PRELIMINARY REPORT OF SUBSURFACE EXPLORATION AND GEOTECHNICAL ENGINEERING SERVICES

P-183 Fort Story SOF Indoor Dynamic Range

Virginia Beach, Virginia

G E T Project No: VB14-185G/Revision 2

December 3, 2014

PREPARED FOR: **CLARK NEXSEN**

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December 3, 2014

TO: **Clark Nexsen**
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Attn: Mr. Erik H. Dupilka, P. E., CEM, LEED AP BD+C

RE: Preliminary Report of Subsurface Investigation and Geotechnical Engineering Services
P-183 Fort Story SOF Indoor Dynamic Range
Virginia Beach, Virginia
G E T Project No: VB14-185G/Revision 2

Dear Mr. Dupilka:

In compliance with your instructions, we have completed the Revision 2 to the preliminary Subsurface Investigation and Geotechnical Engineering Services for the above referenced project. The results of test pits and geotechnical exploration, together with our recommendations, are presented in this report.

Often, because of design and construction details that occur on a project, questions arise concerning subsurface conditions. **G E T Solutions, Inc.** would be pleased to continue its role as Geotechnical Engineer during the project implementation.

We appreciate the opportunity to work with you on this project. We trust that the information contained herein meets your immediate need, and should you have any questions or if we could be of further assistance, please do not hesitate to contact us.

Respectfully Submitted,
G E T Solutions, Inc.

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EXECUTIVE SUMMARY

The project site is located on the north side of Hospital Road just east of its intersection with Vung Tau Street within the Joint Expeditionary Base (JEB) Little Creek/Fort Story in Virginia Beach, Virginia. Based on the topographic site plan provided by the client, it is estimated that up to 7 feet of fill material may be required within the new structure's footprint to achieve the design grade elevations.

This project will be a design-build venture and is expected to consist of constructing a new indoor dynamic range to support Naval Special Warfare Group Two. The installation of stormwater management practices (BMP) adjacent to the northeast area of the building, a paved parking area to the east of the building, as well as other associated infrastructure components are also expected as part of this project.

Our field exploration program included nine (9) 12- to 80-foot deep Standard Penetration Test (SPT) borings drilled throughout the project site. Additionally, California Bearing Ratio (CBR) testing was performed on selected soil samples recovered from the boring locations. Composite soil samples were selected for environmental laboratory testing. Two (2) temporary groundwater monitoring wells were installed within the proposed stormwater management area and two infiltration tests were performed at 3 feet below ground surface. Additionally, a seismic cone penetrometer test and geophysical surveys were conducted at the project site. Also, eight (8) 5- to 8.5-foot deep test pits (designated as TP-1 through TP-8) were excavated throughout the project site. A description of the subsurface soil conditions is detailed in the table below.

AVERAGE DEPTH (Feet)	STRATUM	DESCRIPTION	RANGES OF SPT[(1)] UNCORRECTED N-VALUES
0 to 0.3	Topsoil	4 inches of topsoil at boring location B-1	-
0 to 1	Pavement Section	4 inches of asphalt pavement underlain by 8 inches of aggregate base material at boring location B-3	-
1 to 6	FILL	SAND (SP) with trace amounts of Gravel at boring locations B-1 and B-3	4-21
1-6 to 70	I	SAND (SP, SP-SM, SC) with varying amounts of Silt and Clay	12-88
70 to 80	II	CLAY (CH) and SILT (ML) with varying amounts of Sand	2-9

Note: (1) SPT=Standard Penetration Test, Uncorrected N-Values in Blows-per-foot.

The initial groundwater table was measured to occur at depths ranging from 7 to 14 feet below the existing site grades at the boring locations (corresponding to elevations of 7 to 9 feet NAVD 88). The groundwater level was measured at the temporary well locations (stormwater borings) after 24 and 48 hours, at which time the readings were recorded at 7 to 10.2 feet below grades (elevations of 6.8 to 7.5 feet NAVD88). In the project's area, seasonal groundwater fluctuations of ± 2 feet are common; however, greater fluctuations have been documented.

The following evaluations and recommendations were developed based on our field exploration and laboratory-testing program:

- The expected fill and the structural loading conditions (foundations and slab) associated with the proposed structure are expected to result in a net stress increase within the loose to very dense soils of Stratum I. We evaluated elastic settlement at the point of maximum fill and loading conditions. We selected maximum wall loads (15 klf), maximum floor loads (200 psf) and maximum fill height (7 feet), and evaluated them with the appropriate subsurface information from the borings, sounding and laboratory classification. Based on our analyses, a total settlement magnitude of up to 1 inch and differential settlement magnitudes of up to 0.5 inches are expected to occur within the granular soils of Stratum I. These settlement magnitudes are within industry standards and the stated requirements of the SAES for this project.
- A field testing program is recommended during construction. This testing program should include as a minimum, subgrade load testing (proofrolling), compaction testing and foundation inspections.
- The proposed construction areas should be cleared by means of removing the asphalt, topsoil (minimal), coastal shrubs and any other unsuitable material. Additionally, the uncontrolled fill material located on the western portion of the project site (inside the fenced area) should be undercut (up to 7 feet) and stockpiled for later use. Scattered debris was observed on the portion of the project site located outside the fenced area. This surface debris should be removed from the construction site.
- The shallow subsurface SAND (SP) soils encountered at the project site are expected to meet the criteria recommended in this report for reuse as structural fill.
- The proposed structure can be supported on shallow foundations designed using a net allowable bearing capacity of 2,500 psf (minimum 24-inch embedment and 24-inch width).
- The floor slab may be constructed as a slab-on-grade member.
- The hydraulic conductivities of the soils encountered at 3 feet below grades ranged from 3.52×10^{-2} and 3.91×10^{-2} cm/sec at the BMP boring locations.
- A design CBR value of 17.7 should be used in designing the pavement.

This summary briefly discusses some of the major topics which will be included in the geotechnical report.

1.0 PROJECT INFORMATION

1.1 Project Authorization

G E T Solutions, Inc. has completed our preliminary subsurface investigation and geotechnical engineering services for the proposed Fort Story SOF Indoor Dynamic Range project located in Virginia Beach, Virginia. Authorization to proceed with our services was received from Clark Nexsen in the form of an executed AIA Document C401- 2007, dated May 7, 2014. The conceptual design plans were received on July 1, 2014.

1.2 Project Site Location and Description

The project site is located on the north side of Hospital Road just east of its intersection with Vung Tau Street within the Joint Expeditionary Base (JEB) Little Creek/Fort Story in Virginia Beach, Virginia. The project site is bordered to the north by a development and undeveloped land; to the west by a newly constructed CQC Training building and associated Administration building; and to the east by undeveloped wooded land. The west project limits extend into the fenced area of the indicated CQC complex; and will eliminate an existing paved parking area at that location. It is noted that substantial amounts of construction debris were reported to be encountered at the adjacent CQC site during its construction.

At the time of our site reconnaissance, the project site consisted of an open undeveloped sandy area with surface coastal vegetation, with the exception of the previously mentioned existing paved parking lot to the west. Additionally, scattered debris was observed on the portion of the project site located outside the fenced area. The debris including steel cables, concrete and asphalt fragments and gravel. The existing site grade elevations within the proposed construction areas ranged from approximately 15 feet NAVD 88 (at the middle) to 23 feet NAVD 88 at the west side adjacent to the existing parking lot (as indicated on the site survey provided by the client), with sand dunes to the east. It is possible that the western end of the site was filled during the construction of the CQC parking lot. It is estimated that up to 7 feet of fill material may be required within the new structure's footprint to achieve the design grade elevations. A site vicinity plan is presented in Figure 1.

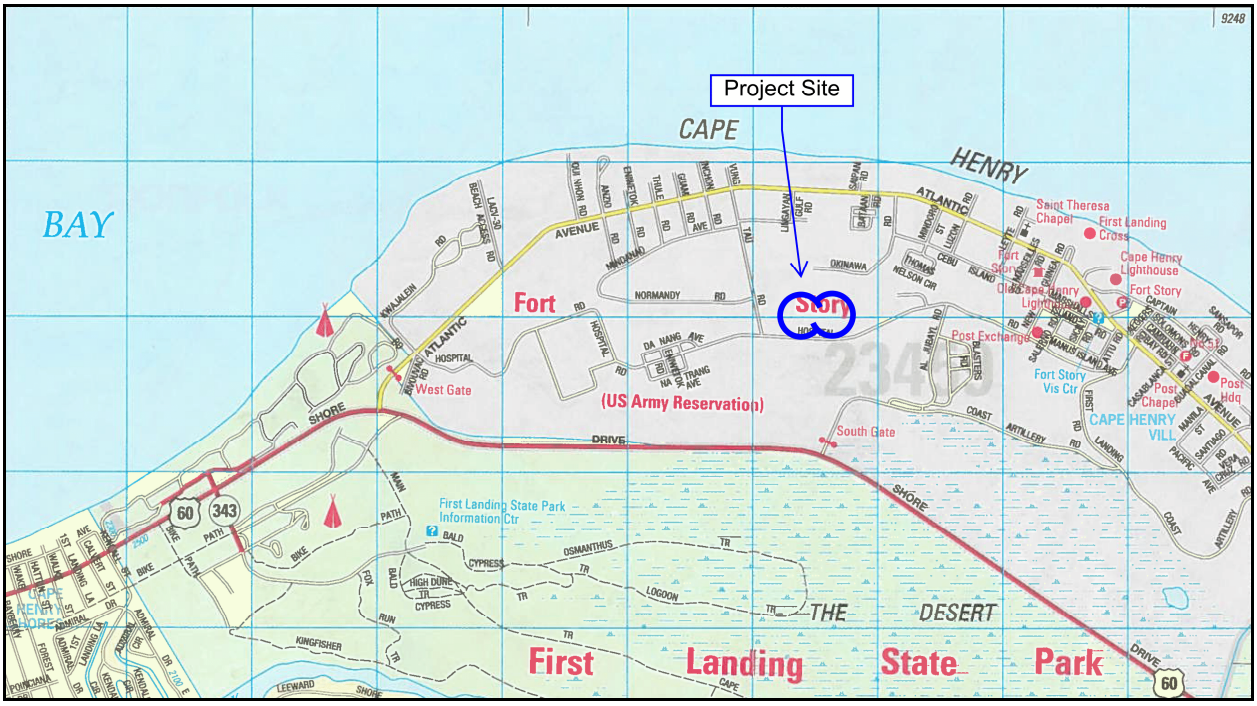

Figure 1: Site Vicinity Plan (ADC The Map People)

1.3 Project Construction Description

This project will be a design-build venture and is expected to consist of constructing a new indoor dynamic range to support Naval Special Warfare Group Two. As stated in the project documents, the building will encompass three types of ranges including an indoor small arms qualification range, a tactical area range, and a two story close range CQC. Additional support areas will include range control rooms, administrative spaces, ready and locker rooms, etc.

The structure is expected to be of steel and concrete construction with exterior concrete walls, measuring approximately 170 feet by 230 feet in plan dimensions. The first floor finished elevation of the new building is expected to be about 22 feet NAVD 88 (based on the FFE of the adjacent CQC building). As such, up to 7 feet of fill material is anticipated to be placed to achieve the design grade elevations. The maximum estimated wall loads associated with the proposed structure are expected to be on the order of 8 KLF or 15 KLF, depending on the final framing system selected by the successful design build contractor. Column loads are not expected at this stage of the design. The estimated maximum uniform distributed first level floor slab live load for the structures is not expected to exceed 200 psf. Column footings are not expected at this stage of the design.

The installation of stormwater management systems (BMP's) adjacent to the northeast area of the building, a paved parking area to the east of the building, as well as other associated infrastructure components are also expected as part of this project.

If any of the noted information is incorrect or has changed, please inform G E T Solutions, Inc. so that we may amend the recommendations presented in this report, if appropriate.

1.4 Purpose and Scope of Services

The purpose of this study was to provide the potential design-build contractors with a preliminary explanation of the general subsurface conditions at the proposed construction site. The geotechnical exploration conducted at the project site is in accordance with the GeoConstructability Publication copyright 2011 by the Geo-Institute of ASCE. The subsurface conditions encountered were then evaluated with respect to the available project characteristics. In this regard, preliminary engineering assessments for the following items were formulated:

1. General assessment of the soils revealed by the borings and test pits performed at the proposed development (SPT and CPT Borings).
2. General location and description of potentially deleterious material encountered in the borings that may interfere with construction progress or structure performance, including existing fills or surficial/subsurface organics. Additionally, the data collected during the performance of an Electromagnetic Induction (EM) and Ground Penetrating Radar (GPR) surveys were used for this purpose.
3. Soil subgrade preparation, including stripping, grading and compaction. Engineering criteria for placement and compaction of approved structural fill material.
4. Preliminary design parameters required for a shallow foundation system including allowable design bearing capacity, footings design criteria and considerations, expected total and differential settlements, and construction criteria.
5. Modulus of subgrade reaction for slab-on-grade design.
6. Preliminary pavement design recommendations based on the field exploration and laboratory testing activities (3 CBR tests) and our experience with similar soil conditions.
7. Determine pertinent information regarding the groundwater conditions and infiltration characteristics of the soils at the site for stormwater management purposes (2 BMP borings, 2 temporary groundwater monitoring wells and 2 infiltration tests).
8. Estimated lateral soil parameters.
9. Seismic site class determination in accordance with the 2012 International Building Code.

The scope of services did not include an environmental assessment for determining the presence or absence of wetlands or hazardous or toxic material in the soil, bedrock, surface water, groundwater or air, on or below or around this site other than the collection of designated samples for environmental screening as described herein (Sections 2.1 and 2.3).

2.0 FIELD AND LABORATORY PROCEDURES

2.1 Field Exploration

The field exploration was divided into two phases. The first phase of the subsurface exploration was performed in July 2014 and included soil test borings, environmental analytical testing, geophysical surveys and seismic cone penetrometer testing. The results of this study were reported in our Preliminary Report of Subsurface Exploration and Geotechnical Engineering Services (VB14-185G) dated July 23, 2014. The results and recommendations of the first phase are incorporated into the current report submittal. Upon review of these findings, clarification and direction were given regarding the extent of the second phase of the investigation. This second phase of the subsurface exploration included the excavation of test pits throughout the project site. The locations of the test pits were established based on the results of the previously performed geophysical surveys and the soil test borings.

Phase I Subsurface Exploration

In order to explore the general subsurface soil types and to aid in developing associated foundation design parameters, four (4) 80-foot deep Standard Penetration Test (SPT) borings (designated as B-1 through B-4) were drilled within the approximate corners of the proposed structure's footprint.

To aid in developing associated pavement design parameters, three (3) 12-foot deep SPT borings (designated as CBR-1, CBR-2, and CBR-3) were drilled within the proposed pavement areas. Also, three (3) bulk subgrade soil samples were collected from the proposed pavement areas at their respective boring locations. The bulk subgrade soil samples were collected from depths ranging from 1 to 3 feet below existing site grades by means of manually excavating to these depths. The bulk soil samples were returned to our laboratory and subjected to CBR testing in accordance with ASTM standards.

In each of two the BMP areas, an SPT boring was drilled to a depth of 15 feet below the existing site grades, and a temporary groundwater monitoring well was installed at each of these locations (designated as BMP-1 and BMP-2). Additionally, infiltration testing was performed at a depth of 3 feet below the existing site grades at the well locations. Groundwater level readings were collected at 24- and 48-hour intervals.

Standard Penetration Tests were performed in the field in general accordance with ASTM D 1586. The tests were performed continuously from the existing ground surface to a depth of 12 feet, and at 3- and 5-foot intervals thereafter. The soil samples were obtained with a standard 1.4" I.D., 2" O.D., 30" long split-spoon sampler. The sampler was driven with blows of a 140 lb. hammer falling 30 inches, using an automatic hammer. The number of blows required to drive the sampler each 6-inch increment of penetration was recorded and is shown on the boring logs. The sum of the second and third penetration increments is termed the SPT N-value (uncorrected for automatic hammer). A representative portion of each disturbed split-spoon sample was collected with each SPT, placed in a glass jar, sealed, labeled, and returned to our laboratory for review.

Four (4) 4-foot deep hand auger borings were advanced adjacent to SPT borings B-1, B-2, B-3, and B-4, to collect composite soil samples for analytical testing. The borings were advanced using a hand operated auger equipped with a 3-inch sampling bucket which was decontaminated before the first boring and between each subsequent boring location using an Alconox rinse. The composite soil samples were collected from between one foot and 4 feet below the existing site grade at each location, and soil gathered from 1 foot below ground surface (bgs) to 4 feet bgs at locations B-1 and B-2 were combined into one sample, B-1/2. Soil collected from 1 foot bgs to 4 feet bgs at locations B-3 and B-4 were combined into one composite sample, B-3/4. Both samples were placed in appropriately preserved, certified clean containers, placed on ice, and hand delivered under chain of custody protocol to a certified laboratory for the following chemical analyses: Toxicity Characteristic Leaching Procedure (TCLP); Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX); and Total Petroleum Hydrocarbons within the diesel and gasoline range of organics (TPH-DRO and TPH-GRO). In addition, sample B-3/4 was also submitted for Corrosivity analysis to include pH, soluble sulphates, chlorides, electrical resistivity, sulfides, and redox potential.

Geophysical surveys including Electromagnetic Induction (EM) and Ground Penetrating Radar (GPR) surveys were performed within the approximate limits of the site in accordance with the scope of work requirements. These efforts were performed for the purpose of documenting potential underground anomalies that may be associated with previous use of the site.

Additionally, a seismic cone penetrometer test (SCPTu) was completed to a depth of approximately 100 feet beneath the existing ground surface. The SCPTu test was advanced using a 20-ton, track mounted rig and performed by ConeTec, Inc. personnel.

Phase 2 Subsurface Exploration

Eight (8) 5- to 8.5-foot deep test pits (designated as TP-1 through TP-8) were excavated throughout the project site. The location and number of test pits were selected in conjunction with the NAVFAC MIDLANT geotechnical engineer following the submittal and review of the geophysical survey. The NAVFAC MIDLANT geotechnical engineer was present on-site during the excavation of the test pits. The test pits were excavated with a hydraulic excavator by **G E T Solutions, Inc**. During the test pit excavations, the surficial soil thickness and the thicknesses of the subsurface soil layer(s) as well as the composition of the excavated materials were logged. The test pit excavations were backfilled with the compacted excavation spoils. The test pits were considered necessary to better ascertain the composition of the uncontrolled fill material.

The boring, sounding and test pit locations were established and staked in the field by a representative of **G E T Solutions, Inc.** by measuring with a tape from existing site features, and by obtaining confirmation from a hand held GPS. The approximate boring, test pit and sounding locations are shown on the attached “Boring, Sounding and Test Pit Location Plan” (Appendix I), which was reproduced based on the plan provided by the client. It is noted that “Miss Utility” was called to mark existing underground utilities at the site in addition to retaining the services of a private utility locator for the same (confirmatory) purpose.

2.2 Laboratory Testing

Representative portions of all soil samples collected during drilling were sealed in glass jars, labeled and transferred to our laboratory for classification and analysis. A Project Engineer performed the soil classification in general accordance with ASTM Specification D 2487. A summary of the soil classification system is provided in Appendix II.

Several representative split spoon and bulk soil samples were selected and subjected to laboratory classification testing, which included natural moisture, -#200 sieve wash, Atterberg Limit testing and analysis in order to corroborate the visual classification. These classification test results are presented on the "Comprehensive Laboratory Test Results" table provided in Appendix III, and are also presented on the "Boring Log" sheets (Appendix IV). The generalized subsurface profile is presented in Appendix V of this report.

In addition, the bulk soil samples were subjected to Atterberg Limits, natural moisture content, -# 200 sieve, standard Proctor, and CBR testing in accordance with ASTM standards. The comprehensive results of the CBR testing are provided in Appendix VI.

2.3 Environmental Laboratory Testing

The two (2) composite soil samples were obtained from boring locations B-1, B-2, B-3, and B-4, with samples from B-1 and B-2 combined for a single composite sample, and samples from B-3 and B-4 were combined for a second composite sample. These two composite samples were submitted to the contract laboratory for analysis for the presence and concentrations of the following chemical analytes: Toxicity Characteristic Leaching Procedure constituents (TCLP volatiles, TCLP semi-volatiles, TCLP Pesticides, TCLP Herbicides, TCLP-8 Metals (arsenic, barium, cadmium, chromium, silver, mercury, lead, and selenium); Total Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX); and Total Petroleum Hydrocarbons-Diesel Range Organics (TPH-DRO) and Total Petroleum Hydrocarbons-Gasoline Range Organics (TPH-GRO). Additionally, the composite sample collected from the B-3 and B-4 boring locations was analyzed for Corrosivity potential including the following analytes: pH, soluble sulfates, chlorides, electrical resistivity, sulfides, and redox potential. The soil samples were collected in laboratory-provided glass jars and then placed on ice and hand delivered to Air, Water & Soil Laboratories (AWS) in Richmond, Virginia. All analyses were performed using EPA-approved laboratory methods.

Based on the analytical report, none of the submitted composite samples produced chemical analytes greater than their respective laboratory method detection limits and are not considered hazardous under an exposure or disposal scenario. The B-3/4 composite sample produced the Corrosivity screen concentrations presented in Table I.

Table I - Composite Sample B-3/4 Corrosivity Screening Analysis

pH (SU)	Chloride (mg/Kg)	Sulfate (mg/Kg)	Sulfide (mg/Kg)	Resistivity (umhos/cm)	Specific Conductance (umhos/cm)	Redox Potential (mV)
10	<10	31.6	<100	<1	40.6	106

SU = Standard Units
mg/Kg = milligrams/kilogram
umhos/cm = micro ohms/centimeter
mV = millivolts

Based upon the Corrosivity screening results, the submitted soil sample appears to exhibit potentially moderate corrosive properties. The soil sample produced a highly alkaline pH of 10 SU. The presence of sulfates poses a risk for metallic materials because under anaerobic conditions (low to no oxygen) sulfates can be reduced to sulfides which are highly corrosive; however sulfides were not detected in the soil sample. The redox potential is a measure of the degree of aeration in a soil. A high redox potential (>100 mV) indicates a high oxygen level. Low redox values (<50 mV) may provide an indication that conditions are conducive to anaerobic microbial activity which can produce sulfides. The redox potential for the submitted soil sample was 106 mV. Resistivity is a broad indicator for Corrosivity. Since ionic current flow is associated with soil corrosion reactions high soil resistivity (>2000 ohm/cm) arguably slows down corrosion reactions. The soil sample produced a resistivity value of <1000 ohms/cm.

It is important to note that the contractor is responsible for characterizing all generated waste material prior to disposal to ensure that the material is handled and disposed in accordance with applicable federal, state, and local regulations. The analytical laboratory report is presented in Appendix VII.

3.0 SITE AND SUBSURFACE CONDITIONS

3.1 Site Geology

The project site lies within a major physiographic province called the Atlantic Coastal Plain. Numerous transgressions and regressions of the Atlantic Ocean have deposited marine, lagoonal, and fluvial (stream lain) sediments. The regional geology is very complex, and generally consists of interbedded layers of varying mixtures of sands, silts and clays. Based on our review of existing geologic and soil boring data, the geologic stratigraphy encountered in our subsurface explorations generally consisted of marine deposited Sands, Silts and Clays, and late Pliocene age deposits of the Yorktown Formation. The Yorktown Formation stratum, once encountered, generally extends to depths of several hundred feet below sea level.

A previous subsurface exploration performed at an adjoining site was provided by NAVFAC. The findings of this exploration were compiled by others and were reviewed and evaluated GET personnel as part of the current study and are presented in the last appendix of this report (Appendix XV).

In order to obtain information regarding historical land use of the project site and its vicinity, we reviewed the 1918, 1955, 1964 and 2000 United States Geological Survey (USGS) geological maps for Cape Henry, Virginia. From this review, it appears that the area of the project site has not been previously developed. Copies of the USGS geological maps are provided in Appendix VIII.

3.2 Subsurface Soil Conditions

The results of our soil test borings indicated the presence of 4 inches topsoil at boring location B-1 and asphalt pavement at boring location B-3. The pavement section consisted of 4 inches of asphalt pavement underlain by 8 inches of aggregate base material. It is noted that the soils occurring beneath the existing parking lot and inside the fenced area of the CQC complex are likely structural fill associated the past parking lot construction. These fill soils extended beneath the ground surface to depths ranging from 5 to 7 feet below grades at boring locations B-1 and B-3. The fill soils consisted of SAND (SP) with trace amounts of Gravel. Underlying the surficial materials and extending to the boring termination depths ranging from 12 to 80 feet below the existing site grades, the subsurface soils were generally arranged in a 2-layer configuration.

The initial soil layer extended to depths ranging from 66.5 to 73 feet below grades. The recovered soils consisted primarily of SAND materials. These were classified as dry to wet, poorly graded fine to medium SAND with occasional traces of Silt (SP, SP-SM) with the exception of the lower 3 to 8.5 feet which consisted of Clayey SAND (SC) recovered from depths ranging from 58 to 73 feet below grades. The upper 40 feet of this material were noted to be tan and brown in color, changing to gray at a depth of approximately 40 feet at the location of borings B-1 through B-4. The shallower CBR and BMP borings were terminated in the tan and brown SAND layer at depths of 12 to 15 feet. The Standard Penetration Test results (N-values) recorded in these granular soils were noted to range between 4 to 20 blows-per-foot within the upper 30 feet, indicating a very loose to medium dense relative density; with the N-values increasing significantly below these depths and ranging between 21 and 88 blows-per-foot indicating a medium dense to very dense relative density.

The second soil layer extended beneath the first soil layer to the termination depth of 80 feet below existing grades. The recovered soils were comprised of CLAY (CH) and SILT (ML) with varying amounts of Sand. The N-values recorded within these cohesive soils ranged from 2 to 9 blows-per foot, indicating a soft to stiff consistency. Deposits of SAND (SM, SC) soils with varying amounts of Gravel were recovered within this stratum at boring locations B-3 and B-4.

The subsurface descriptions are of a generalized nature provided to highlight the major soil strata encountered. The records of the subsurface exploration are included in Appendix IV (Boring and Test Pit Log sheets) and in Appendix V (Generalized Soil Profile), which should be reviewed for specific information as to the individual borings. The stratifications shown on the records of the subsurface exploration represent the conditions only at the actual boring locations. Variations may occur and should be expected between boring locations. The stratifications represent the approximate boundary between subsurface materials and the transition may be gradual. It is noted that the topsoil designation references the presence of surficial organic laden soil, and does not represent any particular quality specification. It is recommended that this material be tested for approval prior to use.

The ground elevations reported on the borings and test pit logs (and Generalized Soil Profiles) were estimated from the previously referenced site survey plan.

3.3 Groundwater Information

The groundwater levels were recorded at the boring locations and as observed through the wetness of the recovered soil samples during the drilling operations. The initial groundwater table was measured to occur at depths ranging from 7 to 14 feet below the existing site grades at the boring locations (corresponding to elevations of 7 to 9 feet NAVD 88). As an exception, the groundwater was not observed at boring location CBR-2 or at the test pit locations to the depths explored (5 to 12 feet below grades). The boreholes were backfilled with cement grout and the test pits with compacted excavation spoils upon completion.

Stabilized groundwater readings were taken at the temporary groundwater monitoring well locations (BMP-1 and BMP-2). At the time of this reporting the groundwater wells remained in place for future monitoring. The groundwater information associated with these wells is tabulated below (Table II).

Table II - Groundwater Level Readings

Boring No.	Initial Groundwater Reading (ft)*	24-Hour Groundwater Reading (ft)*	24-Hour Groundwater Elevation (NAVD 88)	48-Hour Groundwater Reading (ft)*	48-Hour Groundwater Elevation (NAVD 88)
BMP-1	8	7	7.0	7.2	6.8
BMP-2	10	10	7.5	10.2	7.3

* Depth below existing site grade at the well location

Groundwater conditions will vary with seasonal conditions, such as the frequency and magnitude of rainfall patterns, as well as man-made influences, such as existing swales, drainage ponds, underdrains and areas of covered soil (paved parking lots, sidewalks, etc.). This subsurface investigation was performed in the summer season, when groundwater levels are expected to be their lowest. Seasonal groundwater fluctuations of $\pm$ 2 feet or more are common in the project's area; however, greater fluctuations have been documented. We recommend that the contractor determine the actual groundwater levels at the time of the construction to determine groundwater impact on the construction procedures.

As mentioned in Section 3.2, most of the shallow subsurface soil was predominately granular in nature and is considered relatively 'clean'. As such, water seepage at varying elevations should be expected within the side walls of open cut areas. It is important to note that even small quantities of persistent seepage may complicate construction operations when excavations extend near or below areas of saturated soil. Construction difficulties resulting from near surface groundwater or excess soil moisture will be much less likely if work is conducted during the dry season.

3.4 Geophysical Surveys (EM and GPR)

Geophysical surveys including Electromagnetic Induction (EM) and Ground Penetrating Radar (GPR) surveys were performed within the approximate limits of the site in accordance with the scope of work requirements. The traverses of both surveys were conducted on a 10-foot by 10-foot grid. These efforts were performed for the purpose of documenting potential underground anomalies that may be associated with previous use of the site.

3.4.1 Electromagnetic Induction Survey (EM)

Electromagnetic Induction, also called Terrain Conductivity, measures how well the subsurface profile conducts an electric current. A defined electric current is applied to a transmitter coil that induces eddy currents in the material below the instrument. This generates secondary electromagnetic fields that are proportional to the intensity of the current flowing in the subsurface material. A receiver coil located at the other end of the instrument intercepts the secondary EM field and produces a voltage proportional to the subsurface conductivity. Data collection coupled with GPS tracking enables profiling to be generated which maps localized disruptions to the induced magnetic field. This type of procedure is most appropriately suited for mapping of buried materials of highly varying conductivity relative to the surrounding soil (i.e. metallic structures such as buried tanks and large utilities). The EMI is best suited to locate large metal obstructions in the substrate, such as underground storage tanks, buried vehicles and similar items. Typically EMI is not an effective tool for locating smaller underground utilities because it is difficult for such a small item to initiate a change in the primary magnetic field.

For the EM survey, a GSSI Profiler EMP-400 was used to conduct the scan. The EMP-400 has the capability of using up to three frequencies in one survey and compiling each into one data set whereas other EMI units such as EM-31 and EM-61 must be conducted separately.

The EM survey did not identify any significant subsurface anomalies within the project site other than the parked vehicles within the fenced area and the chain-link fence. As shown in the data sets, a lack of a significant change in the primary magnetic field is reason to believe there are no large metal obstructions in the designated scan area.

3.4.2 Ground Penetrating Radar Survey (GPR)

The Ground Penetrating Radar - Subsurface Interface Radar (SIR) technique utilizes impulse radar technology to obtain a continuous, high-resolution profile of the subsurface along the designated survey line. The signal transmitted into the subsurface is produced by discharging a pulse of electromagnetic energy from a specially designed and selected antenna (transmitter/receiver). These antennas typically operate in the range of 80 to 2100 MHZ and are selected to provide optimal depth of penetration and degree of resolution for the type of object or material requiring identification. For this project, the scans were performed utilizing a GSSI SIR-3000 system. For this survey, a 400 MHZ antenna was used.

The transmitted pulse travels through the subsurface until it reaches an interface of materials with differing dielectric characteristics. Then, depending upon the dielectric characteristics of the materials, a portion of the transmitted pulse is reflected back to the surface where it is picked up by the receiver section in the antenna unit. The received signal is processed and a real-time image of the information is displayed on a digital screen. The received signal consists of three basic components. The top portion is the transmitted pulse that serves as a time reference. Immediately following the transmitted pulse is a strong surface reflection. Then, at a time equal to the pulse travel time from the surface to a given characteristic interface and back to the antenna, the interface reflection appears. A continuous stream of received pulses is fed into the graphic recorder and a profile is developed as the antenna is moved across the surface. The profile is developed as the antenna is moved along a traverse line of interest. The data is then displayed on the graphic recorder unit. The operator controls the threshold and amplifier gain levels, and the timing functions that control the vertical and horizontal scales. The greater the contrast in dielectric constant at an interface, the stronger the reflected signal is. Where two materials have similar dielectric constants or where the transition from one material to another is gradual, the interface may not be discernable. It should be emphasized that the process does not identify the specific nature of a subsurface material, but rather reveals the approximate depth and extent of an interface or object.

The results of the ground penetrating radar investigation indicated a strong planar reflective response in the designated survey area at depths ranging between 4 feet and 8 feet. Where detected, this strong reflection appeared to indicate a relatively flat elevation where the changes in depth of signal appeared to match the changes in surface elevation, but that was not always the case in the entire survey area. The data set also indicated a presence of moderate to strong localized or individual reflections which could indicate objects such as rock or other debris within the upper strata and included with the strong planar response noted previously. Some of these materials matched the dielectric constant of the planar response which could indicate a similar composition. The objects that indicate fainter a dielectric reflection could indicate something less dissimilar than the surrounding dry sandy soils such as concrete or other similar debris.

As indicated above, the GPR survey identified significant anomalies in the subsurface soils between 4 to 8 feet below grades. The anomalies were detected on the western half and on the northeast quadrant of the proposed building footprint. The comprehensive results of the geophysical surveys as well as a site plan identifying the location of the subsurface anomalies are presented in Appendix IX.

3.5 Test Pit Exploration

The location and number of test pits were selected in conjunction with the NAVFAC MIDLANT geotechnical engineer following the submittal and review of the geophysical surveys. The purpose of the test pit excavations was to better ascertain the extent and composition of the anomalies identified by the GPR survey.

The test pits revealed that uncontrolled fill materials were recovered at test pits TP-1, TP-2 and TP-3 to depths of 5 to 5.5 feet below grades. These test pits are located adjacent to the parking lot and inside the fenced area of the CQC Training Building and are likely structural fill associated the past parking lot construction. Uncontrolled fill material was not recovered at the remaining test pits. Photographs of the test pit excavations were taken during our exploration and are provided in Appendix X of this report.

4.0 PRELIMINARY EVALUATIONS AND RECOMMENDATIONS

Our recommendations are based on the previously discussed project information, our interpretation of the soil test borings, test pits, sounding and laboratory data, and our observations during our site reconnaissance. If the proposed construction should vary from what was described, we request the opportunity to review our recommendations and make any necessary changes.

The expected fill and the structural loading conditions (foundations and slab) associated with the proposed structure are expected to result in a net stress increase within the loose to very dense soils of Stratum I. We evaluated elastic settlement at the point of maximum fill and loading conditions. We selected maximum wall loads (15 klf), maximum floor loads (200 psf) and maximum fill height (7 feet), and evaluated them with the appropriate subsurface information from the borings, sounding and laboratory classification. Based on our analyses, a total settlement magnitude of up to 1 inch and differential settlement magnitudes of up to 0.5 inches are expected to occur within the granular soils of Stratum I. These settlement magnitudes are within industry standards and the stated requirements of the SAES for this project.

4.1 Clearing and Grading

The proposed construction areas should be cleared by means of removing the surface debris, pavement section, topsoil (minimal), coastal shrubs and any other unsuitable material. Clean topsoil (if any) should be stockpiled for later use in landscaped areas. Additionally, the uncontrolled fill material located on the western portion of the project site (inside the fenced area) should be undercut and stockpiled on-site for reuse as structural fill; any isolated debris present in the undercut fill material should be removed and properly disposed. The stockpiled fill material should be moisture conditioned as necessary to achieve the specified degree of compaction. Undercut of up to 7 feet will be required to remove the uncontrolled fill materials; these undercut magnitudes will taper off toward the fence. The undercut should be monitored by the Geotechnical Engineer. It is recommended that the clearing operations extend laterally at least 5 feet beyond the perimeter of the proposed structure footprint and at least 3 feet outside the new pavement limits.

The site should be graded to enhance surface water runoff to reduce the ponding of water. Ponding of water often results in softening of the near-surface soils. In the event of heavy rainfall within areas to receive fill, we recommend that the grading operations cease until the site has had a chance to dry.

4.2 Subgrade Preparation

The exposed subgrade soils should be densified with a large static drum roller following the clearing operation. After the subgrade soils have been densified, they should be evaluated by a Geotechnical Engineer for stability. Accordingly, the subgrade soils should be proofrolled to check for pockets of loose material hidden beneath a crust of better soil. Several passes should be made by a large rubber-tired roller or loaded dump truck over the construction areas. The number of passes will be determined in the field by the Geotechnical Engineer depending on the soils conditions. Any pumping and unstable areas observed during proofrolling (beyond the initial cut) should be undercut and/or stabilized at the directions of the Geotechnical Engineer.

The natural soil material within the proposed construction areas should be compacted to a dry density of at least 98% of the Modified Proctor maximum dry density (ASTM D 1557). The project's budget should include an allowance for subgrade improvements (undercut and backfill with structural fill).

4.3 Structural Fill and Placement

Any material to be used for structural fill should be evaluated and tested by an independent testing laboratory prior to placement to determine if they are suitable for the intended use. Suitable structural fill material should consist of sand or gravel containing less than 20% by weight of fines (SP, SM, SW, GP, GW – with dimensions not to exceed 2 inches in diameter), having a liquid limit less than 20 and plastic limit less than 6, and should be free of rubble, organics, clay, debris and other unsuitable material.

All structural fill should be compacted to a dry density of at least 98% of the Modified Proctor maximum dry density, in accordance with ASTM Specification D 1557. The moisture content of the structural fill should be within +/- 2% of the optimum moisture content at the time of placement. In general, the compaction should be accomplished by placing the fill in maximum 8-inch loose lifts and mechanically compacting each lift to at least the specified minimum dry density.

Backfill material in utility trenches within the construction areas should consist of structural fill (as previously described), and should be compacted to at least 98% of ASTM Specification D 1557. This fill should be placed in 4 to 6 inch loose lifts when hand compaction equipment is used.

Where applicable, care should be used when operating the compactors near existing structures to avoid transmission of the vibrations that could cause settlement damage or disturb occupants. In this regard, it is recommended that the vibratory roller remain at least 25 feet away from existing structures; these areas should be compacted with small, hand-operated compaction equipment.

4.4 Suitability of On-site Soils

The shallow subsurface SAND (SP) soils encountered at project site appear to meet the criteria recommended in this report for reuse as structural fill. Further classification testing (natural moisture content, gradation analysis, and Proctor testing) should be performed in the field during construction to evaluate the suitability of any excavated soils for reuse as fill within building and pavement areas.

4.5 Shallow Foundation Design Recommendations

Provided that the recommendations presented in the previous sections of this report are properly performed, including the undercut of all unsuitable fill soils (up to 7 feet) and the placement and compaction of all backfill and fill materials, the proposed structure can be supported by shallow foundations bearing upon firm natural soil materials or on well compacted structural fill material. The footings can be designed using a net allowable soil pressure of 2,500 pounds per square foot (psf). In using net pressures, the weight of the footings and backfill over the footings, including the weight of the floor slab, need not be considered. Hence, only loads applied at or above the finished floor need to be used for dimensioning the footings.

In order to develop the recommended bearing capacity of 2,500 pounds per square foot (psf), the base of the footings should have an embedment of at least 24 inches beneath finished grades and wall footings should have a minimum width of 24 inches. The recommended 24-inch footing embedment is considered sufficient to provide adequate cover against frost penetration to the bearing soils. Bearing capacity calculations are provided in Appendix XI.

4.6 Settlements

It is estimated that the maximum resulting total settlement of the foundations should be up to 1 inch and the maximum differential settlement magnitude is expected to be up to 0.5 inches. The settlements were estimated on the basis of the results of the field penetration tests. Careful field control will contribute substantially towards minimizing the settlements.

The settlement analysis was divided in two steps. The first step was to determine the settlement induced by the 7 feet of fill material required to attain finished floor elevation. The second step was to determine the settlement induced by the maximum wall (15 klf) and the floor loads (200 psf). We conducted the elastic settlement calculations using UniSettle 4.0, a computer software package by UniSoft Ltd. Geotechnical Solutions. The software requires as input, quantitative data related to strength of the subsurface materials and the loading scheme. The elastic settlement calculations for the 7 feet of fill material and for the “worse” structural loading conditions (wall loads of 15 klf and floor loads of 200 psf) are provided in Appendix XII.

4.7 Shallow Foundation Excavations

In preparation for shallow foundation support, the footing excavations should bear within firm well compacted structural fill. All foundation excavations should be observed by a qualified Geotechnical Engineer. At that time, the Geotechnical Engineer should also explore the extent of excessively loose, soft, or otherwise unsuitable material within the exposed excavations. Also, at the time of the footing observations, the Geotechnical Engineer will advance hand auger borings in the bases of the foundation excavations to verify that the bearing structural fill is consistent with the recommendations provided in Section 4.3 of this report. The necessary depth of penetration will be established during the subgrade observations.

Where pockets of unstable/unsuitable soils requiring undercut are encountered in the footing excavations, the proposed footing elevation should be re-established by means of backfilling with “flowable fill”, VDOT #57 Stone or a suitable structural fill material compacted to a dry density of at least 98 percent of the Modified Proctor maximum dry density (ASTM D 1557), as described in Section 4.3 of this report, prior to concrete placement. This construction procedure is anticipated to provide for a net allowable bearing capacity of 2,500 psf.

Temporary wood formwork will be required for the foundation elements due to the granular nature of the shallow subsurface soils to prevent the sides of the excavations from sloughing. Immediately prior to foundation concrete placement, it is suggested that the bearing surfaces of all foundations be compacted using hand operated mechanical tampers. In this manner, any localized areas, which have been loosened by excavation operations, should be adequately recompacted. The compaction testing in the base of the foundation may be waived by the Geotechnical Engineer, where firm bearing soils are observed during the foundation inspections.

Soils exposed in the bases of all satisfactory foundation excavations should be protected against any detrimental change in condition such as from physical disturbance, rain or frost. Surface run-off water should be drained away from the excavations and not be allowed to pond. If possible, all footing concrete should be placed the same day the excavation is made. If this is not possible, the footing excavations should be adequately protected. Additionally, if the footing excavations are preformed during the summer months, it may be necessary to moisture condition the exposed footing bearing soils prior to concrete placement, especially if the exposed soils consist of poorly graded SAND (SP).

4.8 Slab-on-Grade Design

The floor slab may be constructed as a slab-on-grade member provided the previously recommended earthwork construction criteria are carried out properly. The estimated k-Value, modulus of subgrade reaction, of the current subgrade is on the order of 30 to 35 pounds per cubic inch. It is recommended that all ground floor slabs be directly supported by at least a 4-inch layer of relatively clean, compacted, poorly graded sand (SP) or gravel (GP) with less than 5% passing the No. 200 Sieve (0.074 mm). The purpose of the 4-inch layer is to act as a capillary barrier and equalize moisture conditions beneath the slab.

It is recommended that all ground floor slabs be "floating". That is, generally ground supported and not rigidly connected to walls or foundations. This is to minimize the possibility of cracking and displacement of the floor slabs because of differential movements between the slab and the foundation.

It is also recommended that the floor slab bearing soils be covered by a vapor barrier or retarder in order to minimize the potential for floor dampness, which can affect the performance of glued tile and carpet. Generally, use a vapor retarder for minimal vapor resistance protection below the slab on grade. When floor finishes, site conditions or other considerations require greater vapor resistance protection; consideration should be given to using a vapor barrier. Selection of a vapor retarder or barrier should be made by the architect based on project requirements.

4.9 Preliminary Pavement Design

The California Bearing Ratio (CBR) test results indicated soaked CBR values ranging from 25.4 to 29.0, with an average soaked CBR value of 26.6. The average soaked CBR value was multiplied by a factor of two-thirds to determine a pavement design CBR value. The two-thirds factor provides the necessary safety margins to compensate for some non-uniformity of the soil. A design CBR value of 17.7 should be used in designing the pavement sections. Based on our experience with similar soil conditions, the pavement sections presented in Table III are typically used.

Table III - Preliminary Pavement Sections

Section	Hot Mix Asphalt		Concrete[1]	Aggregate Base[2]	Subgrade[3]
	Surface (SM-12.5A)	Base (BM-25.0)			
Flexible Standard Duty	2”	-	-	8”	Stable
Flexible Heavy Duty	2”	3”	-	8”	Stable
Rigid (Standard Duty)	-	-	5”	6”	Stable
Rigid (Heavy Duty)	-	-	6”	6”	Stable

(1) Concrete minimal flexural strength of 650 psi at 28 days.
(2) VDOT 21-A or 21-B, compacted to a dry density of at least 98% of the Modified Proctor maximum dry density (ASTM D 1557).
(3) Compacted to a dry density of at least 98% of the Modified Proctor maximum dry density (ASTM D 1557).

CBR test results may vary across the project site as soil composition varies. In addition, CBR test results will vary depending on the laboratory test procedures (e.g. the use of varying surcharge weights will result in varying test results). Actual pavement section thickness should be provided by the design civil engineer based on traffic loads, volume, and the owners design life requirements.

Following pavement rough grading operations, the exposed subgrade should be observed under proofrolling. This proofrolling should be accomplished with a fully loaded dump truck or 7 to 10 ton drum roller to check for pockets of soft material hidden beneath a thin crust of better soil. Any unsuitable materials thus exposed should be removed and replaced with a well-compacted material. The inspection of these phases should be performed by the Geotechnical Engineer or his representative. Where excessively unstable subgrade soils are observed during proofrolling and/or fill placement, it is expected that these weak areas can be stabilized by means of thickening the base course layer to 10 to 12 inches (i.e. placement of 2 to 4 inches of additional aggregate base) and/or lining the subgrade with geotextile fabric. These alternates are to be addressed by the Geotechnical Engineer during construction, if necessary, who will recommend the most economical approach at the time.

4.10 On-Site Shrink/Swell Properties

Based on the laboratory classification results, the shallow subsurface sandy soils encountered within the upper 10 feet at the boring locations are not considered to be expansive in accordance with 1803.5.3 of the 2012 International Building Code. As such, subsurface soil improvements do not appear necessary for shrink/swell considerations.

4.11 Infiltration Testing

Two (2) infiltration tests (designated BMP-1 and BMP-2) were performed at their respective boring locations. The tests were performed at a depth of 3 feet below the existing site grades. The boreholes were prepared utilizing an auger to remove soil clippings from the base. Infiltration testing was then conducted within the vadose zone utilizing a Precision Permeameter and the following testing procedures.

A support stand was assembled and placed adjacent to each borehole. This stand holds a calibrated reservoir (3200 ml) and a cable used to raise and lower the water control unit (WCU). The WCU establishes a constant water head within the borehole during testing by use of a precision valve and float assembly. The WCU was attached to the flow reservoir with a 2-meter (6.6 foot) braided PVC hose and then lowered by cable into the borehole to the test depth elevation. As required by the Glover solution, the WCU was suspended above the bottom of the borehole at an elevation of approximately 5 times the borehole diameter. The shut-off valve was then opened allowing water to pass through the WCU to fill the borehole to the constant water level elevation. The absorption rate slowed as the soil voids became filled and an equilibrium developed as a wetting bulb developed around the borehole. Water was continuously added until the flow rate stabilized. The reservoir was then re-filled in order to begin testing. During testing, as the water drained into the borehole and surrounding soils, the water level within the calibrated reservoir was recorded as well as the elapsed time during each interval. The test was continued until relatively consistent flow rates were documented. During testing the quick release connections and shutoff valve were monitored to ensure that no leakage occurred. The flow rate (Q), height of the constant water level (H), and borehole diameter (D) were used to calculate K_s utilizing the Glover Solution.

Based on the field testing and corroborated with laboratory testing results (published values compared to classification results), the hydraulic conductivities of the tested soil are tabulated below (Table IV) and are presented on the “Hydraulic Conductivity Worksheet” reports (Appendix XIII), included with this report.

Table IV - Infiltration Test Results

Boring No.	Test Depth (ft)*	24-hr. Groundwater Reading (ft)*	Ksat Value (cm/sec)	Ksat Class	USCS Classification
BMP-1	3	7	3.52×10^{-2}	Very High	SP
BMP-2	3	10	3.91×10^{-2}	Very High	SP

* Depth below existing site grade at the test location

The infiltration test results provided in this report are the result of infiltration testing at the locations and depths indicated in Table IV. Varying site conditions, including soil composition, soil density, stratum depth, and stratum thickness should be expected throughout the site. As such, the infiltration test results indicated in Table VI should not be assumed for all locations and depths across the project site.

4.12 Estimated Soil Design Parameters

With regard to the design of the recommended foundation system to resist horizontal loads, the estimated soil parameters presented in Table V can be used.

Table V-Estimated Soil Design Parameters

Soil Type	Compacted Structural FILL (SP, SP-SM) or Natural SAND
Depth(1) (ft)	0 to 30
Moist Unit Weight (pcf)	115
Saturated Unit Weight (pcf)	130
Buoyant Unit Weight (pcf)	68
Friction Angle (ϕ) degrees	30
Cohesion (c) pcf	0
Active Soil Pressure-Ka	0.33
Passive Soil Pressure-Kp	3.0
At-rest Pressure-K_0	0.50

Note: (1) Depths below current grades.

4.13 Seismic Evaluation

The results of our shear wave velocity testing (SCPT sounding) indicate that the average shear wave velocity recorded at the location of CPT-01 (upper 31 meters) was 740 ft/sec. Therefore, this site should be classified as Site Class 'D' in accordance with Table 1613.5.2 of the 2012 International Building Code. The CPT test report is presented in Appendix XIV.

4.14 Liquefaction Potential

Based on the soil parameters, the subsurface granular soils recovered within the upper 100 feet at the project site are expected to have adequate resistance against liquefaction during a magnitude 7.5 earthquake. The liquefaction potential was analyzed in accordance with the "Simplified Procedure", which has become the standard of practice in North America for the past 25 years (refined during the 1996 workshop sponsored by the National Center for Earthquake Engineering Research).

5.0 CONSTRUCTION CONSIDERATIONS

5.1 Drainage and Groundwater Concerns

It is expected that dewatering may be required for excavations that extend near or below the groundwater table. Dewatering above the groundwater level could probably be accomplished by pumping from sumps. Dewatering at depths below the groundwater level may require well pointing; however, well pointing at this project site may induce settlement of the granular soils (by means of hydraulic compaction) within the influence zone. Though not recommended, if the contractor elects to install a well point system the contractor shall submit a dewatering plan with precise well point locations and depths. The dewatering plan should take into account the potential settlement of existing structures located within the influence zone. The dewatering plan shall be reviewed by the Geotechnical engineer prior to installing the well point system.

It would be advantageous to construct all fills early in the construction. If this is not accomplished, disturbance of the existing site drainage could result in collection of surface water in some areas, thus rendering these areas wet and very loose. Temporary drainage ditches should be employed by the contractor to accentuate drainage during construction. Again, we recommend that the contractor determine the actual groundwater levels at the time of construction to determine groundwater impact on this project.

5.2 Site Utility Installation

The base of the utility trenches should be observed by a qualified inspector prior to the utility and structure placement to verify the suitability of the bearing soils. Based on the results of our field exploration program it is expected that the utilities and structures located at depths greater than approximately 7 to 14 feet below current grades (elevations of 7 to 9 feet NAVD 88) may bear in wet granular soils. In these instances the bearing soils may require some stabilization to provide suitable bedding. This stabilization is typically accomplished by providing additional bedding materials (VDOT No. 57 stone). In addition depending on the depth of the utility trench excavation, some means of dewatering may be required to facilitate the utility installation and associated backfilling.

5.3 Additional Geotechnical Investigation

A comprehensive geotechnical investigation is recommended once the final layout (structure's footprint and site grades) and structural loads are determined. The subsurface data documented during this subsurface investigation can be incorporated within the final geotechnical investigation. Specifically, it is recommended to perform additional SPT borings within the limits of the proposed structure and to perform a more refined laboratory testing program to further evaluate the shallow subsurface fill materials and underlying compressible soils.

5.4 Excavations

In Federal Register, Volume 54, No. 209 (October, 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, part 1926, Subpart P". This document was issued to better ensure the safety of workmen entering trenches or excavations. It is mandated by this federal regulation that all excavations, whether they be utility trenches, basement excavation or footing excavations, be constructed in accordance with the new (OSHA) guidelines. It is our understanding that these regulations are being strictly enforced and if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

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

We are providing this information solely as a service to our client. **G E T Solutions, Inc.** is not assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred.

6.0 REPORT LIMITATIONS

The preliminary recommendations submitted are based on the available soil information obtained by **G E T Solutions, Inc.** and the information supplied by the client and their consultants for the proposed project. If there are any revisions to the plans for this project or if deviations from the subsurface conditions noted in this report are encountered during construction, **G E T Solutions, Inc.** should be notified immediately to determine if changes in the foundation recommendations are required. If **G E T Solutions, Inc.** is not retained to perform these functions, **G E T Solutions, Inc.** can not be responsible for the impact of those conditions on the geotechnical recommendations for the project.

The Geotechnical Engineer warrants that the findings, preliminary recommendations, specifications or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

The exploration conducted and for this report is not necessarily in sufficient detail for final geotechnical design of the project. Design-build teams should familiarize themselves with the site and general subsurface conditions and retain the services of their own consultant to make additional subsurface explorations and testing as deemed necessary to design and construct the project. Regardless of the thoroughness of a geotechnical exploration, there is always a possibility that conditions between test locations will be substantially different from those encountered at the specific testing locations. In addition, soil and groundwater conditions may become altered by construction activities and the passage of time. These possibilities should be considered by the designers and contractors.

This report has been prepared for the exclusive use of the client and their consultants for the specific application to the proposed Fort Story SOF Indoor Dynamic Range (P-183) in Virginia Beach, Virginia.

APPENDICES

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APPENDIX III	COMPREHENSIVE LABORATORY TEST RESULTS
APPENDIX IV	BORING LOGS
APPENDIX V	GENERALIZED SOIL PROFILE
APPENDIX VI	CBR TEST RESULTS
APPENDIX VII	ANALYTICAL LABORATORY REPORT
APPENDIX VIII	USGS GEOLOGICAL MAPS
APPENDIX IX	GEOPHYSICAL SURVEYS
APPENDIX X	TEST PIT PHOTOGRAPHIC DOCUMENTATION
APPENDIX XI	BEARING CAPACITY CALCULATIONS
APPENDIX XII	ELASTIC SETTLEMENT CALCULATIONS
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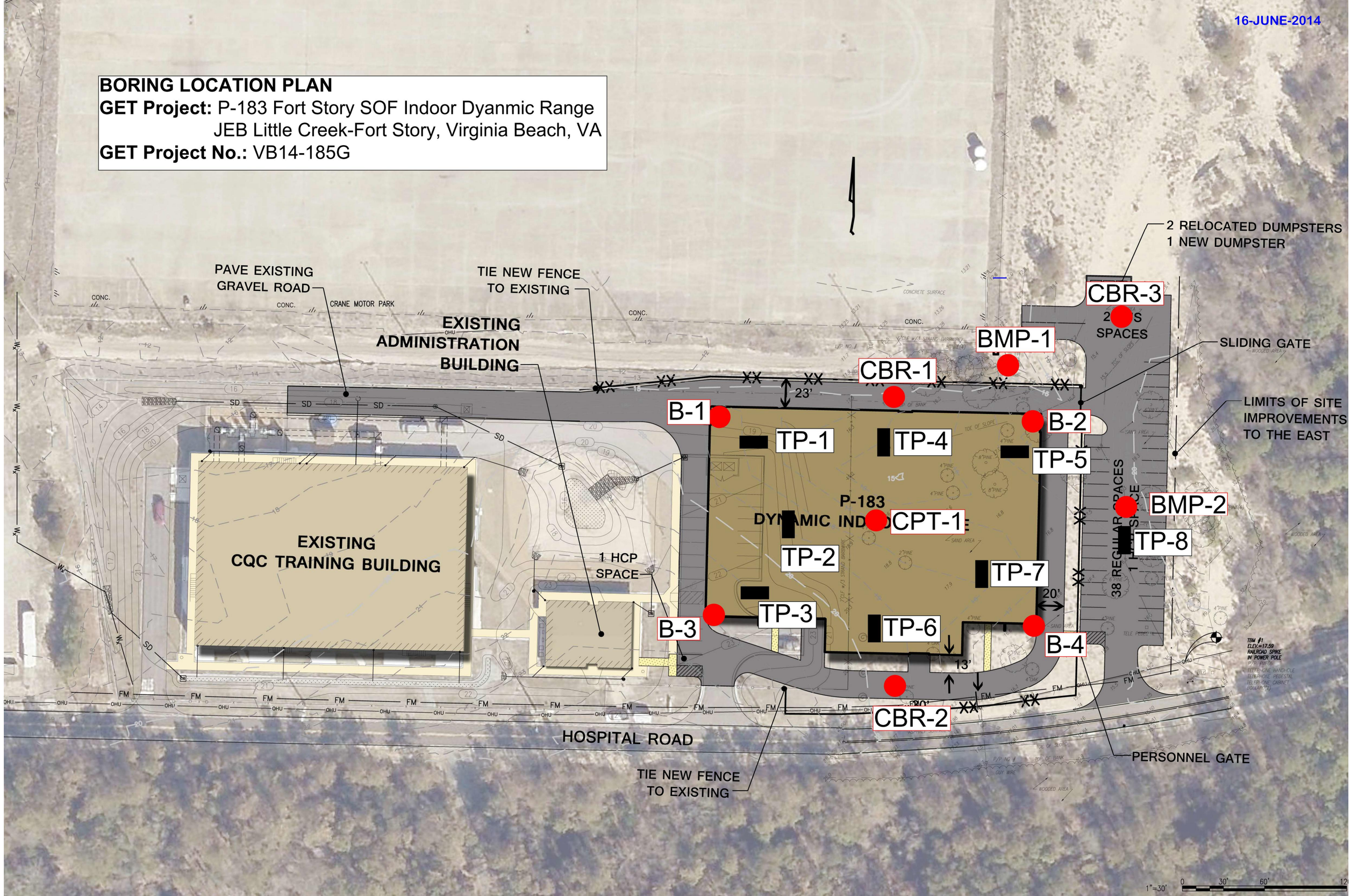
APPENDIX I

BORING, SOUNDING & TEST PIT LOCATION PLAN

16-JUNE-2014

BORING LOCATION PLAN
GET Project: P-183 Fort Story SOF Indoor Dyanmic Range
JEB Little Creek-Fort Story, Virginia Beach, VA
GET Project No.: VB14-185G



APPENDIX II

SUMMARY OF SOIL CLASSIFICATION

GET Solutions, Inc.
Geotechnical • Environmental • Testing

Virginia Beach
204 Grayson Road
Virginia Beach, VA 23462
(757) 518-1703

Williamsburg
1592 Penniman Rd. Suite E
Williamsburg, Virginia 23185
(757) 564-6452

Elizabeth City
504 East Elizabeth St. Suite 2
Elizabeth City, NC 27909
(252) 335-9765

CLASSIFICATION SYSTEM FOR SOIL EXPLORATION

Standard Penetration Test (SPT), N-value

Standard Penetration Tests (SPT) were performed in the field in general accordance with ASTM D 1586. The soil samples were obtained with a standard 1.4" I.D., 2" O.D., 30" long split-spoon sampler. The sampler was driven with blows of a 140 lb. hammer falling 30 inches. The number of blows required to drive the sampler each 6-inch increment (4 increments for each soil sample) of penetration was recorded and is shown on the boring logs. The sum of the second and third penetration increments is termed the SPT N-value.

NON COHESIVE SOILS

(SILT, SAND, GRAVEL and Combinations)

Relative Density

Very Loose	4 blows/ft. or less
Loose	5 to 10 blows/ft.
Medium Dense	11 to 30 blows/ft.
Dense	31 to 50 blows/ft.
Very Dense	51 blows/ft. or more

COHESIVE SOILS

(CLAY, SILT and Combinations)

Consistency

Very Soft	2 blows/ft. or less
Soft	3 to 4 blows/ft.
Medium Stiff	5 to 8 blows/ft.
Stiff	9 to 15 blows/ft.
Very Stiff	16 to 30 blows/ft.
Hard	31 blows/ft. or more

Particle Size Identification

Boulders	8 inch diameter or more	
Cobbles	3 to 8 inch diameter	
Gravel	Coarse	1 to 3 inch diameter
	Medium	$^1/_2$ to 1 inch diameter
	Fine	$^1/_4$ to $^1/_2$ inch diameter
Sand	Coarse	2.00 mm to $^1/_4$ inch (diameter of pencil lead)
	Medium	0.42 to 2.00 mm (diameter of broom straw)
	Fine	0.074 to 0.42 mm (diameter of human hair)
Silt		0.002 to 0.074 mm (cannot see particles)

Relative Proportions

Descriptive Term	Percent
Trace	0-5
Few	5-10
Little	15-25
Some	30-45
Mostly	50-100

Strata Changes

In the column "Description" on the boring log, the horizontal lines represent approximate strata changes.

Groundwater Readings

Groundwater conditions will vary with environmental variations and seasonal conditions, such as the frequency and magnitude of rainfall patterns, as well as tidal influences and man-made influences, such as existing swales, drainage ponds, underdrains and areas of covered soil (paved parking lots, side walks, etc.).

CLASSIFICATION SYMBOLS (ASTM D 2487 and D 2488)

Coarse Grained Soils

More than 50% retained on No. 200 sieve

GW - Well-graded Gravel
GP - Poorly graded Gravel
GW-GM - Well-graded Gravel w/Silt
GW-GC - Well-graded Gravel w/Clay
GP-GM - Poorly graded Gravel w/Silt
GP-GC - Poorly graded Gravel w/Clay
GM - Silty Gravel
GC - Clayey Gravel
GC-GM - Silty, Clayey Gravel
SW - Well-graded Sand
SP - Poorly graded Sand
SW-SM - Well-graded Sand w/Silt
SW-SC - Well-graded Sand w/Clay
SP-SM - Poorly graded Sand w/Silt
SP-SC - Poorly graded Sand w/Clay
SM - Silty Sand
SC - Clayey Sand
SC-SM - Silty, Clayey Sand

Fine-Grained Soils

50% or more passes the No. 200 sieve

CL - Lean Clay
CL-ML - Silty Clay
ML - Silt
OL - Organic Clay/Silt
Liquid Limit 50% or greater
CH - Fat Clay
MH - Elastic Silt
OH - Organic Clay/Silt

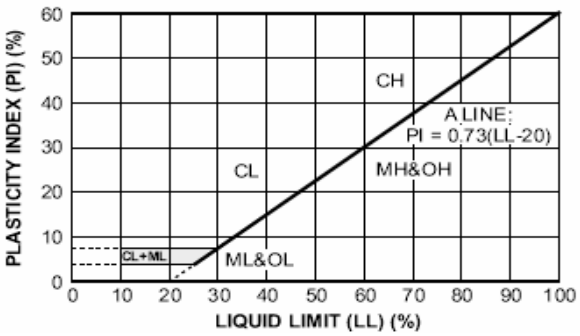
Highly Organic Soils

PT - Peat

Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent	GW, GP, SW,SP
More than 12 percent	GM, GC, SM, SC
5 to 12 percent	Borderline cases requiring dual symbols

Plasticity Chart



APPENDIX III

COMPREHENSIVE LABORATORY TEST RESULTS

GET Solutions, Inc.
204 Grayson Road
Virginia Beach, VA 23452
757-518-1703

SUMMARY OF LABORATORY RESULTS

CLIENT Clark Nexsen **PROJECT NAME** Fort Story SOF Indoor Dynamic Range

PROJECT NUMBER VB14-185G **PROJECT LOCATION** Virginia Beach, VA

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
B-1	19.0				0.075	4	SP	25.3			
B-1	34.0				0.075	5	SP	20.4			
B-1	59.0				0.075	13	SM	22.6			
B-1	79.0	33	30	3	0.075	88	ML	32.9			
B-2	69.0	54	29	25	0.075	88	CH	40.4			
BMP-1	3.0				0.075	0	SP	11.3			
BMP-2	3.0				0.075	0	SP	14.7			
BMP-2	5.0				0.075	1	SP	5.5			
BMP-2	14.0				0.075	1	SP	18.9			
CBR-2	9.0				0.075	1	SP	5.3			

(1) GET - LABORATORY TEST SUMMARY - GET_STANDARD_DATATEMPLATE(1).GDT - 7/23/14 12:21 - G:\GINT\PROJECTS\VB14\VB14-185G FORT STORY SOF INDOOR DYNAMIC RANGE.GPJ

APPENDIX IV

BORING LOGS

RECORD OF SUBSURFACE EXPLORATION

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Elizabeth City
106 Capital Trace Unit E
Elizabeth City, NC 27909
252-335-9765

Jacksonville
415-A Western Blvd
Jacksonville, NC 28546
910-478-9915

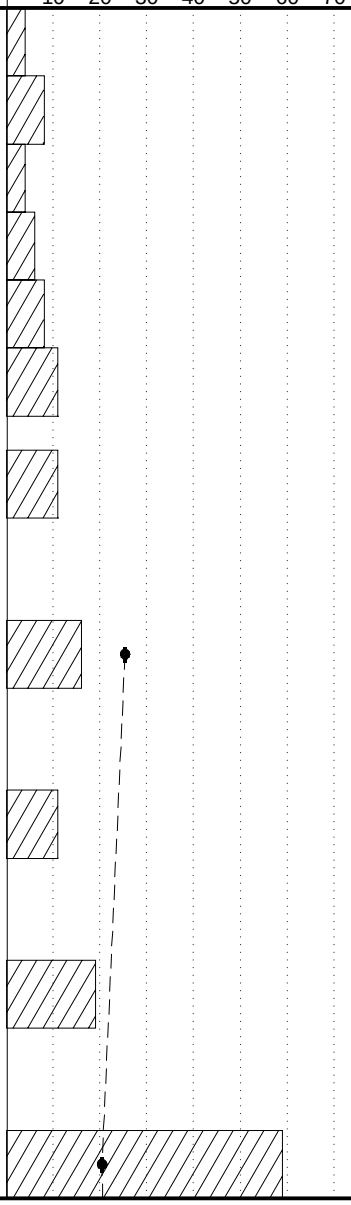
BORING ID B-1

PROJECT NAME: **P-183 Fort Story SOF Indoor Dynamic Range**
PROJECT NUMBER: **VB14-185G**
CLIENT: **Clark Nexsen**
SURFACE ELEVATION (MSL) (ft): **19**
PROJECT LOCATION: **Virginia Beach, VA**
LOGGED BY: **M. Murdock, P.E.**
BORING LOCATION: **See Attached Boring Location Plan**
DATE STARTED: **7/17/2014**
DRILLING METHOD(S): **Rotary wash "mud"**
DATE COMPLETED: **7/17/2014**
GROUNDWATER*: INITIAL (ft) ▽: **11** AFTER ____ HOURS (ft) ▼: ____ CAVE-IN (ft) ◌: ____
DRILLER: **GET Solutions, Inc.**

The initial groundwater readings are not intended to indicate the static groundwater level.

Elevation (ft)	Depth (ft)	STRATA DESCRIPTION	Sample ID	Sample Type	Sample Recovery (in.)	Blow Counts (N-Values)	%<#200
	0.3	4" Topsoil					
		Tan, moist, Poorly graded fine SAND (SP), very loose to loose-Uncontrolled FILL	1	SS		1-1-3-5 (4)	
			2	SS		2-4-4-3 (8)	
15	5.0		3	SS		2-2-2-3 (4)	
	5	Tan, moist to wet, Poorly graded fine SAND (SP), very loose to medium dense	4	SS		2-3-3-3 (6)	
10			5	SS		3-4-4-5 (8)	
▽	10		6	SS		5-5-6-7 (11)	
5			7	SS		6-5-6-8 (11)	
	15						
0			8	SS		7-7-9-10 (16)	4
	20						
	23.0						
-5		Gray-tan, wet, Poorly graded fine SAND (SP), medium dense to very dense	9	SS		8-5-6-6 (11)	
	25						
-10			10	SS		11-10-9-10 (19)	
	30						
-15			11	SS		24-25-34-30 (59)	5
	35						

TEST RESULTS



Sample Type(s):
SS - Split Spoon

Notes: ESHWT approximately at elevation of 9 ft. NAVD 88

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

RECORD OF SUBSURFACE EXPLORATION

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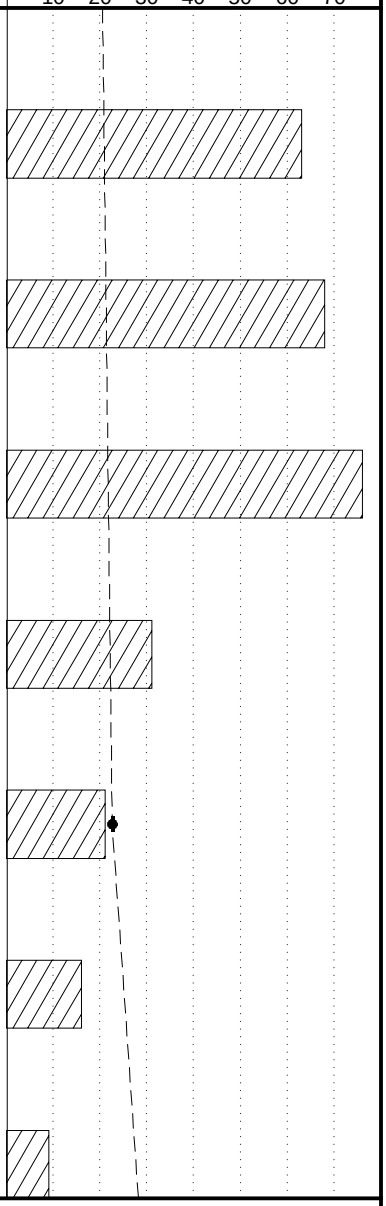
BORING ID B-1

PROJECT NAME: **P-183 Fort Story SOF Indoor Dynamic Range**
PROJECT NUMBER: **VB14-185G**
CLIENT: **Clark Nexsen**
SURFACE ELEVATION (MSL) (ft): **19**
PROJECT LOCATION: **Virginia Beach, VA**
LOGGED BY: **M. Murdock, P.E.**
BORING LOCATION: **See Attached Boring Location Plan**
DATE STARTED: **7/17/2014**
DRILLING METHOD(S): **Rotary wash "mud"**
DATE COMPLETED: **7/17/2014**
GROUNDWATER*: INITIAL (ft) ▽: **11** AFTER ____ HOURS (ft) ▼: ____ CAVE-IN (ft) ◌: ____
DRILLER: **GET Solutions, Inc.**

The initial groundwater readings are not intended to indicate the static groundwater level.

Elevation (ft)	Depth (ft)	STRATA DESCRIPTION	Sample ID	Sample Type	Sample Recovery (in.)	Blow Counts (N-Values)	%<#200
	36.5	Gray, wet, Silty fine SAND (SM), medium dense to very dense					
-20	40		12	SS		23-25-38-47 (63)	
-25	45		13	SS		28-30-38-40 (68)	
-30	50		14	SS		26-39-37-35 (76)	
-35	55		15	SS		15-16-15-22 (31)	
-40	60		16	SS		8-8-13-15 (21)	13
	61.5	Gray, wet, Clayey fine SAND (SC), medium dense					
-45	65		17	SS		7-8-8-10 (16)	
	68.0	Gray, wet, Fat CLAY (CH) with trace Sand, very soft to stiff					
-50	70		18	SS		4-5-4-5 (9)	

TEST RESULTS



Sample Type(s):
SS - Split Spoon

Notes: ESHWT approximately at elevation of 9 ft. NAVD 88

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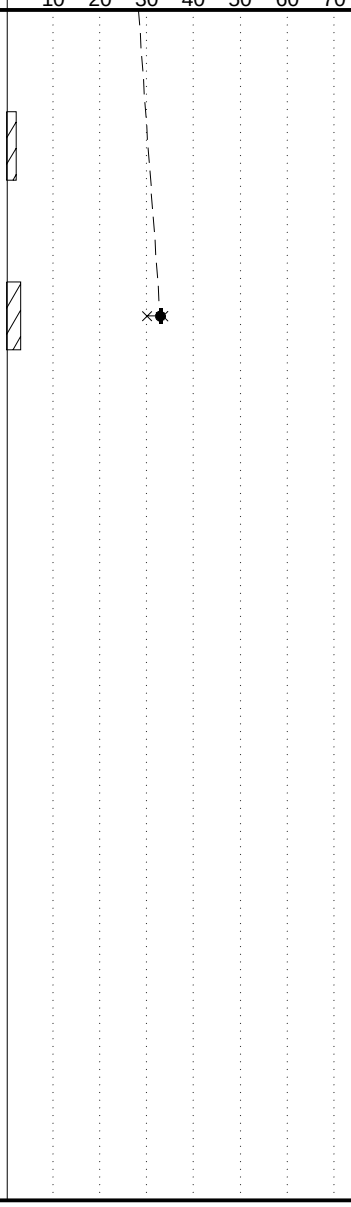
PROJECT NUMBER: **VB14-185G**
CLIENT: **Clark Nexsen**
SURFACE ELEVATION (MSL) (ft): **19**
PROJECT LOCATION: **Virginia Beach, VA**
LOGGED BY: **M. Murdock, P.E.**
BORING LOCATION: **See Attached Boring Location Plan**
DATE STARTED: **7/17/2014**
DRILLING METHOD(S): **Rotary wash "mud"**
DATE COMPLETED: **7/17/2014**
GROUNDWATER*: INITIAL (ft) ▽: **11** AFTER ____ HOURS (ft) ▼: ____ CAVE-IN (ft) ◌: ____
DRILLER: **GET Solutions, Inc.**

The initial groundwater readings are not intended to indicate the static groundwater level.

Elevation (ft)	Depth (ft)	STRATA DESCRIPTION	Sample ID	Sample Type	Sample Recovery (in.)	Blow Counts (N-Values)	%<#200
		Gray, wet, Fat CLAY (CH) with trace Sand, very soft to stiff (layer continued from previous page)					
-55	75		19	SS		1-1-1-3 (2)	
	76.5	Gray, wet, SILT (ML) with few Sand, soft					
-60	80		20	SS		1-1-2-3 (3)	88
	80.0	Boring terminated at 80 feet below existing grade.					

TEST RESULTS

Plastic Limit X——X Liquid Limit
Water Content - ●
Penetration - ▨



Sample Type(s):

SS - Split Spoon

Notes: ESHWT approximately at elevation of 9 ft. NAVD 88

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RECORD OF SUBSURFACE EXPLORATION

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BORING ID B-2

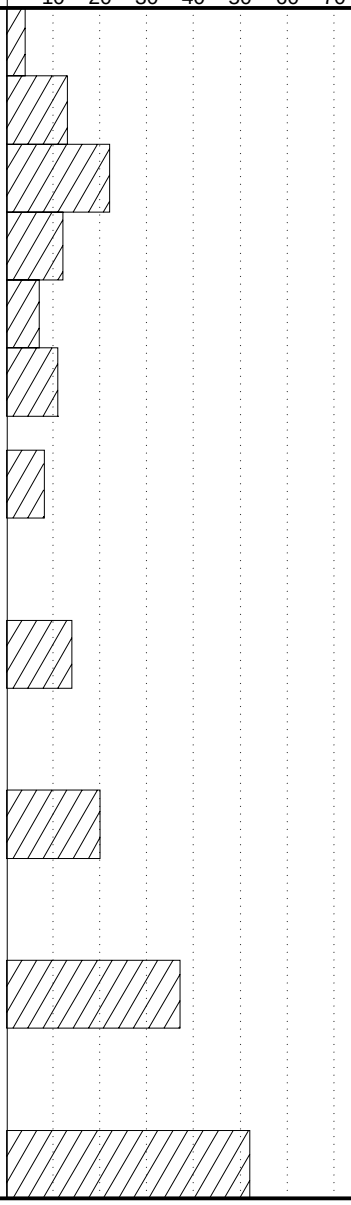
PROJECT NAME: **P-183 Fort Story SOF Indoor Dynamic Range**
PROJECT NUMBER: **VB14-185G**
CLIENT: **Clark Nexsen**
SURFACE ELEVATION (MSL) (ft): **16**
PROJECT LOCATION: **Virginia Beach, VA**
LOGGED BY: **M. Murdock, P.E.**
BORING LOCATION: **See Attached Boring Location Plan**
DATE STARTED: **7/19/2014**
DRILLING METHOD(S): **Rotary wash "mud"**
DATE COMPLETED: **7/19/2014**
GROUNDWATER*: INITIAL (ft) ▽: **9** AFTER ____ HOURS (ft) ▼: ____ CAVE-IN (ft) ◌: ____
DRILLER: **GET Solutions, Inc.**

The initial groundwater readings are not intended to indicate the static groundwater level.

Elevation (ft)	Depth (ft)	STRATA DESCRIPTION	Strata Legend	Sample ID	Sample Type	Sample Recovery (in.)	Blow Counts (N-Values)	%<#200
15		Tan, moist, Poorly graded fine SAND (SP), very loose to medium dense		1	SS		2-2-2-4 (4)	
		3.0						
		Tan mottled dark brown, moist, Poorly graded fine SAND (SP) with trace organics, medium dense		2	SS		4-5-8-11 (13)	
	5			3	SS		8-10-12-12 (22)	
10		6.0						
		Tan mottled dark brown, moist, Poorly graded fine SAND (SP) with interbedded Silty SAND, medium dense		4	SS		9-6-6-5 (12)	
		8.0						
▽		Tan, moist to wet, Poorly graded fine SAND (SP), loose to dense		5	SS		2-3-4-5 (7)	
	10							
5				6	SS		3-6-5-7 (11)	
				7	SS		4-4-4-6 (8)	
	15							
0								
				8	SS		4-7-7-8 (14)	
	20							
-5								
				9	SS		8-10-10-13 (20)	
	25							
-10								
				10	SS		7-18-19-24 (37)	
	30							
-15		31.5						
		Tan-gray, wet, Poorly graded fine SAND (SP), very dense						
				11	SS		18-26-26-28 (52)	
	35							

TEST RESULTS

Plastic Limit X——X Liquid Limit
Water Content - ●
Penetration - ▨



Sample Type(s):

SS - Split Spoon

Notes: ESHWT approximately at elevation of 9 ft. NAVD 88

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910-478-9915

BORING ID
B-2

PROJECT NAME: **P-183 Fort Story SOF Indoor Dynamic Range**
PROJECT NUMBER: **VB14-185G**
CLIENT: **Clark Nexsen**
SURFACE ELEVATION (MSL) (ft): **16**
PROJECT LOCATION: **Virginia Beach, VA**
LOGGED BY: **M. Murdock, P.E.**
BORING LOCATION: **See Attached Boring Location Plan**
DATE STARTED: **7/19/2014**
DRILLING METHOD(S): **Rotary wash "mud"**
DATE COMPLETED: **7/19/2014**
GROUNDWATER*: INITIAL (ft) ▽: **9** AFTER ____ HOURS (ft) ▼: ____ CAVE-IN (ft) ◌: ____
DRILLER: **GET Solutions, Inc.**

The initial groundwater readings are not intended to indicate the static groundwater level.

Elevation (ft)	Depth (ft)	STRATA DESCRIPTION	Sample ID	Sample Type	Sample Recovery (in.)	Blow Counts (N-Values)	%<#200
-20		Tan-gray, wet, Poorly graded fine SAND (SP), very dense (layer continued from previous page)					
	40		12	SS		22-28-30-27 (58)	
-25							
	45		13	SS		22-31-33-32 (64)	
-30							
	49.0	Gray, wet, Poorly graded fine SAND (SP), dense to very dense	14	SS		15-25-32-33 (57)	
	50						
-35							
	55		15	SS		15-20-20-19 (40)	
-40							
	58.0	Gray, wet, Clayey fine SAND (SC), loose to medium dense	16	SS		6-11-14-17 (25)	
	60						
-45							
	65		17	SS		6-5-4-7 (9)	
-50	66.5	Gray, wet, Fat CLAY (CH) with trace to few Sand, very soft to medium stiff					
	70		18	SS		1-1-1-2 (2)	88

TEST RESULTS
Plastic Limit ×——× Liquid Limit
Water Content - ●
Penetration - ▨
10 20 30 40 50 60 70

Sample Type(s):
SS - Split Spoon

Notes: ESHWT approximately at elevation of 9 ft. NAVD 88

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

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BORING ID B-2

PROJECT NAME: **P-183 Fort Story SOF Indoor Dynamic Range**
PROJECT NUMBER: **VB14-185G**
CLIENT: **Clark Nexsen**
SURFACE ELEVATION (MSL) (ft): **16**
PROJECT LOCATION: **Virginia Beach, VA**
LOGGED BY: **M. Murdock, P.E.**
BORING LOCATION: **See Attached Boring Location Plan**
DATE STARTED: **7/19/2014**
DRILLING METHOD(S): **Rotary wash "mud"**
DATE COMPLETED: **7/19/2014**
GROUNDWATER*: INITIAL (ft) ▽: **9** AFTER ____ HOURS (ft) ▼: ____ CAVE-IN (ft) ◌: ____
DRILLER: **GET Solutions, Inc.**

The initial groundwater readings are not intended to indicate the static groundwater level.

Elevation (ft)	Depth (ft)	STRATA DESCRIPTION	Strata Legend	Sample ID	Sample Type	Sample Recovery (in.)	Blow Counts (N-Values)	%<#200	TEST RESULTS (Plastic Limit X——X Liquid Limit; Water Content - ●; Penetration - ▨; 10 20 30 40 50 60 70)
-55		Gray, wet, Fat CLAY (CH) with trace to few Sand, very soft to medium stiff (layer continued from previous page)							
	75			19	X		2-3-2-3 (5)		
-60									
	79.0			20	X		3-3-5-4 (8)		
	80	80.0 Gray, wet, Fat CLAY (CH) with some Sand, medium stiff							
		Boring terminated at 80 feet below existing grade.							

Sample Type(s):
X SS - Split Spoon

Notes: ESHWT approximately at elevation of 9 ft. NAVD 88

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

RECORD OF SUBSURFACE EXPLORATION

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BORING ID B-3

PROJECT NAME: **P-183 Fort Story SOF Indoor Dynamic Range**
PROJECT NUMBER: **VB14-185G**
CLIENT: **Clark Nexsen**
SURFACE ELEVATION (MSL) (ft): **23**
PROJECT LOCATION: **Virginia Beach, VA**
LOGGED BY: **M. Murdock, P.E.**
BORING LOCATION: **See Attached Boring Location Plan**
DATE STARTED: **7/18/2014**
DRILLING METHOD(S): **Rotary wash "mud"**
DATE COMPLETED: **7/18/2014**
GROUNDWATER*: INITIAL (ft) ▽: **14** AFTER ____ HOURS (ft) ▼: ____ CAVE-IN (ft) ◌: ____
DRILLER: **GET Solutions, Inc.**

The initial groundwater readings are not intended to indicate the static groundwater level.

Elevation (ft)	Depth (ft)	STRATA DESCRIPTION	Sample ID	Sample Type	Sample Recovery (in.)	Blow Counts (N-Values)	%<#200
	0.3	4-in. of Asphalt Pavement					
	1.0	8-in. of Aggregate Base Material					
		Tan, moist, Poorly graded fine SAND (SP) with trace fine Gravel, loose to medium dense-Uncontrolled FILL	1	SS		8-12	
20			2	SS		10-12-9-9 (21)	
	5		3	SS		7-8-9-8 (17)	
	7.0		4	SS		6-5-3-3 (8)	
15		Tan, moist to wet, Poorly graded fine SAND (SP), very loose to loose	5	SS		2-3-2-3 (5)	
	10		6	SS		2-2-2-2 (4)	
10 ▽			7	SS		2-2-4-4 (6)	
	14.5	Tan-gray, wet, Poorly graded fine SAND (SP), loose to very dense					
5	15		8	SS		3-4-4-4 (8)	
	20						
0			9	SS		5-6-8-9 (14)	
	25						
-5			10	SS		6-4-4-8 (8)	
	30						
-10			11	SS		8-12-19-22 (31)	
	35						

TEST RESULTS
Plastic Limit X——X Liquid Limit
Water Content - ●
Penetration - ▨
10 20 30 40 50 60 70

Sample Type(s):
SS - Split Spoon

Notes: ESHWT approximately at elevation of 9 ft. NAVD 88

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

RECORD OF SUBSURFACE EXPLORATION

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BORING ID B-3

PROJECT NAME: **P-183 Fort Story SOF Indoor Dynamic Range**
PROJECT NUMBER: **VB14-185G**
CLIENT: **Clark Nexsen**
SURFACE ELEVATION (MSL) (ft): **23**
PROJECT LOCATION: **Virginia Beach, VA**
LOGGED BY: **M. Murdock, P.E.**
BORING LOCATION: **See Attached Boring Location Plan**
DATE STARTED: **7/18/2014**
DRILLING METHOD(S): **Rotary wash "mud"**
DATE COMPLETED: **7/18/2014**
GROUNDWATER*: INITIAL (ft) ▽: **14** AFTER ____ HOURS (ft) ▼: ____ CAVE-IN (ft) ◌: ____
DRILLER: **GET Solutions, Inc.**

The initial groundwater readings are not intended to indicate the static groundwater level.

Elevation (ft)	Depth (ft)	STRATA DESCRIPTION	Sample ID	Sample Type	Sample Recovery (in.)	Blow Counts (N-Values)	%<#200
		Tan-gray, wet, Poorly graded fine SAND (SP), loose to very dense (layer continued from previous page)					
-15	40		12	SS		23-26-33-40 (59)	
	41.5	Gray, wet, Poorly graded fine SAND (SP), medium dense to very dense					
-20	45		13	SS		23-34-32-40 (66)	
-25	50		14	SS		30-43-45-45 (88)	
-30	55		15	SS		25-28-31-32 (59)	
-35	60		16	SS		17-14-22-33 (36)	
-40	65		17	SS		13-14-13-16 (27)	
-45	69.0	Gray, wet, Clayey fine SAND (SC), medium dense	18	SS		5-8-8-12 (16)	
	70						

TEST RESULTS
Plastic Limit X——X Liquid Limit
Water Content - ●
Penetration - ▨
10 20 30 40 50 60 70

Sample Type(s):
SS - Split Spoon

Notes: ESHWT approximately at elevation of 9 ft. NAVD 88

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

RECORD OF SUBSURFACE EXPLORATION

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BORING ID
B-3

PROJECT NAME: **P-183 Fort Story SOF Indoor Dynamic Range**
PROJECT NUMBER: **VB14-185G**
CLIENT: **Clark Nexsen**
SURFACE ELEVATION (MSL) (ft): **23**
PROJECT LOCATION: **Virginia Beach, VA**
LOGGED BY: **M. Murdock, P.E.**
BORING LOCATION: **See Attached Boring Location Plan**
DATE STARTED: **7/18/2014**
DRILLING METHOD(S): **Rotary wash "mud"**
DATE COMPLETED: **7/18/2014**
GROUNDWATER*: INITIAL (ft) ▽: **14** AFTER ____ HOURS (ft) ▼: ____ CAVE-IN (ft) ◌: ____
DRILLER: **GET Solutions, Inc.**

The initial groundwater readings are not intended to indicate the static groundwater level.

Elevation (ft)	Depth (ft)	STRATA DESCRIPTION	Strata Legend	Sample ID	Sample Type	Sample Recovery (in.)	Blow Counts (N-Values)	%<#200	TEST RESULTS (Plastic Limit X——X Liquid Limit; Water Content - ●; Penetration - ▨; 10 20 30 40 50 60 70)
		Gray, wet, Clayey fine SAND (SC), medium dense (layer continued from previous page)							
-50		73.0							
		Gray, wet, Fat CLAY (CH) with trace Sand, soft		19	X		1-2-2-3 (4)		
	75								
-55									
		79.0		20	X		3-3-14-11 (17)		
	80	80.0 Gray, wet, Clayey fine to coarse SAND (SC) with trace Gravel, medium dense							
		Boring terminated at 80 feet below existing grade.							

Sample Type(s):
X SS - Split Spoon

Notes: ESHWT approximately at elevation of 9 ft. NAVD 88

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

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BORING ID B-4

PROJECT NAME: **P-183 Fort Story SOF Indoor Dynamic Range**
PROJECT NUMBER: **VB14-185G**
CLIENT: **Clark Nexsen**
SURFACE ELEVATION (MSL) (ft): **16.5**
PROJECT LOCATION: **Virginia Beach, VA**
LOGGED BY: **M. Murdock, P.E.**
BORING LOCATION: **See Attached Boring Location Plan**
DATE STARTED: **7/18/2014**
DRILLING METHOD(S): **Rotary wash "mud"**
DATE COMPLETED: **7/18/2014**
GROUNDWATER*: INITIAL (ft) ▽: **8** AFTER ____ HOURS (ft) ▼: ____ CAVE-IN (ft) ○: ____
DRILLER: **GET Solutions, Inc.**

The initial groundwater readings are not intended to indicate the static groundwater level.

Elevation (ft)	Depth (ft)	STRATA DESCRIPTION	Sample ID	Sample Type	Sample Recovery (in.)	Blow Counts (N-Values)	%<#200
15		Tan, moist, Poorly graded fine SAND (SP) with trace fine Gravel and trace fibrous organics, loose to medium dense	1	SS		2-2-5-6 (7)	
			2	SS		6-8-8-8 (16)	
	4.0						
	5	Dark tan, moist, Poorly graded fine SAND (SP-SM) with Silt, medium dense	3	SS		7-10-12-13 (22)	
10			4	SS		8-10-10-13 (20)	
▽	8.0						
		Tan, wet, Poorly graded fine SAND (SP), loose to medium dense	5	SS		5-6-7-8 (13)	
	10		6	SS		5-5-6-6 (11)	
5							
			7	SS		6-5-4-5 (9)	
	15						
0							
			8	SS		7-3-3-3 (6)	
	20						
-5							
			9	SS		4-3-7-11 (10)	
	25						
-10	26.5						
		Tan-gray, wet, Poorly graded fine SAND (SP), medium dense to very dense	10	SS		6-7-13-19 (20)	
	30						
-15							
			11	SS		13-17-23-33 (40)	
	35						

TEST RESULTS
Plastic Limit X——X Liquid Limit
Water Content - ●
Penetration - ▨
10 20 30 40 50 60 70

Sample Type(s):
SS - Split Spoon

Notes: ESHWT approximately at elevation of 9 ft. NAVD 88

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

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BORING ID B-4

PROJECT NAME: **P-183 Fort Story SOF Indoor Dynamic Range**
PROJECT NUMBER: **VB14-185G**
CLIENT: **Clark Nexsen**
SURFACE ELEVATION (MSL) (ft): **16.5**
PROJECT LOCATION: **Virginia Beach, VA**
LOGGED BY: **M. Murdock, P.E.**
BORING LOCATION: **See Attached Boring Location Plan**
DATE STARTED: **7/18/2014**
DRILLING METHOD(S): **Rotary wash "mud"**
DATE COMPLETED: **7/18/2014**
GROUNDWATER*: INITIAL (ft) ▽: **8** AFTER ____ HOURS (ft) ▼: ____ CAVE-IN (ft) ◌: ____
DRILLER: **GET Solutions, Inc.**

The initial groundwater readings are not intended to indicate the static groundwater level.

Elevation (ft)	Depth (ft)	STRATA DESCRIPTION	Sample ID	Sample Type	Sample Recovery (in.)	Blow Counts (N-Values)	%<#200
		Tan-gray, wet, Poorly graded fine SAND (SP), medium dense to very dense (layer continued from previous page)					
-20	40		12	SS		22-20-32-44 (52)	
-25	45		13	SS		22-32-39-36 (71)	
-30	50		14	SS		26-25-27-30 (52)	
-35	55		15	SS		19-20-33-24 (53)	
-40	56.5	Gray, wet, Poorly graded fine SAND (SP), medium dense	16	SS		9-14-15-12 (29)	
-45	60		17	SS		5-7-8-7 (15)	
-50	65	65.0 Gray, wet, Clayey fine SAND (SC), medium dense					
	70	68.0 Gray, wet, Fat CLAY (CH), soft	18	SS		2-1-2-4 (3)	

TEST RESULTS
Plastic Limit X——X Liquid Limit
Water Content - ●
Penetration - ▨
10 20 30 40 50 60 70

Sample Type(s):
SS - Split Spoon

Notes: ESHWT approximately at elevation of 9 ft. NAVD 88

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

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BORING ID B-4

PROJECT NAME: **P-183 Fort Story SOF Indoor Dynamic Range**
PROJECT NUMBER: **VB14-185G**
CLIENT: **Clark Nexsen**
SURFACE ELEVATION (MSL) (ft): **16.5**
PROJECT LOCATION: **Virginia Beach, VA**
LOGGED BY: **M. Murdock, P.E.**
BORING LOCATION: **See Attached Boring Location Plan**
DATE STARTED: **7/18/2014**
DRILLING METHOD(S): **Rotary wash "mud"**
DATE COMPLETED: **7/18/2014**
GROUNDWATER*: INITIAL (ft) ▽: **8** AFTER ____ HOURS (ft) ▼: ____ CAVE-IN (ft) ◌: ____
DRILLER: **GET Solutions, Inc.**

The initial groundwater readings are not intended to indicate the static groundwater level.

Elevation (ft)	Depth (ft)	STRATA DESCRIPTION	Strata Legend	Sample ID	Sample Type	Sample Recovery (in.)	Blow Counts (N-Values)	%<#200	TEST RESULTS (Plastic Limit X——X Liquid Limit; Water Content - ●; Penetration - ▨; 10 20 30 40 50 60 70)
		Gray, wet, Fat CLAY (CH), soft (layer continued from previous page)							
-55	71.5	Gray, wet, Silty fine to medium SAND (SM) with trace fine Gravel, medium dense							
	75			19	X		9-11-11-12 (22)		
-60	76.5	Gray, wet, Fat CLAY (CH) with some SAND and little fine Gravel, soft							
	80			20	X		1-2-2-2 (4)		
	80.0	Boring terminated at 80 feet below existing grade.							

Sample Type(s):

X SS - Split Spoon

Notes: ESHWT approximately at elevation of 9 ft. NAVD 88

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

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BORING ID BMP-1

PROJECT NAME: **P-183 Fort Story SOF Indoor Dynamic Range**
PROJECT NUMBER: **VB14-185G**
CLIENT: **Clark Nexsen**
SURFACE ELEVATION (MSL) (ft): **13**
PROJECT LOCATION: **Virginia Beach, VA**
LOGGED BY: **M. Murdock, P.E.**
BORING LOCATION: **See Attached Boring Location Plan**
DATE STARTED: **7/17/2014**
DRILLING METHOD(S): **Rotary wash "mud"**
DATE COMPLETED: **7/17/2014**
GROUNDWATER*: INITIAL (ft) ▽: **8** AFTER ____ HOURS (ft) ▼: **7.2** CAVE-IN (ft) ◌: ____
DRILLER: **GET Solutions, Inc.**

The initial groundwater readings are not intended to indicate the static groundwater level.

Elevation (ft)	Depth (ft)	STRATA DESCRIPTION	Strata Legend	Sample ID	Sample Type	Sample Recovery (in.)	Blow Counts (N-Values)	%<#200
		Tan, moist, Poorly graded fine SAND (SP), loose to medium dense		1	SS		2-3-4-5 (7)	
10				2	SS		4-5-6-6 (11)	0
	5	5.0		3	SS		4-4-4-4 (8)	
		6.0 Gray-tan, moist, Poorly graded fine SAND (SP), loose						
		Dark brown, moist to wet, Poorly graded fine SAND (SP), very loose to loose		4	SS		4-3-4-4 (7)	
5 ▼				5	SS		2-2-3-2 (5)	
	10			6	SS		1-2-2-3 (4)	
0				7	SS		2-3-3-5 (6)	
	15	15.0						
		Boring terminated at 15 feet below existing grade.						

TEST RESULTS
Plastic Limit X——X Liquid Limit
Water Content - ●
Penetration - ▨
10 20 30 40 50 60 70

Sample Type(s):
SS - Split Spoon

Notes: ESHWT approximately at elevation of 9 ft. NAVD 88

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

RECORD OF SUBSURFACE EXPLORATION

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BORING ID BMP-2

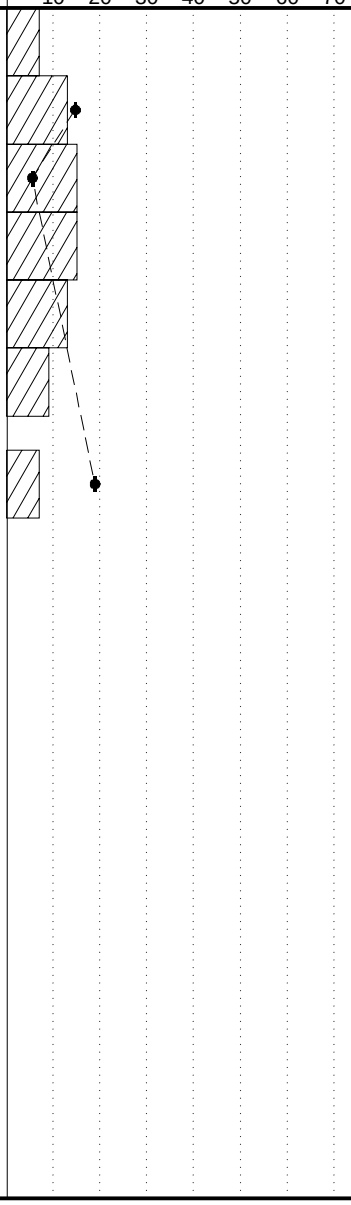
PROJECT NAME: **P-183 Fort Story SOF Indoor Dynamic Range**
PROJECT NUMBER: **VB14-185G**
CLIENT: **Clark Nexsen**
SURFACE ELEVATION (MSL) (ft): **17.5**
PROJECT LOCATION: **Virginia Beach, VA**
LOGGED BY: **M. Murdock, P.E.**
BORING LOCATION: **See Attached Boring Location Plan**
DATE STARTED: **7/17/2014**
DRILLING METHOD(S): **Rotary wash "mud"**
DATE COMPLETED: **7/17/2014**
GROUNDWATER*: INITIAL (ft) ▽: **10** AFTER **24** HOURS (ft) ▼: **10.2** CAVE-IN (ft) ◌: ____
DRILLER: **GET Solutions, Inc.**

The initial groundwater readings are not intended to indicate the static groundwater level.

Elevation (ft)	Depth (ft)	STRATA DESCRIPTION	Strata Legend	Sample ID	Sample Type	Sample Recovery (in.)	Blow Counts (N-Values)	%<#200
		Tan, moist to wet, Poorly graded fine SAND (SP), loose to medium dense		1	SS		2-3-4-6 (7)	
15				2	SS		5-6-7-8 (13)	0
	5			3	SS		5-7-8-10 (15)	1
10				4	SS		7-7-8-8 (15)	
				5	SS		7-7-6-5 (13)	
▼	10			6	SS		4-4-5-5 (9)	
5								
				7	SS		3-3-4-5 (7)	1
	15	15.0 Boring terminated at 15 feet below existing grade.						

TEST RESULTS

Plastic Limit X——X Liquid Limit
Water Content - ●
Penetration - ▨



Sample Type(s):

SS - Split Spoon

Notes: ESHWT approximately at elevation of 9 ft. NAVD 88

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

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BORING ID CBR-1

PROJECT NAME: **P-183 Fort Story SOF Indoor Dynamic Range**
PROJECT NUMBER: **VB14-185G**
CLIENT: **Clark Nexsen**
SURFACE ELEVATION (MSL) (ft): **15**
PROJECT LOCATION: **Virginia Beach, VA**
LOGGED BY: **M. Murdock, P.E.**
BORING LOCATION: **See Attached Boring Location Plan**
DATE STARTED: **7/17/2014**
DRILLING METHOD(S): **Rotary wash "mud"**
DATE COMPLETED: **7/17/2014**
GROUNDWATER*: INITIAL (ft) ▽: **7** AFTER ____ HOURS (ft) ▼: ____ CAVE-IN (ft) ○: ____
DRILLER: **GET Solutions, Inc.**

The initial groundwater readings are not intended to indicate the static groundwater level.

Elevation (ft)	Depth (ft)	STRATA DESCRIPTION	Strata Legend	Sample ID	Sample Type	Sample Recovery (in.)	Blow Counts (N-Values)	%<#200	TEST RESULTS (Plastic Limit X——X Liquid Limit; Water Content - ●; Penetration - ▨; 10 20 30 40 50 60 70)
		Gray-tan to reddish tan, moist, Poorly graded fine SAND (SP), loose		1	SS		1-2-4-4 (6)		
				2	SS		3-5-4-5 (9)		
		4.0							
10	5	Tan, moist to wet, Poorly graded fine SAND (SP), loose		3	SS		5-5-4-3 (9)		
▽				4	SS		2-3-3-3 (6)		
				5	SS		2-2-3-5 (5)		
5	10			6	SS		3-4-5-6 (9)		
		12.0							
		Boring terminated at 12 feet below existing grade.							

Sample Type(s):
SS - Split Spoon

Notes: ESHWT approximately at elevation of 9 ft. NAVD 88

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

RECORD OF SUBSURFACE EXPLORATION

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BORING ID CBR-2

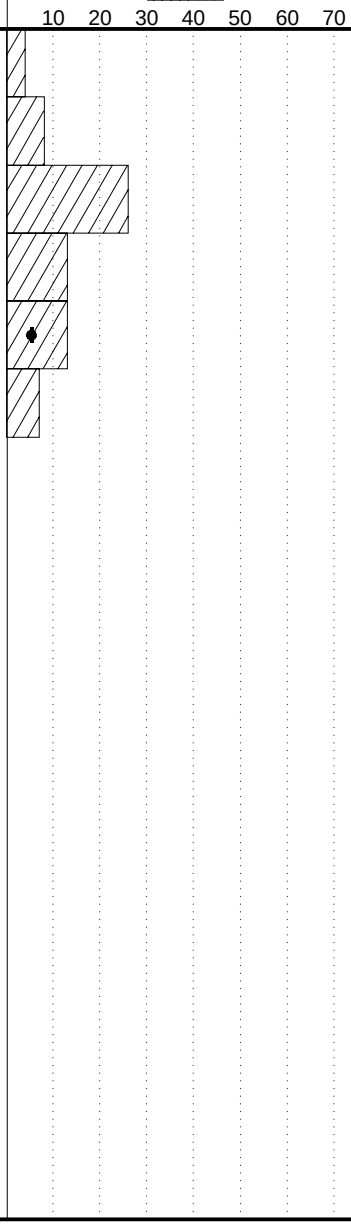
PROJECT NAME: **P-183 Fort Story SOF Indoor Dynamic Range**
PROJECT NUMBER: **VB14-185G**
CLIENT: **Clark Nexsen**
SURFACE ELEVATION (MSL) (ft): **20**
PROJECT LOCATION: **Virginia Beach, VA**
LOGGED BY: **M. Murdock, P.E.**
BORING LOCATION: **See Attached Boring Location Plan**
DATE STARTED: **7/17/2014**
DRILLING METHOD(S): **Rotary wash "mud"**
DATE COMPLETED: **7/17/2014**
GROUNDWATER*: INITIAL (ft) ▽: ____ AFTER ____ HOURS (ft) ▼: ____ CAVE-IN (ft) ◌: ____
DRILLER: **GET Solutions, Inc.**

The initial groundwater readings are not intended to indicate the static groundwater level.

Elevation (ft)	Depth (ft)	STRATA DESCRIPTION	Strata Legend	Sample ID	Sample Type	Sample Recovery (in.)	Blow Counts (N-Values)	%<#200
		Tan, moist, Poorly graded fine SAND (SP), very loose (2.0)		1	SS		1-1-3-4 (4)	
		Tan-gray, moist, Poorly graded fine SAND (SP) with trace fine to medium Gravel, loose to medium dense (4.0)		2	SS		5-4-4-12 (8)	
15	5	Tan, moist, Poorly graded fine SAND (SP), medium dense (6.0)		3	SS		14-15-11-15 (26)	
		Tan-gray, moist, Poorly graded fine SAND (SP), medium dense (8.0)		4	SS		6-6-7-7 (13)	
		Reddish tan, moist, Poorly graded fine SAND (SP), loose to medium dense		5	SS		6-6-7-7 (13)	1
10	10	(12.0)		6	SS		4-3-4-4 (7)	

Boring terminated at 12 feet below existing grade.

TEST RESULTS



Sample Type(s):
SS - Split Spoon

Notes: ESHWT approximately at elevation of 9 ft. NAVD 88

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

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BORING ID CBR-3

PROJECT NAME: **P-183 Fort Story SOF Indoor Dynamic Range**
PROJECT NUMBER: **VB14-185G**
CLIENT: **Clark Nexsen**
SURFACE ELEVATION (MSL) (ft): **15.5**
PROJECT LOCATION: **Virginia Beach, VA**
LOGGED BY: **M. Murdock, P.E.**
BORING LOCATION: **See Attached Boring Location Plan**
DATE STARTED: **7/17/2014**
DRILLING METHOD(S): **Rotary wash "mud"**
DATE COMPLETED: **7/17/2014**
GROUNDWATER*: INITIAL (ft) ▽: **8** AFTER ____ HOURS (ft) ▼: ____ CAVE-IN (ft) ○: ____
DRILLER: **GET Solutions, Inc.**

The initial groundwater readings are not intended to indicate the static groundwater level.

Elevation (ft)	Depth (ft)	STRATA DESCRIPTION	Strata Legend	Sample ID	Sample Type	Sample Recovery (in.)	Blow Counts (N-Values)	%<#200	TEST RESULTS (Plastic Limit X——X Liquid Limit; Water Content - ●; Penetration - ▨; 10 20 30 40 50 60 70)
15		Tan, moist, Poorly graded fine SAND (SP), loose		1	SS		2-3-3-5 (6)		
				2	SS		3-4-5-4 (9)		
	5			3	SS		3-3-4-5 (7)		
10		5.5 / 6.0 Brown, moist, Poorly graded fine SAND (SP), loose							
		Tan, moist to wet, Poorly graded fine SAND (SP), loose		4	SS		3-4-5-3 (9)		
▽				5	SS		3-5-5-5 (10)		
5	10			6	SS		4-5-5-5 (10)		
		12.0 Boring terminated at 12 feet below existing grade.							

Sample Type(s):
SS - Split Spoon

Notes: ESHWT approximately at elevation of 9 ft. NAVD 88

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

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TEST PIT BORING ID TP-1

PROJECT NAME: **P-183 Fort Story SOF Indoor Dynamic Range**
PROJECT NUMBER: **VB14-185G**
CLIENT: **Clark Nexsen**
SURFACE ELEVATION (MSL) (ft): **20**
PROJECT LOCATION: **Virginia Beach, VA**
LOGGED BY: **M. Murdock, P.E.**
BORING LOCATION: **See Attached Boring Location Plan**
DATE STARTED: **9/25/2014**
DRILLING METHOD(S): **Backhoe**
DATE COMPLETED: **9/25/2014**
GROUNDWATER*: INITIAL (ft) ▽: ____ AFTER ____ HOURS (ft) ▼: ____ CAVE-IN (ft) ○: ____
DRILLER: **GET Solutions, Inc.**

The initial groundwater readings are not intended to indicate the static groundwater level.

Elevation (ft)	Depth (ft)	STRATA DESCRIPTION	Strata Legend	Sample ID	Sample Type	Sample Recovery (in.)	%<#200	TEST RESULTS (Plastic Limit X——X Liquid Limit; Water Content - ●; Penetration - ▨; 10 20 30 40 50 60 70)
		0.3 4" Topsoil						
		Tan, moist, Poorly graded fine SAND (SP)-Uncontrolled FILL						
	1							
	2							
	3							
	4	2-foot long steel debris recovered at a depth of 4 ft. below grades						
15	5	5.0 Tan, moist, Poorly graded fine SAND (SP)						
	6							
	7							
	8							
		8.5 Boring terminated at 8.5 feet below existing grade.						

Sample Type(s):

Notes:

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TEST PIT BORING ID TP-2

PROJECT NAME: **P-183 Fort Story SOF Indoor Dynamic Range**
PROJECT NUMBER: **VB14-185G**
CLIENT: **Clark Nexsen**
SURFACE ELEVATION (MSL) (ft): **19**
PROJECT LOCATION: **Virginia Beach, VA**
LOGGED BY: **M. Murdock, P.E.**
BORING LOCATION: **See Attached Boring Location Plan**
DATE STARTED: **9/25/2014**
DRILLING METHOD(S): **Backhoe**
DATE COMPLETED: **9/25/2014**
GROUNDWATER*: INITIAL (ft) ▽: ____ AFTER ____ HOURS (ft) ▼: ____ CAVE-IN (ft) ◌: ____
DRILLER: **GET Solutions, Inc.**

The initial groundwater readings are not intended to indicate the static groundwater level.

Elevation (ft)	Depth (ft)	STRATA DESCRIPTION	Strata Legend	Sample ID	Sample Type	Sample Recovery (in.)	%<#200	TEST RESULTS (Plastic Limit X——X Liquid Limit; Water Content - ●; Penetration - ▨; 10 20 30 40 50 60 70)
		0.3 4" Topsoil						
		Tan, moist, Poorly graded fine SAND (SP)-Uncontrolled FILL						
	1							
	2							
	3							
15	4							
	5	organic staining at 5 ft. below grades						
		5.5 Gray and reddish tan, moist, Poorly graded fine SAND (SP)						
	6							
	7							
		7.5 Boring terminated at 7.5 feet below existing grade.						

Sample Type(s):

Notes:

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TEST PIT BORING ID TP-3

PROJECT NAME: **P-183 Fort Story SOF Indoor Dynamic Range**
PROJECT NUMBER: **VB14-185G**
CLIENT: **Clark Nexsen**
SURFACE ELEVATION (MSL) (ft): **22**
PROJECT LOCATION: **Virginia Beach, VA**
LOGGED BY: **M. Murdock, P.E.**
BORING LOCATION: **See Attached Boring Location Plan**
DATE STARTED: **9/25/2014**
DRILLING METHOD(S): **Backhoe**
DATE COMPLETED: **9/25/2014**
GROUNDWATER*: INITIAL (ft) ▽: ____ AFTER ____ HOURS (ft) ▼: ____ CAVE-IN (ft) ◌: ____
DRILLER: **GET Solutions, Inc.**

The initial groundwater readings are not intended to indicate the static groundwater level.

Elevation (ft)	Depth (ft)	STRATA DESCRIPTION	Strata Legend	Sample ID	Sample Type	Sample Recovery (in.)	%<#200	TEST RESULTS (Plastic Limit X——X Liquid Limit; Water Content - ●; Penetration - ▨; 10 20 30 40 50 60 70)
	0.1	2" Topsoil						
		Tan, moist, Poorly graded fine SAND (SP)-Uncontrolled FILL						
	1							
20	2							
	3							
	4							
	5	organic staining at 5 ft. below grades						
	5.5	Tan, moist, Poorly graded fine SAND (SP)						
	6							
15	7							
	7.5	Boring terminated at 7.5 feet below existing grade.						

Sample Type(s):

Notes:

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

RECORD OF SUBSURFACE EXPLORATION

GET Solutions, Inc.
Geotechnical • Environmental • Testing

Virginia Beach
204 Grayson Road
Virginia Beach, VA 23642
757-518-1703

Williamsburg
1592-E Penniman Road
Williamsburg, VA 23185
757-564-6452

Elizabeth City
106 Capital Trace Unit E
Elizabeth City, NC 27909
252-335-9765

Jacksonville
415-A Western Blvd
Jacksonville, NC 28546
910-478-9915

TEST PIT BORING ID TP-4

PROJECT NAME: **P-183 Fort Story SOF Indoor Dynamic Range**
PROJECT NUMBER: **VB14-185G**
CLIENT: **Clark Nexsen**
SURFACE ELEVATION (MSL) (ft): **15.3**
PROJECT LOCATION: **Virginia Beach, VA**
LOGGED BY: **M. Murdock, P.E.**
BORING LOCATION: **See Attached Boring Location Plan**
DATE STARTED: **9/25/2014**
DRILLING METHOD(S): **Backhoe**
DATE COMPLETED: **9/25/2014**
GROUNDWATER*: INITIAL (ft) ▽: ____ AFTER ____ HOURS (ft) ▼: ____ CAVE-IN (ft) ◌: ____
DRILLER: **GET Solutions, Inc.**

The initial groundwater readings are not intended to indicate the static groundwater level.

Elevation (ft)	Depth (ft)	STRATA DESCRIPTION	Strata Legend	Sample ID	Sample Type	Sample Recovery (in.)	%<#200	TEST RESULTS (Plastic Limit X——X Liquid Limit; Water Content - ●; Penetration - ▨; 10 20 30 40 50 60 70)
15		Tan, moist, Poorly graded fine SAND (SP)						
	1							
	2	1-in. thick organic staining at 2.5 ftl below grades						
	3							
	4							
	5							
10	6							
	6.5	Boring terminated at 6.5 feet below existing grade.						

Sample Type(s):

Notes:

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

RECORD OF SUBSURFACE EXPLORATION

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106 Capital Trace Unit E
Elizabeth City, NC 27909
252-335-9765

Jacksonville
415-A Western Blvd
Jacksonville, NC 28546
910-478-9915

TEST PIT BORING ID TP-5

PROJECT NAME: **P-183 Fort Story SOF Indoor Dynamic Range**
PROJECT NUMBER: **VB14-185G**
CLIENT: **Clark Nexsen**
SURFACE ELEVATION (MSL) (ft): **16**
PROJECT LOCATION: **Virginia Beach, VA**
LOGGED BY: **M. Murdock, P.E.**
BORING LOCATION: **See Attached Boring Location Plan**
DATE STARTED: **9/25/2014**
DRILLING METHOD(S): **Backhoe**
DATE COMPLETED: **9/25/2014**
GROUNDWATER*: INITIAL (ft) ▽: ____ AFTER ____ HOURS (ft) ▼: ____ CAVE-IN (ft) ◌: ____
DRILLER: **GET Solutions, Inc.**

The initial groundwater readings are not intended to indicate the static groundwater level.

Elevation (ft)	Depth (ft)	STRATA DESCRIPTION	Strata Legend	Sample ID	Sample Type	Sample Recovery (in.)	%<#200	TEST RESULTS (Plastic Limit X——X Liquid Limit; Water Content - ●; Penetration - ▨; 10 20 30 40 50 60 70)
		Tan, moist, Poorly graded fine SAND (SP)						
15	1							
	2							
	3	1-in. organic staining at 3 ft. below grades						
	4							
	5							
10	6	6.0 Boring terminated at 6 feet below existing grade.						

Sample Type(s):

Notes:

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

RECORD OF SUBSURFACE EXPLORATION

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757-564-6452

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106 Capital Trace Unit E
Elizabeth City, NC 27909
252-335-9765

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415-A Western Blvd
Jacksonville, NC 28546
910-478-9915

TEST PIT BORING ID TP-6

PROJECT NAME: **P-183 Fort Story SOF Indoor Dynamic Range**
PROJECT NUMBER: **VB14-185G**
CLIENT: **Clark Nexsen**
SURFACE ELEVATION (MSL) (ft): **19.5**
PROJECT LOCATION: **Virginia Beach, VA**
LOGGED BY: **M. Murdock, P.E.**
BORING LOCATION: **See Attached Boring Location Plan**
DATE STARTED: **9/25/2014**
DRILLING METHOD(S): **Backhoe**
DATE COMPLETED: **9/25/2014**
GROUNDWATER*: INITIAL (ft) ▽: ____ AFTER ____ HOURS (ft) ▼: ____ CAVE-IN (ft) ◌: ____
DRILLER: **GET Solutions, Inc.**

The initial groundwater readings are not intended to indicate the static groundwater level.

Elevation (ft)	Depth (ft)	STRATA DESCRIPTION	Strata Legend	Sample ID	Sample Type	Sample Recovery (in.)	%<#200	TEST RESULTS (Plastic Limit X——X Liquid Limit; Water Content - ●; Penetration - ▨; 10 20 30 40 50 60 70)
		Tan, moist, Poorly graded fine SAND (SP)						
	1							
	2							
	3							
	4	change to gray						
15								
	5							
	6							
	6.5	Boring terminated at 6.5 feet below existing grade.						

Sample Type(s):

Notes:

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

RECORD OF SUBSURFACE EXPLORATION

GET Solutions, Inc.
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Williamsburg, VA 23185
757-564-6452

Elizabeth City
106 Capital Trace Unit E
Elizabeth City, NC 27909
252-335-9765

Jacksonville
415-A Western Blvd
Jacksonville, NC 28546
910-478-9915

TEST PIT BORING ID TP-7

PROJECT NAME: **P-183 Fort Story SOF Indoor Dynamic Range**
PROJECT NUMBER: **VB14-185G**
CLIENT: **Clark Nexsen**
SURFACE ELEVATION (MSL) (ft): **17.8**
PROJECT LOCATION: **Virginia Beach, VA**
LOGGED BY: **M. Murdock, P.E.**
BORING LOCATION: **See Attached Boring Location Plan**
DATE STARTED: **9/25/2014**
DRILLING METHOD(S): **Backhoe**
DATE COMPLETED: **9/25/2014**
GROUNDWATER*: INITIAL (ft) ▽: ____ AFTER ____ HOURS (ft) ▼: ____ CAVE-IN (ft) ◌: ____
DRILLER: **GET Solutions, Inc.**

The initial groundwater readings are not intended to indicate the static groundwater level.

Elevation (ft)	Depth (ft)	STRATA DESCRIPTION	Strata Legend	Sample ID	Sample Type	Sample Recovery (in.)	%<#200	TEST RESULTS (Plastic Limit X——X Liquid Limit; Water Content - ●; Penetration - ▨; 10 20 30 40 50 60 70)
		Tan, moist, Poorly graded fine SAND (SP)						
	1							
	2							
15	3							
	4							
	5							
	6							
	6.5	Boring terminated at 6.5 feet below existing grade.						

Sample Type(s):

Notes:

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

RECORD OF SUBSURFACE EXPLORATION

GET Solutions, Inc.
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Virginia Beach
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Williamsburg
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106 Capital Trace Unit E
Elizabeth City, NC 27909
252-335-9765

Jacksonville
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Jacksonville, NC 28546
910-478-9915

TEST PIT BORING ID TP-8

PROJECT NAME: **P-183 Fort Story SOF Indoor Dynamic Range**
PROJECT NUMBER: **VB14-185G**
CLIENT: **Clark Nexsen**
SURFACE ELEVATION (MSL) (ft): **18.3**
PROJECT LOCATION: **Virginia Beach, VA**
LOGGED BY: **M. Murdock, P.E.**
BORING LOCATION: **See Attached Boring Location Plan**
DATE STARTED: **9/25/2014**
DRILLING METHOD(S): **Backhoe**
DATE COMPLETED: **9/25/2014**
GROUNDWATER*: INITIAL (ft) ▽: ____ AFTER ____ HOURS (ft) ▼: ____ CAVE-IN (ft) ◌: ____
DRILLER: **GET Solutions, Inc.**

The initial groundwater readings are not intended to indicate the static groundwater level.

Elevation (ft)	Depth (ft)	STRATA DESCRIPTION	Strata Legend	Sample ID	Sample Type	Sample Recovery (in.)	%<#200	TEST RESULTS (Plastic Limit X——X Liquid Limit; Water Content - ●; Penetration - ▨; 10 20 30 40 50 60 70)
		Tan, moist, Poorly graded fine SAND (SP)						
	1							
	2							
	3							
15								
	4							
	5	5.0						
		Boring terminated at 5 feet below existing grade.						

Sample Type(s):

Notes:

This information pertains only to this boring and should not be interpreted as being indicitive of the site.

APPENDIX V

GENERALIZED SOIL PROFILE

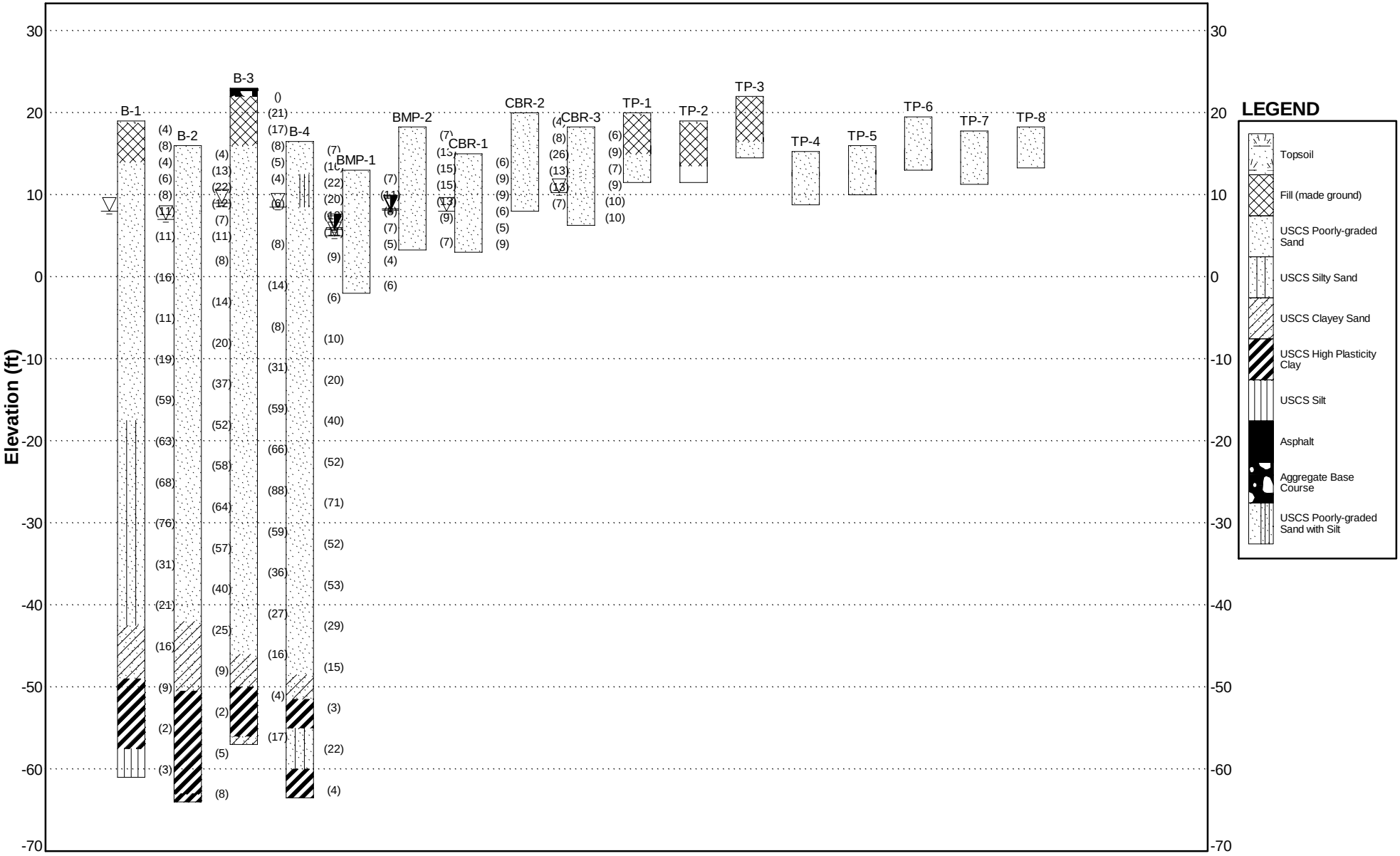
GENERALIZED SOIL PROFILE

PROJECT NAME: **P-183 Fort Story SOF Indoor Dynamic Range**

PROJECT NUMBER: **VB14-185G**

PROJECT LOCATION: **Virginia Beach, VA**

CLIENT: **Clark Nexsen**



(Numerical Value) = Sample N-Value

APPENDIX VI

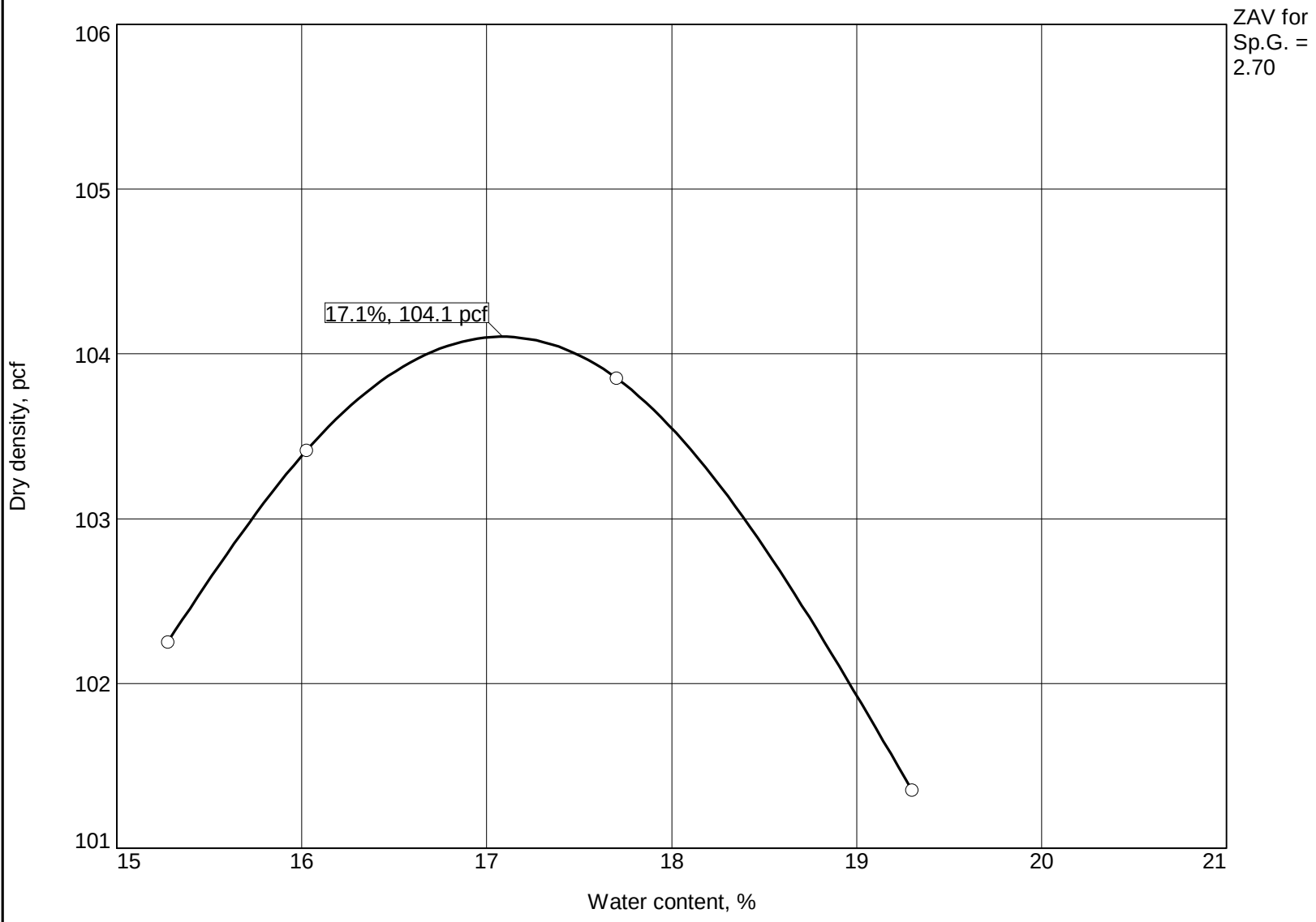
CBR TEST RESULTS

SUMMARY OF CBR TEST RESULTS

Sample Number	CBR-1	CBR-2	CBR-3
Sample Depth (ft.)	1-3	1-3	1-3
Unified Soil Classification Symbol	SP	SP	SP
Natural Moisture Content (%)	5	5	3
Atterberg Limits LL/PL/PI	Non-Plastic	Non-Plastic	Non-Plastic
% Passing #200 Sieve	0.8	0.4	0.3
Maximum Dry Density, pcf	104.1	101.5	101.8
Optimum Moisture %	17.1	16.8	16.7
Soaked CBR Value	25.4	29.0	25.4
Resiliency Factor	3.0	3.0	3.0
Swell %	0	0	0

Fort Story SOF Indoor Dynamic Range
Virginia Beach, Virginia
G E T Project No: VB14-18G

MOISTURE DENSITY RELATIONSHIP (PROCTOR CURVE)



Test specification: ASTM D 698-07 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
1-3 ft.	SP	A-3	5		NP	NP	0.1	0.8

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 104.1 pcf Optimum moisture = 17.1 %	Tan, Poorly Graded SAND

Project No. VB14-185G **Client:** Clark Nexsen

Project: Fort Story SOF Indoor Dynamic Range

○ **Location:** CBR-1 **Sample Number:** CBR-1

Remarks:

Sample Obtained 7/17/14
CBR-1

GET SOLUTIONS, INC.

Figure 1

Particle Size Distribution Report

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.1	0.3	12.7	86.1	0.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.375	100.0		
#4	99.9		
#10	99.6		
#40	86.9		
#80	8.6		
#100	4.0		
#200	0.8		

* (no specification provided)

Material Description

Tan, Poorly Graded SAND

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 0.5469 D_{85}= 0.4155 D_{60}= 0.3223
D_{50}= 0.2938 D_{30}= 0.2420 D_{15}= 0.2020
D_{10}= 0.1856 C_u= 1.74 C_c= 0.98

Classification

USCS= SP AASHTO= A-3

Remarks

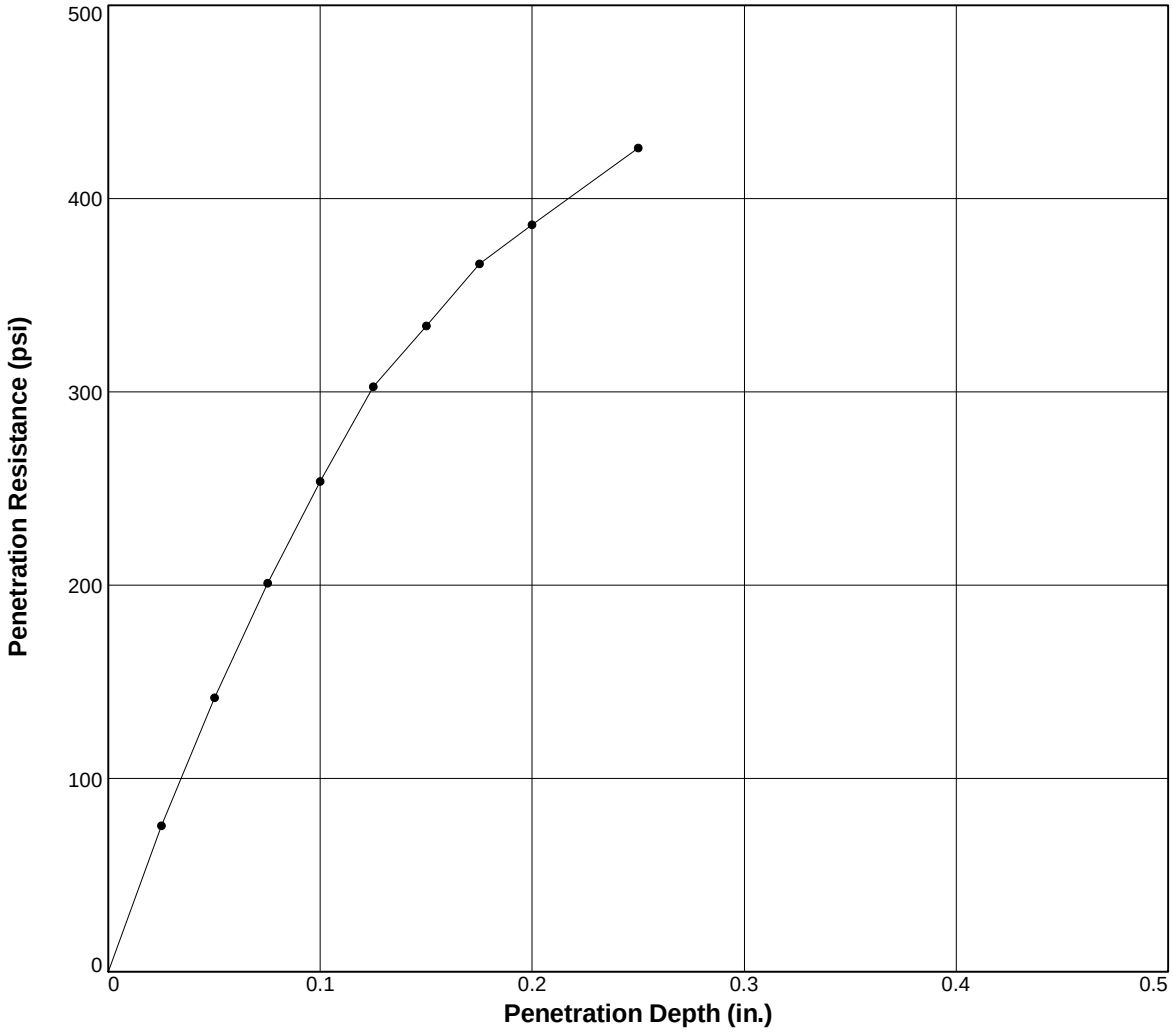
Sample Obtained 7/17/14
CBR-1

Location: CBR-1
Sample Number: CBR-1 **Depth:** 1-3 ft. **Date:** 7/17/14

GET SOLUTIONS, INC.

Client: Clark Nexsen
Project: Fort Story SOF Indoor Dynamic Range
Project No: VB14-185G **Figure** 1A

BEARING RATIO TEST REPORT
ASTM D 1883-07



	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 ○	104.4	100.3	16.6	104.4	100.3	17.2	25.4	25.8	0.000	10	0
2 △											
3 □											

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
Tan, Poorly Graded SAND	SP	104.1	17.1	NP	NP

Project No: VB14-185G

Project: Fort Story SOF Indoor Dynamic Range

Location: CBR-1

Sample Number: CBR-1 **Depth:** 1-3 ft.

Date: 7/17/14

Test Description/Remarks:

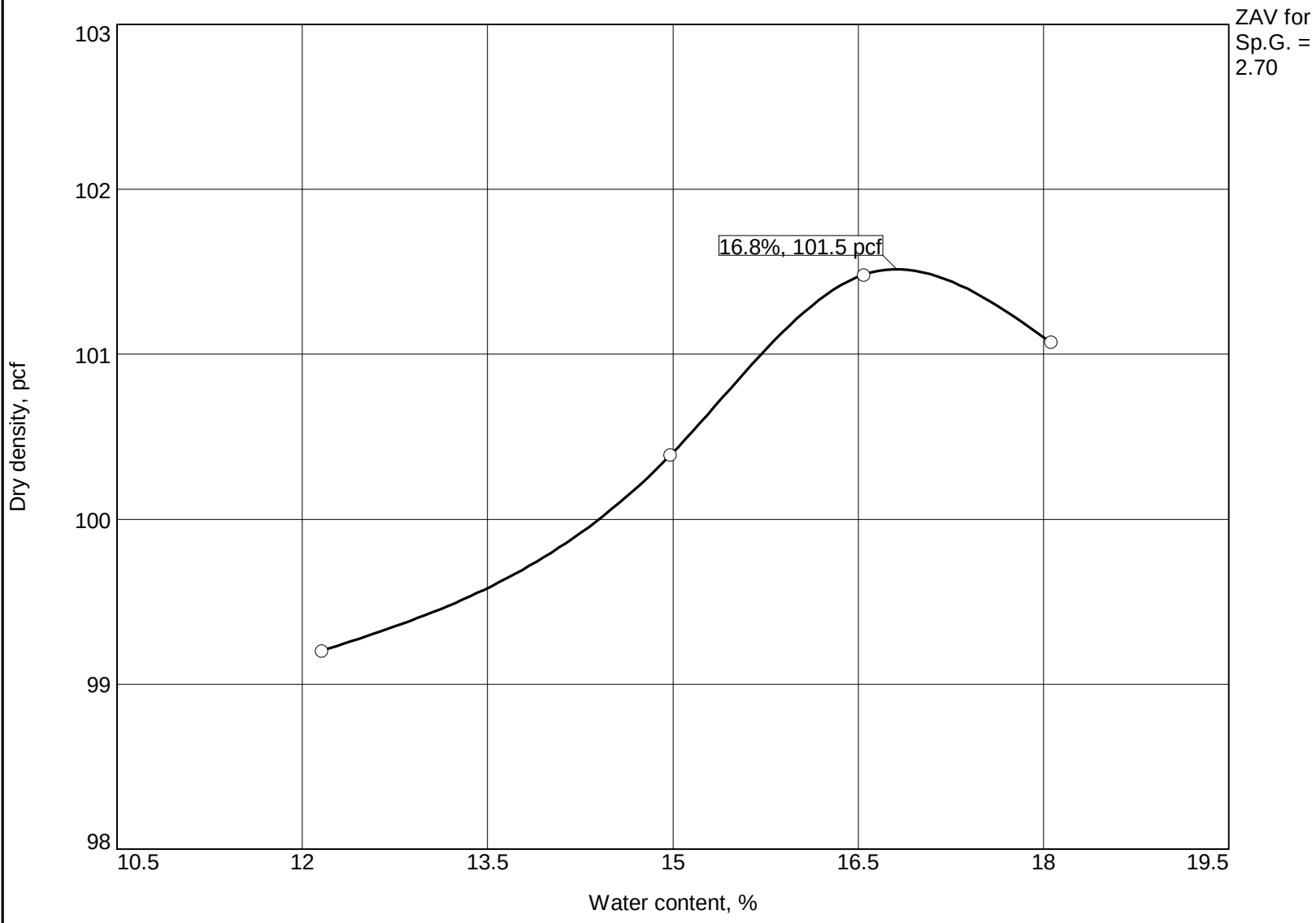
CBR-1
Resiliency Factor = 3.0

BEARING RATIO TEST REPORT

GET SOLUTIONS, INC.

Figure CBR-1

MOISTURE DENSITY RELATIONSHIP (PROCTOR CURVE)



Test specification: ASTM D 698-07 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
1-3 ft.	SP	A-3	5		NP	NP	0.0	0.4

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 101.5 pcf Optimum moisture = 16.8 %	Tan, Poorly Graded SAND

Project No. VB14-185G **Client:** Clark Nexsen

Project: Fort Story SOF Indoor Dynamic Range

○ **Location:** CBR-2 **Sample Number:** CBR-2

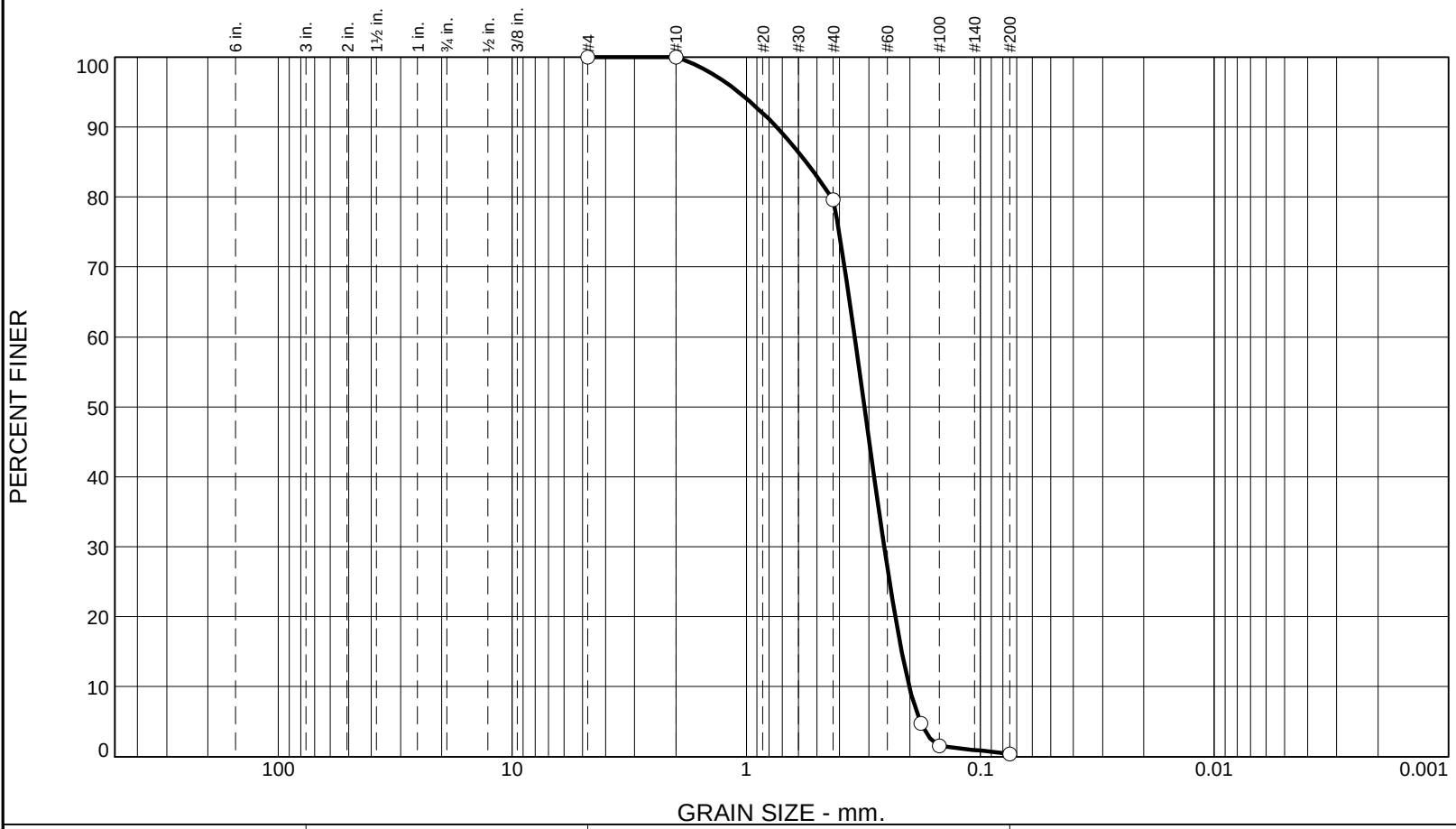
Remarks:

Sample Obtained 7/17/14
CBR-2

GET SOLUTIONS, INC.

Figure 2

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	20.4	79.2	0.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#40	79.6		
#80	4.8		
#100	1.5		
#200	0.4		

* (no specification provided)

Material Description

Tan, Poorly Graded SAND

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 0.7443 D_{85}= 0.5555 D_{60}= 0.3447
D_{50}= 0.3131 D_{30}= 0.2575 D_{15}= 0.2164
D_{10}= 0.2009 C_u= 1.72 C_c= 0.96

Classification

USCS= SP AASHTO= A-3

Remarks

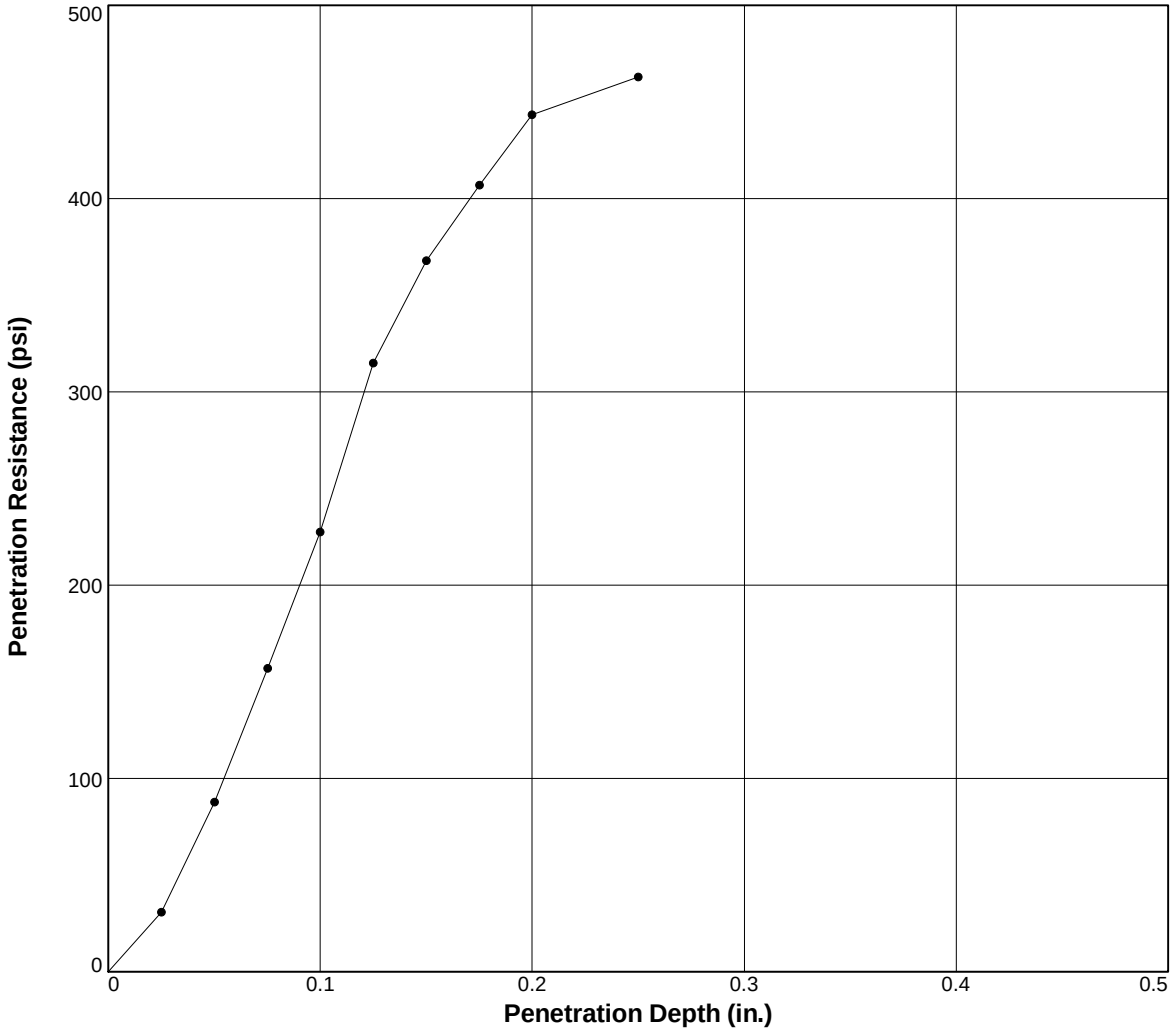
Sample Obtained 7/17/14
CBR-2

Location: CBR-2
Sample Number: CBR-2 **Depth:** 1-3 ft. **Date:** 7/17/14

GET SOLUTIONS, INC.

Client: Clark Nexsen
Project: Fort Story SOF Indoor Dynamic Range
Project No: VB14-185G **Figure** 2A

BEARING RATIO TEST REPORT
ASTM D 1883-07



	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 ○	103.3	101.8	16.9	103.3	101.7	17.2	29.0	30.0	0.018	10	0
2 △											
3 □											

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
Tan, Poorly Graded SAND	SP	101.5	16.8	NP	NP

Project No: VB14-185G

Project: Fort Story SOF Indoor Dynamic Range

Location: CBR-2

Sample Number: CBR-2 **Depth:** 1-3 ft.

Date: 7/17/14

Test Description/Remarks:

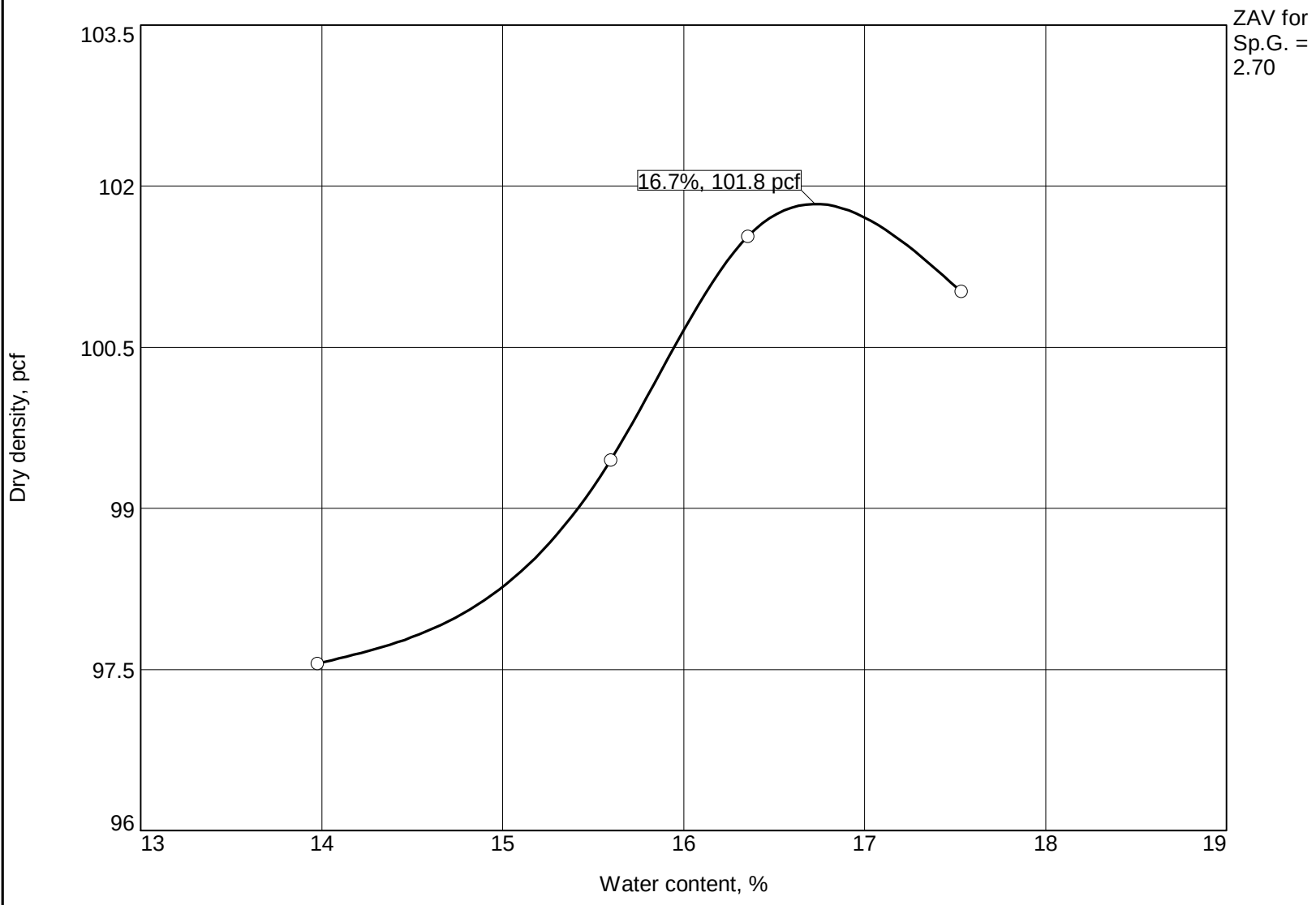
CBR-2
Resiliency Factor = 3.0

BEARING RATIO TEST REPORT

GET SOLUTIONS, INC.

Figure CBR-2

MOISTURE DENSITY RELATIONSHIP (PROCTOR CURVE)



Test specification: ASTM D 698-07 Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > #4	% < No.200
	USCS	AASHTO						
1-3 ft.	SP	A-3	3		NP	NP	3.7	0.3

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 101.8 pcf Optimum moisture = 16.7 %	Tan, Poorly Graded SAND

Project No. VB14-185G **Client:** Clark Nexsen

Project: Fort Story SOF Indoor Dynamic Range

○ **Location:** CBR-3 **Sample Number:** CBR-3

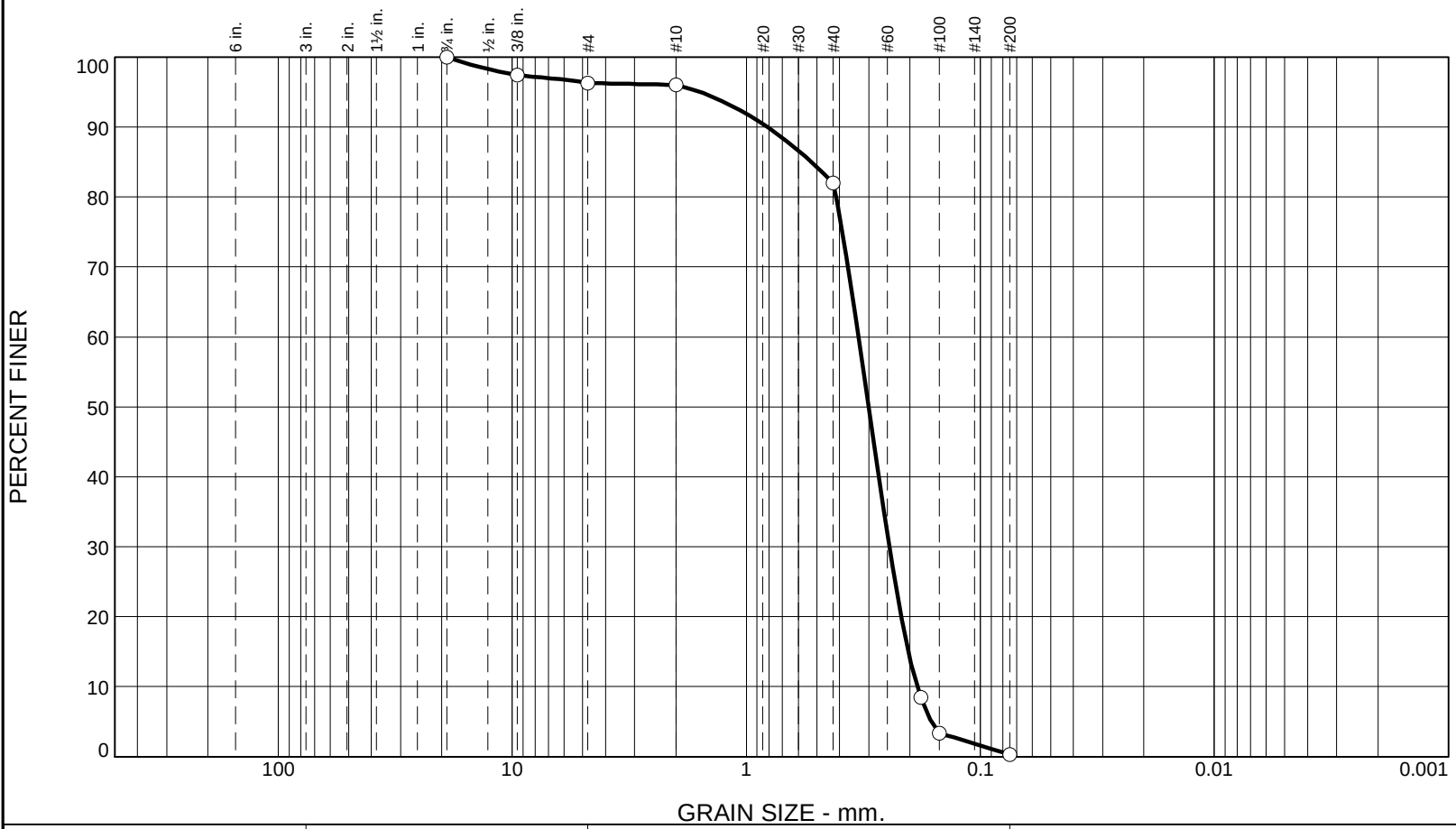
Remarks:

Sample Obtained 7/17/14
CBR-3

GET SOLUTIONS, INC.

Figure 3

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.7	0.3	14.0	81.7	0.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
.75	100.0		
.375	97.4		
#4	96.3		
#10	96.0		
#40	82.0		
#80	8.4		
#100	3.4		
#200	0.3		

* (no specification provided)

Material Description

Tan, Poorly Graded SAND

Atterberg Limits

PL= NP LL= NP PI= NP

Coefficients

D_{90}= 0.8145 D_{85}= 0.5273 D_{60}= 0.3319
D_{50}= 0.3003 D_{30}= 0.2444 D_{15}= 0.2026
D_{10}= 0.1861 C_u= 1.78 C_c= 0.97

Classification

USCS= SP AASHTO= A-3

Remarks

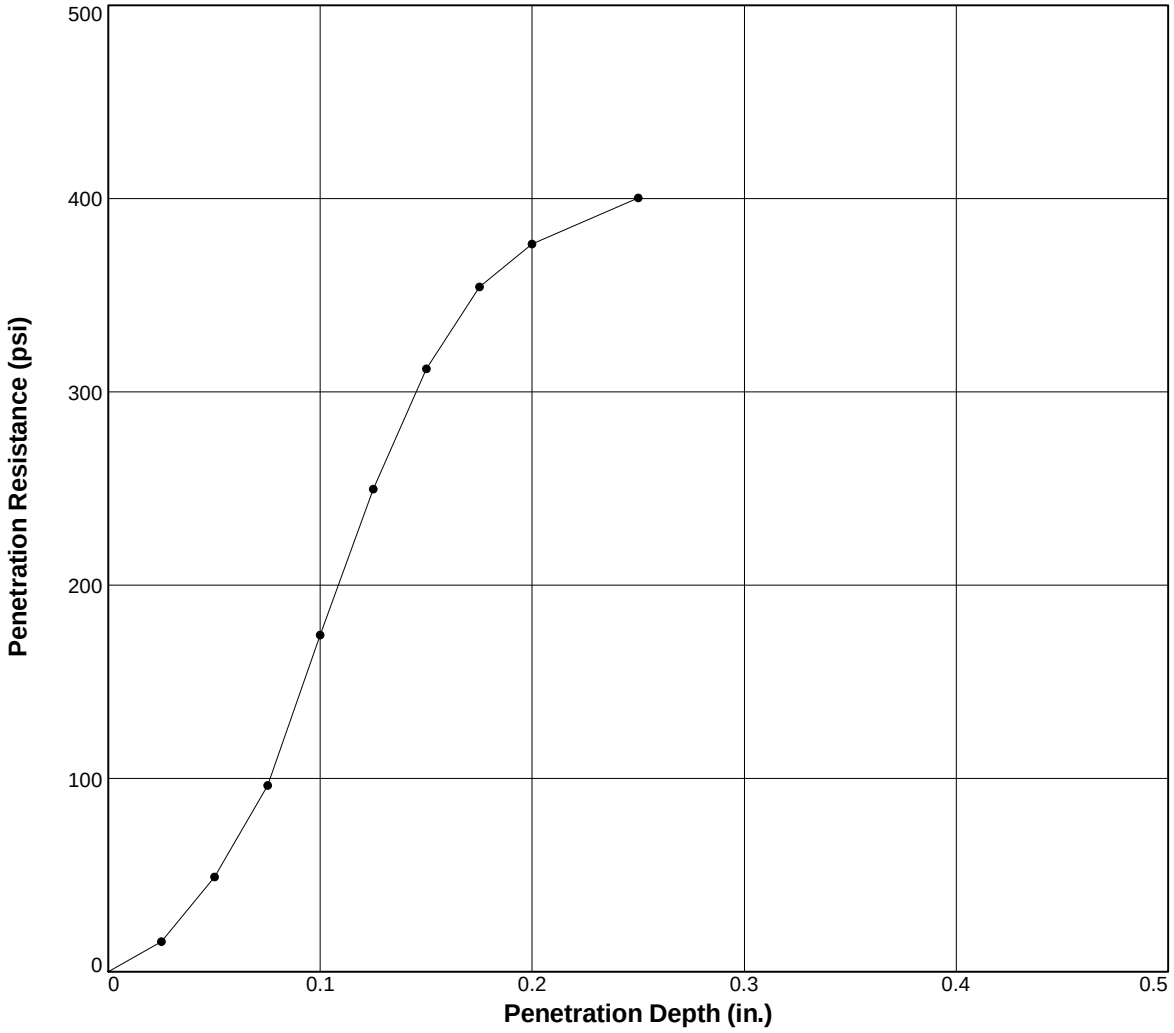
Sample Obtained 7/17/14
CBR-3

Location: CBR-3
Sample Number: CBR-3 **Depth:** 1-3 ft. **Date:** 7/17/14

GET SOLUTIONS, INC.

Client: Clark Nexsen
Project: Fort Story SOF Indoor Dynamic Range
Project No: VB14-185G **Figure** 3A

BEARING RATIO TEST REPORT
ASTM D 1883-07



	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 ○	101.6	99.8	16.5	101.6	99.8	17.1	25.4	26.0	0.027	10	0
2 △											
3 □											

Material Description	USCS	Max. Dens. (pcf)	Optimum Moisture (%)	LL	PI
Tan, Poorly Graded SAND	SP	101.8	16.7	NP	NP

Project No: VB14-185G

Project: Fort Story SOF Indoor Dynamic Range

Location: CBR-3

Sample Number: CBR-3 **Depth:** 1-3 ft.

Date: 7/17/14

Test Description/Remarks:

CBR-3
Resiliency Factor = 3.0

BEARING RATIO TEST REPORT

GET SOLUTIONS, INC.

Figure CBR-3

APPENDIX VII

ANALYTICAL LABORATORY REPORT

1941 Reymet Road ● Richmond, Virginia 23237 ● Tel: (804)-358-8295 Fax: (804)-358-8297

Certificate of Analysis

Final Report

Laboratory Order ID 14G0307

Client Name:	GET Solutions, Inc. 204-B Grayson Road Virginia Beach, VA 23462	Date Received:	July 17, 2014 14:49
		Date Issued:	July 22, 2014 16:53
		Project Number:	[none]
Submitted To:	Adina Rose	Purchase Order:	
Client Site I.D.:	Ft. Story		

Enclosed are the results of analyses for samples received by the laboratory on 07/17/2014 14:49. If you have any questions concerning this report, please feel free to contact the laboratory.

Sincerely,

Ted Soyars

Ted Soyars
Laboratory Manager

End Notes:

The test results listed in this report relate only to the samples submitted to the laboratory and as received by the Laboratory.

Unless otherwise noted, the test results for solid materials are calculated on a wet weight basis. Analyses for pH, dissolved oxygen, temperature, residual chlorine and sulfite that are performed in the laboratory do not meet NELAC requirements due to extremely short holding times. These analyses should be performed in the field. The results of field analyses performed by the Sampler included in the Certificate of Analysis are done so at the client's request and are not included in the laboratory's fields of certification nor have they been audited for adherence to a reference method or procedure.

The signature on the final report certifies that these results conform to all applicable NELAC standards unless otherwise specified. For a complete list of the Laboratory's NELAC certified parameters please contact customer service.

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Certificate of Analysis

Final Report

Laboratory Order ID 14G0307

Client Name:	GET Solutions, Inc. 204-B Grayson Road Virginia Beach VA, 23462	Date Received: Date Issued:	July 17, 2014 14:49 July 22, 2014 16:53
Submitted To:	Adina Rose	Project Number:	[none]
Client Site I.D.:	Ft. Story	Purchase Order:	

ANALYTICAL REPORT FOR SAMPLES

Sample ID	Laboratory ID	Matrix	Date Sampled	Date Received
B-1/2	14G0307-01	Soil	07/17/2014 08:25	07/17/2014 14:49
B-3/4	14G0307-02	Soil	07/17/2014 08:50	07/17/2014 14:49

AIR WATER & SOIL LABORATORIES, INC.

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Certificate of Analysis

Final Report

Laboratory Order ID 14G0307

Client Name:	GET Solutions, Inc. 204-B Grayson Road Virginia Beach VA, 23462	Date Received:	July 17, 2014 14:49
		Date Issued:	July 22, 2014 16:53
Submitted To:	Adina Rose	Project Number:	[none]
Client Site I.D.:	Ft. Story	Purchase Order:	

Analytical Results

Sample I.D. B-1/2 **Laboratory Sample ID:** 14G0307-01

Date/Time Sampled: 07/17/2014 08:25

Parameter	Samp ID	Method	Result	Qual	Reporting Limit	D.F.	Sample Prep Date/Time	Analysis Date/Time	Analyst
TCLP Metals by 6000/7000 Series Methods									
Silver	01	SW6010C	<0.100 mg/L		0.100	1	07/18/14 16:00	07/22/14 15:37	BG
Arsenic	01	SW6010C	<0.100 mg/L		0.100	1	07/18/14 16:00	07/22/14 15:37	BG
Barium	01	SW6010C	<5.00 mg/L		5.00	1	07/18/14 16:00	07/22/14 15:37	BG
Cadmium	01	SW6010C	<0.0400 mg/L		0.0400	1	07/18/14 16:00	07/22/14 15:37	BG
Chromium	01	SW6010C	<0.100 mg/L		0.100	1	07/18/14 16:00	07/22/14 15:37	BG
Mercury	01	SW7470A	<0.008 mg/L		0.008	1	07/18/14 12:00	07/18/14 15:52	MWL
Lead	01	SW6010C	<0.100 mg/L		0.100	1	07/18/14 16:00	07/22/14 15:37	BG
Selenium	01	SW6010C	<0.250 mg/L		0.250	1	07/18/14 16:00	07/22/14 15:37	BG
Extraction Fluid	01	SW1311	**1 #**		--	1	07/17/14 16:40	07/22/14 16:42	KEW
Volatile Organic Compounds by GC									
Benzene	01	SW8021B	<5.00 ug/kg		5.00	1	07/17/14 15:52	07/17/14 15:52	CL
Toluene	01	SW8021B	<5.00 ug/kg		5.00	1	07/17/14 15:52	07/17/14 15:52	CL
Ethylbenzene	01	SW8021B	<5.00 ug/kg		5.00	1	07/17/14 15:52	07/17/14 15:52	CL
m+p-Xylenes	01	SW8021B	<10.0 ug/kg		10.0	1	07/17/14 15:52	07/17/14 15:52	CL
o-Xylene	01	SW8021B	<5.00 ug/kg		5.00	1	07/17/14 15:52	07/17/14 15:52	CL
Xylenes, Total	01	SW8021B	<15.0 ug/kg		15.0	1	07/17/14 15:52	07/17/14 15:52	CL
Surr: 2,5-Dibromotoluene	*01*	*SW8021B*	*90.2 %*		*80-120*		*07/17/14 15:52*	*07/17/14 15:52*	*CL*
TCLP Volatile Organic Compounds									
Extraction Fluid, ZHE	01	SW1311	**1 #**		--	1	07/17/14 11:00	07/18/14 11:08	MKD
TCLP Volatile Organic Compounds by GCMS									
1,1-Dichloroethylene	01	SW8260B	<0.02 mg/L		0.02	1	07/17/14 11:43	07/18/14 14:06	MKD
1,2-Dichloroethane	01	SW8260B	<0.02 mg/L		0.02	1	07/17/14 11:43	07/18/14 14:06	MKD
1,4-Dichlorobenzene	01	SW8260B	<0.02 mg/L		0.02	1	07/17/14 11:43	07/18/14 14:06	MKD
2-Butanone (MEK)	01	SW8260B	<0.20 mg/L		0.20	1	07/17/14 11:43	07/18/14 14:06	MKD
Benzene	01	SW8260B	<0.02 mg/L		0.02	1	07/17/14 11:43	07/18/14 14:06	MKD
Carbon tetrachloride	01	SW8260B	<0.02 mg/L		0.02	1	07/17/14 11:43	07/18/14 14:06	MKD
Chlorobenzene	01	SW8260B	<0.02 mg/L		0.02	1	07/17/14 11:43	07/18/14 14:06	MKD

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Final Report

Laboratory Order ID 14G0307

Client Name:	GET Solutions, Inc. 204-B Grayson Road Virginia Beach VA, 23462	Date Received:	July 17, 2014 14:49
		Date Issued:	July 22, 2014 16:53
Submitted To:	Adina Rose	Project Number:	[none]
Client Site I.D.:	Ft. Story	Purchase Order:	

Analytical Results

Sample I.D. B-1/2 **Laboratory Sample ID:** 14G0307-01

Date/Time Sampled: 07/17/2014 08:25

Parameter	Samp ID	Method	Result	Qual	Reporting Limit	D.F.	Sample Prep Date/Time	Analysis Date/Time	Analyst
TCLP Volatile Organic Compounds by GCMS									
Chloroform	01	SW8260B	<2.00 mg/L		2.00	1	07/17/14 11:43	07/18/14 14:06	MKD
Tetrachloroethylene (PCE)	01	SW8260B	<0.02 mg/L		0.02	1	07/17/14 11:43	07/18/14 14:06	MKD
Trichloroethylene	01	SW8260B	<0.02 mg/L		0.02	1	07/17/14 11:43	07/18/14 14:06	MKD
Vinyl chloride	01	SW8260B	<0.02 mg/L		0.02	1	07/17/14 11:43	07/18/14 14:06	MKD
Surr: 1,2-Dichloroethane-d4	*01*	*SW8260B*	*103 %*		*70-120*		*07/17/14 11:43*	*07/18/14 14:06*	*MKD*
Surr: 4-Bromofluorobenzene	*01*	*SW8260B*	*105 %*		*75-120*		*07/17/14 11:43*	*07/18/14 14:06*	*MKD*
Surr: Dibromofluoromethane	*01*	*SW8260B*	*98.3 %*		*80-119*		*07/17/14 11:43*	*07/18/14 14:06*	*MKD*
Surr: Toluene-d8	*01*	*SW8260B*	*103 %*		*85-120*		*07/17/14 11:43*	*07/18/14 14:06*	*MKD*
Volatile Petroleum Hydrocarbons by GC									
TPH-Volatiles (GRO)	01	SW8015C	<0.10 mg/kg		0.10	1	07/17/14 15:52	07/17/14 15:52	CL
Semivolatile Petroleum Hydrocarbons by GC									
TPH-Semi-Volatiles (DRO)	01	SW8015C	<10.0 mg/kg		10.0	1	07/18/14 09:47	07/21/14 13:46	JHV
Surr: Pentacosane	*01*	*SW8015C*	*82.5 %*		*40-160*		*07/18/14 09:47*	*07/21/14 13:46*	*JHV*
TCLP Semivolatile Organic Compounds									
Extraction Fluid	01	SW1311	**1 #**		--	1	07/17/14 16:40	07/18/14 09:40	MFR
TCLP Semivolatile Organic Compounds by GCMS									
2,4,5-Trichlorophenol	01	SW8270D	<0.01 mg/L		0.01	1	07/21/14 09:50	07/21/14 17:10	JHV
2,4,6-Trichlorophenol	01	SW8270D	<0.01 mg/L		0.01	1	07/21/14 09:50	07/21/14 17:10	JHV
2,4-Dinitrotoluene	01	SW8270D	<0.01 mg/L		0.01	1	07/21/14 09:50	07/21/14 17:10	JHV
Hexachlorobenzene	01	SW8270D	<0.01 mg/L		0.01	1	07/21/14 09:50	07/21/14 17:10	JHV
Hexachlorobutadiene	01	SW8270D	<0.01 mg/L		0.01	1	07/21/14 09:50	07/21/14 17:10	JHV
Hexachloroethane	01	SW8270D	<0.01 mg/L		0.01	1	07/21/14 09:50	07/21/14 17:10	JHV
m+p-Cresols	01	SW8270D	<0.01 mg/L		0.01	1	07/21/14 09:50	07/21/14 17:10	JHV
Nitrobenzene	01	SW8270D	<0.01 mg/L		0.01	1	07/21/14 09:50	07/21/14 17:10	JHV
o+m+p-Cresols	01	SW8270D	<0.01 mg/L		0.01	1	07/21/14 09:50	07/21/14 17:10	JHV
o-Cresol	01	SW8270D	<0.01 mg/L		0.01	1	07/21/14 09:50	07/21/14 17:10	JHV
Pentachlorophenol	01	SW8270D	<0.02 mg/L		0.02	1	07/21/14 09:50	07/21/14 17:10	JHV

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Laboratory Order ID 14G0307

Client Name:	GET Solutions, Inc. 204-B Grayson Road Virginia Beach VA, 23462	Date Received:	July 17, 2014 14:49
		Date Issued:	July 22, 2014 16:53
Submitted To:	Adina Rose	Project Number:	[none]
Client Site I.D.:	Ft. Story	Purchase Order:	

Analytical Results

Sample I.D. B-1/2 **Laboratory Sample ID:** 14G0307-01

Date/Time Sampled: 07/17/2014 08:25

Parameter	Samp ID	Method	Result	Qual	Reporting Limit	D.F.	Sample Prep Date/Time	Analysis Date/Time	Analyst
TCLP Semivolatile Organic Compounds by GCMS									
Pyridine	01	SW8270D	<0.01 mg/L		0.01	1	07/21/14 09:50	07/21/14 17:10	JHV
Surr: 2,4,6-Tribromophenol	*01*	*SW8270D*	*74.0 %*		*40-125*		*07/21/14 09:50*	*07/21/14 17:10*	*JHV*
Surr: 2-Fluorobiphenyl	*01*	*SW8270D*	*57.3 %*		*23-87*		*07/21/14 09:50*	*07/21/14 17:10*	*JHV*
Surr: 2-Fluorophenol	*01*	*SW8270D*	*33.6 %*		*14-52*		*07/21/14 09:50*	*07/21/14 17:10*	*JHV*
Surr: Nitrobenzene-d5	*01*	*SW8270D*	*56.7 %*		*40-110*		*07/21/14 09:50*	*07/21/14 17:10*	*JHV*
Surr: Phenol-d5	*01*	*SW8270D*	*19.4 %*		*5-33*		*07/21/14 09:50*	*07/21/14 17:10*	*JHV*
Surr: p-Terphenyl-d14	*01*	*SW8270D*	*71.9 %*		*22-85*		*07/21/14 09:50*	*07/21/14 17:10*	*JHV*
TCLP Organochlorine Herbicides by GC/ECD									
2,4,5-TP (Silvex)	01	SW8151A	<0.0005 mg/L		0.0005	1	07/18/14 14:05	07/21/14 19:28	RAC/S
2,4-D [2C]	01	SW8151A	<0.001 mg/L		0.001	1	07/18/14 14:05	07/21/14 19:28	RAC/S
Surr: DCAA	*01*	*SW8151A*	*71.0 %*		*60-112*		*07/18/14 14:05*	*07/21/14 19:28*	*RAC/S*
Surr: DCAA [2C]	*01*	*SW8151A*	*66.0 %*		*60-112*		*07/18/14 14:05*	*07/21/14 19:28*	*RAC/S*
TCLP Organochlorine Pesticides and PCBs by GC/ECD									
Endrin	01	SW8081B	<0.005 mg/L		0.005	1	07/18/14 14:05	07/18/14 18:08	SKS/R
gamma-BHC (Lindane)	01	SW8081B	<0.005 mg/L		0.005	1	07/18/14 14:05	07/18/14 18:08	SKS/R
Heptachlor	01	SW8081B	<0.005 mg/L		0.005	1	07/18/14 14:05	07/18/14 18:08	SKS/R
Heptachlor Epoxide	01	SW8081B	<0.005 mg/L		0.005	1	07/18/14 14:05	07/18/14 18:08	SKS/R
Methoxychlor	01	SW8081B	<0.005 mg/L		0.005	1	07/18/14 14:05	07/18/14 18:08	SKS/R
Toxaphene	01	SW8081B	<0.500 mg/L		0.500	1	07/18/14 14:05	07/18/14 18:08	SKS/R
Surr: TCMX	*01*	*SW8081B*	*55.0 %*		*18-112*		*07/18/14 14:05*	*07/18/14 18:08*	*SKS/R*
Surr: DCB	*01*	*SW8081B*	*35.0 %*		*27-131*		*07/18/14 14:05*	*07/18/14 18:08*	*SKS/R*

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Laboratory Order ID 14G0307

Client Name:	GET Solutions, Inc. 204-B Grayson Road Virginia Beach VA, 23462	Date Received:	July 17, 2014 14:49
		Date Issued:	July 22, 2014 16:53
Submitted To:	Adina Rose	Project Number:	[none]
Client Site I.D.:	Ft. Story	Purchase Order:	

Analytical Results

Sample I.D. B-3/4 **Laboratory Sample ID:** 14G0307-02

Date/Time Sampled: 07/17/2014 08:50

Parameter	Samp ID	Method	Result	Qual	Reporting Limit	D.F.	Sample Prep Date/Time	Analysis Date/Time	Analyst
TCLP Metals by 6000/7000 Series Methods									
Silver	02	SW6010C	<0.100 mg/L		0.100	1	07/18/14 16:00	07/22/14 15:46	BG
Arsenic	02	SW6010C	<0.100 mg/L		0.100	1	07/18/14 16:00	07/22/14 15:47	BG
Barium	02	SW6010C	<5.00 mg/L		5.00	1	07/18/14 16:00	07/22/14 15:47	BG
Cadmium	02	SW6010C	<0.0400 mg/L		0.0400	1	07/18/14 16:00	07/22/14 15:47	BG
Chromium	02	SW6010C	<0.100 mg/L		0.100	1	07/18/14 16:00	07/22/14 15:46	BG
Mercury	02	SW7470A	<0.008 mg/L		0.008	1	07/18/14 12:00	07/18/14 16:01	MWL
Lead	02	SW6010C	<0.100 mg/L		0.100	1	07/18/14 16:00	07/22/14 15:47	BG
Selenium	02	SW6010C	<0.250 mg/L		0.250	1	07/18/14 16:00	07/22/14 15:47	BG
Extraction Fluid	02	SW1311	**1 #**		--	1	07/17/14 16:40	07/22/14 16:42	KEW
Volatile Organic Compounds by GC									
Benzene	02	SW8021B	<5.00 ug/kg		5.00	1	07/17/14 16:15	07/17/14 16:15	CL
Toluene	02	SW8021B	<5.00 ug/kg		5.00	1	07/17/14 16:15	07/17/14 16:15	CL
Ethylbenzene	02	SW8021B	<5.00 ug/kg		5.00	1	07/17/14 16:15	07/17/14 16:15	CL
m+p-Xylenes	02	SW8021B	<10.0 ug/kg		10.0	1	07/17/14 16:15	07/17/14 16:15	CL
o-Xylene	02	SW8021B	<5.00 ug/kg		5.00	1	07/17/14 16:15	07/17/14 16:15	CL
Xylenes, Total	02	SW8021B	<15.0 ug/kg		15.0	1	07/17/14 16:15	07/17/14 16:15	CL
Surr: 2,5-Dibromotoluene	*02*	*SW8021B*	*89.8 %*		*80-120*		*07/17/14 16:15*	*07/17/14 16:15*	*CL*
TCLP Volatile Organic Compounds									
Extraction Fluid, ZHE	02	SW1311	**1 #**		--	1	07/17/14 11:00	07/18/14 11:08	MKD
TCLP Volatile Organic Compounds by GCMS									
1,1-Dichloroethylene	02	SW8260B	<0.02 mg/L		0.02	1	07/17/14 11:43	07/18/14 14:29	MKD
1,2-Dichloroethane	02	SW8260B	<0.02 mg/L		0.02	1	07/17/14 11:43	07/18/14 14:29	MKD
1,4-Dichlorobenzene	02	SW8260B	<0.02 mg/L		0.02	1	07/17/14 11:43	07/18/14 14:29	MKD
2-Butanone (MEK)	02	SW8260B	<0.20 mg/L		0.20	1	07/17/14 11:43	07/18/14 14:29	MKD
Benzene	02	SW8260B	<0.02 mg/L		0.02	1	07/17/14 11:43	07/18/14 14:29	MKD
Carbon tetrachloride	02	SW8260B	<0.02 mg/L		0.02	1	07/17/14 11:43	07/18/14 14:29	MKD
Chlorobenzene	02	SW8260B	<0.02 mg/L		0.02	1	07/17/14 11:43	07/18/14 14:29	MKD

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Final Report

Laboratory Order ID 14G0307

Client Name:	GET Solutions, Inc. 204-B Grayson Road Virginia Beach VA, 23462	Date Received:	July 17, 2014 14:49
		Date Issued:	July 22, 2014 16:53
Submitted To:	Adina Rose	Project Number:	[none]
Client Site I.D.:	Ft. Story	Purchase Order:	

Analytical Results

Sample I.D. B-3/4 **Laboratory Sample ID:** 14G0307-02

Date/Time Sampled: 07/17/2014 08:50

Parameter	Samp ID	Method	Result	Qual	Reporting Limit	D.F.	Sample Prep Date/Time	Analysis Date/Time	Analyst
TCLP Volatile Organic Compounds by GCMS									
Chloroform	02	SW8260B	<2.00 mg/L		2.00	1	07/17/14 11:43	07/18/14 14:29	MKD
Tetrachloroethylene (PCE)	02	SW8260B	<0.02 mg/L		0.02	1	07/17/14 11:43	07/18/14 14:29	MKD
Trichloroethylene	02	SW8260B	<0.02 mg/L		0.02	1	07/17/14 11:43	07/18/14 14:29	MKD
Vinyl chloride	02	SW8260B	<0.02 mg/L		0.02	1	07/17/14 11:43	07/18/14 14:29	MKD
Surr: 1,2-Dichloroethane-d4	*02*	*SW8260B*	*98.6 %*		*70-120*		*07/17/14 11:43*	*07/18/14 14:29*	*MKD*
Surr: 4-Bromofluorobenzene	*02*	*SW8260B*	*101 %*		*75-120*		*07/17/14 11:43*	*07/18/14 14:29*	*MKD*
Surr: Dibromofluoromethane	*02*	*SW8260B*	*98.1 %*		*80-119*		*07/17/14 11:43*	*07/18/14 14:29*	*MKD*
Surr: Toluene-d8	*02*	*SW8260B*	*102 %*		*85-120*		*07/17/14 11:43*	*07/18/14 14:29*	*MKD*
Volatile Petroleum Hydrocarbons by GC									
TPH-Volatiles (GRO)	02	SW8015C	<0.10 mg/kg		0.10	1	07/17/14 16:15	07/17/14 16:15	CL
Semivolatile Petroleum Hydrocarbons by GC									
TPH-Semi-Volatiles (DRO)	02	SW8015C	<10.0 mg/kg		10.0	1	07/18/14 09:47	07/21/14 14:13	JHV
Surr: Pentacosane	*02*	*SW8015C*	*86.1 %*		*40-160*		*07/18/14 09:47*	*07/21/14 14:13*	*JHV*
TCLP Semivolatile Organic Compounds									
Extraction Fluid	02	SW1311	**1 #**		--	1	07/17/14 16:40	07/18/14 09:40	MFR
TCLP Semivolatile Organic Compounds by GCMS									
2,4,5-Trichlorophenol	02	SW8270D	<0.01 mg/L		0.01	1	07/21/14 09:50	07/21/14 17:47	JHV
2,4,6-Trichlorophenol	02	SW8270D	<0.01 mg/L		0.01	1	07/21/14 09:50	07/21/14 17:47	JHV
2,4-Dinitrotoluene	02	SW8270D	<0.01 mg/L		0.01	1	07/21/14 09:50	07/21/14 17:47	JHV
Hexachlorobenzene	02	SW8270D	<0.01 mg/L		0.01	1	07/21/14 09:50	07/21/14 17:47	JHV
Hexachlorobutadiene	02	SW8270D	<0.01 mg/L		0.01	1	07/21/14 09:50	07/21/14 17:47	JHV
Hexachloroethane	02	SW8270D	<0.01 mg/L		0.01	1	07/21/14 09:50	07/21/14 17:47	JHV
m+p-Cresols	02	SW8270D	<0.01 mg/L		0.01	1	07/21/14 09:50	07/21/14 17:47	JHV
Nitrobenzene	02	SW8270D	<0.01 mg/L		0.01	1	07/21/14 09:50	07/21/14 17:47	JHV
o+m+p-Cresols	02	SW8270D	<0.01 mg/L		0.01	1	07/21/14 09:50	07/21/14 17:47	JHV
o-Cresol	02	SW8270D	<0.01 mg/L		0.01	1	07/21/14 09:50	07/21/14 17:47	JHV
Pentachlorophenol	02	SW8270D	<0.02 mg/L		0.02	1	07/21/14 09:50	07/21/14 17:47	JHV

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Client Name:	GET Solutions, Inc. 204-B Grayson Road Virginia Beach VA, 23462	Date Received:	July 17, 2014 14:49
		Date Issued:	July 22, 2014 16:53
Submitted To:	Adina Rose	Project Number:	[none]
Client Site I.D.:	Ft. Story	Purchase Order:	

Analytical Results

Sample I.D. B-3/4 **Laboratory Sample ID:** 14G0307-02

Date/Time Sampled: 07/17/2014 08:50

Parameter	Samp ID	Method	Result	Qual	Reporting Limit	D.F.	Sample Prep Date/Time	Analysis Date/Time	Analyst
TCLP Semivolatile Organic Compounds by GCMS									
Pyridine	02	SW8270D	<0.01 mg/L		0.01	1	07/21/14 09:50	07/21/14 17:47	JHV
Surr: 2,4,6-Tribromophenol	*02*	*SW8270D*	*72.3 %*		*40-125*		*07/21/14 09:50*	*07/21/14 17:47*	*JHV*
Surr: 2-Fluorobiphenyl	*02*	*SW8270D*	*44.6 %*		*23-87*		*07/21/14 09:50*	*07/21/14 17:47*	*JHV*
Surr: 2-Fluorophenol	*02*	*SW8270D*	*27.7 %*		*14-52*		*07/21/14 09:50*	*07/21/14 17:47*	*JHV*
Surr: Nitrobenzene-d5	*02*	*SW8270D*	*47.9 %*		*40-110*		*07/21/14 09:50*	*07/21/14 17:47*	*JHV*
Surr: Phenol-d5	*02*	*SW8270D*	*16.1 %*		*5-33*		*07/21/14 09:50*	*07/21/14 17:47*	*JHV*
Surr: p-Terphenyl-d14	*02*	*SW8270D*	*74.2 %*		*22-85*		*07/21/14 09:50*	*07/21/14 17:47*	*JHV*
TCLP Organochlorine Herbicides by GC/ECD									
2,4,5-TP (Silvex)	02	SW8151A	<0.0005 mg/L		0.0005	1	07/18/14 14:05	07/21/14 20:34	RAC/S
2,4-D [2C]	02	SW8151A	<0.001 mg/L		0.001	1	07/18/14 14:05	07/21/14 20:34	RAC/S
Surr: DCAA	*02*	*SW8151A*	*79.0 %*		*60-112*		*07/18/14 14:05*	*07/21/14 20:34*	*RAC/S*
Surr: DCAA [2C]	*02*	*SW8151A*	*81.5 %*		*60-112*		*07/18/14 14:05*	*07/21/14 20:34*	*RAC/S*
TCLP Organochlorine Pesticides and PCBs by GC/ECD									
Endrin	02	SW8081B	<0.005 mg/L		0.005	1	07/18/14 14:05	07/18/14 18:27	SKS/R
gamma-BHC (Lindane)	02	SW8081B	<0.005 mg/L		0.005	1	07/18/14 14:05	07/18/14 18:27	SKS/R
Heptachlor	02	SW8081B	<0.005 mg/L		0.005	1	07/18/14 14:05	07/18/14 18:27	SKS/R
Heptachlor Epoxide	02	SW8081B	<0.005 mg/L		0.005	1	07/18/14 14:05	07/18/14 18:27	SKS/R
Methoxychlor	02	SW8081B	<0.005 mg/L		0.005	1	07/18/14 14:05	07/18/14 18:27	SKS/R
Toxaphene	02	SW8081B	<0.500 mg/L		0.500	1	07/18/14 14:05	07/18/14 18:27	SKS/R
Surr: TCMX	*02*	*SW8081B*	*65.0 %*		*18-112*		*07/18/14 14:05*	*07/18/14 18:27*	*SKS/R*
Surr: DCB	*02*	*SW8081B*	*40.0 %*		*27-131*		*07/18/14 14:05*	*07/18/14 18:27*	*SKS/R*
Ion Chromatography									
Chloride	02RE1	SW9056A	<10.0 mg/kg		10.0	1	07/18/14 11:04	07/18/14 11:04	SKS
Sulfate	02RE1	SW9056A	**31.6 mg/kg**		10.0	1	07/18/14 11:04	07/18/14 11:04	SKS
Wet Chemistry Analysis									
pH	02	SW9045D	**10.0 SU**		0.00	1	07/18/14 09:59	07/18/14 09:59	JCH
Resistivity	02	Calc	<1.0 umhos-cm		1.0	1	07/18/14 13:45	07/18/14 13:45	LBH

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Final Report

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		Date Issued:	July 22, 2014 16:53
Submitted To:	Adina Rose	Project Number:	[none]
Client Site I.D.:	Ft. Story	Purchase Order:	

Analytical Results

Sample I.D. B-3/4 **Laboratory Sample ID:** 14G0307-02

Date/Time Sampled: 07/17/2014 08:50

Parameter	Samp ID	Method	Result	Qual	Reporting Limit	D.F.	Sample Prep Date/Time	Analysis Date/Time	Analyst
Wet Chemistry Analysis									
Specific Conductance	02	SM22 2510B-2011	**40.6 umhos/cm**		1.0	1	07/18/14 13:45	07/18/14 13:45	LBH
Sulfide	02	SW9034 M	<100 mg/kg		100	1	07/21/14 13:46	07/21/14 13:46	TLA

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Analytical Summary

Sample ID	Preparation Factors Initial / Final	Method	Batch ID	Sequence ID	Calibration ID
Ion Chromatography			**Preparation Method:**	**No Prep IC**	
14G0307-02	10.2 g / 100 mL	SW9056A	BXG0372	SXG0403	AG40013
14G0307-02RE1	10.2 g / 100 mL	SW9056A	BXG0372	SXG0403	AG40013

Sample ID	Preparation Factors Initial / Final	Method	Batch ID	Sequence ID	Calibration ID
Semivolatile Petroleum Hydrocarbons by GC			**Preparation Method:**	**SW3550B**	
14G0307-01	50.0 g / 1.00 mL	SW8015C	BXG0357	SXG0435	AK30141
14G0307-02	50.0 g / 1.00 mL	SW8015C	BXG0357	SXG0435	AK30141

Sample ID	Preparation Factors Initial / Final	Method	Batch ID	Sequence ID	Calibration ID
Subcontracted Analysis			**Preparation Method:**		
14G0307-02		ASTM D1498			

Sample ID	Preparation Factors Initial / Final	Method	Batch ID	Sequence ID	Calibration ID
TCLP Metals by 6000/7000 Series Methods			**Preparation Method:**	**SW7470A**	
14G0307-01	1.00 g / 20.0 mL	SW7470A	BXG0359	SXG0404	AG40086
14G0307-01	10.0 mL / 50.0 mL	SW6010C	BXG0381	SXG0460	AG40094
14G0307-01	100 g / 2000 mL	SW1311	BXG0380	SXG0463	
14G0307-02	1.00 g / 20.0 mL	SW7470A	BXG0359	SXG0404	AG40086
14G0307-02	10.0 mL / 50.0 mL	SW6010C	BXG0381	SXG0460	AG40094
14G0307-02	100 g / 2000 mL	SW1311	BXG0380	SXG0463	

Sample ID	Preparation Factors Initial / Final	Method	Batch ID	Sequence ID	Calibration ID
TCLP Organochlorine Herbicides by GC/ECD			**Preparation Method:**	**SW3510C**	
14G0307-01	100 mL / 5.00 mL	SW8151A	BXG0390	SXG0444	AF40104
14G0307-02	100 mL / 5.00 mL	SW8151A	BXG0390	SXG0444	AF40104

Sample ID	Preparation Factors Initial / Final	Method	Batch ID	Sequence ID	Calibration ID

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Sample ID	Preparation Factors Initial / Final	Method	Batch ID	Sequence ID	Calibration ID
TCLP Organochlorine Pesticides and PCBs by GC/ECD			**Preparation Method:**	**SW3510C**	
14G0307-01	100 mL / 1.00 mL	SW8081B	BXG0378	SXG0412	AE40106
14G0307-02	100 mL / 1.00 mL	SW8081B	BXG0378	SXG0412	AE40106

Sample ID	Preparation Factors Initial / Final	Method	Batch ID	Sequence ID	Calibration ID
TCLP Semivolatile Organic Compounds			**Preparation Method:**	**SW1311 SVOC**	
14G0307-01	100 g / 2000 mL	SW1311	BXG0342	SXG0373	AK30138
14G0307-02	100 g / 2000 mL	SW1311	BXG0342	SXG0373	AK30138

Sample ID	Preparation Factors Initial / Final	Method	Batch ID	Sequence ID	Calibration ID
TCLP Semivolatile Organic Compounds by GCMS			**Preparation Method:**	**SW3510C**	
14G0307-01	100 mL / 1.00 mL	SW8270D	BXG0394	SXG0437	AG40011
14G0307-02	100 mL / 1.00 mL	SW8270D	BXG0394	SXG0437	AG40011

Sample ID	Preparation Factors Initial / Final	Method	Batch ID	Sequence ID	Calibration ID
TCLP Volatile Organic Compounds			**Preparation Method:**	**SW1311 ZHE**	
14G0307-01	15.0 g / 300 mL	SW1311	BXG0384	SXG0416	AG40017
14G0307-02	15.0 g / 300 mL	SW1311	BXG0384	SXG0416	AG40017

Sample ID	Preparation Factors Initial / Final	Method	Batch ID	Sequence ID	Calibration ID
TCLP Volatile Organic Compounds by GCMS			**Preparation Method:**	**SW5030B**	
14G0307-01	0.250 mL / 5.00 mL	SW8260B	BXG0385	SXG0417	AG40017
14G0307-02	0.250 mL / 5.00 mL	SW8260B	BXG0385	SXG0417	AG40017

Sample ID	Preparation Factors Initial / Final	Method	Batch ID	Sequence ID	Calibration ID
Volatile Organic Compounds by GC			**Preparation Method:**	**SW5030B**	
14G0307-01	5.21 g / 5.00 mL	SW8021B	BXG0350	SXG0382	AG40061
14G0307-02	5.20 g / 5.00 mL	SW8021B	BXG0350	SXG0382	AG40061

Sample ID	Preparation Factors Initial / Final	Method	Batch ID	Sequence ID	Calibration ID

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Sample ID	Preparation Factors Initial / Final	Method	Batch ID	Sequence ID	Calibration ID
Volatile Petroleum Hydrocarbons by GC			**Preparation Method:**	**SW5030B**	
14G0307-01	5.21 g / 5.00 mL	SW8015C	BXG0350	SXG0382	AG40061
14G0307-02	5.20 g / 5.00 mL	SW8015C	BXG0350	SXG0382	AG40061
14G0307-02	1.00 g / 1.00 mL	SW9045D	BXG0356	SXG0392	
14G0307-02	1.00 g / 1.00 mL	SM22 2510B-2011	BXG0363	SXG0393	
14G0307-02	2.10 g / 200 mL	SW9034 M	BXG0401	SXG0446	

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TCLP Metals by 6000/7000 Series Methods - Quality Control

Air Water & Soil Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qual
Batch BXG0359 - SW7470A										
Blank (BXG0359-BLK1)				Prepared & Analyzed: 07/18/2014						
Mercury	<0.008 mg/L	0.008	mg/L							
LCS (BXG0359-BS1)				Prepared & Analyzed: 07/18/2014						
Mercury	0.053 mg/L	0.008	mg/L	0.0500		106	80-120			
LCS Dup (BXG0359-BSD1)				Prepared & Analyzed: 07/18/2014						
Mercury	0.052 mg/L	0.008	mg/L	0.0500		104	80-120	1.50	20	
Matrix Spike (BXG0359-MS1)		**Source: 14G0307-01**		Prepared & Analyzed: 07/18/2014						
Mercury	0.051 mg/L	0.008	mg/L	0.0500	<0.008 mg/L	103	80-120			
Matrix Spike Dup (BXG0359-MSD1)		**Source: 14G0307-01**		Prepared & Analyzed: 07/18/2014						
Mercury	0.052 mg/L	0.008	mg/L	0.0500	<0.008 mg/L	104	80-120	1.23	20	
Batch BXG0380 - SW1311										
Blank (BXG0380-BLK1)				Prepared: 07/17/2014 Analyzed: 07/22/2014						
Extraction Fluid	1 #	0	#							
Batch BXG0381 - SW3010A										
Blank (BXG0381-BLK1)				Prepared: 07/18/2014 Analyzed: 07/22/2014						
Arsenic	<0.100 mg/L	0.100	mg/L							
Barium	<5.00 mg/L	5.00	mg/L							J
Cadmium	<0.0400 mg/L	0.0400	mg/L							
Chromium	<0.100 mg/L	0.100	mg/L							
Lead	<0.100 mg/L	0.100	mg/L							
Selenium	<0.250 mg/L	0.250	mg/L							
Silver	<0.100 mg/L	0.100	mg/L							

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TCLP Metals by 6000/7000 Series Methods - Quality Control

Air Water & Soil Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qual
Batch BXG0381 - SW3010A										
LCS (BXG0381-BS1)				Prepared: 07/18/2014 Analyzed: 07/22/2014						
Arsenic	2.59 mg/L	0.100	mg/L	2.50		104	80-120			
Barium	<5.00 mg/L	5.00	mg/L	2.50		103	80-120			J
Cadmium	2.53 mg/L	0.0400	mg/L	2.50		101	80-120			
Chromium	2.53 mg/L	0.100	mg/L	2.50		101	80-120			
Lead	2.49 mg/L	0.100	mg/L	2.50		99.8	80-120			
Selenium	2.54 mg/L	0.250	mg/L	2.50		102	80-120			
Silver	0.519 mg/L	0.100	mg/L	0.500		104	80-120			
LCS Dup (BXG0381-BSD1)				Prepared: 07/18/2014 Analyzed: 07/22/2014						
Arsenic	2.57 mg/L	0.100	mg/L	2.50		103	80-120	0.650	20	
Barium	<5.00 mg/L	5.00	mg/L	2.50		101	80-120	1.48	20	J
Cadmium	2.49 mg/L	0.0400	mg/L	2.50		99.5	80-120	1.70	20	
Chromium	2.49 mg/L	0.100	mg/L	2.50		99.6	80-120	1.76	20	
Lead	2.47 mg/L	0.100	mg/L	2.50		98.7	80-120	1.11	20	
Selenium	2.53 mg/L	0.250	mg/L	2.50		101	80-120	0.731	20	
Silver	0.510 mg/L	0.100	mg/L	0.500		102	80-120	1.76	20	
Matrix Spike (BXG0381-MS1)		**Source: 14G0307-01**		Prepared: 07/18/2014 Analyzed: 07/22/2014						
Arsenic	2.58 mg/L	0.100	mg/L	2.50	<0.100 mg/L	103	75-125			
Barium	<5.00 mg/L	5.00	mg/L	2.50	<5.00 mg/L	101	75-125			J
Cadmium	2.51 mg/L	0.0400	mg/L	2.50	<0.0400 mg/L	100	75-125			
Chromium	2.51 mg/L	0.100	mg/L	2.50	<0.100 mg/L	101	75-125			
Lead	2.48 mg/L	0.100	mg/L	2.50	<0.100 mg/L	99.2	75-125			
Selenium	2.49 mg/L	0.250	mg/L	2.50	<0.250 mg/L	99.7	75-125			
Silver	0.516 mg/L	0.100	mg/L	0.500	<0.100 mg/L	103	75-125			
Matrix Spike Dup (BXG0381-MSD1)		**Source: 14G0307-01**		Prepared: 07/18/2014 Analyzed: 07/22/2014						
Arsenic	2.53 mg/L	0.100	mg/L	2.50	<0.100 mg/L	101	75-125	1.94	20	
Barium	<5.00 mg/L	5.00	mg/L	2.50	<5.00 mg/L	101	75-125	0.114	20	J
Cadmium	2.51 mg/L	0.0400	mg/L	2.50	<0.0400 mg/L	101	75-125	0.304	20	
Chromium	2.52 mg/L	0.100	mg/L	2.50	<0.100 mg/L	101	75-125	0.293	20	
Lead	2.48 mg/L	0.100	mg/L	2.50	<0.100 mg/L	99.2	75-125	0.0225	20	
Selenium	2.52 mg/L	0.250	mg/L	2.50	<0.250 mg/L	101	75-125	1.02	20	

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TCLP Metals by 6000/7000 Series Methods - Quality Control

Air Water & Soil Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qual
Batch BXG0381 - SW3010A										
Matrix Spike Dup (BXG0381-MSD1)		**Source: 14G0307-01**		Prepared: 07/18/2014 Analyzed: 07/22/2014						
Silver	0.519 mg/L	0.100	mg/L	0.500	<0.100 mg/L	104	75-125	0.474	20	

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Volatile Organic Compounds by GC - Quality Control

Air Water & Soil Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qual
Batch BXG0350 - SW5030B										
Blank (BXG0350-BLK1)				Prepared & Analyzed: 07/17/2014						
Benzene	<5.00 ug/kg	5.00	ug/kg							
Toluene	<5.00 ug/kg	5.00	ug/kg							
Ethylbenzene	<5.00 ug/kg	5.00	ug/kg							
m+p-Xylenes	<10.0 ug/kg	10.0	ug/kg							
o-Xylene	<5.00 ug/kg	5.00	ug/kg							
Xylenes, Total	<15.0 ug/kg	15.0	ug/kg							
Surr: 2,5-Dibromotoluene	93.5		ug/L	100		93.5	80-120			
LCS (BXG0350-BS1)				Prepared & Analyzed: 07/17/2014						
Benzene	90.3 ug/kg	5.00	ug/kg	98.4		91.8	70-130			
Toluene	92.6 ug/kg	5.00	ug/kg	98.4		94.1	70-130			
Ethylbenzene	94.0 ug/kg	5.00	ug/kg	98.4		95.6	70-130			
m+p-Xylenes	190 ug/kg	10.0	ug/kg	197		96.7	70-130			
o-Xylene	94.5 ug/kg	5.00	ug/kg	98.4		96.0	70-130			
Surr: 2,5-Dibromotoluene	94.4		ug/L	100		94.4	80-120			
LCS Dup (BXG0350-BSD1)				Prepared & Analyzed: 07/17/2014						
Benzene	90.3 ug/kg	5.00	ug/kg	99.0		91.2	70-130	0.0526	20	
Toluene	93.2 ug/kg	5.00	ug/kg	99.0		94.1	70-130	0.592	20	
Ethylbenzene	94.7 ug/kg	5.00	ug/kg	99.0		95.7	70-130	0.728	20	
m+p-Xylenes	191 ug/kg	10.0	ug/kg	198		96.7	70-130	0.499	20	
o-Xylene	95.1 ug/kg	5.00	ug/kg	99.0		96.0	70-130	0.634	20	
Surr: 2,5-Dibromotoluene	96.2		ug/L	100		96.2	80-120			
Matrix Spike (BXG0350-MS1)		**Source: 14G0307-02**		Prepared & Analyzed: 07/17/2014						
Benzene	79.9 ug/kg	5.00	ug/kg	95.4	<5.00 ug/kg	83.7	70-130			
Toluene	80.9 ug/kg	5.00	ug/kg	95.4	<5.00 ug/kg	84.7	70-130			
Ethylbenzene	80.8 ug/kg	5.00	ug/kg	95.4	<5.00 ug/kg	84.7	70-130			
m+p-Xylenes	163 ug/kg	10.0	ug/kg	191	<10.0 ug/kg	85.6	70-130			
o-Xylene	82.4 ug/kg	5.00	ug/kg	95.4	<5.00 ug/kg	86.3	70-130			
Surr: 2,5-Dibromotoluene	92.5		ug/L	100		92.5	80-120			

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Volatile Organic Compounds by GC - Quality Control

Air Water & Soil Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qual
Batch BXG0350 - SW5030B										
Matrix Spike Dup (BXG0350-MSD1)		**Source: 14G0307-02**		Prepared & Analyzed: 07/17/2014						
Benzene	83.7 ug/kg	5.00	ug/kg	96.0	<5.00 ug/kg	87.3	70-130	4.71	20	
Toluene	84.5 ug/kg	5.00	ug/kg	96.0	<5.00 ug/kg	88.1	70-130	4.43	20	
Ethylbenzene	83.6 ug/kg	5.00	ug/kg	96.0	<5.00 ug/kg	87.1	70-130	3.32	20	
m+p-Xylenes	168 ug/kg	10.0	ug/kg	192	<10.0 ug/kg	87.7	70-130	3.04	20	
o-Xylene	85.0 ug/kg	5.00	ug/kg	96.0	<5.00 ug/kg	88.6	70-130	3.11	20	
Surr: 2,5-Dibromotoluene	95.2		ug/L	100		95.2	80-120			

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TCLP Volatile Organic Compounds by GCMS - Quality Control

Air Water & Soil Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qual
Batch BXG0385 - SW5030B										
Blank (BXG0385-BLK1)				Prepared & Analyzed: 07/18/2014						
1,1-Dichloroethylene	<0.02 mg/L	0.02	mg/L							
1,2-Dichloroethane	<0.02 mg/L	0.02	mg/L							
1,4-Dichlorobenzene	<0.02 mg/L	0.02	mg/L							
2-Butanone (MEK)	<0.20 mg/L	0.20	mg/L							
Benzene	<0.02 mg/L	0.02	mg/L							
Carbon tetrachloride	<0.02 mg/L	0.02	mg/L							
Chlorobenzene	<0.02 mg/L	0.02	mg/L							
Chloroform	<2.00 mg/L	2.00	mg/L							
Tetrachloroethylene (PCE)	<0.02 mg/L	0.02	mg/L							
Trichloroethylene	<0.02 mg/L	0.02	mg/L							
Vinyl chloride	<0.02 mg/L	0.02	mg/L							
Surr: 1,2-Dichloroethane-d4	0.968		mg/L	1.00		96.8	70-120			
Surr: 4-Bromofluorobenzene	1.04		mg/L	1.00		104	75-120			
Surr: Dibromofluoromethane	0.964		mg/L	1.00		96.4	80-119			
Surr: Toluene-d8	1.01		mg/L	1.00		101	85-120			
LCS (BXG0385-BS1)				Prepared & Analyzed: 07/18/2014						
1,1-Dichloroethylene	47.6 ug/L		ug/L	50.0		95.2	70-130			
1,2-Dichloroethane	44.1 ug/L		ug/L	50.0		88.2	70-130			
1,4-Dichlorobenzene	49.8 ug/L		ug/L	50.0		99.6	75-125			
2-Butanone (MEK)	46.5 ug/L		ug/L	50.0		92.9	30-150			
Benzene	48.3 ug/L		ug/L	50.0		96.5	80-120			
Carbon tetrachloride	47.6 ug/L		ug/L	50.0		95.1	65-140			
Chlorobenzene	50.6 ug/L		ug/L	50.0		101	80-120			
Chloroform	48.1 ug/L		ug/L	50.0		96.2	65-135			
Tetrachloroethylene (PCE)	59.4 ug/L		ug/L	50.0		119	45-150			
Trichloroethylene	47.1 ug/L		ug/L	50.0		94.2	70-125			
Vinyl chloride	40.5 ug/L		ug/L	50.0		81.1	50-145			
Surr: 1,2-Dichloroethane-d4	0.965		mg/L	1.00		96.5	70-120			
Surr: 4-Bromofluorobenzene	0.985		mg/L	1.00		98.5	75-120			
Surr: Dibromofluoromethane	1.00		mg/L	1.00		100	80-119			

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Final Report

Laboratory Order ID 14G0307

Client Name:	GET Solutions, Inc. 204-B Grayson Road Virginia Beach VA, 23462	Date Received: Date Issued:	July 17, 2014 14:49 July 22, 2014 16:53
Submitted To:	Adina Rose	Project Number:	[none]
Client Site I.D.:	Ft. Story	Purchase Order:	

TCLP Volatile Organic Compounds by GCMS - Quality Control

Air Water & Soil Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qual
Batch BXG0385 - SW5030B										
LCS (BXG0385-BS1)				Prepared & Analyzed: 07/18/2014						
Surr: Toluene-d8	0.982		mg/L	1.00		98.2	85-120			
LCS Dup (BXG0385-BSD1)				Prepared & Analyzed: 07/18/2014						
1,1-Dichloroethylene	51.2 ug/L		ug/L	50.0		102	70-130	7.36	30	
1,2-Dichloroethane	47.9 ug/L		ug/L	50.0		95.9	70-130	8.40	30	
1,4-Dichlorobenzene	53.7 ug/L		ug/L	50.0		107	75-125	7.51	30	
2-Butanone (MEK)	49.8 ug/L		ug/L	50.0		99.5	30-150	6.85	30	
Benzene	51.6 ug/L		ug/L	50.0		103	80-120	6.77	30	
Carbon tetrachloride	51.8 ug/L		ug/L	50.0		104	65-140	8.52	30	
Chlorobenzene	51.0 ug/L		ug/L	50.0		102	80-120	0.770	30	
Chloroform	50.9 ug/L		ug/L	50.0		102	65-135	5.72	30	
Tetrachloroethylene (PCE)	58.7 ug/L		ug/L	50.0		117	45-150	1.10	30	
Trichloroethylene	50.0 ug/L		ug/L	50.0		100	70-125	6.04	30	
Vinyl chloride	44.6 ug/L		ug/L	50.0		89.3	50-145	9.65	30	
Surr: 1,2-Dichloroethane-d4	0.971		mg/L	1.00		97.1	70-120			
Surr: 4-Bromofluorobenzene	0.958		mg/L	1.00		95.8	75-120			
Surr: Dibromofluoromethane	0.996		mg/L	1.00		99.6	80-119			
Surr: Toluene-d8	1.01		mg/L	1.00		101	85-120			
Matrix Spike (BXG0385-MS1)		**Source: 14G0307-02**		Prepared & Analyzed: 07/18/2014						
1,1-Dichloroethylene	47.5 ug/L		ug/L	50.0	< ug/L	95.0	70-130			
1,2-Dichloroethane	44.4 ug/L		ug/L	50.0	< ug/L	88.7	70-130			
1,4-Dichlorobenzene	47.8 ug/L		ug/L	50.0	0.05 ug/L	95.4	75-125			
2-Butanone (MEK)	49.6 ug/L		ug/L	50.0	< ug/L	99.3	30-150			
Benzene	48.1 ug/L		ug/L	50.0	< ug/L	96.1	80-120			
Carbon tetrachloride	47.9 ug/L		ug/L	50.0	< ug/L	95.8	65-140			
Chlorobenzene	50.1 ug/L		ug/L	50.0	< ug/L	100	80-120			
Chloroform	47.4 ug/L		ug/L	50.0	< ug/L	94.8	65-135			
Tetrachloroethylene (PCE)	57.9 ug/L		ug/L	50.0	< ug/L	116	45-150			
Trichloroethylene	47.3 ug/L		ug/L	50.0	< ug/L	94.6	70-125			
Vinyl chloride	40.9 ug/L		ug/L	50.0	< ug/L	81.7	50-145			

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		Date Issued:	July 22, 2014 16:53
Submitted To:	Adina Rose	Project Number:	[none]
Client Site I.D.:	Ft. Story	Purchase Order:	

TCLP Volatile Organic Compounds by GCMS - Quality Control

Air Water & Soil Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qual
Batch BXG0385 - SW5030B										
Matrix Spike (BXG0385-MS1)		**Source: 14G0307-02**		Prepared & Analyzed: 07/18/2014						
Surr: 1,2-Dichloroethane-d4	0.995		mg/L	1.00		99.5	70-120			
Surr: 4-Bromofluorobenzene	0.999		mg/L	1.00		99.9	75-120			
Surr: Dibromofluoromethane	0.994		mg/L	1.00		99.4	80-119			
Surr: Toluene-d8	0.995		mg/L	1.00		99.5	85-120			
Matrix Spike Dup (BXG0385-MSD1)		**Source: 14G0307-02**		Prepared & Analyzed: 07/18/2014						
1,1-Dichloroethylene	52.1 ug/L		ug/L	50.0	< ug/L	104	70-130	9.21	30	
1,2-Dichloroethane	48.3 ug/L		ug/L	50.0	< ug/L	96.6	70-130	8.51	30	
1,4-Dichlorobenzene	51.0 ug/L		ug/L	50.0	0.05 ug/L	102	75-125	6.61	30	
2-Butanone (MEK)	52.4 ug/L		ug/L	50.0	< ug/L	105	30-150	5.43	30	
Benzene	52.1 ug/L		ug/L	50.0	< ug/L	104	80-120	8.11	30	
Carbon tetrachloride	51.8 ug/L		ug/L	50.0	< ug/L	104	65-140	7.79	30	
Chlorobenzene	51.4 ug/L		ug/L	50.0	< ug/L	103	80-120	2.75	30	
Chloroform	51.5 ug/L		ug/L	50.0	< ug/L	103	65-135	8.37	30	
Tetrachloroethylene (PCE)	59.9 ug/L		ug/L	50.0	< ug/L	120	45-150	3.42	30	
Trichloroethylene	49.9 ug/L		ug/L	50.0	< ug/L	99.9	70-125	5.40	30	
Vinyl chloride	45.0 ug/L		ug/L	50.0	< ug/L	90.1	50-145	9.76	30	
Surr: 1,2-Dichloroethane-d4	0.990		mg/L	1.00		99.0	70-120			
Surr: 4-Bromofluorobenzene	1.00		mg/L	1.00		100	75-120			
Surr: Dibromofluoromethane	1.00		mg/L	1.00		100	80-119			
Surr: Toluene-d8	0.998		mg/L	1.00		99.8	85-120			

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Submitted To:	Adina Rose	Project Number:	[none]
Client Site I.D.:	Ft. Story	Purchase Order:	

Volatile Petroleum Hydrocarbons by GC - Quality Control

Air Water & Soil Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qual
Batch BXG0350 - SW5030B										
Blank (BXG0350-BLK1)				Prepared & Analyzed: 07/17/2014						
TPH-Volatiles (GRO)	<0.10 mg/kg	0.10	mg/kg							
LCS (BXG0350-BS1)				Prepared & Analyzed: 07/17/2014						
TPH-Volatiles (GRO)	0.96 mg/kg	0.10	mg/kg	0.984		97.4	70-130			
LCS Dup (BXG0350-BSD1)				Prepared & Analyzed: 07/17/2014						
TPH-Volatiles (GRO)	0.96 mg/kg	0.10	mg/kg	0.990		96.8	70-130	0.0411	20	
Matrix Spike (BXG0350-MS1)		**Source: 14G0307-02**		Prepared & Analyzed: 07/17/2014						
TPH-Volatiles (GRO)	0.81 mg/kg	0.10	mg/kg	0.954	<0.10 mg/kg	85.3	70-130			
Matrix Spike Dup (BXG0350-MSD1)		**Source: 14G0307-02**		Prepared & Analyzed: 07/17/2014						
TPH-Volatiles (GRO)	0.84 mg/kg	0.10	mg/kg	0.960	<0.10 mg/kg	87.4	70-130	2.92	20	

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Client Site I.D.:	Ft. Story	Purchase Order:	

Semivolatile Petroleum Hydrocarbons by GC - Quality Control

Air Water & Soil Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qual
Batch BXG0357 - SW3550B										
Blank (BXG0357-BLK1)				Prepared: 07/18/2014 Analyzed: 07/21/2014						
TPH-Semi-Volatiles (DRO)	<10.0 mg/kg	10.0	mg/kg							
Surr: Pentacosane	3.98		mg/kg	5.02		79.2	40-160			
LCS (BXG0357-BS1)				Prepared: 07/18/2014 Analyzed: 07/21/2014						
TPH-Semi-Volatiles (DRO)	86.3 mg/kg	10.0	mg/kg	100		86.3	40-160			
Surr: Pentacosane	4.39		mg/kg	5.04		87.0	40-160			
LCS Dup (BXG0357-BSD1)				Prepared: 07/18/2014 Analyzed: 07/21/2014						
TPH-Semi-Volatiles (DRO)	87.3 mg/kg	10.0	mg/kg	100		87.3	40-160	1.08	20	
Surr: Pentacosane	4.28		mg/kg	5.04		84.9	40-160			
Matrix Spike (BXG0357-MS1)		**Source: 14G0307-01**		Prepared: 07/18/2014 Analyzed: 07/21/2014						
TPH-Semi-Volatiles (DRO)	82.4 mg/kg	10.0	mg/kg	99.8	<10.0 mg/kg	82.6	40-160			
Surr: Pentacosane	4.30		mg/kg	5.03		85.6	40-160			
Matrix Spike Dup (BXG0357-MSD1)		**Source: 14G0307-01**		Prepared: 07/18/2014 Analyzed: 07/21/2014						
TPH-Semi-Volatiles (DRO)	83.7 mg/kg	10.0	mg/kg	100	<10.0 mg/kg	83.7	40-160	1.50	20	
Surr: Pentacosane	4.30		mg/kg	5.04		85.3	40-160			

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TCLP Semivolatile Organic Compounds by GCMS - Quality Control

Air Water & Soil Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qual
Batch BXG0394 - SW3510C										
Blank (BXG0394-BLK1)				Prepared & Analyzed: 07/21/2014						
2,4,5-Trichlorophenol	<0.01 mg/L	0.01	mg/L							
2,4,6-Trichlorophenol	<0.01 mg/L	0.01	mg/L							
2,4-Dinitrotoluene	<0.01 mg/L	0.01	mg/L							
Hexachlorobenzene	<0.01 mg/L	0.01	mg/L							
Hexachlorobutadiene	<0.01 mg/L	0.01	mg/L							
Hexachloroethane	<0.01 mg/L	0.01	mg/L							
m+p-Cresols	<0.01 mg/L	0.01	mg/L							
Nitrobenzene	<0.01 mg/L	0.01	mg/L							
o+m+p-Cresols	<0.01 mg/L	0.01	mg/L							
o-Cresol	<0.01 mg/L	0.01	mg/L							
Pentachlorophenol	<0.02 mg/L	0.02	mg/L							
Pyridine	<0.01 mg/L	0.01	mg/L							
Surr: 2,4,6-Tribromophenol	0.635		mg/L	1.00		63.5	40-125			
Surr: 2-Fluorobiphenyl	0.236		mg/L	0.500		47.2	23-87			
Surr: 2-Fluorophenol	0.246		mg/L	1.00		24.6	14-52			
Surr: Nitrobenzene-d5	0.203		mg/L	0.500		40.7	40-110			
Surr: Phenol-d5	0.142		mg/L	1.00		14.2	5-33			
Surr: p-Terphenyl-d14	0.315		mg/L	0.500		63.0	22-85			
LCS (BXG0394-BS1)				Prepared & Analyzed: 07/21/2014						
2,4-Dinitrotoluene	0.37 mg/L	0.01	mg/L	0.500		74.2	39-139			
Pentachlorophenol	0.77 mg/L	0.02	mg/L	0.990		77.3	40-115			
Surr: 2,4,6-Tribromophenol	0.756		mg/L	1.00		75.6	40-125			
Surr: 2-Fluorobiphenyl	0.293		mg/L	0.500		58.7	23-87			
Surr: 2-Fluorophenol	0.339		mg/L	1.00		33.9	14-52			
Surr: Nitrobenzene-d5	0.273		mg/L	0.500		54.5	40-110			
Surr: Phenol-d5	0.198		mg/L	1.00		19.8	5-33			
Surr: p-Terphenyl-d14	0.330		mg/L	0.500		66.0	22-85			

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TCLP Semivolatile Organic Compounds by GCMS - Quality Control

Air Water & Soil Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qual
Batch BXG0394 - SW3510C										
LCS Dup (BXG0394-BSD1)				Prepared & Analyzed: 07/21/2014						
2,4-Dinitrotoluene	0.36 mg/L	0.01	mg/L	0.500		71.3	39-139	4.00	20	
Pentachlorophenol	0.78 mg/L	0.02	mg/L	0.990		79.2	40-115	2.33	20	
Surr: 2,4,6-Tribromophenol	0.741		mg/L	1.00		74.1	40-125			
Surr: 2-Fluorobiphenyl	0.268		mg/L	0.500		53.6	23-87			
Surr: 2-Fluorophenol	0.316		mg/L	1.00		31.6	14-52			
Surr: Nitrobenzene-d5	0.254		mg/L	0.500		50.8	40-110			
Surr: Phenol-d5	0.186		mg/L	1.00		18.6	5-33			
Surr: p-Terphenyl-d14	0.344		mg/L	0.500		68.8	22-85			
Matrix Spike (BXG0394-MS1)		**Source: 14G0307-01**		Prepared & Analyzed: 07/21/2014						
2,4-Dinitrotoluene	0.37 mg/L	0.01	mg/L	0.500	<0.01 mg/L	73.5	39-139			
Pentachlorophenol	0.80 mg/L	0.02	mg/L	0.990	<0.02 mg/L	81.0	40-115			
Surr: 2,4,6-Tribromophenol	0.730		mg/L	1.00		73.0	40-125			
Surr: 2-Fluorobiphenyl	0.266		mg/L	0.500		53.3	23-87			
Surr: 2-Fluorophenol	0.311		mg/L	1.00		31.1	14-52			
Surr: Nitrobenzene-d5	0.255		mg/L	0.500		50.9	40-110			
Surr: Phenol-d5	0.194		mg/L	1.00		19.4	5-33			
Surr: p-Terphenyl-d14	0.328		mg/L	0.500		65.6	22-85			
Matrix Spike Dup (BXG0394-MSD1)		**Source: 14G0307-01**		Prepared & Analyzed: 07/21/2014						
2,4-Dinitrotoluene	0.39 mg/L	0.01	mg/L	0.500	<0.01 mg/L	77.2	39-139	4.91	20	
Pentachlorophenol	0.84 mg/L	0.02	mg/L	0.990	<0.02 mg/L	85.3	40-115	5.11	20	
Surr: 2,4,6-Tribromophenol	0.774		mg/L	1.00		77.4	40-125			
Surr: 2-Fluorobiphenyl	0.243		mg/L	0.500		48.5	23-87			
Surr: 2-Fluorophenol	0.323		mg/L	1.00		32.3	14-52			
Surr: Nitrobenzene-d5	0.264		mg/L	0.500		52.8	40-110			
Surr: Phenol-d5	0.199		mg/L	1.00		19.9	5-33			
Surr: p-Terphenyl-d14	0.341		mg/L	0.500		68.2	22-85			

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Client Site I.D.:	Ft. Story	Purchase Order:	

TCLP Organochlorine Herbicides by GC/ECD - Quality Control

Air Water & Soil Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qual
Batch BXG0390 - SW3510C										
Blank (BXG0390-BLK1)				Prepared: 07/18/2014 Analyzed: 07/21/2014						
2,4,5-TP (Silvex)	<0.0005 mg/L	0.0005	mg/L							
2,4-D [2C]	<0.001 mg/L	0.001	mg/L							
Surr: DCAA	0.00750		mg/L	0.0100		75.0	60-112			
Surr: DCAA [2C]	0.00740		mg/L	0.0100		74.0	60-112			
LCS (BXG0390-BS1)				Prepared: 07/18/2014 Analyzed: 07/21/2014						
2,4,5-TP (Silvex)	0.005 mg/L	0.0005	mg/L	0.00500		92.0	52-129			
2,4-D [2C]	0.005 mg/L	0.001	mg/L	0.00496		99.9	53-126			
Surr: DCAA	0.00630		mg/L	0.0100		63.0	60-112			
Surr: DCAA [2C]	0.00655		mg/L	0.0100		65.5	60-112			
LCS Dup (BXG0390-BSD1)				Prepared: 07/18/2014 Analyzed: 07/21/2014						
2,4,5-TP (Silvex)	0.004 mg/L	0.0005	mg/L	0.00500		90.0	52-129	2.20	20	
2,4-D [2C]	0.005 mg/L	0.001	mg/L	0.00496		96.9	53-126	3.08	20	
Surr: DCAA	0.00780		mg/L	0.0100		78.0	60-112			
Surr: DCAA [2C]	0.00740		mg/L	0.0100		74.0	60-112			
Matrix Spike (BXG0390-MS1)		**Source: 14G0307-01**		Prepared: 07/18/2014 Analyzed: 07/21/2014						
2,4,5-TP (Silvex)	0.004 mg/L	0.0005	mg/L	0.00500	<0.0005 mg/L	89.0	52-129			
2,4-D [2C]	0.005 mg/L	0.001	mg/L	0.00496	<0.001 mg/L	96.9	53-126			
Surr: DCAA	0.00785		mg/L	0.0100		78.5	60-112			
Surr: DCAA [2C]	0.00725		mg/L	0.0100		72.5	60-112			
Matrix Spike Dup (BXG0390-MSD1)		**Source: 14G0307-01**		Prepared: 07/18/2014 Analyzed: 07/21/2014						
2,4,5-TP (Silvex)	0.005 mg/L	0.0005	mg/L	0.00500	<0.0005 mg/L	95.0	52-129	6.52	20	
2,4-D [2C]	0.005 mg/L	0.001	mg/L	0.00496	<0.001 mg/L	102	53-126	5.08	20	
Surr: DCAA	0.00740		mg/L	0.0100		74.0	60-112			
Surr: DCAA [2C]	0.00650		mg/L	0.0100		65.0	60-112			

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Certificate of Analysis

Final Report

Laboratory Order ID 14G0307

Client Name:	GET Solutions, Inc. 204-B Grayson Road Virginia Beach VA, 23462	Date Received: Date Issued:	July 17, 2014 14:49 July 22, 2014 16:53
Submitted To:	Adina Rose	Project Number:	[none]
Client Site I.D.:	Ft. Story	Purchase Order:	

TCLP Organochlorine Pesticides and PCBs by GC/ECD - Quality Control

Air Water & Soil Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qual
Batch BXG0378 - SW3510C										
Blank (BXG0378-BLK1)				Prepared & Analyzed: 07/18/2014						
Endrin	<0.005 mg/L	0.005	mg/L							
gamma-BHC (Lindane)	<0.005 mg/L	0.005	mg/L							
Heptachlor	<0.005 mg/L	0.005	mg/L							
Heptachlor Epoxide	<0.005 mg/L	0.005	mg/L							
Methoxychlor	<0.005 mg/L	0.005	mg/L							
Toxaphene	<0.500 mg/L	0.500	mg/L							
Surr: TCMX	0.00140		mg/L	0.00200		70.0	18-112			
Surr: DCB	0.00140		mg/L	0.00200		70.0	27-131			
LCS (BXG0378-BS1)				Prepared & Analyzed: 07/18/2014						
Chlordane	<0.030 mg/L	0.030	mg/L				23-134			
Endrin	<0.005 mg/L	0.005	mg/L	0.000980		81.6	23-134			J
Heptachlor	<0.005 mg/L	0.005	mg/L	0.00100		60.0	23-134			J
Heptachlor Epoxide	<0.005 mg/L	0.005	mg/L	0.00100		70.0	23-134			J
Methoxychlor	<0.005 mg/L	0.005	mg/L	0.000990		80.8	23-134			J
Toxaphene	<0.500 mg/L	0.500	mg/L				23-134			
Surr: TCMX	0.00110		mg/L	0.00200		55.0	18-112			
Surr: DCB	0.00140		mg/L	0.00200		70.0	27-131			
LCS (BXG0378-BS2)				Prepared & Analyzed: 07/18/2014						
Chlordane	<0.030 mg/L	0.030	mg/L				23-134			
Endrin	<0.005 mg/L	0.005	mg/L				23-134			
Heptachlor	<0.005 mg/L	0.005	mg/L				23-134			
Heptachlor Epoxide	<0.005 mg/L	0.005	mg/L				23-134			
Methoxychlor	<0.005 mg/L	0.005	mg/L				23-134			
Toxaphene	<0.500 mg/L	0.500	mg/L	0.0250		52.4	23-134			J
Surr: TCMX	ND		mg/L	0.00200			18-112			
Surr: DCB	ND		mg/L	0.00200			27-131			

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Laboratory Order ID 14G0307

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Submitted To:	Adina Rose	Project Number:	[none]
Client Site I.D.:	Ft. Story	Purchase Order:	

TCLP Organochlorine Pesticides and PCBs by GC/ECD - Quality Control

Air Water & Soil Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qual
Batch BXG0378 - SW3510C										
LCS (BXG0378-BS3)				Prepared & Analyzed: 07/18/2014						
Chlordane	<0.030 mg/L	0.030	mg/L	0.0250		66.4	23-134			J
Endrin	<0.005 mg/L	0.005	mg/L				23-134			
Heptachlor	<0.005 mg/L	0.005	mg/L				23-134			
Heptachlor Epoxide	<0.005 mg/L	0.005	mg/L				23-134			
Methoxychlor	<0.005 mg/L	0.005	mg/L				23-134			
Toxaphene	<0.500 mg/L	0.500	mg/L				23-134			
Surr: TCMX	ND		mg/L	0.00200			18-112			
Surr: DCB	ND		mg/L	0.00200			27-131			
LCS Dup (BXG0378-BSD1)				Prepared & Analyzed: 07/18/2014						
Chlordane	<0.030 mg/L	0.030	mg/L				23-134		20	
Endrin	<0.005 mg/L	0.005	mg/L	0.000980		81.6	23-134	0.00	20	J
Heptachlor	<0.005 mg/L	0.005	mg/L	0.00100		70.0	23-134	15.4	20	J
Heptachlor Epoxide	<0.005 mg/L	0.005	mg/L	0.00100		70.0	23-134	0.00	20	J
Methoxychlor	<0.005 mg/L	0.005	mg/L	0.000990		80.8	23-134	0.00	20	J
Toxaphene	<0.500 mg/L	0.500	mg/L				23-134		20	
Surr: TCMX	0.00110		mg/L	0.00200		55.0	18-112			
Surr: DCB	0.00140		mg/L	0.00200		70.0	27-131			
Matrix Spike (BXG0378-MS1)		**Source: 14G0307-02**		Prepared & Analyzed: 07/18/2014						
Endrin	<0.005 mg/L	0.005	mg/L	0.000980	<0.005 mg/L	81.6	23-134			J
Heptachlor	<0.005 mg/L	0.005	mg/L	0.00100	<0.005 mg/L	60.0	23-134			J
Heptachlor Epoxide	<0.005 mg/L	0.005	mg/L	0.00100	<0.005 mg/L	80.0	23-134			J
Methoxychlor	<0.005 mg/L	0.005	mg/L	0.000990	<0.005 mg/L	90.9	23-134			J
Surr: TCMX	0.00110		mg/L	0.00200		55.0	18-112			
Surr: DCB	0.000600		mg/L	0.00200		30.0	27-131			
Matrix Spike Dup (BXG0378-MSD1)		**Source: 14G0307-02**		Prepared & Analyzed: 07/18/2014						
Endrin	<0.005 mg/L	0.005	mg/L	0.000980	<0.005 mg/L	81.6	23-134	0.00	20	J
Heptachlor	<0.005 mg/L	0.005	mg/L	0.00100	<0.005 mg/L	70.0	23-134	15.4	20	J
Heptachlor Epoxide	<0.005 mg/L	0.005	mg/L	0.00100	<0.005 mg/L	80.0	23-134	0.00	20	J
Methoxychlor	<0.005 mg/L	0.005	mg/L	0.000990	<0.005 mg/L	80.8	23-134	11.8	20	J

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Certificate of Analysis

Final Report

Laboratory Order ID 14G0307

Client Name:	GET Solutions, Inc. 204-B Grayson Road Virginia Beach VA, 23462	Date Received:	July 17, 2014 14:49
		Date Issued:	July 22, 2014 16:53
Submitted To:	Adina Rose	Project Number:	[none]
Client Site I.D.:	Ft. Story	Purchase Order:	

TCLP Organochlorine Pesticides and PCBs by GC/ECD - Quality Control

Air Water & Soil Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qual
Batch BXG0378 - SW3510C										
Matrix Spike Dup (BXG0378-MSD1)		**Source: 14G0307-02**		Prepared & Analyzed: 07/18/2014						
Surr: TCMX	0.00110		mg/L	0.00200		55.0	18-112			
Surr: DCB	0.000600		mg/L	0.00200		30.0	27-131			

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Submitted To:	Adina Rose	Project Number:	[none]
Client Site I.D.:	Ft. Story	Purchase Order:	

Ion Chromatography - Quality Control

Air Water & Soil Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qual
Batch BXG0372 - No Prep IC										
Blank (BXG0372-BLK1)				Prepared & Analyzed: 07/18/2014						
Sulfate	<10.0 mg/kg	10.0	mg/kg							
Chloride	<10.0 mg/kg	10.0	mg/kg							
LCS (BXG0372-BS1)				Prepared & Analyzed: 07/18/2014						
Chloride	5.0 mg/L		mg/L	5.00		100	90-110			
Sulfate	5.03 mg/L		mg/L	5.00		101	90-110			
LCS Dup (BXG0372-BSD1)				Prepared & Analyzed: 07/18/2014						
Sulfate	5.09 mg/L		mg/L	5.00		102	90-110	1.11	20	
Chloride	5.0 mg/L		mg/L	5.00		99.5	90-110	0.441	20	
Matrix Spike (BXG0372-MS1)		**Source: 14G0307-02RE1**		Prepared & Analyzed: 07/18/2014						
Chloride	54.5 mg/kg	10.0	mg/kg	50.0	<10.0 mg/kg	109	80-120			
Sulfate	81.2 mg/kg	10.0	mg/kg	50.0	31.6 mg/kg	99.3	80-120			
Matrix Spike Dup (BXG0372-MSD1)		**Source: 14G0307-02RE1**		Prepared & Analyzed: 07/18/2014						
Sulfate	81.4 mg/kg	10.0	mg/kg	50.0	31.6 mg/kg	99.6	80-120	0.197	20	
Chloride	54.6 mg/kg	10.0	mg/kg	50.0	<10.0 mg/kg	109	80-120	0.275	20	

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		Date Issued:	July 22, 2014 16:53
Submitted To:	Adina Rose	Project Number:	[none]
Client Site I.D.:	Ft. Story	Purchase Order:	

Wet Chemistry Analysis - Quality Control

Air Water & Soil Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qual
Batch BXG0356 - No Prep Wet Chem										
LCS (BXG0356-BS1)				Prepared & Analyzed: 07/18/2014						
pH	4.98 SU		SU	5.00		99.6	94-106			
Duplicate (BXG0356-DUP1)		**Source: 14G0307-02**		Prepared & Analyzed: 07/18/2014						
pH	9.95 SU	0.00	SU		10.0 SU			1.00	20	
Batch BXG0363 - No Prep Wet Chem										
Blank (BXG0363-BLK1)				Prepared & Analyzed: 07/18/2014						
Specific Conductance	<1.0 umhos/cm	1.0	umhos/cm							
LCS (BXG0363-BS1)				Prepared & Analyzed: 07/18/2014						
Specific Conductance	950 umhos/cm		umhos/cm	1000		95.0	90-110			
LCS Dup (BXG0363-BSD1)				Prepared & Analyzed: 07/18/2014						
Specific Conductance	967 umhos/cm		umhos/cm	1000		96.7	90-110	1.77	20	
Duplicate (BXG0363-DUP1)		**Source: 14G0307-02**		Prepared & Analyzed: 07/18/2014						
Specific Conductance	41.3 umhos/cm	1.0	umhos/cm		40.6 umhos/cm			1.71	20	
Batch BXG0401 - No Prep Wet Chem										
Blank (BXG0401-BLK1)				Prepared & Analyzed: 07/21/2014						
Sulfide	<100 mg/kg	100	mg/kg							
LCS (BXG0401-BS1)				Prepared & Analyzed: 07/21/2014						
Sulfide	404 mg/kg	100	mg/kg	399		101	80-120			

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		Date Issued:	July 22, 2014 16:53
Submitted To:	Adina Rose	Project Number:	[none]
Client Site I.D.:	Ft. Story	Purchase Order:	

Wet Chemistry Analysis - Quality Control

Air Water & Soil Laboratories, Inc.

Analyte	Result	Reporting Limit	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qual
Batch BXG0401 - No Prep Wet Chem										
LCS Dup (BXG0401-BSD1)				Prepared & Analyzed: 07/21/2014						
Sulfide	410 mg/kg	100	mg/kg	399		103	80-120	1.47	20	
Matrix Spike (BXG0401-MS1)		**Source: 14G0307-02**		Prepared & Analyzed: 07/21/2014						
Sulfide	292 mg/kg	100	mg/kg	369	<100 mg/kg	79.2	75-125			
Matrix Spike Dup (BXG0401-MSD1)		**Source: 14G0307-02**		Prepared & Analyzed: 07/21/2014						
Sulfide	297 mg/kg	100	mg/kg	366	<100 mg/kg	81.2	75-125	1.73	20	

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Submitted To:	Adina Rose	Project Number:	[none]
Client Site I.D.:	Ft. Story	Purchase Order:	

Certified Analyses included in this Report

Analyte	Certifications
SW1311 in Solids	
Extraction Fluid	VELAP
Extraction Fluid, ZHE	VELAP
SW6010C in Non-Potable Water	
Arsenic	VELAP,NC
Barium	VELAP,NC
Cadmium	VELAP,NC
Chromium	VELAP,NC
Lead	VELAP,NC
Selenium	VELAP,NC
Silver	VELAP,NC
SW7470A in Solids	
Mercury	VELAP,NC
SW8015C in Solids	
TPH-Semi-Volatiles (DRO)	VELAP,NC,WVDEP
TPH-Volatiles (GRO)	VELAP,NC,WVDEP
SW8021B in Solids	
Benzene	VELAP,NC,WVDEP
Toluene	VELAP,NC,WVDEP
Ethylbenzene	VELAP,NC,WVDEP
m+p-Xylenes	VELAP,NC,WVDEP
o-Xylene	VELAP,NC,WVDEP
Xylenes, Total	VELAP,NC,WVDEP
SW8081B in Non-Potable Water	
Endrin	VELAP,NC
gamma-BHC (Lindane)	VELAP,NC
Heptachlor	VELAP,NC
Heptachlor Epoxide	VELAP,NC
Methoxychlor	VELAP,NC
Toxaphene	VELAP,NC
SW8151A in Non-Potable Water	
2,4,5-TP (Silvex)	VELAP,NC
2,4-D [2C]	VELAP,NC
SW8260B in Non-Potable Water	
1,1-Dichloroethylene	VELAP,NC
1,2-Dichloroethane	VELAP,NC

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Submitted To:	Adina Rose	Project Number:	[none]
Client Site I.D.:	Ft. Story	Purchase Order:	

Certified Analyses included in this Report

Analyte	Certifications
1,4-Dichlorobenzene	VELAP,NC
2-Butanone (MEK)	VELAP,NC
Benzene	VELAP,NC
Carbon tetrachloride	VELAP,NC
Chlorobenzene	VELAP,NC
Chloroform	VELAP,NC
Tetrachloroethylene (PCE)	VELAP,NC
Trichloroethylene	VELAP,NC
Vinyl chloride	VELAP,NC
SW8270D in Non-Potable Water	
2,4,5-Trichlorophenol	NC
2,4,6-Trichlorophenol	NC,VELAP
2,4-Dinitrotoluene	NC,VELAP
Hexachlorobenzene	NC,VELAP
Hexachlorobutadiene	NC,VELAP
Hexachloroethane	NC,VELAP
m+p-Cresols	NC
Nitrobenzene	NC,VELAP
o+m+p-Cresols	NC
o-Cresol	NC,VELAP
Pentachlorophenol	NC,VELAP
Pyridine	NC
SW9034 M in Solids	
Sulfide	VELAP
SW9045D in Solids	
pH	VELAP
SW9056A in Solids	
Chloride	VELAP
Sulfate	VELAP

Code	Description	Lab Number	Expires
MdDOE	Maryland DE Drinking Water	341	12/31/2014
NC	North Carolina DENR	495	12/31/2014
PADEP	NELAC-Pennsylvania	001	10/31/2014
VELAP	NELAC-Virginia Certificate #4337	460021	06/14/2015
WVDEP	West Virginia DEP	350	11/30/2014

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Submitted To:	Adina Rose	Project Number:	[none]
Client Site I.D.:	Ft. Story	Purchase Order:	

Summary of Data Qualifiers

RPD	Relative Percent Difference
Qual	Qualifers
-RE	Denotes sample was re-analyzed
D.F.	Dilution Factor. Please also see the Preparation Factor in the Analysis Summary section.

AIR WATER & SOIL LABORATORIES, INC.
1941 REYMET ROAD
RICHMOND, VIRGINIA 23237
(804) 358-8295 PHONE
(804)358-8297 FAX

CHAIN OF CUSTODY

COMPANY NAME: GET Solutions Inc.	INVOICE TO: GET Solutions, Inc.	PROJECT NAME/Quote #: Ft. Story
CONTACT: Adina Rose / Chris Hahn	INVOICE CONTACT:	SITE NAME: Ft. Story
ADDRESS: 204 Grayson Rd, VB, VA 23462	INVOICE ADDRESS: 204 Grayson Rd, Virginia Beach, VA 23462	PROJECT NUMBER:
PHONE #: 757-518-1703	INVOICE PHONE #: 757-518-1703	P.O. #:
FAX #: 757-518-1704	EMAIL: arose@getsolutionsinc.com / chahn@getsolutionsinc.com	Pretreatment Program:
Is sample for compliance reporting? YES (NO)	Is sample from a chlorinated supply? YES (NO)	PWS I.D. #:
SAMPLER NAME (PRINT): Joshua Saar	SAMPLER SIGNATURE: [signature]	Turn Around Time: 3 Day(s)

Matrix Codes: WW=Waste Water/Storm Water GW=Ground Water DW=Drinking Water S=Soil/Solids OR=Organic A=Air WP=Wipe OT=Other_____

CLIENT SAMPLE I.D.	Grab	Composite	Field Filtered (Dissolved Metals)	Composite Start Date	Composite Start Time	Grab Date or Composite Stop Date	Grab Time or Composite Stop Time	Time Preserved	Matrix (See Codes)	Number of Containers	ANALYSIS / (PRESERVATIVE): Full TCLP	TPH-DRO TPH-GRO	BTEX	pH,	Soluble sulphates, Chlorides,	electrical resistivity,	sulfides	Redox	COMMENTS (Preservative Codes: N=Nitric Acid C=Hydrochloric Acid S=Sulfuric Acid H=Sodium Hydroxide A=Ascorbic Acid Z=Zinc Acetate T=Sodium Thiosulfate M=Methanol; PLEASE NOTE PRESERVATIVE(S), INTERFERENCE CHECKS or PUMP RATE (L/min))
1) B-1/2		X		7.17.14	0825				soil		X	X	X						
2) B-3/4		X		7.17.14	0850				soil		X	X	X	X	X	X	X	X	
3)																			
4)																			
5)																			
6)																			
7)																			
8)																			
9)																			
10)																			

RELINQUISHED:	DATE / TIME	RECEIVED:	DATE / TIME
[signature]	7-17-14 11:41	[signature]	7.17.14 11:41
[signature]	7.17.14 1441	[signature]	7/17/14 1441
RELINQUISHED:	DATE / TIME	RECEIVED:	DATE / TIME

QC Data Package: Level I ☐ Level II ☐ Level III ☐ Level IV ☐

LAB USE ONLY

COOLER TEMP 5.7 °C

14G0307

GET
Ft. Story
Recd: 07/17/2014 Due: 07/22/2014

v130325002

AIR WATER & SOIL Laboratories, Inc.
1941 Reymet Road • Richmond, Virginia 23237 • Tel : (804) 358-829

GET **14G0307**

Ft. Story

Sample Conditions Checklist

Recd: 07/17/2014 **Due: 07/22/2014**

v130325002

Opened by: (Initials) MW **Lab ID No.:**

Date Cooler Opened:

		YES	NO	N/A
1.	How were samples received? Fed Ex ☐ UPS ☐ Courier ☐ Walk In ☑			
2.	Were custody seals used?	☐	☑	☐
3.	If yes, are custody seals unbroken and intact at the date and time of arrival?	☐	☐	☑
4.	Are the custody papers filled out completely and correctly?	☑	☐	☐
5.	Do all bottle labels agree with custody papers?	☑	☐	☐
6.	Are the samples received on ice?	☑	☐	☐
7.	Is the temperature blank or representative sample within acceptable limits? (above freezing to 6°C)	☑	☐	☐
8.	Are all samples within holding time for requested laboratory tests?	☑	☐	☐
9	Is a sufficient amount of sample provided to perform the tests indicated?	☑	☐	☐
10	Are all samples in proper containers for the analyses requested?	☑	☐	☐
11	Are all samples appropriately preserved for the analyses requested?	☑	☐	☐
12	Are all volatile organic containers free of headspace?	☐	☐	☑
13	Is Trip blank provided with each VOC sample set? Circle applicable method: (Document if trip blank is not received with the sample set)	☐	☐	☑

EPA 8011 EPA 504 EPA 8260 EPA 624

RSK-175 EPA 8015 (GRO) EPA 8021

EPA 524 GRO Wisconsin DNR (water and/or methanol trip blank must be provided)

COMMENTS

FOR LAB USE ONLY:

CrVI preserved date/time: _____

Buffer Sol'n ID: _____ Analyst intials: _____

1N NaOH ID: _____ or 5N NaOH ID: _____

Pace Analytical Services, Inc.
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

July 22, 2014

Jessica Reich
Air, Water, and Soil Laboratories, Inc.
1941 Reymet Rd
Richmond, VA 23237

RE: Project: 14G0307
Pace Project No.: 60173919

Dear Jessica Reich:
Enclosed are the analytical results for sample(s) received by the laboratory on July 18, 2014. The results relate only to the samples included in this report. Results reported herein conform to the most current TNI standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Alice Flanagan
alice.flanagan@pacelabs.com
Project Manager

Enclosures

cc: AWS Labs Report Email

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without the written consent of Pace Analytical Services, Inc..

Pace Analytical Services, Inc.
9608 Loiret Blvd.
Lenexa, KS 66219
(913)599-5665

CERTIFICATIONS

Project: 14G0307
Pace Project No.: 60173919

Kansas Certification IDs
9608 Loiret Boulevard, Lenexa, KS 66219
WY STR Certification #: 2456.01
Arkansas Certification #: 13-012-0
Illinois Certification #: 003097
Iowa Certification #: 118
Kansas/NELAP Certification #: E-10116
Louisiana Certification #: 03055
Nevada Certification #: KS000212008A
Oklahoma Certification #: 9205/9935
Texas Certification #: T104704407
Utah Certification #: KS00021

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Lenexa, KS 66219
(913)599-5665

SAMPLE SUMMARY

Project: 14G0307
Pace Project No.: 60173919

Lab ID	Sample ID	Matrix	Date Collected	Date Received
60173919001	**14G0307-02**	Solid	07/17/14 08:50	07/18/14 10:40

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SAMPLE ANALYTE COUNT

Project: 14G0307
Pace Project No.: 60173919

Lab ID	Sample ID	Method	Analysts	Analytes Reported
60173919001	**14G0307-02**	ASTM D2974	TMD	1
		SM 2580B	ESM	1

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PROJECT NARRATIVE

Project: 14G0307
Pace Project No.: 60173919

Method: **SM 2580B**
Description: Oxidation/Reduction Potential
Client: Air, Water, and Soil Laboratories, Inc.
Date: July 22, 2014

General Information:
1 sample was analyzed for SM 2580B. All samples were received in acceptable condition with any exceptions noted below.

Hold Time:
The samples were analyzed within the method required hold times with any exceptions noted below.

Method Blank:
All analytes were below the report limit in the method blank, where applicable, with any exceptions noted below.

Laboratory Control Spike:
All laboratory control spike compounds were within QC limits with any exceptions noted below.

Matrix Spikes:
All percent recoveries and relative percent differences (RPDs) were within acceptance criteria with any exceptions noted below.

Duplicate Sample:
All duplicate sample results were within method acceptance criteria with any exceptions noted below.

Additional Comments:

This data package has been reviewed for quality and completeness and is approved for release.

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ANALYTICAL RESULTS

Project: 14G0307
Pace Project No.: 60173919

Sample: 14G0307-02 **Lab ID: 60173919001** Collected: 07/17/14 08:50 Received: 07/18/14 10:40 Matrix: Solid

Results reported on a "dry-weight" basis

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
Percent Moisture	Analytical Method: ASTM D2974							
Percent Moisture	**15.0**	%	0.50	1		07/19/14 00:00		
Oxidation/Reduction Potential	Analytical Method: SM 2580B							
Oxidation/Reduction Potential	**106**	mV	1.0	1		07/22/14 15:15		

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QUALITY CONTROL DATA

Project: 14G0307
Pace Project No.: 60173919

QC Batch: PMST/9844
QC Batch Method: ASTM D2974
Associated Lab Samples: 60173919001

Analysis Method: ASTM D2974
Analysis Description: Dry Weight/Percent Moisture

METHOD BLANK: 1412999
Matrix: Solid
Associated Lab Samples: 60173919001

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Percent Moisture	%	ND	0.50	07/19/14 00:00	

SAMPLE DUPLICATE: 1413000

Parameter	Units	60173958001 Result	Dup Result	RPD	Max RPD	Qualifiers
Percent Moisture	%	18.9	19.0	0	20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: 14G0307
Pace Project No.: 60173919

QC Batch: WET/49184
QC Batch Method: SM 2580B
Analysis Method: SM 2580B
Analysis Description: Oxidation/Reduction Potential
Associated Lab Samples: 60173919001

SAMPLE DUPLICATE: 1414291

Parameter	Units	60173919001 Result	Dup Result	RPD	Max RPD	Qualifiers
Oxidation/Reduction Potential	mV	106	107	1	10	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALIFIERS

Project: 14G0307
Pace Project No.: 60173919

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to changes in sample preparation, dilution of the sample aliquot, or moisture content.

ND - Not Detected at or above adjusted reporting limit.

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit.

S - Surrogate

1,2-Diphenylhydrazine (8270 listed analyte) decomposes to Azobenzene.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: 14G0307
Pace Project No.: 60173919

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
60173919001	**14G0307-02**	ASTM D2974	PMST/9844		
60173919001	**14G0307-02**	SM 2580B	WET/49184		

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Sample Condition Upon Receipt

WO#: 60173919

60173919

Optional
Proj Due Date:
Proj Name:

Client Name: AWS Labs

Courier: Fed Ex ☐ UPS ☑ USPS ☐ Client ☐ Commercial ☐ Pace ☐ Other ☐

Tracking #: 12 F15 16E01 9046 5504 Pace Shipping Label Used? Yes ☐ No ☑

Custody Seal on Cooler/Box Present: Yes ☑ No ☐ Seals intact: Yes ☑ No ☐

Packing Material: Bubble Wrap ☐ Bubble Bags ☐ Foam ☐ None ☐ Other ☐

Thermometer Used: T-239 / T-194 **Type of Ice:** Wet Blue None (circle one) ☐ Samples received on ice, cooling process has begun.

Cooler Temperature: 5.2

Temperature should be above freezing to 6°C

Date and initials of person examining contents: AH 7/18

Chain of Custody present:	☑Yes	☐No	☐N/A	1.
Chain of Custody filled out:	☑Yes	☐No	☐N/A	2.
Chain of Custody relinquished:	☑Yes	☐No	☐N/A	3.
Sampler name & signature on COC:	☑Yes	☑No AH 7/18	☐N/A	4.
Samples arrived within holding time:	☑Yes	☐No	☐N/A	5.
Short Hold Time analyses (<72hr):	☐Yes	☑No	☐N/A	6.
Rush Turn Around Time requested:	☑Yes	☐No	☐N/A	7. 3day
Sufficient volume:	☑Yes	☐No	☐N/A	8.
Correct containers used:	☑Yes	☐No	☐N/A	
Pace containers used:	☑Yes	☐No	☐N/A	9.
Containers intact:	☑Yes	☐No	☐N/A	10.
Unpreserved 5035A soils frozen w/in 48hrs?	☐Yes	☐No	☑N/A	11.
Filtered volume received for dissolved tests?	☐Yes	☐No	☑N/A	12.
Sample labels match COC: Includes date/time/ID/analyses Matrix: SL	☑Yes	☐No	☐N/A	13.
All containers needing preservation have been checked.	☐Yes	☐No	☑N/A	
All containers needing preservation are found to be in compliance with EPA recommendation.	☐Yes	☐No	☑N/A	14.
Exceptions: VOA, coliform, TOC, O&G, WI-DRO (water), Phenolics	☐Yes	☑No		Initial when completed / Lot # of added preservative
Trip Blank present: Pace Trip Blank lot # (if purchased):	☐Yes	☐No	☑N/A	15.
Headspace in VOA vials (>6mm):	☐Yes	☐No	☑N/A	16.
Project sampled in USDA Regulated Area:	☐Yes	☑No	☐N/A	17. List State: VA

Client Notification/ Resolution: Copy COC to Client? Y / N Field Data Required? Y / N

Person Contacted: _____ Date/Time: _____

Comments/ Resolution: _____

Project Manager Review: AH Date: 7/18/14

AIR WATER SOIL LABORATORIES, INC.

PACE KS

1941 REYMET ROAD
RICHMOND, VIRGINIA 23237
(804) 358-8295 PHONE
(804)358-8297 FAX

CHAIN OF CUSTODY

PAGE _____ OF _____

COMPANY NAME: AWS LABS	INVOICE TO:	PROJECT NAME/Quote #:
CONTACT: Jessica Reich	INVOICE CONTACT:	SITE NAME:
ADDRESS:	INVOICE ADDRESS:	PROJECT NUMBER: 14G0307
PHONE #:	INVOICE PHONE #:	P.O. #:
FAX #: EMAIL: # Support@AWSLABS.com		Pretreatment Program:
Is sample for compliance reporting? YES NO	Is sample from a chlorinated supply? YES NO	PWS I.D. #: due 7/22/14
SAMPLER NAME (PRINT):	SAMPLER SIGNATURE:	Turn Around Time: Day(s)

Matrix Codes: WW=Waste Water/Storm Water GW=Ground Water DW=Drinking Water S=Soil/Solids OR=Organic A=Air WP=Wipe OT=Other_____

	CLIENT SAMPLE I.D.	Grab	Composite	Field Filtered (Dissolved Metals)	Composite Start Date	Composite Start Time	Grab Date or Composite Stop Date	Grab Time or Composite Stop Time	Time Preserved	Matrix (See Codes)	Number of Containers	ANALYSIS / (PRESERVATIVE): Oxidation/Reduction Potential SM 2580								COMMENTS
1)	14G0307-02						7/17/14	0850		S	1	X								1(UGKU)
2)																				
3)																				
4)																				
5)																				
6)																				
7)																				
8)																				
9)																				
10)																				

Preservative Codes: N=Nitric Acid C=Hydrochloric Acid S=Sulfuric Acid H=Sodium Hydroxide A=Ascorbic Acid Z=Zinc Acetate T=Sodium Thiosulfate M=Methanol

60173919

PLEASE NOTE PRESERVATIVE(S), INTERFERENCE CHECKS or PUMP RATE (L/min)

RELINQUISHED	DATE / TIME	RECEIVED	DATE / TIME
J Wenrich		UPS NextD	
RELINQUISHED:	DATE / TIME	RECEIVED:	DATE / TIME
		Paul Hamel / PA81	7/18 10:40
RELINQUISHED:	DATE / TIME	RECEIVED:	DATE / TIME

QC Data Package
- Level I ☐
- Level II ☐
- Level III ☐
- Level IV ☐

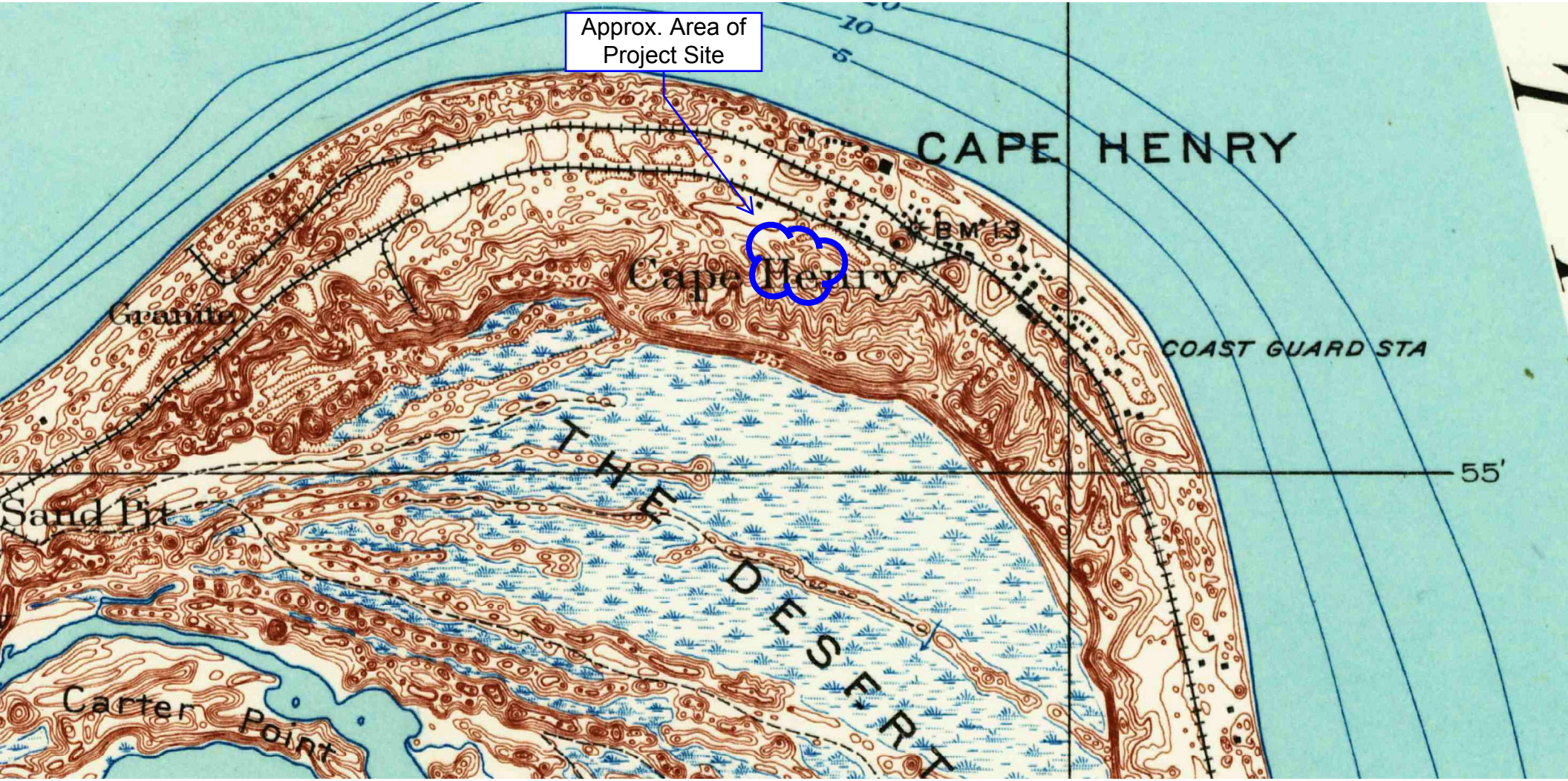
LAB USE ONLY

COOLER TEMP 5.2 °C

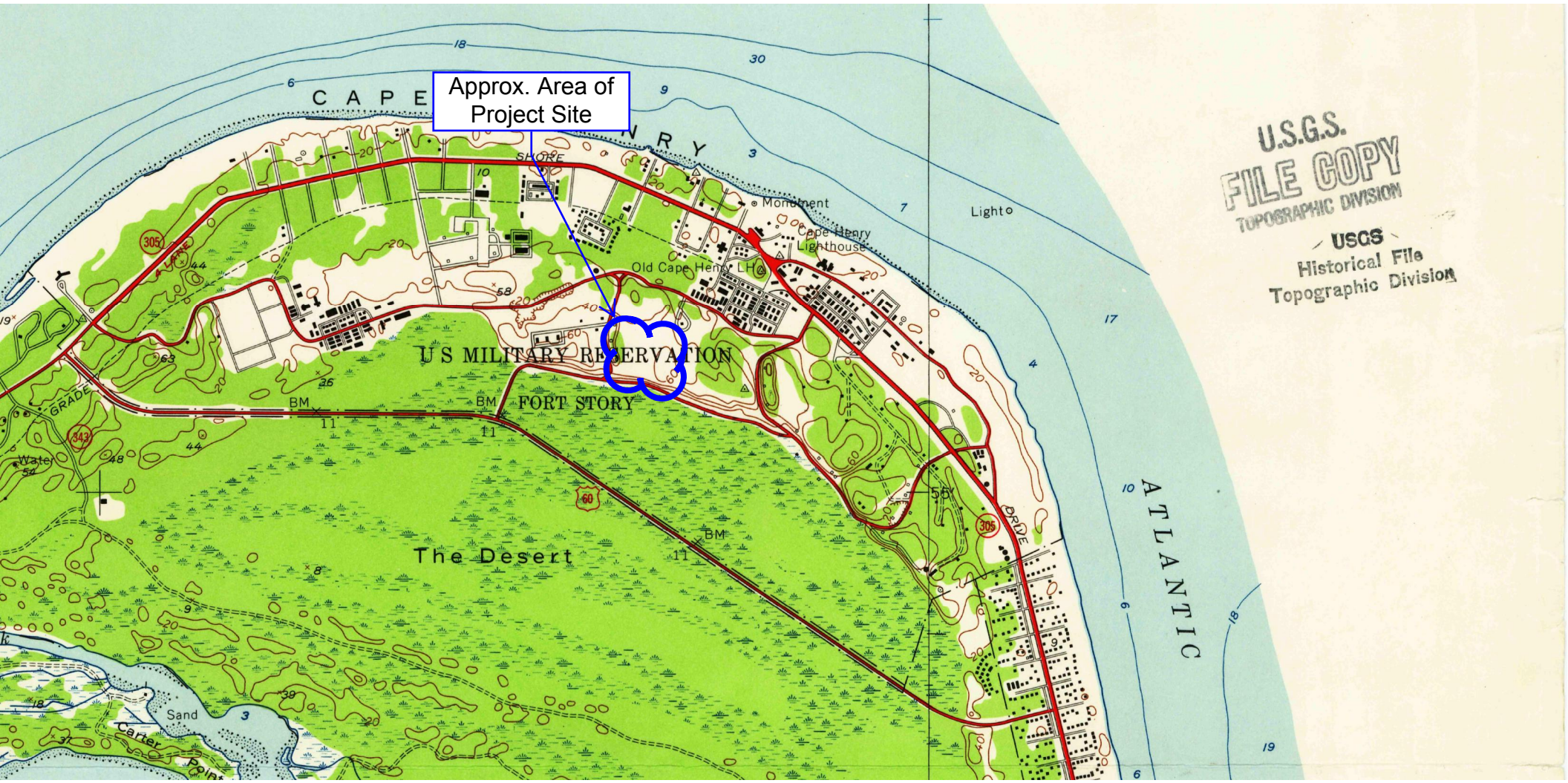
AWS COC_v131206.xls

APPENDIX VIII

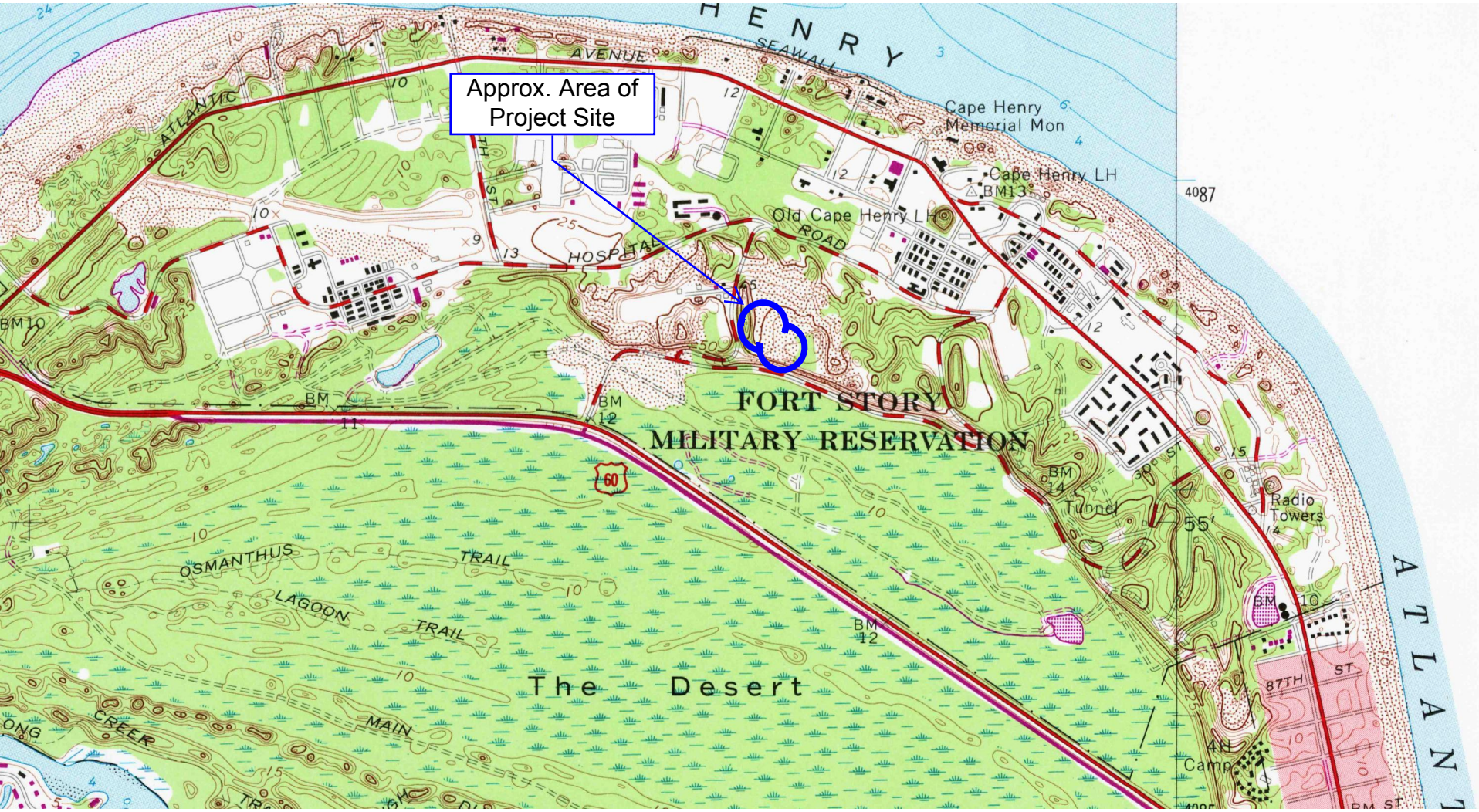
USCG GEOLOGICAL MAPS



US Geological Survey Map
Cape Henry, VA
1918



US Geological Survey Map
Cape Henry, VA
1955



US Geological Survey Map
Cape Henry, VA
1964/Photorevised 1979

US Geological Survey Map
Cape Henry, VA
2010

APPENDIX IX

GEOPHYSICAL SURVEYS

PAVE EXISTING GRAVEL ROAD
CRANE MOTOR PARK
TIE NEW FENCE TO EXISTING
EXISTING ADMINISTRATION BUILDING
EXISTING CQC TRAINING BUILDING
1 HCP SPACE
This whole area showed significant changes in the substrate at approximately 4'-8'
Individualized reflections in these areas.
The anomalies shown in the GPR survey can be identified within these measurements.
P-183
DYNAMIC INDOOR RANGE
23'
20'
13'
30'
120'
75'
30'
2 BUS SPACES
38 REGULAR SPACES
1 HCP SPACE
TP-11
2 RELOCATED
1 NEW DUMPS
SLIDIN
LI
IM
TO
HOSPITAL ROAD
TIE NEW FENCE TO EXISTING
PERSONNEL GATE
1"=30'
0
30'

Project Date: Wednesday, July 23, 2014

Client Company Name: GET Solutions Inc.

Point of Contact: Maria Murdock

Site Address: Fort Story SOF Indoor Dynamic Range

Survey Type: GPR and EMI Investigation

We appreciate the opportunity to work with you on your project at Fort Story in Virginia Beach, VA.

Equipment Used:

GSSI Profiler EMP-400

- A powerful electromagnetic induction tool which creates a primary magnetic field in a 360 degree pattern from its point of origin. When this primary magnetic field impacts a large enough anomaly, a secondary magnetic field is created. The data is illustrated along a frequency scale identified in KHz.
- The EMI does not produce a specific depth of targets but will typically scan a max depth of 3 meters. The anomalies identified by EMI must be investigated further with GPR to clearly identify the type of anomaly and its depth.
- The EMI cannot be used under power lines, next to cars, over concrete, near metal fences or anything that will absorb the magnetic field.
- The EMI will produce a color reading of the surveyed area. The GPRS technician will use this to interpret the findings.
- The EMP-400 has the capabilities of using up to three frequencies in one survey and compiling each into one data set whereas other EMI units such as EM-31 and EM-61 must be conducted separately.
- This machine is much more cost-effective, time-saving, and accurate than executing separate surveys.

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- The EMI is best suited to locate large metal obstructions in the substrate. GPRS has previously used EMI to locate underground storage tanks, buried vehicles and similar items.
- Typically EMI is not an effective tool for locating underground utilities because it is difficult for such a small item to initiate a change in the primary magnetic field.

GSSI SIR-3000

- The ground penetrating radar unit used to conduct this survey was a Geophysical Survey Systems Inc (GSSI) SIR-3000 Radar unit. This is the most advanced GPR unit currently available. It allows for onsite interpretation, as well as data storage for post processing. This equipment is self-calibrating, allowing more precise depth and location measurements. GSSI is a leading GPR designer and manufacturer. Information can be found at www.geophysical.com

400 MHz GSSI antenna

- Used conjunctively with the GSSI SIR-3000, this survey also used a 400MHz antenna. This antenna allows data collection to a depth of 6'-10' in the ground. The signal reflects on all objects which are a different conductivity from the substrate (soil). This reflection is what allows the GPR technician to "see" into the ground. When interpreting the data, the technician is looking for an anomaly or a good hyperbola on the SIR-3000 screen. This is formed when the radar shoots an electromagnetic signal into the concrete and the reflections in the concrete sends back the signal to the antenna.

Scope of Work:

Electromagnetic Induction-

Using an EMP-400, the GPRS technician performed an electromagnetic induction survey along the designated area at Fort Story. The EMP-400 can use up to three frequencies anywhere between 1000 KHz and 16000 KHz. Higher frequencies are used for smaller targets and lower frequencies are generally used to find larger ones. In order to encompass a range, the GPRS technician elected to use 2000 KHz, 8000 KHz, and 15000 KHz as the frequency settings for this project. The GPRS technician began the survey in the rear of the property along the fence line and moved in a north-south pattern to encompass the entire survey zone. Each scan was conducted approximately ten feet from the previous scan. Upon completion of the survey, the data was exported from the EMP-400 onto a computer and e-mailed to another GPRS technician for post-processing.

Results-

The results of the EMI survey did not yield any significant information. Some anomalies can be identified as green and yellow changes in the magnetic field. The scale on the right hand portion of the screen is measured in parts per million on the KHz frequency scale. The anomalies identified are likely vehicles parked inside the survey area and the metal fencing. These locations can be identified by the latitude and longitudinal coordinates associated with each. The first data image for each frequency is identified as the In-phase reading and the second can be identified as the Conductivity reading. As shown in the data sets, a lack of a significant change in the primary magnetic field is cause to believe there are no large metal obstructions in the designated scan area.

Ground Penetrating Radar-

Using a SIR-3000 and 400 MHz antenna, the GPRS technician conducted a ground penetrating radar survey in the designated area. The scans were conducted both north-south and east-west at approximately 10 feet apart. The data is interpreted in real time and was designated in the field with orange paint.

Results-

The results of the ground penetrating radar investigation indicated a strong planar reflective response in the designated survey area at depths ranging between 4 feet and 8 feet. The reflection indicated a flat elevation. In some areas the changes in elevation appeared to match the surface elevation, but that was not always the case in the entire survey area. The data set also indicated a presence of moderate to strong localized or individual reflections which could indicate objects such as rock or other debris within the upper strata and included with the strong planar response noted previously. Some of these materials matched the dielectric constant of the planar response which could indicate a similar composition such as concrete. The objects that indicate fainter a dielectric value could indicate something less reflective such as large areas of debris.

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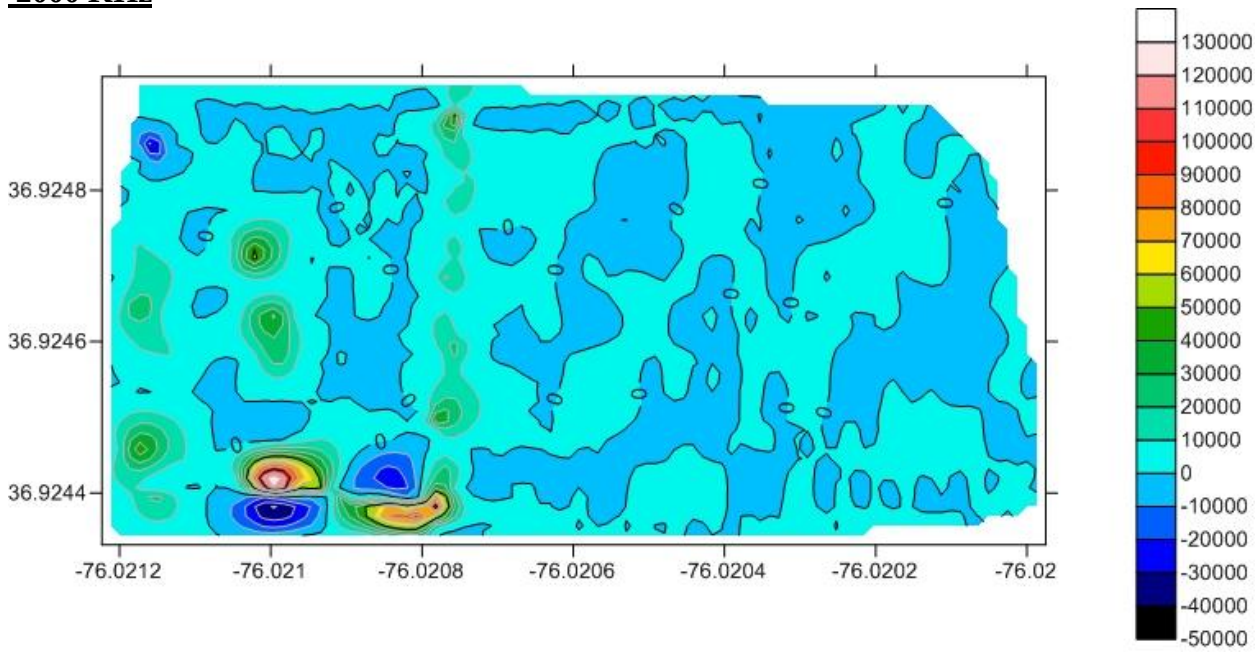
Data Images & Site Photos:

2000 KHz



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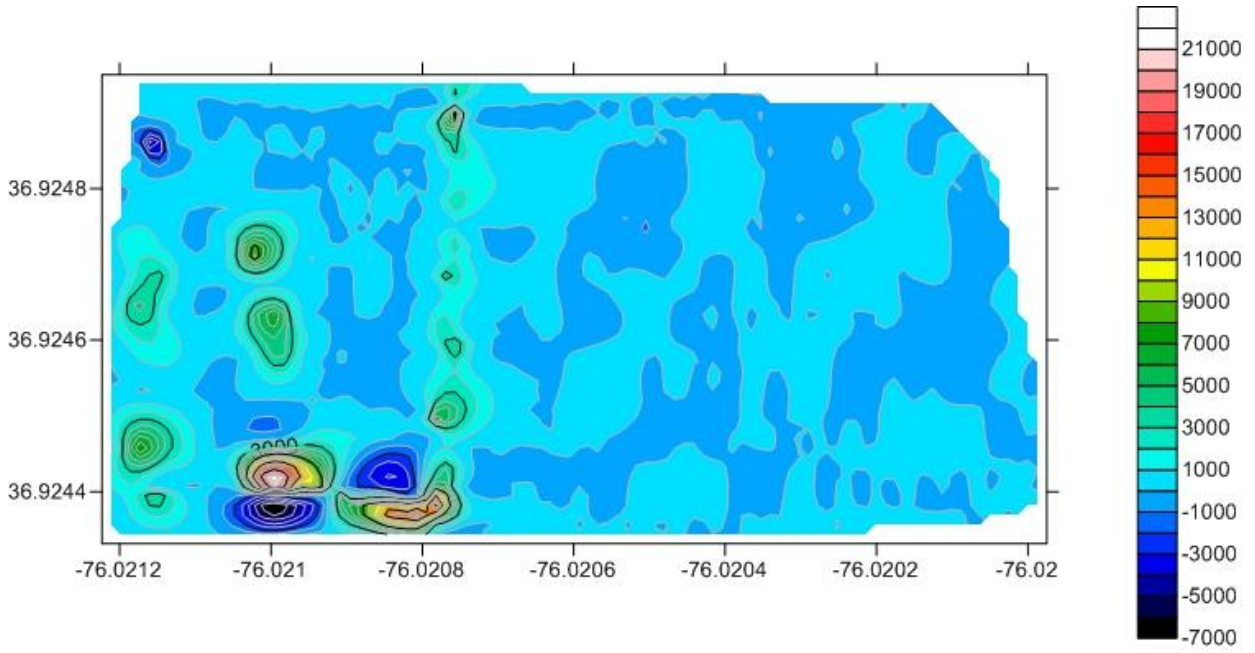
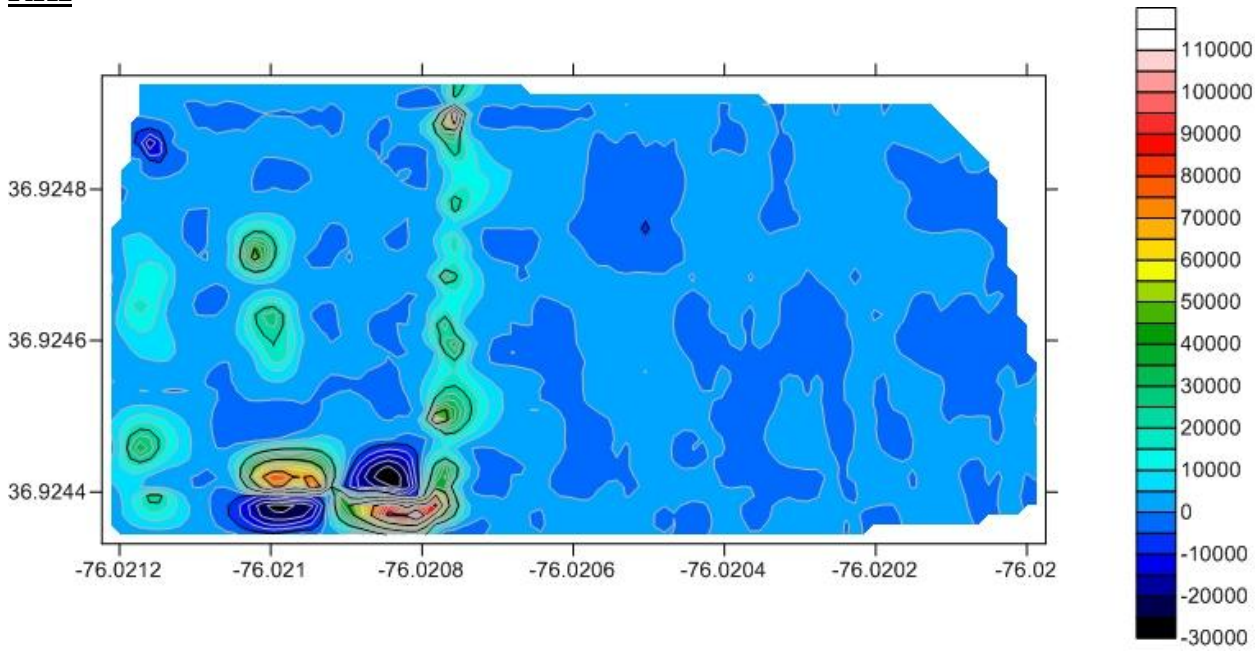


8000 KHz



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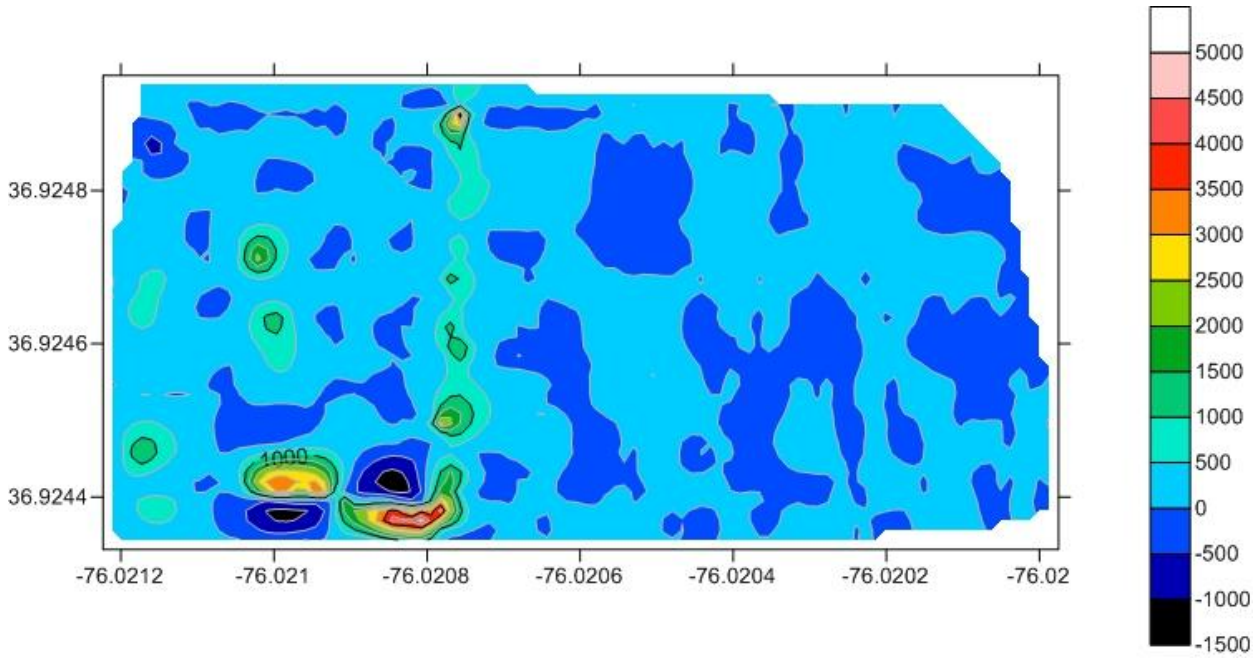
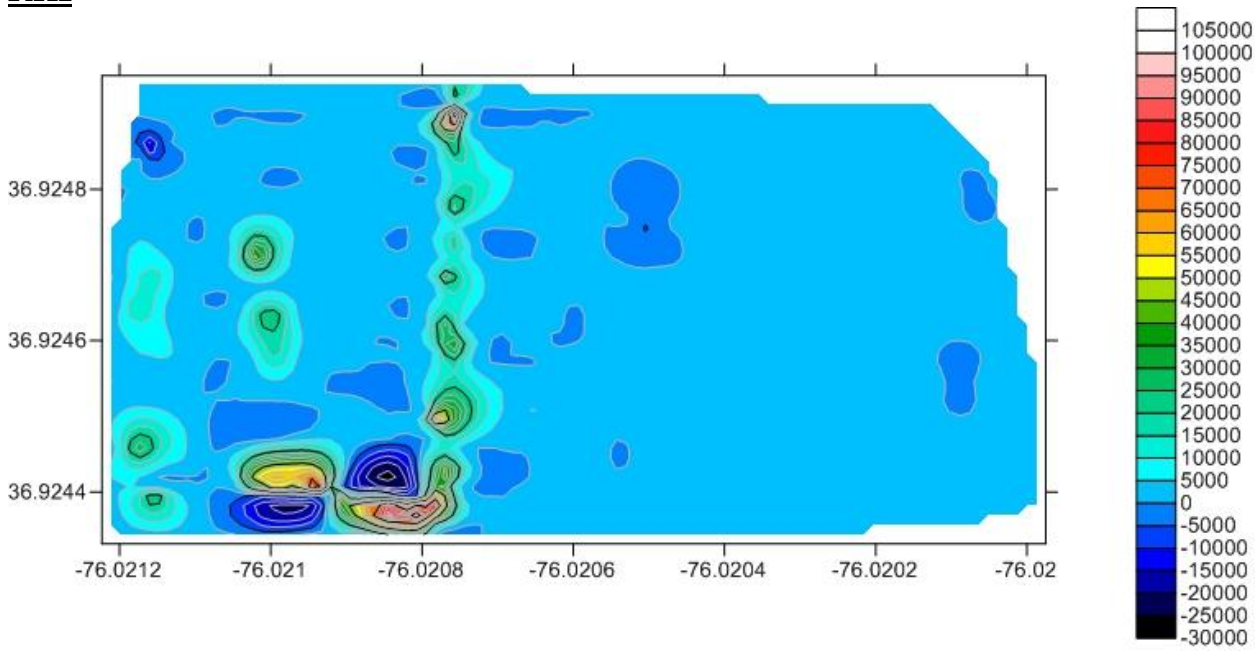


15000 KHz



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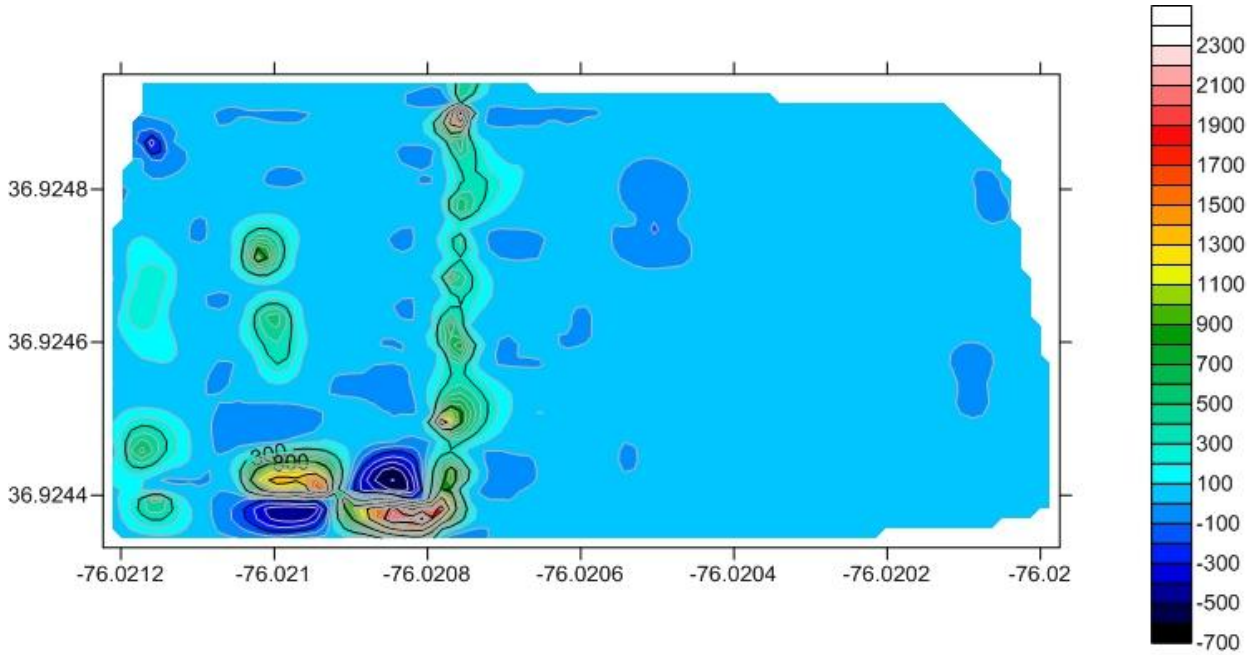

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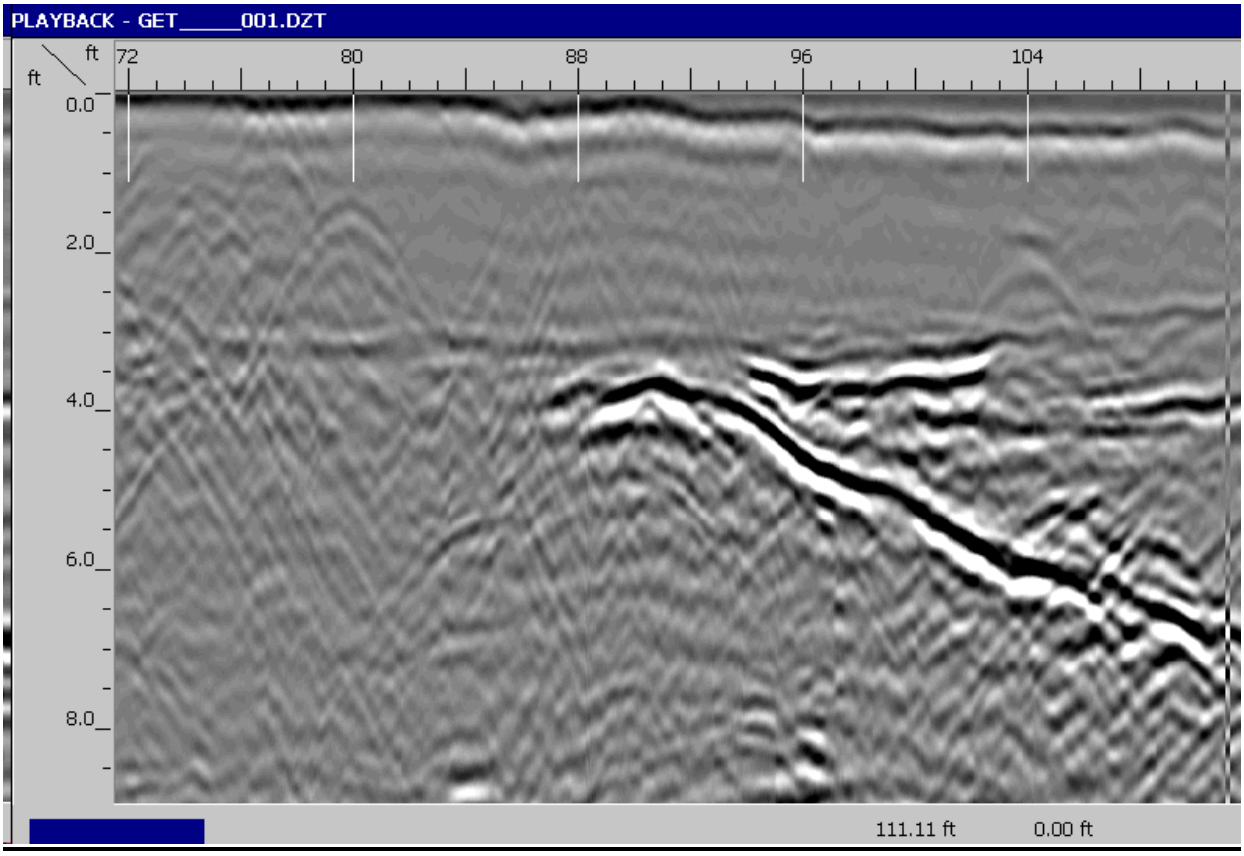

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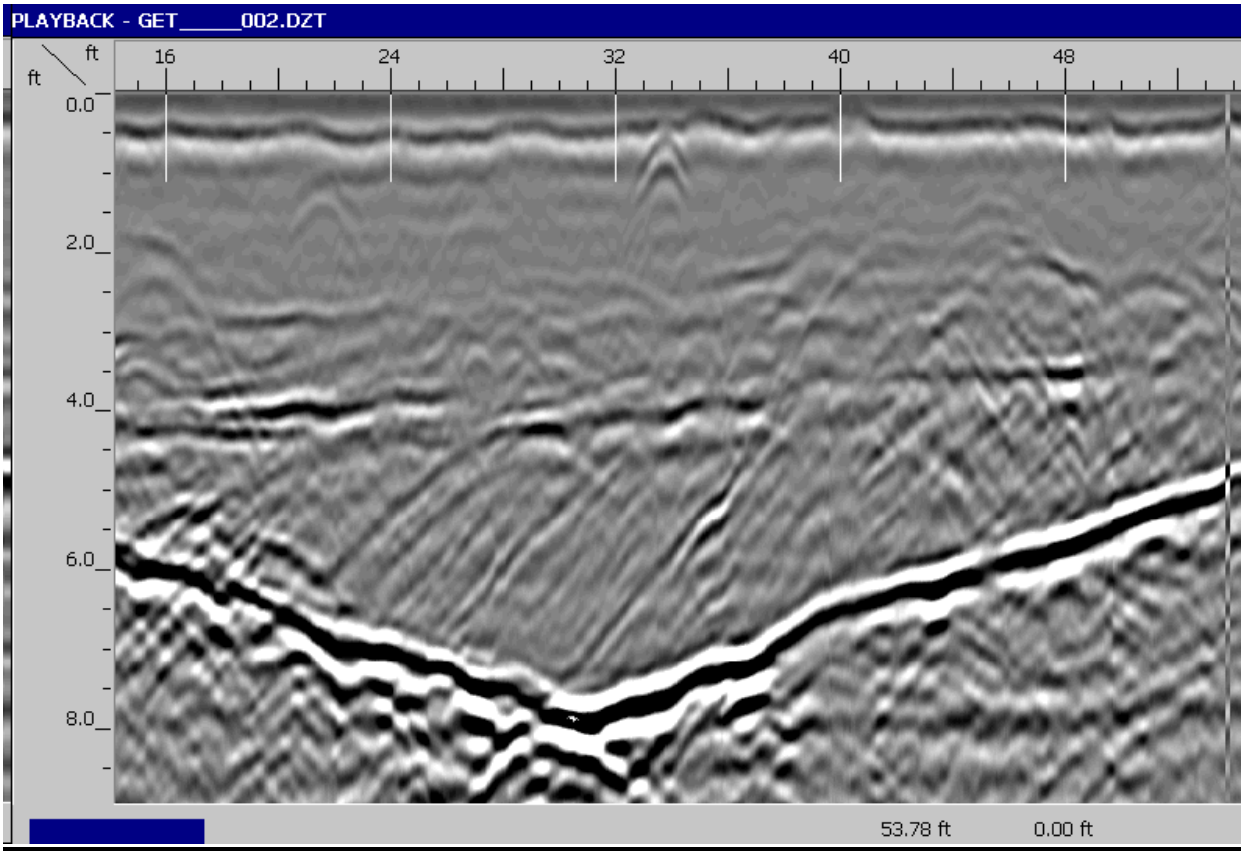

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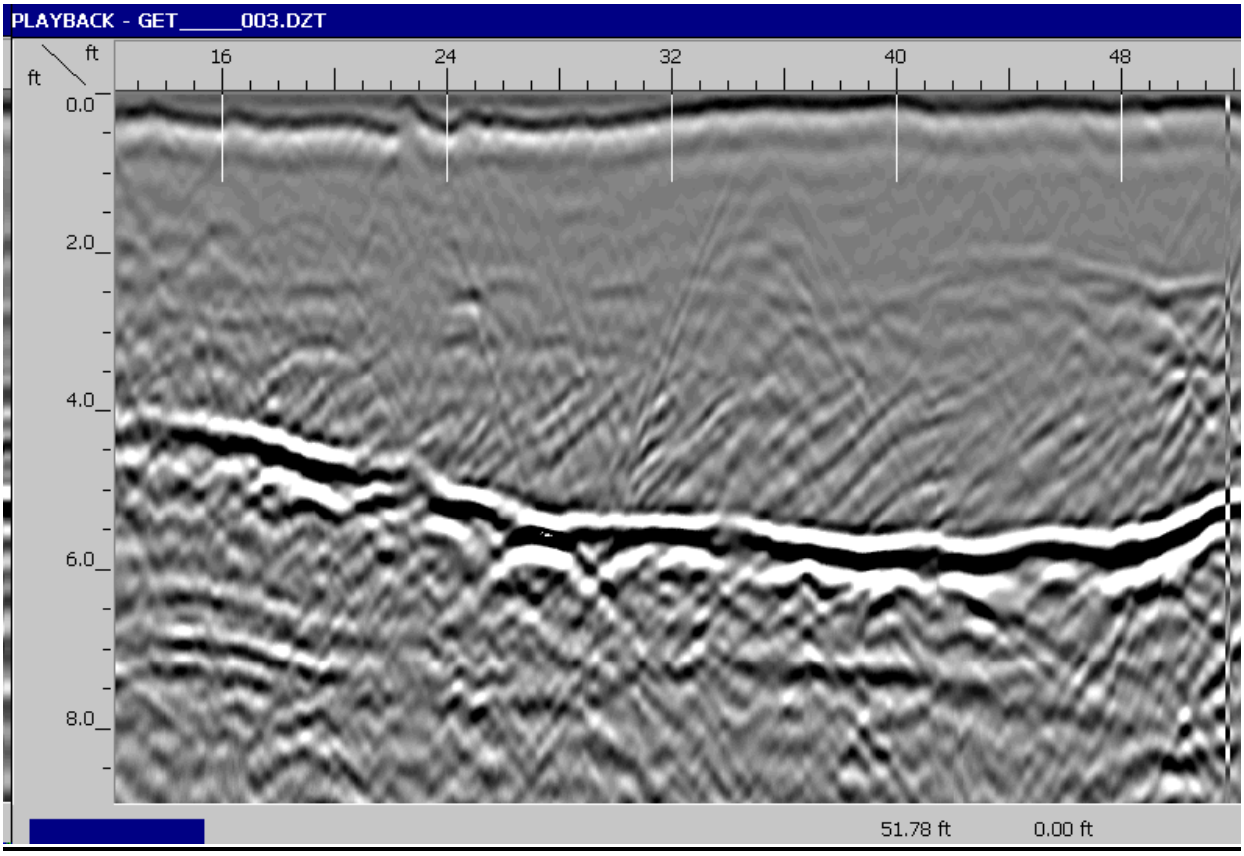

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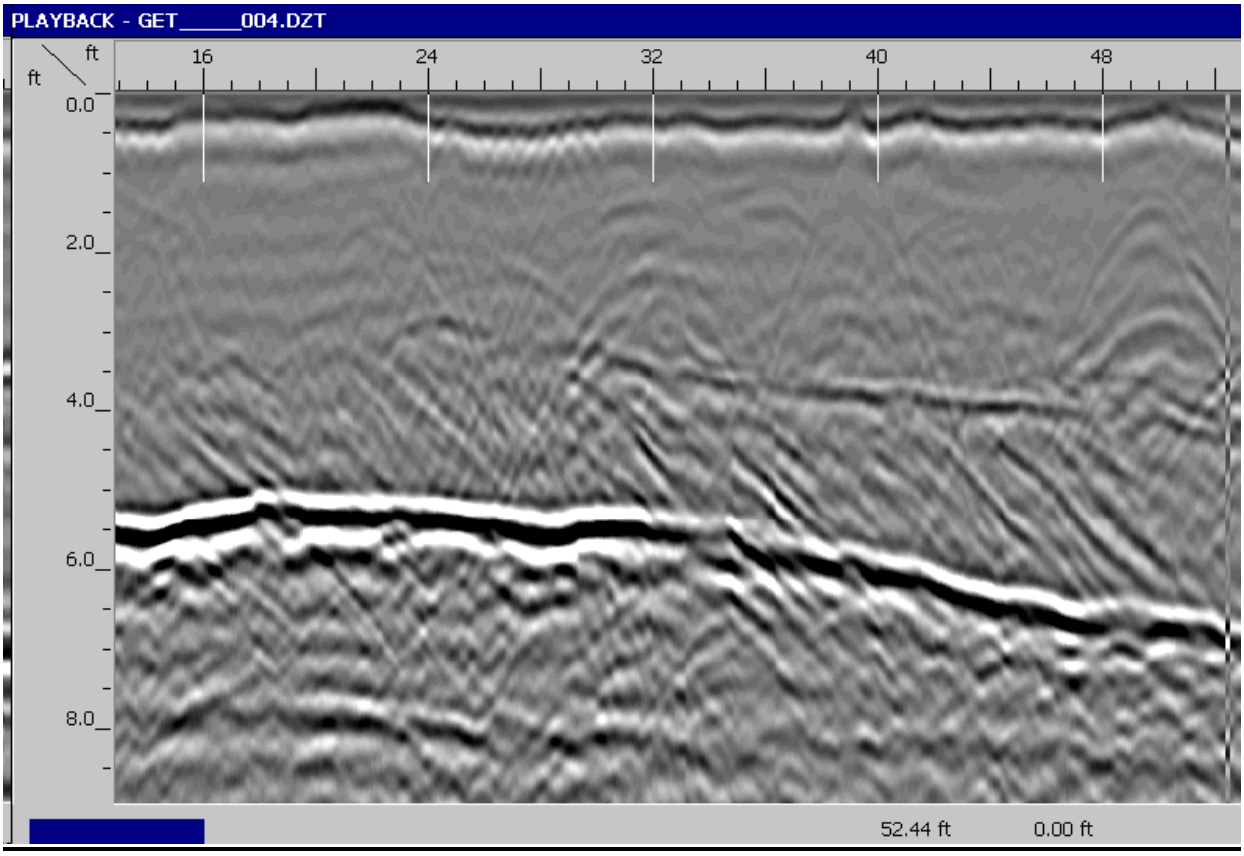

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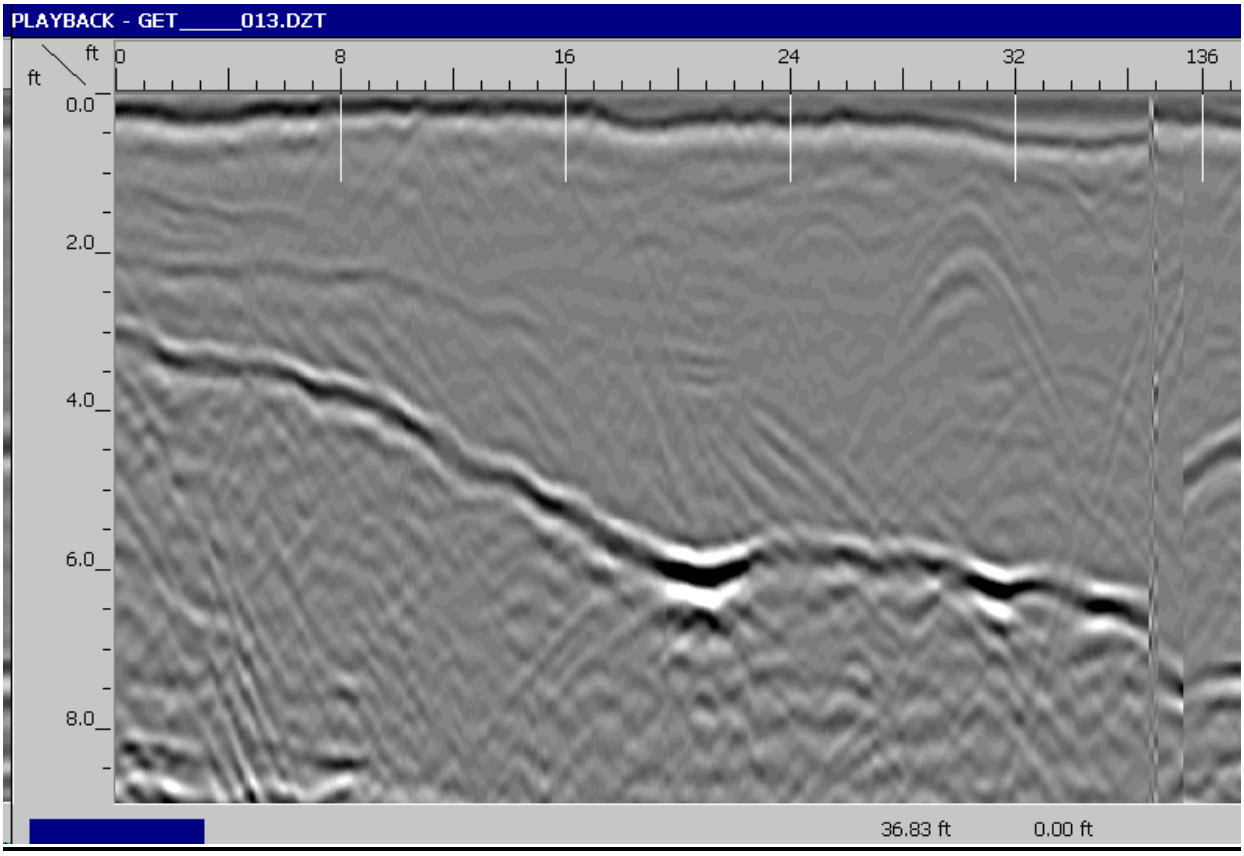

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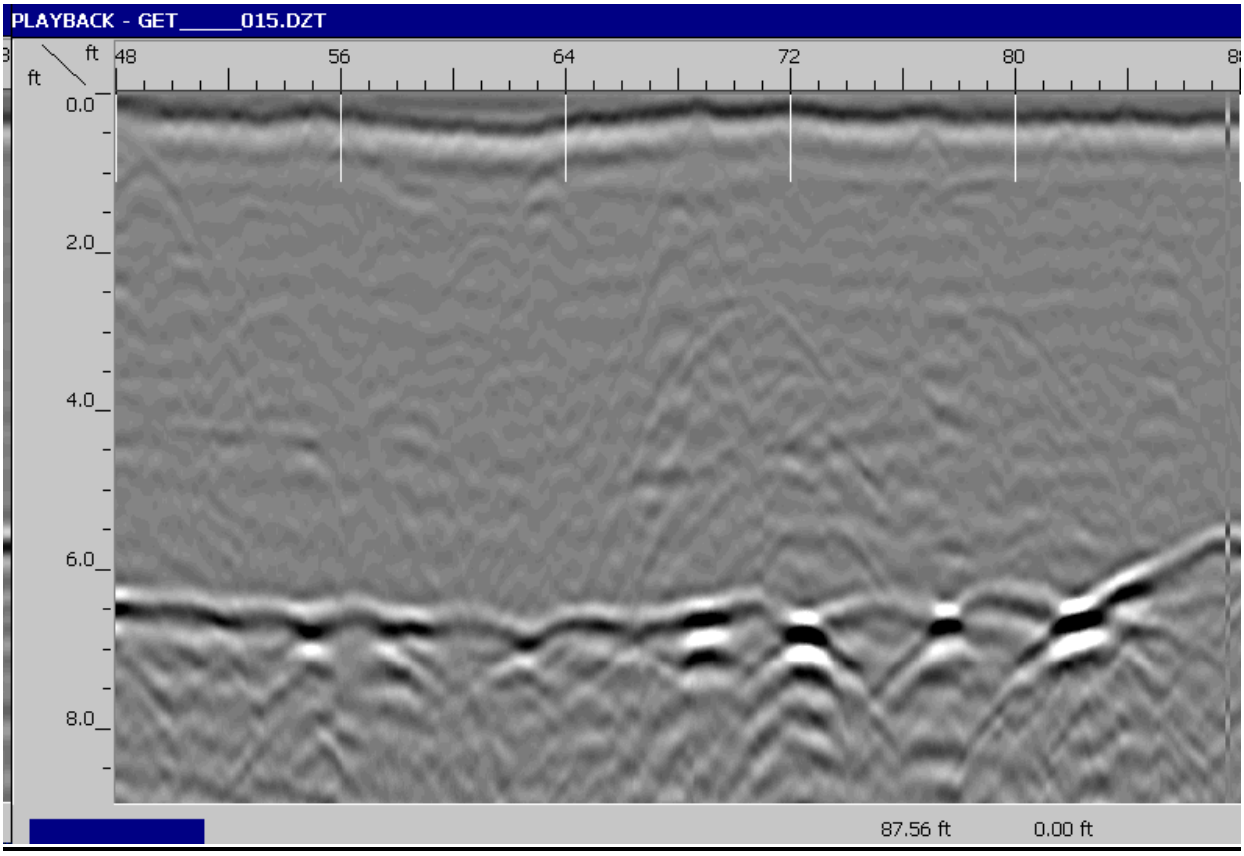

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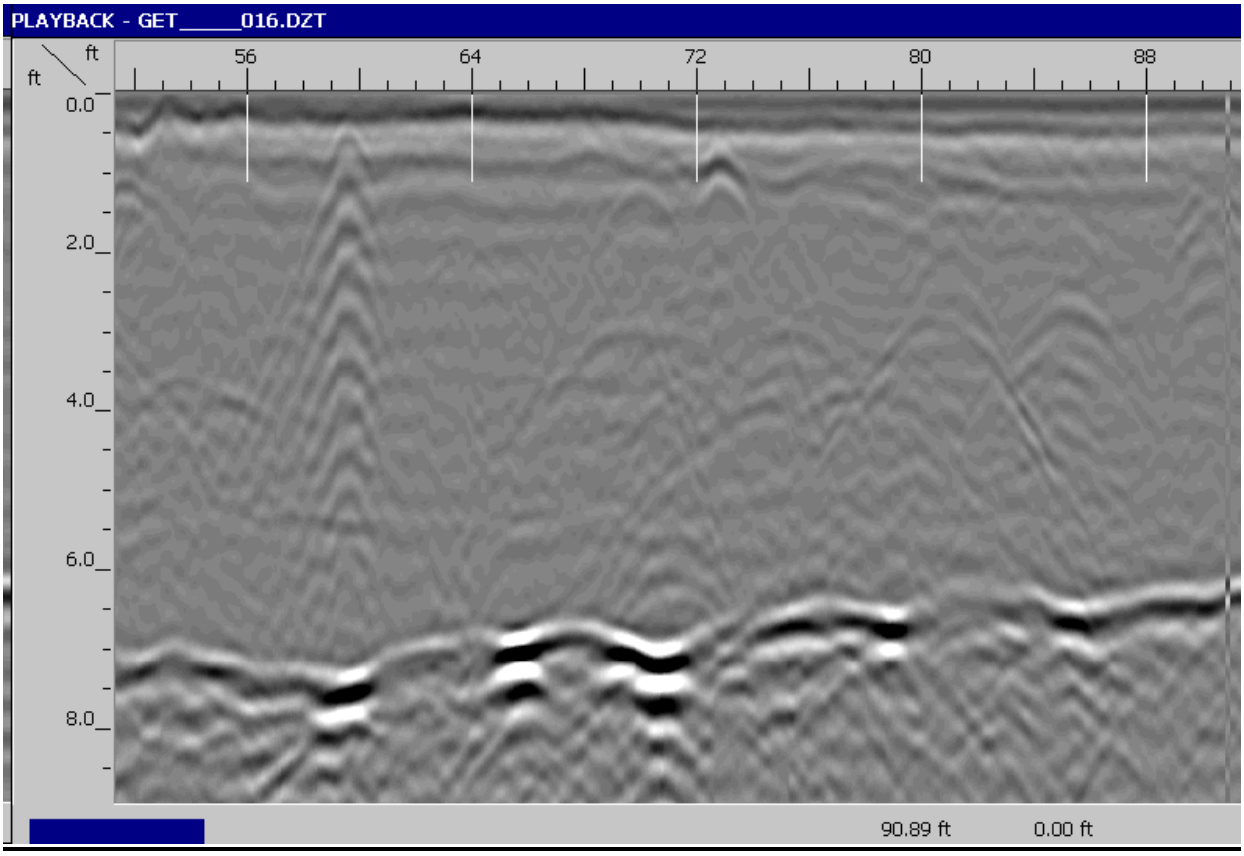

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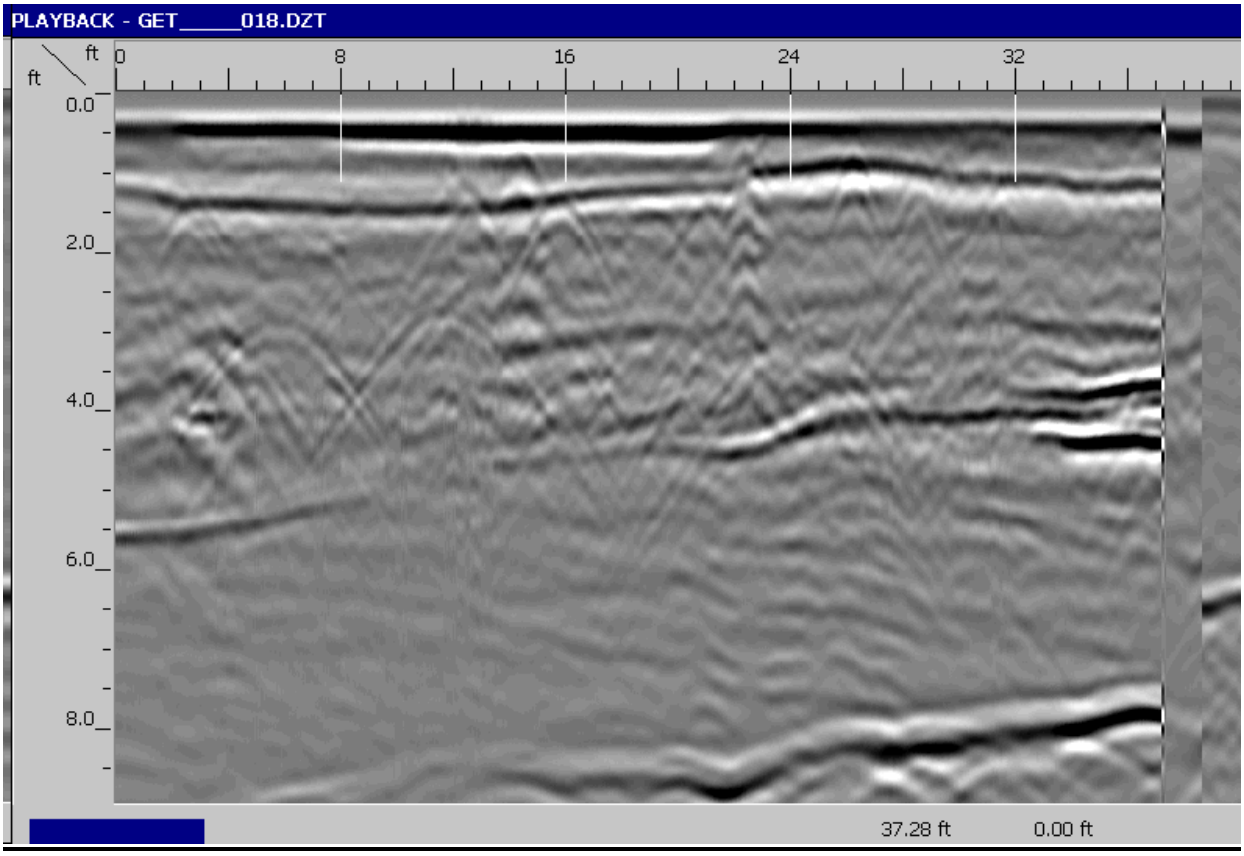

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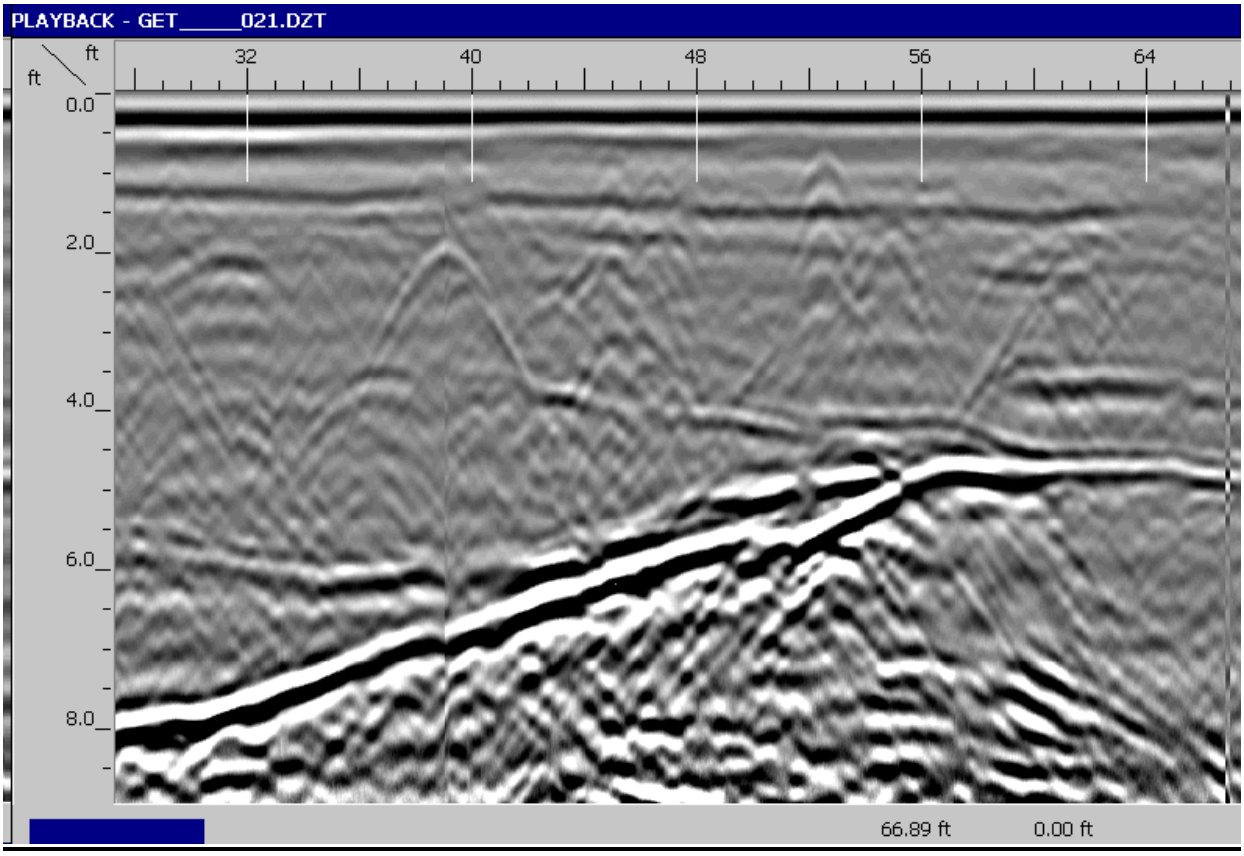
Jonathan.mappin@gp-radar.com



Jonathan Mappin/Project Manager
757-319-1903
Jonathan.mappin@gp-radar.com

APPENDIX X

TEST PIT PHOTOGRAPHIC DOCUMENTATION

PHOTOGRAPHS OF TEST PIT EXCAVATIONS

Figure 1: Test Pit TP-1

Figure 2: Test Pit TP-2

Figure 3: Test Pit TP-3

Figure 4: Test Pit TP-4

Figure 5: Test Pit TP-5

Figure 6: Test Pit TP-6

Figure 7: Test Pit TP-7

Figure 8: Test Pit TP-8

APPENDIX XI

BEARING CAPACITY CALCULATIONS

BEARING CAPACITY CALCULATIONS

Project Name: **Fort Story SOF Indoor Dynamic Range**
Project Number: **VB14-185G**
Project Location: **Virginia Beach, VA**

BEARING CAPACITY-Terzaghi Ultimate Bearing Capacity for Strip and Square Footings					
**Footings Embedded in Structural Fill*					
γ (pcf)=	115				
Φ=	32				
B= min. width of strip footing (ft)=	2.0				
$q = \gamma * D_f$					
$D_{f\ (ft)}$=	2	embdement depth			
Bearing Capacity Factors for Φ of 32 degrees					
Nc=	35.49				
Nq=	23.18				
Nγ=	30.22				
Safety Factor=	3				
ULTIMATE BEARING CAPACITY					
Ultimate Bearing Capacity Strip Footing (psf)=	8,806.70				

ALLOWABLE BEARING CAPACITY					
Ultimate Bearing Capacity Strip Footing (psf)=	2,935.57				

Prepared By: Maria Murdock, P.E.

GET Solutions, Inc.

Ultimate Bearing Capacity Equations:

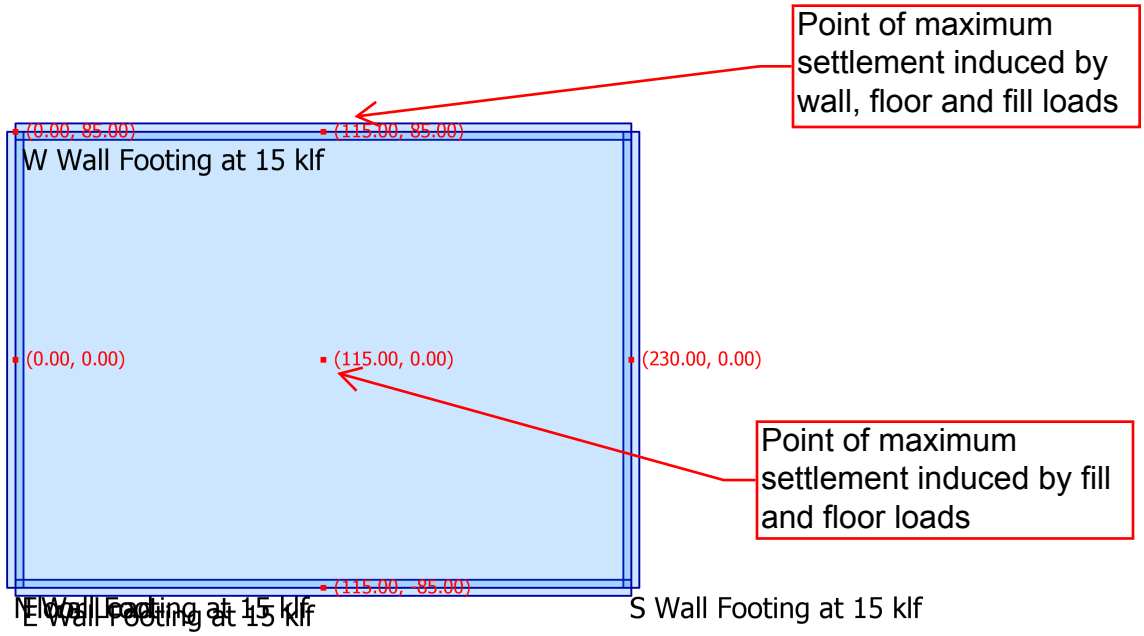
Strip Footings: $q_u = c * N_c + q * N_q + 0.5 * \gamma * B * N_\gamma$

APPENDIX XII

ELASTIC SETTLEMENT CALCULATIONS

Elastic Settlement Calculations

Software: UniSettle 4.0



Loading Conditions:

Wall Loads: 15 klf

Floor Loads: 200 psf

Fill Loads: 805 psf (7 feet of fill)

SUBSURFACE SOIL PARAMETERS
(used in UniSettle 4.0 Software)

Parameters	Fill	SAND 1	SAND 2	SAND 3
Soil Classification	SP, SP-SM (Structural FILL)	SP	SP	SP
Relative Density	dense	medium dense	loose to medium dense	medium dense to very dense
Thickness (ft)	7	8	20	37
Bottom Elevation of Soil Stratum (ft. elevation)	15	7	-13	-50
Dansity (pcf)	115	115	115	115
Elastic Modulus (tsf)	550	300	200	600

Total Settlements induced by 7 feet of fill

Layer Compression - Fort Story SOF Indoor

Westergaard at Fill Load (115.00, 0.00)

Layer			Compression				
#	Name	Thickness	Immediate	Consolidation	Secondary	Total	Ratio
		(ft)	(in)	(in)	(in)	(in)	(%)
1	SAND 1	8.00	0.120	0.000	0.000	0.120	0.125
2	SAND 2	20.00	0.408	0.000	0.000	0.408	0.170
3	SAND 3	37.00	0.203	0.000	0.000	0.203	0.046
Total	All Layers	65.00	0.731	0.000	0.000	0.731	0.094

Total Settlement Induced by 7 feet of fill

Layer Compression - Fort Story SOF Indoor

Westergaard at (115.00, 85.00)

Layer			Compression				
#	Name	Thickness	Immediate	Consolidation	Secondary	Total	Ratio
		(ft)	(in)	(in)	(in)	(in)	(%)
1	SAND 1	8.00	0.068	0.000	0.000	0.068	0.071
2	SAND 2	20.00	0.212	0.000	0.000	0.212	0.088
3	SAND 3	37.00	0.112	0.000	0.000	0.112	0.025
Total	All Layers	65.00	0.392	0.000	0.000	0.392	0.050

Differential Settlements induced by 7 feet of fill

Differential Settlement - Fort Story SOF Indoor

Westergaard

	Fill Load (115.00, 0.00)		(115.00, 85.00)		Differential	
Depth	st	S	st	S	Δst	ΔS
(ft)	(in)	(in)	(in)	(in)	(in)	(in)
			SP1			
0.00	0.031	0.73	0.023	0.39	0.007	0.34
2.00	0.030	0.70	0.015	0.37	0.015	0.33
4.00	0.030	0.67	0.015	0.35	0.015	0.32
6.00	0.029	0.64	0.015	0.34	0.015	0.30
8.00	0.000	0.61	0.000	0.32	0.000	0.29
			SP2			
8.00	0.022	0.61	0.011	0.32	0.011	0.29
9.00	0.022	0.59	0.011	0.31	0.011	0.28
10.00	0.043	0.57	0.022	0.30	0.021	0.27
12.00	0.042	0.52	0.022	0.28	0.020	0.24
14.00	0.042	0.48	0.021	0.26	0.020	0.22
16.00	0.041	0.44	0.021	0.24	0.020	0.20
18.00	0.041	0.40	0.021	0.22	0.020	0.18
20.00	0.040	0.36	0.021	0.19	0.019	0.16
22.00	0.039	0.32	0.021	0.17	0.019	0.15
24.00	0.039	0.28	0.020	0.15	0.018	0.13
26.00	0.038	0.24	0.020	0.13	0.018	0.11
28.00	0.000	0.20	0.000	0.11	0.000	0.09
			SP3			
28.00	0.013	0.20	0.007	0.11	0.006	0.09
30.00	0.012	0.19	0.007	0.11	0.006	0.08
32.00	0.012	0.18	0.007	0.10	0.006	0.08
34.00	0.012	0.17	0.006	0.09	0.006	0.07
36.00	0.012	0.15	0.006	0.09	0.006	0.07
38.00	0.012	0.14	0.006	0.08	0.005	0.06
40.00	0.011	0.13	0.006	0.07	0.005	0.06
42.00	0.011	0.12	0.006	0.07	0.005	0.05
44.00	0.011	0.11	0.006	0.06	0.005	0.05
46.00	0.011	0.10	0.006	0.05	0.005	0.04
48.00	0.011	0.09	0.006	0.05	0.005	0.04
50.00	0.011	0.07	0.006	0.04	0.005	0.03
52.00	0.010	0.06	0.006	0.04	0.004	0.03
54.00	0.010	0.05	0.006	0.03	0.004	0.02
56.00	0.010	0.04	0.006	0.03	0.004	0.02
58.00	0.010	0.03	0.006	0.02	0.004	0.01
60.00	0.010	0.02	0.006	0.01	0.004	0.01
62.00	0.010	0.01	0.006	0.01	0.004	0.01
64.00	0.005	0.00	0.003	0.00	0.002	0.00
65.00	0.000	0.00	0.000	0.00	0.000	0.00

Total Settlement induced by 200 psf floor loads & 15 klf wall loads

Layer Compression - Fort Story SOF Indoor

Westergaard at E Wall Footing at 15 klf (115.00, -85.00)

Layer			Compression				
#	Name	Thickness	Immediate	Consolidation	Secondary	Total	Ratio
		(ft)	(in)	(in)	(in)	(in)	(%)
1	FILL	7.00	0.098	0.000	0.000	0.098	0.117
2	SAND 1	8.00	0.120	0.000	0.000	0.120	0.125
3	SAND 2	20.00	0.210	0.000	0.000	0.210	0.087
4	SAND 3	37.00	0.075	0.000	0.000	0.075	0.017
Total	All Layers	72.00	0.504	0.000	0.000	0.504	0.058

Total Settlement induced by 200 psf floor load

Layer Compression - Fort Story SOF Indoor

Westergaard at Floor Load (115.00, 0.00)

Layer			Compression				
#	Name	Thickness	Immediate	Consolidation	Secondary	Total	Ratio
		(ft)	(in)	(in)	(in)	(in)	(%)
1	FILL	7.00	0.014	0.000	0.000	0.014	0.017
2	SAND 1	8.00	0.028	0.000	0.000	0.028	0.029
3	SAND 2	20.00	0.100	0.000	0.000	0.100	0.042
4	SAND 3	37.00	0.061	0.000	0.000	0.061	0.014
Total	All Layers	72.00	0.203	0.000	0.000	0.203	0.024

Differential Settlement induced by 200 psf floor load & 15 klf wall load

Differential Settlement - Fort Story SOF Indoor

Westergaard

	(0.00, 85.00)		W Wall Footing at 15 klf		Differential	
Depth	st	S	st	S	Δst	ΔS
(ft)	(in)	(in)	(in)	(in)	(in)	(in)
			FILL			
0.00	0.003	0.48	0.003	0.50	0.000	0.02
2.00	0.072	0.48	0.047	0.50	0.025	0.02
4.00	0.033	0.41	0.034	0.45	0.001	0.05
6.00	0.013	0.37	0.014	0.42	0.001	0.04
7.00	0.000	0.36	0.000	0.41	0.000	0.04
			SP1			
7.00	0.037	0.36	0.039	0.41	0.002	0.04
9.00	0.030	0.32	0.032	0.37	0.002	0.04
11.00	0.025	0.29	0.027	0.33	0.002	0.04
13.00	0.021	0.27	0.023	0.31	0.002	0.04
15.00	0.000	0.25	0.000	0.29	0.000	0.04
			SP2			
15.00	0.014	0.25	0.015	0.29	0.001	0.04
16.00	0.013	0.23	0.014	0.27	0.001	0.04
17.00	0.024	0.22	0.027	0.26	0.002	0.03
19.00	0.022	0.20	0.024	0.23	0.002	0.03
21.00	0.020	0.17	0.022	0.20	0.003	0.03
23.00	0.018	0.15	0.021	0.18	0.002	0.03
25.00	0.017	0.14	0.019	0.16	0.002	0.03
27.00	0.016	0.12	0.018	0.14	0.002	0.02
29.00	0.015	0.10	0.017	0.12	0.002	0.02
31.00	0.014	0.09	0.016	0.11	0.002	0.02
33.00	0.013	0.07	0.016	0.09	0.002	0.02
35.00	0.000	0.06	0.000	0.08	0.000	0.01
			SP3			
35.00	0.004	0.06	0.005	0.08	0.001	0.01
37.00	0.004	0.06	0.005	0.07	0.001	0.01
39.00	0.004	0.05	0.005	0.06	0.001	0.01
41.00	0.004	0.05	0.005	0.06	0.001	0.01
43.00	0.004	0.04	0.005	0.06	0.001	0.01
45.00	0.004	0.04	0.004	0.05	0.001	0.01
47.00	0.004	0.04	0.004	0.05	0.001	0.01
49.00	0.003	0.03	0.004	0.04	0.001	0.01
51.00	0.003	0.03	0.004	0.04	0.001	0.01
53.00	0.003	0.03	0.004	0.03	0.001	0.01
55.00	0.003	0.02	0.004	0.03	0.001	0.01
57.00	0.003	0.02	0.004	0.03	0.000	0.01
59.00	0.003	0.02	0.004	0.02	0.001	0.00
61.00	0.003	0.01	0.004	0.02	0.001	0.00
63.00	0.003	0.01	0.003	0.02	0.001	0.00
65.00	0.003	0.01	0.003	0.01	0.001	0.00
67.00	0.003	0.01	0.003	0.01	0.000	0.00
69.00	0.003	0.00	0.003	0.00	0.000	0.00

Differential Settlement - Fort Story SOF Indoor

Westergaard

	(0.00, 85.00)		W Wall Footing at 15 klf		Differential	
Depth	st	S	st	S	Δst	ΔS
(ft)	(in)	(in)	(in)	(in)	(in)	(in)
71.00	0.001	0.00	0.002	0.00	0.000	0.00
72.00	0.000	0.00	0.000	0.00	0.000	0.00

APPENDIX XIII

HYDRAULIC CONDUCTIVITY WORKSHEETS

Constant-Head Borehole Permeameter Test

Analytical Method: Glover Solution

GET Solutions, Inc.

Project Name.....:	Fort Story SOF Indoor Dynamic Range	Project No.....:	VB14-185G
Boring No.....:	BMP-1	Proj. Location...:	Virginia Beach, VA
Investigators.....:	Joshua Saar	Date.....:	7/18/2014
Boring Depth.....:	3 ft.	WCU Base Ht. h:	15.0 cm
Boring Diameter..:	8.3 cm	WCU Susp. Ht. S:	6.4 cm
Boring Radius r...:	4.15 cm	Const. Wtr. Ht. H:	21.4 cm
Soil/Water Tmp. T:	24 °C	H/r** .....:	5.2
Dyn. Visc. @ T °C.:	0.000911 kg/m·s	Dyn. Visc. @ T_B °C.:	0.001170 kg/m·s

Terminology and Solution (R. E. Glover Solution)*

$Ksat_B$: (Coefficient of Permeability) @ Base Tmp. T_B (ºC) 14

Q: Rate of flow of water from the borehole

H: Constant height of water in the borehole

r: Radius of the cylindrical borehole

V: Dyn. Visc. of water @ Tmp. T °C/Dyn. Visc. of water @ T_B

$Ksat = Q[\sinh^{-1}(H/r) - (r^2/H^2+1)^{.5} + r/H]/(2\pi H^2)$ [Basic Glover Solu.]

$Ksat_B = QV[\sinh^{-1}(H/r) - (r^2/H^2+1)^{.5} + r/H]/(2\pi H^2)$ [Tmp. Correction]

VOLUME (ml)	Volume Out (ml)	TIME (h:mm:ss A/P)	Interval Elapsed Time (hr:min:sec)	Interval Elapsed Time (min)	Flow Rate Q (ml/min)	$Ksat_B$ Equivalent Values (cm/min)	(cm/sec)	(cm/day)	(in/hr)	(ft/day)
3,200		9:30:00 AM								
3,000	200	9:30:07 AM	0:00:07	0.12	1,714.29	0.704	1.17E-02	1,014.006	16.634	33.268
2,800	200	9:30:14 AM	0:00:06	0.10	2,000.00	0.822	1.37E-02	1,183.007	19.406	38.813
2,600	200	9:30:19 AM	0:00:05	0.08	2,400.00	0.986	1.64E-02	1,419.609	23.288	46.575
2,400	200	9:30:25 AM	0:00:06	0.10	2,000.00	0.822	1.37E-02	1,183.007	19.406	38.813
2,200	200	9:30:32 AM	0:00:07	0.12	1,714.29	0.704	1.17E-02	1,014.006	16.634	33.268
2,000	200	9:30:37 AM	0:00:06	0.10	2,000.00	0.822	1.37E-02	1,183.007	19.406	38.813
1,800	200	9:30:43 AM	0:00:06	0.10	2,000.00	0.822	1.37E-02	1,183.007	19.406	38.813
1,600	200	9:30:49 AM	0:00:06	0.10	2,000.00	0.822	1.37E-02	1,183.007	19.406	38.813
1,400	200	9:30:56 AM	0:00:06	0.10	2,000.00	0.822	1.37E-02	1,183.007	19.406	38.813
1,200	200	9:31:00 AM	0:00:04	0.07	3,000.00	1.232	2.05E-02	1,774.511	29.109	58.219
1,000	200	9:31:01 AM	0:00:01	0.02	12,000.00	4.929	8.22E-02	7,098.044	116.438	232.875
800	200	9:31:05 AM	0:00:04	0.07	3,000.00	1.232	2.05E-02	1,774.511	29.109	58.219
600	200	9:31:08 AM	0:00:03	0.05	4,000.00	1.643	2.74E-02	2,366.015	38.813	77.625
400	200	9:31:11 AM	0:00:02	0.03	6,000.00	2.465	4.11E-02	3,549.022	58.219	116.438
200	200	9:31:13 AM	0:00:03	0.05	4,000.00	1.643	2.74E-02	2,366.015	38.813	77.625
0	200	9:31:16 AM	0:00:03	0.05	4,000.00	1.643	2.74E-02	2,366.015	38.813	77.625
					Field-Estimated Ksat:	2.113	3.52E-02	3,042.019	49.902	99.804

Natural Moisture.....:	11.3	Relative Density.....	medium dense
USDA Txt./USCS Class:	SP	Water Table Depth...:	7.0
Struct./% Pass. #200.:	0.3	Init. Saturation Time.:	9:30:00 AM

Notes: Estimated field Ksat is determined by averaging and/or rounding of test results for the final three or four stabilized values and analyzing the graph.

*Glover, R. E. I953. Flow from a test-hole located above groundwater level, pp. 69-7l. in: Theory and Problems of Water Percolation. (C. N. Zanger. ed.). USBR. The condition for this solution exists when the distance from the bottom of the borehole to the water table or an impervious layer is at least twice the depth of the water in the well. **H/r>5 to >10 Johnson Permeameter, LLC Revised 11/29/13

Constant-Head Borehole Permeameter Test

Analytical Method: Glover Solution

GET Solutions, Inc.

Project Name.....:	Fort Story SOF Indoor Dynamic Range	Project No.....:	VB14-185G
Boring No.....:	BMP-2	Proj. Location...:	Virginia Beach, VA
Investigators.....:	Joshua Saar	Date.....:	7/18/2014
Boring Depth.....:	3 ft.	WCU Base Ht. h:	15.0 cm
Boring Diameter..:	8.3 cm	WCU Susp. Ht. S:	6.4 cm
Boring Radius r...:	4.15 cm	Const. Wtr. Ht. H:	21.4 cm
Soil/Water Tmp. T:	24 °C	H/r** .....:	5.2
Dyn. Visc. @ T °C.:	0.000911 kg/m·s	Dyn. Visc. @ T_B °C.:	0.001170 kg/m·s

Terminology and Solution (R. E. Glover Solution)*

$Ksat_B$: (Coefficient of Permeability) @ Base Tmp. T_B (ºC) 14

Q: Rate of flow of water from the borehole

H: Constant height of water in the borehole

r: Radius of the cylindrical borehole

V: Dyn. Visc. of water @ Tmp. T °C/Dyn. Visc. of water @ T_B

$Ksat = Q[\sinh^{-1}(H/r) - (r^2/H^2+1)^{.5} + r/H]/(2\pi H^2)$ [Basic Glover Solu.]

$Ksat_B = QV[\sinh^{-1}(H/r) - (r^2/H^2+1)^{.5} + r/H]/(2\pi H^2)$ [Tmp. Correction]

VOLUME (ml)	Volume Out (ml)	TIME (h:mm:ss A/P)	Interval Elapsed Time (hr:min:sec)	Interval Elapsed Time (min)	Flow Rate Q (ml/min)	$Ksat_B$ Equivalent Values (cm/min)	(cm/sec)	(cm/day)	(in/hr)	(ft/day)
3,200		8:30:00 AM								
3,000	200	8:30:08 AM	0:00:08	0.13	1,500.00	0.616	1.03E-02	887.256	14.555	29.109
2,800	200	8:30:13 AM	0:00:05	0.08	2,400.00	0.986	1.64E-02	1,419.609	23.288	46.575
2,600	200	8:30:19 AM	0:00:06	0.10	2,000.00	0.822	1.37E-02	1,183.007	19.406	38.813
2,400	200	8:30:25 AM	0:00:06	0.10	2,000.00	0.822	1.37E-02	1,183.007	19.406	38.813
2,200	200	8:30:31 AM	0:00:06	0.10	2,000.00	0.822	1.37E-02	1,183.007	19.406	38.813
2,000	200	8:30:36 AM	0:00:05	0.08	2,400.00	0.986	1.64E-02	1,419.609	23.288	46.575
1,800	200	8:30:43 AM	0:00:07	0.12	1,714.29	0.704	1.17E-02	1,014.006	16.634	33.268
1,600	200	8:30:48 AM	0:00:05	0.08	2,400.00	0.986	1.64E-02	1,419.609	23.288	46.575
1,400	200	8:30:54 AM	0:00:06	0.10	2,000.00	0.822	1.37E-02	1,183.007	19.406	38.813
1,200	200	8:31:00 AM	0:00:06	0.10	2,000.00	0.822	1.37E-02	1,183.007	19.406	38.813
1,000	200	8:31:02 AM	0:00:02	0.03	6,000.00	2.465	4.11E-02	3,549.022	58.219	116.438
800	200	8:31:04 AM	0:00:02	0.03	6,000.00	2.465	4.11E-02	3,549.022	58.219	116.438
600	200	8:31:07 AM	0:00:03	0.05	4,000.00	1.643	2.74E-02	2,366.015	38.813	77.625
400	200	8:31:09 AM	0:00:02	0.03	6,000.00	2.465	4.11E-02	3,549.022	58.219	116.438
200	200	8:31:12 AM	0:00:03	0.05	4,000.00	1.643	2.74E-02	2,366.015	38.813	77.625
0	200	8:31:13 AM	0:00:01	0.02	12,000.00	4.929	8.22E-02	7,098.044	116.438	232.875
					Field-Estimated Ksat:	2.347	3.91E-02	3,380.021	55.447	110.893

Natural Moisture.....:	14.7	Relative Density.....	loose
USDA Txt./USCS Class:	SP	Water Table Depth...:	10.0
Struct./% Pass. #200.:	0.3	Init. Saturation Time.:	9:30:00 AM

Notes: Estimated field Ksat is determined by averaging and/or rounding of test results for the final three or four stabilized values and analyzing the graph.

*Glover, R. E. I953. Flow from a test-hole located above groundwater level, pp. 69-7l. in: Theory and Problems of Water Percolation. (C. N. Zanger. ed.). USBR. The condition for this solution exists when the distance from the bottom of the borehole to the water table or an impervious layer is at least twice the depth of the water in the well. **H/r>5 to >10 Johnson Permeameter, LLC Revised 11/29/13

APPENDIX XIV

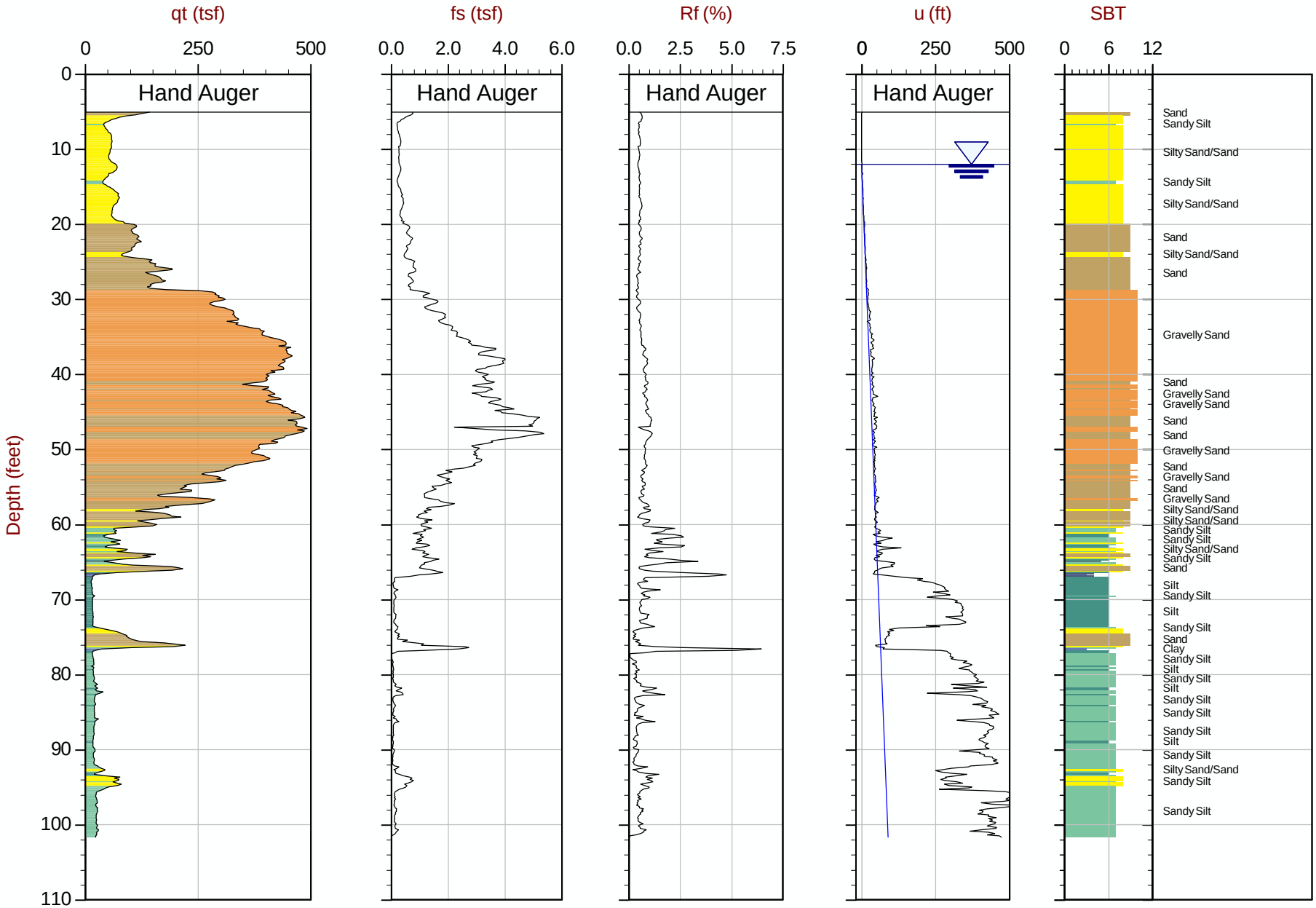
CPT TEST REPORT

CONETEC

GET Solutions

Job No: 14-54066
Date: 07:22:14 13:02
Site: Fort Story Indoor Range

Sounding: CPT-1
Cone: 184:T1500F15U500



Max Depth: 31.000 m / 101.70 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 14-54066_SP01C.COR
Unit Wt: SBT Chart Soil Zones

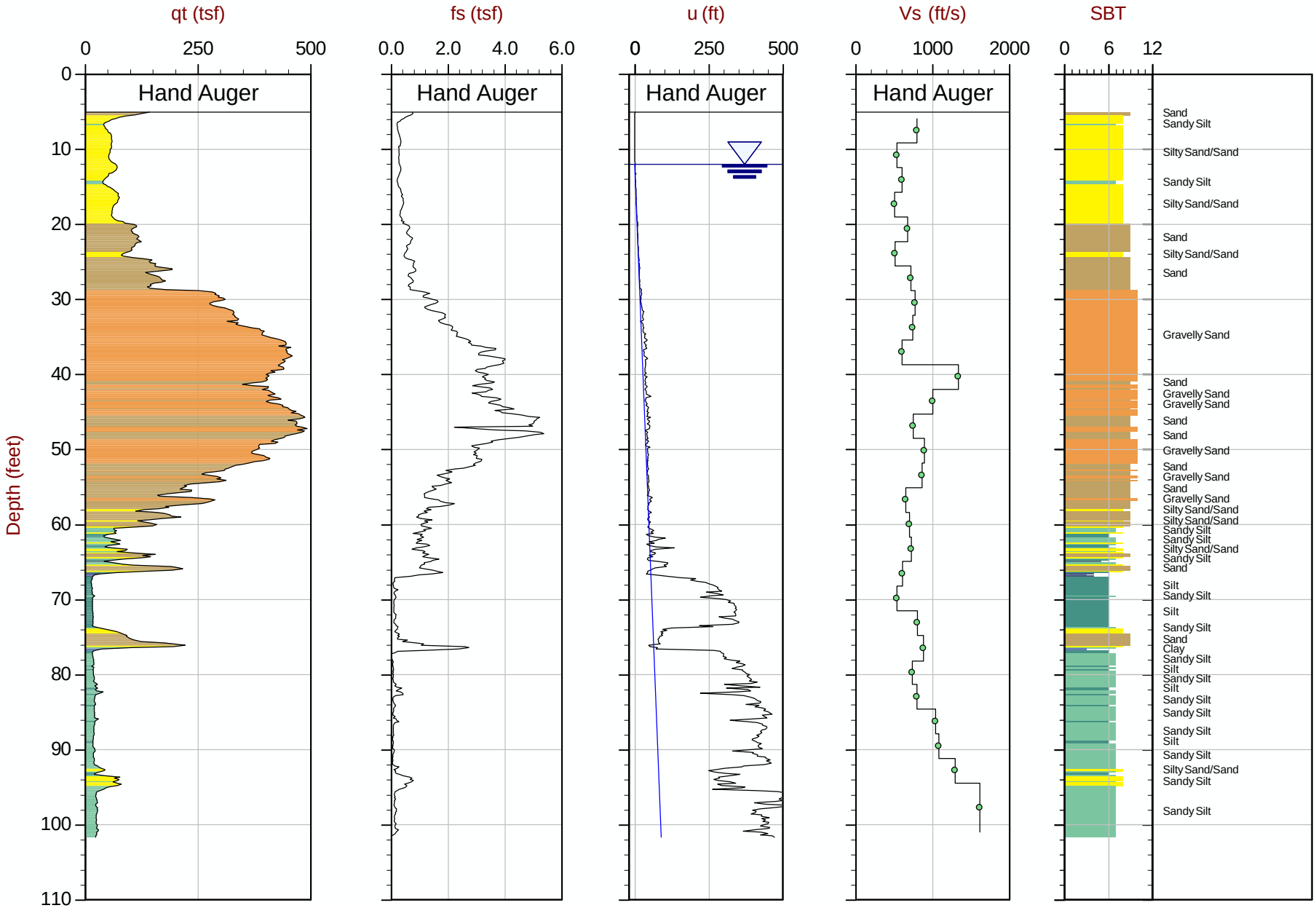
SBT: Lunne, Robertson and Powell, 1997
Coords: Lat: 36.92462 Long: -76.02068
Page No: 1 of 1

CONETEC

GET Solutions

Job No: 14-54066
Date: 07:22:14 13:02
Site: Fort Story Indoor Range

Sounding: CPT-1
Cone: 184:T1500F15U500

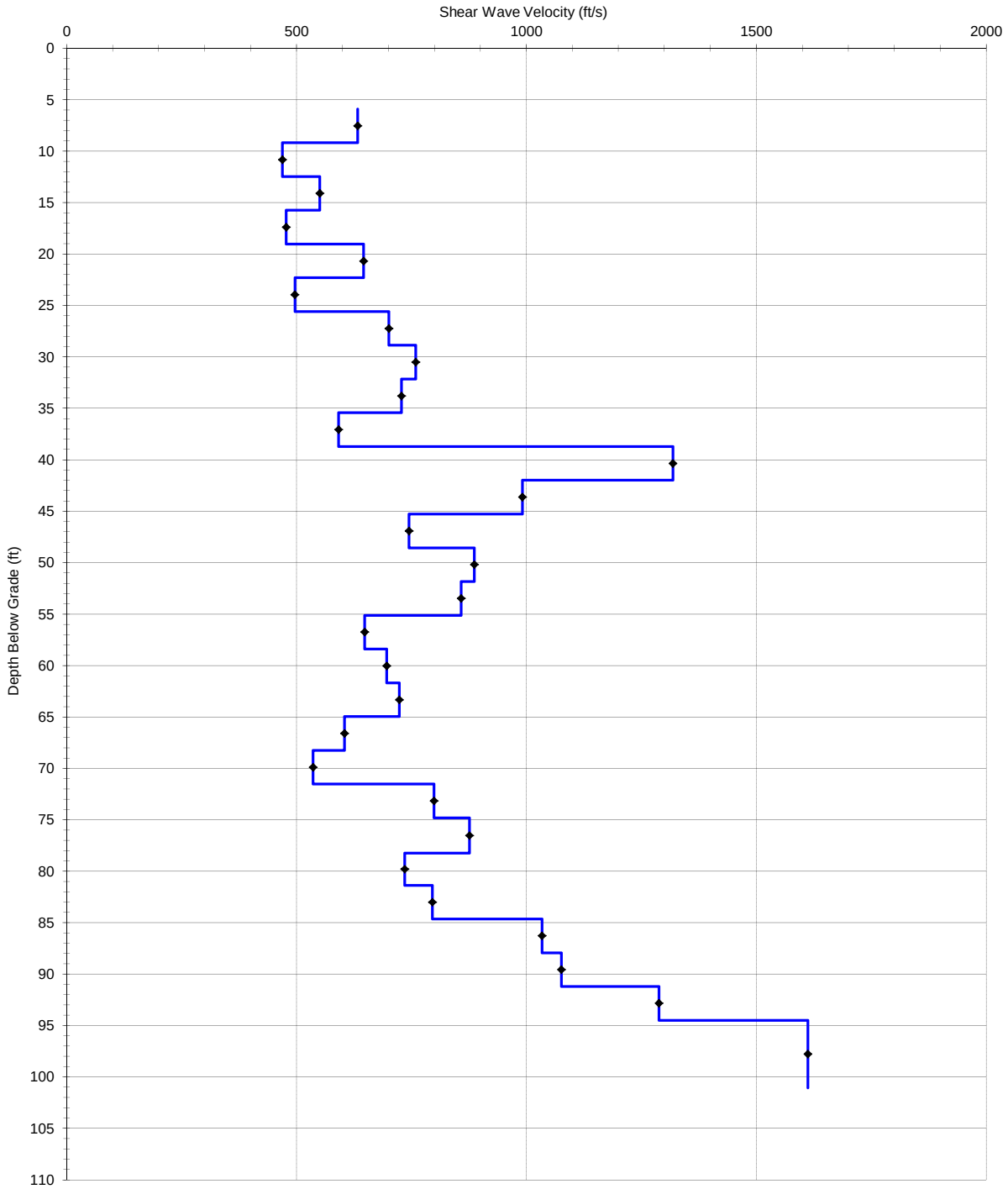


Max Depth: 31.000 m / 101.70 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 14-54066_SP01C.COR
Unit Wt: SBT Chart Soil Zones

SBT: Lunne, Robertson and Powell, 1997
Coords: Lat: 36.92462 Long: -76.02068
Page No: 1 of 1

Shear Wave Velocity- CPT--1
Fort Story Indoor Range
14-54066
July 22, 2014

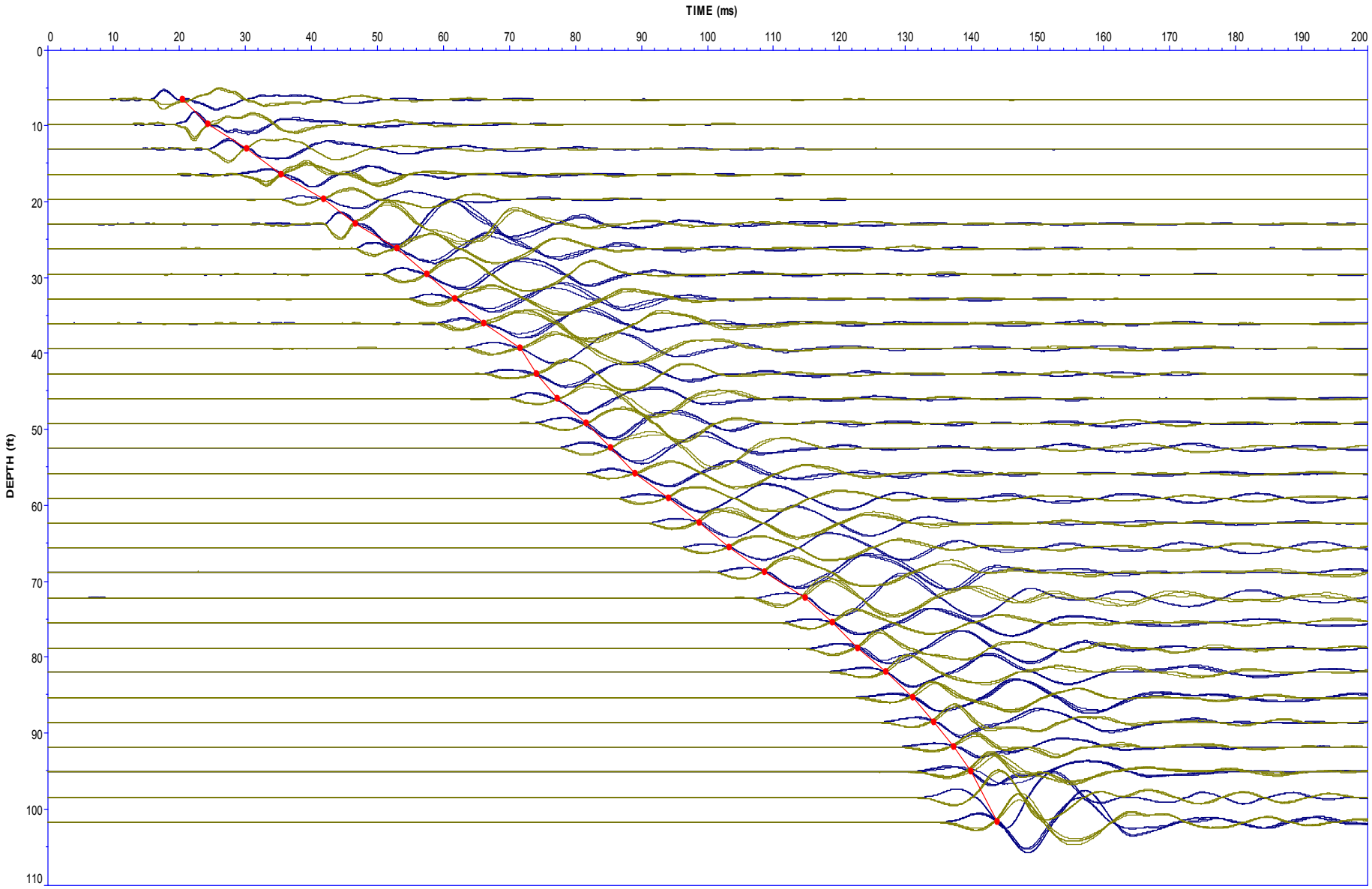


ConeTec Shear Wave Velocity Data Reduction Sheet

Hole:	CPT-1
Location:	Fort Story Indoor Range
Cone:	AD184
Date:	22-Jul-14
Source:	Beam
Source Depth	0.00 m
Source Offset	2.15 m

Tip Depth (m)	Geophone Depth(m)	Travel Path (m)	Interval time (ms)	Velocity (m/s)	Velocity (ft/s)	Interval Depth (m)	Interval Depth (ft)
0.00							
2.00	1.80	2.80					
3.00	2.80	3.53	3.77	192.9	632.8	2.30	7.55
4.00	3.80	4.37	5.84	143.0	469.2	3.30	10.83
5.00	4.80	5.26	5.33	167.8	550.5	4.30	14.11
6.00	5.80	6.19	6.37	145.5	477.3	5.30	17.39
7.00	6.80	7.13	4.81	196.9	645.9	6.30	20.67
8.00	7.80	8.09	6.34	151.3	496.3	7.30	23.95
9.00	8.80	9.06	4.53	213.6	700.7	8.30	27.23
10.00	9.80	10.03	4.21	231.4	759.1	9.30	30.51
11.00	10.80	11.01	4.41	221.9	728.1	10.30	33.79
12.00	11.80	11.99	5.45	180.2	591.2	11.30	37.07
13.00	12.80	12.98	2.45	402.0	1318.7	12.30	40.35
14.00	13.80	13.97	3.27	302.1	991.2	13.30	43.63
15.00	14.80	14.96	4.36	226.9	744.4	14.30	46.92
16.00	15.80	15.95	3.67	270.2	886.4	15.30	50.20
17.00	16.80	16.94	3.79	261.5	857.9	16.30	53.48
18.00	17.80	17.93	5.03	197.5	647.9	17.30	56.76
19.00	18.80	18.92	4.68	212.1	695.9	18.30	60.04
20.00	19.80	19.92	4.51	220.5	723.3	19.30	63.32
21.00	20.80	20.91	5.40	184.1	604.0	20.30	66.60
22.00	21.80	21.91	6.09	163.3	535.8	21.30	69.88
23.00	22.80	22.90	4.09	243.6	799.1	22.30	73.16
24.05	23.85	23.95	3.92	267.0	876.1	23.32	76.52
25.00	24.80	24.89	4.22	224.1	735.2	24.32	79.81
26.00	25.80	25.89	4.11	242.5	795.5	25.30	83.00
27.00	26.80	26.89	3.16	315.2	1034.0	26.30	86.29
28.00	27.80	27.88	3.04	328.0	1076.0	27.30	89.57
29.00	28.80	28.88	2.54	392.6	1288.1	28.30	92.85
31.00	30.80	30.87	4.06	491.4	1612.1	29.80	97.77

Job No: 14-54066 | Client: GET Solutions | Project Title: Fort Story | Operator: TS-TW | Hole: CPT-1 | Site: Fort Story Indo | Date: 07:22:14 13:02 | Oversite: 184:T1500F15U500



APPENDIX XV

PREVIOUS GEOTECHNICAL DATA

SUBSURFACE INVESTIGATION
AND
GEOTECHNICAL EVALUATION

SOF COMBAT SKILLS COMPOUND
FORT STORY, VIRGINIA

Prepared for:

TranSystems Corporation
150 Bousch Street, Suite 1000
Norfolk, Virginia 23510

Prepared by:

CTI CONSULTANTS, INC.
953 Norfolk Square
Norfolk, Virginia 23502

January 15, 2009

CTI Project Number 14G-393

953 Norfolk Square
Norfolk, VA 23502
Tel: 757-461-0826
Fax: 757-461-1436

January 15, 2009

TranSystems Corporation
Town Point Center
150 Bousch Street, Suite 1000
Norfolk, Virginia 23510

Attn: Mr. W. Barry Forbes, P.E.

Re: Report of Subsurface Exploration and Geotechnical Engineering Evaluations
SOF Combat Skills Compound
Fort Story, Virginia
CTI Project No.: 14G-393

Gentlemen:

CTI Consultants, Inc., (CTI) has completed subsurface exploration and geotechnical engineering evaluations for the referenced project as authorized by TranSystems Corporation, per our proposal No. P-14-586-91808 dated September 19, 2008.

This report presents the results of the subsurface exploration program and geotechnical engineering analyses undertaken by CTI in connection with the geotechnical study. The report presents our understanding of the project, reviews our exploration procedures, describes existing site and general subsurface conditions, and presents our evaluations, conclusions, and recommendations.

We appreciate the opportunity to provide geotechnical consultation services for your project. Please contact us if you have any questions regarding this report or if we may be of further service.

Sincerely,
CTI CONSULTANTS, INC.

COMMONWEALTH OF VIRGINIA
BRUCE R. SPIRO
No.015791
PROFESSIONAL ENGINEER

Michael A. Pais, E.I.T.
Senior Project Engineer-Special Projects

Bruce R. Spiro, P.E.
Senior Vice President-Engineering

3CC: Client

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APPENDICES

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APPENDIX B Soil Test Boring Profile
Soil Test Boring Logs
Notes for Soil Test Boring Logs

APPENDIX C Soil Laboratory Test Results

1.0 PURPOSE AND SCOPE OF SERVICES

The purpose of our involvement with this project was to 1) Provide general descriptions of the subsurface soil conditions at the location of the proposed structure(s); 2) Provide foundation, pavement design and construction recommendations; 3) Comment on geotechnical aspects of the proposed construction. In order to accomplish these objectives, CTI undertook the following scope of services:

1) Visited the site to observe existing surface conditions and features and coordinate utility clearance with the owner.

2) Reviewed subsurface information relative to the project site as provided by the client.

3) Executed the proposed subsurface exploration consisting of eight Standard Penetration Test (SPT) borings obtained at the site for foundation design considerations and two bulk soil samples for laboratory California Bearing Ratio (CBR) determination for pavement design considerations.

4) Performed laboratory testing on selected SPT samples recovered from the site. Ten sieve analyses without hydrometer (ASTM D422), twelve natural moisture content determinations (ASTM D2216) and two CBR (ASTM D1883) tests were performed to aid in the classification and determination of engineering properties of the soils at the site.

5) Provide a Seismic Site Class Definition per the 2003 International Building Code (IBC). A site specific shear wave velocity study was not performed.

6) Evaluated the findings of the test borings relative to shallow foundations for the proposed building and for the proposed asphalt surface pavement area(s).

7) Preparation of this report summarizing our work on the project, providing descriptions of the subsurface conditions encountered, providing foundation design criteria, and discussing geotechnical related aspects of the proposed construction. Copies of the test boring logs and laboratory test results are included in the appendices to this report.

Our geotechnical scope of services did not include a survey of the boring locations and elevations, quantity estimates, preparation of plans or specifications, or the identification and evaluation of environmental aspects of the project site. We note that the contracted field infiltration evaluations for stormwater management design considerations will be provided as an addendum to this report.

CTI was provided with a boring location plan, building dimensions, foundation loading and pavement loading information by the client to aid in our evaluations and the preparation of this report.

2.0 SITE AND PROJECT INFORMATION

2.1 Site Information

The project site is located along the north side of Hospital Road, approximately 800 feet east of the Vung Tau Street intersection, at Fort Story in Virginia Beach, Virginia. The project site is predominantly clear with plan dimensions on the order of 250 feet by 400 feet and is bordered by trees along the north side and Hospital Road along the south side. Ground surface elevations range from approximately 7 feet along the south side of the site to 5 feet near the north side of the site where an approximately 1V:10H slope extends for a distance of about 25 feet to the north side of the site along the noted tree line.

2.2 Project Information

The project is proposed to consist of a one-story, steel-framed Combat Skills building on the west side of the site with plan dimensions of approximately 115 feet by 200 feet, a one-story, brick or precast concrete sanitary sewer pump station near the south central portion of the site with plan dimensions of approximately 55 feet by 55 feet and an asphalt parking area along the east side of the site with plan dimensions of approximately 75 feet by 120 feet as shown on the attached *Boring Location Plan* provided in Appendix A. We understand that the well for the pump station will extend to a depth of approximately 6 feet below grade. Slab-on-grade finish floor elevation for the buildings are anticipated to be on the order of 6 feet.

Maximum column and wall loads for the Combat Skills building are to be on the order of 100 kips and 5 kips per linear foot (klf) and maximum wall loads for the sanitary sewer pump station are anticipated to be on the order of 2 klf. Maximum floor loads will be on the order of 50 to 100 pounds per square foot.

We understand that traffic loads are to consist mostly of cars, pick-up trucks, garbage trucks, delivery vehicles and periodic fire vehicles with maximum H-20 loading (32,000 pound rear axle) characteristics.

3.0 GEOTECHNICAL DATA COLLECTION PROCEDURES

3.1 Soil Borings and Sampling

A total of 8 soil test borings, identified as B-1 to B-8, were performed at the project site during the period of December 12 and 15, 2008. Four boring (B-1 to B-4) were performed in the proposed Combat Skills building area to a depth of 50 feet each, one boring (B-5) was performed in the area of the proposed sanitary sewer pump station to a depth of 50 feet and 3 borings (B-6 to B-8) were performed in the proposed parking area to a depth of 15 feet each. Approximate boring locations are shown on the *Boring Location Plan* provided in Appendix A. The boring locations were established in the field by the client.

The soil test borings were performed utilizing a track-mounted CME-45 drill rig equipped with an automatic hammer mechanism. The boreholes were performed with hollow-stem auger drilling techniques to a depth of about 10 feet and thereafter advanced with mud rotary drilling techniques to the termination depths. Standard Penetration Tests (SPT) were performed in general accordance with ASTM D1586 - *Penetration Test and Split-Barrel Sampling of Soils (Standard Penetration Test)*. The tests were performed continuously from the ground surface to a depth of 10 feet and, thereafter, at nominal five-foot intervals to the boring termination depths.

Soil samples were obtained with a standard split-spoon sampler assembly (30-inch total length and 1.4-inch/2.0-inch inside/outside diameters) driven with a 140 lb. hammer falling 30 inches for each blow. The number of blows required to drive the sampler each of four consecutive 6-inch penetration increments was recorded and documented on the boring logs. The sum of the second and third 6-inch penetration increments for

each SPT is termed the "N-value" for that test/sample. The first 6-inch penetration increment is considered to seat the sampler and a fourth penetration increment was obtained in order to collect additional sample. The recovered split-spoon samples were classified at the site by a CTI soils technician. Representative portions of the soil samples obtained from each SPT interval were sealed in a container, labeled and transported to our laboratory for final classification by a geotechnical engineer. The soil samples were visually classified in general accordance with the Unified Soil Classification System (USCS), using visual-manual identification procedures (ASTM D2488) along with the results of laboratory tests (ASTM D2487) performed on selected soil samples.

Since an automatic hammer was used to perform the SPT tests, the sample blows recorded in the field during drilling as noted on the boring logs have been corrected to the appropriate energy, which is approximately 60% of the theoretical energy. The reported N_{60} was determined from the following equation:

$$N_{60} = (N_{field})\ (C_E)$$

where a value of 1.3 was used for C_E in accordance with recommendations as provided by the *Center for Geotechnical Practice and Research* at Virginia Tech in their 1998 publication "Performance and Use of the Standard Penetration Test in Geotechnical Engineering Practice".

Two bulk soil samples (CBR-1 and CBR-2) were obtained from a depth of about ½ to 1½ feet in the proposed parking lot area.

3.2 Soil Laboratory Testing

Laboratory tests consisting of sieve analysis (ASTM D422, without hydrometer) and moisture content determinations (ASTM D2216) were performed on selected split-spoon samples for groundwater, classification and/or soil strength estimates for geotechnical design considerations. CBR tests were performed on the two bulk soil samples for pavement design considerations. Soil laboratory test results are provided in Appendix C.

4.0 SUBSURFACE CONDITIONS

4.1 Regional Geology

The project site lies within the Coastal Plain physiographic province of Virginia, which extends from the Fall Zone eastward to the Atlantic Ocean. Numerous transgressions and regressions of the Atlantic Ocean have deposited marine, lagoonal, and fluvial (stream lain) sediments. The regional geology is very complex, and generally consists of interbedded layers of varying mixtures of sands, silts and clays. Based on our review of existing geologic data and our soil boring data, the geologic stratigraphy in the vicinity of the project site generally consists of natural deposits of the Sand Bridge and Norfolk Formations of the Late Pleistocene age underlain by the Yorktown Formation.

4.2 Subsurface Soil Conditions

The subsurface conditions discussed in the following sections and those shown on the attached boring logs and subsurface profiles represent the subsurface conditions at the boring locations based on interpretation of the boring data in accordance with accepted geotechnical engineering practice. The lines designating strata breaks on the boring logs and subsurface profile represent approximate boundaries between soil types, as the transition may be gradual or may occur between samples. The transitions between different soil strata are usually less distinct than those shown on the boring logs. Although the individual test borings are representative of the subsurface conditions at the boring locations on the date shown, they are not necessarily indicative of subsurface conditions at other locations or at other times.

The following *Figure A – General Soil Stratigraphy* illustrates general subsurface conditions at the project site based on a review of the boring logs provided in Appendix C. Interpretation of the transition of soil strata between the borings as shown on the following illustration is necessarily assumed and may not be correct. We note that subsurface conditions may also change with time and groundwater fluctuations.

Figure A – General Soil Stratigraphy

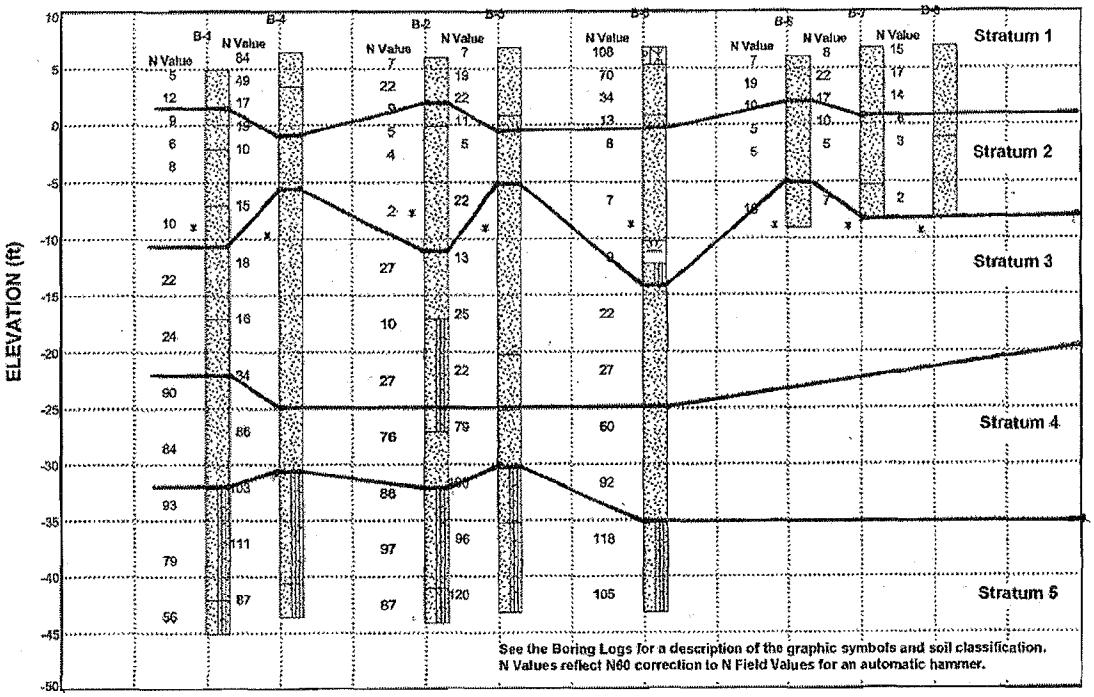


Figure A General Stratigraphy Descriptions

- Stratum 1: Loose to Very Dense, Fine SAND (SP) with traces of gravel (FILL)
- Stratum 2: Very Loose and Loose, Fine SAND (SP)
- Stratum 3: Medium-Dense, Fine SAND (SP)
- Stratum 4: Very Dense, Fine SAND (SP)
- Stratum 5: Very Dense, Silty, Fine SAND (SP-SM), trace silt

The *Figure A - General Stratigraphy Descriptions* as presented above provides a general description of subsurface soil conditions and should not be considered as a substitute for the boring logs that are included in Appendix C of this report.

4.3 Groundwater Conditions

Groundwater was encountered at a depth of approximately 12 to 15 feet during drilling. Visual classification of the split-spoon samples obtained during soil test boring operations indicated wet soil conditions were judged to be encountered at a depth ranging from approximately 12 to 14 feet below grade at the time of drilling.

We note that groundwater levels may fluctuate with tidal changes, seasonal changes, periods of heavy or little rainfall, and other factors. Therefore, the elevation of the groundwater table may be different at other times of the year and from the elevations presented in this report.

5.0 FOUNDATION DESIGN RECOMMENDATIONS

5.1 General

The following findings and recommendations are based on our observations at the site, interpretation of the field and laboratory data obtained during our subsurface exploration, and our experience with similar subsurface conditions and projects. Soil penetration data has been used to evaluate an allowable soil bearing pressure and soil strength parameters using established correlations. Subsurface conditions in unexplored locations may vary from those encountered at the boring locations. Should the loading, elevations or locations of the proposed structures change, we request that CTI be advised so that we may re-evaluate our recommendations.

5.2 Shallow Foundation Design Recommendations

We recommend that shallow foundations be designed for a maximum net allowable bearing pressure of 2,000 pounds per square foot (psf) for foundations bearing in approved subgrade soils or properly compacted controlled structural fill. Lightly loaded continuous wall footings should have a minimum width of 18 inches, and column footings should have a minimum width of 24 inches, to reduce the possibility of a punching shear failure. The structural elements should be centered on the foundations to provide uniform load transfer, unless the foundations are proportioned for eccentric loads. Exterior (perimeter) foundations bearing should bear at a minimum depth of 18 inches below the finished site grades to lessen the potential for damage from frost penetration and for bearing capacity considerations. We recommend that shallow building foundations bear no deeper than 2.5 feet below final exterior grades in order to limit stress influence in the Stratum 2 loose sand materials.

Total settlements of the column and continuous wall foundations were evaluated to be on the order less than one inch. Differential foundation settlements are anticipated to be on the order of one-half the total settlement.

5.3 Floor Slabs

Floor slabs for the proposed buildings may be supported by approved existing subgrade soils or properly compacted controlled structural fill following site preparation as discussed in Section 6.4. A standard modulus of subgrade reaction ("k") of 150 pci may be used for the design of the floor slabs. Floor slabs should be structurally isolated (float freely) from the foundations to allow for differential movement between the slabs and the structure.

A six-inch thick granular base layer consisting of open-graded crushed stone or clean sand (SP per the Unified Soil Classification System) should be placed beneath the floor slabs. This granular base would function as a leveling and load distributing material for the slab and provide a capillary break beneath the slab.

A vapor retarder should be used beneath ground floor slabs that will be covered by tile, wood, carpet, impermeable floor coatings, and/or if other moisture-sensitive equipment or materials will be in contact with the floor. However, the use of vapor retarders may result in excessive curling of floor slabs during curing. We refer the floor slab designer to ACI 302.1R-96, Sections 4.1.5 and 11.11, for further discussion on vapor retarders, curling, and the means to minimize concrete shrinkage and curling.

Proper jointing of the ground floor slab is also essential to lessen potential cracking. ACI suggests that unreinforced, plain concrete slabs may be jointed at spacings of 24 to 36 times the slab thickness, up to a maximum spacing of 18 feet. Floor slab construction should incorporate isolation joints along bearing walls and around column locations to allow minor movements to occur without damage. Utility or other construction excavations in the prepared floor subgrade should be backfilled to a controlled fill criterion to provide uniform floor support.

Settlements associated with the floor slabs are anticipated to be on the order of ½-inch or less.

5.4 Well Excavation and Foundation

Excavations for the sanitary sewer pump station well should be performed in accordance with current OSHA standards. Considering the Stratum 1 and 2 materials, an open excavation for the well would likely require slopes on the order of 2V:1H for stability; however, if water is allowed to seep into the excavation (i.e., from a heavy

rainfall) then it could become unstable at almost any slope. Due to the relatively shallow well depth of 6 feet below grade and even deeper groundwater levels, dewatering and shoring or bracing of the excavation would most likely not be necessary. The pump station well could be supported on a mat foundation bearing on the soils encountered at the anticipated bearing depth of 6 feet below existing grades. Due to the nominal increase in net loading, it is estimated that long term settlement should be negligible.

5.5 Seismic Site Classification

The following recommendations are based on Section 1615.1.1 of the 2003 International Building Code (IBC). We note that scope of services for the current evaluation does not include a seismic condition survey to determine site-specific shear wave velocity information. The IBC provides a methodology to determine a Site Class Definition with an averaging of SPT N-values for distinct soil profiles to a depth of 100 feet. Since the soil test borings for the referenced project were terminated at a maximum depth of 50 feet, additional N-values were assumed to be on the order of 70 blows per foot to a depth of 100 feet. These assumptions were based upon the current subsurface information and our experience in the area.

Based upon subsurface conditions encountered as previously discussed, and in accordance with section 1615.1.1 of the IBC, the project site meets the conditions for a Site Classification D. The D classification is assigned for sites with a predominantly stiff/dense soil profile exhibiting an averaged N-value of between 15 to 50 blows per foot per the IBC guidelines. We have not evaluated the Seismic Design Category for this project.

Based on a Site Classification D determination, the geographical site location and the mapped Maximum Considered Earthquake (MCE) ground motion for 0.2 second and 1.0 second spectral response acceleration, we have estimated spectral response coefficients as presented in the following *Table C – Spectral Response Values*:

Table A – Spectral Response Values

Period (seconds)	MCE (% of gravity)	F_a	F_v	S_{DS}	S_{D1}
0.2	14.5	1.6	-	0.155	-
1.0	6.2	-	2.4	-	0.099

If desired, a seismic condition survey can be performed in order to determine site-specific shear wave velocity characteristics for the project site. We note, however, that this survey may, or may not, result in a Site Classification determination different than as evaluated for the current report.

5.6 Pavement Design Recommendations

CTI has evaluated the following pavement section based on the available traffic data and on a design CBR value of 7 that was obtained based on ⅔'s of the average unsoaked CBR test values. Based on the laboratory CBR test results and projected traffic, the following pavement section is recommended.

2-inches Asphalt Concrete Surface Mix, VDOT SM 9.5A

8-inches Dense-Graded Crushed Aggregate Base, VDOT 21A/B, Type I placed over approved compacted subgrade

All materials and construction should be in accordance with the latest edition of the Virginia Department of Transportation (VDOT) Road and Bridge Specifications, unless otherwise noted. The concrete pavement joints must be properly designed and spaced to ensure satisfactory pavement performance.

The concrete pavement joint spacing, joint design, and joint sealant should be designed in accordance with the recommendations provided in the ACI "Guide for Design and Construction of Concrete Parking Lots" publication ACI 330. A thickened edge is recommended on the outside free edge of slabs subjected to wheel loads.

6.0 CONSTRUCTION RECOMMENDATIONS

6.1 General

The principal purpose of this section is to comment on items related to foundation construction, earthwork and related geotechnical engineering aspects of the proposed construction. It is recommended that the geotechnical engineer be retained to provide soil engineering services during the site and foundation construction phases of the project to help assure that conditions encountered during construction are similar to conditions encountered in the borings. The geotechnical engineer can also assist in interpretation of differing subsurface conditions that may be encountered and recommend remedial work, if needed.

6.2 Site Preparation

Site clearing should include the complete removal of any above grade structures (including pavement sections, medians, surface vegetation, organic materials, root mats and tree stumps) and below grade abandoned structures within the proposed building areas. The resulting depressions should be backfilled with compacted with suitable off-site structural fill material.

Upon completion of the removal of the above materials and after clearing to planned site subgrade elevations, we recommend that a vibratory roller (10 tons or greater) make a series of passes over the exposed subgrade soils extending 10 feet beyond the building area(s) in order to provide some additional densification influence to the Stratum 2 loose sands. This densification should be performed by first making a set of parallel passes traversing across the area at a moderately slow (walking) speed. The next set of passes should then cross the area in a direction perpendicular to the first set of passes. This procedure should be continued, with alternating directions, until a minimum of 8 passes have been completed for the entire building area.

The exposed subgrade materials in the proposed building and pavement areas should be proofrolled while being observed by the geotechnical engineer. Proofrolling should be performed with a loaded tandem axle dump truck during a time of good weather and not while the site is wet as a result of recent rain or snow. The purpose of proofrolling is to detect any isolated soft areas and to evaluate the general stability of the near surface subgrade soils. Any areas that deflect ("pump") during proofrolling should be observed

by a geotechnical engineer with any determined soft or unstable conditions repaired as directed by the engineer following authorization by the Owner. Undercutting and replacement with suitable off-site structural fill material would be the most likely repair procedure. The ground surface should be graded in such a manner that surface water will have positive drainage away from the site at all times during construction.

As previously noted in the *Table A–General Soil Stratigraphy* section, the Stratum 1 soils appear to contain some undocumented fill materials to a depth of as much as approximately 5 feet. A review of the soil test boring logs indicates that the Stratum 1 materials had been previously subjected to some notable compactive effort. Since the recovered fill samples at the boring locations did not contain root, wood, organics, or other deleterious materials, it appears that the fill material may be relatively clean and would likely be suitable for foundation support and/or use as structural fill as addressed in the following sections of this report. However, we note that the composition of undocumented fill soils can vary and cannot preclude the possibility that deleterious materials could be present within the fill at unexplored areas of the site or could be uncovered during site grading and foundation excavation operations. Should construction operations encounter deleterious fill materials considered unsuitable for support of the proposed building and pavement structures, complete removal of such materials from the project site may be necessary followed by replacement with suitable compacted structural fill.

We note that the Stratum 1 sandy soils are not typically very moisture sensitive and would likely remain stable during mild to moderate wet weather conditions; however, if in a very wet condition, construction traffic could possibly deteriorate the stability of these materials.

6.3 Shallow Foundation and Well Foundation Construction

All shallow foundation subgrades should be observed, evaluated, and verified for the design bearing pressure by the geotechnical engineer after excavation and prior to placement of reinforcement steel. If low consistency soils are encountered during foundation construction, localized undercutting and/or in-place stabilization of foundation subgrades will be required. The actual need for, and extent of, undercutting should be based on field observations made by the geotechnical engineer at the time of construction.

Excavations should be made in such a way as to provide bearing surfaces that are firm and free of loose, soft, wet, or otherwise disturbed soils. Foundation concrete should not be placed on frozen or saturated subgrades. If such materials are allowed to remain below foundations, settlements will increase. Foundation excavations should be concreted as soon as practical after they are excavated. If an excavation is left open for an extended period, a thin mat of lean concrete should be placed over the bottom to minimize damage to the bearing surface from weather or construction activities. Water should not be allowed to pond in any excavation.

Field testing of foundation bearing soils should consist of performing shallow hand auger borings and Dynamic Cone Penetrometer (DCP) testing of the bearing grade soils in selected areas. If soft or loose soils are encountered at the footing bearing level(s), undercutting and repair of the footing subgrades will be necessary. Typically, adequate support of the foundations may be achieved by undercutting the softer soils and replacing with washed stone. If undercut excavations are backfilled with VDOT No. 57 washed stone, the stone should be placed up to the planned bearing grade; the washed stone should be placed in lifts no greater than 18 inches thick and compacted with a heavy vibratory plate compactor or firmly tamped/seated in place with an excavator bucket.

6.4 Controlled Structural Fill

Structural fill material, if necessary, should be non-expansive and free of organic matter, debris, and particles larger than 2 inches in size. Proposed fill material should be subjected to laboratory tests consisting of, but not necessarily limited to, moisture density determinations, Atterberg Limits, and sieve analysis. Controlled structural fill should classify per the Unified Soil Classification System (Appendix B) as SW, SP, SP-SM, or SM, with a maximum of 20 percent fines passing the No. 200 sieve. Coal combustion by-products are not suitable for use as controlled structural fill.

Typically, fill materials should be placed in horizontal lifts with maximum height of 12-inches loose measure. We recommend that structural fill be compacted to at least 95 percent of the standard Proctor (ASTM D 698) maximum dry density. In confined areas such as footing excavations, portable compaction equipment and thin lifts of 3-inches to 4-inches may be required to achieve specified degrees of compaction. Each lift of fill should be tested in order to confirm that the recommended degree of compaction is attained. A minimum of two field density tests per lift is recommended to verify fill compaction.

In general, we recommend that the moisture content of fill soils be maintained within three percentage points of the optimum moisture content as determined from the standard Proctor maximum dry density test. Excessively wet or excessively dry soils should not be used as fill material without proper drying or wetting.

6.5 Slope Construction

A review of the site plan provided to CTI indicates that the north side of the Combat Skills building will extend into the noted slope area present along the north side of the site. Cut or fill slopes constructed within 10 feet of any building foundations should be constructed on a maximum 1V:3H grade. Any slopes should be compacted in maximum 1½-foot high horizontal benches. Each bench lift should be compacted to a minimum of 95% of the maximum dry density of the bench material as previously discussed in the Controlled Fill section of this report. Slopes should be properly vegetated as soon as possible to help prevent surface sloughing and erosion.

7.0 LIMITATIONS

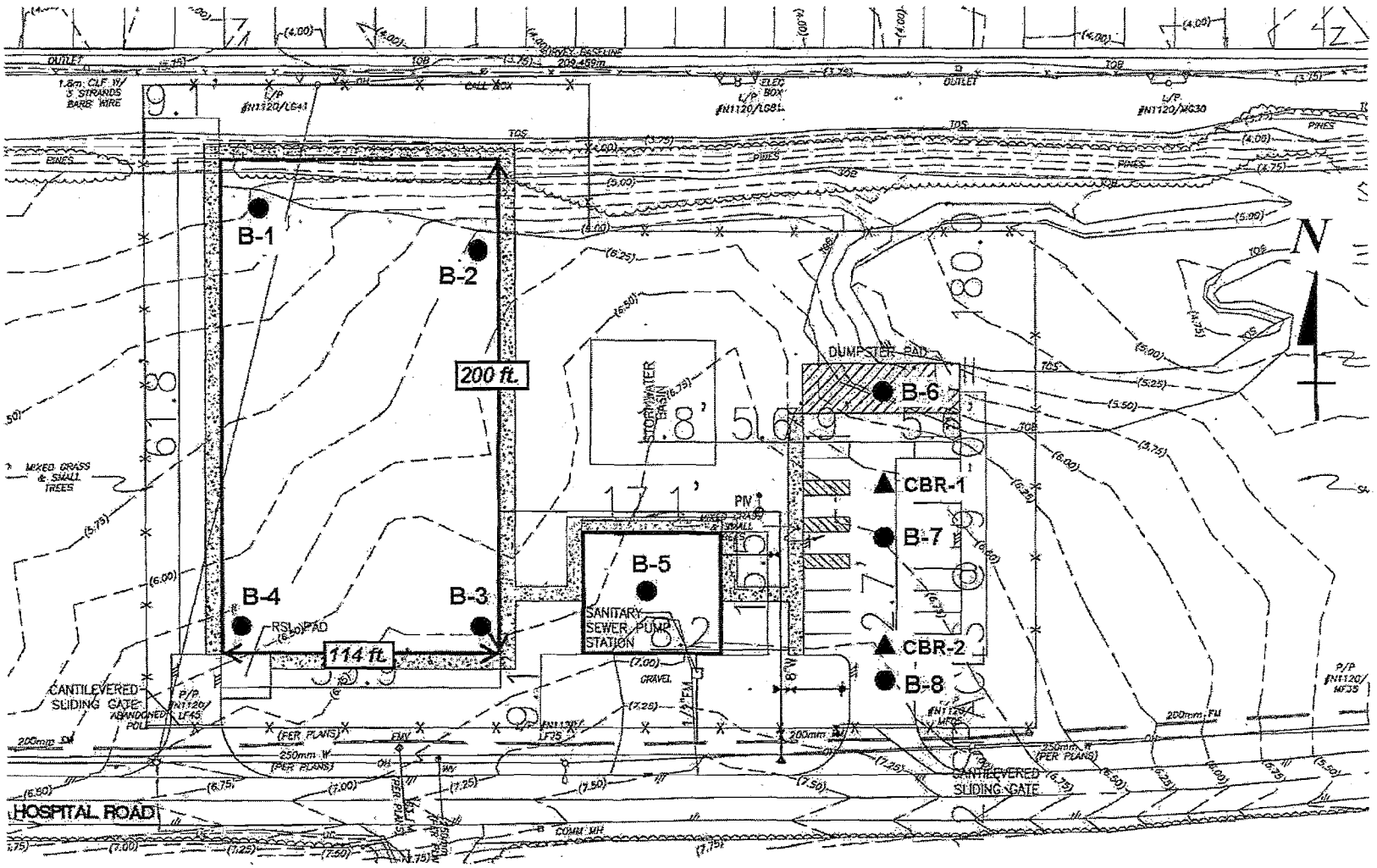
This report has been prepared for the exclusive use of TranSystems Corporation, or their designated agent, for specific application to the referenced project site in Virginia Beach, Virginia, in accordance with generally accepted soil and foundation engineering practices. No other warranty, express or implied, is made. Our conclusions and recommendations are based on design information furnished to CTI, the data obtained from the previously described subsurface exploration program, and generally accepted geotechnical engineering practice. The findings and recommendations do not reflect variations in subsurface conditions, which could exist intermediate of the boring locations or in unexplored areas of the site. Should such variations become apparent during construction, it will be necessary to re-evaluate our conclusions and recommendations based upon on-site observations of the conditions.

Regardless of the thoroughness of a subsurface exploration, there is the possibility that conditions in other areas will differ from those at the boring location, that conditions are not as anticipated by the designers, or that the construction process has altered the soil conditions. Therefore, our experienced geotechnical engineers should evaluate earthwork and foundation construction to verify that the conditions anticipated in design actually exist. Otherwise, we assume no responsibility for construction compliance with the design concepts, specifications, or recommendations.

In the event that changes are made in the design or location of the proposed structures, the recommendations presented in the report shall not be considered valid unless the changes are reviewed by our firm and conclusions of this report modified and/or verified in writing. If this report is copied or transmitted to a third party, it must be copied or transmitted in its entirety, including text, attachments, and enclosures. Interpretations based on only a part of this report may not be valid.

APPENDIX A

BORING LOCATION PLAN



CTI CONSULTANTS, INC
GEOTECHNICAL ENGINEERING • TESTING & INSPECTIONS
QUALITY CONTROL• ENVIRONMENTAL SERVICES
953 Norfolk Square, Norfolk, VA 23502
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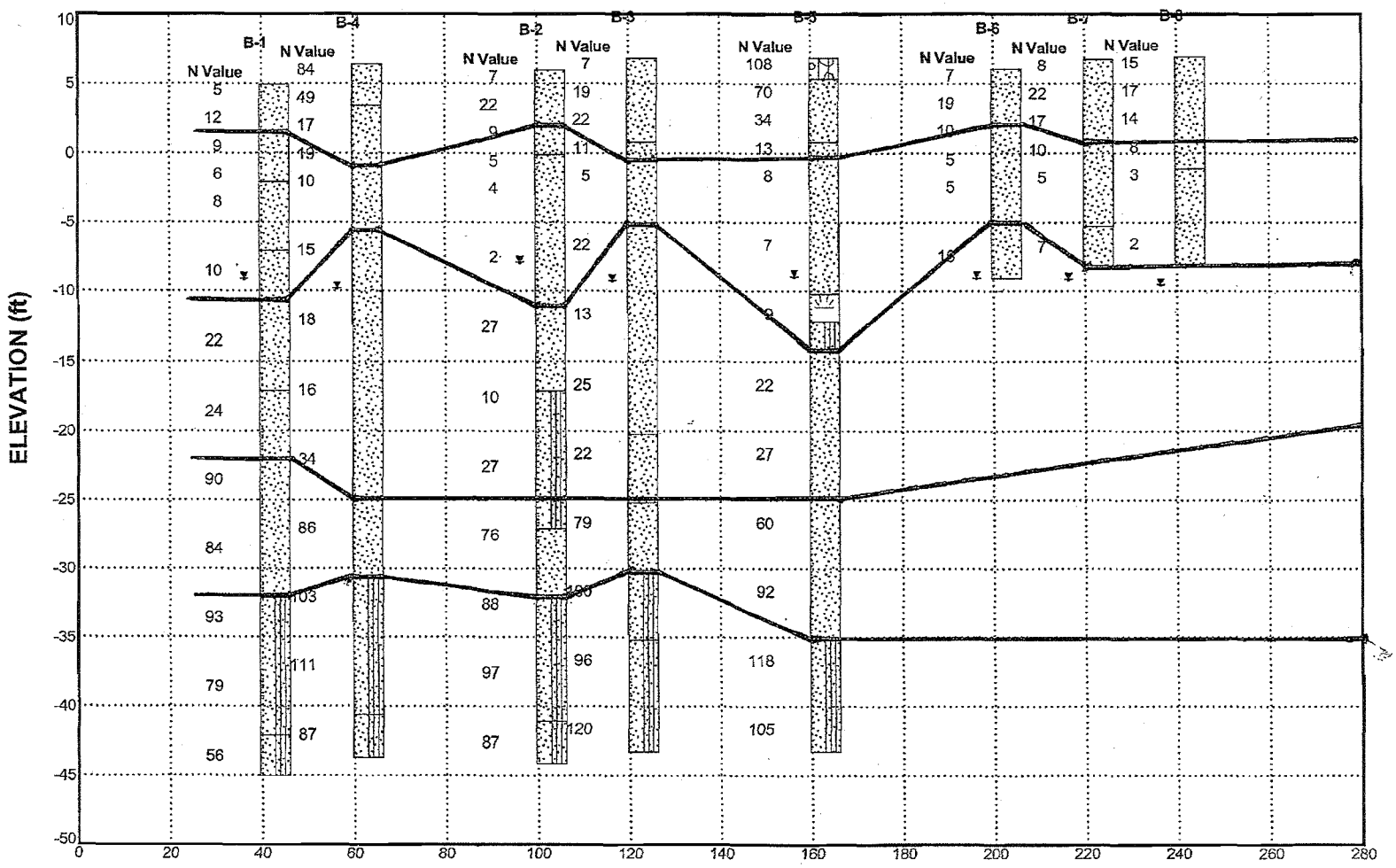
Boring Location Plan

SOF Combat Skills Compound
Fort Story, Virginia

DATE: January 2009		Drawing No.
SCALE: as shown		1
EDITED: map	14G-393	

APPENDIX B

SOIL TEST BORING PROFILE
SOIL TEST BORING LOGS
NOTES FOR TEST BORING LOGS



Drawing No. 3
1

PROJECT #
14G-393

DATE
Jan 09

SOIL TEST BORING PROFILE

SOF Combat Skills Compound
Fort Story, Virginia

CTI Consultants, Inc.
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Norfolk, Virginia Fax: (757) 461-1436

CTI CONSULTANTS INC
953 Norfolk Square (757) 461-0826
Norfolk, Virginia 23502 fax (757) 461-1436

SOIL BORING LOG: B-1

Project Number: 14G-393

Client:	Transystems Corporation	Boring Contractor:	Fishburne Drilling, Inc.
Project Name:	SOF Combat Skills Compound	Foreman:	E. Hester
Project Location:	Fort Story, Virginia	Boring Method:	Mud Rotary
Boring Location:	N 100.0000 E 0.0000 see Boring Location Plan	Inspector:	J. Seargeant
Total Depth 50.00 ft 15.24 m	Elev.: 4.9 ft 1.5 m Referenced Datum:	Completion Date:	December 15, 2008

Elev (ft)	Depth (ft)	DESCRIPTION OF MATERIALS	Stratum Depth(ft)	Sample Number	Sample Blows	N Value	REMARKS
		Loose, Tan, Fine SAND, trace silt, moist (SP)		1	1/3/2/2	5	Sample blows reflect N60 correction for an automatic hammer.
				2	3/5/7/6	12	
0.0	5			3	5/5/4/4	9	
			7.0	4	2/3/3/4	6	
		Very Loose to Loose, Brown, Fine SAND, moist to wet (SP)		5	2/4/4/5	8	
-5.0	10						
			12.0				
		Loose to Medium-Dense, Gray, Fine SAND, trace silt, wet (SP)		6	5/5/5/8	10	Groundwater was encountered at a depth of approximately 12.0 feet during drilling.
-10.0	15						
				7	9/8/14/13	22	
-15.0	20						
			22.0				
		Medium-Dense, Gray, Medium to Fine SAND, wet (SP)		8	8/10/14/21	24	
-20.0	25						
			27.0				
		Dense, Gray, Fine SAND, trace silt, wet (SP)		9	29/36/54/62	90	
-25.0	30						
				10	29/40/44/50	84	
-30.0	35						
			37.0				
		Dense to Medium-Dense, Greenish-Gray, Fine SAND, trace silt, wet (SP-SM)		11	31/44/49/59	93	
-35.0	40						
				12	24/34/45/39	79	
-40.0	45						
			47.0				
		Dense, Greenish-Gray, Fine SAND, trace silt, wet (SP-SM)		13	20/28/28/32	56	
-45.0	50		50.0				
		Boring terminated at 50 feet.					

WATER LEVEL OBSERVATIONS

Noted on Rods: ft

On Completion: 14.0 ft

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SOIL BORING LOG: B-2

Project Number: 14G-393

Client:	Transystems Corporation	Boring Contractor:	Fishburne Drilling, Inc.
Project Name:	SOF Combat Skills Compound	Foreman:	E. Hester
Project Location:	Fort Story, Virginia	Boring Method:	Mud Rotary
Boring Location:	N 100.0000 E 60.0000 see Boring Location Plan	Inspector:	J. Seargeant
Total Depth 50.00 ft 15.24 m	Elev.: 5.9 ft 1.8 m Referenced Datum:	Completion Date:	December 15, 2008

Elev (ft)	Depth (ft)	DESCRIPTION OF MATERIALS	Stratum Depth(ft)	Sample Number	Sample Blows	N Value	REMARKS
5.0		Loose to Medium-Dense, Light Brown, Fine SAND, moist (SP)		1	1/2/5/8	7	Sample blows reflect N60 correction for an automatic hammer.
				2	8/10/12/9	22	
			4.0				
	5	Loose, Light Brown, Fine SAND, moist (SP)		3	5/5/4/2	9	
			6.0				
0.0		Very Loose, Tan, Fine SAND, trace silt, moist to wet (SP)		4	2/3/2/1	5	
				5	2/1/3/1	4	
	10						
-5.0							
				6	2/1/1/3	2	Groundwater was encountered at a depth of approximately 12.0 feet during drilling.
	15						
-10.0			17.0				
		Medium-Dense, Broww, Fine SAND, trace silt, wet (SP)		7	8/13/14/20	27	
	20						
-15.0			23.0				
		Loose to Medium-Dense, Gray, Fine SAND, trace silt, wet (SP-SM)		8	5/4/6/9	10	
	25						
-20.0							
				9	14/13/14/18	27	
	30						
-25.0			33.0				
		Dense, Gray, Medium to Fine SAND, wet (SP)		10	29/36/40/44	76	
	35						
-30.0			38.0				
		Dense, Gray, Fine SAND, trace silt, wet (SP-SM)		11	29/40/48/57	88	
	40						
-35.0							
				12	32/48/55/60	97	
	45						
-40.0			47.0				
		Dense, Greenish-Gray, Fine SAND, trace silt, wet (SP-SM)		13	32/39/48/54	87	
	50		50.0				
-45.0		Boring terminated at 50 feet.					

WATER LEVEL OBSERVATIONS

Noted on Rods: ft

On Completion: 13.8 ft

CTI CONSULTANTS INC
953 Norfolk Square (757) 461-0826
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SOIL BORING LOG: B-3

Project Number: 14G-393

Client:	Transystems Corporation	Boring Contractor:	Fishburne Drilling, Inc.
Project Name:	SOF Combat Skills Compound	Foreman:	E. Hester
Project Location:	Fort Story, Virginia	Boring Method:	Mud Rotary
Boring Location:	N 0.0000 E 80.0000 see Boring Location Plan	Inspector:	J. Seargeant
Total Depth 50.00 ft 15.24 m	Elev.: 6.8 ft 2.1 m Referenced Datum:	Completion Date:	December 12, 2008

Elev (ft)	Depth (ft)	DESCRIPTION OF MATERIALS	Stratum Depth(ft)	Sample Number	Sample Blows	N Value	REMARKS
5.0		Loose to Medium-Dense, Tan, Fine SAND, trace silt, moist (SP)		1	1/2/5/4	7	Sample blows reflect N60 correction for an automatic hammer.
				2	9/10/9/12	19	
	5			3	5/10/12/8	22	
			6.0				
0.0		Loose to Very Loose, Tan, Fine SAND, trace silt, moist (SP)		4	8/6/5/5	11	
				5	4/2/3/4	5	
	10						
-5.0			12.0				
		Medium-Dense, Tan, Fine SAND, trace silt, wet (SP)		6	6/9/13/12	22	Groundwater was encountered at a depth of approximately 12.0 feet during drilling.
	15						
-10.0							
				7	5/5/8/8	13	
	20						
-15.0							
				8	10/12/13/13	25	
	25						
-20.0			27.0				
		Medium-Dense, Tan, Medium to Fine SAND, wet (SP)		9	6/9/13/17	22	
	30						
-25.0			32.0				
		Dense, Tan, Fine SAND, trace coarse sand, wet (SP)		10	24/36/43/45	79	
	35						
-30.0			37.0				
		Dense, Tan, Fine SAND, trace silt, wet (SP-SM)		11	36/48/52/55	100	
	40						
-35.0			42.0				
		Dense, Light Gray, Fine SAND, trace silt, wet (SP-SM)		12	40/44/52/53	96	
	45						
-40.0							WATER LEVEL OBSERVATIONS
				13	45/55/65/76	120	
	50		50.0				Noted on Rods: ft
		Boring terminated at 50 feet.					On Completion: 16.0 ft
-45.0							

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953 Norfolk Square (757) 461-0826
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SOIL BORING LOG: B-4

Project Number: 14G-393

Client:	Transystems Corporation	Boring Contractor:	Fishburne Drilling, Inc.
Project Name:	SOF Combat Skills Compound	Foreman:	E. Hester
Project Location:	Fort Story, Virginia	Boring Method:	Mud Rotary
Boring Location:	N 0.0000 E 20.0000 see Boring Location Plan	Inspector:	J. Seargeant
Total Depth	50.00 ft / 15.24 m; Elev.: 6.4 ft / 2.0 m; Referenced Datum:	Completion Date:	December 12, 2008

Elev (ft)	Depth (ft)	DESCRIPTION OF MATERIALS	Stratum Depth(ft)	Sample Number	Sample Blows	N Value	REMARKS
5.0		Dense, Tan, Fine SAND with gravel, dry (SP)	3.0	1	12/44/40/32	84	Sample blows reflect N60 correction for an automatic hammer.
				2	17/28/21/20	49	
		Medium-Dense to Loose, Tan, Fine SAND, trace silt, moist (SP)		3	5/7/10/9	17	
0.0	5			4	9/9/10/12	19	
				5	6/5/5/5	10	
-5.0	10		12.0				
		Medium-Dense to Dense, Tan, Fine SAND, trace silt, wet (SP)		6	6/6/9/9	15	Groundwater was encountered at a depth of approximately 12.0 feet during drilling.
-10.0	15						
				7	9/8/10/9	18	
-15.0	20						
				8	10/10/6/5	16	
-20.0	25						
				9	13/19/15/17	34	
-25.0	30						
				10	31/41/45/46	86	
-30.0	35		37.0				
		Dense, Light Gray, Fine SAND, trace silt, wet (SP-SM)		11	35/48/55/61	103	
-35.0	40						
				12	35/53/58/61	111	
-40.0	45		47.0				
		Dense, Greenish-Gray, Fine SAND, trace silt, wet (SP-SM)		13	35/39/48/50	87	
-45.0	50	Boring terminated at 50 feet.	50.0				

WATER LEVEL OBSERVATIONS

Noted on Rods: ft

On Completion: 16.2 ft

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SOIL BORING LOG: B-5

Project Number: 14G-393

Client:	Transystems Corporation	Boring Contractor:	Fishburne Drilling, Inc.
Project Name:	SOF Combat Skills Compound	Foreman:	E. Hester
Project Location:	Fort Story, Virginia	Boring Method:	Mud Rotary
Boring Location:	N 20.0000 E 120.0000 see Boring Location Plan	Inspector:	J. Seargeant
Total Depth	50.00 ft / 15.24 m; Elev.: 6.8 ft / 2.1 m; Referenced Datum:	Completion Date:	December 12, 2008

Elev (ft)	Depth (ft)	DESCRIPTION OF MATERIALS	Stratum Depth(ft)	Sample Number	Sample Blows	N Value	REMARKS
		Sandy GRAVEL to tan fine sand (GM)	1.5	1	7/68/50/46	108	Sample blows reflect N60 correction for an automatic hammer.
5.0		Dense, Tan, Fine SAND, trace gravel and shell fragments, moist (SP)		2	24/35/35/31	70	
	5		6.0	3	17/17/17/14	34	
0.0		Medium-Dense to Loose, Tan, Fine SAND, trace silt, moist to wet (SP)		4	7/6/7/5	13	
				5	4/4/4/2	8	
	10						
-5.0				6	2/4/3/4	7	Groundwater was encountered at a depth of approximately 12.0 feet during drilling.
	15		17.0				
-10.0		PEAT and wood fragments	19.0	7	2/4/5/9	9	
	20	Dark Brown, Organically Stained, Fine SAND, trace silt, wet (SP-SM)	21.0				
-15.0		Medium-Dense to Dense, Tan, Fine SAND, trace silt, wet (SP)		8	9/9/13/15	22	
	25						
-20.0				9	9/13/14/14	27	
	30						
-25.0				10	19/28/32/37	60	
	35						
-30.0				11	27/40/52/54	92	
	40		42.0				
-35.0		Dense, Light Gray, Fine SAND, trace silt, wet (SP-SM)		12	42/53/65/67	118	
	45						
-40.0				13	39/48/57/52	105	
	50		50.0				
-45.0		Boring terminated at 50 feet.					

WATER LEVEL OBSERVATIONS

Noted on Rods: ft

On Completion: 15.7 ft

CTI CONSULTANTS INC
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SOIL BORING LOG: B-6

Project Number: 14G-393

Client:	Transystems Corporation	Boring Contractor:	Fishburne Drilling, Inc.
Project Name:	SOF Combat Skills Compound	Foreman:	E. Hester
Project Location:	Fort Story, Virginia	Boring Method:	Mud Rotary
Boring Location:	N 50.0000 E 160.0000 see Boring Location Plan	Inspector:	J. Seargeant
Total Depth 15.00 ft 4.57 m	Elev.: 6.0 ft 1.8 m Referenced Datum:	Completion Date:	December 15, 2008

Elev (ft)	Depth (ft)	DESCRIPTION OF MATERIALS	Stratum Depth(ft)	Sample Number	Sample Blows	N Value	REMARKS
5.0		Loose to Medium-Dense, Tan, Fine SAND, trace silt, moist (SP)		1	1/2/5/6	7	Sample blows reflect N60 correction for an automatic hammer.
				2	6/9/10/9	19	
			4.0				
	5	Loose to Very Loose, Tan, Fine SAND, trace silt, moist (SP)		3	4/5/5/4	10	
0.0				4	4/2/3/2	5	
				5	2/3/2/1	5	
	10		11.0				
-5.0		Medium-Dense, Brown, Fine SAND, trace silt, moist to wet (SP)					
				6	6/7/9/10	16	Groundwater was encountered at a depth of approximately 12.0 feet during drilling.
	15		15.0				
-10.0		Boring terminated at 15 feet.					
	20						
-15.0							
	25						
-20.0							
	30						
-25.0							
	35						
-30.0							
	40						
-35.0							
	45						
-40.0							
	50						
-45.0							

WATER LEVEL OBSERVATIONS	
Noted on Rods:	ft
On Completion:	15.0 ft

CTI CONSULTANTS INC.
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SOIL BORING LOG: B-7

Project Number: 14G-393

Client:	Transystems Corporation	Boring Contractor:	Fishburne Drilling, Inc.
Project Name:	SOF Combat Skills Compound	Foreman:	E. Hester
Project Location:	Fort Story, Virginia	Boring Method:	Mud Rotary
Boring Location:	N 25.0000 E 180.0000 see Boring Location Plan	Inspector:	J. Seargeant
Total Depth 15.00 ft 4.57 m	Elev.: 6.7 ft 2.0 m Referenced Datum:	Completion Date:	December 15, 2008

Elev (ft)	Depth (ft)	DESCRIPTION OF MATERIALS	Stratum Depth(ft)	Sample Number	Sample Blows	N Value	REMARKS
5.0		Loose to Medium-Dense, Tan, Fine SAND, trace silt, moist (SP)		1	1/2/6/9	8	Sample blows reflect N60 correction for an automatic hammer.
				2	6/10/12/13	22	
	5			3	9/10/7/8	17	
			6.0				
0.0		Loose, Tan, Fine SAND, trace silt, moist (SP)		4	5/5/5/5	10	
				5	4/2/3/2	5	
	10						
-5.0			12.0				
		Loose, Brown, Fine SAND, trace silt, moist (SP)		6	2/3/4/4	7	Groundwater was encountered at a depth of approximately 12.0 feet during drilling.
	15		15.0				
-10.0		Boring terminated at 15 feet.					
	20						
-15.0							
	25						
-20.0							
	30						
-25.0							
	35						
-30.0							
	40						
-35.0							
	45						
-40.0							
	50						
-45.0							

WATER LEVEL OBSERVATIONS	
Noted on Rods:	ft
On Completion:	15.8 ft

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SOIL BORING LOG: B-8

Project Number: 14G-393

Client:	Transystems Corporation	Boring Contractor:	Fishburne Drilling, Inc.
Project Name:	SOF Combat Skills Compound	Foreman:	E. Hester
Project Location:	Fort Story, Virginia	Boring Method:	Mud Rotary
Boring Location:	N 0.0000 E 200.0000 see Boring Location Plan	Inspector:	J. Seargeant
Total Depth 15.00 ft 4.57 m	Elev.: 6.9 ft 2.1 m Referenced Datum:	Completion Date:	December 15, 2008

Elev (ft)	Depth (ft)	DESCRIPTION OF MATERIALS	Stratum Depth(ft)	Sample Number	Sample Blows	N Value	REMARKS
5.0		Medium-Dense to Loose, Light Brown to Tan, Fine SAND, trace silt, moist (SP)		1	2/7/8/10	15	Sample blows reflect N60 correction for an automatic hammer.
				2	6/7/10/13	17	
	5			3	6/7/7/7	14	
0.0				4	4/4/4/3	8	
			8.0				
		Very Loose, Tan to Gray, Fine SAND, trace silt, moist to wet (SP)		5	2/2/1/2	3	
	10						
-5.0							Groundwater was encountered at a depth of approximately 12.0 feet during drilling.
				6	1/1/1/2	2	
			15.0				
	15	Boring terminated at 15 feet.					
-10.0							
	20						
-15.0							
	25						
-20.0							
	30						
-25.0							
	35						
-30.0							
	40						
-35.0							
	45						
-40.0							
	50						
-45.0							

WATER LEVEL OBSERVATIONS

Noted on Rods: ft

On Completion: 16.4 ft

NOTES FOR TEST BORING LOGS

KEY TO USCS TERMINOLOGY AND GRAPHIC SYMBOLS

MAJOR DIVISIONS (BASED UPON ASTM D2487-00)			SYMBOLS GRAPHIC	SYMBOLS LETTER
COARSE GRAINED SOILS	GRAVEL AND GRAVELY SOILS	CLEAN GRAVELS (LESS THAN 15% 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 15% PASSING THE NO. 200 SIEVE)		SW
				SP
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES (MORE THAN 15% PASSING THE NO. 200 SIEVE)		SM
				SC
FINE GRAINED SOILS	SILTS AND CLAYS	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
	LIQUID LIMIT LESS THAN 50	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	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
	LIQUID LIMIT GREATER THAN 50	SANDY OR GRAVELY SILT OR CLAY (>30% RETAINED THE NO. 200 SIEVE)		OH
HIGHLY ORGANIC SOILS				PT

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

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	
	PARTIALLY WEATHERED ROCK	LESS THAN 100/2" OR 50/1"	
	HIGHLY WEATHERED ROCK	50 TO 100/2" OR 50/1"	

COARSE GRAINED SOILS
(GRAVEL AND SAND)

DESIGNATION	BLOWS PER FOOT (BPF)
VERY LOOSE	0 - 4
LOOSE	4 - 10
MEDIUM DENSE	10 - 30
DENSE	30 - 50
VERY DENSE	>50

FINE GRAINED SOILS
(SILT AND CLAY)

CONSISTENCY	BPF
VERY SOFT	<2
SOFT	2 - 4
MEDIUM STIFF	4 - 8
STIFF	8 - 15
VERY STIFF	15 - 30
HARD	>30

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

SAMPLE TYPE

DESIGNATION	SYMBOL
SOIL SAMPLE	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.

APPENDIX C

SOIL LABORATORY TEST RESULTS

SUMMARY OF LABORATORY TEST DATA

SAMPLE NO.	SAMPLE DEPTH (ft)	NATURAL MOISTURE CONTENT %	LIQUID LIMIT %	PLASTIC LIMIT %	PLASTICITY INDEX %	PERCENT GRAVEL %	PERCENT SAND %	PERCENT FINES %	OPTIMUM MOISTURE (%)	MAXIMUM DRY DENSITY (PCF)	UNSOAKED CBR VALUE
B-2	3.0	4.6	NP	NP	NP	0.0	98.3	1.7			
	Tan POORLY GRADED SAND (SP) fine sand										
B-2	5.0	3.6	NP	NP	NP	0.0	99.8	0.2			
	Tan POORLY GRADED SAND (SP) fine sand										
B-2	7.0	4.0	NP	NP	NP	0.0	99.9	0.1			
	Tan POORLY GRADED SAND (SP) fine sand										
B-2	9.0	4.8	NP	NP	NP	0.0	99.8	0.2			
	Tan POORLY GRADED SAND (SP) fine sand										
B-2	14.0	25.4	NP	NP	NP	0.0	98.9	1.1			
	Tan POORLY GRADED SAND (SP) fine sand										
B-6	3.0	4.9									
	Tan										
B-6	5.0	4.4	NP	NP	NP	0.0	99.9	0.1			
	Tan POORLY GRADED SAND (SP) fine sand										
B-6	7.0	5.8	NP	NP	NP	0.0	99.9	0.1			
	Tan POORLY GRADED SAND (SP) fine sand										
B-6	9.0	5.2	NP	NP	NP	0.0	99.8	0.2			
	Tan POORLY GRADED SAND (SP) fine sand										
B-6	14.0	19.5									
	Tan										
CBR-1	1.5	4.0	NP	NP	NP	0.0	99.8	0.2	13.3	103.7	9.5
	Tan POORLY GRADED SAND (SP) fine sand										
CBR-2	1.5	6.5	NP	NP	NP	0.0	98.3	0.6	14.6	103.6	11.9
	Tan POORLY GRADED SAND (SP) fine sand										

CTI CONSULTANTS INC.

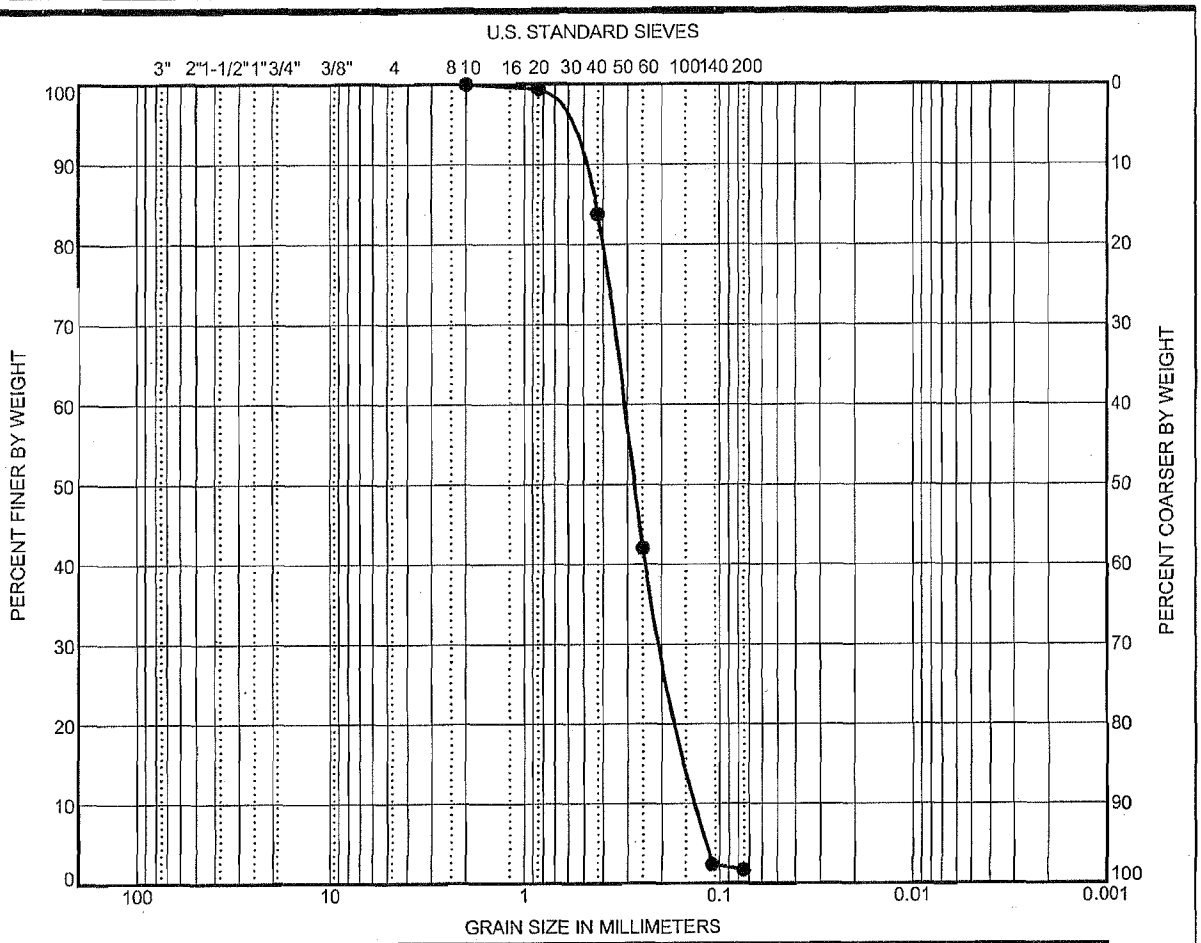
CLIENT NAME: Transystems Corporation

PROJECT NAME: SOF Combat Skills Compound

PROJECT LOCATION: Fort Story, Virginia

CTI PROJECT NO.: 14G-393

DATE: Jan 15, 09



COBBLES	0.0% GRAVEL		98.3% SAND			1.7% FINES	
	coarse	fine	coarse	medium	fine	% Silt	% Clay

Sieve Size	Percent Passing
3-in.	-
2-in.	-
1-1/2-in.	-
1-in.	-
3/4-in.	-
3/8-in.	-
No. 4 (4.75 mm)	-
No. 10 (2.00 mm)	100.0
No. 20 (0.85 mm)	99.4
No. 40 (0.425 mm)	83.8
No. 60 (0.25 mm)	42.1
No. 140 (0.106 mm)	2.3
No. 200 (0.075 mm)	1.7

Sample Description:

Tan POORLY GRADED SAND (SP) fine sand

Source: B2; S2

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PROJECT NO.: 14G-393

Date: Jan 5, 09 Figure 1

PARTICLE SIZE ANALYSIS

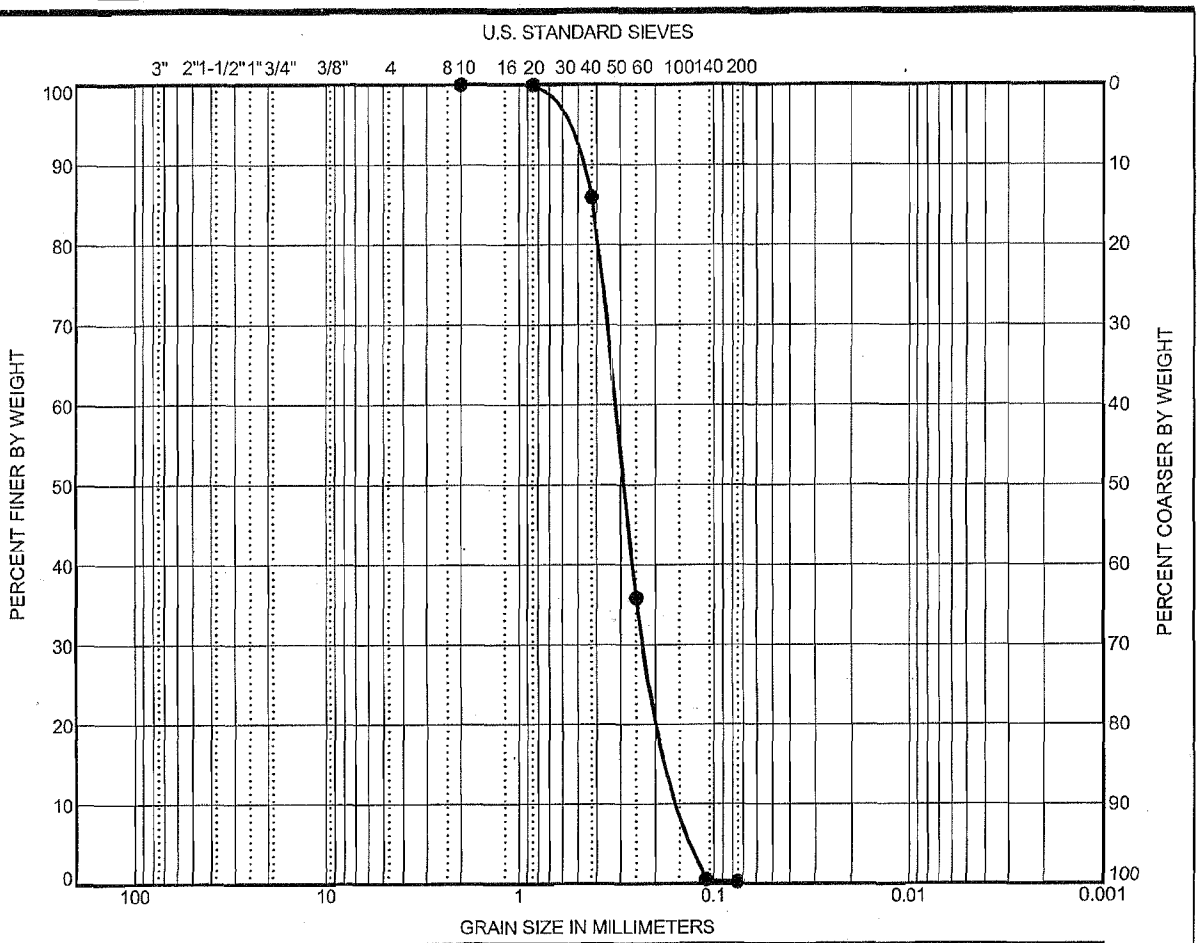
PROJECT: **SOF Combat Skills Compound**

Fort Story, Virginia

CLIENT: **Transystems Corporation**

SAMPLE ID: **B-2 @ 3 ft**

.CTI SIEVE SOILS 14G-393C.GPJ CTI.GDT 1/5/09



COBBLES	0.0% GRAVEL		99.8% SAND			0.2% FINES	
	coarse	fine	coarse	medium	fine	% Silt	% Clay

Sieve Size	Percent Passing
3-in.	-
2-in.	-
1-1/2-in.	-
1-in.	-
3/4-in.	-
3/8-in.	-
No. 4 (4.75 mm)	-
No. 10 (2.00 mm)	100.0
No. 20 (0.85 mm)	100.0
No. 40 (0.425 mm)	86.0
No. 60 (0.25 mm)	35.9
No. 140 (0.106 mm)	0.5
No. 200 (0.075 mm)	0.2

Sample Description:

Tan POORLY GRADED SAND (SP) fine sand

Source: B2; S3

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PROJECT NO.: 14G-393

Date: Jan 5, 09 Figure 2

PARTICLE SIZE ANALYSIS

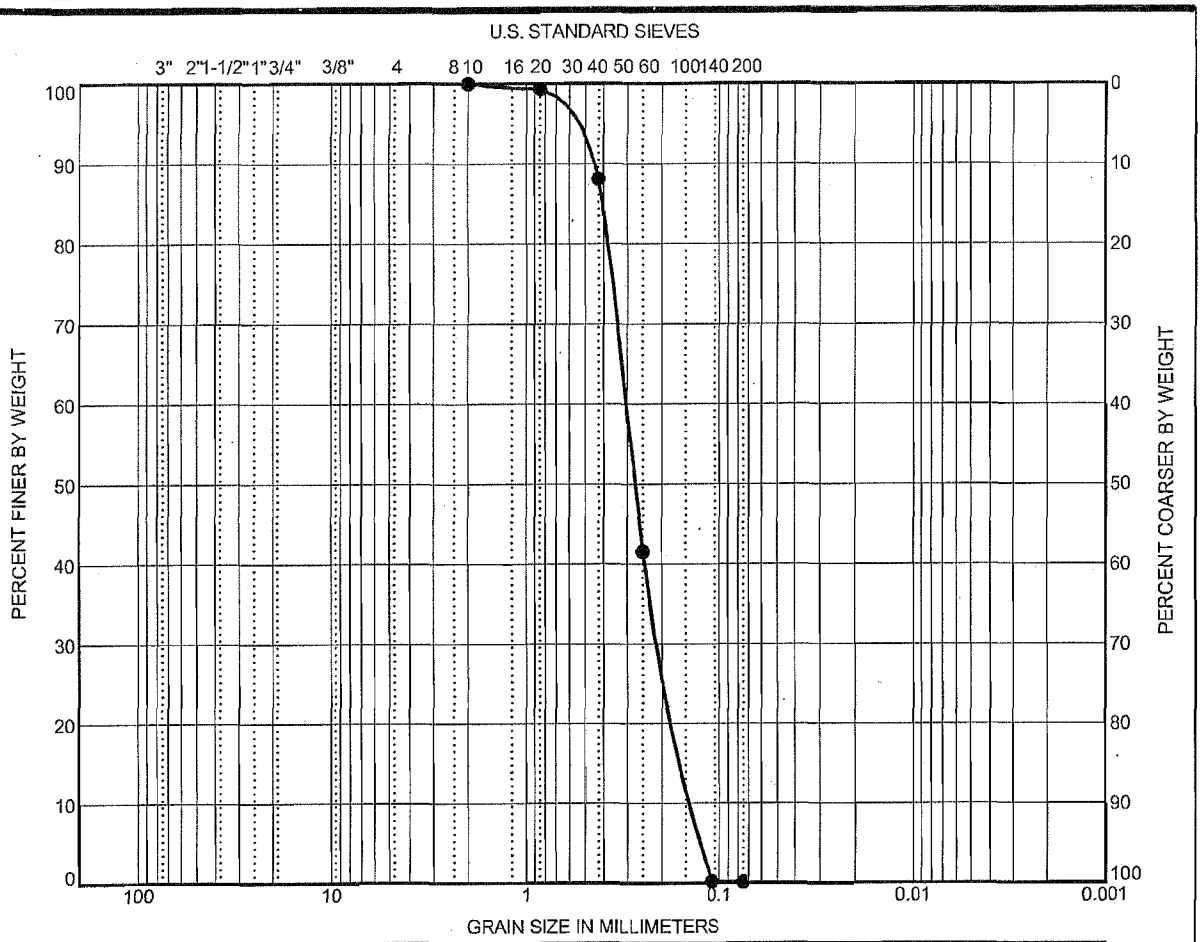
PROJECT: **SOF Combat Skills Compound**

Fort Story, Virginia

CLIENT: **Transystems Corporation**

SAMPLE ID: **B-2 @ 5 ft**

CTI SIEVE SOILS 14G-393C.GPJ CTI.GDT 1/5/09



COBBLES	0.0% GRAVEL		99.9% SAND			0.1% FINES	
	coarse	fine	coarse	medium	fine	% Silt	% Clay

Sieve Size	Percent Passing
3-in.	-
2-in.	-
1-1/2-in.	-
1-in.	-
3/4-in.	-
3/8-in.	-
No. 4 (4.75 mm)	-
No. 10 (2.00 mm)	100.0
No. 20 (0.85 mm)	99.3
No. 40 (0.425 mm)	88.1
No. 60 (0.25 mm)	41.6
No. 140 (0.106 mm)	0.2
No. 200 (0.075 mm)	0.1

Sample Description:

Tan POORLY GRADED SAND (SP) fine sand

Source: B2; S4

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PROJECT NO.: 14G-393

Date: Jan 5, 09 Figure 3

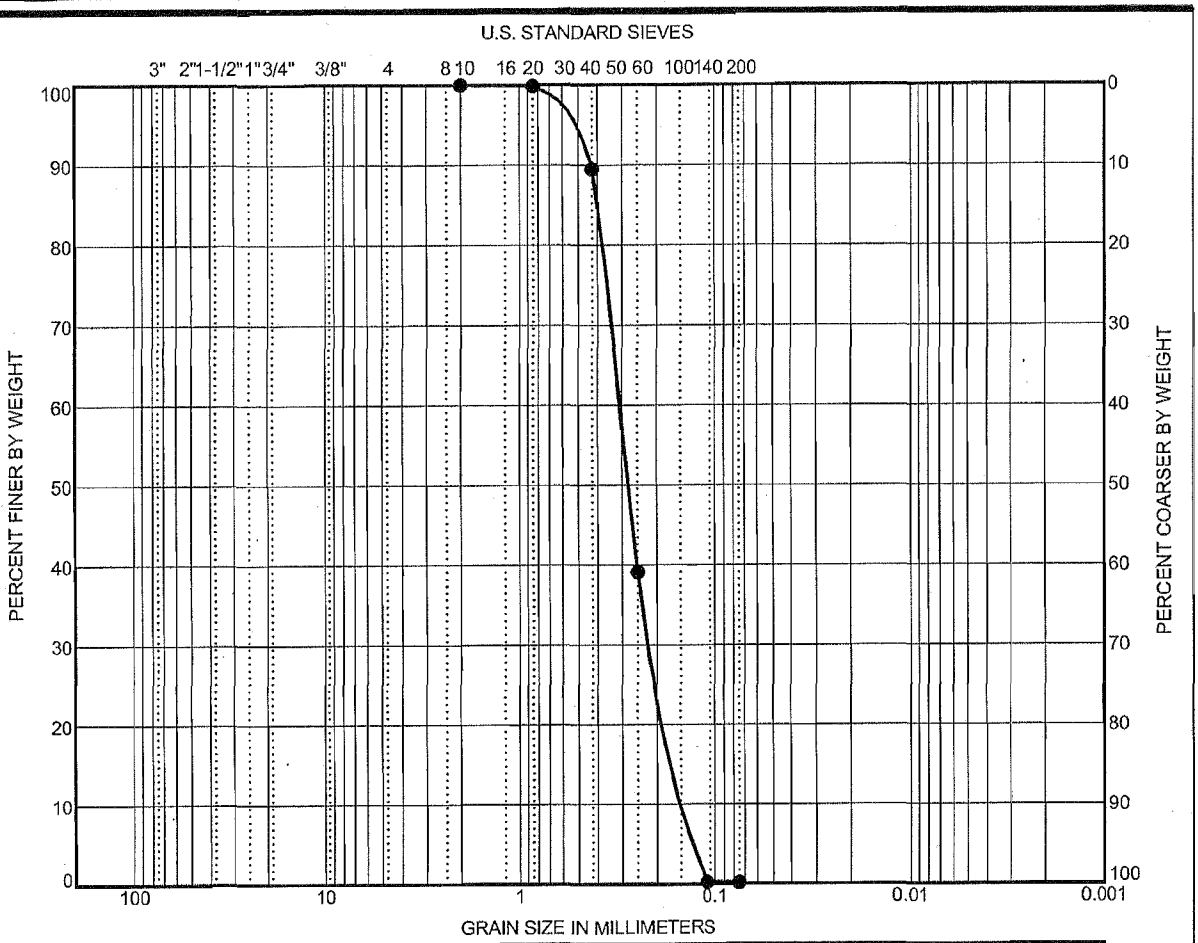
PARTICLE SIZE ANALYSIS

PROJECT: **SOF Combat Skills Compound**

Fort Story, Virginia

CLIENT: **Transystems Corporation**

SAMPLE ID: **B-2 @ 7 ft**



COBBLES	0.0% GRAVEL		99.8% SAND			0.2% FINES	
	coarse	fine	coarse	medium	fine	% Silt	% Clay

Sieve Size	Percent Passing
3-in.	-
2-in.	-
1-1/2-in.	-
1-in.	-
3/4-in.	-
3/8-in.	-
No. 4 (4.75 mm)	-
No. 10 (2.00 mm)	100.0
No. 20 (0.85 mm)	99.9
No. 40 (0.425 mm)	89.5
No. 60 (0.25 mm)	39.1
No. 140 (0.106 mm)	0.2
No. 200 (0.075 mm)	0.2

Sample Description:

Tan POORLY GRADED SAND (SP) fine sand

Source: B2; S5

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PROJECT NO.: 14G-393

Date: Jan 5, 09 Figure 4

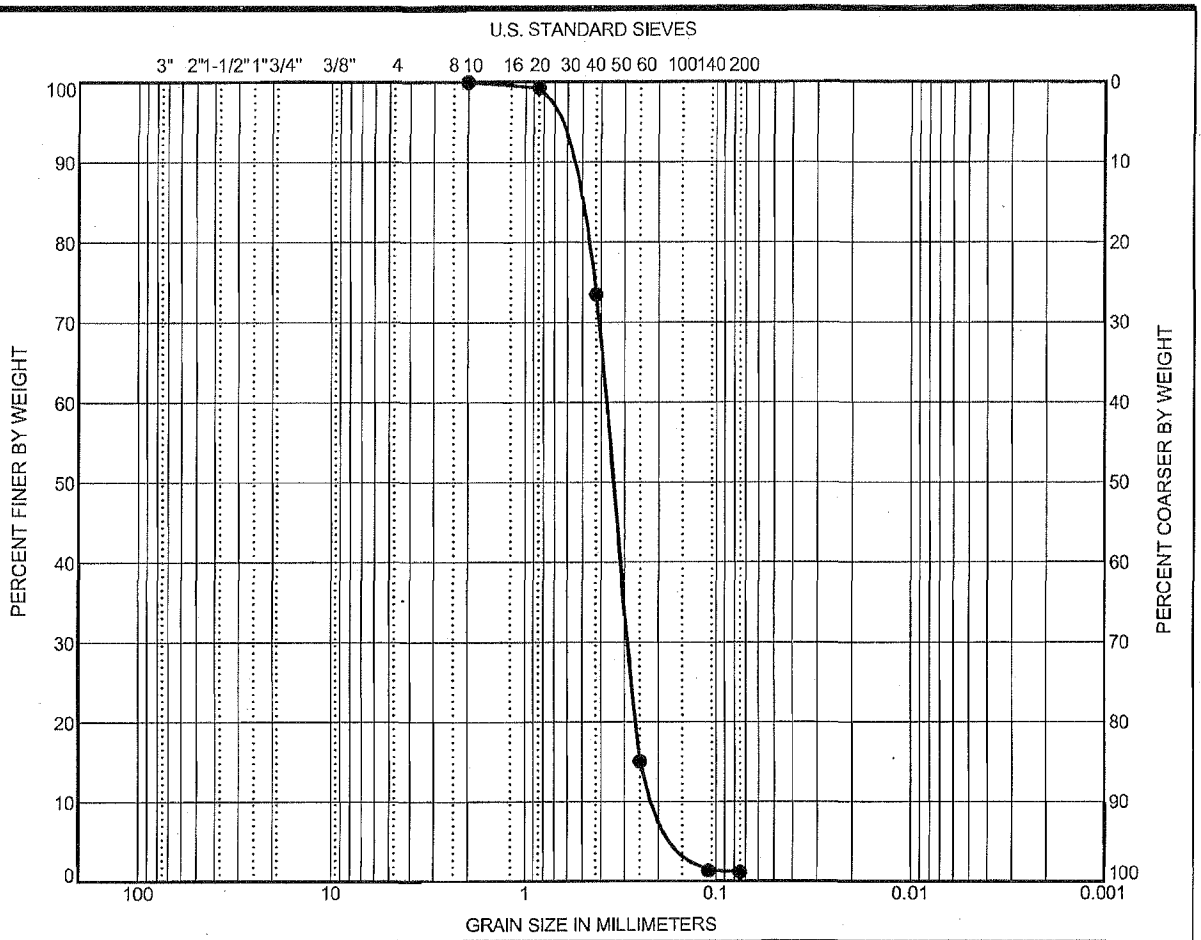
PARTICLE SIZE ANALYSIS

PROJECT: **SOF Combat Skills Compound**

Fort Story, Virginia

CLIENT: **Transystems Corporation**

SAMPLE ID: **B-2 @ 9 ft**



COBBLES	0.0% GRAVEL		98.9% SAND			1.1% FINES	
	coarse	fine	coarse	medium	fine	% Silt	% Clay

Sieve Size	Percent Passing
3-in.	-
2-in.	-
1-1/2-in.	-
1-in.	-
3/4-in.	-
3/8-in.	-
No. 4 (4.75 mm)	-
No. 10 (2.00 mm)	100.0
No. 20 (0.85 mm)	99.3
No. 40 (0.425 mm)	73.5
No. 60 (0.25 mm)	15.1
No. 140 (0.106 mm)	1.3
No. 200 (0.075 mm)	1.1

Sample Description:

Tan POORLY GRADED SAND (SP) fine sand

Source: B2; S6

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PROJECT NO.: 14G-393

Date: Jan 5, 09 Figure 5

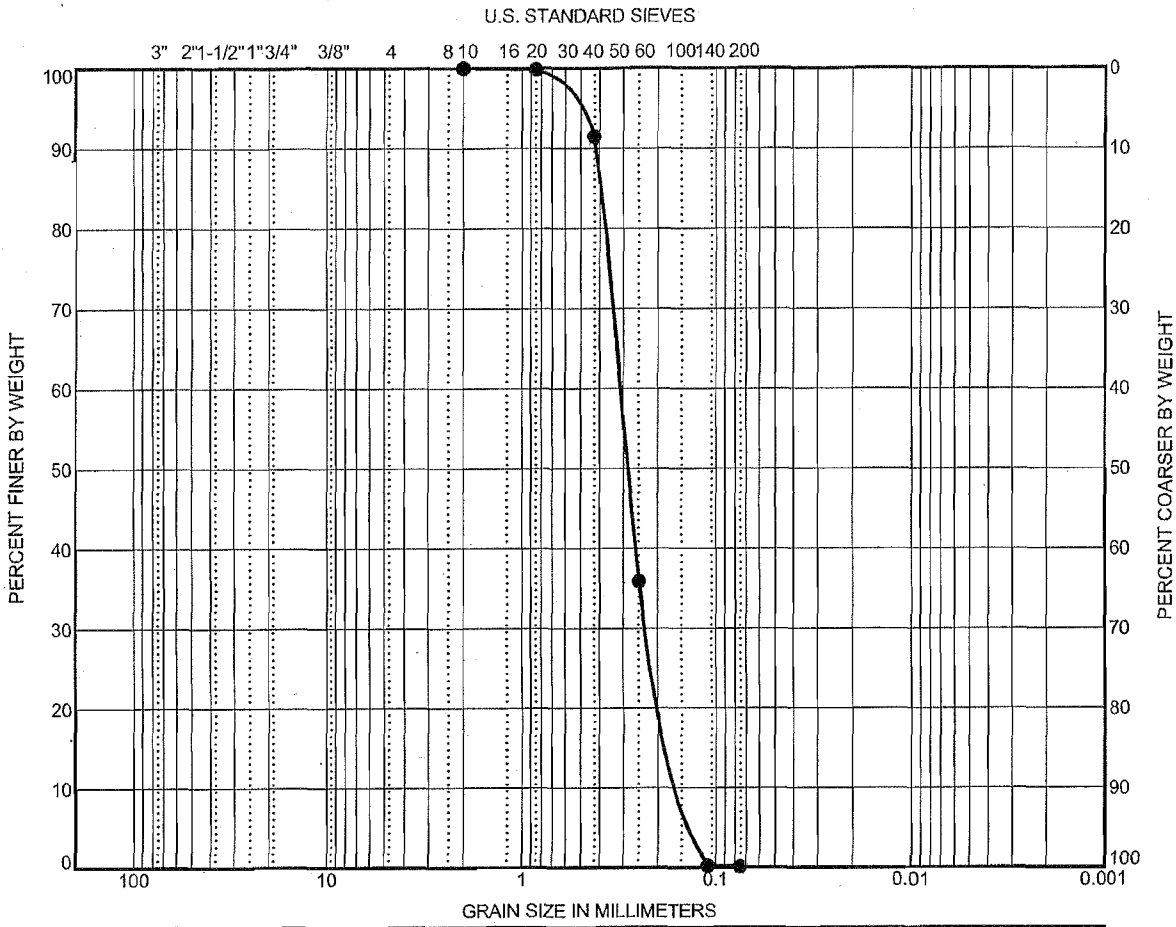
PARTICLE SIZE ANALYSIS

PROJECT: **SOF Combat Skills Compound**

Fort Story, Virginia

CLIENT: **Transystems Corporation**

SAMPLE ID: **B-2 @ 14 ft**



COBBLES	0.0% GRAVEL		99.9% SAND			0.1% FINES	
	coarse	fine	coarse	medium	fine	% Silt	% Clay

Sieve Size	Percent Passing
3-in.	-
2-in.	-
1-1/2-in.	-
1-in.	-
3/4-in.	-
3/8-in.	-
No. 4 (4.75 mm)	-
No. 10 (2.00 mm)	100.0
No. 20 (0.85 mm)	99.9
No. 40 (0.425 mm)	91.5
No. 60 (0.25 mm)	35.9
No. 140 (0.106 mm)	0.2
No. 200 (0.075 mm)	0.1

Sample Description:

Tan POORLY GRADED SAND (SP) fine sand

Source: B6; S3

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PROJECT NO.: 14G-393

Date: Jan 5, 09 Figure 6

PARTICLE SIZE ANALYSIS

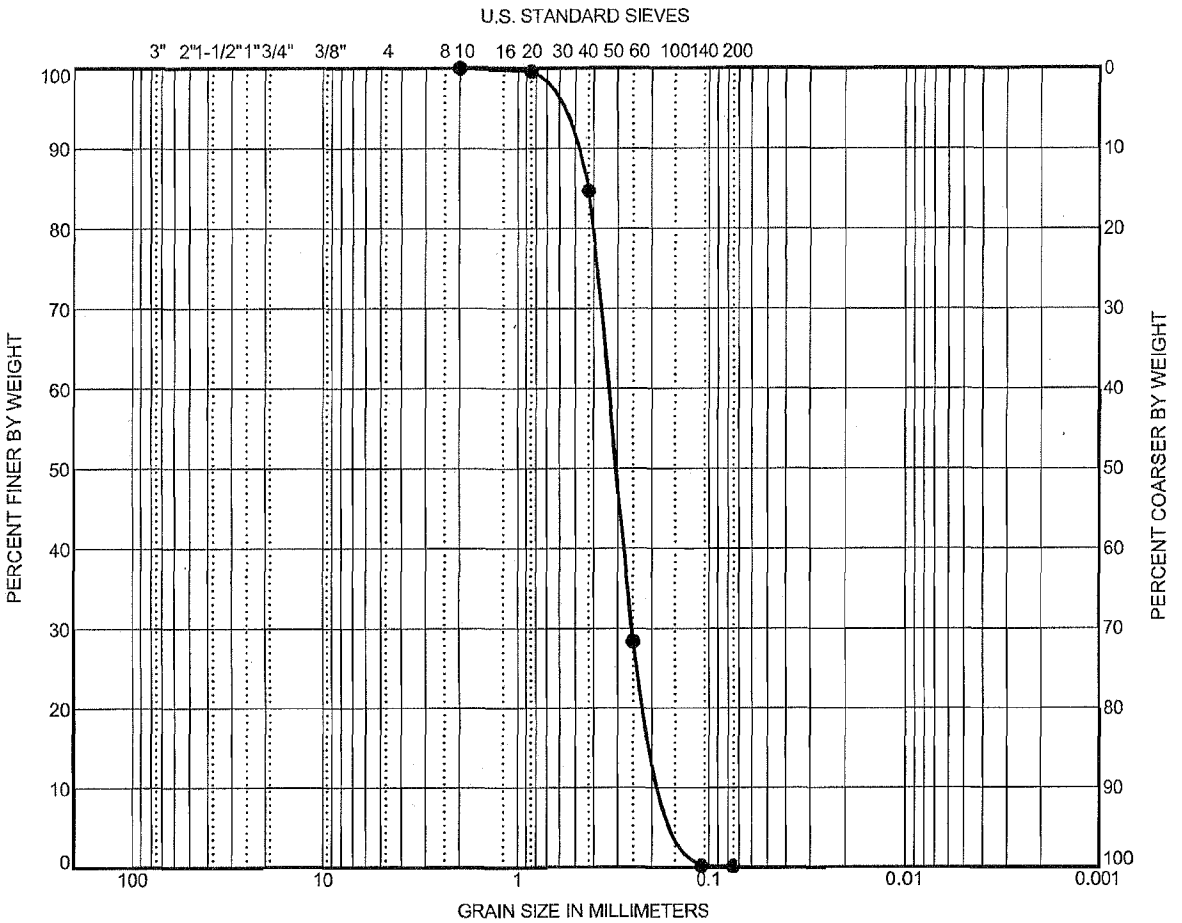
PROJECT: **SOF Combat Skills Compound**

Fort Story, Virginia

CLIENT: **Transystems Corporation**

SAMPLE ID: **B-6 @ 5 ft**

CTI SIEVE SOILS 14G-393C.GPJ CTI.GDT 1/5/09



COBBLES	0.0% GRAVEL		99.9% SAND			0.1% FINES	
	coarse	fine	coarse	medium	fine	% Silt	% Clay

Sieve Size	Percent Passing
3-in.	-
2-in.	-
1-1/2-in.	-
1-in.	-
3/4-in.	-
3/8-in.	-
No. 4 (4.75 mm)	-
No. 10 (2.00 mm)	100.0
No. 20 (0.85 mm)	99.6
No. 40 (0.425 mm)	84.7
No. 60 (0.25 mm)	28.4
No. 140 (0.106 mm)	0.2
No. 200 (0.075 mm)	0.1

Sample Description:

Tan POORLY GRADED SAND (SP) fine sand

Source: B6; S4

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PROJECT NO.: 14G-393

Date: Jan 5, 09 Figure 7

PARTICLE SIZE ANALYSIS

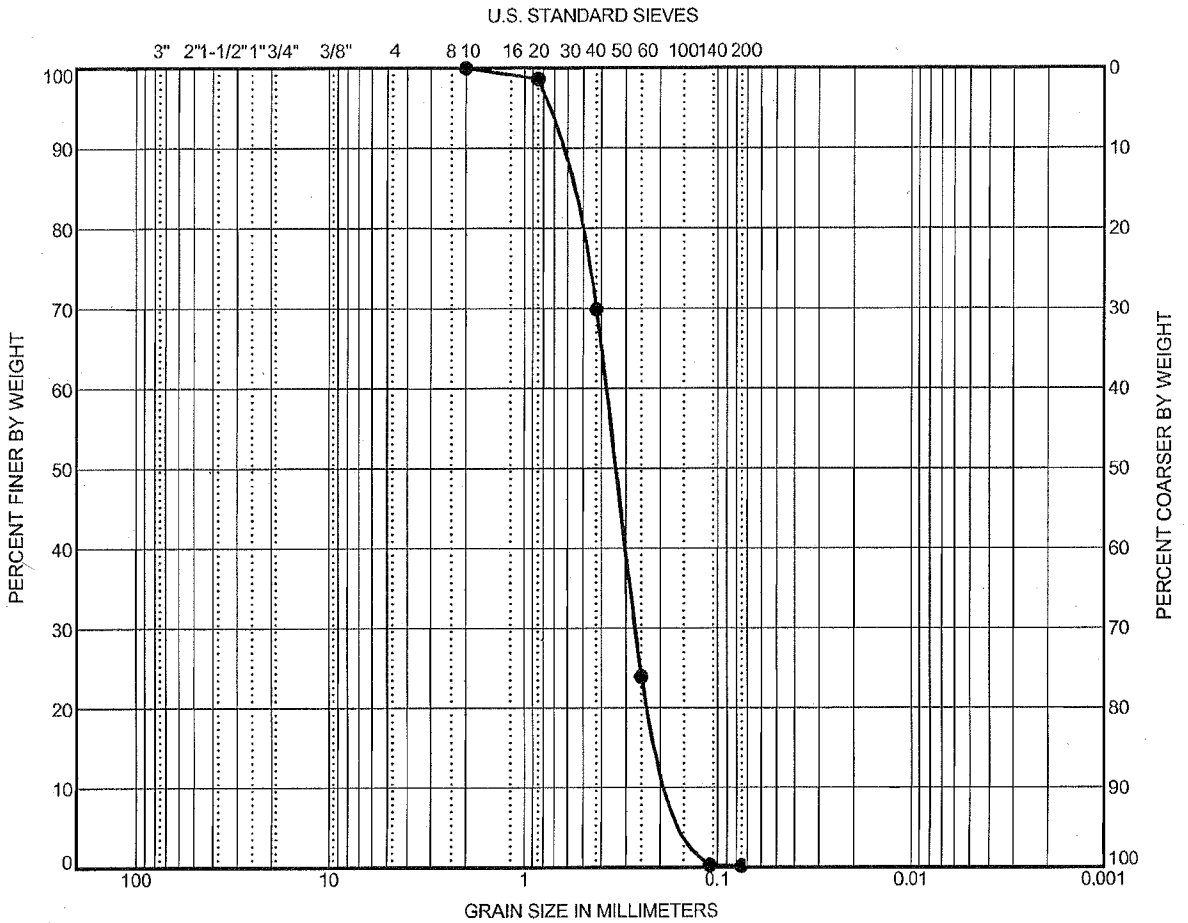
PROJECT: **SOF Combat Skills Compound**

Fort Story, Virginia

CLIENT: **Transystems Corporation**

SAMPLE ID: **B-6 @ 7 ft**

CTI SIEVE SOILS 14G-393C.GPJ CTI.GDT 1/5/09



COBBLES	0.0% GRAVEL		99.8% SAND			0.2% FINES	
	coarse	fine	coarse	medium	fine	% Silt	% Clay

Sieve Size	Percent Passing
3-in.	-
2-in.	-
1-1/2-in.	-
1-in.	-
3/4-in.	-
3/8-in.	-
No. 4 (4.75 mm)	-
No. 10 (2.00 mm)	100.0
No. 20 (0.85 mm)	98.6
No. 40 (0.425 mm)	69.9
No. 60 (0.25 mm)	24.0
No. 140 (0.106 mm)	0.2
No. 200 (0.075 mm)	0.2

Sample Description:

Tan POORLY GRADED SAND (SP) fine sand

Source: B6; S5

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PROJECT NO.: 14G-393

Date: Jan 5, 09 Figure 8

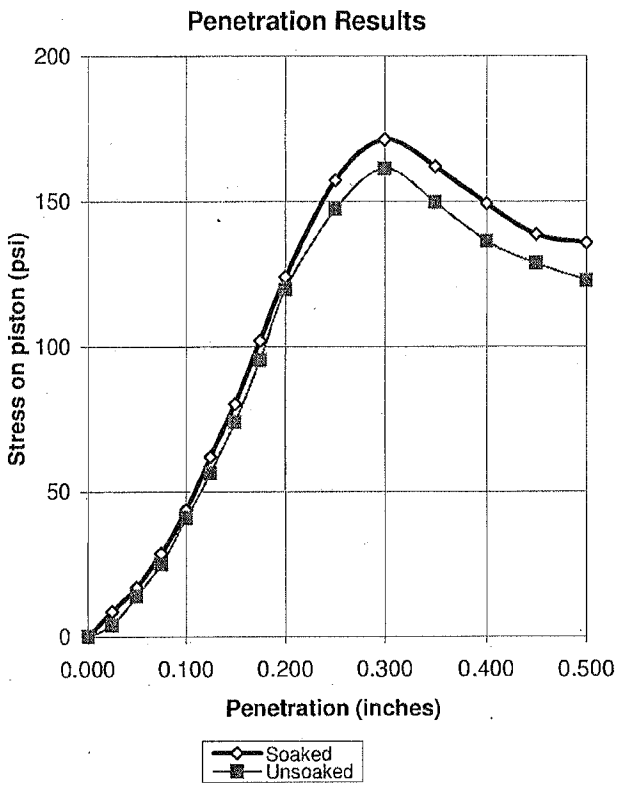
PARTICLE SIZE ANALYSIS

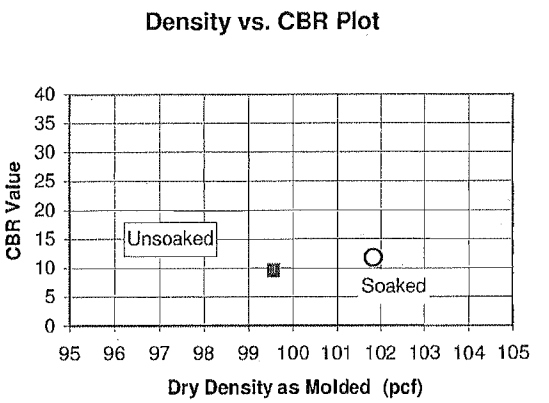
PROJECT: **SOF Combat Skills Compound**

Fort Story, Virginia

CLIENT: **Transystems Corporation**

SAMPLE ID: **B-6 @ 9 ft**





Point Data:	Soaked	Unsoaked
Hammer used	5.5-lb	5.5-lb
No. Layers	3	3
Blows per layer	56	56
Surcharge, lbs	10	10
Molded Dry Density, pcf	98.8	99.6
Percent Moisture	13.2%	13.5%
Percent Compaction	95.3%	96.0%

Classification and Proctor Data	
based on ASTM D 698 (Standard Proctor)	
Maximum Dry Density (pcf)	103.7
Optimum Moisture (%)	13.3%
Natural Moisture	4.0%
Percent Retained on 3/4 inch sieve	0.0%
Percent finer than #200 sieve	0.2%
Liquid Limit	N/A
Plastic Limit	N/A
USCS	SP
AASHTO	N/A

CBR at 0.1 inch	**11.8**	**9.5**
CBR at 0.2 inch	12.4	10.7

Soaked Dry Density	101.8	N/A
Percent Moisture	17.3%	13.6%
Percent Swell	-1.09%	N/A

Specimen ID: **CBR-1 (1.5')**

Source: Between B-6 & B-7

Soil Description: Tan POORLY GRADED SAND (SP) fine sand

Remarks: _____

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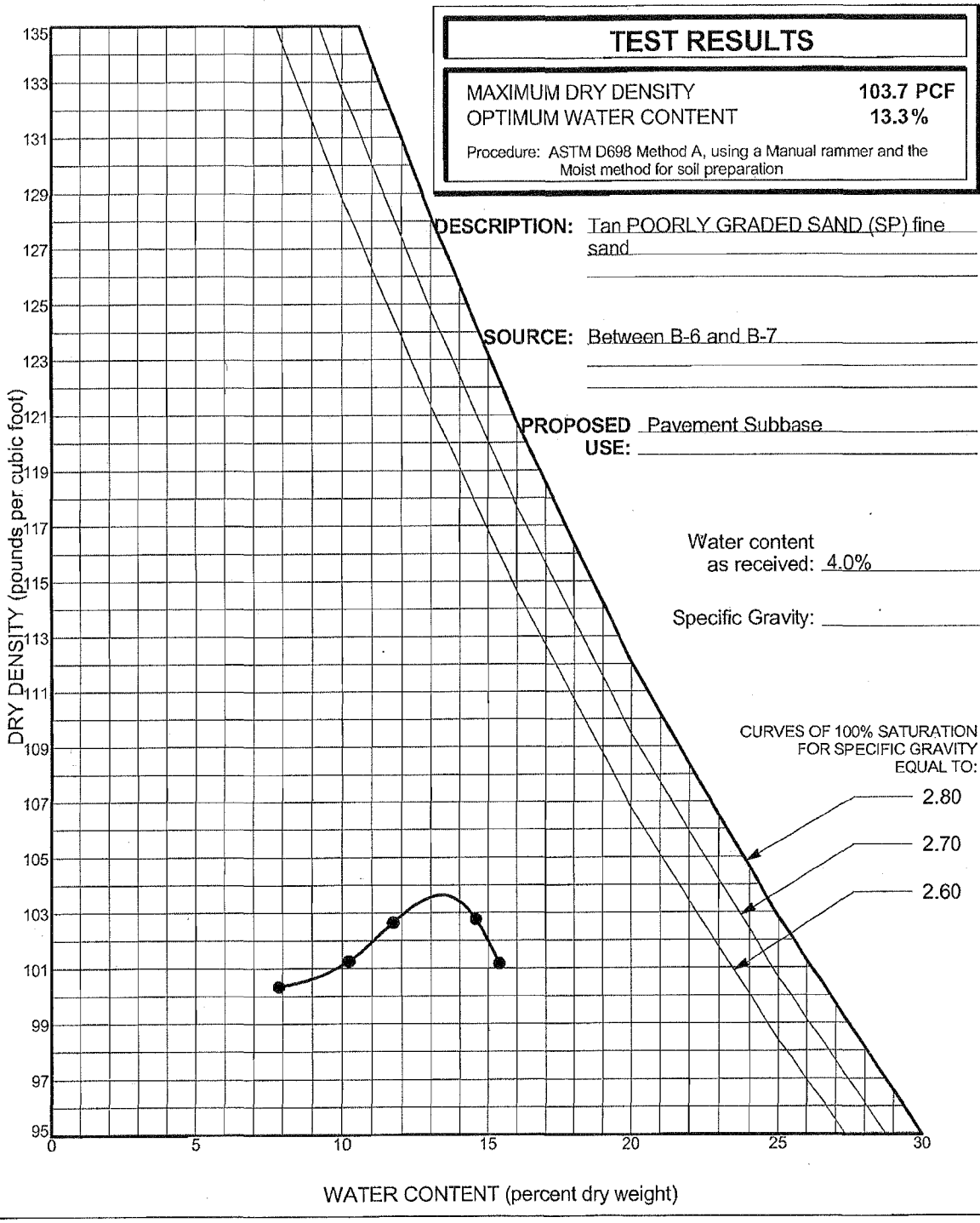
CALIFORNIA BEARING RATIO
(ASTM D 1883)

SOF Combat Skills Compound
Fort Story, Virginia
CTI Project: 14G-393



TEST RESULTS

MAXIMUM DRY DENSITY	**103.7 PCF**
OPTIMUM WATER CONTENT	**13.3%**

Procedure: ASTM D698 Method A, using a Manual rammer and the Moist method for soil preparation

DESCRIPTION: Tan POORLY GRADED SAND (SP) fine sand

SOURCE: Between B-6 and B-7

PROPOSED USE: Pavement Subbase

Water content as received: 4.0%

Specific Gravity:

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PROJECT NO.: 14G-393

Date: Jan 5, 09 Figure 1

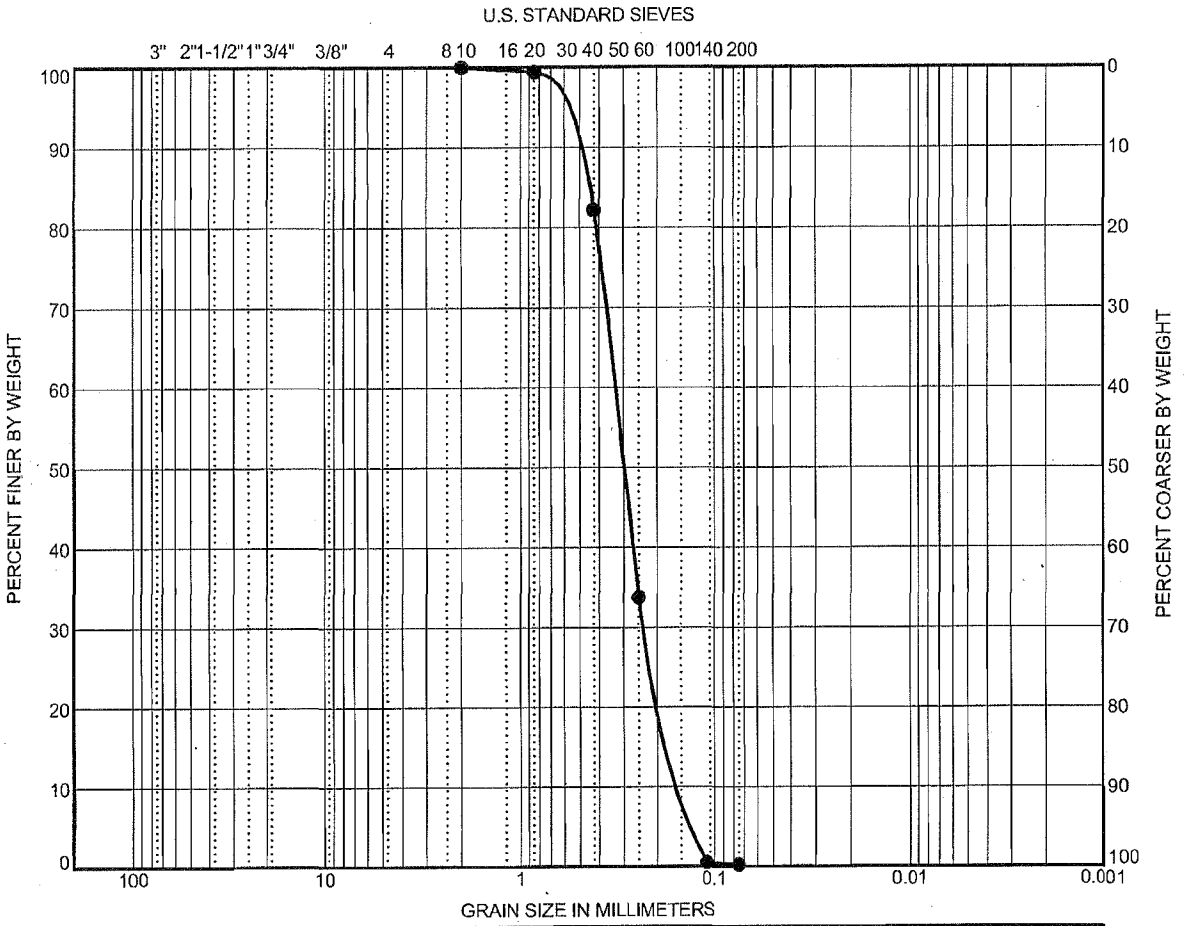
MOISTURE-DENSITY RELATIONSHIP

PROJECT: **SOF Combat Skills Compound**
Fort Story, Virginia

CLIENT: **Transystems Corporation**

SAMPLE ID: **CBR-1**

CTI PROCTOR NEW 14G-393C.GPJ CTI.GDT 1/5/09



COBBLES	0.0% GRAVEL		99.8% SAND			0.2% FINES	
	coarse	fine	coarse	medium	fine	% Silt	% Clay

Sieve Size	Percent Passing
3-in.	-
2-in.	-
1-1/2-in.	-
1-in.	-
3/4-in.	-
3/8-in.	-
No. 4 (4.75 mm)	-
No. 10 (2.00 mm)	100.0
No. 20 (0.85 mm)	99.4
No. 40 (0.425 mm)	82.2
No. 60 (0.25 mm)	33.8
No. 140 (0.106 mm)	0.5
No. 200 (0.075 mm)	0.2

Sample Description:

Tan POORLY GRADED SAND (SP) fine sand

Source: Between B-6 and B-7

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PROJECT NO.: 14G-393

Date: Jan 5, 09 Figure 9

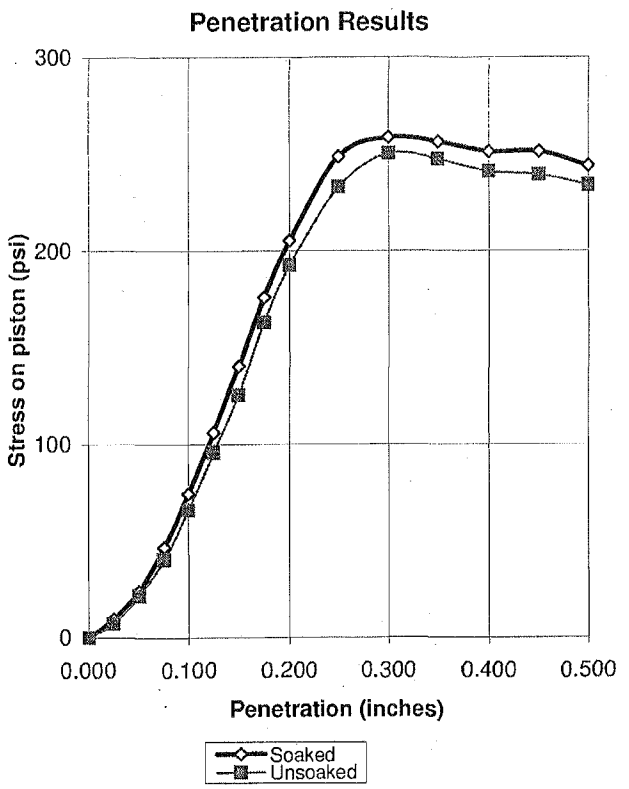
PARTICLE SIZE ANALYSIS

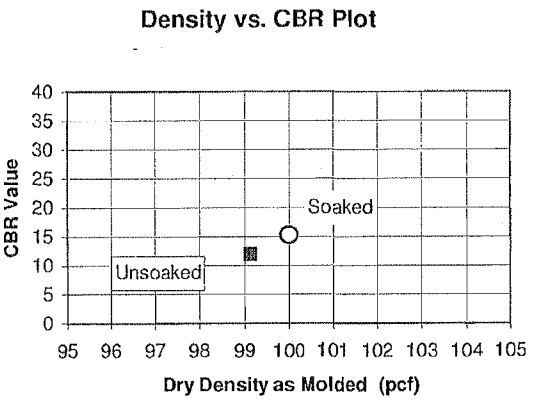
PROJECT: **SOF Combat Skills Compound**

Fort Story, Virginia

CLIENT: **Transystems Corporation**

SAMPLE ID: **CBR-1 @ 1.5 ft**





Point Data:	Soaked	Unsoaked
Hammer used	5.5-lb	5.5-lb
No. Layers	3	3
Blows per layer	56	56
Surcharge, lbs	10	10
Molded Dry Density, pcf	98.9	99.1
Percent Moisture	14.0%	14.1%
Percent Compaction	95.3%	95.6%

Classification and Proctor Data	
based on ASTM D 698 (Standard Proctor)	
Maximum Dry Density (pcf)	103.7
Optimum Moisture (%)	13.8%
Natural Moisture	6.5%
Percent Retained on 3/4 inch sieve	0.0%
Percent finer than #200 sieve	0.6%
Liquid Limit	N/A
Plastic Limit	N/A
USCS	SP
AASHTO	N/A

CBR at 0.1 inch	**15.3**	**11.9**
CBR at 0.2 inch	17.1	16.4

Soaked Dry Density	100.0	N/A
Percent Moisture	17.3%	14.3%
Percent Swell	-0.55%	N/A

Specimen ID: **CBR-2 (1.5')**

Source: B-8

Soil Description: Tan POORLY GRADED SAND (SP) fine sand

Remarks: _____

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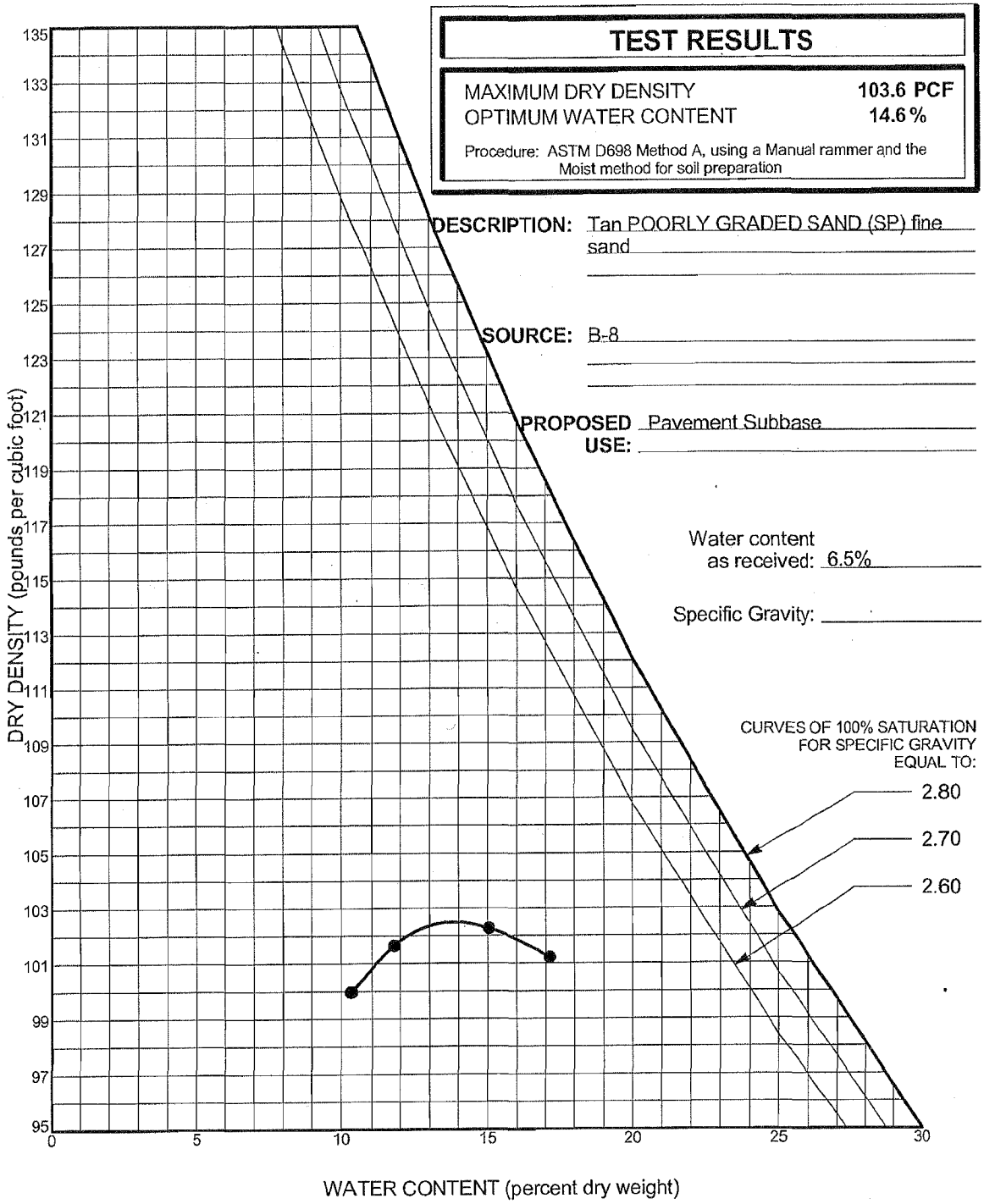
CALIFORNIA BEARING RATIO
(ASTM D 1883)

SOF Combat Skills Compound
Fort Story, Virginia
CTI Project: 14G-393



TEST RESULTS

MAXIMUM DRY DENSITY	**103.6 PCF**
OPTIMUM WATER CONTENT	**14.6 %**

Procedure: ASTM D698 Method A, using a Manual rammer and the Moist method for soil preparation

DESCRIPTION: Tan POORLY GRADED SAND (SP) fine sand

SOURCE: B-8

PROPOSED USE: Pavement Subbase

Water content as received: 6.5%

Specific Gravity:

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PROJECT NO.: 14G-393

Date: Jan 5, 09

Figure 2

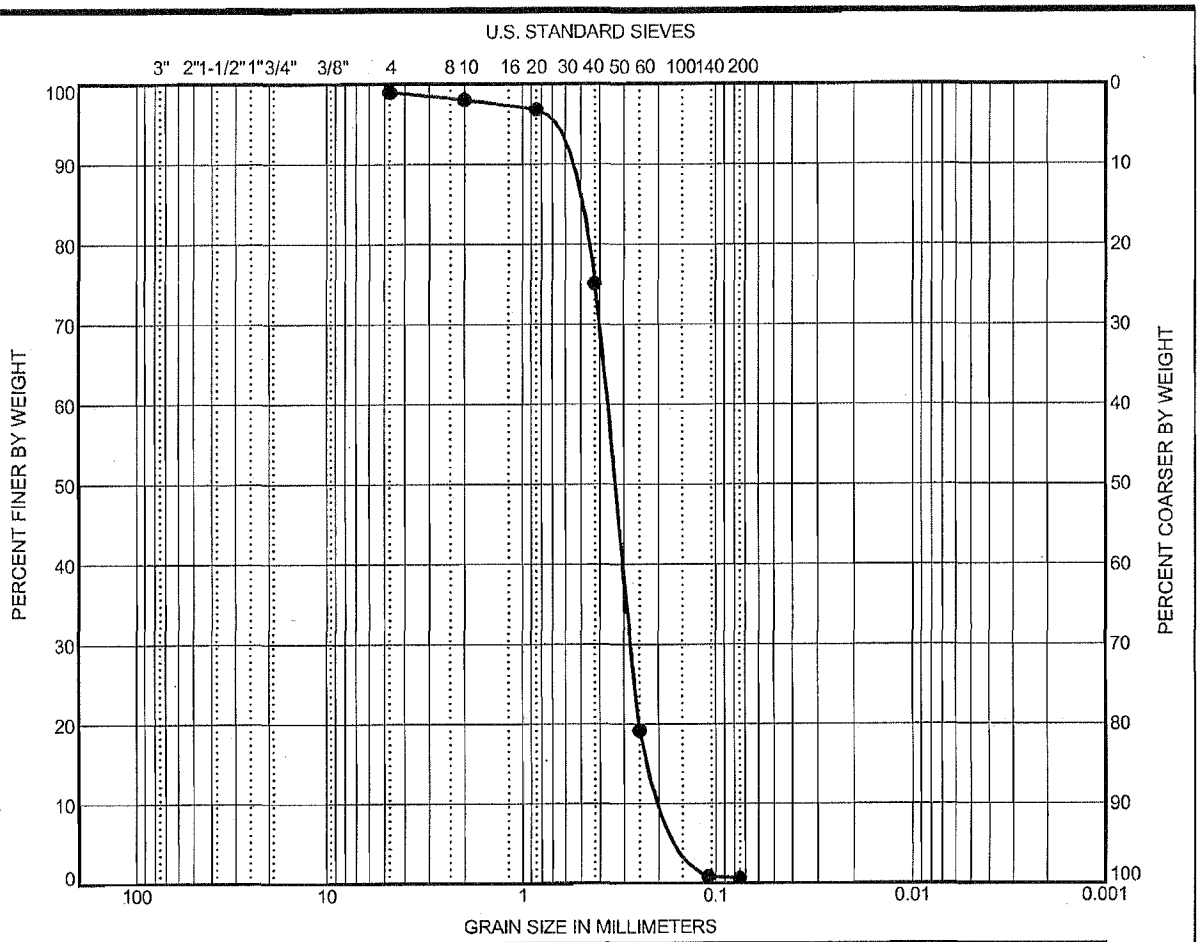
MOISTURE-DENSITY RELATIONSHIP

PROJECT: **SOF Combat Skills Compound**
Fort Story, Virginia

CLIENT: **Transystems Corporation**

SAMPLE ID: **CBR-2**

CTI PROCTOR NEW 14G-393C.GPJ CTI.GDT 1/5/09



COBBLES	0.0% GRAVEL		98.3% SAND			0.6% FINES	
	coarse	fine	coarse	medium	fine	% Silt	% Clay

Sieve Size	Percent Passing
3-in.	-
2-in.	-
1-1/2-in.	-
1-in.	-
3/4-in.	-
3/8-in.	-
No. 4 (4.75 mm)	99.0
No. 10 (2.00 mm)	98.0
No. 20 (0.85 mm)	96.8
No. 40 (0.425 mm)	75.2
No. 60 (0.25 mm)	19.2
No. 140 (0.106 mm)	0.8
No. 200 (0.075 mm)	0.6

Sample Description:

Tan POORLY GRADED SAND (SP) fine sand

Source: B-8

CTI CONSULTANTS INC.
953 Norfolk Square (757) 461-0826
Norfolk, Virginia 23502 Fax (757) 461-1436

PROJECT NO.: 14G-393

Date: Jan 5, 09 Figure 10

PARTICLE SIZE ANALYSIS

PROJECT: **SOF Combat Skills Compound**

Fort Story, Virginia

CLIENT: **Transystems Corporation**

SAMPLE ID: **CBR-2 @ 1.5 ft**