PREPARED FOR: CIVIC BUILDERS

GEOTECHNICAL DESIGN BASIS REPORT

PROPOSED BLACKSTONE VALLEY PREPARATORY SCHOOL CUMBERLAND, RHODE ISLAND

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PARE PROJECT NUMBER 13062.08

AUGUST 2013
AMENDED JANUARY 2014

PARE CORPORATION

GEOTECHNICAL DESIGN BASIS REPORT

TABLE OF CONTENTS

1.0 BACKGROUND/SITE LOCATION

This report presents the results of geotechnical investigations and evaluations undertaken by Pare Corporation (PARE) for the proposed Blackstone Valley Preparatory School, its associated parking areas and site improvements located in Cumberland, Rhode Island. The project site is depicted on Figure 1: Locus Plan. This report has been prepared in general accordance with our proposal and is subject to the geotechnical limitations presented in Appendix D.

1.1 Purpose and Scope

The purpose of this study is to identify the existing subsurface conditions; evaluate potential implications the observed conditions may have upon the proposed structure; and provide geotechnical parameters and recommendations for use during the design of the foundations, buildings, and other site improvements associated with the proposed project. The scope of this evaluation included the following:

- Drilling eight (8) borings within the proposed building footprint, and six (6) borings within the proposed pavement and site improvement areas, for a total of fourteen (14) borings.
- Sampling and performing Standard Penetration Testing (SPT).
- Logging of drilling information and classifying soil samples.
- Performing laboratory tests on soil samples.
- Preparing a geotechnical report summarizing the exploration findings, data evaluations, geotechnical design recommendations, and construction recommendations.

The subsurface exploration program also included headspace screening and the collection of soil samples for the evaluation for the presence of contamination or other environmental concern. The results of this evaluation are presented in an additional report provided under separate cover.

1.2 Background

PARE understands that the proposed elementary school building footprint is approximately 18, 450 square feet, part 2- and part 3-story and no basements. An elevator shaft is to be located in the northwestern portion of the building that will extend to about 9 feet below slab level. Also included in the project are the following:

- One (1) parking area,
- One (1) drop off area, and
- Associated access road entering the site from Broad Street and exiting the site to Chase Street.

As shown on Figure 2: Boring Location Plan, there are several existing structures and features on the site (and within the footprint) of the proposed building. The existing property (the Site) is located between Broad Street and Chase Street on the corner of Lusitana Avenue, and encompasses an area of approximately 1.29 acres. The Site is bordered by Broad Street to the east; Chase Street to the west and private property to the north and south.

1.3 Surface Conditions

In the area of the proposed building footprint, existing grades range from approximately Elevation 77-feet[1] near the west side of the proposed building, to Elevation 74-feet near the east side of the proposed building. The area is flat with grass cover as it supports an existing basketball court, skate park, hockey area with bituminous paving, and access pathways and grass covered landscaping areas.

1.4 Previous Site Conditions

As part of site research, three historic maps of the area were located: 1893, 1940/1946, and 1965 topographic maps. The 1893 map indicates Broad Street, Titus Street, and Lusitania Street with developments along these, but no structures are shown on the main body of the Site. The 1940/1946 map indicates a similar state of development to the 1893 map, but Chase Street is shown to have been constructed. The 1965 map indicates a building on the south-central part of the Site with a small structure (possibly a garage or shed) to the northwest. Boring B13-8 was completed within this area, and indicated that the soils were comprised of fill overlying bedrock.

1.5 Proposed Grading

PARE understands that the finished floor grade is proposed to be elevation 76.5-feet. No basements are proposed, but an elevator pit is planned that will extend to about 9 feet below slab level (approximately elevation 67.5 feet).

1.6 Former Area Coal Mining

After a potential mining issue that may impact the proposed school development was raised by a member of the Rhode Island House of Representatives, PARE performed a review of available published information.

PARE performed a review of the available published information, including:

- The USGS geological map 'Bedrock Geology of the Pawtucket Quadrangle, Rhode Island-Massachusetts (1949),
- USGS Bulletin 615 'Rhode Island Coal' (1915), and
- Historic and Architectural Resources of Cumberland, Rhode Island.

The USGS geological map indicates that a 'small mine or prospect' was located to the southwest of the intersection of Chase Street and Lusitana Avenue (below the present Lusitania Club). This appears to be about 200 feet southwest of the site and about 300 feet southwest of the proposed school location. An enlargement of this map is attached together with extract of the map key (Figures 3a, b & c). No mine entries (shafts, adits, etc.) are shown on the proposed school site on this map.

The USGS Bulletin 615 'Rhode Island Coal' records that small-scale mining had taken place in the vicinity of the project site, but appears to have ended in the late 19th century. This document does not specifically record or suggest mining activities below the proposed school site; however,

[1] Elevations are based on a topographic survey completed by National Surveyors, Inc. dated May, 2013.

an entry in this document (page 11) suggests that coal was worked in this area of Valley Falls to a considerable depth (i.e., greater than 300 feet). There is no information presented within this document or the other available documents to indicate the direction or the extent to which the coal working took place.

In general, the collapse of a void (resulting from the extraction of coal) present within the rock strata could cause subsidence to occur at the ground surface above the area of a mine if the mining operation was sufficiently close to the ground surface. The method of failure typical for the type of mining expected to have been performed in Valley Falls at this time is well documented, and an empirical relationship between the thickness of coal extracted and the thickness of rock present above the workings has been developed. This industry-accepted guidance (see Bureau of Land Management 'Appendix C, Mining Operations and Subsidence', and Pennsylvania Department of Environment website) indicates that subsidence at the surface is managed through the maintenance of at least 100 feet of rock above the mine.

If the coal mining did take place as indicated on the USGS map, and if the mine extended in the direction of the site, then based upon the information in the 'Rhode Island Coal' document, it is possible that voids may be present in the rock below the site. However, based upon the information presented on the geological map and within the 'Rhode Island Coal' document, it is our preliminary assessment that it is unlikely that subsidence will develop at the surface because there is sufficient rock-cover (i.e., greater than 100 feet) above the coal workings on the proposed school site.

In addition to the above information, PARE obtained a copy of a complaint investigation report from the Department of the Interior that summarizes the investigation and treatment of a mine subsidence that occurred on Chase Street in 2005. A copy of this report is attached in Appendix A, and is briefly summarized as follows:

- A void measuring 6 feet in diameter at the surface, widening to 12 feet in diameter below ground, and 17 feet deep developed at the Lusitania Club parking lot at 10 Chase Street.
- The void was located about 130 feet north of the center of Lusitana Avenue and 38 feet west of the centerline of Chase Street.
- The investigator states that the site is located over the abandoned underground mine workings of the Valley Falls Mine that was mined in 1896, and that the coal is at about 40 feet below ground in this area.
- It is stated that a boring was performed by the Office of Surface Mines (OSM) in this area in 1984. Although the report states that a copy of this boring log is included with the report, this was not attached to the report obtained by PARE.
- The first part of the report concludes that the void is mine related and there is a threat to the health and safety of the general public, therefore requires "immediate abatement".
- The second part of the report describes the treatment of the void. After excavation and removal of the overhanging material around the surface opening, 30 tons of flowable fill was placed in the void. The flowable fill was placed to 18 inches below the surface, and after 2 days, 12 tons of gravel were placed, then a wearing course of asphalt.

Other information about the mine and subsidence events has been produced by the RI Representative that presents the location of additional explorations conducted northwest of the Lusitania Club (i.e. the school site is northeast of the Lusitania Club), and suggests a northwesterly direction of the mining. However, the provenance and accuracy of this information cannot be confirmed at this time; therefore, PARE cannot comment on this information. If the

accuracy of this information or other information is provided about the former mine, it is prudent that we review this additional information. These documents would be an important part of a complete assessment, and we do not want to draw final conclusions without this information, particularly as these reports allegedly describe subsidence events that have occurred in this area in the past.

At this time, Pare Corporation does not recommend further subsurface investigation to substantiate claims of a mine, or influence from a mine within the proposed development area. If additional information becomes available and, after review this information, Pare believes that further investigation is warranted, we will provide a recommended investigation program.

2.0 SUBSURFACE EXPLORATIONS

A subsurface exploration program was undertaken to determine subsurface conditions at the site to provide geotechnical guidelines for the design of foundations and pavement for the proposed structures. Logs of the soil borings are included in Appendix B and their locations are shown on Figure 2: Boring Location Plan.

The subsurface investigation program was performed by New Hampshire Boring of Brockton, Massachusetts and observed by PARE personnel from July 9 through July 11, 2013 and on July 23, 2013. Soil borings were advanced from a truck-mounted drill rig utilizing 4-inch casing with wash and drive techniques and 4¼-inch hollow stem augers as noted on the boring logs. PARE personnel provided field observation and coordination for the subsurface exploration program. Field personnel observed the drilling conditions, visually identified the Standard Penetration Test (SPT) soil samples during the advancement of the explorations, and took groundwater measurements.

2.1 Sampling Methodology

The sampling methodology consisted of obtaining disturbed samples of the deposits continuously to a depth of approximately 10-feet and at 5-foot intervals or change in stratum thereafter. The samples were obtained by advancing a thick-walled split-spoon sampler during the performance of the Standard Penetration Test (SPT) in general accordance with ASTM D-1586. The SPT is used to obtain an indication of the characteristics, relative density and consistency of the underlying soils. The test consists of driving a 1 3/8-inch inside diameter standard split spoon sampler at least 18 inches with a 140-pound hammer dropping from a height of 30 inches. The SPT value used in analysis is the number of blows (N) required to drive the sampler from 6 to 18 inches of penetration.

During the explorations, subsurface soils were visually classified utilizing the Burmister Classification System. This systems describes soil composition based upon the percentage of soil particle size present by weight in the sample with the major soil particle size listed first followed by other soil components described as “trace” indicating 0-10% by weight, “little” indicating 10-20% by weight, “some” indicating 20-35% by weight or “and” indicating 35-50% by weight.

2.2 Field Measurement and Methodology

The actual locations of the soil borings were recorded in the field utilizing a handheld GPS with sub-foot accuracy. The surface elevation at each boring was interpolated from an available topographic survey of the site.

2.3 Locations

The subsurface exploration program completed at the site included a total of fourteen (14) soil borings. Borings B13-3, B13-5, B13-7 through B13-9 and B13-11 through B13-14 were performed within the proposed building footprint. As noted about, Boring B13-8 was performed in the footprint of the structure shown on the 1965 map. The above noted borings were advanced to depths ranging from 6 to 25-feet below the existing ground surface. Actual depths of each boring are noted in Table 3-1: Boring Summary.

Borings B13-1, B13-2, B13-4, B13-6 and B13-10 were performed in the proposed parking area and access road. The above noted borings were advanced to depths ranging from 6 to 25-feet below the existing ground surface and terminated with auger or roller bit refusal. Actual depths of each boring are noted in Table 3-1: Boring Summary.

3.0 SUBSURFACE CONDITIONS

The surface of the site generally consists of topsoil or bituminous pavement overlying areas of FILL and/or native deposits of SAND overlying GLACIAL DEPOSITS and/or WEATHERED BEDROCK, overlying BEDROCK.

TABLE 3-1:- BORING SUMMARY

Boring ID	General Location	Approx. Ground Surface Elevation	Approximate Depth to Top of Stratum (ft)						
		(Ft MSL)[1]	(Stratum 1) FILL	(Stratum 2) SAND WITH GRAVEL	(Stratum 3) GLACIAL DEPOSITS	(Stratum 4) WEATHERED ROCK	(Stratum 5) COMPETENT ROCK	Depth of Boring	Groundwater Depth
B13-1	Site	77.0	0.3	NE	NE	7.5	9	9	NE
B13-2	Site	77.3	0.25	5	14	18	22	25	
B13-4	Site	75.5	0.25	NE	NE	7	8.5	8.5	
B13-6	Site	74.2	0.3	NE	8	11	14	14	
B13-10	Site	75.5	NE	0.3	NE	6	NE	6	NE
B13-3	Building	73.5	0.25	NE	NE	NE	6.5	7	
B13-5	Building	76.3	0.25	NE	NE	NE	8.5	9	NE
B13-7	Building	74.9	NE	0.5	NE	2*	7*	7	
B13-8	Building	76.0	0.25	NE	NE	NE	8.5	13.5	
B13-9	Building	74.8	0.3	3	7	14	17	17	12
B13-11	Building	75.8	0.25	NE	8	9.5	11.3	11.3	NE
B13-12	Building	75.1	0.3	6	8	17.2	NE	17.2	10
B13-13	Building	73.5	0.5	8.5	14.5	18	NE	20	15
B13-14	Building	75.7	0.3	NE	8	12.5	NE	12.5	NE

* Possibly cobbles and boulders. An additional hand-auger was performed in this area but was terminated at 2 feet on a cobble/boulder obstruction.

1. Vertical datum reference from National Suveys topographic survey of site, 1991.

3.1 Soil Strata

Stratum 1 – FILL

Deposits of FILL were encountered at the site within the proposed building and site improvement areas and are generally described as brown to tan, fine to medium SAND with "trace" to "and" amounts of fine gravel, "trace" to "some" amounts of silt and "trace" brick debris. Standard Penetration Tests performed in Stratum 2 generally indicate a corrected density of medium dense to very dense.

FILL (Stratum 1) was encountered within most borings (except B13-7, B13-10) at depths of approximately 3 inches below the existing ground surface cover. The thickness of the FILL ranged from 0 to 8.5-feet thick. The deepest area of the FILL was encountered in borings B13-5, B13-8, and B13-13, all of which were within the proposed school footprint.

Stratum 2 – SAND WITH GRAVEL

Natural deposits of SAND WITH GRAVEL encountered at the site underlying the FILL deposits or grassed surface covering are generally described as tan, fine to coarse SAND with "little" to "and" amounts of fine gravel, and "trace" silt. Areas of cobbles were also encountered.

Standard Penetration Tests performed in Stratum 2 generally indicate a corrected density of medium dense.

SAND WITH GRAVEL (Stratum 2) was encountered in borings B13-2, B13-7, B13-9, and B13-12 ranging from approximately 3 to 6 inches underlying the grass surface covering at B13-7 and B13-10 to as deep as 6 feet at boring B13-12. The thickness of the deposit ranged from approximately 2 feet to 9 feet.

Stratum 3 – GLACIAL DEPOSITS

GLACIAL DEPOSITS were encountered underlying the in-situ FILL and native SAND WITH GRAVEL deposits at the site and are generally described as brown to grey, fine to medium SAND with "and" to "some" amounts of silt, and "some" fine gravel. Standard Penetration Tests performed in Stratum No. 3 indicate a corrected density of dense to very dense.

GLACIAL DEPOSITS (Stratum 3) was encountered at borings B13-2, B13-6, and B13-9 underlying the SAND WITH GRAVEL at depths ranging from approximately 7 feet at B13-9 to as deep as 14 feet at boring B13-2. The thickness of the deposit ranged from approximately 2 feet to 9 feet.

Stratum 4 – WEATHERED ROCK

WEATHERED ROCK encountered is described as dark grey to grey, severely weathered MUDSTONE or SANDSTONE. Standard Penetration Tests performed within Stratum 4 indicate a corrected density of very dense.

WEATHERED ROCK was encountered within the proposed building footprint in all of the borings except borings B13-5 and B13-8 at depths ranging from 2 feet at boring B13-7 to 18 feet at boring B13-2. The thickness of the WEATHERED ROCK ranged from 0 feet to 5 feet thick.

Stratum 5 – COMPETENT ROCK

Bedrock was encountered during the subsurface exploration program at all of the borings ranging from depths of 7 below the existing ground surface at boring B13-7 to 22 feet at boring B13-2. Bedrock was confirmed by completing two rock cores. The presence of bedrock was indicated by the drilling action during advancement of the roller bit.

Based upon a visual inspection of the rock core sample obtained from boring B13-2, bedrock consisted of very weak to hard, dark gray, highly weathered to slightly weathered MUDSTONE and dark gray, highly to moderately weathered, hard, extremely to moderately fractured SANDSTONE. The Rock Quality Designation (RQD) value of the core sample was "very poor"[2].

At boring B13-8, bedrock consisted of grey, slightly weathered to fresh, hard to very hard, extremely to slightly fractured, medium grained, very thinly bedded SANDSTONE. The

[2] "Very poor", RQD= 0% to 25%.

Rock Quality Designation (RQD) value of the core sample was "fair"[3]. A summary of rock core depths, lengths, and RQD's are presented on Table 3-2.

TABLE 3-2: ROCK CORE SUMMARY

Soil Boring No.	Depth (ft)	Length (ft)	RQD (%)
B13-2	22-26	4	0
B13-8	8.5-13.5	5	67

3.2 Groundwater

Based on observations taken during the subsurface investigation program, groundwater was encountered within the borings performed on the northern section of the building footprint at depths of approximately 10-15 feet below the existing ground surface. It is important to note that as part of the boring activities, water was introduced to each borehole and may not have dissipated at the time that the initial measurement was taken. Water level measurements were not taken at several holes where the water did not appear to stabilize after the introduction of water during boring activities.

One observation well was temporarily installed at boring B13-6. The groundwater was approximately 12.1 feet below the ground surface approximately 16 hours after boring activities terminated. As noted above, water was used to drill this and nearby borings, and may not have dissipated at the time that the measurement was taken.

It should be noted that groundwater levels are known to fluctuate due to local and regional factors including, but not limited to, precipitation events, seasonal changes, and periods of wet or dry weather.

[3] "Fair", RQD= 50% to 75%.

4.0 LABORATORY TESTING

The laboratory testing program included mechanical grain size determinations performed upon samples from the material strata encountered during the investigation. The results of the laboratory testing are summarized below. The testing data sheets are included in Appendix C.

4.1 Grain Size Analysis

Three (3) grain size analyses were performed on materials recovered during the subsurface investigation with descriptions and results presented as follows:

Table 4-1: Results of Grain Size Analyses

Test No.	Boring No.	Sample No.	Depth (Ft.)	Representative Soil Strata	% Gravel	% Sand	% Fines
1	B13-3	S-2	4-6	FILL	30	49	21
2	B13-8	S-3	4-4.8	FILL	54	40	6
3	B13-9	S-2	4-6	SAND WITH GRAVEL	33	60	7

5.0 IMPLICATIONS OF SUBSURFACE CONDITIONS

5.1 General

Based on the subsurface investigation program and observations made during the fieldwork, the following are the geotechnical issues identified that could potentially impact the development of the site as proposed:

- Topsoil and bituminous pavement was observed across the surface of the site, and is not a suitable bearing stratum for footings or suitable for reuse as backfill materials in the building or parking areas and is recommended to be removed and replaced with suitable material as stated herein.

- The existing FILL (Stratum 1) is not recommended for bearing support for buildings and site features, in its current state. It is not known how this FILL was placed or compacted (e.g., uniformity).

- It appears that reuse of the FILL (Stratum 1) and SAND WITH GRAVEL (Stratum 2) as "Granular Fill" under buildings and pavements will be permissible, but additional grain size analyses will be required as construction proceeds to confirm the suitability of the material. (See Section 6.10 for more information).

- Groundwater was encountered at about 10 to 15 feet below present site grade (approximate El. 58.5 to 65.1 feet). At these depths/elevations groundwater should not impact the construction activities, as the deepest building element (elevator pit foundation) will be placed at about 9 feet below slab level (approximate El. 67.5 feet). It should be noted that groundwater levels will fluctuate due to precipitation events, seasonal changes, etc., hence groundwater control may be needed if groundwater levels rise due to these events, or if perched groundwater tables are encountered.

5.2 Seismic Design and Liquefaction Evaluations

SITE CRITERIA

In accordance with the 2009 International Building Code with state specific amendments in the 10th edition Rhode Island State Building Code, the soil profile of the project site is characterized as Site Class Profile C, very dense soil and soft rock profile (i.e., N>50[4]).

LIQUEFACTION EVALUATION

Liquefaction is the tendency for a soil type, particularly fine sands, to lose a significant amount of strength and behave more similar to a liquid in the event of an earthquake, or sufficient vibrations. Liquefaction analyses generally relate Standard Penetration Test (SPT) N values, corrected for overburden, and measured groundwater levels to the liquefaction potential of the materials in question. In general, in order for liquefaction to occur three conditions have to be

[4] "N" denotes the average Standard Penetration test N-value.

met simultaneously. These are: 1.) loose sandy soils susceptible to liquefaction, 2.) saturated soil conditions, and 3.) vibration.

Based upon the observed relative densities, groundwater location and material composition, the soil profile does not appear to be susceptible to liquefaction at this time.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Foundations and Slabs

Prior to the placement of fill to support foundations and slabs, the topsoil or bituminous pavement and FILL (Stratum 1) should be removed from the influence zone[5] of the proposed building footprint and replaced with compacted materials as discussed herein in Section 6.2.

Given the variable relative density of the existing FILL (Stratum 1), total and differential settlement, and bearing capacity are concerns. As such, it is recommended that this stratum be addressed as discussed herein. It should be noted that the recommendations presented herein are based upon an anticipated finished floor elevation of 76.5-feet. Changes within the finished floor elevation should be reviewed with the Geotechnical Engineer for potential impacts to these recommendations.

6.1.1 Shallow Foundations

A shallow foundation system composed of column (e.g., square) and wall (e.g., continuous) footings bearing on a minimum 12-inch thick layer of compacted "Sand Gravel Fill" or 6-inches of crushed stone (in wet areas) placed on compacted structural "Granular Fill", improved onsite FILL, or the in-situ SAND WITH GRAVEL, GLACIAL DEPOSITS, WEATHERED BEDROCK OR BEDROCK is recommended for effectively transferring building loads to the ground. ***A maximum net allowable soil bearing pressure[6] of 4,000 pounds per square foot for exterior footings and interior footings is recommended in the design of footings bearing on this material.*** The above noted allowable bearing pressure was developed assuming a factor of safety of 3.0 against bearing capacity failure, a minimum embedment of 48-inches for exterior footings and a minimum embedment of 24-inches for interior footings greater than 2-feet wide, a maximum total settlement of 0.5-inches, and a maximum differential settlement of 0.5-inches between foundation elements. The Schmertmann method was used to develop these settlement limited bearing capacities.

Footings should be proportioned to apply no more than the recommended net allowable bearing pressure limited to the following footing widths:

- Interior and exterior column footings between 2 and 8-feet wide, and
- Continuous footings between 2 and 6 feet wide.

For footings greater or less than the above mentioned widths, the net allowable bearing pressure should be reassessed; however, in no case should a continuous footing be less than 18 inches wide or should a column footing be less than 24 inches wide.

These recommendations require that the in-situ fill material (Stratum 1) present at the site be improved as discussed in Section 6.2.

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[5] "Influence Zone" is defined as the area below foundations and slabs bound by a plane extending from their outer edges, down 2 vertical, and out 1 horizontal.

[6] Net allowable bearing pressure is the pressure in excess of the existing overburden pressure that can be safely carried at the footing depth, D (based on settlement limitations).

SLABS

A subgrade modulus (K) of 150 pounds per cubic inch may be used for design of slab on grade placed over 12 inches of compacted "Sand Gravel Fill". The structural engineer will need to design the floor slab for anticipated live and dead loads in accordance with applicable building codes. Should any of the building, mechanical, electrical, or other equipment require independent foundations, additional foundations and/or modifications to the floor slab may be required depending upon the actual load requirements.

GENERAL

The perimeter wall footings, column footings, and the structural slabs should bear on a minimum of 12 inches of compacted "Sand Gravel Fill". Alternatively, a 6-inch layer of crushed stone could be substituted for the compacted “Sand Gravel Fill” in wet conditions. If crushed stone thicknesses exceed 6-inches, then it is recommended to wrap the stone in a geotextile fabric (Mirafi 140N or equivalent) to help reduce the migration of fines from the granular soils into the crushed stone. The excavations for the footings and the slabs should be over-excavated to permit the placement of this layer. Prior to placement of the “Sand Gravel Fill” or “Crushed Stone” layer, the exposed subgrade should be proof rolled as discussed in Section 7.1.

6.2 Ground Modifications

Based upon the observed subsurface conditions, ground modifications are recommended to improve/address the in-situ FILL (Stratum 1) within the influence zone of the proposed building.

The design of the ground modification program should be coordinated with the structural engineer in discussion with the Geotechnical Engineer and the Site/Civil Engineer. Given our current understanding of the project, PARE recommends a combination of Excavation and Replacement with Proof Compaction. The ground improvement program should be designed to provide a uniform bearing stratum meeting the capacity presented in Section 6.1, in addition to considering the effects of differential settlement across the building.

The following summarizes the ground improvement approach to provide suitable bearing for spread footings/foundations.

1. Unsuitable in-situ soils shall be over excavated within the influence zone of the proposed shallow foundation and slabs-on-grade to the top of the soil determined to be an acceptable bearing stratum.
2. The excavation shall then be backfilled with approved material, compacted in lifts, to the bearing elevation of the proposed footing or slabs-on-grade.
3. All fill shall be compacted under the observation of the geotechnical engineer as described in Table 6.3.

This approach, which is the recommended approach in areas of FILL, will address the potential for excessive differential settlement within the FILL. The reuse of the overlying, in-situ FILL material as backfill may be permissible with confirmatory grain size distribution analyses as discussed in Section 6.10.

6.3 Settlement

The current site layout indicates that the proposed school building foundation will bear onto (or be very close to) rock on the northeastern side of the building and onto recompacted on-site fill (Stratum 1), SAND with GRAVEL (Stratum 2) or GLACIAL DEPOSITS (Stratum 3) elsewhere. It is assumed that the bedrock is essentially incompressible, hence the limit for total settlement of the foundations will be the same as the limit for differential settlement (i.e., 0.5 inches).

Settlement of the proposed structures will be limited to 0.5-inch total and differential settlement assuming removal and recompaction of the FILL material to address observed variability in the relative density of the existing fill.

6.4 Lateral Earth Pressures and Retaining Wall Design

For the design of retaining walls with level backfill, recommended lateral earth pressure coefficients are indicated in Table 6-1. A unit weight of 125 pounds per cubic foot (pcf) and an internal friction angle (ϕ) of 35° for imported free draining "Granular Fill" and 34° for the recompacted on-site FILL (Stratum 1) are recommended. The lateral earth pressure coefficient should be increased where the ground surface slopes up behind the wall. The retaining walls should be designed to withstand surcharge loading which may be present over the life of the structure. These would include traffic loads, as well as loads from storage, fill or construction equipment which may be placed adjacent to the wall. The influence zone behind the wall can be defined by a one horizontal to one vertical line extending upward from the outside edge of the wall footing.

The magnitude of lateral earth pressure against retaining walls is dependent upon the type of backfill, method of fill placement, drainage provisions, and the amount of yielding the wall is permitted to undergo after the placement of the backfill. PARE recommends that the retaining walls be backfilled with a free draining "Granular Fill", as defined herein.

The lateral earth pressure distribution against retaining walls should be computed using the appropriate value of K, the coefficient of lateral earth pressure. Recommended values of K are presented in the table below. Friction factors are also presented for use in checking resistance to unbalanced forces on walls.

TABLE 6-1: RECOMMENDED EARTH PRESSURE AND FRICTION COEFFICIENTS

Material	At-Rest Coefficient (K_o)	Active Coefficient (K_a)	Passive Coefficient (K_p)
Compacted Granular Fill	0.43	0.27	3.69
Re-compacted On-Site Fill	0.44	0.28	3.54
FRICTION COEFFICIENTS			
Concrete Poured on Imported Sand Gravel fill			tan δ = 0.45
Precast Concrete on Imported Sand Gravel Fill			tan δ = 0.30

Traffic loads and other anticipated loadings that could occur behind the walls should be considered. In addition, the effect of adjacent footings on lateral walls should be accounted for during design.

6.5 Frost Depth Recommendations

In conformance with the International Building Code (2009), and the 10th edition Rhode Island State Building Code for the Town of Cumberland, exterior footings founded over soils should be placed a minimum depth of 54-inches below the finished grade in order to provide for frost protection. Preparation for pavements and slabs should consider the frost heave susceptibility of subgrade soils. See pavement design recommendations (Section 6.8) for more information.

6.6 Drainage

Based on observations taken during the subsurface investigation, groundwater was encountered within the building footprint at depths generally ranging from 10 to 15 feet below the existing ground surface. Also note that as part of the boring activities, water was introduced to the noted boreholes and may not have dissipated at the time that the measurement was taken, however time was provided to allow the water level to stabilize.

Given the observed groundwater at the time of the explorations, and the understanding of the proposed building geometry, perimeter drains to control groundwater are not anticipated. Note that shallow foundations should be prepared in the dry. Roof drainage and surface water runoff should be directed away from the structures.

6.7 Underground Utilities

Underground pipes and utilities should be placed on bedding in accordance with the manufacturer's specifications. "Granular Fill" should be placed in lifts on the sides and above the utilities. The lift thickness should be sized appropriately for the hand operated compaction equipment used; vibratory plate compactor, 6-inch lift; vibratory drum roller, 12-inch lift.

6.8 Flexible and Rigid Pavement Recommendations

All asphalt, topsoil and organics should be stripped prior to filling. The subgrade should be proof rolled with a minimum 4-6 passes of a vibratory roller with a static weight of 10,000 pounds and a dynamic weight of 20,000 pounds. Caution should be used when compacting the subgrade, if wet, to avoid weaving and disturbance from vibrations.

Table 6-2 presents recommended pavement layer thickness based upon standard AASHTO design procedures for both "Standard Duty" and "Heavy Duty" pavement. "Standard Duty" pavement is applicable for up to 50,000 Equivalent Single 18-kip Axle Loads (ESAL's) while "Heavy Duty" pavement is applicable up to 350,000 EAL's. The recommended base and subbase courses for both "Standard Duty" and "Heavy Duty" areas are as listed below:

TABLE 6-2: RECOMMENDED STANDARD AND HEAVY DUTY FLEXIBLE PAVEMENT LAYER THICKNESS		
Pavement Section	**STD. DUTY**	**HEAVY DUTY**
Finish Course	1-1/2 inches	1-1/2 inches
Binder Course	1-1/2 inches	2-inches
Base Course	6-inches	6-inches
Subbase Course	8-inches	12-inches

Should the actual loading conditions be greater than those assumed, the pavement sections will need to be re-analyzed for the actual conditions. This may result in a thicker pavement section being required.

In areas where concrete and asphalt paving meet, it would be advantageous to provide a strip of free draining soil below the concrete and bituminous interface. The free draining strip should consist of a twenty-four (24) inch layer of "Sand Gravel Fill" extending a minimum of 3 feet laterally below the concrete apron. This should control any minor frost heaving that may occur if water enters the subgrade through this joint.

Base and Subbase course materials should meet the criteria for "Sand Gravel Fill" and "Granular Fill", respectively, as listed below. Subbase and base courses should be compacted in 1-foot (maximum) lifts to 95% of the maximum dry density as determined in accordance with ASTM D1557 (modified Proctor test). Fill below the subbase should be compacted to at least 92% of the maximum dry density as determined in accordance with ASTM D1557 (modified Proctor test).

Heave of silty material is a possibility unless all silty material is removed from within the pavement footprint for the full-recommended frost depth. To reduce the chance of pavement damage due to potential frost heaving and/or excessive settlements, subgrade soils founded below the pavement section to frost depths (i.e., 54 inches) should ideally be free draining and free of organics. However, in lieu of removing and replacing the existing subgrade soils with drainable and organic free material, it may be more feasible to accept a reduced pavement service life. Laboratory testing indicated silt contents ranging from 8 to 22 percent. Free draining material is considered to have less than 10% silt and clay content.

For areas to be paved with Portland cement-based concrete, a 6-inch thick slab on grade is recommended. The concrete should have a minimum unconfined compressive strength of 4,000 pounds per square inch, with air entrainment of 4 to 6 percent. The thickness is based upon the AASHTO Low Volume Road Design procedure and a modulus of subgrade reaction of 150 pounds per cubic inch. Welded wire fabric reinforcement (6x6W2.0xW2.0) is recommended to minimize crack opening.

The concrete paving should be graded to induce runoff. All joints and cracks should be sealed and/or filled on a regular basis as part of a routine maintenance item. If the joints and cracks are not kept sealed, significant frost heaving can be expected during the winter months.

Concrete pavement should have expansion joints at a spacing of 80 feet with a joint filler thickness based on the thermal expansion. All expansion joints should be sealed with an AASHTO-approved

elastomeric joint sealer. Contraction (crack control) joints should be constructed at a spacing of 15 feet. Load transfer between slabs should be provided by epoxy coated #6 dowels, 18-inches long at a spacing of 12-inches. Concrete pavement base and subbase courses should consist of 6-inches of "Sand Gravel Fill", each.

6.9 Construction Materials

Fill materials should be friable soil, free from trash, ice, snow, frozen soils, tree stumps, roots, and other organic matter and deleterious materials. PARE recommends the following soil gradations for imported fill, conforming to the Rhode Island Department of Transportation Standard Specifications for Road and Bridge Construction (State Standards):

- Gravel Borrow utilized as "Sand Gravel Fill" below structures and under pavement should conform to M1.03.0, Type B of the State Standards.
- All other Gravel Borrow material utilized as "Granular Fill" below structures and for material utilized in regrading areas, trench backfill, backfill against below-grade walls as "Granular Fill" should conform to M1.03.0 Type A of the State Standards.
- Crushed Stone Bedding Material should be imported material conforming to Item M2.01.3 of the State Standards.
- A maximum of 10% of recycled asphalt pavement (RAP) may be included in the pavement mixture, as specified in section M.04 of the State Standard Specifications.

6.10 Reuse of On-Site Soils

Based on the visual classifications and limited grain size analyses, the reuse of the onsite FILL (Stratum 1) and SAND WITH GRAVEL (Stratum 2) as backfill below pavement or under structures or slabs is anticipated with confirmatory sieve analyses performed during construction.

6.11 Soils Prone to Disturbance

Based on a review of the visual classifications and limited grain size analyses, and the location of the groundwater table, the material is not anticipated to be prone to disturbance by construction equipment

6.12 Compaction

The subgrade to accept backfill, footings, slabs, and foundations, should be compacted by proof rolling with at least six (6) passes of a 10-ton vibratory roller performed in perpendicular directions.

The fill materials should be compacted as outlined below.

TABLE 6-3: RECOMMENDED MINIMUM COMPACTION REQUIREMENTS	
Location	**Percent of Maximum Dry Density [1]**
Backfill below footings, within the building area and below slabs [2]	95
Backfill for foundation walls	95
Backfill within pavement base and sub base layers	95
Backfill below pavement sub base layers	92
Around and above utilities within the building area	95
Around and above utilities in paved areas	92
Backfill behind retaining walls	95 [3]
Backfill within landscaped areas	85

[1] Maximum dry density as determined by the Modified Proctor test (ASTM D 1557)

[2] Building area is described as an area extending downward and outward from the outside edge of the footing at a 1H:1V slope.

[3] During compaction of fill placed behind retaining walls, care shall be taken so as to maintain uniform elevation along both sides within the embedded areas, and to not overstress the wall by applying too much compactive energy at the top of the wall.

7.0 CONSTRUCTION CONSIDERATIONS/RECOMMENDATIONS

This section presents construction considerations and recommendations, which include excavation, backfilling, utility installation, dewatering, lateral earth support, protection of adjacent structures, and construction monitoring.

7.1 Excavation

SITE PREPARATION

Building Areas: After rough grades have been established, but before placement of compacted "Granular Fill", exposed surfaces should be visually inspected and probed. Frozen, wet, or loose soils and other undesirable materials should be removed. The exposed subgrade should be further tested by proof rolling with a minimum 10,000-pound static weight roller to identify loose or soft pockets that may be present.

The area of the proposed structures will need to be stripped of all asphalt, and grubbed of all vegetation and topsoil. Construction debris from demolished structures and roadways should be removed and properly disposed of in accordance with current regulations. Should the material contain solid wastes, such material should be segregated and disposed of in a manner consistent with local and state regulations.

Existing utilities on the site, including gas, electric, drainage, and sewer pipes, and structures encountered during the progression of the work should be removed to the full extent and the resulting excavations backfilled with compacted "Granular Fill". Alternately the pipes and structures can be filled with grout through tremie grouting procedures. Care should be taken during the procedure to ensure complete filling and venting of the pipes and/or structures.

Should the subgrade become disturbed during excavation and/or construction, all disturbed material should be over-excavated to firm or native soil and replaced with a minimum of one foot of compacted "Granular Fill" or "Crushed Stone" wrapped in a Geotextile Fabric.

Parking and Paved Roadway Surfaces: All topsoil, organic soil, existing asphalt paving, and loose fill should be stripped prior to filling. The subgrade should be proof rolled with a minimum 4-6 passes of a vibratory roller with a static weight of 10,000 pounds and a dynamic weight of 20,000 pounds. Caution should be used when compacting the subgrade, if wet, to avoid weaving and disturbance from vibrations.

7.2 Backfilling

GRAVEL BORROW

PARE recommends that footings, foundation walls, and areas requiring fill below the floor slab be backfilled to within 12 inches of the footings and slabs with compacted "Granular Fill". Compacted "Granular Fill" should be free draining friable soil free from trash, ice, snow, tree stumps, roots, other organic matter, and deleterious materials.

In general, compaction should be accomplished by placing fill in 8 to 12 inch loose horizontal lifts and mechanically compacting each lift to the specified dry density. Thinner lifts may be required in certain instances depending on the type of mechanical compaction equipment utilized Recommended minimum compaction requirements are described in Section 6.12.

SAND GRAVEL FILL

"Sand Gravel Fill" should be placed for the final 12 inches below footings, slabs and as pavement base course layers. This material should be placed in 8 to 12 inch thick layers and compacted to the minimum requirements described in Section 6.12. In areas where wet conditions are encountered, "Crushed Stone" (wrapped in Geotextile Fabric for thicknesses exceeding 6-inches) could be used under footings instead of the "Sand Gravel Fill".

7.3 Utility Installation

Excavations for installation of underground utilities should be made to comply with all OSHA, federal, state, and local regulations. At a minimum, excavations should be wide enough to accommodate the utility to be installed with clearance on each side of the utility to provide space for operating compaction equipment for backfilling of the utility in lifts without damaging the utility. The base of the excavation and bedding layer should be formed to properly support all components of the utility, including pipe bells, manholes, to prevent damage during installation. During backfilling operations, care should be taken to provide properly compacted fill along the length of the utility being installed. All fill material (cobbles and boulders within the native deposits) in excess of 3-inches should be removed from the fill within 12-inches of the utility to prevent damage to the utility during compaction.

7.4 Dewatering

During construction, temporary dewatering may be required to control ponded water resulting from rain and surface runoff. Based on measurements taken during the subsurface investigation, groundwater was encountered within the building footprint at depths generally ranging from 10 to 12 feet below the existing ground surface. Also note that as part of the boring activities, water was introduced to the boreholes and may not have dissipated at the time that the measurement was taken. It should be noted that groundwater levels may fluctuate over time due to variations in rainfall and other factors different from those prevailing at the time the explorations were performed.

Based upon the apparent depth of groundwater, dewatering is not anticipated during the excavation of shallow footings, the excavation of in-situ FILL (Stratum No. 1), and excavation for the elevator pit. The Contractor should provide for proper drainage of surface water away from any excavations. All excavations should be conducted in the dry.

7.5 Lateral Support

Excavation support is solely the Contractor's responsibility. Several excavations are expected within the footprint of the proposed structure for installation of footings, utilities and below-grade walls. Temporary support systems may be required at some locations to retain the surrounding soil and maintain a near-vertical excavation face where it will be necessary to protect the adjacent

building walls, pavement, or underground utilities. Design of cantilever and braced support systems is beyond the scope of this report, and should be performed by the Contractor.

In areas where an open cut is possible without a temporary support system, the final side slopes should conform to Local, State, and Federal safety requirements.

7.6 Protection of Adjacent Structures

PARE recommends that prior to the start of construction, a video and/or photo pre-construction survey is performed at any buildings which are located near the work area which may be affected. This should also include adjacent utilities that may be affected by the construction. This survey would record "before-construction-conditions" of existing structures and utilities that are expected to remain through construction. These surveys are invaluable in resolving potential project claim disputes.

PARE recommends that crack gauges be installed to monitor movement of existing cracks and on any cracks that develop in new or existing concrete foundation walls.

7.7 Construction Monitoring

The site preparation, excavation and backfill, compaction, and foundation installations should be observed by our geotechnical field engineer(s) under the direction of one of our registered professional engineers experienced in geotechnical engineering. While onsite, our engineer(s) could provide field density testing, verification of bearing layers, and assistance in general interpretation of the geotechnical requirements during construction. This would provide an accurate record of construction, alert the designer to changed conditions, and make useful data available for upcoming construction.

Foundation excavations should be observed to confirm that all loose, soft, and undesirable material is removed and that the foundations will bear on a satisfactory material. Excavation subgrade observations should include hand auger borings or hand probing.

As mentioned, compaction criteria for the various imported materials should be developed and included in the specifications. Field density testing should be performed using a nuclear density gauge to confirm that adequate compaction is being achieved. During construction, representative samples of all materials to be used as backfill should also be tested for conformance with the specified material properties.

8.0 SUMMARY

8.1 Subsurface Conditions

- Based upon the referenced historical documentation, a small-scale coal mining operation was located southwest of the proposed school site, and mining appears to have ended in the late 19th Century. At this time, Pare Corporation does not recommend any further subsurface investigation to substantiate claims of a mine, or influence from a mine within the proposed development area. If additional information becomes available and, after review this information, Pare believes that further investigation is warranted, we will provide a recommended investigation program.

- The surface of the site generally consists of topsoil overlying areas of FILL and/or native deposits of SAND WITH GRAVEL, overlying GLACIAL DEPOSITS and/or WEATHERED BEDROCK, overlying COMPETENT BEDROCK. Section 3.1 provides an in-depth description of the subsurface conditions at the proposed building area and site features. Groundwater depths generally ranged from 10 to 15 feet below the existing ground surface.

- Based upon the material type, observed densities and material composition, the soil profile does not appear to be susceptible to liquefaction.

8.2 Conclusions and Recommendations

- For the proposed structure, a shallow foundation system composed of column and wall footings bearing on a minimum 12-inch layer of compacted “Sand-Gravel Fill” over compacted "Granular Fill”, recompacted in-situ FILL (Stratum 1) or the natural SAND WITH GRAVEL (Stratum 2), is recommended for effectively transferring the building loads to the ground. In areas where wet conditions are encountered, 6 inches of “Crushed Stone” (wrapped in Geotextile Fabric for thicknesses exceeding 6-inches) could be used under footings instead of the “Sand Gravel Fill”.

- A net allowable soil bearing pressure of 4,000 pounds per square foot for exterior footings and interior footings can be achieved.

- Based upon the observed subsurface conditions, in-situ FILL (Stratum 2) should be excavated and replaced as discussed in Section 6.2 within the influence zone of the proposed building.

- The perimeter wall footings, column footings, and the structural slabs should bear on a minimum of 12 inches of compacted "Sand Gravel Fill" or 6-inches of “Crushed Stone”.

- A subgrade modulus (K) of 150 pounds per cubic inch may be used for the design of the slab on grade placed over 12 inches of compacted "Sand Gravel Fill".

- For the design of retaining walls with level backfill, recommended lateral earth pressure coefficients are indicated in Table 6-1. A unit weight of 125 pounds per cubic foot (pcf)

and an internal friction angle (ϕ) of 35° for imported "Granular Fill" and 34° for recompacted on-site fill are recommended.

- Recommendations for flexible and rigid pavement design, including "Standard Duty" and "Heavy Duty" pavement are presented in Section 6-8.

- Based on the visual classifications and limited grain size analyses, the reuse of in-situ FILL (Stratum 1) and SAND WITH GRAVEL (Stratum 2) as "Granular Fill" under buildings and pavements may be permissible with the completion of additional confirmatory grain size analyses during construction.
- The fill materials should be compacted as outlined in Table 6-3.

8.3 Construction Considerations/Recommendations

- Temporary support systems may be required at some locations to retain the surrounding soil and maintain a near-vertical excavation face where it will be necessary to protect the adjacent building walls, pavement, or underground utilities. Design of cantilever and braced support systems is beyond the scope of this report, and should be performed by the Contractor.

- The site preparation, excavation and backfill, compaction, dewatering, and foundations installation should be observed by our geotechnical field engineer(s) under the direction of one of our registered professional engineers experienced in geotechnical engineering.

- A pre-construction survey is recommended prior to the start of construction on any nearby building that may be affected by the construction to record the "before construction condition of existing structures. Likewise, a post-construction survey is also recommended after completion of construction. These surveys are invaluable in resolving potential damage claims.

REFERENCES

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6. DAS 1990. "*Principles of Foundation Engineering, 7th Edition"*, 1990.
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8. QUINN, RAY, SEYMOUR. "*Bedrock Geology of the Pawtucket Quadrangle, Rhode Island-Massachusetts"*, 1949.
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FIGURES

PARE CORPORATION

BLACKSTONE VALLEY PREP ELEMENTARY SCHOOL 2

52 BROAD STREET

CUMBERLAND, RHODE ISLAND

Ai3 ARCHITECTS, LLC

LOCUS PLAN

JUNE 2013

FIGURE 1

LEGEND

B13-2 GEOTECHNICAL BORINGS COMPLETED BY NEW HAMPSHIRE BORING JULY 9, 2013 TO JULY 11, 2013 AND JULY 23, 2013. BORINGS WERE OBSERVED BY PARE CORPORATION PERSONNEL.

GRAPHIC SCALE 1"=30'

30' 15' 0 30' 60' 120'

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PARE
PARE CORPORATION
ENGINEERS - SCIENTISTS - PLANNERS
10 LINCOLN ROAD, SUITE 103
FOXBORO, MA 02035
508-543-1255

SCALE ADJUSTMENT GUIDE
0" 1"
BAR IS ONE INCH ON ORIGINAL 24"X36" DRAWING

BLACKSTONE VALLEY PREP ELEMENTARY SCHOOL

52 BROAD STREET
CUMBERLAND, RHODE ISLAND

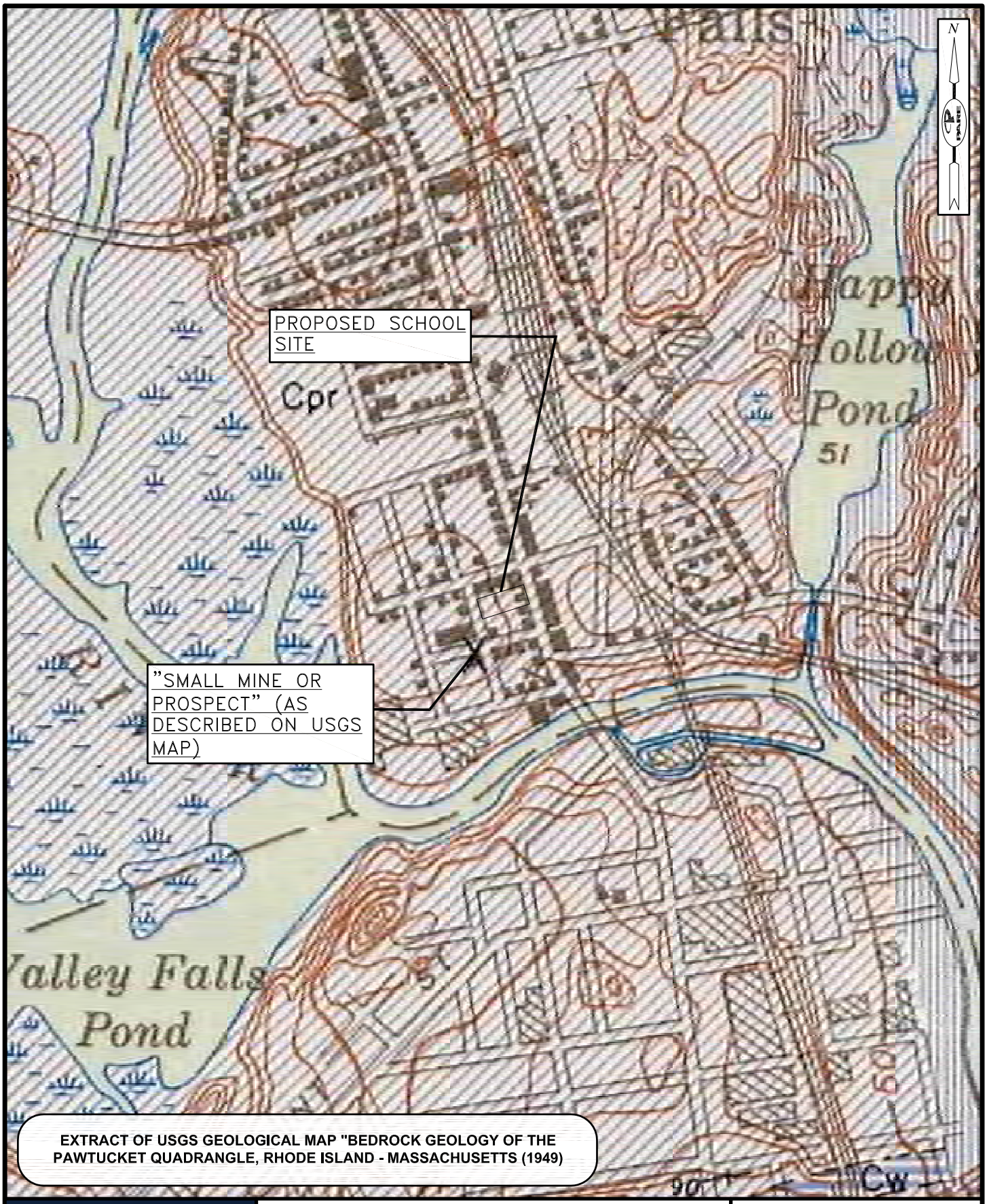
REVISIONS:

PROJECT NO.:	13062.08
DATE:	JUNE 23, 2013
SCALE:	1"=30'
DESIGNED BY:	SM
CHECKED BY:	SM
DRAWN BY:	JHG
APPROVED BY:	JMB

BORING LOCATION PLAN

FIGURE NO. 2

Z:\JOBS\13 Jobs\13062.08 Blackstone Valley Prep - Geotechnical\DWGs\Boring Location Plan.dwg



EXTRACT OF USGS GEOLOGICAL MAP "BEDROCK GEOLOGY OF THE PAWTUCKET QUADRANGLE, RHODE ISLAND - MASSACHUSETTS (1949)

PARE CORPORATION

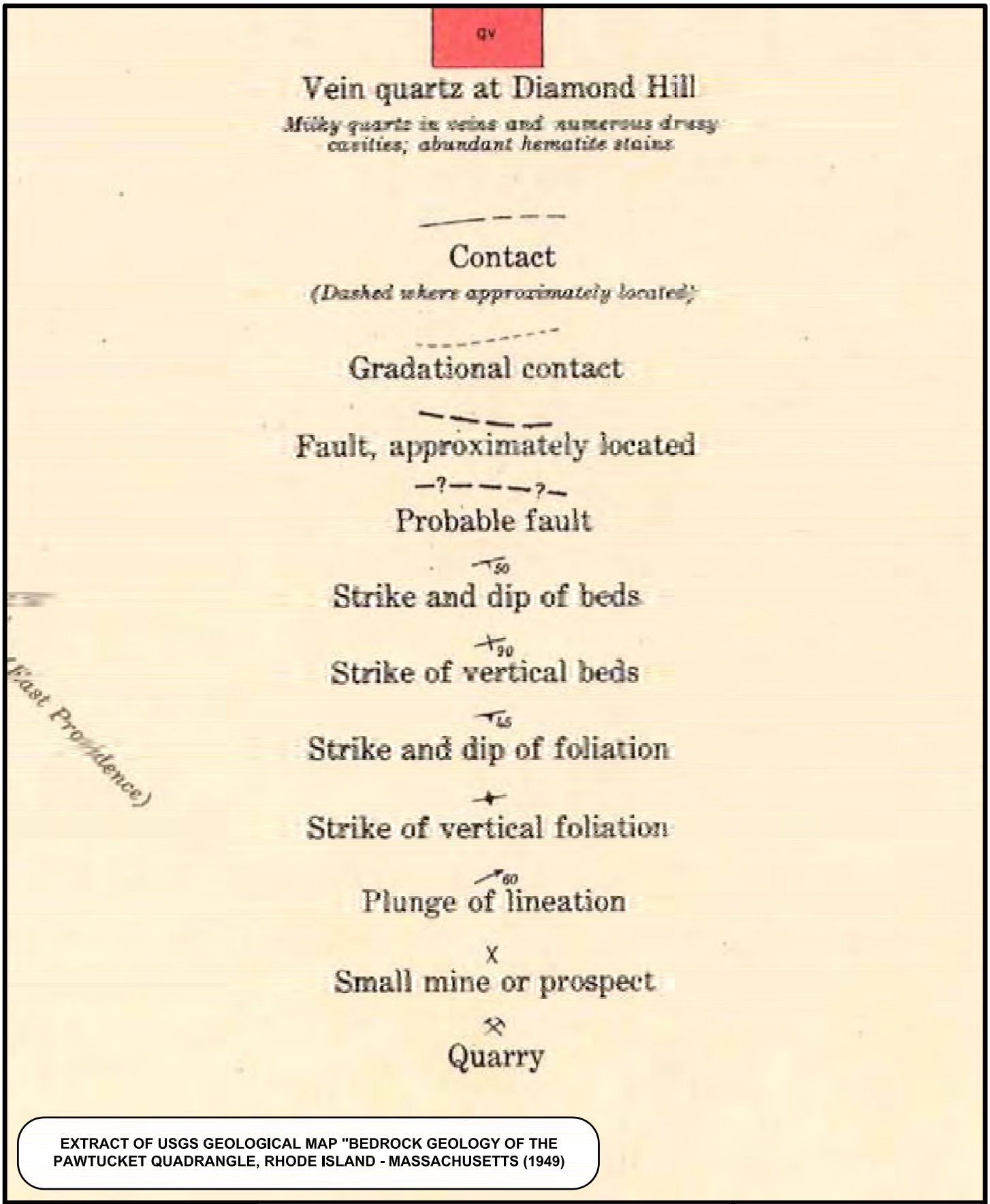
BLACKSTONE VALLEY SCHOOL

CUMBERLAND, RHODE ISLAND

Extract of Geological Map

OCTOBER 2013

FIGURE 3a



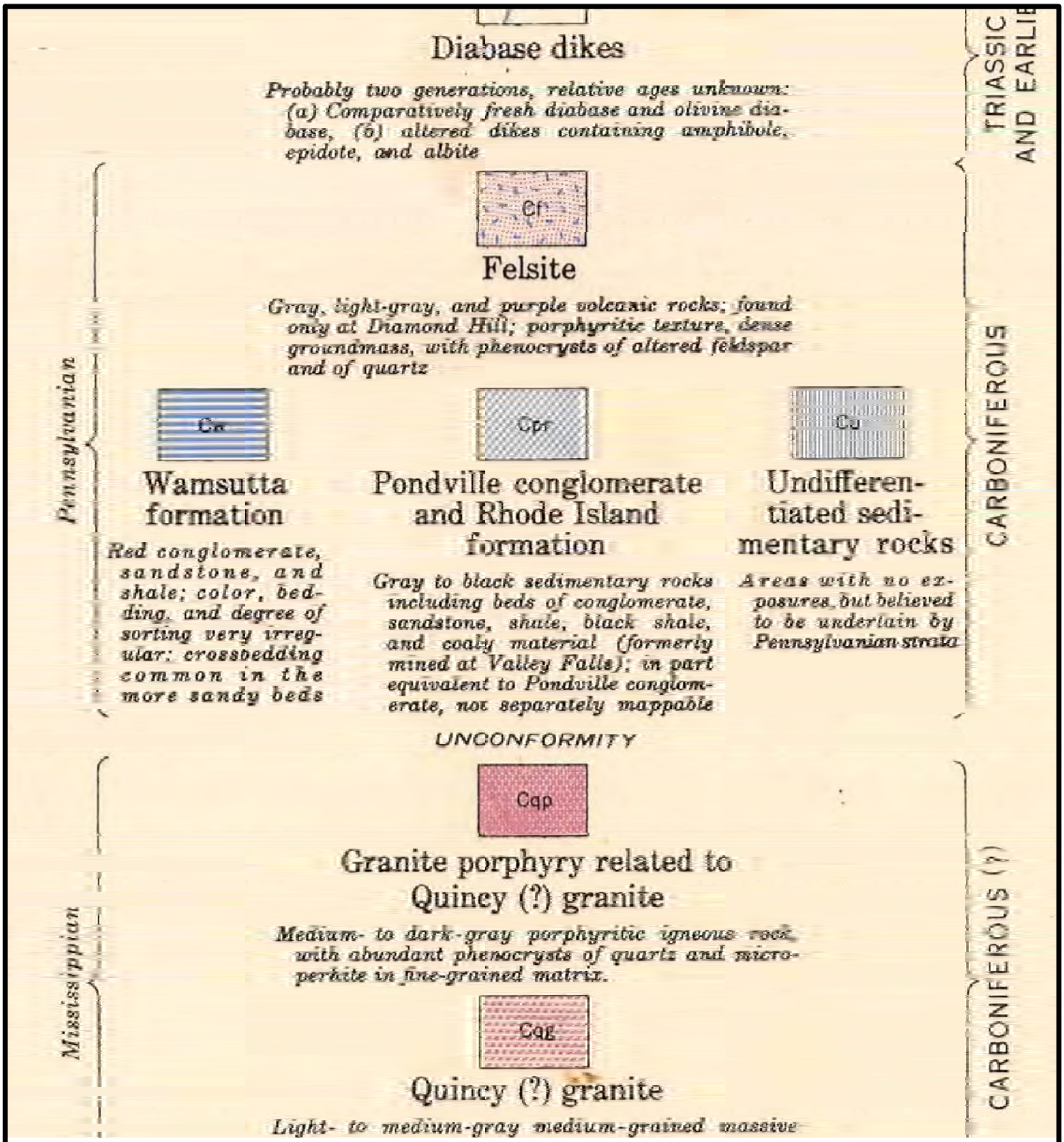
EXTRACT OF USGS GEOLOGICAL MAP "BEDROCK GEOLOGY OF THE PAWTUCKET QUADRANGLE, RHODE ISLAND - MASSACHUSETTS (1949)

PARE CORPORATION

BLACKSTONE VALLEY SCHOOL
CUMBERLAND, RHODE ISLAND

Extract of Geological Map Key

OCTOBER 2013 FIGURE 3b



EXTRACT OF USGS GEOLOGICAL MAP "BEDROCK GEOLOGY OF THE PAWTUCKET QUADRANGLE, RHODE ISLAND - MASSACHUSETTS (1949)

PARE CORPORATION

BLACKSTONE VALLEY SCHOOL
CUMBERLAND, RHODE ISLAND

Extract of Geological Map Key

OCTOBER 2013 FIGURE 3c

APPENDIX A:
Department of Interior Complaint Investigation Report

UNITED STATES DEPARTMENT OF INTERIOR
OFFICE OF SURFACE MINING RECLAMATION AND ENFORCEMENT

COMPLAINT INVESTIGATION REPORT

PROJECT NO.: RI-05-001
NAME: Lusitania Club Subsidence

DESCRIPTION OF COMPLAINT: A void measuring 6′ in diameter at the surface, widening to a 12′ diameter beneath the surface, and extending 17′ vertically in depth

COMPLAINT LOCATION AND ADDRESS: Located in the macadam parking lot of the Lusitania Club at 10 Chase St.

MUNICIPALITY: Cumberland **COUNTY:** Providence **STATE:** RI

REPORTED BY: Craig Showstead (Public Works Director) **DATE:** 5-6-05

ADDRESS: 45 Broad St., Cumberland, RI **PHONE:** 401-728-2400 Ext 40

INDIVIDUAL RECEIVING COMPLAINT: Mick Kuhns (OSM)

INVESTIGATED BY: Bob Bentz **DATE:** 5-9-05

DEP REPRESENTATIVE: None **PHONE:** 570-826-2371

PROPERTY OWNER: Club Juventude Lusitania, Inc.

ADDRESS: Winter St., Cumberland, RI **PHONE:** 401-726-9374

POTENTIALLY AFFECTING: General public

DATE PROBLEM BEGAN OR FIRST NOTICED: 5-6-05

USGS 7½′ QUAD: Pawtucket, RI **COORDINATES:** 41°57′58″ - 71°25′58″

FIELD ELEV.: 86′ **COAL ELEV.:** 40′ **SEAM:** Unknown

NAME OF COLLIERY/COMPANY: Valley Falls Mine

DATE MINING CEASED: 1896

FOLIO LOCATION: ( )-NAF ( )-EMAF ( )-WMAF ( )-SAF

NOTES: No mine maps are available in the Cumberland, RI area.
The complaint site is located 130′ north of the center of Lusitana Ave. and 38′ west of the centerline of Chase St.
Garden City Mall Subsidence (RI-01-001) Emergency was completed 20 miles away in Cranston, RI

ATTACHMENTS: (X) Photographs (X) Topo Map (X) Mine Maps
( ) Cross-Sections ( ) Sketches

pm: Bentz

COMPLAINT INVESTIGATION REPORT

PROJECT NO.: RI-05-001

DESCRIPTIVE NARRATIVE:
On May 9, 2005, I conducted an investigation of a mine subsidence that suddenly occurred in the macadam parking lot of the Lusitania Club, a Portuguese Social Club, located at 10 Chase Street, in the Town of Cumberland, Valley Falls District, Providence County, Rhode Island. The complaint was reported to OSM by Craig Showstead, Cumberland Public Works Department.

Mr. Showstead accompanied me to the complaint site. At the time of the investigation the location of the subsidence was covered with two 16′ by 8′ panels of steel plating. Mr. Showstead contacted a local contractor who removed the panels and exposed the mine void. The void measured 6′ in diameter at the surface, widened to a 12′ diameter beneath the surface, and extended 17′ vertically in depth. The interior walls of the void were irregular in shape. Layered brick, wooden planks, and pieces of concrete were visible beneath the surface to a depth of 7′. It appears that natural ground existed along the sidewalls of the void, beneath the bricks and wood and extending to the bottom. It also appears that a structure may have previously existed at the site of the subsidence. No openings were visible at the bottom of the void and no venting from the void was evident, indicating access to the underground mining was "choked-off". The subsidence is located in the macadam parking lot, 155′ north of the Lusitania Club and 65′ east from the adjacent Concession Pavilion.

The complaint site is located over the abandoned underground mine workings of the Valley Falls Mine that was mined in 1896. An 86′ surface elevation and a 46′ elevation in the subjacent unnamed coalbed indicate a 40′ interval exists between the surface and the underlying coalbed. It appears that the subsidence is located in the vicinity of Borehole SD-26 that was previously drilled by OSM in March, 1984 (Contract No. K6840004). A copy of the borehole log is attached. The depth to the coalbed is unclear due to conflicting information obtained from various maps.

Based on data obtained onsite and from available mapping, it is our opinion that this complaint is mine related and poses a threat to the health and safety of the general public.

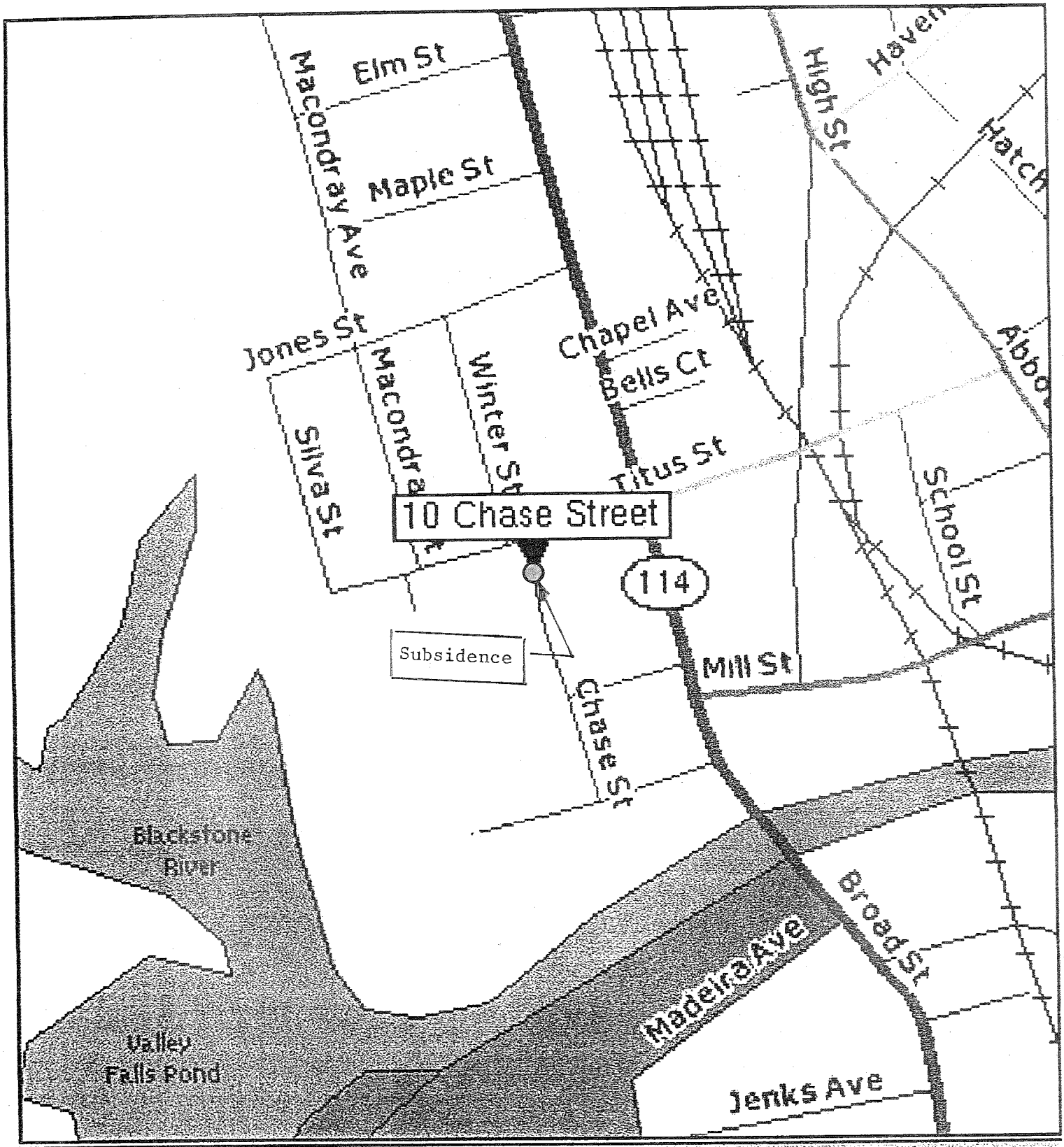
Based on conversation with state and local officials, and private citizens, no other agency can, or will, act expeditiously to abate this problem. Therefore, it is recommended that this abandoned mine land problem be considered for immediate abatement.

RECOMMENDATION:
(X) Problem should be addressed by OSMRE under the emergency program.
( ) Further investigation required, exploration.
( ) Refer to State.
( ) Mining related problem, to be abated by others.
( ) Mining related problem, not an emergency.
( ) Not mine related.

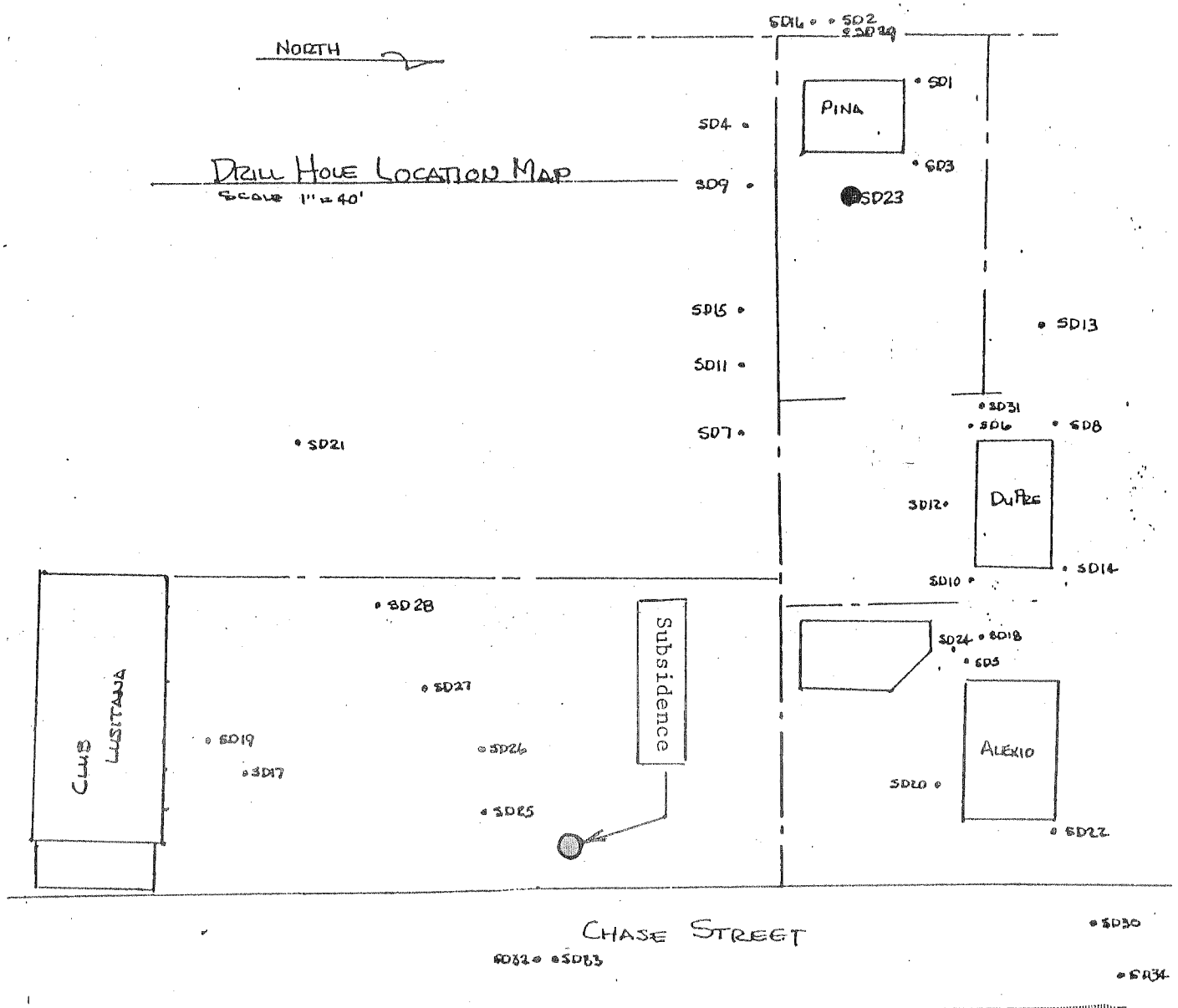
REPORT COMPLETED BY: Robert J. Bentz **DATE:** 05-12-05

REPORT REVIEWED BY: Michael F. Keller **DATE:** 05-16-05

(X) Project ( ) Verify ( ) Monitor ( ) Close Out



Location Map
Not to Scale
RI-05-001



Surface
Scale 1"=80'
RI-05-001

Team Leader Michael L. Nelson Date 12-28-05

FINAL REPORT

PROJECT:	Lusitania Club Subsidence
PROJECT NUMBER:	RI-05-001
PROJECT MANAGER:	Robert J. Bentz
LOCATION:	In the macadam parking lot at 10 Chase Street, Cumberland, Providence County, Rhode Island
COALBED:	Unknown
BRIEFING PAPER FORWARDED:	May 20, 2005
BRIEFING PAPER APPROVED:	May 24, 2005 ($45,000)
NEPA DOCUMENT:	Categorical Exclusion (May 20, 2005)
CONTRACTOR:	J. H. Lynch & Sons, Inc.
CONTRACT BID PRICE:	$28,610.00
CONTRACT NUMBER:	CT512070
WORK STARTED:	June 13, 2005
WORK COMPLETED:	June 16, 2005
FINAL CONTRACT COST:	$13,247.50
INSPECTOR:	Robert J. Bentz (OSM)

SUMMARY

On May 9, 2005, I conducted an investigation of a mine subsidence that suddenly occurred in the macadam parking lot of the Lusitania Social Club property at 10 Chase Street, Cumberland, Providence County, Rhode Island. The complaint consisted of a void that measured 6 feet in diameter at the surface. The void widened to a 12-foot diameter beneath the surface, and extended 17 feet vertically in depth. The subsidence was located in the vicinity of Borehole SD-26 that was previously drilled by OSM in March, 1984 (Contract No. K6840004). The depth from the surface to the coalbed is unclear due to conflicting information obtained from the drilling and various project maps. An 86-foot surface elevation and an estimated 40-foot elevation in the subjacent unknown coalbed indicate a 46-foot interval exists between the surface and the underlying coalbed. The void was located 155 feet north of the Lusitania Club building, and 65 feet east of the Club's Concession Pavilion. The subsidence is located over the abandoned underground mine workings of the Valley Falls Mine that was mined in 1896.

The Briefing Paper, requesting funding for the project, was submitted to ARCC on May 20, and approved on May 24, 2005. Realty, required to access the property, was approved on June 3, 2005. On June 2, 2005, a pre-bid conference was held at the project site with the Contracting Officer, the Contracting Officers Technical Representative and only one Contractor in attendance (J.H. Lynch and Sons, Inc.). On June 9, the only bid, submitted by J.H. Lynch, was opened by the Contracting Officer, Ray Navarro. The bid was accepted in the amount of $28,610.00.

Abatement work began at 7:00 A.M. on June 13, 2005, by removing the protective metal plates that had been placed over the void by the City. The Contractor

then began to excavate the overhanging asphalt and loose material around the surface opening for better placement of the fill material. The Contractor saw-cut a 19-foot by 17-foot section of macadam to prepare for the placement of the new asphalt. The Contractor placed 30 tons of flowable fill into the exposed void. The fill was brought up to a level 18" below the surface. After the flowable fill was placed, the Contractor replaced the metal plates over the fresh concrete to protect the public. After the concrete was allowed to set for two days, the Contractor returned and removed the protective metal plates. Twelve and a half tons of gravel was placed over the flowable fill in preparation for the layers of asphalt. The Contractor placed the binder and wearing course of asphalt over the gravel to complete the backfilling process. The Contractor cleaned up the area, removed the metal plates and all equipment from the project area. The project was completed in a satisfactory manner on June 16, 2005 and approved by the COTR, City Officials, and Lusitania Club Members.

The Contractor submitted his final invoice on June 23, 2005, in the amount of $13,247.50. Payment was approved by the Contracting Officer.

A letter was sent to OSM by the City, expressing gratitude for completing the work prior to the Lusitania Club's annual festival, held on the parking lot.

Robert J. Bentz
Program Specialist

APPENDIX B:
Boring Logs

PARE CORPORATION

10 LINCOLN ROAD, SUITE 103, FOXBORO, MASSACHUSETTS

ENGINEERS *** PLANNERS *** CONSULTANTS

BORING NO. **B13-1**

SHEET 1 OF 1

PROJECT	Blackstone Valley Prep School	PROJECT NO.	13062.08
	Cumberland, RI	CHKD. BY	SJM

BORING CO.	New Hampshire Boring	BORING LOCATION	SEE EXPLORATION LOCATION PLAN
FOREMAN	Jay Stokes	GROUND SURFACE ELEVATION	77.0 DATUM MSL
INSPECTOR	A. Judge	DATE START	7/10/2013 DATE END 7/10/2013

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. SAFETY HAMMER FALLING 30 in.

CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING 300 lb. HAMMER FALLING 24 IN.

CASING SIZE: 4" OTHER: Safety Hammer

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME

DEPTH (ft)	CASING (bl/ft)	SAMPLE NO.	SAMPLE PEN. (in.)/ REC.	SAMPLE DEPTH (FT)	SAMPLE BLOWS/6"	SAMPLE TONS/FT^2 OR KG/CM^2	SAMPLE DESCRIPTION Burmister CLASSIFICATION	REMARKS	STRATUM DESCRIPTION
		S-1	24/10	0-2	4 6		Moist, medium dense, brown, fine to coarse SAND and fine GRAVEL, little silt.		4" TOPSOIL
					13 13				
5		S-2	24/6	4-6	29 49		Moist, very dense, brown, fine to coarse SAND and fine GRAVEL, little silt, trace brick.	1.	FILL
					55 52			2.	BEDROCK
10							END OF EXPLORATION @ 9'.		
15									
20									
25									
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0 - 4	V. LOOSE	<2	V.SOFT
4 - 10	LOOSE	2 - 4	SOFT
10 - 30	M.DENSE	4 - 8	M.STIFF
30 - 50	DENSE	8 - 15	STIFF
>50	V.DENSE	15 - 30	V.STIFF
		>30	HARD

REMARKS:

1. Fractured shale at bottom 1" of sample.
2. Bedrock @ 7.5 feet.

BURMISTER CLASSIFICATION	
TRACE	0 - 10%
LITTLE	10 - 20%
SOME	20 - 35%
AND	35 - 50%
PERCENT BY WEIGHT	

NOTES:

1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.

2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

BORING NO. **B13-1**

PARE CORPORATION

10 LINCOLN ROAD, SUITE 103, FOXBORO, MASSACHUSETTS

ENGINEERS *** PLANNERS *** CONSULTANTS

BORING NO. **B13-2**

SHEET 1 OF 1

PROJECT	Blackstone Valley Prep School	PROJECT NO.	13062.08
	Cumberland, RI	CHKD. BY	SJM

BORING CO.	New Hampshire Boring	BORING LOCATION	SEE EXPLORATION LOCATION PLAN
FOREMAN	Jay Stokes	GROUND SURFACE ELEVATION	77.3 DATUM MSL
INSPECTOR	A. Judge	DATE START	7/8/2013 DATE END 7/8/2013

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. SAFETY HAMMER FALLING 30 in.

CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING 300 lb. HAMMER FALLING 24 IN.

CASING SIZE: 4" OTHER: Safety Hammer

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME

DEPTH (ft)	CASING (bl/ft)	SAMPLE NO.	PEN. (in.)/ REC.	SAMPLE DEPTH (FT)	BLOWS/6"	TONS/FT^2 OR KG/CM^2	SAMPLE DESCRIPTION (Burmister CLASSIFICATION)	REMARKS	STRATUM DESCRIPTION
		S-1	24/6	0-2	13 12		Medium dense, gray, medium to coarse SAND, trace silt.		3" ASPHALT
					12 10				
									FILL
5		S-2	24/12	4-6	5 5		2A: Moist, medium dense, tan, fine to medium SAND, trace fine gravel, trace silt.		
					6 8		2B: Moist, medium dense, beige, fine to medium SAND, trace silt.		
10		S-3	24/10	9-11	39 12		Medium dense, tan, fine to coarse SAND, little fine gravel, trace silt.		SAND
					10 14				
15								1.	
		S-4	24/14	15-17	29 22		Dense, brown, fine to medium SAND and SILT, some fine gravel.		GLACIAL DEPOSITS
					19 12			2.	
								3.	
20		S-5	4/4	19-19'4"	100/4"		Very weak to hard, dark gray, highly weathered to slightly weathered MUDSTONE.		HIGHLY WEATHERED MUDSTONE
							Dark gray, highly to moderately weathered, hard, extremely to moderately fractured SANDSTONE.	4.	
		C-1	24/21	22-25	14 min/ft		TCR = 88%, RQD = 0%		MUDSTONE AND SANDSTONE (BEDROCK)
					11 min/ft				
25		C-2	12/6	25-26	11 min/ft		TCR = 50%, RQD = 0%		
							END OF EXPLORATION @ 25'.		
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0 - 4	V. LOOSE	<2	V.SOFT
4 - 10	LOOSE	2 - 4	SOFT
10 - 30	M.DENSE	4 - 8	M.STIFF
30 - 50	DENSE	8 - 15	STIFF
>50	V.DENSE	15 - 30	V.STIFF
		>30	HARD

REMARKS:

1. Hard material encountered @ 14' advanced roller bit to 15'.
2. Wash changed to dark gray @ 17'.
3. Bedrock @ 18'.
4. Core barrel blocked @ 24' and 25'.

BURMISTER CLASSIFICATION	
TRACE	0 - 10%
LITTLE	10 - 20%
SOME	20 - 35%
AND	35 - 50%
PERCENT BY WEIGHT	

NOTES:

1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.

2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

PARE CORPORATION

10 LINCOLN ROAD, SUITE 103, FOXBORO, MASSACHUSETTS

ENGINEERS *** PLANNERS *** CONSULTANTS

BORING NO. **B13-3**

SHEET 1 OF 1

PROJECT	Blackstone Valley Prep School	PROJECT NO.	13062.08
	Cumberland, RI	CHKD. BY	SJM

BORING CO.	New Hampshire Boring	BORING LOCATION	SEE EXPLORATION LOCATION PLAN
FOREMAN	Jay Stokes	GROUND SURFACE ELEVATION	73.5 DATUM MSL
INSPECTOR	A. Judge	DATE START	7/10/2013 DATE END 7/10/2013

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. SAFETY HAMMER FALLING 30 in.

CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING 300 lb. HAMMER FALLING 24 IN.

CASING SIZE: 4" OTHER: Safety Hammer

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME

DEPTH (ft)	CASING (bl/ft)	SAMPLE NO.	PEN. (in.)/ REC.	SAMPLE DEPTH (FT)	BLOWS/6"	TONS/FT^2 OR KG/CM^2	SAMPLE DESCRIPTION Burmister CLASSIFICATION	REMARKS	STRATUM DESCRIPTION
		S-1	24/0	0-2	10 25		Moist, dense, brown, fine to medium SAND,some fine gravel, some silt.		3" ASPHALT
					24 14				
									FILL
5		S-2	24/12	4-6	15 9		Moist, medium dense, brown, fine to medium SAND, some silt, little gravel.	1.	
					8 37			2.	BEDROCK
							END OF EXPLORATION @ 7'.		
10									
15									
20									
25									
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0 - 4	V. LOOSE	<2	V.SOFT
4 - 10	LOOSE	2 - 4	SOFT
10 - 30	M.DENSE	4 - 8	M.STIFF
30 - 50	DENSE	8 - 15	STIFF
>50	V.DENSE	15 - 30	V.STIFF
		>30	HARD

REMARKS:

1. Fractured shale at tip of spoon.
2. Top of bedrock at 6.5' by drilling action. Advanced roller bit to 7' to confirm bedrock.

BURMISTER CLASSIFICATION	
TRACE	0 - 10%
LITTLE	10 - 20%
SOME	20 - 35%
AND	35 - 50%
PERCENT BY WEIGHT	

NOTES:

1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

BORING NO. **B13-3**

PARE CORPORATION

10 LINCOLN ROAD, SUITE 103, FOXBORO, MASSACHUSETTS

ENGINEERS *** PLANNERS *** CONSULTANTS

BORING NO. **B13-4**

SHEET 1 OF 1

PROJECT	Blackstone Valley Prep School Cumberland, RI	PROJECT NO. CHKD. BY	13062.08 SJM

BORING CO.	New Hampshire Boring	BORING LOCATION	SEE EXPLORATION LOCATION PLAN
FOREMAN	Jay Stokes	GROUND SURFACE ELEVATION	75.5 DATUM MSL
INSPECTOR	A. Judge	DATE START	7/10/2013 DATE END 7/10/2013

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. SAFETY HAMMER FALLING 30 in.

CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING 300 lb. HAMMER FALLING 24 IN.

CASING SIZE: 4" OTHER: Safety Hammer

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME

DEPTH (ft)	CASING (bl/ft)	SAMPLE NO.	PEN. (in.)/ REC.	SAMPLE DEPTH (FT)	BLOWS/6"	TONS/FT^2 OR KG/CM^2	SAMPLE DESCRIPTION Burmister CLASSIFICATION	REMARKS	STRATUM DESCRIPTION
		S-1	24/12	0-2	7 18		Medium dense to dense, brown, fine to medium SAND, little fine gravel, little silt, trace asphalt.		3" ASPHALT
					12 11				
									FILL
5		S-2	24/6	4-6	5 4		Loose, brown, fine to medium SAND, some silt, little fine gravel, trace brick.	1.	
					3 7				
									BEDROCK
							END OF EXPLORATION @ 8.5'.		
10									
15									
20									
25									
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0 - 4	V. LOOSE	<2	V.SOFT
4 - 10	LOOSE	2 - 4	SOFT
10 - 30	M.DENSE	4 - 8	M.STIFF
30 - 50	DENSE	8 - 15	STIFF
>50	V.DENSE	15 - 30	V.STIFF
		>30	HARD

REMARKS:

1. Bedrock @ 7', advanced roller bit to competent rock @ 8.5'.

BURMISTER CLASSIFICATION	
TRACE	0 - 10%
LITTLE	10 - 20%
SOME	20 - 35%
AND	35 - 50%
PERCENT BY WEIGHT	

NOTES:

1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.

2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

BORING NO. **B13-4**

PARE CORPORATION

10 LINCOLN ROAD, SUITE 103, FOXBORO, MASSACHUSETTS

ENGINEERS *** PLANNERS *** CONSULTANTS

BORING NO. **B13-5**

SHEET 1 OF 1

PROJECT	Blackstone Valley Prep School	PROJECT NO.	13062.08
	Cumberland, RI	CHKD. BY	SJM

BORING CO.	New Hampshire Boring	BORING LOCATION	SEE EXPLORATION LOCATION PLAN
FOREMAN	Jay Stokes	GROUND SURFACE ELEVATION	76.3 DATUM MSL
INSPECTOR	A. Judge	DATE START	7/10/2013 DATE END 7/10/2013

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. SAFETY HAMMER FALLING 30 in.

CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING 300 lb. HAMMER FALLING 24 IN.

CASING SIZE: 4" OTHER: Safety Hammer

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
		NE		

DEPTH (ft)	CASING (bl/ft)	SAMPLE NO.	PEN. (in.)/ REC.	SAMPLE DEPTH (FT)	BLOWS/6"	TONS/FT^2 OR KG/CM^2	SAMPLE DESCRIPTION Burmister CLASSIFICATION	REMARKS	STRATUM DESCRIPTION
		S-1	24/12	0-2	12 22		Moist, medium dense, brown, fine to coarse GRAVEL and fine to medium SAND, little silt.	1.	3" ASPHALT
					18 18				
									FILL
5		S-2	24/8	4-6	11 9		Medium dense, fine to coarse SAND, some fine gravel, little silt.		
					9 10				
									BEDROCK
10							END OF EXPLORATION @ 9'.		
15									
20									
25									
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0 - 4	V. LOOSE	<2	V.SOFT
4 - 10	LOOSE	2 - 4	SOFT
10 - 30	M.DENSE	4 - 8	M.STIFF
30 - 50	DENSE	8 - 15	STIFF
>50	V.DENSE	15 - 30	V.STIFF
		>30	HARD

REMARKS:

1. Bedrock @ 8.5', advanced roller bit to 9'.

BURMISTER CLASSIFICATION	
TRACE	0 - 10%
LITTLE	10 - 20%
SOME	20 - 35%
AND	35 - 50%
PERCENT BY WEIGHT	

NOTES:

1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.

2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

PARE CORPORATION

10 LINCOLN ROAD, SUITE 103, FOXBORO, MASSACHUSETTS

ENGINEERS *** PLANNERS *** CONSULTANTS

BORING NO. **B13-6**

SHEET 1 OF 1

PROJECT	Blackstone Valley Prep School	PROJECT NO.	13062.08
	Cumberland, RI	CHKD. BY	SJM

BORING CO.	New Hampshire Boring	BORING LOCATION	SEE EXPLORATION LOCATION PLAN
FOREMAN	Jay Stokes	GROUND SURFACE ELEVATION	74.2 DATUM MSL
INSPECTOR	A. Judge	DATE START	7/8/2013 DATE END 7/8/2013

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. SAFETY HAMMER FALLING 30 in.

CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING 300 lb. HAMMER FALLING 24 IN.

CASING SIZE: 4" OTHER: Safety Hammer

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME

DEPTH (ft)	CASING (bl/ft)	SAMPLE NO.	PEN. (in.)/ REC.	SAMPLE DEPTH (FT)	BLOWS/6"	TONS/FT^2 OR KG/CM^2	SAMPLE DESCRIPTION Burmister CLASSIFICATION	REMARKS	STRATUM DESCRIPTION
		S-1	24/12	0-2	4 6	PID=3.7	Moist, medium dense, brown, fine to medium SAND, some fine gravel, little silt.		4" TOPSOIL
					13 22				FILL
5		S-2	24/10	4-6	21 26	PID=21.9	Moist to wet, very dense, brown, fine GRAVEL and SAND.	1.	
					32 39				GLACIAL DEPOSITS
10		S-3	24/8	9-11	15 23	PID=5.2	Very dense, gray, fine to medium SAND, some silt, some fine gravel.	2.	
					11 32				BEDROCK
15							END OF EXPLORATION @ 14'.		
20									
25									
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0 - 4	V. LOOSE	<2	V.SOFT
4 - 10	LOOSE	2 - 4	SOFT
10 - 30	M.DENSE	4 - 8	M.STIFF
30 - 50	DENSE	8 - 15	STIFF
>50	V.DENSE	15 - 30	V.STIFF
		>30	HARD

REMARKS:

1. Changing stratum @ 8'.
2. Weathered bedrock at 11', advanced roller bit to 14'.

BURMISTER CLASSIFICATION	
TRACE	0 - 10%
LITTLE	10 - 20%
SOME	20 - 35%
AND	35 - 50%
PERCENT BY WEIGHT	

NOTES:

1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

BORING NO. **B13-6**

PARE CORPORATION

10 LINCOLN ROAD, SUITE 103, FOXBORO, MASSACHUSETTS

ENGINEERS *** PLANNERS *** CONSULTANTS

BORING NO. **B13-7**

SHEET 1 OF 1

PROJECT	Blackstone Valley Prep School Cumberland, RI	PROJECT NO. CHKD. BY	13062.08 SJM

BORING CO.	New Hampshire Boring	BORING LOCATION	SEE EXPLORATION LOCATION PLAN
FOREMAN	Jay Stokes	GROUND SURFACE ELEVATION	74.9 DATUM MSL
INSPECTOR	A. Judge	DATE START	7/11/2013 DATE END 7/11/2013

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. SAFETY HAMMER FALLING 30 in.

CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING 300 lb. HAMMER FALLING 24 IN.

CASING SIZE: 4" OTHER: Safety Hammer

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME

DEPTH (ft)	CASING (bl/ft)	SAMPLE NO.	PEN. (in.)/ REC.	SAMPLE DEPTH (FT)	BLOWS/6"	TONS/FT^2 OR KG/CM^2	SAMPLE DESCRIPTION (Burmister CLASSIFICATION)	REMARKS	STRATUM DESCRIPTION
		S-1	24/8	0-2	4 7		Moist, medium dense, tan, fine to coarse SAND and fine to medium GRAVEL, trace silt.	1.	6" TOPSOIL SAND
					10 18				
		S-2	24/12	2-4	28 60		Dry, very dense, gray, fractured COBBLES and coarse GRAVEL.		
					76 100/3"				WEATHERED ROCK
5		S-3	24/19	4-6	25 43		Wet to moist, very dense, gray, fractured COBBLES, some fine to coarse sand, some fine to coarse gravel, trace silt.		
					11 50				
								2.	
							END OF EXPLORATION @ 7'.		
10									
15									
20									
25									
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0 - 4	V. LOOSE	<2	V.SOFT
4 - 10	LOOSE	2 - 4	SOFT
10 - 30	M.DENSE	4 - 8	M.STIFF
30 - 50	DENSE	8 - 15	STIFF
>50	V.DENSE	15 - 30	V.STIFF
		>30	HARD

REMARKS:

1. Changing stratum @ 2'.
2. Advanced roller bit to 7' to competent bedrock.

BURMISTER CLASSIFICATION	
TRACE	0 - 10%
LITTLE	10 - 20%
SOME	20 - 35%
AND	35 - 50%
PERCENT BY WEIGHT	

NOTES:

1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.

2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

BORING NO. **B13-7**

PARE CORPORATION

10 LINCOLN ROAD, SUITE 103, FOXBORO, MASSACHUSETTS

ENGINEERS *** PLANNERS *** CONSULTANTS

BORING NO. **B13-8**

SHEET 1 OF 1

PROJECT	Blackstone Valley Prep School	PROJECT NO.	13062.08
	Cumberland, RI	CHKD. BY	SJM

BORING CO.	New Hampshire Boring	BORING LOCATION	SEE EXPLORATION LOCATION PLAN
FOREMAN	Jay Stokes	GROUND SURFACE ELEVATION	76.0 DATUM MSL
INSPECTOR	J. Costa	DATE START	7/9/2013 DATE END 7/9/2013

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. SAFETY HAMMER FALLING 30 in.

CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING 300 lb. HAMMER FALLING 24 IN.

CASING SIZE: 4" OTHER: Safety Hammer

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME

DEPTH (ft)	CASING (bl/ft)	SAMPLE NO.	PEN. (in.)/ REC.	SAMPLE DEPTH (FT)	BLOWS/6"	TONS/FT^2 OR KG/CM^2	SAMPLE DESCRIPTION (Burmister CLASSIFICATION)	REMARKS	STRATUM DESCRIPTION
		S-1	24/7	0-2	7 16		Wet, dense, black to tan, fine to coarse SAND, some coardse gravel.		3" ASPHALT
					20 22				
		S-2	24/7	2-4	16 14		Moist, medium dense, tan, fine to coarse GRAVEL and fine to coarse sand, trace silt.		
		S-3	24/7	4-4.8	50 100/4	***		1.	FILL
5									
		S-4A	12/3	6-7	9 7		4A: Medium dense, gray to tan, fine to coarse SAND, trace silt.		
		S-4B	12/14	7-8	5 30		4B: Dense, fine to coarse GRAVEL, little fine to medium SAND, trace silt, trace brick fragments, trace soft white fine material.		
							Slightly weathered to fresh, hard to very hard, extremely		
		C-1	60/60	8.5-13.5	11 min/ft		fractured to slightly fractured, medium grained, jointed, very	2.	
10					9 min/ft		thinly bedded SANDSTONE. horizontal dip.		SANDSTONE
					10 min/ft		TCR = 100%		
					11 min/ft		RQD= 67%		
					10 min/ft				
							END OF EXPLORATION @ 13.5'.		
15									
20									
25									
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0 - 4	V. LOOSE	<2	V.SOFT
4 - 10	LOOSE	2 - 4	SOFT
10 - 30	M.DENSE	4 - 8	M.STIFF
30 - 50	DENSE	8 - 15	STIFF
>50	V.DENSE	15 - 30	V.STIFF
		>30	HARD

REMARKS:

***Wet, very dense, gray/tan, fine to coarse GRAVEL, little fine to medium sand.

1. Hit obstruction, moved boring 3' +/- south/southwest of original, washed down to 6' and resumed sampling.
2. Began rock core @ 8.5' +/-.

BURMISTER CLASSIFICATION	
TRACE	0 - 10%
LITTLE	10 - 20%
SOME	20 - 35%
AND	35 - 50%
PERCENT BY WEIGHT	

NOTES:

1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

PARE CORPORATION

10 LINCOLN ROAD, SUITE 103, FOXBORO, MASSACHUSETTS

ENGINEERS *** PLANNERS *** CONSULTANTS

BORING NO. **B13-9**

SHEET 1 OF 1

PROJECT	Blackstone Valley Prep School Cumberland, RI	PROJECT NO. CHKD. BY	13062.08 SJM

BORING CO.	New Hampshire Boring	BORING LOCATION	SEE EXPLORATION LOCATION PLAN
FOREMAN	Jay Stokes	GROUND SURFACE ELEVATION	74.8 DATUM MSL
INSPECTOR	A. Judge	DATE START	7/11/2013 DATE END 7/11/2013

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. SAFETY HAMMER FALLING 30 in.

CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING 300 lb. HAMMER FALLING 24 IN.

CASING SIZE: 4" OTHER: Safety Hammer

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
7/11/13	11:00	12.1'	12'	1 Hr.

DEPTH (ft)	CASING (bl/ft)	SAMPLE NO.	PEN. (in.)/ REC.	SAMPLE DEPTH (FT)	BLOWS/6"	TONS/FT^2 OR KG/CM^2	SAMPLE DESCRIPTION (Burmister CLASSIFICATION)	REMARKS	STRATUM DESCRIPTION
		S-1	24/8	0-2	6 9		Medium dense, brown, fine to medium SAND and SILT, little fine gravel.		4" TOPSOIL
					6 13				FILL
								1.	
5		S-2	24/6	4-6	11 10		Medium dense, brown, fine to coarse SAND, some fine gravel, trace silt.		SAND WITH GRAVEL
					12 16				
								2.	
10		S-3	24/9	9-11	20 18		Wet to moist, very dense, tan, fine to coarse GRAVEL, some sand, little silt.		GLACIAL DEPOSITS
					35 35				
								3.	
15		S-4	24/5	14-16	21 16		Moist, dense, dark gray, highly weathered SANDSTONE.		WEATHERED ROCK
					17 22				
							END OF EXPLORATION @ 17'.		
20									
25									
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0 - 4	V. LOOSE	<2	V.SOFT
4 - 10	LOOSE	2 - 4	SOFT
10 - 30	M.DENSE	4 - 8	M.STIFF
30 - 50	DENSE	8 - 15	STIFF
>50	V.DENSE	15 - 30	V.STIFF
		>30	HARD

REMARKS:

1. Changing stratum @ 3' +/-.
2. Changing stratum @ 7' +/-.
3. Changing stratum @ 14' advanced roller bit to competent rock @ 17.

BURMISTER CLASSIFICATION	
TRACE	0 - 10%
LITTLE	10 - 20%
SOME	20 - 35%
AND	35 - 50%
PERCENT BY WEIGHT	

NOTES:

1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.

2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

BORING NO. **B13-9**

PARE CORPORATION

10 LINCOLN ROAD, SUITE 103, FOXBORO, MASSACHUSETTS

ENGINEERS *** PLANNERS *** CONSULTANTS

BORING NO. **B13-10**

SHEET 1 OF 1

PROJECT	Blackstone Valley Prep School Cumberland, RI	PROJECT NO. CHKD. BY	13062.08 SJM

BORING CO.	New Hampshire Boring	BORING LOCATION	SEE EXPLORATION LOCATION PLAN
FOREMAN	Jay Stokes	GROUND SURFACE ELEVATION	75.5 DATUM MSL
INSPECTOR	A. Judge	DATE START	7/11/2013 DATE END 7/11/2013

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. SAFETY HAMMER FALLING 30 in.

CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING 300 lb. HAMMER FALLING 24 IN.

CASING SIZE: 4 1/4" HSA OTHER: Safety Hammer

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME

DEPTH (ft)	CASING (bl/ft)	SAMPLE NO.	PEN. (in.)/ REC.	SAMPLE DEPTH (FT)	BLOWS/6"	TONS/FT^2 OR KG/CM^2	SAMPLE DESCRIPTION Burmister CLASSIFICATION	REMARKS	STRATUM DESCRIPTION
		S-1	24/8	0-2	4 3	PID=40.2	Topsoil.		4" TOPSOIL
					4 4				SAND WITH GRAVEL
5		S-2	24/6	4-6	24 25	PID=7.2	Dry, very dense, gray, fractured COBBLES, some coarse gravel.		
					30 52				
							END OF EXPLORATION @ 6'.		
10									
15									
20									
25									
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0 - 4	V. LOOSE	<2	V.SOFT
4 - 10	LOOSE	2 - 4	SOFT
10 - 30	M.DENSE	4 - 8	M.STIFF
30 - 50	DENSE	8 - 15	STIFF
>50	V.DENSE	15 - 30	V.STIFF
		>30	HARD

REMARKS:

1. Changing stratum @ 6'.
2. Auger refusal @ 6'. Possible bedrock.

BURMISTER CLASSIFICATION	
TRACE	0 - 10%
LITTLE	10 - 20%
SOME	20 - 35%
AND	35 - 50%
PERCENT BY WEIGHT	

NOTES:

1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

PARE CORPORATION

10 LINCOLN ROAD, SUITE 103, FOXBORO, MASSACHUSETTS

ENGINEERS *** PLANNERS *** CONSULTANTS

BORING NO. **B13-11**

SHEET 1 OF 1

PROJECT	Blackstone Valley Prep School Cumberland, RI	PROJECT NO. CHKD. BY	13062.08 SJM

BORING CO.	New Hampshire Boring	BORING LOCATION	SEE EXPLORATION LOCATION PLAN
FOREMAN	Todd Pentacost	GROUND SURFACE ELEVATION	75.8 DATUM MSL
INSPECTOR	M. Dunn	DATE START	7/23/2013 DATE END 7/23/2013

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. SAFETY HAMMER FALLING 30 in.

CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING 300 lb. HAMMER FALLING 24 IN.

CASING SIZE: 2 1/4" H S A OTHER: Safety Hammer

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
23-Jul		None		

DEPTH (ft)	CASING (bl/ft)	SAMPLE NO.	PEN. (in.)/ REC.	DEPTH (FT)	BLOWS/6"	TONS/FT^2 OR KG/CM^2	SAMPLE DESCRIPTION Burmister CLASSIFICATION	REMARKS	STRATUM DESCRIPTION
		S-1	24/6	0-2	5 7		Moist, medium dense, brown, fine to medium SAND and fine to medium GRAVEL, trace silt.	1	3" ASPHALT
					18 11				FILL
		S-2	24/4	2-4	9 9		Moist, dense, brown, fine GRAVEL and fine to medium SAND, trace silt.		
					23 14				
5		S-3	24/12	4-6	8 9		Moist, medium dense, light brown, fine to coarse SAND and fine to medium GRAVEL.		
					9 8				
		S-4	24/20	6-8	8 7		Moist, medium dense, light brown, fine to coarse SAND, little gravel, trace silt.		
					14 38			2	
		S-5	24/20	8-10	27 25		5A: Moist, very dense, brown, fine to medium GRAVEL*		GLACIAL DEPOSITS
10					72 18		5B: Dry, very dense, light gray, severely weathered SANDSTONE	3	
		S-6	16/10	10-11'4"	15 41				WEATHERED BEDROCK
					100/4"		Moist, very dense, dark gray, highly weath. SANDSTONE	4	
							END OF EXPLORATION 11'4".		
15									
20									
25									
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0 - 4	V. LOOSE	<2	V.SOFT
4 - 10	LOOSE	2 - 4	SOFT
10 - 30	M.DENSE	4 - 8	M.STIFF
30 - 50	DENSE	8 - 15	STIFF
>50	V.DENSE	15 - 30	V.STIFF
		>30	HARD

REMARKS: *and fine to medium SAND, trace silt.

1. Track Mounted ATV.
2. Changing stratum at 8'.
3. Changing stratum at 9.5'.
4. Spoon and Auger Refusal at 11'4"

BURMISTER CLASSIFICATION

TRACE	0 - 10%
LITTLE	10 - 20%
SOME	20 - 35%
AND	35 - 50%

PERCENT BY WEIGHT

NOTES:
1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

BORING NO. **B13-11**

PARE CORPORATION

10 LINCOLN ROAD, SUITE 103, FOXBORO, MASSACHUSETTS

ENGINEERS *** PLANNERS *** CONSULTANTS

BORING NO. **B13-12**

SHEET 1 OF 1

PROJECT: Blackstone Valley Prep School, Cumberland, RI — PROJECT NO. 13062.08 — CHKD. BY SJM

BORING CO. New Hampshire Boring — BORING LOCATION SEE EXPLORATION LOCATION PLAN

FOREMAN Todd Pentacost — GROUND SURFACE ELEVATION 75.1 DATUM MSL

INSPECTOR M. Dunn — DATE START 7/23/2013 DATE END 7/23/2013

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. SAFETY HAMMER FALLING 30 in.

CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING 300 lb. HAMMER FALLING 24 IN.

CASING SIZE: 2 1/4" H S A OTHER: Safety Hammer

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
7/23	11:30am	10'	N/A	0

DEPTH (ft)	CASING (bl/ft)	SAMPLE NO.	PEN. (in.)/ REC.	SAMPLE DEPTH (FT)	BLOWS/6"	TONS/FT^2 OR KG/CM^2	SAMPLE DESCRIPTION (Burmister CLASSIFICATION)	REMARKS	STRATUM DESCRIPTION
		S-1	24/3	0-2	11 15		Topsoil. No recovery.	1.	4" TOPSOIL
					16 10				
		S-2	24/0	2-4	7 9		No recovery.		FILL
					28 27				
5		S-3	24/12	4-6	14 14		Dry, m.dense, tan, fine to coarse SAND, little silt, little fine gravel.		
					11 13			2.	
		S-4	24/20	6-8	11 11		Moist, medium dense, tan, fine to medium SAND, little silt, trace fine gravel.		SAND
					12 13				
		S-5	24/12	8-10	50 61		5A: Moist, very dense, light brown, fine to coarse SAND and fine to medium GRAVEL, little silt.		
10					54 55		5B: Moist, very dense, brown, fine to coarse GRAVEL, some fine to coarse sand, trace silt.	3.	
		S-6	24/13	14-16	75 46		Wet, very dense, dark brown, fine to coarse GRAVEL, some fine to coarse sand, trace silt.		GLACIAL DEPOSITS
15					33 39				
		S-7	25/10	16-17'3"	46 52		Wet, very dense, dark brown, fine to coarse GRAVEL, little fine to coarse sand, trace silt.		
					100/3"				
								4.	
							END OF EXPLORATION @ 17'3".		
20									
25									
30									

GRANULAR SOILS

BLOWS/FT	DENSITY
0 - 4	V. LOOSE
4 - 10	LOOSE
10 - 30	M.DENSE
30 - 50	DENSE
>50	V.DENSE

COHESIVE SOILS

BLOWS/FT	DENSITY
<2	V.SOFT
2 - 4	SOFT
4 - 8	M.STIFF
8 - 15	STIFF
15 - 30	V.STIFF
>30	HARD

REMARKS:

1. Tan, fine to medium sand and fine to medium gravel 10-4; based on auger spoil.
2. Changing stratum @ 6'.
3. Changing stratum @ 8'.
4. Auger refusal @ 17'3".

BURMISTER CLASSIFICATION

TRACE	0 - 10%
LITTLE	10 - 20%
SOME	20 - 35%
AND	35 - 50%

PERCENT BY WEIGHT

NOTES:

1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.
2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

BORING NO. **B13-12**

PARE CORPORATION

10 LINCOLN ROAD, SUITE 103, FOXBORO, MASSACHUSETTS

ENGINEERS *** PLANNERS *** CONSULTANTS

BORING NO. **B13-13**

SHEET 1 OF 1

PROJECT: Blackstone Valley Prep School, Cumberland, RI — PROJECT NO. 13062.08 — CHKD. BY SJM

BORING CO. New Hampshire Boring — BORING LOCATION SEE EXPLORATION LOCATION PLAN

FOREMAN Todd Pentacost — GROUND SURFACE ELEVATION _____ DATUM _____

INSPECTOR M. Dunn — DATE START 7/23/2013 DATE END 7/23/2013

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. SAFETY HAMMER FALLING 30 in.

CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING 300 lb. HAMMER FALLING 24 IN.

CASING SIZE: 2 1/4" H S A OTHER: Safety Hammer

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
7/23/13		15'	N/A	0

DEPTH (ft)	CASING (bl/ft)	SAMPLE NO.	PEN. (in.)/ REC.	DEPTH (FT)	BLOWS/6"	TONS/FT^2 OR KG/CM^2	SAMPLE DESCRIPTION Burmister CLASSIFICATION	REMARKS	STRATUM DESCRIPTION
		S-1	24/10	0-2	9 12		Moist, medium dense, dark brown, fine to medium GRAVEL and fine to coarse SAND, trace silt.		6" TOPSOIL
					7 4				
		S-2	24/8	2-4	13 200		Dry, very dense, tan, fine to coarse SAND and fine to medium GRAVEL, trace silt.		
					20 23				
5		S-3	24/12	4-6	31 44		Moist, very dense, tan, fine to coarse SAND and fine to medium GRAVEL, trace silt.		FILL
					30 52				
		S-4	22/18	6-7.5	51 67		Moist, very dense, light brown, fine to coarse SAND and fine to medium GRAVEL, trace silt.		
					68 81/4"				
		S-5	5/5	8-8.5	100/5"		Moist, very dense, light brown, fine to coarse SAND and fine to medium GRAVEL, trace silt.	1	
10									COBBLES & BOULDERS
								2	
		S-6	24/18	14-16	35 31		6A: Wet, very dense, dark brown, fine to coarse SAND and fine to coarse GRAVEL, trace silt. 6B: Wet, very dense, dark brown to reddish, fine to medium GRAVEL*		GLACIAL DEPOSITS
15					35 39				
		S-7	24/18	16-18			7A: Wet, very dense, dark brown to reddish, fine to medium GRAVEL, some fine to coarse sand, trace silt.**	3	
		S-8	24/10	18-20	53 31		Very dense, dark gray, thinly bedded, highly fractured MUDSTONE.		WEATHERED BEDROCK
20					44 100/6"				
							END OF EXPLORATION @ 20'.		
25									
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0 - 4	V. LOOSE	<2	V.SOFT
4 - 10	LOOSE	2 - 4	SOFT
10 - 30	M.DENSE	4 - 8	M.STIFF
30 - 50	DENSE	8 - 15	STIFF
>50	V.DENSE	15 - 30	V.STIFF
		>30	HARD

REMARKS:

* some fine to coarse sand, trace silt.

**7B: Wet, very dense, light brown, fine to medium SAND and SILT.

1. Changing stratum @ 8.5 ft.
2. Changing stratum @ 14.5 ft.
3. Changing stratum @ 18 ft.

BURMISTER CLASSIFICATION	
TRACE	0 - 10%
LITTLE	10 - 20%
SOME	20 - 35%
AND	35 - 50%
PERCENT BY WEIGHT	

NOTES:

1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.

2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

BORING NO. **B13-13**

PARE CORPORATION

10 LINCOLN ROAD, SUITE 103, FOXBORO, MASSACHUSETTS

ENGINEERS *** PLANNERS *** CONSULTANTS

BORING NO. **B13-14**

SHEET 1 OF 1

PROJECT	Blackstone Valley Prep School	PROJECT NO.	13062.08
	Cumberland, RI	CHKD. BY	SJM

BORING CO.	New Hampshire Boring	BORING LOCATION	SEE EXPLORATION LOCATION PLAN
FOREMAN	Todd Pentacost	GROUND SURFACE ELEVATION	75.7 DATUM MSL
INSPECTOR	M. Dunn	DATE START	7/23/2013 DATE END 7/23/2013

SAMPLER: UNLESS OTHERWISE NOTED, SAMPLER CONSISTS OF A 2" SPLIT SPOON DRIVEN USING A 140 lb. SAFETY HAMMER FALLING 30 in.

CASING: UNLESS OTHERWISE NOTED, CASING DRIVEN USING 300 lb. HAMMER FALLING 24 IN.

CASING SIZE: 2 1/4" H S A OTHER: Safety Hammer

GROUNDWATER READINGS

DATE	TIME	WATER AT	CASING AT	STABILIZATION TIME
7/23/13		NE		0

DEPTH (ft)	CASING (bl/ft)	SAMPLE NO.	PEN. (in.)/ REC.	DEPTH (FT)	BLOWS/6"	TONS/FT^2 OR KG/CM^2	SAMPLE DESCRIPTION Burmister CLASSIFICATION	REMARKS	STRATUM DESCRIPTION
		S-1	24/10	0-2	15 13		Dry, medium dense, brown, fine to medium SAND, little silt, little gravel.		4" TOPSOIL
					13 14				
		S-2	24/8	2-4	5 4		Dry, loose, light brown, fine to medium SAND, little silt, little gravel, trace roots.		
					4 10				
5		S-3	24/15	4-6	10 20		Dry, dense, tan, fine to medium GRAVEL and fine to coarse SAND, little silt.		FILL
					19 22				
		S-4	24/18	6-8	41 61		Moist, very dense, tan, fine to medium SAND, some fine to medium gravel, little silt.		
					50 59				
		S-5	24/20	8-10	22 35		Moist, very dense, grayish brown, fine to medium GRAVEL and fine to coarse SAND, trace silt.	1	
10					39 39				GLACIAL DEPOSITS
								2	
							END OF EXPLORATION @ 12.5'.		
15									
20									
25									
30									

GRANULAR SOILS		COHESIVE SOILS	
BLOWS/FT	DENSITY	BLOWS/FT	DENSITY
0 - 4	V. LOOSE	<2	V.SOFT
4 - 10	LOOSE	2 - 4	SOFT
10 - 30	M.DENSE	4 - 8	M.STIFF
30 - 50	DENSE	8 - 15	STIFF
>50	V.DENSE	15 - 30	V.STIFF
		>30	HARD

REMARKS:

1. Stratum change @ 8'.6".
2. 'Hard' at 11'-12.5', auger refusal @ 12.5'. Possible bedrock.

BURMISTER CLASSIFICATION	
TRACE	0 - 10%
LITTLE	10 - 20%
SOME	20 - 35%
AND	35 - 50%
PERCENT BY WEIGHT	

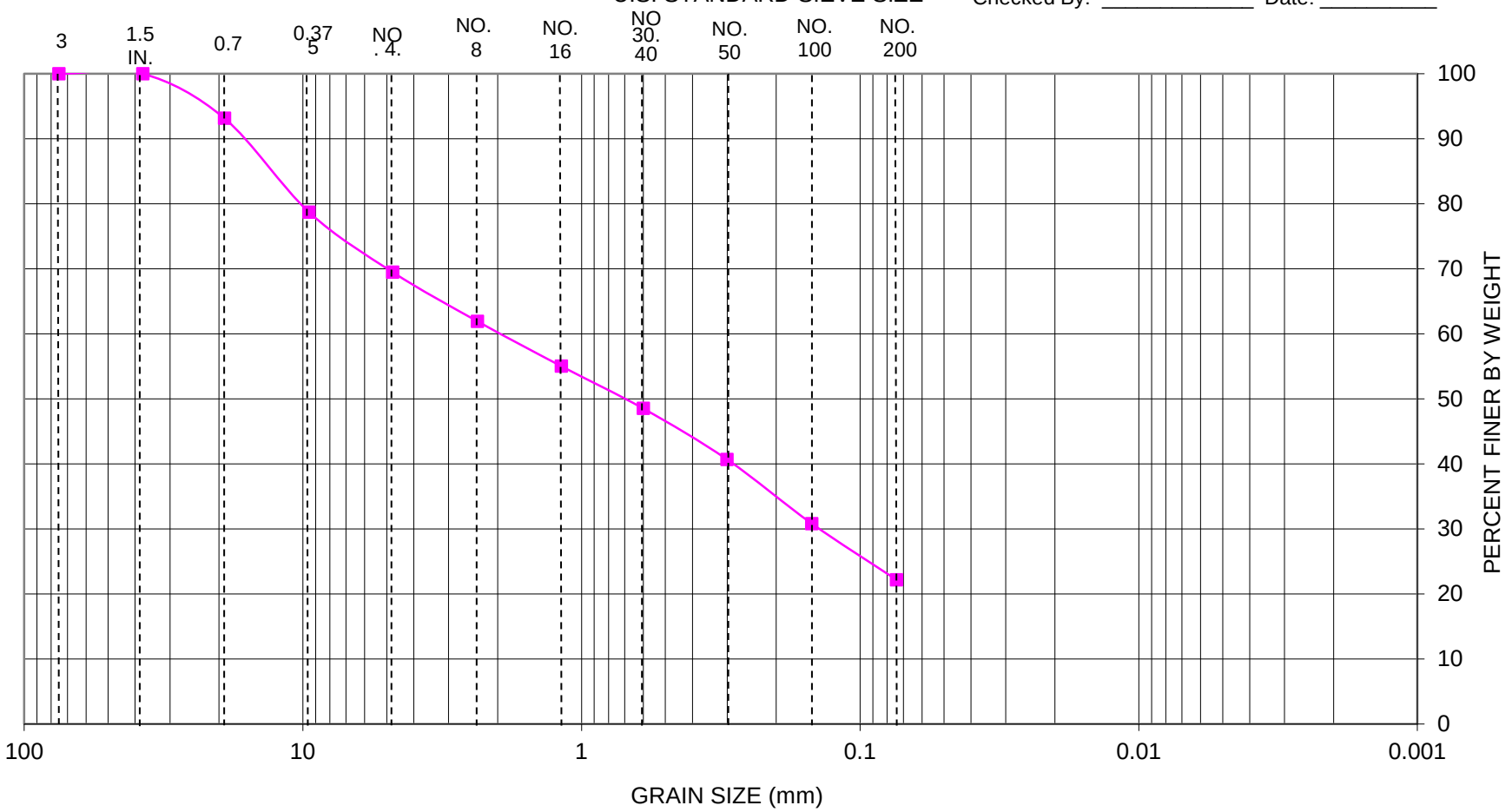
NOTES:

1) THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY BETWEEN SOIL TYPES, TRANSITIONS MAY BE GRADUAL.

2) WATER LEVEL READINGS HAVE BEEN MADE IN THE DRILL HOLES AT TIMES AND UNDER CONDITIONS STATED ON THE BORING LOGS. FLUCTUATIONS IN THE LEVEL OF GROUNDWATER MAY OCCUR DUE TO OTHER FACTORS THAN THOSE PRESENT AT THE TIME MEASUREMENTS WERE MADE.

APPENDIX C:
Laboratory Testing Data

Tested By: ____MD_____ Date: ____7/16/13_____
Checked By: _____ Date: _____



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		

TEST	MATERIAL SOURCE	REMARKS
1	**Blackstone Valley Prep Boring 13-3 Sample 2**	Bumister:fine to medium SAND, some silt, little gravel. USCS: SM, silty SAND with gravel

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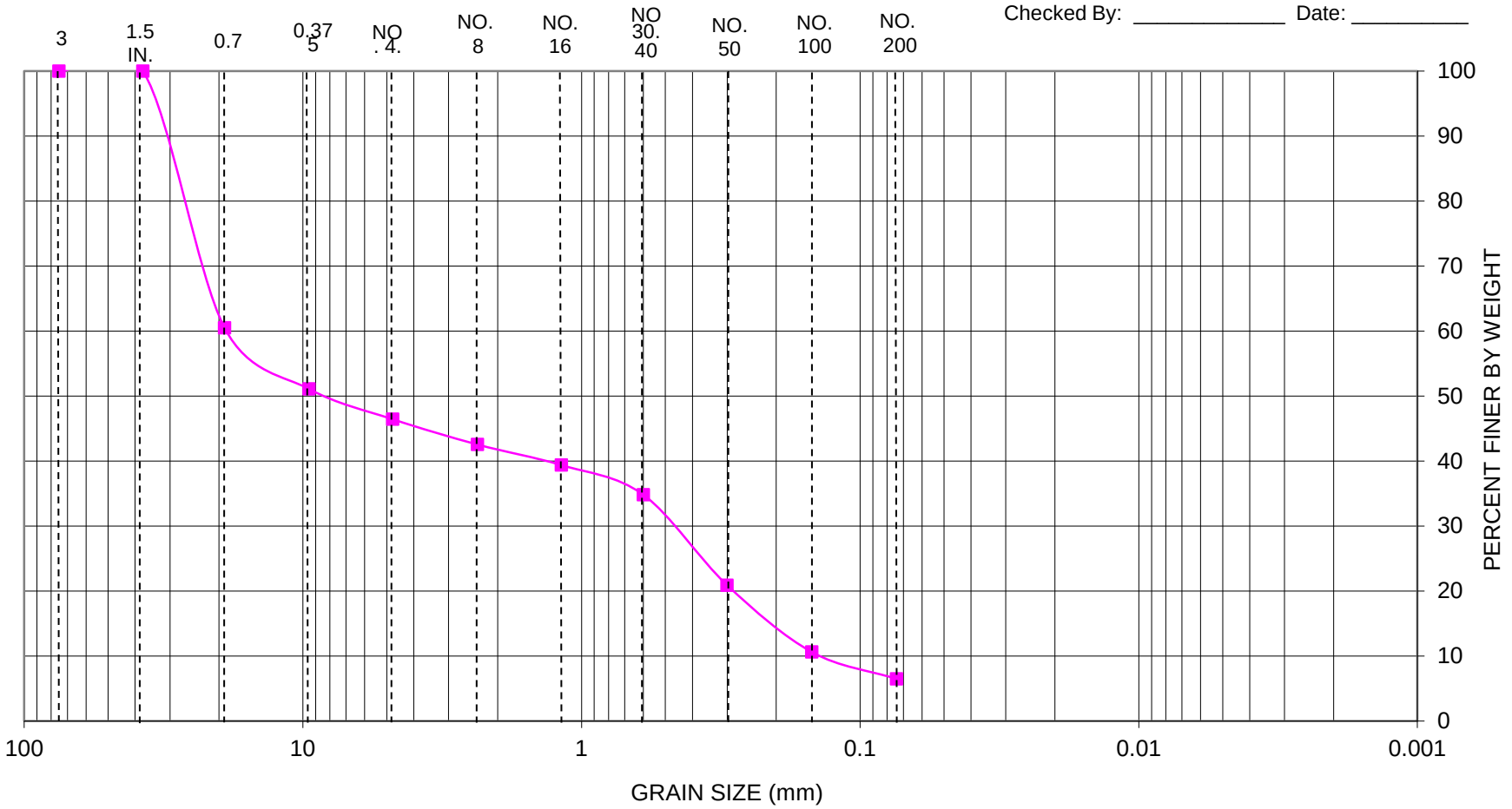
Tested By: ____MD_____ Date: _____7/16/13_____
Checked By: _____ Date: _____

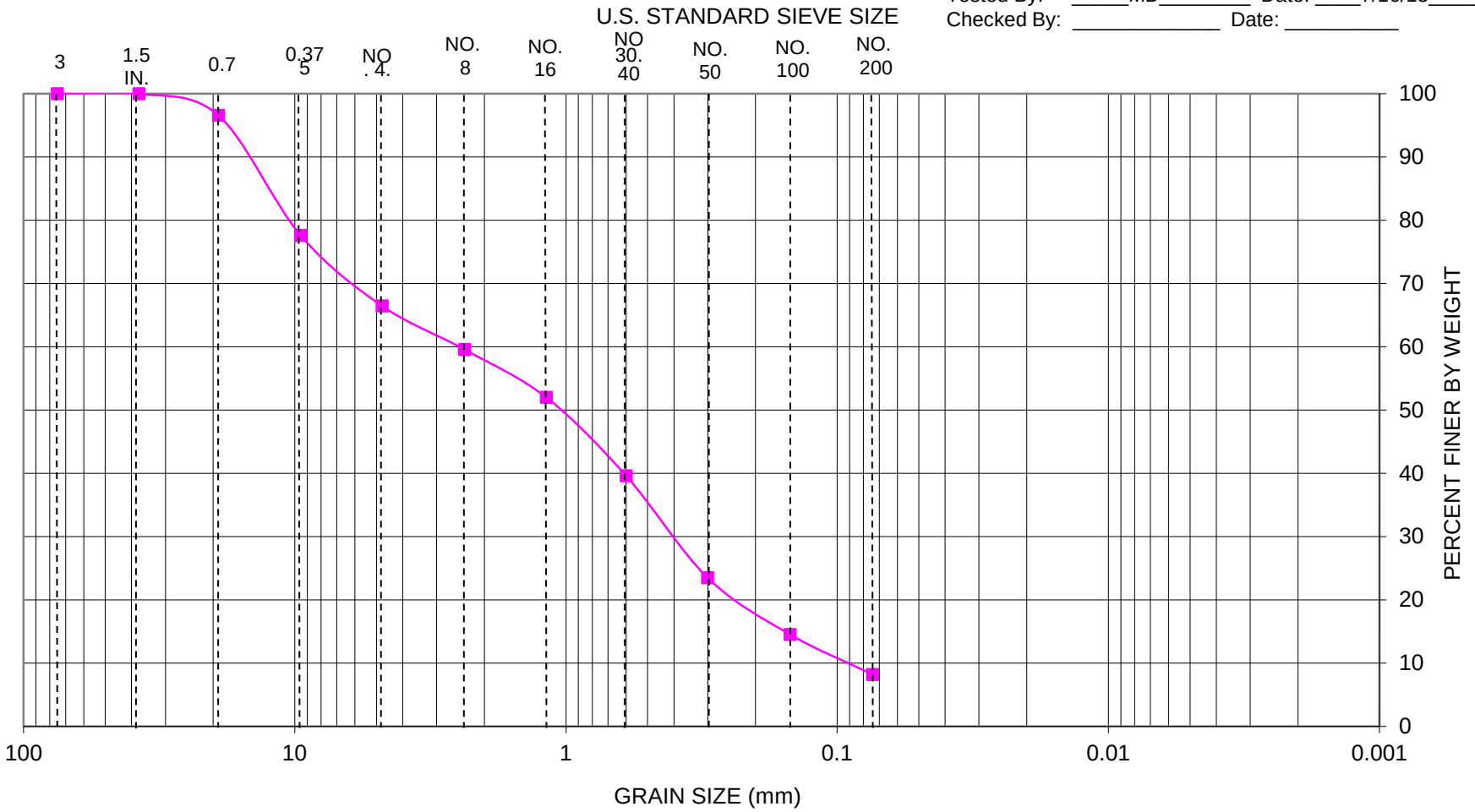


GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		

TEST	MATERIAL SOURCE	REMARKS
2	**Blackstone Valley Prep Boring 13-8 Sample 3**	Burmister:fine to coarse GRAVEL, little fine to coarse sand, trace silt USCS: GP-GM, poorly graded gravel with sand and silt

PARE ENGINEERING CORPORATION

Tested By: _____MD_____ Date: ____7/16/13_____
Checked By: _____ Date: _____



GRAVEL		SAND			SILT	CLAY
COARSE	FINE	COARSE	MEDIUM	FINE		

TEST	MATERIAL SOURCE	REMARKS
3	**Blackstone Valley Prep Boring 13-9 Sample 2**	Burmister: fine to coarse SAND, some fine gravel, trace silt USCS: SP-SM, poorly graded SAND with gravel and silt

PARE
ENGINEERING CORPORATION

APPENDIX D:
Geotechnical Limitations

GEOTECHNICAL LIMITATIONS

Explorations

1. The analyses and recommendations submitted in this report are based in part upon the data obtained from subsurface explorations. The nature and extent of variations between these explorations may not become evident until construction. If variations then appear evident, Pare Corporation (PARE) should be asked to reevaluate the recommendations of this report.

2. The generalized soil profile described in the text is intended to convey trends in the subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretations of widely spaced explorations and samples; actual soil transitions are probably more erratic. For specific information, refer to the boring logs.

3. Water level readings have been made in the drill holes at the times and under the conditions stated on the boring logs. These data have been reviewed and interpretations have been made in the text of this report. However, fluctuations in the level of groundwater may occur due to variations in rainfall, temperature, and other factors occurring since the time the measurements were made.

Review

4. In the event that any changes in the nature or location of the proposed building are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions of this report are verified in writing by PARE. PARE should also be provided with the opportunity for a general review of the final design and specifications in order that the earthwork and foundation recommendations may be properly interpreted and implemented in the design and specifications.

Construction

5. PARE should be retained to provide soil engineering services during construction of the excavation and foundation phases of work in order to observe compliance with the design concepts, specifications, and recommendations and to allow design changes in the event that subsurface conditions differ from those indicated prior to the start of construction.

Use of Report

6. This report has been prepared for the exclusive use of Civic Builders for specific application to the proposed Blackstone Valley Preparatory School located in Cumberland, Rhode Island in accordance with generally accepted engineering practices. No other warranty, expressed or implied, is made.

7. This engineering report has been prepared for this project by PARE. This report is for design purposes only and is not necessarily sufficient to prepare an accurate bid. Contractors wishing a copy of this report may secure it with the understanding that its scope is limited to design considerations only.