24/20          | 3-4-4-5                |                                      |            | S5: Similar to S3, with red.   |
|  |            | S6                 | 15 to 17   | 24/24          | 2-2-2-2                |                                      |            | S6: Similar to S3, reddish brown, wet.   |
|  |            | S7                 | 20 to 22   | 24/22          | 3-2-3-4                |                                      |            | S7: Similar to S3, layer of silt and F sand at top 0-2".   |
| End of boring at 22'. Planned Extent. Backfilled with drill cuttings |            |                    |            |                |                        |                                      |            |  |

### NOTES:

PROJECT NAME: Vessel - Simsbury

CITY/STATE: Simsbury, Connecticut

GEI PROJECT NUMBER: 2203416



GEI WOBURN STD 1-LOCATION-LAYER NAME\_VESSEL\_SIMSBURY.GPJ\_GEI DATA TEMPLATE 2013\_GDT\_12/6/22





# Monitoring Well Installation Log

# MW-1

**Project** Vessel Residential Simsbury  
**City / Town** 466 Hopmeadow Street, Simsbury  
**Client** Vessel Technologies  
**Contractor** New England Boring Contractors  
**Driller** A. McKernan **GEI Rep.** B. Akereyeni & R. Perryman

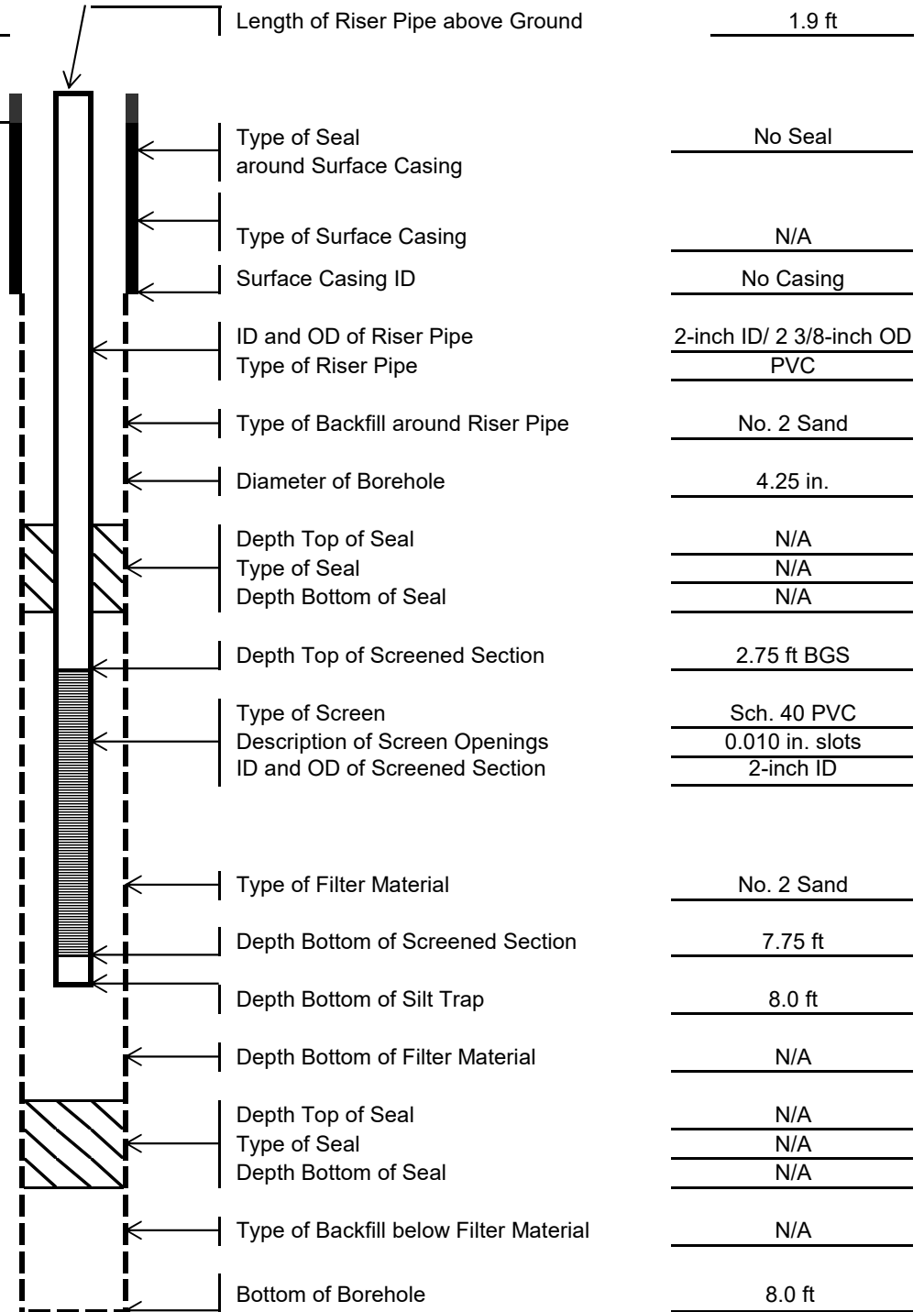
**GEI Proj. No.** 2203416  
**Location** West of Proposed Building  
**Install Date** 9/14/2022

**Survey**

**Datum:** N/A

**Ground**

**Elevation:** 178



|                                     |                 |
|-------------------------------------|-----------------|
| Date                                | 9/14/2022       |
| Time                                | -               |
| Distance to GW below ground surface | Not Encountered |

**Notes:** No survey information available at time of well installation.



# Monitoring Well Installation Log

# MW-2

**Project** Vessel Residential Simsbury  
**City / Town** 466 Hopmeadow Street, Simsbury  
**Client** Vessel Technologies  
**Contractor** New England Boring Contractors  
**Driller** A. McKernan **GEI Rep.** B. Akereyeni & R. Perryman

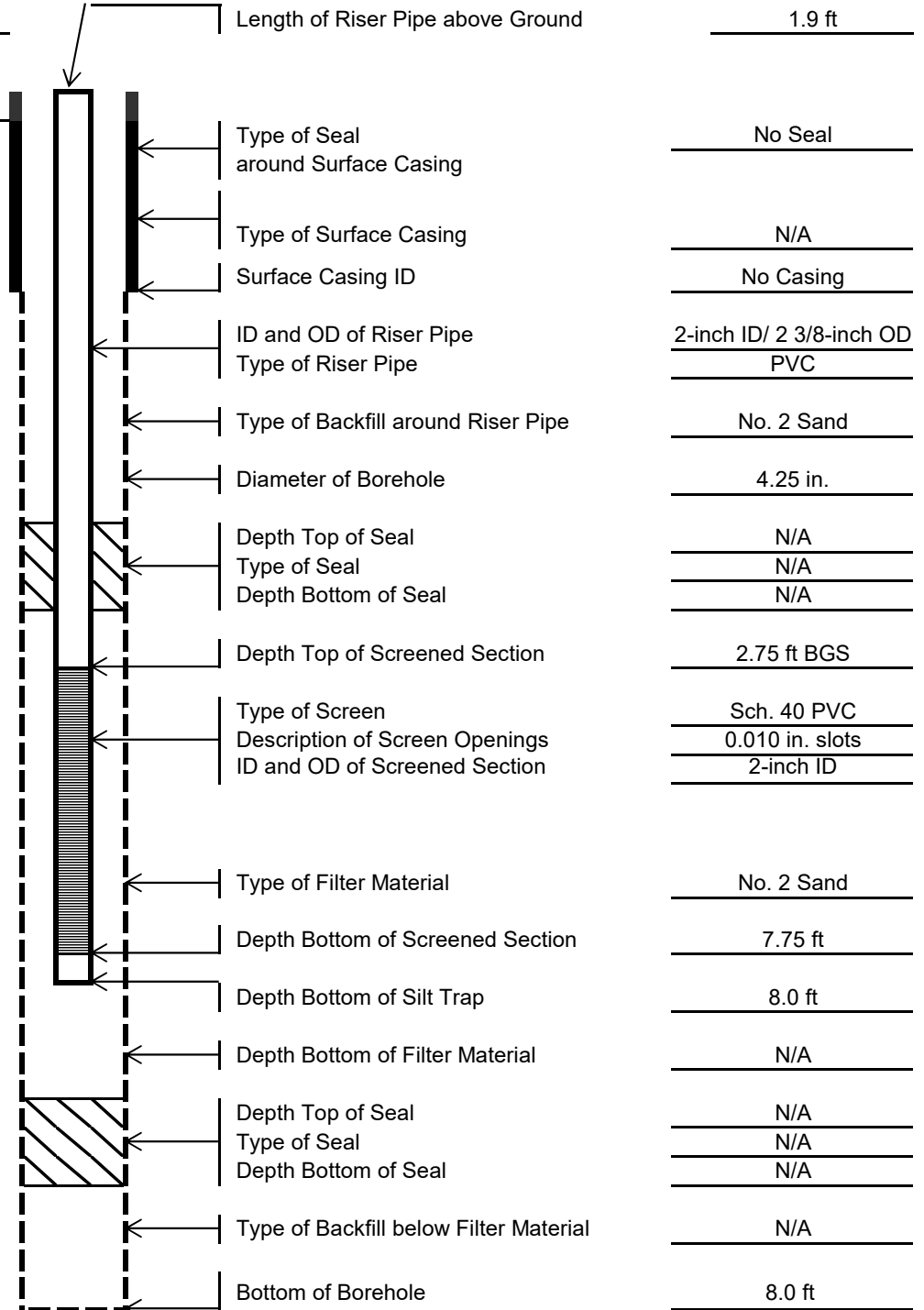
**GEI Proj. No.** 2203416  
**Location** East of Proposed Building  
**Install Date** 9/14/2022

**Survey**

**Datum:** N/A

**Ground**

**Elevation:** 175



|                                     |                 |  |  |
|-------------------------------------|-----------------|--|--|
| Date                                | 9/14/2022       |  |  |
| Time                                | -               |  |  |
| Distance to GW below ground surface | Not Encountered |  |  |

**Notes:** No survey information available at time of well installation.



## **Appendix B**

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### **Laboratory Test Results**



|            |                       |              |            |
|------------|-----------------------|--------------|------------|
| Client:    | GEI Consultants, Inc. |              |            |
| Project:   | Vessel Simsbury       |              |            |
| Location:  | Simsbury, CT          | Project No:  | GTX-316175 |
| Boring ID: | ---                   | Sample Type: | ---        |
| Sample ID: | ---                   | Test Date:   | 10/04/22   |
| Depth :    | ---                   | Test Id:     | 687812     |
|            |                       | Tested By:   | ckg        |
|            |                       | Checked By:  | bfs        |

## Moisture Content of Soil and Rock - ASTM D2216

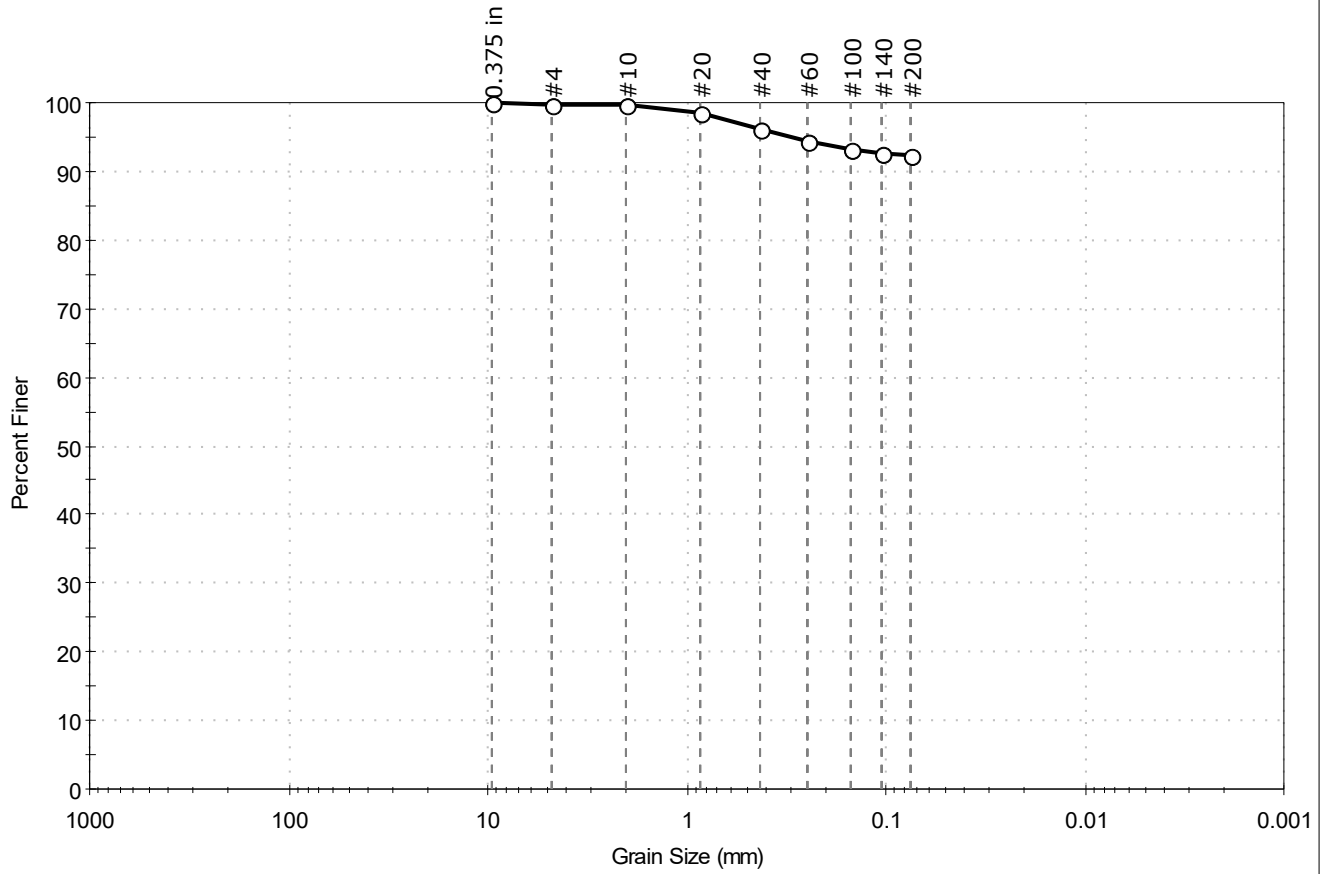
| Boring ID | Sample ID | Depth | Description       | Moisture Content, % |
|-----------|-----------|-------|-------------------|---------------------|
| B1        | S2        | 2-4   | Moist, brown clay | 32.3                |
| B2        | S3        | 4-6   | Moist, brown clay | 32.9                |
| B3        | S4        | 6-8   | Moist, brown clay | 33.2                |

Notes: Temperature of Drying : 110° Celsius



|                                      |                        |
|--------------------------------------|------------------------|
| Client: GEI Consultants, Inc.        | Project No: GTX-316175 |
| Project: Vessel Simsbury             |                        |
| Location: Simsbury, CT               |                        |
| Boring ID: B1                        | Sample Type: bag       |
| Sample ID: S2                        | Test Date: 10/05/22    |
| Depth: 2-4                           | Test Id: 687807        |
| Test Comment: ---                    | Tested By: ckg         |
| Visual Description: Moist, brown WUm | Checked By: bfs        |
| Sample Comment: ---                  |                        |

## Particle Size Analysis - ASTM D6913



|          |          |        |                    |
|----------|----------|--------|--------------------|
| % Cobble | % Gravel | % Sand | % Silt & Clay Size |
| —        | 0.3      | 7.5    | 92.2               |

| Sieve Name | Sieve Size, mm | Percent Finer | Spec. Percent | Complies |
|------------|----------------|---------------|---------------|----------|
| 0.375 in   | 9.50           | 100           |               |          |
| #4         | 4.75           | 100           |               |          |
| #10        | 2.00           | 100           |               |          |
| #20        | 0.85           | 98            |               |          |
| #40        | 0.42           | 96            |               |          |
| #60        | 0.25           | 94            |               |          |
| #100       | 0.15           | 93            |               |          |
| #140       | 0.11           | 93            |               |          |
| #200       | 0.075          | 92            |               |          |
|            |                |               |               |          |
|            |                |               |               |          |

| <u>Coefficients</u>   |                       |
|-----------------------|-----------------------|
| D <sub>85</sub> = N/A | D <sub>30</sub> = N/A |
| D <sub>60</sub> = N/A | D <sub>15</sub> = N/A |
| D <sub>50</sub> = N/A | D <sub>10</sub> = N/A |
| C <sub>u</sub> = N/A  | C <sub>c</sub> = N/A  |

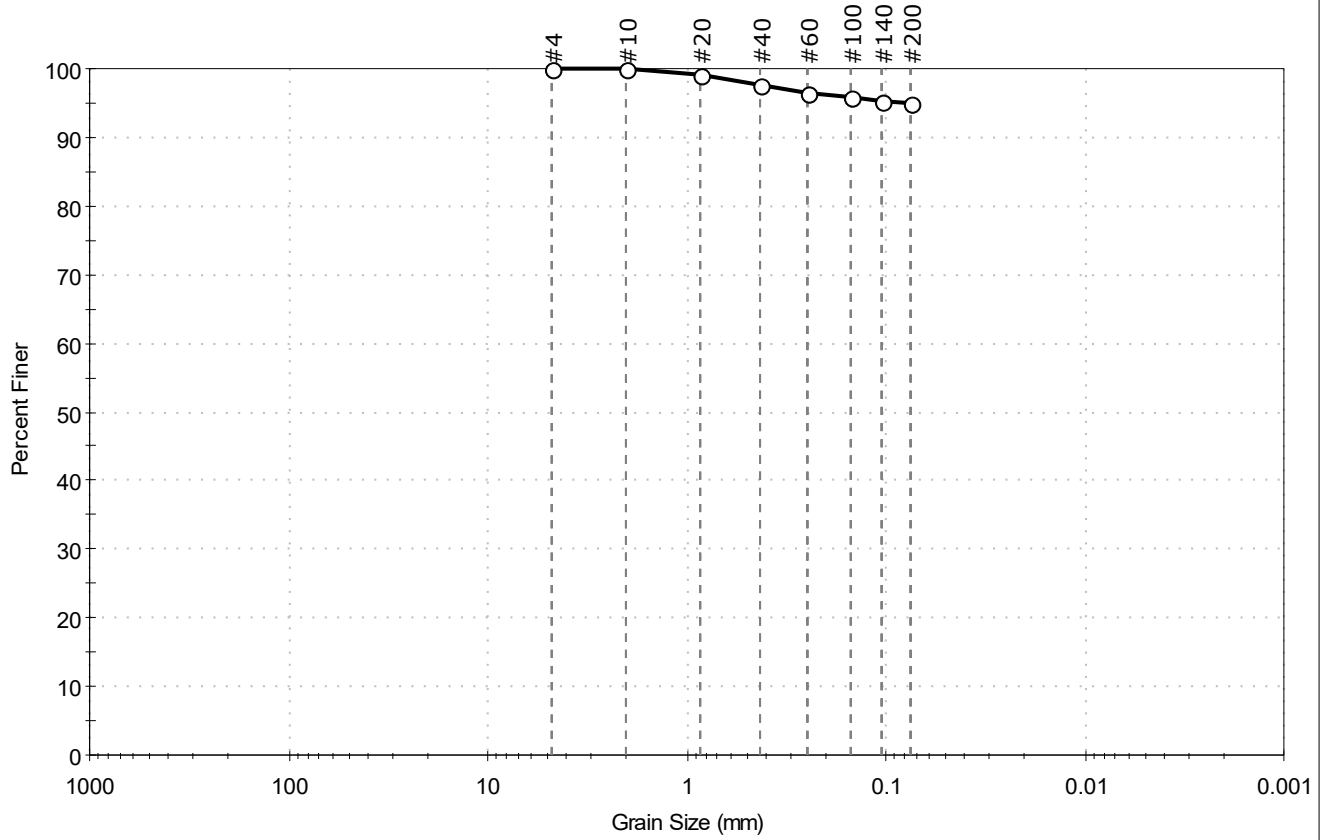
| <u>Classification</u> |                       |
|-----------------------|-----------------------|
| ASTM                  | N/A                   |
| AASHTO                | Silty Soils (A-4 (0)) |

| <u>Sample/Test Description</u>   |
|----------------------------------|
| Sand/Gravel Particle Shape : --- |
| Sand/Gravel Hardness : ---       |



|                                       |                        |
|---------------------------------------|------------------------|
| Client: GEI Consultants, Inc.         | Project No: GTX-316175 |
| Project: Vessel Simsbury              |                        |
| Location: Simsbury, CT                |                        |
| Boring ID: B2                         | Sample Type: bag       |
| Sample ID: S3                         | Test Date: 10/05/22    |
| Depth: 4-6                            | Test Id: 687808        |
| Test Comment: ---                     | Tested By: ckg         |
| Visual Description: Moist, brown clay | Checked By: bfs        |
| Sample Comment: ---                   |                        |

## Particle Size Analysis - ASTM D6913



|          |          |        |                    |
|----------|----------|--------|--------------------|
| % Cobble | % Gravel | % Sand | % Silt & Clay Size |
| —        | 0.0      | 5.1    | 94.9               |

| Sieve Name | Sieve Size, mm | Percent Finer | Spec. Percent | Complies |
|------------|----------------|---------------|---------------|----------|
| #4         | 4.75           | 100           |               |          |
| #10        | 2.00           | 100           |               |          |
| #20        | 0.85           | 99            |               |          |
| #40        | 0.42           | 98            |               |          |
| #60        | 0.25           | 97            |               |          |
| #100       | 0.15           | 96            |               |          |
| #140       | 0.11           | 95            |               |          |
| #200       | 0.075          | 95            |               |          |
|            |                |               |               |          |
|            |                |               |               |          |

| <u>Coefficients</u>   |                       |
|-----------------------|-----------------------|
| D <sub>85</sub> = N/A | D <sub>30</sub> = N/A |
| D <sub>60</sub> = N/A | D <sub>15</sub> = N/A |
| D <sub>50</sub> = N/A | D <sub>10</sub> = N/A |
| C <sub>u</sub> = N/A  | C <sub>c</sub> = N/A  |

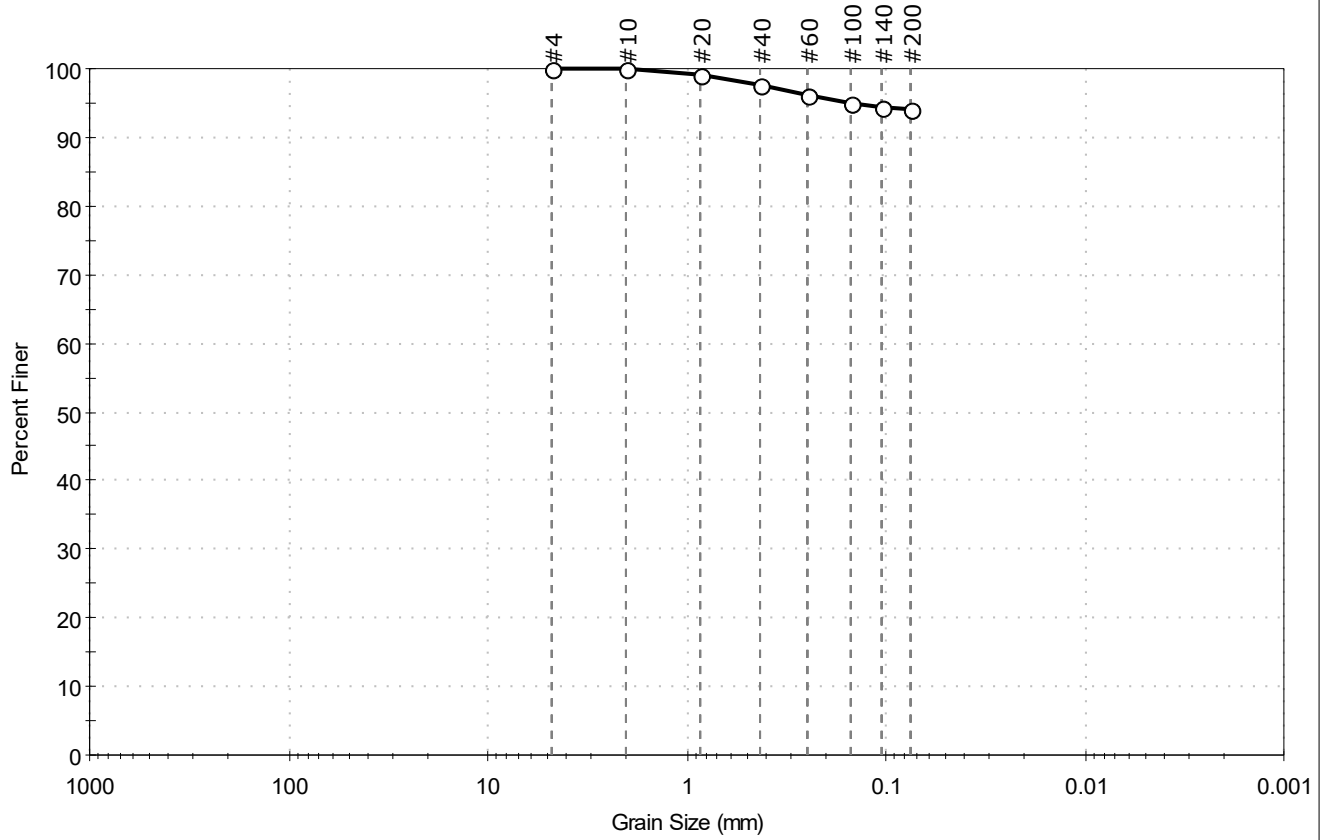
| <u>Classification</u> |                       |
|-----------------------|-----------------------|
| ASTM                  | N/A                   |
| AASHTO                | Silty Soils (A-4 (0)) |

| <u>Sample/Test Description</u>   |
|----------------------------------|
| Sand/Gravel Particle Shape : --- |
| Sand/Gravel Hardness : ---       |



|                                       |                        |
|---------------------------------------|------------------------|
| Client: GEI Consultants, Inc.         | Project No: GTX-316175 |
| Project: Vessel Simsbury              |                        |
| Location: Simsbury, CT                |                        |
| Boring ID: B3                         | Sample Type: bag       |
| Sample ID: S4                         | Test Date: 10/05/22    |
| Depth: 6-8                            | Test Id: 687809        |
| Test Comment: ---                     | Tested By: ckg         |
| Visual Description: Moist, brown clay | Checked By: bfs        |
| Sample Comment: ---                   |                        |

## Particle Size Analysis - ASTM D6913



|          |          |        |                    |
|----------|----------|--------|--------------------|
| % Cobble | % Gravel | % Sand | % Silt & Clay Size |
| —        | 0.0      | 6.0    | 94.0               |

| Sieve Name | Sieve Size, mm | Percent Finer | Spec. Percent | Complies |
|------------|----------------|---------------|---------------|----------|
| #4         | 4.75           | 100           |               |          |
| #10        | 2.00           | 100           |               |          |
| #20        | 0.85           | 99            |               |          |
| #40        | 0.42           | 98            |               |          |
| #60        | 0.25           | 96            |               |          |
| #100       | 0.15           | 95            |               |          |
| #140       | 0.11           | 95            |               |          |
| #200       | 0.075          | 94            |               |          |
|            |                |               |               |          |
|            |                |               |               |          |

| <u>Coefficients</u>   |                       |
|-----------------------|-----------------------|
| D <sub>85</sub> = N/A | D <sub>30</sub> = N/A |
| D <sub>60</sub> = N/A | D <sub>15</sub> = N/A |
| D <sub>50</sub> = N/A | D <sub>10</sub> = N/A |
| C <sub>u</sub> = N/A  | C <sub>c</sub> = N/A  |

| <u>Classification</u> |                       |
|-----------------------|-----------------------|
| ASTM                  | N/A                   |
| AASHTO                | Silty Soils (A-4 (0)) |

| <u>Sample/Test Description</u>   |
|----------------------------------|
| Sand/Gravel Particle Shape : --- |
| Sand/Gravel Hardness : ---       |

## **Appendix C**

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### **Recommended Material Specifications**



**Recommended Material Specifications  
Vessel – 446 Hopmeadow Street  
Simsbury, CT**

The natural fine-grained, brown clays and silts referenced in the Geotechnical Report are not suitable for re-use as Structural Fill on the project due to their high fines content. These soils, where excavated, should be wasted on non-structural areas of the project or removed from the site.

Though data is limited at this time, suitable granular soils might be obtained from upland areas of the site, including, potentially, the western stormwater basin shown on concept plans. If native sands and gravels are encountered and excavated as part of earthwork activities they can possibly be re-used on site as Structural Fill or Ordinary Fill, provided they do not contain oversize, organic, or otherwise deleterious material and can meet the appropriate compaction requirements.

Fill imported from off site should meet the attached gradation requirements. Fill placed within the building limits, within a 3-foot-wide zone outside foundation walls, under pavements, and behind retaining walls should meet the compaction requirements for Structural Fill. Backfill placed in non-structural areas should meet the compaction requirements for Ordinary Fill. Proposed borrow materials that fall slightly outside of these specifications may also be suitable for use, subject to review and approval by GEI.

**Structural Fill**

Imported Structural Fill should consist of hard, durable sand and gravel. It should be free of clay, organic matter, surface coatings, and other deleterious materials. Soil finer than the No. 200 sieve (the “fines”) should be non-plastic. Structural Fill shall meet the following gradation requirements:

| <b>Sieve Size</b> | <b>Percent Passing by Weight</b> |
|-------------------|----------------------------------|
| 3 inches          | 100                              |
| 1 - ½ inch        | 55 – 100                         |
| No. 4             | 35 – 85                          |
| No. 16            | 20 – 65                          |
| No. 50            | 5 – 40                           |
| No. 200 (fines)   | 0 – 10                           |

Structural Fill should be compacted in maximum 12-inch-thick, loose lifts to at least 95 percent of the maximum dry density determined in accordance with ASTM D1557 (Modified AASHTO Compaction). The moisture content should be held to within +/- 3 percent of optimum moisture content (as determined by ASTM D1557).

## Ordinary Fill

Ordinary fill should consist of hard, durable sand and gravel, free of clay, organic matter, surface coatings, and other deleterious materials. Soil finer than the No. 200 sieve (the “fines”) should be nonplastic. Ordinary Fill shall meet the following gradation requirements:

| Sieve Size      | Percent Passing by Weight |
|-----------------|---------------------------|
| 6 inches        | 100                       |
| 3 inches        | 80 – 100                  |
| No. 4           | 20 – 100                  |
| No. 200 (fines) | 0 – 20                    |

Ordinary fill should be compacted in maximum 12-inch-thick, loose lifts to at least 92 percent of the maximum dry density determined in accordance with ASTM D1557 (Modified AASHTO Compaction). The moisture content should be held to within +/- 3 percent of optimum moisture content (as determined by ASTM D1557).

## Crushed Stone

Crushed Stone should consist of a ¾-inch size durable crushed rock or durable crushed gravel stone and shall conform to the requirements of the ConnDOT Form 818, Section M.01.01, No. 6. Crushed stone should be compacted with at least four passes of a vibratory compactor.

## Geotextile Fabric

Geotextile fabric should be a non-woven fabric, consisting of Mirafi 140N or an approved equal product.

## **Appendix D**

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### **Infiltration Testing Results**

446 Hopmeadow Street  
 Simsbury, CT  
 Soil Permeability Calculations  
 Well MW-1



**WELL CALCULATIONS**

$$k'_v = \frac{d^2 \left( \frac{\pi k'_v D}{11 k_v m} + L \right)}{D^2 (t_2 - t_1)} \ln \frac{H_1}{H_2} \quad (\text{"Soil in casing in uniform soil," Lambe and Whitman, 1969.})$$

|                     |      |         |
|---------------------|------|---------|
| Diameter, sand pack | 8.26 | D (cm)  |
| Diam., PVC riser    | 5.08 | d (cm)  |
| Length, slotted PVC | 152  | L (cm)  |
| $k'_v/k_v$          | 1    | Assumed |

**Test 1**

| Height<br>H (cm) | Time<br>t (seconds) | Vertical Perm.<br>$k'_v$ (cm/sec) | Vertical Perm.<br>$k'_v$ (in/hr)** |
|------------------|---------------------|-----------------------------------|------------------------------------|
| 15               | 5                   |                                   |                                    |
| 302              | 20                  | 1.16E+01                          | 16471                              |

\*\*After initial pre-soak, well completely drained within 20 seconds of filling

446 Hopmeadow Street  
 Simsbury, CT  
 Soil Permeability Calculations  
 Well MW-2



**WELL CALCULATIONS**

$$k'_v = \frac{d^2 \left( \frac{\pi k'_v D}{11 k_v m} + L \right)}{D^2 (t_2 - t_1)} \ln \frac{H_1}{H_2} \quad (\text{"Soil in casing in uniform soil," Lambe and Whitman, 1969.})$$

Diameter, sand pack            8.26            D (cm)  
 Diam., PVC riser                5.08            d (cm)  
 Length, slotted PVC            152            L (cm)  
 k'<sub>v</sub>/k<sub>v</sub>                                1                Assumed

**Test 1**

| Height<br>H (cm) | Time<br>t (seconds) | Vertical Perm.<br>k' <sub>v</sub> (cm/sec) | Vertical Perm.<br>k' <sub>v</sub> (in/hr) |
|------------------|---------------------|--|---|
| 146              | 60                  |  |   |
| 147              | 120                 | 6.06E-03                                   | 8.59                                      |
| 148              | 180                 | 2.01E-03                                   | 2.85                                      |
| 148              | 240                 | 6.01E-03                                   | 8.52                                      |
| 150              | 300                 | 1.19E-02                                   | 16.89                                     |
| 152              | 360                 | 1.37E-02                                   | 19.44                                     |
| 152              | 420                 | 0.00E+00                                   | 0.00                                      |
| 153              | 480                 | 5.82E-03                                   | 8.25                                      |
| 154              | 540                 | 5.79E-03                                   | 8.20                                      |
| 155              | 600                 | 5.75E-03                                   | 8.15                                      |
| 156              | 660                 | 7.62E-03                                   | 10.80                                     |
| 157              | 720                 | 3.79E-03                                   | 5.37                                      |
| 158              | 780                 | 3.77E-03                                   | 5.35                                      |
| 158              | 840                 | 5.63E-03                                   | 7.98                                      |
| 159              | 900                 | 3.74E-03                                   | 5.29                                      |
| 160              | 960                 | 5.58E-03                                   | 7.90                                      |
| 161              | 1020                | 3.70E-03                                   | 5.24                                      |
| 162              | 1080                | 5.52E-03                                   | 7.83                                      |
| 162              | 1140                | 1.83E-03                                   | 2.60                                      |
| 162              | 1200                | 3.66E-03                                   | 5.18                                      |
| 164              | 1260                | 7.28E-03                                   | 10.31                                     |
| 165              | 1320                | 5.42E-03                                   | 7.68                                      |
| <b>AVERAGE</b>   |                     |  | <b>6.4</b>                                |