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April 1, 2016

VIA PRIVATE CARRIER

Mr. James R. Carroll
Program Administrator
Land Restoration Program
Land Management Administration
Maryland Department of the Environment
1800 Washington Boulevard, Suite 625
Baltimore, Maryland 21230

Subject: Transmittal of the Bulkhead Soil-Retention Geotechnical Investigation,
Lockheed Martin Middle River Complex,
2323 Eastern Boulevard
Middle River, Maryland

Dear Mr. Carroll:

For your information, please find enclosed two hard copies with CD of the above-referenced document. This report presents the results of a geotechnical and subsurface investigation of the Dark Head Cove bulkhead at the Lockheed Martin River Complex in Baltimore County, Middle River, Maryland.

Please let me know if you have any questions. My office phone is (301) 548-2227.

Sincerely,

Lynnette Drake
Remediation Analyst, Environmental Remediation

Enclosures:

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Bulkhead Soil-Retention Geotechnical Investigation Lockheed Martin Middle River Complex 2323 Eastern Boulevard Middle River, Maryland

Prepared for:

Lockheed Martin Corporation

Prepared by:

Tetra Tech, Inc.

March 2016

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Regional Manager

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ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
ASCE	American Society of Civil Engineers
ASTM	ASTM International
bpf	blows per foot
CL	lean clay (Unified Soil Classification)
CL-ML	silty clay (Unified Soil Classification)
CME	Central Mine Equipment Co.
CU	consolidated undrained
GPS	global positioning system
Lockheed Martin	Lockheed Martin Corporation (Lockheed Martin)
MDE	Maryland Department of the Environment
MRC	Middle River Complex
N	standard penetration test N-value
NAD83	North American Datum of 1983
NAVD88	North American Vertical Datum of 1988
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PP	pocket penetrometer
SC-SM	clayey sand with silt (Unified Soil Classification)
SEI	Structural Engineering Institute
SPT	standard penetration test
Tetra Tech	Tetra Tech, Inc.
USCS	Unified Soil Classification System
USDOT	United States Department of Transportation
UU	unconsolidated undrained
WH	weight of hammer
WR	weight of rod
γ_m	moist unit-weight of soil
γ_s	saturated unit-weight of soil
c’	effective cohesion/drained cohesion
c	total cohesion/undrained cohesion
ϕ'	effective internal-friction angle of soil
ϕ	total internal-friction angle of soil

Section 1
Introduction

On behalf of Lockheed Martin Corporation (Lockheed Martin), Tetra Tech, Inc. (Tetra Tech) has prepared this data report presenting the results of a geotechnical and subsurface investigation of the Dark Head Cove bulkhead. The existing bulkheads along the Dark Head Cove adjacent to Tax Blocks D, D Panhandle, and F at the Lockheed Martin Middle River Complex (MRC) facility are in poor condition and are considered structurally deficient. A substantial portion of the steel surface has completely corroded away, creating large openings through which soil carried by runoff from upland areas is being transported to the cove. A new sheet-pile wall has been proposed to limit migration of possibly impacted soil into the cove. More data were needed before the new bulkhead design could be completed. The results of this geotechnical subsurface-exploration program provide geotechnical parameters that will be used to design the new sheet-pile wall.

This study evaluates subsurface conditions pertinent to the design and construction of the proposed bulkhead. Data from this investigation will be used to develop soil parameters for the bulkhead design. An additional study of the storm-drain system, using a closed-circuit television camera and test-pit excavations, was made coincident with this study; those results will be reported in a separate document. Specific tasks performed during this investigation include:

- exploring/evaluating soil stratigraphy along the existing bulkhead
- developing suitable bulkhead design parameters
- providing geotechnical engineering recommendations relevant to the new bulkhead and storm drain system

Figures and tables follow the text at the end of each section. This report is organized as follows:

Section 2—Site Background: Briefly describes the site and where detailed background information and reports of previous investigations can be found.

Section 3—Investigation Approach: Describes the field activities performed during this investigation.

Section 4— Results: Presents the investigation results.

Section 5—Conclusions: Summarizes the investigation findings.

Section 6—References: Cites references used to compile this report.

Section 2
Site Background

The Lockheed Martin Corporation (Lockheed Martin) Middle River Complex (MRC) at 2323 Eastern Boulevard in Middle River, Maryland is part of the Chesapeake Industrial Park, approximately 11.5 miles northeast of Baltimore. The MRC comprises approximately 161 acres and includes 12 main buildings, an active industrial area and yard, perimeter parking lots, an athletic field, a vacant concrete lot, trailer storage areas, and numerous grassy spaces along its perimeter. The MRC is bounded by Eastern Boulevard (Route 150) to the north, Martin State Airport to the east, Dark Head Cove to the south, and Cow Pen Creek to the west.

Numerous environmental investigations have been conducted at the MRC. Relevant to this geotechnical study of the bulkhead, soils and offshore sediments have been found to be impacted by a range of contaminants, most notably polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and some heavy metals. The existing bulkhead no longer effectively controls the potential migration of soils to the offshore sediments due to significant degradation of the sheet pile; measures must be taken to control this migration pathway.

The MRC was previously entered into the Maryland Department of the Environment (MDE) Voluntary Cleanup Program. Remediation of impacted media at the MRC is now being conducted under the MDE Controlled Hazardous Substances regulatory framework, under an "Administrative Consent Order and Settlement Agreement" effective December 2015, which allows both on- and off-site issues to be addressed under the same program.

2.1 CURRENT SITE CONDITIONS

Various studies of the bulkhead and storm-drain system have been conducted to meet a range of project objectives. The most pertinent information derived from these studies is summarized and referenced in this section. The project area extends southwestward along the shoreline of Dark Head Cove. The site is bounded by Wilson Point Road on the north, Dark Head Cove Road to the

northwest, and Chesapeake Park Plaza to the southwest. The ground surface of the investigation area is fairly level. In Block F, the ground surface slopes slightly to moderately down to the bulkhead, while grades are flatter in Block D.

Historical site plans and as-built drawings of the existing bulkhead appear to indicate that significant fill was placed behind the bulkheads at Blocks D and F, though it appears that the more extensive fill was in Block D (Tetra Tech, 2012). Ground elevations along the top of the existing bulkhead are approximately 4.0–5.0 feet. The typical tide range in this area is about two feet, although the range can vary significantly according to wind direction, atmospheric pressure, and other variables.

The Dark Head Cove shoreline along the MRC consists of two steel bulkhead walls and riprap with a concrete-overlay shoreline. The steel bulkhead has two sections: one adjoins the concrete seaplane ramp at the southern end of the cove in Block F, and one is in Block D at the northern end of Dark Head Cove. Both steel bulkheads are severely corroded. This corrosion resulted in a complete loss of a substantial portion of the bulkhead's steel surface, creating large openings through which soil from the upland areas is transported to Dark Head Cove (Tetra Tech, 2015). A general site plan of the project site is in Appendix A.

A concrete cap and walkway run along the top of the existing bulkhead. Depressions in soil along the upland side of the bulkheads indicate that soil has eroded and been lost through openings in the bulkhead. Depressions in the soil surface over storm drains indicate that soil might have been washed through openings in these drains, or could indicate storm drains that have collapsed. The sizes of the soil depressions vary, from a few feet to more than 10 feet long.

The existing sheet-pile bulkhead is anchored by steel rods connected to timber-pile-supported wales on the upland side of the wall. These anchors will not be used for the new bulkhead due to concerns over their condition, and due to the extent of upland disturbance that would be necessary to incorporate them into a replacement structure. A wall without anchors has the additional benefit of being faster to construct, which will facilitate completion of a new wall before completing additional dredging associated with sediment remediation.

Regulatory permits restrict any in-water construction associated with bulkhead replacement or dredging to occur only between October 15 and February 15. The current projected construction

sequencing and schedule is to address the bulkhead before dredging and to do the work during the 2016/2017 construction work-window, if all permits can be obtained in time. Therefore, construction of a cantilevered sheet-pile wall in front of the existing deteriorated bulkhead will likely be proposed as a means to prevent future migration of impacted upland soil into Dark Head Cove.

We anticipate that the height of the proposed cantilevered sheet-pile wall will (at most) be 15 feet above the proposed dredge line in the northern bulkhead area, and 19 feet above the proposed dredge line in the southern bulkhead area. The timber bulkhead for Dark Head Cove at the southern end of the MRC is also deteriorating. No plans have been made to replace or modify this wall, but borings adjacent to the timber bulkhead were also advanced during this investigation to gather information about this wall for use in the design, if needed.

2.2 GEOLOGY

According to the Maryland Geological Survey's *Geologic Map of Maryland* (1968), the project site is mapped within the Potomac Group, which consists of interbedded quartzose gravels; protoquartzitic to orthoquartzitic argillaceous[1] sands; and white, dark gray, and multicolored silts and clays. The thickness of the Potomac Group varies from 0–800 feet deep. The Potomac Group consists of three formations: the Raritan and Patapsco Formation, the Arundel Clay, and the Patuxent Formation. The Raritan and Patapsco Formations consist of gray, brown, and red variegated silts and clays; lenticular, cross-bedded, argillaceous, sub-rounded sands; and minor gravel. The thickness of the Raritan and Patapsco varies from 0–400 feet. The Arundel Clay consists of dark-gray and maroon lignitic-clays, with thickness varying from 0–100 feet. The Patuxent Formation consists of white or light-gray to orange-brown, moderately sorted, cross-bedded, argillaceous, angular sands, and sub-rounded quartz gravels with silts and clays. The thickness of the Patuxent soil varies from 0–250 feet.

[1]Composed of clay particles.

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Section 3
Investigation Approach

Tetra Tech, Inc. (Tetra Tech) developed a subsurface exploration program that included 12 land borings (TTDHCB-1 through TTDHCB-12) and seven marine borings (TTDHC-1 through TTDHC-7). These borings were used to conduct standard penetration tests (SPTs), and groundwater levels in the borings were recorded. Samples of disturbed and undisturbed soil were also collected. Field operations started on September 29, 2015 and ended on October 9, 2015. The field investigation was conducted in accordance with ASTM standards, including ASTM D 420—"Standard Guide to Site Characterization for Engineering, Design, and Construction Purposes," ASTM D 4220—"Standard Practices for Preserving and Transporting Soil Samples," the geotechnical assessment and work plan for the bulkhead (Tetra Tech, 2015), and the health and safety plan.

3.1 SOIL BORINGS

Labor, equipment, utility-clearance coordination, and permits for the drilling were provided by Uni-Tech Drilling, Inc. Two drilling rigs (models CME-55LC and CME-45C) were used to advance these borings using the mud-rotary drilling method. All land borings were advanced using a CME-55LC skid-mounted drill rig employing hollow-stem auger and mud-rotary sampling techniques. Marine borings were advanced using a CME-45C skid-mounted drill rig on a 30- by 20-foot barge. Drilling locations for these borings were surveyed and positioned using global positioning system (GPS) equipment before installation. Drilling locations were maintained by lowering spuds[2] to the cove floor to keep the barge on station.

The land and marine borings were spaced along the shoreline on both sides of the existing bulkhead. Eight of the 12 land borings were drilled to 40 feet below the ground surface, and four of the 12 were drilled to 70 feet deep. Marine borings were advanced to 50 feet below the mudline.

[2]A pointed leg or stake used to stay or support dredging or earth-boring machinery.

Except where undisturbed tube-samples were taken, two-foot disturbed (split-barrel) soil samples were taken continuously to a depth of 20 feet, and at five-foot intervals thereafter until terminus. The number of blows applied for each six-inch increment was recorded, unless one of the following occurred:

- 50 blows had been applied during any one of four six-inch increments
- 150 blows had been applied
- no observed advance of the sampler was noted after 10 successive blows of the hammer
- the sampler advanced to 24 inches (two feet) without reaching the blow-count limit

As-drilled coordinates for landside and marine borings are shown in Table 3-1. As-drilled boring locations are in Appendix B, and soil boring logs are in Appendix C. Note that the soil strata boundaries shown on the logs in Appendix C are approximate, and are intended to demark general changes in the composite layer (e.g., the predominant soil type and stiffness) and other properties, as interpreted from the samples taken within each boring.

To avoid the downhole transport of contaminated sediment in the marine borings, a steel casing was placed in the top five feet of each boring to contain cuttings and maintain mud circulation during drilling. The casing was driven through standing water into the top five feet of sediment. The length of casing used ranged between 15 and 25 feet, depending on the water depth. The first soil sample from each marine boring was collected five to seven feet below the mudline. Samples were taken continuously to a depth of 25 feet and at five-foot intervals thereafter.

Most soil samples were obtained using a two-inch outside-diameter and 1⅜-inch inside-diameter standard penetration test (SPT) split-barrel samplers driven 24 inches into the soil. SPT sampling was done in accordance with ASTM D 1586—"Standard Test Method for Penetration Test and Split-Barrel Sampling of Soil." The sampler was driven by successive blows of a 140-lb automatic trip-hammer dropped from a height of 30 inches. All disturbed samples were visually classified in the field by a Tetra Tech geotechnical engineer using the Unified Soil Classification System (USCS) for soil identification.

Representative portions of each disturbed sample were labeled and preserved in glass jars for later review and possible laboratory testing. Where cohesive soils were encountered,

three-inch-diameter thin-walled (Shelby tube) samples were attempted. Each undisturbed soil sample was retained in a stainless steel thin-walled tube (having been obtained using a piston-sampling device) and sealed with wax. The Shelby tube was pressed into the soil by a continuous thrust of hydraulic rams on the drilling rig. Samples were observed and classified by the field engineer, who recorded this information in field logs.

After drilling, each hole was completely backfilled using a bentonite-cement grout, tremied (i.e., funneled in) from the bottom of the borehole. Soil cuttings from drilling were collected and placed in United States Department of Transportation (USDOT)-approved 55-gallon drums that were later collected by the drilling contractor and deposited at a controlled location on-site for later disposal at an appropriately permitted off-site landfill approved by Lockheed Martin.

3.2 LABORATORY TESTING

The geotechnical engineer reviewed each sample on-site and selected samples for geotechnical laboratory analyses. The selected soil samples were delivered to Tetra Tech's geotechnical testing laboratory to verify the soil classification recorded in the field, and to provide specific soil parameters for use in design. Shelby-tube samples were packaged, handled, and delivered in accordance with ASTM D1587 and laboratory specifications, including shipping each tube in a vertical orientation with minimal disturbance. Geotechnical laboratory testing was performed by Ardaman & Associates, Inc. (a Tetra Tech company).

Laboratory test results are in Appendix D. Laboratory tests were performed in general accordance with applicable ASTM test procedures. ASTM test designations used for these tests include:

- visual classification (ASTM D2488)
- Atterberg limits (ASTM D4318)
- unconsolidated undrained (UU)
- consolidated undrained (CU)
- corrosivity (ASTM D2976)
- moisture content (ASTM D2216)
- sieve analysis (ASTM D422)
- triaxial compression (ASTM D2850)
- triaxial compression (ASTM D4767)
- organic content (ASTM D2974)

3.3 INVESTIGATION-DERIVED-WASTE MANAGEMENT

Soil cuttings and drilling muds from advancement of the geotechnical borings were collected in 55-gallon drums and staged on-site during the investigation. Drum contents were characterized

and disposed of in accordance with all applicable laws and regulations. Characterization and waste management documentation are in Appendix E.

Table 3-1
Soil Boring Locations

Boring No.	Location	Global coordinates (ft)		Ground elevation* (ft)
		Northing	Easting	
Land borings				
TTDHCB-1	Block D	605630.7943	1475169.5397	+4.14
TTDHCB-2	Block D	605704.9278	1475059.7013	+4.32
TTDHCB-3	Block D	605612.4834	1474865.4765	+4.98
TTDHCB-4	Block D	605516.9785	1474770.6305	+4.59
TTDHCB-5	Block D	605414.8629	1474670.9438	+5.09
TTDHCB-6	Block F	604871.2328	1473853.6657	+5.02
TTDHCB-7	Block F	604794.5472	1473729.9770	+4.68
TTDHCB-8	Block F	604680.4520	1473602.9321	+9.00
TTDHCB-9	Block F	604542.2869	1473578.7008	+7.56
TTDHCB-10	Block F	604429.0408	1473578.8936	+5.52
TTDHCB-11	Block F	604265.0466	1473441.1996	+4.76
TTDHCB-12	Block F	604266.6051	1473373.4247	+5.19
Marine borings				
TTDHC-1	Block D	605675.47	1475119.68	-3.00
TTDHC-2	Block D	605592.81	1474909.09	-7.60
TTDHC-3	Block D	605405.34	1474702.34	-4.30
TTDHC-4	Block F	604854.13	1473871.31	-6.20
TTDHC-5	Block F	604666.67	1473652.01	-6.10
TTDHC-6	Block F	604446.27	1473611.30	-12.30
TTDHC-7	Block F	604244.30	1473385.82	-5.30

Notes: Horizontal datum in NAD83; vertical datum in NAVD88
*Ground elevation of marine borings = mudline elevation

Section 4
Results

4.1 STRATIGRAPHY

Subsurface soil conditions at the site generally correspond to the soil composition of Potomac Group soil in the Atlantic Coastal Plain, which consists of unconsolidated sediment including gravel, sand, silt, and clay. A summary of site soil characteristics and stratigraphy in the investigation area is presented below.

Soil strata at this site tend to be comprised of interlayered deposits with highly variable materials. We have tried to characterize these by strata based on composite properties. Note that the soil classification is often borderline with fines content near 50% and liquid limits near 50%. Variations of less than five percent in fines content or liquid limits are within the normal accuracy range in laboratory tests, and can radically change the initial Unified Soil Classification System (USCS) soil classification recorded in the field.

Natural soils are generally similar despite widely varying classifications. This makes the soil classification less important to the evaluation, because most site soils consist of sandy clays with medium plasticity. Therefore, for the purposes of this report, the strata have been subdivided into "probable fill," "upper fluvial deposits," "lower fluvial deposits," and "deep fluvial deposits," as described below.

Stratum A—probable fill—Stratum A is comprised of apparently human-placed fill materials. Stratum A consists of light brown to reddish-brown silt and clay with varying amounts of fine sand and gravel in the northern portion of the site, and brownish-red to reddish-brown silty-clayey sand in the southern part of the site. Stratum A extends to a depth of approximately 10 to 20 feet below grade. Soil materials generally have medium stiffness, with standard penetration test (SPT) N-values ranging from weight-of-hammer to 14 blows per foot (bpf), except at the depth of 10–14 feet below grade in boring TTDHCB-5. Soil materials in this boring were cemented and

ironized (i.e., contained precipitated iron), with SPT N-values ranging from 20 to 26 bpf. Organic soil was typically observed at shallower depths (less than 10 feet below grade) within this stratum. Soil with organic materials is generally dark gray. This stratum is uncontrolled fill, and was possibly placed during or after construction of the existing bulkhead.

Stratum B—upper fluvial deposits—Stratum B soil underlies Stratum A soil. Stratum B is similar to Stratum A, but appears to be of natural origin, as indicated by the interstratified nature typical of the Potomac Group deposits. Stratum B is composed of interlayered silty clay with varying amounts of fine sand and silt. The thickness of Stratum B, where encountered, ranged from five to 11 feet. This stratum is generally stiff to very stiff (SPT N-values of 7–27 bpf), except in the southern part of the site near borings TTDHCB-3 and TTDHCB-4, where the soil is generally soft to medium-stiff (SPT N-values 1–9 bpf).

Stratum C—lower fluvial deposits—Stratum C is predominantly interstratified fine silty and clayey sand, with infrequent clay and silt layers. The interlayers are thin, ranging from a few inches to two feet. Stratum C is approximately 20–25 feet thick. For concise logging, composite soil is classified as medium clayey sand, but contains interlayers and lenses of varying gradation and classification, including sand, silt, and clay. SPT N-values in Stratum C generally range from 10–30 bpf.

Stratum D—deep fluvial deposits—Stratum D is similar to Stratum C, except that, in general, Stratum D is more consistently very stiff and dense (SPT N-values 17–32). These deeper interstratified deposits have 30–60% fines, and a liquid limit of approximately 30–52%. Stratum D generally extended to the maximum depth explored in Borings TTDHC-5, TTDHC-6, and TTDHC-7, indicating its thickness exceeds 20–32 feet.

Stratum E—deep over-consolidated fluvial deposits—The composition of Stratum E is similar to Stratum D, except it is significantly more stiff, and Stratum E is generally harder and more dense (SPT N-values greater than 32). The deeper interstratified deposits in Stratum E are over-consolidated, with 30–60% fines and a liquid limit of 30–52%. In general, Stratum E extended to the maximum depth explored, indicating its thickness exceeds 20–32 feet.

4.2 SEISMIC CLASSIFICATION

The liquefaction potential for site soil was estimated using the results of the field and laboratory tests conducted for this project, a review of the available geologic mapping, and the site class definitions shown on Figure 4-1 (which is Table 20.3-1 from *Minimum Design Loads for Buildings and Other Structures* [ASCE/SEI 7-10, 2011]). Site soil was assessed as "not liquefiable" due to its significant cohesion. Accordingly, the project site can be classified as Site Class D, "stiff soil," because, except for the upper 10–15 feet (where mean blow-counts generally exceed 15), no soft-clay lenses greater than 10 feet thick were identified.

We recommend that the bulkhead be designed in accordance with American Association of State Highway and Transportation Officials (AASHTO) specifications, which indicate a seven percent probability of exceedance in 75 years (approx. 1000-year return period) for the designed earthquake. Table 4-1 contains the relevant seismic design-factors for this project based on the AASHTO 2010 specifications.

4.3 GROUNDWATER ELEVATIONS

All soil borings were drilled using the mud rotary-drilling method. This method does not permit groundwater measurement during drilling, because the borehole is filled with drilling mud at all times. Groundwater levels were estimated based on moisture observed and by visually estimating the saturation of SPT samples collected. Therefore, groundwater levels presented herein should be considered rough approximations. Groundwater levels can be measured in surrounding monitoring wells, but confined or semiconfined conditions are common at the Middle River Complex, so equilibrated levels are typically higher than the elevation at which saturated conditions are observed in boreholes. The estimated depth to groundwater from this geophysical study is summarized in Table 4-2. Each borehole was grouted immediately after completion of drilling, as a preventive measure against vertical migration of contamination within the hole. Therefore, groundwater readings after 24 hours of drilling were not taken.

Accurately predicting subsurface-water fluctuations is difficult when based upon relatively short-term observations. Groundwater conditions are subject to change, with variations in climatic conditions and tidal influences. Depth to groundwater will be affected by changes in seasonal moisture conditions, site drainage, and other factors, particularly after periods of intense or

sustained precipitation. Groundwater, when present, is typically contained within the pore spaces of overburden soil and within pore spaces. Actual depth to groundwater may vary from the estimated levels herein.

Near the bulkhead, groundwater appears to be at roughly the same level as the water level in the cove. Small movements indicating tidal influence are not observed when estimating the groundwater level by moisture. As such, groundwater fluctuations near the bulkhead are expected to vary with the tide.

4.4 CORROSIVITY

One sample of the Stratum B soil was tested for corrosivity. Results indicate that this soil is "strongly aggressive" to "very strongly aggressive" to buried metal, on a scale that ranges from "virtually nonaggressive" to "slightly aggressive" to "moderately aggressive" to "aggressive" to "strongly aggressive" to "very strongly aggressive." This, coupled with the tidal fluctuation and splash zone effects in Dark Head Cove, indicates that steel sheet-piling must be protected from corrosion. Thickness loss of unprotected steel due to corrosion is expected to exceed 0.5 inches over a 75-year life span (Knöfel, D., 1978). Available drawings indicate that the existing sheet piling was installed between 1945 and 1971. The original half-inch-thick sheet piling, after 40–70 years, has been corroded completely through, indicating that the above estimated corrosion rate is reasonable. However, note that when the piling was actually penetrated is unknown, so the corrosion rate could be higher and should be accounted for when material specifications are made during future design.

Table 4-1

Seismic-Design Coefficients and Factors

Parameter (abbreviation)	Value of coefficient or factor	AASHTO reference
Peak ground-acceleration coefficient (*PGA)*	5%	Figure 3.10.2.1-1
0.2 second spectral-acceleration coefficient (S_s)	10%	Figure 3.10.2.1-2
1.0 second spectral-acceleration coefficient (S_1)	3%	Figure 3.10.2.1-3
Site factor (F_{pga})	1.6 for Site Class D	Table 3.10.3.2-1
Short-period site factor (F_a)	1.6 for Site Class D	Table 3.10.3.2-2
Long Period Site Factor (F_v)	2.4 for Site Class D	Table 3.10.3.2-3

Table 4-2

Estimated Depth to Groundwater in Soil Borings While Drilling

Boring No.	Estimated depth to groundwater while drilling (feet)
TTDHCB-1	6–8
TTDHCB-2	2–4
TTDHCB-3	8–10
TTDHCB-4	8–10
TTDHCB-5	6–8
TTDHCB-6	4–6
TTDHCB-7	6–8
TTDHCB-8	6–8
TTDHCB-9	±6
TTDHCB-10	6–8
TTDHCB-11	10–2
TTDHCB-12	8–10

Figure 4-1
Site-Classification Table with Standard Minimum Design-Loads for Construction

Table 20.3-1 Site Classification

Site Class	$\overline{v}_s$	$\overline{N}$ or $\overline{N}_{ch}$	$\overline{s}_u$
A. Hard rock	>5,000 ft/s	NA	NA
B. Rock	2,500 to 5,000 ft/s	NA	NA
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the following characteristics: —Plasticity index $PI > 20$, —Moisture content $w \geq 40\%$, —Undrained shear strength $\overline{s}_u < 500$ psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

Source: ASCE Standard Minimum Design-Loads for Building and Other Structures (ASTM, 2011)

Section 5
Conclusions

5.1 SUBSURFACE CONDITIONS

Subsurface soil conditions at the site generally correspond to the soil composition of Potomac Group soil in the Atlantic Coastal Plain, consisting of unconsolidated sediment, including gravel, sand, silt, and clay. Profiles of these conditions are in Appendix F. Based on the subsurface conditions at this site, and the location and height of the proposed new bulkhead and walls, we recommend that the design be based on a critical soil-profile. The recommended soil properties for each stratum are summarized on Figures 5-1 and 5-2.

5.2 LIMITATIONS

Subsurface conditions found during this study and at the Middle River Complex vary. Statements about site-wide subsurface variations in this report are estimations only, and are based on the data obtained at specific boring locations, as presented in this report. Tetra Tech strives to perform our services in a manner consistent with the level of care and skill ordinarily exercised by local (i.e., near the site) professionals currently practicing under similar conditions. No other representation, expressed or implied, nor warranty or guarantee is included or intended in this report, nor in any addendum, opinion, document, or other instrument of service.

The results, conclusions, and recommendations in this report are within the scope of work contained in the agreement executed by Tetra Tech and its client. This report is not intended for any other purpose. Tetra Tech makes no claim or representation concerning any activity or condition falling outside the specified purposes of this report as defined by the scope of work. Inquiries regarding our scope of work, or concerning any activity or condition not specifically contained therein, should be directed to Tetra Tech for evaluation and, if necessary, further investigation.

Figure 5-1
Recommended Soil Properties for Bulkhead Construction in Block D
(Cross-Section by Stratum)

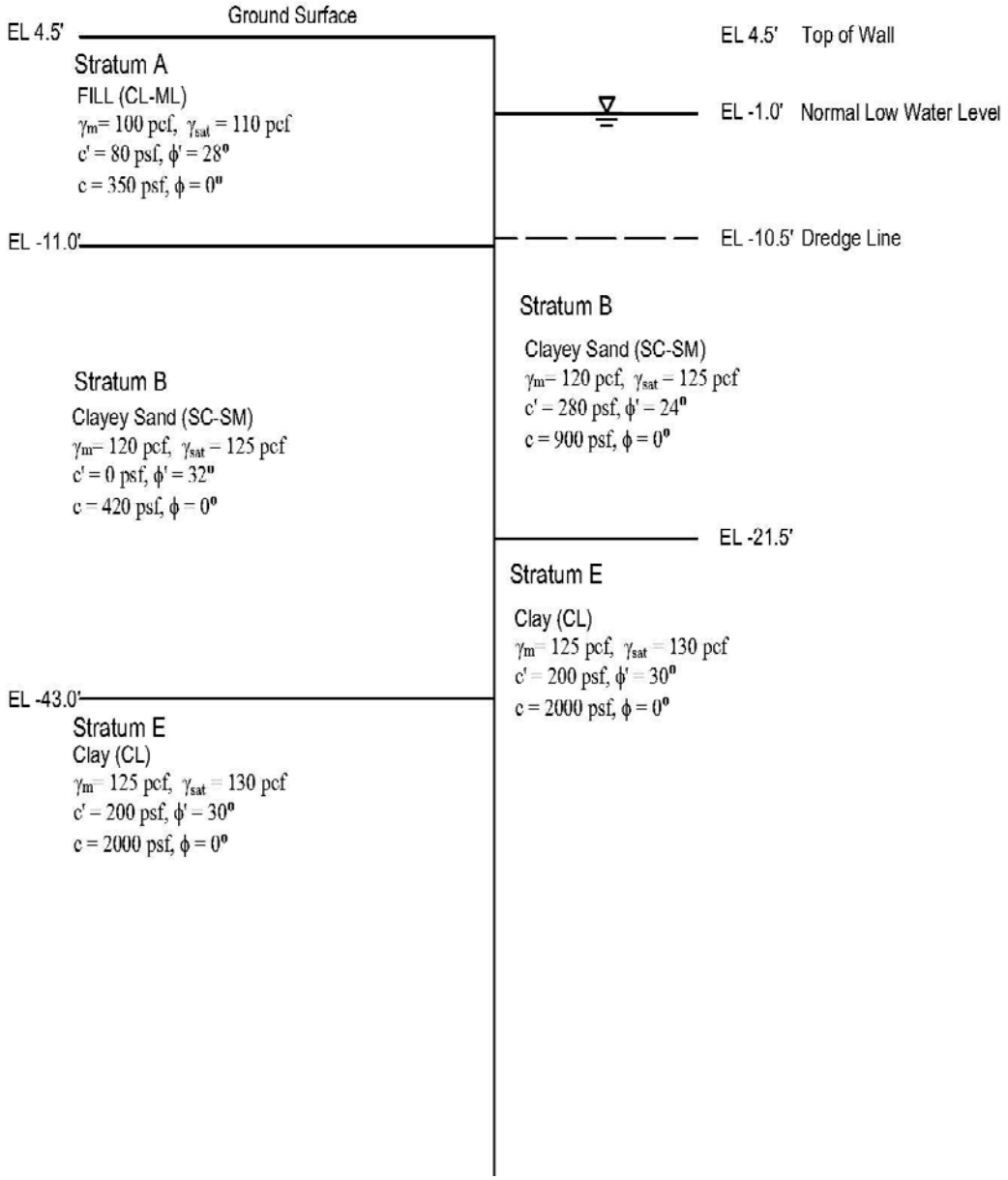
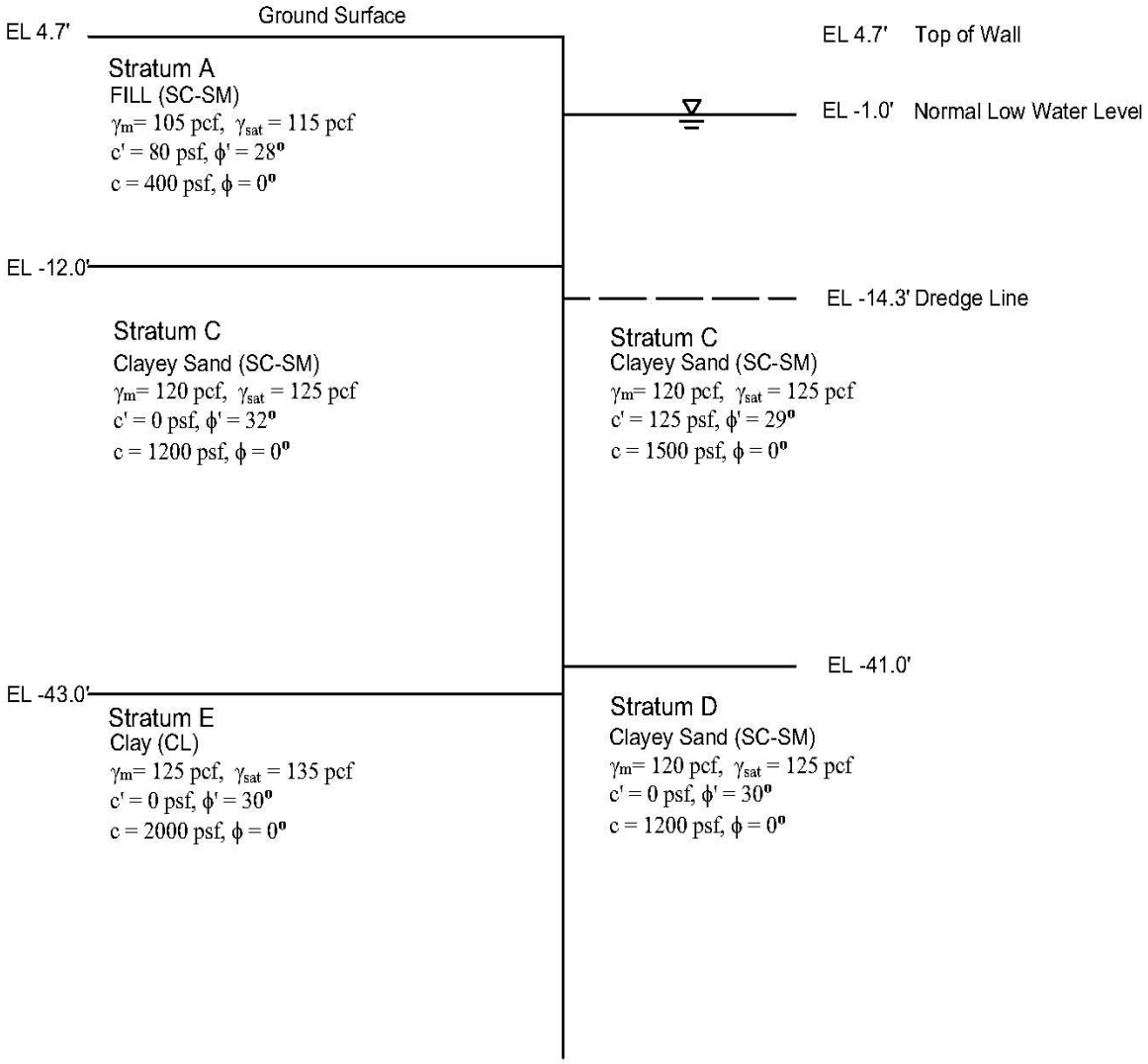


Figure 5-2
Recommended Soil Properties for Bulkhead Construction in Block F
(Cross-Section by Stratum)



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Section 6
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APPENDIX A—SITE PLAN

LEGEND:

- BOREHOLE LOCATION
- TAX BLOCK
- BULKHEAD
- SD — SD — STORMWATER PIPE
- REINFORCED CONCRETE BULKHEAD ON SHEET PILING
- STONE RIPRAP AND CONCRETE W/ OVERGROWN VEGETATION
- RIPRAP W/ CONCRETE OVERLAY

DATA SOURCES

- RECONNAISSANCE REPORT FOR BULKHEAD/SHORELINE EVALUATION, BLOCKS D AND F, DATED NOVEMBER 2012 AND OCTOBER 2015, WERE USED AS REFERENCE.

THE FOLLOWING SURVEYS ARE USED AS SUPPLEMENTAL BACKGROUND INFORMATION:

- COW PEN CREEK SURVEY: COMPILED BY PHOTOGRAMMETRIC METHODS FROM AERIAL PHOTOGRAPHY, EXPOSED 04/03/12, ISSUED OCTOBER 2012 BY LAND & MAPPING SERVICES (300 NORTH SECOND STREET CLEARFIELD, PA 16830). MAPPING FIELD CONTROL BY TETRA TECH, JUNE 2012. FIELD EDIT BY TETRA TECH, NOVEMBER 2012. REFER TO THE FINAL PLAN OF "SURVEYING AND MAPPING OF COW PEN CREEK" DRAWING DATED 12-10-12 FOR MORE INFORMATION.
- UTILITY CROSS-CONNECTION SURVEY, FALL 2011/ WINTER 2012 (INCLUDING MAPPING OF HISTORICAL UTILITIES).

NOTES:

- BOUNDARY INFORMATION: BOUNDARY INFORMATION IS NOT SHOWN ON THIS PLAN. THE LATEST KNOWN BOUNDARY CERTIFICATION IS RECORDED PLAT E.H.K., JR. 51 FOLIO 43 "1ST AMENDED CHESAPEAKE PARK RE-SUBDIVISION" PREPARED BY MARYLAND SURVEYING AND ENGINEERING CO., INC. 4/24/84.
- THE PROJECT AREA IS LOCATED ON 2400100435F FLOOD INSURANCE RATE MAP THAT INDICATES THE 9 FOOT ELEVATION CONTOUR, BASED ON NAVD 88, AS THE 100 YEAR FLOOD LINE. MAP EFFECTIVE DATE 09/26/08.
- ALL BORING LOCATIONS SHOWN ON THIS PLAN ARE CONSIDERED APPROXIMATE.

HORIZ. DATUM: MARYLAND STATE PLANE FEET NAD83 (2007)
VERT. DATUM: NAVD88 FEET

N

0 100 200 Feet

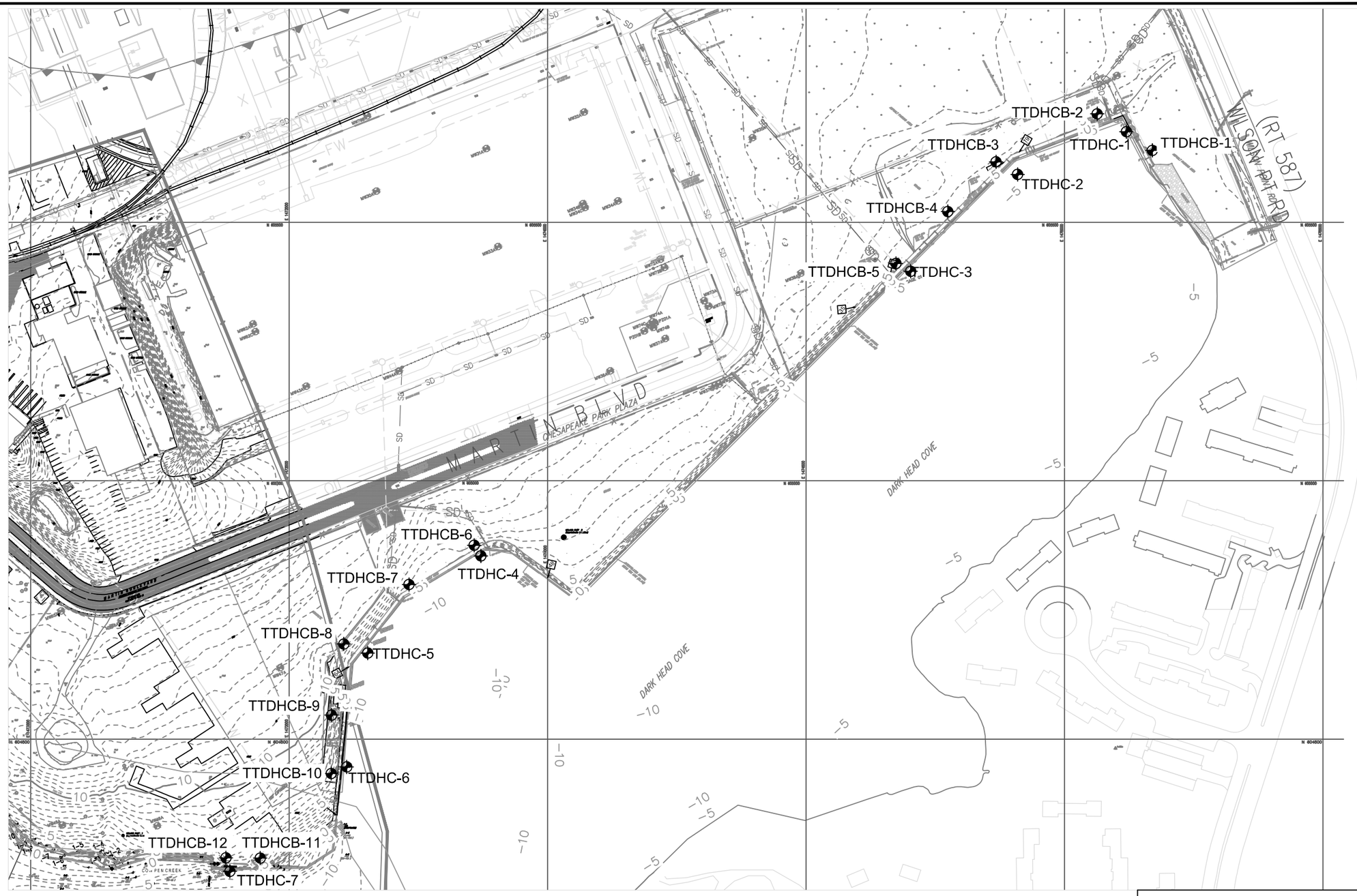
Lockheed Martin
MRC Dark Head Cove Bulkhead Soil Retention

SITE PLAN

TETRA TECH

DESIGNED	PREPARED K.T.	CHECKED	APPROVED	DATE 12-11-2015
SCALE: AS NOTED	CAD FILE: BH LOCATION PLAN WITH AERIAL-REV C.DWG		SH. 1 OF 1	REV B

APPENDIX B—BOREHOLE LOCATION PLAN



Lockheed Martin
MRC Dark Head Cove Bulkhead Soil Retention

BOREHOLE LOCATION PLAN

TETRA TECH

DESIGNED	PREPARED	CHECKED	APPROVED	DATE
	K.T.			12-14-2015

SCALE:	CAD FILE:	SH.	OF	REV
AS NOTED	BH LOCATION PLAN.DWG	1	1	B

APPENDIX C—SOIL BORING LOGS

TETRA TECH

Hole No. TTDHC-1

DRILLING LOG	CLIENT	PROJECT NUMBER	SHEET / OF
	Lockheed Martin Corporation	194-8711	1 OF 3 SHEETS

1. PROJECT	Lockheed Martin MRC
2. LOCATION (Coordinates or Station)	Middle River, MD N 605,675.4700 E 1,475,119.6800
3. DRILLING AGENCY	UniTech
4. HOLE NO. *(As shown on drawing title and file number)*	TTDHC-1
5. NAME OF DRILLER	C. Lopez
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED --- DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	
8. DEPTH DRILLED INTO ROCK	
9. TOTAL DEPTH OF HOLE	50.0
10. DRILLING METHOD	Mud Rotary
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*	MSL
12. MANUFACTURER'S DESIGNATION OF DRILL	
13. TOTAL NO. OF SOIL SAMPLES TAKEN	DISTURBED 18 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	
15. ELEVATION GROUND WATER	
16. DATE HOLE	STARTED 10/8/2015 / COMPLETED 10/9/2015
17. ELEVATION TOP OF HOLE	-6.7
18. TOTAL CORE RECOVERY FOR BORING	%
19. GEOLOGIST	R. Lama Tamang

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
-6.7	0.0		UNSAMPLED			
-11.7	5.0		SILTY SAND (SM) with trace of organics, N=WR & WH, very soft, brownish gray to dark gray	46	SS-1 5.0 7.0	BLOWCOUNT WR-WR-WR-WR N = WR, PP = 0.0 tsf (SM) with organics
-15.2	8.5		Poorly-graded SAND with SILT (SP-SM), 10<N<57, dense to very dense, yellowish brown to light whiteish gray	67	SS-2a SS-2b 7.0 9.0	BLOWCOUNT WH-WH-WH-5 N = WH (SM)
				79	SS-3 9.0 11.0	BLOWCOUNT 21-24-33-43 N = 57 (SP-SM)
				79	SS-4 11.0 13.0	BLOWCOUNT 18-18-15-18 N = 33 (SP-SM)
				67	SS-5a SS-5b 13.0 15.0	BLOWCOUNT 5-5-5-9 N = 10 (SM) (CH)
-22.7	16.0		Interstratified with CLAY (CL) and SILTY CLAY (CL-ML), trace of sand, 41<N<65, hard, yellowish brown to reddish brown	83	SS-6a SS-6b 15.0 17.0	BLOWCOUNT 5-9-15-21 N = 24 Top 12" (SP-SM) Bottom 12" (CL-ML) with sand
				88	SS-7 17.0 19.0	BLOWCOUNT 9-18-23-25 N = 41, PP > 4.0 tsf (CL-ML) with sand
				92	SS-8 19.0 21.0	BLOWCOUNT 14-27-38-54/5" N = 65 (CL)

TETRA TECH

DRILLING LOG (Cont Sheet) | ELEVATION TOP OF HOLE -6.7 | **Hole No. TTDHC-1**

PROJECT: Lockheed Martin MRC | INSTALLATION: | SHEET 2 OF 3 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			Interstratified with CLAY (CL) and SILTY CLAY (CL-ML), trace of sand, 41<N<65, hard, yellowish brown to reddish brown *(continued)*			
				100	SS-9 21.0 23.0	BLOWCOUNT 5-13-28-32 N = 41 (CL-ML) with sand
-29.7	23.0					
			CLAYEY SAND (SC), 33<N<49, dense, varying colors in brown, yellowish brown and whitish gray	100	SS-10 23.0 25.0	BLOWCOUNT 10-16-17-19 N = 33, PP > 4.5 tsf (SC-SM)
						25
				100	SS-11 28.0 30.0	BLOWCOUNT 11-20-29-38 N = 49, PP > 4.5 tsf (SC)
						30
				100	SS-12 33.0 35.0	BLOWCOUNT 4-19-22-24 N = 41, PP > 4.5 tsf (SC)
						35
				100	SS-13 38.0 40.0	BLOWCOUNT 11-14-21-25 N = 35, PP > 4.5 tsf Top 10" (SC) Bottom 14" (CL) with sand
-45.7	39.0					
			CLAY (CL), trace of sand, 29<N<35, very stiff to hard, reddish brown			
						40
				100	SS-14 43.0 45.0	BLOWCOUNT 17-11-18-24 N = 29 (CL) with sand

TETRA TECH

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE: -6.7

Hole No. TTDHC-1

PROJECT: Lockheed Martin MRC

INSTALLATION:

SHEET 3 OF 3 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			CLAY (CL), trace of sand, 29<N<35, very stiff to hard, reddish brown *(continued)*			
				100	SS-15 48.0 50.0	BLOWCOUNT 13-15-20-36 N = 35, PP > 4.5 tsf (CL) with sand
-56.7	50.0		END OF BORING			

45 50 55 60 65

TETRA TECH

Hole No. TTDHC-2

DRILLING LOG	CLIENT	PROJECT NUMBER	SHEET / OF
	Lockheed Martin Corporation	194-8711	1 OF 3 SHEETS

1. PROJECT	Lockheed Martin MRC
2. LOCATION (Coordinates or Station)	Middle River, MD N 605,592.8100 E 1,474,909.0900
3. DRILLING AGENCY	UniTech
4. HOLE NO. *(As shown on drawing title and file number)*	TTDHC-2
5. NAME OF DRILLER	C. Lopez
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED --- DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	
8. DEPTH DRILLED INTO ROCK	
9. TOTAL DEPTH OF HOLE	50.0
10. DRILLING METHOD	Mud Rotary
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*	MSL
12. MANUFACTURER'S DESIGNATION OF DRILL	
13. TOTAL NO. OF SOIL SAMPLES TAKEN	DISTURBED 17 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES	
15. ELEVATION GROUND WATER	
16. DATE HOLE	STARTED 9/29/2015 / COMPLETED 9/29/2015
17. ELEVATION TOP OF HOLE	-3.5
18. TOTAL CORE RECOVERY FOR BORING	%
19. GEOLOGIST	R. Lama Tamang

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
-3.5	0.0		UNSAMPLED			
-8.5	5.0		SILTY CLAY (CL-ML) with sands, trace of organics, N = WR, very soft, gray to dark gray	4	SS-1 5.0 7.0	BLOWCOUNT WR-WR-WR-WR N = WR (CL-ML) with sand
				58	SS-2 7.0 9.0	BLOWCOUNT WR-WR-WR-1 N = WR (CL-ML) with sand
-12.5	9.0		CLAYEY SAND (SC/SC-SM) with thin layers of silty clay and little amont of silt, 10<N<20, N=4 @ 21' to 23', medium dense, light yellowish brown, reddish brown and whitish gray	71	SS-3 9.0 11.0	BLOWCOUNT 4-5-5-9 N = 10 (SC-SM)
				75	SS-4 11.0 13.0	BLOWCOUNT 4-6-6-8 N = 12 (SC-SM)
				50	SS-5 13.0 15.0	BLOWCOUNT 7-9-11-12 N = 20 (SC)
				83	SS-6a SS-6b 15.0 17.0	BLOWCOUNT 5-6-8-15 N = 14 (SC)
				63	SS-7 17.0 19.0	BLOWCOUNT 3-6-6-8 N = 12 (SC-SM)
				46	SS-8 19.0 21.0	BLOWCOUNT 4-4-5-4 N = 9 (SC-SM)

TETRA TECH

DRILLING LOG (Cont Sheet) | ELEVATION TOP OF HOLE -3.5 | **Hole No. TTDHC-2**

PROJECT Lockheed Martin MRC | INSTALLATION | SHEET 2 OF 3 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			CLAYEY SAND (SC/SC-SM) with thin layers of silty clay and little amont of silt, 10<N<20, N=4 @ 21' to 23', medium dense, light yellowish brown, reddish brown and whitish gray *(continued)*			
				58	SS-9 21.0 23.0	BLOWCOUNT 2-2-2-5 N = 4 (SC-SM)
				67	SS-10 23.0 25.0	BLOWCOUNT 3-4-8-10 N = 12 (SC-SM)
-31.5	28.0					
			CLAYEY SAND (SC) with little amuonts of silt, 31<N<48, dense, light reddish brown to brown	100	SS-11 28.0 30.0	BLOWCOUNT 9-15-20-30 N = 35 (SC)
				100	SS-12a SS-12b 33.0 35.0	BLOWCOUNT 10-11-28-41 N = 39 Top 12" (SP-SM) Bottom 12" (SC)
				100	SS-13 38.0 40.0	BLOWCOUNT 10-13-18-26 N = 31 (SC)
				96	SS-14 43.0 45.0	BLOWCOUNT 22-21-27-31 N = 48 (SC)

TETRA TECH

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE: -3.5

Hole No. TTDHC-2

PROJECT: Lockheed Martin MRC

INSTALLATION:

SHEET 3 OF 3 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			CLAYEY SAND (SC) with little amuonts of silt, 31<N<48, dense, light reddish brown to brown *(continued)*			
				100	SS-15 48.0 50.0	BLOWCOUNT 11-18-15-18 N = 33 (SC)
-53.5	50.0		END OF BORING			

TETRA TECH

Hole No. TTDHC-3

DRILLING LOG	CLIENT	PROJECT NUMBER	SHEET / OF
	Lockheed Martin Corporation	194-8711	1 OF 3 SHEETS

1. PROJECT	Lockheed Martin MRC
2. LOCATION (Coordinates or Station)	Middle River, MD N 605,405.3400 E 1,474,702.3400
3. DRILLING AGENCY	UniTech
4. HOLE NO. *(As shown on drawing title and file number)*	TTDHC-3
5. NAME OF DRILLER	C. Lopez
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED --- DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	
8. DEPTH DRILLED INTO ROCK	
9. TOTAL DEPTH OF HOLE	50.0
10. DRILLING METHOD	Mud Rotary
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*	MSL
12. MANUFACTURER'S DESIGNATION OF DRILL	
13. TOTAL NO. OF SOIL SAMPLES TAKEN	DISTURBED 15 / UNDISTURBED 1
14. TOTAL NUMBER CORE BOXES	
15. ELEVATION GROUND WATER	
16. DATE HOLE	STARTED 9/30/2015 / COMPLETED 10/1/2015
17. ELEVATION TOP OF HOLE	-7.1
18. TOTAL CORE RECOVERY FOR BORING	%
19. GEOLOGIST	R. Lama Tamang

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
-7.1	0.0		UNSAMPLED			
-12.1	5.0		CLAY (CL), WH<N<14, very soft to stiff, gray	0	SS-1 5.0 7.0	BLOWCOUNT WH-WH-WH-WH N = WH (CL)
				63	SS-2 7.0 9.0	BLOWCOUNT 3-4-5-6 N = 9 (CL)
				83	ST-1 9.0 10.5	Shelby tube (CL)
				58	SS-3 10.5 12.5	BLOWCOUNT 4-5-9-10 N = 14 (CL)
-19.6	12.5		SILTY SAND (SC-SM) with some amounts of silt and clay, 15<N<23, medium dense, brown, reddish brown, and whitish gray	58	SS-4 12.5 14.5	BLOWCOUNT 6-6-9-14 N = 15 (SC-SM)
				63	SS-5 14.5 16.5	BLOWCOUNT 26-11-12-11 N = 23 (SC-SM)
				92	SS-6 16.5 18.5	BLOWCOUNT 6-8-11-15 N = 19 (SC-SM)
				67	SS-7 18.5 20.5	BLOWCOUNT 6-7-10-10 N = 17 (SC-SM)

TETRA TECH

DRILLING LOG (Cont Sheet) | ELEVATION TOP OF HOLE -7.1 | **Hole No. TTDHC-3**

PROJECT: Lockheed Martin MRC | INSTALLATION | SHEET 2 OF 3 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			SILTY SAND (SC-SM) with some amounts of silt and clay, 15<N<23, medium dense, brown, reddish brown, and whitish gray *(continued)*			
				92	SS-8 20.5 22.5	BLOWCOUNT 5-8-15-18 N = 23 (SC-SM)
-29.6	22.5					
			SILT SAND (SC-SM) with some amounts of silt, 42<N<52, N=24 @ 29.5' to 31.5', medium dense to very dense, varying colors in brown to reddish brown	96	SS-9 22.5 24.5	BLOWCOUNT 9-16-26-32 N = 42 (SC-SM)
				96	SS-10 24.5 26.5	BLOWCOUNT 13-22-30-39 N = 52 (SC-SM)
				100	SS-11 29.5 31.5	BLOWCOUNT 14-20-32-36 N = 24 Top 21" (SC-SM) Bottom 3" (SM)
-38.1	31.0					
			SILTY SAND (SM) with trace of clay, 28<N<37, medium dense to dense, light reddish brown to reddish brown			
				100	SS-12 34.5 36.5	BLOWCOUNT 11-15-22-36 N = 37 (SM)
				100	SS-13 39.5 41.5	BLOWCOUNT 14-15-15-19 N = 30 (SM) with trace of clay

TETRA TECH

DRILLING LOG (Cont Sheet) | ELEVATION TOP OF HOLE -7.1 | **Hole No. TTDHC-3**

PROJECT: Lockheed Martin MRC | INSTALLATION: | SHEET 3 OF 3 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			SILTY SAND (SM) with trace of clay, 28<N<37, medium dense to dense, light reddish brown to reddish brown *(continued)*			
				100	SS-14 44.5 46.5	BLOWCOUNT 10-12-16-19 N = 28 (SM)
				100	SS-15 48.0 50.0	BLOWCOUNT 8-12-18-26 N = 30 (SM)
-57.1	50.0		END OF BORING			

45 50 55 60 65

TETRA TECH

Hole No. TTDHC-4

DRILLING LOG	CLIENT: Lockheed Martin Corporation	PROJECT NUMBER: 194-8711	SHEET 1 OF 3 SHEETS

1. PROJECT: Lockheed Martin MRC
2. LOCATION (Coordinates or Station): Middle River, MD N 604,854.1300 E 1,473,871.3100
3. DRILLING AGENCY: UniTech
4. HOLE NO. *(As shown on drawing title and file number)*: TTDHC-4
5. NAME OF DRILLER: C. Lopez
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ---- DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN:
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE: 50.0
10. DRILLING METHOD: Mud Rotary
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*: MSL
12. MANUFACTURER'S DESIGNATION OF DRILL:
13. TOTAL NO. OF SOIL SAMPLES TAKEN: DISTURBED 15; UNDISTURBED 1
14. TOTAL NUMBER CORE BOXES:
15. ELEVATION GROUND WATER:
16. DATE HOLE: STARTED 10/5/2015; COMPLETED 10/5/2015
17. ELEVATION TOP OF HOLE: -11.8
18. TOTAL CORE RECOVERY FOR BORING: %
19. GEOLOGIST: R. Lama Tamang

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
-11.8	0.0		UNSAMPLED			
-16.8	5.0		SANDY CLAY (CLS) with varying amounts of sand and occasional clay layers, 15<N<34, very stiff to hard, light brown and yellowish brown	67	SS-1 5.0 7.0	BLOWCOUNT 4-8-9-12 N = 17 (CLS)
				100	ST-1 7.0 8.5	Shelby tube PP = 2.5 tsf (CL)
				58	SS-2 8.5 10.5	BLOWCOUNT 4-10-13-15 N = 23, PP = 0.5-2.0 tsf (CL)
				63	SS-3 10.5 12.5	BLOWCOUNT 1-5-10-11 N = 15 (CLS)
-26.3	14.5			100	SS-4 12.5 14.5	BLOWCOUNT 8-15-19-29 N = 34, PP = 0.75-4.5 tsf Top & Bottom 7" (CLS) Middle 10" (SM)
			CLAY (CL) with trace of sand, 44<N<69, N=81/8" @ 18.5' to 20.5', hard, brown to reddish brown	100	SS-5 14.5 16.5	BLOWCOUNT 12-16-28-42 N = 44, PP = 0.75-4.5 tsf (CL)
				100	SS-6 16.5 18.5	BLOWCOUNT 13-21-48-49 N = 69, PP = 3.0-4.5 tsf (CL)
				58	SS-7 18.5 20.5	BLOWCOUNT 18-31-50/2"-x N = 81/8", PP = 2.5-4.5 tsf (CL)

TETRA TECH

DRILLING LOG (Cont Sheet) | ELEVATION TOP OF HOLE -11.8 | **Hole No. TTDHC-4**

PROJECT: Lockheed Martin MRC | INSTALLATION | SHEET 2 OF 3 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
-32.3	20.5					
			SANDY SILT (MLS), 29<N<36, very stiff to hard, brown to reddish brown	100	SS-8 20.5 22.5	BLOWCOUNT 14-15-21-38 N = 36 (MLS)
				100	SS-9 22.5 24.5	BLOWCOUNT 13-12-17-24 N = 29, PP = 1.0-3.5 tsf (MLS)
				100	SS-10 24.5 26.5	BLOWCOUNT 9-18-13-28 N = 31 (MLS)
-39.8	28.0					
			CLAYEY SAND (SC-SM) with varying amounts of silt and clay, 32<N<51, N=51/6" @ 39.5' to 41.5', N=89/10" @ 44.5' to 46.5' dense to very dense, varying colors in brown, reddish brown and dark brown	100	SS-11 29.5 31.5	BLOWCOUNT 18-16-16-15 N = 32 (SM)
				100	SS-12 34.5 36.5	BLOWCOUNT 12-14-37-31 N = 51 (SC-SM)
				50	SS-13 39.5 41.5	BLOWCOUNT 29-51/6"-x-x N = 51/6", PP > 4.5 tsf (SC)

TETRA TECH

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE: -11.8

Hole No. TTDHC-4

PROJECT: Lockheed Martin MRC

INSTALLATION:

SHEET 3 OF 3 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			CLAYEY SAND (SC-SM) with varying amounts of silt and clay, 32<N<51, N=51/6" @ 39.5' to 41.5', N=89/10" @ 44.5' to 46.5' dense to very dense, varying colors in brown, reddish brown and dark brown *(continued)*	67	SS-14 44.5 46.5	BLOWCOUNT 15-39-50/4"-x N = 89/10", PP > 4.5 tsf (SC-SM)
				100	SS-15 48.0 50.0	BLOWCOUNT 27-18-20-24 N = 38, PP > 4.5 tsf (SC-SM)
-61.8	50.0		END OF BORING			

45 50 55 60 65

TETRA TECH

Hole No. TTDHC-5

DRILLING LOG	CLIENT: Lockheed Martin Corporation	PROJECT NUMBER: 194-8711	SHEET 1 OF 3 SHEETS

1. PROJECT: Lockheed Martin MRC
2. LOCATION (Coordinates or Station): Middle River, MD N 604,666.6700 E 1,473,652.0100
3. DRILLING AGENCY: UniTech
4. HOLE NO. *(As shown on drawing title and file number)*: TTDHC-5
5. NAME OF DRILLER: C. Lopez
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ---- DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 50.0
10. DRILLING METHOD: Mud Rotary
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*: MSL
12. MANUFACTURER'S DESIGNATION OF DRILL
13. TOTAL NO. OF SOIL SAMPLES TAKEN: DISTURBED 15; UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE: STARTED 10/6/2015; COMPLETED 10/6/2015
17. ELEVATION TOP OF HOLE: -12.8
18. TOTAL CORE RECOVERY FOR BORING: %
19. GEOLOGIST: R. Lama Tamang

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
-12.8	0.0		UNSAMPLED			
-17.8	5.0		SILTY SAND (SM), CLAYEY SAND (SC) and SANDY SILT (MLS), 27<N<34, medium dense to dense, varying colors in light brown to yellowish brown	63	SS-1 5.0 7.0	BLOWCOUNT 6-16-15-16 N = 31, PP = 3.5 tsf (SM)
				100	SS-2 7.0 9.0	BLOWCOUNT 9-13-19-19 N = 32 (MLS)
				88	SS-3 9.0 11.0	BLOWCOUNT 8-12-15-18 N = 27 (SM)
-25.8	13.0			96	SS-4 11.0 13.0	BLOWCOUNT 4-14-20-26 N = 34 (SC-SM)
			SANDY SILT (MLS), 36<N<49, hard, whitish gray to light brown	100	SS-5 13.0 15.0	BLOWCOUNT 16-25-22-26 N = 47 (MLS)
				100	SS-6 15.0 17.0	BLOWCOUNT 10-17-19-22 N = 36 (MLS)
-31.8	19.0			100	SS-7 17.0 19.0	BLOWCOUNT 12-21-28-36 N = 49, PP > 4.5 tsf (CL=ML) with sand
			CLAYEY SAND (SC-SM) with varying amounts of silt, 17<N<29, N=66/11" @ 23' to 25', medium dense to very dense, reddish brown and brownish red	100	SS-8 19.0 21.0	BLOWCOUNT 3-7-22-25 N = 29, PP > 4.5 tsf (SC-SM)

TETRA TECH

DRILLING LOG (Cont Sheet) | ELEVATION TOP OF HOLE -12.8 | **Hole No. TTDHC-5**

PROJECT: Lockheed Martin MRC | INSTALLATION: | SHEET 2 OF 3 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			CLAYEY SAND (SC-SM) with varying amounts of silt, 17<N<29, N=66/11" @ 23' to 25', medium dense to very dense, reddish brown and brownish red *(continued)*			
				100	SS-9 21.0 23.0	BLOWCOUNT 5-13-16-16 N = 29, PP = 1.5 tsf (SC-SM)
				71	SS-10 23.0 25.0	BLOWCOUNT 6-15-51/5"-x N = 66/11" (SC-SM)
				100	SS-11 28.0 30.0	BLOWCOUNT 10-12-15-23 N = 27 (SC-SM)
				100	SS-12 33.0 35.0	BLOWCOUNT 7-7-10-19 N = 17, PP = 1.0-1.5 tsf (SC-SM)
				100	SS-13 38.0 40.0	BLOWCOUNT 7-9-12-21 N = 21 (SC-SM)
				100	SS-14 43.0 45.0	BLOWCOUNT 8-9-12-14 N = 21 (SM)

25 30 35 40

TETRA TECH

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE: -12.8

Hole No. TTDHC-5

PROJECT: Lockheed Martin MRC

INSTALLATION:

SHEET 3 OF 3 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			CLAYEY SAND (SC-SM) with varying amounts of silt, 17<N<29, N=66/11" @ 23' to 25', medium dense to very dense, reddish brown and brownish red *(continued)*			
				100	SS-15 48.0 50.0	BLOWCOUNT 7-8-11-17 N = 19 (SC-SM)
-62.8	50.0		END OF BORING			

45 50 55 60 65

TETRA TECH

Hole No. TTDHC-6

DRILLING LOG	CLIENT: Lockheed Martin Corporation	PROJECT NUMBER: 194-8711	SHEET 1 OF 3 SHEETS

1. PROJECT: Lockheed Martin MRC
2. LOCATION (Coordinates or Station): Middle River, MD N 604,446.2700 E 1,473,611.3000
3. DRILLING AGENCY: UniTech
4. HOLE NO. *(As shown on drawing title and file number)*: TTDHC-6
5. NAME OF DRILLER: C. Lopez
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ---- DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 50.0
10. DRILLING METHOD: Mud Rotary
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*: MSL
12. MANUFACTURER'S DESIGNATION OF DRILL
13. TOTAL NO. OF SOIL SAMPLES TAKEN: DISTURBED 14; UNDISTURBED 1
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE: STARTED 10/5/2015; COMPLETED 10/5/2015
17. ELEVATION TOP OF HOLE: -8.5
18. TOTAL CORE RECOVERY FOR BORING: %
19. GEOLOGIST: R. Lama Tamang

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
-8.5	0.0		UNSAMPLED			
-13.5	5.0		SILTY CLAY (CL-ML), 8<N<15, stiff, reddish brown and brownish red	63	SS-1 5.0 7.0	BLOWCOUNT 3-5-10-9 N = 15, PP = 2.6-3.5 tsf (CL) with organics
				83	SS-2 7.0 9.0	BLOWCOUNT 3-3-5-9 N = 8, PP = 1.2-2.0 tsf (CL-ML) with sand
				79	SS-3 9.0 11.0	BLOWCOUNT 6-6-8-11 N = 14, PP = 1.5-2.0 tsf (CL-ML)
-19.5	11.0		CLAY (CL) interbedded with varying amonts of silt, 26<N<35, N=15 @ 17' to 19' stiff to hard, brown to reddish brown	71	SS-4 11.0 13.0	BLOWCOUNT 6-11-15-17 N = 26, PP = 2.5-3.0 tsf (CL)
				96	ST-1 13.0 15.0	Shelby tube (CL)
				96	SS-5 15.0 17.0	BLOWCOUNT 9-11-24-29 N = 35, PP > 4.5 tsf (CL)
				100	SS-6 17.0 19.0	BLOWCOUNT 3-5-10-13 N = 15 Top 20" (CL) Bottom 4" (CL-ML)
				100	SS-7 19.0 21.0	BLOWCOUNT 13-16-19-20 N = 35, PP > 4.5 tsf (CL-ML)

TETRA TECH

DRILLING LOG (Cont Sheet) | ELEVATION TOP OF HOLE -8.5 | **Hole No. TTDHC-6**

PROJECT: Lockheed Martin MRC | INSTALLATION: | SHEET 2 OF 3 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			CLAY (CL) interbedded with varying amonts of silt, 26<N<35, N=15 @ 17' to 19' stiff to hard, brown to reddish brown *(continued)*			
-29.5	21.0		CLAYEY SAND (SC-SM) with varying amounts of silt, 30<N<34, medium dense to dense, light brown to whitish gray	100	SS-8 21.0 23.0	BLOWCOUNT 10-14-16-21 N = 30, PP = 4.0 tsf (SC-SM)
				100	SS-9 23.0 25.0	BLOWCOUNT 9-18-22-25 N = 30, PP = 3.0 tsf (SC-SM)
						25
				100	SS-10 28.0 30.0	BLOWCOUNT 16-16-18-20 N = 34, PP = 3.0 tsf (SC-SM)
						30
-41.0	32.5		SANDY CLAY (CLS) with varying amounts of silt, 16<N<32, very stiff to hard, varying colors in reddish brown to brown	100	SS-11 33.0 35.0	BLOWCOUNT 10-11-11-17 N = 22, PP = 0.5 tsf Top 12" (SC-SM) Bottom 12" (CLS)
						35
				100	SS-12 38.0 40.0	BLOWCOUNT 7-8-8-11 N = 16 (CLS)
						40
				100	SS-13 43.0 45.0	BLOWCOUNT 8-9-8-14 N = 17 (CLS)

TETRA TECH

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE: -8.5

Hole No. TTDHC-6

PROJECT: Lockheed Martin MRC

INSTALLATION:

SHEET 3 OF 3 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			SANDY CLAY (CLS) with varying amounts of silt, 16<N<32, very stiff to hard, varying colors in reddish brown to brown *(continued)*			
				100	SS-14 48.0 50.0	BLOWCOUNT 11-16-16-26 N = 32 (CLS)
-58.5	50.0		END OF BORING			

45 50 55 60 65

TETRA TECH

Hole No. TTDHC-7

DRILLING LOG	CLIENT: Lockheed Martin Corporation	PROJECT NUMBER: 194-8711	SHEET 1 OF 3 SHEETS

1. PROJECT: Lockheed Martin MRC
2. LOCATION (Coordinates or Station): Middle River, MD N 604,244.3000 E 1,473,385.8200
3. DRILLING AGENCY: UniTech
4. HOLE NO. *(As shown on drawing title and file number)*: TTDHC-7
5. NAME OF DRILLER: C. Lopez
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ---- DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE: 50.0
10. DRILLING METHOD: Mud Rotary
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*: MSL
12. MANUFACTURER'S DESIGNATION OF DRILL
13. TOTAL NO. OF SOIL SAMPLES TAKEN: DISTURBED 14; UNDISTURBED 2
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE: STARTED 10/8/2015; COMPLETED 10/8/2015
17. ELEVATION TOP OF HOLE: -5.8
18. TOTAL CORE RECOVERY FOR BORING: %
19. GEOLOGIST: R. Lama Tamang

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
-5.8	0.0		UNSAMPLED			
-10.8	5.0		Interstratified with CLAYEY SAND (SC-SM) with varying amonts of silt and SILTY CLAY (CL-ML) with varying amount of sand, 7<N<19, loose to medium dense, brown to reddish brown	71	SS-1 5.0 7.0	BLOWCOUNT 10-11-8-9 N = 19 (SC-SM) with gravel
				79	SS-2 7.0 9.0	BLOWCOUNT 3-3-4-6 N = 7 (CL-ML) with sand
				100	SS-3 9.0 11.0	BLOWCOUNT 4-4-5-5 N = 9 (CL-ML) with sand
				75	ST-1 11.0 13.0	Shelby tube
				100	SS-4 13.0 15.0	BLOWCOUNT 5-3-4-8 N = 7 (SC-SM)
-20.8	15.0		SILTY SAND (SM) with little mounts of clay, 6<N<9, loose, light brown to reddish brown	100	SS-5 15.0 17.0	BLOWCOUNT 3-4-5-6 N = 9 (SM)
				83	SS-6 17.0 19.0	BLOWCOUNT 4-4-4-4 N = 8 (SM)
				50	SS-7 19.0 21.0	BLOWCOUNT 3-3-3-18 N = 6 (SM)

TETRA TECH

DRILLING LOG (Cont Sheet) | ELEVATION TOP OF HOLE -5.8 | **Hole No. TTDHC-7**

PROJECT: Lockheed Martin MRC | INSTALLATION | SHEET 2 OF 3 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			SILTY SAND (SM) with little mounts of clay, 6<N<9, loose, light brown to reddish brown *(continued)*			
-26.8	21.0					
			SILTY CLAY (CL-ML) with trace of sand, 15<N<24, very stiff, varying colors in reddish brown to brownish red	67	SS-8 21.0 23.0	BLOWCOUNT 6-10-14-16 N = 24 (CL-ML) with sand
				67	SS-9 23.0 25.0	BLOWCOUNT 6-9-12-16 N = 21 (CL-ML)
				75	SS-10 28.0 30.0	BLOWCOUNT 5-7-8-10 N = 15 (CL-ML)
-35.8	30.0					
			CLAY (CL), 32<N<38, N=18 @ 32' to 34', hard, gray to dark gray	67	ST-2 30.0 32.0	Shelby tube (CL)
				79	SS-11 32.0 34.0	BLOWCOUNT 5-7-11-15 N = 18 (CL)
				96	SS-12 38.0 40.0	BLOWCOUNT 10-16-21-24 N = 37 (CL)
				100	SS-13 43.0 45.0	BLOWCOUNT 10-17-15-19 N = 32 (CL)

TETRA TECH

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE: -5.8

Hole No. TTDHC-7

PROJECT: Lockheed Martin MRC

INSTALLATION:

SHEET 3 OF 3 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			CLAY (CL), 32<N<38, N=18 @ 32' to 34', hard, gray to dark gray *(continued)*			
				100	SS-14 48.0 50.0	BLOWCOUNT 9-19-19-22 N = 38 (CL)
-55.8	50.0		END OF BORING			

45 50 55 60 65

TETRA TECH

Hole No. TTDHCB-1

DRILLING LOG	CLIENT: Lockheed Martin Corporation	PROJECT NUMBER: 194-8711	SHEET 1 OF 2 SHEETS

1. PROJECT: Lockheed Martin MRC
2. LOCATION (Coordinates or Station): Middle River, MD N 605,630.7943 E 1,475,169.5397
3. DRILLING AGENCY: UniTech
4. HOLE NO. *(As shown on drawing title and file number)*: TTDHCB-1
5. NAME OF DRILLER: D. Evans
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED --- DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN:
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE: 40.0
10. DRILLING METHOD: HSA/Mud Rotary
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*: MSL
12. MANUFACTURER'S DESIGNATION OF DRILL:
13. TOTAL NO. OF SOIL SAMPLES TAKEN: DISTURBED 15 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES:
15. ELEVATION GROUND WATER: -2.9
16. DATE HOLE: STARTED 9/29/2015 / COMPLETED 9/29/2015
17. ELEVATION TOP OF HOLE: +4.1
18. TOTAL CORE RECOVERY FOR BORING: %
19. GEOLOGIST: K. Tu

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
+4.1	0.0		Approx. 3" asphalt	0	N/A 0.0	
+3.6	0.5		Approx. 3" subgrade			
			PROBABLE FILL, mixed material, predominantly SILTY CLAY (CL-ML) with occasional silty sand and trace of gravel, moist, 3<N<14, soft to stiff, varying colors in light brown to brown and reddish brown	44	0.5 SS-1 0.5 2.0	BLOWCOUNT 6-8-6 N = 14 3" Asphalt (SP-SM) with gravel
				0	SS-2 2.0 4.0	BLOWCOUNT 4-4-4-4 N=8 No recovery
				46	SS-3 4.0 6.0	BLOWCOUNT 2-2-2-2 N = 4 (CL-ML) with sand and trace of gravel
				75	SS-4 6.0 8.0	BLOWCOUNT 2-1-2-1 N = 3 (CL-ML) with sand
-3.9	8.0		CLAYEY SAND (SC-SM) with varying amounts of silt, moist, 14<N<34, medium dense to dense, light brown to reddish brown	96	SS-5 8.0 10.0	BLOWCOUNT 3-6-8-10 N = 14 Interstratified in colors of brown and reddish brown (SC-SM)
				100	SS-6 10.0 12.0	BLOWCOUNT 4-7-11-13 N = 18 (SC)
				92	SS-7 12.0 14.0	BLOWCOUNT 3-9-11-11 N = 20 Trace of yellowish brown (SC)
				83	SS-8 14.5 16.0	BLOWCOUNT 8-11-15 N = 19 (SC-SM)
				100	SS-9a SS-9b 16.0 18.0	BLOWCOUNT 10-16-14-18 N = 30 Top 12" Sandy (CL-ML) Bottom 12" (SC-SM)
				100	SS-10 18.0 20.0	BLOWCOUNT 5-9-8-11 N = 17 (SC)

TETRA TECH

DRILLING LOG (Cont Sheet) | ELEVATION TOP OF HOLE 4.1 | **Hole No. TTDHCB-1**

PROJECT: Lockheed Martin MRC | INSTALLATION | SHEET 2 OF 2 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			CLAYEY SAND (SC-SM) with varying amounts of silt, moist, 14<N<34, medium dense to dense, light brown to reddish brown *(continued)*			
				100	SS-11 23.0 25.0	BLOWCOUNT 11-15-19-19 N = 34 Alternate layers of brown and reddish brown (SC-SM)
				100	SS-12 28.0 30.0	BLOWCOUNT 5-9-12-18 N = 21 (SC-SM)
-28.9	33.0		CLAYEY SAND (SC), 53<N<61, very dense, light brown to reddish brown	100	SS-13 33.0 35.0	BLOWCOUNT 17-26-35-40 N = 61 (SC)
				100	SS-14 38.0 40.0	BLOWCOUNT 16-24-29-33 N = 53 (SC)
-35.9	40.0					
			END OF BORING			

25 30 35 40

TETRA TECH

Hole No. TTDHCB-2

DRILLING LOG	CLIENT	PROJECT NUMBER	SHEET / OF
	Lockheed Martin Corporation	194-8711	1 OF 2 SHEETS

1. PROJECT	Lockheed Martin MRC
2. LOCATION (Coordinates or Station)	Middle River, MD N 605,704.9278 E 1,475,059.7013
3. DRILLING AGENCY	UniTech
4. HOLE NO. *(As shown on drawing title and file number)*	TTDHCB-2
5. NAME OF DRILLER	D. Evans
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED --- DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	
8. DEPTH DRILLED INTO ROCK	
9. TOTAL DEPTH OF HOLE	40.0
10. DRILLING METHOD	HSA/Mud Rotary
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*	MSL
12. MANUFACTURER'S DESIGNATION OF DRILL	
13. TOTAL NO. OF SOIL SAMPLES TAKEN	DISTURBED 17 / UNDISTURBED 2
14. TOTAL NUMBER CORE BOXES	
15. ELEVATION GROUND WATER	1.3
16. DATE HOLE	STARTED 9/30/2015 / COMPLETED 9/30/2015
17. ELEVATION TOP OF HOLE	+4.3
18. TOTAL CORE RECOVERY FOR BORING	%
19. GEOLOGIST	K. Tu

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
+4.3	0.0		PROBABLE FILL, CLAY (CL) with sand, occasional silt and organic materials, moist to very moist, 1<N<8, very soft to medium stiff, varying colors in reddish brown, dark gray to gray and white	54	SS-1 0.0 2.0	BLOWCOUNT 1-4-4-4 N = 8 (CLS) Trace of gravel Trace of organics
				67	SS-2 2.0 4.0	BLOWCOUNT 1-3-3-3 N = 6 (CLS) Trace of organics
				0	SS-3 4.0 6.0	BLOWCOUNT 2-1-2-2 N = 3 No recovery
				75	SS-4 6.0 8.0	BLOWCOUNT 1-2-1-2 N = 3 Top 12" (CL) in gray Bottom 12" (CL-ML) in reddish brown & white
				89	ST-1 8.0 9.5	Shelby tube PP = 1.0 tsf (CL) with sand
				100	SS-5a, SS-5b 9.5 11.5	BLOWCOUNT WH-WH-1-2 N = 1 Bottom 12" (CL-ML) with sand Trace of organics
				94	ST-2 11.5 13.0	Shelby tube PP = 0.5 tsf (CL) with sand
				75	SS-6 13.0 15.0	BLOWCOUNT WH-WH-1-WH N = 1 (CL-ML) with sand
				100	SS-7a, SS-7b 15.0 17.0	BLOWCOUNT WR-WH-2-4 N = 2 Trace of organics with woods Top 12" (CL) in gray Bottom 12" (CL-ML) in light brown
-12.7	17.0		CLAYEY SAND (SC-SM) with silt, 3<N<10, very loose to dense, varying colors in light brown to brown, light red to brownish white and reddish brown	100	SS-8a, SS-8b 17.0 19.0	BLOWCOUNT 6-2-4-3 N = 6 Top 12" (SC-SM) in light brown to yellowish brown Bottom 12" (SM) in reddish light brown
				83	SS-9 19.0 21.0	BLOWCOUNT 3-2-1-1 N = 3 (SC-SM)

TETRA TECH

DRILLING LOG (Cont Sheet) | ELEVATION TOP OF HOLE 4.3 | **Hole No. TTDHCB-2**

PROJECT Lockheed Martin MRC | INSTALLATION | SHEET 2 OF 2 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			CLAYEY SAND (SC-SM) with silt, 3<N<10, very loose to dense, varying colors in light brown to brown, light red to brownish white and reddish brown *(continued)*			Thin interbeds of white, red & reddish brown fine sand
				92	SS-10 23.0 25.0	BLOWCOUNT 3-5-5-7 N = 10 (SC-SM) Thin interbeds of white, red & reddish brown fine sand
				100	SS-11 28.0 30.0	BLOWCOUNT 6-4-4-2 N = 8 (SC)
-29.4	33.8			92	SS-12a, SS-12b 33.0 35.0	BLOWCOUNT 3-3-5-10 N = 8 Fine content variable with clay, less than 5% interbedded Top 9" (SC) with varying amount of clay Bottom 15" (SC-SM)
			CLAYEY SAND (SC-SM) with varying amounts of silt, 15<N<23, medium dense, light brown to reddish brown			
				100	SS-13 38.0 40.0	BLOWCOUNT 9-9-14-18 N = 23 (SC-SM)
-35.7	40.0					
			END OF BORING			

25 30 35 40

TETRA TECH

Hole No. TTDHCB-3

DRILLING LOG	CLIENT	PROJECT NUMBER	SHEET / OF
	Lockheed Martin Corporation	194-8711	1 OF 4 SHEETS

1. PROJECT: Lockheed Martin MRC		10. DRILLING METHOD: HSA/Mud Rotary	
2. LOCATION (Coordinates or Station): Middle River, MD N 605,612.4843 E 1,474,865.4765		11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*: MSL	
3. DRILLING AGENCY: UniTech		12. MANUFACTURER'S DESIGNATION OF DRILL	
4. HOLE NO. *(As shown on drawing title and file number)*: TTDHCB-3		13. TOTAL NO. OF SOIL SAMPLES TAKEN	DISTURBED: 19 / UNDISTURBED: 2
5. NAME OF DRILLER: D. Evans		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ---- DEG. FROM VERT.		15. ELEVATION GROUND WATER: -3.0	
		16. DATE HOLE	STARTED: 10/1/2015 / COMPLETED: 10/1/2015
7. THICKNESS OF OVERBURDEN		17. ELEVATION TOP OF HOLE: +5.0	
8. DEPTH DRILLED INTO ROCK		18. TOTAL CORE RECOVERY FOR BORING: %	
9. TOTAL DEPTH OF HOLE: 70.0		19. GEOLOGIST: K. Tu	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
+5.0	0.0		PROBABLE FILL, mixed materials, predominantly SILTY CLAY (CL - ML) with occasional sand and trace of organics, moist to very moist, 2<N<5, very soft to medium stiff, very loose to loose, varying colors in light brown to dark brown and reddish brown.	83	SS-1 0.0 2.0	BLOWCOUNT 1-1-1-1 N = 2 (SM) Trace of gravel
				100	SS-2 2.0 4.0	BLOWCOUNT 1-2-3-2 N = 5 (SM)
				75	SS-3 4.0 6.0	BLOWCOUNT 2-2-2-3 N = 4 (CL-ML) with sand Trace of organics
				83	SS-4 6.0 8.0	BLOWCOUNT WH-1-1-2 N = 2 (SC-SM) with sand and trace of organics
				71	SS-5 8.0 10.0	BLOWCOUNT WH-1-1-2 N = 2 (CL-ML) with sand
				33	ST-1 10.0 12.0	Shelby tube PP = 0.5 tsf 8" recovery
				77	ST-2 12.0 14.0	Shelby tube 18.5" recovery (CL)
-9.0	14.0		SILTY CLAY (CL - ML) with sand, 3<N<9, soft to stiff, dark brown to reddish brown	83	SS-6 14.0 16.0	BLOWCOUNT WH-WH-3-5 N = 3 (CL-ML) with sand
				83	SS-7 16.0 18.0	BLOWCOUNT 2-4-5-7 N = 9 (CL) with sand
-13.0	18.0		CLAYEY SAND (SC-SM) with silt, 10<N<19, medium dense, reddish brown	100	SS-8 18.0 20.0	BLOWCOUNT 3-6-7-9 N = 13 (SM) with varying amount of silt/clay

TETRA TECH

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE: 5.0

Hole No. TTDHCB-3

PROJECT: Lockheed Martin MRC

INSTALLATION:

SHEET 2 OF 4 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			CLAYEY SAND (SC-SM) with silt, 10<N<19, medium dense, reddish brown *(continued)*			
				100	SS-9 23.0 25.0	BLOWCOUNT 6-8-8-8 N = 16 (SC)
				100	SS-10 26.0 28.0	BLOWCOUNT 5-7-7-7 N = 14 (SC-SM)
				100	SS-11 33.0 35.0	BLOWCOUNT 10-8-11-16 N = 19 (SC)
				100	SS-12 38.0 40.0	BLOWCOUNT 6-4-6-9 N = 10 (SC-SM)
-38.0	43.0					
			CLAYEY SAND (SC), 29<N<39, medium dense to dense, reddish brown	100	SS-13 43.0 45.0	BLOWCOUNT 10-13-16-20 N = 29 (SC)

25 30 35 40

TETRA TECH

DRILLING LOG (Cont Sheet) | ELEVATION TOP OF HOLE 5.0 | **Hole No. TTDHCB-3**

PROJECT: Lockheed Martin MRC | INSTALLATION: | SHEET 3 OF 4 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			CLAYEY SAND (SC), 29<N<39, medium dense to dense, reddish brown *(continued)*			
						45
				100	SS-14 48.0 50.0	BLOWCOUNT 10-17-22-26 N = 39 (SC)
						50
				100	SS-15a SS-15b 53.0 55.0	BLOWCOUNT 13-13-15-25 N = 28 Top 14" reddish brown (SC-SM) Top 10" red (SP-SM/SP-SC)
-49.0	54.0					
			CLAYEY SAND (SC) with varying amounts of poorly graded sand with silt, 41<N<63/9", dense to very dense, varying colors in reddish brown			55
				100	SS-16 58.0 60.0	BLOWCOUNT 17-16-25-32 N = 41 Top 12" (SP-SM) Bottom 12" (SC)
						60
				63	SS-17 63.0 65.0	BLOWCOUNT 12-13-50/3"-x N = 63/9" (SC)
						65
-63.0	68.0					

TETRA TECH

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE: 5.0

Hole No. TTDHCB-3

PROJECT: Lockheed Martin MRC

INSTALLATION:

SHEET 4 OF 4 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
-65.0	70.0		FAT CLAY (CH), N = 88/11.5", hard, reddish brown	73	SS-18 68.0 70.0	BLOWCOUNT 23-38-50/5.5"-x N = 88/11.5" (CH)
			END OF BORING			

70 75 80 85 90

TETRA TECH

Hole No. TTDHCB-4

DRILLING LOG	CLIENT: Lockheed Martin Corporation	PROJECT NUMBER: 194-8711	SHEET 1 OF 4 SHEETS

1. PROJECT: Lockheed Martin MRC
2. LOCATION (Coordinates or Station): Middle River, MD N 605,516.9785 E 1,474,770.6305
3. DRILLING AGENCY: UniTech
4. HOLE NO. *(As shown on drawing title and file number)*: TTDHCB-4
5. NAME OF DRILLER: D. Evans
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ---- DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN:
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE: 70.0
10. DRILLING METHOD: HSA/Mud Rotary
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*: MSL
12. MANUFACTURER'S DESIGNATION OF DRILL:
13. TOTAL NO. OF SOIL SAMPLES TAKEN: DISTURBED 19; UNDISTURBED 1
14. TOTAL NUMBER CORE BOXES:
15. ELEVATION GROUND WATER: -3.4
16. DATE HOLE: STARTED 10/5/2015; COMPLETED 10/5/2015
17. ELEVATION TOP OF HOLE: +4.6
18. TOTAL CORE RECOVERY FOR BORING: %
19. GEOLOGIST: K. Tu

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
+4.6	0.0		PROBABLE FILL, predominantly CLAYEY SAND (SC-SM) with occasional silt and trace of gravel, moist to very moist, 1<N<8, very loose to medium dense, varying colors in gray to reddish gray and reddish brown	75	SS-1 0.0 2.0	BLOWCOUNT 4-3-5-5 N = 8 (CL-ML) with creosote smell Trace of gravel
				13	SS-2 2.0 4.0	BLOWCOUNT 5-3-4-4 N = 7 (SC-SM) with creosote smell Trace of gravel
				100	SS-3 4.0 6.0	BLOWCOUNT 4-4-4-4 N = 8 (SC) Trace of gravel
				42	SS-4 6.0 8.0	BLOWCOUNT 2-3-2-2 N = 5 (SC)
				75	SS-5 8.0 10.0	BLOWCOUNT 1/12"-1-1 N = 1 (SC-SM)
				50	SS-6 10.0 12.0	BLOWCOUNT 1/12"-1-1 N = 1 (SC) Trace of gravel
				75	ST-1 12.0 14.0	Shelby tube PP = 2.5 tsf 18" recovery
-9.4	14.0			42	SS-7 13.5 15.5	BLOWCOUNT WH-WH-1-3 N = 1 (CL-ML) with sand
			SILTY CLAY (CL - ML) with sand, 1<N<2, very soft, brownish red and gray			
				96	SS-8 16.0 18.0	BLOWCOUNT 1-1-1-1 N = 2 (CLS)
-13.4	18.0					
			CLAYEY SAND (SC), 8<N<19, loose to medium dense, varying colors in light brown to reddish brown and dark gray	100	SS-9 18.0 20.0	BLOWCOUNT 2-4-4-6 N = 8 (SC)

TETRA TECH

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE: 4.6

Hole No. TTDHCB-4

PROJECT: Lockheed Martin MRC

INSTALLATION:

SHEET 2 OF 4 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			CLAYEY SAND (SC), 8<N<19, loose to medium dense, varying colors in light brown to reddish brown and dark gray *(continued)*			
				92	SS-10 23.0 25.0	BLOWCOUNT 3-4-5-4 N = 9 (SC)
				100	SS-11 28.0 30.0	BLOWCOUNT 4-4-5-8 N = 9 (SC)
				100	SS-12 33.0 35.0	BLOWCOUNT 10-10-9-11 N = 19 (SC)
				100	SS-13 38.0 40.0	BLOWCOUNT 7-10-9-10 N = 19 (SC)
-38.4	43.0					
			CLAYEY SAND (SC-SM) with varying amounts of silt, 29<N<39, N=73 @ 53' to 55', dense to very dense, yellowish brown to reddish brown	100	SS-14 43.0 45.0	BLOWCOUNT 9-13-16-22 N = 29 (SC)

DRILLING LOG (Cont Sheet) | ELEVATION TOP OF HOLE 4.6 | **Hole No. TTDHCB-4**

PROJECT: Lockheed Martin MRC | INSTALLATION: | SHEET 3 OF 4 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			CLAYEY SAND (SC-SM) with varying amounts of silt, 29<N<39, N=73 @ 53' to 55', dense to very dense, yellowish brown to reddish brown *(continued)*			
				100	SS-15 48.0 50.0	BLOWCOUNT 9-13-17-24 N = 30 (SC-SM)
				100	SS-16 53.0 55.0	BLOWCOUNT 13-23-50-x N = 73 (SC-SM) Thin layer of light brown sand
				100	SS-17 58.0 60.0	BLOWCOUNT 15-14-17-20 N = 31 (SM)
				100	SS-18 63.0 65.0	BLOWCOUNT 19-17-22-28 N = 39 (SM)

45 50 55 60 65

TETRA TECH

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE: 4.6

Hole No. TTDHCB-4

PROJECT: Lockheed Martin MRC

INSTALLATION:

SHEET 4 OF 4 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			CLAYEY SAND (SC-SM) with varying amounts of silt, 29<N<39, N=73 @ 53' to 55', dense to very dense, yellowish brown to reddish brown *(continued)*	75	SS-19 68.0 70.0	BLOWCOUNT 15-12-19-N/A N = 31 (SC-SM)
-65.4	70.0		END OF BORING			

70

75

80

85

90

TETRA TECH

Hole No. TTDHCB-5

DRILLING LOG	CLIENT: Lockheed Martin Corporation	PROJECT NUMBER: 194-8711	SHEET 1 OF 2 SHEETS

1. PROJECT: Lockheed Martin MRC
2. LOCATION (Coordinates or Station): Middle River, MD N 605,414.8629 E 1,474,670.9438
3. DRILLING AGENCY: UniTech
4. HOLE NO. *(As shown on drawing title and file number)*: TTDHCB-5
5. NAME OF DRILLER: D. Evans
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED --- DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN:
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE: 40.0
10. DRILLING METHOD: HSA/Mud Rotary
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*: MSL
12. MANUFACTURER'S DESIGNATION OF DRILL:
13. TOTAL NO. OF SOIL SAMPLES TAKEN: DISTURBED 15 / UNDISTURBED 0
14. TOTAL NUMBER CORE BOXES:
15. ELEVATION GROUND WATER: -0.9
16. DATE HOLE: STARTED 9/30/2015 / COMPLETED 9/30/2015
17. ELEVATION TOP OF HOLE: +5.1
18. TOTAL CORE RECOVERY FOR BORING: %
19. GEOLOGIST: K. Tu

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
+5.1	0.0		PROBABLE FILL, predominantly SILTY CLAY (CL - ML) with occasional sand and trace of organics, moist, 5<N<26, medium stiff to very stiff, varying colors in brown to reddish brown and black	83	SS-1 0.0 2.0	BLOWCOUNTNT 2-3-3-4 N = 6 (CL-ML) with sand and gravel Trace of organics
				75	SS-2 2.0 4.0	BLOWCOUNT 2-3-2-4 N = 5 (CL-ML) with sand in color of light brown
				92	SS-3 4.0 6.0	BLOWCOUNT 3-3-5-7 N = 8 (CL-ML) Trace of organics
				75	SS-4 6.0 8.0	BLOWCOUNT 3-5-9-8 N = 14 (CL-ML) with sand
				92	SS-5 8.0 10.0	BLOWCOUNT 7-9-11-15 N = 20 (CL-ML) with sand
				100	SS-6a SS-6b 10.0 12.0	BLOWCOUNT 7-8-12-13 N = 20 (CL-ML) Thin layers of ironized (CL-ML) Top 12" in reddish brown Bottom 12" in reddish black
				100	SS-7 12.0 14.0	BLOWCOUNT 7-11-15-11 N = 26 Cemented (CL-ML)
				100	SS-8 14.0 16.0	BLOWCOUNT 3-7-9-9 N = 16 (CL-ML)
-10.9	16.0		LEAN CLAY (CL) with varying amounts of sand, 11<N<16, stiff, gray	100	SS-9 16.0 18.0	BLOWCOUNT 4-5-6-9 N = 11 (CL)
				100	SS-10 18.0 20.0	BLOWCOUNT 4-5-6-8 N = 11 (CL)

TETRA TECH

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE: 5.1

Hole No. TTDHCB-5

PROJECT: Lockheed Martin MRC

INSTALLATION:

SHEET 2 OF 2 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			LEAN CLAY (CL) with varying amounts of sand, 11<N<16, stiff, gray *(continued)*			
				100	SS-11 23.0 25.0	BLOWCOUNT 3-6-10-1 N = 16 (CL) with sand
-22.9	28.0					
			SILTY CLAY (CL-ML) with sand, N = 18, very stiff, light brown	92	SS-12 28.0 30.0	BLOWCOUNT 4-9-9-10 N = 18 (CL-ML) with sand
-27.9	33.0					
			CLAYEY SAND (SC-SM), 33<N<43, dense to very dense, reddish brown	100	SS-13 33.0 35.0	BLOWCOUNT 8-14-19-28 N = 33 (SC-SM)
				100	SS-14 38.0 40.0	BLOWCOUNT 13-18-25-27 N = 43 (SC)
-34.9	40.0					
			END OF BORING			

TETRA TECH

Hole No. TTDHCB-6

DRILLING LOG	CLIENT: Lockheed Martin Corporation	PROJECT NUMBER: 194-8711	SHEET 1 OF 2 SHEETS

1. PROJECT: Lockheed Martin MRC
2. LOCATION (Coordinates or Station): Middle River, MD N 604,871.2328 E 1,473,853.6657
3. DRILLING AGENCY: UniTech
4. HOLE NO. *(As shown on drawing title and file number)*: TTDHCB-6
5. NAME OF DRILLER: D. Evans
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED --- DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN:
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE: 40.0
10. DRILLING METHOD: HSA/Mud Rotary
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*: MSL
12. MANUFACTURER'S DESIGNATION OF DRILL:
13. TOTAL NO. OF SOIL SAMPLES TAKEN: DISTURBED 15 / UNDISTURBED 1
14. TOTAL NUMBER CORE BOXES:
15. ELEVATION GROUND WATER: 0.0
16. DATE HOLE: STARTED 10/6/2015 / COMPLETED 10/6/2015
17. ELEVATION TOP OF HOLE: +5.0
18. TOTAL CORE RECOVERY FOR BORING: %
19. GEOLOGIST: K. Tu

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
+5.0	0.0		PROBABLE FILL, CLAYEY SAND (SC-SM) with silt and trace of gravel and organics, moist to very moist, 3<N<5, very loose to loose, varying colors in light brown to reddish brown and gray	50	SS-1 0.0 2.0	BLOWCOUNT 2-1-3-2 N = 4 (SM) with trace of organics Trace of gravel
				75	SS-2 2.0 4.0	BLOWCOUNT 2-2-2-2 N = 4 (SC-SM)
				83	SS-3 4.0 6.0	BLOWCOUNT 1-1-2-2 N = 3 (SC)
				100	SS-4a SS-4b 6.0 8.0	BLOWCOUNT 4-2-3-2 N = 5 Top 18" (SC) Bottom 6" Sandy (SC-SM)
-2.5	7.5		CLAYEY SAND (SC), 8<N<14, loose to medium dense, gray	75	SS-5 8.0 10.0	BLOWCOUNT WH-3-5-6 N = 8 (SC)
				83	SS-6 10.0 12.0	BLOWCOUNT 4-6-8-10 N = 14 (SC)
				100	SS-7 12.0 14.0	BLOWCOUNT 3-5-6-7 N = 11 (SC)
				83	SS-8 14.0 16.0	BLOWCOUNT 4-5-7-10 N = 12 (SC)
				100	SS-9 16.0 18.0	BLOWCOUNT 3-5-7-7 N = 12 (CL)
-13.0	18.0		CLAYEY SAND (SC-SM), 18<N<22, medium dense, reddish brown	108	ST-1 18.0 19.5	Shelby tube PP = 1.5 tsf Top 11" (CL) with sand Bottom 3.5" (SC)
				90	SS-10 19.5	BLOWCOUNT 9-9-9-9

TETRA TECH

DRILLING LOG (Cont Sheet) | ELEVATION TOP OF HOLE 5.0 | **Hole No. TTDHCB-6**

PROJECT Lockheed Martin MRC | INSTALLATION | SHEET 2 OF 2 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			CLAYEY SAND (SC-SM), 18<N<22, medium dense, reddish brown *(continued)*		21.5	N = 18 (SC)
				83	SS-11 23.0 25.0	BLOWCOUNT 5-9-13-13 N = 22 (SC-SM)
				83	SS-12 28.0 30.0	BLOWCOUNT 5-8-11-15 N = 19 (SC)
-28.0	33.0					
			CLAYEY SAND (SC-SM), 47<N<71, very dense to dense, reddish brown	100	SS-13 33.0 35.0	BLOWCOUNT 27-21-50-x N = 71 (SC-SM)
				100	SS-14 38.0 40.0	BLOWCOUNT 15-20-27-37 N = 47 (SC)
-35.0	40.0					
			END OF BORING			

TETRA TECH

Hole No. TTDHCB-7

DRILLING LOG	CLIENT	PROJECT NUMBER	SHEET / OF
	Lockheed Martin Corporation	194-8711	1 OF 4 SHEETS

1. PROJECT	Lockheed Martin MRC
2. LOCATION (Coordinates or Station)	Middle River, MD N 604,794.5472 E 1,473,729.9770
3. DRILLING AGENCY	UniTech
4. HOLE NO. *(As shown on drawing title and file number)*	TTDHCB-7
5. NAME OF DRILLER	D. Evans
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED --- DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	
8. DEPTH DRILLED INTO ROCK	
9. TOTAL DEPTH OF HOLE	70.0
10. DRILLING METHOD	HSA/Mud Rotary
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*	MSL
12. MANUFACTURER'S DESIGNATION OF DRILL	
13. TOTAL NO. OF SOIL SAMPLES TAKEN	DISTURBED 22 / UNDISTURBED 1
14. TOTAL NUMBER CORE BOXES	
15. ELEVATION GROUND WATER	-1.3
16. DATE HOLE	STARTED 10/6/2015 / COMPLETED 10/6/2015
17. ELEVATION TOP OF HOLE	+4.7
18. TOTAL CORE RECOVERY FOR BORING	%
19. GEOLOGIST	K. Tu

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
+4.7	0.0		PROBABLE FILL, POORLY GRADED SAND WITH CLAY (SP-SC), moist to very moist, 0<N,3, very loose, varying colors in gray to dark gray, brownish gray and redish brown	83	SS-1 0.0 2.0	BLOWCOUNT 1-1-2-2 N=3 (SC-SM)
				83	SS-2 2.0 4.0	BLOWCOUNT 2-1-2-1 N = 3 (SP-SC)
				100	SS-15 3.0 5.0	BLOWCOUNT 6-9-12-14 N = 21 (SC-SM)
				100	SS-3 4.0 6.0	BLOWCOUNT 1-1-1-1 N = 2 (SP-SC)
				100	SS-4 6.0 8.0	BLOWCOUNT 1-2-1-2 N = 3 (SP-SC)
				50	SS-5 8.0 10.0	BLOWCOUNT 1-1-1-1 N = 2 (SP-SC)
				100	SS-6 10.0 12.0	BLOWCOUNT 1-1-1-1 N = 2 (SP-SC)
				100	SS-7 12.0 14.0	BLOWCOUNT WH-WH-WH-1 N = WH SP-SC
				63	SS-8 14.0 16.0	BLOWCOUNT WH-WH-2-1 N = 2 Top 12" (SP-SC) Bottom 12" (SC-SM)
-11.3	16.0		STILY CLAY (CL-ML) with varying amounts of sand, 10<N<27, stiff to very stiff, light brown to reddish brown	100	SS-9 16.0 18.0	BLOWCOUNT 2-4-6-9 N = 10 (CL-ML) with sand
				75	SS-10a SS-10b 18.0 20.0	BLOWCOUNT 4-7-7-9 N = 14 (CL-ML)

TETRA TECH

DRILLING LOG (Cont Sheet) | ELEVATION TOP OF HOLE 4.7 | **Hole No. TTDHCB-7**

PROJECT Lockheed Martin MRC | INSTALLATION | SHEET 2 OF 4 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			STILY CLAY (CL-ML) with varying amounts of sand, 10<N<27, stiff to very stiff, light brown to reddish brown *(continued)*			
				100	SS-11 23.0 25.0	BLOWCOUNT 9-11-16-18 N = 27 (CL-ML) with sand
-23.3	28.0					
			CLAYEY SAND (SC-SM) with silt, 13<N<24, medium desne, varying colors in light brown to reddish brown and red to brownish red	100	SS-12 28.0 30.0	BLOWCOUNT 10-7-12-17 N = 19 (SC-SM)
				100 33	ST-1 30.0 30.3 SS-13a 30.3 32.3	Shelby tube PP = 2.0-3.0 tsf 3" recovery (SC) BLOWCOUNT 3-7-9-9 N = 16 (SC)
				100	SS-14 33.0 35.0	BLOWCOUNT 5-6-7-8 N = 13 (SM)
				100	SS-16 43.0 45.0	BLOWCOUNT 8-10-14-17 N = 24 (SC-SM) with thin layers of CL-ML

25 30 35 40

TETRA TECH

DRILLING LOG (Cont Sheet)	ELEVATION TOP OF HOLE 4.7	Hole No. TTDHCB-7
PROJECT Lockheed Martin MRC	INSTALLATION	SHEET 3 OF 4 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			CLAYEY SAND (SC-SM) with silt, 13<N<24, medium desne, varying colors in light brown to reddish brown and red to brownish red *(continued)*			
-43.3	48.0		Interbedded CLAYEY SAND (SC-SM) and SILTY CLAY (CL-ML), 35<N<42, N=79 @ 63' to 65', medium dense and hard, varying colors in brownish red to red and gray	100	SS-17 48.0 50.0	BLOWCOUNT 17-18-17-33 N = 35 (SC-SM)
				100	SS-18 53.0 55.0	BLOWCOUNT 8-16-21-38 N = 37 (CL-ML)
				100	SS-19 58.0 60.0	BLOWCOUNT 14-19-23-26 N = 42 (SC-SM)
				96	SS-20 63.0 65.0	BLOWCOUNT 13-39-40-50/5" N = 79 Cemented (CL-ML)

45 50 55 60 65

TETRA TECH

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE: 4.7

Hole No. TTDHCB-7

PROJECT: Lockheed Martin MRC

INSTALLATION:

SHEET 4 OF 4 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			Interbedded CLAYEY SAND (SC-SM) and SILTY CLAY (CL-ML), 35<N<42, N=79 @ 63' to 65', medium dense and hard, varying colors in brownish red to red and gray *(continued)*	100	SS-21 68.0 70.0	BLOWCOUNT 17-18-24-32 N = 42 (CL)
-65.3	70.0		END OF BORING			

70

75

80

85

90

TETRA TECH

Hole No. TTDHCB-8

DRILLING LOG	CLIENT	PROJECT NUMBER	SHEET / OF
	Lockheed Martin Corporation	194-8711	1 OF 2 SHEETS

1. PROJECT	Lockheed Martin MRC
2. LOCATION (Coordinates or Station)	Middle River, MD N 604,680.4520 E 1,473,602.9321
3. DRILLING AGENCY	UniTech
4. HOLE NO. *(As shown on drawing title and file number)*	TTDHCB-8
5. NAME OF DRILLER	D. Evans
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED --- DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	
8. DEPTH DRILLED INTO ROCK	
9. TOTAL DEPTH OF HOLE	40.0
10. DRILLING METHOD	HSA/Mud Rotary
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*	MSL
12. MANUFACTURER'S DESIGNATION OF DRILL	
13. TOTAL NO. OF SOIL SAMPLES TAKEN	DISTURBED 14 / UNDISTURBED 1
14. TOTAL NUMBER CORE BOXES	
15. ELEVATION GROUND WATER	3.0
16. DATE HOLE	STARTED 10/8/2015 / COMPLETED 10/8/2015
17. ELEVATION TOP OF HOLE	+9.0
18. TOTAL CORE RECOVERY FOR BORING	%
19. GEOLOGIST	K. Tu

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
+9.0	0.0		PROBABLE FILL, CLAYEY SAND (SC), moist to very moist, 2<N<7, very loose to loose, varying colors in reddish brown and gray to brownish gray	42	SS-1 0.0 2.0	BLOWCOUNT x-x-7-25 N = 7 8" dirt 4" concrete slab 12" base materials
				63	SS-2 2.0 4.0	BLOWCOUNT 2-1-2-1 N = 3 (SC-SM)
				67	SS-3a SS-3b 4.0 6.0	BLOWCOUNT 2-2-1-1 N = 3 Top 8" (SC) Bottom 8" (CLS)
				92	SS-4 6.0 8.0	BLOWCOUNT WH-1-1-1 N = 2 (CLS)
				100	SS-5 8.0 10.0	BLOWCOUNT 1-2-3-5 N = 5 (SC)
				54	SS-6 10.0 12.0	BLOWCOUNT 5-4-3-3 N = 7 (SC) with gravel
-3.0	12.0		SILTY CLAY (CL-ML) with occasional sand, 7<N<15, medium stiff to stiff, reddish brown	50	SS-7 12.0 14.0	BLOWCOUNT 2-4-7-7 N = 11 (CL-ML) with sand
				100	ST-1 14.0 16.0	Shelby tube 24" recovery
				63	SS-8 16.0 18.0	BLOWCOUNT 6-8-7-8 N = 15 (CL-ML)
				54	SS-9 18.0 20.0	BLOWCOUNT 3-3-4-6 N = 7 (CLS)

TETRA TECH

DRILLING LOG (Cont Sheet) | ELEVATION TOP OF HOLE 9.0 | **Hole No. TTDHCB-8**

PROJECT: Lockheed Martin MRC | INSTALLATION: | SHEET 2 OF 2 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			SILTY CLAY (CL-ML) with occasional sand, 7<N<15, medium stiff to stiff, reddish brown *(continued)*			
-14.0	23.0					
			CLAYEY SAND (SC-SM) with silt and trace of organics, 12<N<20, stiff to very stiff, interstratified with reddish brown and brownish red	96	SS-10 23.0 25.0	BLOWCOUNT 4-7-5-7 N = 12 (SC-SM)
				100	SS-11 28.0 30.0	BLOWCOUNT 5-6-7-9 N = 13 Top 12" (SC-SM) in brown Bottom 12" (CL-ML) in reddish brown
				100	SS-12 33.0 35.0	BLOWCOUNT 6-8-12-13 N = 20 (CLS) Trace of decomposed timber
-29.0	38.0					
			LEAN CLAY (CL) with sand, N = 40, hard, interstratified with reddish brown and brownish red in color	100	SS-13 38.0 40.0	BLOWCOUNT 8-16-24-28 N = 40 (CL)
-31.0	40.0					
			END OF BORING			

25 30 35 40

TETRA TECH

Hole No. TTDHCB-9

DRILLING LOG	CLIENT: Lockheed Martin Corporation	PROJECT NUMBER: 194-8711	SHEET 1 OF 2 SHEETS

1. PROJECT: Lockheed Martin MRC
2. LOCATION (Coordinates or Station): Middle River, MD N 604,542.2869 E 1,473,578.7008
3. DRILLING AGENCY: UniTech
4. HOLE NO. *(As shown on drawing title and file number)*: TTDHCB-9
5. NAME OF DRILLER: D. Evans
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED --- DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN:
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE: 40.0
10. DRILLING METHOD: HSA/Mud Rotary
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*: MSL
12. MANUFACTURER'S DESIGNATION OF DRILL:
13. TOTAL NO. OF SOIL SAMPLES TAKEN: DISTURBED 15 / UNDISTURBED 1
14. TOTAL NUMBER CORE BOXES:
15. ELEVATION GROUND WATER: 1.6
16. DATE HOLE: STARTED 10/8/2015 / COMPLETED 10/8/2015
17. ELEVATION TOP OF HOLE: +7.6
18. TOTAL CORE RECOVERY FOR BORING: %
19. GEOLOGIST: K. Tu

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
+7.6	0.0		PROBABLE FILL, mixed material, predominantly SANDY CLAY (CL), moist to very moist, 1<N<4, very soft to soft and very loose, varying color, reddish brown and gray.	83	SS-1 0.0 2.0	BLOWCOUNT 3-1-3-2 N = 4 (MLS)
				75	SS-2 2.0 4.0	BLOWCOUNT 2-2-1-2 N = 3 (SC-SM)
				92	SS-3 4.0 6.0	BLOWCOUNT 1-1-1-1 N = 2 (CLS)
				83	SS-4 6.0 8.0	BLOWCOUNT WH-WH-1-1 N = 1 (CLS)
				63	SS-5a SS-5b 8.0 10.0	BLOWCOUNT WR-1-2-3 N = 3 Top 11" (SP-SM) Bottom 4" (CL-ML)
-2.4	10.0		SILTY CLAY (CL - ML), 16<N<25, stiff to very stiff, reddish brown	100	SS-6 10.0 12.0	BLOWCOUNT 5-7-9-13 N = 16 PP = 2.0-4.0 tsf (CL-ML)
				100	ST-1 12.0 13.0	Shelby tube PP = 4.0-4.5 tsf 12" recovery (CL)
				100	SS-7a SS-7b 13.0 15.0	BLOWCOUNT 6-10-15-17 N = 25 Top 12" (CL-ML) Bottom 12" (CLS)
-7.4	15.0		CLAYEY SAND (SC) with varying amounts of silt, 10<N<33, medium dense to dense, very stiff, brown to reddish brown	63	SS-8 15.0 17.0	BLOWCOUNT 7-13-20-23 N = 33 (SC)
				100	SS-9 17.0 19.0	BLOWCOUNT 4-7-9-8 N = 16 (SC)
				63	SS-10 19.0 21.0	BLOWCOUNT 4-6-4-4 N = 10 (SC)

TETRA TECH

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE: 7.6

Hole No. TTDHCB-9

PROJECT: Lockheed Martin MRC

INSTALLATION:

SHEET 2 OF 2 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			CLAYEY SAND (SC) with varying amounts of silt, 10<N<33, medium dense to dense, very stiff, brown to reddish brown *(continued)*			
				100	SS-11 23.0 25.0	BLOWCOUNT 4-7-9-11 N = 16 Sandy (SC-SM)
-20.4	28.0					
			SILTY CLAY (CL - ML), 36<N<39, hard, reddish brown	100	SS-12 28.0 30.0	BLOWCOUNT 11-17-22-27 N = 39 PP > 4.5 tsf (CLS)
				100	SS-13 33.0 35.0	BLOWCOUNT 10-16-22-27 N = 38 (CL-ML)
				100	SS-14 38.0 40.0	BLOWCOUNT 9-15-21-30 N = 36 (CL-ML)
-32.4	40.0					

TETRA TECH

Hole No. TTDHCB-10

DRILLING LOG	CLIENT	PROJECT NUMBER	SHEET / OF
	Lockheed Martin Corporation	194-8711	1 OF 2 SHEETS

1. PROJECT	Lockheed Martin MRC
2. LOCATION (Coordinates or Station)	Middle River, MD N 604,429.0408 E 1,473,578.8936
3. DRILLING AGENCY	UniTech
4. HOLE NO. *(As shown on drawing title and file number)*	TTDHCB-10
5. NAME OF DRILLER	D. Evans
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED --- DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	
8. DEPTH DRILLED INTO ROCK	
9. TOTAL DEPTH OF HOLE	40.0
10. DRILLING METHOD	HSA/Mud Rotary
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*	MSL
12. MANUFACTURER'S DESIGNATION OF DRILL	
13. TOTAL NO. OF SOIL SAMPLES TAKEN	DISTURBED 17 / UNDISTURBED 1
14. TOTAL NUMBER CORE BOXES	
15. ELEVATION GROUND WATER	-0.5
16. DATE HOLE	STARTED 10/7/2015 / COMPLETED 10/7/2015
17. ELEVATION TOP OF HOLE	+5.5
18. TOTAL CORE RECOVERY FOR BORING	%
19. GEOLOGIST	K. Tu

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
+5.5	0.0		PROBABLE FILL, CLAYEY SAND (SC) with trace of organics, moist to very moist, 3<N<7, very loose to loose, varying colors in reddish brown and brownish gray to gray	67	SS-1 0.0 2.0	BLOWCOUNT 2-2-4-5 N = 6 (SC-SM) with sand, trace of organics
				83	SS-2 2.0 4.0	BLOWCOUNT 2-2-3-4 N = 5 (CLS) with sand
				92	SS-3a SS-3b 4.0 6.0	BLOWCOUNT 4-2-5-4 N = 7 (CLS) Top 15" in reddish brown Bottom 7" in gray Creosote small
				100	SS-4 6.0 8.0	BLOWCOUNT 1-1-2-1 N = 3 (SC) with organics
				100	SS-5 8.0 10.0	BLOWCOUNT 1-1-1-1 N = 2 (SC) with organics and trace of timber
				75	SS-6a SS-6b 10.0 12.0	BLOWCOUNT WH-2-3-4 N = 5 Top 18" (SC) Bottom 6" (CL-ML)
-6.0	11.5		CLAY (CL-CH) with varying amounts of sand and thin layers of silty clay, 9<N<30, stiff to very stiff, brownish red	83	SS-7 12.0 14.0	BLOWCOUNT 3-4-5-6 N = 9 (CL-ML)
				92	SS-8 14.0 16.0	BLOWCOUNT 8-9-10-14 N = 19 (CH)
				83	SS-9 16.0 18.0	BLOWCOUNT 4-4-7-8 N = 11 (CH)
				0	ST-1 18.0 20.0	Shelby tube No recovery

TETRA TECH

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE: 5.5

Hole No. TTDHCB-10

PROJECT: Lockheed Martin MRC

INSTALLATION:

SHEET 2 OF 2 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			CLAY (CL-CH) with varying amounts of sand and thin layers of silty clay, 9<N<30, stiff to very stiff, brownish red *(continued)*	100	SS-10 20.0 22.0	BLOWCOUNT 4-7-12-14 N = 19 (CH)
				100	SS-11 23.0 25.0	BLOWCOUNT 5-8-12-13 N = 20 (CL)
				100	SS-12 28.0 30.0	BLOWCOUNT 5-11-19-19 N = 30 (CL) with sand
-29.0	34.5			92	SS-13a SS-13b 33.0 35.0	BLOWCOUNT 5-13-18-24 N = 31 Top 15" (CH) Bottom 7" (SC)
			CLAYEY SAND (SC), N = 30, dense, reddish brown.			
-34.5	40.0			100	SS-14 38.0 40.0	BLOWCOUNT 10-15-15-16 N = 30 (SC)
			END OF BORING			

TETRA TECH

Hole No. TTDHCB-11

DRILLING LOG	CLIENT: Lockheed Martin Corporation	PROJECT NUMBER: 194-8711	SHEET 1 OF 4 SHEETS

1. PROJECT: Lockheed Martin MRC
2. LOCATION (Coordinates or Station): Middle River, MD N 604,265.0466 E 1,473,441.1996
3. DRILLING AGENCY: UniTech
4. HOLE NO. *(As shown on drawing title and file number)*: TTDHCB-11
5. NAME OF DRILLER: D. Evans
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED --- DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN:
8. DEPTH DRILLED INTO ROCK:
9. TOTAL DEPTH OF HOLE: 40.0
10. DRILLING METHOD: HSA/Mud Rotary
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*: MSL
12. MANUFACTURER'S DESIGNATION OF DRILL:
13. TOTAL NO. OF SOIL SAMPLES TAKEN: DISTURBED 22; UNDISTURBED 1
14. TOTAL NUMBER CORE BOXES:
15. ELEVATION GROUND WATER: -5.2
16. DATE HOLE: STARTED 10/7/2015; COMPLETED 10/7/2015
17. ELEVATION TOP OF HOLE: +4.8
18. TOTAL CORE RECOVERY FOR BORING: %
19. GEOLOGIST: K. Tu

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
+4.8	0.0		PROBABLE FILL, predominantly CLAYEY SAND (SC) with varying amounts of silt and and traces of organic materials, moist, 9<N<13, loose to medium dense and stiff, varying color, light brown to brown and reddish brown.	83	SS-1 0.0 2.0	BLOWCOUNT 2-6-3-6 N = 9 (CLS/MLS)
				100	SS-2 2.0 4.0	BLOWCOUNT 4-5-5-3 N = 10 (SC) with organics
				100	SS-3 4.0 6.0	BLOWCOUNT 5-5-8-12 N = 13 (SC)
				100	SS-4 6.0 8.0	BLOWCOUNT 2-2-7-8 N = 9 (SC)
-3.2	8.0		CLAYEY SAND (SC) with thin (<2") layers of silty clay, 11<N<28, medium dense, brownish red to reddish brown	100	SS-5 8.0 10.0	BLOWCOUNT 11-11-13-13 N = 24 (SC-SM)
				100	SS-6 10.0 12.0	BLOWCOUNT 5-6-9-9 N = 15 (SC) with thin layer of CL
				100	SS-7 12.0 14.0	BLOWCOUNT 16-15-13-11 N = 28 (SC-SM)
				100	SS-8 14.0 16.0	BLOWCOUNT 7-9-11-11 N = 20 (SC)
				100	SS-9 16.0 18.0	BLOWCOUNT 7-10-13-15 N = 23 (SC)
				92	SS-10 18.0 20.0	BLOWCOUNT 6-7-10-12 N = 17 (SC-SM)

TETRA TECH

DRILLING LOG (Cont Sheet) | ELEVATION TOP OF HOLE 4.8 | **Hole No. TTDHCB-11**

PROJECT: Lockheed Martin MRC | INSTALLATION: | SHEET 2 OF 4 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			CLAYEY SAND (SC) with thin (<2") layers of silty clay, 11<N<28, medium dense, brownish red to reddish brown *(continued)*			
				100	SS-11 23.0 25.0	BLOWCOUNT 6-9-10-11 N = 19 (SC)
-23.9	28.7			100	SS-12a SS-12b 28.0 30.0	BLOWCOUNT 7-8-13-15 N = 21 Top 8" (SC) Bottom 16" (CL)
			LEAN CLAY (CL) with varying amounts of sand, 16<N<32, very stiff to hard, reddish brown to brownish red			
				83	SS-13 33.0 35.0	BLOWCOUNT 4-6-10-12 N = 16 (CL)
				0	ST-1 35.0 37.0	Shelby tube No recovery
				100	SS-14 38.0 40.0	BLOWCOUNT 8-13-19-28 N = 32 (CL)
-37.7	42.5					
			SANDY CLAY (CLS) with a thin layer of clayey sand @ 48', 20<N<56, very stiff to hard, brownish red to reddish brown			
				100	SS-15 43.0 45.0	BLOWCOUNT 6-8-12-17 N = 20 (CLS)

TETRA TECH

DRILLING LOG (Cont Sheet) | ELEVATION TOP OF HOLE 4.8 | **Hole No. TTDHCB-11**

PROJECT: Lockheed Martin MRC | INSTALLATION: | SHEET 3 OF 4 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			SANDY CLAY (CLS) with a thin layer of clayey sand @ 48', 20<N<56, very stiff to hard, brownish red to reddish brown *(continued)*			
				100	SS-16 48.0 50.0	BLOWCOUNT 18-20-21-30 N = 41 Top 12" (SC) Bottom 12" (CL) with sand
				42	SS-17a SS-17b 53.0 55.0	BLOWCOUNT 6-7-18-22 N = 25 (CLS)
				100	SS-18 58.0 60.0	BLOWCOUNT 8-29-27-29 N = 56 (CLS)
				100	SS-19 63.0 65.0	BLOWCOUNT 12-19-24-38 N = 43 (CLS)

45 50 55 60 65

TETRA TECH

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE: 4.8

Hole No. TTDHCB-11

PROJECT: Lockheed Martin MRC

INSTALLATION:

SHEET 4 OF 4 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			SANDY CLAY (CLS) with a thin layer of clayey sand @ 48', 20<N<56, very stiff to hard, brownish red to reddish brown *(continued)*	100	SS-20 68.0 70.0	BLOWCOUNT 11-17-22-26 N = 39 (CLS)
-65.2	70.0		END OF BORING			

70
75
80
85
90

TETRA TECH

Hole No. TTDHCB-12

DRILLING LOG	CLIENT	PROJECT NUMBER	SHEET / OF
	Lockheed Martin Corporation	194-8711	1 OF 2 SHEETS

1. PROJECT	Lockheed Martin MRC
2. LOCATION (Coordinates or Station)	Middle River, MD N 604,266.6051 E 1,473,373.4247
3. DRILLING AGENCY	UniTech
4. HOLE NO. *(As shown on drawing title and file number)*	TTDHCB-12
5. NAME OF DRILLER	D. Evans
6. DIRECTION OF HOLE	☒ VERTICAL ☐ INCLINED --- DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	
8. DEPTH DRILLED INTO ROCK	
9. TOTAL DEPTH OF HOLE	40.0
10. DRILLING METHOD	HSA/Mud Rotary
11. DATUM FOR ELEVATION SHOWN *(TBM or MSL)*	MSL
12. MANUFACTURER'S DESIGNATION OF DRILL	
13. TOTAL NO. OF SOIL SAMPLES TAKEN	DISTURBED 16 / UNDISTURBED 1
14. TOTAL NUMBER CORE BOXES	
15. ELEVATION GROUND WATER	-2.8
16. DATE HOLE	STARTED 10/7/2015 / COMPLETED 10/7/2015
17. ELEVATION TOP OF HOLE	+5.2
18. TOTAL CORE RECOVERY FOR BORING	%
19. GEOLOGIST	K. Tu

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
+5.2	0.0		PROBABLE FILL, predominantly CLAYEY SAND (SC) with occasional clay and trace of organics, moist, 4<N<10, loose to medium dense and stiff, varying colors in grayish brown to reddish brown			
				0	SS-1 0.5 2.5	BLOWCOUNT x-3-4-2 N = 7 6" concrete slab No recovery
				75	SS-2 2.0 4.0	BLOWCOUNT 2-2-2-3 N = 4 (SC)
				100	SS-3 4.0 6.0	BLOWCOUNT 3-3-3-3 N = 6 (SC-SM)
				100	SS-4 6.0 8.0	BLOWCOUNT 3-4-6-8 N = 10 (CLS)
-2.8	8.0		SANDY CLAY (CLS), 6<N<11, medium stiff to stiff, brown to reddish brown and brownish red	63	SS-5 8.0 10.0	BLOWCOUNT 3-4-3-4 N = 7 (CLS)
				50	SS-6 10.0 12.0	BLOWCOUNT WH-1-5-7 N = 6 (CLS)
				75	SS-7 12.0 14.0	BLOWCOUNT 6-5-4-5 N = 9 (CLS)
				100	SS-8 14.0 16.0	BLOWCOUNT 6-5-4-8 N = 9 (CLS)
				100	SS-9 16.0 18.0	BLOWCOUNT 3-4-4-4 N = 8 (CLS)
				100	SS-10 18.0 20.0	BLOWCOUNT 5-5-6-6 N = 11 (CL)

TETRA TECH

DRILLING LOG (Cont Sheet)

ELEVATION TOP OF HOLE: 5.2

Hole No. TTDHCB-12

PROJECT: Lockheed Martin MRC

INSTALLATION:

SHEET 2 OF 2 SHEETS

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV-ERY e	BOX OR SAMPLE NO. f	REMARKS *(Drilling time, water loss, depth weathering, etc., if significant)* g
			SANDY CLAY (CLS), 6<N<11, medium stiff to stiff, brown to reddish brown and brownish red *(continued)*			
				100	SS-11a SS-11b 23.0 25.0	BLOWCOUNT 3-4-4-4 N = 8 (CLS)
				100	SS-12 28.0 30.0	BLOWCOUNT 2-3-4-5 N = 7 (CLS)
-27.8	33.0					
			LEAN CLAY (CL), 11<N<22, stiff to very stiff, brownish red	75	SS-13 33.0 35.0	BLOWCOUNT 2-4-7-9 N = 11 (CL)
				4	ST-1 35.0 37.0	Shelby tube PP = 3.0 tsf 24" recovery (CL)
				92	SS-14 36.0 38.0	BLOWCOUNT 9-11-11-17 N = 22 (CL)
				100	SS-15 38.0 40.0	BLOWCOUNT 6-8-14-15 N = 22 (CL)
-34.8	40.0					

APPENDIX D—LABORATORY TEST RESULTS

SUMMARY OF LABORATORY TEST RESULTS - MARINE BORINGS

Marine Boring	Sample	Depth of Sample Interval (ft)	Description	Water Content (%)	Su [PP] * (lb/ft²)	Organic Content (%)	Atterberg Limits			UU Triaxial Compression							CU Triaxial Compression											Corrosivity					Particle-Size Distribution											Particle Size				
							Liquid Limit	Plastic Limit	Plasticity Index	L (cm)	D (cm)	w_c (%)	γ_t (lb/ft³)	σ_c (lb/ft²)	Su [UU] (lb/ft²)	ε_f (%)	-200 (%)	L (cm)	D (cm)	w_c (%)	γ_t (lb/ft³)	σ_c (lb/ft²)	c' (lb/ft²)	φ' (degrees)	c (lb/ft²)	φ (degrees)	ε_f (%)	pH	Conductivity (µmhos/cm)	Chloride Cl (mg/l)	Sulfate SO_4 (mg/l)	Resistivity (ohm-cm)	Dry Mass (grams)	Fraction Finer by Dry Mass (%)										Fraction by Dry Mass (%)				
																																		3/4-inch	3/8-inch	No. 4	No.10	No. 20	No. 40	No. 60	No. 100	No. 140	No. 200	Gravel	Coarse Sand	Medium Sand	Fine Sand	Clay & Silt
TTDHC-1	2A & 2B	7 - 8.5	Brown sandy lean clay [CL]	33.1			34.0	15.0	19.0																							81.5	100.0	100.0	100.0	99.0	98.0	89.4	72.7	67.3	64.3	61.0	0.0	1.0	9.6	28.4	61.0
	3	9 - 11	Light brown to orange sand with silt [SP-SM]	19.1																												164.4	100.0	100.0	100.0	97.3	97.3	59.3	18.6	10.8	8.5	6.9	0.0	2.7	38.0	52.4	6.9
	5A	13 - 15	Light brown silty sand [SM]	18.6																												177.2	100.0	97.5	97.5	95.6	91.6	49.3	20.3	17.3	16.4	15.6	2.5	1.9	46.3	33.7	15.6
	5B		Brown sandy fat clay [CH]	21.1			53.0	22.0	31.0																																						
	8	19 - 21	Orangish-brown sandy lean clay [CL]	15.1			32.0	15.0	17.0																																						
	10	23 - 25	Light brown to orange clayey sand [SC]	18.2																												175.3	100.0	100.0	100.0	100.0	100.0	99.8	95.6	70.5	50.4	37.2	0.0	0.0	0.2	62.6	37.2
	13	38 - 40	Orangish-brown lean clay [CL]	14.5			36.0	20.0	16.0																																						
TTDHC-2	3	9 - 11	Brown silty sand [SM]	21.2			Non-plastic																									96.7	100.0	100.0	100.0	100.0	100.0	99.9	99.6	87.2	44.4	30.5	26.7	0.0	0.0	0.4	72.9	26.7
	6A	15 - 17	Dark brown clayey sand [SC]	21.2																												179.4	100.0	100.0	100.0	100.0	100.0	98.7	81.6	56.2	41.4	33.8	0.0	0.0	1.3	64.9	33.8
TTDHC-3	2	7 - 9	Dark brown lean clay [CL]	24.1			35.0	20.0	15.0																																						
	3	10.5 - 12.5	Dark brown to dark gray lean clay [CL]	23.1			34.0	20.0	14.0																																						
	ST-1	9 - 10.5	Brown lean clay [CL]	29.3 21.6	---- 3,400													7.1	3.6	22.9	128.2	800.0					14.7	4.9	704.0	60.0	42.0	880.0																
																		7.1	3.6	24.8	125.6	1,598.0	286.0	24.6	983.0	13.7	14.9																						
																		7.1	3.6	24.7	125.1	2,991.0					15.1																						
	12	34.5 - 36.5	Dark brown silty sand [SM]	23.3																												164.6	100.0	100.0	100.0	100.0	100.0	100.0	99.8	80.3	51.4	30.4	0.0	0.0	0.0	69.6	30.4
TTDHC-4	ST-1	7 - 8.5	Reddish-brown lean clay with sand [CL]	31.8 19.0 16.6	----- 4,500 4,500 2,700					7.1	3.6	20.9	131.2	800.0	1,112.0	14.8	76.7																																
				16.6						7.1	3.6	18.4	136.3	1,600.0	3,866.0	5.8	75.1																																
				16.6						7.1	3.6	15.6	138.4	3,000.0	3,500.0	14.8	71.4																																
	7	18.5 - 20.5	Dark brown to light brown lean clay [CL]	21.6			49.0	22.0	27.0																																						
	9	22.5 - 24.5	Dark brown sandy silt	19.7																												182.6	100.0	100.0	100.0	100.0	100.0	99.9	97.1	79.6	64.1	51.8	0.0	0.0	0.1	48.1	51.8
	13	39.5' - 41.5'	Dark reddish-brown lean clay [CL]	17.6			36.0	18.0	18.0																																						
TTDHC-5	6	15 -17	Dark brown sandy silt	19.4																												177.6	100.0	100.0	100.0	100.0	100.0	99.9	99.8	96.2	80.5	60.8	0.0	0.0	0.1	39.1	60.8
TTDHC-6	3	9 - 11	Reddish-brown to yellowish-brown lean clay [CL]	21.2			43.0	17.0	26.0									7.1	3.6	18.1	132.3	1,004.0																										
	ST-1	13 - 15	Reddish-brown sandy lean clay to lean clay [CL] in upper 45.5 cm over brown clayey sand [SC] in lower 7.5 cm	19.3 15.7 17.5 15.3 15.4 18.2	1,650 4,500 4,500 4,400 4,000 3,600													7.1	3.6	15.1	138.2	1,516.0	286.7	24.0	4,098.0	0.0	14.8																						
																		7.1	3.6	17.0	136.1	3,053.0																										
	6	17 - 19	Reddish-brown to yellowish-brown lean clay [CL]	38.5			36.0	17.0	19.0																																						
	12	38 - 40	Reddish-brown sandy clay	21.1																												160.3	100.0	100.0	100.0	100.0	100.0	100.0	99.7	91.0	72.4	51.4	0.0	0.0	0.0	48.6	51.4
TTDHC-7	2	6 - 8	Dark brown sand with silt, wood and and trace organics [SP-SM]	40.0 42.4		--- 8.5																										133.7	100.0	98.2	97.1	95.5	91.6	72.9	34.0	15.9	17.1	9.8	2.9	1.6	22.6	63.1	9.8
	4	13 - 15	Dark brown lean clay [CL]	26.4			42.0	20.0	22.0																																						
	5	15 - 17	Reddish-brown silty sand [SM]	21.3																												184.4	100.0	100.0	100.0	100.0	100.0	99.7	87.1	50.4	37.3	29.5	0.0	0.0	0.3	70.2	29.5
	9	23 - 25'	Dark brown to light gray lean clay[CL]	21.7			42.0	19.0	23.0																																						
	ST-2	30 - 32	Reddish-brown lean clay [CL]	16.0 20.1	3,750 2,200					7.1 7.1	3.5 3.6	22.2 21.1	131.7 133.1	1,800.0 4,000.0	1,196.0 3,283.0	6.6 7.8	96.8 96.6																																

SUMMARY OF LABORATORY TEST RESULTS - LAND BORINGS

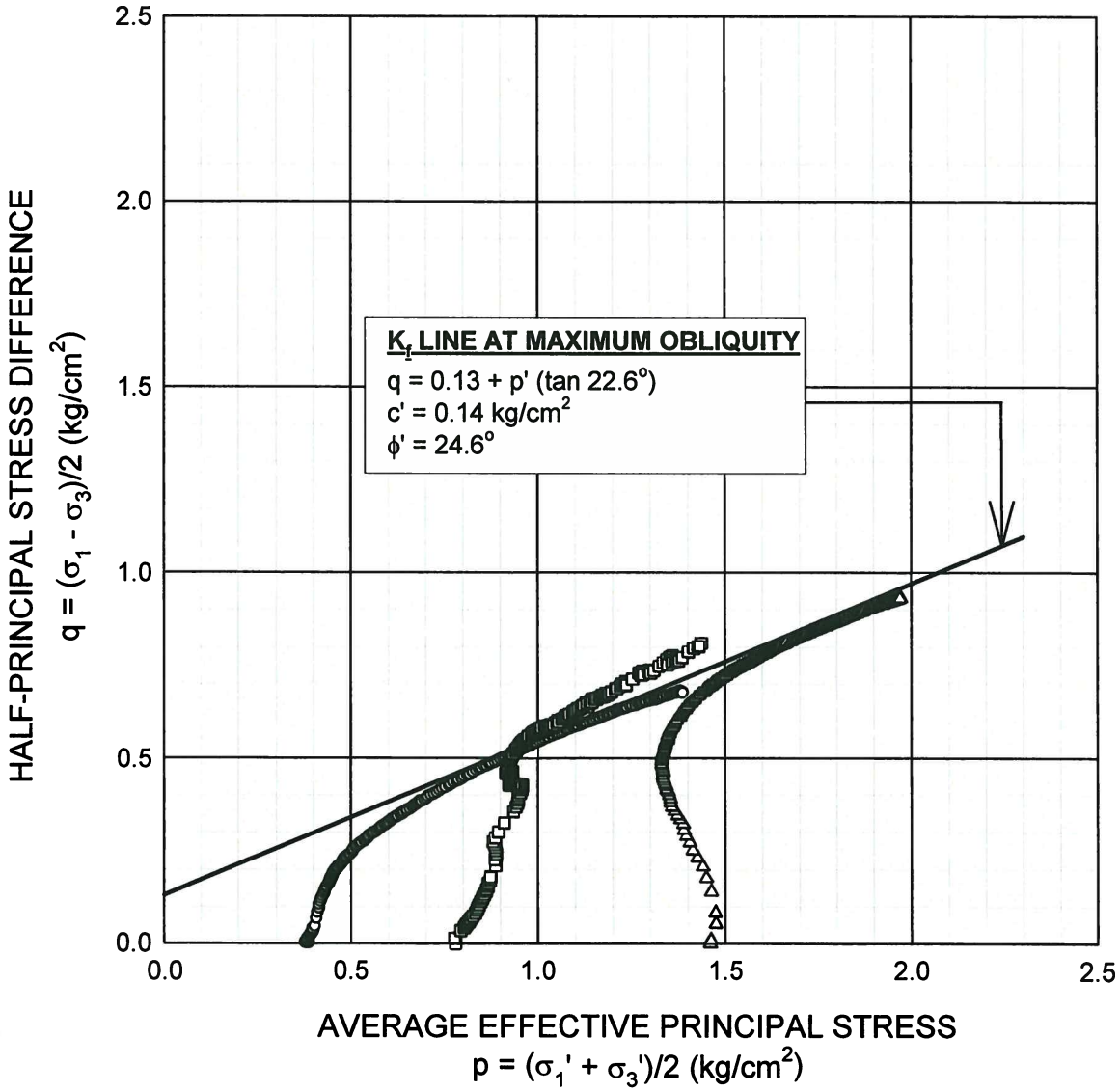
Land Boring	Sample	Depth of Sample Interval (ft)	Description	Water Content (%)	Su [PP] (lb/ft²)	Organic Content (%)	Atterberg Limits			UU Triaxial Compression								CU Triaxial Compression										Particle-Size Distribution										Particle Size				
																												Fraction Finer by Dry Mass (%)										Fraction by Dry Mass (%)				
							Liquid Limit	Plastic Limit	Plasticity Index	L (cm)	D (cm)	w_c (%)	γ_t (lb/ft³)	σ_c (lb/ft²)	Su [UU] (lb/ft²)	ε_f (%)	-200 (%)	L (cm)	D (cm)	w_c (%)	γ_t (lb/ft³)	σ_c (lb/ft²)	c' (lb/ft²)	ϕ' (degrees)	c (lb/ft²)	ϕ (degrees)	ε_f (%)	Dry Mass (grams)	3/4-inch	3/8-inch	No. 4	No.10	No. 20	No. 40	No. 60	No. 100	No. 140	No. 200	Gravel	Coarse Sand	Medium Sand	Fine Sand	Clay & Silt
TTDHCB-1	6	10 - 12	Gray and brown clayey sand [SC]	15.7			33	14	19																															
	10	18 - 20	Tan and gray clayey sand [SC]	14.4																								163.48	100	100	100	99.9	97.1	77.2	42.8	32.8	30.5	29.0	0.0	0.1	22.7	48.2	29.0
TTDHCB-2	2	2 - 4	Reddish-brown sandy clay	19.4																								125.33	100	97.7	95.5	93.8	91.9	89.1	82.8	70.1	63.5	58.2	4.5	1.7	4.7	30.9	58.2
	ST-1	8 - 9.5	Reddish-brown sandy lean clay to lean clay [CL]	21.3 27.6 27.5 30.9	---- 250 250 ----		32	13	19	6.66 6.92 7.06	3.73 3.56 3.54	20.4 16.1 26.2	128.4 133.5 127.3	700 1,400 2,500	188 295 397	13.8 14.6 13.8	72.7 71.4 93.5																										
	ST-2	11.5 - 13	Reddish-brown clayey sand [SC] to sandy lean clay [CL]	24.6 27.1 22.8 21.7	---- 500 250 400																																		
	8A & 8B	17 - 19	Reddish-brown silty sand [SM]	20.4																								154.67	100	100	100	99.6	99.2	76.6	23.8	17.5	15.5	14.5	0.0	0.4	23.0	62.1	14.5
	11	28 - 30	Brown clayey sand [SC]	24.1																								95.34	100	100	100	100	100	99.8	84.6	40.5	27.9	22.2	0.0	0.0	0.2	77.6	22.2
	12A	33 - 35	Brown clayey sand [SC]	24.4			25	12	13																															
TTDHCB-3	ST-2	12 - 14	Dark gray sandy lean clay to lean clay [CL]	62.9 59.8 50.1 21.0	250 250 250 1,000					7.05 7.08 7.08	3.57 3.56 3.54	64.3 61.0 43.0	101.4 103.8 110.9	1,000 2,000 3,000	508 441 414	7.1 7.8 8.6	85.6 75.8 67.8																										
	7	16 - 18	Brown clay with sand [CL]	29.3			40	18	22																															
	8	18 - 20	Dark brown and brown silty sand [SM]	19.6																								154.82	100	100	100	99.8	98.4	96	45.8	26.1	23.5	21.6	0.0	0.2	3.8	74.4	21.6
	9	23 - 25	Gray clayey sand [SC]	16.9																								135.33	100	100	100	100	100	99.3	81.6	47.3	35.4	30.2	0.0	0.0	0.7	69.1	30.2
	14	48 - 50	Brown clayey sand [SC]	17.4																								133.04	100	100	100	99.5	98.1	93.5	74.4	57.6	52.3	49.9	0.0	0.5	6.0	43.6	49.9
	16	58- 60	Brown sand with silt [SP-SM]	23.6																								127.82	100	100	100	100	100	97.5	47.8	14.9	12.5	11.1	0.0	0.0	2.5	86.4	11.1
	18	68 - 70	Brown to gray fat clay with sand [CH]	19.2			51	21	30																															
TTDHCB-4	3	4 - 6	Reddish-brown clayey sand with gravel [SC]	14.5 15.1		--- 1.9																						113.37	100	89.4	83.3	79.3	74.0	68.8	60.1	46.7	39.8	35.6	16.7	4.0	10.5	33.2	35.6
	5	8 - 10	Brown and gray silty sand with trace organics [SM]	14.7 15.5		--- 1.3	Non-plastic																					133.28	100	100	100	98.4	96.0	81.0	53.8	41.3	37.4	34.7	0.0	1.6	17.4	46.3	34.7
	6	10 - 12	Reddish-brown clayey sand with gravel [SC]	14.7			46	18	28																															
	10	23 - 25	Brown silty sand [SM]	20.5			Non-plastic																					103.93	100	100	100	100	100	99.9	91.6	39.4	30.3	27.6	0.0	0.0	0.1	72.3	27.6
	11	28 - 30	Brown clayey sand [SC]	20.6																								182.38	100	100	100	100	100	95.2	53.3	36.0	32.8	30.9	0.0	0.0	4.8	64.3	30.9
	15	48 - 50	Reddish-bown and tan sandy clay [CL]	14.2			32	14	18																															
	18	63 - 65	Brown silty sand [SM]	22.1																								193.80	100	99.3	98.6	97.6	96.4	92.0	61.4	22.5	18.5	16.3	1.4	1.0	5.6	75.7	16.3
TTDHCB-5	8	14 - 16	Brown lean clay [CL]	23.3			40	19	21																															
TTDHCB-6	3	4 - 6	Gray and brown clayey sand [SC]	20.5																								248.19	100	99.7	98.4	96.8	87.4	71.7	58.0	51.5	45.6	45.1	1.6	1.6	25.1	26.6	45.1
	ST-1	18 - 20	Reddish-brown lean clay with sand [CL] in upper 27.8 cm of sample and clayey sand [SC] within lower 8.7 cm of sample	22.4 23.3 20.2 16.7	---- 4,500 4,500 3,750		28	17	11																			161.74 270.81	100 100	100 100	100 100	100 99.9	100 99.9	100 92.6	99.8 71.0	97.8 61.7	90.0 49.0	74.7 39.9	0.0 0.0	0.0 0.1	0.0 7.3	25.3 52.7	74.7 39.9
	11	23 - 25	Brown and tan sandy lean clay [CL]	16.4			37	14	23																															
TTDHCB-7	5	8 - 10	Dark gray sand with silt [SM]	31.1																								130.97	100	100	97.7	94.5	87.6	64.3	34.3	17.0	11.6	9.0	2.3	3.2	30.2	55.3	9.0
	6	10 - 12	Gray sand with clay and organics [SP-SC]	32.9																								191.45	100	99.2	98.6	96.4	91.9	72.2	35.7	16.6	11.7	9.4	1.4	2.2	24.2	62.8	9.4
	18	53 - 55	Brown lean clay [CL]	16.2			40	22	18																															
TTDHCB-8	4	6 - 8	Gray sandy clay with organics	50.9																								144.68	100	100	100	98.6	97.1	89.4	75.9	65.7	60.9	55.1	0.0	1.4	9.2	34.3	55.1
	9	18 - 20	Brown lean clay [CL]	16.3			41	18	23																															
TTDHCB-9	10	19 - 21	Brown clayey sand [SC]	19.9																								239.25	100	100	100	100	100	99.4	81.5	53.7	44.7	38.8	0.0	0.0	0.6	60.6	38.8
	ST-1	12 - 13.5	Reddish-brown lean clay [CL]	32.0 17.5 20.7 21.4	---- 2,250 1,800 2,000		40	22	18	7.07 7.08 7.07	3.58 3.57 3.57	23.2 16.6 17.3	127 135 134	1004 1516 3053	266	33.3	5400	0																						
	12	28 - 30	Brown and tan lean clay CL]	19.9			47	19	28																															
TTDHCB-10	5	8 - 10	Gray clayey sand with organics [SC]	45.8																								173.55	100	100	100	97.9	94.9	87.9	75.9	59.9	46.8	32.2	0.0	2.1	10.0	55.7	32.2
	10	20 - 22	Brown fat clay [CH]	25.1			52	21	31																															
TTDHCB-11	11	23 - 25	Brown clayey sand [SC]	20.2																								233.29	100	100	100	100	100	99.8	89.9	52.0	39.5	34.2	0.0	0.0	0.2	65.6	34.2
	14	38 - 40	Brown lean clay [CL]	18.7			48	19	29																															
TTDHCB-12	6	10 - 12	Brown lean clay with sand clay [CL]	21.9			39	20	19																															
	9	16 - 18	Brown sandy clay	21.6																								203.32	100	100	100	100	96.9	96.2	95.0	86.5	69.8	50.9	0.0	0.0	3.8	45.3	50.9
	ST-1	35 - 37	Reddish-brown lean clay [CL]	27.8 21.6	---- 1,650		39	18	21																			163.87	100	100	100	100	99.9	99.4	98.4	97.6	97.2	96.3	0.0	0.0	0.6	3.1	96.3

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
EFFECTIVE STRESS PATHS

CLIENT: LOCKHEED MARTIN
PROJECT: MRC LABORATORY TESTING
FILE NO.: 15-13-0120

DATE SAMPLE RECEIVED: 10/19/15
DATE TEST SET-UP: 10/31/15
DATE REPORTED: 11/24/15

INCOMING SAMPLE NO.: ------
BORING: **TTDHC-3** SAMPLE: **ST-1**
DEPTH: 9 - 11 ☒ ft; ☐ m
LABORATORY IDENTIFICATION NO.: 150120/HC3
SAMPLE DESCRIPTION: Brown lean clay



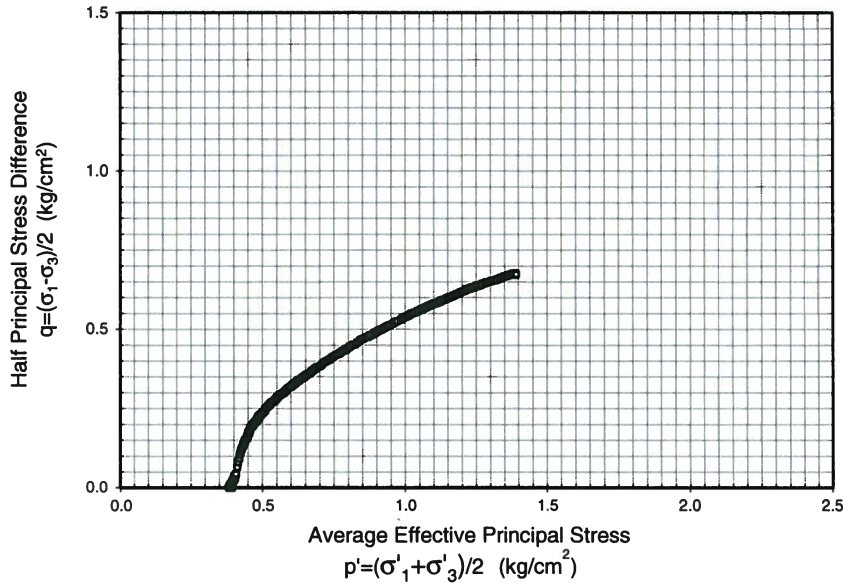
Checked By: TM Date: 11/24/15

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION (CIUC) TEST REPORT

CLIENT: LOCKHEED MARTIN
PROJECT: MRC LABORATORY TESTING
FILE NO.: 15-13-0120
DATE SAMPLE RECEIVED: 10/19/15
DATE TEST SET-UP: 10/31/15
DATE REPORTED: 11/19/15

INCOMING SAMPLE NO.: ----
BORING: **TTDHC-3** SAMPLE: **ST-1**
DEPTH: 9 - 11 ☒ ft; ☐ m
LABORATORY IDENTIFICATION NO.: 150120/HC3/ST1B3
SAMPLE DESCRIPTION: Brown clay

Specimen Dimensions			Initial Conditions			Test Conditions				Pre-shear Conditions					
H (cm)	D (cm)	H/D	w_c (%)	γ_d (lb/ft^3)	S (%)	u_b (kg/cm^2)	σ_c' (kg/cm^2)	$\dot{\varepsilon}$ (%/hour)	B-Factor (%)	ε_{vol} (%)	H_c (cm)	A_c (cm^2)	w_c (%)	γ_d (lb/ft^3)	S (%)
7.11	3.55	2.0	22.9	104.3	100	12.0	0.39	1.0	98	1.3	7.08	10.09	23.6	103.0	100



TEST PROCEDURE: ASTM D4767

Specimen Mounting Method : ☐ Dry Method ☒ Wet Method

Filter Strip Correction Made : ☐ Yes ☒ No
Membrane Correction Made : ☐ Yes ☒ No

A_c Method: ☒ Method A ☐ Method B

w_c determined from: ☒ Entire Specimen ☐ Trimmings

SAMPLE TYPE

Type	Diameter (inch)
☒ Undisturbed	3
☐ Compacted	

☐ Tamped Uniform Lifts: No. of Lifts: _____

☐ Kneading: Blows per Lift: _____
No. of Lifts_____Spring:_____lb

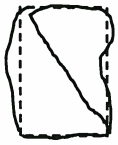
G_s: 2.70 ☒ Assumed ☐ Measured

Stresses and Strains at Failure

Failure Criteria	ε_a (%)	Δu (kg/cm^2)	σ_1' (kg/cm^2)	σ_3' (kg/cm^2)	p' (kg/cm^2)	q (kg/cm^2)
$[\sigma_1 - \sigma_3]_{max}$	14.7	-0.32	2.06	0.71	1.38	0.68
$[\sigma_1' / \sigma_3']_{max}$	3.72	0.08	1.10	0.32	0.71	0.40

FAILURE SKETCH

☒ Diagonal Plane
☐ Bulging
☐ Combination
☐ Other _____



Particle-Size Analysis		U.S. Standard Sieve Size	Gravel			Coarse Sand	Medium Sand		Fine Sand			
☐ ASTM D422 ☒ ASTM D1140-Method B			3/4"	3/8"	No. 4	No. 10	No. 20	No. 40	No. 60	No. 100	No. 140	No. 200
Dry Mass (g)	117.90	Soil Passing (%, dry mass basis)	---	---	---	---	---	---	---	---	---	99.6

Where: H = Specimen height; D = Specimen diameter; w_c = Water content (ASTM D2216); γ_d = Dry density; S = Saturation; σ_c' = Isotropic effective confining stress; $\dot{\varepsilon}$ = Vertical displacement rate; ε_{vol} = Volume change(- denotes consolidation, + denotes swelling); H_c = Consolidated height; A_c = Consolidated area; ε_a = Axial strain; Δu = Excess pore pressure; σ_1' = Major effective principal stress; σ_3'= Minor effective principal stress; p' = Average effective principal stress; q = Half principal stress difference; and G_s = Specific gravity.

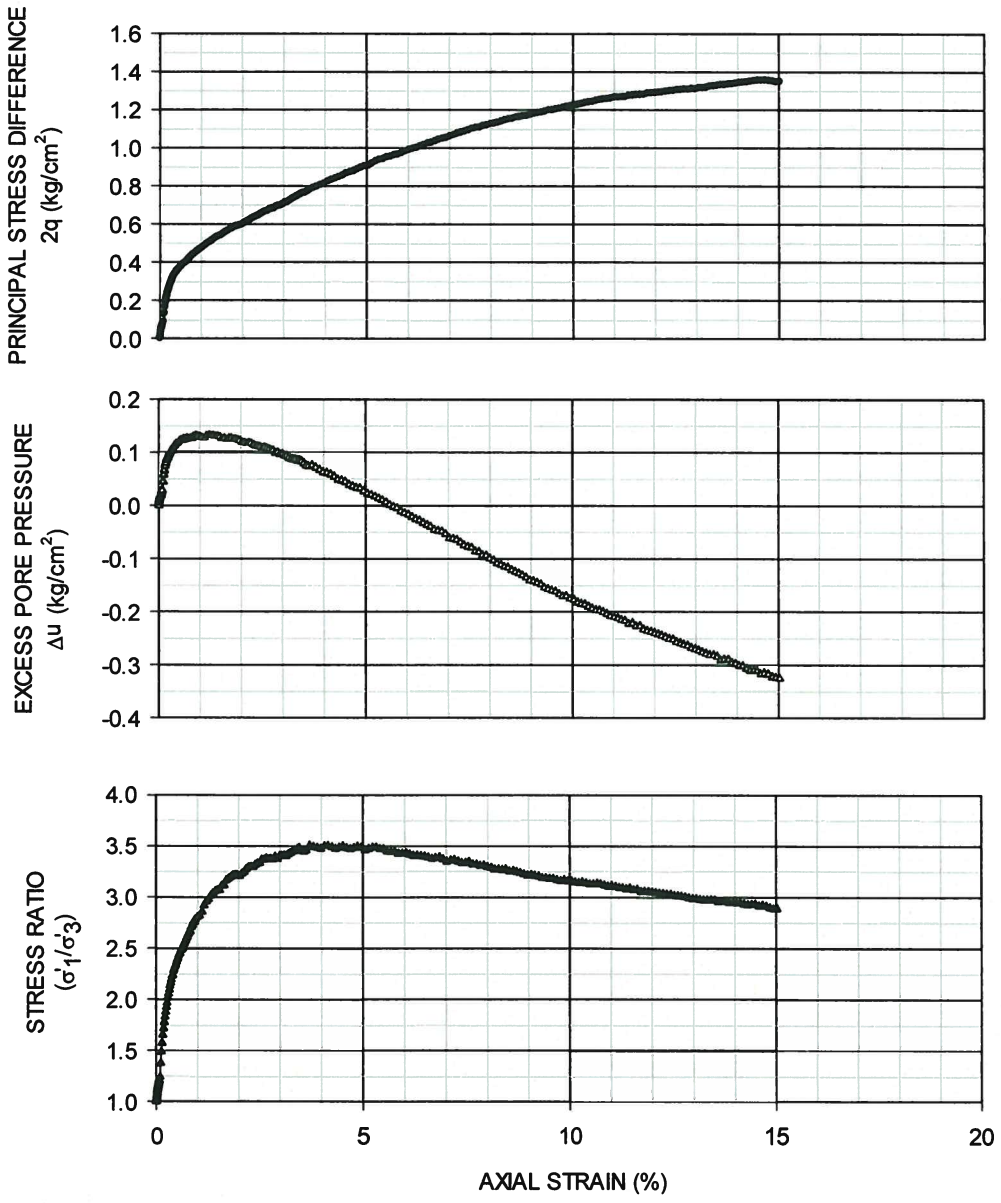
Checked By: TM Date: 11/19/15

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
STRESS - STRAIN CURVES

CLIENT: LOCKHEED MARTIN
PROJECT: MRC LABORATORY TESTING
FILE NO.: 15-13-0120

DATE SAMPLE RECEIVED: 10/19/15
DATE TEST SET-UP: 10/31/15
DATE REPORTED: 11/19/15

INCOMING SAMPLE NO.: ----
BORING TTDHC-3 SAMPLE: ST-1
DEPTH: 9 - 11 ☒ ft; ☐ m
LABORATORY IDENTIFICATION NO.: 150120/HC3/ST1B3
SAMPLE DESCRIPTION: Brown clay
Effective Isotropic Consolidation Stress = 0.39 kg/cm²



The test data and all associated project information presented hereon shall be held in confidence and disclosed to other parties only with the authorization of the Client. Physical and electronic records of each project are kept for a minimum of 7 years. Test samples are kept in storage for at least 10 working days after mailing the test report, prior to being discarded, unless a longer storage period is requested in writing & accepted by Ardaman & Associates, Inc.

Where: Δu = Excess pore pressure; σ_1' = Major effective principal stress; and σ_3'= Minor effective principal stress.

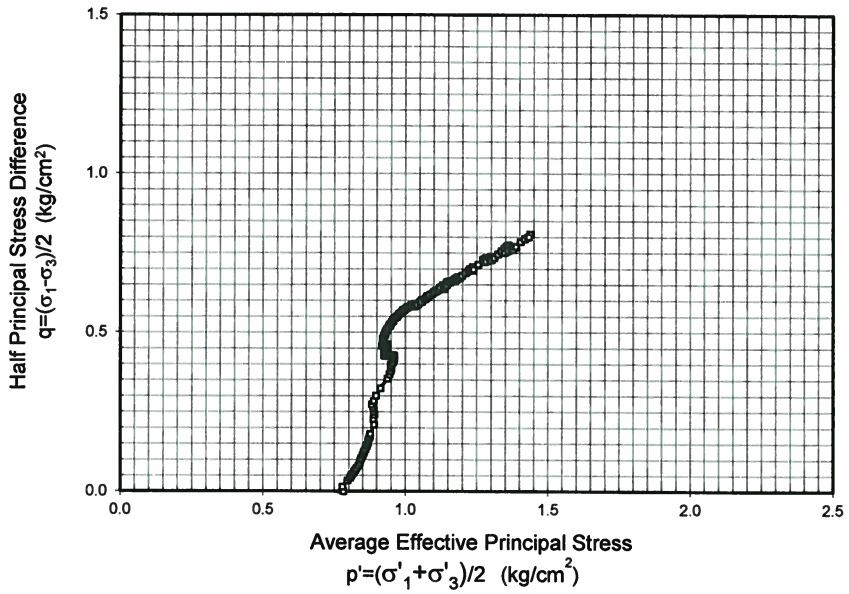
Checked By: TM Date: 11/19/15

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION (CIUC) TEST REPORT

CLIENT: LOCKHEED MARTIN
PROJECT: MRC LABORATORY TESTING
FILE NO.: 15-13-0120
DATE SAMPLE RECEIVED: 10/19/15
DATE TEST SET-UP: 10/31/15
DATE REPORTED: 11/19/15

INCOMING SAMPLE NO.: ----
BORING: **TTDHC-3** SAMPLE: **ST-1**
DEPTH: 9 - 11 ☒ ft; ☐ m
LABORATORY IDENTIFICATION NO.: 150120/HC3/ST1B2
SAMPLE DESCRIPTION: Brown clay

Specimen Dimensions			Initial Conditions			Test Conditions				Pre-shear Conditions					
H (cm)	D (cm)	H/D	w_c (%)	γ_d (lb/ft^3)	S (%)	u_b (kg/cm^2)	σ_{vc}' (kg/cm^2)	$\dot{\varepsilon}$ (%/hour)	B-Factor (%)	ε_{vol} (%)	H_c (cm)	A_c (cm^2)	w_c (%)	γ_d (lb/ft^3)	S (%)
7.12	3.55	2.0	24.8	100.7	100	12.0	0.78	1.0	100	-1.8	7.04	9.83	23.8	102.5	100



TEST PROCEDURE: ASTM D4767

Specimen Mounting Method : ☐ Dry Method ☒ Wet Method

Filter Strip Correction Made : ☐ Yes ☒ No
Membrane Correction Made : ☐ Yes ☒ No

A_c Method: ☒ Method A ☐ Method B

w_c determined from: ☒ Entire Specimen ☐ Trimmings

SAMPLE TYPE

Type	Diameter (inch)
☒ Undisturbed	3
☐ Compacted	

☐ Tamped Uniform Lifts: No. of Lifts:_____

☐ Kneading: Blows per Lift: _____
No. of Lifts_____Spring:_____lb

G_s: 2.70 ☒ Assumed ☐ Measured

Stresses and Strains at Failure

Failure Criteria	ε_a (%)	Δu (kg/cm^2)	σ_1' (kg/cm^2)	σ_3' (kg/cm^2)	p' (kg/cm^2)	q (kg/cm^2)
$[\sigma_1 - \sigma_3]_{max}$	14.9	0.15	2.25	0.63	1.44	0.81
$[\sigma_1' / \sigma_3']_{max}$	3.43	0.36	1.58	0.42	1.01	0.58

FAILURE SKETCH

☒ Diagonal Plane
☐ Bulging
☐ Combination
☐ Other _____

Particle-Size Analysis		U.S. Standard Sieve Size	Gravel			Coarse Sand	Medium Sand		Fine Sand			
☐ ASTM D422 ☒ ASTM D1140-Method B			3/4"	3/8"	No. 4	No. 10	No. 20	No. 40	No. 60	No. 100	No. 140	No. 200
Dry Mass (g)	133.69	Soil Passing (%, dry mass basis)	---	---	---	---	---	---	---	---	---	100

The test data and all associated project information presented hereon shall be held in confidence and disclosed to other parties only with the authorization of the Client. Physical and electronic records of each project are kept for a minimum of 7 years. Test samples are kept in storage for at least 10 working days after mailing the test report, prior to being discarded, unless a longer storage period is requested in writing & accepted by Ardaman & Associates, Inc.

Where: H = Specimen height; D = Specimen diameter; w_c = Water content (ASTM D2216); γ_d = Dry density; S = Saturation; σ_c' = Isotropic effective confining stress; $\dot{\varepsilon}$ = Vertical displacement rate; ε_{vol} = Volume change(- denotes consolidation, + denotes swelling); H_c = Consolidated height; A_c = Consolidated area; ε_a = Axial strain; Δu = Excess pore pressure; σ_1' = Major effective principal stress; σ_3'= Minor effective principal stress; p' = Average effective principal stress; q = Half principal stress difference; and G_s = Specific gravity.

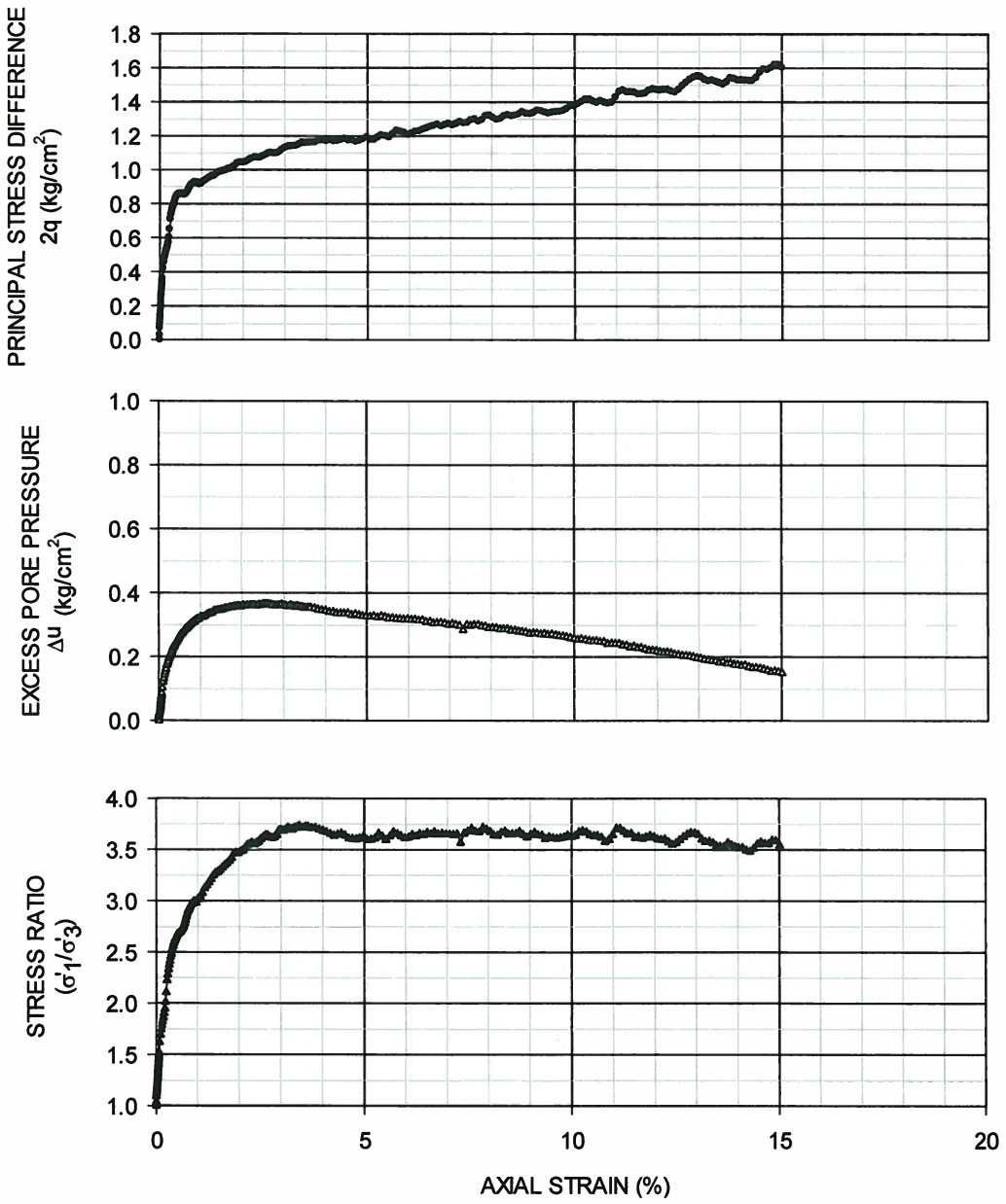
Checked By: TM Date: 11/19/15

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
STRESS - STRAIN CURVES

CLIENT: LOCKHEED MARTIN
PROJECT: MRC LABORATORY TESTING
FILE NO.: 15-13-0120

DATE SAMPLE RECEIVED: 10/19/15
DATE TEST SET-UP: 10/31/15
DATE REPORTED: 11/19/15

INCOMING SAMPLE NO.: ----
BORING: **TTDHC-3** SAMPLE: **ST-1**
DEPTH: 9 - 11 ☒ ft; ☐ m
LABORATORY IDENTIFICATION NO.: 150120/HC3/ST1B2
SAMPLE DESCRIPTION: Brown clay
Effective Isotropic Consolidation Stress = 0.78 kg/cm²



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Where: Δu = Excess pore pressure; σ_1' = Major effective principal stress; and σ_3'= Minor effective principal stress.

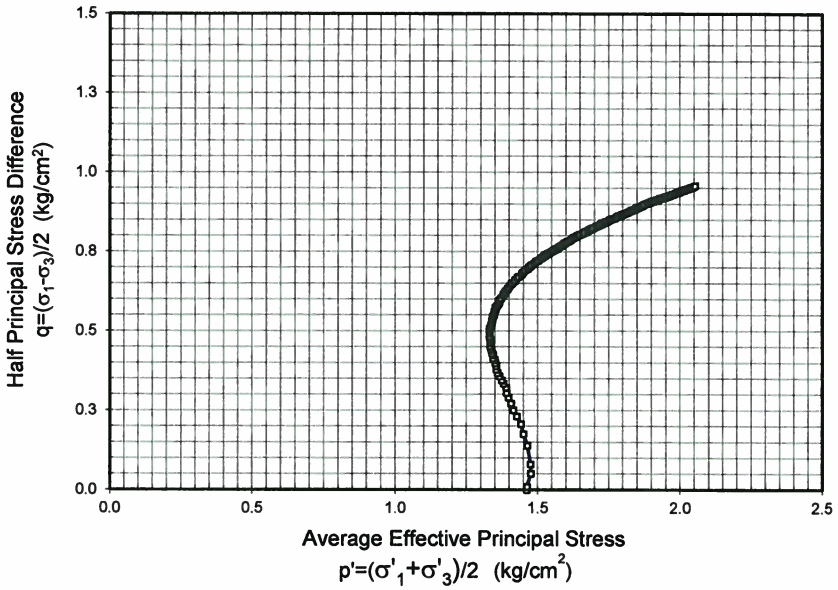
Checked By: TM Date: 11/19/15

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION (CIUC) TEST REPORT

CLIENT: LOCKHEED MARTIN
PROJECT: MRC LABORATORY TESTING
FILE NO.: 15-13-0120
DATE SAMPLE RECEIVED: 10/19/15
DATE TEST SET-UP: 10/31/15
DATE REPORTED: 11/19/15

INCOMING SAMPLE NO.: ----
BORING: TTDHC-3 SAMPLE: ST-1
DEPTH: 9 - 11 ☒ ft; ☐ m
LABORATORY IDENTIFICATION NO.: 150120/HC3/ST1B1
SAMPLE DESCRIPTION: Brown clay

Specimen Dimensions			Initial Conditions			Test Conditions				Pre-shear Conditions					
H (cm)	D (cm)	H/D	w_c (%)	γ_d (lb/ft^3)	S (%)	u_b (kg/cm^2)	σ_c' (kg/cm^2)	$\dot{\varepsilon}$ (%/hour)	B-Factor (%)	ε_{vol} (%)	H_c (cm)	A_c (cm^2)	w_c (%)	γ_d (lb/ft^3)	S (%)
7.05	3.55	2.0	24.7	100.3	98	12.0	1.46	1.0	97	-3.1	7.00	9.68	23.3	103.4	100



TEST PROCEDURE: ASTM D4767

Specimen Mounting Method : ☐ Dry Method ☒ Wet Method

Filter Strip Correction Made : ☐ Yes ☒ No
Membrane Correction Made : ☐ Yes ☒ No

A_c Method: ☒ Method A ☐ Method B

w_c determined from: ☒ Entire Specimen ☐ Trimmings

SAMPLE TYPE

Type	Diameter (inch)
☒ Undisturbed	3
☐ Compacted	

☐ Tamped Uniform Lifts: No. of Lifts:_____

☐ Kneading: Blows per Lift: _____ No. of Lifts_____ Spring:_____lb

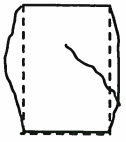
G_s: 2.70 ☒ Assumed ☐ Measured

Stresses and Strains at Failure

Failure Criteria	ε_a (%)	Δu (kg/cm^2)	σ_1' (kg/cm^2)	σ_3' (kg/cm^2)	p' (kg/cm^2)	q (kg/cm^2)
$[\sigma_1 - \sigma_3]_{max}$	15.1	0.37	3.01	1.09	2.05	0.96
$[\sigma_1' / \sigma_3']_{max}$	7.21	0.63	2.42	0.83	1.62	0.79

FAILURE SKETCH

☐ Diagonal Plane
☐ Bulging
☒ Combination
☐ Other _____



Particle-Size Analysis		U.S. Standard Sieve Size	Gravel			Coarse Sand	Medium Sand		Fine Sand			
☐ ASTM D422 ☒ ASTM D1140-Method B			3/4"	3/8"	No. 4	No. 10	No. 20	No. 40	No. 60	No. 100	No. 140	No. 200
Dry Mass (g)	112.33	Soil Passing (%, dry mass basis)	---	---	---	---	---	---	---	---	---	96.8

Where: H = Specimen height; D = Specimen diameter; w_c = Water content (ASTM D2216); γ_d = Dry density; S = Saturation; σ_c' = Isotropic effective confining stress; $\dot{\varepsilon}$ = Vertical displacement rate; ε_{vol} = Volume change(- denotes consolidation, + denotes swelling); H_c = Consolidated height; A_c = Consolidated area; ε_a = Axial strain; Δu = Excess pore pressure; σ_1' = Major effective principal stress; σ_3'= Minor effective principal stress; p' = Average effective principal stress; q = Half principal stress difference; and G_s = Specific gravity.

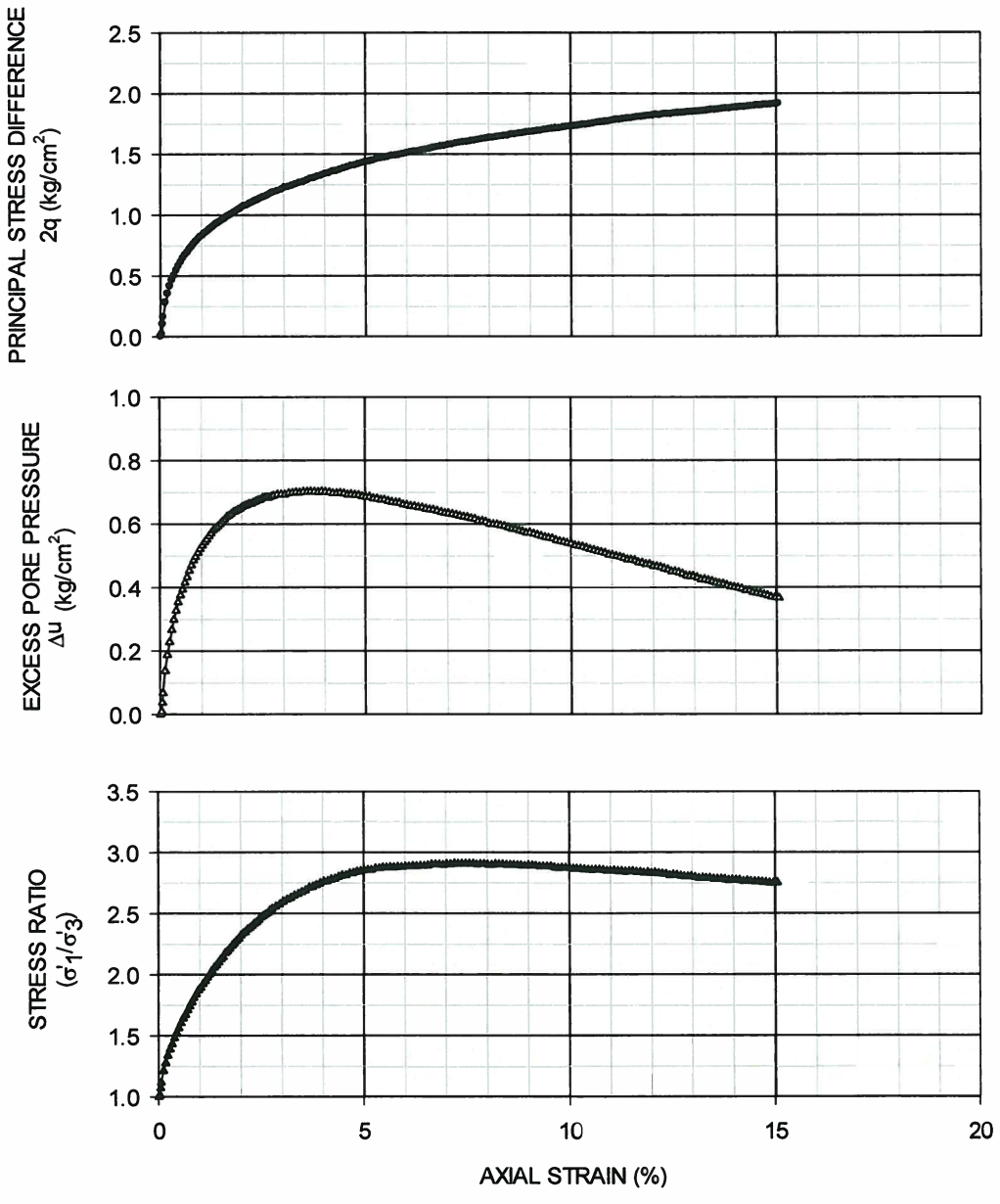
Checked By: TM Date: 11/19/15

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
STRESS - STRAIN CURVES

CLIENT: LOCKHEED MARTIN
PROJECT: MRC LABORATORY TESTING
FILE NO.: 15-13-0120

DATE SAMPLE RECEIVED: 10/19/15
DATE TEST SET-UP: 10/31/15
DATE REPORTED: 11/19/15

INCOMING SAMPLE NO.: ----
BORING: **TTDHC-3** SAMPLE: **ST-1**
DEPTH: 9 - 11 ☒ ft; ☐ m
LABORATORY IDENTIFICATION NO.: 150120/HC3/ST1B1
SAMPLE DESCRIPTION: Brown clay
Effective Isotropic Consolidation Stress = 1.46 kg/cm²



Where: Δu = Excess pore pressure; σ_1' = Major effective principal stress; and σ_3'= Minor effective principal stress.

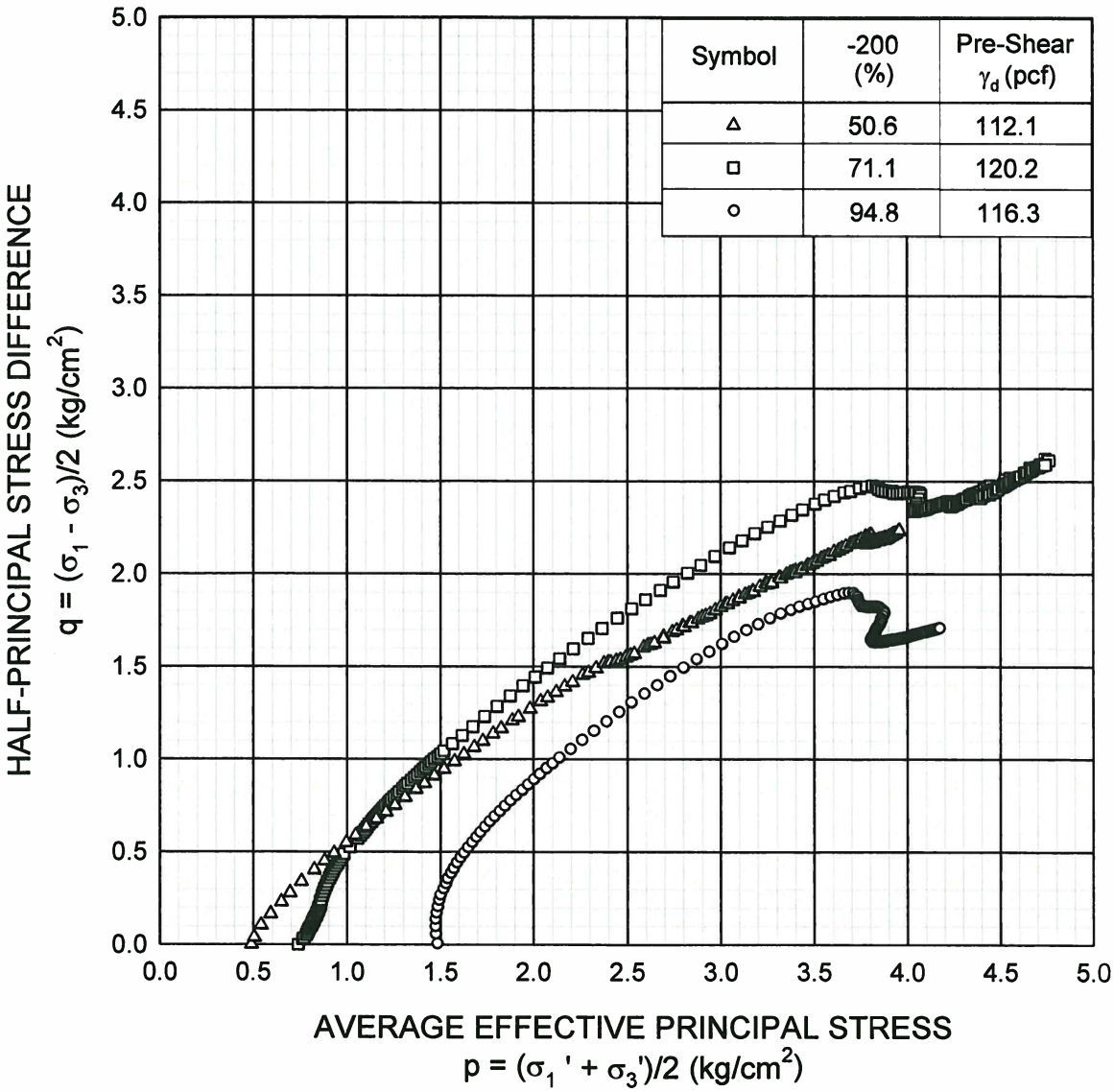
Checked By: TM Date: 11/19/15

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
EFFECTIVE STRESS PATHS

CLIENT: LOCKHEED MARTIN
PROJECT: MRC LABORATORY TESTING
FILE NO.: 15-13-0120

DATE SAMPLE RECEIVED: 10/19/15
DATE TEST SET-UP: 11/04/15
DATE REPORTED: 11/24/15

INCOMING SAMPLE NO.: ------
BORING: **TTDHC-6** SAMPLE: **ST-1**
DEPTH: 13 - 15 ☒ ft; ☐ m
LABORATORY IDENTIFICATION NO.: 150120/HC6
SAMPLE DESCRIPTION: Reddish-brown lean clay to sandy lean clay



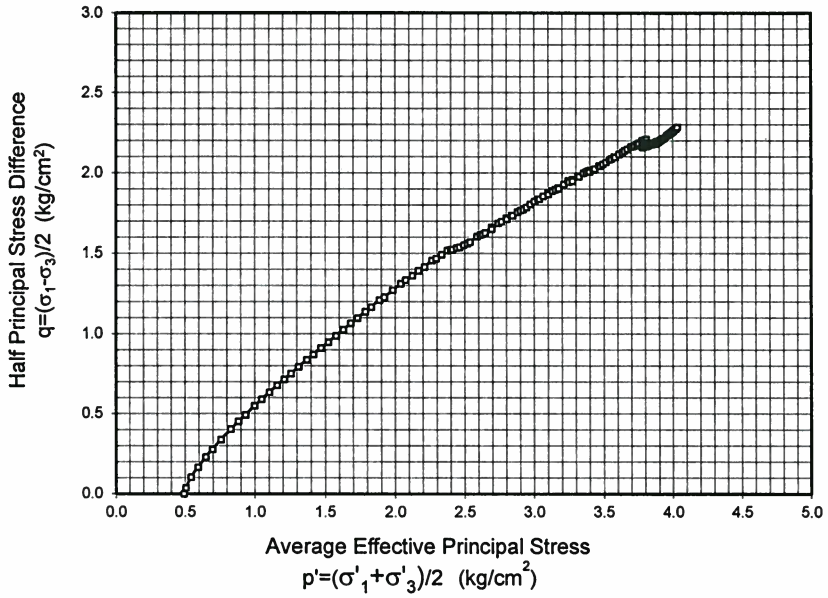
Checked By: JM Date: 11/24/15

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION (CIUC) TEST REPORT

CLIENT: LOCKHEED MARTIN
PROJECT: MRC LABORATORY TESTING
FILE NO.: 15-13-0120
DATE SAMPLE RECEIVED: 10/19/15
DATE TEST SET-UP: 11/04/15
DATE REPORTED: 11/23/15

INCOMING SAMPLE NO.: ----
BORING: **TTDHC-6** SAMPLE: ST-1
DEPTH: 13 - 15 ☒ ft; ☐ m
LABORATORY IDENTIFICATION NO.: 150120/HC6/ST1B1
SAMPLE DESCRIPTION: Reddish-brown sandy lean clay

Specimen Dimensions			Initial Conditions			Test Conditions				Pre-shear Conditions					
H (cm)	D (cm)	H/D	w_c (%)	γ_d (lb/ft^3)	S (%)	u_b (kg/cm^2)	σ_c' (kg/cm^2)	$\dot{\varepsilon}$ (%/hour)	B-Factor (%)	ε_{vol} (%)	H_c (cm)	A_c (cm^2)	w_c (%)	γ_d (lb/ft^3)	S (%)
7.06	3.60	2.0	18.1	112.1	97	12.0	0.49	1.0	97	-2.5	6.97	10.07	17.3	114.9	100



TEST PROCEDURE: ASTM D4767

Specimen Mounting Method : ☐ Dry Method ☒ Wet Method

Filter Strip Correction Made : ☐ Yes ☒ No
Membrane Correction Made : ☐ Yes ☒ No

A_c Method: ☒ Method A ☐ Method B

w_c determined from: ☒ Entire Specimen ☐ Trimmings

SAMPLE TYPE

Type	Diameter (inch)
☒ Undisturbed	3
☐ Compacted	

☐ Tamped Uniform Lifts: No. of Lifts: _____

☐ Kneading: Blows per Lift: _____
No. of Lifts_____Spring:_____lb

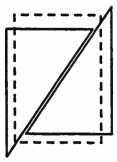
G_s: 2.70 ☒ Assumed ☐ Measured

Stresses and Strains at Failure

Failure Criteria	ε_a (%)	Δu (kg/cm^2)	σ_1' (kg/cm^2)	σ_3' (kg/cm^2)	p' (kg/cm^2)	q (kg/cm^2)
$[\sigma_1 - \sigma_3]_{max}$	14.8	-1.26	6.31	1.75	4.03	2.28
$[\sigma_1' / \sigma_3']_{max}$	1.52	-0.24	3.35	0.73	2.04	1.31

FAILURE SKETCH

☒ Diagonal Plane
☐ Bulging
☐ Combination
☐ Other _____



Particle-Size Analysis		U.S. Standard Sieve Size	Gravel			Coarse Sand	Medium Sand		Fine Sand			
☐ ASTM D422 ☒ ASTM D1140-Method B			3/4"	3/8"	No. 4	No. 10	No. 20	No. 40	No. 60	No. 100	No. 140	No. 200
Dry Mass (g)	129.39	Soil Passing (%, dry mass basis)	100	100	100	100	99.9	99.7	95.1	80.9	65.8	50.6

Where: H = Specimen height; D = Specimen diameter; w_c = Water content (ASTM D2216); γ_d = Dry density; S = Saturation; σ_c' = Isotropic effective confining stress; $\dot{\varepsilon}$ = Vertical displacement rate; ε_{vol} = Volume change(- denotes consolidation, + denotes swelling); H_c = Consolidated height; A_c = Consolidated area; ε_a = Axial strain; Δu = Excess pore pressure; σ_1' = Major effective principal stress; σ_3'= Minor effective principal stress; p' = Average effective principal stress; q = Half principal stress difference; and G_s = Specific gravity.

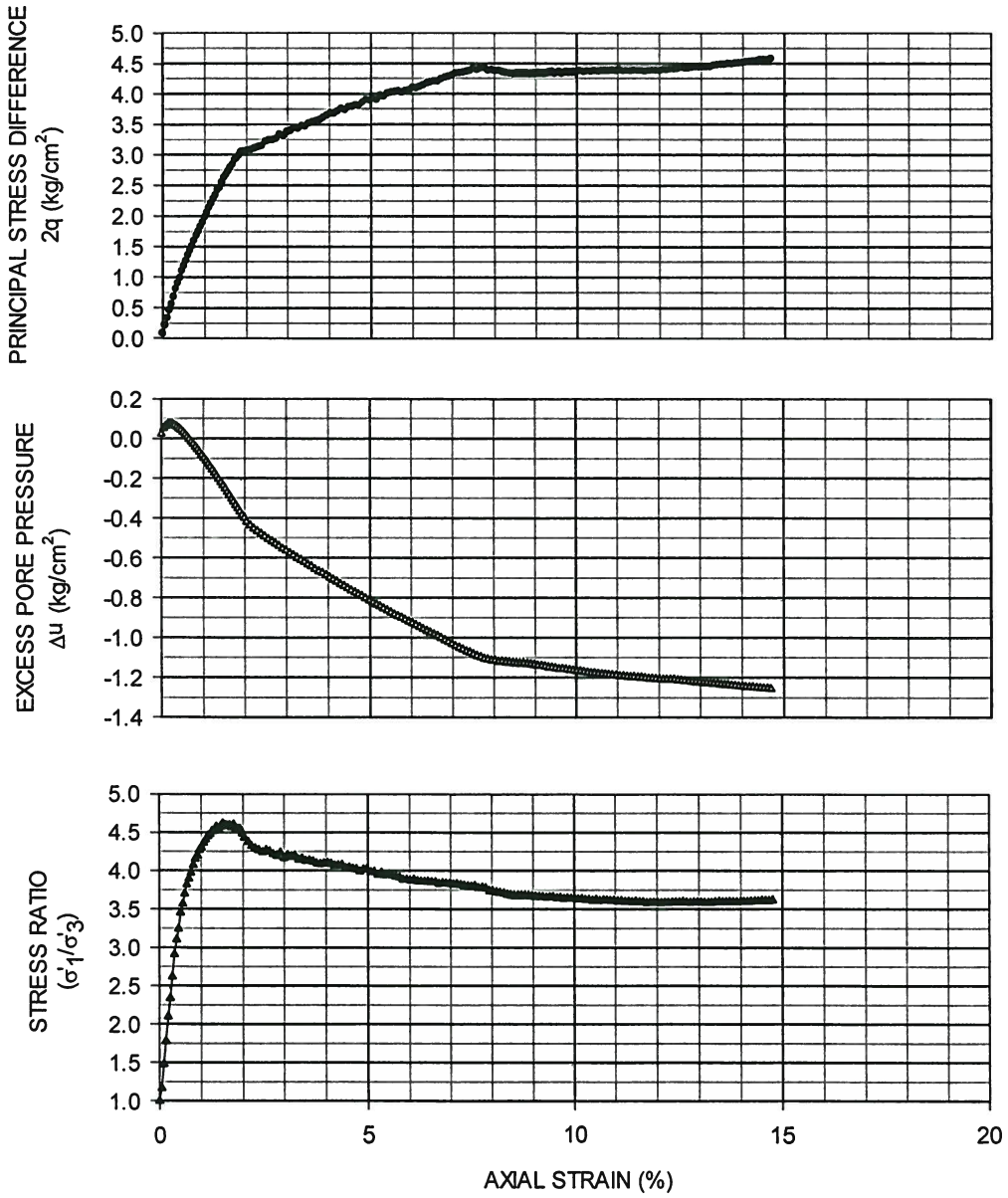
Checked By: PM Date: 11/23/15

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
STRESS - STRAIN CURVES

CLIENT: LOCKHEED MARTIN
PROJECT: MRC LABORATORY TESTING
FILE NO.: 15-13-0120

DATE SAMPLE RECEIVED: 11/04/15
DATE TEST SET-UP: 11/04/15
DATE REPORTED: 11/23/15

INCOMING SAMPLE NO.: ----
BORING: **TTDHC-6** SAMPLE: **ST-1**
DEPTH: 13 - 15 ☒ ft; ☐ m
LABORATORY IDENTIFICATION NO.: 150120/HC6/ST1B1
SAMPLE DESCRIPTION: Reddish-brown sandy lean clay
Effective Isotropic Consolidation Stress = 0.49 kg/cm²



Where: Δu = Excess pore pressure; σ_1' = Major effective principal stress; and σ_3'= Minor effective principal stress.

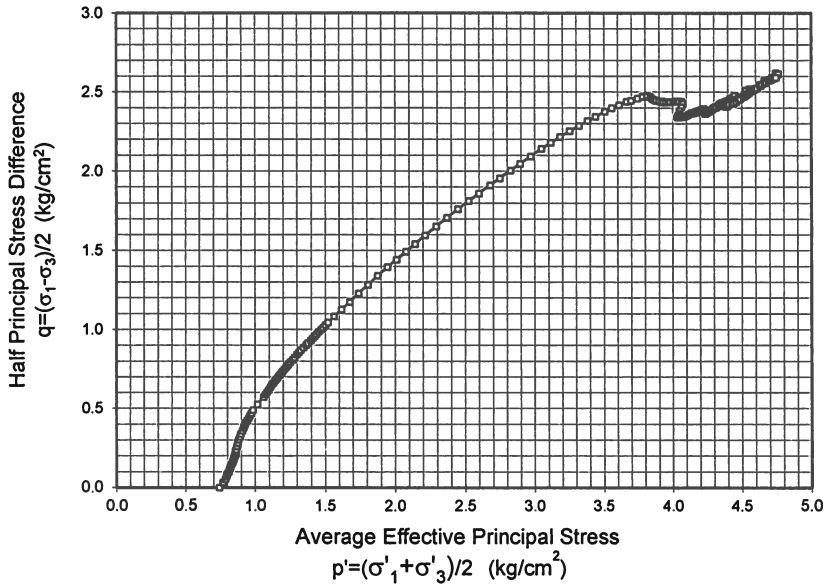
Checked By: JM Date: 11/23/15

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION (CIUC) TEST REPORT

CLIENT: LOCKHEED MARTIN
PROJECT: MRC LABORATORY TESTING
FILE NO.: 15-13-0120
DATE SAMPLE RECEIVED: 10/19/15
DATE TEST SET-UP: 11/04/15
DATE REPORTED: 11/23/15

INCOMING SAMPLE NO.: ----
BORING: **TTDHC-6** SAMPLE: ST-1
DEPTH: 13 - 15 ☒ ft; ☐ m
LABORATORY IDENTIFICATION NO.: 150120/HC6/ST1B2
SAMPLE DESCRIPTION: Reddish-brown lean clay with sand

Specimen Dimensions			Initial Conditions			Test Conditions				Pre-shear Conditions					
H (cm)	D (cm)	H/D	w_c (%)	γ_d (lb/ft³)	S (%)	u_b (kg/cm²)	σ_c' (kg/cm²)	$\dot{\varepsilon}$ (%/hour)	B-Factor (%)	ε_{vol} (%)	H_c (cm)	A_c (cm²)	w_c (%)	γ_d (lb/ft³)	S (%)
7.07	3.58	2.0	15.1	120.2	97	12.0	0.74	1.0	100	0.1	7.02	10.17	15.6	120.1	100



TEST PROCEDURE: ASTM D4767

Specimen Mounting Method : ☐ Dry Method ☒ Wet Method

Filter Strip Correction Made : ☐ Yes ☒ No
Membrane Correction Made : ☐ Yes ☒ No

A_c Method: ☒ Method A ☐ Method B

w_c determined from: ☒ Entire Specimen ☐ Trimmings

SAMPLE TYPE

Type	Diameter (inch)
☒ Undisturbed	3
☐ Compacted	

☐ Tamped Uniform Lifts: No. of Lifts: _____

☐ Kneading: Blows per Lift: _____ No. of Lifts_____Spring:____lb

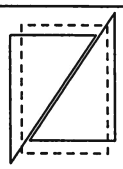
G_s: 2.75 ☒ Assumed ☐ Measured

Stresses and Strains at Failure

Failure Criteria	ε_a (%)	Δu (kg/cm²)	σ_1' (kg/cm²)	σ_3' (kg/cm²)	p' (kg/cm²)	q (kg/cm²)
$[\sigma_1 - \sigma_3]_{max}$	13.9	-1.38	7.36	2.12	4.74	2.62
$[\sigma_1' / \sigma_3']_{max}$	1.55	0.12	3.81	0.62	2.21	1.60

FAILURE SKETCH

☒ Diagonal Plane
☐ Bulging
☐ Combination
☐ Other _____



Particle-Size Analysis		U.S. Standard Sieve Size	Gravel			Coarse Sand	Medium Sand		Fine Sand			
☐ ASTM D422 ☒ ASTM D1140-Method B			3/4"	3/8"	No. 4	No. 10	No. 20	No. 40	No. 60	No. 100	No. 140	No. 200
Dry Mass (g)	137.51	Soil Passing (%, dry mass basis)	100	100	100	99.8	99.5	99.2	97.2	90.4	82.4	71.1

Where: H = Specimen height; D = Specimen diameter; w_c = Water content (ASTM D2216); γ_d = Dry density; S = Saturation; σ_c' = Isotropic effective confining stress; $\dot{\varepsilon}$ = Vertical displacement rate; ε_{vol} = Volume change(- denotes consolidation, + denotes swelling); H_c = Consolidated height; A_c = Consolidated area; ε_a = Axial strain; Δu = Excess pore pressure; σ_1' = Major effective principal stress; σ_3'= Minor effective principal stress; p' = Average effective principal stress; q = Half principal stress difference; and G_s = Specific gravity.

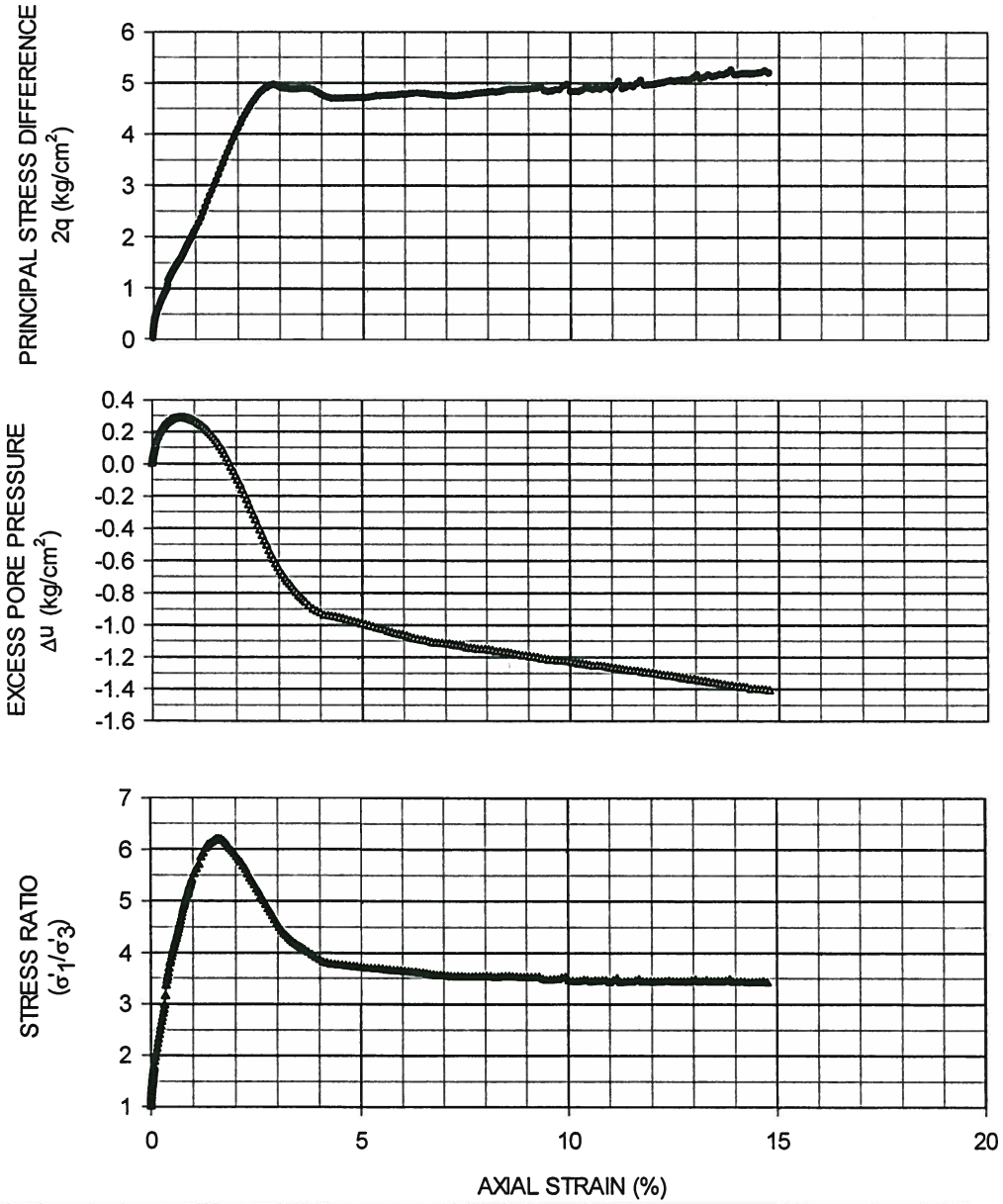
Checked By: TM Date: 11/23/15

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
STRESS - STRAIN CURVES

CLIENT: LOCKHEED MARTIN
PROJECT: MRC LABORATORY TESTING
FILE NO.: 15-13-0120

DATE SAMPLE RECEIVED: 10/19/15
DATE TEST SET-UP: 11/04/15
DATE REPORTED: 11/23/15

INCOMING SAMPLE NO.: ----
BORING: **TTDHC-6** SAMPLE: **ST-1**
DEPTH: 13 - 15 ☒ ft; ☐ m
LABORATORY IDENTIFICATION NO.: 150120/HC6/ST1B2
SAMPLE DESCRIPTION: Reddish-brown lean clay w/sand
Effective Isotropic Consolidation Stress = 0.74 kg/cm²



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Where: Δu = Excess pore pressure; σ_1' = Major effective principal stress; and σ_3'= Minor effective principal stress.

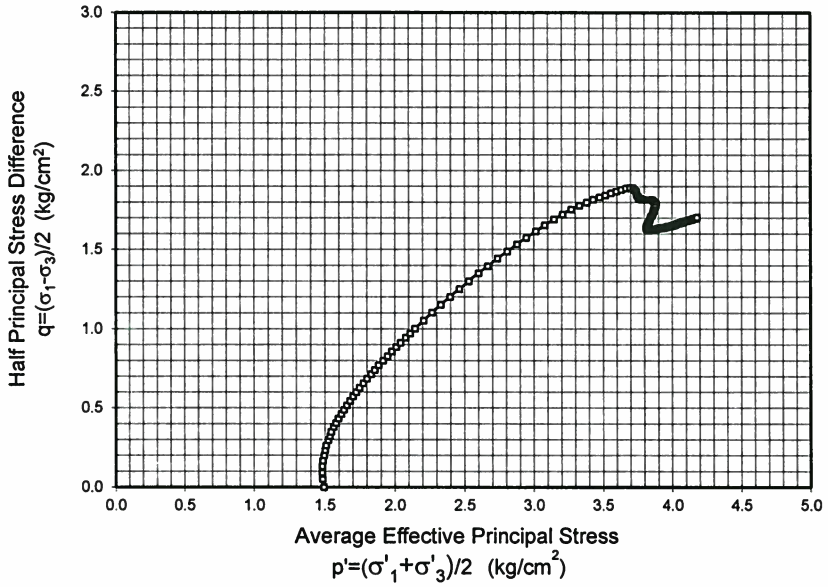
Checked By: TM Date: 11/23/15

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION (CIUC) TEST REPORT

CLIENT: LOCKHEED MARTIN
PROJECT: MRC LABORATORY TESTING
FILE NO.: 15-13-0120
DATE SAMPLE RECEIVED: 10/19/15
DATE TEST SET-UP: 11/04/15
DATE REPORTED: 11/23/15

INCOMING SAMPLE NO.: ----
BORING: **TTDHC-6** SAMPLE: ST-1
DEPTH: 13 - 15 ☒ ft; ☐ m
LABORATORY IDENTIFICATION NO.: 150120/HC6/ST1B3
SAMPLE DESCRIPTION: Reddish-brown lean clay

Specimen Dimensions			Initial Conditions			Test Conditions				Pre-shear Conditions					
H (cm)	D (cm)	H/D	w_c (%)	γ_d (lb/ft^3)	S (%)	u_b (kg/cm^2)	σ_c' (kg/cm^2)	$\dot{\varepsilon}$ (%/hour)	B-Factor (%)	ε_{vol} (%)	H_c (cm)	A_c (cm^2)	w_c (%)	γ_d (lb/ft^3)	S (%)
7.06	3.58	2.0	17.0	116.3	98	12.0	1.49	1.0	100	0.8	7.05	10.16	17.7	115.3	100



TEST PROCEDURE: ASTM D4767

Specimen Mounting Method : ☐ Dry Method ☒ Wet Method

Filter Strip Correction Made : ☐ Yes ☒ No
Membrane Correction Made : ☐ Yes ☒ No

A_c Method: ☒ Method A ☐ Method B

w_c determined from: ☒ Entire Specimen ☐ Trimmings

SAMPLE TYPE

Type	Diameter (inch)
☒ Undisturbed	3
☐ Compacted	

☐ Tamped Uniform Lifts: No. of Lifts: _____

☐ Kneading: Blows per Lift: _____ No. of Lifts_____ Spring:____lb

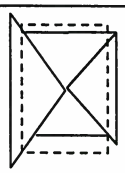
G_s: 2.75 ☒ Assumed ☐ Measured

Stresses and Strains at Failure

Failure Criteria	ε_a (%)	Δu (kg/cm^2)	σ_1' (kg/cm^2)	σ_3' (kg/cm^2)	p' (kg/cm^2)	q (kg/cm^2)
$[\sigma_1 - \sigma_3]_{max}$	3.97	-0.31	5.64	1.80	3.72	1.92
$[\sigma_1' / \sigma_3']_{max}$	2.94	0.04	4.89	1.45	3.17	1.72

FAILURE SKETCH

☒ Diagonal Plane
☐ Bulging
☐ Combination
☐ Other _____



Particle-Size Analysis		U.S. Standard Sieve Size	Gravel			Coarse Sand	Medium Sand		Fine Sand			
☐ ASTM D422 ☒ ASTM D1140-Method B			3/4"	3/8"	No. 4	No. 10	No. 20	No. 40	No. 60	No. 100	No. 140	No. 200
Dry Mass (g)	132.61	Soil Passing (%, dry mass basis)	100	100	100	100	100	99.9	99.7	98.7	97.2	94.8

Where: H = Specimen height; D = Specimen diameter; w_c = Water content (ASTM D2216); γ_d = Dry density; S = Saturation; σ_c' = Isotropic effective confining stress; $\dot{\varepsilon}$ = Vertical displacement rate; ε_{vol} = Volume change(- denotes consolidation, + denotes swelling); H_c = Consolidated height; A_c = Consolidated area; ε_a = Axial strain; Δu = Excess pore pressure; σ_1' = Major effective principal stress; σ_3'= Minor effective principal stress; p' = Average effective principal stress; q = Half principal stress difference; and G_s = Specific gravity.

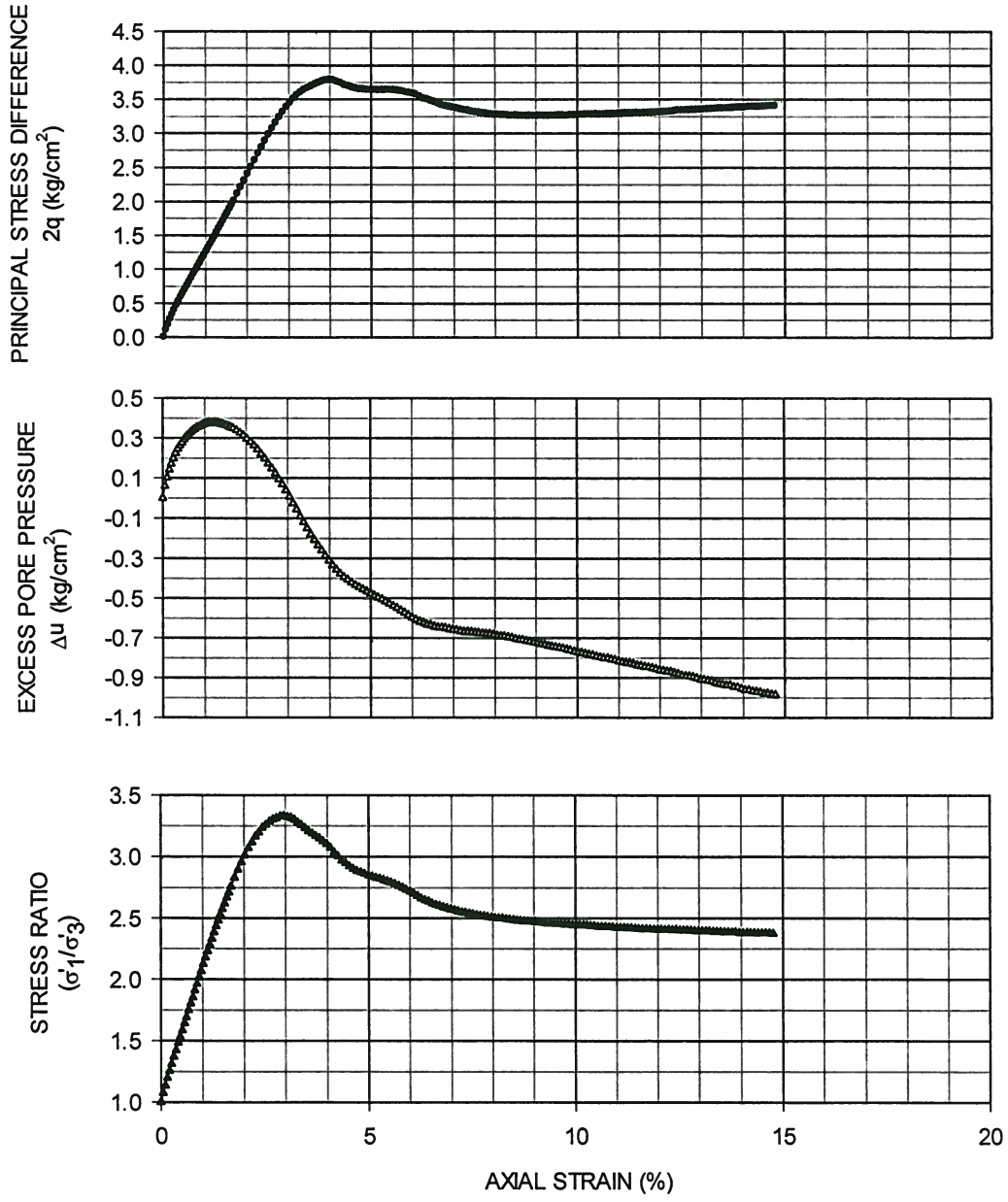
Checked By: TM Date: 11/23/15

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
STRESS - STRAIN CURVES

CLIENT: LOCKHEED MARTIN
PROJECT: MRC LABORATORY TESTING
FILE NO.: 15-13-0120

DATE SAMPLE RECEIVED: 10/19/15
DATE TEST SET-UP: 11/04/15
DATE REPORTED: 11/23/15

INCOMING SAMPLE NO.: ----
BORING: **TTDHC-6** SAMPLE: **ST-1**
DEPTH: 13 - 15 ☒ ft; ☐ m
LABORATORY IDENTIFICATION NO.: 150120/HC6/ST1B3
SAMPLE DESCRIPTION: Reddish-brown lean clay
Effective Isotropic Consolidation Stress = 1.49 kg/cm²



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Where: Δu = Excess pore pressure; σ_1' = Major effective principal stress; and σ_3'= Minor effective principal stress.

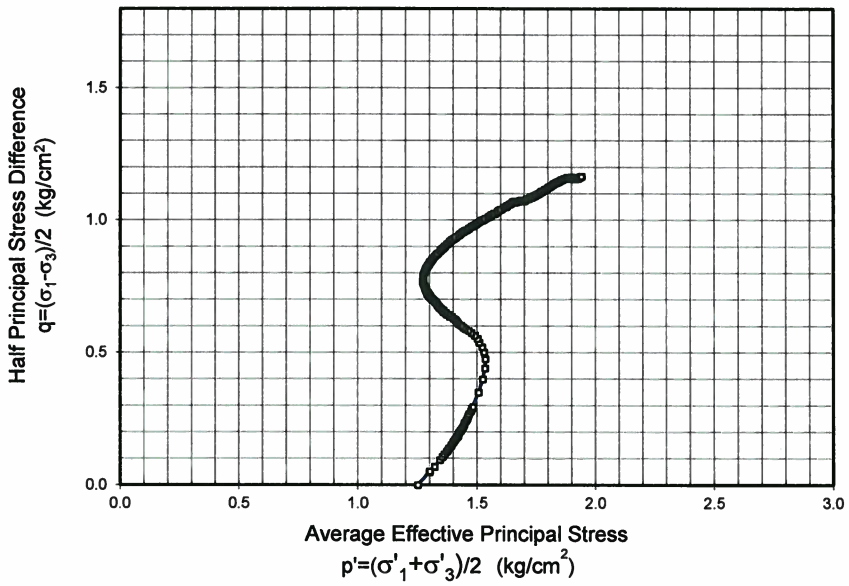
Checked By: TM Date: 11/23/15

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION (CIUC) TEST REPORT

CLIENT: LOCKHEED MARTIN
PROJECT: MRC LABORATORY TESTING
FILE NO.: 15-13-0120
DATE SAMPLE RECEIVED: 10/19/15
DATE TEST SET-UP: 11/16/15
DATE REPORTED: 12/9/15

INCOMING SAMPLE NO.: ----
BORING: **TTDHCB-2** SAMPLE: **ST-2**
DEPTH: 11.5 – 13.5 ☒ ft; ☐ m
LABORATORY IDENTIFICATION NO.: 150120/HB3/ST2B1
SAMPLE DESCRIPTION: Reddish-brown clayey sand (SC)

Specimen Dimensions			Initial Conditions			Test Conditions				Pre-shear Conditions					
H (cm)	D (cm)	H/D	w_c (%)	γ_d (lb/ft^3)	S (%)	u_b (kg/cm^2)	σ_c' (kg/cm^2)	$\dot{\varepsilon}$ (%/hour)	B-Factor (%)	ε_{vol} (%)	H_c (cm)	A_c (cm^2)	w_c (%)	γ_d (lb/ft^3)	S (%)
7.04	3.69	1.9	18.3	112.8	100	12.0	1.25	1.0	99	-3.6	6.91	10.52	16.3	117.0	100



TEST PROCEDURE: ASTM D4767

Specimen Mounting Method : ☐ Dry Method ☒ Wet Method

Filter Strip Correction Made : ☐ Yes ☒ No
Membrane Correction Made : ☐ Yes ☒ No

A_c Method: ☒ Method A ☐ Method B

w_c determined from: ☒ Entire Specimen ☐ Trimmings

SAMPLE TYPE

Type	Diameter (inch)
☒ Undisturbed	3
☐ Compacted	

☐ Tamped Uniform Lifts: No. of Lifts:_____

☐ Kneading: Blows per Lift: _____
No. of Lifts_____Spring:_____lb

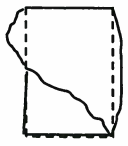
G_s: 2.70 ☒ Assumed ☐ Measured

Stresses and Strains at Failure

Failure Criteria	ε_a (%)	Δu (kg/cm^2)	σ_1' (kg/cm^2)	σ_3' (kg/cm^2)	p' (kg/cm^2)	q (kg/cm^2)
$[\sigma_1 - \sigma_3]_{max}$	14.8	0.48	3.11	0.77	1.94	1.17
$[\sigma_1' / \sigma_3']_{max}$	3.60	0.78	2.32	0.47	1.39	0.93

FAILURE SKETCH

☐ Diagonal Plane
☐ Bulging
☒ Combination
☐ Other _____



Particle-Size Analysis		U.S. Standard Sieve Size	Gravel			Coarse Sand	Medium Sand		Fine Sand			
☐ ASTM D422 ☒ ASTM D1140-Method B			3/4"	3/8"	No. 4	No. 10	No. 20	No. 40	No. 60	No. 100	No. 140	No. 200
Dry Mass (g)	136.30	Soil Passing (%, dry mass basis)	---	---	---	---	---	---	---	---	---	45.8

Where: H = Specimen height; D = Specimen diameter; w_c = Water content (ASTM D2216); γ_d = Dry density; S = Saturation; σ_c' = Isotropic effective confining stress; $\dot{\varepsilon}$ = Vertical displacement rate; ε_{vol} = Volume change(- denotes consolidation, + denotes swelling); H_c = Consolidated height; A_c = Consolidated area; ε_a = Axial strain; Δu = Excess pore pressure; σ_1' = Major effective principal stress; σ_3'= Minor effective principal stress; p' = Average effective principal stress; q = Half principal stress difference; and G_s = Specific gravity.

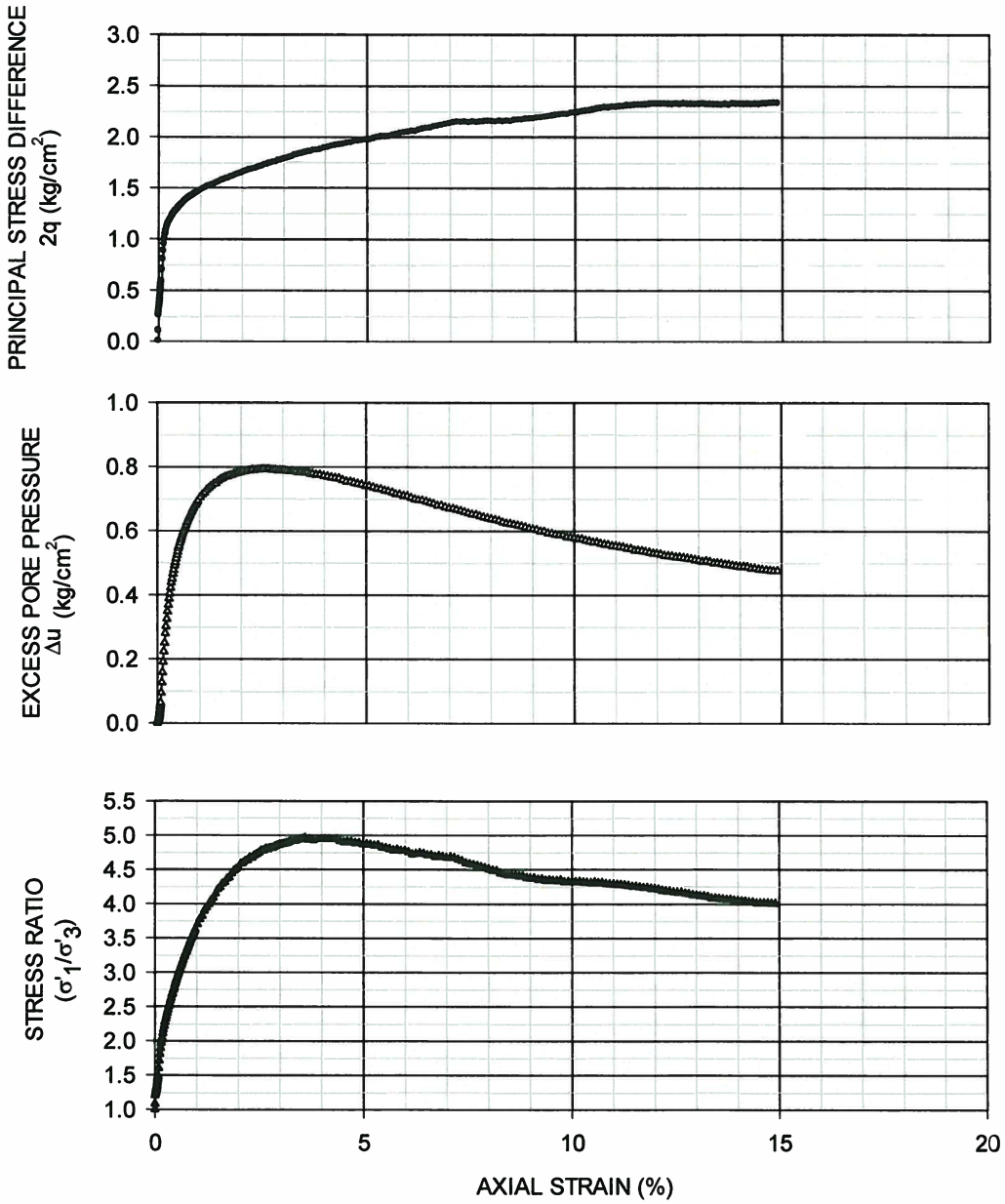
Checked By: TM Date: 12/09/15

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
STRESS - STRAIN CURVES

CLIENT: LOCKHEED MARTIN
PROJECT: MRC LABORATORY TESTING
FILE NO.: 15-13-0120

DATE SAMPLE RECEIVED: 10/19/15
DATE TEST SET-UP: 11/16/15
DATE REPORTED: 12/9/15

INCOMING SAMPLE NO.: ----
BORING: **TTDHCB-2** SAMPLE: **ST-2**
DEPTH: 11.5 – 13.5 ☒ ft; ☐ m
LABORATORY IDENTIFICATION NO.: 150120/HB3/ST2B1
SAMPLE DESCRIPTION: Reddish-brown clayey sand (SC)
Effective Isotropic Consolidation Stress = 1.25 kg/cm²



Where: Δu = Excess pore pressure; σ_1' = Major effective principal stress; and σ_3'= Minor effective principal stress.

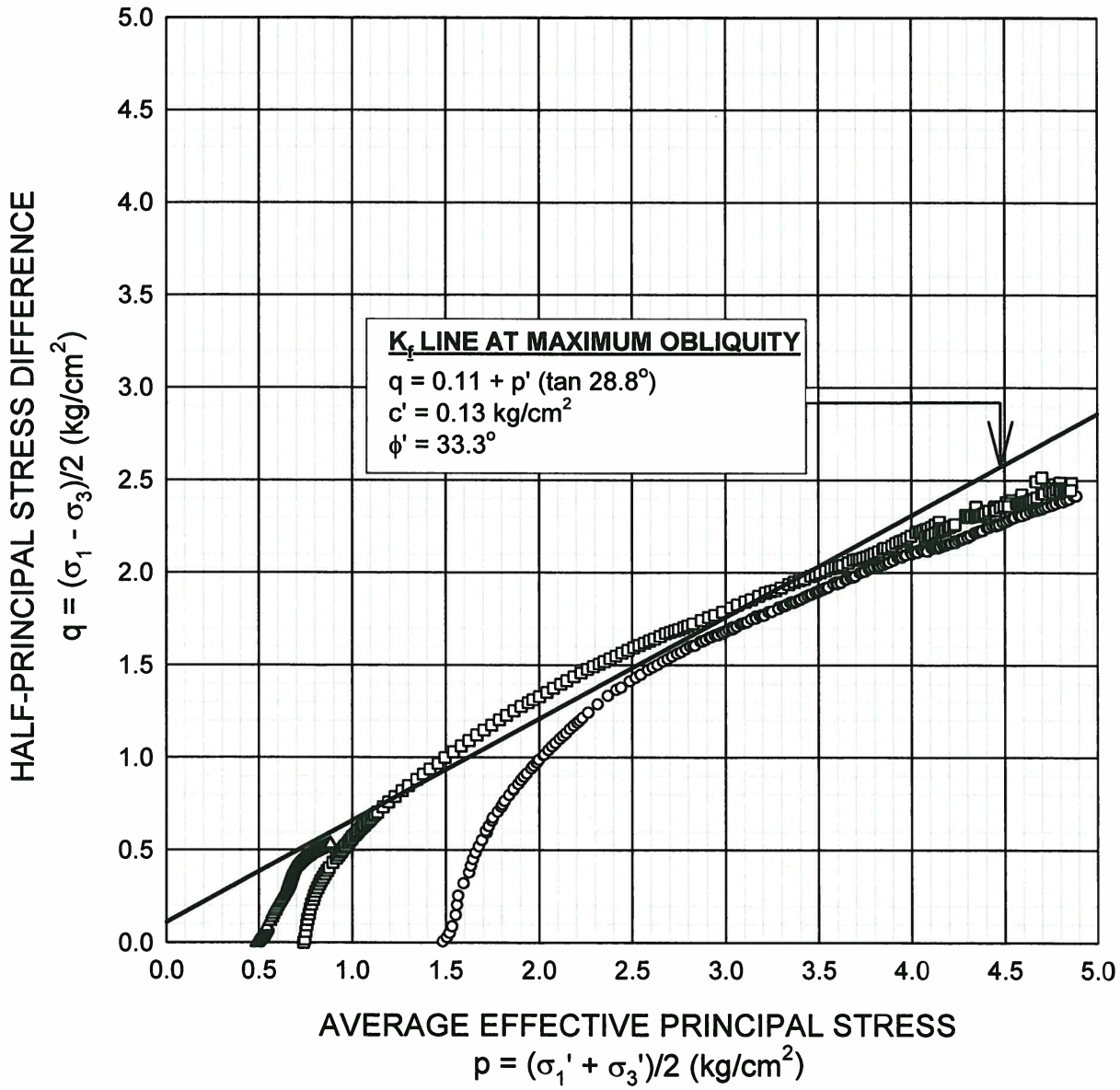
Checked By: DM Date: 12/09/15

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
EFFECTIVE STRESS PATHS

CLIENT: LOCKHEED MARTIN
PROJECT: MRC LABORATORY TESTING
FILE NO.: 15-13-0120

DATE SAMPLE RECEIVED: 10/19/15
DATE TEST SET-UP: 11/16/15
DATE REPORTED: 12/9/15

INCOMING SAMPLE NO.: ------
BORING: **TTDHCB-9** SAMPLE: **ST-1**
DEPTH: 12.0 – 14.0 ☒ ft; ☐ m
LABORATORY IDENTIFICATION NO.: 150120/HB9
SAMPLE DESCRIPTION: Reddish-brown lean clay (CL)



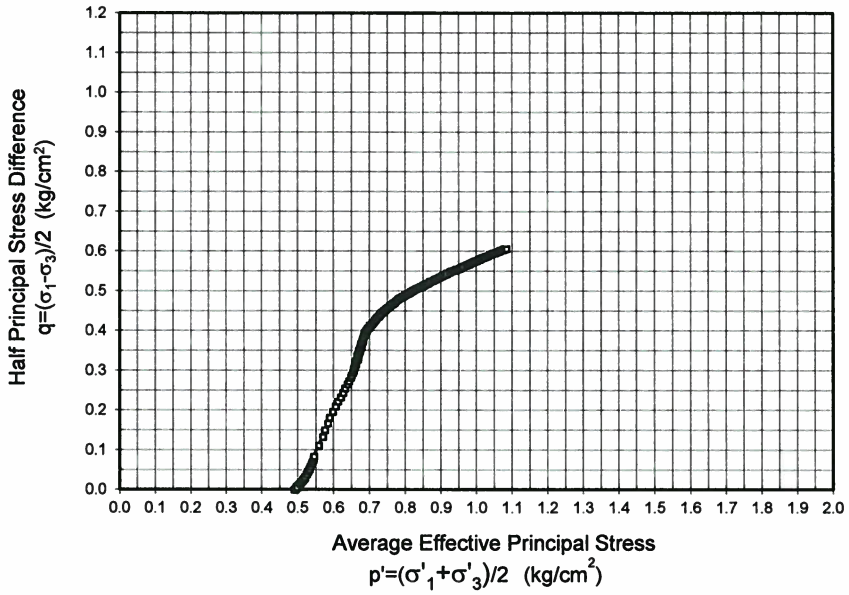
Checked By: TM Date: 12/09/15

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION (CIUC) TEST REPORT

CLIENT: LOCKHEED MARTIN
PROJECT: MRC LABORATORY TESTING
FILE NO.: 15-13-0120
DATE SAMPLE RECEIVED: 10/19/15
DATE TEST SET-UP: 11/16/15
DATE REPORTED: 12/9/15

INCOMING SAMPLE NO.: ----
BORING: **TTDHCB-9** SAMPLE: **ST-1**
DEPTH: 12.0 – 14.0 ☒ ft; ☐ m
LABORATORY IDENTIFICATION NO.: 150120/HB9/ST1B1
SAMPLE DESCRIPTION: Reddish-brown lean clay (CL)

Specimen Dimensions			Initial Conditions			Test Conditions				Pre-shear Conditions					
H (cm)	D (cm)	H/D	w_c (%)	γ_d (lb/ft^3)	S (%)	u_b (kg/cm^2)	σ_{vc}' (kg/cm^2)	$\dot{\varepsilon}$ (%/hour)	B-Factor (%)	ε_{vol} (%)	H_c (cm)	A_c (cm^2)	w_c (%)	γ_d (lb/ft^3)	S (%)
7.07	3.58	2.0	23.2	103.4	99	12.0	0.49	1.0	97	0.6	7.04	10.19	23.7	102.7	100



TEST PROCEDURE: ASTM D4767

Specimen Mounting Method : ☐ Dry Method ☒ Wet Method

Filter Strip Correction Made : ☐ Yes ☒ No
Membrane Correction Made : ☐ Yes ☒ No

A_c Method: ☒ Method A ☐ Method B

w_c determined from: ☒ Entire Specimen ☐ Trimmings

SAMPLE TYPE

Type	Diameter (inch)
☒ Undisturbed	3
☐ Compacted	

☐ Tamped Uniform Lifts: No. of Lifts:_____

☐ Kneading: Blows per Lift: _____ No. of Lifts_____Spring:_____lb

G_s: 2.70 ☒ Assumed ☐ Measured

Stresses and Strains at Failure

Failure Criteria	ε_a (%)	Δu (kg/cm^2)	σ_1' (kg/cm^2)	σ_3' (kg/cm^2)	p' (kg/cm^2)	q (kg/cm^2)
$[\sigma_1 - \sigma_3]_{max}$	14.9	0.02	1.69	0.47	1.08	0.61
$[\sigma_1' / \sigma_3']_{max}$	4.03	0.19	1.26	0.30	0.78	0.48

FAILURE SKETCH

☒ Diagonal Plane
☐ Bulging
☐ Combination
☐ Other _____

Particle-Size Analysis		U.S. Standard Sieve Size	Gravel			Coarse Sand	Medium Sand		Fine Sand			
☐ ASTM D422 ☒ ASTM D1140-Method B			3/4"	3/8"	No. 4	No. 10	No. 20	No. 40	No. 60	No. 100	No. 140	No. 200
Dry Mass (g)	118.11	Soil Passing (%, dry mass basis)	---	---	---	---	---	---	---	---	---	91.9

Where: H = Specimen height; D = Specimen diameter; w_c = Water content (ASTM D2216); γ_d = Dry density; S = Saturation; σ_c' = Isotropic effective confining stress; $\dot{\varepsilon}$ = Vertical displacement rate; ε_{vol} = Volume change(- denotes consolidation, + denotes swelling); H_c = Consolidated height; A_c = Consolidated area; ε_a = Axial strain; Δu = Excess pore pressure; σ_1' = Major effective principal stress; σ_3'= Minor effective principal stress; p' = Average effective principal stress; q = Half principal stress difference; and G_s = Specific gravity.

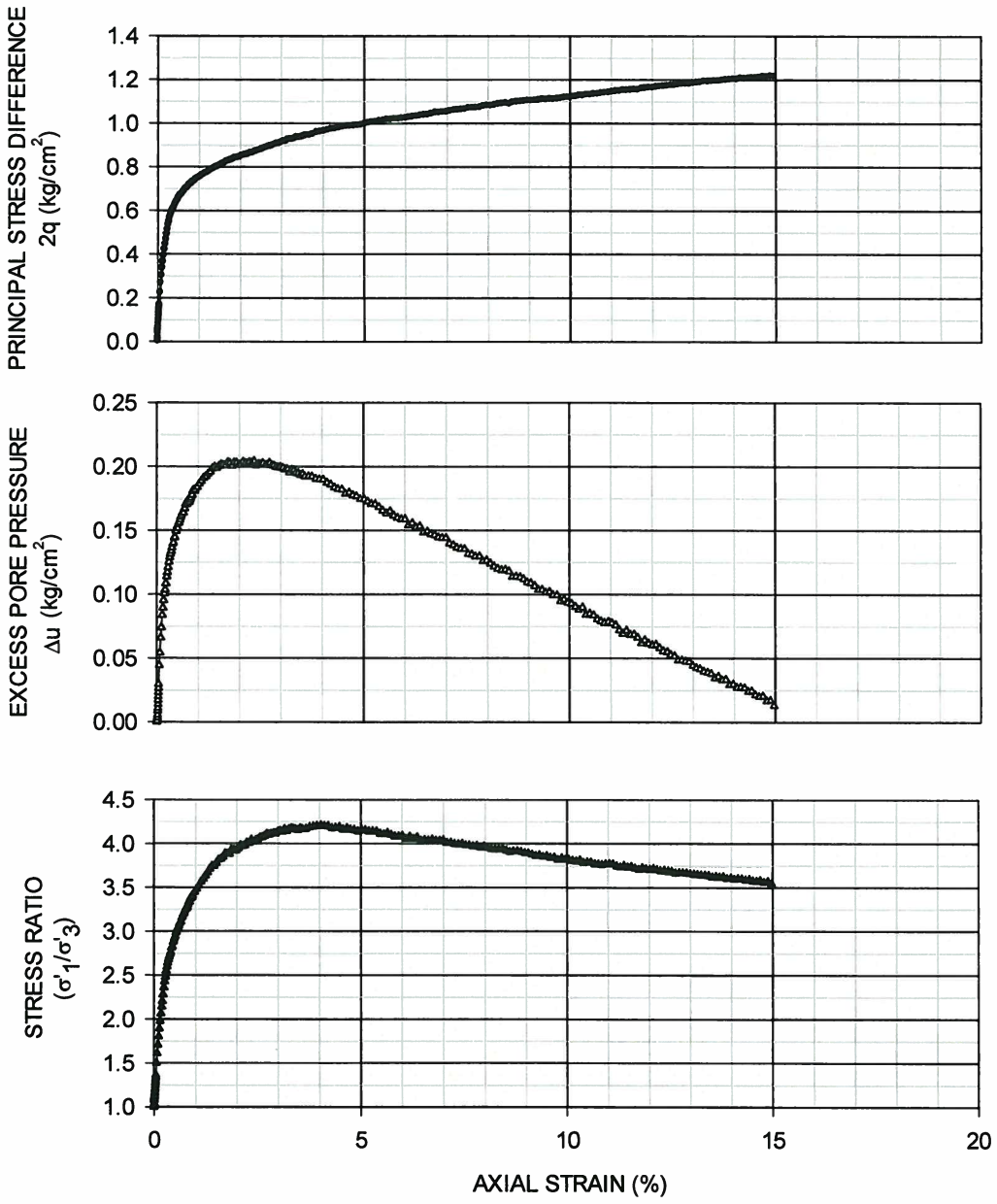
Checked By: tm Date: 12/09/15

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
STRESS - STRAIN CURVES

CLIENT: LOCKHEED MARTIN
PROJECT: MRC LABORATORY TESTING
FILE NO.: 15-13-0120

DATE SAMPLE RECEIVED: 10/19/15
DATE TEST SET-UP: 11/16/15
DATE REPORTED: 12/9/15

INCOMING SAMPLE NO.: ----
BORING: **TTDHCB-9** SAMPLE: **ST-1**
DEPTH: 12.0 – 14.0 ☒ ft; ☐ m
LABORATORY IDENTIFICATION NO.: 150120/HB9/ST1B1
SAMPLE DESCRIPTION: Reddish-brown lean clay (CL)
Effective Isotropic Consolidation Stress = 0.49 kg/cm²



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Where: Δu = Excess pore pressure; σ_1' = Major effective principal stress; and σ_3'= Minor effective principal stress.

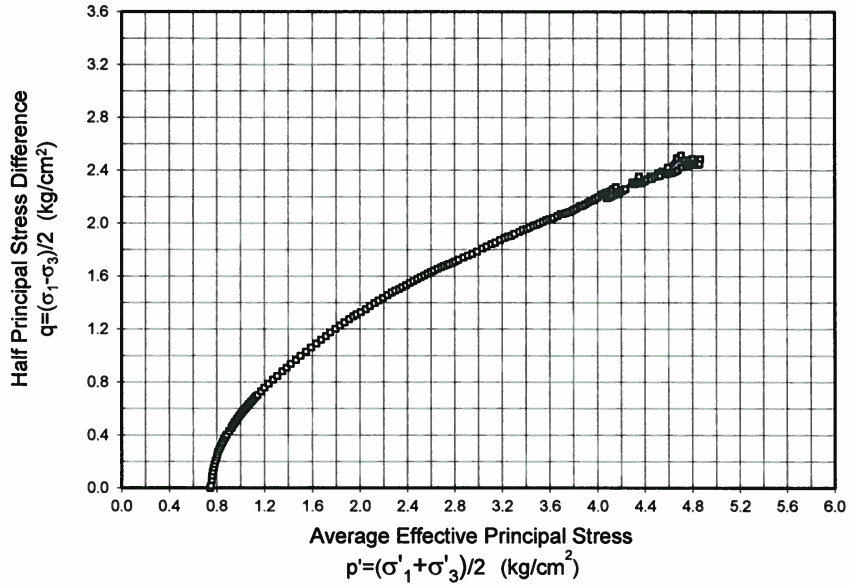
Checked By: PM Date: 12/09/15

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION (CIUC) TEST REPORT

CLIENT: LOCKHEED MARTIN
PROJECT: MRC LABORATORY TESTING
FILE NO.: 15-13-0120
DATE SAMPLE RECEIVED: 10/19/15
DATE TEST SET-UP: 11/16/15
DATE REPORTED: 12/9/15

INCOMING SAMPLE NO.: ----
BORING: TTDHCB-9 SAMPLE: ST-1
DEPTH: 12.0 – 14.0 ☒ ft; ☐ m
LABORATORY IDENTIFICATION NO.: 150120/ HB9/ST1B2
SAMPLE DESCRIPTION: Reddish-brown lean clay (CL)

Specimen Dimensions			Initial Conditions			Test Conditions				Pre-shear Conditions					
H (cm)	D (cm)	H/D	w_c (%)	γ_d (lb/ft^3)	S (%)	u_b (kg/cm^2)	σ_c' (kg/cm^2)	$\dot{\varepsilon}$ (%/hour)	B-Factor (%)	ε_{vol} (%)	H_c (cm)	A_c (cm^2)	w_c (%)	γ_d (lb/ft^3)	S (%)
7.08	3.57	2.0	16.6	116.2	99	12.0	0.74	1.0	100	4.7	7.05	10.54	19.2	111.0	100



TEST PROCEDURE: ASTM D4767

Specimen Mounting Method : ☐ Dry Method ☒ Wet Method

Filter Strip Correction Made : ☐ Yes ☒ No
Membrane Correction Made : ☐ Yes ☒ No

A_c Method: ☒ Method A ☐ Method B

w_c determined from: ☒ Entire Specimen ☐ Trimmings

SAMPLE TYPE

Type	Diameter (inch)
☒ Undisturbed	3
☐ Compacted	

☐ Tamped Uniform Lifts: No. of Lifts: _____

☐ Kneading: Blows per Lift: _____
No. of Lifts_____Spring:_____lb

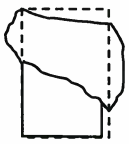
G_s: 2.70 ☒ Assumed ☐ Measured

Stresses and Strains at Failure

Failure Criteria	ε_a (%)	Δu (kg/cm^2)	σ_1' (kg/cm^2)	σ_3' (kg/cm^2)	p' (kg/cm^2)	q (kg/cm^2)
$[\sigma_1 - \sigma_3]_{max}$	12.0	-1.44	7.22	2.18	4.70	2.52
$[\sigma_1' / \sigma_3']_{max}$	1.58	0.17	2.92	0.57	1.74	1.18

FAILURE SKETCH

☒ Diagonal Plane
☐ Bulging
☐ Combination
☐ Other _____



Particle-Size Analysis		U.S. Standard Sieve Size	Gravel			Coarse Sand	Medium Sand		Fine Sand			
☐ ASTM D422 ☒ ASTM D1140-Method B			3/4"	3/8"	No. 4	No. 10	No. 20	No. 40	No. 60	No. 100	No. 140	No. 200
Dry Mass (g)	132.11	Soil Passing (%, dry mass basis)	---	---	---	---	---	---	---	---	---	94.7

Where: H = Specimen height; D = Specimen diameter; w_c = Water content (ASTM D2216); γ_d = Dry density; S = Saturation; σ_c' = Isotropic effective confining stress; $\dot{\varepsilon}$ = Vertical displacement rate; ε_{vol} = Volume change(- denotes consolidation, + denotes swelling); H_c = Consolidated height; A_c = Consolidated area; ε_a = Axial strain; Δu = Excess pore pressure; σ_1' = Major effective principal stress; σ_3'= Minor effective principal stress; p' = Average effective principal stress; q = Half principal stress difference; and G_s = Specific gravity.

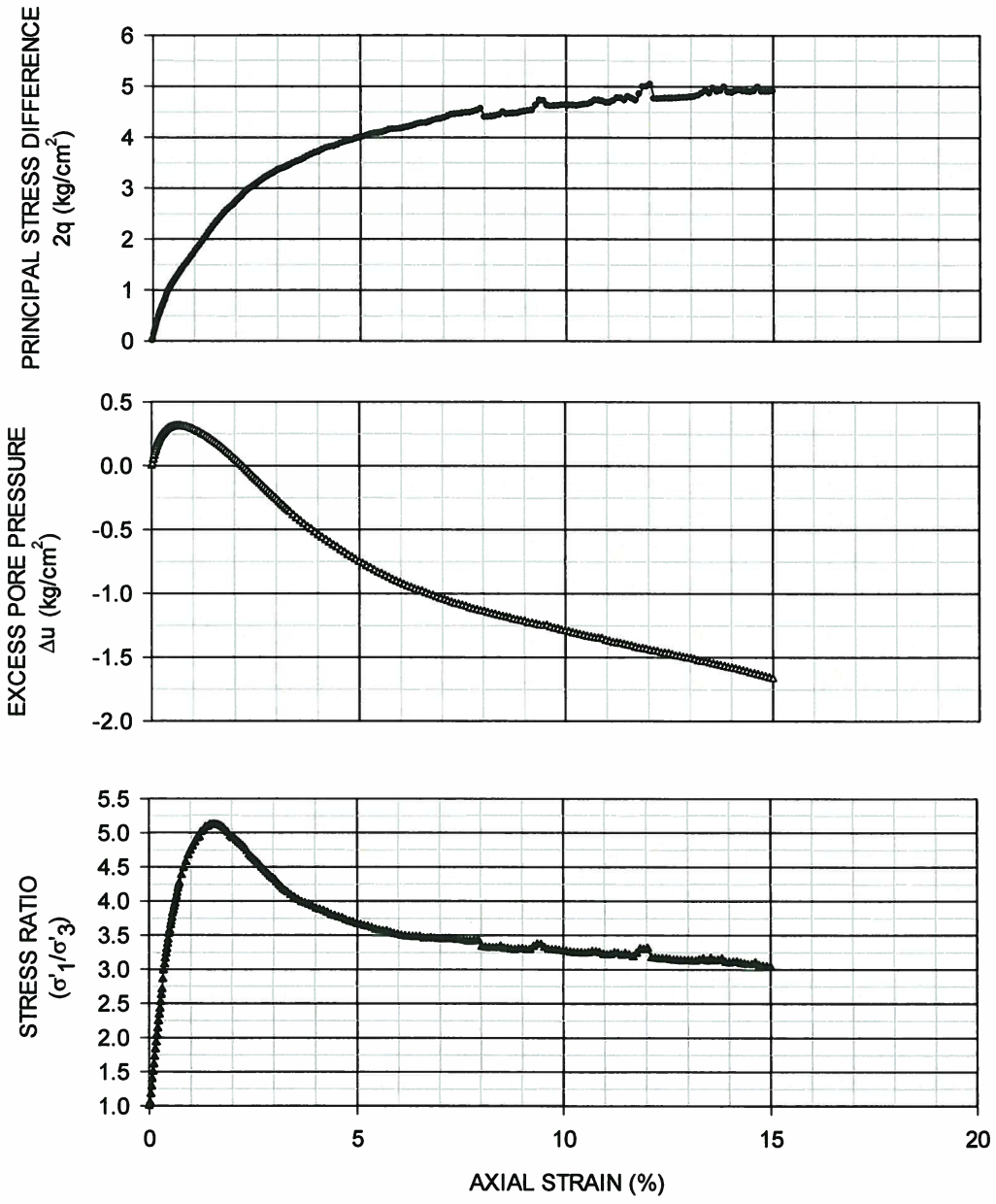
Checked By: TM Date: 12/09/15

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
STRESS - STRAIN CURVES

CLIENT: LOCKHEED MARTIN
PROJECT: MRC LABORATORY TESTING
FILE NO.: 15-13-0120

DATE SAMPLE RECEIVED: 10/19/15
DATE TEST SET-UP: 11/16/15
DATE REPORTED: 12/9/15

INCOMING SAMPLE NO.: ----
BORING **TTDHCB-9** SAMPLE: **ST-1**
DEPTH: 12.0 – 14.0 ☒ ft; ☐ m
LABORATORY IDENTIFICATION NO.: 150120/HB9/ST1B2
SAMPLE DESCRIPTION: Reddish-brown lean clay (CL)
Effective Isotropic Consolidation Stress = 0.74 kg/cm²



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Where: Δu = Excess pore pressure; σ_1' = Major effective principal stress; and σ_3'= Minor effective principal stress.

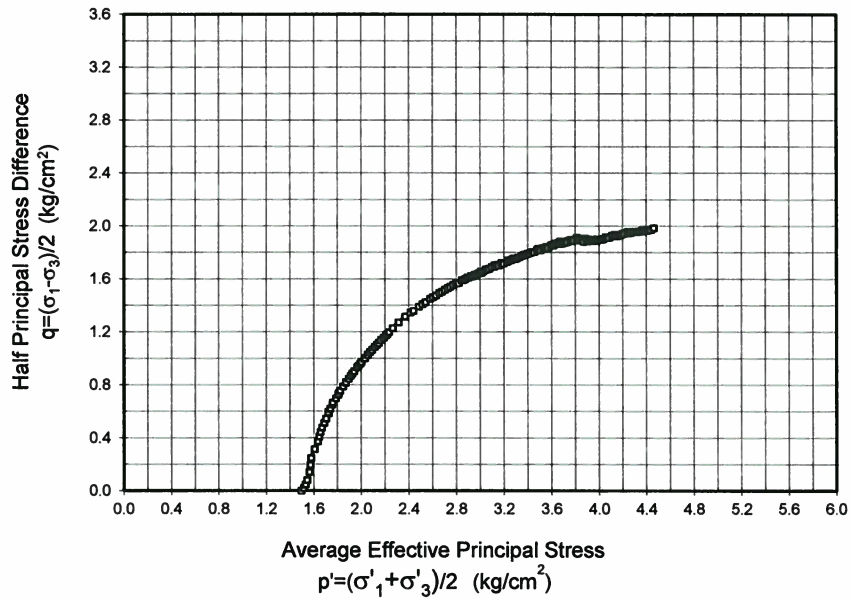
Checked By: TM Date: 12/09/15

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION (CIUC) TEST REPORT

CLIENT: LOCKHEED MARTIN
PROJECT: MRC LABORATORY TESTING
FILE NO.: 15-13-0120
DATE SAMPLE RECEIVED: 10/19/15
DATE TEST SET-UP: 11/16/15
DATE REPORTED: 12/9/15

INCOMING SAMPLE NO.: ----
BORING: **TTDHCB-9** SAMPLE: ST-1
DEPTH: 12.0 – 14.0 ☒ ft; ☐ m
LABORATORY IDENTIFICATION NO.: 150120/ HB9/ST1B3
SAMPLE DESCRIPTION: Reddish-brown lean clay (CL)

Specimen Dimensions			Initial Conditions			Test Conditions				Pre-shear Conditions					
H (cm)	D (cm)	H/D	w_c (%)	γ_d (lb/ft^3)	S (%)	u_b (kg/cm^2)	σ_c' (kg/cm^2)	$\dot{\varepsilon}$ (%/hour)	B-Factor (%)	ε_{vol} (%)	H_c (cm)	A_c (cm^2)	w_c (%)	γ_d (lb/ft^3)	S (%)
7.07	3.57	2.0	17.3	114.3	98	12.0	1.49	1.0	98	3.2	6.99	10.45	19.3	110.8	100



TEST PROCEDURE: ASTM D4767

Specimen Mounting Method : ☐ Dry Method ☒ Wet Method

Filter Strip Correction Made : ☐ Yes ☒ No
Membrane Correction Made : ☐ Yes ☒ No

A_c Method: ☒ Method A ☐ Method B

w_c determined from: ☒ Entire Specimen ☐ Trimmings

SAMPLE TYPE

Type	Diameter (inch)
☒ Undisturbed	3
☐ Compacted	

☐ Tamped Uniform Lifts: No. of Lifts: _____

☐ Kneading: Blows per Lift: _____ No. of Lifts_____Spring:_____lb

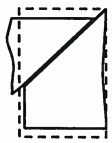
G_s: 2.70 ☒ Assumed ☐ Measured

Stresses and Strains at Failure

Failure Criteria	ε_a (%)	Δu (kg/cm^2)	σ_1' (kg/cm^2)	σ_3' (kg/cm^2)	p' (kg/cm^2)	q (kg/cm^2)
$[\sigma_1 - \sigma_3]_{max}$	15.0	-0.99	7.30	2.48	4.89	2.41
$[\sigma_1' / \sigma_3']_{max}$	1.16	0.37	4.06	1.12	2.59	1.47

FAILURE SKETCH

☒ Diagonal Plane
☐ Bulging
☐ Combination
☐ Other _____



Particle-Size Analysis		U.S. Standard Sieve Size	Gravel			Coarse Sand	Medium Sand		Fine Sand			
☐ ASTM D422 ☒ ASTM D1140-Method B			3/4"	3/8"	No. 4	No. 10	No. 20	No. 40	No. 60	No. 100	No. 140	No. 200
Dry Mass (g)	129.68	Soil Passing (%, dry mass basis)	---	---	---	---	---	---	---	---	---	94.8

Where: H = Specimen height; D = Specimen diameter; w_c = Water content (ASTM D2216); γ_d = Dry density; S = Saturation; σ_c' = Isotropic effective confining stress; $\dot{\varepsilon}$ = Vertical displacement rate; ε_{vol} = Volume change(- denotes consolidation, + denotes swelling); H_c = Consolidated height; A_c = Consolidated area; ε_a = Axial strain; Δu = Excess pore pressure; σ_1' = Major effective principal stress; σ_3'= Minor effective principal stress; p' = Average effective principal stress; q = Half principal stress difference; and G_s = Specific gravity.

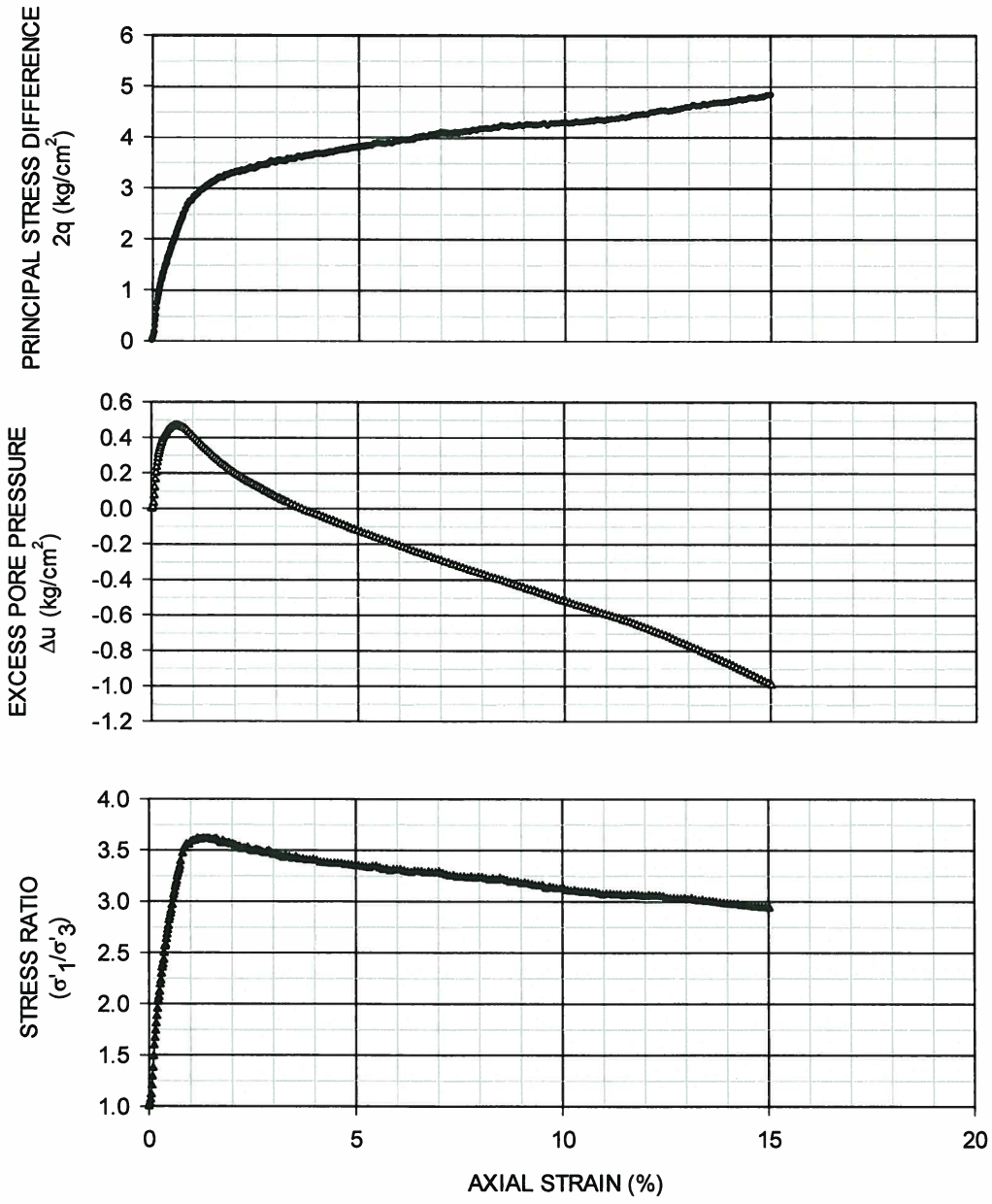
Checked By: PM Date: 12/09/15

ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST
STRESS - STRAIN CURVES

CLIENT: LOCKHEED MARTIN
PROJECT: MRC LABORATORY TESTING
FILE NO.: 15-13-0120

DATE SAMPLE RECEIVED: 10/19/15
DATE TEST SET-UP: 11/16/15
DATE REPORTED: 12/9/15

INCOMING SAMPLE NO.: ----
BORING: **TTDHCB-9** SAMPLE: **ST-1**
DEPTH: 12.0 – 14.0 ☒ ft; ☐ m
LABORATORY IDENTIFICATION NO.: 150120/HB9/ST1B3
SAMPLE DESCRIPTION: Reddish-brown lean clay (CL)
Effective Isotropic Consolidation Stress = 1.49 kg/cm²



The test data and all associated project information presented hereon shall be held in confidence and disclosed to other parties only with the authorization of the Client. Physical and electronic records of each project are kept for a minimum of 7 years. Test samples are kept in storage for at least 10 working days after mailing the test report, prior to being discarded, unless a longer storage period is requested in writing & accepted by Ardaman & Associates, Inc.

Where: Δu = Excess pore pressure; σ_1' = Major effective principal stress; and σ_3'= Minor effective principal stress.

Checked By: RM Date: 12/09/15

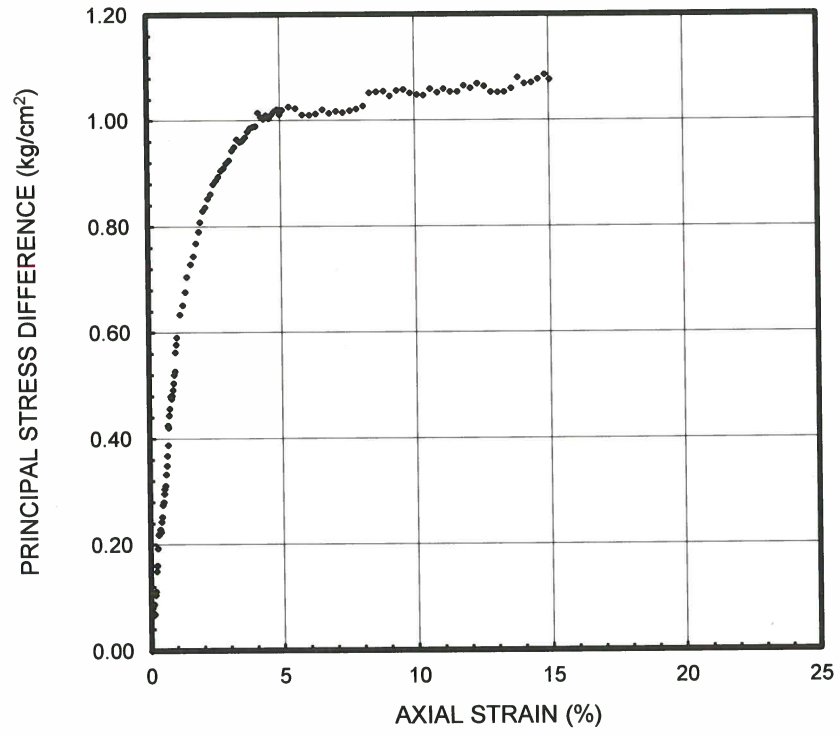
ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT

CLIENT: LOCKHEED MARTIN
PROJECT: MRC LABORATORY TESTING
FILE NO.: 15-13-0120

DATE SAMPLE RECEIVED: 10/19/15
DATE TEST SET-UP: 10/28/15
DATE REPORTED: 11/19/15

INCOMING SAMPLE NO.: ----
BORING: **TTDHC-4** SAMPLE: **ST-1**
DEPTH: 7 - 9 : ft; 9 m
LABORATORY IDENTIFICATION NO.: 150120/C4S1A
SAMPLE DESCRIPTION: Reddish-brown lean clay with sand

Specimen Dimensions			Initial Conditions			Test Conditions			at $(\sigma_1-\sigma_3)_{max}$			
H (cm)	D (cm)	H/D	w_c (%)	γ_d (lb/ft^3)	S (%)	σ_c (kg/cm^2)	Displacement Rate, $\dot{\varepsilon}$ (cm/minute)	Displacement Rate, $\dot{\varepsilon}$ (%/minute)	ε_a (%)	Undrained Shear Strength (kg/cm^2)	σ_1 (kg/cm^2)	σ_3 (kg/cm^2)
7.08	3.57	2.0	20.9	108.5	97	0.39	0.071	1.0	14.8	0.54	1.48	0.39
									Membrane Correction Made: ☐ Yes ☒ No			



TEST PROCEDURE: ASTM D2850

SAMPLE TYPE

Type	Diameter (inch)
☒ Undisturbed	3
☐ Rock Core	
☐ Compacted	

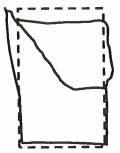
☐ Tamped Uniform Lifts
No. of Lifts: _____

☐ Kneading
No. of Lifts: _____
Spring: _____ lb.
Blows per Lift: _____

G_s: 2.78 ☒ Assumed ☐ Measured

FAILURE SKETCH

☒ Diagonal Plane
☐ Bulging
☐ Combination
☐ Other _____



Particle-Size Analysis		U.S. Standard Sieve Size	Gravel			Coarse Sand	Medium Sand		Fine Sand			
☐ ASTM D422 ☒ ASTM D1140-Method B			3/4"	3/8"	No. 4	No. 10	No. 20	No. 40	No. 60	No. 100	No. 140	No. 200
Dry Mass (g)	122.68	Soil Passing (%, dry mass basis)	---	---	---	---	---	---	---	---	---	76.7

Where: H = Specimen height; D = Specimen diameter; w_c = Water content (ASTM D2216); γ_d = Dry density; S = Saturation; σ_c = Isotropic confining stress; $\dot{\varepsilon}$ = Vertical displacement rate; ε_a = Axial strain; σ_1 = Major principal stress; σ_3 = Minor principal stress; and G_s = Specific gravity.

Checked By: TM
Date: 11/19/15

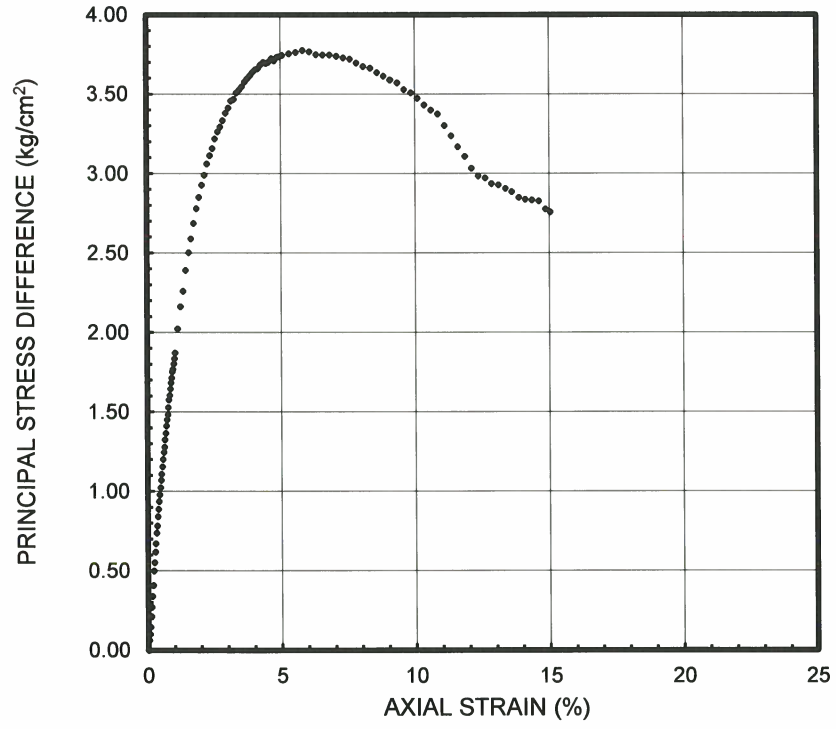
ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT

CLIENT: LOCKHEED MARTIN
PROJECT: MRC LABORATORY TESTING
FILE NO.: 15-13-0120

DATE SAMPLE RECEIVED: 10/19/15
DATE TEST SET-UP: 10/28/15
DATE REPORTED: 11/19/15

INCOMING SAMPLE NO.: ----
BORING: **TTDHC-4** SAMPLE: **ST-1**
DEPTH: 7 - 9 : ft; 9 m
LABORATORY IDENTIFICATION NO.: 150120/C4S1B
SAMPLE DESCRIPTION: Reddish-brown lean clay with sand

Specimen Dimensions			Initial Conditions			Test Conditions			at $(\sigma_1-\sigma_3)_{max}$			
H (cm)	D (cm)	H/D	w_c (%)	γ_d (lb/ft^3)	S (%)	σ_c (kg/cm^2)	Displacement Rate, $\dot{\varepsilon}$ (cm/minute)	Displacement Rate, $\dot{\varepsilon}$ (%/minute)	ε_a (%)	Undrained Shear Strength (kg/cm^2)	σ_1 (kg/cm^2)	σ_3 (kg/cm^2)
7.06	3.56	2.0	18.4	115.1	100	0.78	0.071	1.0	5.8	1.89	4.56	0.78
									Membrane Correction Made: ☐ Yes ☒ No			



TEST PROCEDURE: ASTM D2850

SAMPLE TYPE

Type	Diameter (inch)
☒ Undisturbed	3
☐ Rock Core	
☐ Compacted	

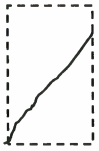
☐ Tamped Uniform Lifts
No. of Lifts: ____

☐ Kneading
No. of Lifts: ____
Spring: ____ lb.
Blows per Lift: ____

G_s: 2.78 ☒ Assumed ☐ Measured

FAILURE SKETCH

☒ Diagonal Plane
☐ Bulging
☐ Combination
☐ Other ____



Particle-Size Analysis		U.S. Standard Sieve Size	Gravel			Coarse Sand	Medium Sand		Fine Sand			
☐ ASTM D422 ☒ ASTM D1140-Method B			3/4"	3/8"	No. 4	No. 10	No. 20	No. 40	No. 60	No. 100	No. 140	No. 200
Dry Mass (g)	129.96	Soil Passing (%, dry mass basis)	---	---	---	---	---	---	---	---	---	75.1

Where: H = Specimen height; D = Specimen diameter; w_c = Water content (ASTM D2216); γ_d = Dry density; S = Saturation; σ_c = Isotropic confining stress; $\dot{\varepsilon}$ = Vertical displacement rate; ε_a = Axial strain; σ_1 = Major principal stress; σ_3 = Minor principal stress; and G_s = Specific gravity.

Checked By: RM
Date: 11/19/15

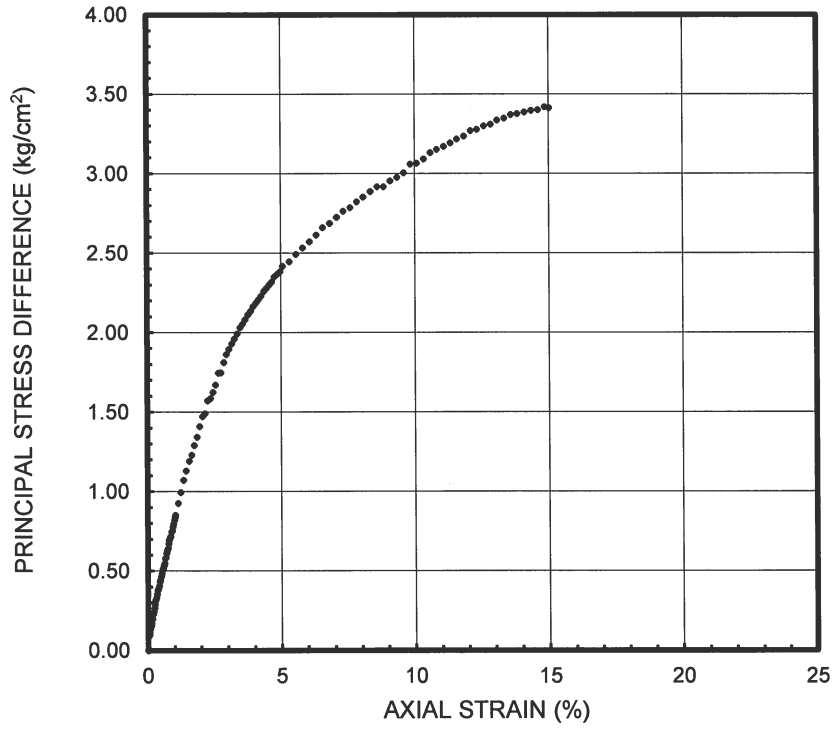
ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT

CLIENT: LOCKHEED MARTIN
PROJECT: MRC LABORATORY TESTING
FILE NO.: 15-13-0120

DATE SAMPLE RECEIVED: 10/19/15
DATE TEST SET-UP: 10/28/15
DATE REPORTED: 11/19/15

INCOMING SAMPLE NO.: ----
BORING: **TTDHC-4** SAMPLE: **ST-1**
DEPTH: 7 - 9 : ft; 9 m
LABORATORY IDENTIFICATION NO.: 150120/C4S1C
SAMPLE DESCRIPTION: Reddish-brown lean clay with sand

Specimen Dimensions			Initial Conditions			Test Conditions			at $(\sigma_1-\sigma_3)_{max}$			
H (cm)	D (cm)	H/D	w_c (%)	γ_d (lb/ft^3)	S (%)	σ_c (kg/cm^2)	Displacement Rate, $\dot{\varepsilon}$ (cm/minute)	Displacement Rate, $\dot{\varepsilon}$ (%/minute)	ε_a (%)	Undrained Shear Strength (kg/cm^2)	σ_1 (kg/cm^2)	σ_3 (kg/cm^2)
7.07	3.57	2.0	15.6	119.7	96	1.46	0.071	1.0	14.8	1.71	4.88	1.46
									Membrane Correction Made: ☐ Yes ☒ No			



TEST PROCEDURE: ASTM D2850

SAMPLE TYPE

Type	Diameter (inch)
☒ Undisturbed	3
☐ Rock Core	
☐ Compacted	

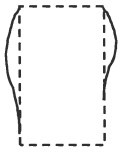
☐ Tamped Uniform Lifts
No. of Lifts: ____

☐ Kneading
No. of Lifts: ____
Spring: ____ lb.
Blows per Lift: ____

G_s: 2.78 ☒ Assumed ☐ Measured

FAILURE SKETCH

☐ Diagonal Plane
☒ Bulging
☐ Combination
☐ Other ____



Particle-Size Analysis		U.S. Standard Sieve Size	Gravel			Coarse Sand	Medium Sand		Fine Sand			
☐ ASTM D422 ☒ ASTM D1140-Method B			3/4"	3/8"	No. 4	No. 10	No. 20	No. 40	No. 60	No. 100	No. 140	No. 200
Dry Mass (g)	136.79	Soil Passing (%, dry mass basis)	---	---	---	---	---	---	---	---	---	71.4

Where: H = Specimen height; D = Specimen diameter; w_c = Water content (ASTM D2216); γ_d = Dry density; S = Saturation; σ_c = Isotropic confining stress; $\dot{\varepsilon}$ = Vertical displacement rate; ε_a = Axial strain; σ_1 = Major principal stress; σ_3 = Minor principal stress; and G_s = Specific gravity.

Checked By: TM
Date: 11/19/15

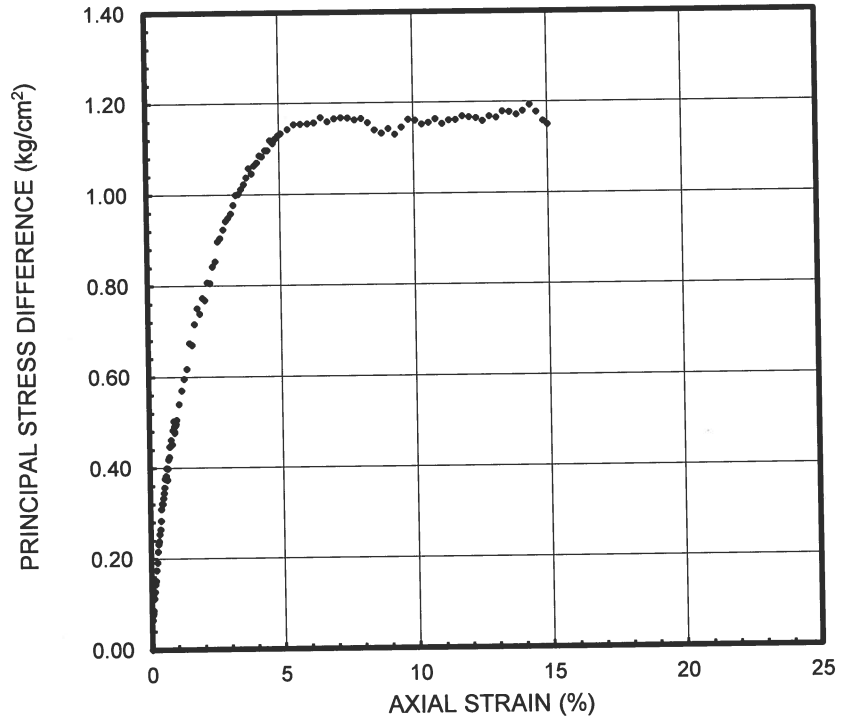
ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT

CLIENT: LOCKHEED MARTIN
PROJECT: MRC LABORATORY TESTING
FILE NO.: 15-13-0120

DATE SAMPLE RECEIVED: 10/19/15
DATE TEST SET-UP: 10/28/15
DATE REPORTED: 11/19/15

INCOMING SAMPLE NO.: ----
BORING: TTDHC-7 SAMPLE: ST-2
DEPTH: 30 - 32 : ft; 9 m
LABORATORY IDENTIFICATION NO.: 150120/C4S1A
SAMPLE DESCRIPTION: Reddish-brown lean clay

Specimen Dimensions			Initial Conditions			Test Conditions			at $(\sigma_1-\sigma_3)_{max}$			
H (cm)	D (cm)	H/D	w_c (%)	γ_d (lb/ft^3)	S (%)	σ_c (kg/cm^2)	Displacement Rate, $\dot{\varepsilon}$ (cm/minute)	Displacement Rate, $\dot{\varepsilon}$ (%/minute)	ε_a (%)	Undrained Shear Strength (kg/cm^2)	σ_1 (kg/cm^2)	σ_3 (kg/cm^2)
7.08	3.55	2.0	22.2	107.8	101	0.88	0.071	1.0	6.6	0.58	2.05	0.88
									Membrane Correction Made: ☐ Yes ☒ No			



TEST PROCEDURE: ASTM D2850

SAMPLE TYPE

Type	Diameter (inch)
☒ Undisturbed	3
☐ Rock Core	
☐ Compacted	

☐ Tamped Uniform Lifts
No. of Lifts: _____

☐ Kneading
No. of Lifts: _____
Spring: _____ lb.
Blows per Lift: _____

G_s: 2.78 ☒ Assumed ☐ Measured

FAILURE SKETCH

☒ Diagonal Plane
☐ Bulging
☐ Combination
☐ Other _____

Particle-Size Analysis		U.S. Standard Sieve Size	Gravel			Coarse Sand	Medium Sand		Fine Sand			
☐ ASTM D422 ☒ ASTM D1140-Method B			3/4"	3/8"	No. 4	No. 10	No. 20	No. 40	No. 60	No. 100	No. 140	No. 200
Dry Mass (g)	120.79	Soil Passing (%, dry mass basis)	---	---	---	---	---	---	---	---	---	96.8

Where: H = Specimen height; D = Specimen diameter; w_c = Water content (ASTM D2216); γ_d = Dry density; S = Saturation; σ_c = Isotropic confining stress; $\dot{\varepsilon}$ = Vertical displacement rate; ε_a = Axial strain; σ_1 = Major principal stress; σ_3 = Minor principal stress; and G_s = Specific gravity.

Checked By: TM
Date: 11/19/15

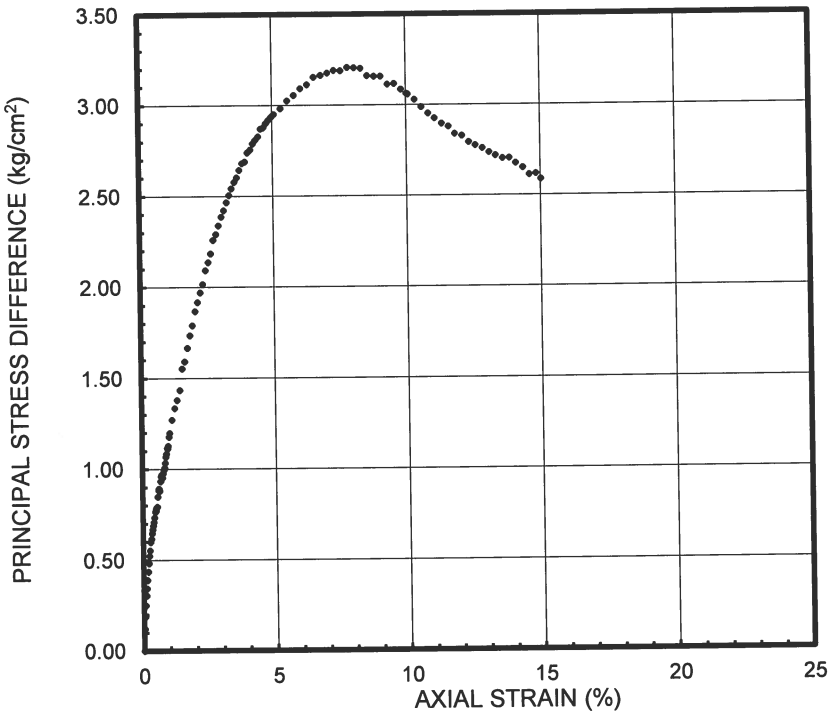
ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT

CLIENT: LOCKHEED MARTIN
PROJECT: MRC LABORATORY TESTING
FILE NO.: 15-13-0120

DATE SAMPLE RECEIVED: 10/19/15
DATE TEST SET-UP: 10/28/15
DATE REPORTED: 11/19/15

INCOMING SAMPLE NO.: ----
BORING: **TTDHC-7** SAMPLE: **ST-2**
DEPTH: 30 - 32 : ft; 9 m
LABORATORY IDENTIFICATION NO.: 150120/C4S1B
SAMPLE DESCRIPTION: Reddish-brown lean clay

Specimen Dimensions			Initial Conditions			Test Conditions			at $(\sigma_1-\sigma_3)_{max}$			
H (cm)	D (cm)	H/D	w_c (%)	γ_d (lb/ft^3)	S (%)	σ_c (kg/cm^2)	Displacement Rate, $\dot{\varepsilon}$ (cm/minute)	Displacement Rate, $\dot{\varepsilon}$ (%/minute)	ε_a (%)	Undrained Shear Strength (kg/cm^2)	σ_1 (kg/cm^2)	σ_3 (kg/cm^2)
7.09	3.56	2.0	21.1	109.9	101	1.95	0.071	1.0	7.8	1.60	5.16	1.95
									Membrane Correction Made: ☐ Yes ☒ No			



TEST PROCEDURE: ASTM D2850

SAMPLE TYPE

Type	Diameter (inch)
☒ Undisturbed	3
☐ Rock Core	
☐ Compacted	

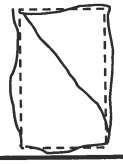
☐ Tamped Uniform Lifts
No. of Lifts: _____

☐ Kneading
No. of Lifts: _____
Spring: _____ lb.
Blows per Lift: _____

G_s: 2.78 ☒ Assumed ☐ Measured

FAILURE SKETCH

☒ Diagonal Plane
☐ Bulging
☐ Combination
☐ Other _____



Particle-Size Analysis		U.S. Standard Sieve Size	Gravel			Coarse Sand	Medium Sand		Fine Sand			
☐ ASTM D422 ☒ ASTM D1140-Method B			3/4"	3/8"	No. 4	No. 10	No. 20	No. 40	No. 60	No. 100	No. 140	No. 200
Dry Mass (g)	124.26	Soil Passing (%, dry mass basis)	---	---	---	---	---	---	---	---	---	96.6

Where: H = Specimen height; D = Specimen diameter; w_c = Water content (ASTM D2216); γ_d = Dry density; S = Saturation; σ_c = Isotropic confining stress; $\dot{\varepsilon}$ = Vertical displacement rate; ε_a = Axial strain; σ_1 = Major principal stress; σ_3 = Minor principal stress; and G_s = Specific gravity.

Checked By: TM
Date: 11/19/15

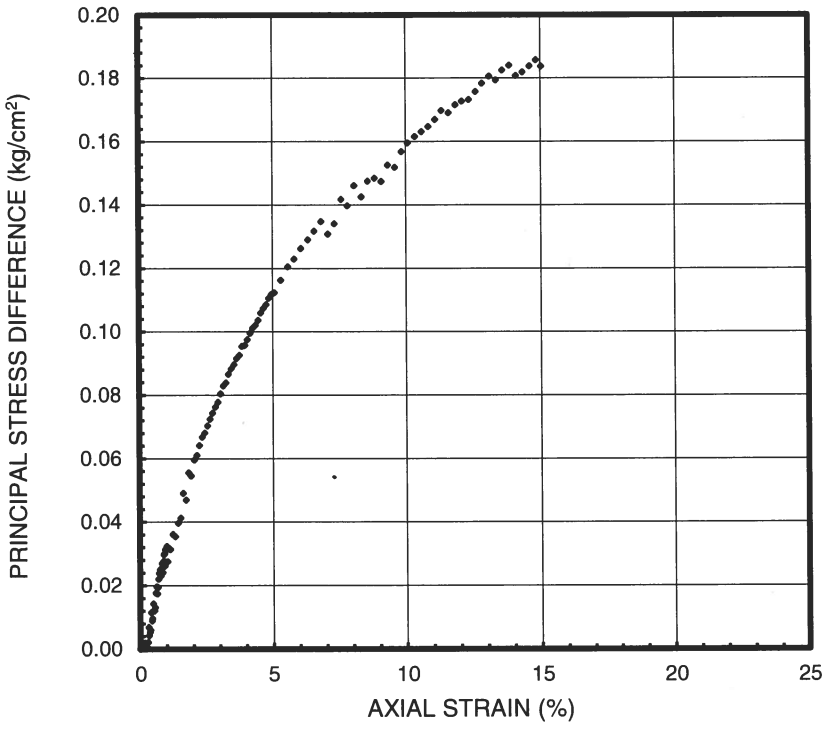
ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT

CLIENT: LOCKHEED MARTIN
PROJECT: MRC LABORATORY TESTING
FILE NO.: 15-13-0120

DATE SAMPLE RECEIVED: 10/19/15
DATE TEST SET-UP: 11/12/15
DATE REPORTED: 11/19/15

INCOMING SAMPLE NO.: ----
BORING: **TTDHCB-2** SAMPLE: **ST-1**
DEPTH: 8 - 10 ☒ ft; ☐ m
LABORATORY IDENTIFICATION NO.: 150120/B2S1A
SAMPLE DESCRIPTION: Reddish-brown lean clay with sand

Specimen Dimensions			Initial Conditions			Test Conditions			at $(\sigma_1-\sigma_3)_{max}$			
H (cm)	D (cm)	H/D	w_c (%)	γ_d (lb/ft^3)	S (%)	σ_c (kg/cm^2)	Displacement Rate, $\dot{\varepsilon}$ (cm/minute)	Displacement Rate, $\dot{\varepsilon}$ (%/minute)	ε_a (%)	Undrained Shear Strength (kg/cm^2)	σ_1 (kg/cm^2)	σ_3 (kg/cm^2)
6.66	3.73	1.8	20.4	106.6	90	0.34	0.071	1.1	13.8	0.090	0.52	0.34
									Membrane Correction Made: ☐ Yes ☒ No			



TEST PROCEDURE: ASTM D2850

SAMPLE TYPE

Type	Diameter (inch)
☒ Undisturbed	3
☐ Rock Core	
☐ Compacted	

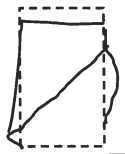
☐ Tamped Uniform Lifts
No. of Lifts: _____

☐ Kneading
No. of Lifts: _____
Spring: _____ lb.
Blows per Lift: _____

G_s: 2.78 ☒ Assumed ☐ Measured

FAILURE SKETCH

☒ Diagonal Plane
☐ Bulging
☐ Combination
☐ Other _____



Particle-Size Analysis		U.S. Standard Sieve Size	Gravel			Coarse Sand	Medium Sand		Fine Sand			
☐ ASTM D422 ☒ ASTM D1140-Method B			3/4"	3/8"	No. 4	No. 10	No. 20	No. 40	No. 60	No. 100	No. 140	No. 200
Dry Mass (g)	123.75	Soil Passing (%, dry mass basis)	---	---	---	---	---	---	---	---	---	72.7

Where: H = Specimen height; D = Specimen diameter; w_c = Water content (ASTM D2216); γ_d = Dry density; S = Saturation; σ_c = Isotropic confining stress; $\dot{\varepsilon}$ = Vertical displacement rate; ε_a = Axial strain; σ_1 = Major principal stress; σ_3 = Minor principal stress; and G_s = Specific gravity.

Checked By: _____
Date: 11/19/15

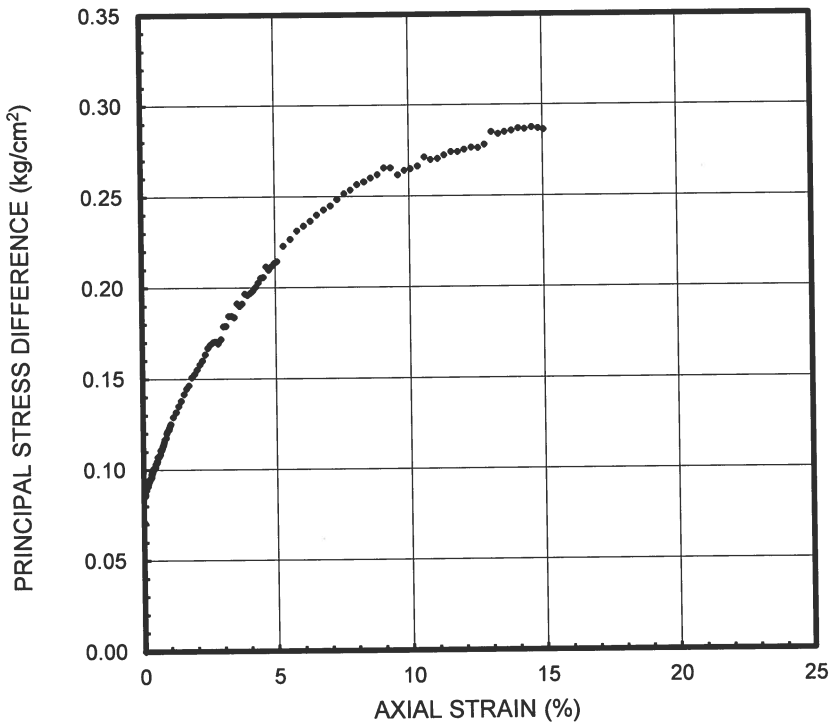
ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT

CLIENT: LOCKHEED MARTIN
PROJECT: MRC LABORATORY TESTING
FILE NO.: 15-13-0120

DATE SAMPLE RECEIVED: 10/19/15
DATE TEST SET-UP: 11/12/15
DATE REPORTED: 11/19/15

INCOMING SAMPLE NO.: ----
BORING: TTDHCB-2 SAMPLE: ST-1
DEPTH: 8 - 10 : ft; 9 m
LABORATORY IDENTIFICATION NO.: 150120/B2S1B
SAMPLE DESCRIPTION: Reddish-brown lean clay with sand

Specimen Dimensions			Initial Conditions			Test Conditions			at $(\sigma_1-\sigma_3)_{max}$			
H (cm)	D (cm)	H/D	w_c (%)	γ_d (lb/ft^3)	S (%)	σ_c (kg/cm^2)	Displacement Rate, $\dot{\varepsilon}$ (cm/minute)	Displacement Rate, $\dot{\varepsilon}$ (%/minute)	ε_a (%)	Undrained Shear Strength (kg/cm^2)	σ_1 (kg/cm^2)	σ_3 (kg/cm^2)
6.92	3.56	1.9	16.1	114.9	88	0.68	0.071	1.0	14.6	0.14	0.97	0.68
									Membrane Correction Made: ☐ Yes ☒ No			



TEST PROCEDURE: ASTM D2850

SAMPLE TYPE

Type	Diameter (inch)
☒ Undisturbed	3
☐ Rock Core	
☐ Compacted	

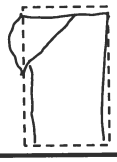
☐ Tamped Uniform Lifts
No. of Lifts: ____

☐ Kneading
No. of Lifts: ____
Spring: ____ lb.
Blows per Lift: ____

G_s: 2.78 ☒ Assumed ☐ Measured

FAILURE SKETCH

☒ Diagonal Plane
☐ Bulging
☐ Combination
☐ Other ____



Particle-Size Analysis		U.S. Standard Sieve Size	Gravel			Coarse Sand	Medium Sand		Fine Sand			
☐ ASTM D422 ☒ ASTM D1140-Method B			3/4"	3/8"	No. 4	No. 10	No. 20	No. 40	No. 60	No. 100	No. 140	No. 200
Dry Mass (g)	126.74	Soil Passing (%, dry mass basis)	---	---	---	---	---	---	---	---	---	71.4

Where: H = Specimen height; D = Specimen diameter; w_c = Water content (ASTM D2216); γ_d = Dry density; S = Saturation; σ_c = Isotropic confining stress; $\dot{\varepsilon}$ = Vertical displacement rate; ε_a = Axial strain; σ_1 = Major principal stress; σ_3 = Minor principal stress; and G_s = Specific gravity.

Checked By: TM
Date: 11/19/15

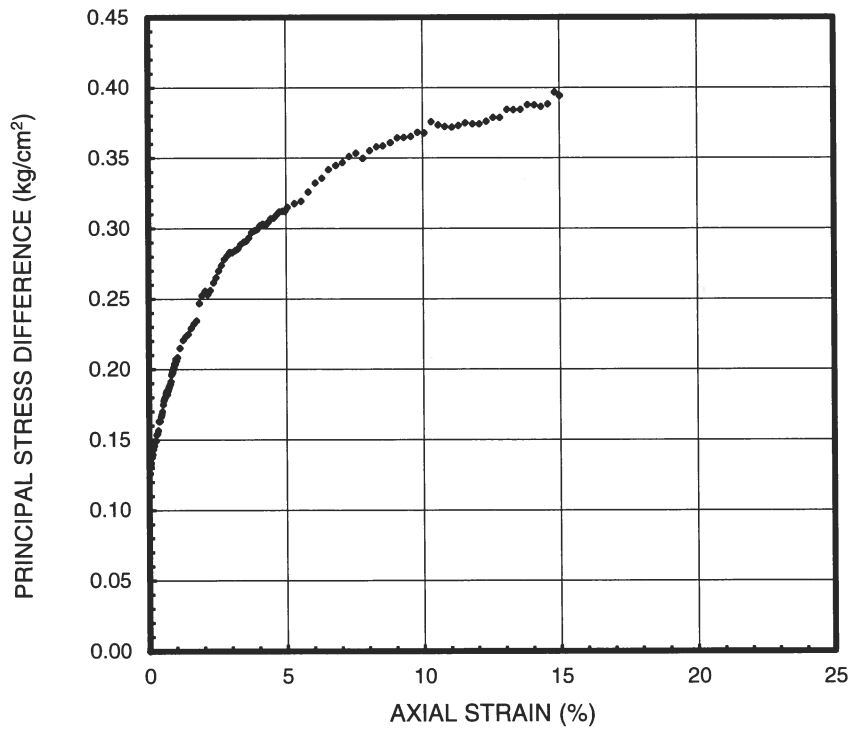
ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT

- CLIENT: LOCKHEED MARTIN
  PROJECT: MRC LABORATORY TESTING
  FILE NO.: 15-13-0120

  DATE SAMPLE RECEIVED: 10/19/15
  DATE TEST SET-UP: 11/12/15
  DATE REPORTED: 11/19/15

INCOMING SAMPLE NO.: ----
BORING: **TTDHCB-2** SAMPLE: **ST-1**
DEPTH: 8 - 10 ☒ ft; ☐ m
LABORATORY IDENTIFICATION NO.: 150120/B2S1C
SAMPLE DESCRIPTION: Reddish-brown lean clay

Specimen Dimensions			Initial Conditions			Test Conditions			at $(\sigma_1-\sigma_3)_{max}$			
H (cm)	D (cm)	H/D	w_c (%)	γ_d (lb/ft^3)	S (%)	σ_c (kg/cm^2)	Displacement Rate, $\dot{\varepsilon}$ (cm/minute)	Displacement Rate, $\dot{\varepsilon}$ (%/minute)	ε_a (%)	Undrained Shear Strength (kg/cm^2)	σ_1 (kg/cm^2)	σ_3 (kg/cm^2)
7.06	3.54	2.0	26.2	100.9	101	1.22	0.071	1.0	13.8	0.19	1.61	1.22
									Membrane Correction Made: ☐ Yes ☒ No			



TEST PROCEDURE: ASTM D2850

SAMPLE TYPE

Type	Diameter (inch)
☒ Undisturbed	3
☐ Rock Core	
☐ Compacted	

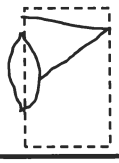
☐ Tamped Uniform Lifts
No. of Lifts: _____

☐ Kneading
No. of Lifts: _____
Spring: _____ lb.
Blows per Lift: _____

G_s: 2.78 ☒ Assumed ☐ Measured

FAILURE SKETCH

☐ Diagonal Plane
☐ Bulging
☒ Combination
☐ Other
_____



Particle-Size Analysis		U.S. Standard Sieve Size	Gravel			Coarse Sand	Medium Sand		Fine Sand			
☐ ASTM D422 ☒ ASTM D1140-Method B			3/4"	3/8"	No. 4	No. 10	No. 20	No. 40	No. 60	No. 100	No. 140	No. 200*
Dry Mass (g)	112.73	Soil Passing (%, dry mass basis)	---	---	---	---	---	---	---	---	---	93.5

Where: H = Specimen height; D = Specimen diameter; w_c = Water content (ASTM D2216); γ_d = Dry density; S = Saturation; σ_c = Isotropic confining stress; $\dot{\varepsilon}$ = Vertical displacement rate; ε_a = Axial strain; σ_1 = Major principal stress; σ_3 = Minor principal stress; and G_s = Specific gravity.

Checked By: [signature]
Date: 11/19/15

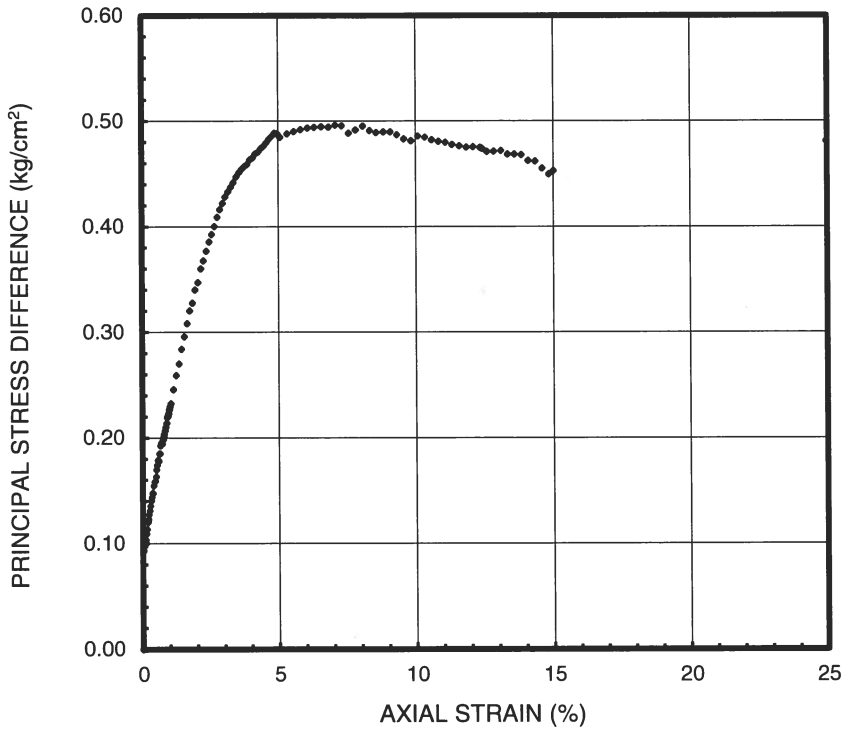
ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT

CLIENT: LOCKHEED MARTIN
PROJECT: MRC LABORATORY TESTING
FILE NO.: 15-13-0120

DATE SAMPLE RECEIVED: 10/19/15
DATE TEST SET-UP: 11/12/15
DATE REPORTED: 11/19/15

INCOMING SAMPLE NO.: ----
BORING: **TTDHCB-3** SAMPLE: **ST-2**
DEPTH: 12 - 14 ☒ ft; ☐ m
LABORATORY IDENTIFICATION NO.: 150120/B3S2A
SAMPLE DESCRIPTION: Dark gray clay

Specimen Dimensions			Initial Conditions			Test Conditions			at $(\sigma_1-\sigma_3)_{max}$			
H (cm)	D (cm)	H/D	w_c (%)	γ_d (lb/ft^3)	S (%)	σ_c (kg/cm^2)	Displacement Rate, $\dot{\varepsilon}$ (cm/minute)	Displacement Rate, $\dot{\varepsilon}$ (%/minute)	ε_a (%)	Undrained Shear Strength (kg/cm^2)	σ_1 (kg/cm^2)	σ_3 (kg/cm^2)
7.05	3.57	2.0	64.3	61.8	99	0.49	0.071	1.0	7.1	0.25	0.99	0.49
									Membrane Correction Made: ☐ Yes ☒ No			



TEST PROCEDURE: ASTM D2850

SAMPLE TYPE

Type	Diameter (inch)
☒ Undisturbed	3
☐ Rock Core	
☐ Compacted	

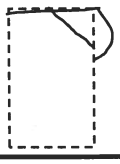
☐ Tamped Uniform Lifts
No. of Lifts: _____

☐ Kneading
No. of Lifts: _____
Spring: _____ lb.
Blows per Lift: _____

G_s: 2.75 ☒ Assumed ☐ Measured

FAILURE SKETCH

☐ Diagonal Plane
☐ Bulging
☒ Combination
☐ Other _____



Particle-Size Analysis		U.S. Standard Sieve Size	Gravel			Coarse Sand	Medium Sand		Fine Sand			
☐ ASTM D422 ☒ ASTM D1140-Method B			3/4"	3/8"	No. 4	No. 10	No. 20	No. 40	No. 60	No. 100	No. 140	No. 200
Dry Mass (g)	69.38	Soil Passing (%, dry mass basis)	---	---	---	---	---	---	---	---	---	85.6

Where: H = Specimen height; D = Specimen diameter; w_c = Water content (ASTM D2216); γ_d = Dry density; S = Saturation; σ_c = Isotropic confining stress; $\dot{\varepsilon}$ = Vertical displacement rate; ε_a = Axial strain; σ_1 = Major principal stress; σ_3 = Minor principal stress; and G_s = Specific gravity.

Checked By: TM
Date: 11/19/15

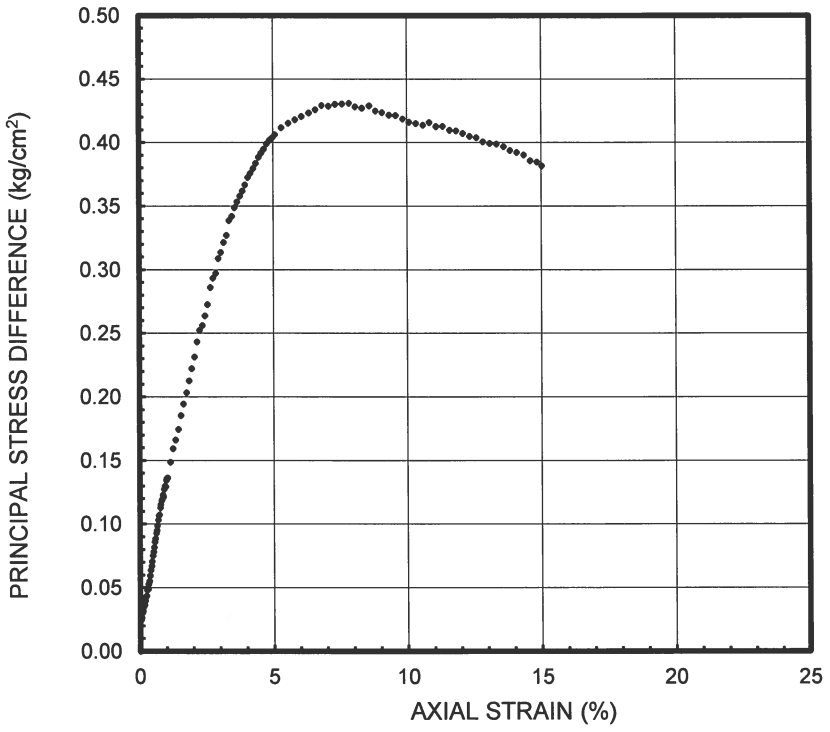
ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT

CLIENT: LOCKHEED MARTIN
PROJECT: MRC LABORATORY TESTING
FILE NO.: 15-13-0120

DATE SAMPLE RECEIVED: 10/19/15
DATE TEST SET-UP: 11/12/15
DATE REPORTED: 11/19/15

INCOMING SAMPLE NO.: ----
BORING: **TTDHCB-3** SAMPLE: **ST-2**
DEPTH: 12 - 14 : ft; 9 m
LABORATORY IDENTIFICATION NO.: 150120/B3S2B
SAMPLE DESCRIPTION: Dark gray clay with sand

Specimen Dimensions			Initial Conditions			Test Conditions			at $(\sigma_1-\sigma_3)_{max}$			
H (cm)	D (cm)	H/D	w_c (%)	γ_d (lb/ft^3)	S (%)	σ_c (kg/cm^2)	Displacement Rate, $\dot{\varepsilon}$ (cm/minute)	Displacement Rate, $\dot{\varepsilon}$ (%/minute)	ε_a (%)	Undrained Shear Strength (kg/cm^2)	σ_1 (kg/cm^2)	σ_3 (kg/cm^2)
7.08	3.56	2.0	61.0	64.5	101	0.98	0.071	1.0	7.8	0.22	1.41	0.98
									Membrane Correction Made: ☐ Yes ☒ No			



TEST PROCEDURE: ASTM D2850

SAMPLE TYPE

Type	Diameter (inch)
☒ Undisturbed	3
☐ Rock Core	
☐ Compacted	

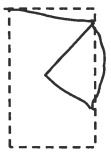
☐ Tamped Uniform Lifts
No. of Lifts: _____

☐ Kneading
No. of Lifts: _____
Spring: _____ lb.
Blows per Lift: _____

G_s: 2.75 ☒ Assumed ☐ Measured

FAILURE SKETCH

☐ Diagonal Plane
☒ Bulging
☐ Combination
☐ Other _____



Particle-Size Analysis		U.S. Standard Sieve Size	Gravel			Coarse Sand	Medium Sand		Fine Sand			
☐ ASTM D422 ☒ ASTM D1140-Method B			3/4"	3/8"	No. 4	No. 10	No. 20	No. 40	No. 60	No. 100	No. 140	No. 200
Dry Mass (g)	74.60	Soil Passing (%, dry mass basis)	---	---	---	---	---	---	---	---	---	75.8

Where: H = Specimen height; D = Specimen diameter; w_c = Water content (ASTM D2216); γ_d = Dry density; S = Saturation; σ_c = Isotropic confining stress; $\dot{\varepsilon}$ = Vertical displacement rate; ε_a = Axial strain; σ_1 = Major principal stress; σ_3 = Minor principal stress; and G_s = Specific gravity.

Checked By: TM
Date: 11/19/15

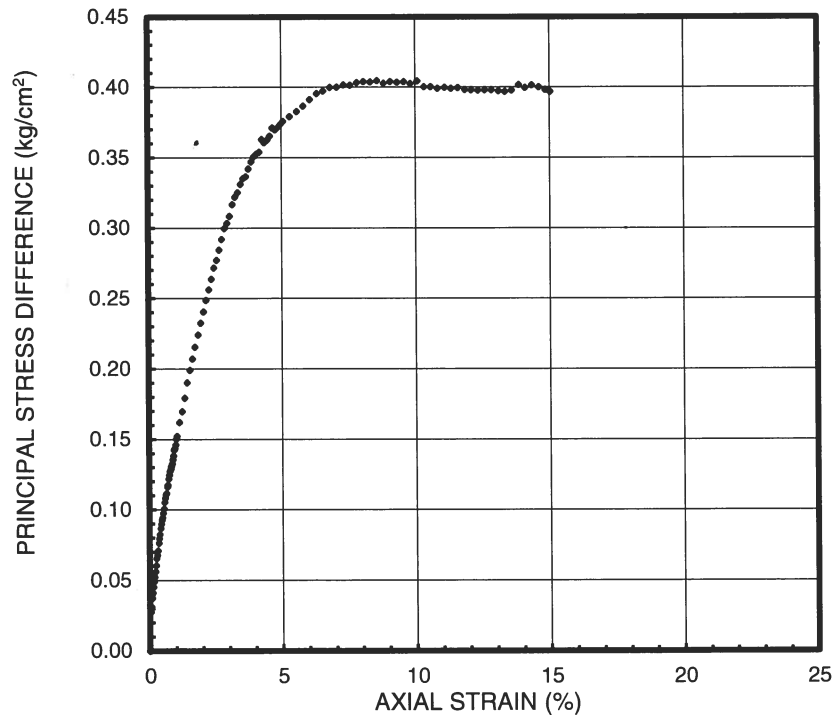
ARDAMAN & ASSOCIATES, INC. GEOTECHNICAL TESTING LABORATORY
UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT

CLIENT: LOCKHEED MARTIN
PROJECT: MRC LABORATORY TESTING
FILE NO.: 15-13-0120

DATE SAMPLE RECEIVED: 10/19/15
DATE TEST SET-UP: 11/12/15
DATE REPORTED: 11/19/15

INCOMING SAMPLE NO.: ----
BORING: **TTBHCB-3** SAMPLE: **ST-2**
DEPTH: 12 - 14 ☒ ft; ☐ m
LABORATORY IDENTIFICATION NO.: 150120/B3S2C
SAMPLE DESCRIPTION: Dark gray sandy clay

Specimen Dimensions			Initial Conditions			Test Conditions			at $(\sigma_1-\sigma_3)_{max}$			
H (cm)	D (cm)	H/D	w_c (%)	γ_d (lb/ft^3)	S (%)	σ_c (kg/cm^2)	Displacement Rate, $\dot{\varepsilon}$ (cm/minute)	Displacement Rate, $\dot{\varepsilon}$ (%/minute)	ε_a (%)	Undrained Shear Strength (kg/cm^2)	σ_1 (kg/cm^2)	σ_3 (kg/cm^2)
7.08	3.54	2.0	43.0	77.6	98	1.46	0.071	1.0	8.6	0.20	1.86	1.46
									Membrane Correction Made: ☐ Yes ☒ No			



TEST PROCEDURE: ASTM D2850

SAMPLE TYPE

Type	Diameter (inch)
☒ Undisturbed	3
☐ Rock Core	
☐ Compacted	

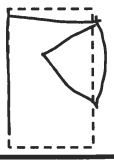
☐ Tamped Uniform Lifts
No. of Lifts: _____

☐ Kneading
No. of Lifts: _____
Spring: _____ lb.
Blows per Lift: _____

G_s: 2.75 ☒ Assumed ☐ Measured

FAILURE SKETCH

☐ Diagonal Plane
☒ Bulging
☐ Combination
☐ Other
_____



Particle-Size Analysis		U.S. Standard Sieve Size	Gravel			Coarse Sand	Medium Sand		Fine Sand			
☐ ASTM D422 ☒ ASTM D1140-Method B			3/4"	3/8"	No. 4	No. 10	No. 20	No. 40	No. 60	No. 100	No. 140	No. 200
Dry Mass (g)	86.33	Soil Passing (%, dry mass basis)	---	---	---	---	---	---	---	---	---	67.8

Where: H = Specimen height; D = Specimen diameter; w_c = Water content (ASTM D2216); γ_d = Dry density; S = Saturation; σ_c = Isotropic confining stress; $\dot{\varepsilon}$ = Vertical displacement rate; ε_a = Axial strain; σ_1 = Major principal stress; σ_3 = Minor principal stress; and G_s = Specific gravity.

Checked By: TM
Date: 11/19/15
Form SR-3A Rev. 1/dock

APPENDIX E—INVESTIGATION-DERIVED-WASTE DOCUMENTATION

Please print or type. (Form designed for use on elite (12-pitch) typewriter.) D4 150 4092462 SC PPW 12/4/2015

Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator ID Number: MDR 000 524 413
2. Page 1 of: 1
3. Emergency Response Phone: (800) 483-3718
4. Manifest Tracking Number: 009024101 FLE

GENERATOR

5. Generator's Name and Mailing Address
Lockheed Martin
199 Chesapeake Park Plaza
Baltimore, MD 21220
Generator's Phone: (810) 666-4012 ATTN: Mike Musheno

Generator's Site Address (if different than mailing address)
3323 Eastern Blvd
Middle River, MD 21220

6. Transporter 1 Company Name: Clean Harbors Environmental Service, Inc.
U.S. EPA ID Number: MAD039322250

7. Transporter 2 Company Name:
U.S. EPA ID Number:

8. Designated Facility Name and Site Address
Clean Harbors Chattanooga LLC
3300 Cummings Road
Chattanooga, TN 37419
Facility's Phone: (423) 821-6926
U.S. EPA ID Number: TND982141392

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes
	NON D.O.T. REGULATED, (SOIL, WATER)	46	DM	34,000	P	
	NON HAZARDOUS, NON D.O.T. REGULATED	2	DM	500	P	
	3.					
	4.					

14. Special Handling Instructions and Additional Information
1. CH1109341
2. CH582298
48 x 55 DM
3 x 55 DM

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name: X Michael Musheno
Signature:
Month: 12 Day: 17 Year: 15

INT'L

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter signature (for exports only): Date leaving U.S.:

TRANSPORTER

17. Transporter Acknowledgment of Receipt of Materials
Transporter 1 Printed/Typed Name: Kelly Blanchard
Signature:
Month: 12 Day: 17 Year: 15
Transporter 2 Printed/Typed Name:
Signature:
Month: Day: Year:

DESIGNATED FACILITY

18. Discrepancy
18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection
Manifest Reference Number:
18b. Alternate Facility (or Generator) U.S. EPA ID Number
Facility's Phone:
18c. Signature of Alternate Facility (or Generator) Month: Day: Year:

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

1.	2.	3.	4.
H141	H141		

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a
Printed/Typed Name: Signature: Month: Day: Year:

EPA Form 8700-22 (Rev. 3-05) Previous editions are obsolete.

GENERATOR'S INITIAL COPY

Clean Harbors has the appropriate permits for and will accept the waste the generator is shipping.

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator ID Number	2. Page 1 of	3. Emergency Response Phone	4. Manifest Tracking Number
MD0000324413	1		008750748 FLE

GENERATOR

5. Generator's Name and Mailing Address
Lockheed Martin
195 Chesapeake Park Plaza ATTN MICHAEL MUSHENO
Baltimore Md, 21220 410 456 1012

Generator's Site Address (if different than mailing address)
Lockheed Martin
2323 Eastern Blvd
Middle River, MD 21220

Generator's Phone:

6. Transporter 1 Company Name
Clean Harbors Env Services INC

U.S. EPA ID Number
MA0032222250

7. Transporter 2 Company Name

U.S. EPA ID Number

8. Designated Facility Name and Site Address
Clean Harbors El Dorado LLC
2547 American Circle
El Dorado, AR 71720 870-863-7173

U.S. EPA ID Number
AR0007743192

Facility's Phone:

9a. HM	9b. U.S. DOT Description (Including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes		
	1. NA 3082, Hazardous waste, Liquid, n.o.s., (Perchloroethylene), 9, PG III	1	DM	200	P	D039		
	2.							
	3.							
	4.							

14. Special Handling Instructions and Additional Information
1. 4911934 ERG#171 1x55DM

15. **GENERATOR'S/OFFEROR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name: Michael Musheno
Signature:
Month: 12 Day: 17 Year: 15

INT'L

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter signature (for exports only): Date leaving U.S.:

TRANSPORTER

17. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name: Kelly Cleveringa
Signature:
Month: Day: Year:

Transporter 2 Printed/Typed Name:
Signature:
Month: Day: Year:

DESIGNATED FACILITY

18. Discrepancy

18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

18b. Alternate Facility (or Generator)
U.S. EPA ID Number
Facility's Phone:

18c. Signature of Alternate Facility (or Generator)
Month: Day: Year:

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

1.	2.	3.	4.

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a

Printed/Typed Name:
Signature:
Month: Day: Year:

CleanHarbors
ENVIRONMENTAL SERVICES®

Land Disposal Restriction Notification Form

Printed Date :Dec 16, 2015

MANIFEST INFORMATION

Generator : Lockheed Martin

Address: 2323 Eastern Blvd.
Baltimore,MD 21220

EPA ID #: MDR000524413

Manifest Tracking Info.
008750748 FLE

Sales Order No: 1504092462

LINE ITEM INFORMATION

Line Item:	Page No:	Profile No:	Treatability Group:	LDR Disposal Category
1.	1	CH1109336	NON-WASTEWATER	2 (This is subject to LDR.)

EPA Waste Code	EPA Waste SubCategory
D034	NONE

Certification	Applies to Manifest Line Items
Pursuant to 40 CFR 268.7(a), I hereby notify that this shipment contains waste restricted under 40 CFR Part 268.	1.

Waste analysis data, where available, is attached.

Signature : Michael Mushero Print Name Michael Mushero

Title : Sr. Staff ESH Engineer Date : 12-17-15

WASTE MATERIAL PROFILE SHEET

Clean Harbors Profile No. CH1109336

A. GENERAL INFORMATION

GENERATOR EPA ID #/REGISTRATION # MDR000524413 ~~MDR000518700~~ | GENERATOR NAME: Lockheed Martin

GENERATOR CODE (Assigned by Clean Harbors) LO2553 | CITY Baltimore | STATE/PROVINCE MD | ZIP/POSTAL CODE 21220

ADDRESS ~~701 Wilson Point Road~~ 2323 EASTERN BLVD | PHONE: (610) 656-4012

CUSTOMER CODE (Assigned by Clean Harbors) TE0740 | CUSTOMER NAME: Tetra Tech Inc

ADDRESS 20251 Century Boulevard Suite 200 | CITY Germantown | STATE/PROVINCE MD | ZIP/POSTAL CODE 20874

B. WASTE DESCRIPTION

WASTE DESCRIPTION: Solids/Water with PCE

PROCESS GENERATING WASTE: Demolition and support of remedial activity

IS THIS WASTE CONTAINED IN SMALL PACKAGING CONTAINED WITHIN A LARGER SHIPPING CONTAINER ? No

C. PHYSICAL PROPERTIES (at 25C or 77F)

PHYSICAL STATE

- SOLID WITHOUT FREE LIQUID
- POWDER
- MONOLITHIC SOLID
- [x] LIQUID WITH NO SOLIDS
- [x] LIQUID/SOLID MIXTURE
  - % FREE LIQUID: 25.00 - 75.00
  - % SETTLED SOLID: 25.00 - 75.00
  - % TOTAL SUSPENDED SOLID
- SLUDGE
- GAS/AEROSOL

NUMBER OF PHASES/LAYERS

- [x] 1 2 3
- % BY VOLUME (Approx.): TOP 0.00 | MIDDLE 0.00 | BOTTOM 0.00

VISCOSITY (if liquid present)

- [x] 1 - 100 (e.g. Water)
- 101 - 500 (e.g. Motor Oil)
- 501 - 10,000 (e.g. Molasses)
- > 10,000

COLOR: varies

ODOR

- [x] NONE
- MILD
- STRONG

Describe:

BOILING POINT °F (°C)

- <= 95 (<=35)
- 95 - 100 (35-38)
- 101 - 129 (38-54)
- [x] >= 130 (>54)

MELTING POINT °F (°C)

- < 140 (<60)
- 140-200 (60-93)
- [x] > 200 (>93)

TOTAL ORGANIC CARBON

- [x] <= 1%
- 1-9%
- >= 10%

FLASH POINT °F (°C)

- < 73 (<23)
- 73 - 100 (23-38)
- 101 - 140 (38-60)
- 141 -200 (60-93)
- [x] > 200 (>93)

pH

- <= 2
- 2.1 - 6.9
- [x] 7 (Neutral)
- 7.1 - 12.4
- >= 12.5

SPECIFIC GRAVITY

- < 0.8 (e.g. Gasoline)
- 0.8-1.0 (e.g. Ethanol)
- 1.0 (e.g. Water)
- 1.0-1.2 (e.g. Antifreeze)
- [x] > 1.2 (e.g. Methylene Chloride)

ASH

- < 0.1
- 0.1 - 1.0
- 1.1 - 5.0
- 5.1 - 20.0
- > 20
- [x] Unknown

BTU/LB (MJ/kg)

- [x] < 2,000 (<4.6)
- 2,000-5,000 (4.6-11.6)
- 5,000-10,000 (11.6-23.2)
- > 10,000 (>23.2)

Actual:

D. COMPOSITION (List the complete composition of the waste, include any inert components and/or debris. Ranges for individual components are acceptable. If a trade name is used, please supply an MSDS. Please do not use abbreviations.)

CHEMICAL	MIN	--	MAX	UOM
PERCHLOROETHANE	39000.000000	--	39000.0000000	PPB
SOIL	25.0000000	--	75.0000000	%
WATER	25.0000000	--	75.0000000	%

DOES THIS WASTE CONTAIN ANY HEAVY GAUGE METAL DEBRIS OR OTHER LARGE OBJECTS (EX., METAL PLATE OR PIPING >1/4" THICK OR >12" LONG, METAL REINFORCED HOSE >12" LONG, METAL WIRE >12" LONG, METAL VALVES, PIPE FITTINGS, CONCRETE REINFORCING BAR OR PIECES OF CONCRETE >3")? YES [ ] NO [x]

If yes, describe, including dimensions:

DOES THIS WASTE CONTAIN ANY METALS IN POWDERED OR OTHER FINELY DIVIDED FORM? YES [ ] NO [x]

DOES THIS WASTE CONTAIN OR HAS IT CONTACTED ANY OF THE FOLLOWING: ANIMAL WASTES, HUMAN BLOOD, BLOOD PRODUCTS, BODY FLUIDS, MICROBIOLOGICAL WASTE, PATHOLOGICAL WASTE, HUMAN OR ANIMAL DERIVED SERUMS OR PROTEINS OR ANY OTHER POTENTIALLY INFECTIOUS MATERIAL? YES [ ] NO [x]

I acknowledge that this waste material is neither infectious nor does it contain any organism known to be a threat to human health. This certification is based on my knowledge of the material. Select the answer below that applies.

The waste was never exposed to potentially infectious material. YES NO

Chemical disinfection or some other form of sterilization has been applied to the waste. YES NO

I ACKNOWLEDGE THAT THIS PROFILE MEETS THE CLEAN HARBORS BATTERY PACKAGING REQUIREMENTS. YES NO

I ACKNOWLEDGE THAT MY FRIABLE ASBESTOS WASTE IS DOUBLE BAGGED AND WETTED. YES NO

SPECIFY THE SOURCE CODE ASSOCIATED WITH THE WASTE: G39 | SPECIFY THE FORM CODE ASSOCIATED WITH THE WASTE: W301

E. CONSTITUENTS

Are these values based on testing or knowledge? ☑ Knowledge ☐ Testing

If based on knowledge, please describe in detail, the rationale applied to identify and characterize the waste material. Please include reference to Material Safety Data Sheets (MSDS) when applicable. Include the chemical or trade-name represented by the MSDS, and or detailed process or operating procedures which generate the waste.

generator knowledge

Please indicate which constituents below apply. Concentrations must be entered when applicable to assist in accurate review and expedited approval of your waste profile. Please note that the total regulated metals and other constituents sections require answers.

RCRA	REGULATORY LEVEL (mg/l)	TCLP mg/l	TOTAL	UOM	NOT APPLICABLE
REGULATED METALS					
D004 ARSENIC	5.0				☑
D005 BARIUM	100.0				☑
D006 CADMIUM	1.0				☑
D007 CHROMIUM	5.0				☑
D008 LEAD	5.0				☑
D009 MERCURY	0.2				☑
D010 SELENIUM	1.0				☑
D011 SILVER	5.0				☑
VOLATILE COMPOUNDS					
D018 BENZENE	0.5				
D019 CARBON TETRACHLORIDE	0.5				
D021 CHLOROBENZENE	100.0				
D022 CHLOROFORM	6.0				
D028 1,2-DICHLOROETHANE	0.5				
D029 1,1-DICHLOROETHYLENE	0.7				
D035 METHYL ETHYL KETONE	200.0				
D039 TETRACHLOROETHYLENE	0.7				
D040 TRICHLOROETHYLENE	0.5				
D043 VINYL CHLORIDE	0.2				
SEMI-VOLATILE COMPOUNDS					
D023 o-CRESOL	200.0				
D024 m-CRESOL	200.0				
D025 p-CRESOL	200.0				
D026 CRESOL (TOTAL)	200.0				
D027 1,4-DICHLOROBENZENE	7.5				
D030 2,4-DINITROTOLUENE	0.13				
D032 HEXACHLOROBENZENE	0.13				
D033 HEXACHLOROBUTADIENE	0.5				
D034 HEXACHLOROETHANE	3.0	*3.9000*			
D036 NITROBENZENE	2.0				
D037 PENTACHLOROPHENOL	100.0				
D038 PYRIDINE	5.0				
D041 2,4,5-TRICHLOROPHENOL	400.0				
D042 2,4,6-TRICHLOROPHENOL	2.0				
PESTICIDES AND HERBICIDES					
D012 ENDRIN	0.02				
D013 LINDANE	0.4				
D014 METHOXYCHLOR	10.0				
D015 TOXAPHENE	0.5				
D016 2,4-D	10.0				
D017 2,4,5-TP (SILVEX)	1.0				
D020 CHLORDANE	0.03				
D031 HEPTACHLOR (AND ITS EPOXIDE)	0.008				

OTHER CONSTITUENTS	MAX	UOM	NOT APPLICABLE
BROMINE			☑
CHLORINE			☑
FLUORINE			☑
IODINE			☑
SULFUR			☑
POTASSIUM			☑
SODIUM			☑
AMMONIA			☑
CYANIDE AMENABLE			☑
CYANIDE REACTIVE			☑
CYANIDE TOTAL			☑
SULFIDE REACTIVE			☑

HOCs

☑ NONE
☐ < 1000 PPM
☐ >= 1000 PPM

PCBs

☑ NONE
☐ < 50 PPM
☐ >=50 PPM

IF PCBS ARE PRESENT, IS THE WASTE REGULATED BY TSCA 40 CFR 761?

☐ YES ☑ NO

ADDITIONAL HAZARDS

DOES THIS WASTE HAVE ANY UNDISCLOSED HAZARDS OR PRIOR INCIDENTS ASSOCIATED WITH IT, WHICH COULD AFFECT THE WAY IT SHOULD BE HANDLED?

☐ YES ☑ NO (If yes, explain)

CHOOSE ALL THAT APPLY

☐ DEA REGULATED SUBSTANCES	☐ EXPLOSIVE	☐ FUMING	☐ OSHA REGULATED CARCINOGENS
☐ POLYMERIZABLE	☐ RADIOACTIVE	☐ REACTIVE MATERIAL	☑ NONE OF THE ABOVE

F. REGULATORY STATUS

☑ YES ☐ NO USEPA HAZARDOUS WASTE?

D034

YES ☑ NO DO ANY STATE WASTE CODES APPLY?

Texas Waste Code

YES ☑ NO DO ANY CANADIAN PROVINCIAL WASTE CODES APPLY?

☑ YES ☐ NO IS THIS WASTE PROHIBITED FROM LAND DISPOSAL WITHOUT FURTHER TREATMENT PER 40 CFR PART 268?

LDR CATEGORY VARIANCE INFO: *This is subject to LDR.*

YES ☑ NO IS THIS A UNIVERSAL WASTE?

YES ☐ NO IS THE GENERATOR OF THE WASTE CLASSIFIED AS CONDITIONALLY EXEMPT SMALL QUANTITY GENERATOR (CESQG)?

YES ☐ NO IS THIS MATERIAL GOING TO BE MANAGED AS A RCRA EXEMPT COMMERCIAL PRODUCT, WHICH IS FUEL (40 CFR 261.2 (C)(2)(II))?

YES ☑ NO DOES TREATMENT OF THIS WASTE GENERATE A F006 OR F019 SLUDGE?

YES ☐ NO IS THIS WASTE STREAM SUBJECT TO THE INORGANIC METAL BEARING WASTE PROHIBITION FOUND AT 40 CFR 268.3(C)?

YES ☑ NO DOES THIS WASTE CONTAIN VOC'S IN CONCENTRATIONS >=500 PPM?

YES ☐ NO DOES THE WASTE CONTAIN GREATER THAN 20% OF ORGANIC CONSTITUENTS WITH A VAPOR PRESSURE >= .3KPA (.044 PSIA)?

YES ☑ NO DOES THIS WASTE CONTAIN AN ORGANIC CONSTITUENT WHICH IN ITS PURE FORM HAS A VAPOR PRESSURE > 77 KPA (11.2 PSIA)?

YES ☑ NO IS THIS CERCLA REGULATED (SUPERFUND) WASTE ?

YES ☑ NO IS THE WASTE SUBJECT TO ONE OF THE FOLLOWING NESHAP RULES?

Hazardous Organic NESHAP (HON) rule (subpart G) Pharmaceuticals production (subpart GGG)

YES ☑ NO IF THIS IS A US EPA HAZARDOUS WASTE, DOES THIS WASTE STREAM CONTAIN BENZENE?

YES NO Does the waste stream come from a facility with one of the SIC codes listed under benzene NESHAP or is this waste regulated under the benzene NESHAP rules because the original source of the waste is from a chemical manufacturing, coke by-product recovery, or petroleum refinery process?

YES NO Is the generating source of this waste stream a facility with Total Annual Benzene (TAB) >10 Mg/year?

What is the TAB quantity for your facility? Megagram/year (1 Mg = 2,200 lbs)

The basis for this determination is: Knowledge of the Waste Or Test Data Knowledge Testing

Describe the knowledge:

G. DOT/TDG INFORMATION

DOT/TDG PROPER SHIPPING NAME:

NA3082, HAZARDOUS WASTE, LIQUID, N.O.S., (PERCHLOROETHANE), 9, PG III

H. TRANSPORTATION REQUIREMENTS

ESTIMATED SHIPMENT FREQUENCY ☑ ONE TIME WEEKLY MONTHLY QUARTERLY YEARLY OTHER

☑ **CONTAINERIZED**

1-1 CONTAINERS/SHIPMENT

STORAGE CAPACITY: *1*

CONTAINER TYPE:

CUBIC YARD BOX PALLET

TOTE TANK ☑ DRUM

OTHER: DRUM SIZE *55*

BULK LIQUID

GALLONS/SHIPMENT: *0 Min -0 Max* GAL.

BULK SOLID

SHIPMENT UOM: TON YARD

TONS/YARDS/SHIPMENT: *0 Min - 0 Max*

I. SPECIAL REQUEST

COMMENTS OR REQUESTS

GENERATOR'S CERTIFICATION

I certify that I am authorized to execute this document as an authorized agent. I hereby certify that all information submitted in this and attached documents is correct to the best of my knowledge.I also certify that any samples submitted are representative of the actual waste.If Clean Harbors discovers a discrepancy during the approval process, Generator grants Clean Harbors the authority to amend the profile, as Clean Harbors deems necessary, to reflect the discrepancy.

AUTHORIZED SIGNATURE: Michael Mushano NAME (PRINT): Michael Mushano TITLE: Sr. Staff ESH Engineer DATE: 12-4-15

WASTE MATERIAL PROFILE SHEET

Clean Harbors Profile No. CH1109341

A. GENERAL INFORMATION

GENERATOR EPA ID #/REGISTRATION #: MDR000524413 ~~MDR000548708~~ | GENERATOR NAME: Lockheed Martin

GENERATOR CODE (Assigned by Clean Harbors): LO2553 | CITY: Baltimore | STATE/PROVINCE: MD | ZIP/POSTAL CODE: 21220

ADDRESS: ~~701 Wilson Point Road~~ 2323 EASTERN BLVD | PHONE: (610) 656-4012

CUSTOMER CODE (Assigned by Clean Harbors): TE0740 | CUSTOMER NAME: Tetra Tech Inc

ADDRESS: 20251 Century Boulevard Suite 200 | CITY: Germantown | STATE/PROVINCE: MD | ZIP/POSTAL CODE: 20874

B. WASTE DESCRIPTION

WASTE DESCRIPTION: MRC Non haz soil and water

PROCESS GENERATING WASTE: IDW Waste

IS THIS WASTE CONTAINED IN SMALL PACKAGING CONTAINED WITHIN A LARGER SHIPPING CONTAINER ?: No

C. PHYSICAL PROPERTIES (at 25C or 77F)

PHYSICAL STATE
- [ ] SOLID WITHOUT FREE LIQUID
- [ ] POWDER
- [ ] MONOLITHIC SOLID
- [x] LIQUID WITH NO SOLIDS
- [ ] LIQUID/SOLID MIXTURE

% FREE LIQUID: 25.00 - 75.00
% SETTLED SOLID: 75.00 - 25.00
- [ ] % TOTAL SUSPENDED SOLID
- [ ] SLUDGE
- [ ] GAS/AEROSOL

NUMBER OF PHASES/LAYERS
- [x] 1 [ ] 2 [ ] 3

% BY VOLUME (Approx.)
TOP: 0.00
MIDDLE: 0.00
BOTTOM: 0.00

VISCOSITY (If liquid present)
- [ ] 1 - 100 (e.g. Water)
- [x] 101 - 500 (e.g. Motor Oil)
- [ ] 501 - 10,000 (e.g. Molasses)
- [ ] > 10,000

COLOR: Brown/Soil

ODOR
- [x] NONE
- [ ] MILD
- [ ] STRONG

Describe:

BOILING POINT °F (°C)
- [ ] <= 95 (<=35)
- [ ] 95 - 100 (35-38)
- [ ] 101 - 129 (38-54)
- [x] >= 130 (>54)

MELTING POINT °F (°C)
- [ ] < 140 (<60)
- [ ] 140-200 (60-93)
- [x] > 200 (>93)

TOTAL ORGANIC CARBON
- [x] <= 1%
- [ ] 1-9%
- [ ] >= 10%

FLASH POINT °F (°C)
- [ ] < 73 (<23)
- [ ] 73 - 100 (23-38)
- [ ] 101 - 140 (38-60)
- [ ] 141 - 200 (60-93)
- [x] > 200 (>93)

pH
- [ ] <= 2
- [ ] 2.1 - 6.9
- [x] 7 (Neutral)
- [ ] 7.1 - 12.4
- [ ] >= 12.5

SPECIFIC GRAVITY
- [ ] < 0.8 (e.g. Gasoline)
- [ ] 0.8-1.0 (e.g. Ethanol)
- [ ] 1.0 (e.g. Water)
- [ ] 1.0-1.2 (e.g. Antifreeze)
- [x] > 1.2 (e.g. Methylene Chloride)

ASH
- [ ] < 0.1
- [ ] 0.1 - 1.0
- [ ] 1.1 - 5.0
- [ ] 5.1 - 20.0
- [ ] > 20
- [x] Unknown

BTU/LB (MJ/kg)
- [x] < 2,000 (<4.6)
- [ ] 2,000-5,000 (4.6-11.6)
- [ ] 5,000-10,000 (11.6-23.2)
- [ ] > 10,000 (>23.2)

Actual:

D. COMPOSITION (List the complete composition of the waste. Include any inert components and/or debris. Ranges for individual components are acceptable. If a trade name is used, please supply an MSDS. Please do not use abbreviations.)

CHEMICAL	MIN	--	MAX	UOM
IDW SOIL	80.0000000	--	95.0000000	%
WATER	5.0000000	--	20.0000000	%

DOES THIS WASTE CONTAIN ANY HEAVY GAUGE METAL DEBRIS OR OTHER LARGE OBJECTS (EX., METAL PLATE OR PIPING >1/4" THICK OR >12" LONG, METAL REINFORCED HOSE >12" LONG, METAL WIRE >12" LONG, METAL VALVES, PIPE FITTINGS, CONCRETE REINFORCING BAR OR PIECES OF CONCRETE >3")? [ ] YES [x] NO

If yes, describe, including dimensions:

DOES THIS WASTE CONTAIN ANY METALS IN POWDERED OR OTHER FINELY DIVIDED FORM? [ ] YES [x] NO

DOES THIS WASTE CONTAIN OR HAS IT CONTACTED ANY OF THE FOLLOWING; ANIMAL WASTES, HUMAN BLOOD, BLOOD PRODUCTS, BODY FLUIDS, MICROBIOLOGICAL WASTE, PATHOLOGICAL WASTE, HUMAN OR ANIMAL DERIVED SERUMS OR PROTEINS OR ANY OTHER POTENTIALLY INFECTIOUS MATERIAL? [ ] YES [x] NO

I acknowledge that this waste material is neither infectious nor does it contain any organism known to be a threat to human health. This certification is based on my knowledge of the material. Select the answer below that applies:

The waste was never exposed to potentially infectious material. YES NO

Chemical disinfection or some other form of sterilization has been applied to the waste. YES NO

I ACKNOWLEDGE THAT THIS PROFILE MEETS THE CLEAN HARBORS BATTERY PACKAGING REQUIREMENTS. YES NO

I ACKNOWLEDGE THAT MY FRIABLE ASBESTOS WASTE IS DOUBLE BAGGED AND WETTED. YES NO

SPECIFY THE SOURCE CODE ASSOCIATED WITH THE WASTE: G49

SPECIFY THE FORM CODE ASSOCIATED WITH THE WASTE: W301

E. CONSTITUENTS

Are these values based on testing or knowledge? ☑ Knowledge ☐ Testing

If based on knowledge, please describe in detail, the rationale applied to identify and characterize the waste material. Please include reference to Material Safety Data Sheets (MSDS) when applicable. Include the chemical or trade name represented by the MSDS, and or detailed process or operating procedures which generate the waste.

generator knowledge

Please indicate which constituents below apply. Concentrations must be entered when applicable to assist in accurate review and expedited approval of your waste profile. Please note that the total regulated metals and other constituents sections require answers.

RCRA	REGULATED METALS	REGULATORY LEVEL (mg/l)	TCLP mg/l	TOTAL	UOM	NOT APPLICABLE
D004	ARSENIC	5.0				☑
D005	BARIUM	100.0				☑
D006	CADMIUM	1.0				☑
D007	CHROMIUM	5.0				☑
D008	LEAD	5.0				☑
D009	MERCURY	0.2				☑
D010	SELENIUM	1.0				☑
D011	SILVER	5.0				☑

	VOLATILE COMPOUNDS					
D018	BENZENE	0.5				☑
D019	CARBON TETRACHLORIDE	0.5				☑
D021	CHLOROBENZENE	100.0				☑
D022	CHLOROFORM	6.0				☑
D028	1,2-DICHLOROETHANE	0.5				☑
D029	1,1-DICHLOROETHYLENE	0.7				☑
D035	METHYL ETHYL KETONE	200.0				☑
D039	TETRACHLOROETHYLENE	0.7				☑
D040	TRICHLOROETHYLENE	0.5				☑
D043	VINYL CHLORIDE	0.2				☑
	SEMI-VOLATILE COMPOUNDS					
D023	o-CRESOL	200.0				☑
D024	m-CRESOL	200.0				☑
D025	p-CRESOL	200.0				☑
D026	CRESOL (TOTAL)	200.0				☑
D027	1,4-DICHLOROBENZENE	7.5				☑
D030	2,4-DINITROTOLUENE	0.13				☑
D032	HEXACHLOROBENZENE	0.13				☑
D033	HEXACHLOROBUTADIENE	0.5				☑
D034	HEXACHLOROETHANE	3.0				☑
D036	NITROBENZENE	2.0				☑
D037	PENTACHLOROPHENOL	100.0				☑
D038	PYRIDINE	5.0				☑
D041	2,4,5-TRICHLOROPHENOL	400.0				☑
D042	2,4,6-TRICHLOROPHENOL	2.0				☑
	PESTICIDES AND HERBICIDES					
D012	ENDRIN	0.02				☑
D013	LINDANE	0.4				☑
D014	METHOXYCHLOR	10.0				☑
D015	TOXAPHENE	0.5				☑
D016	2,4-D	10.0				☑
D017	2,4,5-TP (SILVEX)	1.0				☑
D020	CHLORDANE	0.03				☑
D031	HEPTACHLOR (AND ITS EPOXIDE)	0.008				☑

OTHER CONSTITUENTS	MAX	UOM	NOT APPLICABLE
BROMINE			☑
CHLORINE			☑
FLUORINE			☑
IODINE			☑
SULFUR			☑
POTASSIUM			☑
SODIUM			☑
AMMONIA			☑
CYANIDE AMENABLE			☑
CYANIDE REACTIVE			☑
CYANIDE TOTAL			☑
SULFIDE REACTIVE			☑

HOCs

☑ NONE
< 1000 PPM
>= 1000 PPM

PCBs

☑ NONE
< 50 PPM
>=50 PPM

IF PCBS ARE PRESENT, IS THE WASTE REGULATED BY TSCA 40 CFR 761?

YES ☑ NO

ADDITIONAL HAZARDS

DOES THIS WASTE HAVE ANY UNDISCLOSED HAZARDS OR PRIOR INCIDENTS ASSOCIATED WITH IT, WHICH COULD AFFECT THE WAY IT SHOULD BE HANDLED?

YES ☑ NO (If yes, explain)

CHOOSE ALL THAT APPLY

DEA REGULATED SUBSTANCES	EXPLOSIVE	FUMING	OSHA REGULATED CARCINOGENS
POLYMERIZABLE	RADIOACTIVE	REACTIVE MATERIAL	☑ NONE OF THE ABOVE

F. REGULATORY STATUS

YES ☑ NO USEPA HAZARDOUS WASTE?

YES ☑ NO DO ANY STATE WASTE CODES APPLY?

Texas Waste Code

YES ☑ NO DO ANY CANADIAN PROVINCIAL WASTE CODES APPLY?

YES ☑ NO IS THIS WASTE PROHIBITED FROM LAND DISPOSAL WITHOUT FURTHER TREATMENT PER 40 CFR PART 268?

LDR CATEGORY VARIANCE INFO: ***Not subject to LDR***

YES ☑ NO IS THIS A UNIVERSAL WASTE?

YES ☑ NO IS THE GENERATOR OF THE WASTE CLASSIFIED AS CONDITIONALLY EXEMPT SMALL QUANTITY GENERATOR (CESQG)?

YES NO IS THIS MATERIAL GOING TO BE MANAGED AS A RCRA EXEMPT COMMERCIAL PRODUCT, WHICH IS FUEL (40 CFR 261.2 (C)(2)(II))?

YES ☑ NO DOES TREATMENT OF THIS WASTE GENERATE A F006 OR F019 SLUDGE?

YES NO IS THIS WASTE STREAM SUBJECT TO THE INORGANIC METAL BEARING WASTE PROHIBITION FOUND AT 40 CFR 268.3(C)?

YES ☑ NO DOES THIS WASTE CONTAIN VOC'S IN CONCENTRATIONS >=500 PPM?

YES NO DOES THE WASTE CONTAIN GREATER THAN 20% OF ORGANIC CONSTITUENTS WITH A VAPOR PRESSURE >= .3KPA (.044 PSIA)?

YES ☑ NO DOES THIS WASTE CONTAIN AN ORGANIC CONSTITUENT WHICH IN ITS PURE FORM HAS A VAPOR PRESSURE > 77 KPA (11.2 PSIA)?

YES ☑ NO IS THIS CERCLA REGULATED (SUPERFUND) WASTE ?

YES ☑ NO IS THE WASTE SUBJECT TO ONE OF THE FOLLOWING NESHAP RULES?

Hazardous Organic NESHAP (HON) rule (subpart G) Pharmaceuticals production (subpart GGG)

YES NO IF THIS IS A US EPA HAZARDOUS WASTE, DOES THIS WASTE STREAM CONTAIN BENZENE?

YES NO Does the waste stream come from a facility with one of the SIC codes listed under benzene NESHAP or is this waste regulated under the benzene NESHAP rules because the original source of the waste is from a chemical manufacturing, coke by-product recovery, or petroleum refinery process?

YES NO Is the generating source of this waste stream a facility with Total Annual Benzene (TAB) >10 Mg/year?

What is the TAB quantity for your facility? Megagram/year (1 Mg = 2,200 lbs)

The basis for this determination is: Knowledge of the Waste Or Test Data Knowledge Testing

Describe the knowledge:

G. DOT/TDG INFORMATION

DOT/TDG PROPER SHIPPING NAME:

NON D.O.T. REGULATED, (SOIL, WATER)

H. TRANSPORTATION REQUIREMENTS

ESTIMATED SHIPMENT FREQUENCY: ONE TIME WEEKLY MONTHLY QUARTERLY ☑ YEARLY OTHER ***Other***

☑ **CONTAINERIZED**

1-50 CONTAINERS/SHIPMENT

STORAGE CAPACITY: ***200***

CONTAINER TYPE:

CUBIC YARD BOX PALLET

TOTE TANK ☑ DRUM

OTHER

DRUM SIZE: ***55***

BULK LIQUID

GALLONS/SHIPMENT: ***0 Min -0 Max*** GAL.

BULK SOLID

SHIPMENT UOM: TON YARD

TONS/YARDS/SHIPMENT: ***0 Min - 0 Max***

I. SPECIAL REQUEST

COMMENTS OR REQUESTS:

cnos

GENERATOR'S CERTIFICATION

I certify that I am authorized to execute this document as an authorized agent. I hereby certify that all information submitted in this and attached documents is correct to the best of my knowledge. I also certify that any samples submitted are representative of the actual waste. If Clean Harbors discovers a discrepancy during the approval process, Generator grants Clean Harbors the authority to amend the profile, as Clean Harbors deems necessary, to reflect the discrepancy.

AUTHORIZED SIGNATURE	NAME (PRINT)	TITLE	DATE
Michael Moreno	Michael Moreno	Sr. Staff EST Engineer	12-4-15

Waste Identifcation and Classification Form

Remediation Project	Middle River Complex Geotechnical Bulkhead Investigation	**State Generated**	MD
Description of Waste			
Generic Name	Debris-Decontamination Pad Plastic	**Solid, Liquid, Gas**	Solid-Debris
		Additional Info.	
Date of Waste Generation	9/29/2015-10/9/15	**Ongoing (Y/N)?**	N

Description of Process Generating Waste

2 drums of plastic sheeting fromdecontamination pad from mud rotary drilling both onshore and offshore for geotechnical bulkhead investigation at Lockheed Martin Middle River Complex.

Listed Waste ? (Y/N)	N	**F,K, P or U Codes**	

Justification for Waste Classification (attached supporting documentation)

No sample collected, profiled as nonhazardous based on sample analysis of sediment/water IDW. Drums removed from the site December 17th, 2015.

Form completed by	Tony Apanavage
Date	12/7/2015

Waste Identifcation and Classification Form

Remediation Project	Middle River Complex Geotechnical Bulkhead Investigation	**State Generated**	MD
Description of Waste			
Generic Name	Sediment-Liquid/Solid Mixture	**Solid, Liquid, Gas**	Sediment-Liquid/Solid Mixture
		Additional Info.	
Date of Waste Generation	9/29/2015-10/9/15	**Ongoing (Y/N)?**	N

Description of Process Generating Waste

1 drum of hazardous sediment (water and solids mixture) for PCE from mud rotary drilling from offshore boring for geotechnical bulkhead investigation at Lockheed Martin Middle River Complex.

Listed Waste ? (Y/N)	N	**F,K, P or U Codes**	D034

Justification for Waste Classification (attached supporting documentation)

Waste characterization sample collected, profiled as hazardous based on sample analysis and elevated PCE detection. Drum removed from the site December 17th, 2015.

Form completed by	Tony Apanavage
Date	12/7/2015

APPENDIX F—GEOTECHNICAL PROFILES

Ardaman and Associates

SUBSURFACE DIAGRAM

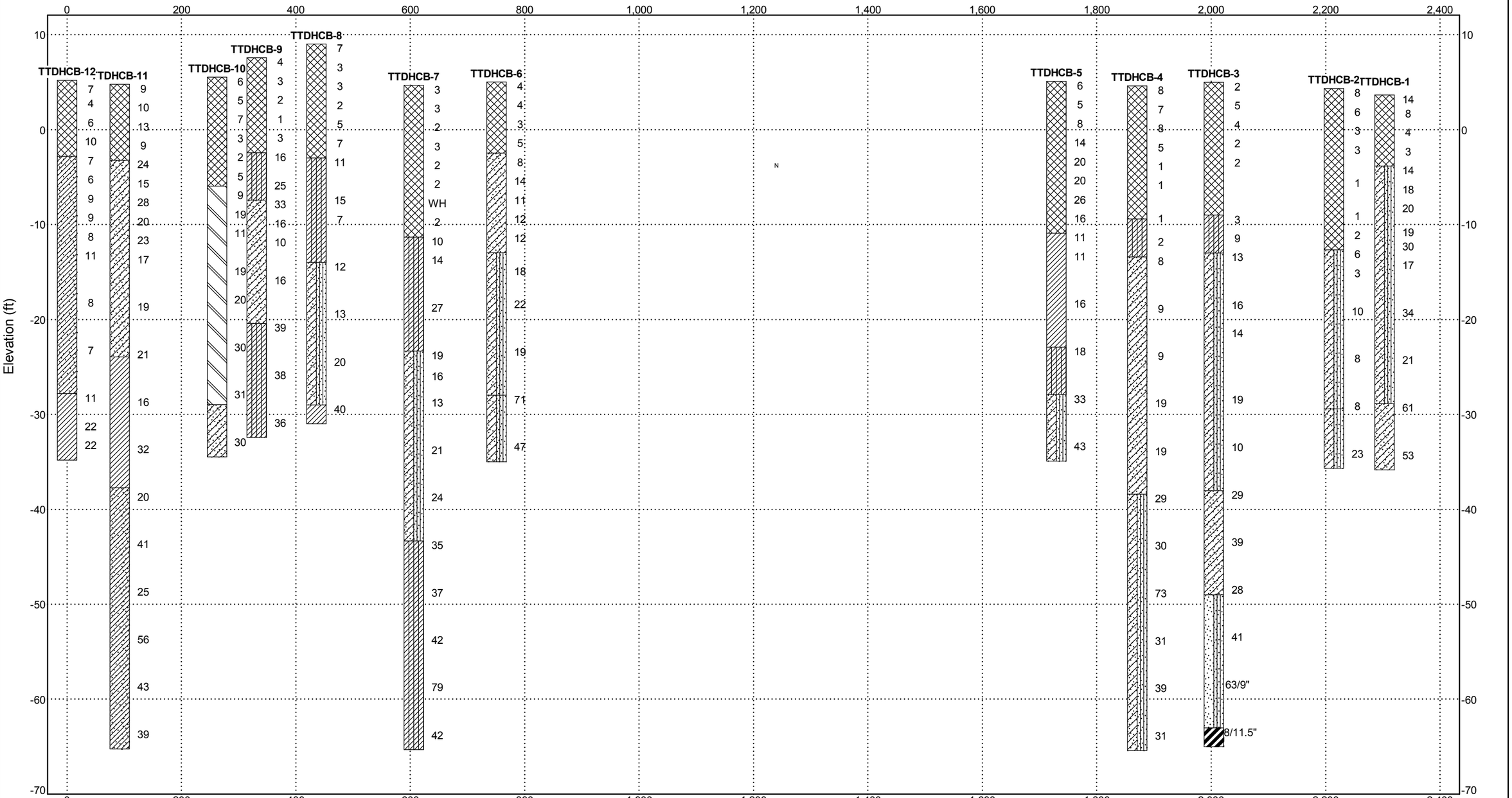
CLIENT Lockheed Martin Corporation

PROJECT NUMBER 194-8711

PROJECT NAME Lockheed Martin MRC

PROJECT LOCATION Middle River, MD

- Fill (made ground)
- USCS Low to High Plasticity Clay
- USCS Low Plasticity Silty Clay
- USCS Clayey Sand
- USCS Low Plasticity Clay
- USCS Poorly-graded Sand with Silt
- USCS Clayey Sand
- USCS Low Plasticity Sandy Clay
- USCS High Plasticity Clay



STRATIGRAPHY & GW - B SIZE - ACE_1836.GDT - 12/10/15 17:28 - C:\USERS\JIHANE.ROUGUIDESKTOP\LOCKHEED - GINTL\LOCKHEED-MRC.GPJ

SUBSURFACE DIAGRAM

Ardaman and Associates

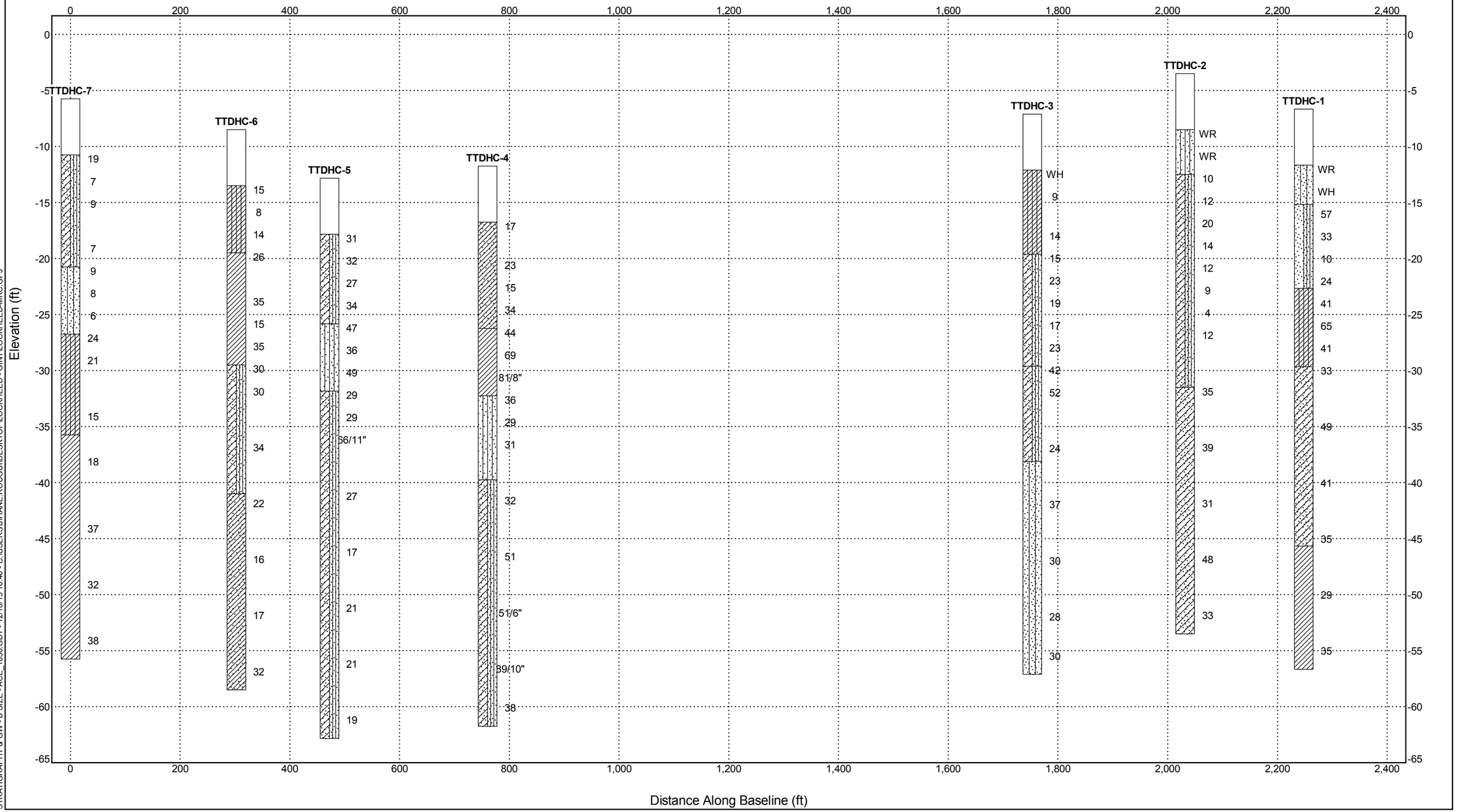
CLIENT Lockheed Martin Corporation

PROJECT NUMBER 194-8711

PROJECT NAME Lockheed Martin MRC

PROJECT LOCATION Middle River, MD

- USCS Silty Sand
- USCS Clayey Sand
- USCS Clayey Sand
- USCS Poorly-graded Sand with Silt
- USCS Low Plasticity Clay
- USCS Low Plasticity Sandy Clay
- USCS Low Plasticity Silty Clay
- USCS Sandy Silt



STRATIGRAPHY & GW - B SIZE - ACE_1836.GDT - 12/10/15 16:40 - C:\USERS\JIHANE.ROUGUI\DESKTOP\LOCKHEED - GINT\LOCKHEED-MRC.GPJ