



## MEMORANDUM

24 May 2012  
File No. 39579-003

TO: Beacon Architectural Associates  
J. Michael Sullivan, A.I.A LEED AP

FROM: Haley & Aldrich, Inc.  
Todd R. Butler, P.E., Bryan P. Sweeney, P.E.

SUBJECT: Summary of Subsurface Explorations and Geotechnical Design Recommendations  
Proposed Multipurpose Synthetic Athletic Field  
Xaverian Brother's High School  
800 Clapboardtree Street  
Westwood, MA

This memorandum summarizes the results of subsurface explorations, provides recommendations for geotechnical design and comments on geotechnical-related construction considerations for a new multipurpose synthetic turf athletic field. This work was undertaken in accordance with our proposal 30 April 2012 and your subsequent written authorization.

### EXECUTIVE SUMMARY

Site preparation activities will require the following activities:

- Significant rock excavation, with controlled blasting as a likely requirement.
- Excavation and off-site disposal of miscellaneous materials including septic system, tanks, trash and debris.
- Off-site disposal of soils and other materials will likely require chemical analysis by the receiving facility. These chemical analyses may result in identifying reportable conditions to the Massachusetts Department of Environmental Protection.

The volume of rock excavation may be reduced by raising the field. However, this will require more filling in other areas and some design changes (e.g., grading and walls).

### SITE CONDITIONS

The proposed field site is currently a wooded area southeast of the existing football field on the campus of Xaverian Brothers High School in Westwood, Massachusetts. Ground surface elevations at the site range from approximately El 139 to El. 155 (1929 NGVD).

## PROPOSED CONSTRUCTION

Our understanding of the project is based on conversations with the project design team including Beacon Architectural Associates (BAA), Activitas, Nitsch Engineering, and The Cecile Croup as well as preliminary drawings included in the Notification Intent Submission to the town of Westwood dated 1 May 2013. A new synthetic turf field and ancillary sport structures (bleachers and dugouts) are proposed to be located within the limits of the site with finish grades within the field ranging from approximately El. 146.5 to El. 148. Support structures currently planned consist of dugouts and grandstand seating.

## SUBSURFACE EXPLORATIONS

A total of fifteen (15) test pit explorations (TP-13 through TP-25, including TP-16A and TP-21A) were completed by Earthwork Industries, Inc. of Plainville, Massachusetts on 13 May and 14 May 2013. Conditions encountered at each test pit location were monitored and documented by a Haley & Aldrich geologist. The designations and approximate locations of the test pits are shown on Figure 2, Site and Subsurface Exploration Location Plan.

Table I provides a summary of the near surface soil units we identified based on soil conditions encountered in the test pits. Detailed descriptions of the subsurface conditions encountered at each test pit location are provided on the Test Pit Logs included in Appendix A. Also included in Appendix A are photographs taken at several of the completed test pits.

### Soil Conditions

Subsurface strata encountered in the recently completed test pits are described below, generally in order of occurrence below ground surface. At some locations, strata may be absent or in a different sequence.

- **Forest Mat** – A surficial layer of forest mat was encountered in the test pits within the wooded portions of the site and consisted of dark brown, organic soil with sand, roots and forest mat debris. Where encountered, the thickness of the forest mat ranged from 0.8 to 1.5 ft.
- **Fill** – A layer of fill soil was encountered below ground surface in test pits TP-13, TP-14, TP-16, TP-18, TP-19, TP-21, TP-21A, TP-23 and TP-25. Where encountered, the thickness of the fill ranged from 1 to 6 ft. Fill soils varied from dark brown SAND with organic silt; to brown silty SAND with gravel. Numerous cobbles and boulders were present across the site.

A large area (approximately 8,000 SF) of nested boulder/cobble fill exists at the site as shown on the attached Figure 2. Test Pits TP-18 and TP-25 were excavated in this boulder/cobble fill area of the site. Fill in this area is primarily cobbles and boulders, with a little organic soil, and brown silty sand. Large quantities of cobbles and boulders were also observed in the fill at other locations such as TP-14 and TP-19.

An area (approximately 2,500 SF) of fill containing a large percentage of miscellaneous trash and debris exists at the site in the area indicated on the attached Figure 2. Test Pits TP-21 and TP-23 were conducted in this area of the site. Fill in this area includes broken glass, glass bottles and miscellaneous metal debris. Additionally, large quantities of concrete, asphalt, and metal debris were observed in TP-

16. The area around TP-16 and TP-16A has metal debris, tires and other trash located at ground surface. Miscellaneous trash was observed intermittently at ground surface throughout the site.

- **Loess** – A layer of Loess underlies the Forest Mat (where encountered) or fill and consisted of orange-brown SILT or sandy Silt. Where encountered, the thickness of the loess ranged from 1.2 to 2.7 ft.
- **Glacial Till** – Glacial till was observed in eleven (11) test pits below the fill or loess deposits. Glacial till was typically described as dense, well bonded, olive-gray silty SAND with gravel, cobbles and boulders. Excavation with a backhoe in the glacial till was difficult due to the density of the material and the presence of gravel, cobbles, and boulders.
- **Geotechnical Laboratory Results** – Grain Size Distribution tests were performed in general accordance with ASTM D 422-63. The tests were conducted on representative soil samples within the Glacial Till Deposits from test pits TP-13 and TP-19 at depths ranging from about 3 ft. to 8.5 ft. below existing grades. Additionally, grain size distribution tests and compaction testing were performed in accordance with ASTM 422 and D1557, respectively, on a composite soil sample of the Glacial Till collected from TP-13, TP-19, and TP-22 from depths ranging from 3 ft. to 8.5 ft. below ground surface. Results are included in Appendix B.

### **Bedrock**

Bedrock was encountered in Test Pits TP-14, TP-17, TP-18, TP-21, TP-21A, and TP-23 through TP-25. Encountered bedrock consists of pink-gray GRANITE. The top of bedrock varied considerably within individual test pits from El. 146.1 to El. 155.0. Based on previous explorations conducted on other parts of the school campus localized intrusions of very hard DIABASE are present in the GRANITE.

### **Groundwater Conditions**

No observation wells were installed during the investigation program. Groundwater was not encountered in the test pits at the time they were conducted. However, during periods of precipitation, groundwater will be present below existing grades.

Groundwater levels will fluctuate with seasons, precipitation, and snowmelt, nearby construction activities, leakage into and out of utilities, and other factors. Groundwater levels encountered during construction may vary from those encountered during the exploration program.

## **GEOTECHNICAL DESIGN RECOMMENDATIONS**

### **Synthetic Turf Field**

A new synthetic turf field is proposed to be located within the limits of the site with proposed finish grades within the footprint of the field ranging from approximately El. 146.5 in the outfield to El. 148 at the pitcher's mound. The subgrade for the field will be approximately 1 ft below finished grades, except in areas where rock is present (2 ft in those areas). Current ground surface elevations at the site range from approximately El 139 to El. 155.

We recommend the field sub-drainage system design be comprised of a minimum 9 inch layer of double-washed, 3/4-in. crushed stone with perforated HDPE pipes (sized by the Project Civil Engineer) embedded within the crushed stone to collect and transport water that filters through the turf playing surface to an appropriately sized on-site collection/groundwater recharge system (or direct discharge into a permitted storm drain). Prior to placing the crushed stone and perforated piping, a nonwoven geotextile fabric (Mirafi 160N or similar) is recommended to be placed on top of the prepared and approved subgrade.

The following Work shall be conducted in connection with preparing the subgrade for the field and other proposed improvements.

- Excavation/stripping and removal of unsuitable subgrade materials (Topsoil, Forest Mat, Fill and Loess) is required in all areas of proposed construction (e.g., limits of the field, bleachers, landscaping, etc.).
- All debris and manmade materials exposed at or located below subgrade shall be excavated and replaced with compacted backfill. This includes removal of existing pavements, concrete pads, former foundations, septic systems, tanks and other remnants of previous site developments.
- Existing site grades and localized excavations to remove unsuitable materials (including topsoil, loess and debris) will require up to 7 ft or more of compacted fill.
- Rock excavation (controlled blasting and/or mechanical excavation, e.g., hoe-ramming) will be required to achieve subgrade. Rock, boulders and cobbles must be over-excavated and replaced with compacted backfill to provide a minimum of 12 inches of soil below proposed subgrade elevations. Non-woven Geotextile (Filter fabric) shall be placed over any exposed rock surfaces prior to placement of soil above to prevent the migration of fine grained soils.

We assume that the Civil Engineer will design and detail a stormwater runoff collection and management system. Anticipated subsurface conditions at and/or within shallow depths of the anticipated design subgrade level for the new synthetic turf field are likely to consist of fine-grained soils and rock that have poor drainage characteristics – vertically and laterally. Design of any sub-turf drainage systems must consider the effect these relatively impermeable subgrade conditions can have on the field's drainage capacity.

#### **Ancillary Support Structures**

Proposed site improvements include the construction of dugouts and grandstands. Foundation elements for proposed support structures should be designed to bear on naturally deposited glacial soils or compacted granular fill following removal of unsuitable soils. Foundation elements can be designed using a bearing pressure of 2 kips per square foot (ksf) for naturally deposited glacial soils of granular fill. Footings need to bear a minimum of 4 ft. below adjacent site grades for frost protection.

#### **CONSTRUCTION CONSIDERATIONS**

The primary purpose of this section is to comment on items related to foundation construction and related geotechnical engineering aspects of the proposed construction. Prospective contractors for the project should evaluate potential construction problems on the basis of their own knowledge and experience, taking into account their own proposed construction methods and procedures.

In addition to the construction guidelines and recommendations made herein, all construction activities should conform to the requirements of OSHA and all other applicable municipal and state regulatory agencies.

### **General Excavation**

Excavation includes the removal of dense soils, cobbles, boulders, trash, rock and other miscellaneous debris. This will require large excavators and the machines will have wear and tear that require replacement of backhoe teeth, etc.

Excavation to achieve subgrades for the proposed field will require rock excavation. Rock excavation can consist of mechanical removal with the use of pneumatic hammers (hoe-ram) or controlled blasting. Based on our experience, controlled blasting would be the more efficient than hoe-ramming. Numerous State and local regulations must be followed, including pre-blast condition surveys on all houses, buildings and other structures located within 250 ft. of the blast zone. Vibration monitoring should also be conducted at and adjacent to structures. These surveys and vibration monitoring can be conducted by either the blasting contractor or the Owner. The blasting contractor should have a current license in the State of Massachusetts.

Conventional blasting mats should be used during blasting to prevent fly rock. The Contractor is required to obtain all necessary local, state, and federal permits prior to blasting.

Rock excavation should be observed by a qualified representative of the Owner to assess if bedrock excavation is being conducted in accordance with the Contract Documents and the contractor's approved submittals. We propose to prepare a Controlled Blasting Specification Section for the contract documents. Additional information pertaining to controlled blasting will be included in the contract specifications.

### **Construction Dewatering**

We recommend dewatering and surface water control be implemented to maintain a dry and undisturbed design subgrade. Temporary re-grading should be conducted so as to divert possible surface runoff away from the work areas.

Dewatering should be performed as necessary to allow all final excavation and backfilling to be conducted in the dry. The Contractor should control the flow of surface water and seepage water into the excavation at all times. Dewatering procedures should be conducted in a manner that protects exposed field and footing subgrades and in-place compacted fill and that avoids pumping of fines. Dewatering can likely be performed using shallow sumping and drainage trenches.

Dewatering effluent should be recharged on-site in temporary recharge pits constructed by the contractor away from the work area. This may not be feasible due to the low permeability of on-site soils. Dewatering effluent cannot be allowed to enter site drainage system without a permit.

### **Reuse of Excavated Soil/Blasted Rock Materials**

We recommend that excavated materials be reused on site to the extent possible to reduce off-site disposal costs. This may require on site processing and reuse in landscaped areas as common fill. Reuse below the field will require that gradation and compaction requirements be achieved. The Topsoil, Forest Mat and Loess are not suitable for reuse as fill material below the new field or other site improvements. These materials may be suitable for reuse in landscape areas outside the limits of the synthetic field.

Fill and glacial soils may be reused as fill following screening, processing/mixing and removal of 6 in. plus cobbles and boulders. Blast rock, boulders and cobbles could be processed on site by crushing. Processing on site soils and rock materials together would improve the usability and quality of on-site soils for reuse. On-site processing will require an area for segregating, processing and stockpiling excavated soils.

Re-use of excavated soils is dependent upon the physical properties (e.g., grain size distribution and cobble size) and degree of compaction that can be achieved in the field.

### **Off-Site Disposal and Trash/Debris Removal**

If the onsite soils, cobbles, and boulders cannot be reused on site, off-site disposal will require management of these materials in compliance with all applicable federal, state, and local laws and regulations. This will likely include chemical testing of soils by receiving facilities. Chemical testing may result in regulatory reporting requirements and other issues.

There are areas on the site where trash/debris are present as shown on Figure 2. These materials are recommended to be excavated and legally disposed off-site prior to general excavation and earthwork to reduce mixing with other materials. The facility that receives these materials will likely require the collection and chemical analysis of samples prior to accepting the materials. The process of sampling, testing and acceptance may take up to 8 weeks from the time the samples are collected to arrange for off-site disposition of the materials.

### **Backfilling and Subgrade Preparation**

Backfill shall consist of well graded granular materials. Backfill placed to raise grades to the design subgrade elevation shall be compacted to 95% of the material's maximum dry unit weight (determined in accordance with ASTM D1557). As a minimum, each layer of fill should receive four complete coverages with suitable compaction equipment.

The field subgrade will generally consist of glacial till or compacted fill after removing unsuitable materials and rock. The glacial soils and other in situ soils are very susceptible to disturbance due to moisture, construction traffic and freezing and thawing temperatures.

The following measures are recommended:

- Final excavations should be made by hand or using smooth-bladed equipment to remove all soft or disturbed soil.
- Back-blading to smooth the surface should not be permitted.

- The exposed subgrade should be compacted with a roller. Compaction should be discontinued if disturbance occurs due to the presence of water. If, during proof compaction of the subgrades pumping, or weaving conditions are observed, alternate compaction techniques may be required and/or additional subgrade preparation may be recommended (e.g., removal and replacement of soft, compressible soils).

### **Plan and Specification Review**

It is recommended that Haley & Aldrich be provided the opportunity to review geotechnical aspects of the final plans and specifications in order to confirm that the recommendations made in this report were interpreted and implemented as intended.

### **Additional Explorations**

We recommend that additional subsurface explorations be conducted to further define areas of rock excavation. This work may consist of explorations on a grid pattern to collect additional top of rock information. Explorations would consist of drill holes conducted with an air track drill rig or test pits conducted with and excavator. Substantial site clearing would be required to conduct this work prior to construction.

### **Construction Monitoring**

A geotechnical engineer or technician qualified by training and experience is highly recommended to be present during construction to provide monitoring. The field representative should be present to monitor the following construction activities and facilitate problem resolution:

- Excavation of site soils and rock, including Controlled Blasting if conducted and processing of site material.
- Monitor preparation of field and foundation surfaces including removal of existing unsuitable materials, and to confirm the character of the material encountered at bearing levels.
- Confirm that fill and backfill materials meet the requirements of the project plans and specifications, and make judgments regarding the suitability of excavated soils for reuse as fill;
- Observe placement and test compaction of compacted fills.
- Conduct vibration monitoring activities during controlled blasting and other earthwork activities.

It is recommended that Haley & Aldrich be retained to perform full-time field observations of the geotechnical aspects of construction based on familiarity with the subsurface conditions, design concepts, and specifications. Field observations are intended to confirm compliance with the design concepts and to facilitate design changes in the event that subsurface conditions differ from those anticipated prior to construction.

## LIMITATIONS

The scope of work undertaken for this report does not include environmental consulting services to assess the need for cost contingencies associated with handling and disposal of excavated soil materials. If excess soils will be generated for off-site disposal, we recommend that Haley & Aldrich conduct a program to characterize excavated soil for off-site disposal. We would be happy to provide a proposal for these services if the need arises.

This report has been prepared for specific application to the proposed multipurpose athletic field site at Xaverian Brothers High School in Westwood, Massachusetts. The recommendations contained in this report are based, in part, on information obtained from subsurface explorations and information that was provided to us by BAA. The nature and extent of variations in the subsurface conditions between explorations may not become evident until construction, and the project design may change from our current understanding. Any additional information pertaining to the project that becomes available should be provided to Haley & Aldrich, Inc., so that our conclusions and recommendations can be reviewed and modified, as necessary.

Please do not hesitate to contact us should you have any questions or require additional information.

### Enclosures:

Table I – Summary of Test Pit Explorations

Figure 1 – Site and Subsurface Exploration Location Plan

Appendix A – Test Pit Reports and Photographs

Appendix B – Geotechnical Laboratory Analysis Test Results

G:\39579\003 - Baseball Field\Geotech Memo\2013\_0524\_HAI\_Geotech Memo-XBHS Baseball Field-F.docx



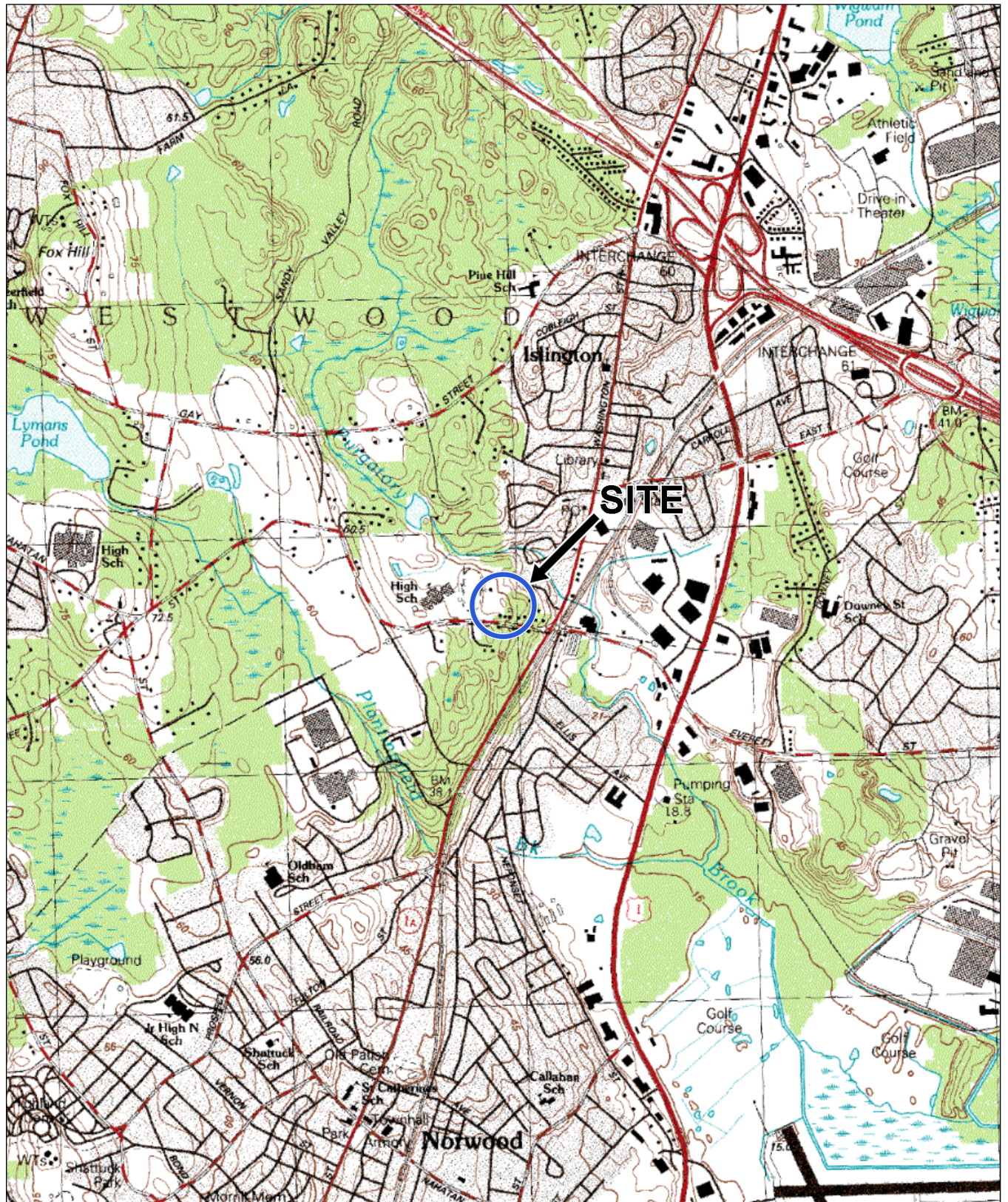
**TABLE I - SUMMARY OF TEST PIT DATA**

XAVERIAN BROTHERS HIGH SCHOOL  
 800 CLAPBOARDTREE STREET  
 WESTWOOD, MASSACHUSETTS  
 39579-003

Test Boring ID	Date	Ground Surface El. [ft]	Total Test Pit Depth [ft]	Bottom of Test Pit Elevation [ft]	Forest Mat		Fill		Loess Deposits		Glacial Till		Bedrock*
					Top Elevation [ft]	Thickness [ft]	Top Elevation [ft]	Thickness [ft]	Top Elevation [ft]	Thickness [ft]	Top Elevation [ft]	Thickness [ft]	Top Elevation [ft]
TP-13	5/13/2013	155.5	8.5	147.0	NE	NE	155.5	3.0	NE	NE	152.5	NP	-
TP-14	5/14/2013	155.0	7.0	148.0	NE	NE	155.0	6.0	NE	NE	NE	NE	-
TP-15	5/14/2013	148.5	4.0	144.5	148.5	0.8	NE	NE	147.8	1.2	146.5	NP	-
TP-16	5/13/2013	153.0	5.8	147.3	NE	NE	153.0	1.6	NE	NE	151.4	NP	-
TP-16A	5/13/2013	153.5	6.0	147.5	153.5	1.5	NE	NE	152.0	1.5	150.5	NP	-
TP-17	5/14/2013	155.0	4.0	151.0	155.0	0.8	NE	NE	154.3	1.2	153.0	2.0	151 to 155
TP-18	5/14/2013	150.5	4.5	146.0	NE	NE	150.5	4.5	NE	NE	NE	NE	146.5 to 150
TP-19	5/13/2013	151.5	7.0	144.5	NE	NE	151.5	3.0	NE	NE	148.5	NP	-
TP-20	5/13/2013	152.0	7.0	145.0	152.0	1.0	NE	NE	151.0	1.0	150.0	NP	-
TP-21	5/14/2013	150.0	3.9	146.1	NE	NE	150.0	1.0	149.0	2.7	146.3	0.2	146.1 to 148.5
TP-21A	5/14/2013	154.5	3.0	151.5	NE	NE	154.5	1.5	NE	NE	NE	NE	151.5 to 153
TP-22	5/13/2013	152.7	8.0	144.7	152.7	1.5	NE	NE	151.2	1.5	149.7	NP	-
TP-23	5/14/2013	151.0	4.0	147.0	NE	NE	151.0	1.5	149.5	2.0	147.5	0.3	147.3
TP-24	5/14/2013	155.0	0.9	154.1	155.0	0.9	NE	NE	NE	NE	NE	NE	154.1
TP-25	5/14/2013	152.0	3.0	149.0	NE	NE	152	1.5	150.5	1.3	149.3	0.2	149.0

**NOTES:**

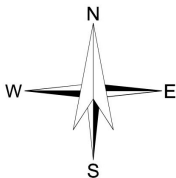
1. NE = Not Encountered
2. Elevations are in feet and reference National Geodetic Vertical Datum of 1929 (NGVD 1929).
3. NP = Not penetrated
4. \* indicates includes weathered rock.



SITE COORDINATES: 42°12'52"N, 71°11'37"W

**HALEY & ALDRICH**

XAVERIAN BROTHERS HIGH SCHOOL  
 NEW BASEBALL FIELD  
 800 CLAPBOARDTREE STREET  
 WESTWOOD, MASSACHUSETTS

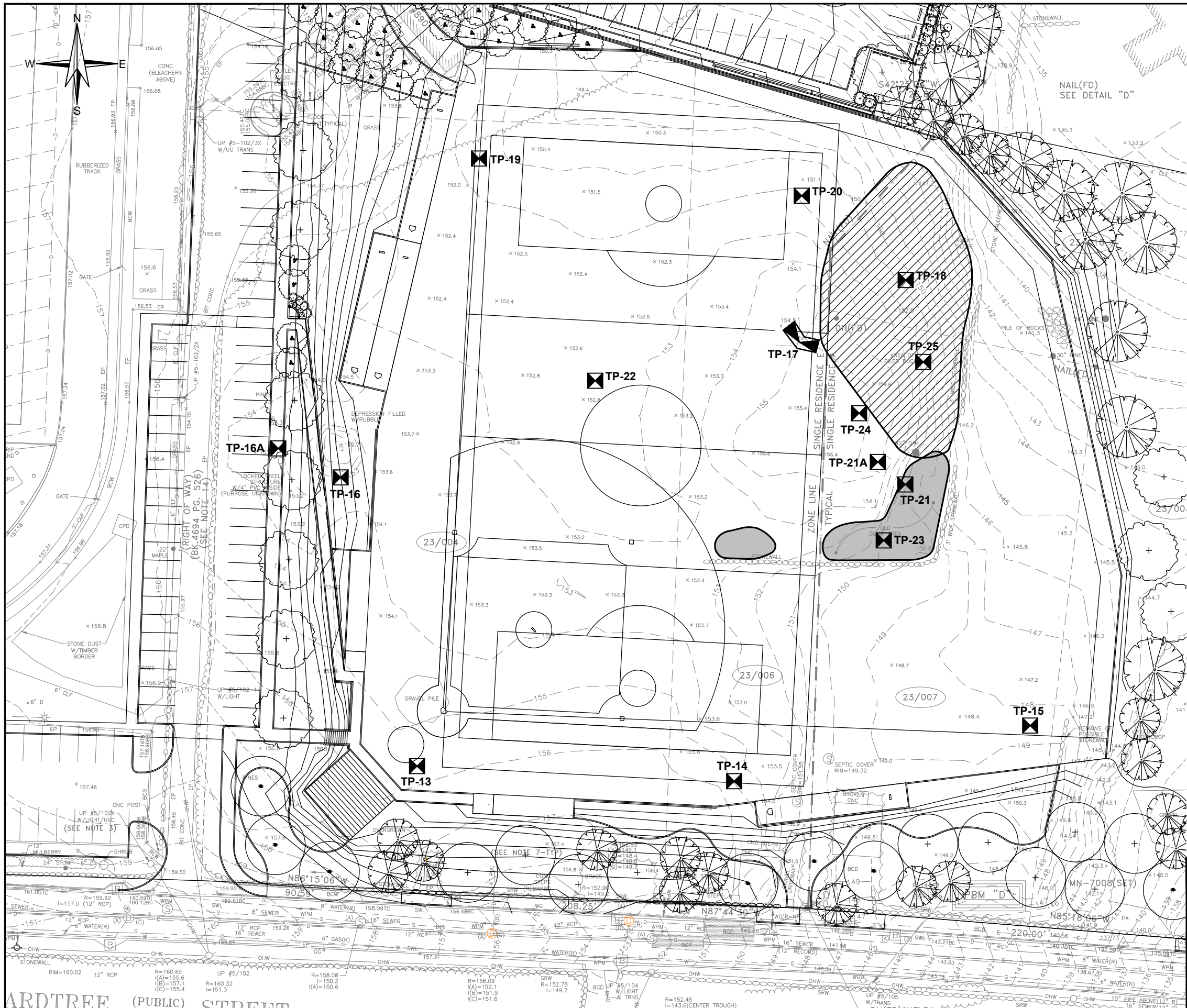


U.S.G.S. QUADRANGLE: NORWOOD, MA

PROJECT LOCUS

SCALE: 1:24,000  
 MAY 2013

FIGURE 1

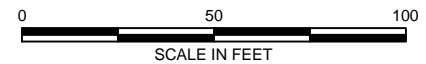


**LEGEND:**

- TP-13** DESIGNATION APPROXIMATE LOCATION OF TEST PIT EXCAVATED BY EARTHWORK INDUSTRIES, INC. ON 13 AND 14 MAY 2013 AND MONITORED BY HALEY & ALDRICH, INC.
- INDICATES APPROXIMATE LIMITS OF BOULDER/COBBLE FILL VISIBLE AT GROUND SURFACE
- INDICATES APPROXIMATE LIMITS OF FILL CONTAINING RANDOM TRASH VISIBLE AT GROUND SURFACE

**NOTES:**

1. BASE PLAN TAKEN FROM ELECTRONIC FILE TITLED "2013-05-15 Base.dwg" PROVIDED BY THE CECIL GROUP, RECEIVED 16 MARCH 2013.
2. ELEVATIONS SHOWN REFER TO NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD 1929).
3. EXPLORATION LOCATIONS IDENTIFIED WITH GPS OR FIELD TAPE MEASURE TO EXISTING SURFACE FEATURES BY HALEY & ALDRICH, INC. EXPLORATION LOCATIONS SHOULD BE CONSIDERED APPROXIMATE.



**HALEY & ALDRICH** XAVERIAN BROTHERS HIGH SCHOOL  
800 CLAPBOARD TREE STREET  
WESTWOOD, MASSACHUSETTS

**SITE AND SUBSURFACE  
EXPLORATION LOCATION PLAN**

SCALE: AS SHOWN  
MAY 2013

**FIGURE 2**

J:\GRAPHICS\39579\39579-003-B010.DWG

**APPENDIX A**

**Test Pit Photos and Logs**



**HALEY &  
ALDRICH**

UNDERGROUND  
ENGINEERING &  
ENVIRONMENTAL  
SOLUTIONS

Xaverian Brothers High School  
Proposed Baseball Field  
Westwood, Massachusetts

**PHOTOGRAPHS OF  
TEST PIT TP-13**

FILE NO. 39579-003

**TEST PIT LOG**

**Test Pit No. TP-13**

**Project** XAVERIAN BROTHERS HIGH SCHOOL- BASEBALL FIELD  
**Location** WESTWOOD, MA  
**Client** XAVERIAN BROTHERS HIGH SCHOOL  
**Contractor** EARTHWORKS INDUSTRIES, INC.  
**Equipment Used** Bobcat E45

**File No.** 39579-003  
**H&A Rep** C. Sullivan  
**Date** 13 May 2013  
**Weather** Sunny, 55° F

**Ground El.:** 155.5 (est.)  
**El. Datum:** NGVD 1929

**Location:** See Plan

**Groundwater depths/entry rates (in./min.):** NE

Depth (ft)	Sample ID	Stratum Change Elev./Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (color, natural grain size and artificial component percentage estimates, maximum particle size, manual test properties, structure, odors, moisture, other descriptions and observations GEOLOGIC INTERPRETATION)	Gravel		Sand			Field Tests				
					% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength
0			SM	Dark brown silty SAND (SM), mps 1 in., no structure, roots throughout, moist, forest mat with buried large boulders, mps 28 in., filled  -FILL-	5	5		10	50	30				
2		154.0 1.5	ML	Orange-brown sandy SILT (ML) with boulders in top of strata, mps 35 in., no structure, no odor, moist, appears to be reworked  -FILL-	5	5	5	5	45	35				
4		152.5 3.0	SM	Olive-gray silty SAND with gravel (SM), mps 4 in., well bonded, no odor, moist  -GLACIAL TILL DEPOSIT-	5	5	5	5	45	35				
8		147.0 8.5		BOTTOM OF EXPLORATION 8.5 FT										

**Obstructions:**

**Remarks:**

**Field Tests**  
 Dilatancy R - Rapid S - Slow N - None  
 Toughness L - Low M - Medium H - High  
 Plasticity N - Nonplastic L - Low M - Medium H - High  
 Dry Strength N - None L - Low M - Medium H - High V - Very High

**Standing Water in Completed Pit**  
 at depth not encountered ft  
 measured after hours elapsed

**Boulders**  
 Diameter (in.) Number Approx. Vol. (cu.ft)  
 12 to 24 10 =  
 over 24 2 =

**Test Pit Dimensions (ft)**  
 Pit Length x Width (ft) 9.0 x 5.0  
 Pit Depth (ft) 8.5

**NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.**



**HALEY &  
ALDRICH**

Xaverian Brothers High School  
Proposed Baseball Field  
Westwood, Massachusetts

**PHOTOGRAPHS OF  
TEST PIT TP-14**

UNDERGROUND  
ENGINEERING &  
ENVIRONMENTAL  
SOLUTIONS

FILE NO. 39579-003

May 2013

**TEST PIT LOG**

**Test Pit No. TP-14**

**Project** XAVERIAN BROTHERS HIGH SCHOOL- BASEBALL FIELD  
**Location** WESTWOOD, MA  
**Client** XAVERIAN BROTHERS HIGH SCHOOL  
**Contractor** EARTHWORKS INDUSTRIES, INC.  
**Equipment Used** Bobcat E45

**File No.** 39579-003  
**H&A Rep** C. Sullivan  
**Date** 14 May 2013  
**Weather** Sunny, 55° F

**Ground El.:** 155.0 (est.)  
**El. Datum:** NGVD 1929

**Location:** See Plan

**Groundwater depths/entry rates (in./min.):** NE

Depth (ft)	Sample ID	Stratum Change Elev./Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (color, natural grain size and artificial component percentage estimates, maximum particle size, manual test properties, structure, odors, moisture, other descriptions and observations GEOLOGIC INTERPRETATION)	Gravel		Sand			Field Tests				
					% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength
0			SM	Brown silty SAND with gravel (SM), with cobbles and boulders throughout, mps 40 in., appears to be blasted rock or similar, no structure, no odor	5	5	5	10	40	35				
1														
2														
3														
4				-BOULDER-COBBLE FILL-										
5														
6		149.0 6.0		TOP OF BEDROCK 6.0 FT Granite Note: Bedrock starts at 6.0 ft and slopes to the west. -BEDROCK-										
7		148.0 7.0		BOTTOM OF EXPLORATION 7.0 FT Note: Refusal on BEDROCK. -BEDROCK-										

**Obstructions:**

**Remarks:**

Field Tests			
Dilatancy	R - Rapid	S - Slow	N - None
Toughness	L - Low	M - Medium	H - High
Plasticity	N - Nonplastic L - Low M - Medium H - High		
Dry Strength	N - None	L - Low	M - Medium H - High V - Very High

**Standing Water in Completed Pit**  
 at depth not encountered ft  
 measured after hours elapsed

**Boulders**  
 Diameter (in.) Number Approx. Vol. (cu.ft)  
 12 to 24 50 =  
 over 24 10 =

**Test Pit Dimensions (ft)**  
 Pit Length x Width (ft) 11.5 x 4.5  
 Pit Depth (ft) 7.0

**NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.**





**HALEY &  
ALDRICH**

UNDERGROUND  
ENGINEERING &  
ENVIRONMENTAL  
SOLUTIONS

Xaverian Brothers High School  
Proposed Baseball Field  
Westwood, Massachusetts

**PHOTOGRAPHS OF  
TEST PIT TP-15**

FILE NO. 39579-003

May 2013

**TEST PIT LOG**

**Test Pit No. TP-15**

**Project** XAVERIAN BROTHERS HIGH SCHOOL- BASEBALL FIELD  
**Location** WESTWOOD, MA  
**Client** XAVERIAN BROTHERS HIGH SCHOOL  
**Contractor** EARTHWORKS INDUSTRIES, INC.  
**Equipment Used** Bobcat E45

**File No.** 39579-003  
**H&A Rep** C. Sullivan  
**Date** 14 May 2013  
**Weather** Sunny, 55° F

**Ground El.:** 148.5 (est.)  
**El. Datum:** NGVD 1929

**Location:** See Plan

**Groundwater depths/entry rates (in./min.):** NE

Depth (ft)	Sample ID	Stratum Change Elev./Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (color, natural grain size and artificial component percentage estimates, maximum particle size, manual test properties, structure, odors, moisture, other descriptions and observations GEOLOGIC INTERPRETATION)	Gravel		Sand			Field Tests				
					% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength
0			SM	Dark brown silty SAND with trace gravel (SM), mps 1 in., no structure, forest mat, roots throughout -FOREST MAT-	5	5		10	50	30				
1		147.8 0.8	ML	Orange-brown sandy SILT with gravel (ML), mps 1.5 in., no structure, no odor, moist -LOESS DEPOSIT-	5	5	5	40	45					
2		146.5 2.0	SM	Olive-gray silty SAND (SM) with gravel, mps 4 in., well bonded, no odor, moist Note: Difficult to excavate.	5	5	5	15	40	30				
3				-GLACIAL TILL DEPOSIT-										
4		144.5 4.0		BOTTOM OF EXPLORATION 4.0 FT										

**Obstructions:**

**Remarks:**

**Field Tests**  
 Dilatancy R - Rapid S - Slow N - None  
 Toughness L - Low M - Medium H - High  
 Plasticity N - Nonplastic L - Low M - Medium H - High  
 Dry Strength N - None L - Low M - Medium H - High V - Very High

**Standing Water in Completed Pit**  
 at depth not encountered ft  
 measured after hours elapsed

**Boulders**  
 Diameter (in.) Number Approx. Vol. (cu.ft)  
 12 to 24 - = -  
 over 24 - = -

**Test Pit Dimensions (ft)**  
 Pit Length x Width (ft) 8.0 x 4.0  
 Pit Depth (ft) 4.0

**NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.**

**TEST PIT LOG**

**Test Pit No. TP-16**

**Project** XAVERIAN BROTHERS HIGH SCHOOL- BASEBALL FIELD  
**Location** WESTWOOD, MA  
**Client** XAVERIAN BROTHERS HIGH SCHOOL  
**Contractor** EARTHWORKS INDUSTRIES, INC.  
**Equipment Used** Bobcat E45

**File No.** 39579-003  
**H&A Rep** C. Sullivan  
**Date** 13 May 2013  
**Weather** Sunny, 55° F

**Ground El.:** 153.0 (est.)  
**El. Datum:** NGVD 1929

**Location:** See Plan

**Groundwater depths/entry rates (in./min.):** NE

Depth (ft)	Sample ID	Stratum Change Elev./Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (color, natural grain size and artificial component percentage estimates, maximum particle size, manual test properties, structure, odors, moisture, other descriptions and observations GEOLOGIC INTERPRETATION)	Gravel		Sand			Field Tests				
					% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength
0			SM	Dark brown silty SAND (SM), mps 0.5 in., pieces of asphalt, concrete, aluminum cans throughout, mps of asphalt is 10 in., no odor, moist		5		10	50	35				
1				-FILL-										
2		151.4 1.6	SM	Olive-brown to tan-brown silty SAND with gravel (SM), mps 12 in., well bonded Note: Difficult to excavate.	5	5	5	10	45	30				
3														
4				-GLACIAL TILL DEPOSIT-										
5														
		147.3 5.8		<b>BOTTOM OF EXPLORATION 5.75 FT</b> Notes: Refusal on dense till. Area around test pit appears to be old dumping spot with rusted out trash barrels, old water heater, asphalt and concrete.										

HA-TP07-1.GDT G:\39579\003 - BASEBALL FIELD\GINT\39579-003\_TP.GPJ May 21, 13 HA-TP07-1.BOS.GLB HA-TESTPIT-07-1

<b>Obstructions:</b>	<b>Remarks:</b>	<b>Field Tests</b>		
		Dilatancy	R - Rapid S - Slow N - None	
<b>Standing Water in Completed Pit</b> at depth not encountered ft measured after hours elapsed	<b>Boulders</b> Diameter (in.) Number Approx. Vol. (cu.ft) 12 to 24 1 = over 24 0 =	<b>Test Pit Dimensions (ft)</b> Pit Length x Width (ft) 6.0 x 5.0 Pit Depth (ft) 5.8		
		<b>NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley &amp; Aldrich, Inc.</b>		



G:\39579\003 - Baseball Field\Geotech Memo\Appendix A - Test Pit Photos and Logs\2013 0515-TP Photographs.xls\Photos

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**PHOTOGRAPHS OF  
TEST PIT TP-16A**

FILE NO. 39579-003

May 2013

**TEST PIT LOG**

**Test Pit No. TP-16A**

**Project** XAVERIAN BROTHERS HIGH SCHOOL- BASEBALL FIELD  
**Location** WESTWOOD, MA  
**Client** XAVERIAN BROTHERS HIGH SCHOOL  
**Contractor** EARTHWORKS INDUSTRIES, INC.  
**Equipment Used** Bobcat E45

**File No.** 39579-003  
**H&A Rep** C. Sullivan  
**Date** 13 May 2013  
**Weather** Sunny, 55° F

**Ground El.:** 153.5 (est.)  
**El. Datum:** NGVD 1929

**Location:** See Plan

**Groundwater depths/entry rates (in./min.):** NE

Depth (ft)	Sample ID	Stratum Change Elev./Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (color, natural grain size and artificial component percentage estimates, maximum particle size, manual test properties, structure, odors, moisture, other descriptions and observations GEOLOGIC INTERPRETATION)	Gravel		Sand			Field Tests				
					% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength
0			SM	Dark brown silty SAND (SM), mps 0.75 in., no structure, no odor, moist, no oversize, forest mat with roots	5	5	5	10	40	35				
1				-FOREST MAT-										
1.5		152.0	ML	Orange-brown sandy SILT (ML), mps 3 in., no structure, no odor, moist, no oversize, trace roots	5	5	10	20	60					
2				-LOESS DEPOSIT-										
3		150.5	SM	Olive-gray silty SAND with trace gravel (SM), mps 4 in., no oversize no structure, no odor, moist	5	5	10	50	30					
4		3.0		-GLACIAL TILL DEPOSIT-										
5				Note: Test pit excavated next to old steel structure, partly protruding out of the ground. Soil immediately adjacent to steel structure appears disturbed.										
6		147.5		BOTTOM OF EXPLORATION 6.0 FT										
6		6.0												

Localized Fill Adjacent to Steel Structure

Approximate Limits of Steel Structure Exposed in Test Pit. Refer to Photos

HA-TP07-1.GDT G:\39579\003 - BASEBALL FIELD\GINT\39579-003\_TP.GPJ May 21, 13 HA-TP07-1.BOS.GLB HA-TESTPIT-07-1

<b>Obstructions:</b>		<b>Remarks:</b>			<b>Field Tests</b>					
					Dilatancy	R - Rapid	S - Slow	N - None		
					Toughness	L - Low	M - Medium	H - High		
					Plasticity	N - Nonplastic L - Low M - Medium H - High				
					Dry Strength	N - None	L - Low	M - Medium	H - High	V - Very High
<b>Standing Water in Completed Pit</b>				<b>Boulders</b>			<b>Test Pit Dimensions (ft)</b>			
at depth	not encountered	ft		Diameter (in.)	Number	Approx. Vol. (cu.ft)	Pit Length x Width (ft) 7.0 x 4.5			
measured after		hours elapsed		12 to 24	-	= -	Pit Depth (ft) 6.0			
				over 24	-	= -				

**NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.**



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**PHOTOGRAPHS OF  
TEST PIT TP-17**

FILE NO. 39579-003

**TEST PIT LOG**

**Test Pit No. TP-17**

**Project** XAVERIAN BROTHERS HIGH SCHOOL- BASEBALL FIELD  
**Location** WESTWOOD, MA  
**Client** XAVERIAN BROTHERS HIGH SCHOOL  
**Contractor** EARTHWORKS INDUSTRIES, INC.  
**Equipment Used** Bobcat E45

**File No.** 39579-003  
**H&A Rep** C. Sullivan  
**Date** 14 May 2013  
**Weather** Sunny, 53° F

**Ground El.:** 155.0 (est.)  
**El. Datum:** NGVD 1929

**Location:** See Plan

**Groundwater depths/entry rates (in./min.):** NE

Depth (ft)	Sample ID	Stratum Change Elev./ Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (color, natural grain size and artificial component percentage estimates, maximum particle size, manual test properties, structure, odors, moisture, other descriptions and observations GEOLOGIC INTERPRETATION)	Gravel		Sand			Field Tests			
					% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity
0			SM	Dark brown silty SAND (SM), mps 0.5 in., no structure, roots throughout, no odor, moist, forest mat -FOREST MAT-	5	5	10	45	35				
154.3 0.8			ML	Orange-brown sandy SILT (ML), mps 2 in., no structure, no odor, wet  -LOESS DEPOSIT-	5	5	10	30	50				
153.0 2.0			SM	Olive-gray silty SAND with gravel (SM), mps 8 in., well bonded, no odor, moist, no oversize Note: Difficult to excavate  Approximate Limits of Bedrock Surface Exposed in Test Pit. Refer to Photos	10	15	10	10	25	30			
3				-GLACIAL TILL-									
4		151.0 4.0		BOTTOM OF EXPLORATION 4.0 FT Note: Refusal on BEDROCK (granite). -BEDROCK-									

<b>Obstructions:</b>	<b>Remarks:</b>	<b>Field Tests</b>			
		Dilatancy	R - Rapid	S - Slow	N - None
		Toughness	L - Low	M - Medium	H - High
		Plasticity	N - Nonplastic L - Low M - Medium H - High		
		Dry Strength	N - None L - Low M - Medium H - High V - Very High		

<b>Standing Water in Completed Pit</b>			<b>Boulders</b>			<b>Test Pit Dimensions (ft)</b>	
at depth	not encountered	ft	Diameter (in.)	Number	Approx. Vol. (cu.ft)	Pit Length x Width (ft)	20.0 x 5
measured after		hours elapsed	12 to 24	-	= -	Pit Depth (ft)	4.0
			over 24	-	= -		

**NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.**



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**PHOTOGRAPHS OF  
TEST PIT TP-18**

FILE NO. 39579-003



**TEST PIT LOG**

**Test Pit No. TP-18**

**Project** XAVERIAN BROTHERS HIGH SCHOOL- BASEBALL FIELD  
**Location** WESTWOOD, MA  
**Client** XAVERIAN BROTHERS HIGH SCHOOL  
**Contractor** EARTHWORKS INDUSTRIES, INC.  
**Equipment Used** Bobcat E45

**File No.** 39579-003  
**H&A Rep** C. Sullivan  
**Date** 14 May 2013  
**Weather** Sunny, 53° F

**Ground El.:** 150.5 (est.)  
**El. Datum:** NGVD 1929

**Location:** See Plan

**Groundwater depths/entry rates (in./min.):** NE

Depth (ft)	Sample ID	Stratum Change Elev./Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (color, natural grain size and artificial component percentage estimates, maximum particle size, manual test properties, structure, odors, moisture, other descriptions and observations GEOLOGIC INTERPRETATION)	Gravel		Sand			Field Tests									
					% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength					
0			SM	Loose cobble and boulder fill mixed in with black organic TOPSOIL (SM)															
1				<b>Note: Bedrock starts at 1.0 ft and slopes to the east.</b>															
2				-BOULDER-COBBLE FILL-															
3																			
4		146.0 4.5		Approximate Limits of Bedrock Surface Exposed in Test Pit. Refer to Photos															
				BOTTOM OF EXPLORATION 4.5 FT Note: Refusal at BEDROCK (granite). -BEDROCK-															

**Obstructions:**

**Remarks:**

Field Tests			
Dilatancy	R - Rapid	S - Slow	N - None
Toughness	L - Low	M - Medium	H - High
Plasticity	N - Nonplastic L - Low M - Medium H - High		
Dry Strength	N - None	L - Low	M - Medium H - High V - Very High

**Standing Water in Completed Pit**  
 at depth not encountered ft  
 measured after hours elapsed

Boulders		
Diameter (in.)	Number	Approx. Vol. (cu.ft)
12 to 24	100	=
over 24	10	=

**Test Pit Dimensions (ft)**  
 Pit Length x Width (ft) 7.5 x 4.5  
 Pit Depth (ft) 4.5

**NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.**



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**PHOTOGRAPHS OF  
TEST PIT TP-19**

FILE NO. 39579-003

May 2013

**TEST PIT LOG**

**Test Pit No. TP-19**

**Project** XAVERIAN BROTHERS HIGH SCHOOL- BASEBALL FIELD  
**Location** WESTWOOD, MA  
**Client** XAVERIAN BROTHERS HIGH SCHOOL  
**Contractor** EARTHWORKS INDUSTRIES, INC.  
**Equipment Used** Bobcat E45

**File No.** 39579-003  
**H&A Rep** C. Sullivan  
**Date** 13 May 2013  
**Weather** Sunny, 55° F

**Ground El.:** 151.5 (est.)  
**El. Datum:** NGVD 1929

**Location:** See Plan

**Groundwater depths/entry rates (in./min.):** NE

Depth (ft)	Sample ID	Stratum Change Elev./Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (color, natural grain size and artificial component percentage estimates, maximum particle size, manual test properties, structure, odors, moisture, other descriptions and observations GEOLOGIC INTERPRETATION)	Gravel		Sand			Field Tests								
					% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength				
0			SM	Dark brown silty SAND (SM) combined with boulders, mps 24 in., no structure, no odor, moist, roots throughout, area appears to be filled in with blast rock or similar	10	10												
1				-BOULDER-COBBLE FILL-														
150.0 1.5			ML	Orange-brown sandy SILT (ML) with boulders commingled into strata, mps 20 in., no structure, no odor, appears to be disturbed	5	10	5	5	30	45								
2				-FILL-														
148.5 3.0			SM	Olive-gray silty SAND with gravel and boulders (SM), mps 24 in., well bonded, no odor, moist Note: Difficult to excavate.	10	10	10	10	30	30								
4																		
5				-GLACIAL TILL DEPOSIT-														
6																		
144.5 7.0				BOTTOM OF EXPLORATION 7.0 FT														

<b>Obstructions:</b>	<b>Remarks:</b>	<b>Field Tests</b>			
		Dilatancy	R - Rapid	S - Slow	N - None
		Toughness	L - Low	M - Medium	H - High
		Plasticity	N - Nonplastic L - Low M - Medium H - High		
		Dry Strength	N - None L - Low M - Medium H - High V - Very High		

<b>Standing Water in Completed Pit</b>			<b>Boulders</b>			<b>Test Pit Dimensions (ft)</b>	
at depth	not encountered	ft	Diameter (in.)	Number	Approx. Vol. (cu.ft)	Pit Length x Width (ft)	8.5 x 4.5
measured after		hours elapsed	12 to 24	15	=	Pit Depth (ft)	7.0
			over 24	9	=		

**NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.**

HA-TP07-1.GDT G:\39579\003 - BASEBALL FIELD\GINT\39579-003\_TP.GPJ May 21, 13 HA-TP07-1.BOS.GLB HA-TESTPIT-07-1



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**PHOTOGRAPHS OF  
TEST PIT TP-20**

FILE NO. 39579-003

May 2013

**TEST PIT LOG**

**Test Pit No. TP-20**

**Project** XAVERIAN BROTHERS HIGH SCHOOL- BASEBALL FIELD  
**Location** WESTWOOD, MA  
**Client** XAVERIAN BROTHERS HIGH SCHOOL  
**Contractor** EARTHWORKS INDUSTRIES, INC.  
**Equipment Used** Bobcat E45

**File No.** 39579-003  
**H&A Rep** C. Sullivan  
**Date** 13 May 2013  
**Weather** Sunny, 55° F

**Ground El.:** 152.0 (est.)  
**El. Datum:** NGVD 1929

**Location:** See Plan

**Groundwater depths/entry rates (in./min.):** NE

Depth (ft)	Sample ID	Stratum Change Elev./Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (color, natural grain size and artificial component percentage estimates, maximum particle size, manual test properties, structure, odors, moisture, other descriptions and observations GEOLOGIC INTERPRETATION)	Gravel		Sand			Field Tests				
					% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength
0			SM	Dark brown silty SAND (SM), mps 0.5 in., no structure, no odor, roots throughout  -FOREST MAT-			5	20	40	35				
1		151.0 1.0	ML	Orange-brown sandy SILT (ML), mps 3 in., no structure, no odor, moist, trace roots  -LOESS DEPOSIT-	5	5	5	25	60					
2		150.0 2.0	SM	Tan-brown to olive-gray silty SAND with gravel (SM), mps 32 in., no structure, no odor, moist. Cobbles and boulders throughout.	10	10	15	15	30	20				
3														
4														
5														
6														
7		145.0 7.0												
BOTTOM OF EXPLORATION 7.0 FT														

**Obstructions:**

**Remarks:**

Field Tests			
Dilatancy	R - Rapid	S - Slow	N - None
Toughness	L - Low	M - Medium	H - High
Plasticity	N - Nonplastic L - Low M - Medium H - High		
Dry Strength	N - None	L - Low	M - Medium H - High V - Very High

**Standing Water in Completed Pit**  
 at depth not encountered ft  
 measured after hours elapsed

**Boulders**  
 Diameter (in.) Number Approx. Vol. (cu.ft)  
 12 to 24 8 =  
 over 24 4 =

**Test Pit Dimensions (ft)**  
 Pit Length x Width (ft) 9.0 x 8.5  
 Pit Depth (ft) 7.0

**NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.**



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**PHOTOGRAPHS OF  
TEST PIT TP-21**

FILE NO. 39579-003

**TEST PIT LOG**

**Test Pit No. TP-21**

**Project** XAVERIAN BROTHERS HIGH SCHOOL- BASEBALL FIELD  
**Location** WESTWOOD, MA  
**Client** XAVERIAN BROTHERS HIGH SCHOOL  
**Contractor** EARTHWORKS INDUSTRIES, INC.  
**Equipment Used** Bobcat E45

**File No.** 39579-003  
**H&A Rep** C. Sullivan  
**Date** 14 May 2013  
**Weather** Sunny, 53° F

**Ground El.:** 150.0 (est.)  
**El. Datum:** NGVD 1929

**Location:** See Plan

**Groundwater depths/entry rates (in./min.):** NE

Depth (ft)	Sample ID	Stratum Change Elev./Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (color, natural grain size and artificial component percentage estimates, maximum particle size, manual test properties, structure, odors, moisture, other descriptions and observations GEOLOGIC INTERPRETATION)	Gravel		Sand			Field Tests			
					% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity
0			SM	Dark brown silty SAND (SM), mps 0.5 in., no structure, no odor, moist, forest mat, debris throughout: glass bottles, 1942 license plate, miscellaneous metal  -FILL-	5	5	15	40	35				
1		149.0 1.0	ML	Orange-brown sandy SILT with trace gravel (ML), mps 2 in., no structure, no odor, moist, trace roots <b>Note: Bedrock at eastern edge of pit (granite) at 1.5 ft and slopes to the west.</b>	5	5	10	40	40				
2				-LOESS DEPOSIT-									
3				Approximate Limits of Bedrock Surface Exposed in Test Pit. Refer to Photos									
4		146.3 3.7 146.1 3.9	SM	Tan-brown to olive-gray silty SAND with trace gravel (SM), mps 2 in., well bonded, no odor, moist <b>Note: Difficult to excavate.</b> -GLACIAL TILL- BOTTOM OF EXPLORATION 3 FT 10 IN. <b>Note: Refusal on BEDROCK (granite).</b> -BEDROCK-	10	10	20	30	30				

<b>Obstructions:</b>	<b>Remarks:</b>	<b>Field Tests</b>					
		Dilatancy	R - Rapid	S - Slow	N - None		
		Toughness	L - Low	M - Medium	H - High		
		Plasticity	N - Nonplastic L - Low M - Medium H - High				
		Dry Strength	N - None	L - Low	M - Medium	H - High	V - Very High

<b>Standing Water in Completed Pit</b>			<b>Boulders</b>			<b>Test Pit Dimensions (ft)</b>	
at depth	not encountered	ft	Diameter (in.)	Number	Approx. Vol. (cu.ft)	Pit Length x Width (ft) 5.0 x 4.0	
measured after	hours elapsed		12 to 24	-	=	Pit Depth (ft) 4.0	
			over 24	-	=		

**NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.**



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**PHOTOGRAPHS OF  
TEST PIT TP-21A**

FILE NO. 39579-003

May 2013



**TEST PIT LOG**

**Test Pit No. TP-21A**

**Project** XAVERIAN BROTHERS HIGH SCHOOL- BASEBALL FIELD  
**Location** WESTWOOD, MA  
**Client** XAVERIAN BROTHERS HIGH SCHOOL  
**Contractor** EARTHWORKS INDUSTRIES, INC.  
**Equipment Used** Bobcat E45

**File No.** 39579-003  
**H&A Rep** C. Sullivan  
**Date** 14 May 2013  
**Weather** Sunny, 53° F

**Ground El.:** 154.5 (est.)  
**El. Datum:** NGVD 1929

**Location:** See Plan

**Groundwater depths/entry rates (in./min.):** NE

Depth (ft)	Sample ID	Stratum Change Elev./ Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (color, natural grain size and artificial component percentage estimates, maximum particle size, manual test properties, structure, odors, moisture, other descriptions and observations GEOLOGIC INTERPRETATION)	Gravel		Sand			Field Tests								
					% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength				
0			SM	Brown TOPSOIL (SM) with glass and debris throughout, roots, forest mat														
1				-FILL-														
		153.0 1.5		Granite BEDROCK sloping to southeast														
2				-BEDROCK-														
3		151.5 3.0		BOTTOM OF EXPLORATION 3.0 FT														

**Obstructions:**

**Remarks:**

**Field Tests**

Dilatancy R - Rapid S - Slow N - None  
 Toughness L - Low M - Medium H - High  
 Plasticity N - Nonplastic L - Low M - Medium H - High  
 Dry Strength N - None L - Low M - Medium H - High V - Very High

**Standing Water in Completed Pit**

at depth not encountered ft  
 measured after hours elapsed

**Boulders**

Diameter (in.)	Number	Approx. Vol. (cu.ft)
12 to 24	-	= -
over 24	-	= -

**Test Pit Dimensions (ft)**

Pit Length x Width (ft) 10.0 x 8.0  
 Pit Depth (ft) 3.0

**NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.**



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Xaverian Brothers High School  
Proposed Baseball Field  
Westwood, Massachusetts

**PHOTOGRAPHS OF  
TEST PIT TP-22**

FILE NO. 39579-003

**TEST PIT LOG**

**Test Pit No. TP-22**

**Project** XAVERIAN BROTHERS HIGH SCHOOL- BASEBALL FIELD  
**Location** WESTWOOD, MA  
**Client** XAVERIAN BROTHERS HIGH SCHOOL  
**Contractor** EARTHWORKS INDUSTRIES, INC.  
**Equipment Used** Bobcat E45

**File No.** 39579-003  
**H&A Rep** C. Sullivan  
**Date** 13 May 2013  
**Weather** Sunny, 55° F

**Ground El.:** 152.7 (est.)  
**El. Datum:** NGVD 1929

**Location:** See Plan

**Groundwater depths/entry rates (in./min.):** NE

Depth (ft)	Sample ID	Stratum Change Elev./Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (color, natural grain size and artificial component percentage estimates, maximum particle size, manual test properties, structure, odors, moisture, other descriptions and observations GEOLOGIC INTERPRETATION)	Gravel		Sand			Field Tests				
					% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength
0			SM	Dark brown silty SAND (SM), mps 0.25 in., no structure, no odor, moist, roots throughout, forest mat  -FOREST MAT-		5		10	50	35				
2		151.2 1.5	ML	Orange-brown sandy SILT (ML), mps 1.75 in., no structure, no odor, moist, trace roots  -LOESS DEPOSIT-	5	5	5	10	45	30				
4		149.7 3.0	SM	Tan-brown to olive-gray silty SAND (SM) with gravel and boulders, mps 28 in., well bonded, no odor, moist  -GLACIAL TILL DEPOSIT-	10	10	5	10	35	30				
6				Note: Concentration of large boulders increasing with depth.										
8		144.7 8.0		BOTTOM OF EXPLORATION 8.0 FT										

**Obstructions:**

**Remarks:**

Field Tests			
Dilatancy	R - Rapid	S - Slow	N - None
Toughness	L - Low	M - Medium	H - High
Plasticity	N - Nonplastic L - Low M - Medium H - High		
Dry Strength	N - None	L - Low	M - Medium H - High V - Very High

Standing Water in Completed Pit		
at depth	not encountered	ft
measured after		hours elapsed

Boulders		
Diameter (in.)	Number	Approx. Vol. (cu.ft)
12 to 24	9	= -
over 24	4	= -

Test Pit Dimensions (ft)	
Pit Length x Width (ft)	8.0 x 4.0
Pit Depth (ft)	8.0

**NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.**



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Proposed Baseball Field  
Westwood, Massachusetts

**PHOTOGRAPHS OF  
TEST PIT TP-23**

FILE NO. 39579-003

May 2013

**TEST PIT LOG**

**Test Pit No. TP-23**

**Project** XAVERIAN BROTHERS HIGH SCHOOL- BASEBALL FIELD  
**Location** WESTWOOD, MA  
**Client** XAVERIAN BROTHERS HIGH SCHOOL  
**Contractor** EARTHWORKS INDUSTRIES, INC.  
**Equipment Used** Bobcat E45

**File No.** 39579-003  
**H&A Rep** C. Sullivan  
**Date** 14 May 2013  
**Weather** Sunny, 53° F

**Ground El.:** 151.0 (est.)  
**El. Datum:** NGVD 1929

**Location:** See Plan

**Groundwater depths/entry rates (in./min.):** NE

Depth (ft)	Sample ID	Stratum Change Elev./Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (color, natural grain size and artificial component percentage estimates, maximum particle size, manual test properties, structure, odors, moisture, other descriptions and observations GEOLOGIC INTERPRETATION)	Gravel		Sand			Field Tests			
					% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity
0			SM	Dark brown silty SAND (SM) with roots and debris throughout, glass bottles, miscellaneous metal, mps 20 in., no structure, no odor, moist	5	5	15	40	35				
1				-FILL-									
149.5 1.5			ML	Orange-brown sandy SILT (ML), mps 2 in., no structure, no odor, moist	5	5	5	40	45				
2				-LOESS DEPOSIT-									
147.5 3.5			SM	Tan-brown to olive-gray silty SAND (SM) with gravel, mps 4 in., well bonded	10	10	5	15	30	30			
147.3 3.8			Granite	-GLACIAL TILL-									
147.0 4.0				Decomposed granite rock fabric -WEATHERED BEDROCK-									
				BOTTOM OF EXPLORATION 4.0 FT Note: Refusal at BEDROCK (granite). -BEDROCK-									

**Obstructions:**

**Remarks:**

**Field Tests**

Dilatancy R - Rapid S - Slow N - None  
 Toughness L - Low M - Medium H - High  
 Plasticity N - Nonplastic L - Low M - Medium H - High  
 Dry Strength N - None L - Low M - Medium H - High V - Very High

**Standing Water in Completed Pit**

at depth not encountered ft  
 measured after hours elapsed

**Boulders**

Diameter (in.) Number Approx. Vol. (cu.ft)  
 12 to 24 2 =  
 over 24 0 =

**Test Pit Dimensions (ft)**

Pit Length x Width (ft) 5.0 x 4.0  
 Pit Depth (ft) 4.0

**NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.**



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**PHOTOGRAPHS OF  
TEST PIT TP-24**

FILE NO. 39579-003

May 2013

**TEST PIT LOG**

**Test Pit No. TP-24**

**Project** XAVERIAN BROTHERS HIGH SCHOOL- BASEBALL FIELD  
**Location** WESTWOOD, MA  
**Client** XAVERIAN BROTHERS HIGH SCHOOL  
**Contractor** EARTHWORKS INDUSTRIES, INC.  
**Equipment Used** Bobcat E45

**File No.** 39579-003  
**H&A Rep** C. Sullivan  
**Date** 14 May 2013  
**Weather** Light rain

**Ground El.:** 155.0 (est.)  
**El. Datum:** NGVD 1929

**Location:** See Plan

**Groundwater depths/entry rates (in./min.):** NE

Depth (ft)	Sample ID	Stratum Change Elev./Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (color, natural grain size and artificial component percentage estimates, maximum particle size, manual test properties, structure, odors, moisture, other descriptions and observations GEOLOGIC INTERPRETATION)	Gravel		Sand			Field Tests								
					% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength				
0			SM	Dark brown silty SAND (SM) with trace gravel, mps 0.5 in., no structure, no odor, moist, roots throughout, forest mat	5	5	5	50	35									
1		154.1 0.9		-FOREST MAT-														
				BOTTOM OF EXPLORATION 10.0 IN. Note: Refusal on BEDROCK (granite). -BEDROCK-														

<b>Obstructions:</b>	<b>Remarks:</b>	<b>Field Tests</b>		
		Dilatancy	R - Rapid S - Slow N - None	
		Toughness	L - Low M - Medium H - High	
		Plasticity	N - Nonplastic L - Low M - Medium H - High	
		Dry Strength	N - None L - Low M - Medium H - High V - Very High	

<b>Standing Water in Completed Pit</b>			<b>Boulders</b>			<b>Test Pit Dimensions (ft)</b>	
at depth	not encountered	ft	Diameter (in.)	Number	Approx. Vol. (cu.ft)	Pit Length x Width (ft)	7.0 x 4.0
measured after		hours elapsed	12 to 24	-	= -	Pit Depth (ft)	1.0
			over 24	-	= -		

**NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.**



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Westwood, Massachusetts

**PHOTOGRAPHS OF  
TEST PIT TP-25**

FILE NO. 39579-003



**TEST PIT LOG**

**Test Pit No. TP-25**

**Project** XAVERIAN BROTHERS HIGH SCHOOL- BASEBALL FIELD  
**Location** WESTWOOD, MA  
**Client** XAVERIAN BROTHERS HIGH SCHOOL  
**Contractor** EARTHWORKS INDUSTRIES, INC.  
**Equipment Used** Bobcat E45

**File No.** 39579-003  
**H&A Rep** C. Sullivan  
**Date** 14 May 2013  
**Weather** Light rain, 53° F

**Ground El.:** 152.0 (est.)      **Location:** See Plan      **Groundwater depths/entry rates (in./min.):** NE  
**El. Datum:** NGVD 1929

Depth (ft)	Sample ID	Stratum Change Elev./Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (color, natural grain size and artificial component percentage estimates, maximum particle size, manual test properties, structure, odors, moisture, other descriptions and observations GEOLOGIC INTERPRETATION)	Gravel		Sand			Field Tests				
					% Coarse	% Fine	% Coarse	% Medium	% Fine	% Fines	Dilatancy	Toughness	Plasticity	Strength
0			SM	Brown silty SAND (SM) with cobbles, mps 25 in., no structure, no odor, moist	5	5			50	35				
1				-BOULDER-COBBLE FILL										
150.5 1.5			ML	Orange-brown sandy SILT with trace gravel (ML), mps 2 in., no structure, no odor, moist	5	5	5	35	50					
2				-LOESS DEPOSIT-										
149.3 2.8			SM	Olive-gray silty SAND with gravel (SM), mps 4 in., well bonded, moist	15	10	5	10	40	30				
149.0 3.0				-GLACIAL TILL-										
				BOTTOM OF EXPLORATION 3.0 FT Note: Refusal on BEDROCK (granite). -BEDROCK-										

<b>Obstructions:</b>	<b>Remarks:</b>	<b>Field Tests</b>			
		Dilatancy	R - Rapid	S - Slow	N - None
		Toughness	L - Low	M - Medium	H - High
		Plasticity	N - Nonplastic L - Low M - Medium H - High		
		Dry Strength	N - None L - Low M - Medium H - High V - Very High		

<b>Standing Water in Completed Pit</b>			<b>Boulders</b>			<b>Test Pit Dimensions (ft)</b>	
at depth	not encountered	ft	Diameter (in.)	Number	Approx. Vol. (cu.ft)	Pit Length x Width (ft)	8.0 x 4.0
measured after		hours elapsed	12 to 24	6	=	Pit Depth (ft)	3.0
			over 24	4	=		

**NOTE: Soil identification based on visual-manual methods of the USCS system as practiced by Haley & Aldrich, Inc.**

**APPENDIX B**

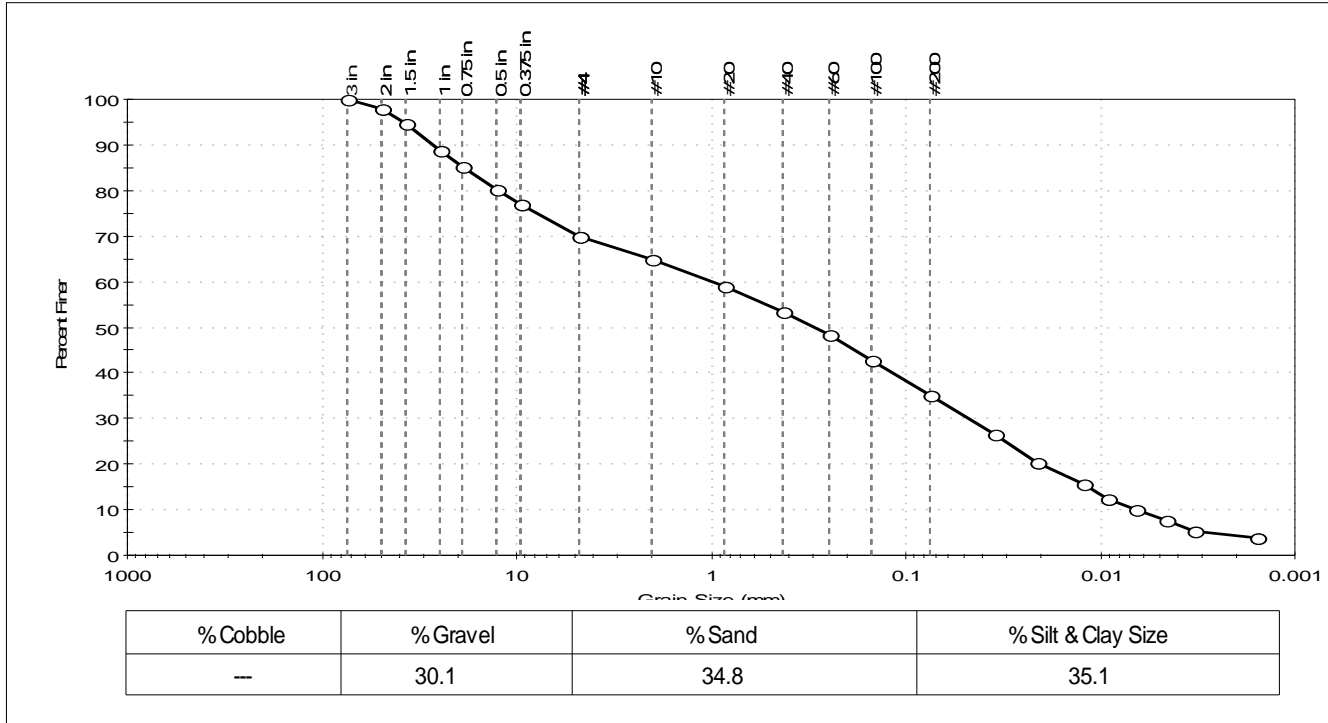
**Geotechnical Laboratory Results**





Client:	Haley & Aldrich, Inc.		
Project:	Xaverian Brothers High School - Parking Lot		
Location:	Westwood, MA	Project No:	GTX-300410
Boring ID:	---	Sample Type:	bag
Sample ID:	TP-19	Test Date:	05/16/13
Depth:	---	Test Id:	265522
Test Comment:	---		
Sample Description:	Moist, olive brown silty sand with gravel		
Sample Comment:	---		

## Particle Size Analysis - ASTM D422



Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3 in	75.00	100		
2 in	50.00	98		
1.5 in	37.50	95		
1 in	25.00	89		
0.75 in	19.00	85		
0.5 in	12.70	80		
0.375 in	9.50	77		
#4	4.75	70		
#4	4.75	70		
#10	2.00	65		
#20	0.85	59		
#40	0.42	53		
#60	0.25	48		
#100	0.15	43		
#200	0.075	35		
---	Particle Size (mm)	Percent Finer	Spec. Percent	Complies
---	0.0353	26		
---	0.0214	20		
---	0.0122	16		
---	0.0093	12		
---	0.0066	10		
---	0.0046	8		
---	0.0033	5		
---	0.0016	4		

**Coefficients**

D <sub>85</sub> = 18.5432 mm	D <sub>30</sub> = 0.0480 mm
D <sub>60</sub> = 0.9942 mm	D <sub>15</sub> = 0.0116 mm
D <sub>50</sub> = 0.2977 mm	D <sub>10</sub> = 0.0065 mm
C <sub>u</sub> = 152.954	C <sub>c</sub> = 0.357

**Classification**

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

**Sample/Test Description**

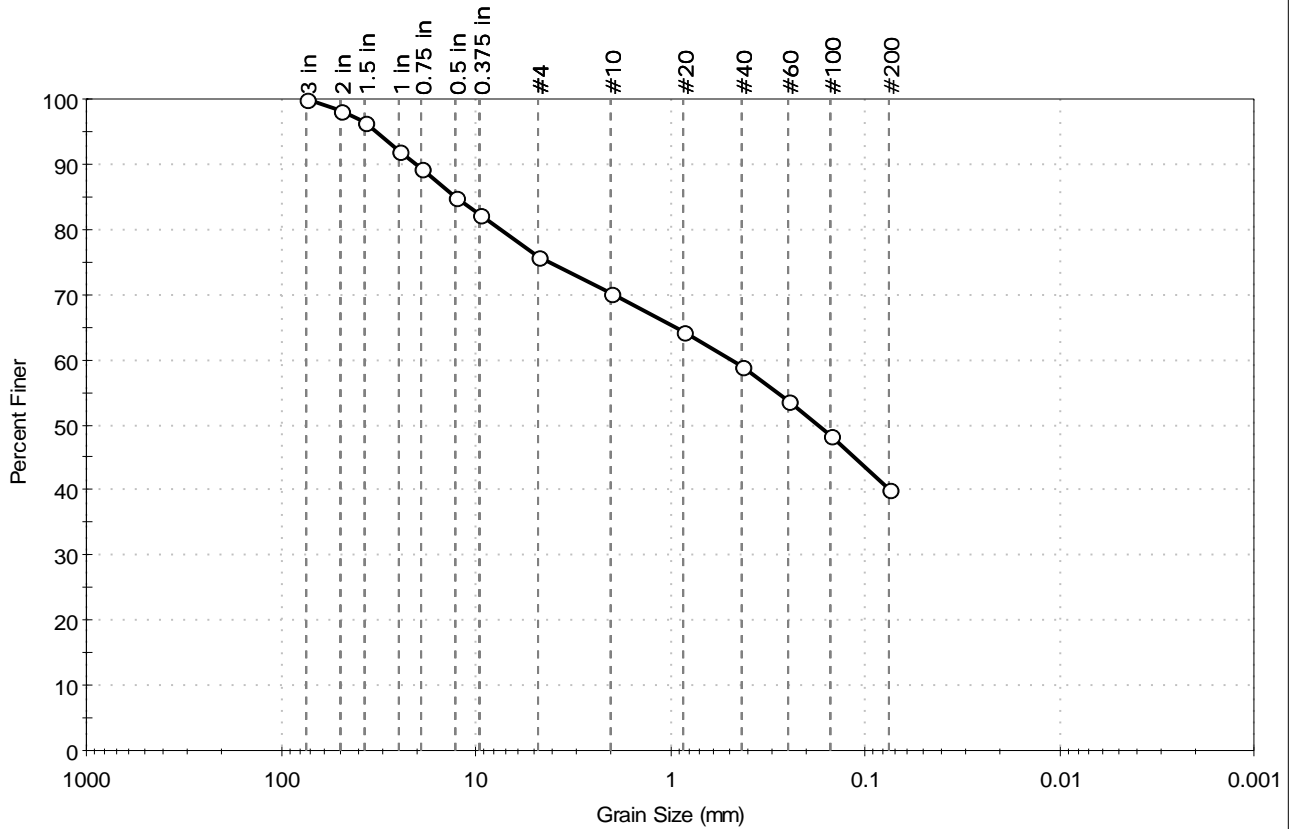
Sand/Gravel Particle Shape : **ROUNDED**

Sand/Gravel Hardness : **HARD**



Client:	Haley & Aldrich, Inc.		
Project:	Xaverian Brothers High School - Parking Lot		
Location:	Westwood, MA	Project No:	GTX-300410
Boring ID:	---	Sample Type:	bag
Sample ID:	TP-13, TP-19, TP-22	Test Date:	05/16/13
Depth:	---	Checked By:	jdt
		Test Id:	265523
Test Comment:	---		
Sample Description:	Moist, olive brown silty sand with gravel		
Sample Comment:	Composite sample of TP-13, TP-19, and TP-22		

## Particle Size Analysis - ASTM D422



% Cobble	% Gravel	% Sand	% Silt & Clay Size
---	24.1	35.7	40.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
3 in	75.00	100		
2 in	50.00	98		
1.5 in	37.50	97		
1 in	25.00	92		
0.75 in	19.00	89		
0.5 in	12.70	85		
0.375 in	9.50	82		
#4	4.75	76		
#10	2.00	70		
#20	0.85	64		
#40	0.42	59		
#60	0.25	54		
#100	0.15	48		
#200	0.075	40		

<u>Coefficients</u>	
D <sub>85</sub> = 12.7744 mm	D <sub>30</sub> = N/A
D <sub>60</sub> = 0.4831 mm	D <sub>15</sub> = N/A
D <sub>50</sub> = 0.1749 mm	D <sub>10</sub> = N/A
C <sub>u</sub> = N/A	C <sub>c</sub> = N/A

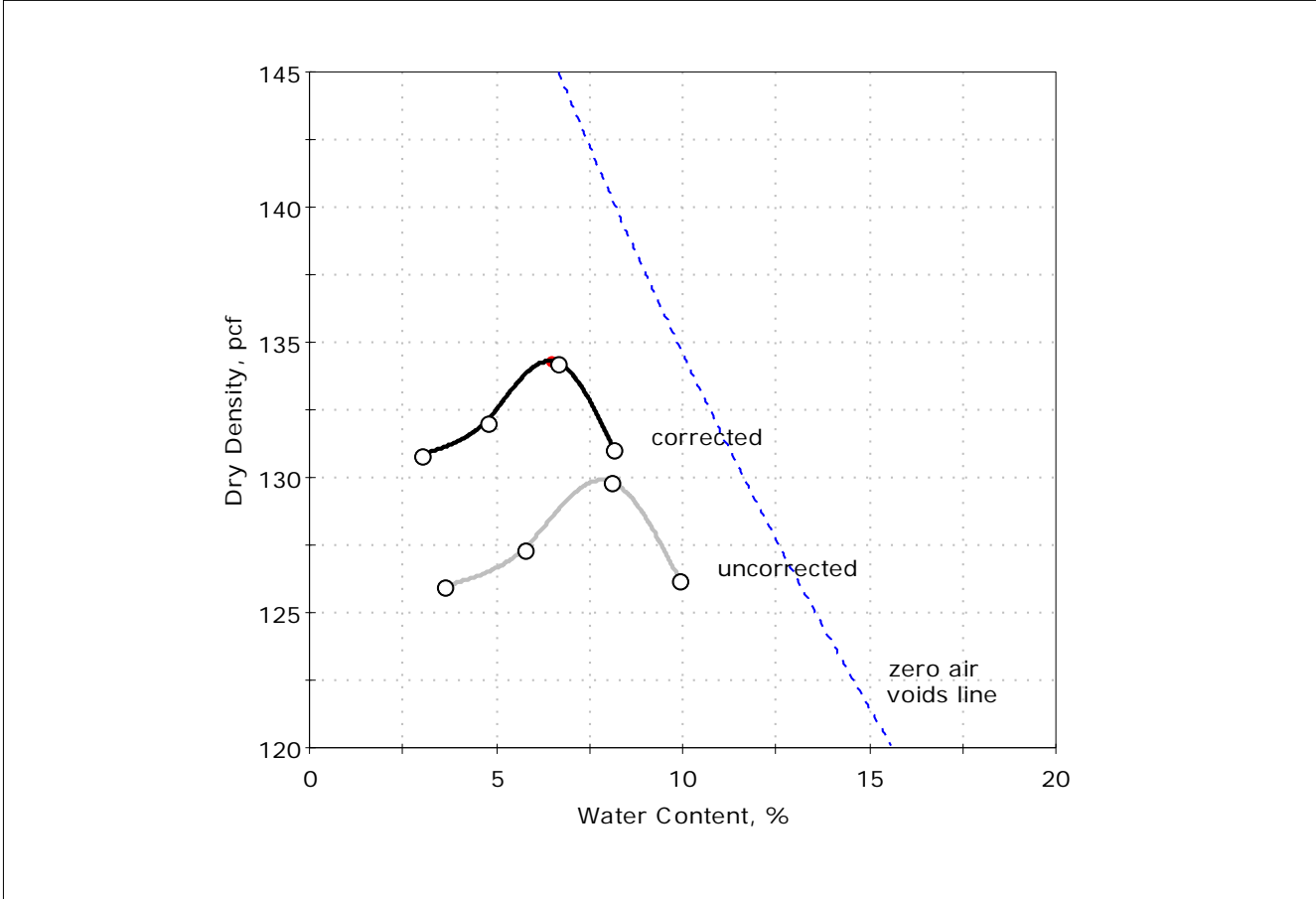
<u>Classification</u>	
<u>ASTM</u>	N/A
<u>AASHTO</u>	Silty Soils (A-4 (0))

<u>Sample/Test Description</u>	
Sand/Gravel Particle Shape :	ROUNDED
Sand/Gravel Hardness :	HARD



Client:	Haley & Aldrich, Inc.		
Project:	Xaverian Brothers High School - Parking Lot		
Location:	Westwood, MA	Project No:	GTX-300410
Boring ID:	---	Sample Type:	bag
Sample ID:	TP-13, TP-19, TP-22	Test Date:	05/16/13
Depth:	---	Test Id:	265524
Test Comment:	---		
Sample Description:	Moist, olive brown silty sand with gravel		
Sample Comment:	Composite sample of TP-13, TP-19, and TP-22		

## Compaction Report - ASTM D1557



Data Points	Point 1	Point 2	Point 3	Point 4
Dry density, pcf	126.0	127.3	129.8	126.2
Moisture Content, %	3.6	5.8	8.1	9.9

Method : B  
 Preparation : WET  
 As received Moisture : 15 %  
 Rammer : Manual  
 Zero voids line based on assumed specific gravity of 2.75

Maximum Dry Density= 130.0 pcf  
 Optimum Moisture= 8.0 %

Oversize Correction (17.8% > 3/8 inch Sieve)  
 Corrected Maximum Dry Density= 134.5 pcf  
 Corrected Optimum Moisture= 6.5 %  
 Assumed Average Bulk Specific Gravity = 2.55