Geotechnical Engineering Report

Proposed Condominium Development
207 Beach Rd., Salisbury, MA 01952

Prepared For: Millennium Engineering, Inc.
Attn: Mr. Eric Botterman
62 Elm St.
Salisbury, MA 01952

Prepared By:

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Project #1623
October 19, 2021
Revision 01 (February 2, 2022)

AAT Engineering, LLC
Civil & Geotechnical Engineering

October 19, 2021
(Revision 01 February 2, 2022)

Millennium Engineering, Inc.
Attn: Mr. Eric Botterman
62 Elm St.
Salisbury, MA 01952

Re: Limited Geotechnical Engineering Report
Proposed Condominium Development – 207 Beach Rd., Salisbury, MA
Project #1623.A

Mr. Botterman:

AAT Engineering, LLC (AAT) is pleased to present this report regarding our geotechnical exploration to support foundation design recommendations for the proposed 2.5-story condominium structures located at 207 Beach Rd. in Salisbury, Massachusetts (Site). We understand there will be 6 duplex structures and 2 single structures. This report was prepared in general accordance with our proposal dated August 5, 2021 and is subject to the *Limitations* included in (Appendix A).

PURPOSE

The purpose of this subsurface exploration program is to assess the subsurface soil and groundwater conditions at the Site as they relate to foundation design recommendations and construction conditions for the proposed structures.

SITE AND PROJECT DESCRIPTION

The project site is located at the corner of Old County Rd and Beach Road in Salisbury, Massachusetts. The site is currently undeveloped with a grass vegetative surface. The general topography of the property is flat with a gentle slope from the east towards a vegetative wetland located along the west side of the property. The Site is bound by multi-unit residences on the east, single family duplexes to the north and Old County Rd and Beach Rd to the east and south.

The proposed development consists of constructing a 6 new 2.5-story multi-family structures and 2 single family structures with roadway and driveways. It is our understanding the new structure will be constructed as slab-on-grade with no basements.

FIELD EXPLORATION

Between August 30, 2021 and August 31, 2021, Soil X Corp of Leominster, Massachusetts advanced eleven (11) test borings, identified as B1 through B11. The approximate locations of the test borings are shown on the *Test Boring Location Plan* (Figure 2). The borings were conducted under the observation of a field engineer from our office. The test boring was advanced using a B-57 Mobile ATV mounted drill rig using 4 ¼-inch hollow stem augers. The borings were advanced to depths ranging from 12 to 22 feet below existing grade. Soil samples were obtained with a standard 2-inch outside diameter split-barrel sampler at 2 and 5 foot intervals.

Standard Penetration Tests (SPTs) were performed at the sampling intervals in general accordance with ASTM-D1586 *(Standard Method for Penetration Test and Split-Barrel Sampling of Soils)*. *Test boring logs* prepared by AAT Engineering are included in (Appendix B) of this report.

SUBSURFACE CONDITIONS

The subsurface conditions as determined by the test borings typically identified a thin surficial layer underlain by a granular fill layer underlain by a organic peat deposit underlain by a fine grained glaciofluvial outwash deposit.

The characteristics of the soils are described below in order of increasing depth below ground surface based on visual and physical characteristics.

Granular Fill
The surficial organic layer is approximately 2 to 4 inches thick and is underlain by a granular fill layer. The granular fill layer is described as a; dark brown to brown, fine grained sand with trace amount gravel, cobbles, slag, asphalt and bricks. The overall fill layer appears to range in thickness from 4 to 7 feet. The relative density of this layer as correlated to the SPT value is typically loose to medium dense with blow counts ranging from 3 to 28 blows per foot.

Mucky Peat
A deposit of soft organic silt (Muck and Peat) with an average thickness of 5 feet was encountered below the granular fill layer. This layer is described as; a very soft, dark brown, organic, sandy silt with fibrous root matter. The relative density of this layer as correlated to the SPT value is typically very soft with blow counts of Weight of Hammer blows per foot.

Glaciofluvial Sand
A deposit of glaciofluvial sand and outwash sand was encountered below the Mucky Peat deposit to the extent of sampling. This deposit is generally described

as a; brown to olive/brown, fine and fine to coarse grained sand. The relative density of this layer as correlated to the SPT's is typically medium dense to dense with blow counts ranging from 10 to 40 blows per foot.

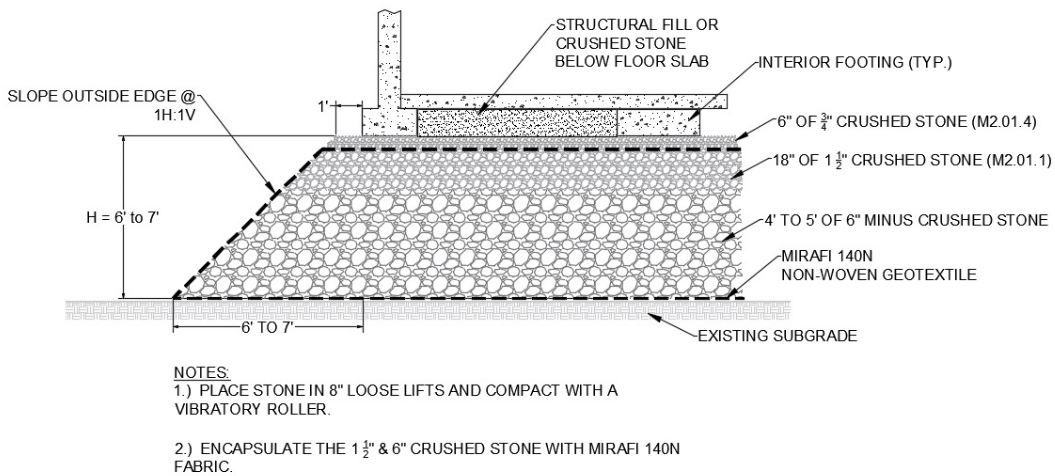
Groundwater Levels
Observations were made during drilling to assess groundwater levels. The groundwater was typically observed at 5 feet below grade at all test borings with the exception of B8 and B11 where it was observed at 2 feet below grade. The shallower groundwater depth appears to be due to a perched water condition resulting from lower permeability soils below. Groundwater conditions will vary depending on temperature, season, precipitation, perched conditions due to restrictive layers and other conditions that may differ from those at the time of the drilling.

GEOTECHNICAL RECOMMENDATIONS

Foundation Recommendations
The underlying soils encountered within the footprint of the proposed structures are typically granular fill underlain by very soft organic peat underlain by medium dense glaciofluvial sands to an explored depth of 22 feet below existing grade. It is expected that the peat will settle when subjected to new foundation loads. The compression of the peat is difficult to predict however it could be expected to settle about ½ inch for every foot of peat thickness. As a result of these poor soil conditions, the very soft organic soils are not suitable for supporting shallow foundations. Therefore, we provide the following three recommendations to consider:

Option #1 – Remove and Replace
Remove and replace is considered a viable option only if groundwater can be controlled and the side of the open excavation can be kept stable. Excavation depths of 10 to 11 feet are anticipated for this option which will be well below the observed groundwater elevation. The open excavation will need to be continuously dewatered during activities. If so, then we would recommend that the base below the new footings be improved by constructing a crushed stone mat. The new footings should bear on a working mat constructed over the medium dense native glaciofluvial outwash soils. The working mat should consist of a 6 to 7 foot thick layer of compacted crushed stones varying in size from 6-inch minus to ¾-inch. The larger stones should be placed first with smaller stones near the top of the mat. Prior to placement of the larger stone, we recommend that a layer of non-woven geotextile fabric such as Mirafi 140N be installed over the subgrade to minimize the movement of the underlying fine soils into the crushed stone. The filter fabric should be overlapped 3 feet and stretched and kept taut while placing the stone. The crushed stone should be placed in 8-inch to 12-inch lifts and compacted using vibratory compactors. The top of the stone mat should extend a minimum of 1 foot beyond each edge of the footing to extend out past the bearing zone. The footing-bearing zone is described as a line drawn from one foot outside the exterior footing edge down at a one-

horizontal to one-vertical (1H:1V) theoretical line. See sketch below showing details for the proposed *Base Improvement Mat*



Base Improvement Mat

We recommend a maximum net allowable bearing pressure of 3,000 pounds per square foot (1.5 tsf) for footings bearing on the Base Improvement Mat placed directly over the native sandy subsoils. Individual spread footings and strip footings should be no less than 3 feet and 2 feet wide respectively. Exterior footings should be protected from frost with at least 4 feet of earthen cover or other insulating material providing equivalent resistance against heat transfer

Footings designed in accordance with these recommendations provided herein are expected to have total and differential settlements of less than 1 inch and ½ inch, respectively. Since the native soil is granular, we expect that the settlement will occur during construction and shortly thereafter as load is applied to the foundation.

Option #2 – Ground Improvement
Improve the underlying soil conditions by using soil densification techniques to allow for the use of shallow foundations such as strip footings and spread footings. For this process we would recommend using Rammed Aggregate Piers known as (RAPs) which are a proprietary system designed and installed by a qualified specialty contractor such as Geopier Tensar. RAPs use rammed aggregate in augured borings to simultaneously create strong vertical columns for point load support and also densifies the soil between the piers. The benefit of RAPs is that they allow for installation of lower cost conventional spread and strip foundations and concrete slab-on-grade rather than needing costly pile caps, grade beams and piles to support concrete slabs.

<u>RAPs</u>

RAPs consist of compacted crushed stone, installed in relatively thin lifts within a cased or open borehole. Boreholes are typically around 20 to 30 inches in diameter and are spaced on a grid to support the overlying structure and pavement area. The piers are advanced to a depth to strengthen the loose soil layers. We would anticipate that the gravel piers would be at least 20 to 25 feet below grade.

Where soils are subject to collapse due to groundwater, casing is typically used to temporarily support the sides of the piers during construction. As the casing is lifted approximately 2 feet, aggregate is placed and compacted at the bottom of the hole, and the process is repeated to grade. The compaction of the aggregate creates a "stone column" beneath individual building columns and wall footings. In addition, the compacted aggregate creates a densified zone surrounding the stone column. Piers are spaced at a predetermined distance below each column.

Specific design of RAPs for a given site is generally done by the installer of the system, Geopier Tensar. The size and spacing of the piers is normally based on the vertical loads, slab loading, and the properties of the underlying soil. It is common to achieve net allowable bearing capacities of 4,000 to 6,000 pounds per square foot (psf) using this ground improvement process. Prior to commencing with the stabilization, the RAP designer will be able to provide an anticipated net allowable bearing capacity that can be expected upon completion of installing the RAPs.

<u>*Option #3 – Helical Piles*</u>

Helical piles may be considered as a deep foundation alternative. The recent test boring data shows that the underlying glaciofluvial deposit is favorable for supporting helical piles. Our test boring data doesn't indicate the presence of large cobbles or boulders however obstructions may be present within the granular fill layer which may hinder the installation of some helical piles. If this occurs, the helical piles should be extracted and re-installed in close proximity to the original location.

Helical piles consist of galvanized steel shafts that are fitted with helical sections that vary from about 8 to 14 inches in diameter. Helical piles derive their support through torque rather than end bearing and are best suited in medium dense to dense granular soils. The installation of these piles is considered vibration free and can be installed with smaller track mounted equipment and/or by hand held equipment. Helical piles would be installed through the granular fill, organic peat/muck and achieve bearing capacity in the underlying glaciofluvial deposit at an approximate depth of 20 to 25 feet below existing ground surface.

Preliminary design estimates suggest that an allowable capacity of ±10 tons may be achieved with helical piles using a (FS=2) with a pile length of 20 to 25 feet below existing grade. The piles should be galvanized (ASTM A123) for long-term corrosion protection.

The preliminary design assumes the helical plate configuration shall be a minimum of three plates; 14-inch, 12-inch and 10-inch (14/12/10) in diameter. The plates should not be less than 3/8-inch thickness. The shaft used for the preliminary design was 2-7/8 inch outside-diameter (minimum 0.203 wall thickness). The hollow tubular steel shaft can be filled with flowable cement grout to add stiffness to the shaft to resist lateral buckling through the loose and soft layers.

The final determination for helical pile capacity will be based on end torque values. Once the helices penetrate the underlying glaciofluvial deposit, the determination of embedment will be based on torque values. Preliminary estimates of torque required to achieve vertical load capacity will range from 4,500 to 5,000 ft-lbs.

We recommend that a foundation contractor that specializes in foundation stabilization be retained for the project. The contractor should provide a *Technical Submittal* completed by or reviewed and approved by a Professional Engineer with a license in the Commonwealth of Massachusetts prior to installing the piles. The submittal shall include the pile type, capacity calculations, helical sections, shaft size, plate thickness, minimum installation torque, torque motor specifications, means to verify torque for quality control, structural properties of the pile sections including lateral buckling, corrosion protection, couplings, end-connections and other items considered relevant to the design and construction. AAT Engineering should have the opportunity to review the *Technical Submittal* for compliance with the project design.

Concrete Slab-On-Grade – Excavate and Replace or RAPs
If excavate and replace or RAPs are used, we would recommend the floor slab and garage slab be designed to be soil-supported, bearing directly on a minimum 8-inch thick layer of ¾" crushed stone (M2.01.4) placed over the compacted structural fill. A modulus of subgrade reaction of 200 pounds per cubic inch may be used for slab design. The structural engineer or concrete consultant shall design steel reinforcing and joint spacing appropriate to slab thickness and function.

The architect and/or flooring consultant should select the vapor retarding products compatible with the flooring and adhesive materials. At a minimal, we would recommend that a minimum 10 mil thick polyethylene vapor barrier be installed beneath all floor slabs prior to pouring concrete.

Concrete Slab-On-Grade – Helical Piles
If helical piles are used, we would recommend that the floor slab and garage slab be designed as structural floor slabs. They will need to be supported by the piles to minimize differential settlement. The structural engineer shall design steel reinforcing and joint spacing appropriate to slab thickness and function.

Seismic Considerations
The subsurface conditions were reviewed in accordance with Article 1613.0 "EARTHQUAKE LOADS" of the *2015 International Building Code* and Table 20.3-1 "Site Classification" of *ASCE 7.* Exploratory sampling such as soil sampling and rock coring was not performed to a depth of 100 feet during this exploration. Therefore, based on information obtained at the exploration locations, we interpret the subsurface site conditions, as defined by the standard penetration resistance (N-value method), to correspond to a Seismic Site Class "D"

Liquefaction Potential
Liquefaction potential of saturated clean medium to fine sands was evaluated. The liquefaction potential of these soils induced by seismic shaking is unlikely based on the medium dense nature of the glaciofluvial soils.

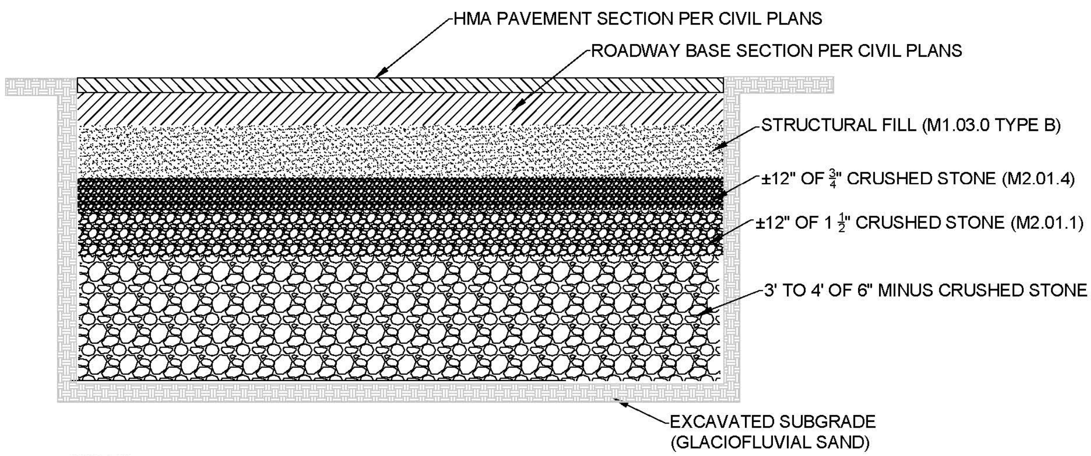
Waterproofing and Foundation Drainage
It is our understanding the proposed structures are going to be constructed as slab-on-grade structures with no basement. The bottom floor is expected to be above grade. Therefore, waterproofing and foundation drainage is not deemed necessary. The foundation walls should be damp-proofed.

Site Utilities
Site utilities should be soil-supported bearing directly on a minimum 6-inch thick layer of compacted structural fill, crushed stone, or other suitable pipe bedding materials. Fill placed as backfill for utilities should consist of compacted structural fill or suitable pipe bedding material. Backfill should be compacted to at least 95 percent of the maximum dry density determined by the Modified Proctor Test (ASTM D1557).

Landscape Areas
If base improvements or piles are performed under the structures only as described in Option #1 and Option #3, the remaining area of the property will likely settle over time independently from the structures due to the consolidation and decomposition of organic matter in the buried peat deposit. This may result in surface depressions in landscape areas. Surface depressions in landscaped areas can be maintained with placement of additional loam as needed over time.

Pavement Section – Roadway Base Improvement
Over excavation of the peat layer is recommended to minimize future pavement distress and damage. The organic peat should be removed and replaced with compacted backfill material comprised of crushed stone and structural fill. It is anticipated that removal of the peat layer will result in excavation depths of 5 to 6 feet below the groundwater level. Therefore, we recommend that the lower portion of the backfill material be performed using crushed rock. Once groundwater is not an issue, backfilling to the proposed roadway section subgrade can be achieved using compacted structural fill material in accordance with the recommendations of the *Fill Materials* Section of this report.

See sketch below showing details for the proposed *Roadway Base Improvement*



NOTES:

1.) EXCAVATE ALL ORGANIC PEAT TO EXPOSE EXISTING GLACIOFLUVIAL SAND DEPOSIT.

2.) SLOPE SIDES OF EXCAVATION IN ACCORDANCE WITH OSHA REQUIREMENTS AND PUMP GROUNDWATER FROM THE EXCAVATION.

3.) PLACE STONE IN 12" LOOSE LIFTS AND COMPACT WITH A 10 TON VIBRATORY RIDING ROLLER.

4.) EACH LAYER OF STRUCTURAL FILL SHALL BE COMPACTED TO AT LEAST 95 PERCENT OF THE MAXIMUM DRY DENSITY DETERMINED BY THE MODIFIED PROCTOR TEST (ASTM D1557).

5.) THE 3/4" & 1 1/2" CRUSHED STONE LAYERS CAN BE SUBSTITUTED WITH COMPACTED STRUCTURAL FILL IF A LAYER OF MIRAFI 140N IS INSTALLED OVER THE 6" MINUS STONE TO PREVENT SOIL MIGRATION.

Roadway Base Improvement

CONSTRUCTION CONSIDERATIONS

Base Improvement Mat Preparation

Removal of the surficial granular fill soils and underlying organic peat soil is required and expected to extend to a depth of 10 to 11 feet below grade. Dewatering will be necessary during excavation to confirm excavation depth into the native glaciofluvial sand deposit. Once subgrade is confirmed, the Mirafi 140N non-woven geotextile should be installed over the subgrade prior to installing the crushed stone. The crushed stone should be compacted in lifts using a 5 to 10 ton vibratory roller. Excavated soils should be disposed of off-site.

Foundation and Floor Slab Preparation
All subgrades should be re-established by placing compacted ¾" crushed stone or compacted lifts of engineered structural fill as needed. Structural fill placement should follow the guidelines specified in the *Fill Materials* section of this report. The placement and compaction of more than 12 inches of structural fill should be monitored and tested by a registered professional engineer or his/her designated representative, in accordance with the Section 1803.5.8 of the IBC 2015.

Fill Materials
¾" and 1 ½" Crushed Stone/Structural Fill/Dense Graded Crushed Stone:
Off-site fill materials placed below the footings and concrete floor slab should be free of organic, frozen, or other deleterious material and conform to the gradation requirements outlined in *Table 1* in (Appendix C) of this report. Fill placed to support a footing shall be extended out past the bearing zone. The footing-bearing zone is described as a line drawn from one foot outside the exterior footing edge down at a one-horizontal to one-vertical (1H:1V) theoretical line. ¾" crushed stone may be compacted with walk behind compaction equipment. Structural fill will need to be compacted and should be placed in loose lifts not exceeding 6 inches for walk behind vibratory compactors and 8 inches for riding vibratory rollers. Each layer of structural fill shall be compacted to at least 95 percent of the maximum dry density determined by the Modified Proctor Test (ASTM D1557).

Construction Dewatering
Dewatering is expected during construction. Dewatering may be accomplished by contractor selected means and methods with prior approval from local conservation officials or similar regulated departments. Subgrade soils that become unstable should be replaced with crushed stone, as necessary. Discharge of groundwater to surface water during construction may require federal, state or local permits.

Temporary Excavations
The owner and the contractor should be aware of applicable local, state and federal safety regulations, including current Occupational Safety and Health Administration (OSHA) excavation and trench safety standards. Construction site safety is the responsibility of the contractor, who shall be solely responsible for the means, methods, and sequencing of construction operations. The contractor should be aware that slope height, slope inclination, or excavation depths (including utility trenches) should not exceed those specified in the OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926. Such regulations are strictly enforced and, if not followed, the owner, the contractor, or earthwork or utility subcontractors could be liable for substantial penalties. The design and construction of any earth support utilized by the contractor will be by others and is outside the scope of this report.

DOCUMENTATION REVIEW AND CONSTRUCTION MONITORING

All backfill shall be tested for compaction in accordance with the requirements stated in the *Fill Materials* section of the report and the test results shall be reviewed by a Professional Engineer. During the placement of fill, compactive efforts should be evaluated and confirmed by field density testing such as field density/moisture content test (ASTM D2922/D3017).

We trust that the above is sufficient for your present requirements. Should you have any questions concerning the recommendations presented herein, please do not hesitate to call us.

Very truly yours,
AAT Engineering, LLC

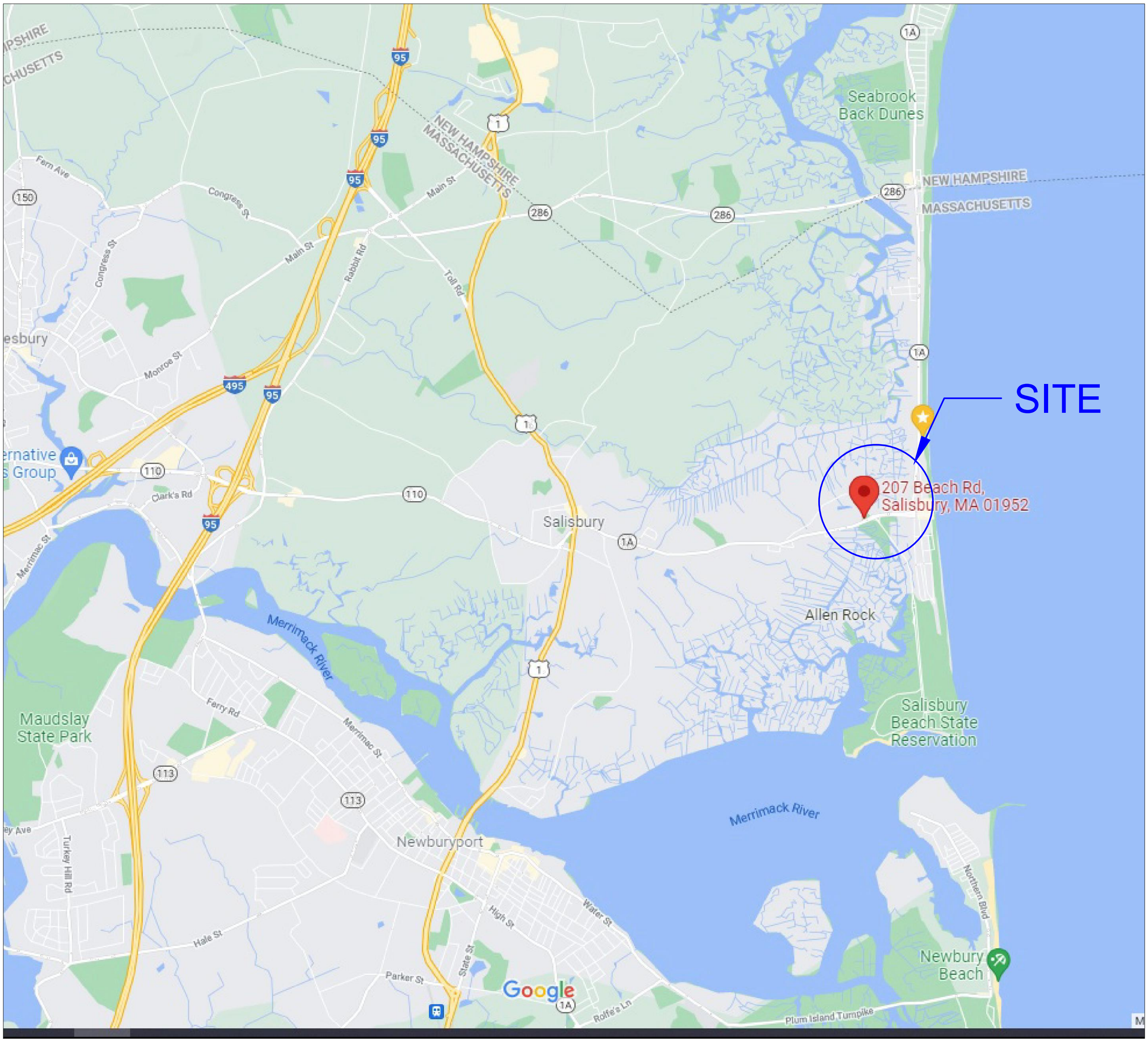
Alfred Taney, P.E.

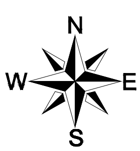
Digitally signed by Alfred Taney, P.E.
Date: 2022.02.02 10:02:38 -05'00'

COMMONWEALTH OF MASSACHUSETTS
ALFRED A. TANEY
CIVIL
NO. 41218
REGISTERED
PROFESSIONAL ENGINEER

Alfred A. Taney, P.E.
Geotechnical Engineer

Attachments:
- Figure 1 – Site Location Plan
- Figure 2 – Test Boring Location Plan
- Appendix A – Limitations
- Appendix B – Test Boring Logs
- Appendix C – Gradation Specifications





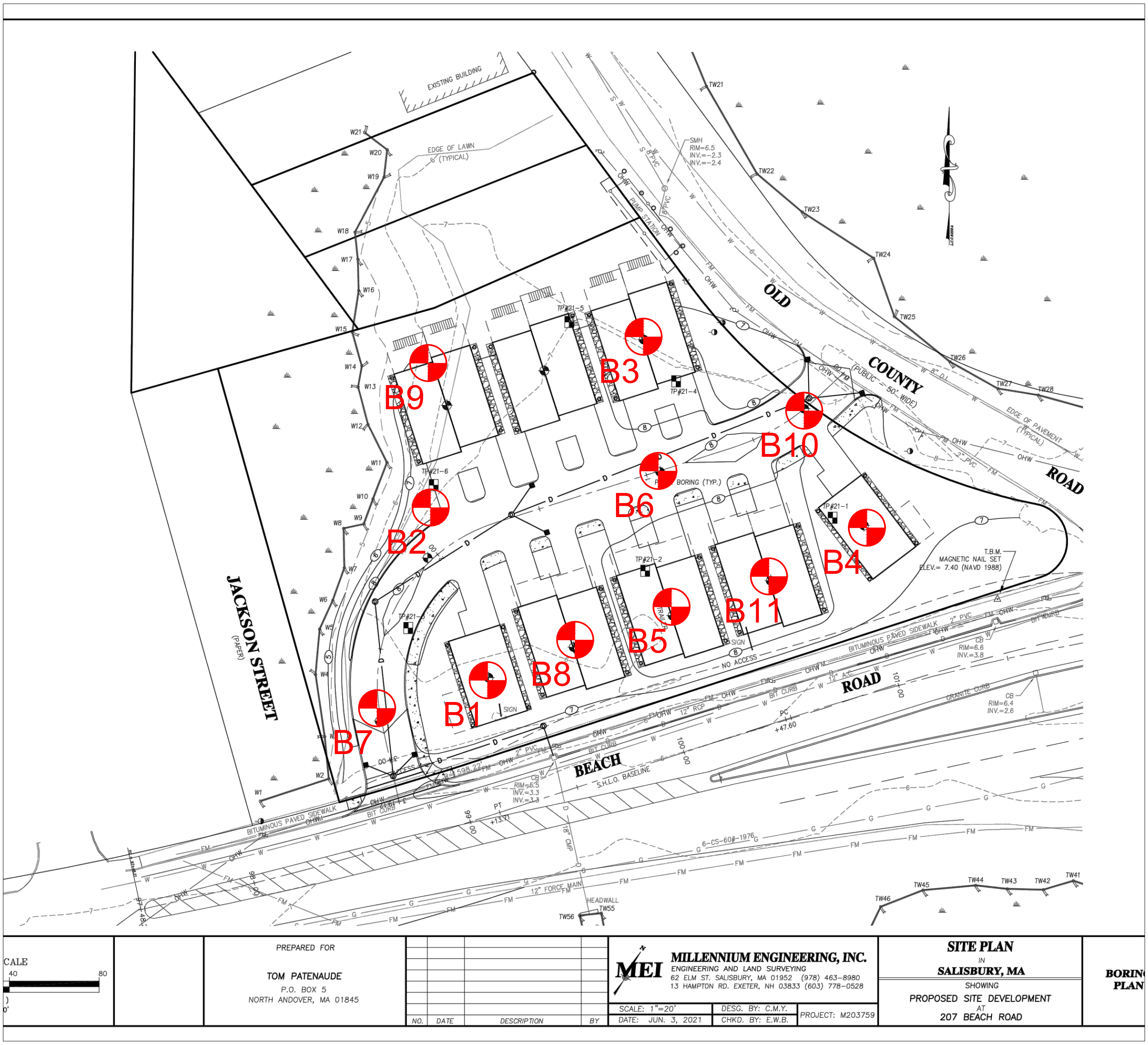
PROJECT LOCATION:
207 Beach Rd.
Salisbury, MA 01952

TITLE:
SITE LOCATION PLAN

CLIENT:
Millennium Engineering, Inc.
62 Elm St.
Salisbury, MA 01952

AAT Engineering, LLC
34 Summit Terrace
Peabody, Massachusetts 01960
Tel (978) 979-1182 Fax (978) 278-3304
www.aatengineering.com

DATE:	09/07/21
SCALE:	N.T.S.
DESIGN:	AAT
DRAWN:	AAT
FIGURE:	1
PROJECT:	1623



NOTES:

1. TEST BORINGS WERE PERFORMED BY SOIL X CORP. ON 08/30/21 & 08/31/21.
2. TEST BORING LOCATIONS ARE APPROXIMATED.
3. PROJECT ADDRESS IS: 207 BEACH RD., SAILISBURY, MA

LEGEND:

B1 TEST BORING

N W E S

TITLE: TEST BORING LOCATION PLAN

CLIENT: Millennium Engineering, Inc.
62 Elm St.
Salisbury, MA 01952

AAT Engineering, LLC
34 Summit Terrace
Peabody, Massachusetts 01960
Tel (978) 979-1182 Fax (978) 278-3304
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DATE:	09/07/21
SCALE:	N.T.S.
DESIGN:	AAT
DRAWN:	AAT
FIGURE:	2
PROJECT:	1623

APPENDIX A

Limitations

LIMITATIONS

1. This report has been prepared on behalf of and for the exclusive use of Milllennium Engineering, Inc. for the specific application to the proposed condominium structures at the 207 Beach Rd., Salisbury, MA in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.

2. In the event that any changes in nature or design of the structure occur, the conclusions and recommendations contained within this report should not be considered valid unless the changes are reviewed and conclusions of this report are modified or verified in writing.

3. The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the approximate locations indicated on the enclosed plan. If variations in the nature and extent of subsurface conditions observed in the test borings become evident during the course of construction, it will be necessary for a re-evaluation of the recommendations of this report to be made after performing on-site observations during the construction period and noting the characteristics of any variations.

4. The generalized soil profile described in the text is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretation of widely spaced explorations and samples.

5. Observations have been made during exploration work to assess site groundwater levels. Fluctuations in water levels will occur due to variations in rainfall, localized layer entrapment due to low permeability soils, tidal influence, temperature and other factors.

APPENDIX B

Test Boring Logs

AAT ENGINEERING TEST BORING LOG

PROJ. NAME:	Beach Rd. Development	**HAMMER**	**SAMPLER**	**CASING**		**SHEET 1 OF 1**
LOCATION:	207 Beach Rd., Salisbury, MA	TYPE: Safety	SS	H S A	DRILL RIG	
PROJECT NO.:	1623	SIZE: 140 lbs	2" OD	4-1/4"	ATV	**BORING: B1**
DATE START:	8/30/2021	FALL: 30 inches	Drop Method:	Automatic		
DATE END:	8/30/2021					
BORING CO.:	Soil X Corp.	**GROUNDWATER OBSERVATIONS**				
CO. LOCATION:	Leominster, MA	**Groundwater was observed at 5' bgs. during sampling**				
FOREMAN:	Pat					
FIELD ENG:	AAT					

Depth (ft)	SAMPLING No.	Depth (ft.)	Blows/ 6"	Penet./	Rec. (in)	SAMPLE DESCRIPTION	STRATA CHANGE
1	S1	0-2	1-2-10-12	24	16	2" (LOAM) underlain by 6" of light brown, f-m SAND, over SAND, Slag, Asphalt, Gravel (FILL)	
2							FILL
3	S2	2-4	3-4-3-6	24	12	dry, loose, dark brown, silty fine SAND (FILL)	
4							
5	S3	5-7	1-1-1-1	24	4	wet, very loose, dark brown, fine SAND, fibrous root matter (ORGANIC/PEAT)	5'
6							
7	S4	7-9	WOH(18")-1	24	12	wet, very soft, dark brown, organic Silt with fibers (PEAT)	PEAT
8							
9							
10	S5	10-12	4-14-10-12	24	18	wet, medium dense, dark brown, f-m SAND (GLACIOFLUVIAL)	10'
11							
12							GLACIO-FLUVIAL
13							
14							
15	S6	15-17	1-5-10-14	24	24	wet, medium dense, olive/brown, fine SAND, trace Clay (GLACIOFLUVIAL)	
16							
17							
18							
19							
20	S7	20-22	4-12-16-17	24	24	wet, medium dense, olive/brown, fine SAND (GLACIOFLUVIAL)	
21							
22						Terminate exploration at 22' BGS not due to refusal	
23							
24							
25							

ENGINEERING

Notes:

Proportions Used: trace (1-10%), little (10-20%), some (20-35%), and (35-50%).

Cohesive Consistency (Blows/ft.)		Cohesionless Relative Density (Blows/ft)	
very soft	0-2	very loose	0-4
soft	2-4	loose	4-10
med stiff	4-8	medium dense	10-30
stiff	8-15	dense	30-50
very stiff	15-30	very dense	50+
hard	30+		

AAT ENGINEERING TEST BORING LOG

PROJ. NAME:	Beach Rd. Development	**HAMMER**		**SAMPLER**	**CASING**		**SHEET 1 OF 1**
LOCATION:	207 Beach Rd., Salisbury, MA	TYPE:	Safety	SS	H S A	DRILL RIG	
PROJECT NO.:	1623	SIZE:	140 lbs	2" OD	4-1/4"	ATV	**BORING: B2**
DATE START:	8/30/2021	FALL:	30 inches	Drop Method:	Automatic		
DATE END:	8/30/2021						

BORING CO.:	Soil X Corp.	**GROUNDWATER OBSERVATIONS**
CO. LOCATION:	Leominster, MA	**Groundwater was observed at 5' bgs. during sampling**
FOREMAN:	Pat	
FIELD ENG:	AAT	

Depth (ft)	SAMPLING No.	Depth (ft.)	Blows/ 6"	Penet./	Rec. (in)	SAMPLE DESCRIPTION	STRATA CHANGE
1	S1	0-2	2-3-3-12	24	4	2" (LOAM) underlain by loose, light brown, f-m SAND (FILL)	
2							FILL
3	S2	2-4	5-16-11-8	24	6	moist, medium dense, dark brown, f-m SAND, Slag, Asphalt, Gravel (FILL)	
4							
5	S3	5-7	5-10-6-1	24	12	wet, medium dense, dark brown, fine SAND, trace Gravel, rounded Cobbles (FILL)	
6							
7	S4	7-9	1-1-1-1	24	12	wet, very soft, dark brown, organic SILT with fibrous root matter (PEAT)	7'
8							
9							PEAT
10	S5	10-12	2-9-12-7	24	20	wet, medium dense, brown, f-m SAND (GLACIOFLUVIAL)	10'
11							GLACIO-FLUVIAL
12							
13							
14							
15	S6	15-17	3-4-6-7	24	20	wet, loose, olive/brown, f-c SAND (GLACIOFLUVIAL)	
16							
17							
18							
19							
20	S7	20-22	5-13-14-12	24	10	wet, medium dense, olive/brown, fine SAND (GLACIOFLUVIAL)	
21							
22						Terminate exploration at 22' BGS not due to refusal	
23							
24							
25							

ENGINEERING

Notes:

Proportions Used: trace (1-10%), little (10-20%), some (20-35%), and (35-50%).

Cohesive Consistency (Blows/ft.)		Cohesionless Relative Density (Blows/ft)	
very soft	0-2	very loose	0-4
soft	2-4	loose	4-10
med stiff	4-8	medium dense	10-30
stiff	8-15	dense	30-50
very stiff	15-30	very dense	50+
hard	30+		

AAT ENGINEERING TEST BORING LOG

PROJ. NAME:	Beach Rd. Development	**HAMMER**		**SAMPLER**	**CASING**		**SHEET 1 OF 1**
LOCATION:	207 Beach Rd., Salisbury, MA	TYPE:	Safety	SS	H S A	DRILL RIG	**BORING: B2**
PROJECT NO.:	1623	SIZE:	140 lbs	2" OD	4-1/4"	ATV	
DATE START:	8/30/2021	FALL:	30 inches	Drop Method:	Automatic		
DATE END:	8/30/2021						
BORING CO.:	Soil X Corp.	**GROUNDWATER OBSERVATIONS**					
CO. LOCATION:	Leominster, MA	**Groundwater was observed at 5' bgs. during sampling**					
FOREMAN:	Pat						
FIELD ENG:	AAT						

Depth (ft)	SAMPLING No.	Depth (ft.)	Blows/ 6"	Penet./	Rec. (in)	SAMPLE DESCRIPTION	STRATA CHANGE
1	S1	0-2	4-9-8-9	24	8	2" (LOAM) underlain by 4" of light brown, f-m SAND, over SAND, Slag, Asphalt, Gravel (FILL)	
2							FILL
3							
4							
5	S2	5-7	5-4-4-5	24	18	wet, loose, dark brown, organic f-m SAND with roots (ORGANIC)	5'
6							6' ORGANIC
7	S4	7-9	7-12-13-13	24	24	wet, medium dense, dark brown, fine SAND (GLACIOFLUVIAL)	
8							
9							
10	S5	10-12	6-10-18-28	24	24	wet, medium dense, brown, fine SAND, trace medium Sand (GLACIOFLUVIAL)	
11							
12							GLACIO-FLUVIAL
13							
14							
15	S6	15-17	8-16-24-24	24	24	wet, dense, olive/brown, fine SAND (GLACIOFLUVIAL)	
16							
17							
18							
19							
20	S7	20-22	6-6-7-6	24	24	wet, medium dense, olive/brown, fine SAND (GLACIOFLUVIAL)	
21							
22						Terminate exploration at 22' BGS not due to refusal	
23							
24							
25							

ENGINEERING

Notes:

Proportions Used: trace (1-10%), little (10-20%), some (20-35%), and (35-50%).

Cohesive Consistency (Blows/ft.)		Cohesionless Relative Density (Blows/ft)	
very soft	0-2	very loose	0-4
soft	2-4	loose	4-10
med stiff	4-8	medium dense	10-30
stiff	8-15	dense	30-50
very stiff	15-30	very dense	50+
hard	30+		

AAT ENGINEERING TEST BORING LOG

PROJ. NAME:	Beach Rd. Development	**HAMMER**		**SAMPLER**	**CASING**		**SHEET 1 OF 1**
LOCATION:	207 Beach Rd., Salisbury, MA	TYPE:	Safety	SS	H S A	DRILL RIG	
PROJECT NO.:	1623	SIZE:	140 lbs	2" OD	4-1/4"	ATV	**BORING: B4**
DATE START:	8/30/2021	FALL:	30 inches	Drop Method:	Automatic		
DATE END:	8/30/2021						

BORING CO.:	Soil X Corp.	**GROUNDWATER OBSERVATIONS**
CO. LOCATION:	Leominster, MA	**Groundwater was observed at 5' bgs. during sampling**
FOREMAN:	Pat	
FIELD ENG:	AAT	

Depth (ft)	SAMPLING No.	Depth (ft.)	Blows/ 6"	Penet./	Rec. (in)	SAMPLE DESCRIPTION	STRATA CHANGE
1	S1	0-2	2-3-7-11	24	6	dry, medium dense, dark brown, f-m SAND, Slag, Gravel (FILL)	
2							FILL
3	S2	2-4	8-8-8-8	24	10	moist, medium dense, brown, fine SAND (FILL)	
4							
5	S3	5-7	WOH(12")-1-1	24	18	wet, very soft, dark brown, organic SILT with fibrous root matter (PEAT)	5'
6							
7	S4	7-9	WOH(18")-1	24	16	wet, very soft, dark brown, organic SILT with fibrous root matter (PEAT)	PEAT
8							
9							
10	S5	10-12	3-8-12-13	24	20	wet, medium dense, brown, fine SAND (GLACIOFLUVIAL)	10'
11							GLACIO-FLUVIAL
12							
13							
14							
15	S6	15-17	3-6-10-11	24	18	wet, medium dense, brown, f-m SAND, trace Gravel (GLACIOFLUVIAL)	
16							
17							
18							
19							
20	S7	20-22	1-5-11-10	24	18	wet, medium dense, olive/brown, fine SAND, trace medium Sand (GLACIOFLUVIAL)	
21							
22						Terminate exploration at 22' BGS not due to refusal	
23							
24							
25							

ENGINEERING

Notes:

Proportions Used: trace (1-10%), little (10-20%), some (20-35%), and (35-50%).

Cohesive Consistency (Blows/ft.)		Cohesionless Relative Density (Blows/ft)	
very soft	0-2	very loose	0-4
soft	2-4	loose	4-10
med stiff	4-8	medium dense	10-30
stiff	8-15	dense	30-50
very stiff	15-30	very dense	50+
hard	30+		

AAT ENGINEERING TEST BORING LOG

PROJ. NAME:	Beach Rd. Development	**HAMMER**		**SAMPLER**	**CASING**		**SHEET 1 OF 1**
LOCATION:	207 Beach Rd., Salisbury, MA	TYPE:	Safety	SS	H S A	DRILL RIG	**BORING: B5**
PROJECT NO.:	1623	SIZE:	140 lbs	2" OD	4-1/4"	ATV	
DATE START:	8/30/2021	FALL:	30 inches	Drop Method:	Automatic		
DATE END:	8/30/2021						
BORING CO.:	Soil X Corp.	**GROUNDWATER OBSERVATIONS**					
CO. LOCATION:	Leominster, MA	**Groundwater was observed at 5' bgs. during sampling**					
FOREMAN:	Pat						
FIELD ENG:	AAT						

Depth (ft)	SAMPLING No.	Depth (ft.)	Blows/ 6"	Penet./	Rec. (in)	SAMPLE DESCRIPTION	STRATA CHANGE
1	S1	0-2	1-1-3-4	24	12	dry, very loose, brown, f-m SAND (FILL)	
2							FILL
3	S2	2-4	2-3-25-30	24	8	moist, medium dense, brown, fine SAND and COBBLES (FILL)	
4							
5	S3	5-7	4-4-1-2	24	6	wet, loose, black, fine SAND with roots (MUCK)	5'
6							
7	S4	7-9	1-1-1-3	24	16	wet, very loose, black, fine SAND (MUCK)	MUCK -
8							
9							
10	S5	10-12	1-1-1-5	24	8	wet, loose, reddish/brown, fine SAND with roots (PEAT)	
11							11'
12							
13							GLACIO-FLUVIAL
14							
15	S6	15-17	6-7-10-10	24	16	wet, medium dense, brown, fine SAND (GLACIOFLUVIAL)	
16							
17							
18							
19							
20	S7	20-22	2-6-14-25	24	12	wet, medium dense, olive/brown, fine SAND (GLACIOFLUVIAL)	
21							
22						Terminate exploration at 22' BGS not due to refusal	
23							
24							
25							

ENGINEERING

Notes:

Proportions Used: trace (1-10%), little (10-20%), some (20-35%), and (35-50%).

Cohesive Consistency (Blows/ft.)		Cohesionless Relative Density (Blows/ft)	
very soft	0-2	very loose	0-4
soft	2-4	loose	4-10
med stiff	4-8	medium dense	10-30
stiff	8-15	dense	30-50
very stiff	15-30	very dense	50+
hard	30+		

AAT ENGINEERING TEST BORING LOG

PROJ. NAME:	Beach Rd. Development	**HAMMER**	**SAMPLER**	**CASING**		**SHEET 1 OF 1**
LOCATION:	207 Beach Rd., Salisbury, MA	TYPE: Safety	SS	H S A	DRILL RIG	
PROJECT NO.:	1623	SIZE: 140 lbs	2" OD	4-1/4"	ATV	**BORING: B6**
DATE START:	8/31/2021	FALL: 30 inches	Drop Method:	Automatic		
DATE END:	8/31/2021					
BORING CO.:	Soil X Corp.	**GROUNDWATER OBSERVATIONS**				
CO. LOCATION:	Leominster, MA	**Groundwater was observed at 4' bgs. during sampling**				
FOREMAN:	Pat					
FIELD ENG:	AAT					

Depth (ft)	SAMPLING No.	Depth (ft.)	Blows/ 6"	Penet./ Rec. (in)		SAMPLE DESCRIPTION	STRATA CHANGE
1	S1	0-2	3-7-10-7	24	12	dry, medium dense, dark brown, f-m SAND, Slag, Gravel (FILL)	
2							FILL
3	S2	2-4	6-11-9-4	24	2	wet, medium dense, dark brown, fine SAND, trace Gravel, rounded Cobbles (FILL)	
4							
5	S3	5-7	1-1-1-1	24	24	wet, very soft, dark brown, organic SILT with fibrous root matter (PEAT)	5'
6							
7	S4	7-9	2-2-3-4	24	20	wet, loose, dark brown, fine SAND, trace medium Sand, root matter	PEAT
8							
9							
10	S5	10-12	2-5-18-24	24	20	wet, medium dense, reddish/brown, f-m SAND, trace Gravel (GLACIOFLUVIAL)	
11							11'
12							GLACIO-FLUVIAL
13							
14							
15	S6	15-17	4-6-10-8	24	24	wet, medium dense, brown, f-m SAND, trace Gravel (GLACIOFLUVIAL)	
16							
17							
18							
19							
20	S7	20-22	3-3-12-26	24	20	wet, medium dense, olive/brown, fine and f-m SAND (GLACIOFLUVIAL)	
21							
22						Terminate exploration at 22' BGS not due to refusal	
23							
24							
25							

ENGINEERING

Notes:

Proportions Used: trace (1-10%), little (10-20%), some (20-35%), and (35-50%).

Cohesive Consistency (Blows/ft.)		Cohesionless Relative Density (Blows/ft)	
very soft	0-2	very loose	0-4
soft	2-4	loose	4-10
med stiff	4-8	medium dense	10-30
stiff	8-15	dense	30-50
very stiff	15-30	very dense	50+
hard	30+		

AAT ENGINEERING TEST BORING LOG

PROJ. NAME:	Beach Rd. Development	**HAMMER**	**SAMPLER**	**CASING**		**SHEET 1 OF 1**
LOCATION:	207 Beach Rd., Salisbury, MA	TYPE: Safety	SS	H S A	DRILL RIG	
PROJECT NO.:	1623	SIZE: 140 lbs	2" OD	4-1/4"	ATV	**BORING: B7**
DATE START:	8/31/2021	FALL: 30 inches	Drop Method:	Automatic		
DATE END:	8/31/2021					
BORING CO.:	Soil X Corp.	**GROUNDWATER OBSERVATIONS**				
CO. LOCATION:	Leominster, MA	**Groundwater was observed at 5' bgs. during sampling**				
FOREMAN:	Pat					
FIELD ENG:	AAT					

Depth (ft)	**SAMPLING** No.	Depth (ft.)	Blows/ 6"	Penet./	Rec. (in)	SAMPLE DESCRIPTION	STRATA CHANGE
1	S1	0-2	1-5-14-15	24	18	2" (LOAM) underlain by 6" of loose, light brown, f-m SAND over brown, silty SAND with Slag (FILL)	
2							FILL
3	S2	2-4	16-16-12-3	24	8	dry, medium dense, dark brown, fine SAND, trace silt, trace Gravel, Slag, Brick, Asphalt (FILL)	
4							
5	S3	5-7	WOH(18")-1	24	20	wet, very soft, dark brown, organic SILT with fibrous root matter (PEAT)	5'
6							
7	S4	7-9	WOH(18")-1	24	12	wet, very loose, dark brown, fine SAND, trace medium Sand, root matter (PEAT)	PEAT
8							
9							
10	S5	10-12	1-2-5-5	24	20	wet, medium dense, brown, f-m SAND (GLACIOFLUVIAL)	
11							11'
12							
13							GLACIO-FLUVIAL
14							
15	S6	15-17	3-8-9-14	24	20	wet, medium dense, brown, f-m SAND (GLACIOFLUVIAL)	
16							
17							
18							
19							
20	S7	20-22	5-7-12-15	24	18	wet, medium dense, olive/brown, fine SAND (GLACIOFLUVIAL)	
21							
22						Terminate exploration at 22' BGS not due to refusal	
23							
24							
25							

ENGINEERING

Notes:

Proportions Used: trace (1-10%), little (10-20%), some (20-35%), and (35-50%).

Cohesive Consistency (Blows/ft.)		Cohesionless Relative Density (Blows/ft)	
very soft	0-2	very loose	0-4
soft	2-4	loose	4-10
med stiff	4-8	medium dense	10-30
stiff	8-15	dense	30-50
very stiff	15-30	very dense	50+
hard	30+		

AAT ENGINEERING TEST BORING LOG

PROJ. NAME:	Beach Rd. Development	**HAMMER**	**SAMPLER**	**CASING**		**SHEET 1 OF 1**
LOCATION:	207 Beach Rd., Salisbury, MA	TYPE: Safety	SS	H S A	DRILL RIG	
PROJECT NO.:	1623	SIZE: 140 lbs	2" OD	4-1/4"	ATV	**BORING: B8**
DATE START:	8/31/2021	FALL: 30 inches	Drop Method:	Automatic		
DATE END:	8/31/2021					
BORING CO.:	Soil X Corp.	**GROUNDWATER OBSERVATIONS**				
CO. LOCATION:	Leominster, MA	**Groundwater was observed at 2' bgs. during sampling.**				
FOREMAN:	Pat	**(Likely a perched water level)**				
FIELD ENG:	AAT					

Depth (ft)	SAMPLING No.	Depth (ft.)	Blows/ 6"	Penet./	Rec. (in)	SAMPLE DESCRIPTION	STRATA CHANGE
1	S1	0-2	5-7-4-4	24	18	2" (LOAM) underlain by 6" of loose, light brown, f-m SAND over dark brown, silty SAND (FILL)	
2							FILL
3	S2	2-4	3-8-8-10	24	8	wet, medium dense, dark brown, fine SAND, trace silt, trace Gravel, Cobbles (FILL)	
4							
5	S3	5-7	10-6-1-1	24	6	Tree Stump (ORGANIC)	5'
6							
7	S4	7-9	1-1-1-1	24	12	wet, very loose, dark brown, fine SAND with root matter (PEAT)	PEAT
8							
9							
10	S5	10-12	1-1-6-10	24	6	10' to 11': wet, very loose, dark brown, fine SAND with root matter (PEAT)	
11						15	11'
12							GLACIO-FLUVIAL
13							
14							
15	S6	15-17	6-7-6-7	24	12	wet, medium dense, brown, fine SAND (GLACIOFLUVIAL)	
16							
17							
18							
19							
20	S7	20-22	16-19-22-20	24	14	wet, dense, olive/brown, fine SAND (GLACIOFLUVIAL)	
21							
22						Terminate exploration at 22' BGS not due to refusal	
23							
24							
25							

ENGINEERING

Notes:

Proportions Used: trace (1-10%), little (10-20%), some (20-35%), and (35-50%).

Cohesive Consistency (Blows/ft.)		Cohesionless Relative Density (Blows/ft)	
very soft	0-2	very loose	0-4
soft	2-4	loose	4-10
med stiff	4-8	medium dense	10-30
stiff	8-15	dense	30-50
very stiff	15-30	very dense	50+
hard	30+		

AAT ENGINEERING TEST BORING LOG

PROJ. NAME:	Beach Rd. Development	**HAMMER** / **SAMPLER** / **CASING**	**SHEET 1 OF 1**
LOCATION:	207 Beach Rd., Salisbury, MA	TYPE: Safety / SS / H S A / DRILL RIG	
PROJECT NO.:	1623	SIZE: 140 lbs / 2" OD / 4-1/4" / ATV	**BORING: B9**
DATE START:	8/31/2021	FALL: 30 inches / Drop Method: Automatic	
DATE END:	8/31/2021		
BORING CO.:	Soil X Corp.	**GROUNDWATER OBSERVATIONS**	
CO. LOCATION:	Leominster, MA	**Groundwater was observed at 5' bgs. during sampling.**	
FOREMAN:	Pat		
FIELD ENG:	AAT		

Depth (ft)	SAMPLING No.	Depth (ft.)	Blows/ 6"	Penet./	Rec. (in)	SAMPLE DESCRIPTION	STRATA CHANGE
1	S1	0-2	6-5-7-12	24	20	4" (LOAM) underlain by 8" of loose, light brown, f-m SAND over dark brown, silty SAND (FILL)	
2							FILL
3	S2	2-4	7-8-9-8	24	12	dry, medium dense, dark brown, f-m SAND, Slag, Asphalt, Gravel (FILL)	
4							
5	S3	5-7	1-1-1-1	24	20	wet, very soft, dark brown, organic SILT with fibrous root matter (PEAT)	5'
6							
7	S4	7-9	1-2-2-4	24	20	wet, very loose, dark brown, fine SAND with roots (PEAT)	PEAT
8							
9							
10	S5	10-12	3-5-11-13	24	20	wet, medium dense, brown, fine SAND, trace medium Sand (GLACIOFLUVIAL)	10'
11							
12							GLACIO-FLUVIAL
13							
14							
15	S6	15-17	4-8-8-13	24	24	wet, medium dense, olive/brown, f-m SAND (GLACIOFLUVIAL)	
16							
17						Terminate exploration at 17' BGS not due to refusal	
18							
19							
20							
21							
22							
23							
24							
25							

ENGINEERING

Notes:

Proportions Used: trace (1-10%), little (10-20%), some (20-35%), and (35-50%).

Cohesive Consistency (Blows/ft.)		Cohesionless Relative Density (Blows/ft)	
very soft	0-2	very loose	0-4
soft	2-4	loose	4-10
med stiff	4-8	medium dense	10-30
stiff	8-15	dense	30-50
very stiff	15-30	very dense	50+
hard	30+		

AAT ENGINEERING TEST BORING LOG

PROJ. NAME:	Beach Rd. Development	**HAMMER**	**SAMPLER**	**CASING**		**SHEET 1 OF 1**
LOCATION:	207 Beach Rd., Salisbury, MA	TYPE: Safety	SS	H S A	DRILL RIG	
PROJECT NO.:	1623	SIZE: 140 lbs	2" OD	4-1/4"	ATV	**BORING: B10**
DATE START:	8/31/2021	FALL: 30 inches	Drop Method:	Automatic		
DATE END:	8/31/2021					
BORING CO.:	Soil X Corp.	**GROUNDWATER OBSERVATIONS**				
CO. LOCATION:	Leominster, MA	**Groundwater was observed at 5' bgs. during sampling**				
FOREMAN:	Pat					
FIELD ENG:	AAT					

Depth (ft)	SAMPLING No.	Depth (ft.)	Blows/ 6"	Penet./ Rec. (in)		SAMPLE DESCRIPTION	STRATA CHANGE
1	S1	0-2	5-5-9-4	24	20	2" (LOAM) underlain by 6" of loose, light brown, f-m SAND over SAND, Slag, Gravel (FILL)	
2							FILL
3	S2	2-4	3-2-1-3	24	12	dry, very loose, dark brown, silty SAND (FILL)	
4							4'
5	S3	5-7	1-1-1-1	24	18	wet, very soft, dark brown, organic SILT with fibrous root matter (PEAT)	
6							
7	S4	7-9	3-4-5-6	24	18	wet, loose, dark brown, fine SAND, little organic Silt with roots (PEAT)	PEAT
8							
9							
10	S5	10-12	4-8-13-17	24	20	wet, medium dense, brown, fine SAND (GLACIOFLUVIAL)	10'
11							GLACIO-FLUVIAL
12						Terminate exploration at 12' BGS not due to refusal	
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							

ENGINEERING

Notes:

Proportions Used: trace (1-10%), little (10-20%), some (20-35%), and (35-50%).

Cohesive Consistency (Blows/ft.)		Cohesionless Relative Density (Blows/ft)	
very soft	0-2	very loose	0-4
soft	2-4	loose	4-10
med stiff	4-8	medium dense	10-30
stiff	8-15	dense	30-50
very stiff	15-30	very dense	50+
hard	30+		

AAT ENGINEERING TEST BORING LOG

PROJ. NAME:	Beach Rd. Development	**HAMMER**	**SAMPLER**	**CASING**		**SHEET 1 OF 1**
LOCATION:	207 Beach Rd., Salisbury, MA	TYPE: Safety	SS	H S A	DRILL RIG	
PROJECT NO.:	1623	SIZE: 140 lbs	2" OD	4-1/4"	ATV	**BORING: B11**
DATE START:	8/31/2021	FALL: 30 inches	Drop Method:	Automatic		
DATE END:	8/31/2021					
BORING CO.:	Soil X Corp.	**GROUNDWATER OBSERVATIONS**				
CO. LOCATION:	Leominster, MA	**Groundwater was observed at 2' bgs. during sampling.**				
FOREMAN:	Pat	**(Likely a perched water level)**				
FIELD ENG:	AAT					

Depth (ft)	SAMPLING No.	Depth (ft.)	Blows/ 6"	Penet.	Rec. (in)	SAMPLE DESCRIPTION	STRATA CHANGE
1	S1	0-2	4-6-7-6	24	12	1" (LOAM) underlain by 4" of loose, light brown, f-m SAND over SAND, Slag, Gravel (FILL)	
2							FILL
3	S2	2-4	5-3-3-3	24	8	wet, loose, brown, fine SAND (FILL)	
4							
5	S3	5-7	WOH(18")-1	24	20	wet, very soft, dark brown, organic SILT with fibrous root matter (PEAT)	5'
6							
7							PEAT
8							
9							
10	S4	10-12	1-7-9-11	24	16	wet, medium dense, reddish/brown, f-m SAND (GLACIOFLUVIAL)	10.5'
11							
12							GLACIO-FLUVIAL
13							
14							
15	S5	15-17	4-6-8-7	24	20	wet, medium dense, olive/brown, fine SAND (GLACIOFLUVIAL)	
16							
17							
18							
19							
20	S6	20-22	6-8-6-8	24	20	wet, medium dense, olive/brown, fine SAND (GLACIOFLUVIAL)	
21							
22						Terminate exploration at 22' BGS not due to refusal	
23							
24							
25							

ENGINEERING

Notes:

Proportions Used: trace (1-10%), little (10-20%), some (20-35%), and (35-50%).

Cohesive Consistency (Blows/ft.)		Cohesionless Relative Density (Blows/ft)	
very soft	0-2	very loose	0-4
soft	2-4	loose	4-10
med stiff	4-8	medium dense	10-30
stiff	8-15	dense	30-50
very stiff	15-30	very dense	50+
hard	30+		

APPENDIX C

Gradation Specifications

TABLE 1
GRADATION SPECIFICATIONS

	PERCENT PASSING BY WEIGHT			
SIEVE	1 ½" CRUSHED STONE (1)	¾" CRUSHED STONE (2)	STRUCTURAL FILL (3)	DENSE GRADED CRUSHED STONE (4)
6-inch	-	-	-	-
3-inch	-	-	100	-
2-inch	100	-	-	100
1 ½-inch	95-100	-	-	70-100
1 – inch	35-70	100	-	-
¾-inch	0-25	90-100	-	50-85
½-inch	-	10-50	50-85	-
¼-inch	-	-	-	-
3/8-inch	-	0-20	-	-
No. 4	-	0-5	40-75	30-55
No.10	-	-	-	-
No.40	-	-	-	-
No.50	-	-	8-28	8-24
No.200	-	-	0-10	3-10

(1) Mass Highway Dept. M2.01.2
(2) Mass Highway Dept. M2.01.4
(3) Mass Highway Dept. M1.03.0 type b
(4) Mass Highway Dept. M2.01.7