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memo

to:	Josh Morse, Commissioner of Public Buildings City of Newton
from:	Thomas A. Scarlata, CSI, CCS, CCCA, AIA Principal
date:	March 10, 2023
project name & number:	Gath Memorial Pool Improvement Project BH+A Project No. 3457
subject:	Geotechnical Report
cc:	BH+A Project File

BH+A engaged PSI-Intertek to prepare a Geotechnical Engineering Report of the existing Gath Memorial Pool Complex. Four borings were taken to capture below grade conditions in areas where the proposed design was expanding.

One of the borings was taken at the existing pool deck to determine the fill material used to elevate the existing pool. BH+A reviewed minutes of Recreation Committee Meetings from the 1964 and located conversations related to the current design and need to elevate the pool above the flood level of Cheesecake Brook.

Ground Water: The existing pool deck is set at Elevation 30.0. The Main Floor of the Bathhouse is elevation 30.5; filtration level is elevation 19.5 feet. Ground water was observed at elevations 14.5 to 10.0, more than 5 ½ feet below the filtration room floor.

Application of Report
Bathhouse Entry and Steps: These elements can be excavated and backfilled using the existing material.

Pool Decks, Retaining Walls, and Ramp/Stairs: Specifications will be developed to reuse as much of the existing on site material as possible. This will include the services of a geotechnical engineer on site to review subgrades during excavation, proof-rolling and, testing existing fill and supplementing were required.

Pool and Spray Deck Subgrade: Pools are typically built over a 12 inch layer of ¾ inch crushed stone over a non-woven geotextile. The stone provides a stable work base, addresses geotechnical concerns, and serves as a drainage plain in the event ground water is encountered. The deepest part of the excavation will be within a foot of the ground water. The 12 inch stone layer will be extended beyond the face of the pool wall and a vertical HDPE pipe installed from the stone layer to the pool deck. This assembly provides in-construction dewatering as well as permanent dewatering points for future pool maintenance.

The main drains of the pool are equipped with hydrostatic pressure relief valves to protect against buoyancy when the pool is drained for maintenance.

November 21, 2022

Mr. Thomas A. Scarlata
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Boston, MA 02210
Phone: 617-456-2222
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Subject: **Geotechnical Engineering Report**
Harry Gath Memorial Pool Improvements
256 Albemarle Road
Newton, MA 02460
PSI Project No.: 04461180

Dear Mr. Scarlata:

Thank you for choosing Professional Service Industries, Inc. (PSI), an Intertek company, as your consultant for the above referenced project. PSI is pleased to submit this report presenting the results of the geotechnical engineering services regarding the proposed Harry Gath Memorial Pool Improvements in Newton, Massachusetts. Our services were conducted in accordance with PSI's Proposal No. 0446-385584 dated October 24, 2022.

PSI recommends that the geotechnical engineer and/or their representative be present during earthwork operations to observe the field conditions with respect to the design assumptions and specifications. PSI will not be held responsible for interpretations and field quality control observations made by others.

Should there be any questions regarding this report, please do not hesitate to call our office at (781) 821-2355. PSI would be pleased to continue providing geotechnical services throughout design and construction of the project, and we look forward to working with you and your organization on this and future projects.

Respectfully submitted,
Professional Service Industries, Inc.

Brianna Hansen	Paul McMichael	Philip G. Clark, P.E.
Project Manager	Principal Consultant	Senior Engineer

GEOTECHNICAL ENGINEERING REPORT

For the Proposed

Harry Gath Memorial Pool Improvements
256 Albemarle Road
Newton, MA 02460

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Project Manager

Prepared for

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PSI PROJECT NO. 04461180

November 21, 2022

TABLE OF CONTENTS

1.0 PROJECT INFORMATION 1

1.1 PROJECT AUTHORIZATION 1
1.2 PROJECT DESCRIPTION 1
1.3 SITE DESCRIPTION 2
1.4 EXPLORATION PROGRAM 2

2.0 SITE AND SUBSURFACE CONDITIONS 3

2.1 SUBSURFACE CONDITIONS 3
2.1.1 Local Geology 3
2.1.2 Soil Test Borings 3
2.2 GROUNDWATER CONDITIONS 4
2.3 SOIL LABORATORY TESTING 5

3.0 RECOMMENDATIONS 5

3.1 GENERAL 5
3.2 EARTHWORK 6
3.3 FILL MATERIALS 7
3.3.1 Reuse of Excavated Soil 8
3.4 POOL EXCAVATION/CONSTRUCTION 8
3.5 CONCRETE SLAB 9
3.6 LATERAL EARTH PRESSURE 10
3.7 RETAINING WALL BACKFILL RECOMMENDATIONS 11
3.8 BATHHOUSE ENTRY STEPS AND RAMP 12
3.9 SEISMIC CONSIDERATIONS 13

4.0 CONSTRUCTION CONSIDERATIONS 14

4.1 EARTHWORK 14
4.2 CONSTRUCTION DEWATERING 14

5.0 GEOTECHNICAL RISK 15

6.0 REPORT LIMITATIONS 15

FIGURES
FIGURE 1: USGS SITE LOCATION PLAN
FIGURE 2: BORING LOCATION PLAN
FIGURE 3: SURFICIAL GEOLOGY

APPENDIX A
BORING LOGS
SOIL PROFILES
MATERIAL TEST REPORTS

1.0 PROJECT INFORMATION

1.1 PROJECT AUTHORIZATION

Authorization to proceed with this project was provided by Mr. Thomas A. Scarlata with Bargmann Hendrie + Archetype, Inc. by signing the Proposal Authorization included with PSI's Proposal No. 0446-385584 on October 24, 2022.

1.2 PROJECT DESCRIPTION

Project information provided to PSI included the following:

- Newton Gath Pool Option 4 Overall Plan (dated 5/20/2022)
- 250 Albemarle Road Survey (dated 6/6/2022)
- Proposed Plan for the Installation of Shade Structure at Gath Pool (dated 5/11/2007)
- Swimming Pool & Bathhouse Site Plan: Drawing A-1 (dated 10/15/1964)
- Swimming Pool & Bathhouse Plans: Drawing A-3 (dated 10/15/1964)

The project consists of the demolition of the existing pool structures and surrounding concrete decks and the construction of a new pool configuration with new concrete decks. Both cut excavations and fill placements appear to be necessary to adapt the existing pool configuration to the new pool configuration The new pool will have similar depths as the existing pool with depths ranging from 1 foot to 12 feet. The new concrete decks will be expanded to the north, south, and east and raised 6 inches to align with the existing bathhouse floor level.

Additionally, a new ramp and entry steps to the existing bathhouse will be constructed as well as a possible areaway to the basement on the south side of the existing building. The basement of the bathhouse is approximately 5 feet below the front sidewalk.

Structural loading information was not provided. Therefore, this report is based on slab loads not exceeding 150-psf. Additionally, PSI has based our recommendations on grading cuts/fills not exceeding 2 feet from existing grades.

Should any of the information identified herein be incorrect or should supplemental information become available, PSI must be notified and have the opportunity to reassess conditions and amend the report where necessary. The modification of the old to new pool configuration may require fill placements up to 1/2-a-foot and cut excavations up to 12 feet are anticipated for the new pool configuration.

The objective of our services summarized herein was to provide subsurface information and geotechnical engineering recommendations to members of the design team for use in designing foundations for the proposed addition.

1.3 SITE DESCRIPTION

The referenced site (42° 21' 27.50" N, 71° 12' 56.50" W) is located at 256 Albemarle Road in Newton, Massachusetts, as shown in *Figure 1, USGS Site Location Plan*. The site consists of an existing 1-story bathhouse building with a basement and an existing outdoor pool and concrete deck to the east, which will be removed and replaced. There is associated pavement to the west.

Around the outdoor pool and concrete deck, the site is generally level to slightly sloping uphill to the east. The concrete pool deck is approximately 4 to 5 feet higher in elevation than the park. The existing pool depths range from 3 feet to 12 feet. Information contained on the 250 Albemarle Road Survey indicates existing surface grades of approximately EL 24 to 34 feet, NAVD within the project site.

1.4 EXPLORATION PROGRAM

PSI conducted a geotechnical exploration program at the site in conformance with generally accepted geotechnical engineering practices to provide subsurface information about the site. This information was utilized to develop geotechnical engineering recommendations for members of the design team for use on this project.

The subsurface exploration program consisted of the performance of four Standard Penetration Test (SPT) borings to assess the depth and characteristics of the underlying material. The exploration locations were marked out per the Client's proposed boring locations and Dig Safe System, Inc. was notified for public utility clearance. The exploration locations were also scanned by a private utility locating service, Ground Penetrating Radar Systems LLC, prior to performing the explorations at the site.

Soil X Corporation of Leominster, MA drilled four soil test borings on November 3, 2022 at the approximate locations shown in *Figure 2, Boring Location Plan*. Borings B-1 and B-2 were drilled adjacent to the fenced in pool area, Boring B-3 was drilled within the fenced in pool area, and Boring B-4 was drilled in the area of the proposed new ramp and entry steps to the bathhouse. A PSI representative observed the exploration activities for this project, retrieved soil samples for classification and testing, and prepared the attached Soil Test Boring Logs.

The borings were advanced by flush joint casing using a Geoprobe 6610 drill rig, equipped with an automatic hammer, to depths of approximately 22 to 27 feet below the existing ground surfaces (bgs), where the borings were terminated at the planned termination depth.

Standard Penetration Tests (SPT) were performed and split spoon samples were retrieved at approximate 2-foot intervals to depths of approximately 12 to 17 feet bgs and at approximate 5-foot intervals thereafter. The number of hammer blows required to drive the sampler into the soil in 6-inch increments is recorded on the Soil Test Boring Logs attached in the Appendix for reference. The sum of the hammer blows for the second and third interval provides the Standard Penetration Resistance (N) and is a measure of soil strength. Three soil samples retrieved from the borings were selected for laboratory testing to assist in classifying the material. The remaining samples will be stored in our laboratory and disposed of after 6 months.

PSI classified the soil strata shown in the Soil Test Boring Logs based upon its interpretation of the subsurface conditions encountered at the boring locations. The stratifications shown on the Soil Test Boring Logs represent the conditions only at the actual boring locations and variations will occur and should be expected at other locations. It is also possible that there could be thin layers of material lying between the sampling intervals that are not described on the logs and which might not become known until construction. Likewise, the depth to each soil stratum is approximate and may be more gradual or different in the field.

2.0 SITE AND SUBSURFACE CONDITIONS

2.1 SUBSURFACE CONDITIONS

2.1.1 LOCAL GEOLOGY

Based on the "Surficial Materials Map of the Newton Quadrangle, Massachusetts" by Byron D. Stone and Mary L. DiGiacomo-Cohen in 2018, the surficial geology of the project site is coarse deposits, as shown in *Figure 3, Surficial Geology*. The subsurface conditions encountered below the Fill material at this site generally fits the geologic description.

Based on the "Bedrock Geologic Map of Massachusetts," compiled by Zen, E-an, Goldsmith, Richard, Ratcliffe, N.M., Robinson, Peter, Stanley, R.S., Hatch, N.L., Shride, A.F., Weed, E.G.A., and Wones, D.R. in 1983, the bedrock geology generally consists of Cambridge Argillite, which consists of gray argillite and minor quartzite. Bedrock, however, was not encountered to the depths explored at this site.

2.1.2 SOIL TEST BORINGS

The subsurface conditions encountered at the specific boring locations for the proposed improvements are presented as individual soil profiles and descriptions on the Soil Test Boring Logs in the Appendix. The stratifications presented are based on a visual assessment of the recovered soil samples and the interpretation of field logs by a PSI representative. The Standard Penetration Test values (N-values), which are shown on the Soil Test Boring Logs, have been empirically correlated with various soil properties and are indicative of the relative density of cohesionless soils.

A brief description of the soils encountered at the site is presented in this section. Details are shown in the Soil Test Boring Logs.

FILL – Approximately 2½ to 10 feet of material classified as Fill was encountered at the surface of the site. The Fill material is most likely the result of original site development (possibly site grading). The general material description is brown, dark brown, and grayish brown, fine to coarse sand, trace to little silt, with trace to some gravel. The Standard Penetration Test (SPT) N-values within the Fill ranged from 2 to 45 blows per foot (bpf), indicating very loose to dense relative densities. It should be stressed that in miscellaneous fill, the N-values can be erratic, reflecting the variable composition of the fill material. The presence of obstruction and/or cobbles within fill can result in locally high N-values, even in a very loose soil. Other obstructions may be present in a miscellaneous uncontrolled fill and may not be readily detectable with exploratory drill rig methods.

SAND – At the boring locations, Sand soils were encountered below the Fill and extending to depths of approximately 7 to 21 feet bgs. The general material description is light brown and brown, fine to coarse sand, trace silt, with trace gravel. The SPT N-values ranged from 5 to 20 bpf, indicating loose to medium dense relative densities, with the majority of the N-values in the loose relative density range.

SAND AND GRAVEL – At Borings B-1, B-2 and B-3, Sand and Gravel soils were encountered below the Sand soils, beginning at depths of approximately 15 to 21 feet bgs and extending to depths of approximately 22 to 27 feet bgs, where the borings were terminated. The general material description is brown, fine to coarse sand, trace to little silt, with trace to some gravel. The SPT N-values ranged from 11 to 19 bpf, indicating medium dense relative densities.

SILTY SAND TO SANDY SILT – Silty Sand to Sandy Silt soils were encountered at Boring B-4, beginning at a depth of approximately 7 feet bgs and extending to a depth of approximately 22 feet bgs, where the boring was terminated. The general material description is brown, fine to medium sand, some silt and brown, fine to medium sand and silt. The SPT N-values ranged from 6 to 12 bpf, indicating loose to medium dense relative densities, with the majority of the N-values in the loose relative density range.

2.2 GROUNDWATER CONDITIONS

At the time of our borings (November 2022), infiltrating groundwater was encountered during drilling and sampling operations at the depths shown in the following table. Ground elevation is based on information contained on the provided 250 Albemarle Road Survey (dated 6/6/2022). For safety purposes, the borings were backfilled upon completion of drilling and sampling.

Boring	Approximate Depth (ft.) of Groundwater (bgs)	Approximate Elevation of Groundwater
B-1	8 feet bgs	EL 20
B-2	6 feet bgs	EL 20.5
B-3	10 feet bgs	EL 20
B-4	6 feet bgs	EL 19.8

The observations represent the groundwater condition at the time of measurement and may not be indicative of other times. The level of groundwater below the ground surface fluctuates based on conditions such as season, temperature, and amount of precipitation that might be different from the time when the observations were made. Therefore, the groundwater levels can be higher or lower during construction and during the life of the structure. This fact must be taken into consideration when developing earthwork procedures.

2.3 SOIL LABORATORY TESTING

PSI tested soil samples for moisture content and gradation to assist in classifying the material and determining the percent fines (percent passing the Number 200 sieve). The material test reports for the samples are in the Appendix of this report and results are summarized in the following table.

Boring No.	Sample No.	Sample Depth (feet)	USCS Classification[1]	Moisture Content (%)	Fines Content (%)
B-2	S1	½' – 2½'	Well-Graded Sand with Silt and Gravel (SW-SM)	5.9	11
B-3	S2	2½' – 4½'	Silty Sand with Gravel (SM)	9.3	13
B-4	S4	7' - 9'	Silty Sand (SM)	20.1	28
[1]For USCS Soil Classification definitions, refer to the Soil Classification Chart in the APPENDIX					

3.0 RECOMMENDATIONS

3.1 GENERAL

The following geotechnical design recommendations have been developed for the proposed Harry Gath Memorial Pool improvements based on the previously described project information and subsurface conditions encountered at this site. If there are any changes in the project criteria, PSI should review the changes to determine if modifications to these recommendations are necessary.

The subsurface conditions encountered at this site within the test borings consisted of approximately 2½ to 10 feet of very loose to dense Fill material underlain by loose to medium dense Sand soils and then medium dense Sand and Gravel soils and loose to medium dense Silty Sand to Sandy Silt soils to the depths explored.

The Fill material is undocumented and may be associated with previously placed, general fill placed to attain the design finished subgrades. Undocumented fill is fill material in which no information was provided regarding the procedures that might have been used to backfill and compact the material to satisfactory engineering standards. Due to the potential variability and potential for deleterious inclusions of human-placed fill, total and differential settlement predictions for grade-supported concrete slabs supported on undocumented fill carry with it less confidence and, therefore, more risk.

The existing Fill material can be evaluated to be suitable or stable during construction provided the Owner understands there is some risk for settlement of grade supported slabs and foundations, if applicable, for undocumented fill materials. Construction procedures such as observing the material during construction, proof-rolling the material with a vibratory compactor followed by selective compaction testing should be performed during construction. This would be based on field judgements and the required field testing of the existing soil during construction.

Conversely, it is possible that the material when exposed and proof-rolled could be unsatisfactory, requiring removal. Therefore, the alternative with the least degree of risk is to plan on removing all existing Fill within the pool area footprint. However, the existing Fill below the existing concrete deck was encountered to a significant depth of 10 feet below grade and the groundwater was measured at approximately 10 feet bgs (EL 20), making methods to completely remove and replace the existing Fill not economically feasible because of the depth of excavation and dewatering may be required. Given the granular composition and predominantly medium dense to dense relative density of the Fill observed in the borings below 2 to 4 feet bgs, a program of partial undercutting of the Fill combined with inspection during construction is proposed. If the proposed excavation program exposes excessive debris in the Fill or other unsuitable conditions, a more extensive removal and replacement program will be required. Additionally, a ground improvement system may also be considered as a risk-adverse alternative for implementation of grade-supported slabs for the new improvements. The degree of acceptable risk of excessive total and differential settlement must be evaluated and accepted by the Owner.

3.2 EARTHWORK

The recommendations provided herein which should be followed to attain subgrades.

1. Following initial demolition (removal of existing pavements, concrete, and utilities to be abandoned/relocated) and removal of all surficial vegetation, topsoil, root mat, shrubbery, and trees (including root systems and root balls) at the design finished subgrades in planned cut areas and prior to placement of new fill (if needed), the exposed subgrades should be proof-rolled using a minimum 10-ton, smooth-drum roller. Proof-rolling should be performed in the presence of a representative of PSI. Subgrade materials exhibiting yielding and/or rutting conditions should be scarified, aerated, and re-compacted, removed and replaced, or stabilized in place through addition of geo-grid and/or coarse aggregate.

2. Soil compaction criteria requires compaction of at least 95 percent of the maximum dry density determined in accordance with ASTM D1557 at plus/minus 2% of the optimum moisture content. Lifts must be controlled so that they do not exceed 6 inches in confined areas and 12 inches in open areas where larger compactors can be utilized. Use hand-operated equipment within 10 feet behind retaining walls and do not over-compact the backfill material. All fill placed within and below the structure must be compacted in accordance with ASTM D1557.

3. All excavations shall be stabilized by cutting back the side slopes or using shoring and bracing as required by 29 CFR 1926 Subpart P, Excavations. Plans and specifications should refer to this requirement so that contractors are aware of their responsibility.

4. Drainage must not be directed onto adjacent property either during construction or as part of the design grading, especially if this would affect groundwater and / or moisture conditions on the adjacent parcel.

3.3 FILL MATERIALS

PSI recommends that the following material gradations and names be used for consistency on the drawings and in the earthwork specifications. All material must be well graded between the limits shown herein and be capable of being compacted to the required degree of density. The material shall have sufficient fines so that it does not shove and remains stable.

PSI also recommends that the specifications not allow the use of recycled material such as reprocessed building demolition material. Material having more than 30 percent retained on the ¾-inch sieve may be difficult to test for compaction. Therefore, PSI recommends that the material selected also be satisfactory for compaction testing purposes.

Common Borrow

Friable, natural soil containing no gravel greater than 2/3 loose lift thickness and free of trash, snow, ice, organics, roots, and tree stumps and no more than 35 percent passing the No. 200 sieve. Common borrow can be used as general site backfill provided it can be compacted and stabilized for the intended purpose.

Structural Fill (recommended for over-excavation backfill below footing grade):

Natural or processed materials meeting the following grading ranges.

Sieve Size	Percent Finer
3-inches	100
½-inches	50 - 100
No. 4	30 - 85
No. 10	20 - 75
No. 40	5 - 35
No. 200	0-10

Granular Fill (recommended for general site fill and backfill above footing grade):

Natural or processed materials meeting the following grading ranges.

Sieve Size	Percent Finer
2-inches	100
No. 10	30 - 95
No. 40	10 - 70
No. 200	0 - 15

Dense Graded Crushed Stone (recommended as the granular base for floor slabs):

Dense graded crushed rock meeting the following grading ranges.

Sieve Size	Percent Finer
2-inch	100
1½-inch	70 - 100
¾-inches	50 - 85
No. 4	30 - 55
No. 50	8 - 24
No. 200	3 - 10

Crushed Stone:

The crushed stone should meet the requirements for material M2.01.4 (3/4-inch gradation) stated in the Massachusetts Highway Department Standard Specifications for Highways and Bridges.

3.3.1 Reuse of Excavated Soil

Based on the results of the laboratory testing, PSI anticipates that shallow excavated Fill soils may not meet the specific gradation requirements for Structural Fill due to the fines content. However, the material may meet the requirements for Granular Fill, which could be used below the slab subgrade and above footing bearing levels, and as general site fill provided that the material continues to meet the project specifications and can be compacted to the required degree of compaction. The material can also be reused as common borrow in landscaped areas.

3.4 Pool Excavation/Construction

PSI understands that an exterior in-ground pool will be constructed to the east of the existing bathhouse building. We have assumed that a specialty contractor will design and install the pool.

Soil conditions at the pool and concrete deck area consist of an approximately 5 to 10 feet of very loose to dense Fill material underlain by loose to medium dense Sand soils and then medium dense Sand and Gravel soils. Moreover, the groundwater may be encountered during excavation and the contractor should be prepared for dewatering and subgrade stabilization measures during construction. Where dewatering is necessary for deeper foundation undercuts, PSI recommends that a stable platform be constructed to facilitate backfill compaction. This may consist of a geotextile filter fabric (e.g. Mirafi 140N) wrapped coarse aggregate (AASHTO #1 aggregate).

Exposed subgrades should be proof-rolled under the observation of a representative of PSI. Where unsuitable/unstable Fill materials are present, then materials will need to be removed and replaced with Structural Fill; however, actual field conditions will dictate the actual extent of removal and replacement.

Proof-rolling and placement/compaction of new fill should be performed in accordance with Section 3.2 of this report. Following subgrade stabilization (as needed), new fill meeting the Granular gradation recommendation presented in Section 3.3 of this report should be placed and compacted to attain the design finished soil subgrade elevation.

The slab subgrade should be proof-rolled to check that the soil is firm prior to constructing the slab base course layer. PSI recommends that the pool floor slab be constructed over a freely draining medium, such as ¾-inch crushed stone or dense graded crushed stone, to avoid undrained groundwater conditions below and around the pool. The material must be tamped into firm interlock (crushed stone) or compacted (freely draining granular soil) so that it is firm and stable. Base course soil material must be compacted to at least 95% of the maximum dry density determined in accordance with ASTM D1557.

The pool structure designed in accordance with these recommendations is expected to have a total settlement less than 1 inch provided that the subgrade soil has not been disturbed and remains compact.

Sufficient drainage medium should be placed behind the pool walls so that water cannot accumulate behind the walls. PSI recommends placing ¾-inch crushed stone, encased in filter fabric, along the back of the walls. The drainage layer should extend to 1-foot horizontally along the walls.

We have assumed that the pool walls will be designed for the “at-rest” soil condition where rotation will not occur. Recommendations for pressures are included in Section 3.4.

Given the relatively shallow groundwater at this site that may be above the bottom of the pool level at different times of the year or vary from year to year, the pool designer should consider buoyancy uplift forces when the pool is empty and implement any necessary permanent dewatering and/or tied down measures to resist them. The designer should consider a more conservative or higher groundwater elevation than was encountered within our soil test borings at the site at the time of our exploration.

3.5 CONCRETE SLAB

Provided the risk of settlement of unremoved Fill is accepted by the Owner and all subgrade soils exhibiting yielding or rutting under proof-roll equipment loads are corrected, the concrete slabs may be designed as grade-supported slabs and the existing Fill may be densified rather than being over-excavated and replaced. Fill required to raise the site to the slab base course grade should be compacted Structural or Granular Fill.

The slab subgrade should be proof-rolled to verify that the soil is firm prior to constructing the slab base course layer. A vibratory drum compactor (10-ton minimum weight at the drum) should be used, making at least 5 passes over the subgrade at the bottom of the excavation. Soft soils exhibiting yielding and/or rutting conditions under proof-roll equipment loads should be overexcavated to a dense underlying stratum and replaced with compacted Structural or Granular Fill.

To reduce the possibility of capillary rise of groundwater and moisture into the floor slab, PSI recommends that the concrete floor slabs be constructed over a 4-inch thick layer of compacted, freely draining base course material such as the ¾-inch angular Crushed Stone or a 6-inch thick layer of Dense Graded Crushed Stone, both as specified herein. Base course soil material must be compacted to at least 95% of the maximum dry density determined in accordance with ASTM D1557. Crushed Stone must be tamped into firm interlock so that it is firm and stable.
PSI recommends that a continuous vapor retarder of at least 10-mil thick, or as specified by the structural engineer, be installed between the slab and the base course to reduce migration of moisture.

For subgrade prepared as recommended and properly compacted Granular or Structural Fill, a modulus of subgrade reaction, *k* value, of 150 pounds per cubic inch (pci) may be used in the grade slab design based on values typically obtained from 1 ft. x 1ft. plate load tests. However, depending on how the slab load is applied, the value will have to be geometrically modified. The value should be adjusted for larger areas using the following expression for cohesive and cohesionless soil:

Modulus of Subgrade Reaction, $k_s = \left(\frac{k}{B}\right)$ for cohesive soil and

$k_s = k\ \left(\frac{B+1}{2B}\right)^2$ for cohesionless soil

where: k_s = coefficient of vertical subgrade reaction for loaded area
k = coefficient of vertical subgrade reaction for 1x1 square foot area
B = width of area loaded, in feet

3.6 LATERAL EARTH PRESSURE

Lateral earth pressure is developed from the soils present within a wedge formed by the vertical wall and an imaginary line extending up and away from the bottom of the wall at an approximate 45° + Φ/2 angle. The lateral earth pressures are determined by multiplying the vertical applied pressure by the appropriate lateral earth pressure coefficient K. Below-grade / retaining walls may be designed based on at-rest (K_o) conditions.

Recommended parameters for use in below-grade / retaining wall designs are presented in the following table.

Recommended Parameters for use in Retaining Wall Design

Material Type	Drained Friction Angle (Φ'), degrees	Total Density Ɣ (pcf)	Earth Pressure Coefficient **		
			At-Rest (K_o)	Active (K_a)	Passive (K_p)
On-Site Soils	30	120	0.50	0.33	1.50
Wall Drainage Aggregate	35	110	0.43	0.27	2.46
Granular Backfill	33	125	0.46	0.29	2.26

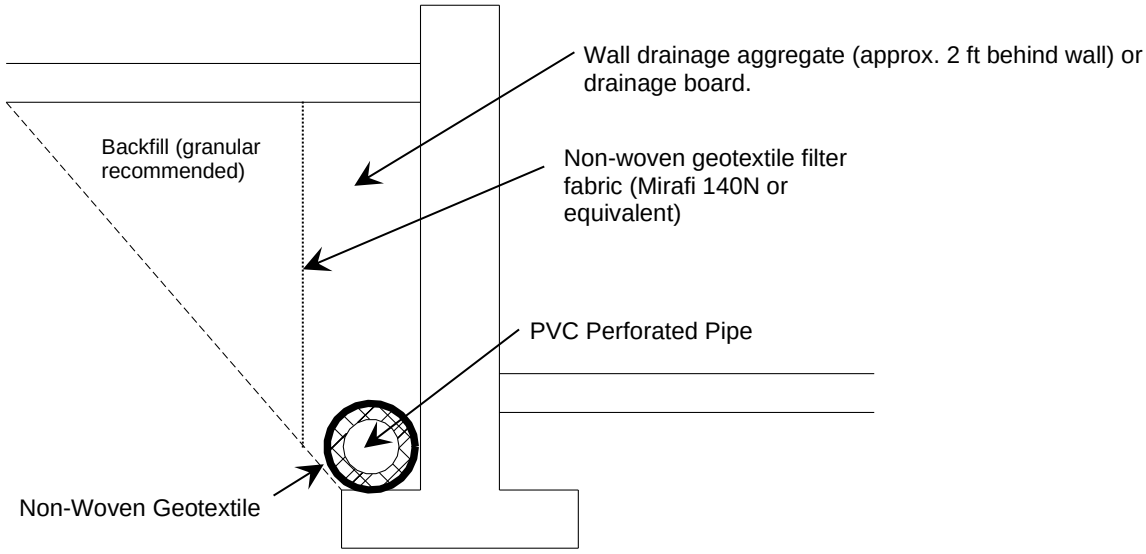
*** Earth pressure coefficients valid for level and drained backfill conditions.*
These values may be used for design only if the aggregate backfill extends back from the wall certain distances. These are a horizontal distance approximately equal to or greater than the total height of the wall at the surface, and at least one-foot beyond the heel of the wall footing. A Factor of Safety of 1.5 has been applied to passive pressure coefficients.

The values presented in the previous table were calculated based on positive foundation drainage being provided to prevent the buildup of hydrostatic pressure. An “equivalent fluid” pressure can be obtained from the above table values by multiplying the appropriate K-factor times the total unit weight of the soil. This applies to unsaturated conditions only. If a saturated “equivalent fluid” pressure is needed, the effective unit weight (total unit weight minus unit weight of water) should be multiplied times the appropriate K-factor and the unit weight of water added to that resultant. However, PSI does not recommend that the walls be designed with a hydrostatic load and PSI does recommend that drainage should be provided to relieve the pressure.

3.7 RETAINING WALL BACKFILL RECOMMENDATIONS

The backfill materials should be placed in lifts that do not exceed 4 to 6-inches loose. The lift thickness may need to be reduced to thinner lifts immediately behind the walls to achieve the desired compaction without overstressing the wall with the compaction process. The backfill materials should be compacted to at least 95% of the Modified Proctor maximum dry density (ASTM D1557). If granular materials (USCS Classifications SM, SP, GM, GP) are selected for the wall backfill in lieu of approved on-site or imported clayey soils and do not exhibit a well-defined moisture-density relationship curve per ASTM D1557, they should be compacted to at least 70% relative density per ASTM D4253/4254.

Backfill that is placed within 5 feet of the walls, should be placed in thinner lifts with hand compaction equipment to achieve the specified density. Heavy compactors and grading equipment should not be allowed to operate within these limits during the backfilling of the retaining wall to reduce the developing of excessive temporary or long-term lateral soil pressures from the installation process. PSI recommends that a representative of the geotechnical engineer be present to monitor the below grade wall excavation, construction, and backfilling processes. Care should be exercised during the backfilling operation to prevent overstressing and damaging the wall. A typical wall cross-section is as follows:



The placement of a limited amount of granular material behind a site retaining wall does not appreciably change the coefficient of lateral earth pressure acting on that wall. The lateral earth pressure acting on a retaining structure is a function of the weight of the soil that exists above the theoretical plane projecting up from the heel of the wall footing (the back of the footing at the base of the wall). The soil above this plane is held in place by two forces, the strength of the soil itself and the lateral resistance of the wall. Therefore, a thin layer of granular material behind the wall (such as a vertical drain on the back of the wall) is of little consequence on the soil forces acting on the wall; however, it will have significant consequences for wall drainage and therefore hydrostatic pressures.

3.8 BATHHOUSE ENTRY STEPS AND RAMP

In general, the existing Sand soils encountered below the 2½-foot layer of Fill are suitable for supporting the entry steps and ramp foundations. We recommend that all excavations for new foundations be extended below the existing Fill to the underlying Sand soils. Based on the Department of the Army Technical Manual (TM 5-852-3), the existing shallow soils are classified as Group F2 materials (sands containing between 3 to 15 percent fines). These materials exhibit a low to medium degree of frost susceptibility. However, PSI recommends that the foundations be constructed over a suitable base course material, such as the Structural Fill or Dense Graded Crushed Stone described in Section 3.3 of this report.

Where excavations to attain the elevation of the Sand soils result in overexcavations below the design bearing levels or those required for a base course material below the foundations, backfill should consist of Structural Fill or Dense Graded Crushed Stone. Backfill materials should be placed and compacted in accordance with Section 3.3 of this report.

In this geographic area, the typical design bearing depth for frost protection is 4 feet below the lowest adjacent exterior finished grade. PSI recommends that the foundations be designed as frost-protected shallow foundations for the local conditions.

New foundations bearing in the properly compacted backfill materials as discussed above or natural Sand soils may be proportioned using a maximum allowable net bearing pressure of 3,000 psf. For this pressure, maximum settlements of 1-inch are anticipated and the settlement is expected to occur during construction and shortly thereafter. Therefore, long-term settlement is not expected. Based on the information provided, we anticipate that the bearing pressure will be substantially less than 3,000 psf and, consequently, settlements will likely be less than 1 inch. If the actual loads are greater than expected or design conditions change, PSI must be notified to determine if alterative recommendations are warranted.

For any planned at-grade slab subgrades, prepared as recommended above, a Modulus of Subgrade Reaction, k value, of 150 pounds per cubic inch (pci) may be used, based on a presumed value for a 1-foot by 1-foot plate load test. If the software used to model the equipment pads requires a subgrade modulus based on the full footprint of the pad, the modulus of subgrade reaction should be reduced in accordance with the following equation for the actual foundation dimensions selected.

Kr = K {(B+1)/2B}2

where: Kr = reduced subgrade modulus (pci)
K = unit subgrade modulus (pci)
B = foundation width (feet)

All excavations and overexcavations (if necessary) should be observed by a representative of PSI prior to placement of backfill materials to confirm and document that the materials are consistent with the materials described in the report. Proof-rolling using walk-behind or driven, smooth-drum rollers (if excavation dimensions permit) should be performed to identify loose/yielding conditions. Where such conditions are observed, additional overexcavation to a denser stratum and placement of one of the aforementioned backfill materials should be performed.

3.9 SEISMIC CONSIDERATIONS

Subsurface conditions beginning at the surface of the site within the boring locations consist of approximately 2½ to 10 feet of very loose to dense Fill material underlain by loose to medium dense Sand soils and then medium dense Sand and Gravel soils and loose to medium dense Silty Sand to Sandy Silt soils to the depths explored.

Therefore, it is PSI's opinion that the site should be classified as Site Class D as defined in the Building Code and using the available information, if necessary, for design. Seismic values based on Site Class D are presented in the following table.

2015 International Building Code and Massachusetts Amendments	Reference	Equation	Value
City – Newton, MA			
Site Class Definition	1613.3.2	D	
Earthquake Design Factors (short)	Table 1604.11	S_S	0.208
Earthquake Design Factors (1 -sec)	Table 1604.11	S_1	0.068
Site Coefficient - F_a	Table 1613.3.3(1)	F_a	1.6
Site Coefficient - F_v	Table 1613.3.3(2)	F_v	2.4
Max EQ spectral response - S_{MS}	Eq 16-37	F_a*S_S	0.333
Max EQ spectral response - S_{M1}	Eq 16-38	F_v*S_1	0.163
Design spectral response acceleration - S_{DS}	Eq 16-39	2/3*S_{MS}	0.222
Design spectral response acceleration - S_{D1}	Eq 16-40	2/3*S_{M1}	0.109

The subsurface conditions to the depths explored at the site were also assessed for its liquefaction potential using the guidance provided in the 2015 International Building Code and Massachusetts Amendments. It is PSI's opinion that the site is not susceptible to liquefaction to the depths explored.

4.0 CONSTRUCTION CONSIDERATIONS

4.1 EXCAVATION CONSIDERATIONS

In Federal Register, Volume 54, No. 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, Part 1926, Subpart P". This document was established to better enhance the safety of workers entering trenches or excavations.

Federal regulation mandates that all excavations, whether they be utility trenches, basement or footing excavations or others (i.e. underground storage tanks), be constructed in accordance with the OSHA requirements. It is our understanding that these regulations are being strictly enforced and if they are not closely followed, the Owner and the contractor could risk injury to workers and be liable for substantial financial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's responsible person, as defined in “29 CFR Part 1926”, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination or excavation depth, including utility trench excavation depth, exceed those specified in local, state and federal safety regulations.

We are providing this information solely as a service to our Client. PSI is not assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred.

4.2 CONSTRUCTION DEWATERING

The depth at which groundwater was observed within the boreholes during drilling operations was at approximately 6 to 10 feet below surface grade (EL 19.8 to 20.5) during the field exploration program at the site.

Should groundwater or wet conditions be encountered, it is PSI’s opinion that dewatering can be handled by pumping from gravel-lined, cased sumps to lower the water 1 to 2 feet. Additional groundwater lowering will likely require the use of wellpoints or deep wells. If dewatering is necessary, the contractor is solely responsible for designing all dewatering systems and maintaining a groundwater level that is at least 24 inches below the bottom of the excavation so that the bottom of the excavation remains firm and dry to allow placing and compacting of fill.

The contractor is responsible for maintaining a dewatered and firm subgrade condition and is solely responsible for selecting the method of groundwater control, designing, and maintaining the system. PSI recommends that this requirement be stated in the project specifications.

5.0 GEOTECHNICAL RISK

The concept of risk is an important aspect of the geotechnical evaluation. The primary reason for this is that the analytical methods used to develop geotechnical recommendations do not comprise an exact science. Site exploration identifies actual subsurface conditions only at those points where samples are taken.

A geotechnical report is based on conditions that existed at the time of the subsurface exploration. The analytical tools which geotechnical engineers use are generally empirical and must be used in conjunction with engineering judgment and experience. Therefore, the solutions and recommendations presented in the geotechnical evaluation should not be considered risk-free and, more importantly, are not a guarantee that the interaction between the soils and the proposed structure will perform as planned.

The engineering recommendations presented in the preceding sections constitute PSI's professional estimate of those measures that are necessary for the proposed structure to perform according to the proposed design based on the information generated and referenced during this evaluation, and PSI's experience in working with these conditions.

6.0 REPORT LIMITATIONS

PSI's professional services have been performed and our findings presented in accordance with generally accepted geotechnical engineering principles and practices. PSI is not responsible for the conclusions, opinions, or recommendations made by others based on this data. No other warranties are implied or expressed. As stated previously, our recommendations are made based on the limited information available.

The scope of explorations was intended to assess soil conditions within the influence of the proposed foundations. The analyses and recommendations submitted in this report are based upon the data obtained from the soil borings performed at the locations indicated. If subsoil variations become evident during this project, a re-assessment of the recommendations contained in this report will be necessary after we have had an opportunity to observe the characteristics of the conditions encountered. The applicability of the report should also be reviewed in the event significant changes occur in the design, nature, or location of the proposed structure.

The scope of our services does not include any environmental assessment or investigation for the presence or absence of hazardous or toxic materials in the soil, groundwater, or surface water within or beyond the site studied. Any statements in this report regarding odors, staining of soils, or other unusual conditions observed are strictly for the information of our Client.

PSI did not provide any service to investigate or detect the presence of moisture, mold or other biological contaminate in or around any structure, or any service that was designed or intended to prevent or lower the risk of the occurrence of the amplification of the same. Mold is ubiquitous to the environment with mold amplification occurring when building materials are impacted by moisture. Site conditions are outside of PSI's control, and mold amplification will likely occur, or continue to occur, in the presence of moisture. As such, PSI cannot and shall not be held responsible of the occurrence or recurrence of mold amplification.

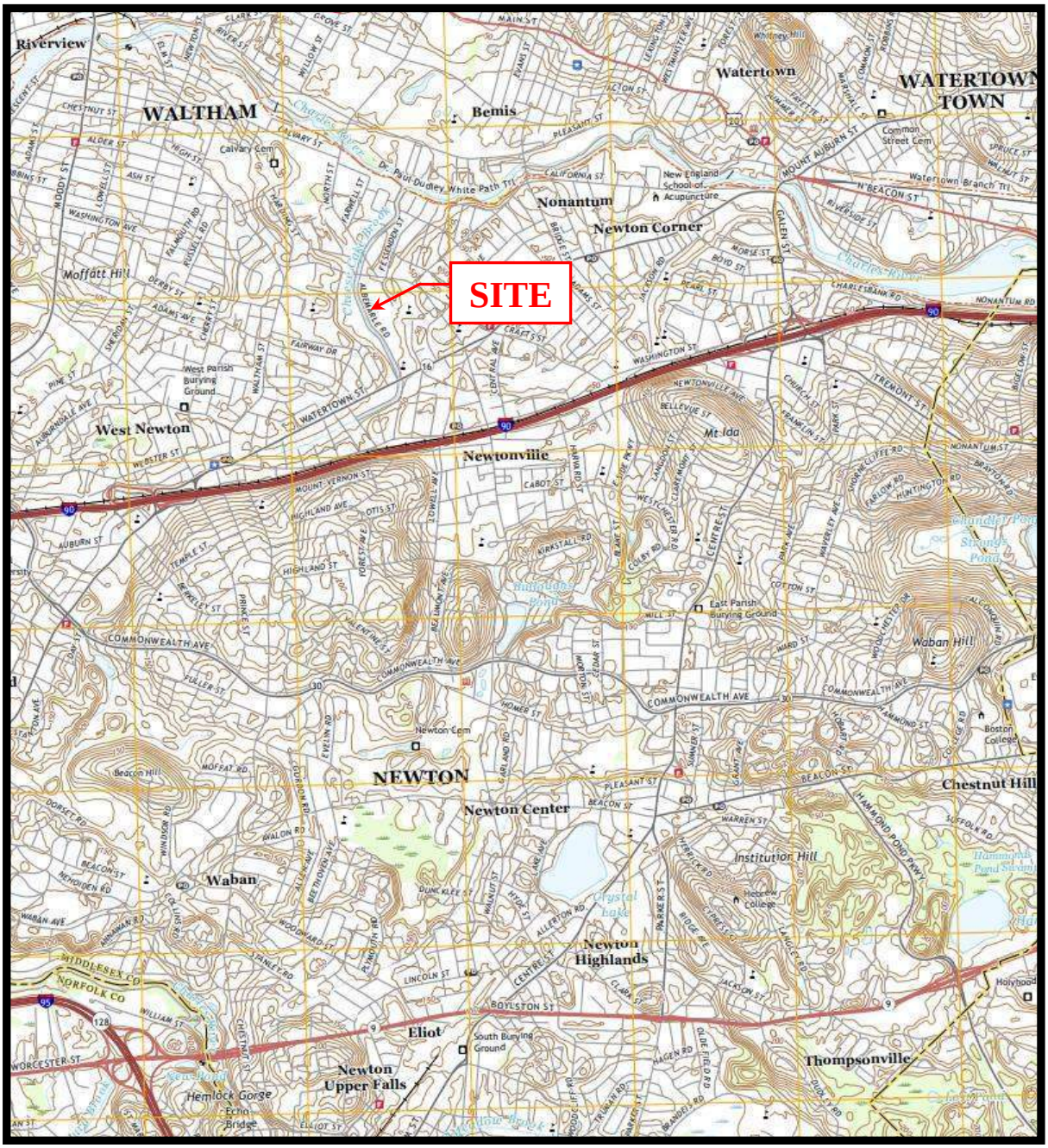
After the plans and specifications are more complete, the geotechnical engineer should be retained and provided the opportunity to review the final design plans and specifications to check that our engineering recommendations have been properly incorporated into the design documents. At that time, it may be necessary to submit supplementary recommendations.

FIGURES

Figure 1: USGS Site Location Plan

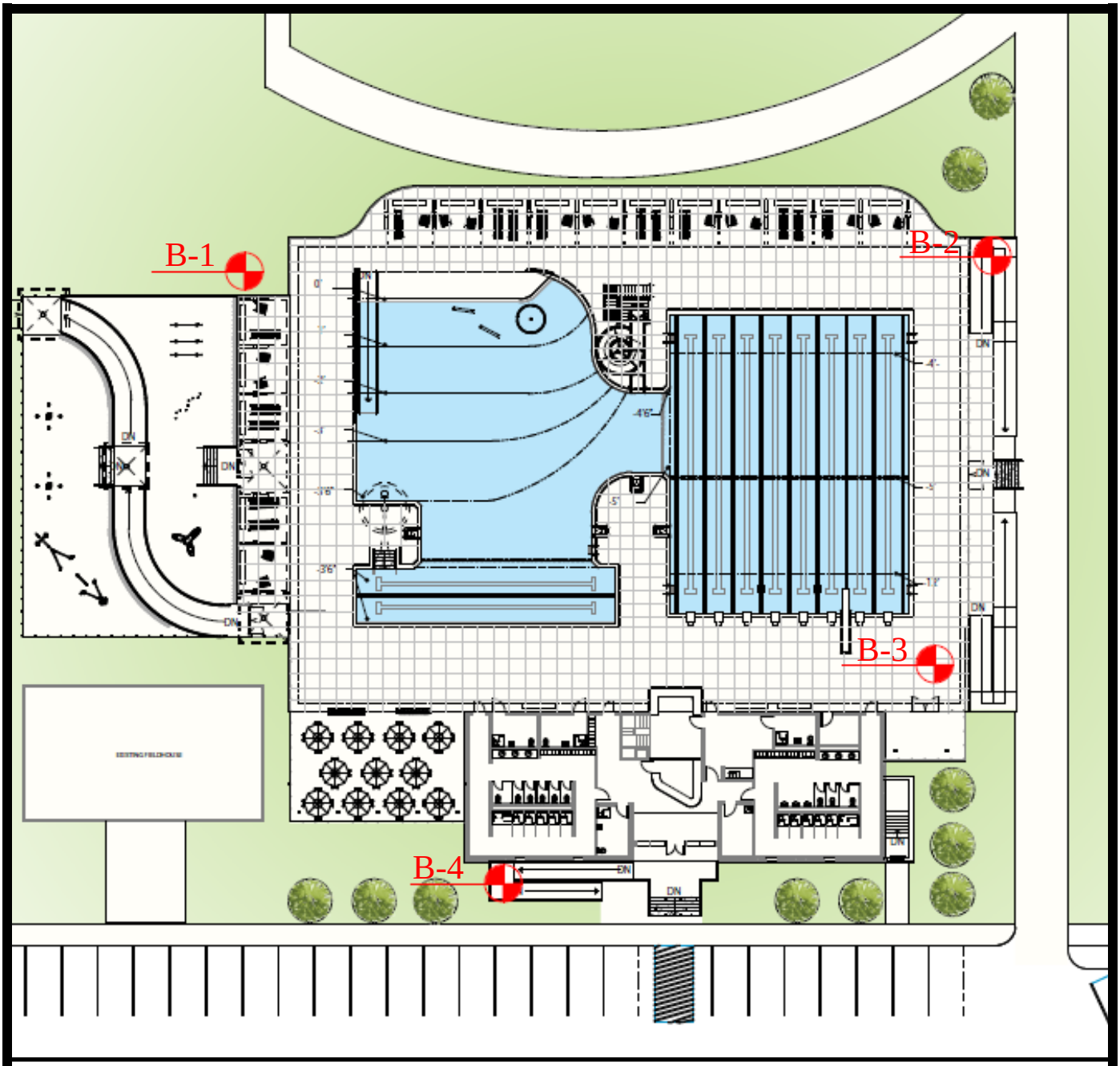
Figure 2: Boring Location Plan

Figure 3: Surficial Geology



REFERENCE: U.S.G.S. "NEWTON, MA" 7.5' QUADRANGLE MAP
ISSUED: 2021

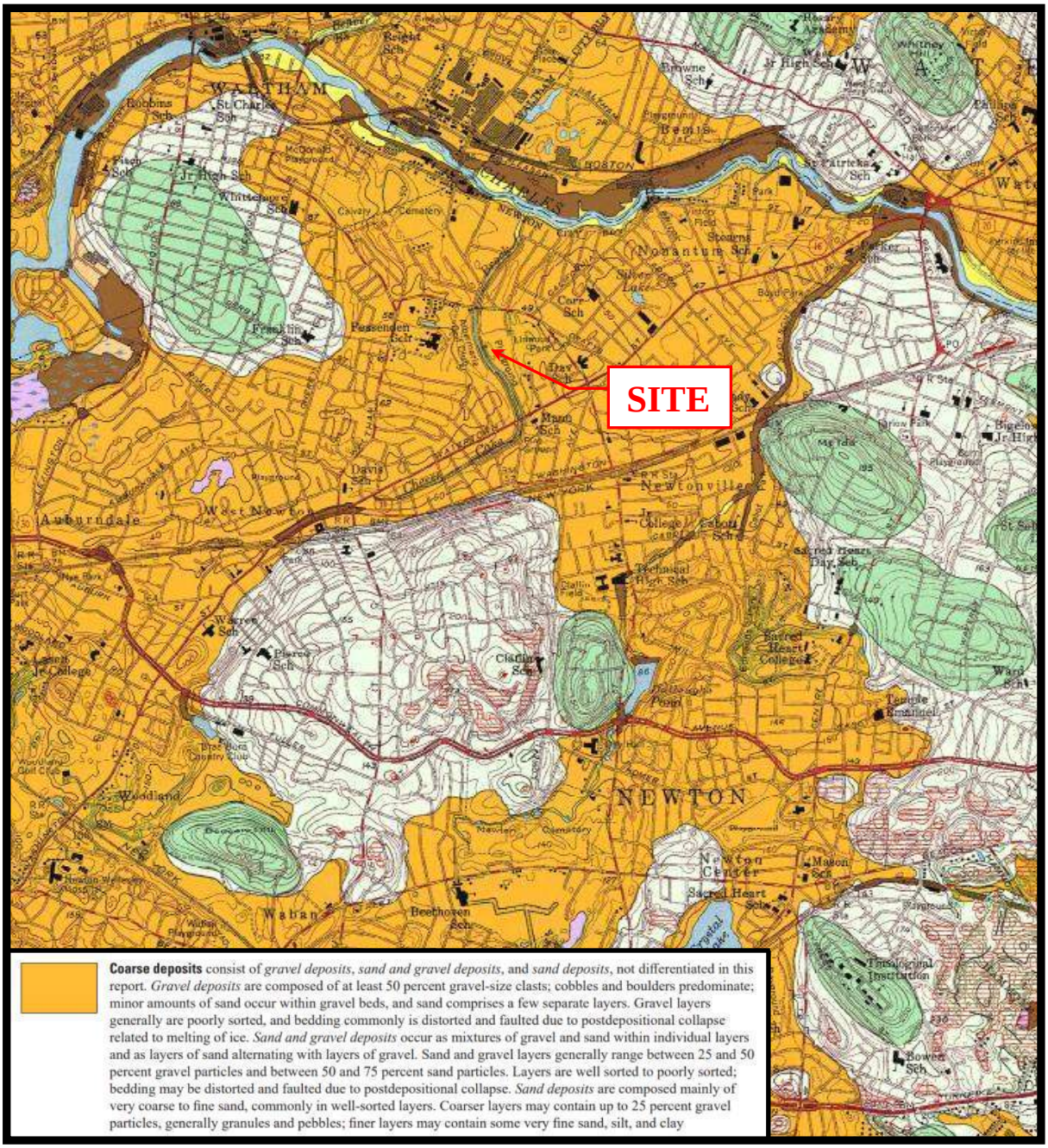
FIGURE 1: USGS SITE LOCATION PLAN		PSI Project No.	Date	Scale
PROJECT NAME: Harry Gath Memorial Pool 256 Albemarle Road Newton, MA 02460		04461180	November 2022	N.T.S.



Boring Location

- Base Plan is Overall Plan (dated 5/20/22) provided by the Client.
- Borings were located in the field by PSI. Locations are approximate.
- Borings were drilled on November 3, 2022 by Soil X Corporation of Leominster, MA.

FIGURE 2: BORING LOCATION PLAN	PSI Project No.	Date	
PROJECT: Harry Gath Memorial Pool 256 Albemarle Road Newton, MA 02460	04461180	November 2022	



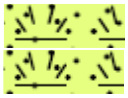
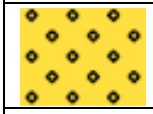
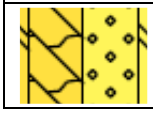
REFERENCE: "Surficial Materials Map of the Newton Quadrangle, Massachusetts"
Compiled by Byron D. Stone and Mary L. DiGiacomo-Cohen - 2018

FIGURE 3: SURFICIAL GEOLOGY		PSI Project No.	Date	Scale
PROJECT NAME: Harry Gath Memorial Pool 256 Albemarle Road Newton, MA 02460		04461180	November 2022	N.T.S.

APPENDIX

Boring Logs

Legend for Graphic Log

	**Topsoil**
	**Bituminous Concrete**
	**Concrete**
	**Fill**
	**Sand**
	**Sand and Gravel**
	**Silty Sand to Sandy Silt**

BORING B-1

DATE STARTED:	11/3/22	**DRILL COMPANY:**	Soil X Corp.
DATE COMPLETED:	11/3/22	**DRILLER**	Michael Tisdale
COMPLETION DEPTH	22.0 ft	**LOGGED BY:**	Intertek-PSI
BENCHMARK:	N/A	**DRILL RIG:**	Geoprobe 6610
ELEVATION:	28 ft	**DRILLING METHOD:**	Flush Joint Casing
LATITUDE:		**SAMPLING METHOD:**	SS
LONGITUDE:		**HAMMER TYPE:**	Automatic
STATION:	N/A	**EFFICIENCY**	N/A
OFFSET:	N/A	**REVIEWED BY:**	Brianna Hansen

Water While Drilling 8 feet

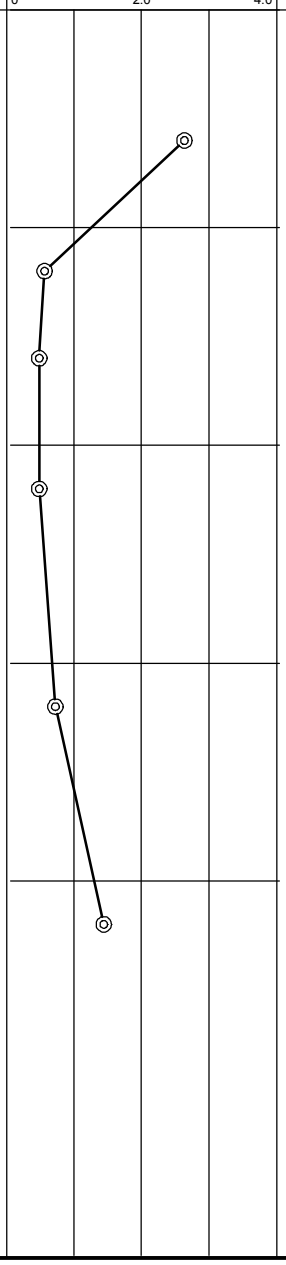
BORING LOCATION:

REMARKS: Ground elevation is based on information contained on provided 250 Albemarle Road Survey (dated 6/6/2022) and is approximate.

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %
	0			Approximately 6" of topsoil			
		1	15	Very loose, brown, fine to coarse sand, trace to little silt, trace gravel **(Fill)**		woh-woh-2-3	
		2	19	Dense Top 4"- brown, fine to coarse sand, trace to little silt **(Fill)** 5"- dark brown, fine to medium sand, little silt, little gravel **(Fill)**		4-16-17-17 N=33	
	5			Brown, fine to coarse sand, trace to little silt, little to some gravel **(Fill)**			
		3	18	Loose, light brown, fine to coarse sand, trace silt		8-4-3-3 N=7	
		4	21	Loose, light brown, fine to coarse sand, trace silt		4-3-3-2 N=6	
	10	5	20	Loose, light brown to brown, fine to coarse sand. trace silt, trace fine gravel		woh-2-4-4 N=6	
	15	6	18	Loose, brown, fine to coarse sand, trace to little silt, trace fine gravel		17-4-5-15 N=9	
	20	7	9	Medium dense, brown, fine to coarse sand, trace silt, little to some gravel		6-7-11-10 N=18	
				Boring terminated at ~22 feet bgs			

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
Moisture ✕ PL ◪ LL ✚
0 25 50
STRENGTH, tsf
Qu ▲ Qp ✳
0 2.0 4.0

Additional Remarks



Professional Service Industries, Inc.
480 Neponset Street, Suite 9C
Canton, MA 02021
Telephone: (781) 821-2355

PROJECT NO.: 04461180
PROJECT: Harry Gath Memorial Pool Improvements
LOCATION: 256 Albemarle Road
Newton, MA 02460

The stratification lines represent approximate boundaries. The transition may be gradual.

BORING B-2

DATE STARTED:	11/3/22	**DRILL COMPANY:**	Soil X Corp.
DATE COMPLETED:	11/3/22	**DRILLER**	Michael Tisdale
COMPLETION DEPTH	22.0 ft	**LOGGED BY:**	Intertek-PSI
BENCHMARK:	N/A	**DRILL RIG:**	Geoprobe 6610
ELEVATION:	26.5 ft	**DRILLING METHOD:**	Flush Joint Casing
LATITUDE:		**SAMPLING METHOD:**	SS
LONGITUDE:		**HAMMER TYPE:**	Automatic
STATION:	N/A	**EFFICIENCY**	N/A
OFFSET:	N/A	**REVIEWED BY:**	Brianna Hansen

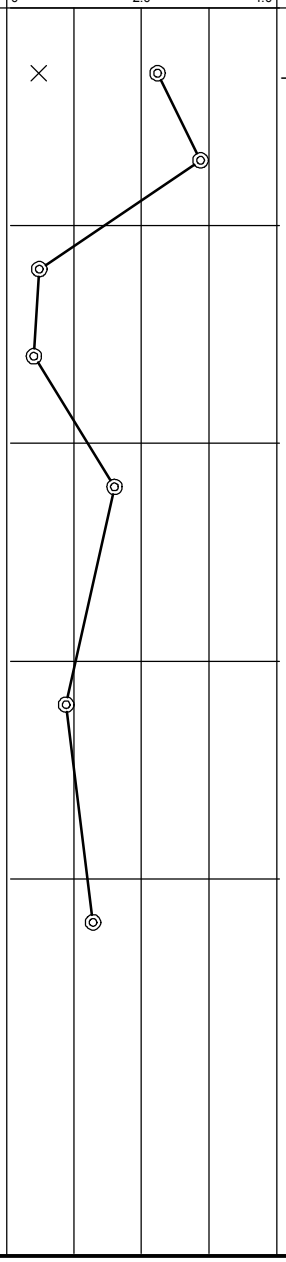
Water While Drilling 6 feet

BORING LOCATION:

REMARKS: Ground elevation is based on information contained on provided 250 Albemarle Road Survey (dated 6/6/2022) and is approximate.

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
25	0	1	11	Approximately 2" of bituminous concrete Medium dense, brown, fine to coarse sand, trace to little silt, little to some fine gravel **(Fill)**		6-11-17-14 N=28	6	-200 = 11%
		2	16	Dense Top 3"- grayish brown, fine to coarse sand, trace silt, little gravel **(Fill)** 3" lense of stone		20-16-20-19 N=36		
20	5	3	13	Brown, fine to coarse sand, trace to little silt, little to some gravel **(Fill)** Loose, light brown, fine to coarse sand, trace silt Lenses of fine sand		7-3-3-2 N=6		
		4	18	Loose, light brown, fine to coarse sand, trace silt, trace to little gravel		2-3-2-5 N=5		
15	10	5	13	Medium dense, light brown, fine to coarse sand, trace silt, trace fine gravel Lense of fine sand		11-9-1-13 N=20		
10	15	6	11	Medium dense, brown, fine to coarse sand, trace silt, little gravel		4-4-7-9 N=11		
5	20	7	11	Medium dense, brown, fine to coarse sand, trace silt, little to some gravel		10-11-5-7 N=16		
				Boring terminated at ~22 feet bgs				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
× Moisture ◪ PL ✚ LL
0 25 50
STRENGTH, tsf
▲ Qu ✳ Qp
0 2.0 4.0



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LOCATION: 256 Albemarle Road
Newton, MA 02460

The stratification lines represent approximate boundaries. The transition may be gradual.

BORING B-3

DATE STARTED:	11/3/22	**DRILL COMPANY:**	Soil X Corp.
DATE COMPLETED:	11/3/22	**DRILLER**	Michael Tisdale
COMPLETION DEPTH	27.0 ft	**LOGGED BY:**	Intertek-PSI
BENCHMARK:	N/A	**DRILL RIG:**	Geoprobe 6610
ELEVATION:	30 ft	**DRILLING METHOD:**	Flush Joint Casing
LATITUDE:		**SAMPLING METHOD:**	SS
LONGITUDE:		**HAMMER TYPE:**	Automatic
STATION:	N/A	**EFFICIENCY**	N/A
OFFSET:	N/A	**REVIEWED BY:**	Brianna Hansen

Water While Drilling 10 feet

BORING LOCATION:

REMARKS: Ground elevation is based on information contained on provided 250 Albemarle Road Survey (dated 6/6/2022) and is approximate.

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
	0			Approximately 6" of bituminous concrete				
		1	9	Loose, dark brown, fine to coarse sand, little silt, little gravel **(Fill)**		9-5-5-4 N=10		
		2	13	Loose, dark brown, fine to coarse sand, little silt, little to some fine gravel **(Fill)**		3-3-2-5 N=5	9	-200 = 13%
25	5	3	16	Dense, grayish brown, fine to coarse sand, trace silt, little to some gravel **(Fill)**		24-24-21-17 N=45		
		4	16	Medium dense, grayish brown, fine to coarse sand, trace silt, little to some gravel **(Fill)**		19-13-9-7 N=22		
20	10	5	16	Loose, light brown, fine to coarse sand, trace silt		5-3-3-3 N=6		
		6	22	Loose, light brown, fine to coarse sand, trace silt; 5" lense of medium to coarse sand, trace to little fine sand, trace silt, trace fine gravel		2-4-3-5 N=7		
15	15	7	13	Loose, light brown, fine to coarse sand, trace silt		woh-4-4-4 N=8		
10	20	8	10	Loose, light brown, fine to coarse sand, trace silt		5-4-5-6 N=9		
				Loose, brown, fine to coarse sand, trace silt, little gravel				
5	25	9	12	Medium dense, brown, fine to coarse sand, little silt, trace to little gravel		4-7-12-12 N=19		
				Boring terminated at ~27 feet bgs				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
Moisture PL LL
0 25 50
STRENGTH, tsf
Qu Qp
0 2.0 4.0

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Newton, MA 02460

The stratification lines represent approximate boundaries. The transition may be gradual.

BORING B-4

DATE STARTED:	11/3/22	**DRILL COMPANY:**	Soil X Corp.
DATE COMPLETED:	11/3/22	**DRILLER**	Michael Tisdale
COMPLETION DEPTH	22.0 ft	**LOGGED BY:**	Intertek-PSI
BENCHMARK:	N/A	**DRILL RIG:**	Geoprobe 6610
ELEVATION:	25.8 ft	**DRILLING METHOD:**	Flush Joint Casing
LATITUDE:		**SAMPLING METHOD:**	SS
LONGITUDE:		**HAMMER TYPE:**	Automatic
STATION:	N/A	**EFFICIENCY**	N/A
OFFSET:	N/A	**REVIEWED BY:**	Brianna Hansen

Water While Drilling 6 feet

BORING LOCATION:

REMARKS: Ground elevation is based on information contained on provided 250 Albemarle Road Survey (dated 6/6/2022) and is approximate.

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	SPT Blows per 6-inch (SS)	Moisture, %	Additional Remarks
25	0			Approximately 2" of bituminous concrete				
		1	7	Loose Top 4"- brown, fine to coarse sand, trace to little silt, little gravel **(Fill)** Dark brown, fine to coarse sand, little silt, little gravel **(Fill)**		5-3-7-4 N=10		
		2	17	Loose, light brown, fine to coarse sand, trace silt		5-4-4-3 N=8		
20	5	3	20	Very loose, brown, fine to coarse sand, trace silt		4-2-2-2 N=4		
		4	24	Loose, brown, fine to medium sand, some silt		3-3-4-3 N=7	20	-200 = 28%
15	10	5	24	Loose, brown, fine to medium sand, some silt		woh-3-3-4 N=6		
10	15	6	24	Loose, brown, fine to medium sand and silt		3-2-5-5 N=7		
5	20	7	22	Medium dense, brown, fine to medium sand and silt		5-6-6-6 N=12		
				Boring terminated at ~22 feet bgs				

STANDARD PENETRATION TEST DATA
N in blows/ft ◎
Moisture × PL ◪ LL ✚
0 25 50
STRENGTH, tsf
Qu ▲ Qp ✳
0 2.0 4.0

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Newton, MA 02460

The stratification lines represent approximate boundaries. The transition may be gradual.

FIELD CLASSIFICATION SYSTEM FOR SOIL EXPLORATION

COHESIONLESS SOILS

(Silt, Sand, Gravel and Combinations)

Density

Very Loose	4 blows per foot or less
Loose	5 - 10 blows per foot
Medium Dense	11 - 30 blows per foot
Dense	31 - 50 blows per foot
Very Dense	51 blows per foot or more

Relative Properties

Descriptive Term	Percent
Trace	1 - 10
Little	11 - 20
Some	21 - 35
And	36 - 50

Particle Size Indentification

Boulders	8 inch diameter or more	
Cobbles	3 - 8 inch diameter	
Gravel	Coarse	1 - 3 inches
	Medium	1/2 - 1 inch
	Fine	1/4 - 1/2 inch
Sand	Coarse	0.6 mm - 1/4 inch (diameter of pencil lead)
	Medium	0.2 mm - 0.6 mm (diameter of broom straw)
	Fine	0.05 mm - 0.2 mm (diameter of human hair)
Silt		0.002 mm - 0.05 mm (cannot see particles)

COHESIVE SOILS

(Clay, Silt and Combinations)

Consistency

Very soft	2 blows per foot or less
Soft	3 - 4 blows per foot
Medim Stiff	5 - 8 blows per foot
Stiff	9 - 15 blows per foot
Very Stiff	16 - 30 blows per foot
Hard	31 blows per foot or more

Plasticity

Degree of Plasticity	Plasticity Index
None to slight	0 - 4
Slight	5 - 7
Medium	8 - 22
High to very high	over 22

CLASSIFICATION ON LOGS ARE MADE BY VISUAL EXAMINATION OF SAMPLES.

Standard Penetration Test — Driving a 2.0" O.D., 1 3/8" I.D., sampler a distance of 2.0 feet into undisturbed soil with a 140 pound hammer free falling a distance of 30 inches. The number of hammer blows required to drive the sampler into the soil in 6-inch increments is recorded. The sum of the hammer blows for the second and third interval provides the Standard Penetration Resistance (N) and is a measure of soil strength. The reader is referenced to ASTM D1586.

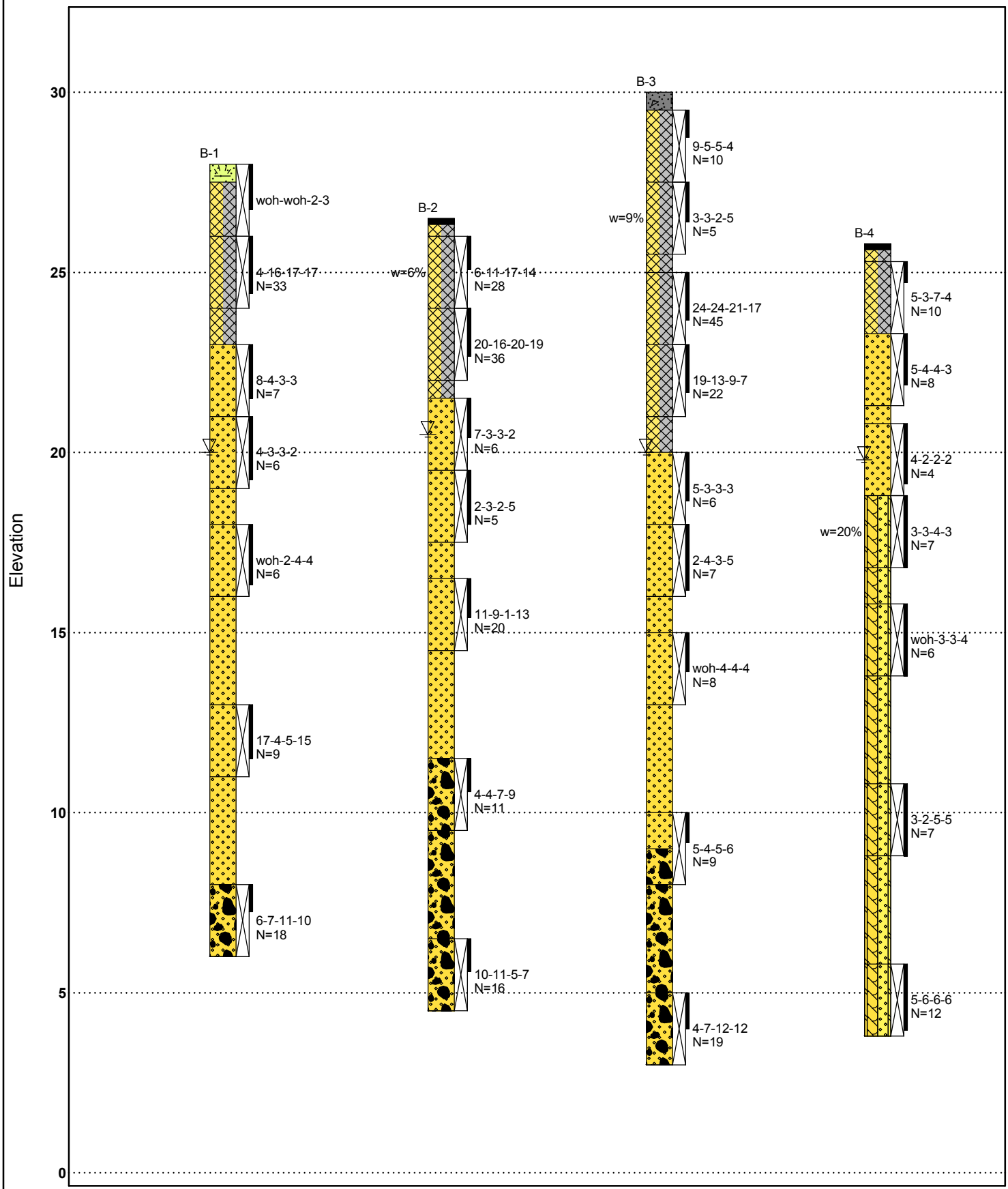
Strata Changes — Boundaries between soil layers are considered approximate based upon observed changes during the drilling operations or noted changes within representative samples.

Groundwater — Observations were made to determine either the depth or elevation of water at the times indicated on the Soil Exploration Logs. The water so encountered may be groundwater or perched water. The depth or elevations indicated for water may fluctuate due to seasonal changes or other unknown factors.

intertek psi

Soil Profiles

Profile



Professional Service Industries, Inc.
480 Neponset Street, Suite 9C
Canton, MA 02021
Telephone: (781) 821-2355

Harry Gath Memorial Pool Improvements
PSI Project Number: 04461180

Material Test Reports

Professional Service Industries, Inc.
480 Neponset Street, Suite 9C
Canton, MA 02021

Phone: (781) 821-2355
Fax: (781) 821-6276

Report No: MAT:04461180-1-S1
Issue No: 1

Material Test Report

Client: BARGMANN HENDRIE ARCHETYPE
9 CHANNEL CENTER STREET,
SUITE 300
BOSTON, MA 02210
CC:

Project: GATH MEMORIAL POOL IMPROVEMENT
NEWTON, MA

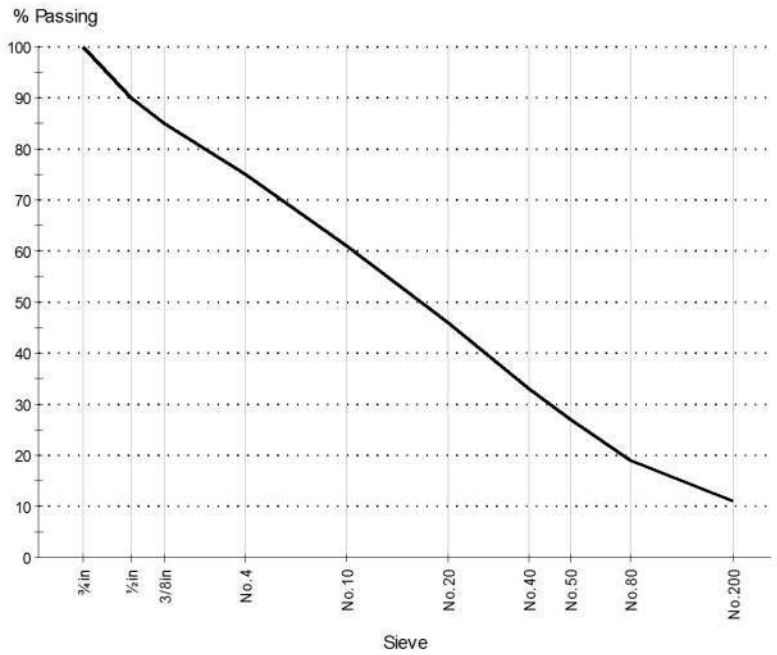
Approved Signatory: Yannick Lastennet (Department Manager)
Date of Issue: 11/15/2022

Sample Details

Sample ID:	04461180-1-S1
Client Sample ID:	
Date Sampled:	11/03/22
Sampled By:	PSI
Specification:	No Spec. Sieve
Supplier:	
Source:	On-site Boring
Material:	
Sampling Method:	Soil Boring Split Spoon Sample
General Location:	B-2 (0.5'-2.5')
Location:	
Lift:	

Sample Description:

Particle Size Distribution



COBBLES	GRAVEL		SAND			FINES (10.8%)	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
(0.0%)	(0.0%)	(24.7%)	(13.9%)	(28.2%)	(22.5%)		

Grading: ASTM C 136, ASTM C 117

Date Tested: 11/9/2022
Tested By: Gary Brooks

Sieve Size	% Passing	Limits
¾in (19.0mm)	100	
½in (12.5mm)	90	
3/8in (9.5mm)	85	
No.4 (4.75mm)	75	
No.10 (2.0mm)	61	
No.20 (850µm)	46	
No.40 (425µm)	33	
No.50 (300µm)	27	
No.80 (180µm)	19	
No.200 (75µm)	11	

D85: 9.5000 **D60:** 1.8891 **D50:** 1.0679
D30: 0.3571 **D15:** 0.1162 **D10:** 0.0672
Cu: 28.10 **Cc:** 1.00

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Issue No: 1

Material Test Report

Client: BARGMANN HENDRIE ARCHETYPE
9 CHANNEL CENTER STREET, SUITE 300
BOSTON, MA 02210

CC:

Project: GATH MEMORIAL POOL IMPROVEMENT
NEWTON, MA

Approved Signatory: Yannick Lastennet (Department Manager)
Date of Issue: 11/15/2022

Sample Details

Sample ID: 04461180-1-S1
Client Sample ID:
Date Sampled: 11/03/22
Sampled By: PSI
Specification: No Spec. Sieve
Supplier:
Source: On-site Boring
Material:
Sampling Method: Soil Boring Split Spoon Sample
General Location: B-2 (0.5'-2.5')
Location:
Lift:

Other Test Results

Description	Method	Result	Limits
Water content (%)	ASTM D 2216	5.9	
Method		B	
Tested By		Pritesh Solanki	
Date Tested		11/4/2022	

Comments

N/A

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480 Neponset Street, Suite 9C
Canton, MA 02021

Phone: (781) 821-2355
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Report No: MAT:04461180-1-S2
Issue No: 1

Material Test Report

Client: BARGMANN HENDRIE ARCHETYPE
9 CHANNEL CENTER STREET, SUITE 300
BOSTON, MA 02210
CC:

Project: GATH MEMORIAL POOL IMPROVEMENT
NEWTON, MA

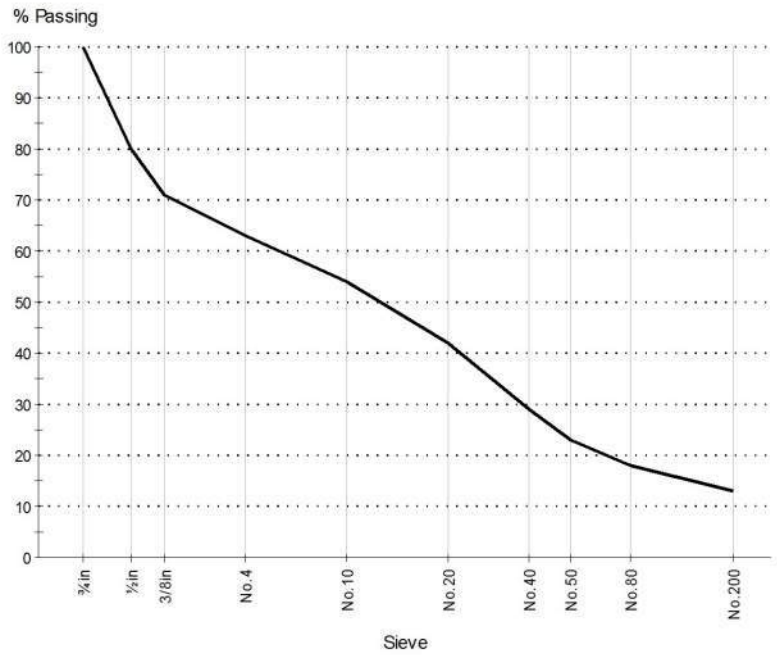
Approved Signatory: Yannick Lastennet (Department Manager)
Date of Issue: 11/15/2022

Sample Details

Sample ID:	04461180-1-S2
Client Sample ID:	
Date Sampled:	11/03/22
Sampled By:	PSI
Specification:	No Spec. Sieve
Supplier:	
Source:	On-site Boring
Material:	
Sampling Method:	Soil Boring Split Spoon Sample
General Location:	B-3 (2.5'-4.5')
Location:	
Lift:	

Sample Description:

Particle Size Distribution



COBBLES	GRAVEL		SAND			FINES (13.1%)	
(0.0%)	Coarse (0.0%)	Fine (36.8%)	Coarse (9.6%)	Medium (24.9%)	Fine (15.6%)	Silt	Clay

Grading: ASTM C 136, ASTM C 117

Date Tested: 11/9/2022
Tested By: Gary Brooks

Sieve Size	% Passing	Limits
¾in (19.0mm)	100	
½in (12.5mm)	80	
3/8in (9.5mm)	71	
No.4 (4.75mm)	63	
No.10 (2.0mm)	54	
No.20 (850µm)	42	
No.40 (425µm)	29	
No.50 (300µm)	23	
No.80 (180µm)	18	
No.200 (75µm)	13	

D85: 13.8794 **D60:** 3.5602 **D50:** 1.5037
D30: 0.4483 **D15:** 0.1065 **D10:** N/A

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Report No: MAT:04461180-1-S2
Issue No: 1

Material Test Report

Client: BARGMANN HENDRIE ARCHETYPE
9 CHANNEL CENTER STREET, SUITE 300
BOSTON, MA 02210

CC:

Project: GATH MEMORIAL POOL IMPROVEMENT
NEWTON, MA

Approved Signatory: Yannick Lastennet (Department Manager)
Date of Issue: 11/15/2022

Sample Details

Sample ID: 04461180-1-S2
Client Sample ID:
Date Sampled: 11/03/22
Sampled By: PSI
Specification: No Spec. Sieve
Supplier:
Source: On-site Boring
Material:
Sampling Method: Soil Boring Split Spoon Sample
General Location: B-3 (2.5'-4.5')
Location:
Lift:

Other Test Results

Description	Method	Result	Limits
Water content (%)	ASTM D 2216	9.3	
Method		B	
Tested By		Pritesh Solanki	
Date Tested		11/4/2022	

Comments

N/A

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Report No: MAT:04461180-1-S3
Issue No: 1

Material Test Report

Client: BARGMANN HENDRIE ARCHETYPE
9 CHANNEL CENTER STREET,
SUITE 300
BOSTON, MA 02210
CC:

Project: GATH MEMORIAL POOL IMPROVEMENT
NEWTON, MA

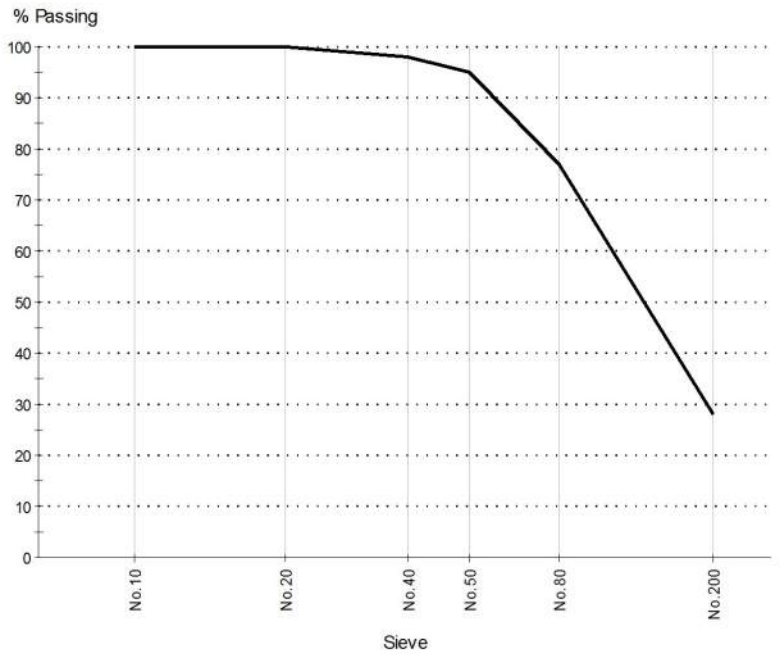
Approved Signatory: Yannick Lastennet (Department Manager)
Date of Issue: 11/15/2022

Sample Details

Sample ID:	04461180-1-S3
Client Sample ID:	
Date Sampled:	11/03/22
Sampled By:	PSI
Specification:	No Spec. Sieve
Supplier:	
Source:	On-site Boring
Material:	
Sampling Method:	Soil Boring Split Spoon Sample
General Location:	B-4 (7'-9')
Location:	
Lift:	

Sample Description:

Particle Size Distribution



COBBLES	GRAVEL		SAND			FINES (28.5%)	
(0.0%)	Coarse (0.0%)	Fine (0.0%)	Coarse (0.0%)	Medium (1.6%)	Fine (70.0%)	Silt	Clay

Grading: ASTM C 136, ASTM C 117

Date Tested: 11/9/2022
Tested By: Gary Brooks

Sieve Size	% Passing	Limits
No.10 (2.0mm)	100	
No.20 (850µm)	100	
No.40 (425µm)	98	
No.50 (300µm)	95	
No.80 (180µm)	77	
No.200 (75µm)	28	

D85: 0.2259 **D60:** 0.1329 **D50:** 0.1111
D30: 0.0777 **D15:** N/A **D10:** N/A

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Report No: MAT:04461180-1-S3
Issue No: 1

Material Test Report

Client: BARGMANN HENDRIE ARCHETYPE
9 CHANNEL CENTER STREET, SUITE 300
BOSTON, MA 02210

CC:

Project: GATH MEMORIAL POOL IMPROVEMENT
NEWTON, MA

Approved Signatory: Yannick Lastennet (Department Manager)
Date of Issue: 11/15/2022

Sample Details

Sample ID: 04461180-1-S3
Client Sample ID:
Date Sampled: 11/03/22
Sampled By: PSI
Specification: No Spec. Sieve
Supplier:
Source: On-site Boring
Material:
Sampling Method: Soil Boring Split Spoon Sample
General Location: B-4 (7'-9')
Location:
Lift:

Other Test Results

Description	Method	Result	Limits
Water content (%)	ASTM D 2216	20.1	
Method		B	
Tested By		Pritesh Solanki	
Date Tested		11/9/2022	

Comments

N/A