January 10, 2018 REVISION 1

RJ LEE GROUP
DELIVERING SCIENTIFIC RESOLUTION

October 26, 2017

CH2M HILL Plateau Remediation Company
2420 Stevens Center Place
P.O. Box 1600
Richland, WA 99354
Attn.: Tracey A. Burch

**Subject: Geotechnical Laboratory Testing Services, Data Deliverable for SDG # W709013, Rev. 0**

Enclosed is the final report on geotechnical analyses performed by RJ Lee Group in conjunction with PBS Engineering and Environmental, Inc. (PBS) for Sample Delivery Group number (SDG #) W709013.

**General Set Comments**
RJ Lee Group received from CH2M-Hill Plateau Remediation Company (CHPRC) 1 sample to be tested for geotechnical analysis at the Columbia Basin Analytical Laboratories. There are no SIRs associated with this SDG.

The CHPRC sample, in SDG # W709013, has been assigned a PBS Geotechnical Lab Sample number per the below table.

| CHPRC Sample # | SDG # | Geotechnical Lab Sample # | Date Processed |
|---|---|---|---|
| B3BX66 | W709013 | H-0187A | 10/17/2017 |
| B3BJH7 | W709013 | H-0187B | 10/17/2017 |

This project deliverable, provided in Attachment 1, contains the reports of the requested analytical results and a copy of the associated chain of custody for the sample listed above.

The analytical results provided in this deliverable relate only to the items tested. The sample was received in acceptable condition unless otherwise noted in the attached report(s).

I certify that this analytical report is in compliance with the Hanford SOW, both technically and for completeness. Release of the data contained in this hard copy report has been authorized by the Laboratory Director or a designee as verified by the following signature.

Donald J. Smith

10/26/2017

Donald Smith
Laboratory Director, Columbia Basin Analytical Laboratories

Date

If you have any questions, please feel free to contact us at 509-545-4989 or email at don.smith@rjleegroup.com.

# Attachment 1

PBS Geotechnical Laboratory Testing Results, SDG # W709013,
Dated October 26, 2017

January 10, 2018

REVISION 1

October 17, 2017

Mr. Larry Lockrem
RJ Lee Group, Inc.
2710 North 20th Avenue
Pasco, Washington 99301

Via email: llockrem@rjleegroup.com

Regarding: Geotechnical Laboratory Testing Results
CH2M HILL Plateau Remediation
Sample Delivery Group No. W709013
PBS Project No. 63797.000

Dear Mr. Lockrem:

PBS Engineering and Environmental Inc. (PBS) is pleased to present the results of our recent geotechnical laboratory testing in accordance with the request provided with Sample Delivery Group (SDG) number W709013.

PBS performed the following tests in general accordance with the relevant ASTM Standards:

- Grain Size Analysis (ASTM D422)
- Permeability of Granular Soils–Constant Head (ASTM D2434)

We trust this letter meets your current needs. If you have any questions, or wish to further discuss our observations, conclusions, and recommendations, please contact us at 509.942.1600.

Sincerely,

10/17/2017

Adam M. Swenson, PE
Project Geotechnical Engineer

Attachment(s): Report of Laboratory Testing – Grain-size Analysis
Report of Laboratory Testing – Permeability of Granular Soils–Constant Head
Chain of Custody

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RJ LEE GROUP
DELIVERING SCIENTIFIC RESOLUTION

**REPORT OF LABORATORY TESTING**

| | | | |
|---|---|---|---|
| **Report to:** | CH2M-Hill - Plateau Remediation<br>2420 Stevens Center Place<br>PO Box 1600<br>Richland, WA 99354 | **Date:**<br>**Sample Delivery Group No.:**<br>**Sample Authorization No.:** | 10/17/2017<br>W709013<br>F16-040 |
| **Project:** | CHPRC Laboratory | **Project No.:** | 63797.000 |
| **Report of:** | Grain Size Analysis - Hydrometer (ASTM D422) | **Lab Technician:** | P. Brice |

**Items Received:**
Two samples were provided to us containing soil material obtained by you, the client.
PBS performed the following test:

Particle/Grain Size Analysis - Hydrometer (ASTM D422):
Mechanical Grain Size Analyses (wet sieve) were conducted on each of the soil samples to determine their grain size distribution. In addition, hydrometer tests were conducted on portions of the soil samples passing the No. 10 sieve. The results of the mechnical grain size analyses and hydrometer testing are plotted on the attached Figure (Particle Size Analysis Test Results - Hydrometer, pages 1 through 3).

**LABORATORY TEST RESULTS**

**Particle Grain Size Analysis - Hydrometer (ASTM D422) - Sieve Portion**

| Customer Sample Number | Laboratory Sample Number | Percent Passing by Sieve Size | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 3-in. | 1½-in. | ¾-in. | ⅜-in. | No. 4 | No. 10 | No. 20 | No. 40 | No. 60 | No. 100 | No. 140 | No. 200 |
| B3BX66 | H-187A | 100 | 83.1 | 71.4 | 55.4 | 47.7 | 43.8 | 40.4 | 32.7 | 19.5 | 9.6 | 6.9 | 5.6 |
| B3BJH7 | H-187B | 100 | 92.4 | 82.3 | 69.7 | 65.8 | 63.8 | 62.2 | 38.3 | 22.6 | 10.1 | 6.4 | 4.8 |
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SHEET 1 OF 3 REVIEWED BY: A. Swenson, P.E.

January 10, 2018 REVISION 1

RJ LEE GROUP
DELIVERING SCIENTIFIC RESOLUTION

**REPORT OF LABORATORY TESTING**

| | | | |
|---|---|---|---|
| **Report to:** | CH2M-Hill - Plateau Remediation<br>2420 Stevens Center Place<br>PO Box 1600<br>Richland, WA 99354 | **Date:**<br>**Sample Delivery Group No.:**<br>**Sample Authorization No.:** | 10/17/2017<br>W709013<br>F16-040 |
| **Project:** | CHPRC Laboratory | **Project No.:** | 63797.000 |
| **Report of:** | Grain Size Analysis - Hydrometer (ASTM D422) | **Lab Technician:** | P. Brice |

Particle/Grain Size Analysis - Hydrometer (ASTM D422):
See page 1 of 3

**LABORATORY TEST RESULTS**

**Particle Grain Size Analysis - Hydrometer (ASTM D422) - Hydrometer Portion**

| Laboratory Sample Number | Hydrometer Readings | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 min | | 5min | | 15 min | | 30 min | | 60 min | | 250 min | | 1440 min | |
| | Dia. (mm) | Finer (%) | Dia. (mm) | Finer (%) | Dia. (mm) | Finer (%) | Dia. (mm) | Finer (%) | Dia. (mm) | Finer (%) | Dia. (mm) | Finer (%) | Dia. (mm) | Finer (%) |
| H-187A | 0.036 | 3.4 | 0.023 | 2.7 | 0.013 | 2.3 | 0.009 | 2.0 | 0.007 | 1.7 | 0.003 | 1.7 | 0.001 | 1.0 |
| H-187B | 0.037 | 2.9 | 0.023 | 2.4 | 0.013 | 2.4 | 0.009 | 2.4 | 0.007 | 1.8 | 0.003 | 1.7 | 0.001 | 1.0 |
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SHEET 2 OF 3 REVIEWED BY: A. Swenson, P.E.

RJ LEE GROUP
DELIVERING SCIENTIFIC RESOLUTION

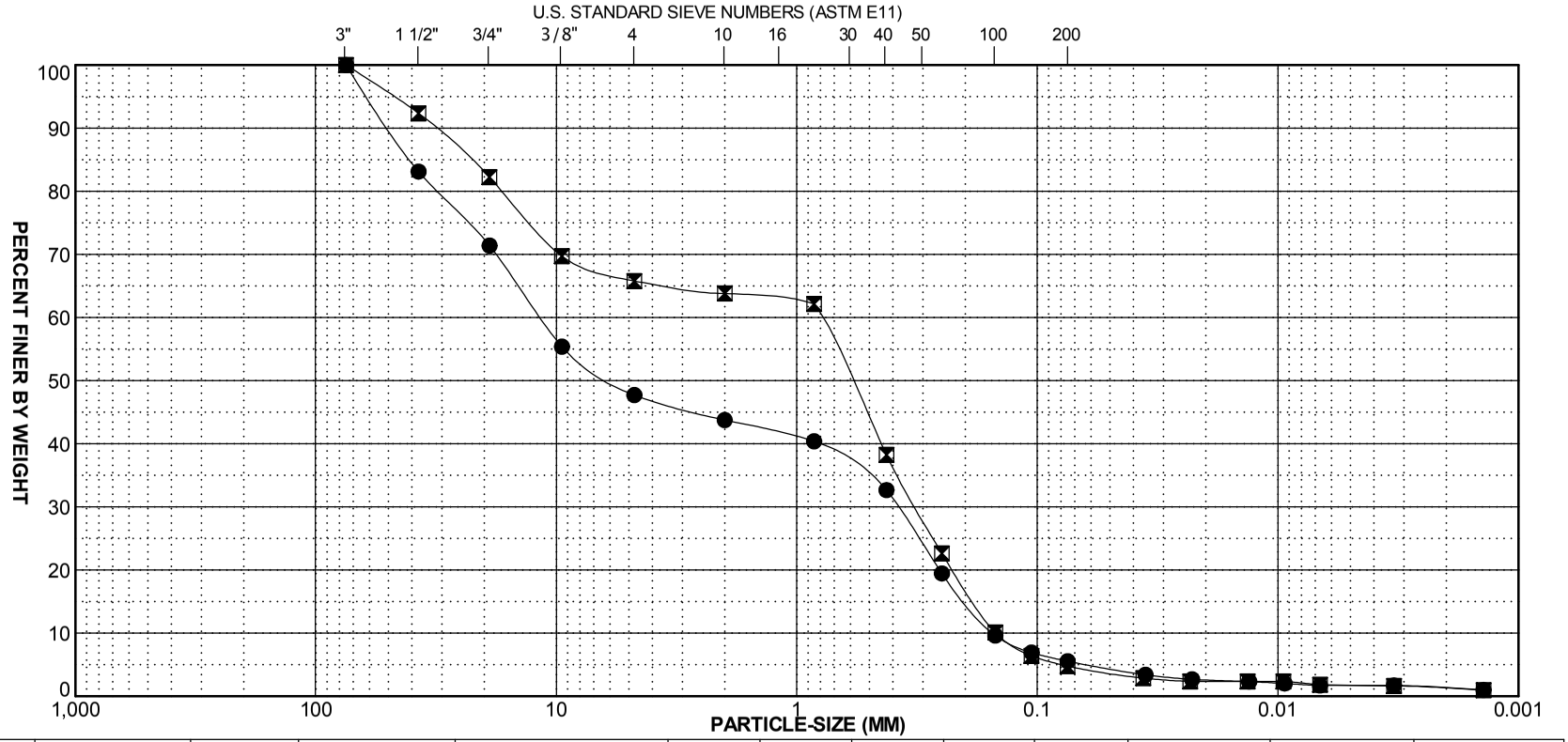
# PARTICLE-SIZE ANALYSIS TEST RESULTS

CHPRC - GEOTECHNICAL LABORATORY

PBS PROJECT NUMBER: 63797

**TEST METHOD: ASTM D422**

| BOULDERS | COBBLES | GRAVEL | | SAND | | | FINES | |
|---|---|---|---|---|---|---|---|---|
| | | COARSE | FINE | COARSE | MEDIUM | FINE | SILT | CLAY |




| KEY | EXPLORATION NUMBER | SAMPLE NUMBER | SAMPLE DEPTH (FEET) | MOISTURE CONTENT (PERCENT) | D60 (MM) | D50 (MM) | D30 (MM) | D10 (MM) | D5 (MM) | GRAVEL (PERCENT) | SAND (PERCENT) | FINES (PERCENT) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | H-187A | B3BX66 | 47.4 | 9 | 11.6 | 5.8 | 0.4 | 0.2 | 0.06 | 52 | 42 | 6 |
| ⊠ | H-187B | B3BJH7 | 47.9 | 12 | 0.8 | 0.6 | 0.3 | 0.1 | 0.08 | 34 | 61 | 5 |
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RJ LEE GROUP
DELIVERING SCIENTIFIC RESOLUTION

**REPORT OF LABORATORY TESTING**

| | | | |
|---|---|---|---|
| **Report to:** | CH2M-Hill - Plateau Remediation<br>2420 Stevens Center Place<br>PO Box 1600<br>Richland, WA 99354 | **Date:**<br>**Sample Delivery Group No.:**<br>**Sample Authorization No.:** | 10/17/2017<br>W709013<br>F16-040 |

| | | | |
|---|---|---|---|
| **Project:** | CHPRC Laboratory | **Project No.:** | 63797.000 |
| **Report of:** | Permeability of Granular Soils - Constant Head (ASTM D2434) | **Lab Tech:** | P. Brice |

**Items Received:**
Two samples were provided to us containing soil material obtained by you, the client.
PBS performed the following test:

Permeability of Granular Soils - Constant Head (ASTM D2434).
The permeability of the representative soil was determined in the laboratory using the above referenced samples. The samples were prepared for the permeameter and all the required measures were taken. Air was evacuated from the samples and were then saturated with low mineral content water. The manometer system was attached and a stable head condition was attained. The quantity of flow, water temperature, water head and time were measured. This was repeated, if necessary, to establish an accurate region of laminar flow with velocity.

**LABORATORY TEST RESULTS**

**Permeability of Granular Soils - Constant Head (ASTM D2434)**

| Customer Sample Number | Laboratory Sample Number | Date of Analysis | Quantity of flow discharged ($cm^3$) | Dist. between manometers, L (cm) | Specimen area, A ($cm^2$) | Total discharge time, t (sec) | Head diff. betw. manometers, h (cm) | Avg. Hydraulic Conductivity, k (cm/s) |
|---|---|---|---|---|---|---|---|---|
| B3BX66 | H-0187A | 10/16/2017 | 59 | 7.62 | 45.84 | 420 | 36.2 | 6.35E-04 |
| B3BJH7 | H-0187B | 10/16/2017 | 256 | 7.62 | 45.84 | 420 | 33.0 | 3.20E-03 |
| | | | | | | | | |
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SHEET 1 OF 1 REVIEWED BY: A. Swenson, P.E.

# SAMPLE ISSUE RESOLUTION (SIR) REPORT

**SIR Number:** SIR18-0358
**Rev. Number:** 0
**Date Initiated:** 01/10/2018

## SAMPLE EVENT INFORMATION

**SAF NUM(S):** F16-040

**LABORATORY:** RJL-GT

## SAMPLING INFORMATION

**NUMBER OF SAMPLES:** 1

**SAMPLE NUMBERS:** B3BX66

**SAMPLE MATRIX:** SOIL

**SDG NUM(S):** W709013

## ISSUE BACKGROUND

**CLASS:** Sample Management Issues

**TYPE:** Cancellation of Analyses

**DESCRIPTION:** D422_PARTICLE SIZE analysis indicated that D2434_PERMEABILITY should be run

## RESOLUTION

**PROPOSED RESOLUTION:** D5084_HYDRAULIC CONDUDTIVITY should be canceled from B3BX66.

**FINAL RESOLUTION:** Accept proposed resolution.

**SUBMITTED BY:**

TOLE, KM 01/10/2018

**ACCEPTED BY:**

NAGEL, SE 01/10/2018

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| CH2MHill Plateau Remediation Company | CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST | | | F16-040-254 | PAGE 1 OF 1 |
|---|---|---|---|---|---|
| COLLECTOR: Daniel Klug, CHPRC | COMPANY CONTACT: LYNCH, SA | TELEPHONE NO.: 373-5586 | PROJECT COORDINATOR: LYNCH, SA | PRICE CODE: 8H | DATA TURNAROUND |
| SAMPLING LOCATION: C9715, I-001 | PROJECT DESIGNATION: 100-HR-3 Long Term & Interim Action Monitoring - Soil | | SAF NO.: F16-040 | AIR QUALITY: ☐ | 30 Days / 30 Days |
| ICE CHEST NO.: N/A | FIELD LOGBOOK NO.: HNF-N-645-6 | ACTUAL SAMPLE DEPTH: 44.90-49.90' | COA: 304343 | METHOD OF SHIPMENT: GOVERNMENT VEHICLE | ORIGINAL |
| SHIPPED TO: RJ LEE - GEOTECHNICAL | OFFSITE PROPERTY NO.: N/A | | BILL OF LADING/AIR BILL NO.: N/A | | |

MATRIX*
A=Air
DL=Drum Liquids
DS=Drum Solids
L=Liquid
O=Oil
S=Soil
SE=Sediment
T=Tissue
V=Vegetation
W=Water
WI=Wipe
X=Other

**POSSIBLE SAMPLE HAZARDS/ REMARKS**
*Contains Radioactive Material at concentrations that are not be regulated for transportation per 49 CFR/IATA Dangerous Goods Regulations but are not releasable per DOE Order 458.1.

**SPECIAL HANDLING AND/OR STORAGE**
NA

| | |
|---|---|
| PRESERVATION | None |
| HOLDING TIME | None |
| TYPE OF CONTAINER | Split Spoon Liner |
| NO. OF CONTAINER(S) | 1 |
| VOLUME | 1000g |
| SAMPLE ANALYSIS | D5084_HYRDRAULIC CONDUCTIVITY : COMMON; |

11.6°C

| SAMPLE NO. | MATRIX* | SAMPLE DATE | SAMPLE TIME | |
|---|---|---|---|---|
| B3BX66 | SOIL | AUG 31 2017 | 0852 | ✓ |

* Liner E: 47.40 - 47.90

| CHAIN OF POSSESSION | | SIGN/ PRINT NAMES | |
|---|---|---|---|
| RELINQUISHED BY/REMOVED FROM: Daniel Klug, CHPRC | DATE/TIME: AUG 31 2017 1400 | RECEIVED BY/STORED IN: SSU-1 | DATE/TIME: AUG 31 2017 1400 |
| RELINQUISHED BY/REMOVED FROM: SSU-1 | DATE/TIME: SEP 05 2017 0950 | RECEIVED BY/STORED IN: CHPRC | DATE/TIME: SEP 05 2017 0950 |
| RELINQUISHED BY/REMOVED FROM: CHPRC | DATE/TIME: SEP 05 2017 11:00 | RECEIVED BY/STORED IN: RJ Lee Group | DATE/TIME: SEP 05 2017 11:00 |
| RELINQUISHED BY/REMOVED FROM | DATE/TIME | RECEIVED BY/STORED IN | DATE/TIME |
| RELINQUISHED BY/REMOVED FROM | DATE/TIME | RECEIVED BY/STORED IN | DATE/TIME |
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| RELINQUISHED BY/REMOVED FROM | DATE/TIME | RECEIVED BY/STORED IN | DATE/TIME |

**SPECIAL INSTRUCTIONS**
TRVL-17-163; ** All requests for Geotechnical Parameters will be given a unique HEIS sample number and be assigned to a separate COC. In addition, all split spoon sleeves will be properly stored until authorized for shipment.** Laboratory shall perform the Particle Size (Dry Sieve) analysis to determine if they should proceed with Permeability by D2434 or Hydraulic Conductive by D5084.

| | | | |
|---|---|---|---|
| LABORATORY SECTION | RECEIVED BY | TITLE | DATE/TIME |
| FINAL SAMPLE DISPOSITION | DISPOSAL METHOD | DISPOSED BY | DATE/TIME |

PRINTED ON 8/1/2017 FSR ID = FSR46339 TRVL NUM = TRVL-17-163 A-6003-618 (REV 2)

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| CH2MHill Plateau Remediation Company | CHAIN OF CUSTODY/SAMPLE ANALYSIS REQUEST | | | F16-040-155 | PAGE 1 OF 1 |
|---|---|---|---|---|---|
| COLLECTOR: Daniel Klug CHPRC | COMPANY CONTACT: LYNCH, SA | TELEPHONE NO.: 373-5586 | PROJECT COORDINATOR: LYNCH, SA | PRICE CODE: 8H | DATA TURNAROUND: 30 Days / 30 Days |
| SAMPLING LOCATION: C9715, I-001 | PROJECT DESIGNATION: 100-HR-3 Long Term & Interim Action Monitoring - Soil | | SAF NO.: F16-040 | AIR QUALITY: ☐ | |
| ICE CHEST NO.: NA | FIELD LOGBOOK NO.: HNF-N-645-6 | ACTUAL SAMPLE DEPTH: 44.90 - 49.90 | COA: 304343 | METHOD OF SHIPMENT: GOVERNMENT VEHICLE | ORIGINAL |
| SHIPPED TO: RJ LEE - GEOTECHNICAL | OFFSITE PROPERTY NO.: NA | | BILL OF LADING/AIR BILL NO.: NA | | |

MATRIX*
A=Air
DI=Drum Liquids
DS=Drum Solids
L=Liquid
O=Oil
S=Soil
SE=Sediment
T=Tissue
V=Vegetation
W=Water
WI=Wipe
X=Other

**POSSIBLE SAMPLE HAZARDS/ REMARKS**
*Contains Radioactive Material at concentrations that are not be regulated for transportation per 49 CFR/IATA Dangerous Goods Regulations but are not releasable per DOE Order 458.1.

**SPECIAL HANDLING AND/OR STORAGE**
NA

| | |
|---|---|
| PRESERVATION | None |
| HOLDING TIME | 6 Months |
| TYPE OF CONTAINER | Split Spoon Liner |
| NO. OF CONTAINER(S) | 1 |
| VOLUME | 1000g |
| SAMPLE ANALYSIS | SEE ITEM (1) IN SPECIAL INSTRUCTIONS |

12.4°C

| SAMPLE NO. | MATRIX* | SAMPLE DATE | SAMPLE TIME | |
|---|---|---|---|---|
| B3BJH7 | SOIL | AUG 31 2017 | 0852 | ✓ |

* Liner D: 47.90 - 48.40

| CHAIN OF POSSESSION | | SIGN/ PRINT NAMES | |
|---|---|---|---|
| RELINQUISHED BY/REMOVED FROM: Daniel Klug CHPRC D. Klug | DATE/TIME: AUG 31 2017 1400 | RECEIVED BY/STORED IN: SSU-1 | DATE/TIME: AUG 31 2017 1400 |
| RELINQUISHED BY/REMOVED FROM: SSU-1 | DATE/TIME: SEP 05 2017 0950 | RECEIVED BY/STORED IN: [illegible] | DATE/TIME: SEP 05 2017 0950 |
| RELINQUISHED BY/REMOVED FROM: [illegible] | DATE/TIME: SEP 05 2017 11:00 | RECEIVED BY/STORED IN: [illegible] | DATE/TIME: SEP 05 2017 11:00 |
| RELINQUISHED BY/REMOVED FROM | DATE/TIME | RECEIVED BY/STORED IN | DATE/TIME |
| RELINQUISHED BY/REMOVED FROM | DATE/TIME | RECEIVED BY/STORED IN | DATE/TIME |
| RELINQUISHED BY/REMOVED FROM | DATE/TIME | RECEIVED BY/STORED IN | DATE/TIME |
| RELINQUISHED BY/REMOVED FROM | DATE/TIME | RECEIVED BY/STORED IN | DATE/TIME |

**SPECIAL INSTRUCTIONS**
TRVL-17-163; ** All requests for Geotechnical Parameters will be given a unique HEIS sample number and be assigned to a separate COC. In addition, all split spoon sleeves will be properly stored until authorized for shipment.** Laboratory shall perfo
(1) D2434_PERMEABILITY: COMMON; D422_PARTICLE SIZE (Dry Sieve): COMMON;

| | | | |
|---|---|---|---|
| LABORATORY SECTION | RECEIVED BY | TITLE | DATE/TIME |
| FINAL SAMPLE DISPOSITION | DISPOSAL METHOD | DISPOSED BY | DATE/TIME |

PRINTED ON 8/1/2017 FSR ID = FSR46339 TRVL NUM = TRVL-17-163 A-6003-618 (REV 2)

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