E-PROJECTS Work Order Number: 1168092

Appropriation: MCON

PART SIX ATTACHMENTS

Design-Build RFP for the

SIMULATOR CENTER and RANGE CONTROL BUILDING

at

Marine Corps Base Camp Lejeune
North Carolina

FY'16 MCON PROJECT P-1346

PREPARED BY:

HBA Architecture and Interior Design
and
Hankins and Anderson Architects and Engineers,
A Joint Venture
One Columbus Center, Suite 1000
Virginia Beach, VA 23462
(A/E Contract N40082-10-D-5301, Task Order 0025)

REQUEST FOR PROPOSAL PREPARED BY:

Architectural:	Thomas Ellis, AIA	Surveying:	Avolis Engineering
Interior:	Maxine Baer, NCIDQ	Mechanical:	Scott O'Connell, P.E.
Civil:	John Moore, P.E.	Electrical:	Mike Lally, LEED AP BD+C
Structural:	Dennis Claytor, P.E.	Plumbing:	Michael Pearce, CPD
Geotechnical:	Charles Crawley, P.E.	Fire Protection:	Justin Wheeler, P.E.

Telecommunications: Kenny Shultz, P.E.,RCDD,CTS

Final Submission
20 November 2015

REQUEST FOR PROPOSAL APPROVED BY:

Submitted by: Joseph Bovee, AIA
For Commander, NAVFAC MID-ATLANTIC:
Date: November 20, 2015

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REPORT OF PRELIMINARY GEOTECHNICAL EXPLORATION

P-1346 Simulator Center and Range Control Building Marine Corps Base Camp Lejeune, NC

A/E Contract N40085-10-D-5301-0025-02
GER Project No. 110-6170

prepared for
HBA-H&A Joint Venture
Virginia Beach, Virginia

April 10, 2013
Revised March 6, 2015

GER Consulting Engineers
GeoEnvironmental Resources, Inc.
Environmental • Groundwater • Hazardous Materials • Geotechnical • Industrial Hygiene

2712 Southern Boulevard, Suite 101
Virginia Beach, Virginia 23452
757-463-3200 Fax 757-463-3080 www.geronline.com

GeoEnvironmental Resources, Inc.
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April 10, 2013
Revised March 6, 2015

HBA-H&A Joint Venture

c/o HBA Architecture & Interior Design, Inc.
One Columbus Center, Suite 1000
Virginia Beach, Virginia 23462

Attention: **Mr. Macklin Smith, AIA**

Subject: **Report of Preliminary Geotechnical Exploration**
P-1346 Simulator Center and Range Control Building
Marine Corps Base, Camp Lejeune, North Carolina
A/E Contract No. N40085-10-D-5301, CTO 0025, Mod 02
HBA-H&A JV Project No. 09049.22A
GER Project No. 110-6170

Geo**E**nvironmental **R**esources, Inc. is pleased to present this report of preliminary geotechnical exploration for the above referenced project. Our services were performed in accordance with our proposal P12-110-5622 dated November 7, 2012 and authorized by Mr. Joseph Bovee of HBA on January 24, 2013.

We appreciate the opportunity to serve as your geotechnical consultant on this project and trust that you will contact us at your convenience with any questions concerning this report or the project in general.

Sincerely,
Geo**E**nvironmental **R**esources, Inc.

Charles F. P. Crawley, III, P.E.
Assistant Vice President

NORTH CAROLINA PROFESSIONAL SEAL 028246 ENGINEER CHARLES F. P. CRAWLEY, III

EXECUTIVE SUMMARY

The subsurface conditions for the anticipated structure locations at the project site were explored by 7 standard penetration test (SPT) soil borings performed to depths of 30 to 60 feet below the ground surface and by one piezocone penetration test (CPTu) sounding performed to refusal at a depth of 69 feet below the ground surface. Down hole shear wave velocity measurements were obtained at the CPTu test location. Eight SPT soil borings to a depth of 10 to 15 feet were conducted for prospective BMP and pavement areas. The exploration also included 2 temporary water observation piezometers, performing 4 field infiltration tests and collecting 4 bulk samples. Laboratory testing included natural moisture content, grain size, plasticity, pH, CBR, standard Proctor and chemical analyses on selected samples.

The subsurface conditions encountered in the soil borings and sounding were composed manmade and native deposits in 3 general stratigraphic layers. These layers included:

- Stratum A - Uncontrolled fill at 6 test locations to depths of about 1 to $8^1/_2$ feet below grade
- Stratum 1 - Very loose to dense, clayey, silty to relatively clean sand to depths of about 47 to more than 60 feet below grade
- Stratum 2 - Firm to very dense sand with shells to the termination depths at 4 test locations

The static groundwater table was encountered in the soil borings and sounding at depths ranging from about 9 to 15 feet below the ground surface during the exploration. Seasonal high groundwater levels at the site were determined at depths of about 4 to 6 feet below the ground surface. Seasonal perched water table conditions may possibly be encountered at or near the existing ground surface.

Based on initial assessment of the preliminary subsurface data collected and anticipated structural reactions, we expect shallow foundation and grade slab systems are feasible for supporting the proposed buildings. However, ground improvement is expected to be necessary at parts of the site for settlement control. The preliminary bearing pressure for foundation design is 2,000 psf. A mat foundation sized for a bearing pressure of 2,000 to 3,000 psf can be considered for supporting the communications tower.

The northern portion of the project site is the former location of the Marine Corps Brig. The Stratum A uncontrolled fill layer was encountered in this area. To mitigate potential foundation settlement in fill areas, we expect it will be necessary to improve the site using techniques such as (a) over excavation and replacement with structural fill, (b) dynamic compaction to densify the existing materials in-situ, or (c) supporting the foundations on aggregate piers that penetrate below the uncontrolled fill. Additional subsurface investigations should be made to further characterize the depth and extent of the uncontrolled fill material and to check for the presence of old building foundations.

Preliminary design values for new pavement thickness design are CBR value of 10 and subgrade modulus k-value of 200 pci for the upper soils in a compact and stable condition.

Constant head borehole permeameter tests conducted in the upper 5 feet indicated in-situ soil infiltration rates ranging from about 0.6 to 1 inch per hour. Our past experience with similar soil types suggests that post-construction infiltration rates may be substantially less than the in-situ measured rates.

Site Class D for seismic design was determined for the site based on the results of this exploration.

Much of the existing site soil materials are expected to be suitable for reuse as fill on the project based on the field and laboratory test results.

The soil types encountered in the borings are not expected to have expansive potential. Soil corrosion potential for slightly acidic pH levels should be evaluated during final design of the project.

TCLP metal elements Barium, Chromium and Lead were detected in 3 composite soil samples from the upper 4 feet but at concentrations well below regulatory action levels.

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Purpose of Exploration

The purpose of this exploration was to obtain preliminary geotechnical data from the proposed project site and to provide preliminary geotechnical recommendations associated with the project foundations and site improvements based on analysis of the field and laboratory data obtained.

Project Information

The proposed project will prepare a design-build RFP solicitation for a new simulator and range operations facility in the Hadnot Point area of Marine Corps Base (MCB) Camp Lejeune, North Carolina. The site location is shown in Figure 1 and on Drawing 1 in Appendix A.

The project will include a single story simulator center building (88,964 SF), single story range operations building (20,301 SF), single story covered training area (5,231 SF), and single story boat shop/warehouse building (9,914 SF). Building construction is anticipated to include structural steel framing, CMU walls, brick veneer, standing seam metal roof, and concrete slab floors with passive ventilation system. Site improvements will include light duty bituminous pavement for POV parking, heavy duty flexible and rigid pavement for tactical vehicle parking, roadways and intersection improvements, loading dock, a 150-foot tall communications tower, fencing, walks, utilities and stormwater management using low impact development (LID) techniques to the extent possible. Preliminary building structural loads are anticipated to be less than 100 kips for columns and 3 kips/ft for bearing walls. Final site grading information is unknown at this time.

Site Description

The project site is located on the southeast side of Duncan Street near the intersection with Hickory Street at MCB Camp Lejeune. The general northern portion of the site is the former location of the Marine Corps Brig. The former building and site has been demolished and recently regraded. This portion of the site is open with soil, grass and gravel ground cover. The new Brig is constructed east of the project site, and the south and west parts of the project site are mostly undeveloped with thick brush and woods. Tank trails, drainage ravines and wetland areas exist within and along

Figure 1. *Site Location*

the southern and western site edges. Site ground elevations within the proposed new development areas typically range from about 25 to 31 feet (NAVD88) based on the site survey provided.

Site Geology

The project site lies within North Carolina's Atlantic Coastal Plain physiographic province. The Coastal Plain is characterized by an eastward thickening wedge of marine, estuarine and fluvial sediments that were deposited in a series of marine transgressive-regressive cycles, or high and low stands of sea level, during the Holocene to Miocene epochs of the late Cenozoic era.

According to the 1985 Geologic Map of North Carolina, the upper geologic units at the site are composed of unconsolidated Holocene and Upper Pleistocene age deposits of undivided members. Older underlying units include consolidated Tertiary deposits of the Belgrade, River Bend and Castle Hayne Formations, undivided, described as fossiliferous clay and shelly sand deposits. Metasedimentary and igneous basement bedrock is located at more than 1000 feet below sea level.

Exploration Program

The subsurface exploration program consisted of the following sampling and testing at the approximate locations shown in Figure 2 and on Drawings 2A and 2B in Appendix A:

- ❑ 7 standard penetration test (SPT) soil borings, designated B-1 to B-7, to a depth of 30 to 60 feet below existing grades near anticipated structure locations.
- ❑ 1 piezocone penetration test (CPTu) sounding, designated CPT-1, pushed to refusal at a depth of 69 feet below existing grade near the center of the anticipated simulator building location along with down-hole shear wave velocity (Vs) measurements performed at nominal 1 meter intervals.
- ❑ 4 SPT soil borings, designated PB-1 to PB-4, to a depth of 10 feet below existing grade for prospective pavement areas.
- ❑ 4 composite bulk samples collected from the upper 1 to 3 feet at the PB boring locations for laboratory CBR tests.
- ❑ 4 SPT soil borings, designated BMP-1 to BMP-4, to a depth of 15 feet below existing grades for prospective LID BMP areas.
- ❑ 4 in-situ constant head permeability tests for measuring soil infiltration rates at depths of about 3 to 5 feet below existing grades at the BMP boring locations.
- ❑ 2 temporary piezometers installed to depths of 15 feet below existing grades for measuring 24-hour stabilized water levels at locations BMP-1 and BMP-3.
- ❑ 3 composite soil samples collected from the upper 1 to 4 feet at locations B-1, BMP-3 and PB-2 for laboratory chemical analyses for Benzene, Toluene, Ethyl Benzene and Xylene (BTEX), total petroleum hydrocarbons (TPH) for both diesel and gasoline range organics (DRO & GRO), and toxicity characteristic leaching procedure (TCLP) for the 8 RCRA metals.
- ❑ Geotechnical laboratory testing that included natural moisture content, grain size, plasticity, pH, and CBR with standard Proctor on selected samples recovered from the soil borings.

The testing locations and depths were selected by **GER** in consultation with the A/E. Test locations were selected in part based on site accessibility and in avoidance of areas lacking prior UXO scans. Field exploration test results are provided in Appendix B. Laboratory test results are provided in Appendix C. Exploration procedures are provided in Appendix D.

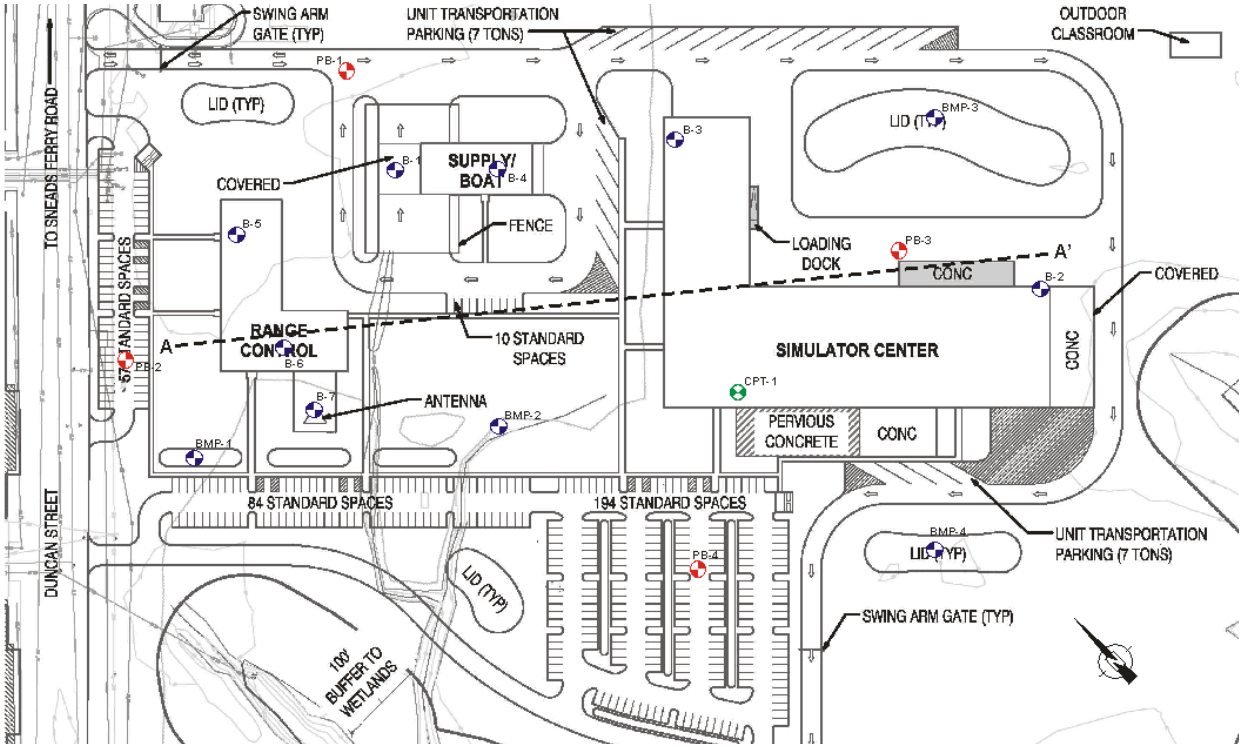


Figure 2. *Testing Locations Relative to the Proposed Concept Plan*

The field testing was conducted during March 4-7, 2013. Test borings were advanced by a CME 55 ATV mounted drill rig using nominal 3-inch diameter boreholes with both mud rotary and hollow stem augering techniques. Standard penetration test (SPT) sampling was conducted in the borings at discreet intervals in general accordance with ASTM D 1586. An automatic hammer was used to drive the sampler. Small disturbed samples were obtained during the test and were used to classify the soil. The SPT is an index test and the resistances can provide a generic indication of soil strength and compressibility.

The cone penetrometer test (CPT) sounding was conducted using an integrated electronic seismic piezocone with a 15 cm^2 tip and a 225 cm^2 friction sleeve. The cone is designed with an equal end area friction sleeve and a tip end area ratio of 0.80. The piezocone dimensions and the operating procedure were in accordance with ASTM D 5778. Pore pressure filter elements made of porous plastic were saturated under a vacuum using silicone oil as the saturating fluid. The pore pressure element was 6 mm thick and was located immediately behind the tip (the U_2 location).

The cone was advanced using a 20-ton track mounted CPT rig. Tip resistance (qc), sleeve friction (fs) and dynamic pore pressure (u) data were recorded every five centimeters as the cone was advanced into the ground. The reported tip resistance (qt) was corrected for porewater effects.

Field saturated hydraulic conductivity tests were conducted using a constant head borehole permeameter. The constant head method is based on Darcy's Law, Q=kiA. The test involves creating a ponded height of water in an open well or borehole to establish a bulb of field saturated soil around the base of the borehole. Once the saturated bulb becomes established, the flow of water out of the borehole and into the soil should approach a constant rate (steady state flow). To accomplish the tests, boreholes were augered to the requested testing depths. After the inserting the permeameter into the boreholes, measurements of flow and time were recorded until a relatively steady flow rate was observed or until it was obvious that a steady state flow would not be achieved. The field saturated hydraulic conductivity, K_{fsat}, was calculated according to the procedures of Reynolds et al. (1993) and the US Bureau of Reclamation (1990).

A subsequent field investigation was made on March 26, 2013 with a soil scientist from the NCDENR Wilmington District Office. Five hand augered bore holes, designated BORE 1 to BORE 5, were made in prospective BMP areas for the purpose of verifying the estimated seasonal high water table (SHWT) at the site. The results of this additional site visit are included in Appendix B.

Exploration Results

The subsurface conditions encountered at the boring and sounding locations are shown on the test boring records and cone penetration test record in Appendix B. The test boring records represent our interpretation of the subsurface conditions based on visual examination of field samples obtained and laboratory classification testing on selected samples. The CPT sounding records represent direct measurement and interpretation of the subsurface conditions based on published correlations to strength, stiffness and other index properties. The lines designating the interface between various strata on the testing records represent the approximate interface location. In addition, the transition between strata may be gradual. The material types and strata depths shown on the testing records are not necessarily representative of all materials that will be encountered during construction.

Water levels shown on the testing records only represent the conditions observed at the time frame of the exploration. Ground elevations shown on the testing records were estimated using nearby spot elevations and contour lines shown on the provided site plan and shall be considered approximate.

Soil Stratigraphy

The interpreted subsurface profile from the testing locations is composed of 3 general stratigraphic layers. Figure 3 and Drawing 3 in Appendix A show an estimated subsurface profile based on selected test boring and sounding locations. Variations between the estimated profile and actual subsurface conditions should be expected.

STRATUM A was composed of uncontrolled FILL that typically consisted of silty sand mixed with

fragments of asphalt, concrete, stone, brick, etc. This stratum was encountered at test locations B-1, B-4, B-5, B-6, PB-1 and PB-2 in the former Brig vicinity. The depth of the uncontrolled fill was less than 2 feet except at location B-5 where it appeared to extend to a depth of about $8^1/_2$ feet below the ground surface. SPT resistances in Stratum A ranged from 3 to 13 blows per foot (bpf) and averaged about 6 bpf. Strength and density parameters for this layer are expected to be variable.

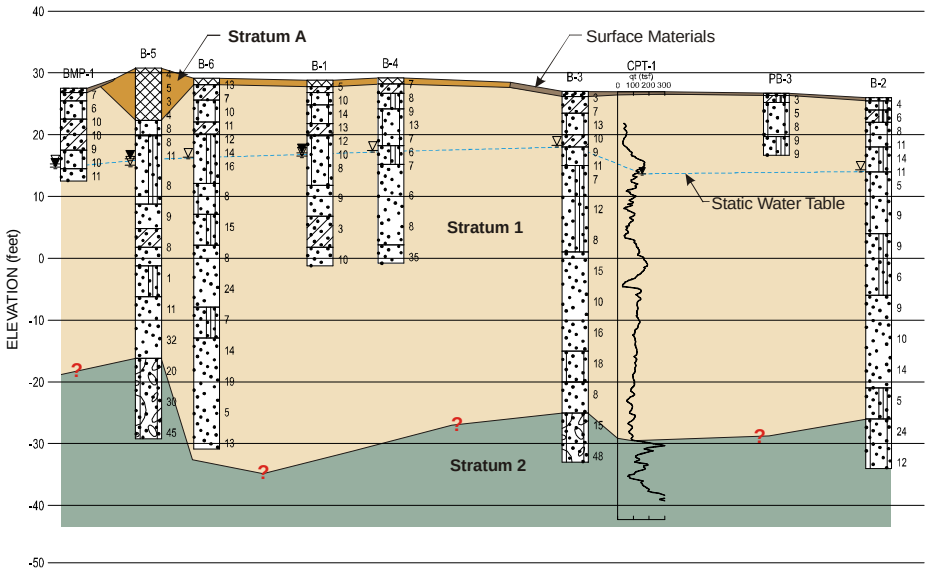


Figure 3. *Estimated Subsurface Profile*

STRATUM 1 was composed of very loose to dense, predominantly fine gradation, clayey, silty to relatively clean SAND (SC, SC-SM, SM, SP-SM, SP). Stratum 1 was encountered at all test locations from below surface materials or Stratum A to depths of about 47 to more than 60 feet below the existing ground surface. Borings B-6 and B-7 terminated in this stratum. SPT resistances ranged from 1 to 35 bpf and averaged about 9 bpf. CPT tip resistance ranged from 31 to 190 tsf and averaged about 100 tsf. Angle of internal friction is estimated to range from about 28° to 39° in Stratum 1 and average about 34°.

STRATUM 2 was encountered below Stratum 1 in the deep borings and sounding and extended to the termination depths at those locations. It was indicated as firm to very dense, fine to coarse gradation, silty SAND (SM) with abundant shells to trace shell fragments and clay. SPT resistances ranged from 12 to 48 bpf and averaged about 28 bpf. CPT tip resistance ranged from about 70 to 600 tsf and averaged about 330 tsf in this stratum. Angle of internal friction is estimated to range from about 32° to 43° and average roughly 37° for this layer.

Figure 4 and Drawing 4 in Appendix A show a plot of SPT resistances (uncorrected) with depth. Figure 5 and Drawing 5 in Appendix A show tip resistance and estimated soil parameter profiles from the CPT sounding.

Groundwater

The static groundwater table was encountered in the test borings and CPT sounding at depths ranging from about 9 to 15 feet below the ground surface. This includes immediate and 24-hour stabilized measurements made prior to filling the boreholes with grout. The encountered water level depths correspond to free groundwater table

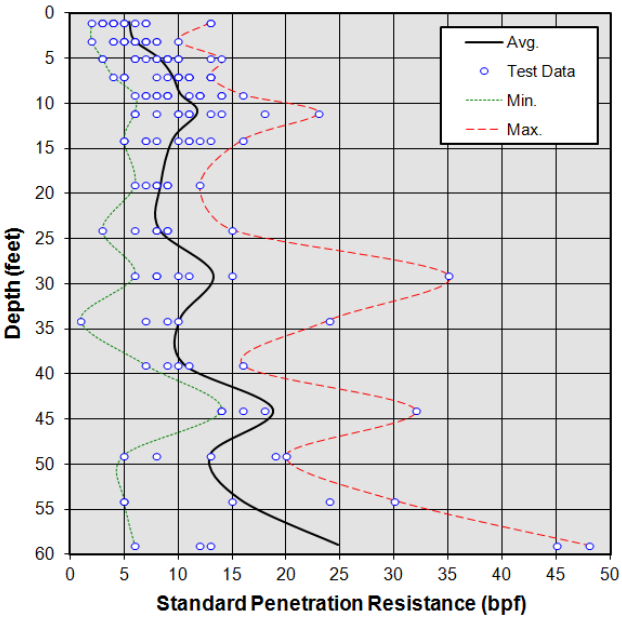


Figure 4. *SPT Resistance Profile*

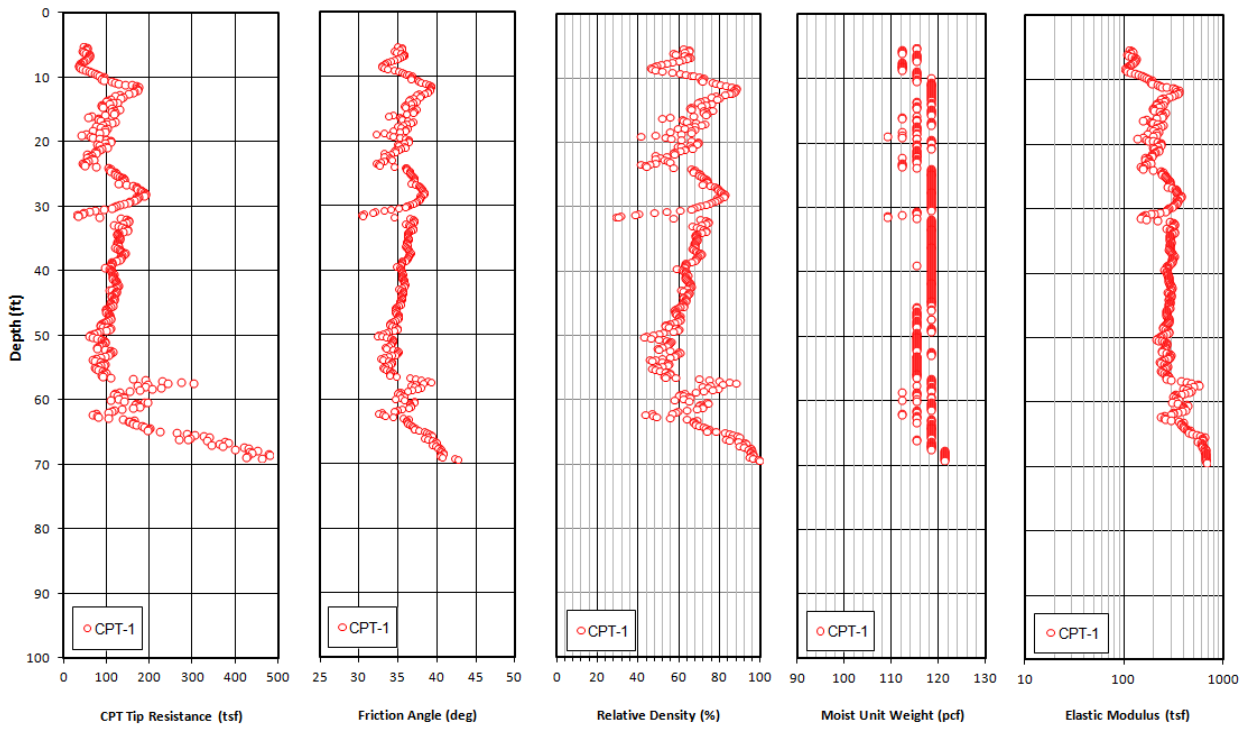


Figure 5. *Resistance and Estimated Soil Parameters from CPT*

elevations of about 12 to 18 feet, project datum. The reported water levels represent the conditions encountered at the time frame of the exploration and do not necessarily represent the water conditions that will be encountered during construction. Seasonal perched water table conditions may possibly be encountered at or near the existing ground surface. Fluctuation in the water levels may occur due to variations in precipitation, evaporation, construction activity, tides, surface runoff and other local factors.

The estimated seasonal high water table (SHWT) levels were determined during a 26-Mar-13 on-site meeting with the NCDENR soil scientist. Five test bores to observe soil color, texture and other characteristics were made at representative site locations. The findings indicated SHWT depths that ranged from about 50 to more than 65 inches below the ground surface. The corresponding SHWT elevations for the site are approximately 19.6 to 26.6 feet, project datum.

Surface Materials

An approximate 4 to 10 inch veneer of topsoil like material was encountered at testing locations performed in undeveloped grass and wooded areas of the site. Topsoil is a generic description meaning the surface soil horizon and does not necessarily imply the material is suitable for reuse on the project. Surface material thickness and composition can be expected to vary across the project site limits.

Subsurface Evaluation

We have evaluated the project information, site conditions and subsurface conditions described in the preceding sections with regard to supporting the proposed single-story buildings, tower and the associated site development. Our initial assessment suggests that the proposed structures can likely be supported using shallow foundation and grade slab systems following appropriate site and subgrade preparation. However, we expect that ground improvement will be necessary around the former Brig location to minimize risks associated with foundations bearing on uncontrolled fill material.

Ground improvement techniques that appear most feasible for mitigating risks associated with the uncontrolled fill material include:

- ❑ Over excavation to remove all or part of the fill at proposed foundation locations and replacement with structural fill. This is a

relatively straightforward technique that can be performed by most local foundation and grading contractors. However, deep excavation depths may be required in some areas based on Boring B-5.

- ❑ Dynamic compaction to densify the existing materials in-situ. The technique involves systematically dropping a heavy tamping weight from a crane to vertically displace the existing soils and filling the displaced surface with structural backfill. The process is fast, relatively economical and can permit the use of spread footings designed for high bearing pressures. The technique will require a specialty geotechnical contractor.
- ❑ Supporting spread footings on aggregate pier elements that penetrate below the uncontrolled fill. Both drilled and displacement techniques can be used to create compacted columns of aggregate in the existing soil to the design depth. The process creates a stiff composite matrix bearing material to permit the use of spread footings designed for high bearing pressures. This technique also requires a specialty geotechnical contractor.

Additional subsurface investigations should be made to further characterize the depth and extent of the uncontrolled fill material and to check for the presence of old building foundations. This should include test pit excavations in addition to soil borings and in-situ testing. Consideration can also be given to redesigning the site layout to avoid siting structures in the former Brig location.

Based on the limited data collected, we expect the existing surface materials will in general be suitable for supporting normal duty concrete slab-on-grade floors. Removal or other improvement to the uncontrolled fill can be made as necessary based on field conditions encountered during construction. If significant site grade increases are planned for the proposed buildings, the site grading effects should be evaluated during final design of the project.

Moderately high laboratory CBR values in the range of 17 to 25 were determined for well compacted samples from the upper site materials. A preliminary design CBR value on the order of 10 should be used for the project to account for site variability, seasonal factors and for subgrade degradation that may occur during construction.

Soil types and preliminary infiltration test results from prospective BMP areas indicate that the site is marginally satisfactory for infiltration and bio-retention LID techniques. However, our past experience with similar soil types suggests that post-construction infiltration rates may be substantially less than pre-development rates measured in-situ. We understand Camp Lejeune has a history of constructed infiltration and bioretention systems not functioning as intended.

Chemical analyses of 3 composite soil samples collected from the upper 4 feet at the site detected TCLP metal elements Barium, Chromium and Lead. However, the detected concentrations are well below regulatory action levels. Results for all other TCLP metal analytes, BTEX, TPH-DRO and TPH-GRO and were non detect (ND) at the laboratory reporting limit (RL). Based on these limited sampling results, it does not appear that special handling and disposal considerations will be required for excavated soil materials.

Preliminary Recommendations

Based on the subsurface data obtained from the site and our understanding of the project, the following preliminary recommendations are provided for information and cost estimating purposes.

Structure Foundations

- ❑ A shallow foundation system can be the basis for the design-build RFP. The preliminary design bearing pressure is 2,000 psf for building footings bearing on approved Stratum 1 soils and structural fill material. It will be necessary to prepare and/or improve the subgrade where unsuitable material is encountered.
- ❑ The previously discussed ground improvement techniques should be considered for structures sited in the former Brig location. Design bearing pressures will be determined by the specialty contractor and/or the design-build team's geotechnical engineer.
- ❑ Building footings should bear at least 18 inches below final building grades for bearing capacity considerations and for protective embedment.
- ❑ The minimum footing width should be 30 inches for columns and 18 inches for walls for ease of

construction and to prevent a punching failure of the supporting soils.

- Total settlement of properly supported footings for structural loads of 100 kips for columns and 3 kips per linear foot for walls is estimated at less than $^3/_4$ of an inch based on the preliminary data. Differential settlement on the order of $^1/_2$ of an inch is estimated.
- A mat foundation sized for a bearing pressure in the range of 2,000 to 3,000 psf can be considered for supporting the communications tower. A bearing depth in the range of 4 to 8 feet may be required for shear and overturning resistance.
- Prior to installing reinforcing steel and concrete, footing subgrades should be composed of relatively firm, dry suitable soils free of debris, highly organic and loose material. This should be verified by the contractor's field inspector and contracting officer's representative. If unsuitable subgrade is encountered at the footing locations, the unsuitable material should be undercut to reach firm suitable soil and replaced with approved structural backfill.

Ground Slabs

- It is expected that conventional ground supported concrete floor slabs constructed over select fill and approved existing soils can be used for the project. Floating slabs should generally be jointed at column lines and along load bearing walls so that foundations and the slab can settle differentially without damage.
- A minimum 4 inch thick layer of porous gravel or clean sand fill should be used directly beneath the slabs to provide a capillary break and for lateral drainage of moisture. If sand is chosen, it should conform to ASTM C 33 concrete fine aggregate or equivalent.

Subgrade Preparation

- The ground surface in the building and pavement areas should be cleared, grubbed and stripped of all topsoil, vegetation and debris to reach firm soils. Site clearing and surface material stripping should extend approximately 5 feet beyond the outside of building and pavement lines.
- Site preparation work should be conducted during an extended period of dry weather to avoid excessive deterioration of the subgrade. Positive surface drainage should be maintained at all times during construction to prevent water accumulation on the subgrade.
- If existing underground utilities are present within the new building areas, they should be removed and rerouted to outside of proposed building lines. Any old building foundations and slabs encountered in new building areas should be removed. Excavations should be backfilled as specified herein.
- The exposed subgrade soils in the building and pavement areas should be compacted and inspected by proofrolling to check for pockets of soft soils prior to filling and foundation and pavement construction. Proofrolling should be conducted after a suitable period of dry weather to avoid degrading an otherwise acceptable subgrade. A loaded dump truck or similar heavy rubber tired construction equipment should be used for proofrolling.
- Site stripping, grading and proofrolling should be observed by a field inspector. If unsuitable soil conditions are observed, they should be corrected by excavating and replacement with structural fill or improved by other methods that are acceptable to the contracting officer's representative.

Pavements

- A preliminary design CBR value of 10 and design subgrade modulus k-value of 200 pci may be used for the existing upper soils in new pavement areas. Preliminary pavement thickness designs may be made using these values along with estimated traffic data.
- Pavement materials and construction should conform to current UFC and/or NCDOT criteria and specifications as applicable.
- Pavement construction is best suited for the traditionally drier summer and fall months to minimize deterioration of the subgrade soils caused by construction traffic and exposure to the environment. Use of geogrid and/or geotextile fabric products should be considered in the pavement design to potentially reduce quantities of unsuitable soil removal.

Fill and Backfill

- Representative samples of each proposed fill material should be collected before filling operations begin and tested to determine maximum dry density, optimum moisture content, natural moisture content, gradation, plasticity and CBR. These tests are needed for quality control during construction and to determine if the fill material is acceptable.
- Fill and backfill soil used in building and pavement areas should consist of non plastic local granular material having a maximum of 25 percent fines by ASTM D 1140, and maximum liquid limit of 30 and maximum plasticity index of 9 by ASTM D 4318. Acceptable soil classifications by ASTM D 2487 include GW, GP, GM, SW, SP, SP-SM and some SM soils.
- Much of the existing site materials having classifications of SM, SP-SM and SP are expected to be suitable for reuse as structural fill and backfill. Soils with debris and clay content are not recommended for reuse.
- Crushed stone can be used for backfilling beneath structures for ease of construction. Material should consist of washed crushed quarry stone conforming to ASTM C 33 or NCDOT gradation #57.
- Fill and backfill soils should be spread in thin, even layers not exceeding 8 inches loose thickness prior to compaction. Each layer of soil in building and pavement areas should be compacted to achieve no less than 95 percent of the laboratory maximum dry density as determined by ASTM D 698.
- The moisture content of fill soils should be maintained within ±3 percentage points of the optimum moisture content determined from the laboratory Proctor density test. Fills should be free of debris and deleterious materials.
- The fill surface must be adequately maintained during fill construction. The fill surface should be compacted smooth and properly graded to improve surface runoff while construction is temporarily halted. Excavations to receive backfill should not be left open for extended periods.
- Fill should not be placed on wet or frozen ground. Fill which becomes softened from excess moisture should be aerated and recompacted to acceptable levels, removed and replaced with new compacted fill, or as otherwise directed by the contracting officer's representative.

Seismic Parameters

- The following preliminary seismic design parameters for 5% critical damping and 2% probability of exceedence in 50 years were determined from 2009 IBC mapped values for the geographic site location using the general procedure and USGS software:

Site Class	D
Peak Ground Acceleration	0.079g
0.2s Design Spectral Response S_{Ds}	0.210g
1.0s Design Spectral Response S_{D1}	0.119g

- Preliminary liquefaction analysis of saturated sands in the general soil profile using the in-situ parameters measured from CPT and Vs testing indicate a satisfactory factor of safety for the probabilistic maximum considered seismic event. Probability of surface fault rupture, earthquake induced slope failure and lateral spreading is low.

Expansive and Corrosive Soil Potential

- The soil types encountered at the site are sands with non and low plasticity fines. These soil types are not expected to require designs for expansive soil conditions.
- Laboratory measured pH values in the range of 5 to 8 were determined for the upper soils. Soil corrosion potential for slightly acidic pH levels should be evaluated during final design of the project.

LID Stormwater Management

- The Stratum 1 soils were determined to have in-situ infiltration rates ranging from about 0.6 to 1 inch per hour. Post-construction infiltration rates may be substantially less than the in-situ measured rates.
- A factor of safety should be applied to the infiltration test results. A minimum safety factor of 2 is typical; however, do to clogging of the infiltration soils, a much higher safety factor should be considered.
- Seasonal high water table (SHWT) elevations at the site are estimated to range from 19.6 to

26.6 feet (project datum) based on the site visit with the NCDENR soil scientist. It may be difficult to achieve the 2-foot minimum separation requirement between the bottom of the LID feature and the SHWT on parts of the site.

- ❑ Stormwater basins should use side slopes of 3H:1V or flatter to protect from sloughing. Slopes should be protected from erosion using one or more widely available erosion control methods (turf, vegetation, geosynthetics, hard armor revetment, etc.).

Limitations

We have conducted this exploration and prepared this report using that degree of care and skill ordinarily exercised under similar conditions by reputable members of our profession practicing in the same or similar locality. No other warranty, expressed or implied, is made.

The analyses and preliminary recommendations provided are based in part on project information provided to us. They only apply to the specific project limits discussed in this report. If the project information section in this report contains incorrect information or if additional information is available, you should convey the correct or additional information to us and retain us to review our recommendations.

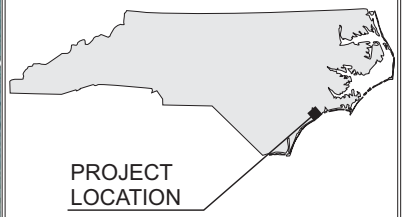
The exploration conducted and this report are not necessarily in sufficient detail for final geotechnical design of the project. Design-build teams should familiarize themselves with the site and general subsurface conditions and retain the services of their own consultant to make additional subsurface explorations 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 materially different from those encountered at the specific test locations. In addition, soil and groundwater conditions may become altered by construction activity, climactic factors and the passage of time. These possibilities should be considered by the designers and contractors.

APPENDIX A

DRAWINGS

VICINITY MAP



SOURCE:

Camp Lejeune, NC

USGS 7.5 Minute Topographic
Quadrangle Map
2010
(not to scale)

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Virginia Beach, VA 23452

SITE LOCATION PLAN

P-1346 Simulator Center &
Range Control Building
MCB Camp Lejeune, NC

PROJECT NUMBER	DRAWING NUMBER
110-6170	1

LEGEND:

- Approximate SPT Soil Boring Location
- Approximate CBR Sample & Soil Boring Location
- Approximate Seismic CPT Sounding Location
- Subsurface Profile Baseline on Drawing 3

SCALE:

0' 80' 160'

Graphic Scale

SHEET SIZE:

11" x 17"

NOTES:

Field testing locations were not surveyed and may be several feet from the locations indicated. The testing locations shown on this plan shall be considered approximate.

Aerial photograph ca. 2010, courtesy of Google Earth™.

TESTING LOCATIONS RELATIVE TO FORMER/ EXISTING CONDITIONS

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TESTING LOCATION PLAN

P-1346 Simulator Center & Range Control Building
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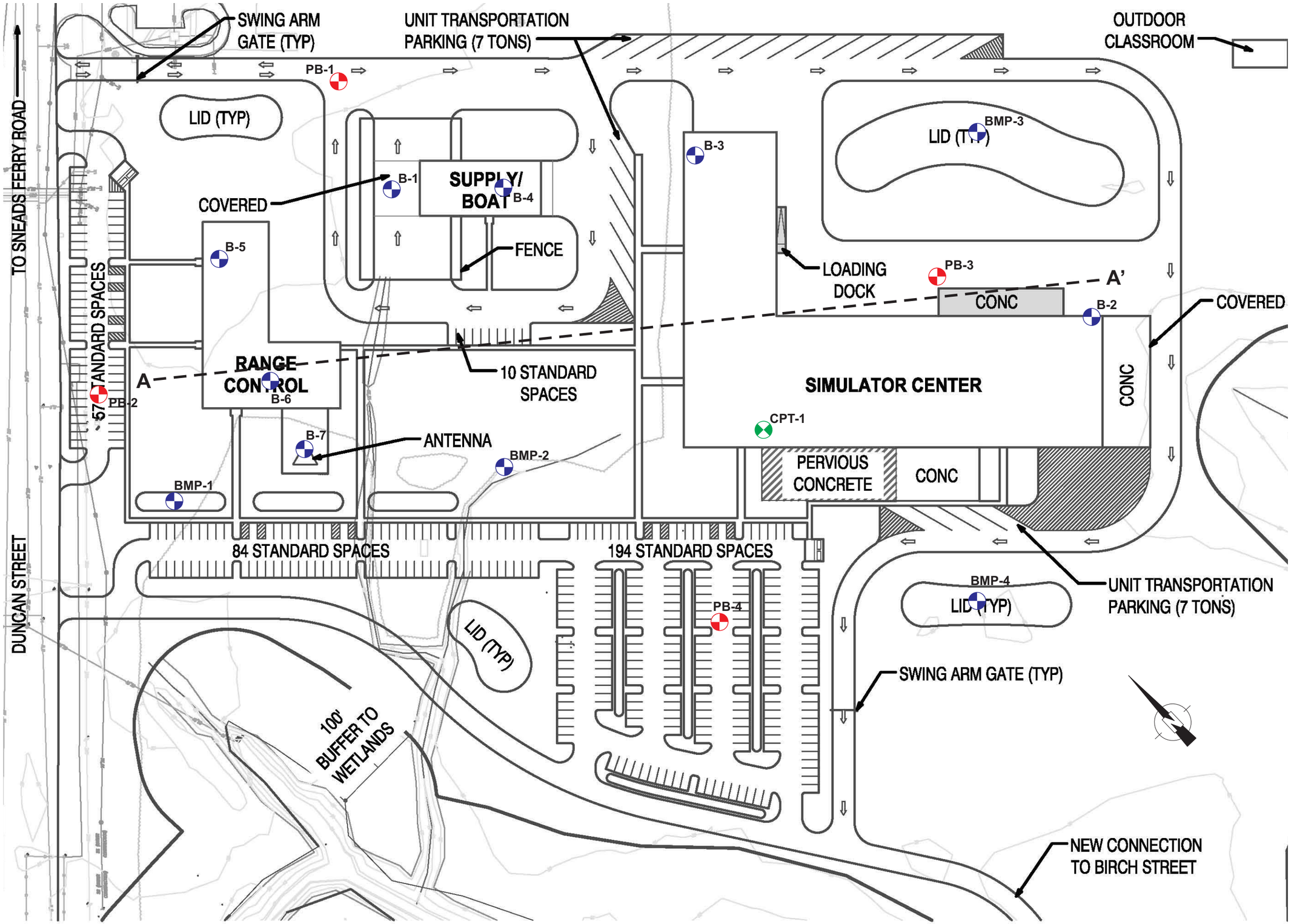
PROJECT NUMBER	DRAWING NUMBER
110-6170	2A



LEGEND:

- Approximate SPT Soil Boring Location
- Approximate CBR Sample & Soil Boring Location
- Approximate Seismic CPT Sounding Location
- Subsurface Profile Baseline on Drawing 3

SCALE:

0' 100' 200'

Graphic Scale 1"=100'

SHEET SIZE:

11" x 17"

NOTES:

Field testing locations were not surveyed and may be several feet from the locations indicated. The testing locations shown on this plan shall be considered approximate.

Edited site plan courtesy of HBA.

TESTING LOCATIONS RELATIVE TO PROPOSED CONCEPT PLAN

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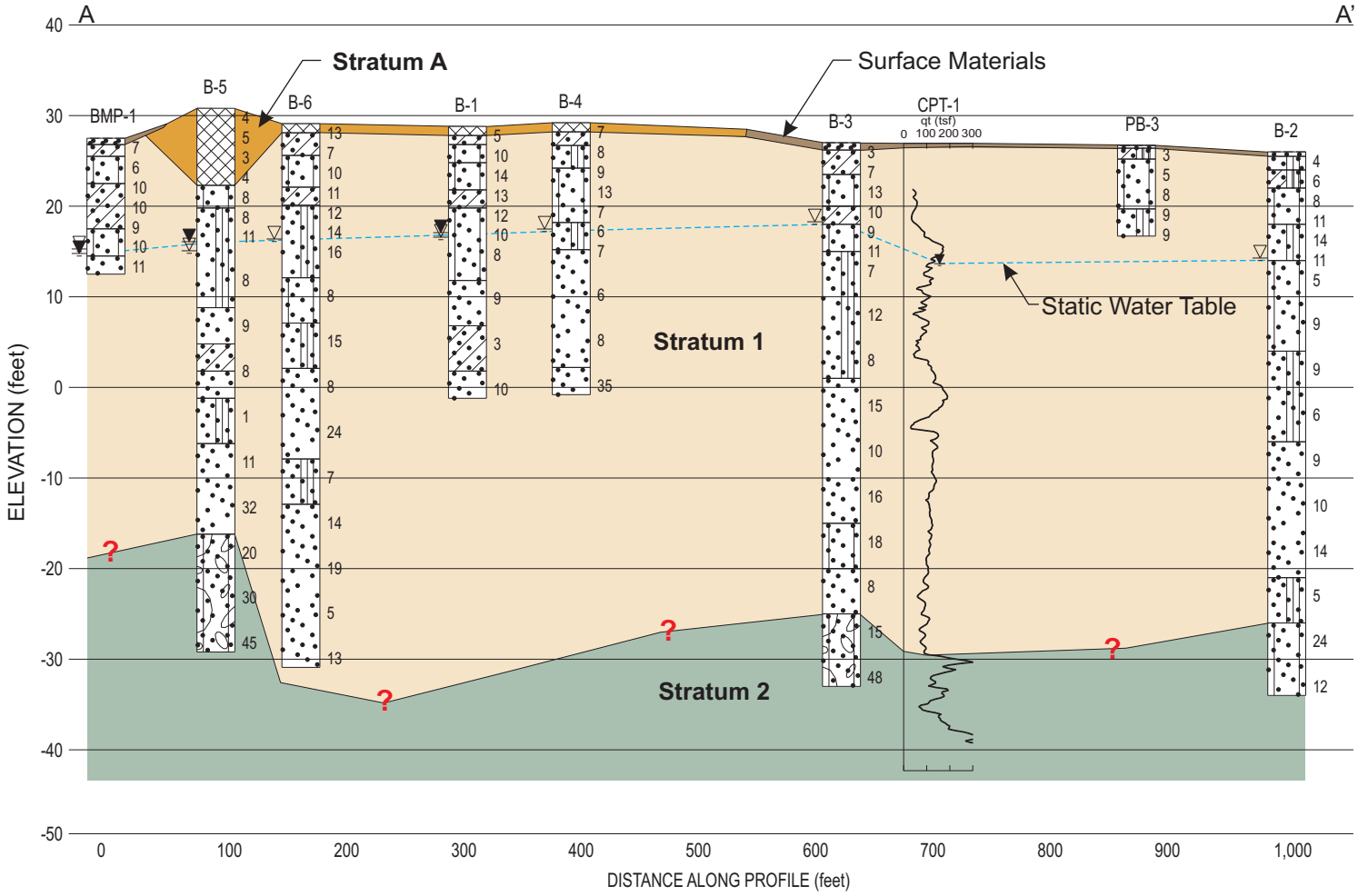
TESTING LOCATION PLAN

P-1346 Simulator Center & Range Control Building
MCB Camp Lejeune, NC

PROJECT NUMBER	DRAWING NUMBER
110-6170	2B



Lithology Graphics

- Fill
- Topsoil
- SC, Clayey Sand
- SP-SM, Slightly Silty Poorly-graded Sand
- SM, Silty Sand
- SC-SM, Clayey-Silty Sand
- SP, Poorly-graded Sand
- Silty Sand and Shells

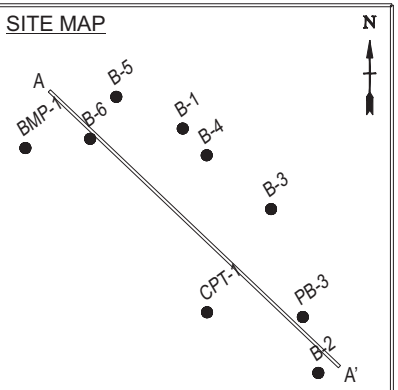
INTERPRETED STRATIGRAPHY

Stratum A: FILL as silty sand with debris (concrete, brick, asphalt, etc.)

Stratum 1: Very loose to dense clayey, silty and clean SAND (SC, SC-SM, SM, SP-SM, SP)

Stratum 2: Firm to very dense silty SAND and SHELL (SM)

SITE MAP



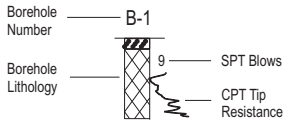
NOTES

The subsurface conditions presented are interpreted based on the data collected at specific test locations only. Actual subsurface conditions will likely vary from those indicated.

Not all testing locations are shown for improved viewing.

Elevations and strata depths shown shall be considered approximate.

Explanation



- Water level reading during drilling
- Water level reading after drilling
- ? Denotes additional uncertainty

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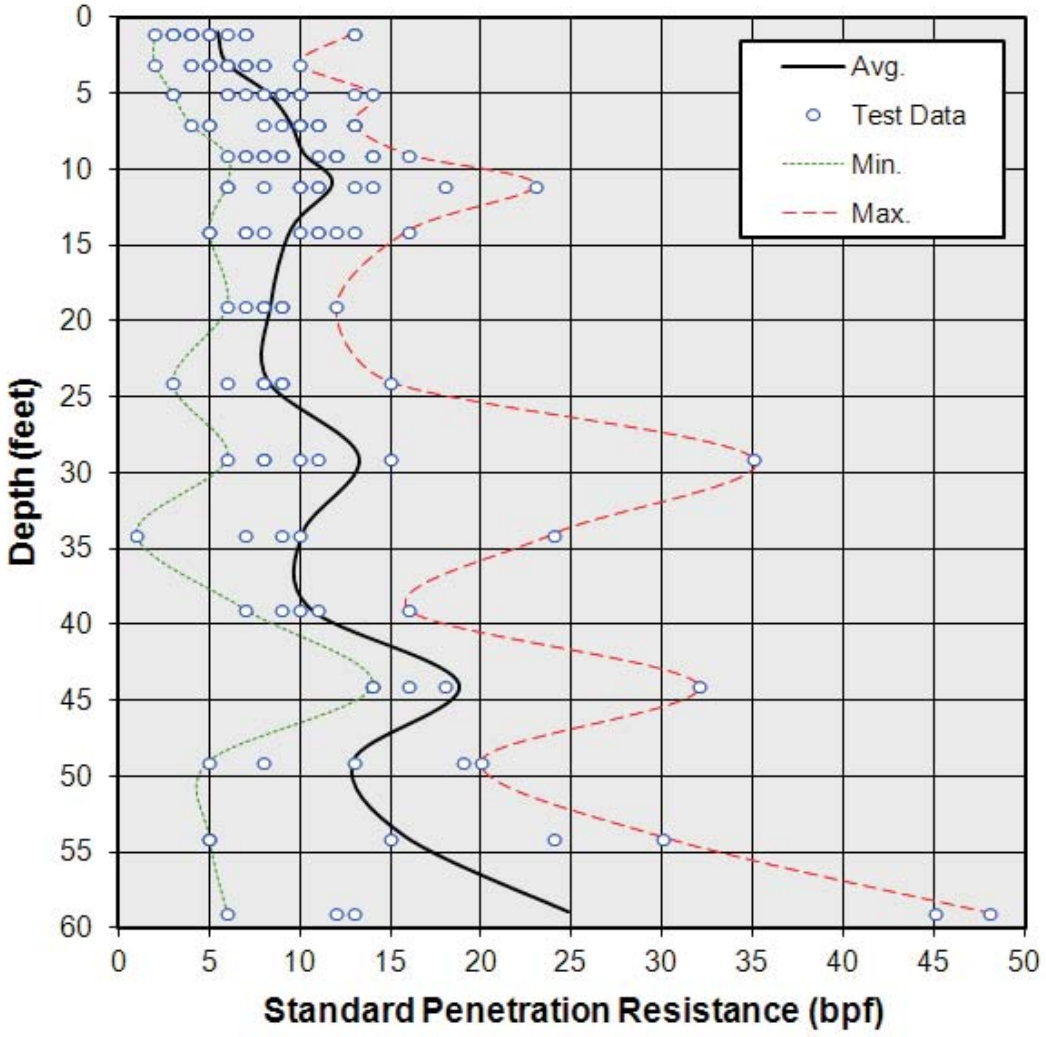
SUBSURFACE PROFILE

P-1346 Simulator Center & Range Control Building
MCB Camp Lejeune, NC

PROJECT NUMBER	DRAWING NUMBER
110-6170	3



SPT resistances provide a generic indication of soil shear strength and compressibility parameters.

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SPT RESISTANCES

P-1346 Simulator Center &
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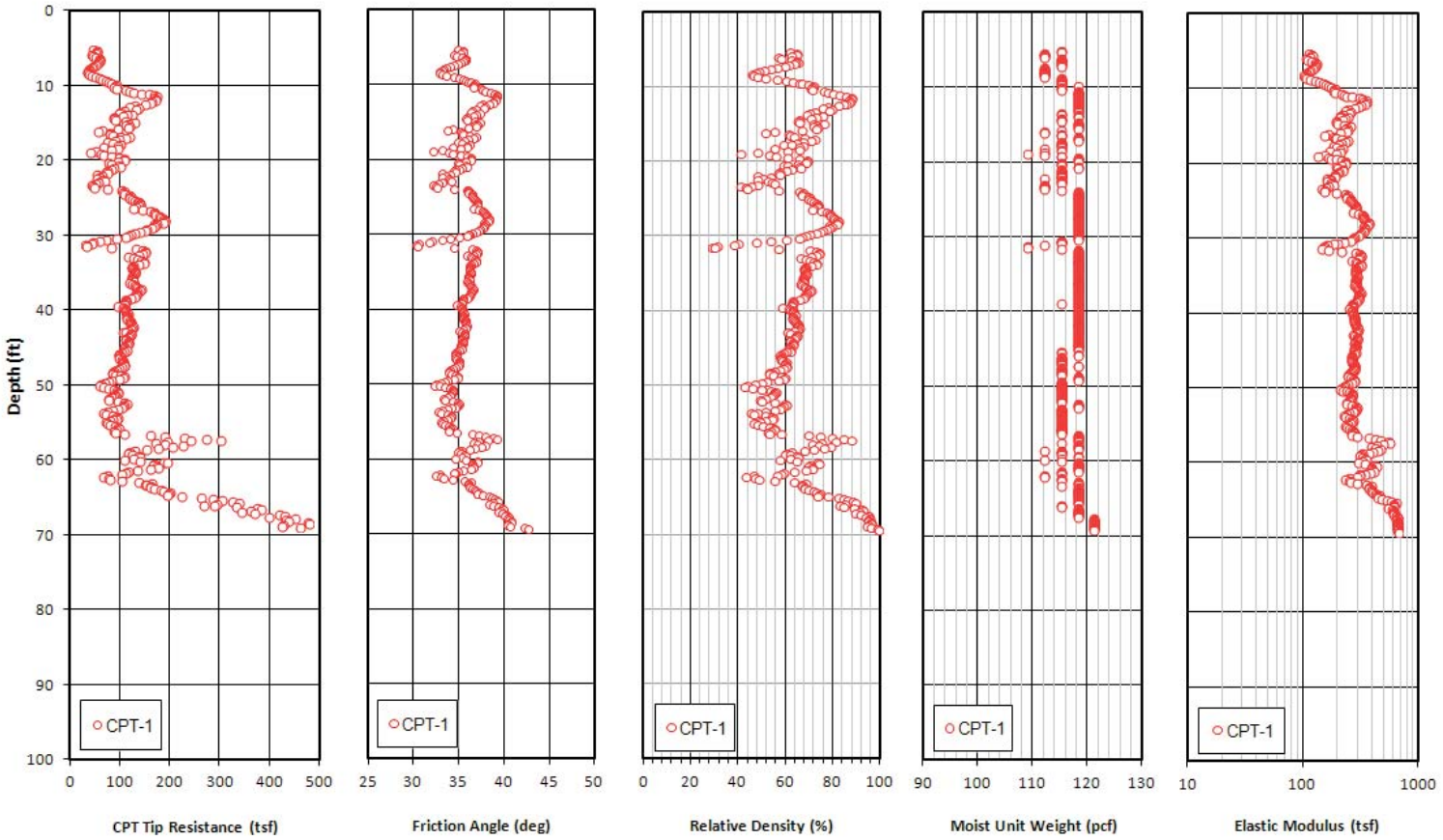
MCB Camp Lejeune, NC

PROJECT NUMBER	DRAWING NUMBER
110-6170	4



Soil parameters are estimated based on established correlations to CPT measurements. Refer to Appendix D of the geotechnical report for correlation references.

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CPT SOIL PARAMETERS

P-1346 Simulator Center &
Range Control Building
MCB Camp Lejeune, NC

PROJECT NUMBER	DRAWING NUMBER
110-6170	5

APPENDIX B

FIELD TEST DATA

TEST BORING RECORDS

The enclosed test boring records represent our interpretation of the subsurface conditions encountered at the specific boring locations at the time explorations were made based on visual examination of the field samples obtained and selected laboratory classification testing if performed. The lines designating the interface between various strata on the boring records represent the approximate interface location. In addition, the transition between strata may be more gradual than indicated. Water levels shown represent the conditions only at the time of the field exploration. It is possible that soil and groundwater conditions between the individual boring locations will be different from those indicated. Boring surface and strata elevations, if shown, shall be considered approximate and are referenced to project datum shown on the plans or described in the geotechnical report unless noted otherwise.

BORING LOG LEGEND

KEY TO DRILLING SYMBOLS

Split Spoon Sample (ASTM D 1586)	Water Table at Time of Drilling	**H.S.A.**	Hollow Stem Auger Drilling
Undisturbed Sample (ASTM D 1587)	Water Table after 24 hrs.	**M.R.**	Mud Rotary Wash Drilling
Rock Coring (ASTM D 2113)	Boring Cave In	**PP**	Pocket Penetrometer (tsf)
Roller Cone Advanced	Loss of Drilling Fluid	**REC**	Core Recovery (%)
Seepage into Borehole	Auger Refusal	**RQD**	Rock Quality Designator (%)
	Roller Cone Refusal	**SCR**	Solid Core Recovery (%)

Approximate Strata Change Depth Different Soil Types

Approximate Strata Change Depth Similar Soil Types

CORRELATION OF RELATIVE DENSITY AND CONSISTENCY WITH STANDARD PENETRATION TEST RESISTANCE (ASTM D 1586)[§]

SPT RESISTANCE (N) IN BLOWS PER FOOT

SPT N	RELATIVE DENSITY[†] SAND & GRAVEL	SPT N	CONSISTENCY[†] SILT & CLAY
0 - 4	Very Loose	0 - 2	Very Soft
5 - 10	Loose	3 - 4	Soft
11 - 30	Firm	5 - 8	Firm
31 - 50	Dense	9 - 15	Stiff
51 +	Very Dense	16 - 30	Very Stiff
		31 - 50	Hard
		51 +	Very Hard

ROCK QUALITY[‡]

FRACTURES, JOINT SPACING AND BEDDING

RQD (%)	DIAGNOSTIC DESCRIPTION	ROCK PARAMETER FIELD/LAB RATIO	SPACING	JOINTS	BEDDING
0 - 25	Very Poor	0.15	Less than 2"	Very Close	Very Thin
25 - 50	Poor	0.20	2" to 1'	Close	Thin
50 - 75	Fair	0.25	1' to 3'	Moderately Close	Medium
75 - 90	Good	0.30 to 0.70	3' to 10'	Wide	Thick
90 - 100	Excellent	0.70 to 1.00	More than 10'	Very Wide	Very Thick

HARDNESS

Very Hard - Breaking specimens requires several hard hammer blows

Hard - Hard hammer blow required to detach specimens

Moderately Hard - Light hammer blow required to detach specimens

Medium - May be scratched 1/16" deep by a knife or nail, breaks into several pieces by light hammer blow

Soft - Can be gouged readily by knife or nail, corners and edges broken by finger pressure

Very Soft - May be carved with a knife and readily broken by finger pressure

WEATHERING

Fresh - Fresh rock, bright crystals, no staining

Slight - Minimum stainaing and discoloration, open joints contain clay

Moderate - Significant portions of rock shows staining and discoloration, strong rock fragments

Severe - All rock shows staining, rock fabric evident but reduced strength

Very Severe - All rock shows staining, rock mass effectively reduced to soil with strong rock fragments remaining

Complete - Rock reduced to soil with rock fabric not discernable

[§] *Resistance of a standard 2-inch O.D., 1.375-inch I.D. split spoon sampler driven by a 140 pound hammer free-falling 30 inches.*

[†] *after Terzaghi and Peck, 1968*

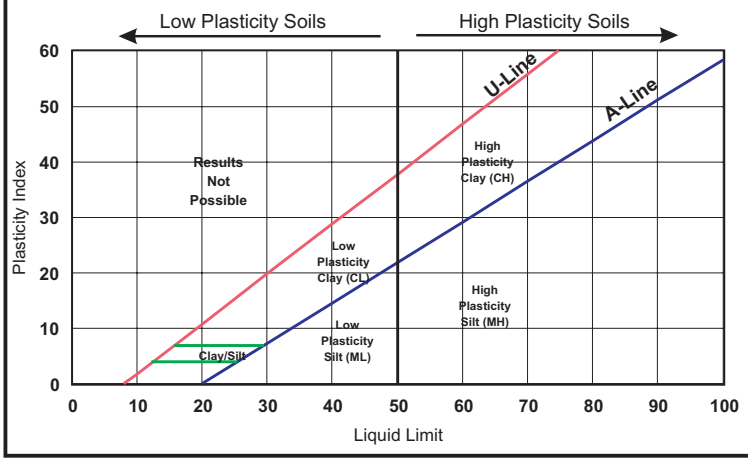
[‡] *after D. U. Deere, 1963, 1967*

GER

SOIL CLASSIFICATION CHART (ASTM D 2487)

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS — MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS — MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS — MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS — MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LOW PLASTICITY LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, CLAYEY SILTS, SILT-VERY FINE SAND MIXTURES, ROCK FLOUR
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY, SANDY, SILTY, & LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC CLAYS OF LOW PLASTICITY
		HIGH PLASTICITY LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS AND MICACEOUS, DIATOMACEOUS AND ELASTIC SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
OTHER SOILS	HIGHLY ORGANIC SOILS			PT	PEAT, HUMUS, MUCK, SWAMP SOILS WITH VERY HIGH ORGANIC CONTENTS
	UNCONTROLLED FILLS				DISTURBED SOILS WITH POSSIBLE DEBRIS AND RUBBLE, OLD CONSTRUCTION WASTES, NON-ENGINEERED BACKFILLS
	DECOMPOSED OR PARTIALLY WEATHERED ROCK				TRANSITIONAL MATERIAL BETWEEN SOIL AND ROCK WHICH MAY RETAIN THE RELICT STRUCTURE OF THE PARENT ROCK

Atterberg Limits



PARTICLE SIZE IDENTIFICATION

BOULDERS:		Greater than 300 mm (12 in.)
COBBLES:		75 mm to 300 mm (3 - 12 in.)
GRAVEL:	Coarse -	19.0 mm to 75 mm (0.75 - 3 in.)
	Fine -	4.75 mm to 19.0 mm (#4 - 0.75 in.)
SANDS:	Coarse -	2.00 mm to 4.75 mm
	Medium -	0.425 mm to 2.00 mm
	Fine -	0.075 mm to 0.425 mm
SILTS & CLAYS:		Less than 0.075 mm

PLASTICITY INDEX (PI) & SHRINK-SWELL POTENTIAL

0 - 4	None
4 - 15	Slight or Low
15 - 30	Medium to High
31+	High to Very High

ADDITIONAL RELATIVE DESCRIPTIVE VALUES

Trace < 10%	Some < 35% but > 20%
Little < 20% but > 10%	And > 35%

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TEST BORING RECORD

GeoEnvironmental Resources, Inc. Environmental, Groundwater, Hazardous Materials, Geotechnical & Industrial Engineering Consultants		Boring #: **B-1** (Page 1 of 1)
Project: **P-1346 Simulator & Range Control Center**	GER Project Number: **110-6170**	Date Drilled: **3/4/2013**
Location: **MCB Camp Lejeune, NC**	Driller: **Fishburne Drilling**	Drill Method: **3" Mud Rotary**
Depth (ft.): **30.0**	Elevation (ft.): **28.8** Client: **HBA-H&A JV**	Hammer Type: **Automatic**

Elevation ft	Elevation m	Depth ft	Depth m	Lithology	Material Description	Ground Water	Comments	SPT	Uncorrected Penetration Resistance (blows/foot)
					FILL Sampled as silty sand, light brown, fine, trace concrete, brick and clay			3 2 3	5
					Clayey SAND (SC) Loose, brown, fine			2 4 5	10
25	8	1			**Silty SAND (SM)** Loose, tan and white, fine			5 5 6	
		5			**Silty SAND (SM)** Firm, light gray with tan and orange, fine, trace clay			6 6 8	14
	7		2					8 9 7	13
					Clayey SAND (SC) Firm, light gray with tan and orange, fine			6 6 6	12
20	6	10			**Silty SAND (SM)** Loose, tan with white, fine to medium, trace to little clay			6 6 6	10
			3					5 5 5	
	5					▽		5 6 4	8
15			4					4 5	
	4	15						5	
			5		**Clean SAND (SP)** Loose, white and tan, fine, trace clay			6 4 5	9
10	3	20						6	
			6					3 1 2	3
	2				**Clayey SAND (SC)** Very loose, orange-brown, fine to medium			4	
5		25	7						
	1								
			8		**Clean SAND (SP)** Loose, light gray, fine to medium, trace organic material			5 5 5 6	10
0	0		9						
		30			Boring terminated at 30 feet.				
	-1		10						
-5									

TEST BORING RECORD WITH HAMMER INFO 6170.GPJ GEOENVIRONMENTAL RESOURCES.GDT 4/8/13

TEST BORING RECORD

GeoEnvironmental Resources, Inc. Environmental, Groundwater, Hazardous Materials, Geotechnical & Industrial Engineering Consultants		Boring #: **B-2** (Page 1 of 2)
Project: **P-1346 Simulator & Range Control Center**	GER Project Number: **110-6170**	Date Drilled: **3/5/2013**
Location: **MCB Camp Lejeune, NC**	Driller: **Fishburne Drilling**	Drill Method: **3" Mud Rotary**
Depth (ft.): **60.0** / Elevation (ft.): **26.0**	Client: **HBA-H&A JV**	Hammer Type: **Automatic**

Elevation ft	Elevation m	Depth ft	Depth m	Lith-ology	Material Description	Ground Water	Comments	SPT	Uncorrected Penetration Resistance (blows/foot) 0 25 50
					5" topsoil like material				
25	7		1		**Slightly Silty SAND (SP-SM)** Very loose, tan, fine, trace roots			3 2 2 2	4
					Clayey Silty SAND (SC-SM) Loose, brown, fine			2 3 3 3	6
		5			**Silty SAND (SM)** Loose to firm, tan with white and orange, fine, with thin clay lenses			3 4 3 5	8
20	6		2					5 4 4 7	11
					Slightly Silty SAND (SP-SM) Firm, tan with white and orange, fine, trace clay			7 5 7 7	14
	5	10	3					5 5 6 6	11
15					**Silty SAND (SM)** Loose, light gray with orange, fine, little clay	▽		3 3 2 2	5
	4		4						
		15							
10	3		5					5 5 4 5	9
		20	6						
5					**Slightly Silty SAND (SP-SM)** Loose, orange and tan, fine			5 4 5 6	9
	2		7						
		25							
0	1		8					4 3 3 4	6
	0	30	9						
-5	-1				**Clean SAND (SP)** Loose to firm, orange and tan, fine to medium			4 3 6 5	9
	-2		10						

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TEST BORING RECORD

GeoEnvironmental Resources, Inc. Environmental, Groundwater, Hazardous Materials, Geotechnical & Industrial Engineering Consultants		Boring #: **B-2** (Page 2 of 2)
Project: **P-1346 Simulator & Range Control Center**	GER Project Number: **110-6170**	Date Drilled: **3/5/2013**
Location: **MCB Camp Lejeune, NC**	Driller: **Fishburne Drilling**	Drill Method: **3" Mud Rotary**
Depth (ft.): **60.0** / Elevation (ft.): **26.0**	Client: **HBA-H&A JV**	Hammer Type: **Automatic**

Elevation ft	Elevation m	Depth ft	Depth m	Lith-ology	Material Description	Ground Water	Comments	SPT	Uncorrected Penetration Resistance (blows/foot) 0 25 50
-10	-3	40	11		**Clean SAND (SP)** Loose to firm, orange and tan, fine to medium *(continued)*			5 4 6 6	10
-15	-4	45	12					6 6 8 9	14
-20	-5	50	13					3 2 3 4	5
-25	-6	55	14		**Slightly Silty SAND (SP-SM)** Loose, dark gray, fine to medium, trace clay			10 12 12 14	24
-30	-7	60	15					3 4 8 7	12
-35	-8	65	16		**Silty SAND (SM)** Firm, gray, fine to medium, trace shell fragments, trace clay				
-40	-9		17						
	-10		18						
	-11		19						
	-12		20						
	-13		21		Boring terminated at 60 feet.				

TEST BORING RECORD WITH HAMMER INFO 6170.GPJ GEOENVIRONMENTAL RESOURCES.GDT 4/8/13

TEST BORING RECORD

GeoEnvironmental Resources, Inc. Environmental, Groundwater, Hazardous Materials, Geotechnical & Industrial Engineering Consultants		Boring #: **B-3** (Page 1 of 2)
Project: **P-1346 Simulator & Range Control Center**	GER Project Number: **110-6170**	Date Drilled: **3/5/2013**
Location: **MCB Camp Lejeune, NC**	Driller: **Fishburne Drilling**	Drill Method: **3" Mud Rotary**
Depth (ft.): **60.0**	Elevation (ft.): **27.0** Client: **HBA-H&A JV**	Hammer Type: **Automatic**

Elevation ft	Elevation m	Depth ft	Depth m	Lith-ology	Material Description	Ground Water	Comments	SPT	Uncorrected Penetration Resistance (blows/foot) 0 25 50
					10" topsoil like material			1 1	
					Clayey SAND (SC) Very loose to loose, grayish-brown, fine, trace roots			2 2	3
								3 3	7
		1						4 5	
					Silty SAND (SM) Firm to loose, tan, fine			5 5	13
		5						5 8	
			2					5 4	10
20	6				**Clayey SAND (SC)** Loose, tan with light gray and orange, fine, trace roots			5 5	
						▽		6 3	9
					Silty SAND (SM) Loose to firm, tan with white and orange, fine, trace clay			4 5	
		10	3					7 6	11
15	5							5 6	
								7	
			4		**Slightly Silty SAND (SP-SM)** Loose to firm, white, fine			4 3	7
	4	15						4 4	
			5						
10	3							5 5	12
								7 7	
		20	6						
	2							2 3	8
5	1		7					5 4	
		25							
			8		**Clean SAND (SP)** Firm to loose, orange and tan, fine, with thin clay lenses			5 7	15
0	0							8 10	
		30	9						
-5	-1								
			10					3 4	10
	-2							6 5	

TEST BORING RECORD WITH HAMMER INFO 6170.GPJ GEOENVIRONMENTAL RESOURCES.GDT 4/8/13

TEST BORING RECORD

GeoEnvironmental Resources, Inc. Environmental, Groundwater, Hazardous Materials, Geotechnical & Industrial Engineering Consultants		Boring #: **B-3** (Page 2 of 2)
Project: **P-1346 Simulator & Range Control Center**	GER Project Number: **110-6170**	Date Drilled: **3/5/2013**
Location: **MCB Camp Lejeune, NC**	Driller: **Fishburne Drilling**	Drill Method: **3" Mud Rotary**
Depth (ft.): **60.0** / Elevation (ft.): **27.0**	Client: **HBA-H&A JV**	Hammer Type: **Automatic**

Elevation ft	Elevation m	Depth ft	Depth m	Lith-ology	Material Description	Ground Water	Comments	SPT	Uncorrected Penetration Resistance (blows/foot) 0 25 50
-10	-3	40	12		**Clean SAND (SP)** Firm to loose, orange and tan, fine, with thin clay lenses *(continued)*			6 8 8 9	16
-15	-4	45	13		**Silty SAND (SM)** Firm, dark gray, fine to medium			6 9 9 11	18
-20	-6	50	14		**Clean SAND (SP)** Loose, dark gray, fine to medium			3 3 5 5	8
-25	-7	55	16		**Silty SAND and SHELL (SM)** Firm to dense, gray and white, fine to coarse, trace clay			7 8 7 9	15
-30	-9	60	17					15 23 25 19	48
-35	-10	65	18		Boring terminated at 60 feet.				
-40	-11		19						
	-12		20						
	-13		21						

TEST BORING RECORD WITH HAMMER INFO 6170.GPJ GEOENVIRONMENTAL RESOURCES.GDT 4/8/13

TEST BORING RECORD

GeoEnvironmental Resources, Inc. Environmental, Groundwater, Hazardous Materials, Geotechnical & Industrial Engineering Consultants		Boring #: **B-4** (Page 1 of 1)
Project: **P-1346 Simulator & Range Control Center**	GER Project Number: **110-6170**	Date Drilled: **3/5/2013**
Location: **MCB Camp Lejeune, NC**	Driller: **Fishburne Drilling**	Drill Method: **3" Mud Rotary**
Depth (ft.): **30.0** / Elevation (ft.): **29.2**	Client: **HBA-H&A JV**	Hammer Type: **Automatic**

Elevation ft	Elevation m	Depth ft	Depth m	Lith-ology	Material Description	Ground Water	Comments	SPT	Uncorrected Penetration Resistance (blows/foot) 0 25 50
					FILL Sampled as silty sand, light brown, fine, trace brick and stone			3 4 3 3	7
					Clayey SAND (SC) Loose, brown, fine			3 4 4 4	8
25	8	5	1		**Slightly Silty SAND (SP-SM)** Loose, white and tan, fine, trace clay			4 5 4 5	9
	7		2		**Silty SAND (SM)** Loose to firm, light gray and tan, fine, trace clay			3 6 7 7	13
20	6	10	3					5 4 3 3	7
					Slightly Silty SAND (SP-SM) Loose, tan with white and orange, fine	▽		4 3 3 3	6
15	5		4					3 3 4 5	7
	4	15	5		**Clean SAND (SP)** Loose, white with tan and orange, fine, trace clay			3 3 3 3	6
10	3	20	6					2 4 4 3	8
	2		7					13 16 19 20	35
5	1	25	8		**Clean SAND (SP)** Dense, tan, fine				
0	0	30	9		Boring terminated at 30 feet.				
	-1		10						
-5									

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TEST BORING RECORD

GeoEnvironmental Resources, Inc. Environmental, Groundwater, Hazardous Materials, Geotechnical & Industrial Engineering Consultants		Boring #: **B-5** (Page 1 of 2)
Project: **P-1346 Simulator & Range Control Center**	GER Project Number: **110-6170**	Date Drilled: **3/4/2013**
Location: **MCB Camp Lejeune, NC**	Driller: **Fishburne Drilling**	Drill Method: **3" Mud Rotary**
Depth (ft.): **60.0** / Elevation (ft.): **30.8**	Client: **HBA-H&A JV**	Hammer Type: **Automatic**

Elevation ft	Elevation m	Depth ft	Depth m	Lithology	Material Description	Ground Water	Comments	SPT	Uncorrected Penetration Resistance (blows/foot) 0 25 50
30	9				**FILL** Sampled as silty sand, tan to gray and brown, fine, trace stone, concrete, brick, asphalt and metal			2 2 2 1	4
		5	1					5 2 3 2	5
25	8							3 1 2 5	3
		10	2					0 3 1 2	4
20	7							1 3 5 5	8
			3		**Silty SAND (SM)** Loose, light gray and orange, fine, trace clay			3 3 5 6	8
15	6	15			**Slightly Silty SAND (SP-SM)** Loose to firm, tan with white and orange, fine, trace clay			5 5 6 6	11
			4			▼			
10	5					▽			
		20	5						
5	4							2 3 5 6	8
			6		**Clean SAND (SP)** Loose, white and tan, fine, with thin clay lenses				
0	3	25						5 5 4 7	9
			7						
-5	2				**Clayey SAND (SC)** Loose, orange and tan, fine				
			8					2 2 6 6	8
-10	1	30			**Clean SAND (SP)** Loose, tan, fine to medium				
			9						
-15	0				**Slightly Silty SAND (SP-SM)** Very loose, dark gray to gray, fine to medium			2 0 1 1	1
			10						
-20	-1								

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TEST BORING RECORD

GeoEnvironmental Resources, Inc. Environmental, Groundwater, Hazardous Materials, Geotechnical & Industrial Engineering Consultants		Boring #: **B-5** (Page 2 of 2)
Project: **P-1346 Simulator & Range Control Center**	GER Project Number: **110-6170**	Date Drilled: **3/4/2013**
Location: **MCB Camp Lejeune, NC**	Driller: **Fishburne Drilling**	Drill Method: **3" Mud Rotary**
Depth (ft.): **60.0** / Elevation (ft.): **30.8**	Client: **HBA-H&A JV**	Hammer Type: **Automatic**

Elevation ft	Elevation m	Depth ft	Depth m	Lith-ology	Material Description	Ground Water	Comments	SPT	Uncorrected Penetration Resistance (blows/foot) 0 25 50
-5	-2	40	12		**Slightly Silty SAND (SP-SM)** Very loose, dark gray to gray, fine to medium *(continued)*			4 5 6 7	11
-10	-3	45	14		**Clean SAND (SP)** Firm to dense, dark gray to gray, fine to medium			7 11 21 28	32
-15	-5	50	15		**Silty SAND and SHELL (SM)** Firm to dense, gray, fine to coarse			14 10 10 8	20
-20	-6	55	17					14 14 16 13	30
-25	-8	60	18		Boring terminated at 60 feet.			18 21 24 20	45
-30	-9	65	20						
-35	-10		21						
	-11								

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TEST BORING RECORD

GeoEnvironmental Resources, Inc. Environmental, Groundwater, Hazardous Materials, Geotechnical & Industrial Engineering Consultants		Boring #: **B-6** (Page 1 of 2)
Project: **P-1346 Simulator & Range Control Center**	GER Project Number: **110-6170**	Date Drilled: **3/6/2013**
Location: **MCB Camp Lejeune, NC**	Driller: **Fishburne Drilling**	Drill Method: **3" Mud Rotary**
Depth (ft.): **60.0** / Elevation (ft.): **29.1**	Client: **HBA-H&A JV**	Hammer Type: **Automatic**

Elevation ft	Elevation m	Depth ft	Depth m	Lith-ology	Material Description	Ground Water	Comments	SPT	Uncorrected Penetration Resistance (blows/foot) 0 25 50
25	8	0	0		**FILL** Sampled as silty sand, brown and tan, fine, trace stone, asphalt and organic material			3 4 9 5	13
					Clayey SAND (SC) Loose, brown, fine			3 3 4 5	7
		5	1		**Silty SAND (SM)** Loose to firm, tan with light gray, fine, trace clay			4 5 5 6	10
	7		2		**Clayey SAND (SC)** Firm, tan with light gray, fine			6 6 5 6	11
20	6	10	3		**Slightly Silty SAND (SP-SM)** Firm, tan with white and orange, fine, trace clay			6 6 6 5	12
						▽		5 6 8 9	14
15	5	15	4					6 7 9 7	16
	4		5						
10	3	20	6		**Silty SAND (SM)** Loose, tan with white and orange, fine, little clay			3 4 4 7	8
	2	25	7		**Slightly Silty SAND (SP-SM)** Firm, white with tan and orange, fine, with thin clay lenses			4 7 8 8	15
5	1		8						
0	0	30	9		**Clean SAND (SP)** Loose to firm, orange to tan, fine to medium, trace clay			4 3 5 5	8
	-1		10					12 12 12 15	24
-5									

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TEST BORING RECORD

GeoEnvironmental Resources, Inc. Environmental, Groundwater, Hazardous Materials, Geotechnical & Industrial Engineering Consultants		Boring #: **B-6** (Page 2 of 2)
Project: **P-1346 Simulator & Range Control Center**	GER Project Number: **110-6170**	Date Drilled: **3/6/2013**
Location: **MCB Camp Lejeune, NC**	Driller: **Fishburne Drilling**	Drill Method: **3" Mud Rotary**
Depth (ft.): **60.0** / Elevation (ft.): **29.1**	Client: **HBA-H&A JV**	Hammer Type: **Automatic**

Elevation ft	Elevation m	Depth ft	Depth m	Lith-ology	Material Description	Ground Water	Comments	SPT	Uncorrected Penetration Resistance (blows/foot) 0 25 50
	-2		11		**Clean SAND (SP)** Loose to firm, orange to tan, fine to medium, trace clay *(continued)*				
-10	-3	40	12		**Slightly Silty SAND (SP-SM)** Loose, orange-brown, fine to medium, trace clay			3 3 4 5	7
	-4		13		**Clean SAND (SP)** Firm to loose, orange to dark gray, fine to medium			6 7 7 9	14
-15	-5	45	14						
								9 9 10 10	19
-20	-6	50	15						
	-7		16					2 3 2 2	5
-25		55							
	-8		17						
	-9		18					7 6 7 8	13
-30		60			Boring terminated at 60 feet.				
	-10		19						
-35		65							
	-11		20						
	-12		21						
-40									

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TEST BORING RECORD

GeoEnvironmental Resources, Inc. Environmental, Groundwater, Hazardous Materials, Geotechnical & Industrial Engineering Consultants		Boring #: **B-7** (Page 1 of 2)
Project: **P-1346 Simulator & Range Control Center**	GER Project Number: **110-6170**	Date Drilled: **3/6/2013**
Location: **MCB Camp Lejeune, NC**	Driller: **Fishburne Drilling**	Drill Method: **3" Mud Rotary**
Depth (ft.): **60.0**	Elevation (ft.): **27.4** Client: **HBA-H&A JV**	Hammer Type: **Automatic**

Elevation ft	Elevation m	Depth ft	Depth m	Lithology	Material Description	Ground Water	Comments	SPT	Uncorrected Penetration Resistance (blows/foot) 0 25 50
					4" topsoil like material			1	
					Silty SAND (SM) Very loose to loose, brown to tan, fine, trace roots, trace clay			1 2 2	3
25	8	1						1 2 2	4
		5						3 3 4	9
	7		2		**Clayey Silty SAND (SC-SM)** Loose, tan and light gray, fine			3 4 5	
								6 4 5	10
20					**Silty SAND (SM)** Loose to firm, tan with light gray and orange, fine			5 5 5	
	6							5 6 6	12
		10	3					7 7 11	23
					Slightly Silty SAND (SP-SM) Firm, white and tan, fine, with thin clay lenses	▽		12 11 6	
15			4					7 5 9	12
	5	15							
			5						7
10					**Clean SAND (SP)** Loose, tan with white and orange, fine, trace clay			4 3 4 4	
	3								
		20	6						
	2								
5					**Silty SAND (SM)** Loose, orange and tan, fine, little clay				6
	1		7					3 3 3 4	
		25							
			8						
0	0				**Slightly Silty SAND (SP-SM)** Firm, orange, fine to medium				11
								4 5 6 7	
		30	9						
	-1								
-5					**Clean SAND (SP)** Loose to firm, tan and orange, fine to medium				7
	-2		10					3 3 4 6	

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TEST BORING RECORD

GeoEnvironmental Resources, Inc. Environmental, Groundwater, Hazardous Materials, Geotechnical & Industrial Engineering Consultants		Boring #: **B-7** (Page 2 of 2)
Project: **P-1346 Simulator & Range Control Center**	GER Project Number: **110-6170**	Date Drilled: **3/6/2013**
Location: **MCB Camp Lejeune, NC**	Driller: **Fishburne Drilling**	Drill Method: **3" Mud Rotary**
Depth (ft.): **60.0**	Elevation (ft.): **27.4** Client: **HBA-H&A JV**	Hammer Type: **Automatic**

Elevation ft	Elevation m	Depth ft	Depth m	Lith-ology	Material Description	Ground Water	Comments	SPT	Uncorrected Penetration Resistance (blows/foot) 0 25 50
			11		**Clean SAND (SP)** Loose to firm, tan and orange, fine to medium *(continued)*			5 4 5 6	9
-10	-3								
		40	12						
	-4								
-15			13					6 6 10 10	16
	-5								
		45							
			14						
-20	-6							6 6 7 6	13
			15						
		50							
	-7								
-25			16		**Clean SAND (SP)** Loose, orange to dark gray, fine to medium			2 2 3 4	5
	-8								
		55							
			17						
-30	-9								
			18					3 2 4 4	6
	-10	60			Boring terminated at 60 feet.				
-35			19						
	-11								
		65							
			20						
-40	-12								
			21						

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TEST BORING RECORD

GeoEnvironmental Resources, Inc. Environmental, Groundwater, Hazardous Materials, Geotechnical & Industrial Engineering Consultants		Boring #: **BMP-1** (Page 1 of 1)
Project: **P-1346 Simulator & Range Control Center**	GER Project Number: **110-6170**	Date Drilled: **3/5/2013**
Location: **MCB Camp Lejeune, NC**	Driller: **Fishburne Drilling**	Drill Method: **3" Mud Rotary**
Depth (ft.): **15.0** / Elevation (ft.): **27.5**	Client: **HBA-H&A JV**	Hammer Type: **Automatic**

Elevation ft	Elevation m	Depth ft	Depth m	Lith-ology	Material Description	Ground Water	Comments	SPT
					8" topsoil and stone			
					Clayey SAND (SC) Loose, brown, fine			
25	8	5	1		**Silty SAND (SM)** Loose, tan, fine, trace clay			
20	6	10	2		**Clayey SAND (SC)** Loose, grayish-tan to white, fine, trace roots			
15	5	15	3		**Silty SAND (SM)** Loose, tan with white and orange, fine, trace clay	▽	Temporary piezometer	
10	3	20	4		**Clean SAND (SP)** Firm, white, fine, trace clay			
5	2	25	5		Boring terminated at 15 feet.			
0	0	30	6					
-5	-1		7					
	-2		8					
			9					
			10					

Uncorrected Penetration Resistance (blows/foot)

0 25 50

SPT: 3 3 4 4 4 3 3 3 4 5 5 6 5 5 5 7 6 5 4 4 4 5 5 5 5 5 4 7 7

7 6 10 10 9 10 11

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TEST BORING RECORD

GeoEnvironmental Resources, Inc. Environmental, Groundwater, Hazardous Materials, Geotechnical & Industrial Engineering Consultants		Boring #: **BMP-2** (Page 1 of 1)
Project: **P-1346 Simulator & Range Control Center**	GER Project Number: **110-6170**	Date Drilled: **3/6/2013**
Location: **MCB Camp Lejeune, NC**	Driller: **Fishburne Drilling**	Drill Method: **3" Mud Rotary**
Depth (ft.): **15.0** Elevation (ft.): **25.0**	Client: **HBA-H&A JV**	Hammer Type: **Automatic**

Elevation ft	Elevation m	Depth ft	Depth m	Lith-ology	Material Description	Ground Water	Comments	SPT	Uncorrected Penetration Resistance (blows/foot) 0 25 50
					8" topsoil like material				
					Silty SAND (SM) Very loose to loose, dark brown to light brown, fine, trace roots			2 2 2 2 2 2	4
								2 2 2 4	4
								3 3 3 4	6
					Silty SAND (SM) Loose, tan with light gray and orange, fine, trace to little clay			5 5 5 6	10
								6 5 3 3	8
					Slightly Silty SAND (SP-SM) Firm, tan and orange, fine			7 9 9 11	18
					Clean SAND (SP) Firm, white and tan, fine	▽		5 6 7 7	13
					Boring terminated at 15 feet.				

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TEST BORING RECORD

GeoEnvironmental Resources, Inc. Environmental, Groundwater, Hazardous Materials, Geotechnical & Industrial Engineering Consultants		Boring #: **BMP-3** (Page 1 of 1)
Project: **P-1346 Simulator & Range Control Center**	GER Project Number: **110-6170**	Date Drilled: **3/5/2013**
Location: **MCB Camp Lejeune, NC**	Driller: **Fishburne Drilling**	Drill Method: **3" Mud Rotary**
Depth (ft.): **15.0**	Elevation (ft.): **26.8** Client: **HBA-H&A JV**	Hammer Type: **Automatic**

Elevation ft	Elevation m	Depth ft	Depth m	Lith-ology	Material Description	Ground Water	Comments	SPT	Uncorrected Penetration Resistance (blows/foot) 0 25 50
					6" topsoil like material				
					Silty SAND (SM) Firm to loose, brown to tan and white, fine, trace roots, trace clay			3 6 7 4 4 4 3 4 4 3 4 3 3 2 3 2 3 4 3 3 3 3 3 3 3 2 3 3	13 7 7 5 7 6 5
					Slightly Silty SAND (SP-SM) Loose, tan with white and orange, fine, trace clay	▽	Temporary piezometer		
					Boring terminated at 15 feet.				

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TEST BORING RECORD

GeoEnvironmental Resources, Inc. Environmental, Groundwater, Hazardous Materials, Geotechnical & Industrial Engineering Consultants		Boring #: **BMP-4** (Page 1 of 1)
Project: **P-1346 Simulator & Range Control Center**	GER Project Number: **110-6170**	Date Drilled: **3/5/2013**
Location: **MCB Camp Lejeune, NC**	Driller: **Fishburne Drilling**	Drill Method: **3" Mud Rotary**
Depth (ft.): **15.0** / Elevation (ft.): **25.3**	Client: **HBA-H&A JV**	Hammer Type: **Automatic**

Elevation ft	Elevation m	Depth ft	Depth m	Lith-ology	Material Description	Ground Water	Comments	SPT
					6" topsoil like material			
					Clayey SAND (SC) Very loose, brown, fine, some roots			4 2 2
					Silty SAND (SM) Loose, orange to tan, fine, trace roots			3 2 3
								2 3 3
								3 3 3
								3 3 4
					Clayey Silty SAND (SC-SM) Loose, tan with light gray and orange, fine			4 5 5
					Slightly Silty SAND (SP-SM) Loose, tan and white, fine, trace clay			6 5 6
								8 7 6
					Clean SAND (SP) Firm to loose, tan with white and orange, fine to medium, trace clay	▼		7 4 4
								6 7
					Boring terminated at 15 feet.			

Uncorrected Penetration Resistance (blows/foot): 0 — 25 — 50

4, 5, 6, 8, 11, 13, 10

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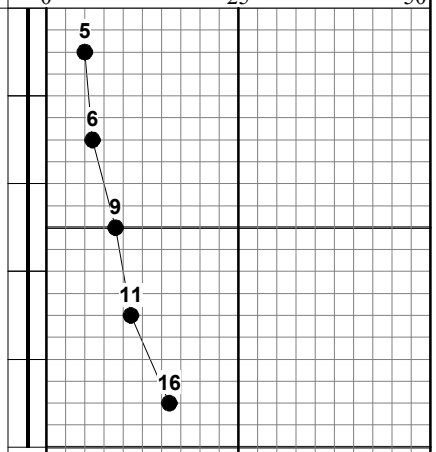
TEST BORING RECORD

GeoEnvironmental Resources, Inc. Environmental, Groundwater, Hazardous Materials, Geotechnical & Industrial Engineering Consultants		Boring #: **PB-1** (Page 1 of 1)
Project: **P-1346 Simulator & Range Control Center**	GER Project Number: **110-6170**	Date Drilled: **3/6/2013**
Location: **MCB Camp Lejeune, NC**	Driller: **Fishburne Drilling**	Drill Method: **2-1/4" HSA**
Depth (ft.): **10.0**	Elevation (ft.): **30.5** Client: **HBA-H&A JV**	Hammer Type: **Automatic**

Elevation ft	Elevation m	Depth ft	Depth m	Lith-ology	Material Description	Ground Water	Comments	SPT
					FILL Sampled as silty sand, brown, fine, trace stone			3 3
					Clayey Silty SAND (SC-SM) Loose, brown, fine			2 3
					Silty SAND (SM) Loose, brown to tan, fine, trace clay			3 3 3 5
					Clayey SAND (SC) Loose, light gray and tan, fine			4 4 5 6
					Silty SAND (SM) Firm, tan with white and orange, fine, trace clay			7 5 6 10
					Slightly Silty SAND (SP-SM) Firm, white and tan, fine			6 7 9 10
					Boring terminated at 10 feet.			

Uncorrected Penetration Resistance (blows/foot)



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TEST BORING RECORD

GeoEnvironmental Resources, Inc. Environmental, Groundwater, Hazardous Materials, Geotechnical & Industrial Engineering Consultants		Boring #: **PB-2** (Page 1 of 1)
Project: **P-1346 Simulator & Range Control Center**	GER Project Number: **110-6170**	Date Drilled: **3/6/2013**
Location: **MCB Camp Lejeune, NC**	Driller: **Fishburne Drilling**	Drill Method: **2-1/4" HSA**
Depth (ft.): **10.0**	Elevation (ft.): **28.5** Client: **HBA-H&A JV**	Hammer Type: **Automatic**

Elevation ft	Elevation m	Depth ft	Depth m	Lithology	Material Description	Ground Water	Comments	SPT	Uncorrected Penetration Resistance (blows/foot) 0 25 50
					FILL Sampled as silty sand, brown and white, fine, trace gravel and asphalt			2 3 3	6
					Silty SAND (SM) Loose, brown to tan, fine, little to trace clay			3 2 3	8
								4 4 6	9
					Clayey SAND (SC) Loose, light gray and orange, fine			4 5 5	13
					Silty SAND (SM) Firm, tan with white and orange, fine, trace clay			5 5 7	14
					Clean SAND (SP) Firm, white and tan, fine			6 7 7	
					Boring terminated at 10 feet.			8	

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TEST BORING RECORD

GeoEnvironmental Resources, Inc. Environmental, Groundwater, Hazardous Materials, Geotechnical & Industrial Engineering Consultants		Boring #: **PB-3** (Page 1 of 1)
Project: **P-1346 Simulator & Range Control Center**	GER Project Number: **110-6170**	Date Drilled: **3/5/2013**
Location: **MCB Camp Lejeune, NC**	Driller: **Fishburne Drilling**	Drill Method: **2-1/4" HSA**
Depth (ft.): **10.0** / Elevation (ft.): **26.7**	Client: **HBA-H&A JV**	Hammer Type: **Automatic**

Elevation ft	Elevation m	Depth ft	Depth m	Lith-ology	Material Description	Ground Water	Comments	SPT	Uncorrected Penetration Resistance (blows/foot) 0 25 50
					4" topsoil like material			3	
					Clayey Silty SAND (SC-SM) Very loose, brown, fine, trace roots			2	
					Silty SAND (SM) Loose, brown to tan and orange, fine, trace clay, trace roots			1	
								3	
								3	
								3	5
								2	
								3	
								3	
								4	8
								4	
								6	
								5	9
								5	
								4	
								5	9
								4	
								5	
								4	
								3	
					Boring terminated at 10 feet.				

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TEST BORING RECORD

GeoEnvironmental Resources, Inc. Environmental, Groundwater, Hazardous Materials, Geotechnical & Industrial Engineering Consultants		Boring #: **PB-4** (Page 1 of 1)
Project: **P-1346 Simulator & Range Control Center**	GER Project Number: **110-6170**	Date Drilled: **3/6/2013**
Location: **MCB Camp Lejeune, NC**	Driller: **Fishburne Drilling**	Drill Method: **2-1/4" HSA**
Depth (ft.): **10.0**	Elevation (ft.): **26.0** Client: **HBA-H&A JV**	Hammer Type: **Automatic**

Elevation ft	Elevation m	Depth ft	Depth m	Lith-ology	Material Description	Ground Water	Comments	SPT	Uncorrected Penetration Resistance (blows/foot) 0 25 50
					6" topsoil like material			1 1	
25	7	1			**Silty SAND (SM)** Very loose, brown, fine, trace roots			1 1 1 1	2
					Slightly Silty SAND (SP-SM) Very loose, tan and white, fine, trace roots			1 1 1 2	2
		5			**Clayey Silty SAND (SC-SM)** Very loose to loose, tan and white, fine			1 1 2 2	3
20	6	2						2 2 2 3	5
					Slightly Silty SAND (SP-SM) Loose, white and tan, fine, trace clay			3 2 3 3	6
	5	10	3		Boring terminated at 10 feet.			3	
15									
	4		4						
		15							
10	3		5						
		20							
5	2		6						
			7						
	1	25							
0	0		8						
	-1	30	9						
-5									
	-2		10						

TEST BORING RECORD WITH HAMMER INFO 6170.GPJ GEOENVIRONMENTAL RESOURCES.GDT 4/8/13

CPTu SOUNDINGS

References: ASTM D 5778, "**Standard Test Method for Performing Electronic Friction Cone and Piezocone Penetration Testing of Soils**," Annual Book of ASTM Standards, Vol. 04.08, American Society for Testing and Materials, January 1996.

Lunne, T., Robertson, P.K., and Powell, J.J.M., "**Cone Penetration Testing in Geotechnical Practice**," Spoon Press, 1997.

Riaund, J. L. and Miran, J., "**The Cone Penetrometer Test**," Publication No. FHWA-SA-91-043, Final Report, U.S. Department of Transportation, Federal Highway Administration, February 1992.

Contractor: ConeTec, Inc.

Procedures: The CPT is a profiling tool described in ASTM D 5778 and various other publications. No physical soil sampling is conducted during the test. A compression model electronic piezocone penetrometer with a 15 cm^2 tip and a 225 cm^2 friction sleeve was used. The cone is designed with an equal end area friction sleeve and a tip end area ratio of 0.8. Prior to testing, the cone internal force transducers were calibrated in a laboratory. At the beginning of each sounding, the cone was outfitted with a vacuum-saturated, 6 mm thick porous plastic pore pressure element that is located immediately behind the tip (the u_2 location). The cone was advanced using a 15-ton hydraulic ramset mounted in a 25-ton truck or on a 20-ton tracked vehicle. As the cone was advanced into the ground, tip resistance (qc), sleeve friction (fs) and dynamic pore water pressure (u) were recorded every 2.5 centimeters (approximately every one inch).

Limitations: The enclosed testing records represent an interpretation of the subsurface conditions encountered at the specific testing locations at the time explorations were made. It is possible that subsurface conditions between testing locations will be different from those indicated. Strata contacts and surface elevations, if shown, shall be considered approximate and are referenced to project datum shown on the plans or described in the geotechnical report unless noted otherwise.

GER GeoEnvironmental Resources, Inc. Consulting Engineers

Environmental
Groundwater
Hazardous Materials
Geotechnical
Industrial Hygiene

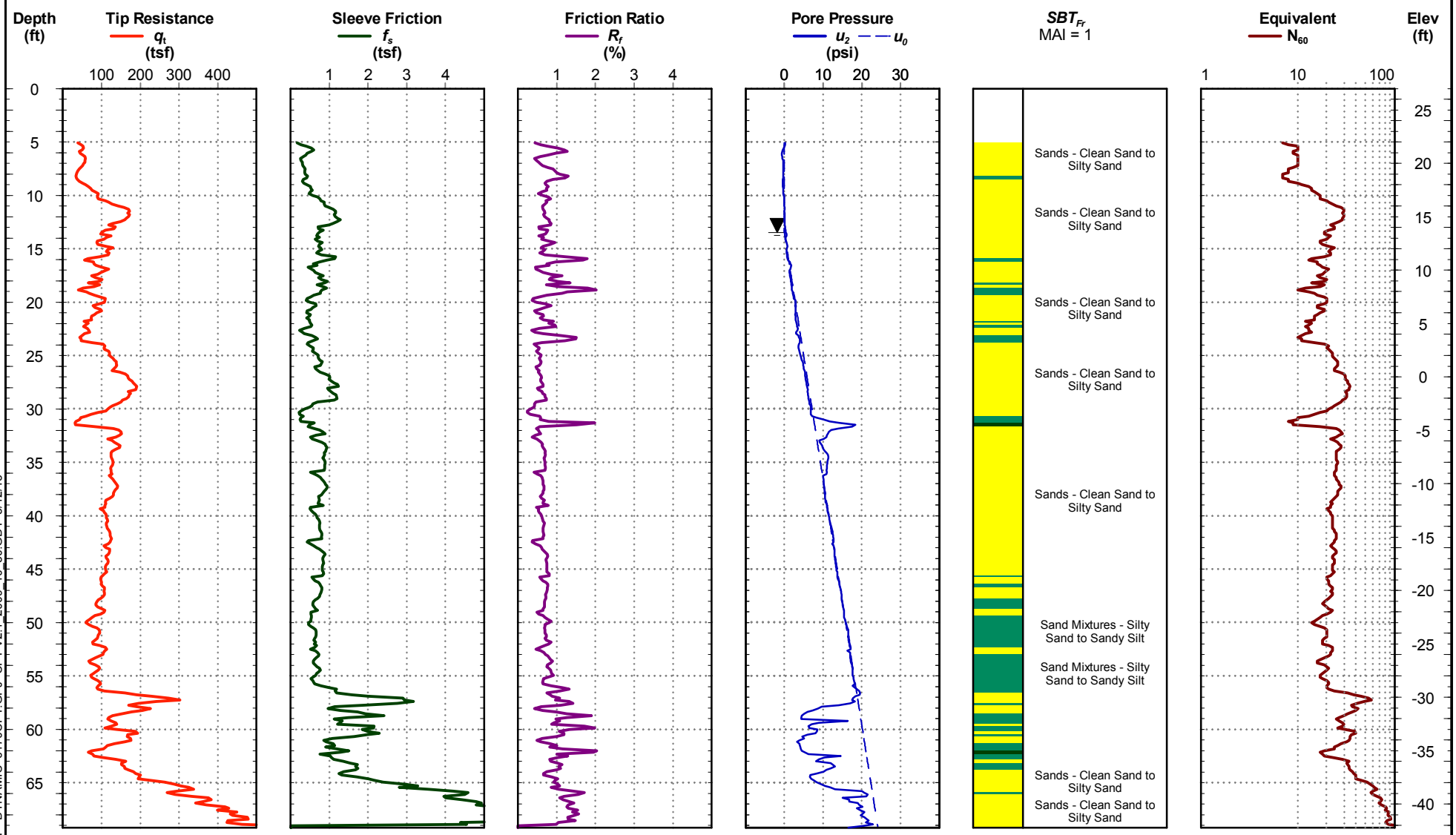
P-1346 Simulator & Range Control Center
MCB Camp Lejeune, NC
Project No: 110-6170

Cone Penetration Test CPT-1

Test Date: Mar. 7, 2013
Est. Water Depth: 13.5 (ft)
Rig/Operator: ConeTec

Northing/Latitude: 34.665365
Easting/Longitude: -77.324832
Surface Elevation: 27 (ft)

Total Depth: 69.2 (ft)
Termination Criteria: Refusal
Cone Size: 15 cm^2



CPT REPORT - DYNAMIC 6170CPT.GPJ CPT V2.1_2009_10_30.GDT 3/12/13

Electronic Filename: 13-54017_SP01.COR

CPT-1

SHEAR WAVE VELOCITY TESTS

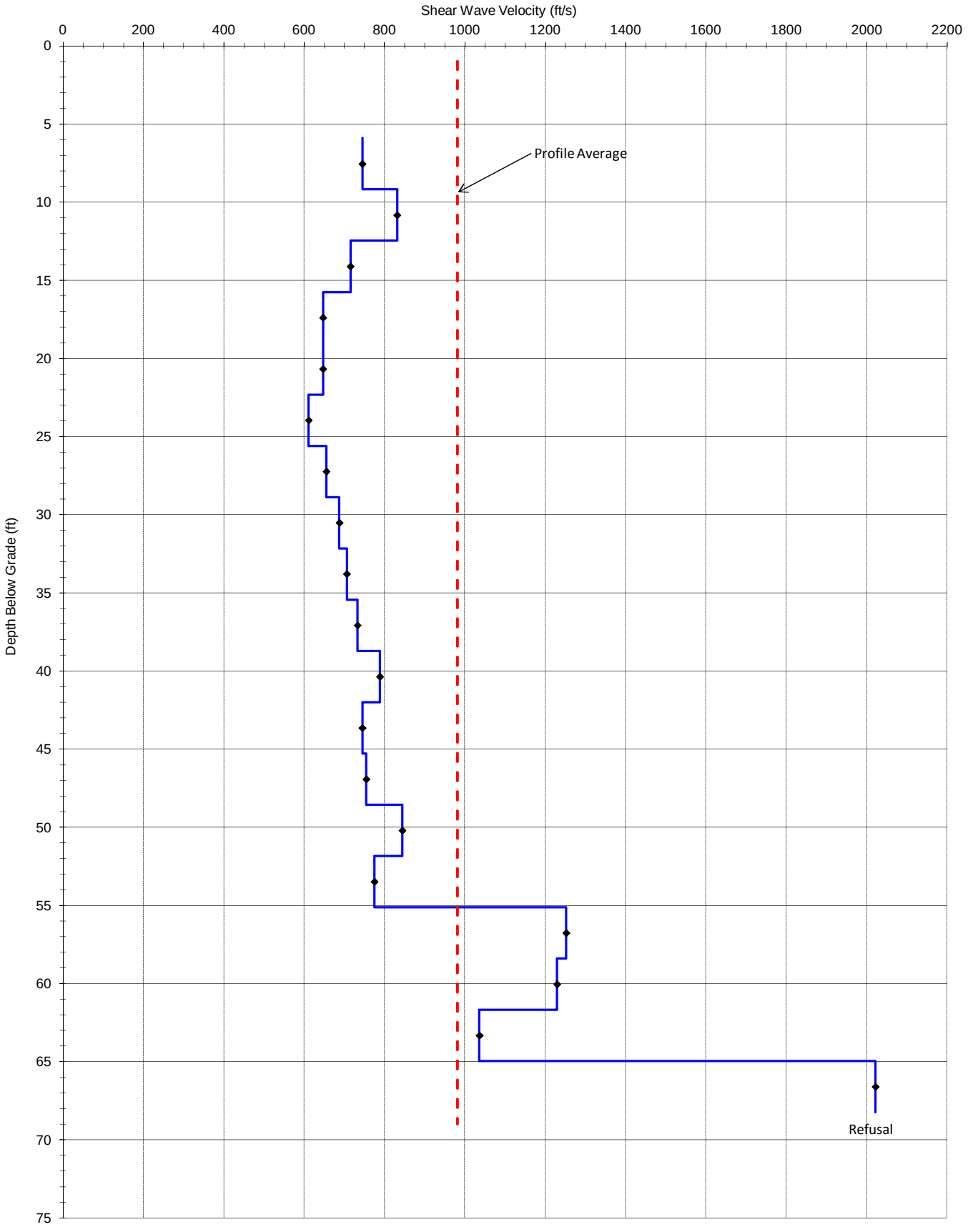
GER

Shear Wave Velocity at CPT-1
P-1346 Simulator Center
MCB Camp Lejeune, NC
March 7, 2013

CONETEC

GER GeoEnvironmental Resources, Inc. Consulting Engineers

Environmental
Groundwater
Hazardous Materials
Geotechnical
Industrial Hygiene



ConeTec Shear Wave Velocity Data Reduction Sheet

Hole: CPT-1
Location: P-1346 Simulator Center
Cone: AD304
Date: 7-Mar-13
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	3.20	226.9	744.6	2.30	7.55
4.00	3.80	4.37	3.30	253.3	831.0	3.30	10.83
5.00	4.80	5.26	4.10	217.9	714.9	4.30	14.11
6.00	5.80	6.19	4.70	197.1	646.5	5.30	17.39
7.00	6.80	7.13	4.80	197.1	646.7	6.30	20.67
8.00	7.80	8.09	5.15	186.2	611.0	7.30	23.95
9.00	8.80	9.06	4.85	199.6	654.8	8.30	27.23
10.00	9.80	10.03	4.65	209.5	687.4	9.30	30.51
11.00	10.80	11.01	4.55	215.1	705.8	10.30	33.79
12.00	11.80	11.99	4.40	223.3	732.5	11.30	37.07
13.00	12.80	12.98	4.10	240.2	788.2	12.30	40.35
14.00	13.80	13.97	4.35	226.9	744.5	13.30	43.63
15.00	14.80	14.96	4.30	230.0	754.4	14.30	46.92
16.00	15.80	15.95	3.85	257.2	843.8	15.30	50.20
17.00	16.80	16.94	4.20	236.0	774.4	16.30	53.48
18.00	17.80	17.93	2.60	381.7	1252.1	17.30	56.76
19.00	18.80	18.92	2.65	374.7	1229.3	18.30	60.04
20.00	19.80	19.92	3.15	315.7	1035.8	19.30	63.32
21.00	20.80	20.91	1.61	616.2	2021.6	20.30	66.60

FIELD PERMEABILITY TESTS

GER

MEASUREMENT OF FIELD SATURATED HYDRAULIC CONDUCTIVITY

Project: **P-1346 Simulator & Range Control Center**
Location: **MCB Camp Lejeune, NC**
GER Project #: **110-6170**
Client: **HBA-H&A, JV**
Contract #: **N40085-10-D-5301**

Environmental
Groundwater
Hazardous Materials
Geotechnical
Industrial Hygiene

GER Consulting Engineers — GeoEnvironmental Resources, Inc.

Boring/Test No: BMP-1

Setup Data

Test Date: 5-Mar-13 | Investigator: CFC

Test Depth: 152.4 H (cm) | Depth to Water Table: 396.2 S (cm)

Borehole Diameter: 8.3 2r (cm) | Depth to Impermeable: N/A (cm)

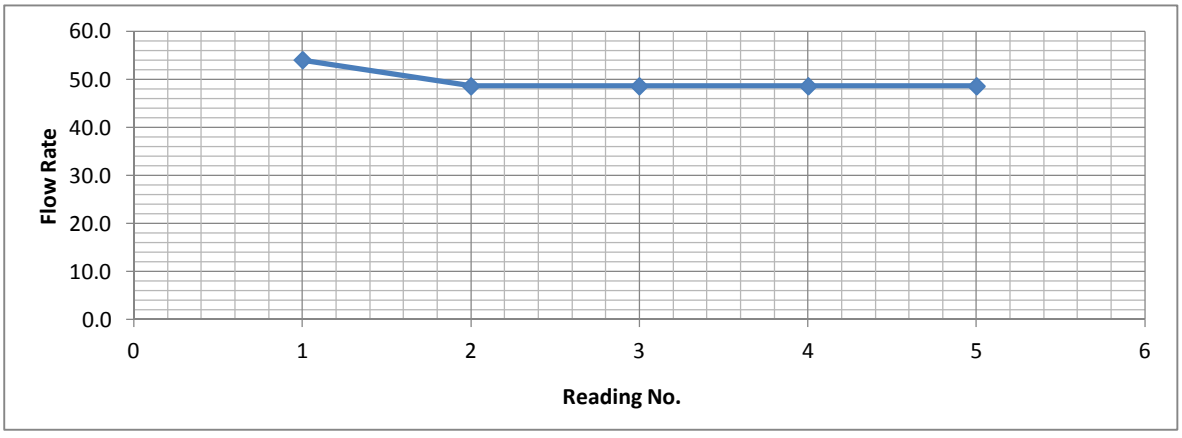
Reservoir Height: 61.0 D (cm) | Reservoir Area: 81.1 A (cm^2)

Constant Head: 20.0 h (cm) | Water Temperature: 16 (^oC)

Soil Description: Tan fine clayey SAND (SC) | Soil Alpha: 0.12

Field Readings

Reading No.	Time Actual (HH:mm:ss)	Reservoir Level (cm)	Reservoir Level (mL)	Time Interval (min)	Water Consumption (cm)	Water Consumption (mL)	Flow Rate (cm/min)	Flow Rate (mL/min)
0	15:03:00	30	1218					
1	15:04:30	29	1299	1.5	1	81	0.67	54.05
2	15:06:10	28	1380	1.7	1	81	0.60	48.64
3	15:07:50	27	1461	1.7	1	81	0.60	48.64
4	15:09:30	26	1542	1.7	1	81	0.60	48.64
5	15:11:10	25	1623	1.7	1	81	0.60	48.64



Calculations

L = 263.8
L/h = 13.19
h/r = 4.85
C = 1.70
V_k/V_a = 0.93

Field Saturated Hydraulic Conductivity, K_{fsat}

by US Bureau of Reclamation, 1990	K_{fsat} =	0.028	cm/min
	K_{fsat} =	0.671	in/hr
by Reynolds et al., 1993	K_{fsat} =	0.023	cm/min
	K_{fsat} =	0.535	in/hr
AVG =		**0.026**	cm/min
		0.60	in/hr

MEASUREMENT OF FIELD SATURATED HYDRAULIC CONDUCTIVITY

Project: **P-1346 Simulator & Range Control Center**
Location: **MCB Camp Lejeune, NC**
GER Project #: **110-6170**
Client: **HBA-H&A, JV**
Contract #: **N40085-10-D-5301**

Environmental
Groundwater
Hazardous Materials
Geotechnical
Industrial Hygiene

GER Consulting Engineers — GeoEnvironmental Resources, Inc.

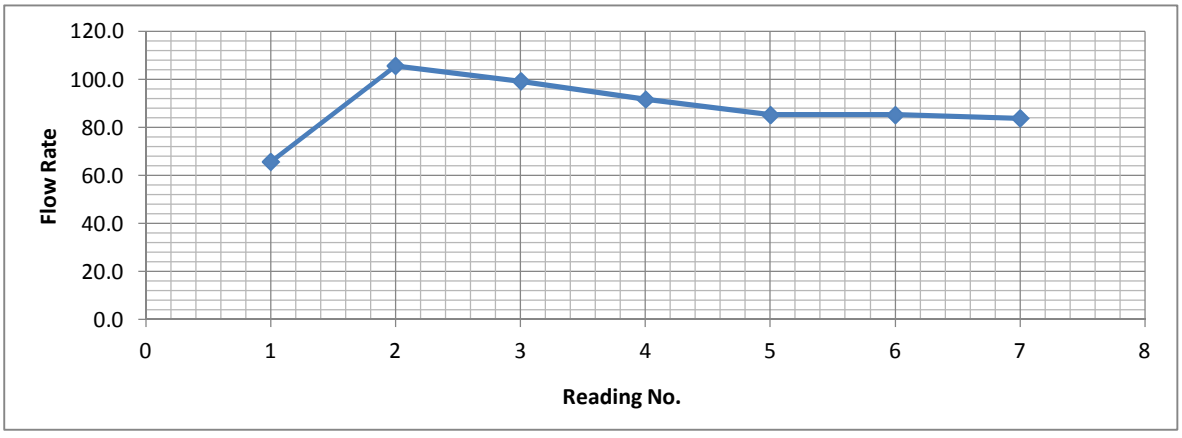
Boring/Test No: **BMP-2**

Setup Data

Test Date:	5-Mar-13		Investigator:	CFC	
Test Depth:	91.4	H (cm)	Depth to Water Table:	396.2	S (cm)
Borehole Diameter:	8.3	2r (cm)	Depth to Impermeable:	N/A	(cm)
Reservoir Height:	30.5	D (cm)	Reservoir Area:	81.1	A (cm^2)
Constant Head:	20.0	h (cm)	Water Temperature:	16	(^oC)
Soil Description:	Brown fine silty SAND (SM)		Soil Alpha:	0.12	

Field Readings

Reading No.	Time Actual (HH:mm:ss)	Reservoir Level (cm)	Reservoir Level (mL)	Time Interval (min)	Water Consumption (cm)	Water Consumption (mL)	Flow Rate (cm/min)	Flow Rate (mL/min)
0	15:32:30	41	326					
1	15:33:44	40	407	1.2	1	81	0.81	65.74
2	15:34:30	39	488	0.8	1	81	1.30	105.75
3	15:35:19	38	569	0.8	1	81	1.22	99.27
4	15:36:12	37	650	0.9	1	81	1.13	91.78
5	15:37:09	36	731	0.9	1	81	1.05	85.34
6	15:38:06	35	812	0.9	1	81	1.05	85.34
7	15:39:04	34	894	1.0	1	81	1.03	83.87



Calculations

L = 324.8
L/h = 16.24
h/r = 4.85
C = 1.70
V_k/V_a = 0.93

Field Saturated Hydraulic Conductivity, K_{fsat}

by US Bureau of Reclamation, 1990	K_{fsat} =	0.049	cm/min
	K_{fsat} =	1.156	in/hr
by Reynolds et al., 1993	K_{fsat} =	0.040	cm/min
	K_{fsat} =	0.939	in/hr
AVG =		**0.044**	cm/min
		1.05	in/hr

MEASUREMENT OF FIELD SATURATED HYDRAULIC CONDUCTIVITY

Project: **P-1346 Simulator & Range Control Center**
Location: **MCB Camp Lejeune, NC**
GER Project #: **110-6170**
Client: **HBA-H&A, JV**
Contract #: **N40085-10-D-5301**

Environmental
Groundwater
Hazardous Materials
Geotechnical
Industrial Hygiene

GER Consulting Engineers — GeoEnvironmental Resources, Inc.

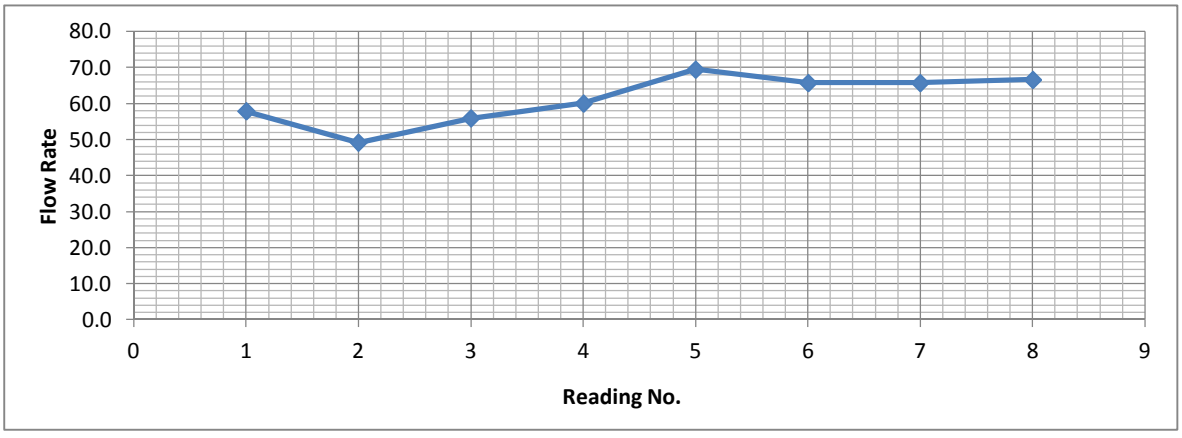
Boring/Test No: **BMP-3**

Setup Data

Test Date:	5-Mar-13		Investigator:	CFC	
Test Depth:	137.2	H (cm)	Depth to Water Table:	365.8	S (cm)
Borehole Diameter:	8.3	2r (cm)	Depth to Impermeable:	N/A	(cm)
Reservoir Height:	45.7	D (cm)	Reservoir Area:	81.1	A (cm^2)
Constant Head:	20.0	h (cm)	Water Temperature:	16	(^oC)
Soil Description:	Tan fine silty SAND (SM) with clay		Soil Alpha:	0.12	

Field Readings

Reading No.	Time Actual (HH:mm:ss)	Reservoir Level (cm)	Reservoir Level (mL)	Time Interval (min)	Water Consumption (cm)	Water Consumption (mL)	Flow Rate (cm/min)	Flow Rate (mL/min)
0	8:33:30	22	1866					
1	8:34:54	21	1947	1.4	1	81	0.71	57.91
2	8:36:33	20	2029	1.7	1	81	0.61	49.14
3	8:38:00	19	2110	1.4	1	81	0.69	55.91
4	8:39:21	18	2191	1.4	1	81	0.74	60.05
5	8:40:31	17	2272	1.2	1	81	0.86	69.49
6	8:41:45	16	2353	1.2	1	81	0.81	65.74
7	8:42:59	15	2434	1.2	1	81	0.81	65.74
8	8:44:12	14	2515	1.2	1	81	0.82	66.64



Calculations

L = 248.6
L/h = 12.43
h/r = 4.85
C = 1.70
V_k/V_a = 0.93

Field Saturated Hydraulic Conductivity, K_{fsat}

by US Bureau of Reclamation, 1990	K_{fsat} =	0.039	cm/min
	K_{fsat} =	0.919	in/hr
by Reynolds et al., 1993	K_{fsat} =	0.031	cm/min
	K_{fsat} =	0.733	in/hr
AVG =		**0.035**	cm/min
		0.83	in/hr

MEASUREMENT OF FIELD SATURATED HYDRAULIC CONDUCTIVITY

Project: **P-1346 Simulator & Range Control Center**
Location: **MCB Camp Lejeune, NC**
GER Project #: **110-6170**
Client: **HBA-H&A, JV**
Contract #: **N40085-10-D-5301**

Environmental
Groundwater
Hazardous Materials
Geotechnical
Industrial Hygiene

GER Consulting Engineers — GeoEnvironmental Resources, Inc.

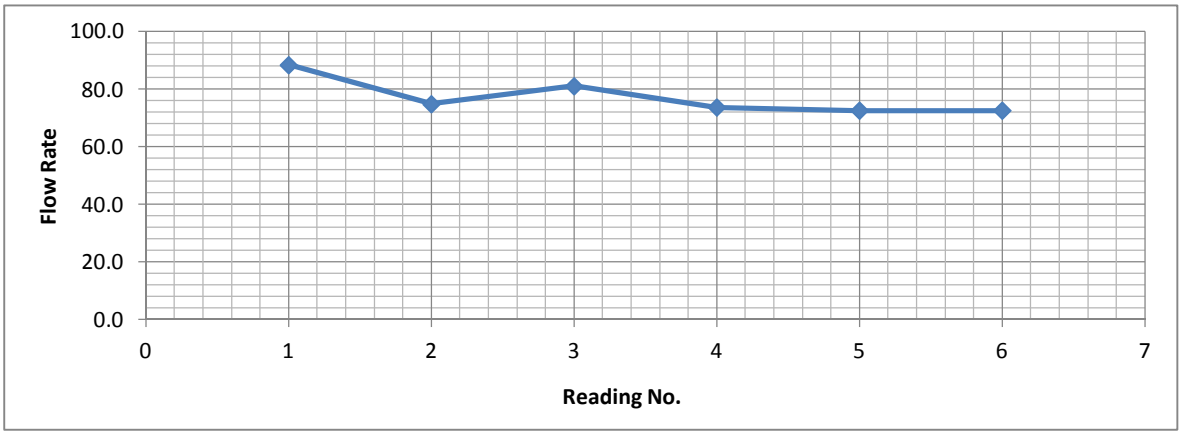
Boring/Test No: **BMP-4**

Setup Data

Test Date:	5-Mar-13		Investigator:	CFC	
Test Depth:	152.4	H (cm)	Depth to Water Table:	365.8	S (cm)
Borehole Diameter:	8.3	2r (cm)	Depth to Impermeable:	N/A	(cm)
Reservoir Height:	61.0	D (cm)	Reservoir Area:	81.1	A (cm^2)
Constant Head:	20.0	h (cm)	Water Temperature:	16	(^oC)
Soil Description:	Tan fine silty SAND (SM)		Soil Alpha:	0.12	

Field Readings

Reading No.	Time Actual (HH:mm:ss)	Reservoir Level (cm)	Reservoir Level (mL)	Time Interval (min)	Water Consumption (cm)	Water Consumption (mL)	Flow Rate (cm/min)	Flow Rate (mL/min)
0	9:04:00	25	1623					
1	9:04:55	24	1704	0.9	1	81	1.09	88.44
2	9:06:00	23	1785	1.1	1	81	0.92	74.84
3	9:07:00	22	1866	1.0	1	81	1.00	81.07
4	9:08:06	21	1947	1.1	1	81	0.91	73.70
5	9:09:13	20	2029	1.1	1	81	0.90	72.60
6	9:10:20	19	2110	1.1	1	81	0.90	72.60



Calculations

L = 233.4
L/h = 11.67
h/r = 4.85
C = 1.70
V_k/V_a = 0.93

Field Saturated Hydraulic Conductivity, K_{fsat}

by US Bureau of Reclamation, 1990	K_{fsat} =	0.042	cm/min
	K_{fsat} =	1.001	in/hr
by Reynolds et al., 1993	K_{fsat} =	0.034	cm/min
	K_{fsat} =	0.799	in/hr
AVG =		**0.038**	cm/min
		0.90	in/hr

NCDENR SITE VISIT NOTES

GER

DIVISION OF WATER QUALITY
INFILTRATION SYSTEM INVESTIGATION

Complete and email this form to Vincent.Lewis@ncdenr.gov. If there are more than 7 areas to be tested, attach a second sheet.

State Soil Scientist Confirmation Visit date/time: 26-Mar-13 / 12:00 *

Project Name: P-1346 Simulator Center **County: Onslow**

Street Address: Duncan Street, MCB Camp Lejeune

Directions from the nearest intersection of two major roads: From the Main Gate go south 3 miles. Turn left on Sneads Ferry Rd. Go 0.8 mile and turn right at the 2nd traffic light on Duncan St. Site is on the left side of Duncan St. past the Brig and Bldg 1042.

>1 acre being disturbed? ☒YES ☐NO **CAMA Major required? ☐YES ☒NO**

Consultant Name: Charles Crawley **Phone:757-463-3200 / 757-439-1666**

Consultant Firm Name: GeoEnvironmental Resources (GER)

Bore Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**
a) Existing Ground Elevation	31.0	26.5	27.5	27.5	25.0		
b) Proposed Bottom Elevation							
c) Difference (a minus b)							
d) Add 2 ft. (Min. Bore Depth)							
e) Hardpan Depth?							
f) Approx. Elev. Of SHWT	26.6	21.9	23.3	22.8	19.6		
g) Max. lowest bottom elev.							
h) Infiltration Rate OK? *							
i) Confirmation of SHWT *							

For projects requiring more than 5 hand borings, manpower or equipment to conduct the excavation must be provided by the consultant.
*State Soil Scientist Use ONLY

Comments Consultant will be present and will assist in locating the above areas and in making hand auger borings as necessary.

Required Attachments:

1. Legible vicinity map.
2. Complete Soils Report.
3. PDF formatted site plan with the boring locations to be tested. Site plans should be emailed or hand-delivered only. Illegible faxed maps will not be accepted.

All proposed infiltration areas and existing, active utility lines located within the proposed basin/trench must be marked and flagged. If these areas are not flagged, the Soils Scientist reserves the right to decline to do the investigation. If the proposed infiltration system will be located in an area of existing pavement and there is no open area nearby, equipment capable of breaking through the impervious layer must be provided. The soils investigation does not take the place of a soils report prepared by an appropriate professional. The Soils Scientist will only verify the soil conditions that are reported in the Soils Report, and make a determination as to the suitability of the site to meet the infiltration design requirements under NCAC 2H.1000, and assumes no liability should the system fail.

P-1346 SIMULATOR CENTER
MCB CAMP LEJEUNE, NC

NCDENR SITE VISIT REQUEST
26 MARCH 2013

● = APPROXIMATE BORE LOCATION

BLDG 1042

SWING ARM GATE (TYP)

UNIT TRANSPORTATION PARKING (7 TONS)

BORE 1

LID (TYP)

BORE 2

LID (TYP)

SUPPLY/ BOAT

COVERED

FENCE

1000' SNEADS FERRY ROAD AIR CORRIDOR

LOADING DOCK

CONC

COVERED

57 STANDARD SPACES

RANGE CONTROL

10 STANDARD SPACES

SIMULATOR CENTER

CONC

ANTENNA

BORE 3

PERVIOUS CONCRETE

CONC

84 STANDARD SPACES

194 STANDARD SPACES

BORE 4

LID (TYP)

BORE 5

UNIT TRANSPORTATION PARKING (7 TONS)

LID (TYP)

SWING ARM GATE (TYP)

100' BUFFER TO WETLANDS

NEW CONNECTION TO BIRCH STREET

60 0 30 60 120

GRAPHIC SCALE:

APPENDIX C

LABORATORY TEST DATA

LABORATORY TESTING

The enclosed laboratory results represent the subsurface soil properties encountered at the specific boring locations based on the laboratory testing performed. It is possible that soil properties and conditions between the individual boring locations and depths will be different from those indicated.

LABORATORY TEST RESULTS SUMMARY

Project: **P-1346 Simulator & Range Control Center**
MCB Camp Lejeune, NC

Number: **110-6170**

Date: **04/01/2013**

SAMPLE NUMBER	DEPTH (FEET)	SAMPLE TYPE	CLASS.	MOISTURE CONTENT (%)	% FINES	LL	PL	PI	pH	OTHER TESTS
B-1	3	SS	SM	14.4	15.0	-	-	-	-	SIEVE
B-1	9	SS	SM	17.3	24.2	-	-	-	-	SIEVE
B-2	3	SS	SC-SM	14.6	28.2	-	-	-	-	-
B-2	7	SS	SM	13.9	15.1	-	-	-	-	SIEVE
B-2	14	SS	SM	30.4	-	-	-	-	-	-
B-3	1	SS	SC	17.2	38.3	25	15	10	-	-
B-3	5	SS	SM	15.8	13.1	-	-	-	-	SIEVE
B-3	9	SS	SC	25.5	43.2	-	-	-	-	-
B-3	24	SS	SP-SM	30.2	-	-	-	-	-	-
B-4	5	SS	SM	15.6	23.8	-	-	-	-	SIEVE
B-4	11	SS	SP-SM	20.6	11.5	-	-	-	-	-
B-5	3	SS	SM	12.9	19.9	-	-	-	-	-
B-5	9	SS	SM	17.2	25.1	-	-	-	-	SIEVE
B-5	19	SS	SP-SM	27.1	11.9	-	-	-	-	SIEVE
B-6	1	SS	SC-SM	8.0	27.7	-	-	-	-	-
B-6	7	SS	SC	14.7	-	-	-	-	-	-
B-6	14	SS	SP-SM	24.1	11.6	-	-	-	-	SIEVE
B-7	3	SS	SM	16.2	-	-	-	-	5.03	-
B-7	9	SS	SM	19.2	-	-	-	-	5.05	-

Tests performed in accordance with applicable ASTM Standards**.**

GER

LABORATORY TEST RESULTS SUMMARY

Project: **P-1346 Simulator & Range Control Center**
MCB Camp Lejeune, NC

Number: **110-6170**

Date: **04/01/2013**

SAMPLE NUMBER	DEPTH (FEET)	SAMPLE TYPE	CLASS.	MOISTURE CONTENT (%)	% FINES	pH	MAXIMUM DRY DENSITY (PCF)	OPTIMUM MOISTURE (%)	CBR	SWELL (%)	OTHER TESTS
BMP-1	5	SS	SC-SM	16.2	23.0	-	-	-	-	-	-
BMP-2	3	SS	SM	13.1	22.7	-	-	-	-	-	SIEVE
BMP-3	7	SS	SM	15.9	21.2	-	-	-	-	-	SIEVE
BMP-4	5	SS	SM	14.5	17.9	-	-	-	-	-	-
PB-1	1 to 3	Bulk	SM	10.6	18.4	7.92	111.8	11.7	23.0	0.0	-
PB-2	1 to 3	Bulk	SM	8.3	18.7	-	113.8	10.8	24.9	0.0	SIEVE
PB-3	1 to 3	Bulk	SM	10.7	17.9	5.62	112.8	11.3	24.4	0.0	-
PB-4	1 to 3	Bulk	SM	12.8	18.9	-	107.2	13.5	17.1	0.0	SIEVE

Tests performed in accordance with applicable ASTM Standards**.**

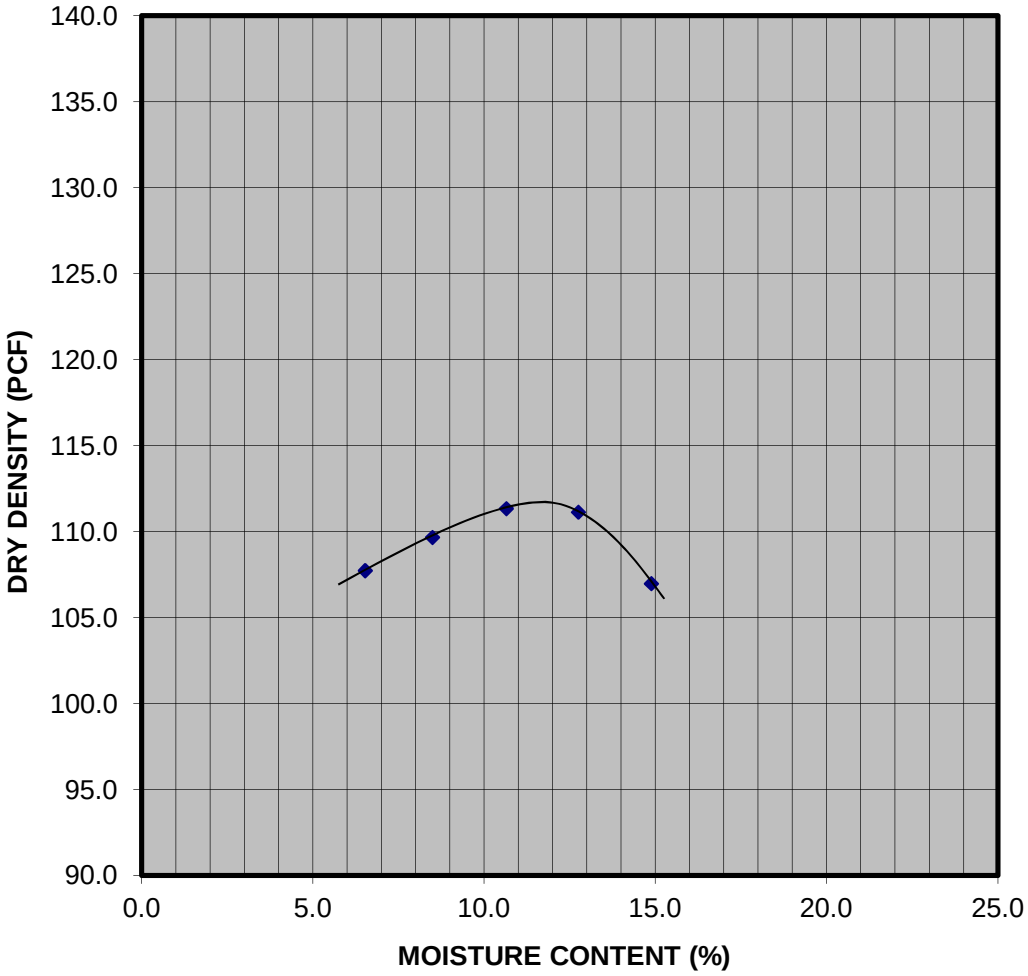
GER

Engineering and Testing Consultants, Inc.

MOISTURE-DENSITY RELATIONSHIP

Project Name:	**P-1346 Simulator & Range Control Center** **MCB Camp Lejeune, NC**
GER Project Number:	**110-6170**
Number:	5510-110
Sample Number:	**PB-1**
Sample Depth:	1 to 3 feet
Sample Description:	Silty SAND (SM), Brown, Fine, Trace Clay
Test Method:	ASTM D 698A

Maximum Dry Density (pcf): **111.8**
Optimum Moisture (%): **11.7**



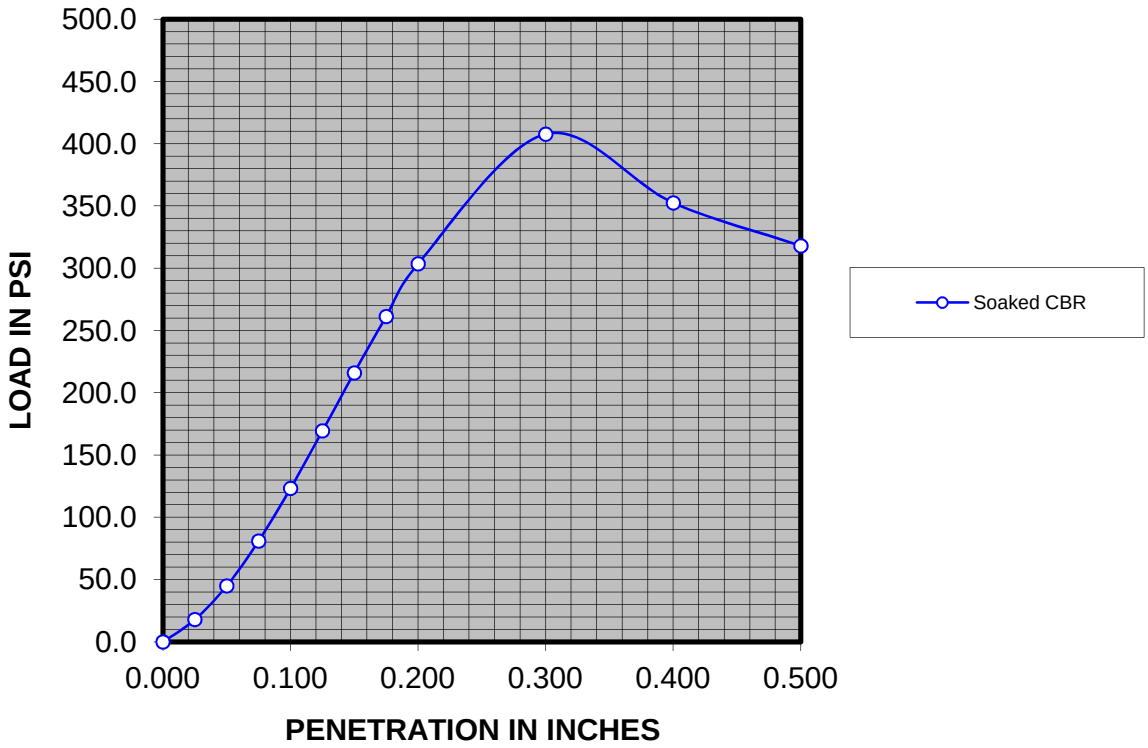
Engineering and Testing Consultants, Inc.

CALIFORNIA BEARING RATIO TEST

Project Name:	**P-1346 Simulator & Range Control Center** **MCB Camp Lejeune, NC**
GER Project Number:	**110-6170**
Number:	5510-110
Sample Number:	**PB-1**
Sample Depth:	1 to 3 feet
Sample Description:	Silty SAND (SM), Brown, Fine, Trace Clay
Test Method:	ASTM D 1883

Maximum Dry Density (pcf):	111.8	Blows Per Layer:	32
Optimum Moisture (%):	11.7	Surcharge Weight (lbs.):	10
In Situ Moisture (%):	10.6	Compaction Before Soaking (%):	96.8
After Soaking Moisture (%):	13.8	Compaction After Soaking (%):	96.8

Unsoaked CBR Value:	**N/A**
Soaked CBR Value:	**23.0**
Swell (%):	**0.0**



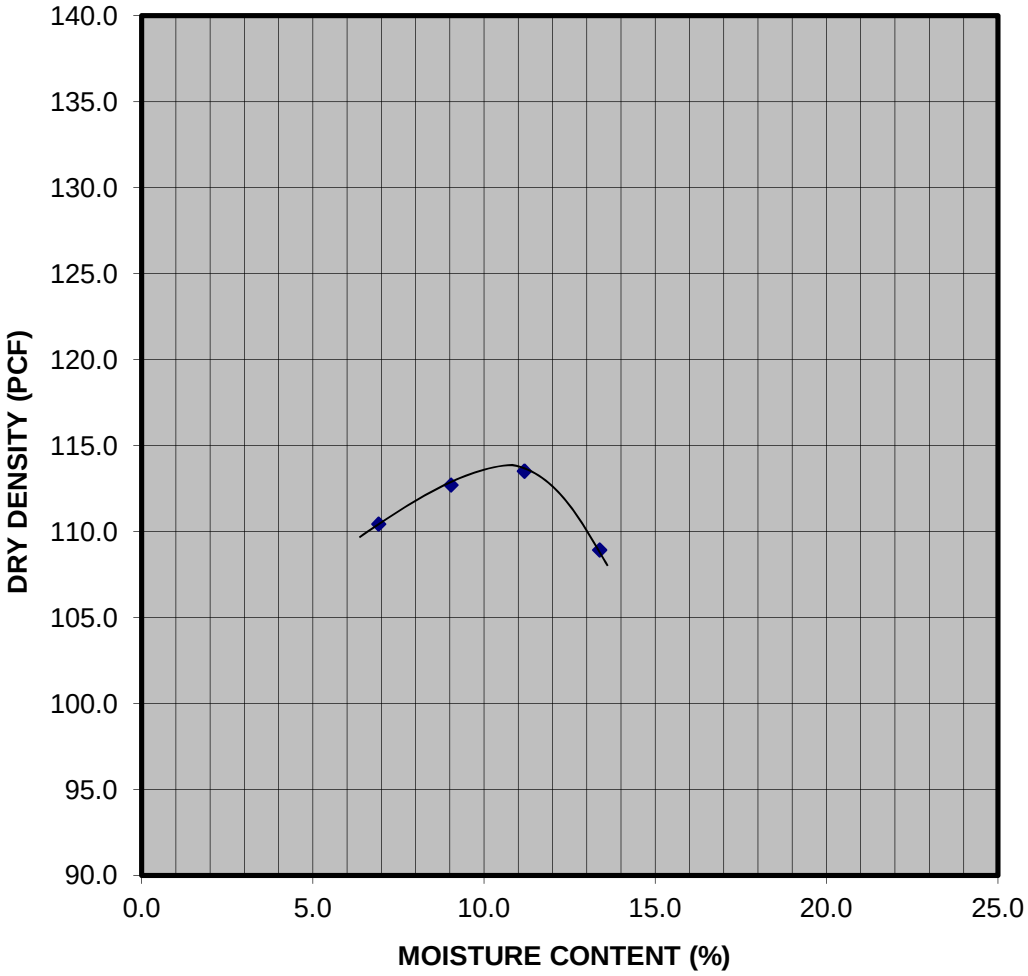
*CBR value corrected for concave upward shape

Engineering and Testing Consultants, Inc.

MOISTURE-DENSITY RELATIONSHIP

Project Name:	**P-1346 Simulator & Range Control Center** **MCB Camp Lejeune, NC**
GER Project Number:	**110-6170**
Number:	5510-110
Sample Number:	**PB-2**
Sample Depth:	1 to 3 feet
Sample Description:	Silty SAND (SM), Tan, Fine
Test Method:	ASTM D 698A

Maximum Dry Density (pcf): **113.8**
Optimum Moisture (%): **10.8**



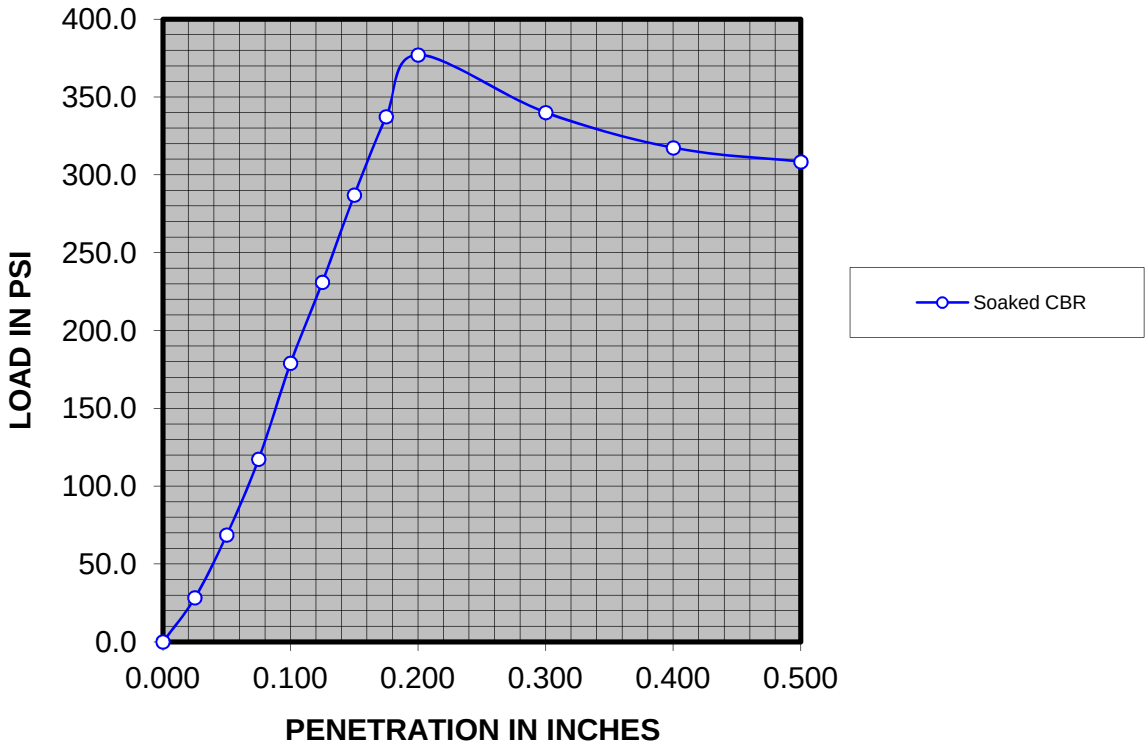
Engineering and Testing Consultants, Inc.

CALIFORNIA BEARING RATIO TEST

Project Name:	**P-1346 Simulator & Range Control Center**
	MCB Camp Lejeune, NC
GER Project Number:	**110-6170**
Number:	5510-110
Sample Number:	**PB-2**
Sample Depth:	1 to 3 feet
Sample Description:	Silty SAND (SM), Tan, Fine
Test Method:	ASTM D 1883

Maximum Dry Density (pcf):	113.8	Blows Per Layer:	30
Optimum Moisture (%):	10.8	Surcharge Weight (lbs.):	10
In Situ Moisture (%):	8.3	Compaction Before Soaking (%):	98.0
After Soaking Moisture (%):	13.0	Compaction After Soaking (%):	98.0

Unsoaked CBR Value:	**N/A**
Soaked CBR Value:	**24.9**
Swell (%):	**0.0**



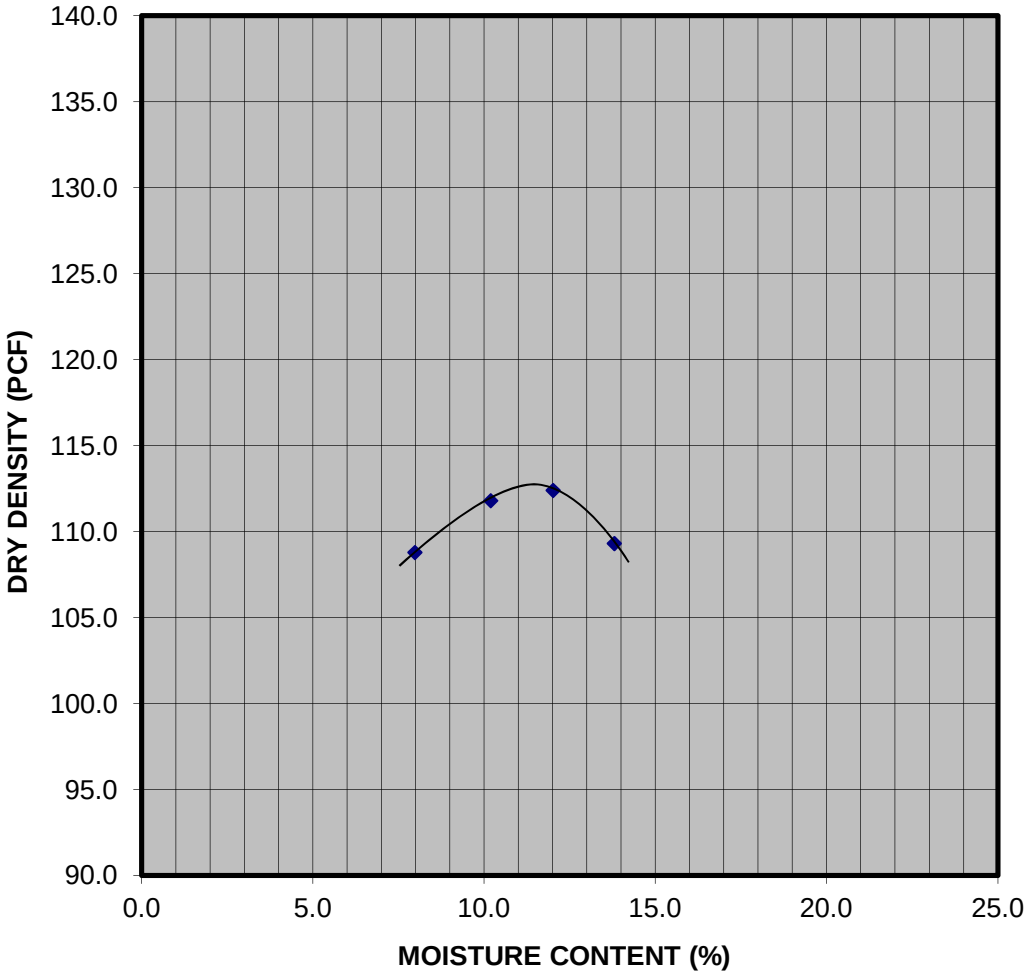
*CBR value corrected for concave upward shape

Engineering and Testing Consultants, Inc.

MOISTURE-DENSITY RELATIONSHIP

Project Name:	**P-1346 Simulator & Range Control Center** **MCB Camp Lejeune, NC**
GER Project Number:	**110-6170**
Number:	5510-110
Sample Number:	**PB-3**
Sample Depth:	1 to 3 feet
Sample Description:	Silty SAND (SM), Dark Tan, Fine, Trace Clay
Test Method:	ASTM D 698A

Maximum Dry Density (pcf): **112.8**
Optimum Moisture (%): **11.3**



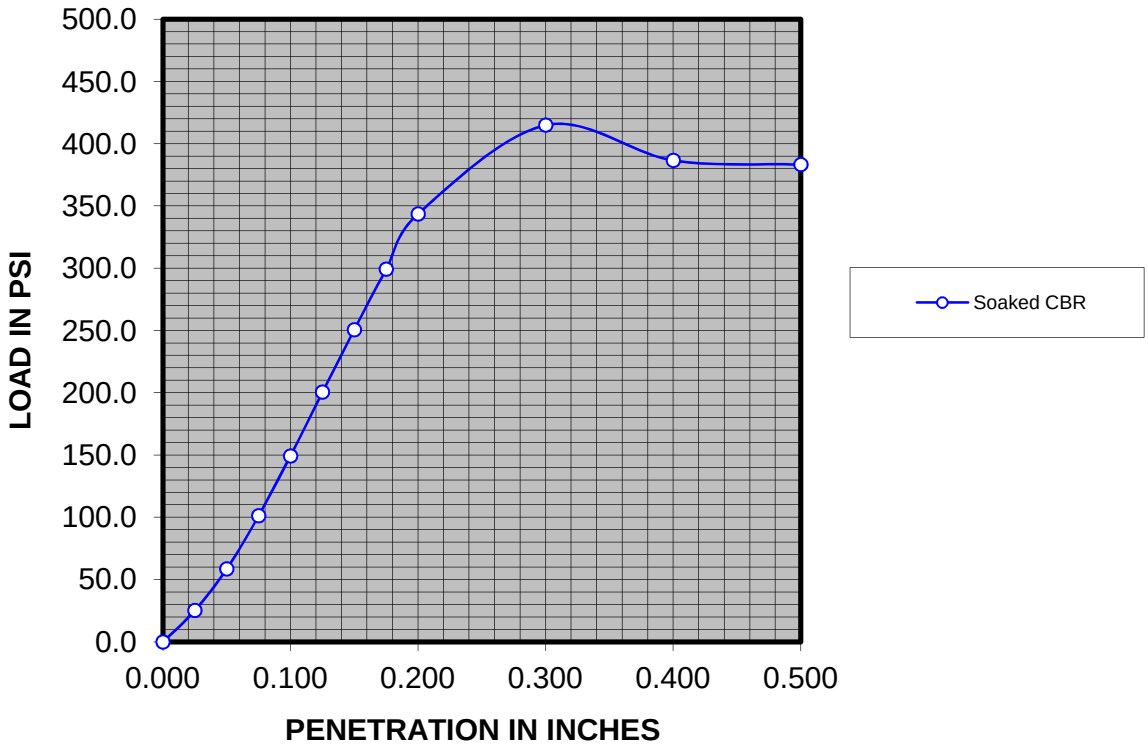
Engineering and Testing Consultants, Inc.

CALIFORNIA BEARING RATIO TEST

Project Name:	**P-1346 Simulator & Range Control Center**
	MCB Camp Lejeune, NC
GER Project Number:	**110-6170**
Number:	5510-110
Sample Number:	**PB-3**
Sample Depth:	1 to 3 feet
Sample Description:	Silty SAND (SM), Dark Tan, Fine, Trace Clay
Test Method:	ASTM D 1883

Maximum Dry Density (pcf):	112.8	Blows Per Layer:	28
Optimum Moisture (%):	11.3	Surcharge Weight (lbs.):	10
In Situ Moisture (%):	10.7	Compaction Before Soaking (%):	97.8
After Soaking Moisture (%):	14.5	Compaction After Soaking (%):	97.8

Unsoaked CBR Value:	**N/A**
Soaked CBR Value:	**24.4**
Swell (%):	**0.0**



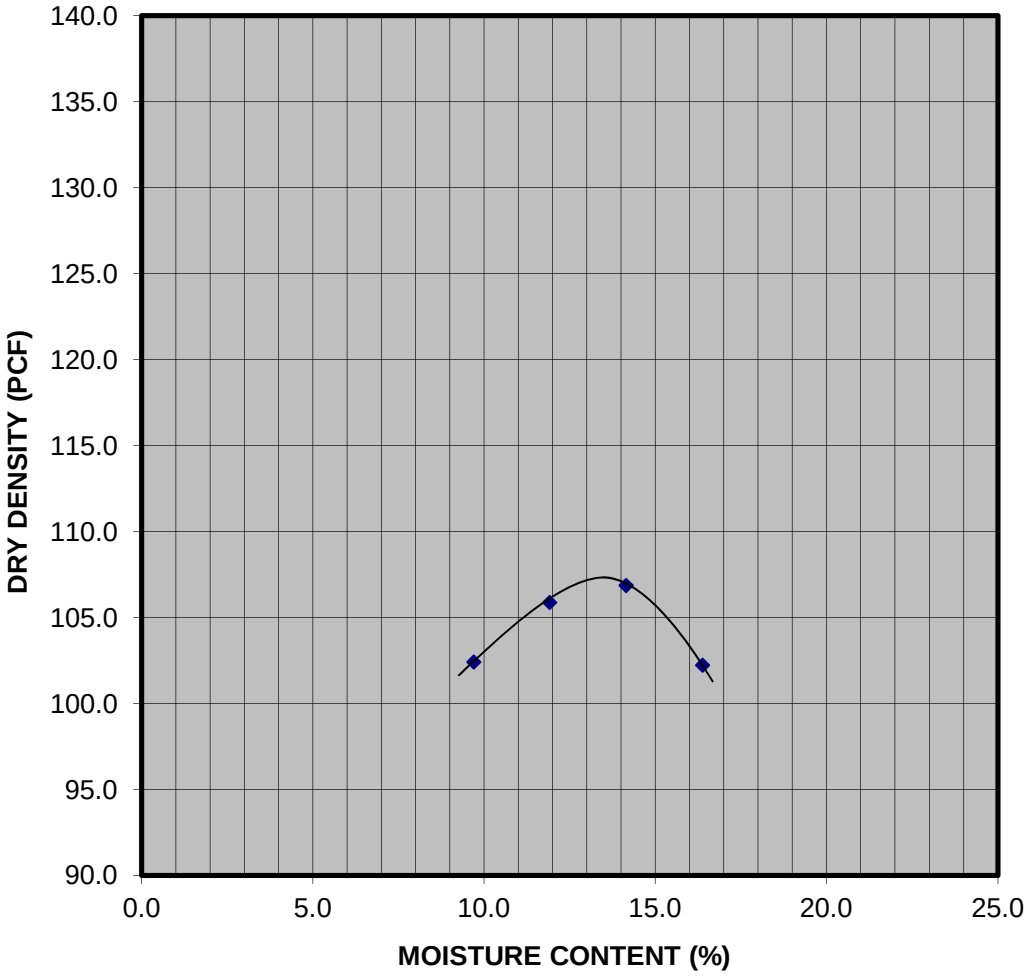
*CBR value corrected for concave upward shape

Engineering and Testing Consultants, Inc.

MOISTURE-DENSITY RELATIONSHIP

Project Name:	**P-1346 Simulator & Range Control Center** **MCB Camp Lejeune, NC**
GER Project Number:	**110-6170**
Number:	5510-110
Sample Number:	**PB-4**
Sample Depth:	1 to 3 feet
Sample Description:	Silty SAND (SM), Dark Tan and Gray, Fine
Test Method:	ASTM D 698A

Maximum Dry Density (pcf): **107.2**
Optimum Moisture (%): **13.5**



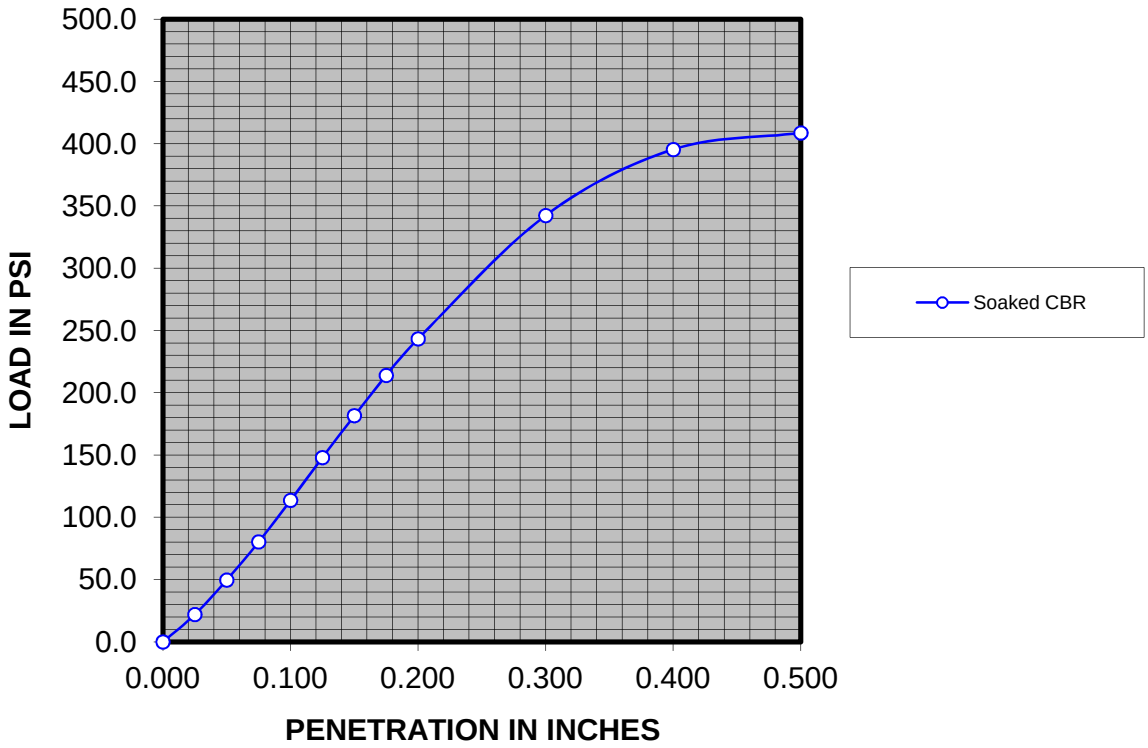
Engineering and Testing Consultants, Inc.

CALIFORNIA BEARING RATIO TEST

Project Name:	**P-1346 Simulator & Range Control Center** **MCB Camp Lejeune, NC**
GER Project Number:	**110-6170**
Number:	5510-110
Sample Number:	**PB-4**
Sample Depth:	1 to 3 feet
Sample Description:	Silty SAND (SM), Dark Tan and Gray, Fine
Test Method:	ASTM D 1883

Maximum Dry Density (pcf):	107.2	Blows Per Layer:	25
Optimum Moisture (%):	13.5	Surcharge Weight (lbs.):	10
In Situ Moisture (%):	12.8	Compaction Before Soaking (%):	95.4
After Soaking Moisture (%):	19.7	Compaction After Soaking (%):	95.3

Unsoaked CBR Value:	**N/A**
Soaked CBR Value:	**17.1**
Swell (%):	**0.0**



*CBR value corrected for concave upward shape

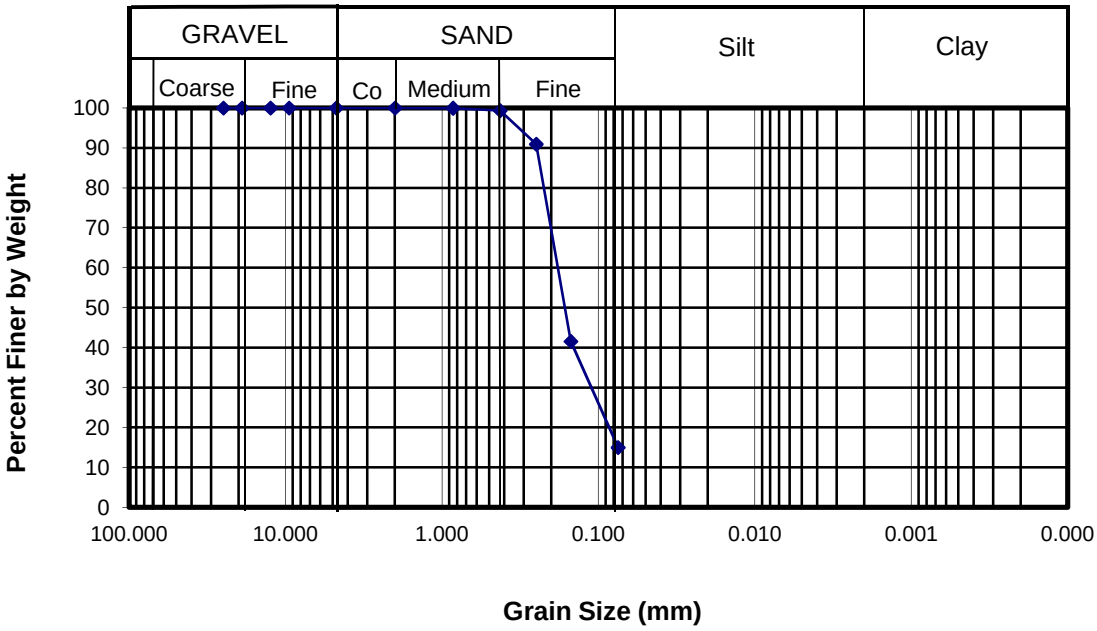
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**P-1346 Simulator & Range Control Center** **MCB Camp Lejeune, NC**
GER Project Number:	**110-6170**
Project Number:	5510-110
Sample Number:	B-1
Sample Depth:	3 feet
Sample Description:	Silty SAND (SM), Light Tan, Fine
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	100.0
20	100.0
40	99.3
60	90.9
100	41.6
200	15.0



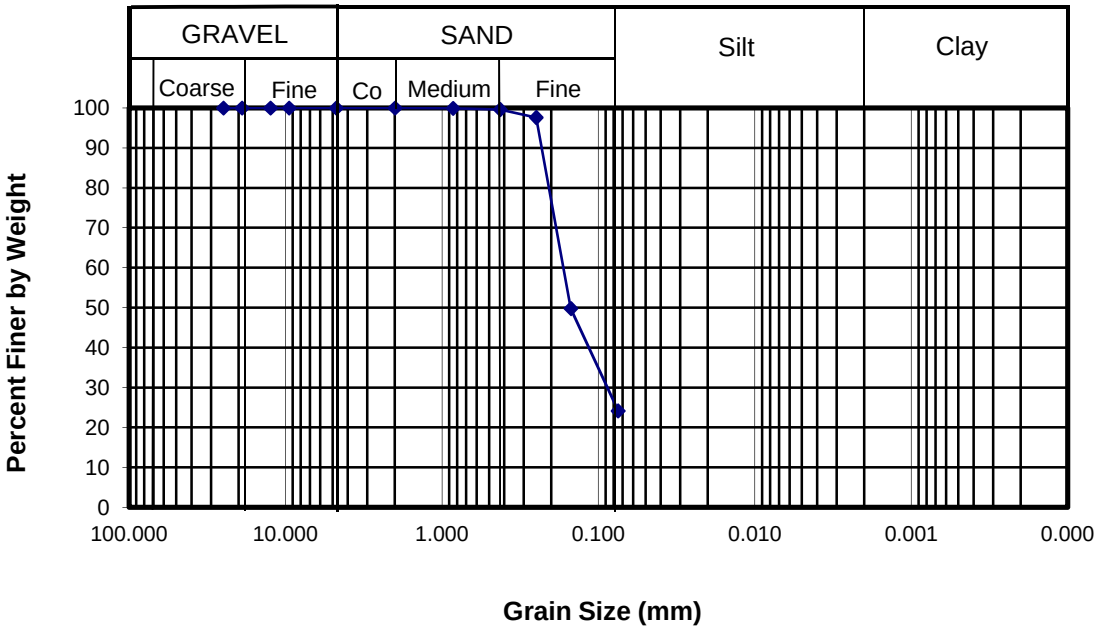
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**P-1346 Simulator & Range Control Center** **MCB Camp Lejeune, NC**
GER Project Number:	**110-6170**
Project Number:	5510-110
Sample Number:	B-1
Sample Depth:	9 feet
Sample Description:	Silty SAND (SM), Tan and Light Gray, Fine, Trace Clay
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	100.0
20	100.0
40	99.6
60	97.6
100	49.8
200	24.2



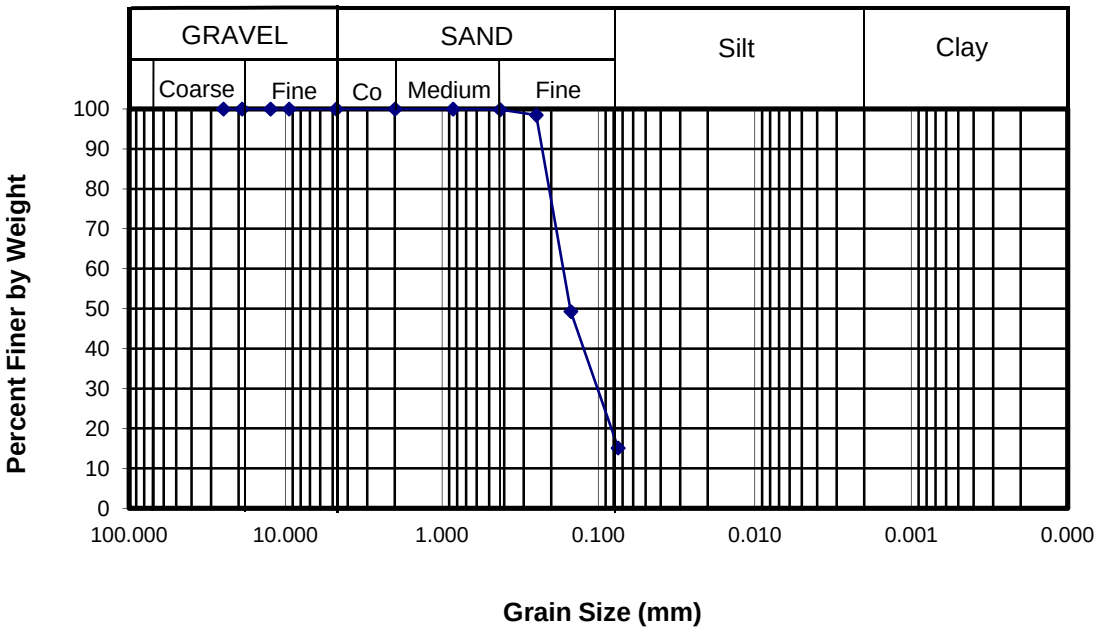
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**P-1346 Simulator & Range Control Center** **MCB Camp Lejeune, NC**
GER Project Number:	**110-6170**
Project Number:	5510-110
Sample Number:	B-2
Sample Depth:	7 feet
Sample Description:	Silty SAND (SM), Light Tan, Fine
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	100.0
20	100.0
40	99.8
60	98.5
100	49.3
200	15.1



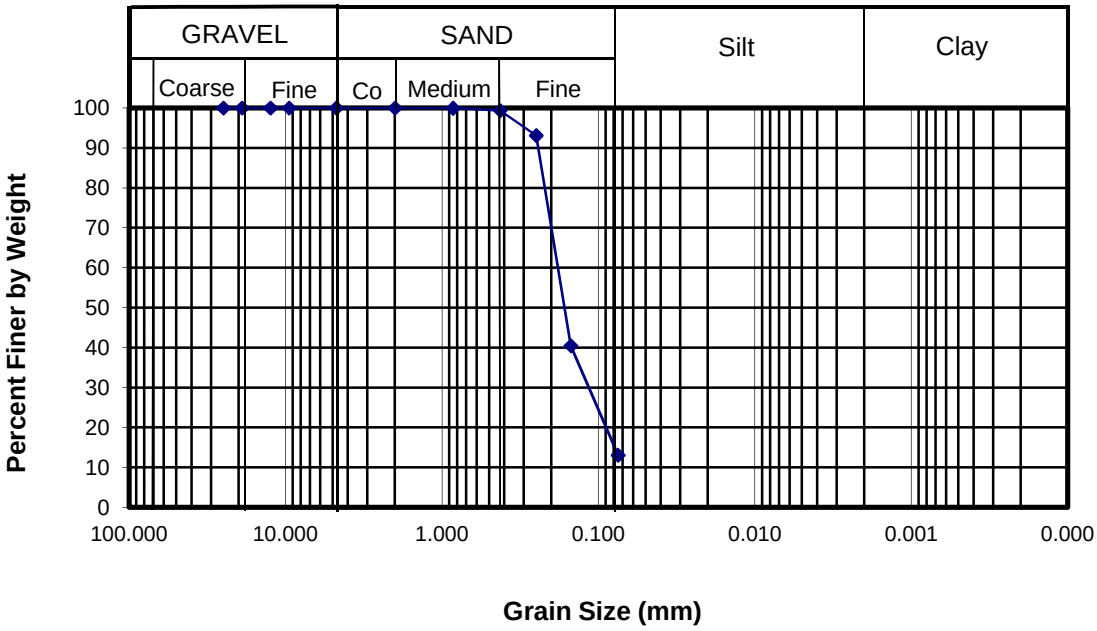
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**P-1346 Simulator & Range Control Center** **MCB Camp Lejeune, NC**
GER Project Number:	**110-6170**
Project Number:	5510-110
Sample Number:	B-3
Sample Depth:	5 feet
Sample Description:	Silty SAND (SM), Tan, Fine
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	100.0
20	100.0
40	99.4
60	93.1
100	40.5
200	13.1



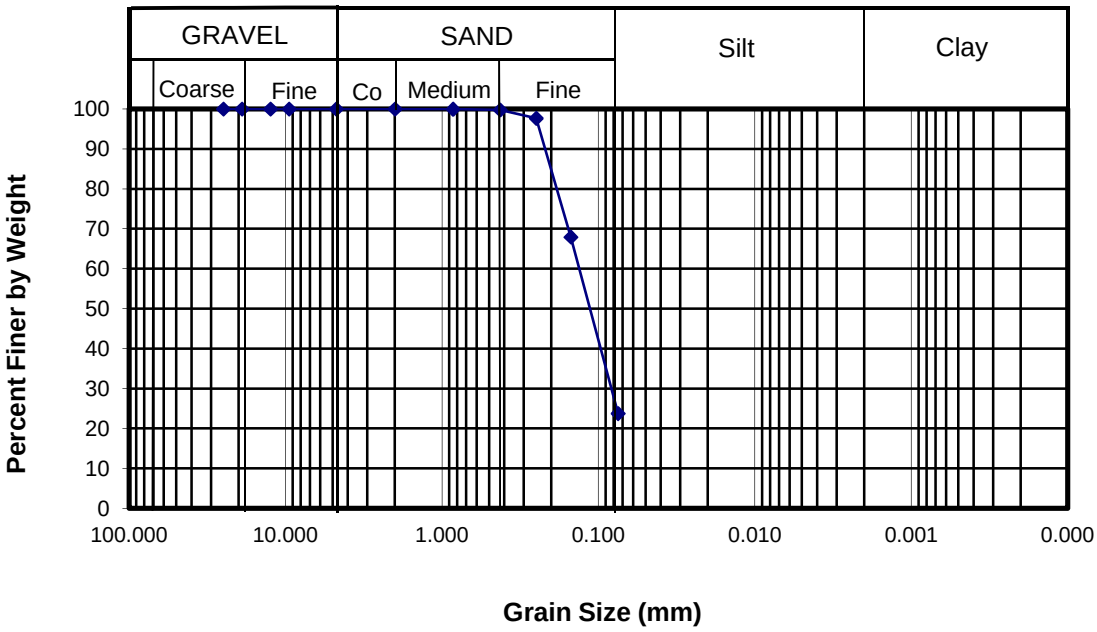
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**P-1346 Simulator & Range Control Center** **MCB Camp Lejeune, NC**
GER Project Number:	**110-6170**
Project Number:	5510-110
Sample Number:	B-4
Sample Depth:	5 feet
Sample Description:	Silty SAND (SM), Tan and Light Gray, Fine
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	100.0
20	100.0
40	99.8
60	97.7
100	67.9
200	23.8



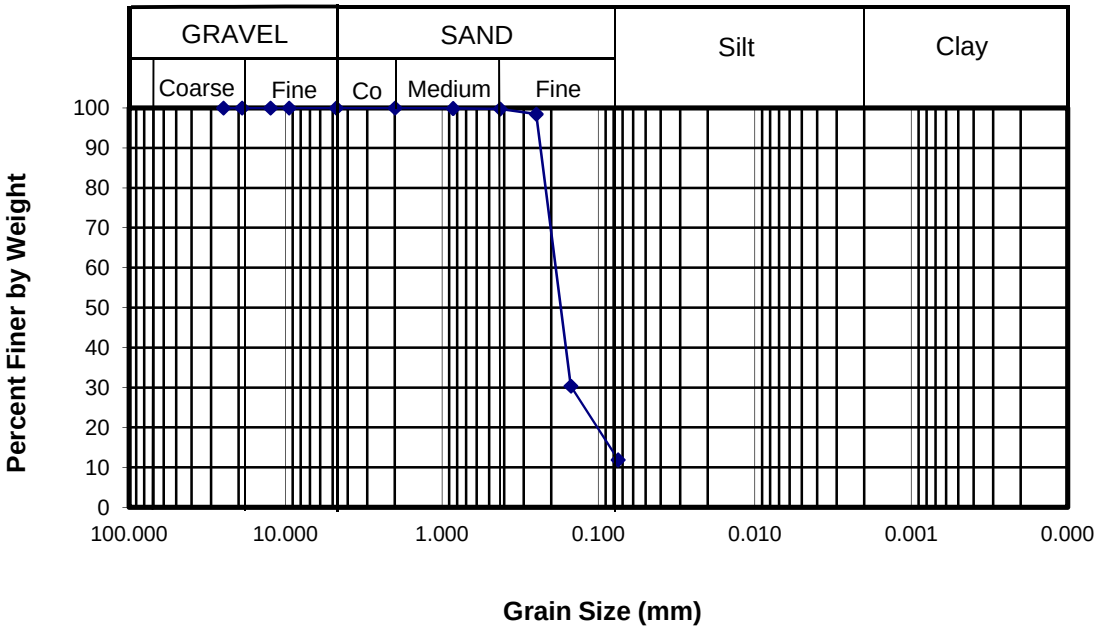
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**P-1346 Simulator & Range Control Center** **MCB Camp Lejeune, NC**
GER Project Number:	**110-6170**
Project Number:	5510-110
Sample Number:	B-5
Sample Depth:	19 feet
Sample Description:	SAND (SP-SM), Tan and Light Gray, Fine, with Silt
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	100.0
20	99.9
40	99.8
60	98.5
100	30.4
200	11.9



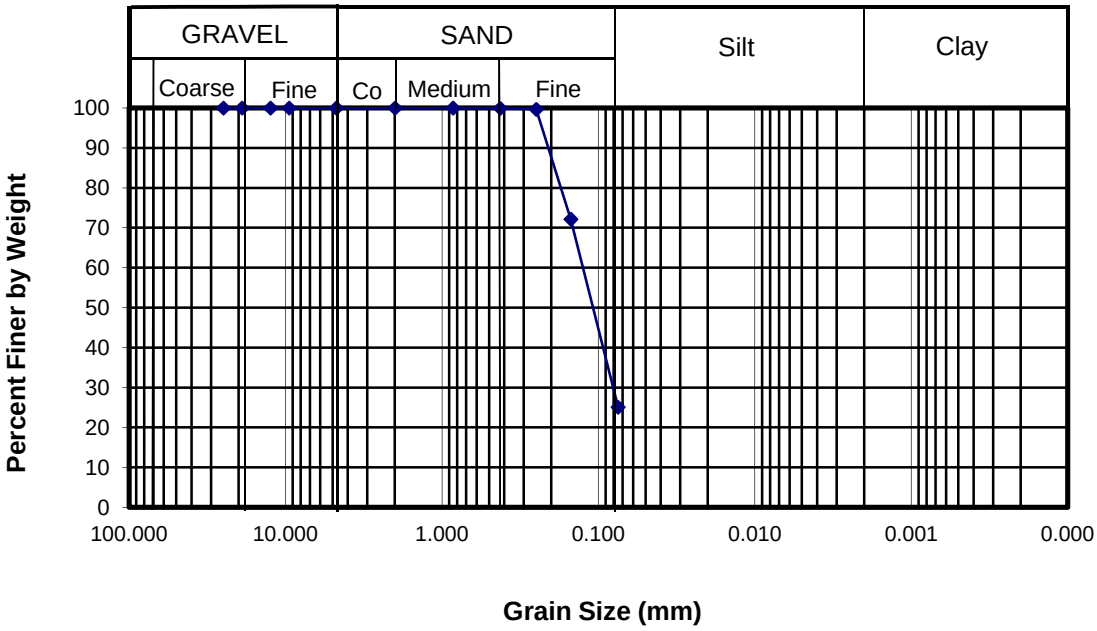
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**P-1346 Simulator & Range Control Center** **MCB Camp Lejeune, NC**
GER Project Number:	**110-6170**
Project Number:	5510-110
Sample Number:	B-5
Sample Depth:	9 feet
Sample Description:	Silty SAND (SM), Tan and Gray, Fine, Trace Clay
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	100.0
20	100.0
40	99.9
60	99.7
100	72.2
200	25.1



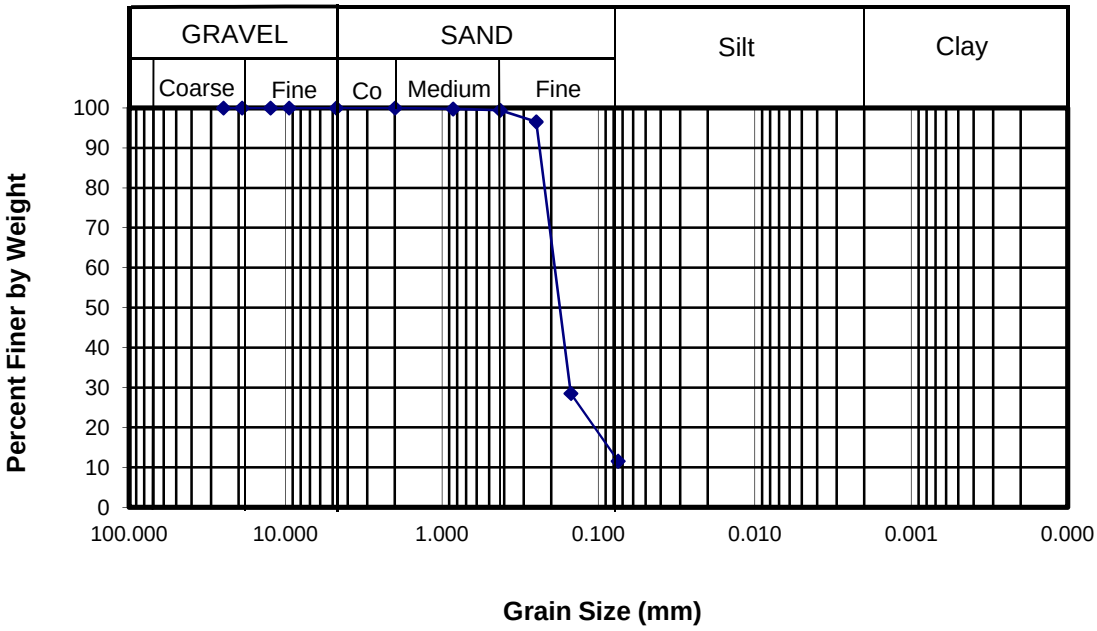
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**P-1346 Simulator & Range Control Center** **MCB Camp Lejeune, NC**
GER Project Number:	**110-6170**
Project Number:	5510-110
Sample Number:	B-6
Sample Depth:	14 feet
Sample Description:	SAND (SP-SM), Tan and Light Gray, Fine, with Silt
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	100.0
20	99.7
40	99.4
60	96.6
100	28.5
200	11.6



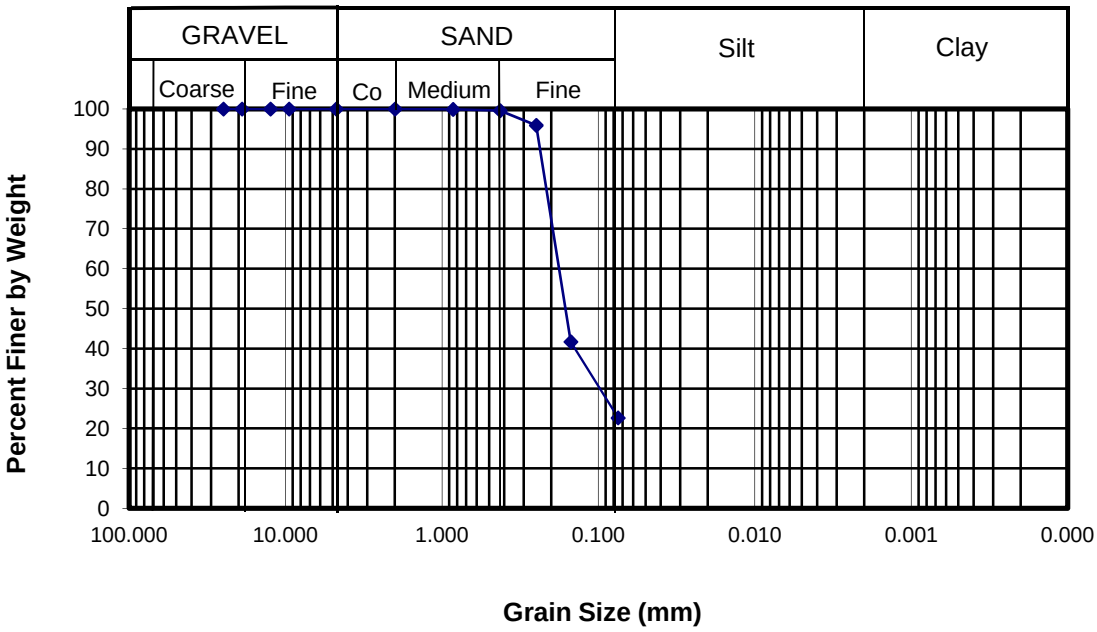
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**P-1346 Simulator & Range Control Center** **MCB Camp Lejeune, NC**
GER Project Number:	**110-6170**
Project Number:	5510-110
Sample Number:	BMP-2
Sample Depth:	3 feet
Sample Description:	Silty SAND (SM), Brown, Fine
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	100.0
20	99.9
40	99.6
60	95.9
100	41.7
200	22.7



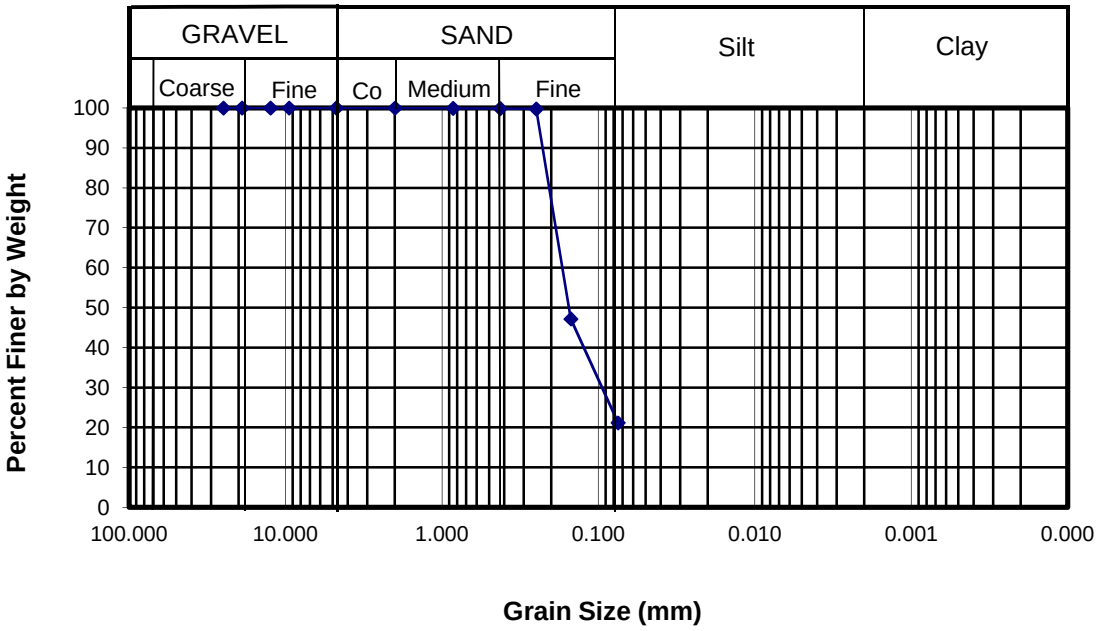
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**P-1346 Simulator & Range Control Center** **MCB Camp Lejeune, NC**
GER Project Number:	**110-6170**
Project Number:	5510-110
Sample Number:	BMP-3
Sample Depth:	7 feet
Sample Description:	Silty SAND (SM), Tan and Light Gray, Fine
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	100.0
20	99.9
40	99.9
60	99.8
100	47.2
200	21.2



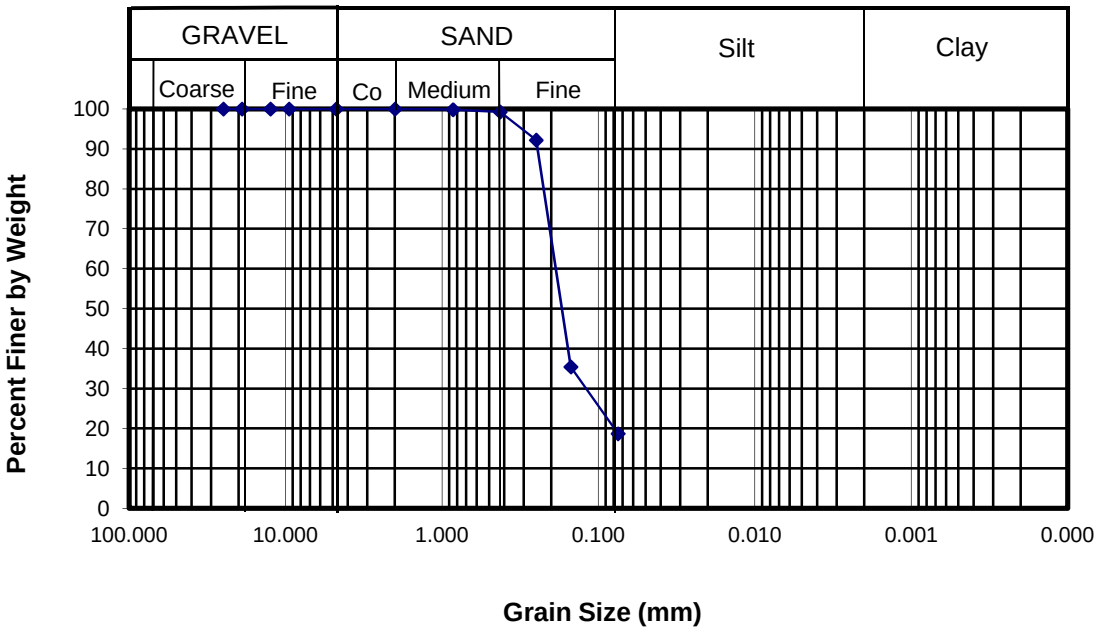
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**P-1346 Simulator & Range Control Center** **MCB Camp Lejeune, NC**
GER Project Number:	**110-6170**
Project Number:	5510-110
Sample Number:	PB-2
Sample Depth:	1 to 3 feet
Sample Description:	Silty SAND (SM), Tan, Fine
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	100.0
20	99.8
40	99.3
60	92.2
100	35.4
200	18.7



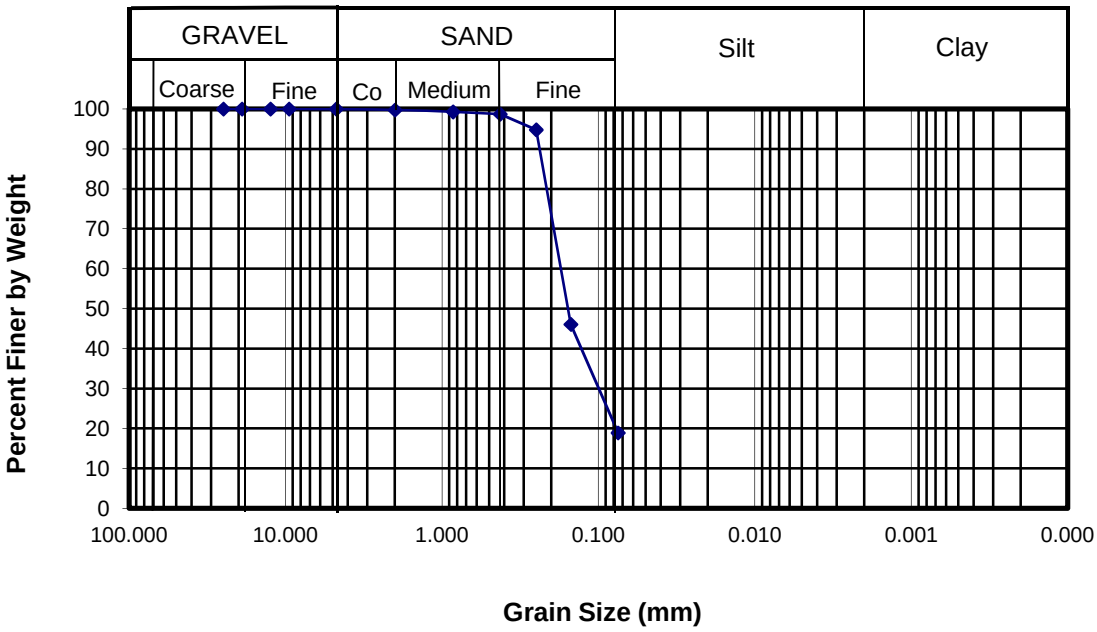
Engineering and Testing Consultants, Inc.

SIEVE ANALYSIS

Project Name:	**P-1346 Simulator & Range Control Center** **MCB Camp Lejeune, NC**
GER Project Number:	**110-6170**
Project Number:	5510-110
Sample Number:	PB-4
Sample Depth:	1 to 3 feet
Sample Description:	Silty SAND (SM), Dark Tan and Gray, Fine
Test Method:	ASTM D 422

Sieve Analysis Data

SIEVE NO.	PERCENT PASSING
1 Inch	100.0
3/4 Inch	100.0
1/2 Inch	100.0
3/8 Inch	100.0
4	100.0
10	99.7
20	99.3
40	98.7
60	94.8
100	46.1
200	18.9



LABORATORY CHEMICAL ANALYSES

GER

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

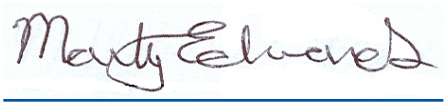
ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Pensacola
3355 McLemore Drive
Pensacola, FL 32514
Tel: (850)474-1001

TestAmerica Job ID: 400-73109-1
Client Project/Site: P-1346 Camp LeJeune 110-6170

For:
GeoEnvironmental Resources Inc GER
2712 Southern Blvd
Suite 101
Virginia Beach, Virginia 23452

Attn: Mr. Charles F.P. Crawley



Authorized for release by:
3/24/2013 3:06:13 PM

Marty Edwards
Customer Service Manager
marty.edwards@testamericainc.com

Table of Contents

Qualifiers

GC VOA

Qualifier	Qualifier Description
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.

GC Semi VOA

Qualifier	Qualifier Description
4	MS, MSD: The analyte present in the original sample is 4 times greater than the matrix spike concentration; therefore, control limits are not applicable.
F	RPD of the MS and MSD exceeds the control limits
X	Surrogate is outside control limits

Metals

Qualifier	Qualifier Description
B	Compound was found in the blank and sample.
J	Result is less than the RL but greater than or equal to the MDL and the concentration is an approximate value.
F	MS or MSD exceeds the control limits
F	RPD of the MS and MSD exceeds the control limits

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Job ID: 400-73109-1

Laboratory: TestAmerica Pensacola

Narrative

Job Narrative
400-73109-1

Comments
No additional comments.

Receipt
The samples were received on 3/9/2013 9:56 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 2.1° C.

GC/MS VOA
No analytical or quality issues were noted.

GC VOA
No analytical or quality issues were noted.

GC Semi VOA
No analytical or quality issues were noted.

Metals
Method 6010C: The continuing calibration verification (CCV) for silver associated with batch 400-174503 recovered above the upper control limit. The samples associated with this CCV were non-detects for the affected analytes; therefore, the data have been reported.

No other analytical or quality issues were noted.

Organic Prep
No analytical or quality issues were noted.

Detection Summary

Client: GeoEnvironmental Resources Inc GER
Project/Site: P-1346 Camp LeJeune 110-6170

TestAmerica Job ID: 400-73109-1

Client Sample ID: BMP-3 @ 1'-4' — Lab Sample ID: 400-73109-1

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Barium	0.15	J B	5.0	0.050	mg/L	5		6010C	TCLP

Client Sample ID: PB-2 @ 1'-4' — Lab Sample ID: 400-73109-2

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Barium	0.027	J B	1.0	0.010	mg/L	1		6010C	TCLP
Chromium	0.0082		0.0050	0.0020	mg/L	1		6010C	TCLP
Lead	0.0065		0.0050	0.0020	mg/L	1		6010C	TCLP

Client Sample ID: B-1 @ 1'-4' — Lab Sample ID: 400-73109-3

Analyte	Result	Qualifier	RL	MDL	Unit	Dil Fac	D	Method	Prep Type
Barium	0.016	J B	1.0	0.010	mg/L	1		6010C	TCLP
Lead	0.0020	J	0.0050	0.0020	mg/L	1		6010C	TCLP

This Detection Summary does not include radiochemical test results.

Sample Summary

Client: GeoEnvironmental Resources Inc GER
Project/Site: P-1346 Camp LeJeune 110-6170

TestAmerica Job ID: 400-73109-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
400-73109-1	BMP-3 @ 1'-4'	Solid	03/06/13 08:40	03/09/13 09:56
400-73109-2	PB-2 @ 1'-4'	Solid	03/06/13 09:30	03/09/13 09:56
400-73109-3	B-1 @ 1'-4'	Solid	03/06/13 09:00	03/09/13 09:56

Client Sample ID: BMP-3 @ 1'-4'

Lab Sample ID: 400-73109-1

Date Collected: 03/06/13 08:40
Matrix: Solid
Date Received: 03/09/13 09:56
Percent Solids: 85.9

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	<0.00054		0.0056	0.00054	mg/Kg	☼	03/15/13 15:00	03/16/13 02:05	1
Toluene	<0.00078		0.0056	0.00078	mg/Kg	☼	03/15/13 15:00	03/16/13 02:05	1
Ethylbenzene	<0.00068		0.0056	0.00068	mg/Kg	☼	03/15/13 15:00	03/16/13 02:05	1
Xylenes, Total	<0.0021		0.011	0.0021	mg/Kg	☼	03/15/13 15:00	03/16/13 02:05	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene	*98*		*72 - 122*	*03/15/13 15:00*	*03/16/13 02:05*	*1*
Dibromofluoromethane	*105*		*79 - 123*	*03/15/13 15:00*	*03/16/13 02:05*	*1*
Toluene-d8 (Surr)	*103*		*80 - 120*	*03/15/13 15:00*	*03/16/13 02:05*	*1*

Method: 8015C - GRO by 8015C

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Gasoline Range Organics (GRO) C6--C10	<0.050		0.10	0.050	mg/Kg	☼	03/15/13 10:00	03/15/13 18:23	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
a,a,a-Trifluorotoluene (fid)	*96*		*65 - 125*	*03/15/13 10:00*	*03/15/13 18:23*	*1*

Method: 8015C - Nonhalogenated Organics using GC/FID -Modified (Diesel Range Organics)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C28	<2.0		2.9	2.0	mg/Kg	☼	03/11/13 13:54	03/12/13 21:39	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl (Surr)	*74*		*30 - 118*	*03/11/13 13:54*	*03/12/13 21:39*	*1*

Method: 6010C - RCRA Metals - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.020		0.025	0.020	mg/L		03/12/13 12:19	03/14/13 05:02	5
Barium	**0.15**	**J B**	5.0	0.050	mg/L		03/12/13 12:19	03/14/13 05:02	5
Cadmium	<0.0050		0.025	0.0050	mg/L		03/12/13 12:19	03/14/13 05:02	5
Chromium	<0.010		0.025	0.010	mg/L		03/12/13 12:19	03/14/13 05:02	5
Lead	<0.010		0.025	0.010	mg/L		03/12/13 12:19	03/14/13 05:02	5
Selenium	<0.020		0.050	0.020	mg/L		03/12/13 12:19	03/14/13 05:02	5
Silver	<0.010		0.025	0.010	mg/L		03/12/13 12:19	03/14/13 05:02	5

Method: 7470A - Mercury (CVAA) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.00056		0.0016	0.00056	mg/L		03/13/13 07:55	03/13/13 14:00	1

Client Sample ID: PB-2 @ 1'-4'

Lab Sample ID: 400-73109-2

Date Collected: 03/06/13 09:30
Matrix: Solid
Date Received: 03/09/13 09:56
Percent Solids: 91.1

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	<0.00052		0.0054	0.00052	mg/Kg	☼	03/15/13 15:00	03/16/13 02:27	1
Toluene	<0.00075		0.0054	0.00075	mg/Kg	☼	03/15/13 15:00	03/16/13 02:27	1
Ethylbenzene	<0.00065		0.0054	0.00065	mg/Kg	☼	03/15/13 15:00	03/16/13 02:27	1
Xylenes, Total	<0.0020		0.011	0.0020	mg/Kg	☼	03/15/13 15:00	03/16/13 02:27	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene	*105*		*72 - 122*	*03/15/13 15:00*	*03/16/13 02:27*	*1*

Client Sample ID: PB-2 @ 1'-4'

Lab Sample ID: 400-73109-2

Date Collected: 03/06/13 09:30
Matrix: Solid
Date Received: 03/09/13 09:56
Percent Solids: 91.1

Method: 8260B - Volatile Organic Compounds (GC/MS) (Continued)

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
Dibromofluoromethane	*102*		*79 - 123*	*03/15/13 15:00*	*03/16/13 02:27*	*1*
Toluene-d8 (Surr)	*111*		*80 - 120*	*03/15/13 15:00*	*03/16/13 02:27*	*1*

Method: 8015C - GRO by 8015C

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Gasoline Range Organics (GRO) C6--C10	<0.054		0.11	0.054	mg/Kg	☼	03/15/13 10:00	03/15/13 20:13	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
a,a,a-Trifluorotoluene (fid)	*95*		*65 - 125*	*03/15/13 10:00*	*03/15/13 20:13*	*1*

Method: 8015C - Nonhalogenated Organics using GC/FID -Modified (Diesel Range Organics)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C28	<1.8		2.7	1.8	mg/Kg	☼	03/11/13 13:54	03/12/13 21:49	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
o-Terphenyl (Surr)	*75*		*30 - 118*	*03/11/13 13:54*	*03/12/13 21:49*	*1*

Method: 6010C - RCRA Metals - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.0040		0.0050	0.0040	mg/L		03/12/13 12:19	03/14/13 17:29	1
Barium	**0.027**	**J B**	1.0	0.010	mg/L		03/12/13 12:19	03/14/13 17:29	1
Cadmium	<0.0010		0.0050	0.0010	mg/L		03/12/13 12:19	03/14/13 17:29	1
Chromium	**0.0082**		0.0050	0.0020	mg/L		03/12/13 12:19	03/14/13 17:29	1
Lead	**0.0065**		0.0050	0.0020	mg/L		03/12/13 12:19	03/14/13 17:29	1
Selenium	<0.0040		0.010	0.0040	mg/L		03/12/13 12:19	03/14/13 17:29	1
Silver	<0.0020		0.0050	0.0020	mg/L		03/12/13 12:19	03/14/13 17:29	1

Method: 7470A - Mercury (CVAA) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.00056		0.0016	0.00056	mg/L		03/13/13 07:55	03/13/13 14:01	1

Client Sample ID: B-1 @ 1'-4'

Lab Sample ID: 400-73109-3

Date Collected: 03/06/13 09:00
Matrix: Solid
Date Received: 03/09/13 09:56
Percent Solids: 89.4

Method: 8260B - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	<0.00057		0.0058	0.00057	mg/Kg	☼	03/15/13 15:00	03/16/13 02:49	1
Toluene	<0.00081		0.0058	0.00081	mg/Kg	☼	03/15/13 15:00	03/16/13 02:49	1
Ethylbenzene	<0.00071		0.0058	0.00071	mg/Kg	☼	03/15/13 15:00	03/16/13 02:49	1
Xylenes, Total	<0.0022		0.012	0.0022	mg/Kg	☼	03/15/13 15:00	03/16/13 02:49	1

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
4-Bromofluorobenzene	*101*		*72 - 122*	*03/15/13 15:00*	*03/16/13 02:49*	*1*
Dibromofluoromethane	*98*		*79 - 123*	*03/15/13 15:00*	*03/16/13 02:49*	*1*
Toluene-d8 (Surr)	*111*		*80 - 120*	*03/15/13 15:00*	*03/16/13 02:49*	*1*

Method: 8015C - GRO by 8015C

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Gasoline Range Organics (GRO) C6--C10	<0.053		0.11	0.053	mg/Kg	☼	03/15/13 10:00	03/15/13 20:40	1

Client: GeoEnvironmental Resources Inc GER
Project/Site: P-1346 Camp LeJeune 110-6170

TestAmerica Job ID: 400-73109-1

Client Sample ID: B-1 @ 1'-4'
Date Collected: 03/06/13 09:00
Date Received: 03/09/13 09:56

Lab Sample ID: 400-73109-3
Matrix: Solid
Percent Solids: 89.4

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
a,a,a-Trifluorotoluene (fid)	*94*		*65 - 125*	*03/15/13 10:00*	*03/15/13 20:40*	*1*

Method: 8015C - Nonhalogenated Organics using GC/FID -Modified (Diesel Range Organics)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C28	<1.9		2.8	1.9	mg/Kg	☼	03/11/13 13:54	03/12/13 21:58	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
o-Terphenyl (Surr)	*76*		*30 - 118*	*03/11/13 13:54*	*03/12/13 21:58*	*1*

Method: 6010C - RCRA Metals - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.0040		0.0050	0.0040	mg/L		03/12/13 12:19	03/14/13 17:32	1
Barium	**0.016**	**J B**	1.0	0.010	mg/L		03/12/13 12:19	03/14/13 17:32	1
Cadmium	<0.0010		0.0050	0.0010	mg/L		03/12/13 12:19	03/14/13 17:32	1
Chromium	<0.0020		0.0050	0.0020	mg/L		03/12/13 12:19	03/14/13 17:32	1
Lead	**0.0020**	**J**	0.0050	0.0020	mg/L		03/12/13 12:19	03/14/13 17:32	1
Selenium	<0.0040		0.010	0.0040	mg/L		03/12/13 12:19	03/14/13 17:32	1
Silver	<0.0020		0.0050	0.0020	mg/L		03/12/13 12:19	03/14/13 17:32	1

Method: 7470A - Mercury (CVAA) - TCLP

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.00056		0.0016	0.00056	mg/L		03/13/13 07:55	03/13/13 14:03	1

Method: 8260B - Volatile Organic Compounds (GC/MS)

Lab Sample ID: MB 400-174788/1-A
Matrix: Solid
Analysis Batch: 174867

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 174788

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Benzene	<0.00049		0.0050	0.00049	mg/Kg		03/15/13 07:00	03/15/13 17:14	1
Toluene	<0.00070		0.0050	0.00070	mg/Kg		03/15/13 07:00	03/15/13 17:14	1
Ethylbenzene	<0.00061		0.0050	0.00061	mg/Kg		03/15/13 07:00	03/15/13 17:14	1
Xylenes, Total	<0.0019		0.010	0.0019	mg/Kg		03/15/13 07:00	03/15/13 17:14	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
4-Bromofluorobenzene	*103*		*72 - 122*	*03/15/13 07:00*	*03/15/13 17:14*	*1*
Dibromofluoromethane	*99*		*79 - 123*	*03/15/13 07:00*	*03/15/13 17:14*	*1*
Toluene-d8 (Surr)	*111*		*80 - 120*	*03/15/13 07:00*	*03/15/13 17:14*	*1*

Lab Sample ID: LCS 400-174788/2-A
Matrix: Solid
Analysis Batch: 174867

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 174788

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Benzene	0.0500	0.0480		mg/Kg		96	74 - 119
Toluene	0.0500	0.0480		mg/Kg		96	76 - 116
Ethylbenzene	0.0500	0.0468		mg/Kg		94	78 - 116
Xylenes, Total	0.150	0.151		mg/Kg		100	77 - 118

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
4-Bromofluorobenzene	*97*		*72 - 122*
Dibromofluoromethane	*99*		*79 - 123*
Toluene-d8 (Surr)	*107*		*80 - 120*

Lab Sample ID: LCSD 400-174788/3-A
Matrix: Solid
Analysis Batch: 174867

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 174788

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Benzene	0.0500	0.0421		mg/Kg		84	74 - 119	13	30
Toluene	0.0500	0.0446		mg/Kg		89	76 - 116	7	30
Ethylbenzene	0.0500	0.0427		mg/Kg		85	78 - 116	9	30
Xylenes, Total	0.150	0.141		mg/Kg		94	77 - 118	7	30

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
4-Bromofluorobenzene	*104*		*72 - 122*
Dibromofluoromethane	*99*		*79 - 123*
Toluene-d8 (Surr)	*107*		*80 - 120*

Method: 8015C - GRO by 8015C

Lab Sample ID: MB 400-175012/2-A
Matrix: Solid
Analysis Batch: 174769

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 175012

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Gasoline Range Organics (GRO) C6--C10	<0.050		0.10	0.050	mg/Kg		03/15/13 10:00	03/15/13 14:43	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
a,a,a-Trifluorotoluene (fid)	*96*		*65 - 125*	*03/15/13 10:00*	*03/15/13 14:43*	*1*

Lab Sample ID: LCS 400-175012/1-A
Matrix: Solid
Analysis Batch: 174769

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 175012

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Gasoline Range Organics (GRO) C6--C10			1.00	1.03		mg/Kg		103	62 - 141		

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
a,a,a-Trifluorotoluene (fid)	*98*		*65 - 125*

Lab Sample ID: 400-73041-A-1-H MS
Matrix: Solid
Analysis Batch: 174769

Client Sample ID: Matrix Spike
Prep Type: Total/NA
Prep Batch: 175012

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
Gasoline Range Organics (GRO) C6--C10	0.057	J	1.11	0.738		mg/Kg	☼	61	10 - 150		

Surrogate	*MS %Recovery*	*MS Qualifier*	*Limits*
a,a,a-Trifluorotoluene (fid)	*95*		*65 - 125*

Lab Sample ID: 400-73041-A-1-I MSD
Matrix: Solid
Analysis Batch: 174769

Client Sample ID: Matrix Spike Duplicate
Prep Type: Total/NA
Prep Batch: 175012

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Gasoline Range Organics (GRO) C6--C10	0.057	J	1.14	0.574		mg/Kg	☼	45	10 - 150	25	32

Surrogate	*MSD %Recovery*	*MSD Qualifier*	*Limits*
a,a,a-Trifluorotoluene (fid)	*97*		*65 - 125*

Method: 8015C - Nonhalogenated Organics using GC/FID -Modified (Diesel Range Organics)

Lab Sample ID: MB 400-174423/20-A
Matrix: Solid
Analysis Batch: 174540

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 174423

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
C10-C28	<1.7		2.5	1.7	mg/Kg		03/11/13 13:54	03/12/13 19:19	1

Method: 8015C - Nonhalogenated Organics using GC/FID -Modified (Diesel Range Organics) (Continued)

Lab Sample ID: MB 400-174423/20-A
Matrix: Solid
Analysis Batch: 174540

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 174423

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
o-Terphenyl (Surr)	71		30 - 118	03/11/13 13:54	03/12/13 19:19	1

Lab Sample ID: LCS 400-174423/19-A
Matrix: Solid
Analysis Batch: 174540

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 174423

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
C10-C28			342	246		mg/Kg		72	61 - 136		

Surrogate	LCS %Recovery	LCS Qualifier	Limits
o-Terphenyl (Surr)	91		30 - 118

Lab Sample ID: 700-75165-A-1-B MS
Matrix: Solid
Analysis Batch: 174564

Client Sample ID: Matrix Spike
Prep Type: Total/NA
Prep Batch: 174423

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
C10-C28	6200		341	5730	4	mg/Kg		-142	10 - 150		

Surrogate	MS %Recovery	MS Qualifier	Limits
o-Terphenyl (Surr)	86		30 - 118

Lab Sample ID: 700-75165-A-1-C MSD
Matrix: Solid
Analysis Batch: 174564

Client Sample ID: Matrix Spike Duplicate
Prep Type: Total/NA
Prep Batch: 174423

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
C10-C28	6200		338	9180	4 F	mg/Kg		877	10 - 150	46	40

Surrogate	MSD %Recovery	MSD Qualifier	Limits
o-Terphenyl (Surr)	125	X	30 - 118

Method: 6010C - RCRA Metals

Lab Sample ID: LCS 400-174503/2-A
Matrix: Solid
Analysis Batch: 174664

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 174503

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Arsenic			1.00	1.09		mg/L		109	80 - 120		
Barium			5.99	6.57		mg/L		110	80 - 120		
Cadmium			0.500	0.538		mg/L		108	80 - 120		
Chromium			1.00	1.13		mg/L		113	80 - 120		
Lead			1.00	1.09		mg/L		109	80 - 120		
Selenium			1.00	1.09		mg/L		109	80 - 120		
Silver			0.500	0.570		mg/L		114	80 - 120		

Method: 6010C - RCRA Metals (Continued)

Lab Sample ID: LB 400-174446/1-B LB
Matrix: Solid
Analysis Batch: 174664

Client Sample ID: Method Blank
Prep Type: TCLP
Prep Batch: 174503

Analyte	LB Result	LB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	<0.020		0.025	0.020	mg/L		03/12/13 12:19	03/14/13 04:10	5
Barium	0.207	J	5.0	0.050	mg/L		03/12/13 12:19	03/14/13 04:10	5
Cadmium	<0.0050		0.025	0.0050	mg/L		03/12/13 12:19	03/14/13 04:10	5
Chromium	<0.010		0.025	0.010	mg/L		03/12/13 12:19	03/14/13 04:10	5
Lead	<0.010		0.025	0.010	mg/L		03/12/13 12:19	03/14/13 04:10	5
Selenium	<0.020		0.050	0.020	mg/L		03/12/13 12:19	03/14/13 04:10	5
Silver	<0.010		0.025	0.010	mg/L		03/12/13 12:19	03/14/13 04:10	5

Lab Sample ID: 700-75225-A-1-E MS
Matrix: Solid
Analysis Batch: 174664

Client Sample ID: Matrix Spike
Prep Type: TCLP
Prep Batch: 174503

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Arsenic	<0.020		1.00	1.05		mg/L		105	75 - 125
Barium	0.30	J B	5.99	1.31	J F	mg/L		17	75 - 125
Cadmium	<0.0050		0.500	0.517		mg/L		103	75 - 125
Chromium	<0.010		1.00	1.09		mg/L		109	75 - 125
Lead	0.15		1.00	1.20		mg/L		105	75 - 125
Selenium	<0.020		1.00	1.03		mg/L		103	75 - 125
Silver	<0.010		0.500	0.548		mg/L		110	75 - 125

Lab Sample ID: 700-75225-A-1-F MSD
Matrix: Solid
Analysis Batch: 174664

Client Sample ID: Matrix Spike Duplicate
Prep Type: TCLP
Prep Batch: 174503

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Arsenic	<0.020		1.00	1.05		mg/L		105	75 - 125	0	20
Barium	0.30	J B	5.99	6.66	F	mg/L		106	75 - 125	134	20
Cadmium	<0.0050		0.500	0.519		mg/L		104	75 - 125	0	20
Chromium	<0.010		1.00	1.10		mg/L		110	75 - 125	1	20
Lead	0.15		1.00	1.21		mg/L		106	75 - 125	1	20
Selenium	<0.020		1.00	1.05		mg/L		105	75 - 125	2	20
Silver	<0.010		0.500	0.551		mg/L		110	75 - 125	1	20

Method: 7470A - Mercury (CVAA)

Lab Sample ID: LCS 400-174560/15-A
Matrix: Solid
Analysis Batch: 174621

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 174560

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	0.00802	0.00770		mg/L		96	80 - 120

Lab Sample ID: LB 400-174446/1-C LB
Matrix: Solid
Analysis Batch: 174621

Client Sample ID: Method Blank
Prep Type: TCLP
Prep Batch: 174560

Analyte	LB Result	LB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Mercury	<0.00056		0.0016	0.00056	mg/L		03/13/13 07:55	03/13/13 13:41	1

Method: 7470A - Mercury (CVAA) (Continued)

Lab Sample ID: 700-75225-A-1-I MS
Matrix: Solid
Analysis Batch: 174621

Client Sample ID: Matrix Spike
Prep Type: TCLP
Prep Batch: 174560

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits
Mercury	<0.00056		0.0160	0.0146		mg/L		91	75 - 125

Lab Sample ID: 700-75225-A-1-J MSD
Matrix: Solid
Analysis Batch: 174621

Client Sample ID: Matrix Spike Duplicate
Prep Type: TCLP
Prep Batch: 174560

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Mercury	<0.00056		0.0160	0.0148		mg/L		92	75 - 125	1	20

GC/MS VOA

Prep Batch: 174788

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LCS 400-174788/2-A	Lab Control Sample	Total/NA	Solid	5035	
LCSD 400-174788/3-A	Lab Control Sample Dup	Total/NA	Solid	5035	
MB 400-174788/1-A	Method Blank	Total/NA	Solid	5035	

Analysis Batch: 174867

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
400-73109-1	BMP-3 @ 1'-4'	Total/NA	Solid	8260B	174869
400-73109-2	PB-2 @ 1'-4'	Total/NA	Solid	8260B	174869
400-73109-3	B-1 @ 1'-4'	Total/NA	Solid	8260B	174869
LCS 400-174788/2-A	Lab Control Sample	Total/NA	Solid	8260B	174788
LCSD 400-174788/3-A	Lab Control Sample Dup	Total/NA	Solid	8260B	174788
MB 400-174788/1-A	Method Blank	Total/NA	Solid	8260B	174788

Prep Batch: 174869

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
400-73109-1	BMP-3 @ 1'-4'	Total/NA	Solid	5035	
400-73109-2	PB-2 @ 1'-4'	Total/NA	Solid	5035	
400-73109-3	B-1 @ 1'-4'	Total/NA	Solid	5035	

GC VOA

Analysis Batch: 174769

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
400-73041-A-1-H MS	Matrix Spike	Total/NA	Solid	8015C	175012
400-73041-A-1-I MSD	Matrix Spike Duplicate	Total/NA	Solid	8015C	175012
400-73109-1	BMP-3 @ 1'-4'	Total/NA	Solid	8015C	175012
400-73109-2	PB-2 @ 1'-4'	Total/NA	Solid	8015C	175012
400-73109-3	B-1 @ 1'-4'	Total/NA	Solid	8015C	175012
LCS 400-175012/1-A	Lab Control Sample	Total/NA	Solid	8015C	175012
MB 400-175012/2-A	Method Blank	Total/NA	Solid	8015C	175012

Prep Batch: 175012

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
400-73041-A-1-H MS	Matrix Spike	Total/NA	Solid	5035	
400-73041-A-1-I MSD	Matrix Spike Duplicate	Total/NA	Solid	5035	
400-73109-1	BMP-3 @ 1'-4'	Total/NA	Solid	5035	
400-73109-2	PB-2 @ 1'-4'	Total/NA	Solid	5035	
400-73109-3	B-1 @ 1'-4'	Total/NA	Solid	5035	
LCS 400-175012/1-A	Lab Control Sample	Total/NA	Solid	5035	
MB 400-175012/2-A	Method Blank	Total/NA	Solid	5035	

GC Semi VOA

Prep Batch: 174423

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
400-73109-1	BMP-3 @ 1'-4'	Total/NA	Solid	3550C	
400-73109-2	PB-2 @ 1'-4'	Total/NA	Solid	3550C	
400-73109-3	B-1 @ 1'-4'	Total/NA	Solid	3550C	
700-75165-A-1-B MS	Matrix Spike	Total/NA	Solid	3550C	
700-75165-A-1-C MSD	Matrix Spike Duplicate	Total/NA	Solid	3550C	

GC Semi VOA (Continued)

Prep Batch: 174423 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LCS 400-174423/19-A	Lab Control Sample	Total/NA	Solid	3550C	
MB 400-174423/20-A	Method Blank	Total/NA	Solid	3550C	

Analysis Batch: 174540

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
400-73109-1	BMP-3 @ 1'-4'	Total/NA	Solid	8015C	174423
400-73109-2	PB-2 @ 1'-4'	Total/NA	Solid	8015C	174423
400-73109-3	B-1 @ 1'-4'	Total/NA	Solid	8015C	174423
LCS 400-174423/19-A	Lab Control Sample	Total/NA	Solid	8015C	174423
MB 400-174423/20-A	Method Blank	Total/NA	Solid	8015C	174423

Analysis Batch: 174564

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
700-75165-A-1-B MS	Matrix Spike	Total/NA	Solid	8015C	174423
700-75165-A-1-C MSD	Matrix Spike Duplicate	Total/NA	Solid	8015C	174423

Metals

Leach Batch: 174446

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
400-73109-1	BMP-3 @ 1'-4'	TCLP	Solid	1311	
400-73109-2	PB-2 @ 1'-4'	TCLP	Solid	1311	
400-73109-3	B-1 @ 1'-4'	TCLP	Solid	1311	
700-75225-A-1-E MS	Matrix Spike	TCLP	Solid	1311	
700-75225-A-1-F MSD	Matrix Spike Duplicate	TCLP	Solid	1311	
700-75225-A-1-I MS	Matrix Spike	TCLP	Solid	1311	
700-75225-A-1-J MSD	Matrix Spike Duplicate	TCLP	Solid	1311	
LB 400-174446/1-B LB	Method Blank	TCLP	Solid	1311	
LB 400-174446/1-C LB	Method Blank	TCLP	Solid	1311	

Prep Batch: 174503

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
400-73109-1	BMP-3 @ 1'-4'	TCLP	Solid	3010A	174446
400-73109-2	PB-2 @ 1'-4'	TCLP	Solid	3010A	174446
400-73109-3	B-1 @ 1'-4'	TCLP	Solid	3010A	174446
700-75225-A-1-E MS	Matrix Spike	TCLP	Solid	3010A	174446
700-75225-A-1-F MSD	Matrix Spike Duplicate	TCLP	Solid	3010A	174446
LB 400-174446/1-B LB	Method Blank	TCLP	Solid	3010A	174446
LCS 400-174503/2-A	Lab Control Sample	Total/NA	Solid	3010A	

Prep Batch: 174560

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
400-73109-1	BMP-3 @ 1'-4'	TCLP	Solid	7470A	174446
400-73109-2	PB-2 @ 1'-4'	TCLP	Solid	7470A	174446
400-73109-3	B-1 @ 1'-4'	TCLP	Solid	7470A	174446
700-75225-A-1-I MS	Matrix Spike	TCLP	Solid	7470A	174446
700-75225-A-1-J MSD	Matrix Spike Duplicate	TCLP	Solid	7470A	174446
LB 400-174446/1-C LB	Method Blank	TCLP	Solid	7470A	174446
LCS 400-174560/15-A	Lab Control Sample	Total/NA	Solid	7470A	

Metals (Continued)

Analysis Batch: 174621

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
400-73109-1	BMP-3 @ 1'-4'	TCLP	Solid	7470A	174560
400-73109-2	PB-2 @ 1'-4'	TCLP	Solid	7470A	174560
400-73109-3	B-1 @ 1'-4'	TCLP	Solid	7470A	174560
700-75225-A-1-I MS	Matrix Spike	TCLP	Solid	7470A	174560
700-75225-A-1-J MSD	Matrix Spike Duplicate	TCLP	Solid	7470A	174560
LB 400-174446/1-C LB	Method Blank	TCLP	Solid	7470A	174560
LCS 400-174560/15-A	Lab Control Sample	Total/NA	Solid	7470A	174560

Analysis Batch: 174664

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
400-73109-1	BMP-3 @ 1'-4'	TCLP	Solid	6010C	174503
700-75225-A-1-E MS	Matrix Spike	TCLP	Solid	6010C	174503
700-75225-A-1-F MSD	Matrix Spike Duplicate	TCLP	Solid	6010C	174503
LB 400-174446/1-B LB	Method Blank	TCLP	Solid	6010C	174503
LCS 400-174503/2-A	Lab Control Sample	Total/NA	Solid	6010C	174503

Analysis Batch: 174767

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
400-73109-2	PB-2 @ 1'-4'	TCLP	Solid	6010C	174503
400-73109-3	B-1 @ 1'-4'	TCLP	Solid	6010C	174503

General Chemistry

Analysis Batch: 174374

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
400-73109-1	BMP-3 @ 1'-4'	Total/NA	Solid	Moisture	
400-73109-2	PB-2 @ 1'-4'	Total/NA	Solid	Moisture	
400-73109-3	B-1 @ 1'-4'	Total/NA	Solid	Moisture	

Lab Chronicle

Client: GeoEnvironmental Resources Inc GER
Project/Site: P-1346 Camp LeJeune 110-6170

TestAmerica Job ID: 400-73109-1

Client Sample ID: BMP-3 @ 1'-4'

Lab Sample ID: 400-73109-1

Date Collected: 03/06/13 08:40
Matrix: Solid
Date Received: 03/09/13 09:56
Percent Solids: 85.9

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035			174869	03/15/13 15:00	SH	TAL PEN
Total/NA	Analysis	8260B		1	174867	03/16/13 02:05	SH	TAL PEN
Total/NA	Prep	5035			175012	03/15/13 10:00	GK	TAL PEN
Total/NA	Analysis	8015C		1	174769	03/15/13 18:23	GK	TAL PEN
Total/NA	Prep	3550C			174423	03/11/13 13:54	RT	TAL PEN
Total/NA	Analysis	8015C		1	174540	03/12/13 21:39	AR	TAL PEN
TCLP	Leach	1311			174446	03/11/13 16:00	SC	TAL PEN
TCLP	Prep	7470A			174560	03/13/13 07:55	BG	TAL PEN
TCLP	Analysis	7470A		1	174621	03/13/13 14:00	BG	TAL PEN
TCLP	Prep	3010A			174503	03/12/13 12:19	KN	TAL PEN
TCLP	Analysis	6010C		5	174664	03/14/13 05:02	GS	TAL PEN
Total/NA	Analysis	Moisture		1	174374	03/09/13 17:00	LEC	TAL PEN

Client Sample ID: PB-2 @ 1'-4'

Lab Sample ID: 400-73109-2

Date Collected: 03/06/13 09:30
Matrix: Solid
Date Received: 03/09/13 09:56
Percent Solids: 91.1

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035			174869	03/15/13 15:00	SH	TAL PEN
Total/NA	Analysis	8260B		1	174867	03/16/13 02:27	SH	TAL PEN
Total/NA	Prep	5035			175012	03/15/13 10:00	GK	TAL PEN
Total/NA	Analysis	8015C		1	174769	03/15/13 20:13	GK	TAL PEN
Total/NA	Prep	3550C			174423	03/11/13 13:54	RT	TAL PEN
Total/NA	Analysis	8015C		1	174540	03/12/13 21:49	AR	TAL PEN
TCLP	Leach	1311			174446	03/11/13 16:00	SC	TAL PEN
TCLP	Prep	7470A			174560	03/13/13 07:55	BG	TAL PEN
TCLP	Analysis	7470A		1	174621	03/13/13 14:01	BG	TAL PEN
TCLP	Prep	3010A			174503	03/12/13 12:19	KN	TAL PEN
TCLP	Analysis	6010C		1	174767	03/14/13 17:29	GS	TAL PEN
Total/NA	Analysis	Moisture		1	174374	03/09/13 17:00	LEC	TAL PEN

Client Sample ID: B-1 @ 1'-4'

Lab Sample ID: 400-73109-3

Date Collected: 03/06/13 09:00
Matrix: Solid
Date Received: 03/09/13 09:56
Percent Solids: 89.4

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	5035			174869	03/15/13 15:00	SH	TAL PEN
Total/NA	Analysis	8260B		1	174867	03/16/13 02:49	SH	TAL PEN
Total/NA	Prep	5035			175012	03/15/13 10:00	GK	TAL PEN
Total/NA	Analysis	8015C		1	174769	03/15/13 20:40	GK	TAL PEN
Total/NA	Prep	3550C			174423	03/11/13 13:54	RT	TAL PEN
Total/NA	Analysis	8015C		1	174540	03/12/13 21:58	AR	TAL PEN
TCLP	Leach	1311			174446	03/11/13 16:00	SC	TAL PEN

Lab Chronicle

Client: GeoEnvironmental Resources Inc GER
Project/Site: P-1346 Camp LeJeune 110-6170

TestAmerica Job ID: 400-73109-1

Client Sample ID: B-1 @ 1'-4'
Date Collected: 03/06/13 09:00
Date Received: 03/09/13 09:56

Lab Sample ID: 400-73109-3
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
TCLP	Prep	7470A			174560	03/13/13 07:55	BG	TAL PEN
TCLP	Analysis	7470A		1	174621	03/13/13 14:03	BG	TAL PEN
TCLP	Prep	3010A			174503	03/12/13 12:19	KN	TAL PEN
TCLP	Analysis	6010C		1	174767	03/14/13 17:32	GS	TAL PEN
Total/NA	Analysis	Moisture		1	174374	03/09/13 17:00	LEC	TAL PEN

Laboratory References:

TAL PEN = TestAmerica Pensacola, 3355 McLemore Drive, Pensacola, FL 32514, TEL (850)474-1001

Certification Summary

Client: GeoEnvironmental Resources Inc GER
Project/Site: P-1346 Camp LeJeune 110-6170

TestAmerica Job ID: 400-73109-1

Laboratory: TestAmerica Pensacola

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
Alabama	State Program	4	40150	06-30-13
Arizona	State Program	9	AZ0710	01-11-14
Arkansas DEQ	State Program	6	88-0689	09-01-13
Florida	NELAP	4	E81010	06-30-13
Georgia	State Program	4	N/A	06-30-13
Illinois	NELAP	5	200041	10-09-13
Iowa	State Program	7	367	08-01-14
Kansas	NELAP	7	E-10253	10-31-13
Kentucky (UST)	State Program	4	53	07-05-13
Louisiana	NELAP	6	30976	06-30-13
Maryland	State Program	3	233	09-30-13
Massachusetts	State Program	1	M-FL094	06-30-13
Michigan	State Program	5	9912	06-30-13
New Hampshire	NELAP	1	2505	08-16-13
New Jersey	NELAP	2	FL006	06-30-13
North Carolina DENR	State Program	4	314	12-31-13
Oklahoma	State Program	6	9810	08-31-13
Pennsylvania	NELAP	3	68-00467	01-31-14
Rhode Island	State Program	1	LAO00307	12-31-13
South Carolina	State Program	4	96026	06-30-12
Tennessee	State Program	4	TN02907	06-30-13
Texas	NELAP	6	T104704286-12-5	09-30-13
USDA	Federal		P330-10-00407	12-10-13
Virginia	NELAP	3	460166	06-14-13
West Virginia DEP	State Program	3	136	06-30-13

Method Summary

Client: GeoEnvironmental Resources Inc GER
Project/Site: P-1346 Camp LeJeune 110-6170

TestAmerica Job ID: 400-73109-1

Method	Method Description	Protocol	Laboratory
8260B	Volatile Organic Compounds (GC/MS)	SW846	TAL PEN
8015C	GRO by 8015C	SW846	TAL PEN
8015C	Nonhalogenated Organics using GC/FID -Modified (Diesel Range Organics)	SW846	TAL PEN
6010C	RCRA Metals	SW846	TAL PEN
7470A	Mercury (CVAA)	SW846	TAL PEN
Moisture	Percent Moisture	EPA	TAL PEN

Protocol References:

EPA = US Environmental Protection Agency

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL PEN = TestAmerica Pensacola, 3355 McLemore Drive, Pensacola, FL 32514, TEL (850)474-1001

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

CHAIN OF CUSTODY RECORD

400-73109 Chain of Custody

TestAmerica

Customer Information		Project Information		Analysis/Methods			
PO:	110-6170	Project Name:	P-1346 CAMP LEJEUNE	A	TCLP RCRA METALS (13K)/6010/7470	K	
WO:		Project Number:	110-6170	B	TPH DRO (8015)	L	
Company:	GER, INC.	Bill To:		C	TPH GRO (8015)	M	
Report to:	CHARLES CRAWLEY	Invoice ATTN:	CHARLES CRAWLEY	D	BTEX (8260)	N	
Address:	2712 SOUTHERN BLVD. STE. 101 VA. BEACH, VA 23452	Address:	SAME	E		O	
				F			
				G			
Email:	CFCRAWLEY@GERONLINE.COM			H			
Phone:	757 463 3200	Phone:		I		Other:	
Fax:	3080	Fax:		J			

No.	Sample Description	Preservation	Date	Time	Type	Matrix	# Container	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	BMP-3@1'-4'	ICE	3/6/13	08:40	CO	SO	1	X	X	X	X											
2	PB-2@1'-4'	ICE	3/6/13	09:30	CO	SO	1	X	X	X	X											
3	B-1@1'-4'	ICE	3/6/13	09:00	CO	SO	1	X	X	X	X											
4																						
5																						
6																						
7																						

Sampler: CFC | Shipment Method: TestAmerica Courier/Fed Ex | Date Due (fax):

1. Relinquished by:	Date:	2. Received by:	Date:	3. Relinquished by:	Date:	4. Received by:	Date:
Company: GER	Time: 2:30	Company: TestAmerica	Time: 2:30	Company: TestAmerica	Time: 2:45	Company: TA	Time: 2:45

Comments:

3-6-13 PSC

Standard turn Other

Rush turn

TestAmerica

2.PC IR-5

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Login Sample Receipt Checklist

Client: GeoEnvironmental Resources Inc GER

Job Number: 400-73109-1

Login Number: 73109

List Source: TestAmerica Pensacola

List Number: 1

Creator: Crawford, Lauren E

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	N/A	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	2.1°C IR-5
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

APPENDIX D

PROCEDURES

GEOTECHNICAL EXPLORATION PROCEDURES

Boring, Sampling & Standard Penetration Testing

Standard penetration testing and split barrel sampling are conducted at regular intervals in a borehole in accordance with ASTM D 1586. Standard practice on most **GER** projects is to perform this testing and sampling continuously within the upper 10 feet of the subsurface, and then at maximum 5-foot center-to-center intervals thereafter. At the desired test depth, the drilling tools are removed and a split barrel sampler is connected to the drilling rods and lowered back into the borehole. The sampler is first seated six inches into the bottom of the hole to penetrate any loose cuttings from the drilling operations. It is then driven an additional 12 inches by the impact of a 140 pound hammer free-falling 30 inches. The number of hammer blows required to drive the sampler for each 6-inch interval is recorded. The combined number of blows required to drive the sampler the final 12 inches is designated *standard penetration resistance* or *N-value*. Representative portions of soil from each split barrel sample are placed in air tight glass jars or plastic bags and transported to a laboratory.

Undisturbed Sampling

Split barrel samples are used for visual examination and simple laboratory classification tests; however, they are disturbed and not sufficiently intact for quantitative laboratory testing such as strength or consolidation. When such laboratory testing is desired, relatively undisturbed samples are obtained by slowly pushing a 3-inch diameter, thin-walled (16 gauge) galvanized steel tube into the soil at desired sampling depths. This is followed by carefully removing the soil-filled tube from the borehole and sealing the ends to prevent moisture loss. The procedure is described in ASTM D 1587. Undisturbed tube samples are most frequently used for sampling cohesive soils (clay and silt), but may be used to sample fine grained cohesionless soils with the aid of a piston sampling head.

Excavation

When explorations do not require machine-drilled borings, excavations, test pits, hand auger borings and other means described in ASTM D 4700 may be used to observe shallow subsurface conditions and to collect soil samples. The maximum depth of these methods is generally limited by the depth of groundwater. These methods are useful in obtaining bulk samples for laboratory classification, compaction and other remolded tests.

Rock Coring

Core drilling methods described in ASTM D 2113 are used to advance boreholes into rock or extremely dense soils which are not penetrable by conventional boring methods and typically exhibit more than 100 blows per foot by ASTM D 1586. Core drilling methods employed by **GER** use double tube swivel-type designed equipment with a drilling fluid, in which an outer tube rotates and performs the cutting while the inner tube remains stationary and collects a continuous sample of rock.

In-Situ Methods

In-situ tests are sometimes used on projects to obtain additional subsurface data. These methods provide direct and empirical measurement of various soil properties without collection of actual samples. Because samples are not collected, it is not common practice in the U. S. to

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utilize in-situ tests alone to accomplish geotechnical investigations. On projects where in-situ testing is used, it is customary to perform them in conjunction with borings.

Soil Classification

Soil classification tests provide a general guide to the engineering properties of various soil types. Samples obtained during drilling operations are examined and visually classified by an engineer or geologist according to consistency, color and texture. These classification descriptions are included on the boring records. The classification system is primarily qualitative and for detailed soil classification, two laboratory tests are necessary; grain size tests and plasticity tests. Using these test results, the soil can be classified according to the AASHTO or Unified Classification System (ASTM D 2487). Each of these classification systems and the in-place physical soil properties provides an index for estimating the soil's behavior. The soil classification and physical properties obtained are presented on the following sheets.

Grain Size Tests

Grain size tests are performed to determine the soil classification and the grain size distribution. The soil samples are prepared for testing according to ASTM D 421 (dry preparation) or ASTM D 2217 (wet preparation). The grain size distribution of soils coarser than the #200 U.S. Standard Sieve (0.074 mm opening) is determined by passing the samples through a standard set of nested sieves. Materials passing the No. 200 sieve are suspended in water and the grain size distribution calculated from the measured settlement rate. These tests are conducted in accordance with ASTM D 422.

Plasticity Tests

Plasticity tests are performed to determine the soil classification and plasticity characteristics. The soil plasticity characteristics are defined by the Plastic Index (PI) and the Liquid Limit (LL). The PI is related to the volume changes which occur in confined soils beneath foundations. The PI and LL are determined in accordance with ASTM D 4318.

Physical Properties

The in-place physical properties are described by the specific gravity, wet unit weight, moisture content, dry unit weight, void ratio and percent saturation of the soil. The specific gravity and moisture content are determined by ASTM D 854 and D 2216, respectively. The wet unit weight is found by obtaining a known volume of soil and dividing the wet sample weight by the known volume. The dry unit weight, void ratio and percent saturation are calculated values.

California Bearing Ratio

The California Bearing Ratio (CBR) test is a comparative measure of the shearing resistance of a soil. It is used with empirical curves to design asphalt pavement structures. The test is performed in accordance with ASTM D 1883 or Virginia Test Method Designation VTM-8. A representative bulk sample is compacted in a six-inch diameter CBR mold in five (5) equal layers, using 45 evenly spaced blows per layer with a 5.5 lb. hammer falling 12 inches. CBR tests may be run on the compacted samples in either soaked or unsoaked conditions, with samples penetrated at the rate of .05 inches per minute to a depth of 0.5 inches. The CBR value is the percentage of the load it takes to penetrate the soil to a specified depth compared to the load it takes to penetrate a standard crushed stone to the same depth.

Consolidation Tests

Consolidation tests determine the change in height of a soil sample with increasing load. The results of these tests are used to estimate the settlement and time rate of settlement of structures constructed on similar soils. The test is run in accordance with ASTM D 2435 on a single element of an extruded undisturbed sample. The test sample is trimmed into a disk approximately 2½ inches in diameter and one inch thick. The disk is confined in a stainless steel ring and sandwiched between porous plates and subjected to incrementally increasing vertical loads, with the resulting deformations measured with micrometer dial gauges. Void ratios and percent strain deformation are then calculated from these readings. The test results are presented in the form of a stress-strain or vertical pressure versus void ratio curve.

Triaxial Shear Tests

Triaxial shear tests are used to determine the strength characteristics and elastic properties of a soil sample. Triaxial shear tests are conducted either on relatively undisturbed samples of virgin material or on remolded-compacted samples of representative site materials. The samples are then trimmed into cylinders and encased in rubber membranes. Each is then placed into a compression chamber and confined by hydrostatic cell pressure. An axial load is applied until the sample fails in shear. Test results are presented in the form of stress-strain curves and stress paths to failure.

Various types of triaxial tests may be performed. The most suitable type of triaxial test is determined by the loading conditions imposed on the soil in the field and by drainage characteristics of the site. Types of triaxial tests normally performed include:

- Consolidated-Isotropic-Undrained (CIU test)
- Consolidated-Anisotropic-Undrained (CK_oU test)
- Consolidated-Isotropic-Drained (CID test)
- Consolidated-Anisotropic-Drained (CK_oD test)
- Unconsolidated-Undrained (UU test)

CONETEC INTERPRETATION METHODS

A Detailed Description of the Methods Used in ConeTec's CPT Interpretation and Plotting Software

Revision SZW-Rev 02
March 12, 2008

Prepared by Jim Greig

ConeTec Interpretations as of March 12, 2008

ConeTec's interpretation routine provides a tabular output of geotechnical parameters based on current published CPT correlations and is subject to change to reflect the current state of practice. The interpreted values are not considered valid for all soil types. The interpretations are presented only as a guide for geotechnical use and should be carefully scrutinized for consideration in any geotechnical design. Reference to current literature is strongly recommended. ConeTec does not warranty the correctness or the applicability of any of the geotechnical parameters interpreted by the program and does not assume liability for any use of the results in any design or review. Representative hand calculations should be made for any parameter that is critical for design purposes. The end user of the interpreted output should also be fully aware of the techniques and the limitations of any method used in this program. The purpose of this document is to inform the user as to which methods were used and what the appropriate papers and/or publications are for further reference.

The CPT interpretations are based on values of tip, sleeve friction and pore pressure averaged over a user specified interval (e.g. 0.20m). Note that q_t is the tip resistance corrected for pore pressure effects and q_c is the recorded tip resistance. Since all ConeTec cones have equal end area friction sleeves, pore pressure corrections to sleeve friction, f_s, are not required.

The tip correction is: $q_t = q_c + (1-a) \bullet u_2$

where: q_t is the corrected tip resistance
q_c is the recorded tip resistance
u_2 is the recorded dynamic pore pressure behind the tip (u_2 position)
a is the Net Area Ratio for the cone (typically 0.80 for ConeTec cones)

The total stress calculations are based on soil unit weights that have been assigned to the Soil Behavior Type zones, from a user defined unit weight profile or by using a single value throughout the profile. Effective vertical overburden stresses are calculated based on a hydrostatic distribution of equilibrium pore pressures below the water table or from a user defined equilibrium pore pressure profile (this can be obtained from CPT dissipation tests). For over water projects the effects of the column of water have been taken into account as has the appropriate unit weight of water. How this is done depends on where the instruments were zeroed (i.e. on deck or at mud line).

Details regarding the interpretation methods for all of the interpreted parameters are provided in Table 1. The appropriate references cited in Table 1 are listed in Table 2. Where methods are based on charts or techniques that are too complex to describe in this summary the user should refer to the cited material.

The estimated Soil Behavior Types (normalized and non-normalized) are based on the charts developed by Robertson and Campanella shown in Figures 1 and 2. The Bq classification charts are not reproduced in this document but can be reviewed in Lunne, Robertson and Powell (1997) or Robertson (1990).

Where the results of a calculation/interpretation are declared *'invalid'* the value will be represented by the text strings "-9999" or "-9999.0". In some cases the value 0 will be used. Invalid results will occur because of (and not limited to) one or a combination of:

1. Invalid or undefined CPT data (e.g. drilled out section or data gap).

2. Where the interpretation method is inappropriate, for example, drained parameters in an undrained material (and vice versa).

3. Where interpretation input values are beyond the range of the referenced charts or specified limitations of the interpretation method.

4. Where pre-requisite or intermediate interpretation calculations are invalid.

The parameters selected for output from the program are often specific to a particular project. As such, not all of the interpreted parameters listed in Table 1 may be included in the output files delivered with this report.

The output files are provided in Microsoft Excel XLS format. The ConeTec software has several options for output depending on the number or types of interpreted parameters desired. Each output file will be named using the original COR file basename followed by a three or four letter indicator of the interpretation set selected (e.g. BSC, TBL, NLI or IFI) and possibly followed by an operator selected suffix identifying the characteristics of the particular interpretation run.

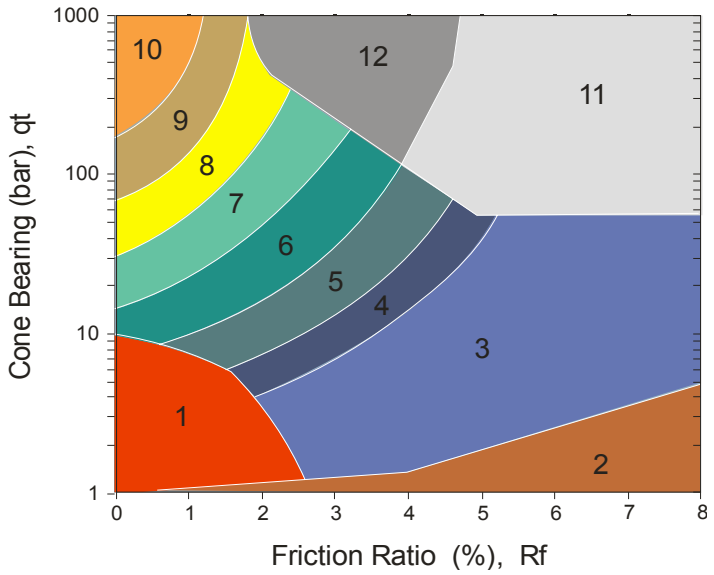
Table 1
CPT Interpretation Methods

Interpreted Parameter	Description	Equation	Ref
Depth	Mid Layer Depth *(where interpretations are done at each point then Mid Layer Depth = Recorded Depth)*	*Depth (Layer Top) + Depth (Layer Bottom) / 2.0*	
Elevation	Elevation of Mid Layer based on sounding collar elevation supplied by client	Elevation = Collar Elevation - Depth	
Avgqc	Averaged recorded tip value (q_c)	$Avgqc = \frac{1}{n}\sum_{i=1}^{n} q_c$ *n=1 when interpretations are done at each point*	
Avgqt	Averaged corrected tip (q_t) where: $q_t = q_c + (1-a) \bullet u$	$Avgqt = \frac{1}{n}\sum_{i=1}^{n} q_t$ *n=1 when interpretations are done at each point*	
Avgfs	Averaged sleeve friction (f_s)	$Avgfs = \frac{1}{n}\sum_{i=1}^{n} fs$ *n=1 when interpretations are done at each point*	
AvgRf	Averaged friction ratio (Rf) where friction ratio is defined as: $Rf = 100\% \bullet \frac{fs}{qt}$	$AvgRf = 100\% \bullet \frac{Avgfs}{Avgqt}$ *n=1 when interpretations are done at each point*	
Avgu	Averaged dynamic pore pressure *(u)*	$Avgu = \frac{1}{n}\sum_{i=1}^{n} u_i$ *n=1 when interpretations are done at each point*	
AvgRes	Averaged Resistivity (this data is not always available since it is a specialized test requiring an additional module)	$Avgu = \frac{1}{n}\sum_{i=1}^{n} RESISTIVITY_i$ *n=1 when interpretations are done at each point*	
AvgUVIF	Averaged UVIF ultra-violet induced fluorescence (this data is not always available since it is a specialized test requiring an additional module)	$Avgu = \frac{1}{n}\sum_{i=1}^{n} UVIF_i$ *n=1 when interpretations are done at each point*	
AvgTemp	Averaged Temperature (this data is not always available since it is a specialized test)	$Avgu = \frac{1}{n}\sum_{i=1}^{n} TEMPERATURE_i$ *n=1 when interpretations are done at each point*	
AvgGamma	Averaged Gamma Counts (this data is not always available since it is a specialized test requiring an additional module)	$Avgu = \frac{1}{n}\sum_{i=1}^{n} GAMMA_i$ *n=1 when interpretations are done at each point*	
SBT	Soil Behavior Type as defined by Robertson and Campanella	See Figure 1	2, 5

Interpreted Parameter	Description	Equation	Ref
U.Wt.	Unit Weight of soil determined from one of the following user selectable options: 1) uniform value 2) value assigned to each SBT zone 3) user supplied unit weight profile	See references	5
T. Stress σ_v	Total vertical overburden stress at Mid Layer Depth. *A layer is defined as the averaging interval specified by the user. For data interpreted at each point the Mid Layer Depth is the same as the recorded depth.*	$TStress = \sum_{i=1}^{n} \gamma_i h_i$ *where* γ_i is layer unit weight h_i is layer thickness	
E. Stress σ_v'	Effective vertical overburden stress at Mid Layer Depth	$Estress = Tstress - u_{eq}$	
Ueq	Equilibrium pore pressure determined from one of the following user selectable options: 1) hydrostatic from water table depth 2) user supplied profile	For hydrostatic option: $u_{eq} = \gamma_w \bullet (D - D_{wt})$ where u_{eq} is equilibrium pore pressure γ_w is unit weight of water D is the current depth D_{wt} is the depth to the water table	
Cn	SPT N_{60} overburden correction factor	$Cn=(\sigma_v')^{-0.5}$ where σ_v' *is in tsf* $0.5 < C_n < 2.0$	
N_{60}	SPT N value at 60% energy calculated from qt/N ratios assigned to each SBT zone. This method has abrupt N value changes at zone boundaries.	*See Figure 1*	4, 5
$(N_1)_{60}$	SPT N_{60} value corrected for overburden pressure	$(N_1)_{60} = Cn \bullet N_{60}$	4
$N_{60}I_c$	SPT N_{60} values based on the Ic parameter	(qt/pa)/ N_{60} = 8.5 (1 – Ic/4.6)	5
$(N_1)_{60}Ic$	SPT N_{60} value corrected for overburden pressure (using N_{60} $I_{c)}$. User has 2 options.	1) $(N_1)_{60}Ic = Cn \bullet (N_{60} Ic)$ 2) $q_{c1n}/ (N_1)_{60}Ic$ = 8.5 (1 – Ic/4.6)	4 5
$(N_1)_{60cs}Ic$	Clean sand equivalent SPT $(N_1)_{60}Ic$. User has 3 options.	1) $(N_1)_{60cs}Ic = \alpha + \beta((N_1)_{60}Ic)$ 2) $(N_1)_{60cs}Ic = K_{SPT} * ((N_1)_{60}Ic)$ 3) $q_{c1ncs}/ (N_1)_{60cs}Ic$ = 8.5 (1 – Ic/4.6) FC ≤ 5%: α = 0, β=1.0 FC ≥ 35% α = 5.0, β=1.2 5% < FC < 35% α = exp[1.76 – (190/FC^2)] β = [0.99 + ($FC^{1.5}$/1000)]	10 10 5
Su	Undrained shear strength - N_{kt} is user selectable	$Su = \frac{qt - \sigma_v}{N_{kt}}$	1, 5
k	Coefficient of permeability (assigned to each SBT zone)		5
Bq	Pore pressure parameter	$Bq = \frac{\Delta u}{qt - \sigma_v}$ *where:* $\Delta u = u - u_{eq}$ *and u = dynamic pore pressure* *u_{eq} = equilibrium pore pressure*	1, 5
Q_t	Normalized q_t for Soil Behavior Type classification as defined by Robertson, 1990	$Qt = \frac{qt - \sigma_v}{\sigma_v'}$	2, 5

Interpreted Parameter	Description	Equation	Ref
F_r	Normalized Friction Ratio for Soil Behavior Type classification as defined by Robertson, 1990	$Fr = 100\% \bullet \frac{fs}{qt - \sigma_v}$	2, 5
SBTn	Normalized Soil Behavior Type as defined by Robertson and Campanella	See Figure 2	2, 5
SBT-BQ	Non-normalized soil behavior type based on the Bq parameter	See Figure 5.7 (reference 5)	2, 5
SBT-BQn	Normalized Soil Behavior base on the Bq parameter	See Figure 5.8 (reference 5) or Figure 3 (reference 2)	2, 5
I_c	Soil index for estimating grain characteristics	$Ic = [(3.47 - log_{10}Q)^2 + (log_{10} Fr + 1.22)^2]^{0.5}$ *Where:* $Q = \left(\frac{qt - \sigma_v}{P_{a2}}\right)\left(\frac{P_a}{\sigma_v'}\right)^n$ *And* *Fr is in percent* *P_a = atmospheric pressure* *P_{a2} = atmospheric pressure* *n varies from 0.5 to 1.0 and is selected in an iterative manner based on the resulting I_c*	3, 8
FC	Apparent fines content (%)	*$FC=1.75(Ic^{3.25}) - 3.7$* *FC=100 for Ic > 3.5* *FC=0 for Ic < 1.26* *FC = 5% if 1.64 < Ic < 2.6 AND F_r<0.5*	3
Ic Zone	This parameter is the Soil Behavior Type zone based on the Ic parameter (valid for zones 2 through 7 on SBTn chart)	Ic < 1.31 Zone = 7 1.31 < Ic < 2.05 Zone = 6 2.05 < Ic < 2.60 Zone = 5 2.60 < Ic < 2.95 Zone = 4 2.95 < Ic < 3.60 Zone = 3 Ic > 3.60 Zone = 2	3
PHI ϕ	Friction Angle determined from one of the following user selectable options: a) Campanella and Robertson b) Durgunoglu and Mitchel c) Janbu d) Kulhawy and Mayne	See reference	5 5 5 11
Dr	Relative Density determined from one of the following user selectable options: a) Ticino Sand b) Hokksund Sand c) Schmertmann 1976 d) Jamiolkowski - All Sands	See reference	5
OCR	Over Consolidation Ratio	a) Based on Schmertmann's method involving a plot of $S_u/\sigma_v' / (S_u/\sigma_v')_{NC}$ and OCR where the Su/p' ratio for NC clay is user selectable	9
State Parameter	The state parameter is used to describe whether a soil is contractive (SP is positive) or dilative (SP is negative) at large strains based on the work by Been and Jefferies	See reference	8, 6, 5
Es/qt	Intermediate parameter for calculating Young's Modulus, E, in sands. It is the Y axis of the reference chart.	Based on Figure 5.59 in the reference	5

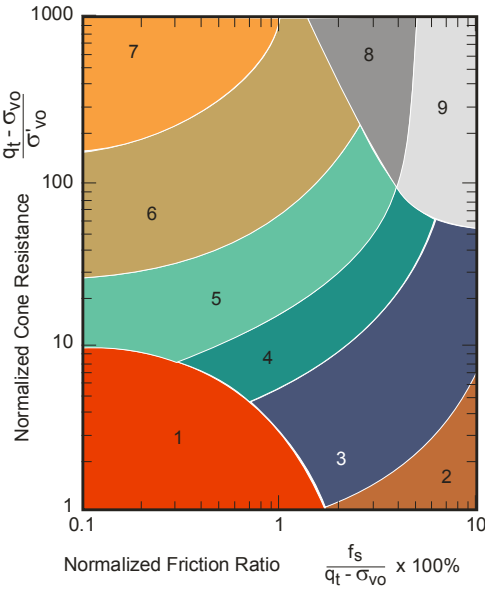
Interpreted Parameter	Description	Equation	Ref
Young's Modulus E	Young's Modulus based on the work done in Italy. There are three types of sands considered in this technique. The user selects the appropriate type for the site from: a) OC Sands b) Aged NC Sands c) Recent NC Sands Each sand type has a family of curves that depend on mean normal stress. The program calculates mean normal stress and linearly interpolates between the two extremes provided in the Es/qt chart.	Mean normal stress is evaluated from: $\sigma'_m = \frac{1}{3} \bullet (\sigma'_v + \sigma'_h + \sigma'_h)^3$ where σ_v'= vertical effective stress σ_h'= horizontal effective stress and $\sigma_h = K_o * \sigma_v'$ with Ko assumed to be 0.5	5
q_{c1}	q_t normalized for overburden stress used for seismic analysis	$q_{c1} = q_t \bullet (Pa/\sigma_v')^{0.5}$ where: Pa = atm. Pressure q_t is in Mpa	3
q_{c1n}	q_{c1} in dimensionless form used for seismic analysis	$q_{c1n} = (q_{c1} / Pa)(Pa/\sigma_v')$ where: Pa = atm. Pressure and n ranges from 0.5 to 0.75 based on Ic.	3
K_{SPT}	Equivalent clean sand factor for $(N_1)60$	$K_{SPT} = 1 + ((0.75/30) * (FC - 5))$	10
K_{CPT}	Equivalent clean sand correction for q_{c1N}	$K_{cpt} = 1.0$ for $I_c \leq 1.64$ $K_{cpt} = f(I_c)$ for $I_c > 1.64$ (see reference)	10
q_{c1ncs}	Clean sand equivalent q_{c1n}	$q_{c1ncs} = q_{c1n} \bullet K_{cpt}$	3
CRR	Cyclic Resistance Ratio (for Magnitude 7.5)	$q_{c1ncs} < 50$: $CRR_{7.5} = 0.833 [(q_{c1ncs}/1000] + 0.05$ $50 \leq q_{c1ncs} < 160$: $CRR_{7.5} = 93 [(q_{c1ncs}/1000]^3 + 0.08$	10
CSR	Cyclic Stress Ratio	$CSR = (\tau_{av}/\sigma_v') = 0.65 (a_{max} / g) (\sigma_v / \sigma_v') r_d$ $r_d = 1.0 - 0.00765 z$ $z \leq 9.15$m $r_d = 1.174 - 0.0267 z$ $9.15 < z \leq 23$m $r_d = 0.744 - 0.008 z$ $23 < z \leq 30$m $r_d = 0.50$ $z > 30$m	10
MSF	Magnitude Scaling Factor	See Reference	10
FofS	Factor of Safety against Liquefaction	$FS = (CRR_{7.5} / CSR) MSF$	10
Liquefaction Status	Statement indicating possible liquefaction	Takes into account FofS and limitations based I_c and q_{c1ncs}.	10



Zone	qt / N	Soil Behavior Type
1	2	sensitive fine grained
2	1	organic material
3	1	clay
4	1.5	silty clay to clay
5	2	clayey silt to silty clay
6	2.5	sandy silt to clayey silt
7	3	silty sand to sandy silt
8	4	sand to silty sand
9	5	sand
10	6	gravelly sand to sand
11	1	very stiff fine grained *
12	2	sand to clayey sand *

* overconsolidated or cemented

Figure 1 Non-Normalized Behavior Type Classification Chart



Zone	Normalized Soil Behavior Type
1	sensitive fine grained
2	organic material
3	clay to silty clay
4	clayey silt to silty clay
5	silty sand to sandy silt
6	clean sands to silty sands
7	gravelly sand to sand
8	very stiff sand to clayey sand
9	very stiff fine grained

Figure 2 Normalized Behavior Type Classification Chart

Table 2 References

No.	References
1	Robertson, P.K., Campanella, R.G., Gillespie, D. and Greig, J., 1986, "Use of Piezometer Cone Data", Proceedings of InSitu 86, ASCE Specialty Conference, Blacksburg, Virginia.
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5	Lunne, T., Robertson, P.K. and Powell, J. J. M., 1997, " Cone Penetration Testing in Geotechnical Practice," Blackie Academic and Professional.
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7	Jefferies, M.G. and Davies, M.P., 1993. "Use of CPTu to Estimate equivalent N_{60}", Geotechnical Testing Journal, 16(4): 458-467.
8	Been, K. and Jefferies, M.P., 1985, "A state parameter for sands", Geotechnique, 35(2), 99-112.
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10	Proceedings of theNCEER Workshop on Evaluation of Liquefaction Resistance of Soils, Salt LakeCity, 1996. Chaired by Leslie Youd. 11
11	Kulhawy, F.H. and Mayne, P.W. ,1990, Manual on Estimating Soil Properties for Foundation Design, *Report No. EL-6800*, Electric Power Research Institute, Palo Alto, CA, August 1990, 306 p.

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June 10, 2015

HBA-H&A Joint Venture
c/o HBA Architecture & Interior Design, Inc.
One Columbus Center, Suite 1000
Virginia Beach, Virginia 23462

Attention: **Mr. Thomas N. Ellis, AIA**

Subject: **Addendum 1 to Report of Preliminary Geotechnical Exploration**
P-1346 Simulator Center and Range Control Building
Marine Corps Base, Camp Lejeune, North Carolina
A/E Contract No. N40085-10-D-5301, CTO 0025, Mod 05
HBA-H&A JV Project No. 09049.22E
GER Project No. 110-6170

Pursuant to your request, **G**eo**E**nvironmental **R**esources, Inc. is providing this Addendum 1 to our Report of Preliminary Geotechnical Exploration dated April 10, 2013 (revised March 6, 2015) for the above referenced project. This addendum provides the results of the supplemental field investigation program requested by NAVFAC Mid-Atlantic and addresses possible impacts for the proposed site and building construction.

Supplemental Investigation Program

On June 2, 2015, we performed nine geotechnical test pit excavations on the project site to supplement the findings from the test borings and soundings described in the above referenced geotechnical report. The general test pit locations were selected by NAVFAC Mid-Atlantic and were primarily intended to correspond to the locations of previous structures associated with the former Brig facility. The approximate test pit locations relative to the former site conditions are shown in Attachment 1. The GPS recorded coordinates and estimated surface elevations of the test pits are provided in Attachment 2.

The test pits were excavated using a John Deere 310 backhoe equipped with a 24-inch wide bucket. The test pit excavations extended to depths ranging from approximately 4 to 10 feet below the ground surface. Excavation was monitored by a geotechnical engineer and the materials observed during each excavation were visually classified in general accordance with the Unified Soil Classification System (USCS) referenced in ASTM D2487. The excavations were logged, photographed and subsequently backfilled with the excavated materials.

Supplemental Investigation Findings

The subsurface conditions encountered at the supplemental test pit locations are shown on the test pit records and excavation photographs in Attachments 3 and 4, respectively. The test pit records represent our interpretation of the subsurface conditions based on visual examination of the excavated materials. The lines designating the interface between various strata on the test pit records represent the approximate interface location. In addition, the transition between strata may be more gradual than implied. Elevations shown on the test pit records were estimated to the nearest foot using the site topographic survey performed in February 2013 and the elevations shall be considered approximate only. Water level observations shown on the test pit records only represent the water conditions present at the time of excavation.

To summarize the findings in the supplemental test pits, the excavated materials appeared relatively similar to the Stratum A uncontrolled fill and Stratum 1 native sand materials described in the preliminary geotechnical report. The Stratum A uncontrolled fill materials were composed primarily of fine silty and clayey sands mixed with debris such as concrete, CMU, brick, crushed stone, asphalt, wood, metal, etc. In the majority of the test pits, the debris was a relatively minor component of the overall fill composition. Material excavated from Test Pit TP-3 had a higher percentage of debris mixed with the soil, and excavation at locations TP-2, TP-3 and TP-5 encountered a few debris pieces having sizes up to approximately 14 inches in diameter. We did not observe the presence of intact old building foundations; however, an intact 6-inch diameter iron pipe was encountered at location TP-3.

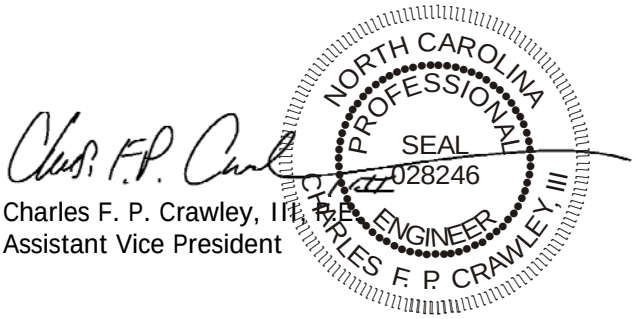
From the supplemental test pits, we confirmed the presence of uncontrolled fill material extending to depths up to approximately 5 feet below the ground surface in the vicinity of the former Brig building and to depths of about 1 foot or less beyond the former Brig building footprint. Most of the excavations also revealed an apparent transition layer beneath the uncontrolled fill which we have termed “possible fill.” We did not observe the presence of debris within the possible fill layer, but from the observed soil composition it was difficult to determine whether the material was native undisturbed soil or local soil that had been excavated and replaced. The possible fill layer extended to depths of about 3 to 8 feet below the ground surface in the vicinity of the former Brig building. The bottom 2 to 5 feet of the test pit excavations were composed of apparent Stratum 1 native undisturbed fine sands having USCS classification symbols SC, SC-SM, SM and SP-SM. We did not observe any water enter into the test pit excavations during this supplemental investigation.

Assessment of Findings

The results of supplemental test pit excavations are consistent with the upper subsurface characterization discussed in the preliminary geotechnical report with the confirmed presence of uncontrolled fill material and suspect material extending to depths of about 3 to 8 feet below the ground surface in the vicinity of the former Brig building and to depths of about 1 foot or less elsewhere. As such, the subsurface evaluations and recommendations provided in the preliminary geotechnical report are valid. Design-build teams should anticipate the need for mitigating unsuitable subgrade and upper subsurface conditions at the site as discussed in the original report and based on their own studies. As-built drawings of the former Brig facility, if available, should be provided with the design-build RFP to assist teams in evaluating former conditions and design and construction alternatives for the new facility.

We appreciate the opportunity to serve as your geotechnical consultant and trust that you will contact us at your convenience with any questions concerning this project.

Sincerely,
Geo**E**nvironmental **R**esources, Inc.



Charles F. P. Crawley, III, P.E.
Assistant Vice President

Attachments: 1 - Drawing A1-1 Testing Location Plan
2 - Test Pit Location Data
3 - Test Pit Records
4 - Test Pit Excavation Photographs

ATTACHMENT 1

LEGEND:

- Approximate SPT Soil Boring Location
- Approximate CBR Sample & Soil Boring Location
- Approximate Seismic CPT Sounding Location
- Approximate Test Pit Location

SCALE:

0' 80' 160'

Graphic Scale

SHEET SIZE:

11" x 17"

NOTES:

Field testing locations were not surveyed and may be several feet from the locations indicated. The testing locations shown on this plan shall be considered approximate.

Aerial photograph ca. 2010, courtesy of Google Earth™.

TESTING LOCATIONS RELATIVE TO FORMER/ EXISTING CONDITIONS

Environmental
Groundwater
Hazardous Materials
Geotechnical
Industrial Hygiene

GER Consulting Engineers — GeoEnvironmental Resources, Inc.

GeoEnvironmental Resources, Inc.
2712 Southern Boulevard, Suite 101
Virginia Beach, VA 23452

TESTING LOCATION PLAN

P-1346 Simulator Center & Range Control Building
MCB Camp Lejeune, NC

PROJECT NUMBER	DRAWING NUMBER
110-6170	A1-1

ATTACHMENT 2

TEST PIT LOCATION DATA

P-1346 Simulator Center & Range Control Building
MCB Camp Lejeune, NC
GER Project No. 110-6170

Test Pit No.	Geographic Coordinates[1,2]		Est. Surface Elevation[3] (feet)
	Latitude	Longitude	
TP-1	34.66740	-77.32536	31
TP-2	34.66707	-77.32559	31
TP-3	34.66698	-77.32594	31
TP-4	34.66666	-77.32582	29
TP-5	34.66672	-77.32548	30
TP-6	34.66701	-77.32523	30
TP-7	34.66719	-77.32500	30
TP-8	34.66674	-77.32505	29
TP-9	34.66648	-77.32470	29

NOTES:

1. Coordinates are WGS84 and shall be considered accurate to no more than 10 feet.
2. Test Pits were field located using a handheld GPS device and were not physically surveyed.
3. Surface elevations were estimated to the nearest foot using the site topographic survey performed in February 2013 and not physically surveyed.

ATTACHMENT 3

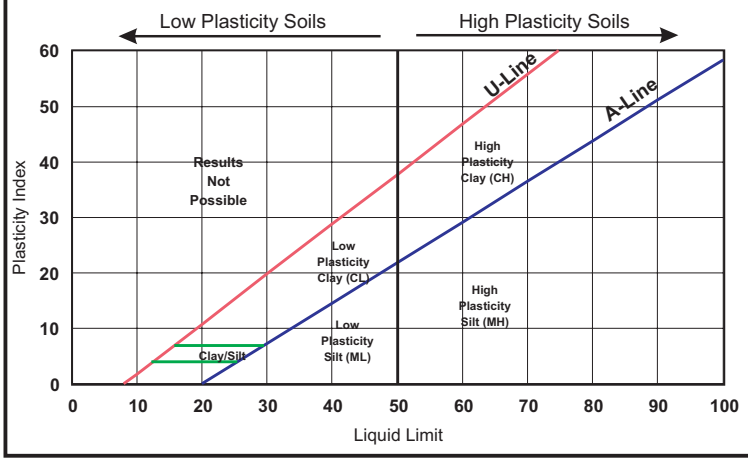
TEST PIT RECORDS

The enclosed test pit records represent our interpretation of the subsurface conditions encountered at the specific testing locations based on visual examination of the excavated materials and selected laboratory classification testing on discreet samples where performed. The lines designating the interface between various strata on the test pit records represent the approximate interface location. In addition, the transition between strata may be more gradual than indicated. Water levels shown only represent the conditions observed at the time of the field exploration. It is possible that soil material and groundwater conditions between the individual test locations will be different from those indicated. Elevations shown on the test pit records shall be considered approximate and are referenced to the project datum stated in the geotechnical report.

SOIL CLASSIFICATION CHART (ASTM D 2487)

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS — MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS — MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS — MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS — MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LOW PLASTICITY LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS, CLAYEY SILTS, SILT-VERY FINE SAND MIXTURES, ROCK FLOUR
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY, SANDY, SILTY, & LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC CLAYS OF LOW PLASTICITY
		HIGH PLASTICITY LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS AND MICACEOUS, DIATOMACEOUS AND ELASTIC SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
OTHER SOILS	HIGHLY ORGANIC SOILS			PT	PEAT, HUMUS, MUCK, SWAMP SOILS WITH VERY HIGH ORGANIC CONTENTS
	UNCONTROLLED FILLS				DISTURBED SOILS WITH POSSIBLE DEBRIS AND RUBBLE, OLD CONSTRUCTION WASTES, NON-ENGINEERED BACKFILLS
	DECOMPOSED OR PARTIALLY WEATHERED ROCK				TRANSITIONAL MATERIAL BETWEEN SOIL AND ROCK WHICH MAY RETAIN THE RELICT STRUCTURE OF THE PARENT ROCK

Atterberg Limits



PARTICLE SIZE IDENTIFICATION

BOULDERS:		Greater than 300 mm (12 in.)
COBBLES:		75 mm to 300 mm (3 - 12 in.)
GRAVEL:	Coarse -	19.0 mm to 75 mm (0.75 - 3 in.)
	Fine -	4.75 mm to 19.0 mm (#4 - 0.75 in.)
SANDS:	Coarse -	2.00 mm to 4.75 mm
	Medium -	0.425 mm to 2.00 mm
	Fine -	0.075 mm to 0.425 mm
SILTS & CLAYS:		Less than 0.075 mm

PLASTICITY INDEX (PI) & SHRINK-SWELL POTENTIAL

0 - 4	None
4 - 15	Slight or Low
15 - 30	Medium to High
31+	High to Very High

ADDITIONAL RELATIVE DESCRIPTIVE VALUES

Trace < 10%	Some < 35% but > 20%
Little < 20% but > 10%	And > 35%

GER

TEST PIT RECORD

GeoEnvironmental Resources, Inc. Environmental, Groundwater, Hazardous Materials, Geotechnical & Industrial Engineering Consultants			Test Pit No. **TP-1**
Project: **P-1346 Simulator & Range Control Center**	GER Project Number: **110-6170**		Sheet No. **1** of **1**
Location: **MCB Camp Lejeune, NC**	Inspector: **CFC** Excavator: **FDI**		Date: **6/2/2015**
Depth (ft.): **8.0**	Elevation (ft.): **31.0**	Client: **HBA-H&A JV**	Equipment: **JD 310 Backhoe**

Elevation ft.	Elevation m	Depth ft.	Depth m	Lith-ology	Material Description	Ground Water	Comments
30	9	1			**FILL** Sampled as silty and clayey sand, brown, tan and orange, fine, with trace crushed stone and crushed concrete		
		2			**Clayey-Silty SAND (SC-SM)** Brown, tan and orange, fine (Possible Fill)		Inconclusive but suspected uncontrolled fill based on soil characteristics
		3	1				
		4			**Slightly Silty SAND (SP-SM)** Tan and white, fine, trace clay		
	8	5			**Silty SAND (SM)** Tan and white, fine, trace clay		
25		6					
		7	2				
	7	8			Excavation terminated at 8 feet.		No water observed during excavation
		9					
		10	3				
20	6	11					

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TEST PIT RECORD

GeoEnvironmental Resources, Inc. Environmental, Groundwater, Hazardous Materials, Geotechnical & Industrial Engineering Consultants			Test Pit No. **TP-2**
Project: **P-1346 Simulator & Range Control Center**	GER Project Number: **110-6170**		Sheet No. **1** of **1**
Location: **MCB Camp Lejeune, NC**	Inspector: **CFC** Excavator: **FDI**		Date: **6/2/2015**
Depth (ft.): **10.0**	Elevation (ft.): **31.0**	Client: **HBA-H&A JV**	Equipment: **JD 310 Backhoe**

Elevation ft.	Elevation m	Depth ft.	Depth m	Lith-ology	Material Description	Ground Water	Comments
30	9	1			**FILL** Sampled as silty sand, tan and light gray, fine, with trace crushed stone and trace clay balls		
		2			**FILL** Sampled as silty sand, brown, tan and white, fine, with trace concrete and CMU rubble up to 8 inch diameter, trace brick fragments, trace black plastic sheeting		
		3	1				
		4					
	8	5			**Clayey-Silty SAND (SC-SM)** Mottled light gray-tan-orange, fine		
25		6					
			2				
		7					
	7	8					
		9					
			3				
		10			Excavation terminated at 10 feet.		No water observed during excavation
20		11					
	6						

TEST PIT RECORD 6170TESTPITS.GPJ CPT.GDT 6/10/15

TEST PIT RECORD

GeoEnvironmental Resources, Inc.	Environmental, Groundwater, Hazardous Materials, Geotechnical & Industrial Engineering Consultants	Test Pit No.	**TP-3**
Project: **P-1346 Simulator & Range Control Center**	GER Project Number: **110-6170**	Sheet No.	**1** of **1**
Location: **MCB Camp Lejeune, NC**	Inspector: **CFC** Excavator: **FDI**	Date: **6/2/2015**	
Depth (ft.): **10.0**	Elevation (ft.): **31.0** Client: **HBA-H&A JV**	Equipment: **JD 310 Backhoe**	

Elevation ft.	Elevation m	Depth ft.	Depth m	Lithology	Material Description	Ground Water	Comments
30	9	1			**FILL** Sampled as silty sand, tan, fine, with trace to some concrete, CMU and brick rubble up to 14 inch diameter, trace metal wire Iron pipe 1 foot below ground surface		6 inch diameter intact iron pipe oriented diagonal to site noted in corner of excavation
		2			**FILL** Sampled as silty sand, dark brown, tan and light gray, fine, with trace clay, asphalt and brick fragments		
		3	1				
		4					
	8	5			**Silty SAND (SM)** Brown, tan and light gray, fine, trace clay (Possible Fill)		Inconclusive but suspected uncontrolled fill based on soil characteristics
25		6	2				
		7					
	7	8			**Clayey-Silty SAND (SC-SM)** Mottled light gray-orange, fine		
		9					
		10	3		Excavation terminated at 10 feet.		No water observed during excavation
20	6	11					

TEST PIT RECORD 6170TESTPITS.GPJ CPT.GDT 6/10/15

TEST PIT RECORD

GeoEnvironmental Resources, Inc. Environmental, Groundwater, Hazardous Materials, Geotechnical & Industrial Engineering Consultants			Test Pit No. **TP-4**
Project: **P-1346 Simulator & Range Control Center**	GER Project Number: **110-6170**		Sheet No. **1** of **1**
Location: **MCB Camp Lejeune, NC**	Inspector: **CFC** Excavator: **FDI**		Date: **6/2/2015**
Depth (ft.): **6.5**	Elevation (ft.): **29.0**	Client: **HBA-H&A JV**	Equipment: **JD 310 Backhoe**

Elevation ft.	Elevation m	Depth ft.	Depth m	Lithology	Material Description	Ground Water	Comments
					FILL Sampled as silty sand, light brown, fine, with trace crushed stone, wood and metal straps		
		1			**Clayey-Silty SAND (SC-SM)** Brown to tan, fine (Possible Fill)		Inconclusive but suspected uncontrolled fill based on soil characteristics
		2					
	8	3	1				
25		4			**Slightly Silty SAND (SP-SM)** White and tan, fine		
		5			**Silty SAND (SM)** Light gray and orange, fine, little to trace clay		
	7	6					
			2		Excavation terminated at 6.5 feet.		No water observed during excavation
		7					
		8					
20		9					
	6						
		10	3				
		11					

TEST PIT RECORD 6170TESTPITS.GPJ CPT.GDT 6/10/15

TEST PIT RECORD

GeoEnvironmental Resources, Inc. Environmental, Groundwater, Hazardous Materials, Geotechnical & Industrial Engineering Consultants			Test Pit No. **TP-5**
Project: **P-1346 Simulator & Range Control Center**	GER Project Number: **110-6170**		Sheet No. **1** of **1**
Location: **MCB Camp Lejeune, NC**	Inspector: **CFC** Excavator: **FDI**		Date: **6/2/2015**
Depth (ft.): **7.0**	Elevation (ft.): **30.0**	Client: **HBA-H&A JV**	Equipment: **JD 310 Backhoe**

Elevation ft.	Elevation m	Depth ft.	Depth m	Lith-ology	Material Description	Ground Water	Comments
	9	1			**FILL** Sampled as silty sand, light and dark brown, fine, with trace concrete rubble up to 8 inch diameter, trace brick, asphalt and wood fragments		
		2			**Clayey-Silty SAND (SC-SM)** Brown, fine (Possible Fill)		Inconclusive but suspected uncontrolled fill based on soil characteristics
		3	1		**Slightly Silty SAND (SP-SM)** White and tan, fine		
	8	4			**Silty SAND (SM)** Tan, fine, trace clay		
25		5			**Clayey SAND (SC)** Mottled tan-brown-light gray, fine		
		6	2				
	7	7			Excavation terminated at 7 feet.		No water observed during excavation
		8					
		9					
20		10	3				
	6						
		11					

TEST PIT RECORD 6170TESTPITS.GPJ CPT.GDT 6/10/15

TEST PIT RECORD

GeoEnvironmental Resources, Inc. Environmental, Groundwater, Hazardous Materials, Geotechnical & Industrial Engineering Consultants			Test Pit No. **TP-6**
Project: **P-1346 Simulator & Range Control Center**	GER Project Number: **110-6170**		Sheet No. **1** of **1**
Location: **MCB Camp Lejeune, NC**	Inspector: **CFC** Excavator: **FDI**		Date: **6/2/2015**
Depth (ft.): **6.5**	Elevation (ft.): **30.0**	Client: **HBA-H&A JV**	Equipment: **JD 310 Backhoe**

Elevation ft.	Elevation m	Depth ft.	Depth m	Lith-ology	Material Description	Ground Water	Comments
	9	1			**FILL** Sampled as clayey sand, dark brown and gray, fine, with trace crushed concrete, crushed stone and organic material		
		2			**FILL** Sampled as silty and clayey sand, brown, tan, gray and white, fine, trace organic material		
		3	1				
	8	4			**Silty SAND (SM)** Mottled orange-tan-light gray, fine, trace clay		
25		5					
		6	2		Excavation terminated at 6.5 feet.		No water observed during excavation
	7	7					
		8					
		9	3				
20		10					
	6						
		11					

TEST PIT RECORD 6170TESTPITS.GPJ CPT.GDT 6/10/15

TEST PIT RECORD

GeoEnvironmental Resources, Inc. Environmental, Groundwater, Hazardous Materials, Geotechnical & Industrial Engineering Consultants			Test Pit No. **TP-7**
Project: **P-1346 Simulator & Range Control Center**	GER Project Number: **110-6170**		Sheet No. **1** of **1**
Location: **MCB Camp Lejeune, NC**	Inspector: **CFC** Excavator: **FDI**		Date: **6/2/2015**
Depth (ft.): **5.0**	Elevation (ft.): **30.0**	Client: **HBA-H&A JV**	Equipment: **JD 310 Backhoe**

Elevation ft.	Elevation m	Depth ft.	Depth m	Lith-ology	Material Description	Ground Water	Comments
					Topsoil-like material		
	9				**FILL** Sampled as slightly silty sand, tan and white, fine, trace metal wire		
		1			**Clayey SAND (SC)** Brown and light gray, fine (Possible Fill)		Inconclusive but suspected uncontrolled fill based on soil characteristics
		2					
		3	1		**Silty SAND (SM)** Tan and light gray, fine, trace clay		
	8	4					
25		5			Excavation terminated at 5 feet.		No water observed during excavation
		6	2				
	7	7					
		8					
		9					
20		10	3				
	6						
		11					

TEST PIT RECORD 6170TESTPITS.GPJ CPT.GDT 6/10/15

TEST PIT RECORD

GeoEnvironmental Resources, Inc.	Environmental, Groundwater, Hazardous Materials, Geotechnical & Industrial Engineering Consultants	Test Pit No.	**TP-8**
Project: **P-1346 Simulator & Range Control Center**	GER Project Number: **110-6170**	Sheet No.	**1** of **1**
Location: **MCB Camp Lejeune, NC**	Inspector: **CFC** Excavator: **FDI**	Date: **6/2/2015**	
Depth (ft.): **4.5**	Elevation (ft.): **29.0**	Client: **HBA-H&A JV**	Equipment: **JD 310 Backhoe**

Elevation ft.	Elevation m	Depth ft.	Depth m	Lith-ology	Material Description	Ground Water	Comments
		0			**FILL** Sampled as slightly silty sand, white, fine, with trace crushed stone and crushed concrete		
		1			**Silty SAND (SM)** Tan with white, fine, trace clay		
	8	3	1				
25		4			Excavation terminated at 4.5 feet.		No water observed during excavation
		5					
	7	6					
		7	2				
		8					
20		9					
	6						
		10	3				
		11					

TEST PIT RECORD 6170TESTPITS.GPJ CPT.GDT 6/10/15

TEST PIT RECORD

GeoEnvironmental Resources, Inc.	Environmental, Groundwater, Hazardous Materials, Geotechnical & Industrial Engineering Consultants	Test Pit No.	**TP-9**
Project: **P-1346 Simulator & Range Control Center**	GER Project Number: **110-6170**	Sheet No.	**1** of **1**
Location: **MCB Camp Lejeune, NC**	Inspector: **CFC** Excavator: **FDI**	Date: **6/2/2015**	
Depth (ft.): **4.0**	Elevation (ft.): **29.0**	Client: **HBA-H&A JV**	Equipment: **JD 310 Backhoe**

Elevation ft.	Elevation m	Depth ft.	Depth m	Lith-ology	Material Description	Ground Water	Comments
		0			**FILL** Sampled as tan silty sand mixed with crushed stone and shells		
		1			**Clayey SAND (SC)** Brown, fine		
		2			**Silty SAND (SM)** Light brown with white, fine, trace clay		
	8	3	1				
25		4			Excavation terminated at 4 feet.		No water observed during excavation
		5					
	7	6	2				
		7					
		8					
20		9					
	6						
		10	3				
		11					

TEST PIT RECORD 6170TESTPITS.GPJ CPT.GDT 6/10/15

ATTACHMENT 4

TEST PIT EXCAVATION PHOTOGRAPHS

Project: **P-1346 Simulator Center & Range Control Building**
Location: **MCB Camp Lejeune, NC**
GER Project #: **110-6170**
Client: **HBA-H&A JV**
Contract #: **N40085-10-D-5301**

Environmental
Groundwater
Hazardous Materials
Geotechnical
Industrial Hygiene

GER Consulting Engineers
GeoEnvironmental Resources, Inc.

Test Pit No.: **TP-1** Excavation Date: **6/2/2015**

TEST PIT EXCAVATION PHOTOGRAPHS

Project: **P-1346 Simulator Center & Range Control Building**
Location: **MCB Camp Lejeune, NC**
GER Project #: **110-6170**
Client: **HBA-H&A JV**
Contract #: **N40085-10-D-5301**

Environmental
Groundwater
Hazardous Materials
Geotechnical
Industrial Hygiene

GER Consulting Engineers
GeoEnvironmental Resources, Inc.

Test Pit No.: **TP-2** Excavation Date: **6/2/2015**

TEST PIT EXCAVATION PHOTOGRAPHS

Project: **P-1346 Simulator Center & Range Control Building**
Location: **MCB Camp Lejeune, NC**
GER Project #: **110-6170**
Client: **HBA-H&A JV**
Contract #: **N40085-10-D-5301**

Environmental
Groundwater
Hazardous Materials
Geotechnical
Industrial Hygiene

GER Consulting Engineers
GeoEnvironmental Resources, Inc.

Test Pit No.: **TP-3** Excavation Date: **6/2/2015**

TEST PIT EXCAVATION PHOTOGRAPHS

Project: **P-1346 Simulator Center & Range Control Building**
Location: **MCB Camp Lejeune, NC**
GER Project #: **110-6170**
Client: **HBA-H&A JV**
Contract #: **N40085-10-D-5301**

Environmental
Groundwater
Hazardous Materials
Geotechnical
Industrial Hygiene

GER Consulting Engineers
GeoEnvironmental Resources, Inc.

Test Pit No.: **TP-3** Excavation Date: **6/2/2015**

TEST PIT EXCAVATION PHOTOGRAPHS

Project: **P-1346 Simulator Center & Range Control Building**
Location: **MCB Camp Lejeune, NC**
GER Project #: **110-6170**
Client: **HBA-H&A JV**
Contract #: **N40085-10-D-5301**

Environmental
Groundwater
Hazardous Materials
Geotechnical
Industrial Hygiene

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Test Pit No.: **TP-4** Excavation Date: **6/2/2015**

TEST PIT EXCAVATION PHOTOGRAPHS

Project: **P-1346 Simulator Center & Range Control Building**
Location: **MCB Camp Lejeune, NC**
GER Project #: **110-6170**
Client: **HBA-H&A JV**
Contract #: **N40085-10-D-5301**

Environmental
Groundwater
Hazardous Materials
Geotechnical
Industrial Hygiene

GER Consulting Engineers
GeoEnvironmental Resources, Inc.

Test Pit No.: **TP-5** Excavation Date: **6/2/2015**

TEST PIT EXCAVATION PHOTOGRAPHS

Project: **P-1346 Simulator Center & Range Control Building**
Location: **MCB Camp Lejeune, NC**
GER Project #: **110-6170**
Client: **HBA-H&A JV**
Contract #: **N40085-10-D-5301**

Environmental
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Test Pit No.: **TP-6** Excavation Date: **6/2/2015**

TEST PIT EXCAVATION PHOTOGRAPHS

Project: **P-1346 Simulator Center & Range Control Building**
Location: **MCB Camp Lejeune, NC**
GER Project #: **110-6170**
Client: **HBA-H&A JV**
Contract #: **N40085-10-D-5301**

Environmental
Groundwater
Hazardous Materials
Geotechnical
Industrial Hygiene

GER Consulting Engineers
GeoEnvironmental Resources, Inc.

Test Pit No.: **TP-7** Excavation Date: **6/2/2015**

TEST PIT EXCAVATION PHOTOGRAPHS

Project: **P-1346 Simulator Center & Range Control Building**
Location: **MCB Camp Lejeune, NC**
GER Project #: **110-6170**
Client: **HBA-H&A JV**
Contract #: **N40085-10-D-5301**

Environmental
Groundwater
Hazardous Materials
Geotechnical
Industrial Hygiene

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GeoEnvironmental Resources, Inc.

Test Pit No.: **TP-8** Excavation Date: **6/2/2015**

TEST PIT EXCAVATION PHOTOGRAPHS

Project: **P-1346 Simulator Center & Range Control Building**
Location: **MCB Camp Lejeune, NC**
GER Project #: **110-6170**
Client: **HBA-H&A JV**
Contract #: **N40085-10-D-5301**

Environmental
Groundwater
Hazardous Materials
Geotechnical
Industrial Hygiene

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GeoEnvironmental Resources, Inc.

Test Pit No.: **TP-9** Excavation Date: **6/2/2015**

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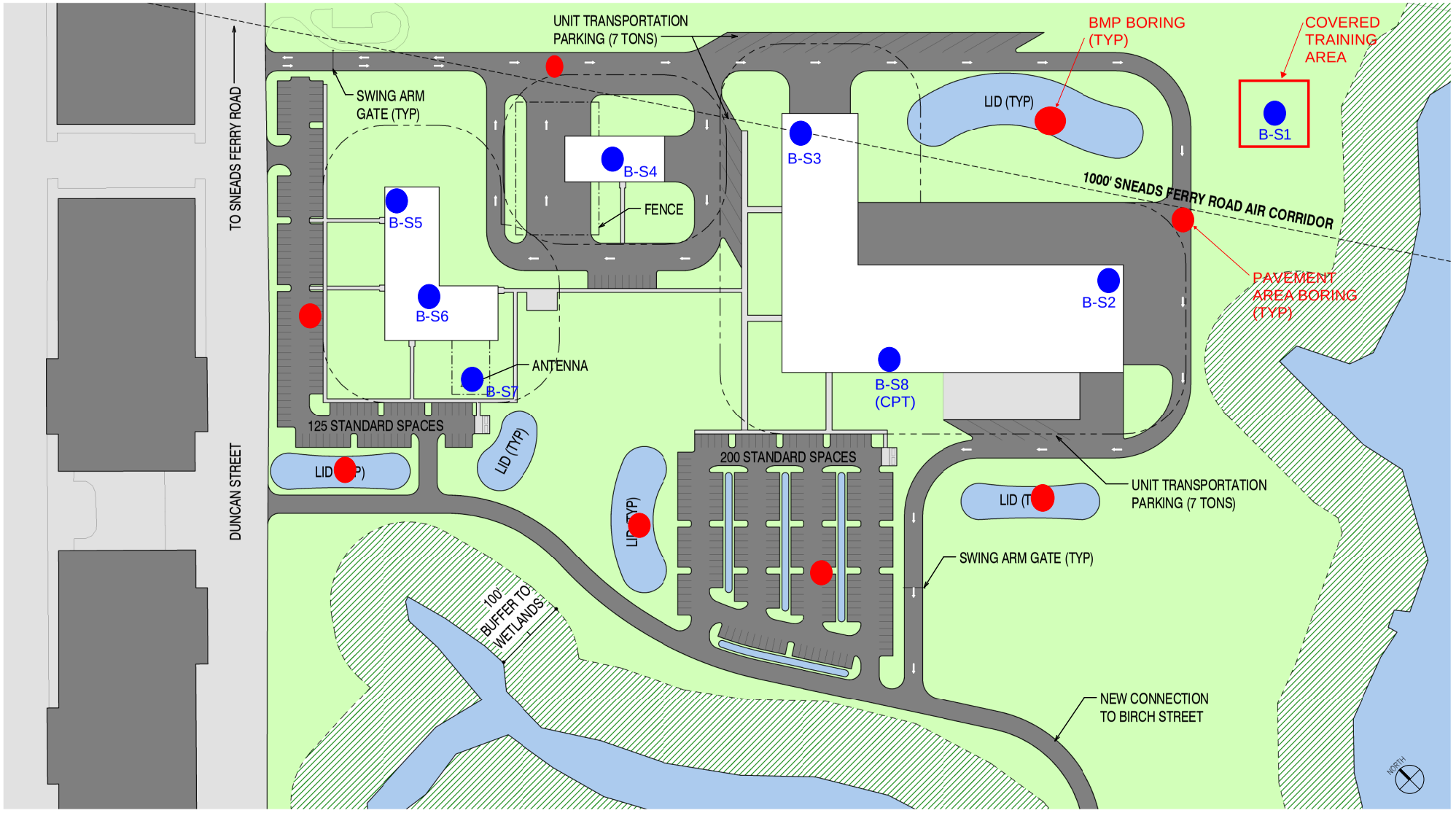

SITE PLAN

SCALE: 1" = 120'-0" 0 30' 60' 120'

P-1346 SIMULATOR CENTER & RANGE CONTROL BUILDING
MCB CAMP LEJEUNE, NORTH CAROLINA

JANUARY 10,2013

H&A HBA ARCHITECTURE INTERIOR DESIGN