GEO-TECHNOLOGY ASSOCIATES, INC.

GEOTECHNICAL AND
ENVIRONMENTAL CONSULTANTS

A Practicing ASFE Member Firm

January 20, 2015

Laurel School District
District Office
1160 S Central Avenue
Laurel, Delaware 19956

Attn: Mr. Donn Steele
Supervisor of Facilities and Transportation

Re: Report of Geotechnical Exploration
Laurel Elementary School
Sussex County, Delaware

Gentlemen:

In accordance with our agreement dated November 3, 2014, Geo-Technology Associates, Inc. (GTA) has performed a geotechnical exploration for the proposed Laurel Elementary School. Anew elementary school is proposed at the existing middle school campus located along S. Central Avenue in laurel, Delaware. Transmitted herein is a report of our findings and conclusions regarding subsurface conditions, with respect to foundation and floor slab support, and related geotechnical considerations.

We appreciate the opportunity to be of assistance on this project. Should you have questions or require additional information, please contact our office at (302) 326-2100.

Sincerely,
GEO-TECHNOLOGY ASSOCIATES, INC.

Meghan Lester, P.E.
Principal

Christopher M. Reith, P.E.
Principal

ML/CMR/amd
142126
Attachments

REPORT OF GEOTECHNICAL EXPLORATION

LAUREL ELEMENTARY SCHOOL
SUSSEX COUNTY, DELAWARE

JANUARY 2015

Prepared For:

Laurel School District
District Office
1160 S Central Avenue
Laurel, Delaware 19956

Attn: Donn Steele

Prepared By:

GEO-TECHNOLOGY ASSOCIATES, INC.
Geotechnical and Environmental Consultants
18 Boulden Circle, Suite 36
New Castle, Delaware 19720
(302) 326-2100

GTA Job No: 141081

TABLE OF CONTENTS

PAGE

INTRODUCTION 1

SITE DESCRIPTION 1

PROPOSED CONSTRUCTION 2

RELEVANT GEOLOGY 3

SUBSURFACE EXPLORATION 3

SUBSURFACE CONDITIONS 5

INFILTRATION TESTING 6

LABORATORY ANALYSIS 7

CONCLUSIONS AND RECOMMENDATIONS 8

- Site Preparation 8
- Earthwork 9
- Subsurface Utilities 11
- Foundations 12
- Seismic Information 13
- Floor Slabs 13
- Lateral Earth Pressure 14
- Stormwater Management 15
- Pavement Design 16

DESIGN DEVELOPMENT AND CONSTRUCTION MONITORING SCOPE 17

LIMITATIONS 18

ASFE—Important Information About Your Geotechnical Engineering Report

APPENDICES

Appendix A – Figures
- Figure No. 1 – Site Location Map
- Figure No. 2 – Exploration Location Plan

Appendix B – Subsurface Exploration Data
- Notes for Exploration Logs
- Boring Logs (I-1 through I-8, S-1 through S-6, 14 Sheets)
- CPT Soundings (CPT-1 through CPT-12, 12 Sheets)
- Hand Auger Probes (HA-1 through HA-6, 6 Sheets)

Appendix C – Laboratory Data
- Grain Size Distribution Curves (1 Sheet)
- Moisture Density Relationship Curve (1 Sheet)
- California Bearing Ratio Test Report (1 Sheet)

REPORT OF GEOTECHNICAL EXPLORATION

LAUREL ELEMENTARY SCHOOL
SUSSEX COUNTY, DELAWARE
JANUARY 2015

INTRODUCTION

This report presents the results of the geotechnical exploration performed for the proposed Laurel Elementary School, in Sussex County, Delaware. GTA was provided with a plan titled *Laurel Elementary School Soil Boring Location Exhibit Sheet 1* prepared by Becker Morgan Group, Inc. dated November 19, 2014. The plan indicated the existing site conditions, configuration of the proposed building, parking and access drives, and other improvements, as well as existing topography. GTA was also provided an additional plan titled *Existing Conditions Plan* prepared by Becker Morgan Group, Inc. dated October 23, 2014.

The scope of this study included a field exploration, laboratory testing, and engineering analysis. Included in our field exploration were 14 Standard Penetration Test (SPT) borings within the proposed site and stormwater management areas, and 12 Cone Penetrometer Test (CPT) soundings performed within the building footprint, and six hand augers probes. Limited laboratory testing was performed on samples obtained from the test borings and hand augers to verify the visual classifications and characterize the general subsurface conditions. Conclusions and recommendations regarding the design and construction of the proposed single-story building and proposed SWM facilities were derived from engineering analysis of field and laboratory data, and review of the previously referenced plans.

SITE DESCRIPTION

The approximate 26-acre site is located at 801 South Central Avenue in Laurel, Delaware, more specifically, east of the existing Middle School and administration buildings. The site is identified as Tax Parcel 332-1.11-87.00. At the time the exploration was performed, the site contained four buildings with associated working and drive lanes, and various athletic fields. Site topography is relatively flat to gently sloping, with surface drainage generally directed toward the northeast. The existing ground surface elevations range from approximate elevation (EL) 22 to 27.

PROPOSED CONSTRUCTION

The proposed construction consists of a 145,000 square feet, slab-on-grade elementary school. Additional improvements will include parking and access ways and new SWM facilities to handle the increase in impervious coverage from the proposed construction. GTA was provided will the aforementioned plans for use in our field exploration. Based on projects of similar scope, we anticipate that construction of the new school building will consist of steel framing with concrete masonry, stone, or brick veneer. Reportedly, the finished cafeteria/auditorium floor and gymnasium floors will be established at grade. Maximum column loads are estimated to be approximately 120 for exterior columns and 200 kips for interior columns, and wall loads are estimated to be about 4 kips per linear foot.

Although final proposed grades were not available at the time this report was prepared, information provided by BMG indicated a finished floor at EL 27.5, and parking lot grades ranging from EL 25 to 26. As such, fills on the order of 1 to 5 feet will be required to establish the slab subgrade elevation and stone subgrade elevation.

Preliminary information indicates that the SWM facilities are planned to be designed as bio-retention and infiltration basins. The progress plans indicate the proposed type of facility; however, excavations to the practice invert were not provided. Details regarding the size, function and depth were under review by BMG.

Two entrances will be constructed off of Evergreen Drive for a separate bus loop and bus parking lot. Additional entrances will be provided along S. Central Avenue and West 8th Street and will provide access to the staff parking lot and drop off/pick-up areas, located east and north of the proposed structure. Average daily traffic is estimated to be approximately 2175 vehicles.

The new building will overlay existing below grade utilities, most notably a sanitary sewer main which crosses the site and runs southwest to northeast. The sanitary sewer invert was not shown on the referenced site plan. We estimate that his utility and associated trench backfill materials could extend 10+ feet below the proposed finished floor grades.

RELEVANT GEOLOGY

Based on the *Geologic Map of the Georgetown Quadrangle* (2010), Delaware, prepared by the Delaware Geological Survey (DGS), the site is located in the Coastal Plain Physiographic Province, which is characterized by undifferentiated and interlayered sedimentary deposits. Specifically, the site is underlain by the Turtle Branch Formation. The Turtle Branch Formation is described as a fining-upward sequence of a thin (less than 1 foot thick), gravelly sand, to an interlaminated, medium to coarse sand with heavy mineral laminae, to a well-sorted fine to medium, fluffy sand that makes up the bulk of the unit. Near the present stream valleys, 1 to 5-foot thick beds of light-grayish-brown to brown, organic-rich, clayey silt are common. Along the margins of the unit where it is adjacent to the Beaverdam Formation, the unit commonly consists of pale-yellow to yellowish-brown, fine to very fine silty sand. The unit is less than 5 foot thick over much of its mapped area but can range up to 20 feet thick near the present stream valleys. The well-sorted sands of the Turtle Branch Formation are differentiated from those of the dune deposits by their slightly coarser texture, better developed soil profile, and common presence of heavy mineral laminae. This Formation is interpreted to be a sand-dominated fluvial to tidal and shoreline deposit associated with a high stand of sea level during the middle Pleistocene.

The USGS Web Soil Survey published by the USDA indicates that the soils of the Henlopen-Rosedale-Urban land complex series are present on the site. These soils are described as containing well to excessively-drained, silty and sandy soils, with a depth to water of 40 inches to greater than 80 inches.

The Delaware Geologic Information Resource (DGIR) Map Viewer << http://maps.dgs.udel.edu/dgir/>> indicates the water table is approximately 9 to 16 feet below existing grades during the normal season and approximately 6 to 9 feet below existing grades during the wet seasons.

SUBSURFACE EXPLORATION

The field exploration consisted of drilling SPT borings at 6 locations within the parking and drive lanes and 8 locations within the SWM areas, and performing 12 CPT soundings within

the proposed building area. The borings are designated as I-1 through I-8 and S-1 through S-6, and the CPT soundings are designated as B-1 through B-12. The test borings were drilled from December 6, 2014, using an ATV mounted CME 550X drill rig. Additionally, six hand augers were performed across the site.

Standard Penetration Testing was performed in the boreholes, with soil samples obtained approximately every 2 feet in the upper 10 feet and at 5-foot intervals thereafter. The SPT test involves driving a 2-inch O.D., 1⅜-inch I.D. split-spoon sampler with a 140-pound hammer free-falling from a height of 30-inches. The number of blows required to drive the sampler was recorded in six-inch intervals. The SPT N-value, given as blows per foot, is defined as the total number of blows required to drive the sampler from the 6- to 18-inch interval.

The soil samples retrieved from the test borings were brought to GTA's soil mechanics laboratory for visual classification by engineering personnel and limited laboratory testing. The soil descriptions indicated on the individual test boring logs are based on visual observations of the individual soil samples using the Unified Soil Classification System as summarized in *Notes for Explorations Logs*, included in Appendix B, supplemented by the laboratory test results.

The CPT soundings were performed from December 7, 2014 to depths of approximately 20 feet below the ground surface. The CPT soundings were performed by pushing an electronically instrumented cone shaped probe into the soil with the hydraulic system of a track-mounted reaction device. The cone is equipped with an instrumented tip and a friction sleeve that measures tip resistance and soil-to-steel friction, respectively, as the cone is being pushed. In addition, the pore water pressure response to cone penetration is measured.

Measurements of tip resistance, sleeve friction, and pore pressure were taken at approximately 1-inch depth intervals. This data was transmitted to recording devices at the ground surface. Graphical cone sounding logs were constructed to show the variations of tip resistance, local friction, friction ratio, and pore pressure with depth. When properly interpreted, these values can be used to evaluate soil strength, compressibility, and classification. The tip resistance profile graphically presents the relative strength of the soil strata. The friction ratio,

the numerical ratio of the local friction to the tip resistance, was computed for each depth interval. This ratio is an indicator of the material type, i.e. sand, silt, or clay. The friction, friction ratio, and pore pressure profiles are used primarily to interpret soil type. The data from the upper 1 to 3 feet should be ignored as a dummy probe was used to penetrate the asphalt and stone base prior to performing the CPT soundings. Refer to the attached CPT logs for detailed graphical interpretation of the subsurface conditions at each sounding.

The borings and CPT soundings were field located by GTA, with the approximate locations indicated on the *Exploration Location Plan, Figure 2*, included in Appendix A. An instrument survey for elevation was not performed and the elevations at the test locations indicated were interpolated from the provided aerial topography or Google Earth imagery. Therefore, it should be understood that all elevations, as well as transitions in soil strata indicated on the boring and CPT sounding logs, are approximate.

SUBSURFACE CONDITIONS

Borings

In agreement with the published geology and our knowledge of previous development activities at the site, the SPT borings typically encountered existing fill and natural soils consistent with the Turtle Branch Formation to the completion depths of the borings. Asphalt and crushed stone were encountered at ground surface at Boring I-4 through I-6 measured about 4 to 6 inches. Topsoil was encountered at the ground surface of the remaining exploration holes and measured about 5 to 12 inches thick. Underlying the surficial materials (topsoil and pavement section), the borings encountered predominantly granular soils throughout the depths explored. The granular soils were visually classified as silty sand (SM), clayey sand (SC), and poorly-graded sand with silt (SP-SM). Uncorrected SPT N-values for the granular materials ranged from 3 to 21 bpf, with an average value of 12 bpf, indicating the soils are generally medium dense.

Cone Penetrometer Testing (CPT)

The CPT soundings were advanced to depths of about 20 feet below the existing ground surface. Based on review of the CPT soundings, and the SPT borings, the soils encountered are

consistent with material encountered in the SPT borings. Surficial fine-grained soils were encountered to depths of 1 to 4 feet below the ground surface, underlain by more granular materials consisting of silty sand and poorly-graded sand, interlayered with clay lenses.

Cone tip resistances typically ranged from approximately 250 to 1000 psi in the upper 10 feet indicating loose to medium dense soils. Underlying the surficial soils, the soundings typically encountered granular materials with tip resistances ranging from 500 to 2,500 psi to depths of 20 feet. Refer to the attached CPT logs for a detailed graphical interpretation of the subsurface conditions encountered at each sounding.

Groundwater was encountered during drilling in the CPT soundings at depths of about 16 to 18 feet below existing grades, corresponding to EL 8 to 9. The borings were grouted or backfilled after the water levels were recorded. The water table will fluctuate several feet due to variations in precipitation and surface runoff.

Hand Augers

The hand augers were performed on December 12, 2014, and encountered materials consistent with the Turtle Branch Formation. Topsoil was encountered at the ground surface of the remaining exploration holes and measured about 8 to 12 inches thick. Underlying the surficial materials (topsoil), the hand augers encountered predominantly granular soils throughout the depths explored. The granular soils were visually classified as silty sand (SM), and clayey sand. Please refer to the hand auger logs for more detailed information.

INFILTRATION TESTING

In addition, offset auger probes were advanced to perform infiltration testing at a depths of approximately 4 to 5 feet below existing grades, or about EL 21 to 22. Infiltration testing was performed in general accordance with the procedures outlined in the ASTM D5126 to estimate hydraulic conductivity in the unsaturated zone. The test consisted of an open-bottom, 4-inch diameter casing approximately 2 to 4 inches into the test subgrade soils. After the pre-soak period, water was added, and water level measurements were taken at approximately 15 to 30

minute intervals over a two to four-hour period. The steady state values over the last hour are recorded in the table below.

FIELD INFILTRATION TEST SUMMARY

Location	Test Depth (ft)	Soil Description	Field Infiltration Rate
I-1	4	Silty SAND	8 inches per hour
I-2	4	Clayey SAND	1 inch per hour
I-2	5	Silty SAND	5 inches per hour
I-3	4	Silty SAND	4 inches per hour
I-4	4½	Silty SAND	8 inches per hour
I-5	4½	Silty SAND	8 inches per hour
I-6	4	Silty SAND	8 inches per hour
I-7	4½	Silty SAND	8 inches per hour
I-8	5	Silty SAND	8 inches per hour

LABORATORY ANALYSIS

Selected samples obtained from the borings were tested for grain-size analysis, Atterberg Limits, and natural moisture contents. The grain-size analysis and Atterberg Limits testing were performed to determine the Unified Soil Classification System (USCS) designation for the soil. USCS classifications provide information regarding soil engineering behavior.

One bulk, composite sample of the near-surface soils obtained from Borings 1 and 4 was tested for moisture-density relationships in accordance with the Standard Proctor (ASTM D-698, AASHTO T-99) testing for use in evaluating the suitability of these soils for reuse as fill. The composite bulk sample was also subjected to California Bearing Ratio (CBR) testing for use in evaluation of pavement subgrade supporting quality. Results of these tests are summarized in the following table.

SUMMARY OF COMPACTION AND CBR TESTING
(ASTM D-698/AASHTO T-99, Standard Proctor; ASTM D-1883, CBR)

BORING NO.	DEPTH (ft)	MAXIMUM DRY DENSITY (PCF)	OPTIMUM MOISTURE (%)	NMC (%)	CBR AT 95% COMPACTION (%)
S-1 and S-4	1.0 – 5.0	126.1	9.5	9.6	7.1

Please refer to the laboratory test results included within Appendix C for additional information.

CONCLUSIONS AND RECOMMENDATIONS

Based upon the results of this study, it is our opinion that construction of the proposed improvements is feasible, given that the geotechnical recommendations outlined herein are followed, and that the standard level of care is maintained during construction. The primary geotechnical issues related to site development will be the presence of existing fills associated with the previous development, the presence of below grade components from the existing structures, and locally loose/soft surficial soils, the moisture contents of the on-site soils at the time construction proceeds. Discussions of these issues as well as general site development procedures are included in the following paragraphs.

Site Preparation

Prior to construction, GTA recommends that a thorough evaluation of the existing and abandoned below grade utilities be performed. Several utilities such as a sewer, water, gas, and storm sewer may be located within the proposed building footprint and improvement areas. Underground utilities may be encountered at the proposed foundation subgrade or within the zone of stress influence. We recommend that any existing underground utilities within the proposed building area be re-routed outside of the construction area in case the utility requires service in the future and to eliminate the concern for damage to utilities during construction. All excavations should be sloped or shored in accordance with OSHA trench safety regulations for Class C (sandy) soil types.

Details should be provided on the structural drawings and foundation plans to address utilities that cross footing lines, such as stepping the foundation bearing levels below the utilities, or providing lintels or casings for "live" lines. "Dead" utilities should be removed or abandoned in-place by grouting the conduit or pipe with grout or flowable fill; however, GTA recommends removal and replacement of the trench backfill even if the pipe remains in-situ. Any excavations made for the removal of below grade tanks or utilities should be backfilled with compacted structural fill meeting the requirements specified below. Compacted structural fill, if required, can then be placed to achieve the proposed design grades in accordance with the specifications outlined in this report. Alternatively, the excavations can be backfilled with open-graded aggregate, concrete, or flowable fill.

If the utilities cannot be rerouted outside the proposed building area, the footings should be lowered to the invert elevation of the sanitary sewer. If lowering the footings is necessary, it may be more appropriate to perform footing construction in this area prior to the placement of new structural to achieve slab subgrade. This will limit the depth of excavation for footing subgrades, and ease in the construction of pier pedestals for the columns. The footing excavations should be backfilled with compacted structural fill in accordance with the guidelines outlined below.

Earthwork

Topsoil/cultivated soil was encountered at depths ranging approximately 5 to 12 inches. The actual stripping thickness will be dependent on localized topsoil development, root mat thickness, precipitation, soil moisture, construction traffic disturbance and contractor care. Topsoil should be stripped from within 5 feet beyond the proposed building and pavement limits. The topsoil may be stockpiled on-site for future use in landscaped area but would not be suitable for reuse in structural areas.

We recommend that positive drainage be maintained across the site during construction to prevent ponding of water, since the exposed subgrades could destabilize in combination with construction traffic and precipitation, given the presence moisture sensitive surficial soils and the potentially shallow depth of groundwater in the lower elevations of the site. Furthermore, heavy

construction traffic should generally be run on designated haul roads during periods of wet weather to reduce the potential for destabilization of more subgrade areas than necessary. If the subgrade is disturbed by construction traffic and becomes unstable, undercutting and replacement of these surficial materials will likely be required. After stripping, the exposed subgrade should be evaluated by the geotechnical engineer or his representative prior to fill placement. This evaluation will likely include visual observations and proofrolling supplemented by hand probing to estimate the relative consistency or density of the surficial soils prior to fill placement.

New structural fill should be placed in lifts and compacted in accordance with the specifications included in this report. The non-organic, on-site soils are generally considered suitable for use as structural fill. The on-site granular materials with liquid limits less than 35 and plasticity index less than 15 are also considered suitable for use in structural fill construction. The granular soils exhibiting slight plasticity and any fine-grained soils will require more drying effort if they are wet of optimum at the time earthwork proceeds; however, they will likely be limited within the depths of excavation anticipated. Also, moisture conditioning of the non-plastic granular soils above the groundwater table should not be a significant problem during favorable weather conditions. The excavated materials will generally need to be within 2 to 4 percentage points of the optimum moisture for compaction before compactive effort is applied. Off-site borrow, if required, should meet Unified Soil Classification System (USCS) designation SC, SM, SP, GP, GM, or GW and be approved by the Geotechnical Engineer prior to use. All structural fill should be constructed in maximum 8-inch thick loose lifts and be compacted to the following specifications:

COMPACTION SPECIFICATIONS

Structure / Fill Location	Compaction / Moisture Specification
Below foundations, retaining walls, floor slabs, and within wall backfill or slopes steeper than 5H:1V	95% of ASTM D-698 Moisture: ± 3% of optimum
Top 1 foot of pavement subgrade	98% of ASTM D-698 Moisture: ± 2% of optimum

Structure / Fill Location	Compaction / Moisture Specification
Fills below 1 foot of pavement subgrade	95% of ASTM D-698 Moisture: ± 3% of optimum

Fill subgrades and each lift of fill should be observed and tested by a soils technician on a full-time basis, under the supervision of a registered engineer as required per the 2009/2012 International Building Code. All compactive effort should be verified by in-place density testing. New fills constructed on slopes steeper than 5H:1V (horizontal to vertical) should be keyed into existing slopes for stability considerations. All fill slopes steeper than 5H:1V should generally be placed as structural fill and be controlled and compacted to minimum densities as specified above. Fill for slopes in non-structural areas, such as landscape berms, can be constructed as steep as 3H: 1V up to a height of ten feet.

Subsurface Utilities

The natural soils are considered suitable for support of below grade utilities. Based on the results of the borings, GTA anticipates that the excavations may be accomplished using standard utility construction equipment. Based on the test boring data, groundwater was encountered at depths greater than 16 feet below existing grades. Problems associated with groundwater include seepage into the excavation, running sands, loss of stability, sidewall collapse, and sloughing of soils. These problems can be reduced through the use of sumps, but well-points will likely be more effective. Trench shields may also be required for support of vertical cut excavations where utilities are deeper than 4 feet to reduce sidewall collapse. Due to the potential for collapse of unsupported excavation in granular soils, the utility contractor should be prepared to provide adequate earth support systems during utility construction.

Utilities excavations that extend below structural areas such as pavements should be backfilled and compacted as recommended in the *Earthwork* section of this report. Depending on the soil moisture content at the time of construction, moisture conditioning may be required to attain the required of compaction.

Utilities adjacent to new foundations should be designed such that they meet requirements of the 2006 International Plumbing Code Section 307.5 Trench Location.

Foundations

Assuming maximum wall loads of 4 kips per linear foot and column loads of up to 200 kips, footings designed for the specified net allowable bearing pressure 4,000 pounds per square foot (psf) would result in approximately 1-inch of total settlement and up to ½-inch of differential settlement when supported on the medium dense/medium stiff, natural soils. Minimum widths for wall footings of 24 inches and column footings of 36 inches are recommended when design based on 4,000 psf results in a more narrow footing. This bearing pressure is considered feasible provided that any existing fills associated with the previous development and any soft, natural soils are removed and replaced prior to constructing the footings. Exterior footings should be founded a minimum of 30 inches below the final exterior grades to provide protection from frost action. We recommend that footing subgrades be compacted with a vibra-plate prior to the placement of reinforcing steel.

Footings should be supported on medium dense/medium stiff natural soils or compacted structural fill materials. Where soft/loose natural soils are encountered at the footing subgrade or within the zone of stress influence, the foundation subgrades should be over-excavated through these materials to a suitable stratum. The undercut volume should be backfilled to the design bearing grade with additional concrete or AASHTO Size No. 57 aggregate, compacted by tamping with the equipment bucket or a vibra-plate.

Groundwater is not anticipated to be encountered during foundation construction. However, the isolated or perched water may exist and, if encountered, will soften/loosen the foundation subgrade. If water is encountered during excavations, the use of dewatering devices such as sumps or gravity flow trenches may be necessary.

Detailed foundation excavation evaluations should be performed in each footing excavation prior to the placement of crushed stone, reinforcing steel, or concrete. These evaluations should be performed by a representative of the registered Geotechnical Engineer to

confirm that the design allowable soil bearing pressure is available. The foundation bearing surface evaluations should be performed using a combination of visual observation, hand-rod probing, comparison with the borings, and Dynamic Cone Penetrometer (DCP) testing, as applicable.

Seismic Information

Based on Table 1615.5.3 of the *International Building Code 2006* and subsurface information obtained during drilling of the test borings, GTA recommends that Site Class "D" be used for seismic analysis.

Floor Slabs

Floor slabs can be designed as concrete slabs-on-grade. We understand that precast slabs will be used for the lower level. Based on the results of the field and laboratory analysis, we recommend that the design of the floor slabs be based on a subgrade modulus of 75 to 125 pounds per cubic inch (pci). GTA recommends that the concrete floor slabs supported on grade be founded on a minimum 4-inch thick open-graded coarse granular layer to act as a capillary beam. A polyethylene retarder barrier should be installed in accordance with ACI and ASTM guidelines to interrupt the rise of moisture through the slab if moisture-sensitive floor coverings are planned. Compacted fill subgrades for support of the floor slabs should be observed to evaluate stability prior to placement of concrete. The slabs may bear on footing projections, but they should be jointed so that the foundation walls can settle independently from the slab.

Utility and footing backfill below floor slabs should meet the compaction requirements specified herein. Construction activities and exposure to weather often cause deterioration of slab subgrades. The contractor should exercise care during floor slab preparation to limit disturbance to exposed subgrades. We recommend that the slab subgrade soils be evaluated by a representative of the Geotechnical Engineer immediately prior to stone and concrete placement. This evaluation may include a combination of visual observations, proofrolling, hand-rod probing, and field density tests to verify that the subgrade soils have been prepared properly. If soft or loose soils are encountered, recommendations for remedial measures should be provided by the geotechnical engineer at the time of construction.

Lateral Earth Pressure

Although architectural details and structural drawings were not available at the time this report was prepared, it is unlikely that below grade walls will be constructed for this project. However, if below grade or retaining walls are required, the walls will need to be designed to resist the lateral earth pressure from the soil retained in additional loads from surface surcharges as applicable. Walls that are braced to prevent rotation should be designed for at-rest earth pressures. Walls that are free to rotate can be designed for active earth pressures. Assuming the use of non-plastic granular soils placed and compacted as structural fill, we recommend below grade walls be designed using the values tabulated below. Hydrostatic pressure is not included in the above values since it is assumed that adequate drainage will be provided as described below.

LATERAL EARTH PRESSURE SUMMARY

Soil Property	Recommended Values
Unit Weight, γ	125 pcf
Angle of Internal Friction, Φ	32°
Coefficient of Active Earth Pressure (Ka)	0.30
Coefficient of Passive Earth Pressure (Kp)	3.25
Coefficient of Earth Pressure at Rest (Ko)	0.47
Base Friction, tan δ	0.6
Equivalent Fluid Pressure (Unrestrained Top of Wall)	38 psf/ft
Equivalent Fluid Pressure (Restrained Top of Wall)	59 psf/ft

Wall backfill should be free of organic matter, rocks greater than 3 inches in diameter, and construction debris. Backfill should be placed and compacted in lifts in a manner that does not damage the foundation or water proofing. Additionally, foundation wall backfill should not be placed until the concrete has achieved adequate strength and the structure is braced per the design requirements.

At a minimum, we recommend that drainage panels and a perimeter drain be provided behind below grade walls to carry away any infiltrating surface water so that hydrostatic pressures do not develop. The perimeter drain should consist of a 4-inch-diameter slotted or perforated pipe encased in a minimum of 6 inches of crushed stone and be wrapped by a geotextile filter. The crushed stone should meet the gradational requirements of AASHTO Size

No. 57 aggregate. The perimeter drain should tie into weep holes, a sump pit, adjacent storm sewer, or off-site drainage system. All below-grade walls should be water-proofed.

Stormwater Management

Based on our observations made during the subsurface exploration, it is our opinion that managing stormwater quality through the use of bio-retention and/or infiltration practices is generally feasible. The guidelines established in the Delaware Sediment and Stormwater program technical Document Article 3.06, Appendix 3.06.2. *A-1 Soil Investigation Procedures* indicate that the minimum infiltration rate for all runoff reduction and infiltration practices is 1 inch per hour. Also, a vertical separation of two (2) feet from the seasonal high groundwater elevation is required for all infiltration practices unless an underdrain is provided.

Unfactored field measured infiltration rates ranged from 1 to 8 inches per hour. Areas where infiltration rates exceed 2 inches per hour are generally considered suitable for infiltration practices. We recommend that a design infiltration rate of no more than 25 to 50 of the field measured rate for that test locations and depths be used for the final design of the facility. This recommendation is based on the inherent problems associated with these systems as they become less permeable due to densification during construction and partial clogging or siltation occurring over time. Groundwater was not encountered during drilling and is not expected to be a problem during construction of the underground storage facilities.

Infiltration potential will generally may limited in the surficial soils, generally the upper 4 feet of the ground surface. Infiltration practices in these soils or at these depths may be feasible in these areas by over-excavation or replacement with concrete sand, open-graded aggregate, depending on final design and a review of the site conditions at the time of construction.

Groundwater was observed within the CPT sounding holes at depths of 16 to 18 feet below existing grades. We estimate seasonal high ground water to be approximately 10 feet or deeper below existing grades over the majority of the site.

GTA recommends that the infiltration facilities be excavated using a track-mounted excavator, which will generally eliminate the need to operate equipment directly on the subgrade. If underground facilities are used, the subgrade should be hand cleaned using a shovel to remove any disturbed soil prior to placing the foundation stone below the chambers. Based on the field explorations, the proposed subgrades soils within the SWM facilities can support a net allowable bearing pressure of up to 3,000 psf. The grading operations within the SWM facility should be performed in accordance with the *Earthwork* section of this report. GTA should be provided the opportunity to review the plans when the location, depths and sizes have been determined to evaluate if the geotechnical issues have been addressed.

Pavement Design

GTA recommends that the upper 12 to 18 inches of roadway subgrade be constructed with the following characteristics:

PAVEMENT SUBGRADE SPECIFICATIONS

Liquid Limit	35 percent or less
Plasticity Index	15 percent or less
Maximum Dry Density	120 pcf or greater
California Bearing Ratio	7 or greater

The laboratory testing suggests that majority of the on-site soils would likely meet the above criteria. However, the surficial plastic granular soils and fine-grained soils encountered in a few of the borings may exhibit a higher PI and lower CBR value and will likely require moisture conditioning and reworking or replacement with approved materials prior to placement of the base course stone. Also, the natural site soils may become disturbed and softened from excess moisture and construction equipment traffic. Contractors should anticipate that remedial work could be required to achieve a stable subgrade prior to paving, even if the subgrade soils had previously been compacted to the required densities. Prudent planning and earthwork procedures will reduce the potential necessity for remedial work. Road fills should be placed and compacted in accordance with the recommendations outlined in the *Earthwork* section of this report.

The flexible pavement sections provided herein were designed in accordance with the AASHTO Design Guide. Our analysis is based on 492,000 ESALs, and a design life of 20 years. The results of laboratory testing indicated a soaked California Bearing Ratio (CBR) value of 7. The following minimum pavement design sections are considered appropriate provided the pavement section is constructed on properly prepared and compacted subgrades. The pavement section should be reviewed for structural adequacy if the traffic projections are higher than those assumed in the design for the 20-year design life.

Heavy Duty Pavement Section

Asphalt Concrete Top Course (DelDOT Type C Surface)	=	2 inches
Asphalt Concrete Base Course (DelDOT Type B Base)	=	3 inches
Crushed Stone Subbase Course (DelDOT Type B, CR-6)	=	8 inches

Light Duty Pavement Section

Asphalt Concrete Top Course (DelDOT Type C Surface)	=	1.5 inches
Asphalt Concrete Base Course (DelDOT Type C Surface)	=	2.5 inches
Crushed Stone Subbase Course (DelDOT Type B, CR-6)	=	8 inches

Design Assumptions

- terminal serviceability = 2.0
- reliability = 85%
- initial serviceability = 4.2
- standard deviation= 0.49 for flexible pavements

Heavy construction traffic should not be allowed on partial pavement sections since such traffic can damage the pavement. The paving contractor should be advised that they must control construction traffic to limit disturbance of previously approved subgrade, stone base course, or completed asphalt. Some patching and repair may be necessary prior to placement of the final wearing surface layer of asphalt due to construction traffic.

DESIGN DEVELOPMENT AND CONSTRUCTION MONITORING SCOPE

We recommended that during design development and construction of the subject project, GTA be retained to provide additional design consultation and observation and testing during construction generally as follows:

- Review final site and structural plans to evaluate if they conform with the intent of this report.
- Provide on-site observation and testing of structural fill.
- Observe excavated footings for compliance with the project drawings and the intent of this geotechnical report.
- Observe the proof-rolling of roadways and parking lot areas prior to base paving to evaluate stability.
- Perform Special Inspections as required by the project specifications and Sussex County.

LIMITATIONS

This report has been prepared for the exclusive use of Laurel School District in accordance with generally accepted geotechnical engineering practice. No warranty, express or implied, is made. Use and reproduction of this report by any other person without the expressed written permission of GTA and Laurel School District is unauthorized and such use is at the sole risk of the user.

The analysis and recommendations contained in this report are based on the data obtained from the test borings. The test borings indicate soil conditions only at specific locations and times and only to the depths penetrated. They do not necessarily reflect strata variations that may exist between the test boring locations. If variations in subsurface conditions from those described are noted during construction, recommendations in this report may need to be re-evaluated.

In the event that any changes in the nature, design, or location of the facilities are planned, the conclusions and recommendations contained in this report should not be considered valid unless the changes are reviewed and conclusions of this report are verified in writing. Geo-Technology Associates, Inc. is not responsible for any claims, damages, or liability associated with interpretation of subsurface data or reuse of the subsurface data or engineering analysis without the express written authorization of Geo-Technology Associates, Inc.

The scope of our services for this geotechnical exploration did not include any environmental assessment or investigation for the presence or absence of wetlands, or hazardous or toxic materials in the soil, surface water, groundwater or air, on or below or around this site. Any statements in this report or on the logs regarding odors or unusual or suspicious items or conditions observed are strictly for the information of our Client.

This report and the attached logs are instruments of service. If certain conditions or items are noted during our investigation, Geo-Technology Associates, Inc. may be required by prevailing statutes to notify and provide information to regulatory or enforcement agencies. Geo-Technology Associates, Inc. will notify our Client should a required disclosure condition exist.

142126 **GEO-TECHNOLOGY ASSOCIATES, INC.**

Important Information About Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

The following information is provided to help you manage your risks.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you ASFE-member geotechnical engineer for more information.

ASFE
The Best People on Earth

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org

Copyright 2004 by ASFE, Inc. Duplication, reproduction, or copying of this document, in whole or in part, by any means whatsoever, is strictly prohibited, except with ASFE's specific written permission. Excerpting, quoting, or otherwise extracting wording from this document is permitted only with the express written permission of ASFE, and only for purposes of scholarly research or book review. Only members of ASFE may use this document as a complement to or as an element of a geotechnical engineering report. Any other firm, individual, or other entity that so uses this document without being an ASFE member could be commiting negligent or intentional (fraudulent) misrepresentation.

IIGER06045.0M

APPENDIX A

N

Notes:

1) Base map obtained from Google Earth Imagery, Inc. from July 2010.
2) Site Location Plan should be reviewed in conjunction with GTA Report dated January 20, 2015.

GEO-TECHNOLOGY ASSOCIATES, INC.
Geotechnical and Environmental Consultants
18 Boulden Circle, Suite 36
New Castle, Delaware 19720
(302) 326-2100
Fax (302) 326-2399

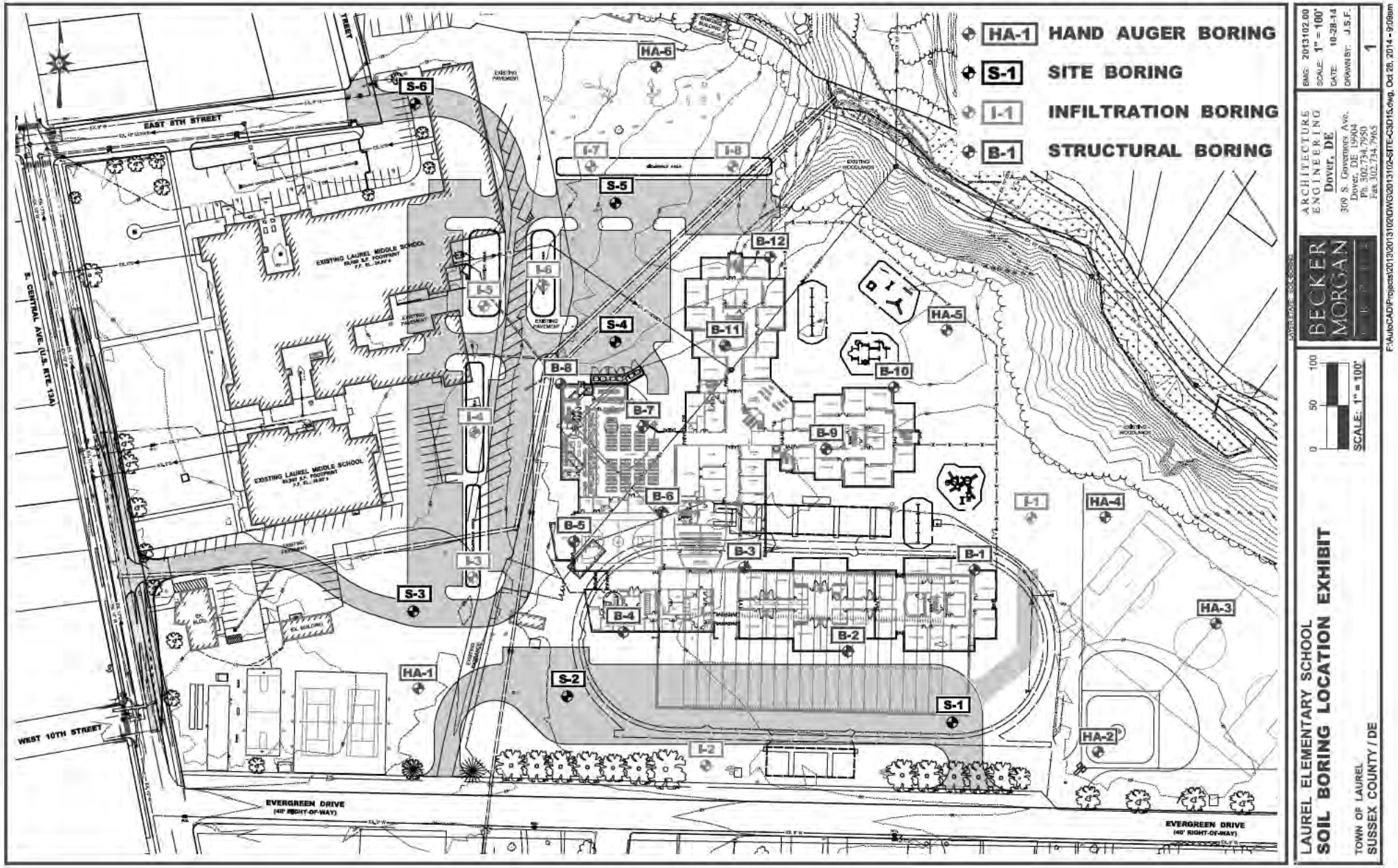
SITE LOCATION MAP

LAUREL ELEMENTARY SCHOOL

SUSSEX COUNTY, DELAWARE

SCALE	DATE	DRAWN BY	REVIEW BY	JOB NO	FIGURE NO.
NTS	JAN 2015	GOOGLE	ML	142126	1

FIGURE 2: EXPLORATION LOCATION PLAN



APPENDIX B

NOTES FOR EXPLORATION LOGS

KEY TO USCS TERMINOLOGY AND GRAPHIC SYMBOLS

MAJOR DIVISIONS (BASED UPON ASTM D 2488)			SYMBOLS GRAPHIC	SYMBOLS LETTER
COARSE-GRAINED SOILS	GRAVEL AND GRAVELY SOILS	CLEAN GRAVELS (LESS THAN 5% PASSING THE NO. 200 SIEVE)		GW
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE			GP
		GRAVELS WITH FINES (MORE THAN 15% PASSING THE NO. 200 SIEVE)		GM
				GC
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SANDS (LESS THAN 5% PASSING THE NO. 200 SIEVE)		SW
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE			SP
		SANDS WITH FINES (MORE THAN 15% PASSING THE NO. 200 SIEVE)		SM
				SC
FINE-GRAINED SOILS	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50	SILT OR CLAY (<15% RETAINED THE NO. 200 SIEVE)		ML
		SILT OR CLAY WITH SAND OR GRAVEL (15% TO 30% RETAINED THE NO. 200 SIEVE)		CL
		SANDY OR GRAVELY SILT OR CLAY (>30% RETAINED THE NO. 200 SIEVE)		OL
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50	SILT OR CLAY (<15% RETAINED THE NO. 200 SIEVE)		MH
		SILT OR CLAY WITH SAND OR GRAVEL (15% TO 30% RETAINED THE NO. 200 SIEVE)		CH
		SANDY OR GRAVELY SILT OR CLAY (>30% RETAINED THE NO. 200 SIEVE)		OH
HIGHLY ORGANIC SOILS				PT

NOTE: DUAL SYMBOLS ARE USED TO INDICATE COARSE-GRAINED SOILS CONTAINING AN ESTIMATED 10% FINES BY VISUAL CLASSIFICATION OR WHEN THE SOIL HAS BETWEEN 5 AND 12 PERCENT FINES FROM LABORATORY TESTS; AND FOR FINE-GRAINED SOILS WHEN THE PLOT OF LIQUID LIMIT & PLASTICITY INDEX VALUES FALLS IN THE PLASTICITY CHART'S CROSSHATCHED AREA. RESULTS OF LABORATORY TESTING ARE USED TO SUPPLEMENT THE CLASSIFICATION OF THE SOILS BASED ON THE VISUAL-MANUAL PROCEDURES OF ASTM D2488.

ADDITIONAL TERMINOLOGY AND GRAPHIC SYMBOLS

	DESCRIPTION		GRAPHIC SYMBOLS
ADDITIONAL DESIGNATION	TOPSOIL		
	MAN-MADE FILL		
	GLACIAL TILL		
	COBBLES AND BOULDERS		
RESIDUAL SOIL DESIGNATION	DESCRIPTION	"N" VALUE	
	HIGHLY WEATHERED ROCK	50 TO 50/1"	
	PARTIALLY WEATHERED ROCK	MORE THAN 50 BLOWS FOR 1" PENETRATION, AUGER PENETRABLE	

COARSE-GRAINED SOILS
(GRAVEL AND SAND)

DESIGNATION	BLOWS PER FOOT (BPF) "N"
VERY LOOSE	0 - 4
LOOSE	5 - 10
MEDIUM DENSE	11 - 30
DENSE	31 - 50
VERY DENSE	>50

NOTE: "N" VALUE DETERMINED AS PER ASTM D1586

FINE-GRAINED SOILS
(SILT AND CLAY)

CONSISTENCY	BPF "N"
VERY SOFT	<2
SOFT	2 - 4
MEDIUM STIFF	5 - 8
STIFF	9 - 15
VERY STIFF	16 - 30
HARD	>30

NOTE: ADDITIONAL DESIGNATIONS TO ADVANCE SAMPLER INDICATED IN BLOW COUNT COLUMN:
WOH = WEIGHT OF HAMMER
WOR = WEIGHT OF ROD(S)

SAMPLE TYPE

DESIGNATION	SYMBOL
SPLIT-SPOON	S-
SHELBY TUBE	U-
ROCK CORE	R-

WATER DESIGNATION

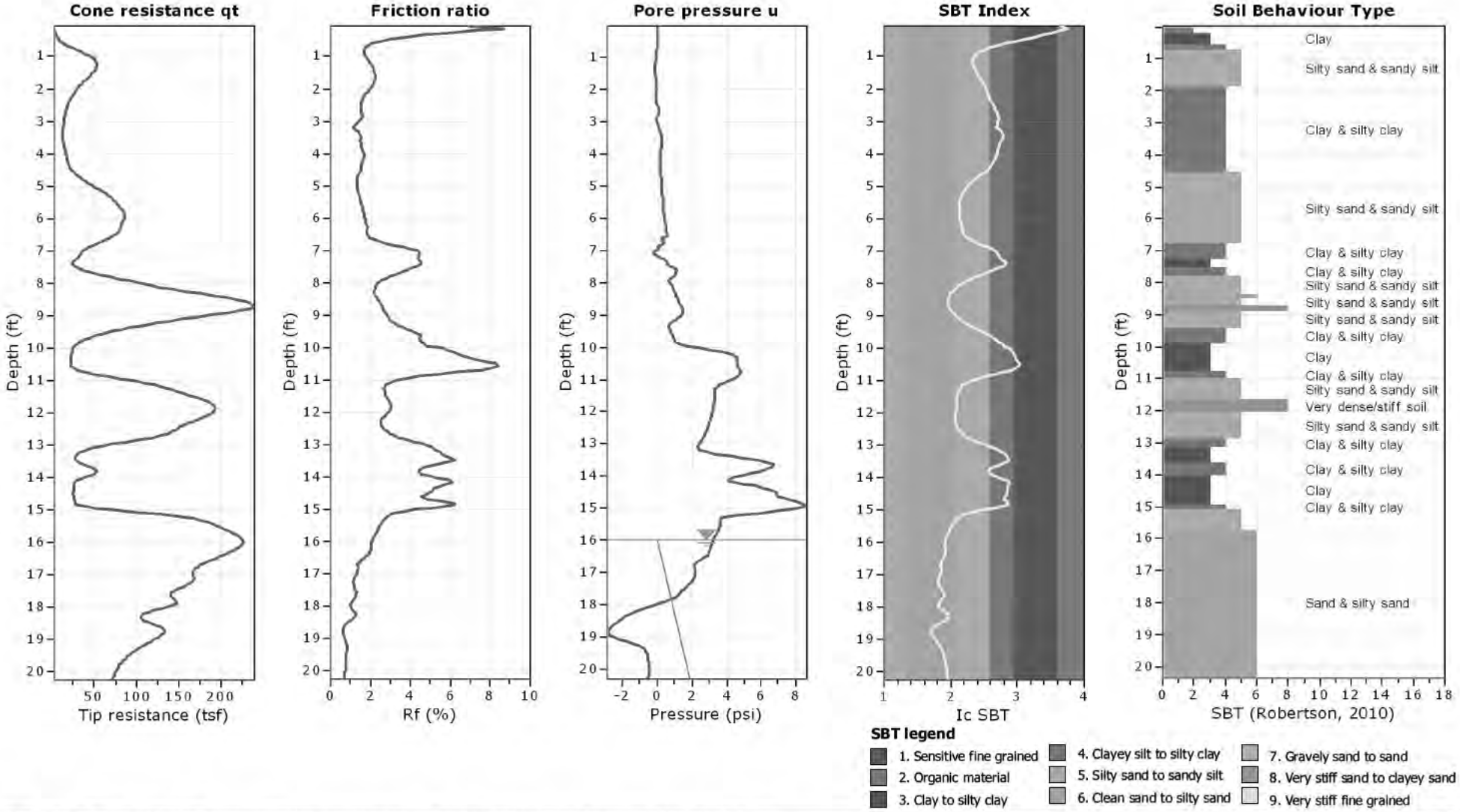
DESCRIPTION	SYMBOL
ENCOUNTERED DURING DRILLING	▽
UPON COMPLETION OF DRILLING	▼
24 HOURS AFTER COMPLETION	⧩

NOTE: WATER OBSERVATIONS WERE MADE AT THE TIME INDICATED. POROSITY OF SOIL STRATA, WEATHER CONDITIONS, SITE TOPOGRAPHY, ETC. MAY CAUSE WATER LEVEL CHANGES.

Geo-Technology Associates, Inc.
18 Boulden Circle, Suite 36
New Castle, Delaware
(302) 326-2100 Fax (302) 326-2399

Project: **Laurel Elementary School**
Location: **Sussex County, Delaware**

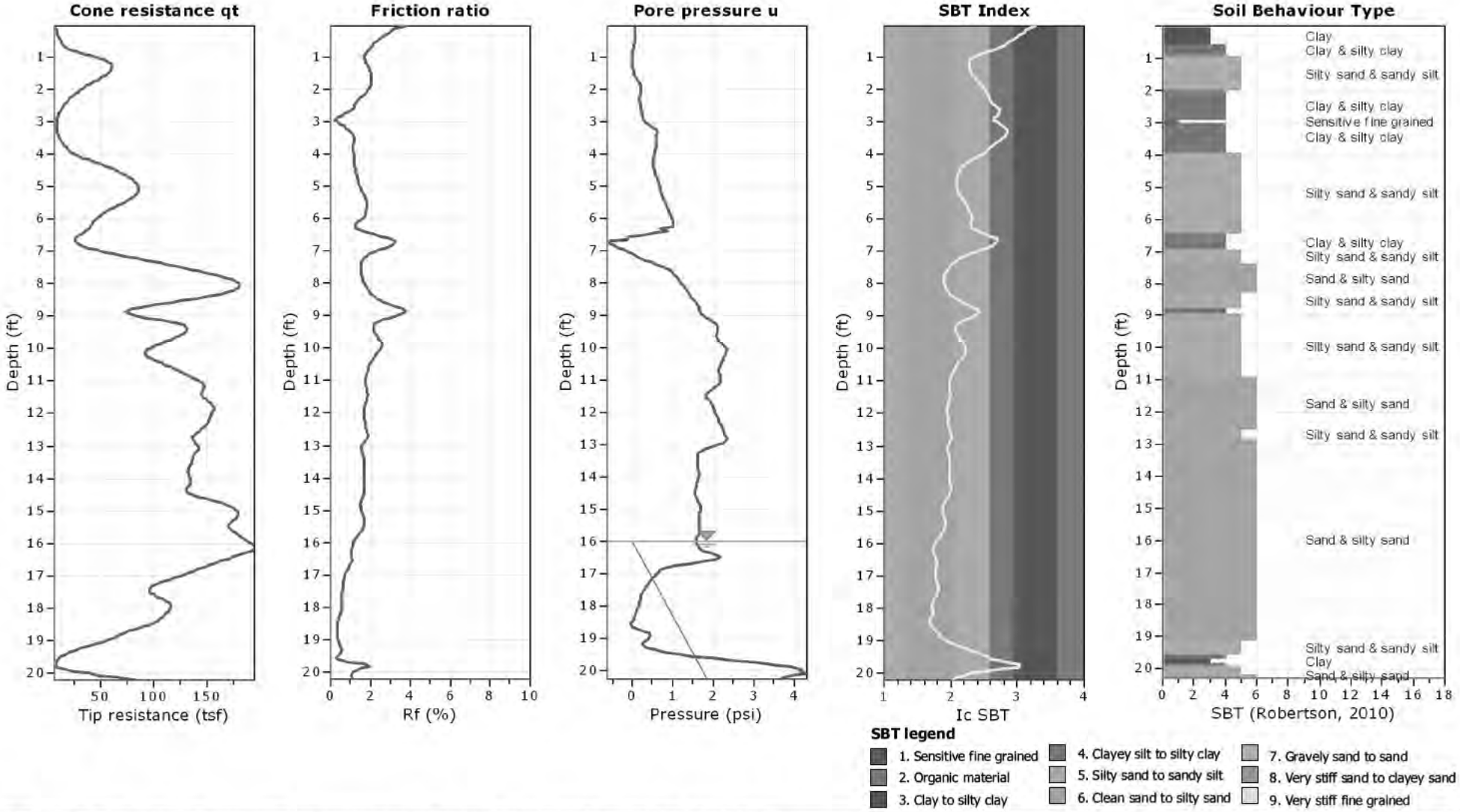
CPT: B-1
Total depth: 20.28 ft, Date: 12/7/2014
Surface Elevation: 25.00 ft
Cone Type: Hogentogler
Cone Operator: K. Kozak



Geo-Technology Associates, Inc.
18 Boulden Circle, Suite 36
New Castle, Delaware
(302) 326-2100 Fax (302) 326-2399

Project: **Laurel Elementary School**
Location: **Sussex County, Delaware**

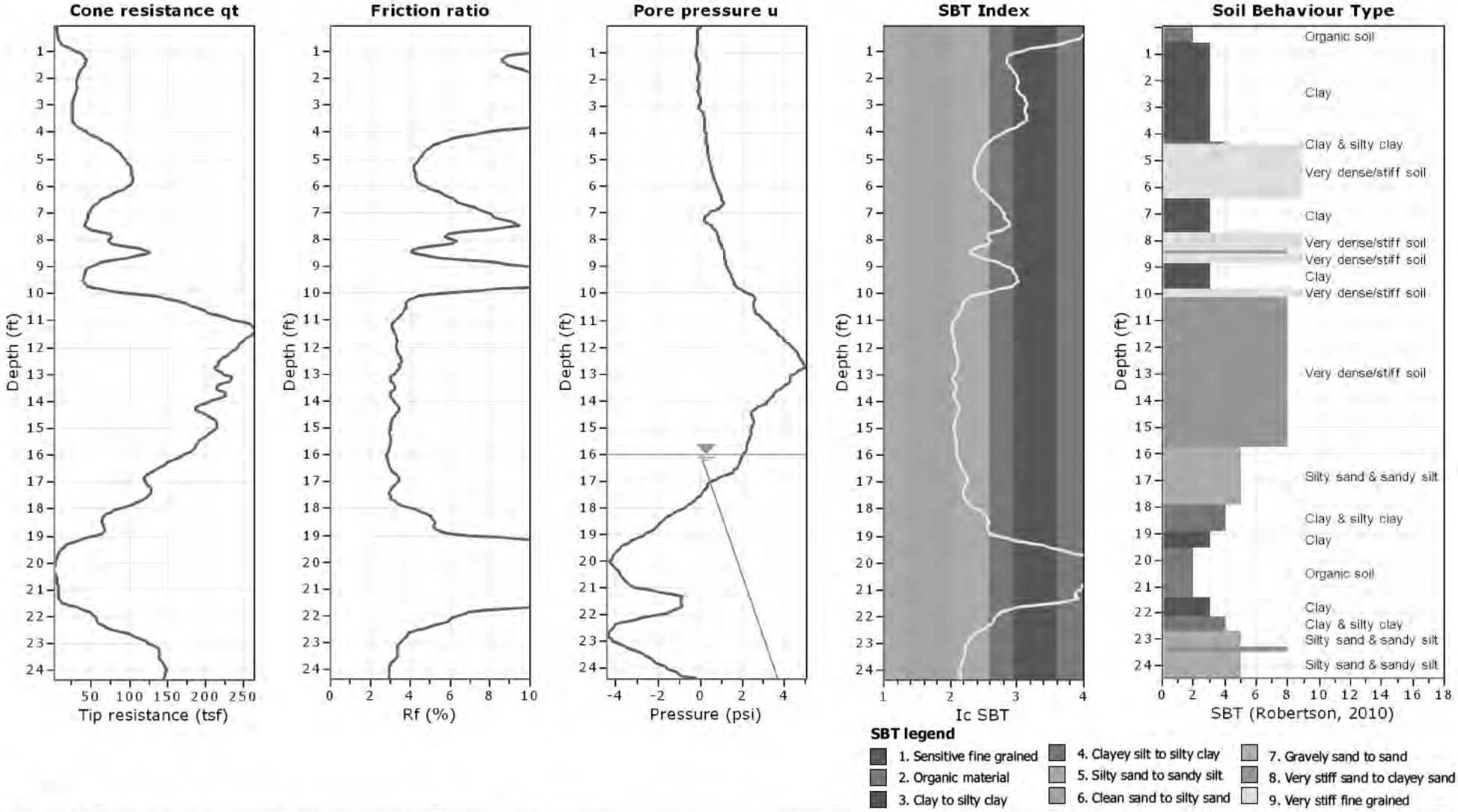
CPT: B-2
Total depth: 20.21 ft, Date: 12/7/2014
Surface Elevation: 25.00 ft
Cone Type: Hogentogler
Cone Operator: K. Kozak



Geo-Technology Associates, Inc.
18 Boulden Circle, Suite 36
New Castle, Delaware
(302) 326-2100 Fax (302) 326-2399

CPT: B-3
Total depth: 24.34 ft, Date: 12/7/2014
Surface Elevation: 25.00 ft
Cone Type: Hogentogler
Cone Operator: K. Kozak

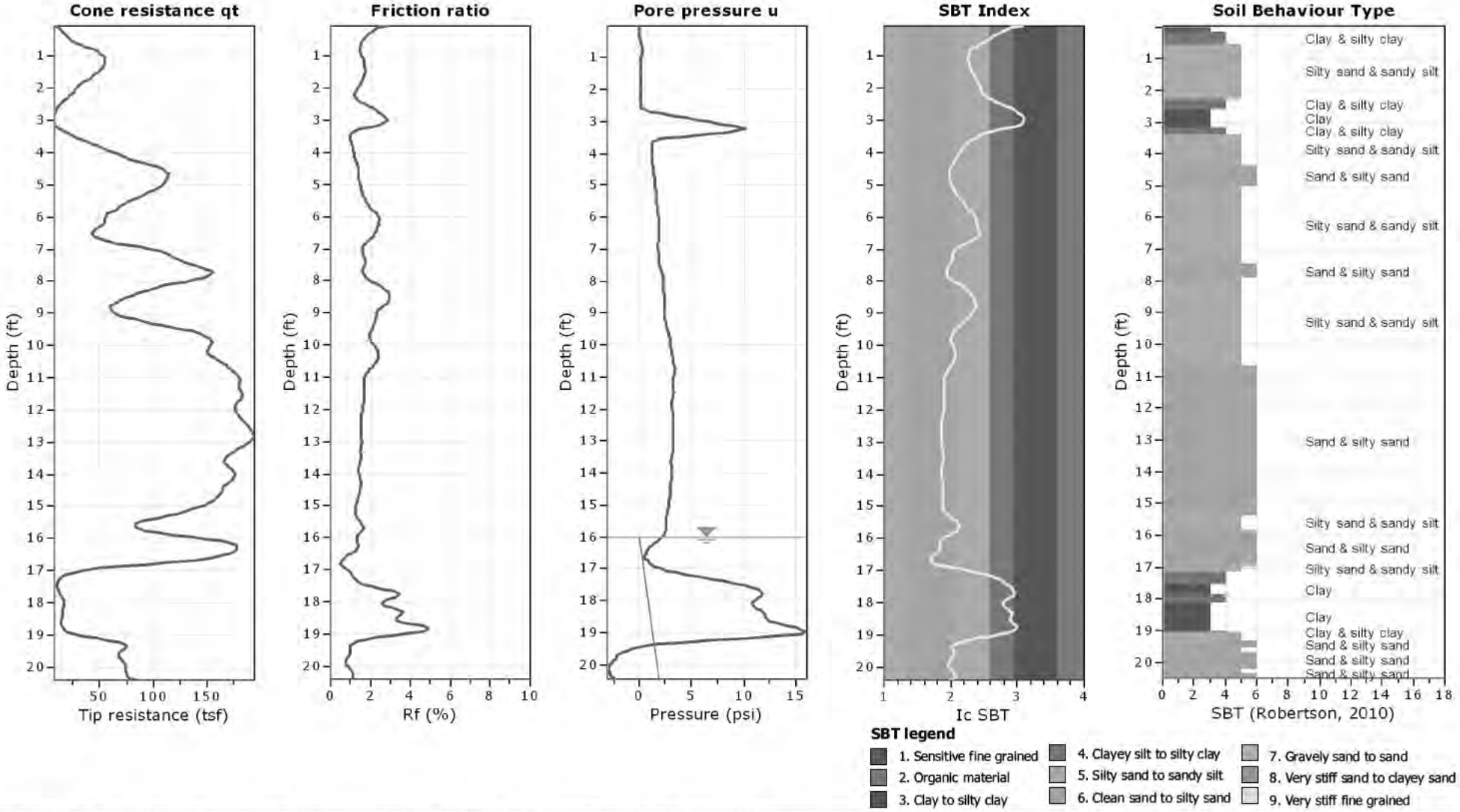
Project: **Laurel Elementary School**
Location: **Sussex County, Delaware**



Geo-Technology Associates, Inc.
18 Boulden Circle, Suite 36
New Castle, Delaware
(302) 326-2100 Fax (302) 326-2399

Project: Laurel Elementary School
Location: Sussex County, Delaware

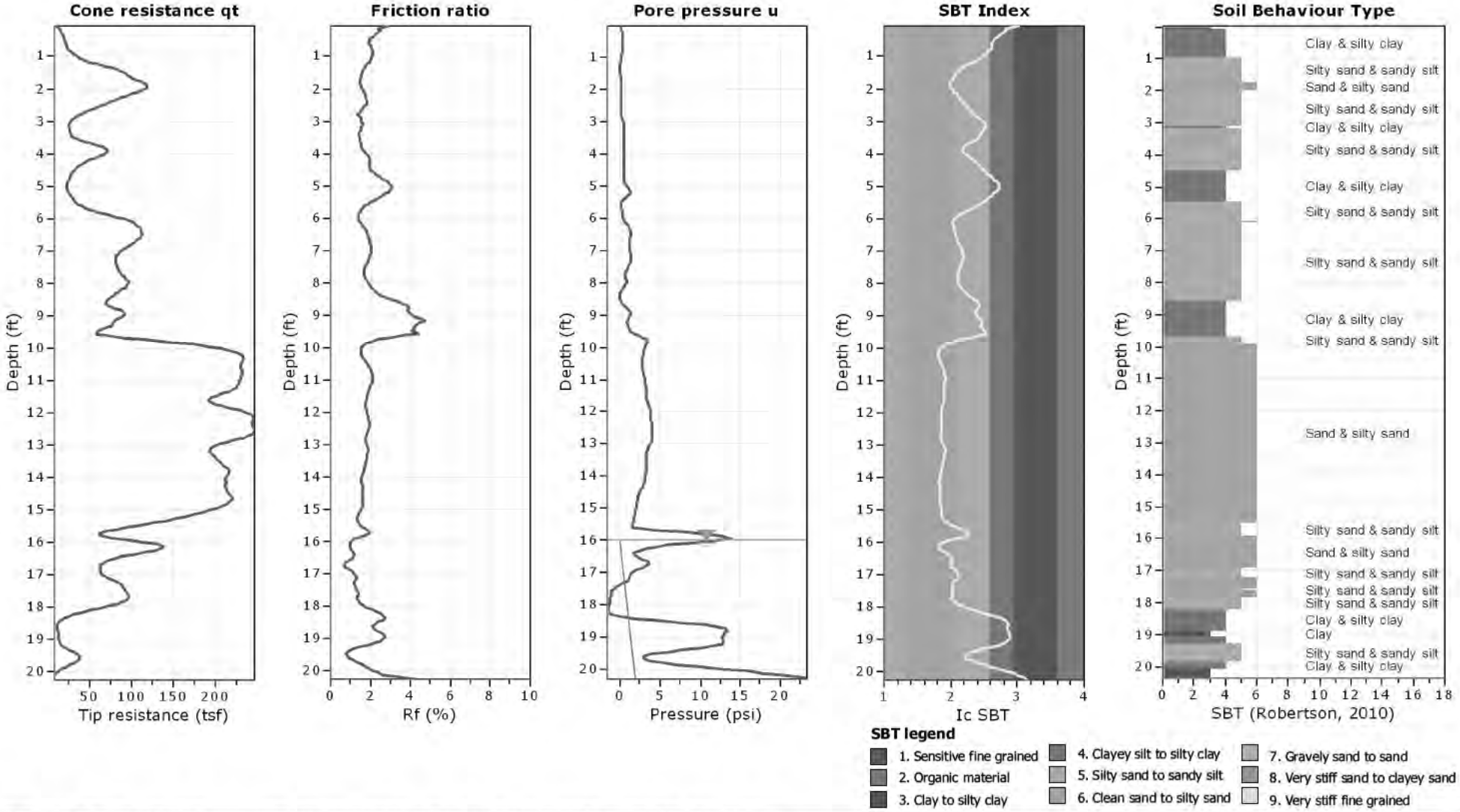
CPT: B-4
Total depth: 20.41 ft, Date: 12/7/2014
Surface Elevation: 25.00 ft
Cone Type: Hogentogler
Cone Operator: K. Kozak



Geo-Technology Associates, Inc.
18 Boulden Circle, Suite 36
New Castle, Delaware
(302) 326-2100 Fax (302) 326-2399

Project: **Laurel Elementary School**
Location: **Sussex County, Delaware**

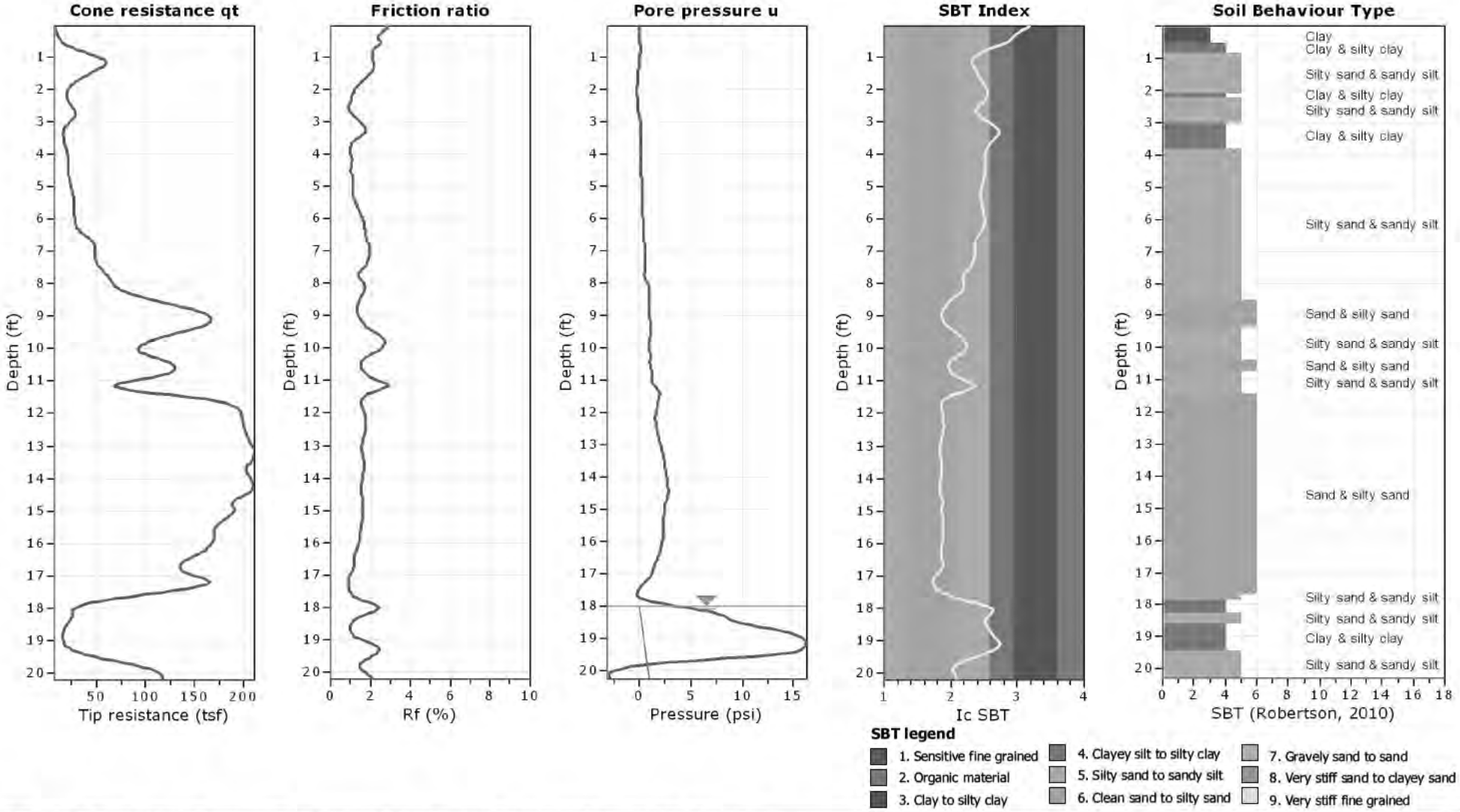
CPT: B-5
Total depth: 20.28 ft, Date: 12/7/2014
Surface Elevation: 25.00 ft
Cone Type: Hogentogler
Cone Operator: K. Kozak



Geo-Technology Associates, Inc.
18 Boulden Circle, Suite 36
New Castle, Delaware
(302) 326-2100 Fax (302) 326-2399

Project: **Laurel Elementary School**
Location: **Sussex County, Delaware**

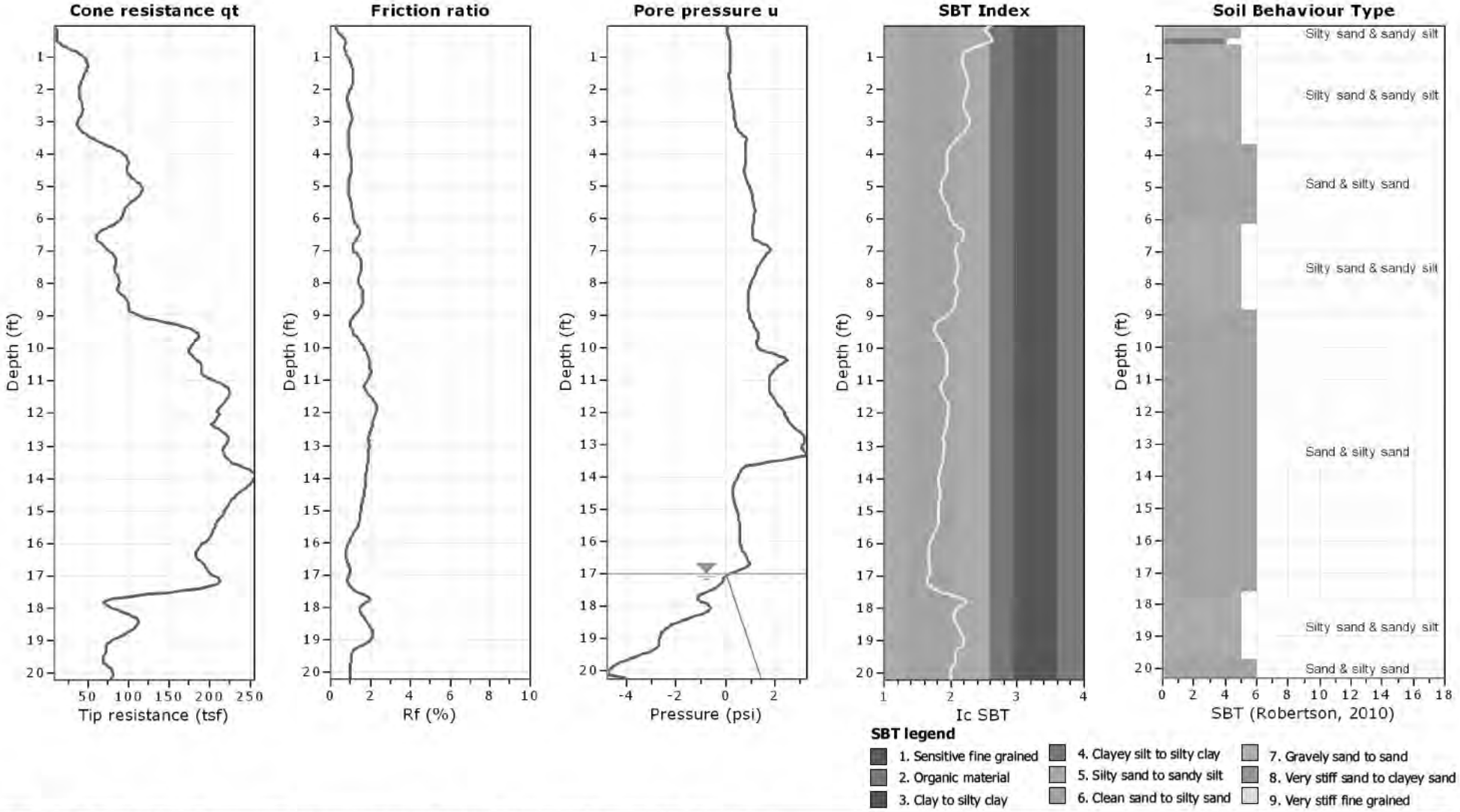
CPT: B-6
Total depth: 20.21 ft, Date: 12/7/2014
Surface Elevation: 26.00 ft
Cone Type: Hogentogler
Cone Operator: K. Kozak



Geo-Technology Associates, Inc.
18 Boulden Circle, Suite 36
New Castle, Delaware
(302) 326-2100 Fax (302) 326-2399

Project: **Laurel Elementary School**
Location: **Sussex County, Delaware**

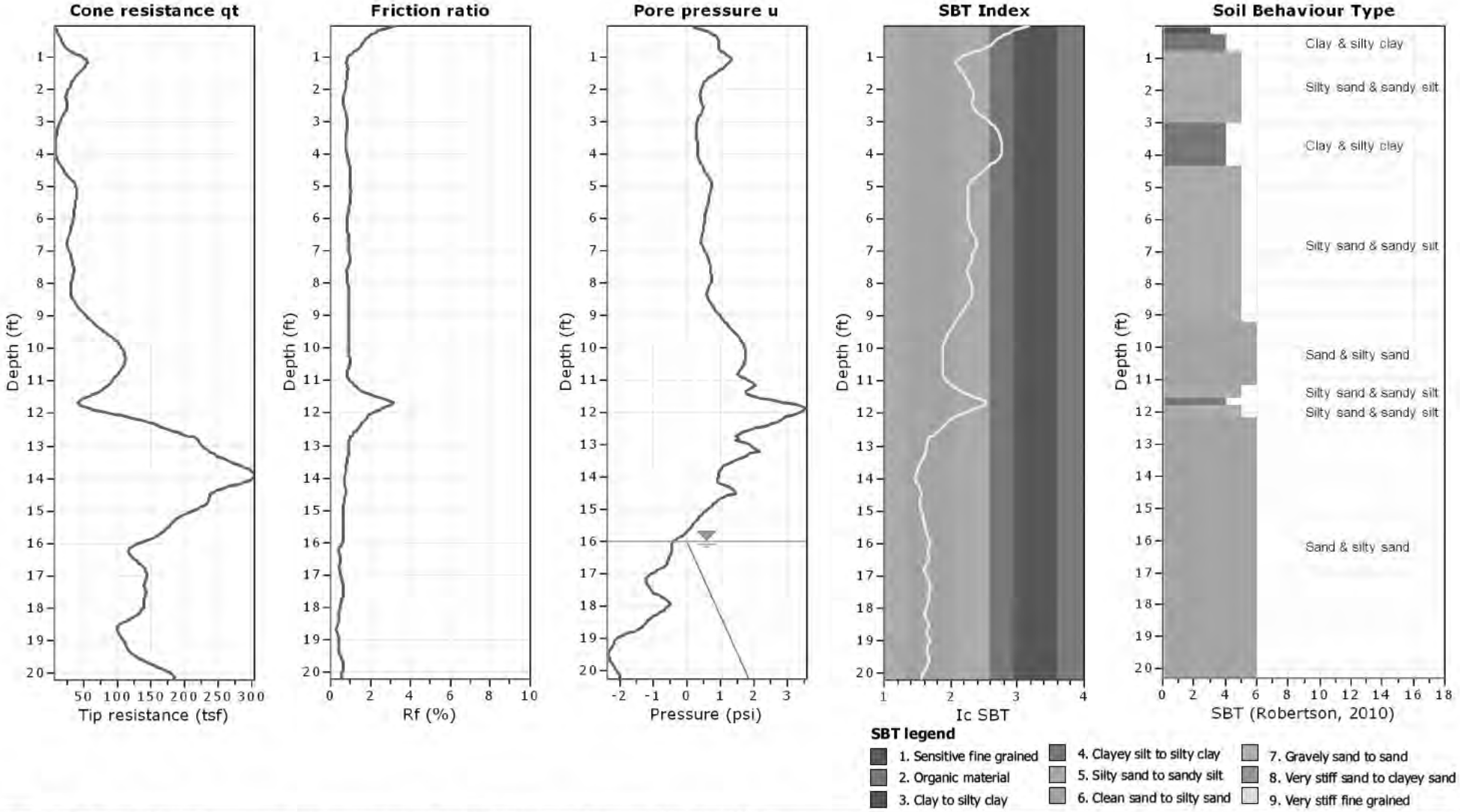
CPT: B-7
Total depth: 20.21 ft, Date: 12/7/2014
Surface Elevation: 25.00 ft
Cone Type: Hogentogler
Cone Operator: K. Kozak



Geo-Technology Associates, Inc.
18 Boulden Circle, Suite 36
New Castle, Delaware
(302) 326-2100 Fax (302) 326-2399

Project: **Laurel Elementary School**
Location: **Sussex County, Delaware**

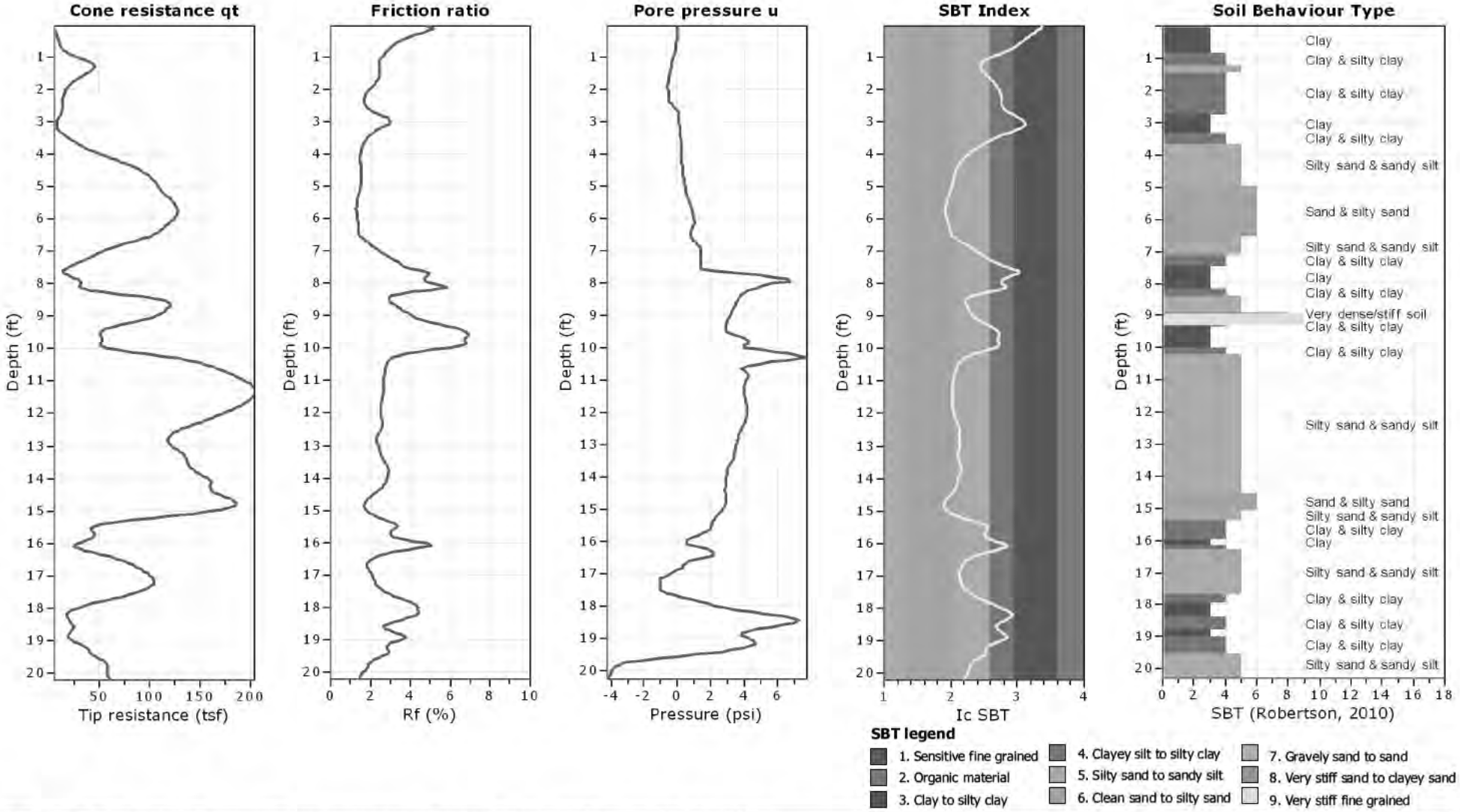
CPT: B-8
Total depth: 20.21 ft, Date: 12/7/2014
Surface Elevation: 25.00 ft
Cone Type: Hogentogler
Cone Operator: K. Kozak



Geo-Technology Associates, Inc.
18 Boulden Circle, Suite 36
New Castle, Delaware
(302) 326-2100 Fax (302) 326-2399

Project: **Laurel Elementary School**
Location: **Sussex County, Delaware**

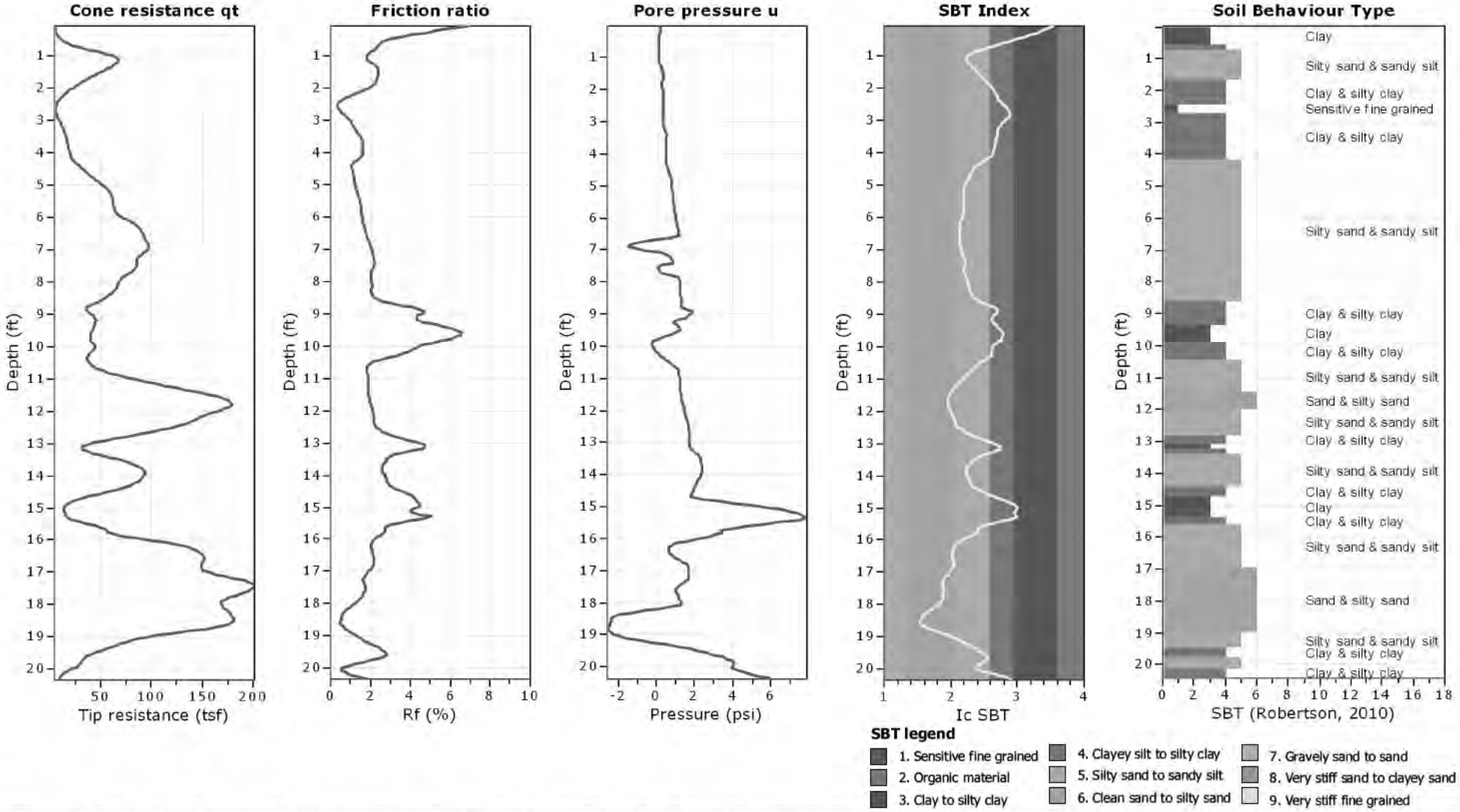
CPT: B-9
Total depth: 20.21 ft, Date: 12/7/2014
Surface Elevation: 26.00 ft
Cone Type: Hogentogler
Cone Operator: K. Kozak



Geo-Technology Associates, Inc.
18 Boulden Circle, Suite 36
New Castle, Delaware
(302) 326-2100 Fax (302) 326-2399

Project: **Laurel Elementary School**
Location: **Sussex County, Delaware**

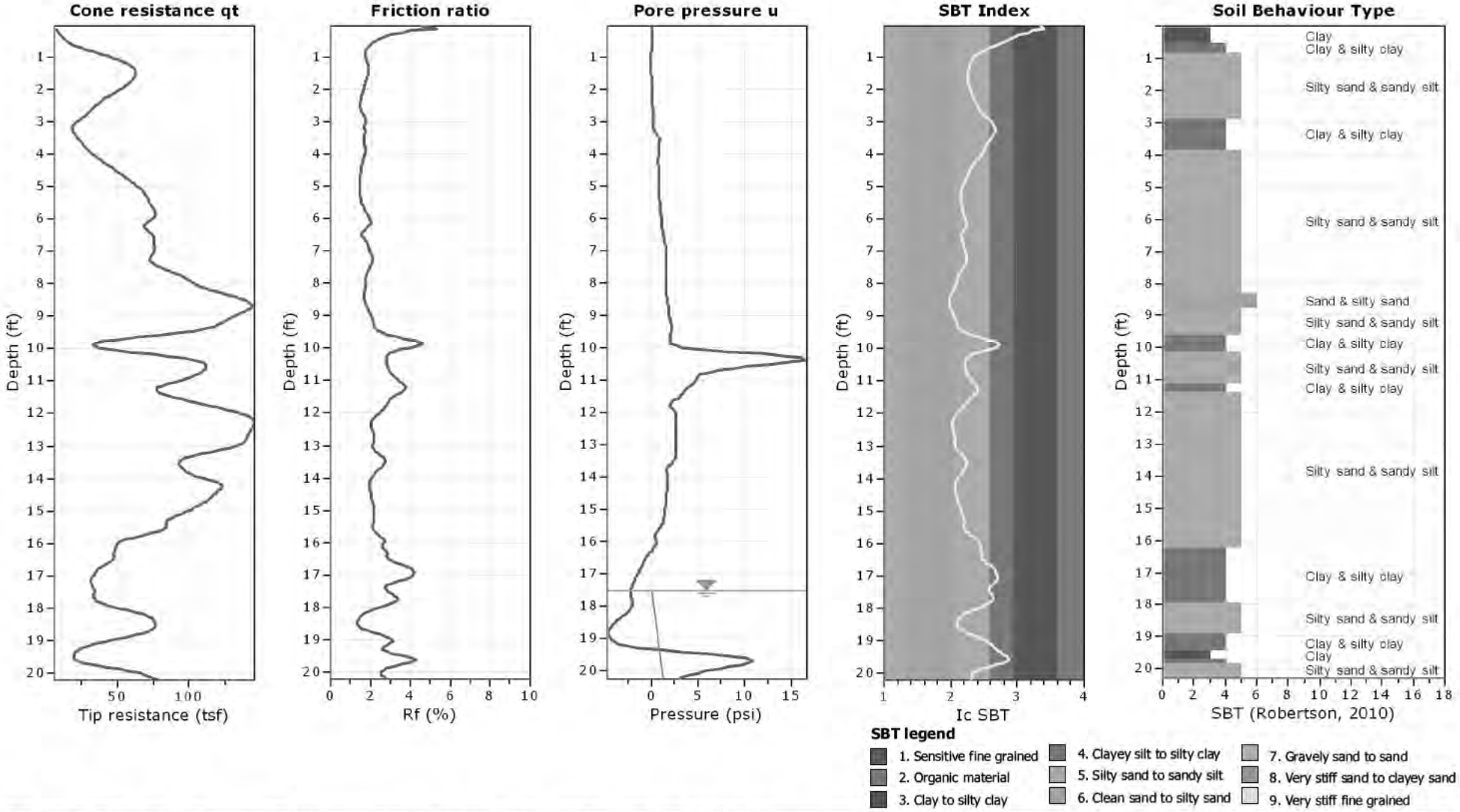
CPT: B-10
Total depth: 20.34 ft, Date: 12/7/2014
Surface Elevation: 26.00 ft
Cone Type: Hogentogler
Cone Operator: K. Kozak



Geo-Technology Associates, Inc.
18 Boulden Circle, Suite 36
New Castle, Delaware
(302) 326-2100 Fax (302) 326-2399

Project: **Laurel Elementary School**
Location: **Sussex County, Delaware**

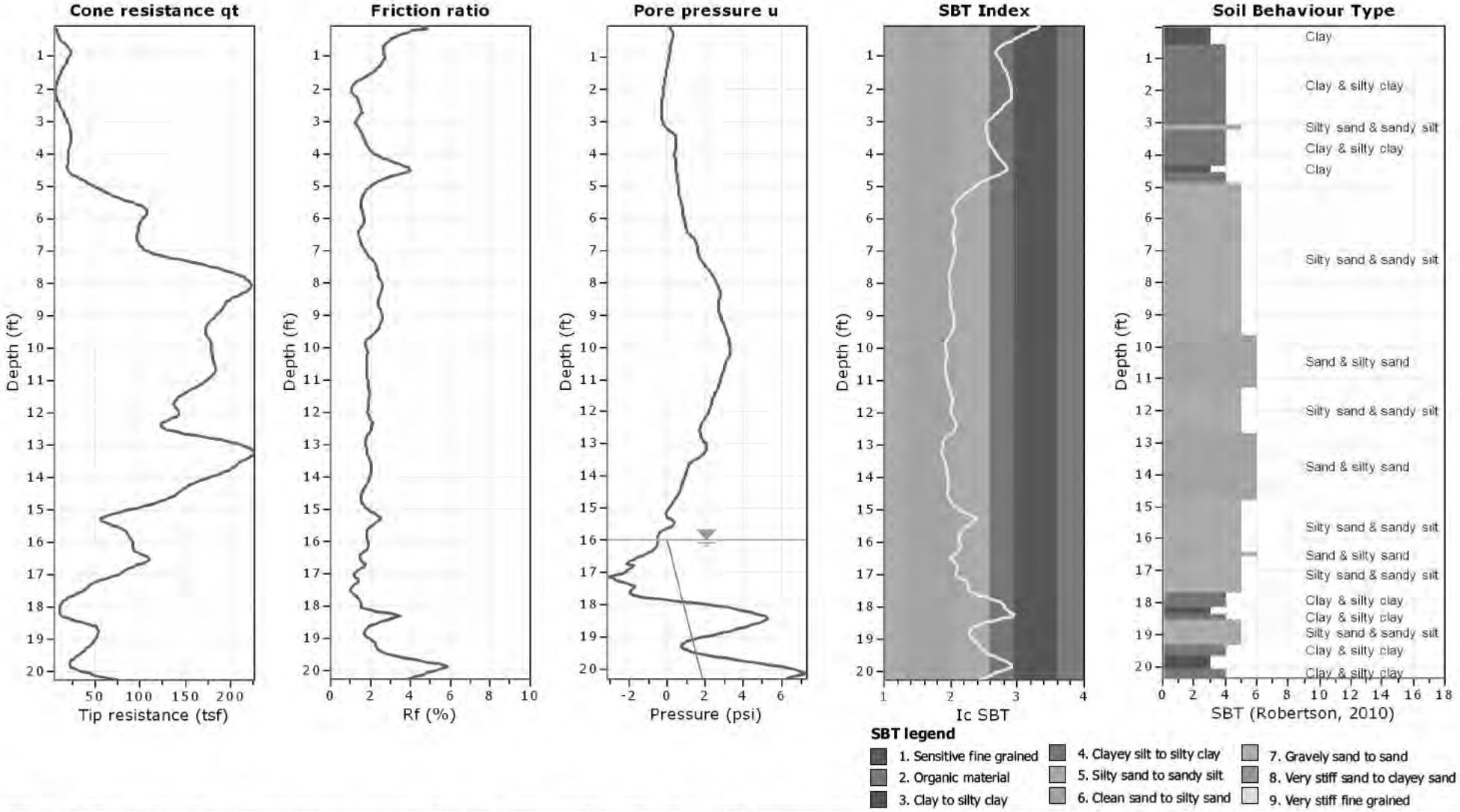
CPT: B-11
Total depth: 20.21 ft, Date: 12/7/2014
Surface Elevation: 25.00 ft
Cone Type: Hogentogler
Cone Operator: K. Kozak



Geo-Technology Associates, Inc.
18 Boulden Circle, Suite 36
New Castle, Delaware
(302) 326-2100 Fax (302) 326-2399

Project: **Laurel Elementary School**
Location: **Sussex County, Delaware**

CPT: B-12
Total depth: 20.28 ft, Date: 12/7/2014
Surface Elevation: 24.00 ft
Cone Type: Hogentogler
Cone Operator: K. Kozak



LOG OF BORING NO. I-1

PROJECT: **Laurel Elementary School**
PROJECT NO.: **142126**
PROJECT LOCATION: **Sussex County, Delaware**

WATER LEVEL (ft): Dry | BOC |
DATE: 12/6/14 | 12/6/2014 |
CAVED (ft): 5.5 | |

DATE STARTED: **12/06/2014**
DATE COMPLETED: **12/06/2014**
DRILLING CONTRACTOR: **GTA**
DRILLER: **D. Hans Jr.**
DRILLING METHOD: **Split Spoon**
SAMPLING METHOD: **Hollow Stem Auger**

WATER ENCOUNTERED DURING DRILLING (ft) **Dry**
GROUND SURFACE ELEVATION: **26**
DATUM: **Topo**
EQUIPMENT: **ATV CME550X**
LOGGED BY: **E. Rabe**
CHECKED BY: **M. Lester**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
					26.0	0			Topsoil +/- 7 inches	
S-1	0.0	17	1-1-2-2	3	25.4		SM		Brown, moist, very loose, Silty SAND	
S-2	2.0	19	2-2-2-2	4		2			Same	
S-3	4.0	17	2-1-2-2	3		4			Same	
S-4	6.0	21	1-2-7-8	9	20.0	6	SC		Brown and gray, moist, loose, Clayey SAND	
S-5	8.0	24	7-9-10-8	19	18.0	8	SM		Brown and gray, moist, medium dense, Silty SAND	
					16.0	10			Boring terminated at 10.0 feet.	

NOTES: **Elevation and location should be considered approximate.**

GEO-TECHNOLOGY ASSOCIATES, INC.
18 Boulden Circle, Suite 36
New Castle, DE 19720

LOG OF BORING NO. I-1

LOG OF BORING NO. I-2

PROJECT: **Laurel Elementary School**
PROJECT NO.: **142126**
PROJECT LOCATION: **Sussex County, Delaware**

WATER LEVEL (ft): Dry | BOC |
DATE: 12/6/14 | 12/6/2014 |
CAVED (ft): 5.1 | |

DATE STARTED: **12/06/2014**
DATE COMPLETED: **12/06/2014**
DRILLING CONTRACTOR: **GTA**
DRILLER: **D. Hans Jr.**
DRILLING METHOD: **Split Spoon**
SAMPLING METHOD: **Hollow Stem Auger**

WATER ENCOUNTERED DURING DRILLING (ft) **Dry**
GROUND SURFACE ELEVATION: **25**
DATUM: **Topo**
EQUIPMENT: **ATV CME550X**
LOGGED BY: **E. Rabe**
CHECKED BY: **M. Lester**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
					25.0	0			Topsoil +/- 6 inches	
S-1	0.0	18	2-3-5-5	8	24.5		SM		Gray, moist, loose, Silty SAND	
S-2	2.0	16	2-3-3-4	6	23.0	2	SC		Brown, moist, loose, Clayey SAND	
S-3	4.0	16	1-5-6-7	11	21.0	4	SM		Brown, moist, medium dense, Silty SAND	
S-4	6.0	19	4-3-4-4	7		6			Same, loose	
S-5	8.0	18	3-2-3-8	5	17.0	8	SC		Gray, moist, loose, Clayey SAND	
					15.0	10			Boring terminated at 10.0 feet.	

NOTES: **Elevation and location should be considered approximate.**

GEO-TECHNOLOGY ASSOCIATES, INC.
18 Boulden Circle, Suite 36
New Castle, DE 19720

LOG OF BORING NO. I-2

LOG OF BORING NO. I-3

PROJECT: **Laurel Elementary School**
PROJECT NO.: **142126**
PROJECT LOCATION: **Sussex County, Delaware**

WATER LEVEL (ft): Dry | BOC |
DATE: 12/6/14 | 12/6/2014 |
CAVED (ft): 6.0 | |

DATE STARTED: **12/06/2014**
DATE COMPLETED: **12/06/2014**
DRILLING CONTRACTOR: **GTA**
DRILLER: **D. Hans Jr.**
DRILLING METHOD: **Split Spoon**
SAMPLING METHOD: **Hollow Stem Auger**

WATER ENCOUNTERED DURING DRILLING (ft) **Dry**
GROUND SURFACE ELEVATION: **25**
DATUM: **Topo**
EQUIPMENT: **ATV CME550X**
LOGGED BY: **E. Rabe**
CHECKED BY: **M. Lester**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
					25.0	0			Topsoil +/- 5 inches	
					24.6		SM		Brown, moist, loose, Silty SAND	
S-1	0.0	18	2-3-2-2	5		2			Same, very loose	
S-2	2.0	19	2-2-2-2	4		4			Same	
S-3	4.0	14	2-2-3-3	5		6			Same	
S-4	6.0	16	2-3-7-8	10		8			Gray, moist, medium dense, Silty SAND	
S-5	8.0	16	7-9-12-14	21						
					15.0	10			Boring terminated at 10.0 feet.	

NOTES: **Elevation and location should be considered approximate.**

GEO-TECHNOLOGY ASSOCIATES, INC.
18 Boulden Circle, Suite 36
New Castle, DE 19720

LOG OF BORING NO. I-3

LOG OF BORING NO. I-4

PROJECT: **Laurel Elementary School**
PROJECT NO.: **142126**
PROJECT LOCATION: **Sussex County, Delaware**

WATER LEVEL (ft): Dry | BOC |
DATE: 12/6/14 | 12/6/2014 |
CAVED (ft): 5.5 | |

DATE STARTED: **12/06/2014**
DATE COMPLETED: **12/06/2014**
DRILLING CONTRACTOR: **GTA**
DRILLER: **D. Hans Jr.**
DRILLING METHOD: **Split Spoon**
SAMPLING METHOD: **Hollow Stem Auger**

WATER ENCOUNTERED DURING DRILLING (ft) **Dry**
GROUND SURFACE ELEVATION: **25**
DATUM: **Topo**
EQUIPMENT: **ATV CME550X**
LOGGED BY: **E. Rabe**
CHECKED BY: **M. Lester**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
						0				
					24.7				Asphalt +/- 4 inches	
S-1	0.0	15	6-6-5	11			SM		Brown, moist, medium dense, Silty SAND	
						2				
S-2	2.0	17	3-2-2-3	4					Same, very loose	
						4				
S-3	4.0	16	2-2-2-3	4					Same, very loose	
						6				
S-4	6.0	15	3-3-3-4	6					Same, loose	
						8				
S-5	8.0	18	3-4-8-5	12					Same	
					15.0	10			Boring terminated at 10.0 feet.	

NOTES: **Elevation and location should be considered approximate.**

GEO-TECHNOLOGY ASSOCIATES, INC.
18 Boulden Circle, Suite 36
New Castle, DE 19720

LOG OF BORING NO. I-4

LOG OF BORING NO. I-5

PROJECT: **Laurel Elementary School**
PROJECT NO.: **142126**
PROJECT LOCATION: **Sussex County, Delaware**

WATER LEVEL (ft): Dry | BOC |
DATE: 12/6/14 | 12/6/2014 |
CAVED (ft): 4.0 | |

DATE STARTED: **12/06/2014**
DATE COMPLETED: **12/06/2014**
DRILLING CONTRACTOR: **GTA**
DRILLER: **D. Hans Jr.**
DRILLING METHOD: **Split Spoon**
SAMPLING METHOD: **Hollow Stem Auger**

WATER ENCOUNTERED DURING DRILLING (ft) **Dry**
GROUND SURFACE ELEVATION: **25**
DATUM: **Topo**
EQUIPMENT: **ATV CME550X**
LOGGED BY: **E. Rabe**
CHECKED BY: **M. Lester**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
					24.8	0			Asphalt +/- 3 inches	
S-1	0.0	12	4-4-4	8			SM		Brown, moist, loose, Silty SAND	
						2			Same	
S-2	2.0	16	4-3-3-2	6						
						4			Same, medium dense	
S-3	4.0	19	3-6-7-8	13						
						6			Same, medium dense	
S-4	6.0	16	5-7-7-8	14						
						8			Same, medium dense	
S-5	8.0	16	7-8-7-6	15						
					15.0	10			Boring terminated at 10.0 feet.	

NOTES: **Elevation and location should be considered approximate.**

GEO-TECHNOLOGY ASSOCIATES, INC.
18 Boulden Circle, Suite 36
New Castle, DE 19720

LOG OF BORING NO. I-5

LOG OF BORING NO. I-6

PROJECT: **Laurel Elementary School**
PROJECT NO.: **142126**
PROJECT LOCATION: **Sussex County, Delaware**

WATER LEVEL (ft): Dry | Dry |
DATE: 12/6/14 | 12/6/2014 |
CAVED (ft): 3.8 | |

DATE STARTED: **12/06/2014**
DATE COMPLETED: **12/06/2014**
DRILLING CONTRACTOR: **GTA**
DRILLER: **D. Hans Jr.**
DRILLING METHOD: **Split Spoon**
SAMPLING METHOD: **Hollow Stem Auger**

WATER ENCOUNTERED DURING DRILLING (ft) **Dry**
GROUND SURFACE ELEVATION: **25**
DATUM: **Topo**
EQUIPMENT: **ATV CME550X**
LOGGED BY: **E. Rabe**
CHECKED BY: **M. Lester**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
					24.8	0			Asphalt +/- 3 inches	
S-1	0.0	16	5-8-7	15			SM		Brown, moist, medium dense, Silty SAND	
S-2	2.0	16	4-4-3-3	7		2			Same, loose	
S-3	4.0	15	2-3-6-7	9	21.0	4	SP-SM		Tan, moist, loose, Poorly-graded SAND with Silt	
S-4	6.0	20	5-6-5-7	11		6			Same, medium dense	
S-5	8.0	18	6-7-8-10	15		8			Same, medium dense	
					15.0	10			Boring terminated at 10.0 feet.	

NOTES: **Elevation and location should be considered approximate.**

GEO-TECHNOLOGY ASSOCIATES, INC.
18 Boulden Circle, Suite 36
New Castle, DE 19720

LOG OF BORING NO. I-6

LOG OF BORING NO. I-7

PROJECT: **Laurel Elementary School**
PROJECT NO.: **142126**
PROJECT LOCATION: **Sussex County, Delaware**

WATER LEVEL (ft): Dry | BOC |
DATE: 12/6/14 | 12/6/2014 |
CAVED (ft): 4.5 | |

DATE STARTED: **12/06/2014**
DATE COMPLETED: **12/06/2014**
DRILLING CONTRACTOR: **GTA**
DRILLER: **D. Hans Jr.**
DRILLING METHOD: **Split Spoon**
SAMPLING METHOD: **Hollow Stem Auger**

WATER ENCOUNTERED DURING DRILLING (ft) **Dry**
GROUND SURFACE ELEVATION: **24**
DATUM: **Topo**
EQUIPMENT: **ATV CME550X**
LOGGED BY: **E. Rabe**
CHECKED BY: **M. Lester**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
					24.0	0			Topsoil +/- 6 inches	
					23.5		SM		Brown, moist, loose, Silty SAND	
S-1	0.0	20	2-2-6-4	8		2			Same	
S-2	2.0	12	2-3-2-3	5		4			Same	
S-3	4.0	15	2-2-3-5	5		6			Same, medium dense	
S-4	6.0	18	5-7-7-7	14		8			Same, medium dense	
S-5	8.0	20	5-6-9-10	15						
					14.0	10			Boring terminated at 10.0 feet.	

NOTES: **Elevation and location should be considered approximate.**

GEO-TECHNOLOGY ASSOCIATES, INC.
18 Boulden Circle, Suite 36
New Castle, DE 19720

LOG OF BORING NO. I-7

LOG OF BORING NO. I-8

PROJECT: **Laurel Elementary School**
PROJECT NO.: **142126**
PROJECT LOCATION: **Sussex County, Delaware**

WATER LEVEL (ft): Dry | BOC |
DATE: 12/6/14 | 12/6/2014 |
CAVED (ft): 8.5 | |

DATE STARTED: **12/06/2014**
DATE COMPLETED: **12/06/2014**
DRILLING CONTRACTOR: **GTA**
DRILLER: **D. Hans Jr.**
DRILLING METHOD: **Split Spoon**
SAMPLING METHOD: **Hollow Stem Auger**

WATER ENCOUNTERED DURING DRILLING (ft) **Dry**
GROUND SURFACE ELEVATION: **22**
DATUM: **Topo**
EQUIPMENT: **ATV CME550x**
LOGGED BY: **E. Rabe**
CHECKED BY: **M. Lester**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
					22.0	0			Topsoil +/- 6 inches	
					21.5		SM		Dark gray, moist, loose, Silty SAND	
S-1	0.0	20	1-2-3-5	5		2			Same, brown and tan	
S-2	2.0	15	3-5-4-4	9		4			Same, brown and tan	
S-3	4.0	14	2-3-2-2	5		6			Same, brown and tan	
S-4	6.0	16	2-3-3-4	6		8			Brown and tan, wet, loose, Silty SAND	
S-5	8.0	16	4-4-5-5	9						
					12.0	10			Boring terminated at 10.0 feet.	

NOTES: **Elevation and location should be considered approximate.**

GEO-TECHNOLOGY ASSOCIATES, INC.
18 Boulden Circle, Suite 36
New Castle, DE 19720

LOG OF BORING NO. I-8

LOG OF BORING NO. S-1

PROJECT: **Laurel Elementary School**
PROJECT NO.: **142126**
PROJECT LOCATION: **Sussex County, Delaware**

WATER LEVEL (ft): Dry | BOC |
DATE: 12/6/14 | 12/6/14 |
CAVED (ft): 4.5 | |

DATE STARTED: **12/06/2014**
DATE COMPLETED: **12/06/2014**
DRILLING CONTRACTOR: **GTA**
DRILLER: **D. Hans Jr.**
DRILLING METHOD: **Split Spoon**
SAMPLING METHOD: **Hollow Stem Auger**

WATER ENCOUNTERED DURING DRILLING (ft) **Dry**
GROUND SURFACE ELEVATION: **27**
DATUM: **Topo**
EQUIPMENT: **ATV CME550X**
LOGGED BY: **E. Rabe**
CHECKED BY: **M. Lester**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
					27.0	0			Topsoil +/- 6 inches	
S-1	0.0	20	1-2-2-3	4	26.5		SM		Brown and tan, moist, very loose, Silty SAND	
S-2	2.0	20	1-1-2-2	3		2			Same	
S-3	4.0	16	2-3-4-5	7		4			Same, loose	
					21.0	6			Boring terminated at 6.0 feet.	
						8				
						10				

NOTES: **Elevation and location should be considered approximate.**

GEO-TECHNOLOGY ASSOCIATES, INC.
18 Boulden Circle, Suite 36
New Castle, DE 19720

LOG OF BORING NO. S-1

LOG OF BORING NO. S-2

PROJECT: **Laurel Elementary School**
PROJECT NO.: **142126**
PROJECT LOCATION: **Sussex County, Delaware**

WATER LEVEL (ft): Dry | BOC |
DATE: 12/6/14 | 12/6/2014 |
CAVED (ft): 5.0 | |

DATE STARTED: **12/06/2014**
DATE COMPLETED: **12/06/2014**
DRILLING CONTRACTOR: **GTA**
DRILLER: **D. Hans Jr.**
DRILLING METHOD: **Split Spoon**
SAMPLING METHOD: **Hollow Stem Auger**

WATER ENCOUNTERED DURING DRILLING (ft) **Dry**
GROUND SURFACE ELEVATION: **25**
DATUM: **Topo**
EQUIPMENT: **ATV CME550X**
LOGGED BY: **E. Rabe**
CHECKED BY: **M. Lester**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
					25.0	0			Topsoil +/- 6 inches	
					24.5					
S-1	0.0	20	1-2-5-6	7			SM		Brown, moist, very loose, Silty SAND	
						2			Same, tan	
S-2	2.0	16	6-4-3-2	7						
						4			Same	
S-3	4.0	17	5-4-3-3	7						
					19.0	6			Boring terminated at 6.0 feet.	
						8				
						10				

NOTES: **Elevation and location should be considered approximate.**

GEO-TECHNOLOGY ASSOCIATES, INC.
18 Boulden Circle, Suite 36
New Castle, DE 19720

LOG OF BORING NO. S-2

LOG OF BORING NO. S-3

PROJECT: **Laurel Elementary School**
PROJECT NO.: **142126**
PROJECT LOCATION: **Sussex County, Delaware**

WATER LEVEL (ft): Dry | BOC |
DATE: 12/6/14 | 12/6/201 |
CAVED (ft): 4.8 | |

DATE STARTED: **12/06/2014**
DATE COMPLETED: **12/06/2014**
DRILLING CONTRACTOR: **GTA**
DRILLER: **D. Hans Jr.**
DRILLING METHOD: **Split Spoon**
SAMPLING METHOD: **Hollow Stem Auger**

WATER ENCOUNTERED DURING DRILLING (ft) **Dry**
GROUND SURFACE ELEVATION: **25**
DATUM: **Topo**
EQUIPMENT: **ATV CME550X**
LOGGED BY: **E. Rabe**
CHECKED BY: **M. Lester**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
					25.0	0			Topsoil +/- 6 inches	
S-1	0.0	18	1-2-3-4	5	24.5		SM		Brown, moist, loose, Silty SAND	
S-2	2.0	14	2-2-2-2	4		2			Brown and tan, moist, very loose, Silty SAND	
S-3	4.0	20	4-5-5-7	10		4			Brown, moist, loose, Silty SAND	
					19.0	6			Boring terminated at 6.0 feet.	
						8				
						10				

NOTES: **Elevation and location should be considered approximate.**

GEO-TECHNOLOGY ASSOCIATES, INC.
18 Boulden Circle, Suite 36
New Castle, DE 19720

LOG OF BORING NO. S-3

LOG OF BORING NO. S-4

PROJECT: **Laurel Elementary School**
PROJECT NO.: **142126**
PROJECT LOCATION: **Sussex County, Delaware**

WATER LEVEL (ft): Dry | BOC |
DATE: 12/6/14 | 12/6/2014 |
CAVED (ft): 3.0 | |

DATE STARTED: **12/06/2014**
DATE COMPLETED: **12/06/2014**
DRILLING CONTRACTOR: **GTA**
DRILLER: **D. Hans Jr.**
DRILLING METHOD: **Split Spoon**
SAMPLING METHOD: **Hollow Stem Auger**

WATER ENCOUNTERED DURING DRILLING (ft) **Dry**
GROUND SURFACE ELEVATION: **24**
DATUM: **Topo**
EQUIPMENT: **ATV CME550X**
LOGGED BY: **E. Rabe**
CHECKED BY: **M. Lester**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
					24.0	0			Topsoil +/- 5 inches	
S-1	0.0	20	1-2-4-5	6	23.6		SC		Gray, moist, loose, Clayey SAND, contains gravel	
					22.0	2	SM		Brown and tan, moist, loose, Silty SAND	
S-2	2.0	14	3-5-5-4	10						
						4			Same	
S-3	4.0	18	4-3-6-6	9						
					18.0	6			Boring terminated at 6.0 feet.	
						8				
						10				

NOTES: **Elevation and location should be considered approximate.**

GEO-TECHNOLOGY ASSOCIATES, INC.
18 Boulden Circle, Suite 36
New Castle, DE 19720

LOG OF BORING NO. S-4

LOG OF BORING NO. S-5

PROJECT: **Laurel Elementary School**
PROJECT NO.: **142126**
PROJECT LOCATION: **Sussex County, Delaware**

WATER LEVEL (ft): Dry | BOC |
DATE: 12/6/14 | 12/6/2014 |
CAVED (ft): 5.0 | |

DATE STARTED: **12/06/2014**
DATE COMPLETED: **12/06/2014**
DRILLING CONTRACTOR: **GTA**
DRILLER: **D. Hans Jr.**
DRILLING METHOD: **Split Spoon**
SAMPLING METHOD: **Hollow Stem Auger**

WATER ENCOUNTERED DURING DRILLING (ft) **Dry**
GROUND SURFACE ELEVATION: **24**
DATUM: **Topo**
EQUIPMENT: **ATV CME550X**
LOGGED BY: **E. Rabe**
CHECKED BY: **M. Lester**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
					24.0	0			Topsoil +/- 6 inches	
					23.5					
S-1	0.0	18	3-5-7-6	12			SM		Brown, moist, medium dense, Silty SAND	
						2			Same, very loose	
S-2	2.0	16	2-2-2-2	4						
						4			Same, very loose	
S-3	4.0	14	2-2-2-3	4						
					18.0	6			Boring terminated at 6.0 feet.	
						8				
						10				

NOTES: **Elevation and location should be considered approximate.**

GEO-TECHNOLOGY ASSOCIATES, INC.
18 Boulden Circle, Suite 36
New Castle, DE 19720

LOG OF BORING NO. S-5

LOG OF BORING NO. S-6

PROJECT: **Laurel Elementary School**
PROJECT NO.: **142126**
PROJECT LOCATION: **Sussex County, Delaware**

WATER LEVEL (ft): Dry | BOC |
DATE: 12/6/14 | 12/6/2014 |
CAVED (ft): 5.0 | |

DATE STARTED: **12/06/2014**
DATE COMPLETED: **12/06/2014**
DRILLING CONTRACTOR: **GTA**
DRILLER: **D. Hans Jr.**
DRILLING METHOD: **Split Spoon**
SAMPLING METHOD: **Hollow Stem Auger**

WATER ENCOUNTERED DURING DRILLING (ft): **Dry**
GROUND SURFACE ELEVATION: **27**
DATUM: **Topo**
EQUIPMENT: **ATV CME550X**
LOGGED BY: **E. Rabe**
CHECKED BY: **M. Lester**

SAMPLE NUMBER	SAMPLE DEPTH (ft.)	SAMPLE RECOVERY (in.)	SAMPLE BLOWS/6 inches	N (blows/ft.)	ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
					27.0	0			Topsoil +/- 4 inches	
S-1	0.0	20	1-3-4-3	7	26.7		SM		Gray and brown, moist, loose, Silty SAND	
						2			Same, very loose	
S-2	2.0	18	1-2-2-2	4						
						4			Same, very loose	
S-3	4.0	15	1-2-2-2	4						
					21.0	6			Boring terminated at 6.0 feet.	
						8				
						10				

NOTES: **Elevation and location should be considered approximate.**

GEO-TECHNOLOGY ASSOCIATES, INC.
18 Boulden Circle, Suite 36
New Castle, DE 19720

LOG OF BORING NO. S-6

LOG OF AUGER PROBE NO. HA-1

PROJECT: **Laurel Elementary School**
PROJECT LOCATION: **Sussex County, Delaware**
CLIENT: **Laurel School District**

PROJECT NO.: **142126**

DATE STARTED: **12/12/2014**
DATE COMPLETED: **12/12/2014**
CONTRACTOR: **GTA**

GROUNDWATER ENCOUNTERED: **Dry**
GROUND SURFACE ELEVATION: **26**
DATUM: **Topo**
LOGGED BY: **M. Antonio**
CHECKED BY: **M. Lester**

ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
	0			Topsoil +/- 10 inches	
25.2		SM		Tan, moist, Silty SAND	
	2				
23.8		SC		Brown, moist, Clayey SAND	
23.3		SM		Orange, moist, Silty SAND	
	4				
	6			Tan and orange, mottled, moist, Silty SAND	
19.0				Hand Auger terminated at 7.0 feet.	
	8				
	10				
	12				

NOTES: **Elevation and location should be considered approximate.**

GEO-TECHNOLOGY ASSOCIATES, INC.
18 Boulden Circle, Suite 36
New Castle, DE 19720

LOG OF AUGER PROBE NO. HA-1

LOG OF AUGER PROBE NO. HA-2

PROJECT: **Laurel Elementary School**
PROJECT LOCATION: **Sussex County, Delaware**
CLIENT: **Laurel School District**

PROJECT NO.: **142126**

DATE STARTED: **12/12/2014**
DATE COMPLETED: **12/12/2014**
CONTRACTOR: **GTA**

GROUNDWATER ENCOUNTERED: **Dry**
GROUND SURFACE ELEVATION: **27**
DATUM: **Topo**
LOGGED BY: **M. Antonio**
CHECKED BY: **M. Lester**

ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
	0			Topsoil +/- 12 inches	
26.0	2	SM		Brown, moist, Silty SAND	
24.5		SC		Brown, moist, Clayey SAND	
23.3	4	SM		Brown and tan, moist, Silty SAND	
20.0	6			Hand Auger terminated at 7.0 feet.	
	8				
	10				
	12				

NOTES: **Elevation and location should be considered approximate.**

GEO-TECHNOLOGY ASSOCIATES, INC.
18 Boulden Circle, Suite 36
New Castle, DE 19720

LOG OF AUGER PROBE NO. HA-2

LOG OF AUGER PROBE NO. HA-3

PROJECT: **Laurel Elementary School**
PROJECT LOCATION: **Sussex County, Delaware**
CLIENT: **Laurel School District**

PROJECT NO.: **142126**

DATE STARTED: **12/12/2014**
DATE COMPLETED: **12/12/2014**
CONTRACTOR: **GTA**

GROUNDWATER ENCOUNTERED: **Dry**
GROUND SURFACE ELEVATION: **27**
DATUM: **Topo**
LOGGED BY: **M. Antonio**
CHECKED BY: **M. Lester**

ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
	0			Topsoil +/- 12 inches	
26.0		SM		Tan, moist, Silty SAND	
	2				
	4				
	6				
20.0				Hand Auger terminated at 7.0 feet.	
	8				
	10				
	12				

NOTES: **Elevation and location should be considered approximate.**

GEO-TECHNOLOGY ASSOCIATES, INC.
18 Boulden Circle, Suite 36
New Castle, DE 19720

LOG OF AUGER PROBE NO. HA-3

LOG OF AUGER PROBE NO. HA-4

PROJECT: **Laurel Elementary School**
PROJECT LOCATION: **Sussex County, Delaware**
CLIENT: **Laurel School District**

PROJECT NO.: **142126**

DATE STARTED: **12/12/2014**
DATE COMPLETED: **12/12/2014**
CONTRACTOR: **GTA**

GROUNDWATER ENCOUNTERED: **Dry**
GROUND SURFACE ELEVATION: **26**
DATUM: **Topo**
LOGGED BY: **M. Antonio**
CHECKED BY: **M. Lester**

ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
	0			Topsoil +/- 12 inches	
25.0		SM		Brown, moist, Silty SAND	
	2				
	4				
20.0	6	SC		Tan and brown, mottled, moist, Clayey SAND	
19.0				Hand Auger terminated at 7.0 feet.	
	8				
	10				
	12				

NOTES: **Elevation and location should be considered approximate.**

GEO-TECHNOLOGY ASSOCIATES, INC.
18 Boulden Circle, Suite 36
New Castle, DE 19720

LOG OF AUGER PROBE NO. HA-4

LOG OF AUGER PROBE NO. HA-5

PROJECT: **Laurel Elementary School**
PROJECT LOCATION: **Sussex County, Delaware**
CLIENT: **Laurel School District**

PROJECT NO.: **142126**

DATE STARTED: **12/12/2014**
DATE COMPLETED: **12/12/2014**
CONTRACTOR: **GTA**

GROUNDWATER ENCOUNTERED: **Dry**
GROUND SURFACE ELEVATION: **26**
DATUM: **Topo**
LOGGED BY: **M. Antonio**
CHECKED BY: **M. Lester**

ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
	0			Topsoil +/- 10 inches	
25.2		SM		Brown, moist, Silty SAND	
	2				
	4			Brown and tan, moist, Silty SAND	
	6				
19.3		SC		Brown, moist, Clayey SAND	
19.0				Hand Auger terminated at 7.0 feet.	
	8				
	10				
	12				

NOTES: **Elevation and location should be considered approximate.**

GEO-TECHNOLOGY ASSOCIATES, INC.
18 Boulden Circle, Suite 36
New Castle, DE 19720

LOG OF AUGER PROBE NO. HA-5

LOG OF AUGER PROBE NO. HA-6

PROJECT: **Laurel Elementary School**
PROJECT LOCATION: **Sussex County, Delaware**
CLIENT: **Laurel School District**

PROJECT NO.: **142126**

DATE STARTED: **12/12/2014**
DATE COMPLETED: **12/12/2014**
CONTRACTOR: **GTA**

GROUNDWATER ENCOUNTERED: **Dry**
GROUND SURFACE ELEVATION: **24**
DATUM: **Topo**
LOGGED BY: **M. Antonio**
CHECKED BY: **M. Lester**

ELEVATION (ft.)	DEPTH (ft.)	USCS	GRAPHIC SYMBOL	DESCRIPTION	REMARKS
	0			Topsoil +/- 8 inches	
23.3		SM		Brown, moist, Silty SAND	
22.0	2	SC		Brown, moist, Clayey SAND	
21.0		SM		Tan, moist, Silty SAND	
	4				
	6				
17.0				Hand Auger terminated at 7.0 feet.	
	8				
	10				
	12				

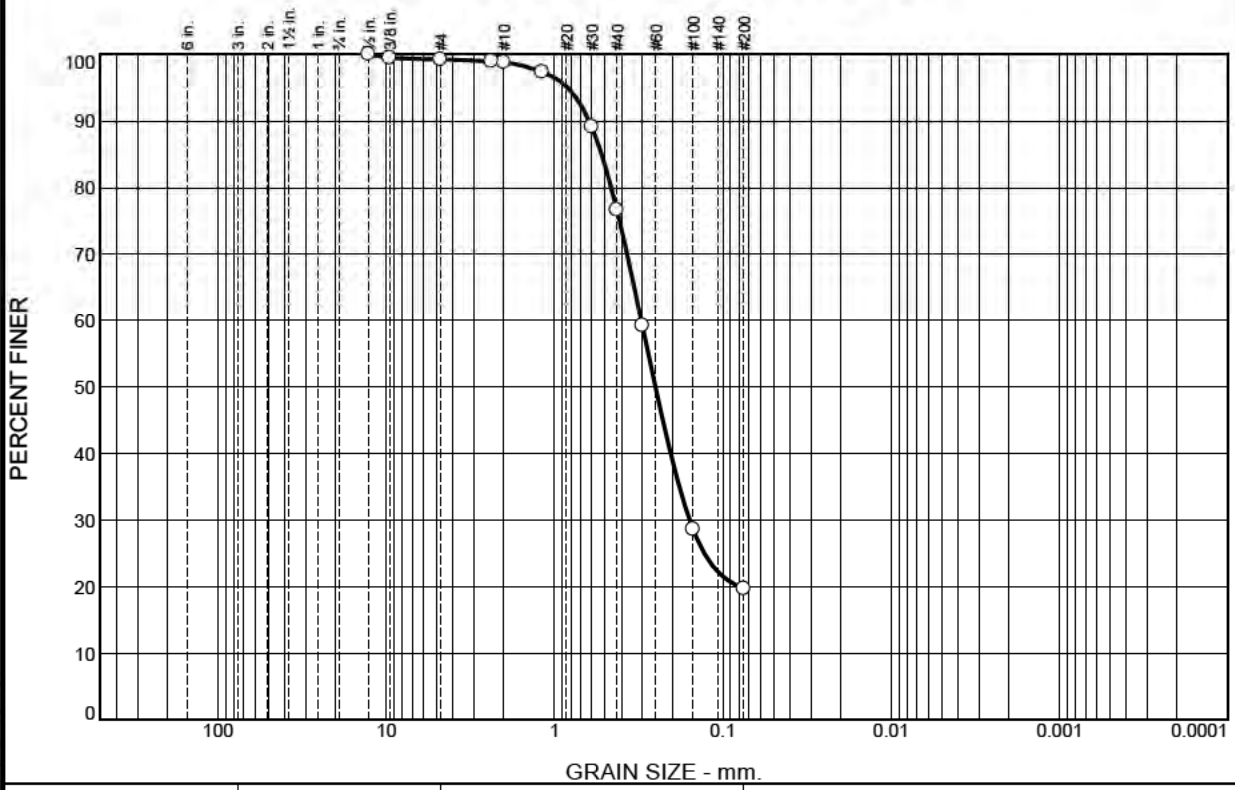
NOTES: **Elevation and location should be considered approximate.**

GEO-TECHNOLOGY ASSOCIATES, INC.
18 Boulden Circle, Suite 36
New Castle, DE 19720

LOG OF AUGER PROBE NO. HA-6

APPENDIX C

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.8	0.4	22.1	57.0	19.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
5	100.0		
.375	99.4		
#4	99.2		
#8	98.9		
#10	98.8		
#16	97.3		
#30	89.1		
#40	76.7		
#50	59.2		
#100	28.6		
#200	19.7		

* (no specification provided)

Soil Description

Brown, moist, Silty SAND

Atterberg Limits

PL= NP LL= NP PI= NP NM= 9.6

Coefficients

D_{90}= 0.6214 D_{85}= 0.5242 D_{60}= 0.3045
D_{50}= 0.2510 D_{30}= 0.1870 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= SM AASHTO= A-2-4(0)

Remarks

Source of Sample: B-1 & B-4 Composite **Depth:** 0-5.0

Date: 12/8/2014

GEO-TECHNOLOGY ASSOCIATES, INC.
18 Boulden Circle, Suite 36
New Castle, DE 19720

Client: Laurel School District
Project: Laurel Elementary School

Project No: 142126 **Figure** 3

ASTM Specifications performed may include D421, D422, D2216, D2217 and D4318.

Tested By: J. Barnes **Checked By:** M. Lester

MOISTURE DENSITY RELATIONSHIP TEST REPORT
ASTM D 698 Method B Standard

Project No.: 142126 **Date:** 12/8/2014

Project: Laurel Elementary School

Client: Laurel School District

Source of Sample: B-1 & B-4 Composite **Depth:** 0-5.0

Remarks:

MATERIAL DESCRIPTION

Description: Brown, moist, Silty SAND

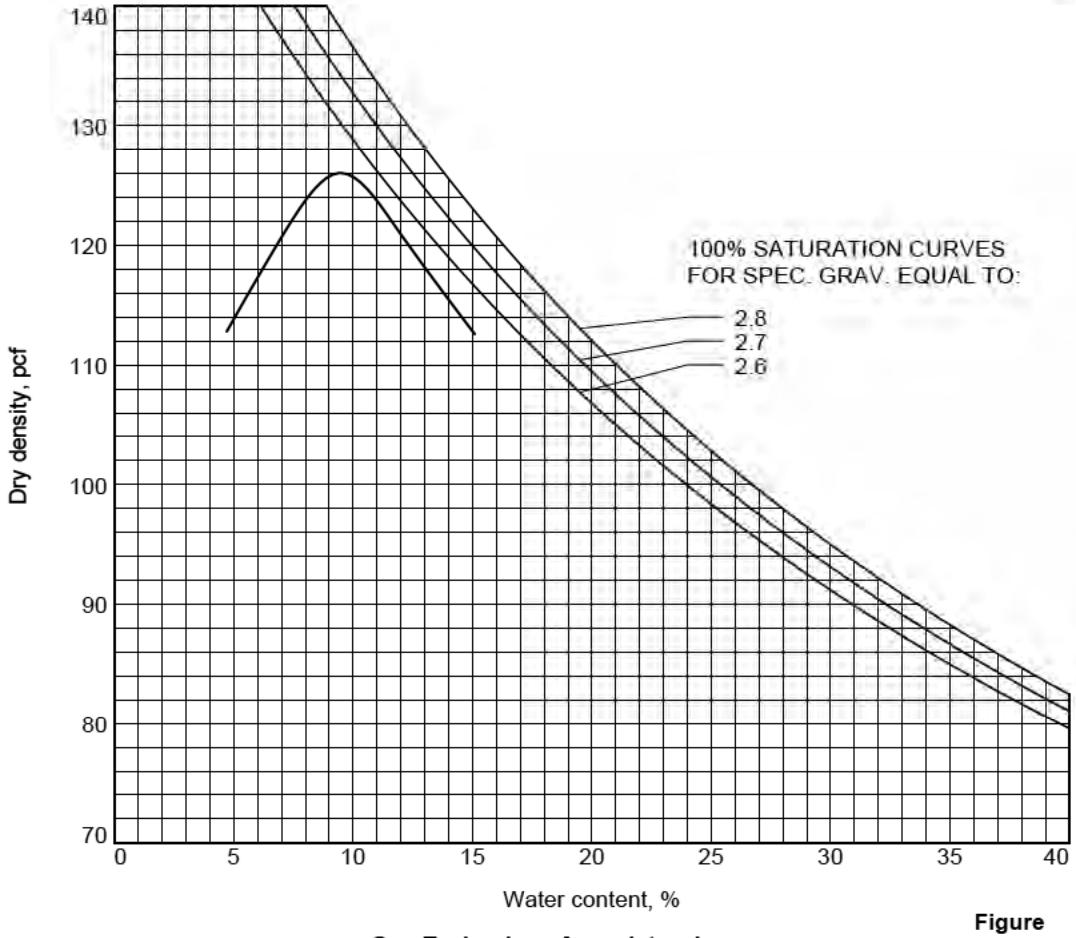
Classifications - **USCS:** SM **AASHTO:** A-2-4(0)

Nat. Moist. = 9.6 % **Sp.G. =** 2.6

Liquid Limit = NP **Plasticity Index =** NP

% < No.200 = 19.7 %

TEST RESULTS
Maximum dry density = 126.1 pcf
Optimum moisture = 9.5 %



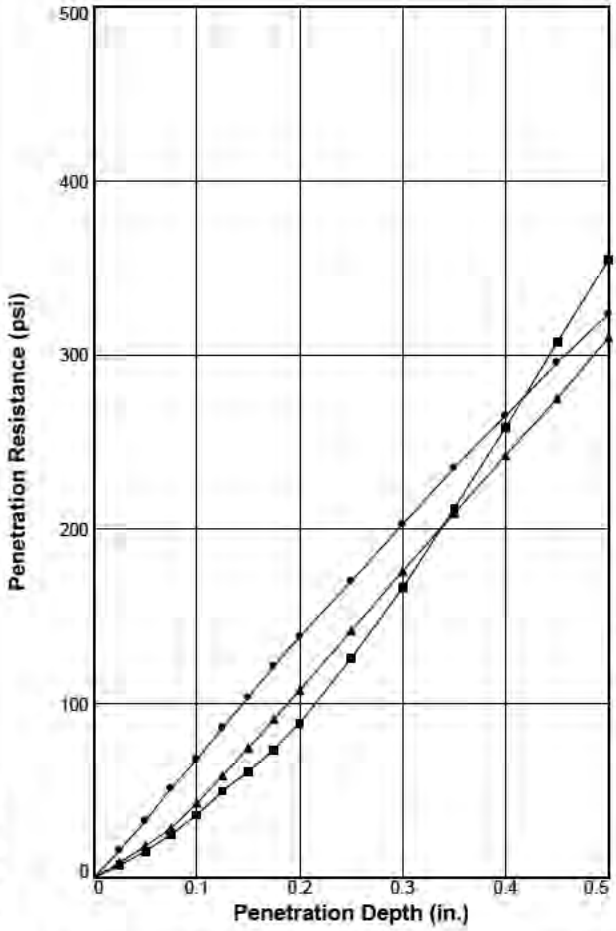
ASTM Specifications performed may include D421, D422, D2216, D2217 and D4318.

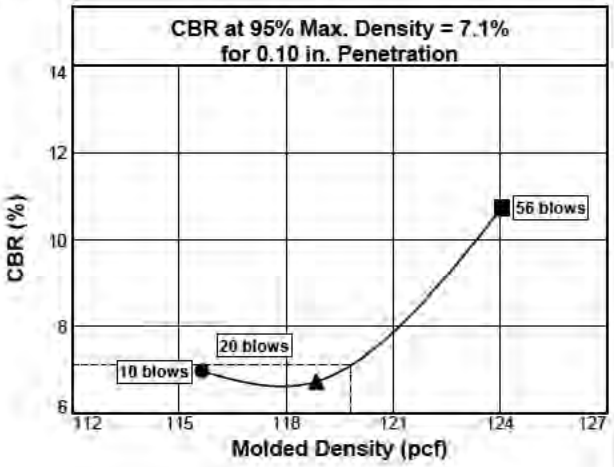
Figure 4

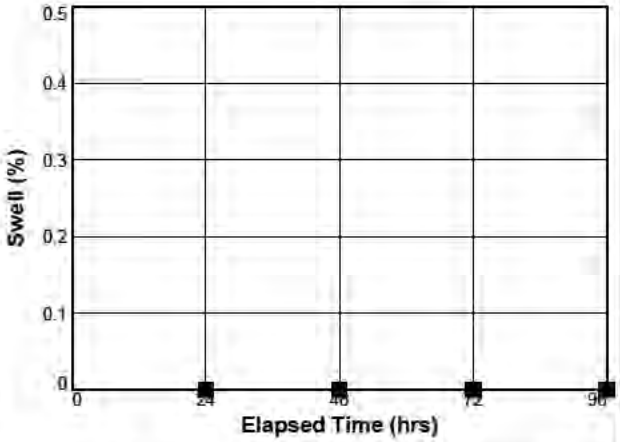
Geo-Technology Associates, Inc.

Tested By: J. Barnes **Checked By:** M. Lester

BEARING RATIO TEST REPORT
ASTM D 1883







	Molded			Soaked			CBR (%)		Linearity Correction (in.)	Surcharge (lbs.)	Max. Swell (%)
	Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.10 in.	0.20 in.			
1 ○	115.7	91.8	11.5	115.7	91.7	11.5	7.0	9.3	0.002	20	0
2 △	118.9	94.3	11.1	118.9	94.3	11.1	6.7	8.9	0.039	20	0
3 □	124.1	98.4	10.9	124.1	98.4	10.3	10.7	12.6	0.125	20	0

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
Brown, moist, Silty SAND	SM	126.1	9.5	NP	NP

Project No: 142126

Project: Laurel Elementary School

Source of Sample: B-1 & B-4 Composite **Depth:** 0-5.0

Date: 12/8/2014

GEO-TECHNOLOGY ASSOCIATES, INC.
18 Boulden Circle, Suite 36
New Castle, DE 19720

Test Description/Remarks:

Figure 5

ASTM Specifications performed may include D421, D422, D2216, D2217 and D4318.

U.S. Department of Labor
Employment Standards Administration
Wage and Hour Division

PAYROLL

(For Contractor's Optional Use; See Instructions, Form WH-347 Inst.)

Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number.

Rev. April 2006

NAME OF CONTRACTOR ☐ OR SUBCONTRACTOR ☐ | ADDRESS | OMB No.: 1215-0149 Expires: 04/30/2009

PAYROLL NO. | FOR WEEK ENDING | PROJECT AND LOCATION | PROJECT OR CONTRACT NO.

(1) NAME, ADDRESS, AND SOCIAL SECURITY NUMBER OF EMPLOYEE	(2) NO. OF WITHHOLDING EXEMPTIONS	(3) WORK CLASSIFICATION	OT. OR ST.	(4) DAY AND DATE — HOURS WORKED EACH DAY	(5) TOTAL HOURS	(6) RATE OF PAY	(7) GROSS AMOUNT EARNED	(8) DEDUCTIONS: FICA	WITH-HOLDING TAX			OTHER	TOTAL DEDUCTIONS	(9) NET WAGES PAID FOR WEEK
			O											
			S											
			O											
			S											
			O											
			S											
			O											
			S											
			O											
			S											
			O											
			S											
			O											
			S											
			O											
			S											

The Copeland Act (40 U.S.C. 3145) requires contractors and subcontractors performing work on Federally financed or assisted construction contracts to "furnish weekly a statement with respect to the wages paid each employee during the preceding week." U.S. Department of Labor (DOL) Regulations 29 CFR Part 5.5(a)(3)(ii) require contractors to submit weekly a copy of all payrolls to the Federal agency contracting for or financing the construction project, accompanied by a signed "Statement of Compliance" indicating that the payrolls are correct and complete and that each laborer or mechanic has been paid not less than the proper Davis-Bacon prevailing wage rate for the work performed. Compliance with these requirements is mandatory. DOL and federal contracting agencies receiving this information review the information to determine that employees have received legally required wages and fringe benefits.

We estimate that it will take an average of 56 minutes to complete this collection of information, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. If you have any comments regarding these estimates or any other aspect of this collection of information, including suggestions for reducing this burden, send them to the Administrator, Wage and Hour Division, ESA, U. S. Department of Labor, Room S3502, 200 Constitution Avenue, N. W., Washington, D. C. 20210.

Date _____

I, _____ _____
(Name of Signatory Party) (Title)

do hereby state:

(1) That I pay or supervise the payment of the persons employed by

_____ on the
(Contractor or Subcontractor)

_____; that during the payroll period commencing on the
(Building or Work)

_____ day of _____, _____, and ending the _____ day of _____, _____,

all persons employed on said project have been paid the full weekly wages earned, that no rebates have been or will be made either directly or indirectly to or on behalf of said

_____ from the full
(Contractor or Subcontractor)

weekly wages earned by any person and that no deductions have been made either directly or indirectly from the full wages earned by any person, other than permissible deductions as defined in Regulations, Part 3 (29 CFR Subtitle A), issued by the Secretary of Labor under the Copeland Act, as amended (48 Stat. 948, 63 Start. 108, 72 Stat. 967; 76 Stat. 357; 40 U.S.C. 276c), and described below:

_____

_____

_____

_____

(2) That any payrolls otherwise under this contract required to be submitted for the above period are correct and complete; that the wage rates for laborers or mechanics contained therein are not less than the applicable wage rates contained in any wage determination Incorporated into the contract; that the classifications set forth therein for each laborer or mechanic conform with the work he performed.

(3) That any apprentices employed in the above period are duly registered in a bona fide apprenticeship program registered with a State apprenticeship agency recognized by the Bureau of Apprenticeship and Training, United States Department of Labor, of if no such recognized agency exists in a State, are registered with the Bureau of Apprenticeship and Training, United States Department of Labor.

(4) That:

(a) WHERE FRINGE BENEFITS ARE PAID TO APPROVED PLANS, FUNDS, OR PROGRAMS

☐ – in addition to the basic hourly wage rates paid to each laborer or mechanic listed in the above referenced payroll, payments of fringe benefits as listed in the contract have been or will be made to appropriate programs for the benefit of such employees, except as noted in Section 4(c) below.

(b) WHERE FRINGE BENEFITS ARE PAID IN CASH

☐ – Each laborer or mechanic listed in the above referenced payroll has been paid, as indicated on the payroll, an amount not less than the sum of the applicable basic hourly wage rate plus the amount of the required fringe benefits as listed in the contract, except as noted in Section 4(c) below.

(c) EXCEPTIONS

EXCEPTION (CRAFT)	EXPLANATION

REMARKS:

NAME AND TITLE	SIGNATURE

THE WILLFUL FALSIFICATION OF ANY OF THE ABOVE STATEMENTS MAY SUBJECT THE CONTRACTOR OR SUBCONTRACTOR TO CIVIL OR CRIMINAL PROSECUTION. SEE SECTION 1001 OF TITLE 18 AND SECTION 231 OF TITLE 31 OF THE UNITED STATES CODE.

* U.S. G.P.O.:1997 519 861