



LAC

LAC  
MINERALS (USA) LLC  
CUNNINGHAM HILL MINE  
RECLAMATION PROJECT  
1655 Mountain City Hwy  
Elko, NV 89801  
TELEPHONE: 505.471.0434

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May 27, 2022

Ms. Anne Maurer  
New Mexico Environmental Department  
Groundwater Quality Bureau  
1190 South St. Francis Drive  
Santa Fe, NM 87502

Ms. Carmen Rose  
Mining and Minerals Division  
Mining Act Reclamation Program  
1220 South St. Francis Drive  
Santa Fe, NM 87505

**RE: Waste Rock Pile Workplan Design Package  
Discharge Permit 55 (DP-55) and Abatement Plan 27 (AP-27)  
Cunningham Hill Mine Reclamation Project**

Ms. Maurer and Ms. Rose,

On February 16, 2022, LAC Minerals USA LLC (LAC) received approval of the December 27, 2021 Waste Rock Pile Workplan. In the workplan LAC noted that engineering design documentation, including stockpile materials soil analysis, would be submitted to the agency for approval. Enclosed is the North Slope Cover Improvements design and supporting technical drawings prepared by Daniel B. Stephens & Associates, Inc.

Should you have any questions or require further information, you can contact Daniel Lattin at (775) 397-7215 or at [dlattin@barrick.com](mailto:dlattin@barrick.com).

Sincerely,

Jennifer L Ortega  
Health, Safety and Environmental Superintendent

Enclosure

ec: Joe Fox, Acting Program Manager, NMED-MECS  
Holland Shepherd, Program Manager, EMNRD-MMD  
Kevin Myers, EMNRD-MMD  
Friends of Santa Fe County (Charles de Saillan, [cdesaillan@nmelc.org](mailto:cdesaillan@nmelc.org))  
Daniel Lattin, LAC  
Brad Bingham, LAC



**DBS&A**  
*Daniel B. Stephens & Associates, Inc.*  
a Geo-Logic Company

May 25, 2022

Ms. Jennifer Ortega  
LAC Minerals (USA) LLC  
582 County Road 55  
Cerrillos, New Mexico 87010  
Delivered by e-mail: Jennifer.Ortega@barrick.com

Re: North Slope Cover Improvements

Dear Ms. Ortega:

Daniel B. Stephens & Associates, Inc. (DBS&A) is pleased to provide LAC Minerals (USA) LLC (LAC) the attached drawing set (Attachment 1) for proposed cover and drainage improvements to the North Slope waste rock pile (WRP) at the Cunningham Hill Mine Reclamation Project located in Santa Fe County, New Mexico. Attachment 2 provides a bid table to use when bidding the work for construction. Attachments 3 and 4 provide soil testing results for samples collected from an on-site soil stockpile that will be used to provide soil to make the cover and drainage improvements. Soil chemistry analytical laboratory results demonstrate that the soil has low acid-generating potential and is suitable for cover placement (Attachment 4). Rock for a proposed riprap channel is stockpiled near the on-site soil stockpile. Attachment 5 provides a seed mix for revegetation of repaired areas.

### **Design Basis**

The basis for the design is to improve stormwater drainage along selected areas of the North Slope WRP benches and to repair areas impacted by erosion. The design is based on site reconnaissance conducted by DBS&A on March 18 and April 5, 2022 and a topographic survey conducted and provided by Meridian Partners, LLC. Key design elements are discussed in the following sections and presented in the drawing set (Attachment 1).

### ***Grading of Benches***

The seven benches on the North Slope WRP are intended to convey stormwater laterally toward a riprap channel located along the east side of the cover, commonly referred to as the east groin. The slopes of the benches were inspected during site reconnaissance and analyzed using AutoCAD to identify flatter or depressed areas where fill could be added to promote positive drainage. A total of 12 areas were identified where topographic depressions or flatter sections impede the flow of water. Locations and profiles of these areas are shown in Sheets 3 and 4, respectively, of the drawing set (Attachment 1).

To promote drainage along the benches, DBS&A proposes that 11 of the 12 areas be filled with soil from the on-site soil stockpile, and that the fill be compacted in place. The purpose of the fill is to remove the identified depressions and create a continuous slope that dips to the east. DBS&A calculated the volume of soil needed to appropriately fill the 11 areas. These volumes are presented on Sheet 4 of the drawing sheet (Attachment 1) and assume a fluff factor of 1.5. This factor was used to convert in-place cubic yardage to a loose cubic yardage equivalent. The total compacted fill volume is approximately 100 cubic yards, and will require approximately 150 cubic yards of loose soil from the on-site soil stockpile. One of the 12 areas (Section F-F') requires a small cut to increase slope.

In addition, four areas were identified during site reconnaissance where water is flowing off the edge of the benches and onto the cover. In these areas, the benches have flattened. DBS&A proposes to restore the bench slopes so that stormwater is directed toward the toe of the cover (i.e., south side of the bench), where it can then flow laterally toward the east groin. This design element is shown in Detail 2 on Sheet 5 of the design set (Attachment 1).

### *Rill Mitigation*

During site reconnaissance, DBS&A identified two areas where erosion has resulted in the development of rills. The rills are small, and there appears to be minimal potential for their sizes to increase substantially due to the presence of healthy vegetation. However, DBS&A proposes to fill the rills in order to restore cover thickness and mitigate soil loss. The rills will be filled with soil from the on-site soil stockpile, and the fill will be compacted in place. The locations of the rills are shown on Sheet 3 of the design set (Attachment 1).

### *Road Swales*

DBS&A identified three areas during site reconnaissance where road swales can be installed or improved. The purpose of the swales is to prevent stormwater from flowing onto the North Slope WRP cover. Two of the three swales are new. One of them will also help to convey stormwater associated with a proposed new, 18-inch-wide riprap channel. The other new swale is at the base of the cover (i.e., at its north end), and will help move water away from an area with clear signs of desiccation and soil ponding. One existing swale is showing signs of erosion and will be rebuilt to improve its functionality. The design for the swales is shown in Detail 1 on Sheet 5 of the design set (Attachment 1).

### *Revegetation of Improvement Areas*

Areas where improvements are made or are disturbed during construction will be reseeded. Reseeding will be conducted using previously approved specifications and seed mix (Attachment 5).

Ms. Jennifer Ortega  
May 19, 2022  
Page 3

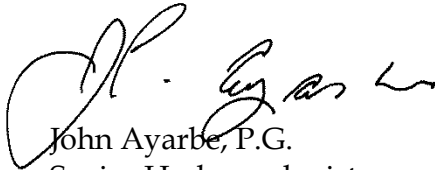
## Closing

DBS&A has developed the attached design set to improve drainage and repair erosion to the cover of the North Slope WRP. The design elements use soil from an existing on-site borrow source.

We appreciate the opportunity to support LAC at the Cunningham Hill Mine Reclamation Project. Please contact us at (505) 822-9400 with any questions or comments.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC.

Handwritten signature of John Ayarbe in black ink.

John Ayarbe, P.G.  
Senior Hydrogeologist

Handwritten signature of Jeffrey Samson in blue ink.

Jeffrey Samson, P.E.  
Project Engineer

JA/JS/rpf  
Attachments

Attachment 1

Drawings

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**This attachment is provided as a separate PDF file.**

# Attachment 2

## Bid Table

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**Cunningham Hill Mine Reclamation Project**  
*Waste Rock Pile Cover Improvements*

Item No	Description	Quantity	Units	Unit Price	Extended Price
1.1	Mobilization/demobilization	1	LS		
1.2	Screen existing soils (no material larger than 3/4") in sufficient quantity to complete the work	1	LS		
1.3	Fill and compaction of rills, and cleanout inlet on Bench 1	1	LS		
1.4	Construction of two new swales (approximate total length - 75 ft)	1	LS		
1.5	Rehabilitation of existing swale (approximate length - 80 ft)	1	LS		
1.6	Grading of benches, including approximately 100 CY of compacted fill, and 5 CY of cut	1	LS		
1.7	Construct 18" wide riprap channel by placing 6" minimum riprap and compacting in place (approximate length - 50 ft)	1	LS		
1.8	Rebuild the bench to slope water toward toe in 4 locations	1	LS		
1.9	Reseed improvement areas	0.25	Ac		
				Total	

Notes: LS = Lump sum  
 Ac = Acre



Attachment 3

DBS&A Soils Properties  
Laboratory Report

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# Laboratory Report for Barrick Gold Corporation

Cunningham Hill

August 24, 2017



*Daniel B. Stephens & Associates, Inc.*

4400 Alameda Blvd. NE, Suite C • Albuquerque, New Mexico 87113



August 24, 2017

David Wykoff  
Barrick Gold Corporation  
582 County Road 55  
Cerrillos, NM 87010  
(505) 471-0434

Re: DBS&A Laboratory Report for the Barrick Gold Corporation Cunningham Hill Project

Dear Mr. Wykoff:

Enclosed is the report for the Barrick Gold Corporation, Cunningham Hill project samples. Please review this report and provide any comments as samples will be held for a maximum of 30 days. After 30 days samples will be returned or disposed of in an appropriate manner.

All testing results were evaluated subjectively for consistency and reasonableness, and the results appear to be reasonably representative of the material tested. However, DBS&A does not assume any responsibility for interpretations or analyses based on the data enclosed, nor can we guarantee that these data are fully representative of the undisturbed materials at the field site. We recommend that careful evaluation of these laboratory results be made for your particular application.

The testing utilized to generate the enclosed report employs methods that are standard for the industry. The results do not constitute a professional opinion by DBS&A, nor can the results affect any professional or expert opinions rendered with respect thereto by DBS&A. You have acknowledged that all the testing undertaken by us, and the report provided, constitutes mere test results using standardized methods, and cannot be used to disqualify DBS&A from rendering any professional or expert opinion, having waived any claim of conflict of interest by DBS&A.

We are pleased to provide this service to Barrick Gold Corporation and look forward to future laboratory testing on other projects. If you have any questions about the enclosed data, please do not hesitate to call.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC.  
SOIL TESTING & RESEARCH LABORATORY

Joleen Hines  
Laboratory Manager

Enclosure

*Daniel B. Stephens & Associates, Inc.*  
*Soil Testing & Research Laboratory*

4400 Alameda Blvd. NE, Suite C  
Albuquerque, NM 87113

505-889-7752  
FAX 505-889-0258

## **Summaries**



### Summary of Tests Performed

Laboratory Sample Number	Initial Soil Properties <sup>1</sup>			Saturated Hydraulic Conductivity <sup>2</sup>			Moisture Characteristics <sup>3</sup>							Particle Size <sup>4</sup>			Specific Gravity <sup>5</sup>		Air Perm-eability	Atterberg Limits	Proctor Compaction	
	G	VM	VD	CH	FH	FW	HC	PP	FP	DPP	RH	EP	WHC	K <sub>unsat</sub>	DS	WS	H	F				C
TP-1															X	X					X	X
TP-1 (85%)	X	X				X																
TP-1 (90%)	X	X				X																
TP-2															X	X					X	X
TP-2 (85%)	X	X				X																
TP-2 (90%)	X	X				X																

<sup>1</sup> G = Gravimetric Moisture Content, VM = Volume Measurement Method, VD = Volume Displacement Method

<sup>2</sup> CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall

<sup>3</sup> HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box, EP = Effective Porosity, WHC = Water Holding Capacity, K<sub>unsat</sub> = Calculated Unsaturated Hydraulic Conductivity

<sup>4</sup> DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer

<sup>5</sup> F = Fine (<4.75mm), C = Coarse (>4.75mm)



## Notes

### **Sample Receipt:**

Two samples were hand delivered on July 19, 2017. Each sample arrived in two 5-gallon buckets sealed with lids. Both samples were received in good order.

### **Sample Preparation and Testing Notes:**

The samples were subjected to particle size analysis and Atterberg limits testing.

Each sample was subjected to standard proctor compaction testing. A portion of each sample was remolded into a testing ring to target 85% and 90% of the respective maximum dry bulk density at the respective optimum moisture content. The sub-samples were then extruded from the testing rings and were subjected to saturated hydraulic conductivity testing via the flexible wall method. The actual percentage of maximum dry bulk density achieved was added to each sub-sample ID.

Particles larger than 4.75 mm were removed from the bulk material prior to remolding the sub-samples. Oversize correction calculations are provided since the removed fraction is larger than 5% of the bulk sample mass.

Porosity calculations are based on the use of an assumed specific gravity value of 2.65.



### Summary of Sample Preparation/Volume Changes

Sample Number	Proctor Data		Target Remold Parameters <sup>1</sup>			Actual Remold Data			Volume Change Post Saturation <sup>2</sup>		
	Optimum Moisture Content (%)	Max. Dry Density (g/cm <sup>3</sup> )	Moisture Content (%)	Dry Bulk Density (g/cm <sup>3</sup> )	% of Max. Density (%)	Moisture Content (%)	Dry Bulk Density (g/cm <sup>3</sup> )	% of Max. Density (%)	Dry Bulk Density (g/cm <sup>3</sup> )	% Volume Change (%)	% of Max. Density (%)
TP-1 85%	17.8	1.67	17.8	1.42	85%	17.8	1.42	85%	1.43	-0.8%	85.8%
TP-1 90%	17.8	1.67	17.8	1.50	90%	18.0	1.49	90%	1.50	-0.7%	90.3%
TP-2 85%	18.1	1.68	18.1	1.43	85%	18.4	1.43	85%	1.43	+0.1%	85.0%
TP-2 90%	18.1	1.68	18.1	1.51	90%	18.2	1.51	90%	1.49	+1.1%	89.0%

<sup>1</sup>Target Remold Parameters: Provided by the client: 85% and 90% of maximum dry density at optimum moisture content.

<sup>2</sup>Volume Change Post Saturation: Volume change measurements were obtained after saturated hydraulic conductivity testing.

Notes:

"+" indicates sample swelling, "-" indicates sample settling, and "---" indicates no volume change occurred.



**Summary of Initial Moisture Content, Dry Bulk Density  
Wet Bulk Density and Calculated Porosity**

Sample Number	Moisture Content				Dry Bulk Density (g/cm <sup>3</sup> )	Wet Bulk Density (g/cm <sup>3</sup> )	Calculated Porosity (%)
	As Received		Remolded				
	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )			
TP-1	17.0	NA	---	---	NA	NA	NA
TP-1 (85%)	NA	NA	17.8	25.2	1.42	1.67	46.5
TP-1 (90%)	NA	NA	18.0	26.9	1.49	1.76	43.6
TP-2	13.8	NA	---	---	NA	NA	NA
TP-2 (85%)	NA	NA	18.4	26.3	1.43	1.69	46.1
TP-2 (90%)	NA	NA	18.2	27.5	1.51	1.79	43.0

NA = Not analyzed

--- = This sample was not remolded





### Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K <sub>sat</sub> (cm/sec)	Oversize Corrected K <sub>sat</sub> (cm/sec)	Method of Analysis	
			Constant Head Flexible Wall	Falling Head Flexible Wall
TP-1 85%	8.5E-04	6.9E-04		X
TP-1 90%	1.4E-04	1.2E-04		X
TP-2 85%	4.6E-04	4.1E-04		X
TP-2 90%	1.2E-04	1.0E-04		X

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

NA = Not applicable



### Summary of Particle Size Characteristics

Sample Number	d <sub>10</sub> (mm)	d <sub>50</sub> (mm)	d <sub>60</sub> (mm)	C <sub>u</sub>	C <sub>c</sub>	Method	ASTM Classification	USDA Classification
TP-1	0.00038	0.070	0.14	368	12	WS/H	Sandy silt with gravel s(ML)g	Loam <sup>†</sup> (Est)
TP-2	0.00067	0.055	0.076	113	9.5	WS/H	Sandy silt s(ML)	Loam <sup>†</sup> (Est)

d<sub>50</sub> = Median particle diameter

Est = Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

<sup>†</sup> Greater than 10% of sample is coarse material



**Percent Gravel, Sand, Silt and Clay\***

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
TP-1	18.6	29.8	36.5	15.2
TP-2	10.2	30.0	45.0	14.9

\*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.



### Summary of Atterberg Tests

Sample Number	Liquid Limit	Plastic Limit	Plasticity Index	Classification
TP-1	38	25	13	ML
TP-2	36	25	11	ML

---

--- = Soil requires visual-manual classification due to non-plasticity



### Summary of Proctor Compaction Tests

Sample Number	Measured		Oversize Corrected	
	Optimum Moisture Content (% g/g)	Maximum Dry Bulk Density (g/cm <sup>3</sup> )	Optimum Moisture Content (% g/g)	Maximum Dry Bulk Density (g/cm <sup>3</sup> )
TP-1	17.8	1.67	14.6	1.79
TP-2	18.1	1.68	16.1	1.75

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

NA = Not applicable

## **Initial Properties**



**Summary of Initial Moisture Content, Dry Bulk Density  
Wet Bulk Density and Calculated Porosity**

Sample Number	Moisture Content				Dry Bulk Density (g/cm <sup>3</sup> )	Wet Bulk Density (g/cm <sup>3</sup> )	Calculated Porosity (%)
	As Received		Remolded				
	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )	Gravimetric (%, g/g)	Volumetric (%, cm <sup>3</sup> /cm <sup>3</sup> )			
TP-1	17.0	NA	---	---	NA	NA	NA
TP-1 (85%)	NA	NA	17.8	25.2	1.42	1.67	46.5
TP-1 (90%)	NA	NA	18.0	26.9	1.49	1.76	43.6
TP-2	13.8	NA	---	---	NA	NA	NA
TP-2 (85%)	NA	NA	18.4	26.3	1.43	1.69	46.1
TP-2 (90%)	NA	NA	18.2	27.5	1.51	1.79	43.0

NA = Not analyzed

--- = This sample was not remolded



Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Barrick Gold Corporation
Job Number: DB17.1190.00
Sample Number: TP-1
Project Name: Cunningham Hill
Date Sampled: 7/17/17

Table with 3 columns: Test Date, As Received, Remolded. Rows include Field weight\* of sample (g), Tare weight, ring (g), Tare weight, pan/plate (g), Tare weight, other (g), Dry weight of sample (g), Sample volume (cm^3), and Assumed particle density (g/cm^3).

Table with 2 columns: Property, Value. Rows include Gravimetric Moisture Content (% g/g), Volumetric Moisture Content (% vol), Dry bulk density (g/cm^3), Wet bulk density (g/cm^3), Calculated Porosity (% vol), and Percent Saturation.

Laboratory analysis by: C. Krous
Data entered by: C. Krous
Checked by: J. Hines

Comments:

- \* Weight including tares
NA = Not analyzed
--- = This sample was not remolded





**Data for Initial Moisture Content,  
Bulk Density, Porosity, and Percent Saturation**

Job Name: Barrick Gold Corporation  
 Job Number: DB17.1190.00  
 Sample Number: TP-1 (85%)  
 Project Name: Cunningham Hill  
 Date Sampled: 7/17/17

	<u>As Received</u>	<u>Remolded</u>
Test Date:	NA	10-Aug-17
Field weight* of sample (g):		376.21
Tare weight, ring (g):		0.00
Tare weight, pan/plate (g):		0.00
Tare weight, other (g):		0.00
Dry weight of sample (g):		319.46
Sample volume (cm <sup>3</sup> ):		225.43
Assumed particle density (g/cm <sup>3</sup> ):		2.65
<hr/>		
Gravimetric Moisture Content (% g/g):		17.8
Volumetric Moisture Content (% vol):		25.2
Dry bulk density (g/cm <sup>3</sup> ):		1.42
Wet bulk density (g/cm <sup>3</sup> ):		1.67
Calculated Porosity (% vol):		46.5
Percent Saturation:		54.1
<hr/>		
Laboratory analysis by:		D. O'Dowd
Data entered by:		C. Krous
Checked by:		J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded



**Data for Initial Moisture Content,  
Bulk Density, Porosity, and Percent Saturation**

Job Name: Barrick Gold Corporation  
 Job Number: DB17.1190.00  
 Sample Number: TP-1 (90%)  
 Project Name: Cunningham Hill  
 Date Sampled: 7/17/17

	<u>As Received</u>	<u>Remolded</u>
Test Date:	NA	10-Aug-17
Field weight* of sample (g):		398.21
Tare weight, ring (g):		0.00
Tare weight, pan/plate (g):		0.00
Tare weight, other (g):		0.00
Dry weight of sample (g):		337.49
Sample volume (cm <sup>3</sup> ):		226.00
Assumed particle density (g/cm <sup>3</sup> ):		2.65
<hr/>		
Gravimetric Moisture Content (% g/g):		18.0
Volumetric Moisture Content (% vol):		26.9
Dry bulk density (g/cm <sup>3</sup> ):		1.49
Wet bulk density (g/cm <sup>3</sup> ):		1.76
Calculated Porosity (% vol):		43.6
Percent Saturation:		61.6
<hr/>		
Laboratory analysis by:		D. O'Dowd
Data entered by:		C. Krous
Checked by:		J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded



Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Barrick Gold Corporation
Job Number: DB17.1190.00
Sample Number: TP-2
Project Name: Cunningham Hill
Date Sampled: 7/17/17

Table with 3 columns: Test Date, As Received, Remolded. Rows include Field weight\* of sample (g), Tare weight, ring (g), Tare weight, pan/plate (g), Tare weight, other (g), Dry weight of sample (g), Sample volume (cm³), and Assumed particle density (g/cm³).

Table with 2 columns: Property, Value. Rows include Gravimetric Moisture Content (% g/g), Volumetric Moisture Content (% vol), Dry bulk density (g/cm³), Wet bulk density (g/cm³), Calculated Porosity (% vol), and Percent Saturation.

Laboratory analysis by: C. Krous
Data entered by: C. Krous
Checked by: J. Hines

Comments:

- \* Weight including tares
NA = Not analyzed
--- = This sample was not remolded



**Data for Initial Moisture Content,  
Bulk Density, Porosity, and Percent Saturation**

Job Name: Barrick Gold Corporation  
 Job Number: DB17.1190.00  
 Sample Number: TP-2 (85%)  
 Project Name: Cunningham Hill  
 Date Sampled: 7/17/17

	<u>As Received</u>	<u>Remolded</u>
Test Date:	NA	10-Aug-17
Field weight* of sample (g):		379.89
Tare weight, ring (g):		0.00
Tare weight, pan/plate (g):		0.00
Tare weight, other (g):		0.00
Dry weight of sample (g):		320.91
Sample volume (cm <sup>3</sup> ):		224.49
Assumed particle density (g/cm <sup>3</sup> ):		2.65
<hr/>		
Gravimetric Moisture Content (% g/g):		18.4
Volumetric Moisture Content (% vol):		26.3
Dry bulk density (g/cm <sup>3</sup> ):		1.43
Wet bulk density (g/cm <sup>3</sup> ):		1.69
Calculated Porosity (% vol):		46.1
Percent Saturation:		57.0
<hr/>		
Laboratory analysis by:		D. O'Dowd
Data entered by:		C. Krous
Checked by:		J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded



**Data for Initial Moisture Content,  
Bulk Density, Porosity, and Percent Saturation**

Job Name: Barrick Gold Corporation  
 Job Number: DB17.1190.00  
 Sample Number: TP-2 (90%)  
 Project Name: Cunningham Hill  
 Date Sampled: 7/17/17

	<u>As Received</u>	<u>Remolded</u>
Test Date:	NA	10-Aug-17
Field weight* of sample (g):		402.46
Tare weight, ring (g):		0.00
Tare weight, pan/plate (g):		0.00
Tare weight, other (g):		0.00
Dry weight of sample (g):		340.44
Sample volume (cm <sup>3</sup> ):		225.28
Assumed particle density (g/cm <sup>3</sup> ):		2.65
<hr/>		
Gravimetric Moisture Content (% g/g):		18.2
Volumetric Moisture Content (% vol):		27.5
Dry bulk density (g/cm <sup>3</sup> ):		1.51
Wet bulk density (g/cm <sup>3</sup> ):		1.79
Calculated Porosity (% vol):		43.0
Percent Saturation:		64.1
<hr/>		
Laboratory analysis by:		D. O'Dowd
Data entered by:		C. Krous
Checked by:		J. Hines

Comments:

- \* Weight including tares
- NA = Not analyzed
- = This sample was not remolded

## **Saturated Hydraulic Conductivity**



### Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K <sub>sat</sub> (cm/sec)	Oversize Corrected K <sub>sat</sub> (cm/sec)	Method of Analysis	
			Constant Head Flexible Wall	Falling Head Flexible Wall
TP-1 85%	8.5E-04	6.9E-04		X
TP-1 90%	1.4E-04	1.2E-04		X
TP-2 85%	4.6E-04	4.1E-04		X
TP-2 90%	1.2E-04	1.0E-04		X

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

NA = Not applicable



### Saturated Hydraulic Conductivity Flexible Wall Falling Head-Rising Tail Method

Job Name: Barrick Gold Corporation  
 Job Number: DB17.1190.00  
 Sample Number: TP-1 85%  
 Project Name: Cunningham Hill  
 Date Sampled: 7/17/17

#### Remolded or Initial Sample Properties

Initial Mass (g): 376.21  
 Diameter (cm): 6.141  
 Length (cm): 7.611  
 Area (cm<sup>2</sup>): 29.62  
 Volume (cm<sup>3</sup>): 225.43  
 Dry Density (g/cm<sup>3</sup>): 1.42  
 Dry Density (pcf): 88.5  
 Water Content (% g/g): 17.8  
 Water Content (% vol): 25.2  
 Void Ratio (e): 0.87  
 Porosity (% vol): 46.5  
 Saturation (%): 54.1

#### Post Permeation Sample Properties

Saturated Mass (g): 423.88  
 Dry Mass (g): 319.46  
 Diameter (cm): 6.115  
 Length (cm): 7.612  
 Deformation (%)\*\*: 0.01  
 Area (cm<sup>2</sup>): 29.37  
 Volume (cm<sup>3</sup>): 223.55  
 Dry Density (g/cm<sup>3</sup>): 1.43  
 Dry Density (pcf): 89.2  
 Water Content (% g/g): 32.7  
 Water Content (% vol): 46.7  
 Void Ratio(e): 0.85  
 Porosity (% vol): 46.1  
 Saturation (%)\*: 101.4

#### Test and Sample Conditions

Permeant liquid used: Tap Water  
 Sample Preparation:  In situ sample, extruded  
 Remolded Sample  
 Number of Lifts: 3  
 Split: #4  
 Percent Coarse Material (%): 18.6  
 Particle Density(g/cm<sup>3</sup>): 2.65  Assumed  Measured  
 Cell pressure (PSI): 81.0  
 Influent pressure (PSI): 80.0  
 Effluent pressure (PSI): 80.0  
 Panel Used:  A  B  C  
 Reading:  Annulus  Pipette  
 Date/Time  
 B-Value (% saturation) prior to test\*: 0.99 8/11/17 820  
 B-Value (% saturation) post to test: 0.99 8/11/17 901

\* Per ASTM D5084 percent saturation is ensured (B-Value ≥ 95%) prior to testing, as post test saturation values may be exaggerated or skewed during depressurizing and sample removal.

\*\*Percent Deformation: based on initial sample length and post permeation sample length.

Laboratory analysis by: D. O'Dowd  
 Data entered by: D. O'Dowd  
 Checked by: J. Hines



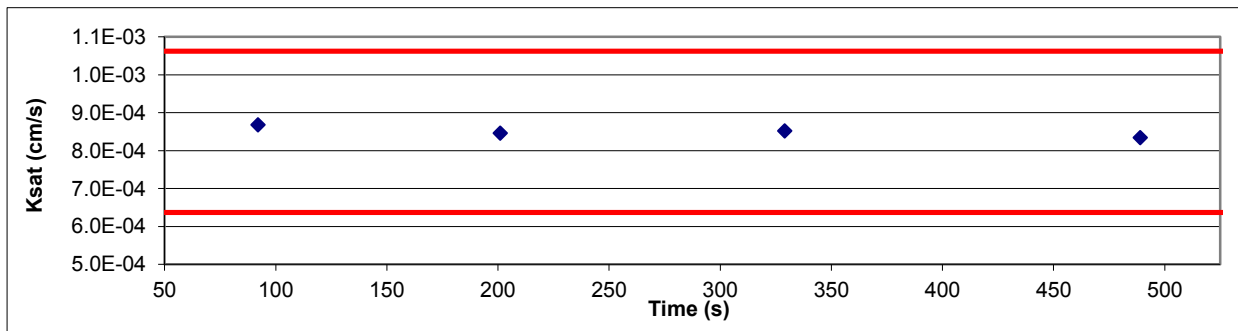


### Saturated Hydraulic Conductivity Flexible Wall Falling Head-Rising Tail Method

Job Name: Barrick Gold Corporation  
 Job Number: DB17.1190.00  
 Sample Number: TP-1 85%  
 Project Name: Cunningham Hill  
 Date Sampled: 7/17/17

Date	Time	Temp (°C)	Influent Pipette Reading	Effluent Pipette Reading	Gradient ( $\Delta H/\Delta L$ )	Average Flow (cm <sup>3</sup> )	Elapsed Time (s)	Ratio (outflow to inflow)	Change in Head (Not to exceed 25%)	k <sub>sat</sub> T°C (cm/s)	k <sub>sat</sub> Corrected (cm/s)
Test # 1:											
11-Aug-17	08:50:22	21.5	11.00	19.00	1.21	2.39	92	1.00	12%	9.00E-04	8.68E-04
11-Aug-17	08:51:54	21.5	11.50	18.50	1.06	2.39	92	1.00	12%	9.00E-04	8.68E-04
Test # 2:											
11-Aug-17	08:51:54	21.5	11.50	18.50	1.06	2.39	109	1.00	14%	8.77E-04	8.46E-04
11-Aug-17	08:53:43	21.5	12.00	18.00	0.91	2.39	109	1.00	14%	8.77E-04	8.46E-04
Test # 3:											
11-Aug-17	08:53:43	21.5	12.00	18.00	0.91	2.39	128	1.00	17%	8.83E-04	8.52E-04
11-Aug-17	08:55:51	21.5	12.50	17.50	0.76	2.39	128	1.00	17%	8.83E-04	8.52E-04
Test # 4:											
11-Aug-17	08:55:51	21.5	12.50	17.50	0.76	2.39	160	1.00	20%	8.64E-04	8.34E-04
11-Aug-17	08:58:31	21.5	13.00	17.00	0.61	2.39	160	1.00	20%	8.64E-04	8.34E-04

**Average Ksat (cm/sec): 8.50E-04**  
 Calculated Gravel Corrected Average Ksat (cm/sec): 6.92E-04



ASTM Required Range (+/- 25%)

Ksat (-25%) (cm/s): 6.37E-04

Ksat (+25%) (cm/s): 1.06E-03



## Oversize Correction Data Sheet

*Job Name:* Barrick Gold Corporation  
*Job Number:* DB17.1190.00  
*Sample Number:* TP-1 85%  
*Project Name:* Cunningham Hill  
*Date Sampled:* 7/17/17

*Split (3/4", 3/8", #4):* #4  
*Calculated Porosity of Fines (% vol):* 46.5

	<u>Coarse Fraction*</u>	<u>Fines Fraction</u>	<u>Composite</u>
<i>Subsample Mass (g):</i>	18.57	81.43	100.00
<i>Bulk Density (g/cm<sup>3</sup>):</i>	2.65	1.42	1.55
<i>Volume of Solids (cm<sup>3</sup>):</i>	7.01	30.73	37.74
<i>Volume of Voids (cm<sup>3</sup>):</i>	0.00	26.73	26.73
<i>Total Volume (cm<sup>3</sup>):</i>	7.01	57.46	64.47
<i>Volumetric Fraction (%):</i>	10.87	89.13	100.00
<i>Mass Fraction (%):</i>	18.57	81.43	100.00
<i>Ksat (cm/sec):</i>	NM	8.5E-04	6.9E-04

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NM = Not measured

\* = Porosity and moisture content of coarse fraction assumed to be zero.

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* D. O'Dowd  
*Checked by:* J. Hines



### Saturated Hydraulic Conductivity Flexible Wall Falling Head-Rising Tail Method

Job Name: Barrick Gold Corporation  
 Job Number: DB17.1190.00  
 Sample Number: TP-1 90%  
 Project Name: Cunningham Hill  
 Date Sampled: 7/17/17

#### Remolded or Initial Sample Properties

Initial Mass (g): 398.21  
 Diameter (cm): 6.148  
 Length (cm): 7.613  
 Area (cm<sup>2</sup>): 29.69  
 Volume (cm<sup>3</sup>): 226.00  
 Dry Density (g/cm<sup>3</sup>): 1.49  
 Dry Density (pcf): 93.2  
 Water Content (% g/g): 18.0  
 Water Content (% vol): 26.9  
 Void Ratio (e): 0.77  
 Porosity (% vol): 43.6  
 Saturation (%): 61.6

#### Post Permeation Sample Properties

Saturated Mass (g): 438.61  
 Dry Mass (g): 337.49  
 Diameter (cm): 6.125  
 Length (cm): 7.613  
 Deformation (%)\*\*: 0.00  
 Area (cm<sup>2</sup>): 29.46  
 Volume (cm<sup>3</sup>): 224.31  
 Dry Density (g/cm<sup>3</sup>): 1.50  
 Dry Density (pcf): 93.9  
 Water Content (% g/g): 30.0  
 Water Content (% vol): 45.1  
 Void Ratio(e): 0.76  
 Porosity (% vol): 43.2  
 Saturation (%)\*: 104.3

#### Test and Sample Conditions

Permeant liquid used: Tap Water  
 Sample Preparation:  In situ sample, extruded  
 Remolded Sample  
 Number of Lifts: 3  
 Split: #4  
 Percent Coarse Material (%): 18.6  
 Particle Density(g/cm<sup>3</sup>): 2.65  Assumed  Measured  
 Cell pressure (PSI): 81.0  
 Influent pressure (PSI): 80.0  
 Effluent pressure (PSI): 80.0  
 Panel Used:  A  B  C  
 Reading:  Annulus  Pipette  
 Date/Time  
 B-Value (% saturation) prior to test\*: 1.00 8/11/17 822  
 B-Value (% saturation) post to test: 1.00 8/11/17 1005

\* Per ASTM D5084 percent saturation is ensured (B-Value ≥ 95%) prior to testing, as post test saturation values may be exaggerated or skewed during depressurizing and sample removal.  
 \*\*Percent Deformation: based on initial sample length and post permeation sample length.

Laboratory analysis by: D. O'Dowd  
 Data entered by: D. O'Dowd  
 Checked by: J. Hines

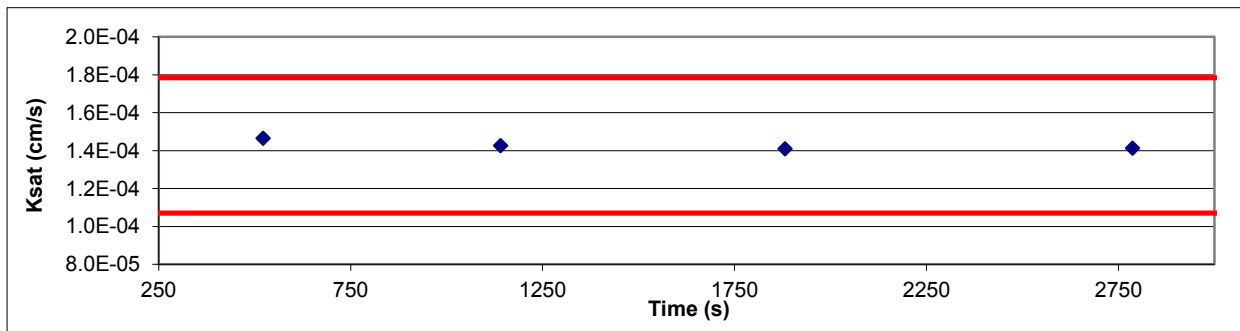


### Saturated Hydraulic Conductivity Flexible Wall Falling Head-Rising Tail Method

Job Name: Barrick Gold Corporation  
 Job Number: DB17.1190.00  
 Sample Number: TP-1 90%  
 Project Name: Cunningham Hill  
 Date Sampled: 7/17/17

Date	Time	Temp (°C)	Influent Pipette Reading	Effluent Pipette Reading	Gradient ( $\Delta H/\Delta L$ )	Average Flow (cm <sup>3</sup> )	Elapsed Time (s)	Ratio (outflow to inflow)	Change in Head (Not to exceed 25%)	k <sub>sat</sub> T°C (cm/s)	k <sub>sat</sub> Corrected (cm/s)
Test # 1:											
11-Aug-17	09:14:18	21.5	11.00	19.00	1.21	2.31	522	1.00	12%	1.52E-04	1.46E-04
11-Aug-17	09:23:00	21.5	11.50	18.50	1.06	2.31	522	1.00	12%	1.52E-04	1.46E-04
Test # 2:											
11-Aug-17	09:23:00	21.5	11.50	18.50	1.06	2.31	619	1.00	14%	1.48E-04	1.43E-04
11-Aug-17	09:33:19	21.5	12.00	18.00	0.91	2.31	619	1.00	14%	1.48E-04	1.43E-04
Test # 3:											
11-Aug-17	09:33:19	21.5	12.00	18.00	0.91	2.31	741	1.00	17%	1.46E-04	1.41E-04
11-Aug-17	09:45:40	21.5	12.50	17.50	0.76	2.31	741	1.00	17%	1.46E-04	1.41E-04
Test # 4:											
11-Aug-17	09:45:40	21.5	12.50	17.50	0.76	2.31	905	1.00	20%	1.46E-04	1.41E-04
11-Aug-17	10:00:45	21.5	13.00	17.00	0.61	2.31	905	1.00	20%	1.46E-04	1.41E-04

**Average Ksat (cm/sec): 1.43E-04**  
 Calculated Gravel Corrected Average Ksat (cm/sec): 1.16E-04



ASTM Required Range (+/- 25%)

Ksat (-25%) (cm/s): 1.07E-04

Ksat (+25%) (cm/s): 1.78E-04



## Oversize Correction Data Sheet

Job Name: Barrick Gold Corporation  
Job Number: DB17.1190.00  
Sample Number: TP-1 90%  
Project Name: Cunningham Hill  
Date Sampled: 7/17/17

Split (3/4", 3/8", #4): #4  
Calculated Porosity of Fines (% vol): 43.6

	<u>Coarse Fraction*</u>	<u>Fines Fraction</u>	<u>Composite</u>
Subsample Mass (g):	18.57	81.43	100.00
Bulk Density (g/cm <sup>3</sup> ):	2.65	1.49	1.63
Volume of Solids (cm <sup>3</sup> ):	7.01	30.73	37.74
Volume of Voids (cm <sup>3</sup> ):	0.00	23.80	23.80
Total Volume (cm <sup>3</sup> ):	7.01	54.53	61.54
Volumetric Fraction (%):	11.39	88.61	100.00
Mass Fraction (%):	18.57	81.43	100.00
Ksat (cm/sec):	NM	1.4E-04	1.2E-04

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NM = Not measured

\* = Porosity and moisture content of coarse fraction assumed to be zero.

Laboratory analysis by: D. O'Dowd  
Data entered by: D. O'Dowd  
Checked by: J. Hines



### Saturated Hydraulic Conductivity Flexible Wall Falling Head-Rising Tail Method

Job Name: Barrick Gold Corporation  
 Job Number: DB17.1190.00  
 Sample Number: TP-2 85%  
 Project Name: Cunningham Hill  
 Date Sampled: 7/17/17

#### Remolded or Initial Sample Properties

Initial Mass (g): 379.89  
 Diameter (cm): 6.127  
 Length (cm): 7.614  
 Area (cm<sup>2</sup>): 29.48  
 Volume (cm<sup>3</sup>): 224.49  
 Dry Density (g/cm<sup>3</sup>): 1.43  
 Dry Density (pcf): 89.2  
 Water Content (% g/g): 18.4  
 Water Content (% vol): 26.3  
 Void Ratio (e): 0.85  
 Porosity (% vol): 46.1  
 Saturation (%): 57.0

#### Post Permeation Sample Properties

Saturated Mass (g): 426.42  
 Dry Mass (g): 320.91  
 Diameter (cm): 6.135  
 Length (cm): 7.603  
 Deformation (%)\*\*: 0.15  
 Area (cm<sup>2</sup>): 29.56  
 Volume (cm<sup>3</sup>): 224.74  
 Dry Density (g/cm<sup>3</sup>): 1.43  
 Dry Density (pcf): 89.1  
 Water Content (% g/g): 32.9  
 Water Content (% vol): 46.9  
 Void Ratio(e): 0.86  
 Porosity (% vol): 46.1  
 Saturation (%)\*: 101.8

#### Test and Sample Conditions

Permeant liquid used: Tap Water  
 Sample Preparation:  In situ sample, extruded  
 Remolded Sample  
 Number of Lifts: 3  
 Split: #4  
 Percent Coarse Material (%): 10.2  
 Particle Density(g/cm<sup>3</sup>): 2.65  Assumed  Measured  
 Cell pressure (PSI): 81.0  
 Influent pressure (PSI): 80.0  
 Effluent pressure (PSI): 80.0  
 Panel Used:  D  E  F  
 Reading:  Annulus  Pipette  
 Date/Time  
 B-Value (% saturation) prior to test\*: 0.99 8/11/17 825  
 B-Value (% saturation) post to test: 0.99 8/11/17 922

\* Per ASTM D5084 percent saturation is ensured (B-Value ≥ 95%) prior to testing, as post test saturation values may be exaggerated during depressurizing and sample removal.

\*\*Percent Deformation: based on initial sample length and post permeation sample length.

Laboratory analysis by: D. O'Dowd  
 Data entered by: D. O'Dowd  
 Checked by: J. Hines

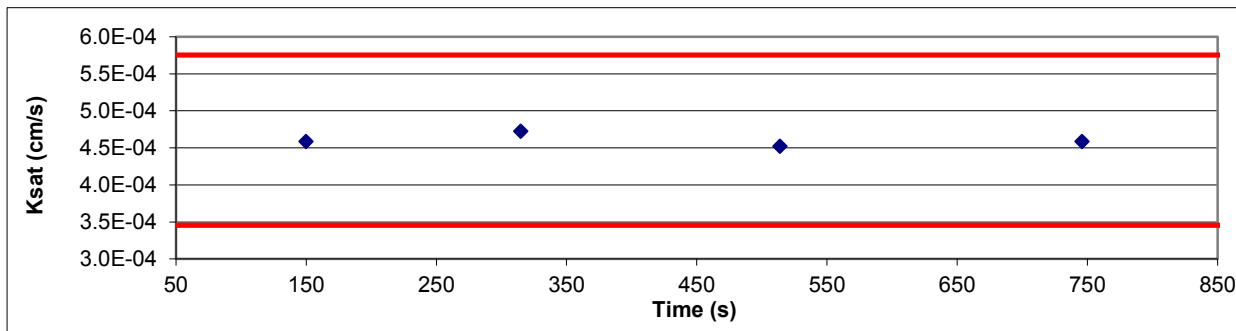


### Saturated Hydraulic Conductivity Flexible Wall Falling Head-Rising Tail Method

Job Name: Barrick Gold Corporation  
 Job Number: DB17.1190.00  
 Sample Number: TP-2 85%  
 Project Name: Cunningham Hill  
 Date Sampled: 7/17/17

Date	Time	Temp (°C)	Influent Pipette Reading	Effluent Pipette Reading	Gradient ( $\Delta H/\Delta L$ )	Average Flow (cm <sup>3</sup> )	Elapsed Time (s)	Ratio (outflow to inflow)	Change in Head (Not to exceed 25%)	k <sub>sat</sub> T°C (cm/s)	k <sub>sat</sub> Corrected (cm/s)
Test # 1:											
11-Aug-17	09:07:18	21.5	10.00	19.00	1.37	2.35	150	1.00	11%	4.75E-04	4.58E-04
11-Aug-17	09:09:48	21.5	10.50	18.50	1.22	2.35	165	1.00	13%	4.90E-04	4.72E-04
Test # 2:											
11-Aug-17	09:09:48	21.5	10.50	18.50	1.22	2.35	165	1.00	13%	4.90E-04	4.72E-04
11-Aug-17	09:12:33	21.5	11.00	18.00	1.06	2.35	199	1.00	14%	4.69E-04	4.52E-04
Test # 3:											
11-Aug-17	09:12:33	21.5	11.00	18.00	1.06	2.35	199	1.00	14%	4.69E-04	4.52E-04
11-Aug-17	09:15:52	21.5	11.50	17.50	0.91	2.35	232	1.00	17%	4.75E-04	4.59E-04
Test # 4:											
11-Aug-17	09:15:52	21.5	11.50	17.50	0.91	2.35	232	1.00	17%	4.75E-04	4.59E-04
11-Aug-17	09:19:44	21.5	12.00	17.00	0.76	2.35	232	1.00	17%	4.75E-04	4.59E-04

**Average Ksat (cm/sec): 4.60E-04**  
 Calculated Gravel Corrected Average Ksat (cm/sec): 4.14E-04



ASTM Required Range (+/- 25%)

Ksat (-25%) (cm/s): 3.45E-04

Ksat (+25%) (cm/s): 5.75E-04



## Oversize Correction Data Sheet

*Job Name:* Barrick Gold Corporation  
*Job Number:* DB17.1190.00  
*Sample Number:* TP-2 85%  
*Project Name:* Cunningham Hill  
*Date Sampled:* 7/17/17

*Split (3/4", 3/8", #4):* #4  
*Calculated Porosity of Fines (% vol):* 46.1

	<u>Coarse Fraction*</u>	<u>Fines Fraction</u>	<u>Composite</u>
<i>Subsample Mass (g):</i>	10.18	89.82	100.00
<i>Bulk Density (g/cm<sup>3</sup>):</i>	2.65	1.43	1.50
<i>Volume of Solids (cm<sup>3</sup>):</i>	3.84	33.89	37.74
<i>Volume of Voids (cm<sup>3</sup>):</i>	0.00	28.94	28.94
<i>Total Volume (cm<sup>3</sup>):</i>	3.84	62.83	66.67
<i>Volumetric Fraction (%):</i>	5.76	94.24	100.00
<i>Mass Fraction (%):</i>	10.18	89.82	100.00
<i>Ksat (cm/sec):</i>	NM	4.6E-04	4.1E-04

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NM = Not measured

\* = Porosity and moisture content of coarse fraction assumed to be zero.

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* D. O'Dowd  
*Checked by:* J. Hines





### Saturated Hydraulic Conductivity Flexible Wall Falling Head-Rising Tail Method

Job Name: Barrick Gold Corporation  
 Job Number: DB17.1190.00  
 Sample Number: TP-2 90%  
 Project Name: Cunningham Hill  
 Date Sampled: 7/17/17

#### Remolded or Initial Sample Properties

Initial Mass (g): 402.46  
 Diameter (cm): 6.139  
 Length (cm): 7.611  
 Area (cm<sup>2</sup>): 29.60  
 Volume (cm<sup>3</sup>): 225.28  
 Dry Density (g/cm<sup>3</sup>): 1.51  
 Dry Density (pcf): 94.3  
 Water Content (% g/g): 18.2  
 Water Content (% vol): 27.5  
 Void Ratio (e): 0.75  
 Porosity (% vol): 43.0  
 Saturation (%): 64.1

#### Post Permeation Sample Properties

Saturated Mass (g): 440.85  
 Dry Mass (g): 340.44  
 Diameter (cm): 6.173  
 Length (cm): 7.610  
 Deformation (%)\*\*: 0.01  
 Area (cm<sup>2</sup>): 29.93  
 Volume (cm<sup>3</sup>): 227.75  
 Dry Density (g/cm<sup>3</sup>): 1.49  
 Dry Density (pcf): 93.3  
 Water Content (% g/g): 29.5  
 Water Content (% vol): 44.1  
 Void Ratio(e): 0.77  
 Porosity (% vol): 43.6  
 Saturation (%)\*: 101.1

#### Test and Sample Conditions

Permeant liquid used: Tap Water  
 Sample Preparation:  In situ sample, extruded  
 Remolded Sample  
 Number of Lifts: 3  
 Split: #4  
 Percent Coarse Material (%): 10.2  
 Particle Density(g/cm<sup>3</sup>): 2.65  Assumed  Measured  
 Cell pressure (PSI): 81.0  
 Influent pressure (PSI): 80.0  
 Effluent pressure (PSI): 80.0  
 Panel Used:  D  E  F  
 Reading:  Annulus  Pipette  
 Date/Time  
 B-Value (% saturation) prior to test\*: 0.98 8/11/17 828  
 B-Value (% saturation) post to test: 0.99 8/11/17 1022

\* Per ASTM D5084 percent saturation is ensured (B-Value ≥ 95%) prior to testing, as post test saturation values may be exaggerated during depressurizing and sample removal.

\*\*Percent Deformation: based on initial sample length and post permeation sample length.

Laboratory analysis by: D. O'Dowd  
 Data entered by: D. O'Dowd  
 Checked by: J. Hines

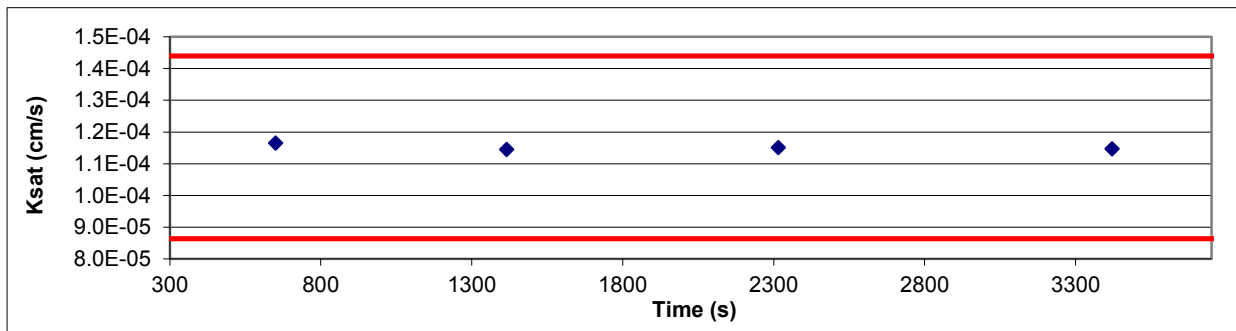


### Saturated Hydraulic Conductivity Flexible Wall Falling Head-Rising Tail Method

Job Name: Barrick Gold Corporation  
 Job Number: DB17.1190.00  
 Sample Number: TP-2 90%  
 Project Name: Cunningham Hill  
 Date Sampled: 7/17/17

Date	Time	Temp (°C)	Influent Pipette Reading	Effluent Pipette Reading	Gradient (ΔH/ΔL)	Average Flow (cm <sup>3</sup> )	Elapsed Time (s)	Ratio (outflow to inflow)	Change in Head (Not to exceed 25%)	k <sub>sat</sub> T°C (cm/s)	k <sub>sat</sub> Corrected (cm/s)
Test # 1:											
11-Aug-17	09:21:54	21.5	11.00	19.00	1.21	2.32	651	1.00	12%	1.21E-04	1.17E-04
11-Aug-17	09:32:45	21.5	11.50	18.50	1.06	2.32	765	1.00	14%	1.19E-04	1.14E-04
Test # 2:											
11-Aug-17	09:32:45	21.5	11.50	18.50	1.06	2.32	765	1.00	14%	1.19E-04	1.14E-04
11-Aug-17	09:45:30	21.5	12.00	18.00	0.91	2.32	900	1.00	17%	1.19E-04	1.15E-04
Test # 3:											
11-Aug-17	09:45:30	21.5	12.00	18.00	0.91	2.32	900	1.00	17%	1.19E-04	1.15E-04
11-Aug-17	10:00:30	21.5	12.50	17.50	0.76	2.32	1105	1.00	20%	1.19E-04	1.15E-04
Test # 4:											
11-Aug-17	10:00:30	21.5	12.50	17.50	0.76	2.32	1105	1.00	20%	1.19E-04	1.15E-04
11-Aug-17	10:18:55	21.5	13.00	17.00	0.61	2.32	1105	1.00	20%	1.19E-04	1.15E-04

**Average Ksat (cm/sec): 1.15E-04**  
 Calculated Gravel Corrected Average Ksat (cm/sec): 1.03E-04



ASTM Required Range (+/- 25%)

Ksat (-25%) (cm/s): 8.64E-05

Ksat (+25%) (cm/s): 1.44E-04



## Oversize Correction Data Sheet

*Job Name:* Barrick Gold Corporation  
*Job Number:* DB17.1190.00  
*Sample Number:* TP-2 90%  
*Project Name:* Cunningham Hill  
*Date Sampled:* 7/17/17

*Split (3/4", 3/8", #4):* #4  
*Calculated Porosity of Fines (% vol):* 43.0

	<u>Coarse Fraction*</u>	<u>Fines Fraction</u>	<u>Composite</u>
<i>Subsample Mass (g):</i>	10.18	89.82	100.00
<i>Bulk Density (g/cm<sup>3</sup>):</i>	2.65	1.51	1.58
<i>Volume of Solids (cm<sup>3</sup>):</i>	3.84	33.89	37.74
<i>Volume of Voids (cm<sup>3</sup>):</i>	0.00	25.54	25.54
<i>Total Volume (cm<sup>3</sup>):</i>	3.84	59.44	63.28
<i>Volumetric Fraction (%):</i>	6.07	93.93	100.00
<i>Mass Fraction (%):</i>	10.18	89.82	100.00
<i>Ksat (cm/sec):</i>	NM	1.2E-04	1.0E-04

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NM = Not measured

\* = Porosity and moisture content of coarse fraction assumed to be zero.

*Laboratory analysis by:* D. O'Dowd  
*Data entered by:* D. O'Dowd  
*Checked by:* J. Hines

# Particle Size Analysis



### Summary of Particle Size Characteristics

Sample Number	d <sub>10</sub> (mm)	d <sub>50</sub> (mm)	d <sub>60</sub> (mm)	C <sub>u</sub>	C <sub>c</sub>	Method	ASTM Classification	USDA Classification	
TP-1	0.00038	0.070	0.14	368	12	WS/H	Sandy silt with gravel s(ML)g	Loam †	(Est)
TP-2	0.00067	0.055	0.076	113	9.5	WS/H	Sandy silt s(ML)	Loam †	(Est)

d<sub>50</sub> = Median particle diameter

Est = Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

$$C_u = \frac{d_{60}}{d_{10}}$$

$$C_c = \frac{(d_{30})^2}{(d_{10})(d_{60})}$$

DS = Dry sieve

H = Hydrometer

WS = Wet sieve

† Greater than 10% of sample is coarse material



**Percent Gravel, Sand, Silt and Clay\***

Sample Number	% Gravel (>4.75mm)	% Sand (<4.75mm, >0.075mm)	% Silt (<0.075mm, >0.002mm)	% Clay (<0.002mm)
TP-1	18.6	29.8	36.5	15.2
TP-2	10.2	30.0	45.0	14.9

\*USCS classification does not classify clay fraction based on particle size. USDA definition of clay (<0.002mm) used in this table.



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Barrick Gold Corporation  
 Job Number: DB17.1190.00  
 Sample Number: TP-1  
 Project Name: Cunningham Hill  
 Date Sampled: 7/17/17  
 Test Date: 15-Aug-17

Initial Dry Weight of Sample (g): 18129.39  
 Weight Passing #10 (g): 14280.67  
 Weight Retained #10 (g): 3848.73  
 Weight of Hydrometer Sample (g): 74.85  
 Calculated Weight of Sieve Sample (g): 95.02

Shape: Angular  
 Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	18129.39	100.00
	2"	50	1004.20	1004.20	17125.19	94.46
	1.5"	38.1	419.40	1423.60	16705.79	92.15
	1"	25	467.70	1891.30	16238.09	89.57
	3/4"	19.0	438.50	2329.80	15799.59	87.15
	3/8"	9.5	605.60	2935.40	15193.99	83.81
	4	4.75	431.00	3366.40	14762.99	81.43
	10	2.00	482.33	3848.73	14280.67	78.77
-10	(Based on calculated sieve wt.)					
	20	0.85	3.30	23.47	71.55	75.30
	40	0.425	4.85	28.32	66.70	70.19
	60	0.250	4.11	32.43	62.59	65.87
	140	0.106	7.85	40.28	54.74	57.61
	200	0.075	5.64	45.92	49.10	51.67
	dry pan			1.76	47.68	47.34
wet pan				47.34	0.00	

d<sub>10</sub> (mm): 0.00038      d<sub>50</sub> (mm): 0.070  
 d<sub>16</sub> (mm): 0.0026      d<sub>60</sub> (mm): 0.14  
 d<sub>30</sub> (mm): 0.025      d<sub>84</sub> (mm): 9.9

Median Particle Diameter--d<sub>50</sub> (mm): 0.070  
 Uniformity Coefficient, C<sub>u</sub>--[d<sub>60</sub>/d<sub>10</sub>] (mm): 368  
 Coefficient of Curvature, C<sub>c</sub>--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 12  
 Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 3.3

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

Classification of fines: ML

ASTM Soil Classification: Sandy silt with gravel s(ML)g  
 USDA Soil Classification: Loam †

† Greater than 10% of sample is coarse material

Laboratory analysis by: J. Falance  
 Data entered by: C. Krous  
 Checked by: J. Hines



**Particle Size Analysis  
Hydrometer Data**

Job Name: Barrick Gold Corporation  
 Job Number: DB17.1190.00  
 Sample Number: TP-1  
 Project Name: Cunningham Hill  
 Date Sampled: 7/17/17  
 Test Date: 8-Aug-17  
 Start Time: 9:00

Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 74.85  
 Total Sample Wt. (g): 18129.39  
 Wt. Passing #10 (g): 14280.67

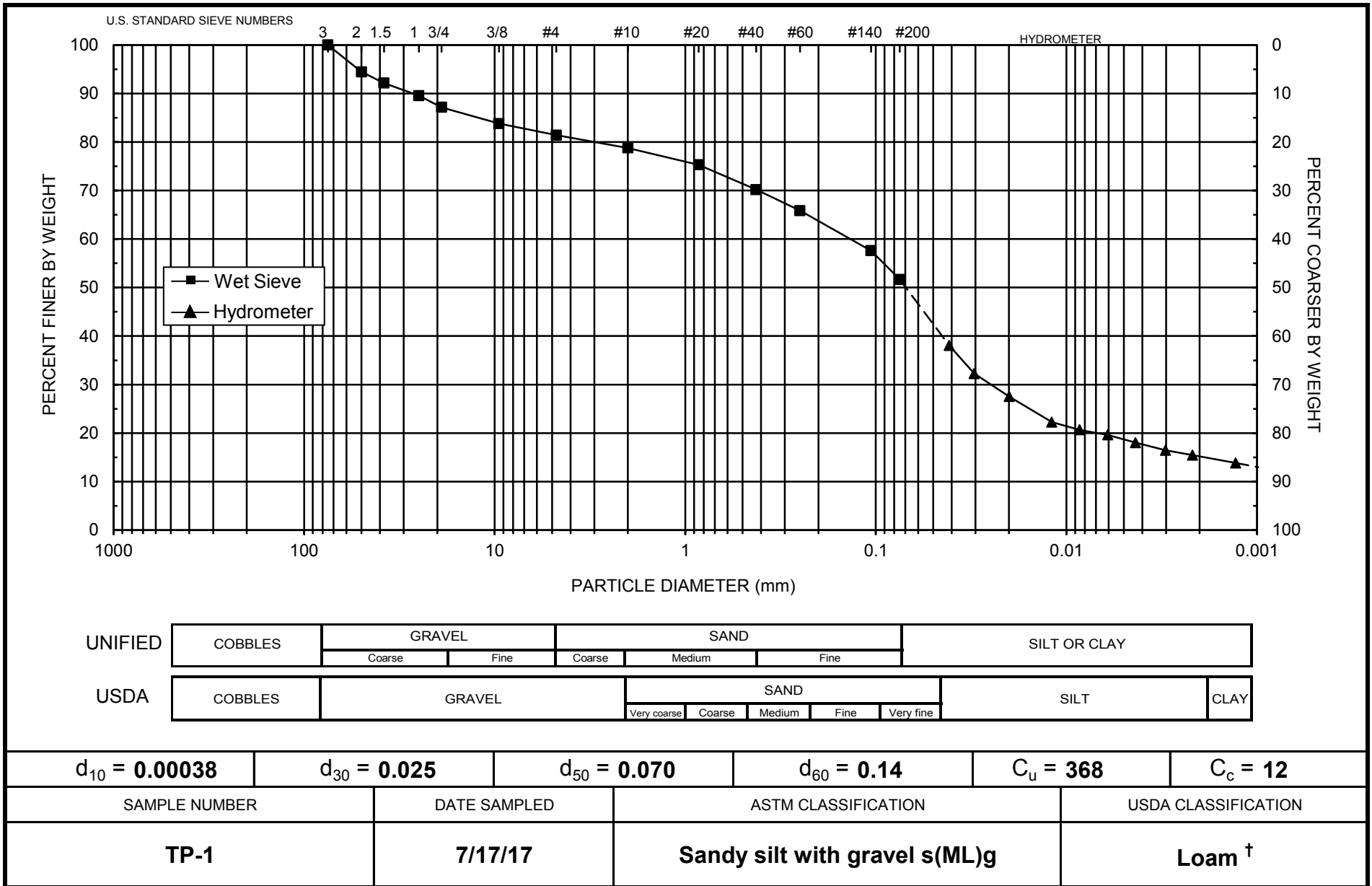
Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
8-Aug-17	1	21.6	41.5	5.4	36.1	9.5	0.04117	48.3	38.0
	2	21.6	36.0	5.4	30.6	10.4	0.03047	40.9	32.2
	5	21.6	31.5	5.4	26.1	11.1	0.01994	34.9	27.5
	15	21.6	26.5	5.4	21.1	12.0	0.01193	28.2	22.2
	30	21.6	25.0	5.4	19.6	12.2	0.00852	26.2	20.7
	60	21.6	24.0	5.4	18.6	12.4	0.00607	24.9	19.6
	120	21.5	22.5	5.4	17.1	12.6	0.00434	22.9	18.0
	252	21.5	21.0	5.4	15.6	12.9	0.00302	20.9	16.4
	483	22.1	20.0	5.3	14.7	13.0	0.00218	19.6	15.5
	9-Aug-17	1417	21.5	18.5	5.4	13.1	13.3	0.00129	17.5

Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Bland  
 Data entered by: C. Krous  
 Checked by: J. Hines





† Greater than 10% of sample is coarse material

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



Daniel B. Stephens & Associates, Inc.



**Particle Size Analysis  
Wet Sieve Data (#10 Split)**

Job Name: Barrick Gold Corporation  
 Job Number: DB17.1190.00  
 Sample Number: TP-2  
 Project Name: Cunningham Hill  
 Date Sampled: 7/17/17  
 Test Date: 15-Aug-17

Initial Dry Weight of Sample (g): 17935.11  
 Weight Passing #10 (g): 15651.95  
 Weight Retained #10 (g): 2283.16  
 Weight of Hydrometer Sample (g): 78.09  
 Calculated Weight of Sieve Sample (g): 89.48

Shape: Angular  
 Hardness: Hard and durable

Test Fraction	Sieve Number	Diameter (mm)	Wt. Retained	Cum Wt. Retained	Wt. Passing	% Passing
+10	3"	75	0.00	0.00	17935.11	100.00
	2"	50	0.00	0.00	17935.11	100.00
	1.5"	38.1	0.00	0.00	17935.11	100.00
	1"	25	543.10	543.10	17392.01	96.97
	3/4"	19.0	202.39	745.49	17189.62	95.84
	3/8"	9.5	586.70	1332.19	16602.92	92.57
	4	4.75	494.10	1826.29	16108.82	89.82
	10	2.00	456.87	2283.16	15651.95	87.27
-10	(Based on calculated sieve wt.)					
	20	0.85	2.68	14.07	75.41	84.27
	40	0.425	3.46	17.53	71.95	80.41
	60	0.250	3.89	21.42	68.06	76.06
	140	0.106	8.27	29.69	59.79	66.82
	200	0.075	6.24	35.93	53.55	59.85
	dry pan			1.45	37.38	52.10
wet pan				52.10	0.00	

d<sub>10</sub> (mm): 0.00067      d<sub>50</sub> (mm): 0.055  
 d<sub>16</sub> (mm): 0.0024      d<sub>60</sub> (mm): 0.076  
 d<sub>30</sub> (mm): 0.022      d<sub>84</sub> (mm): 0.81

Median Particle Diameter--d<sub>50</sub> (mm): 0.055  
 Uniformity Coefficient, C<sub>u</sub>--[d<sub>60</sub>/d<sub>10</sub>] (mm): 113  
 Coefficient of Curvature, C<sub>c</sub>--[(d<sub>30</sub>)<sup>2</sup>/(d<sub>10</sub>\*d<sub>60</sub>)] (mm): 9.5  
 Mean Particle Diameter--[(d<sub>16</sub>+d<sub>50</sub>+d<sub>84</sub>)/3] (mm): 0.29

Note: Reported values for d<sub>10</sub>, C<sub>u</sub>, C<sub>c</sub>, and soil classification are estimates, since extrapolation was required to obtain the d<sub>10</sub> diameter

Classification of fines: ML

ASTM Soil Classification: Sandy silt s(ML)  
 USDA Soil Classification: Loam †

† Greater than 10% of sample is coarse material

Laboratory analysis by: J. Falance  
 Data entered by: C. Krous  
 Checked by: J. Hines



**Particle Size Analysis  
Hydrometer Data**

Job Name: Barrick Gold Corporation  
 Job Number: DB17.1190.00  
 Sample Number: TP-2  
 Project Name: Cunningham Hill  
 Date Sampled: 7/17/17  
 Test Date: 8-Aug-17  
 Start Time: 9:06

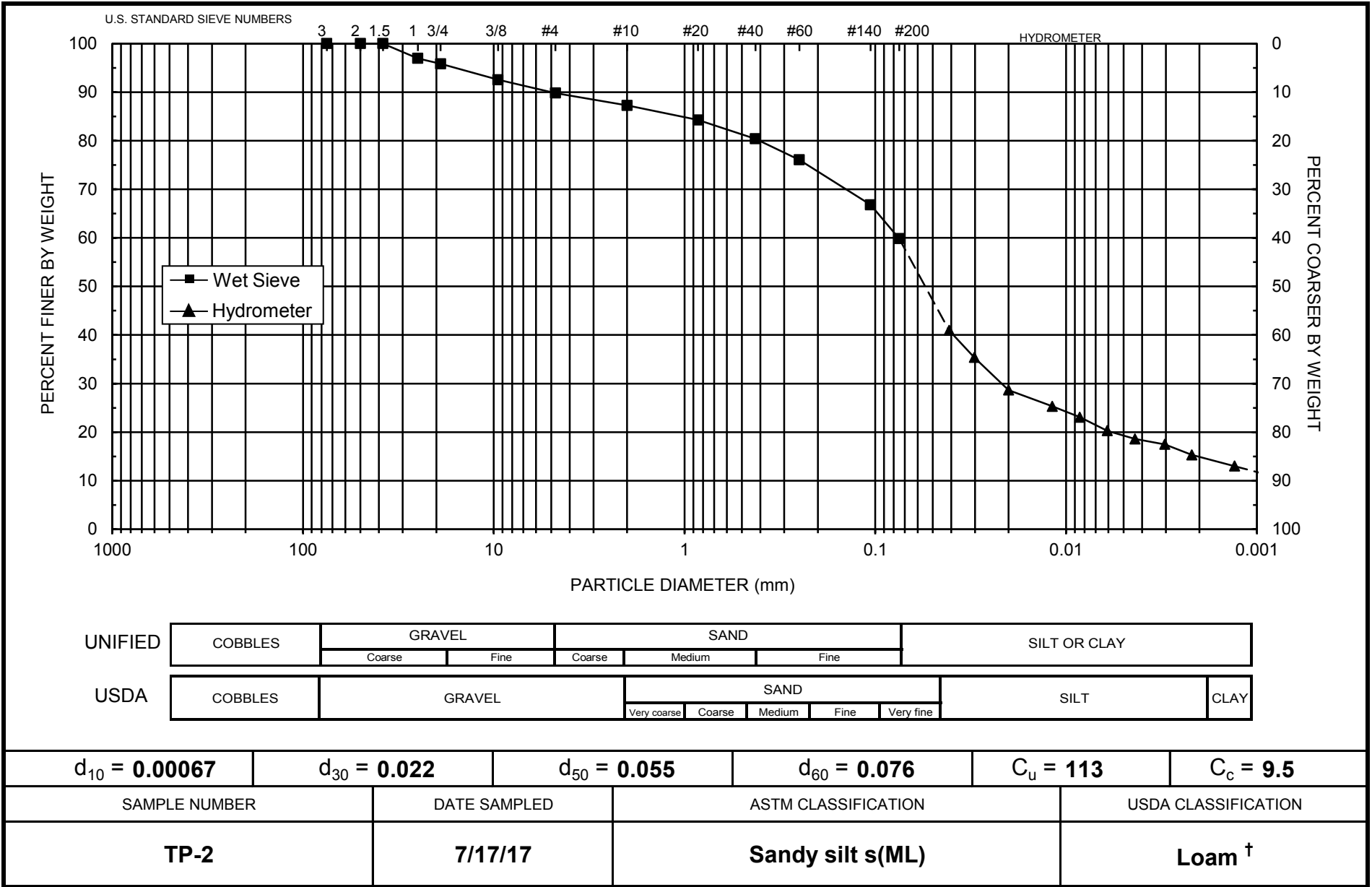
Type of Water Used: DISTILLED  
 Reaction with H<sub>2</sub>O<sub>2</sub>: NA  
 Dispersant\*: (NaPO<sub>3</sub>)<sub>6</sub>  
 Assumed particle density: 2.65  
 Initial Wt. (g): 78.09  
 Total Sample Wt. (g): 17935.11  
 Wt. Passing #10 (g): 15651.95

Date	Time (min)	Temp (°C)	R (g/L)	R <sub>L</sub> (g/L)	R <sub>corr</sub> (g/L)	L (cm)	D (mm)	P (%)	% Finer
8-Aug-17	1	21.6	42.0	5.4	36.6	9.4	0.04100	46.9	40.9
	2	21.6	37.0	5.4	31.6	10.2	0.03022	40.5	35.4
	5	21.6	31.0	5.4	25.6	11.2	0.02001	32.8	28.7
	15	21.6	28.0	5.4	22.6	11.7	0.01181	29.0	25.3
	30	21.6	26.0	5.4	20.6	12.0	0.00846	26.4	23.1
	60	21.6	23.5	5.4	18.1	12.4	0.00609	23.2	20.3
	120	21.4	22.0	5.4	16.6	12.7	0.00436	21.3	18.6
	250	21.5	21.0	5.4	15.6	12.9	0.00303	20.0	17.5
	480	22.5	19.0	5.3	13.7	13.2	0.00219	17.5	15.3
	9-Aug-17	1413	21.5	17.0	5.4	11.6	13.5	0.00131	14.9

Comments:

\* Dispersion device: mechanically operated stirring device

Laboratory analysis by: A. Bland  
 Data entered by: C. Krous  
 Checked by: J. Hines



† Greater than 10% of sample is coarse material

Note: Reported values for  $d_{10}$ ,  $C_u$ ,  $C_c$ , and ASTM classification are estimates, since extrapolation was required to obtain the  $d_{10}$  diameter



Daniel B. Stephens & Associates, Inc.

## **Atterberg Limits/ Identification of Fines**



### Summary of Atterberg Tests

Sample Number	Liquid Limit	Plastic Limit	Plasticity Index	Classification
TP-1	38	25	13	ML
TP-2	36	25	11	ML

---

--- = Soil requires visual-manual classification due to non-plasticity



## Atterberg Limits

Job Name: Barrick Gold Corporation  
Job Number: DB17.1190.00  
Sample Number: TP-1  
Project Name: Cunningham Hill  
Date Sampled: 7/17/17  
Test Date: 11-Aug-17

### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:	26	25	18
Pan number:	LL1	LL2	LL3
Weight of pan plus moist soil (g):	121.58	120.14	117.35
Weight of pan plus dry soil (g)	120.40	119.12	116.39
Weight of pan (g):	117.28	116.40	113.88
Gravimetric moisture content (% g/g):	37.82	37.50	38.25
Liquid Limit:	38		

### Plastic Limit

	Trial 1	Trial 2
Pan number:	PL1	PL2
Weight of pan plus moist soil (g):	119.38	119.90
Weight of pan plus dry soil (g)	118.00	118.54
Weight of pan (g):	112.56	113.16
Gravimetric moisture content (% g/g):	25.37	25.28
Plastic Limit:	25	

### Results

Percent of Sample Retained on #40 Sieve:

Liquid Limit: 38  
Plastic Limit: 25  
Plasticity Index: 13  
Classification: ML

#### Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: A. Bland  
Data entered by: A. Bland  
Checked by: J. Hines



## Atterberg Limits

Job Name: Barrick Gold Corporation  
 Job Number: DB17.1190.00  
 Sample Number: TP-2  
 Project Name: Cunningham Hill  
 Date Sampled: 7/17/17  
 Test Date: 11-Aug-17

### Liquid Limit

	Trial 1	Trial 2	Trial 3
Number of drops:	35	23	16
Pan number:	LL1	LL2	LL3
Weight of pan plus moist soil (g):	121.12	121.18	120.42
Weight of pan plus dry soil (g)	119.96	119.62	118.46
Weight of pan (g):	116.65	115.31	113.22
Gravimetric moisture content (% g/g):	35.05	36.19	37.40
Liquid Limit:	36		

### Plastic Limit

	Trial 1	Trial 2
Pan number:	PL1	PL2
Weight of pan plus moist soil (g):	119.22	124.58
Weight of pan plus dry soil (g)	118.39	122.91
Weight of pan (g):	115.16	116.11
Gravimetric moisture content (% g/g):	25.70	24.56
Plastic Limit:	25	

### Results

Percent of Sample Retained on #40 Sieve:

Liquid Limit: 36  
 Plastic Limit: 25  
 Plasticity Index: 11  
 Classification: ML

#### Comments:

- = Soil requires visual-manual classification due to non-plasticity
- \* = 1-point method requested by client

Laboratory analysis by: A. Bland  
 Data entered by: A. Bland  
 Checked by: J. Hines



# Proctor Compaction



### Summary of Proctor Compaction Tests

Sample Number	Measured		Oversize Corrected	
	Optimum Moisture Content (% g/g)	Maximum Dry Bulk Density (g/cm <sup>3</sup> )	Optimum Moisture Content (% g/g)	Maximum Dry Bulk Density (g/cm <sup>3</sup> )
TP-1	17.8	1.67	14.6	1.79
TP-2	18.1	1.68	16.1	1.75

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

NA = Not applicable



**Proctor Compaction Data**

Job Name: Barrick Gold Corporation  
 Job Number: DB17.1190.00  
 Sample Number: TP-1  
 Project Name: Cunningham Hill  
 Date Sampled: 7/17/17  
 Test Date: 8-Aug-17

Split (3/4", 3/8", #4): #4  
 Mass of coarse material (g): 18.57  
 Mass of fines material (g): 81.43  
 Mold weight (g): 4371  
 Mold volume (cm<sup>3</sup>): 944.58  
 Compaction Method: Standard A  
 Preparation Method: Dry  
 Type of Rammer: Mechanical

As Received Moisture Content (% g/g): NA

Trial	Weight of Mold and Compacted Soil (g)	Weight of Container and Wet Soil (g)	Weight of Container and Dry Soil (g)	Weight of Container (g)	Dry Bulk Density (g/cm <sup>3</sup> )	Moisture Content (% g/g)
1	6035	954.51	865.80	210.00	1.55	13.53
2	6165	929.94	831.83	210.85	1.64	15.80
3	6225	1115.43	987.49	269.32	1.67	17.81
4	6229	1048.31	911.30	212.72	1.64	19.61
5	6169	1040.06	886.09	210.03	1.55	22.77

Soil Fractions

Coarse Fraction (% g/g): 18.6  
 Fines Fraction (% g/g): 81.4

Properties of Coarse Material

Assumed particle density (g/cm<sup>3</sup>): 2.65  
 Assumed Initial Moisture Content (% g/g): 0.0

Oversize Corrected Values for Dry Bulk Density and Moisture Content

Trial	Dry Bulk Density of Composite (g/cm <sup>3</sup> )	Moisture Content of Composite (% g/g)
1	1.68	11.02
2	1.76	12.87
3	1.79	14.51
4	1.77	15.97
5	1.68	18.55

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: A. Bland  
 Data entered by: C. Krous  
 Checked by: J. Hines

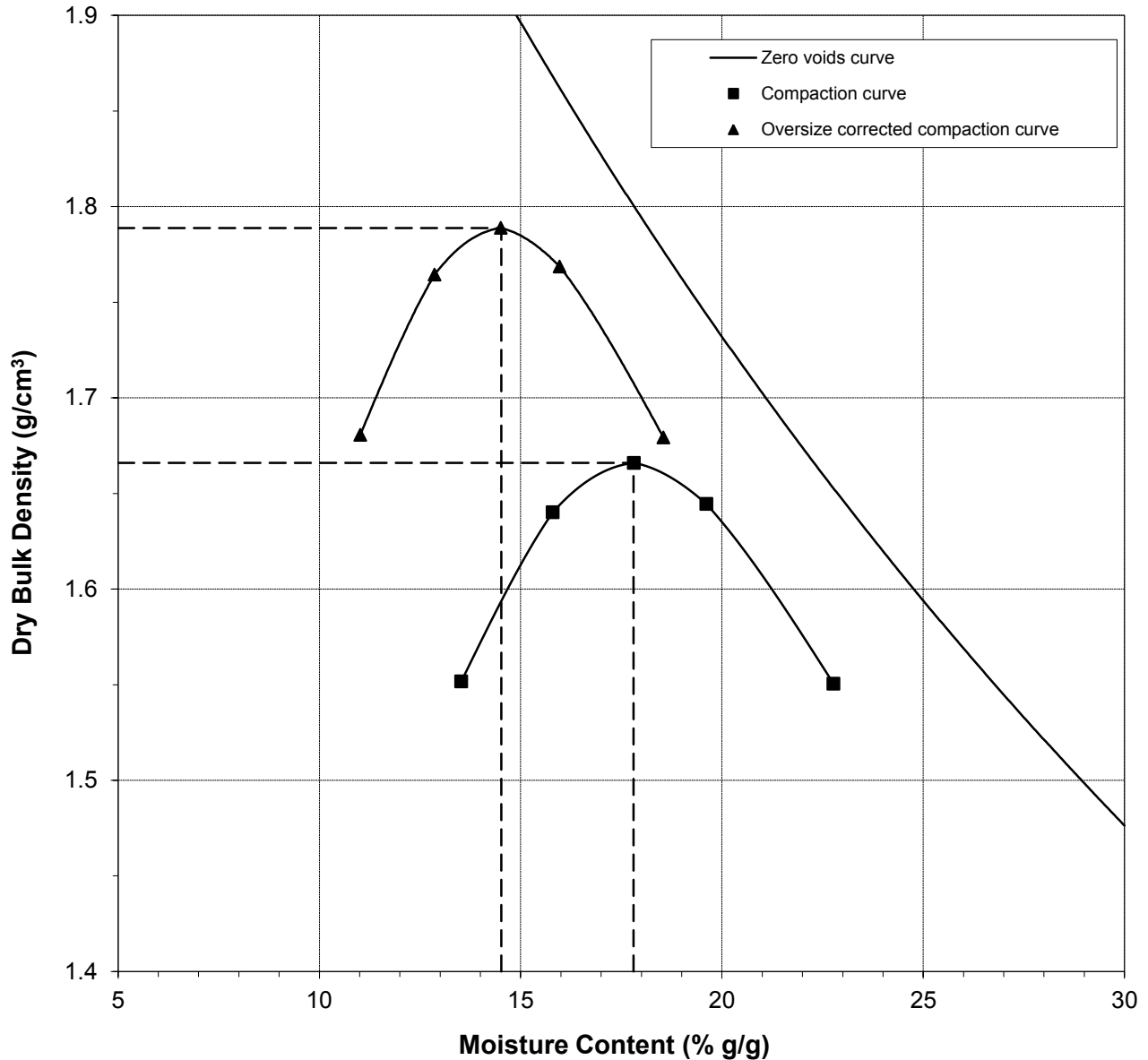


**Proctor Compaction Data Points with Fitted Curve**

Sample Number: TP-1

	Measured	Corrected
Optimum Moisture Content (% g/g):	17.8	14.5
Maximum Dry Bulk Density (g/cm <sup>3</sup> ):	1.67	1.79

Test Date: 8-Aug-17



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: A. Bland  
 Data entered by: C. Krous  
 Checked by: J. Hines



**Proctor Compaction Data**

Job Name: Barrick Gold Corporation  
 Job Number: DB17.1190.00  
 Sample Number: TP-2  
 Project Name: Cunningham Hill  
 Date Sampled: 7/17/17  
 Test Date: 8-Aug-17

Split (3/4", 3/8", #4): #4  
 Mass of coarse material (g): 10.18  
 Mass of fines material (g): 89.82  
 Mold weight (g): 4371  
 Mold volume (cm<sup>3</sup>): 944.58  
 Compaction Method: Standard A  
 Preparation Method: Dry  
 Type of Rammer: Mechanical

As Received Moisture Content (% g/g): NA

Trial	Weight of Mold and Compacted Soil (g)	Weight of Container and Wet Soil (g)	Weight of Container and Dry Soil (g)	Weight of Container (g)	Dry Bulk Density (g/cm <sup>3</sup> )	Moisture Content (% g/g)
1	6101	1183.06	1070.72	269.68	1.61	14.02
2	6187	1116.66	1002.02	293.40	1.65	16.18
3	6246	1057.25	935.96	268.89	1.68	18.18
4	6222	1085.88	938.68	210.76	1.63	20.22
5	6147	1070.52	919.71	266.50	1.53	23.09

Soil Fractions

Coarse Fraction (% g/g): 10.2  
 Fines Fraction (% g/g): 89.8

Properties of Coarse Material

Assumed particle density (g/cm<sup>3</sup>): 2.65  
 Assumed Initial Moisture Content (% g/g): 0.0

Oversize Corrected Values for Dry Bulk Density and Moisture Content

Trial	Dry Bulk Density of Composite (g/cm <sup>3</sup> )	Moisture Content of Composite (% g/g)
1	1.67	12.60
2	1.72	14.53
3	1.74	16.33
4	1.70	18.16
5	1.60	20.74

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: A. Bland  
 Data entered by: C. Krous  
 Checked by: J. Hines

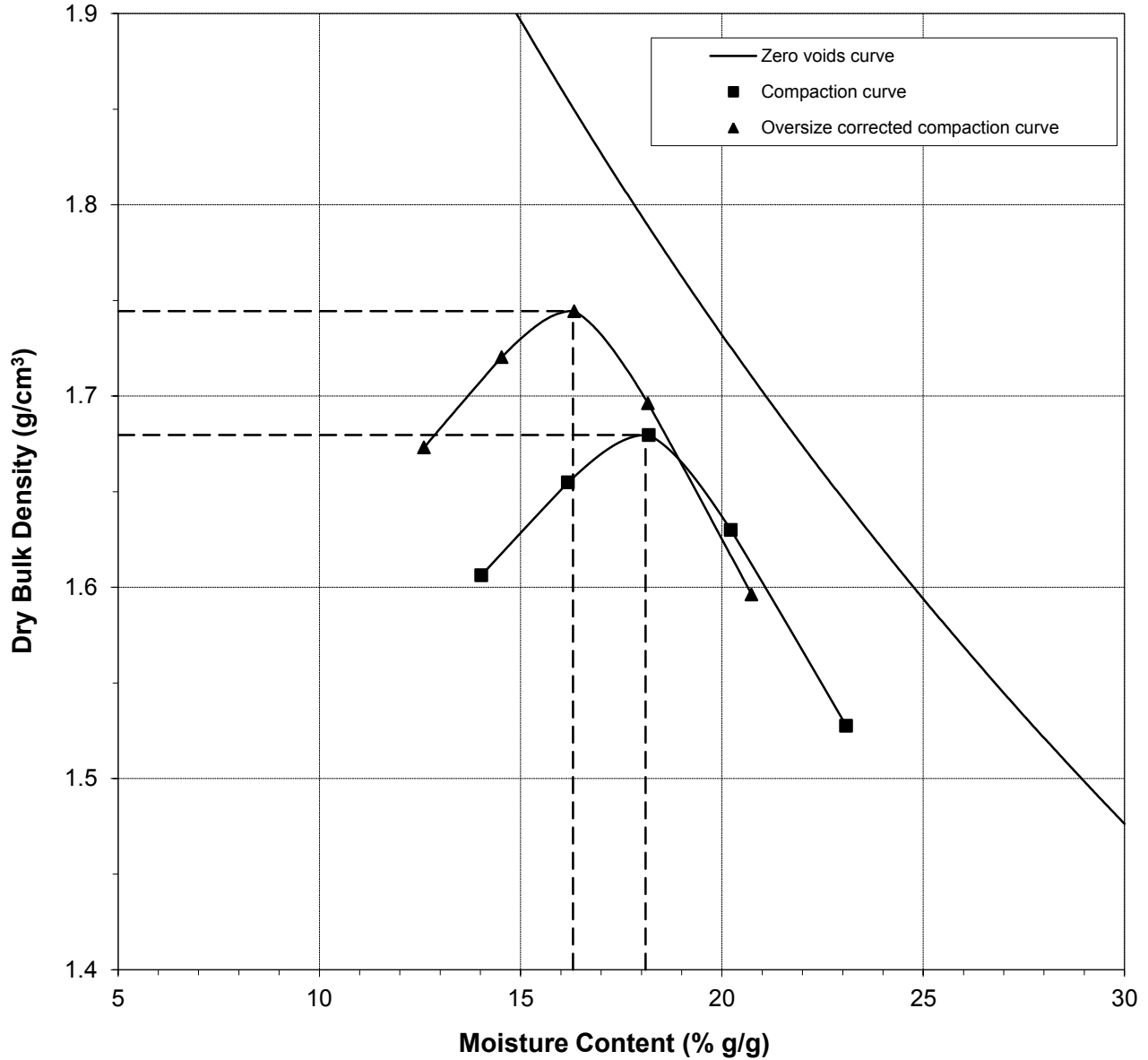


**Proctor Compaction Data Points with Fitted Curve**

Sample Number: TP-2

	Measured	Corrected
Optimum Moisture Content (% g/g):	18.1	16.3
Maximum Dry Bulk Density (g/cm <sup>3</sup> ):	1.68	1.74

Test Date: 8-Aug-17



--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

Laboratory analysis by: A. Bland  
 Data entered by: C. Krous  
 Checked by: J. Hines

# **Laboratory Tests and Methods**



## Tests and Methods

Dry Bulk Density:	ASTM D7263
Moisture Content:	ASTM D7263, ASTM D2216
Calculated Porosity:	ASTM D7263
Saturated Hydraulic Conductivity:	
Falling Head Rising Tail: (Flexible Wall)	ASTM D5084
Particle Size Analysis:	ASTM D7928, ASTM D6913
USCS (ASTM) Classification:	ASTM D7928, ASTM D6913, ASTM D2487
USDA Classification:	ASTM D7928, ASTM D6913, USDA Soil Textural Triangle
Atterberg Limits:	ASTM D4318
Standard Proctor Compaction:	ASTM D698



# Attachment 4

## Soil Chemistry and Particle Size Analysis

---



# ANALYTICAL SUMMARY REPORT

December 19, 2021

Meridiam Partners LLC  
PO Box 102380  
Denver, CO 80210-2380

Work Order: H21110626

Project Name: Cunningham Hill WRP

Energy Laboratories Inc Helena MT received the following 2 samples for Meridiam Partners LLC on 11/24/2021 for analysis.

Lab ID	Client Sample ID	Collect Date	Receive Date	Matrix	Test
H21110626-001	BP-1	09/21/21 15:00	11/24/21	Soil	Metals by ICP/ICPMS, Total Metals, NH4OAC Extractable Metals, Saturated Paste Acid/Base Potential Conductivity, Saturated Paste Extract Fertilizer Recommendation Anions, Saturated Paste Extract Lime as CaCO3 Moisture Nitrate as N, KCL Extract Organic Carbon/Matter Walkley-Black Net Acid Generation pH, Saturated Paste Phosphorus-Olsen Total Metals Digestion by SW3050B KCL Soil Extract ASA33-3 Lime Percentage USDA23c NaHCO3 Soil Extract ASA24-5 Ammonium Acetate Extraction ASA13-3 Total Organic Matter Prep ASA29-3 Particle Size Analysis / Texture Prep ASA15-5 Saturated Paste Extraction ASA Particle Size Analysis / Texture Sulfur Forms Soil Preparation USDA1
H21110626-002	BP-2	09/21/21 15:00	11/24/21	Soil	Same As Above

The analyses presented in this report were performed by Energy Laboratories, Inc., 3161 E. Lyndale Ave., Helena, MT 59604, unless otherwise noted. Any exceptions or problems with the analyses are noted in the report package. Any issues encountered during sample receipt are documented in the Work Order Receipt Checklist.

The results as reported relate only to the item(s) submitted for testing. This report shall be used or copied only in its entirety. Energy Laboratories, Inc. is not responsible for the consequences arising from the use of a partial report.

If you have any questions regarding these test results, please contact your Project Manager.

Report Approved By:



**CLIENT:** Meridiam Partners LLC  
**Project:** Cunningham Hill WRP  
**Work Order:** H21110626

**Report Date:** 12/19/21

## **CASE NARRATIVE**

---

The soil analyses were given to Neal Fehring, an independent Certified Agronomist. Neal has prepared your fertilizer recommendation based upon these analyses and your proposed use and yield. If you have any questions Mr. Fehring can be reached at (406) 373-5985 or (406) 860-3647.



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HELENA, MT

Toll Free: 877.472.0711 • 406.442.0711 • F: 406.442.0712  
PO Box 5688, Helena, MT 59604-5688 • 3161 E. Lyndale Ave (59601)

**TO:** Meridiam Partners LLC  
**ADDRESS:** Attn: Dan Duche  
1001 W. Arizona Ave  
Denver, CO 80223

**LAB NO.:** H21110626-001-002  
**DATE:** 12/17/21

## Cunningham Hill WRP

### FERTILIZER RECOMMENDATIONS

Fertilizer Suggested in Actual Pounds per Acre

FIELD	BP-1	BP-2
CROP	Grass	Grass
PROJECTED YIELD	1/2T	1/2T
<b>Nitrogen</b>		
Total	0	20
Preplant		
Banded		
<b>Phosphrus (P<sub>2</sub>O<sub>5</sub>)</b>		
Broadcast	0	40
Banded		
<b>Potassium (K<sub>2</sub>O)</b>		
Broadcast	0	0
Banded		
Gypsum	0	0
Compost	0	5 tons

**COMMENTS:**

No issues with BP-1 except extractable iron seems high. Conductivity is 2.0 mmhos/cm but that should not be an issue for native vegetation. BP-2 is extremely low in organic matter and N, P & K. Conductivity is only 0.4 mmhos/cm for this sample. Iron is twice that of BP-1. I do not know what the toxicity level of extractable iron is.

PREPARED BY: Neal Fehringer, Certified Professional Agronomist, C.C.A., (406) 860-3647.



## LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

**Client:** Meridiam Partners LLC  
**Project:** Cunningham Hill WRP  
**Lab ID:** H21110626-001  
**Client Sample ID:** BP-1

**Report Date:** 12/19/21  
**Collection Date:** 09/21/21 15:00  
**Date Received:** 11/24/21  
**Matrix:** Soil

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
<b>NET ACID GENERATION</b>							
NAG pH	8.0	s.u.		0.01		AADP-NAG	12/10/21 15:06 / swj
<b>PHYSICAL CHARACTERISTICS</b>							
Moisture	2.9	wt%		0.2		D2974	11/30/21 00:00 / iej
Sand	46	%		1		ASA15-5	12/03/21 09:08 / sah
Silt	30	%		1		ASA15-5	12/03/21 09:08 / sah
Clay	24	%		1		ASA15-5	12/03/21 09:08 / sah
Texture	L			1		ASA15-5	12/03/21 09:08 / sah
<b>SATURATED PASTE</b>							
pH, sat. paste	7.6	s.u.		0.1		ASA10-3	12/07/21 08:39 / jjp
<b>SATURATED PASTE EXTRACT</b>							
Conductivity, sat. paste	2.0	mmhos/cm		0.1		ASA10-3	12/07/21 13:00 / jjp
Calcium	320	mg/L		1		SW6010B	12/08/21 16:28 / sld
Calcium, sat. paste	16.0	meq/L		0.05		SW6010B	12/08/21 16:28 / sld
Sodium	33	mg/L		1		SW6010B	12/08/21 16:28 / sld
Sodium, sat. paste	1.42	meq/L		0.04		SW6010B	12/08/21 16:28 / sld
Sulfate	128	mg/L		1		E300.0	12/07/21 15:54 / JAR
<b>CHEMICAL CHARACTERISTICS</b>							
Potassium, Available	289	mg/kg	D	3		SW6010B	12/03/21 22:36 / sld
Organic Matter	3.5	%		0.2		ASA29-3	12/08/21 08:43 / sah
Lime as CaCO3	4.60	%		0.01		USDA23c	12/03/21 14:33 / SRW
<b>ACID BASE</b>							
Neutralization Potential	45	t/kt				Sobek Modifie	12/03/21 13:51 / SRW
Acid Potential	2.5	t/kt		0.01		Sobek Modifie	12/07/21 09:33 / stp
Acid/Base Potential	43	t/kt				Sobek Modifie	12/07/21 09:33 / stp
Sulfur, Total	0.08	%		0.01		Sobek Modifie	12/07/21 15:18 / stp
Sulfur, Hot Water Extractable	0.06	%		0.01		Sobek Modifie	12/07/21 15:18 / stp
Sulfur, HCl Extractable	ND	%		0.01		Sobek Modifie	12/07/21 15:18 / stp
Sulfur, HNO3 Extractable	ND	%		0.01		Sobek Modifie	12/07/21 15:18 / stp
Sulfur, Residual	0.01	%		0.01		Sobek Modifie	12/07/21 15:18 / stp
<b>NUTRIENTS</b>							
Phosphorus, Olsen	13	mg/kg-dry		1		ASA24-5	12/06/21 12:31 / GEM
Nitrate as N, KCL Extract	65	mg/kg-dry		1		ASA33-8	12/06/21 10:44 / GEM
<b>3050 EXTRACTABLE METALS</b>							
Arsenic	7	mg/kg		1		SW6020	12/02/21 17:46 / dck
Boron	8	mg/kg	D	4		SW6010B	12/02/21 13:31 / sld
Cadmium	ND	mg/kg		1		SW6020	12/02/21 17:46 / dck
Copper	23	mg/kg	D	3		SW6020	12/02/21 17:46 / dck
Iron	19600	mg/kg	D	200		SW6010B	12/03/21 12:39 / sld

**Report** RL - Analyte Reporting Limit

**Definitions:** QCL - Quality Control Limit

D - Reporting Limit (RL) increased due to sample matrix

MCL - Maximum Contaminant Level

ND - Not detected at the Reporting Limit (RL)



### LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

**Client:** Meridiam Partners LLC  
**Project:** Cunningham Hill WRP  
**Lab ID:** H21110626-001  
**Client Sample ID:** BP-1

**Report Date:** 12/19/21  
**Collection Date:** 09/21/21 15:00  
**Date Received:** 11/24/21  
**Matrix:** Soil

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
<b>3050 EXTRACTABLE METALS</b>							
Lead	16	mg/kg		1		SW6020	12/02/21 17:46 / dck
Manganese	441	mg/kg	D	3		SW6020	12/02/21 17:46 / dck
Molybdenum	1	mg/kg		1		SW6020	12/02/21 17:46 / dck
Nickel	11	mg/kg		1		SW6020	12/02/21 17:46 / dck
Selenium	ND	mg/kg		1		SW6020	12/02/21 17:46 / dck
Zinc	43	mg/kg	D	5		SW6010B	12/02/21 13:31 / sld

**Report Definitions:**  
RL - Analyte Reporting Limit  
QCL - Quality Control Limit  
D - Reporting Limit (RL) increased due to sample matrix

MCL - Maximum Contaminant Level  
ND - Not detected at the Reporting Limit (RL)



### LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

**Client:** Meridiam Partners LLC  
**Project:** Cunningham Hill WRP  
**Lab ID:** H21110626-002  
**Client Sample ID:** BP-2

**Report Date:** 12/19/21  
**Collection Date:** 09/21/21 15:00  
**Date Received:** 11/24/21  
**Matrix:** Soil

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
<b>NET ACID GENERATION</b>							
NAG pH	9.1	s.u.		0.01		AADP-NAG	12/10/21 15:07 / swj
<b>PHYSICAL CHARACTERISTICS</b>							
Moisture	2.6	wt%		0.2		D2974	11/30/21 00:00 / iej
Sand	68	%		1		ASA15-5	12/03/21 09:08 / sah
Silt	16	%		1		ASA15-5	12/03/21 09:08 / sah
Clay	16	%		1		ASA15-5	12/03/21 09:08 / sah
Texture	SL			1		ASA15-5	12/03/21 09:08 / sah
<b>SATURATED PASTE</b>							
pH, sat. paste	8.1	s.u.		0.1		ASA10-3	12/07/21 08:40 / jjp
<b>SATURATED PASTE EXTRACT</b>							
Conductivity, sat. paste	0.4	mmhos/cm		0.1		ASA10-3	12/07/21 13:01 / jjp
Calcium	57	mg/L		1		SW6010B	12/08/21 16:42 / sld
Calcium, sat. paste	2.83	meq/L		0.05		SW6010B	12/08/21 16:42 / sld
Sodium	6	mg/L		1		SW6010B	12/08/21 16:42 / sld
Sodium, sat. paste	0.24	meq/L		0.04		SW6010B	12/08/21 16:42 / sld
Sulfate	20	mg/L		1		E300.0	12/07/21 16:09 / JAR
<b>CHEMICAL CHARACTERISTICS</b>							
Potassium, Available	160	mg/kg	D	3		SW6010B	12/03/21 22:58 / sld
Organic Matter	0.2	%		0.2		ASA29-3	12/08/21 08:43 / sah
Lime as CaCO3	3.91	%		0.01		USDA23c	12/03/21 14:51 / SRW
<b>ACID BASE</b>							
Neutralization Potential	44	t/kt				Sobek Modifie	12/03/21 13:59 / SRW
Acid Potential	ND	t/kt		0.01		Sobek Modifie	12/07/21 09:33 / stp
Acid/Base Potential	39	t/kt				Sobek Modifie	12/07/21 09:33 / stp
Sulfur, Total	ND	%		0.01		Sobek Modifie	12/07/21 15:32 / stp
Sulfur, Hot Water Extractable	ND	%		0.01		Sobek Modifie	12/07/21 15:32 / stp
Sulfur, HCl Extractable	ND	%		0.01		Sobek Modifie	12/07/21 15:32 / stp
Sulfur, HNO3 Extractable	ND	%		0.01		Sobek Modifie	12/07/21 15:32 / stp
Sulfur, Residual	ND	%		0.01		Sobek Modifie	12/07/21 15:32 / stp
<b>NUTRIENTS</b>							
Phosphorus, Olsen	2	mg/kg-dry		1		ASA24-5	12/06/21 12:28 / GEM
Nitrate as N, KCL Extract	1	mg/kg-dry		1		ASA33-8	12/06/21 10:45 / GEM
<b>3050 EXTRACTABLE METALS</b>							
Arsenic	16	mg/kg		1		SW6020	12/02/21 17:51 / dck
Boron	ND	mg/kg	D	4		SW6010B	12/02/21 13:49 / sld
Cadmium	ND	mg/kg		1		SW6020	12/02/21 17:51 / dck
Copper	116	mg/kg	D	3		SW6020	12/02/21 17:51 / dck
Iron	39200	mg/kg	D	200		SW6010B	12/03/21 12:58 / sld

**Report** RL - Analyte Reporting Limit

**Definitions:** QCL - Quality Control Limit

D - Reporting Limit (RL) increased due to sample matrix

MCL - Maximum Contaminant Level

ND - Not detected at the Reporting Limit (RL)



### LABORATORY ANALYTICAL REPORT

Prepared by Helena, MT Branch

**Client:** Meridiam Partners LLC  
**Project:** Cunningham Hill WRP  
**Lab ID:** H21110626-002  
**Client Sample ID:** BP-2

**Report Date:** 12/19/21  
**Collection Date:** 09/21/21 15:00  
**Date Received:** 11/24/21  
**Matrix:** Soil

Analyses	Result	Units	Qualifiers	RL	MCL/ QCL	Method	Analysis Date / By
<b>3050 EXTRACTABLE METALS</b>							
Lead	33	mg/kg		1		SW6020	12/02/21 17:51 / dck
Manganese	1850	mg/kg	D	3		SW6020	12/02/21 17:51 / dck
Molybdenum	4	mg/kg		1		SW6020	12/02/21 17:51 / dck
Nickel	53	mg/kg		1		SW6020	12/02/21 17:51 / dck
Selenium	ND	mg/kg		1		SW6020	12/02/21 17:51 / dck
Zinc	85	mg/kg	D	5		SW6010B	12/02/21 13:49 / sld

**Report Definitions:**  
RL - Analyte Reporting Limit  
QCL - Quality Control Limit  
D - Reporting Limit (RL) increased due to sample matrix

MCL - Maximum Contaminant Level  
ND - Not detected at the Reporting Limit (RL)





# QA/QC Summary Report

Prepared by Helena, MT Branch

**Client:** Meridiam Partners LLC

**Work Order:** H21110626

**Report Date:** 12/19/21

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual	
<b>Method:</b> AADP-NAG							al Run: SOIL PH METER - ORION A211_211213B			
<b>Lab ID:</b> ICV_1_211210_1	Initial Calibration Verification Standard									
NAG pH	7.0	s.u.	0.010	100	98	102			12/10/21 15:00	
<b>Lab ID:</b> CCV_1_211210_1	Continuing Calibration Verification Standard									
NAG pH	7.0	s.u.	0.010	100	98	102			12/10/21 15:01	
<b>Lab ID:</b> CCV1_1_211210_1	Continuing Calibration Verification Standard									
NAG pH	4.0	s.u.	0.010	100	90	110			12/10/21 15:02	
<b>Method:</b> AADP-NAG							Batch: 211210_1_PH-NAG-S			
<b>Lab ID:</b> H21110626-002ADUP	Sample Duplicate									
NAG pH	9.1	s.u.	0.010				0.3	20	Run: SOIL PH METER - ORION A2 12/10/21 15:09	

**Qualifiers:**

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)



## QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Meridiam Partners LLC

Work Order: H21110626

Report Date: 12/19/21

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
<b>Method: ASA10-3</b>							Analytical Run: SOIL EC_211208A		
<b>Lab ID:</b> ICV_1_211206_1	Initial Calibration Verification Standard								12/07/21 12:57
Conductivity, sat. paste	1.44	mmhos/cm	0.10	102	90	110			
<b>Lab ID:</b> CCV_1_211206_1	Continuing Calibration Verification Standard								12/07/21 12:57
Conductivity, sat. paste	4.72	mmhos/cm	0.10	94	90	110			
<b>Lab ID:</b> CCV1_1_211206_1	Continuing Calibration Verification Standard								12/07/21 12:59
Conductivity, sat. paste	0.971	mmhos/cm	0.10	97	90	110			
<b>Method: ASA10-3</b>							Batch: 59339		
<b>Lab ID:</b> MB-59339	Method Blank								12/07/21 12:59
Conductivity, sat. paste	ND	mmhos/cm	0.05						Run: SOIL EC_211208A
<b>Lab ID:</b> LCS-59339	Laboratory Control Sample								12/07/21 13:00
Conductivity, sat. paste	4.66	mmhos/cm	0.10	111	80	120			Run: SOIL EC_211208A
<b>Lab ID:</b> H21110626-002ADUP	Sample Duplicate								12/07/21 13:01
Conductivity, sat. paste	0.362	mmhos/cm	0.10				4.7	20	Run: SOIL EC_211208A
<b>Method: ASA10-3</b>							al Run: SOIL PH METER - ORION A211_211207B		
<b>Lab ID:</b> ICV_1_211206_1	Initial Calibration Verification Standard								12/07/21 08:33
pH, sat. paste	7.02	s.u.	0.10	100	98.6	101.4			
<b>Lab ID:</b> CCV_1_211206_1	Continuing Calibration Verification Standard								12/07/21 08:36
pH, sat. paste	7.02	s.u.	0.10	100	98.6	101.4			
<b>Lab ID:</b> CCV1_1_211206_1	Continuing Calibration Verification Standard								12/07/21 08:37
pH, sat. paste	4.00	s.u.	0.10	100	97.5	102.5			
<b>Method: ASA10-3</b>							Batch: 59339		
<b>Lab ID:</b> LCS-59339	Laboratory Control Sample								12/07/21 08:38
pH, sat. paste	7.93	s.u.	0.10	99	95	105			Run: SOIL PH METER - ORION A2
<b>Lab ID:</b> H21110626-002ADUP	Sample Duplicate								12/07/21 08:41
pH, sat. paste	8.07	s.u.	0.10				0.0	20	Run: SOIL PH METER - ORION A2

**Qualifiers:**

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)



# QA/QC Summary Report

Prepared by Helena, MT Branch

**Client:** Meridiam Partners LLC

**Work Order:** H21110626

**Report Date:** 12/19/21

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
<b>Method: ASA15-5</b>							Batch: 59300		
<b>Lab ID:</b> H21110626-002ADUP	Sample Duplicate					Run: SOIL HYDROMETER_211206	12/03/21 09:08		
Sand	70.0	%	1.0				2.9	20	
Silt	14.0	%	1.0				13	20	
Clay	16.0	%	1.0				0.0	20	
Texture	SL		1.0						
<b>Lab ID:</b> LCS-59300	Laboratory Control Sample					Run: SOIL HYDROMETER_211206	12/03/21 09:08		
Sand	48.0	%	1.0	114	70	130			
Silt	28.0	%	1.0	88	70	130			
Clay	24.0	%	1.0	92	70	130			

**Qualifiers:**

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)



# QA/QC Summary Report

Prepared by Helena, MT Branch

**Client:** Meridiam Partners LLC

**Work Order:** H21110626

**Report Date:** 12/19/21

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
<b>Method: ASA24-5</b>							Analytical Run: SEAL AA500_211206A		
<b>Lab ID: CCV</b> Phosphorus, Olsen	Continuing Calibration Verification Standard								12/06/21 12:47
	2.5	mg/kg-dry	1.0	99	85	115			
<b>Lab ID: CCB</b> Phosphorus, Olsen	Continuing Calibration Blank								12/06/21 12:49
	0.026	mg/kg-dry	1.0						
<b>Method: ASA24-5</b>							Batch: 59298		
<b>Lab ID: MB-59298</b> Phosphorus, Olsen	Method Blank								12/06/21 12:25
	0.6	mg/kg-dry	0.05						
<b>Lab ID: LCS-59298</b> Phosphorus, Olsen	Laboratory Control Sample								12/06/21 12:26
	53	mg/kg-dry	1.0	122	70	130			
<b>Lab ID: H21110626-002AMS</b> Phosphorus, Olsen	Sample Matrix Spike								12/06/21 12:29
	36	mg/kg-dry	1.0	85	80	120			
<b>Lab ID: H21110628-005Adup</b> Phosphorus, Olsen	Sample Duplicate								12/06/21 12:34
	1.9	mg/kg-dry	1.0				7.8	30	

**Qualifiers:**

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)



# QA/QC Summary Report

Prepared by Helena, MT Branch

**Client:** Meridiam Partners LLC

**Work Order:** H21110626

**Report Date:** 12/19/21

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
<b>Method:</b> ASA29-3									Batch: 59303
<b>Lab ID:</b> LCS-59303	Laboratory Control Sample								Run: MISC SOILS_211208B 12/08/21 08:43
Organic Matter	1.13	%	0.17	116	70	130			
<b>Lab ID:</b> MB-59303	Method Blank								Run: MISC SOILS_211208B 12/08/21 08:43
Organic Matter	ND	%	0.2						
<b>Lab ID:</b> H21110626-002ADUP	Sample Duplicate								Run: MISC SOILS_211208B 12/08/21 08:43
Organic Matter	ND	%	0.17						

**Qualifiers:**

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)



## QA/QC Summary Report

Prepared by Helena, MT Branch

**Client:** Meridiam Partners LLC

**Work Order:** H21110626

**Report Date:** 12/19/21

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
<b>Method: ASA33-8</b>							Analytical Run: FIA203-HE_211206A		
<b>Lab ID: ICV</b>	Initial Calibration Verification Standard								12/06/21 11:58
Nitrate as N, KCL Extract	1.0	mg/kg-dry	1.0	102	90	110			
<b>Lab ID: ICV</b>	Initial Calibration Verification Standard								12/06/21 10:31
Nitrate as N, KCL Extract	0.951	mg/kg-dry	1.0	95	90	110			
<b>Lab ID: CCV</b>	Continuing Calibration Verification Standard								12/06/21 10:53
Nitrate as N, KCL Extract	0.453	mg/kg-dry	1.0	91	90	110			
<b>Method: ASA33-8</b>							Batch: 59304		
<b>Lab ID: MB-59304</b>	Method Blank								12/06/21 10:35
Nitrate as N, KCL Extract	0.4	mg/kg-dry	0.1				Run: FIA203-HE_211206A		
<b>Lab ID: LCS-59304</b>	Laboratory Control Sample								12/06/21 10:36
Nitrate as N, KCL Extract	6.05	mg/kg-dry	1.0	90	70	130	Run: FIA203-HE_211206A		
<b>Lab ID: H21110608-001CMS</b>	Sample Matrix Spike								12/06/21 10:38
Nitrate as N, KCL Extract	5.37	mg/kg-dry	1.0	85	80	120	Run: FIA203-HE_211206A		
<b>Lab ID: H21110626-002ADUP</b>	Sample Duplicate								12/06/21 10:47
Nitrate as N, KCL Extract	0.903	mg/kg-dry	1.0				Run: FIA203-HE_211206A		30

**Qualifiers:**

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)



# QA/QC Summary Report

Prepared by Helena, MT Branch

**Client:** Meridiam Partners LLC

**Work Order:** H21110626

**Report Date:** 12/19/21

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
<b>Method:</b> D2974									Batch: PMOIST_211130_A
<b>Lab ID:</b> H21110626-001A DUP	Sample Duplicate								Run: SOIL DRYING OVEN 2_21113 11/30/21 00:00
Moisture	2.85	wt%	0.20				0.4	20	

**Qualifiers:**

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)



## QA/QC Summary Report

Prepared by Helena, MT Branch

**Client:** Meridiam Partners LLC

**Work Order:** H21110626

**Report Date:** 12/19/21

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
<b>Method:</b> E300.0									Analytical Run: IC METROHM_211206A
<b>Lab ID:</b> ICV	Initial Calibration Verification Standard								
Sulfate	393	mg/L	1.0	98	90	110			12/06/21 13:52
<b>Lab ID:</b> CCV	Continuing Calibration Verification Standard								
Sulfate	204	mg/L	1.0	102	90	110			12/06/21 14:35
<b>Lab ID:</b> CCB	Continuing Calibration Blank								
Sulfate	0.0140	mg/L	1.0						12/06/21 15:04
<b>Method:</b> E300.0									Batch: 59339
<b>Lab ID:</b> MB-59339	Method Blank								
Sulfate, meq	ND	meq/L	0.002						Run: IC METROHM_211206A 12/07/21 15:26
<b>Lab ID:</b> LCS-59339	Laboratory Control Sample								
Sulfate, meq	29.9	meq/L	0.021	97	70	130			Run: IC METROHM_211206A 12/07/21 15:40
<b>Lab ID:</b> H21110626-002ADUP	Sample Duplicate								
Sulfate, meq	0.391	meq/L	0.021				7.7		Run: IC METROHM_211206A 12/07/21 16:23 20
<b>Lab ID:</b> H21120029-002AMS	Sample Matrix Spike								
Sulfate, meq	760	meq/L	0.22	109	90	110			Run: IC METROHM_211206A 12/07/21 19:45

**Qualifiers:**

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)





# QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Meridiam Partners LLC

Work Order: H21110626

Report Date: 12/19/21

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
<b>Method: Sobek Modified</b>							Analytical Run: LECO632_211208A		
<b>Lab ID: 502-671.1.16</b>	Initial Calibration Verification Standard						12/07/21 09:28		
Sulfur, Total	1.2	%	0.010	100	90	110			
<b>Lab ID: AR-1685.164</b>	Initial Calibration Verification Standard						12/07/21 09:35		
Sulfur, Total	0.16	%	0.010	96	90	110			
<b>Lab ID: AR-1683.052</b>	Continuing Calibration Verification Standard						12/07/21 09:38		
Sulfur, Total	0.050	%	0.010	97	90	110			
<b>Lab ID: AR-1700.35</b>	Continuing Calibration Verification Standard						12/07/21 09:42		
Sulfur, Total	0.33	%	0.010	95	90	110			
<b>Method: Sobek Modified</b>							Batch: R170770		
<b>Lab ID: LCS-211207</b>	Laboratory Control Sample				Run: LECO632_211208A		12/07/21 13:57		
Sulfur, Total	0.47	%	0.010	104	80	120			
Sulfur, Hot Water Extractable	0.15	%	0.010	103	70	130			
Sulfur, HCl Extractable	0.040	%	0.010	134	52	148			
Sulfur, HNO3 Extractable	0.18	%	0.010	90	69	131			
Sulfur, Residual	0.099	%	0.010	129	70	130			
<b>Lab ID: H21110626-002ADUP</b>	Sample Duplicate				Run: LECO632_211208A		12/07/21 15:45		
Sulfur, Total	ND	%	0.010						30
Sulfur, Hot Water Extractable	ND	%	0.010						30
Sulfur, HCl Extractable	ND	%	0.010						30
Sulfur, HNO3 Extractable	ND	%	0.010						30
Sulfur, Residual	ND	%	0.010						30
<b>Method: Sobek Modified</b>							Batch: 59310		
<b>Lab ID: MB-59310</b>	Method Blank				Run: MAN-TECH_211206A		12/03/21 12:01		
Neutralization Potential	0.2	t/kt							
<b>Lab ID: LCS-59310</b>	Laboratory Control Sample				Run: MAN-TECH_211206A		12/03/21 12:08		
Neutralization Potential	53	t/kt		112	70	130			
<b>Lab ID: H21110626-002ADUP</b>	Sample Duplicate				Run: MAN-TECH_211206A		12/03/21 14:08		
Neutralization Potential	45	t/kt					1.9		20
<b>Method: Sobek Modified</b>							Batch: 59310		
<b>Lab ID: H21110626-002ADUP</b>	Sample Duplicate				Run: SOIL CALC_211208B		12/07/21 09:33		
Acid Potential	ND	t/kt	0.010						20
Acid/Base Potential	45	t/kt					14		20

**Qualifiers:**

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)



# QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Meridiam Partners LLC

Work Order: H21110626

Report Date: 12/19/21

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
<b>Method: SW6010B</b>							Analytical Run: ICP2-HE_211202B		
<b>Lab ID: ICV</b>	Initial Calibration Verification Standard								12/02/21 08:42
Boron	0.795	mg/L	0.10	99	90	110			
Zinc	0.798	mg/L	0.010	100	90	110			
<b>Lab ID: CCV</b>	Continuing Calibration Verification Standard								12/02/21 08:45
Boron	2.51	mg/L	0.10	100	90	110			
Zinc	2.50	mg/L	0.010	100	90	110			
<b>Lab ID: ICB</b>	Continuing Calibration Blank								12/02/21 08:56
Boron	0.000370	mg/L	0.10						
Zinc	0.000630	mg/L	0.010						
<b>Lab ID: ICSA</b>	Interference Check Sample A								12/02/21 09:04
Boron	0.00277	mg/L	0.10		0	0			
Zinc	0.00571	mg/L	0.010		0	0			
<b>Lab ID: ICSAB</b>	Interference Check Sample AB								12/02/21 09:08
Boron	1.02	mg/L	0.10	102	80	120			
Zinc	1.02	mg/L	0.010	102	80	120			
<b>Method: SW6010B</b>							Batch: 59281		
<b>Lab ID: MB-59281</b>	Method Blank				Run: ICP2-HE_211202B		12/02/21 13:19		
Boron	ND	mg/kg	0.7						
Iron	ND	mg/kg	20						
Manganese	ND	mg/kg	0.4						
Zinc	ND	mg/kg	1						
Iron as Fe2O3	ND	mg/kg	30						
<b>Lab ID: LFB-59281</b>	Laboratory Fortified Blank				Run: ICP2-HE_211202B		12/02/21 13:23		
Boron	49.3	mg/kg	1.0	100	80	120			
Iron	245	mg/kg	22	99	80	120			
Manganese	249	mg/kg	1.0	101	80	120			
Zinc	50.2	mg/kg	1.0	101	80	120			
<b>Lab ID: LCS-59281</b>	Laboratory Control Sample				Run: ICP2-HE_211202B		12/02/21 13:27		
Boron	109	mg/kg	3.8	85	59.5	106.2			
Iron	15400	mg/kg	110	94	51.7	131.9			
Manganese	422	mg/kg	1.9	97	81.1	116.6			
Zinc	236	mg/kg	5.2	102	75.3	111.7			
<b>Lab ID: H21110626-001ADIL</b>	Serial Dilution				Run: ICP2-HE_211202B		12/02/21 13:34		
Boron	ND	mg/kg	19		0	0		10	
Iron	21300	mg/kg	550		0	0	12	10	R
Manganese	435	mg/kg	9.5		0	0	11	10	R
Zinc	48.6	mg/kg	26		0	0		10	N
Iron as Fe2O3	30400	mg/kg	790		0	0			

**Qualifiers:**

RL - Analyte Reporting Limit

N - Analyte concentration was not sufficiently high to calculate a Relative Percent Difference (RPD) for the serial dilution test

ND - Not detected at the Reporting Limit (RL)

R - Relative Percent Difference (RPD) exceeds advisory limit



## QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Meridiam Partners LLC

Work Order: H21110626

Report Date: 12/19/21

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
<b>Method: SW6010B</b>							Batch: 59281		
<b>Lab ID:</b> H21110626-001APDS	Post Digestion/Distillation Spike			Run: ICP2-HE_211202B			12/02/21 13:38		
Boron	239	mg/kg	3.9	90	75	125			
Iron	20500	mg/kg	110		75	125			A
Manganese	1520	mg/kg	1.9	88	75	125			
Zinc	274	mg/kg	5.4	90	75	125			
<b>Lab ID:</b> H21110626-001AMS	Sample Matrix Spike			Run: ICP2-HE_211202B			12/02/21 13:42		
Boron	55.7	mg/kg	3.8	97	75	125			
Iron	20200	mg/kg	110		75	125			A
Manganese	629	mg/kg	1.9	96	75	125			
Zinc	91.3	mg/kg	5.2	99	75	125			
<b>Lab ID:</b> H21110626-001AMSD	Sample Matrix Spike Duplicate			Run: ICP2-HE_211202B			12/02/21 13:45		
Boron	54.8	mg/kg	3.8	95	75	125	1.6	20	
Iron	20300	mg/kg	110		75	125	0.0	20	A
Manganese	613	mg/kg	1.9	90	75	125	2.4	20	
Zinc	90.0	mg/kg	5.2	96	75	125	1.4	20	

**Qualifiers:**

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

A - Analyte level was greater than four times the spike level - in accordance with the method, percent recovery is not calculated



## QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Meridiam Partners LLC

Work Order: H21110626

Report Date: 12/19/21

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
<b>Method: SW6010B</b>							Analytical Run: ICP2-HE_211203A		
<b>Lab ID: ICV</b>	Initial Calibration Verification Standard								12/03/21 09:12
Iron	3.86	mg/L	0.030	97	90	110			
Manganese	3.94	mg/L	0.010	99	90	110			
Potassium	40.1	mg/L	1.0	100	90	110			
<b>Lab ID: CCV</b>	Continuing Calibration Verification Standard								12/03/21 09:16
Iron	2.42	mg/L	0.030	97	90	110			
Manganese	2.46	mg/L	0.010	99	90	110			
Potassium	24.2	mg/L	1.0	97	90	110			
<b>Lab ID: ICB</b>	Continuing Calibration Blank								12/03/21 09:19
Iron	0.00224	mg/L	0.030						
Manganese	0.000460	mg/L	0.010						
Potassium	0.00655	mg/L	1.0						
<b>Lab ID: ICSA</b>	Interference Check Sample A								12/03/21 09:27
Iron	176	mg/L	0.030	88	80	120			
Manganese	-0.0260	mg/L	0.010		0	0			
Potassium	0.00279	mg/L	1.0		0	0			
<b>Lab ID: ICSAB</b>	Interference Check Sample AB								12/03/21 09:31
Iron	177	mg/L	0.030	88	80	120			
Manganese	0.449	mg/L	0.010	90	80	120			
Potassium	19.5	mg/L	1.0	98	80	120			
<b>Method: SW6010B</b>							Batch: 59299		
<b>Lab ID: MB-59299</b>	Method Blank								Run: ICP2-HE_211203A 12/03/21 22:24
Potassium	0.4	mg/kg	0.3						
<b>Lab ID: LFB-59299</b>	Laboratory Fortified Blank								Run: ICP2-HE_211203A 12/03/21 22:28
Potassium	2810	mg/kg	3.2	112	80	120			
<b>Lab ID: LCS-59299</b>	Laboratory Control Sample								Run: ICP2-HE_211203A 12/03/21 22:32
Potassium	661	mg/kg	3.1	101	70	130			
<b>Lab ID: H21110626-001AMS2</b>	Sample Matrix Spike								Run: ICP2-HE_211203A 12/03/21 22:51
Potassium, Available	3250	mg/kg	3.2	118	75	125			
Potassium, Extractable	8.33	meq/100g	0.0082	119	75	125			
<b>Lab ID: H21110626-001AMSD2</b>	Sample Matrix Spike Duplicate								Run: ICP2-HE_211203A 12/03/21 22:55
Potassium, Available	3100	mg/kg	3.2	112	75	125	4.7	20	
Potassium, Extractable	7.94	meq/100g	0.0082	113	75	125	4.7	20	
<b>Lab ID: H21110626-002Adup</b>	Sample Duplicate								Run: ICP2-HE_211203A 12/03/21 23:02
Potassium, Available	148	mg/kg	3.1				8.2	20	
Potassium, Extractable	0.379	meq/100g	0.0080				8.2	20	

**Qualifiers:**

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)



# QA/QC Summary Report

Prepared by Helena, MT Branch

**Client:** Meridiam Partners LLC

**Work Order:** H21110626

**Report Date:** 12/19/21

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
<b>Method: SW6010B</b>							Analytical Run: ICP2-HE_211208B		
<b>Lab ID: ICV</b>	Initial Calibration Verification Standard								12/08/21 12:28
Calcium	40.1	mg/L	1.0	100	90	110			
Sodium	39.7	mg/L	1.0	99	90	110			
<b>Lab ID: CCV</b>	Continuing Calibration Verification Standard								12/08/21 12:32
Calcium	25.0	mg/L	1.0	100	90	110			
Sodium	25.0	mg/L	1.0	100	90	110			
<b>Lab ID: ICB</b>	Continuing Calibration Blank								12/08/21 12:35
Calcium	0.0706	mg/L	1.0						
Sodium	0.00103	mg/L	1.0						
<b>Lab ID: ICSA</b>	Interference Check Sample A								12/08/21 12:43
Calcium	459	mg/L	1.0	92	80	120			
Sodium	0.0400	mg/L	1.0		0	0			
<b>Lab ID: ICSAB</b>	Interference Check Sample AB								12/08/21 12:47
Calcium	463	mg/L	1.0	93	80	120			
Sodium	20.0	mg/L	1.0	100	80	120			
<b>Method: SW6010B</b>							Batch: 59339		
<b>Lab ID: MB-59339</b>	Method Blank								Run: ICP2-HE_211208B 12/08/21 16:16
Calcium	ND	mg/L	0.1						
Sodium	ND	mg/L	0.02						
Calcium, sat. paste	ND	meq/L	0.007						
Sodium, sat. paste	ND	meq/L	0.0009						
<b>Lab ID: LFB-59339</b>	Laboratory Fortified Blank								Run: ICP2-HE_211208B 12/08/21 16:20
Calcium	50.5	mg/L	1.0	101	80	120			
Sodium	49.9	mg/L	1.0	100	80	120			
Calcium, sat. paste	2.52	meq/L	0.050	101	80	120			
Sodium, sat. paste	2.17	meq/L	0.043	100	80	120			
<b>Lab ID: LCS-59339</b>	Laboratory Control Sample								Run: ICP2-HE_211208B 12/08/21 16:24
Calcium	256	mg/L	1.0	118	70	130			
Sodium	737	mg/L	1.0	120	70	130			
Calcium, sat. paste	12.8	meq/L	0.050	118	70	130			
Sodium, sat. paste	32.0	meq/L	0.043	120	70	130			
<b>Lab ID: H21110626-001AMS2</b>	Sample Matrix Spike								Run: ICP2-HE_211208B 12/08/21 16:35
Calcium	420	mg/L	1.0	100	70	130			
Sodium	142	mg/L	1.0	109	70	130			
Calcium, sat. paste	20.9	meq/L	0.050	100	70	130			
Sodium, sat. paste	6.18	meq/L	0.043	109	70	130			
<b>Lab ID: H21110626-001AMSD2</b>	Sample Matrix Spike Duplicate								Run: ICP2-HE_211208B 12/08/21 16:39
Calcium	421	mg/L	1.0	101	70	130	0.4	20	

**Qualifiers:**

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)



# QA/QC Summary Report

Prepared by Helena, MT Branch

**Client:** Meridiam Partners LLC

**Work Order:** H21110626

**Report Date:** 12/19/21

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
<b>Method: SW6010B</b>							Batch: 59339		
<b>Lab ID: H21110626-001AMSD2</b>	Sample Matrix Spike Duplicate			Run: ICP2-HE_211208B			12/08/21 16:39		
Sodium	143	mg/L	1.0	110	70	130	0.3	20	
Calcium, sat. paste	21.0	meq/L	0.050	101	70	130	0.4	20	
Sodium, sat. paste	6.20	meq/L	0.043	110	70	130	0.3	20	
<b>Lab ID: H21110626-002Adup</b>	Sample Duplicate			Run: ICP2-HE_211208B			12/08/21 16:54		
Calcium	53.2	mg/L	1.0				6.5	30	
Sodium	5.38	mg/L	1.0				4.0	30	
Calcium, sat. paste	2.65	meq/L	0.050				6.5	30	
Sodium, sat. paste	0.234	meq/L	0.043				4.0	30	

**Qualifiers:**

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)



# QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Meridiam Partners LLC

Work Order: H21110626

Report Date: 12/19/21

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
<b>Method: SW6020</b>							Analytical Run: ICPMS205-H_211202B		
<b>Lab ID: ICV</b>	Initial Calibration Verification Standard							12/02/21 11:13	
Arsenic	0.0594	mg/L	0.0010	99	90	110			
Cadmium	0.0295	mg/L	0.0010	98	90	110			
Copper	0.0595	mg/L	0.0010	99	90	110			
Lead	0.0570	mg/L	0.0010	95	90	110			
Manganese	0.292	mg/L	0.0010	97	90	110			
Molybdenum	0.0562	mg/L	0.0010	94	90	110			
Nickel	0.0598	mg/L	0.0010	100	90	110			
Selenium	0.0568	mg/L	0.0010	95	90	110			
<b>Lab ID: ICSA</b>	Interference Check Sample A							12/02/21 11:20	
Arsenic	0.0000714	mg/L	0.0010						
Cadmium	0.000141	mg/L	0.0010						
Copper	-0.00124	mg/L	0.0010						
Lead	-0.000281	mg/L	0.0010						
Manganese	0.000175	mg/L	0.0010		0	0			
Molybdenum	0.835	mg/L	0.0010	104	70	130			
Nickel	-0.0000395	mg/L	0.0010		0	0			
Selenium	0.0000620	mg/L	0.0010						
<b>Lab ID: ICSAB</b>	Interference Check Sample AB							12/02/21 11:24	
Arsenic	0.0105	mg/L	0.0010	105	70	130			
Cadmium	0.0105	mg/L	0.0010	105	70	130			
Copper	0.0200	mg/L	0.0010	100	70	130			
Lead	-0.000294	mg/L	0.0010		0	0			
Manganese	0.0221	mg/L	0.0010	110	70	130			
Molybdenum	0.843	mg/L	0.0010	105	70	130			
Nickel	0.0212	mg/L	0.0010	106	70	130			
Selenium	0.0103	mg/L	0.0010	103	70	130			
<b>Lab ID: CCB</b>	Continuing Calibration Verification Standard							12/02/21 11:31	
Arsenic	0.0539	mg/L	0.0010	108	90	110			
Cadmium	0.0530	mg/L	0.0010	106	90	110			
Copper	0.0536	mg/L	0.0010	107	90	110			
Lead	0.0524	mg/L	0.0010	105	90	110			
Manganese	0.0535	mg/L	0.0010	107	90	110			
Molybdenum	0.0527	mg/L	0.0010	105	90	110			
Nickel	0.0537	mg/L	0.0010	107	90	110			
Selenium	0.0523	mg/L	0.0010	105	90	110			
<b>Lab ID: CCB</b>	Continuing Calibration Blank							12/02/21 11:33	
Arsenic	0.0000531	mg/L	0.0010						
Cadmium	0.0000286	mg/L	0.0010						
Copper	-0.000851	mg/L	0.0010						
Lead	-0.000253	mg/L	0.0010						
Manganese	0.000118	mg/L	0.0010						

**Qualifiers:**

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)



# QA/QC Summary Report

Prepared by Helena, MT Branch

**Client:** Meridiam Partners LLC

**Work Order:** H21110626

**Report Date:** 12/19/21

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
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**Method:** SW6020

Analytical Run: ICPMS205-H\_211202B

**Lab ID:** CCB Continuing Calibration Blank 12/02/21 11:33

Molybdenum	0.000364	mg/L	0.0010						
Nickel	0.0000143	mg/L	0.0010						
Selenium	0.0000799	mg/L	0.0010						

**Lab ID:** ICV Initial Calibration Verification Standard 12/02/21 15:14

Arsenic	0.0597	mg/L	0.0010	100	90	110			
Cadmium	0.0299	mg/L	0.0010	100	90	110			
Copper	0.0595	mg/L	0.0010	99	90	110			
Lead	0.0574	mg/L	0.0010	96	90	110			
Manganese	0.295	mg/L	0.0010	98	90	110			
Molybdenum	0.0563	mg/L	0.0010	94	90	110			
Nickel	0.0589	mg/L	0.0010	98	90	110			
Selenium	0.0581	mg/L	0.0010	97	90	110			

**Lab ID:** ICSA Interference Check Sample A 12/02/21 15:21

Arsenic	0.0000468	mg/L	0.0010						
Cadmium	0.000177	mg/L	0.0010						
Copper	-0.000966	mg/L	0.0010						
Lead	-1.55E-06	mg/L	0.0010						
Manganese	0.000204	mg/L	0.0010		0	0			
Molybdenum	0.859	mg/L	0.0010	107	70	130			
Nickel	0.0000812	mg/L	0.0010		0	0			
Selenium	0.000260	mg/L	0.0010						

**Lab ID:** ICSAB Interference Check Sample AB 12/02/21 15:25

Arsenic	0.0104	mg/L	0.0010	104	70	130			
Cadmium	0.0109	mg/L	0.0010	109	70	130			
Copper	0.0197	mg/L	0.0010	99	70	130			
Lead	7.73E-06	mg/L	0.0010		0	0			
Manganese	0.0215	mg/L	0.0010	107	70	130			
Molybdenum	0.852	mg/L	0.0010	107	70	130			
Nickel	0.0203	mg/L	0.0010	102	70	130			
Selenium	0.0105	mg/L	0.0010	105	70	130			

**Method:** SW6020

Batch: 59281

**Lab ID:** MB-59281 Method Blank Run: ICPMS205-H\_211202B 12/02/21 17:40

Arsenic	ND	mg/kg	0.2						
Cadmium	ND	mg/kg	0.04						
Copper	ND	mg/kg	1						
Lead	ND	mg/kg	0.5						
Manganese	ND	mg/kg	1						
Molybdenum	ND	mg/kg	0.2						
Nickel	ND	mg/kg	0.5						
Selenium	ND	mg/kg	0.1						

**Qualifiers:**

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)





# QA/QC Summary Report

Prepared by Helena, MT Branch

Client: Meridiam Partners LLC

Work Order: H21110626

Report Date: 12/19/21

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
<b>Method: SW6020</b>							Batch: 59281		
<b>Lab ID: LCS-59281</b>	Laboratory Control Sample			Run: ICPMS205-H_211202B			12/02/21 17:42		
Arsenic	166	mg/kg	1.0	85	66.4	104			
Cadmium	101	mg/kg	1.0	102	79.2	121			
Copper	131	mg/kg	3.2	96	73.9	113			
Lead	110	mg/kg	1.3	105	71.6	128			
Manganese	433	mg/kg	3.0	100	74.4	123			
Molybdenum	123	mg/kg	1.0	97	61.3	124			
Nickel	83.5	mg/kg	1.2	97	70.6	116			
Selenium	184	mg/kg	1.0	90	72.3	111			
<b>Lab ID: H21110626-001ADIL</b>	Serial Dilution			Run: ICPMS205-H_211202B			12/02/21 17:49		
Arsenic	6.68	mg/kg	2.0		0	0		10	N
Cadmium	ND	mg/kg	1.0		0	0		10	
Copper	23.2	mg/kg	16		0	0		10	N
Lead	15.1	mg/kg	6.4		0	0		10	N
Manganese	439	mg/kg	15		0	0	0.3	10	
Molybdenum	ND	mg/kg	3.0		0	0		10	
Nickel	11.0	mg/kg	6.2		0	0		10	N
Selenium	ND	mg/kg	1.7		0	0		10	
<b>Lab ID: LFB-59281</b>	Laboratory Fortified Blank			Run: ICPMS205-H_211202B			12/02/21 17:53		
Arsenic	50.5	mg/kg	1.0	102	80	120			
Cadmium	25.9	mg/kg	1.0	105	80	120			
Copper	50.5	mg/kg	3.2	102	80	120			
Lead	52.2	mg/kg	1.3	105	80	120			
Manganese	248	mg/kg	3.0	100	80	120			
Molybdenum	49.3	mg/kg	1.0	100	80	120			
Nickel	50.0	mg/kg	1.2	101	80	120			
Selenium	48.4	mg/kg	1.0	98	80	120			
<b>Lab ID: H21110626-001APDS1</b>	Post Digestion/Distillation Spike			Run: ICPMS205-H_211202B			12/02/21 17:55		
Arsenic	18.5	mg/kg	1.0	96	75	125			
Cadmium	12.9	mg/kg	1.0	102	75	125			
Copper	35.4	mg/kg	3.2	97	75	125			
Lead	28.2	mg/kg	1.3	100	75	125			
Manganese	458	mg/kg	3.0		75	125			A
Molybdenum	14.5	mg/kg	1.0	107	75	125			
Nickel	23.6	mg/kg	1.2	99	75	125			
Selenium	12.3	mg/kg	1.0	99	75	125			
<b>Lab ID: H21110626-001AMS</b>	Sample Matrix Spike			Run: ICPMS205-H_211202B			12/02/21 17:57		
Arsenic	55.8	mg/kg	1.0	100	75	125			
Cadmium	25.8	mg/kg	1.0	104	75	125			
Copper	73.0	mg/kg	3.2	100	75	125			
Lead	70.2	mg/kg	1.3	110	75	125			
Manganese	744	mg/kg	3.0	123	75	125			

**Qualifiers:**

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)

A - Analyte level was greater than four times the spike level - in accordance with the method, percent recovery is not calculated  
N - Analyte concentration was not sufficiently high to calculate a Relative Percent Difference (RPD) for the serial dilution test



# QA/QC Summary Report

Prepared by Helena, MT Branch

**Client:** Meridiam Partners LLC

**Work Order:** H21110626

**Report Date:** 12/19/21

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
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**Method:** SW6020

Batch: 59281

Lab ID:	H21110626-001AMS	Sample Matrix Spike			Run:	ICPMS205-H_211202B	12/02/21 17:57		
Molybdenum	49.5	mg/kg	1.0	98	75	125			
Nickel	61.5	mg/kg	1.2	102	75	125			
Selenium	45.7	mg/kg	1.0	92	75	125			

Lab ID:	H21110626-001AMSD	Sample Matrix Spike Duplicate			Run:	ICPMS205-H_211202B	12/02/21 17:59		
Arsenic	56.4	mg/kg	1.0	100	75	125	1.0	20	
Cadmium	25.6	mg/kg	1.0	102	75	125	0.8	20	
Copper	82.0	mg/kg	3.2	118	75	125	12	20	
Lead	69.8	mg/kg	1.3	109	75	125	0.6	20	
Manganese	739	mg/kg	3.0	120	75	125	0.7	20	
Molybdenum	49.2	mg/kg	1.0	97	75	125	0.7	20	
Nickel	61.5	mg/kg	1.2	101	75	125	0.1	20	
Selenium	46.6	mg/kg	1.0	94	75	125	2.0	20	

**Qualifiers:**

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)



# QA/QC Summary Report

Prepared by Helena, MT Branch

**Client:** Meridiam Partners LLC

**Work Order:** H21110626

**Report Date:** 12/19/21

Analyte	Result	Units	RL	%REC	Low Limit	High Limit	RPD	RPDLimit	Qual
<b>Method: USDA23c</b>							Batch: 59311		
<b>Lab ID: MB-59311</b>	Method Blank					Run: MAN-TECH_211206A	12/03/21 14:16		
Neutralization Potential	ND	Tons/1000T		0.05					
Lime as CaCO3	ND	%		0.005					
<b>Lab ID: LCS-59311</b>							Run: MAN-TECH_211206A		
Laboratory Control Sample							12/03/21 14:24		
Neutralization Potential	50.8	Tons/1000T		0.10	95	80 120			
Lime as CaCO3	5.08	%		0.010	95	80 120			
<b>Lab ID: H21110626-001ADUP</b>							Run: MAN-TECH_211206A		
Sample Duplicate							12/03/21 14:43		
Neutralization Potential	46.4	Tons/1000T		0.10			0.9	20	
Lime as CaCO3	4.64	%		0.010			0.9	20	

**Qualifiers:**

RL - Analyte Reporting Limit

ND - Not detected at the Reporting Limit (RL)



# Work Order Receipt Checklist

Meridiam Partners LLC

H21110626

Login completed by: Jessica C. Smith

Date Received: 11/24/2021

Reviewed by: Wanda Johnson

Received by: RMF

Reviewed Date: 12/19/2021

Carrier name: FedEx Ground

Shipping container/cooler in good condition?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>	Not Present <input type="checkbox"/>
Custody seals intact on all shipping container(s)/cooler(s)?	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Not Present <input checked="" type="checkbox"/>
Custody seals intact on all sample bottles?	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Not Present <input checked="" type="checkbox"/>
Chain of custody present?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>	
Chain of custody signed when relinquished and received?	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	
Chain of custody agrees with sample labels?	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	
Samples in proper container/bottle?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>	
Sample containers intact?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>	
Sufficient sample volume for indicated test?	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>	
All samples received within holding time? (Exclude analyses that are considered field parameters such as pH, DO, Res Cl, Sulfite, Ferrous Iron, etc.)	Yes <input checked="" type="checkbox"/>	No <input type="checkbox"/>	
Temp Blank received in all shipping container(s)/cooler(s)?	Yes <input type="checkbox"/>	No <input checked="" type="checkbox"/>	Not Applicable <input type="checkbox"/>
Container/Temp Blank temperature:	9.5°C No Ice		
Containers requiring zero headspace have no headspace or bubble that is <6mm (1/4").	Yes <input type="checkbox"/>	No <input type="checkbox"/>	No VOA vials submitted <input checked="" type="checkbox"/>
Water - pH acceptable upon receipt?	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Not Applicable <input checked="" type="checkbox"/>

## Standard Reporting Procedures:

Lab measurement of analytes considered field parameters that require analysis within 15 minutes of sampling such as pH, Dissolved Oxygen and Residual Chlorine, are qualified as being analyzed outside of recommended holding time.

Solid/soil samples are reported on a wet weight basis (as received) unless specifically indicated. If moisture corrected, data units are typically noted as –dry. For agricultural and mining soil parameters/characteristics, all samples are dried and ground prior to sample analysis.

Radiochemical precision results represent a 2-sigma Total Measurement Uncertainty.

## Contact and Corrective Action Comments:

The Chain of Custody was not signed and there is no date and time on the COC when the client relinquished the COC. No collection date or time on samples -Used date and time from COC. Emailed client for list of metals. jcs 11/24/2021



Trust our People. Trust our Data.

# Chain of Custody & Analytical Request Record

www.energylab.com

Page \_\_\_\_ of \_\_\_\_

Page 28 of 34

### Account Information *(Billing information)*

Company/Name Meridian Partners, LLC		
Contact Dan Duche'		
Phone 720-636-1831		
Mailing Address 1001 W. Arizona Ave		
City, State, Zip Denver CO 80223		
Email dduche@meridiampartners.com		
Receive Invoice <input type="checkbox"/> Hard Copy <input checked="" type="checkbox"/> Email	Receive Report <input type="checkbox"/> Hard Copy <input checked="" type="checkbox"/> Email	
Purchase Order	Quote	Bottle Order

### Report Information *(if different than Account Information)*

Company/Name	
Contact	
Phone	
Mailing Address	
City, State, Zip	
Email	
Receive Report <input type="checkbox"/> Hard Copy <input type="checkbox"/> Email	
Special Report/Formats: <input type="checkbox"/> LEVEL IV <input type="checkbox"/> NELAC <input type="checkbox"/> EDD/EDT <i>(contact laboratory)</i> <input type="checkbox"/> Other _____	

### Comments

Need recommendations for soil amendments (if necessary). Area is mountain/Desert region outside of Santa Fe. Native vegetation is grass, sage, pinon & juniper.

### Project Information

Project Name, PWSID, Permit, etc. Cunningham Hill WRP	
Sampler Name Dan Duche'	Sampler Phone 720-636-1831
Sample Origin State New Mexico	EPA/State Compliance <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
URANIUM MINING CLIENTS MUST indicate sample type	
<input type="checkbox"/> Unprocessed Ore	
<input type="checkbox"/> Processed Ore (Ground or Refined) **CALL BEFORE SENDING	
<input type="checkbox"/> 11(e)2 Byproduct Material (Can ONLY be Submitted to ELI Casper Location)	

Matrix Codes
A - Air
W - Water
S - Soils/ Solids
V - Vegetation
B - Bioassay
O - Oil
DW - Drinking Water

### Analysis Requested

Complete Analysis (Lawn & Garden)	Acid Base Accounting	pH Saturated Paste	Extractable Metals	Analysis Requested						See Attached
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>							
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>							

All turnaround times are standard unless marked as RUSH  
Energy Laboratories MUST be contacted prior to RUSH sample submittal for charges and scheduling - See Instructions Page

Sample Identification <i>(Name, Location, Interval, etc.)</i>	Collection		Number of Containers	Matrix <i>(See Codes Above)</i>	Complete Analysis (Lawn & Garden)	Acid Base Accounting	pH Saturated Paste	Extractable Metals					See Attached	RUSH TAT	ELI LAB ID <i>Laboratory Use Only</i>
	Date	Time													
1 BP-1	09/21/2021	3:00 pm	1	S	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>							H21110626
2 BP-2	09/21/2021	3:00 pm	1	S	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>							
3															
4															
5															
6															
7															
8															
9															

ELI is REQUIRED to provide preservative traceability. If the preservatives supplied with the bottle order were NOT used, please attach your preservative information with this COC

Custody Record MUST be signed	Relinquished by (print)	Date/Time	Signature	Received by (print)	Date/Time	Signature
	Relinquished by (print)	Date/Time	Signature	Received by Laboratory (print)	Date/Time	Signature

LABORATORY USE ONLY									
Shipped By FedEx	Cooler ID(s) Box	Custody Seals Y (N) C B	Intact Y N	Receipt Temp 9.5 °C	Temp Blank Y (N)	On Ice Y (N)	Payment Type CC Cash Check	Amount \$	Receipt Number <i>(cash/check only)</i>

In certain circumstances, samples submitted to Energy Laboratories, Inc. may be subcontracted to other certified laboratories in order to complete the analysis requested. This serves as notice of this possibility. All subcontracted data will be clearly notated on your analytical report.

# SOILS

## RECOMMENDATIONS FOR SAMPLING AND METHODS LISTINGS, continued

MEASUREMENT	Extraction Method	Analysis Method	Minimum As Received Sample Required for Analysis
Organic Carbon & Organic Matter (Walkley-Black)	ASA Mono. #9, Part 2, Method 29-3.5.2	Spectrophotometer	100 g (soil jar)
Organic Nitrogen	Calculation from TKN-NH <sub>3</sub>	Calculation	100 g (soil jar)
pH, Saturated Paste	ASA Mono. #9, Part 2, Method 10-3.2	pH Meter	1500 g (half of gallon resealable bag)
Particle Size Analysis (PSA) includes % sand, silt, clay	ASA Mono. #9, Part 1, Method 15-5	Hydrometer	1500 g (half of gallon resealable bag)
Phosphorus, NaHCO <sub>3</sub> (Olsen)	ASA Mono. #9, Part 2, Method 24-5.4	E365.1	100 g (soil jar)
Phosphorus, (Bray)	ASA Mono. #9, Part 2, Method 24-5.1	E365.1	100 g (soil jar)
Potassium (NH <sub>4</sub> Oac)	ASA Mono. #9, Part 2, Method 13-3.5	E6010/E6020	100 g (soil jar)
Saturated Paste Extracts	ASA Mono #9, Part 2, Method 10-2.3.1	E6010/E6020	1500 g (half of gallon resealable bag)
Saturation Percentage	USDA Handbook 60, Method 27A	N/A	1500 g (half of gallon resealable bag)
Sieve Analysis	ASA Mono. #9, Part 1, Method 15-2.2	Specified Sieve Sizes	1500 g (half of gallon resealable bag)
Sodium Adsorption Ratio (SAR-Ca, Mg, Na)	ASA Mono. #9, Part 2, Method 10-3.4	E6010/E6020	1500 g (half of gallon resealable bag)
Sodium, extractable (NH <sub>4</sub> OAc)	ASA Mono #9, Part 2, Method 13-4.3	E6010/E6020	100 g (soil jar)
Sodium, available	ASA Mono. #9, Part 2, Method 13-4.5	E6010/E6020	100 g (soil jar)
Sodium, soluble (saturated paste)	ASA Mono. #9, Part 2, Method 10-3.4	E6010/E6020	100 g (soil jar)
Sulfate, water soluble	ASA Mono. #9, Part 2, Method 28-5.1	E300.0	100 g (soil jar)
Sulfate, HCl soluble (geochemical)	Montana State Department of Highways	Gravimetric	100 g (soil jar)
Sulfur Forms (Modified Sobek)	Field & Lab. Methods Applicable to Overburdens & Mine Spoil, Sobek, 1978 pp60-62	LECO SC-444 (203-601-222)	100 g (soil jar)
Total Nitrogen	Calculation from TKN & NO <sub>3</sub>	Calculation	100 g (soil jar)
Total Kjeldahl Nitrogen (TKN)	ASA Mono. #9, Part 2, Method 31-3.1	A 4500 N org	100 g (soil jar)
Total Sulfur	N/A	LECO SC-444 (203-601-222)	100 g (soil jar)
Very Fine Sands (VFS)	ASA Mono. #9, Part 1, Method 15-5	140 mesh sieve	1500 g (half of gallon resealable bag)
ABDTPA Extracts	ASA Mono. #9, Part 2, Method 3-5.2	E6010/E6020	100 g (soil jar)
DTPA Extracts	ASA Mono. #9, Part 2, Method 19-3.3	E6010/E6020	100 g (soil jar)
Saturated Paste Extracts (H <sub>2</sub> O)	ASA Mono. #9, Part 2, Method 10-2.3.1	E6010/E6020	1500 g (half of gallon resealable bag)
HCl Extracts	ASA Mono. #9, Part 2, Method 19-3.4	E6010/E6020	100 g (soil jar)

# SOILS

## 4. SOIL AND OVERBURDEN – METALS, continued

PARAMETER	DETECTION LIMIT, TOTALS	DETECTION LIMIT, EXTRACTABLES	UNITS
Manganese	1	0.1	mg/Kg
Mercury	1	0.1	mg/Kg
Molybdenum	1	0.1	mg/Kg
Nickel	1	0.1	mg/Kg
Selenium	1	0.01	mg/Kg
Silver	1	0.5	mg/Kg
Zinc	1	0.1	mg/Kg

## 5. SOIL AND OVERBURDEN – CYANIDES

PARAMETER	DETECTION LIMIT	UNIT
Cyanide, Total	0.5	mg/Kg
Cyanide, Weak Acid Dissociable	0.5	mg/Kg
Cyanide, Free	2.0	mg/Kg

## 6. SOIL AND OVERBURDEN – GEOTECHNICAL SOILS ANALYSES

PARAMETER	DETECTION LIMIT	UNIT
pH	0.1	s.u.
Marble pH	0.1	s.u.
Sulfate	0.01	%
Conductivity, Saturated Paste Extract	0.01	mmhos/cm
Resistivity, Calculated		ohm-cm
Minimum Resistivity	100	Ohm X cm

## 7. SOIL AND OVERBURDEN – ICP SCAN

Aluminum	Calcium	Lead	Phosphorus	Strontium
Barium	Chromium	Magnesium	Potassium	Thallium
Beryllium	Cobalt	Manganese	Silicon	Titanium
Boron	Copper	Molybdenum	Silver	Vanadium
Cadmium	Iron	Nickel	Sodium	Zinc

**NOTES:** These elements analyzed in solids by ICP to 50 mg/Kg reporting limit. (Other elements are available on request)

**ORGANIC CONTAMINANTS** - see *Organic Chemistry* section

**PETROLEUM CONTAMINATED SOILS** – see *Organic Chemistry* section

**RADIOCHEMISTRY** – see *Radiochemistry* section

## SOILS

### RECOMMENDATIONS FOR SAMPLING AND METHODS LISTINGS

MEASUREMENT	Extraction Method	Analysis Method	Minimum As Received Sample Required for Analysis
Acid Base Potential (ABP)	Calculated from Acid & Neutralization Potential	Calculation	100 g (soil jar)
Acid Potential	Calculated from Non-Sulfate Sulfur	Calculation	100 g (soil jar)
Alkalinity, saturated paste	ASA Mono. #9, Part 2, Method 10-3.2	A 2320B	1500 g (half of gallon resealable bag)
Ammonia as N, KCl Extract	ASA Mono. #9, Part 2, Method 37-7	E350.1	100 g (soil jar)
Base Saturation	Calculation from NH <sub>4</sub> Oac Ca, Mg, Na, K, and CEC	Calculation	1500 g (half of gallon resealable bag)
Carbon, Total	NA	LECO SC-444 (203-601-222)	100 g (soil jar)
Cation Exchange Capacity (CEC)	USDA Handbook 60, Method 19	E6010/E6020	100 g (soil jar)
Chloride (H <sub>2</sub> O Extract)	ASA Mono. #9, Part 2, Method 10-2.3.2	E300.0 (Ion Chromatography)	100 g (soil jar)
Coarse Fragments	ASA Mono #9, Part 1, Method 15-5	2 mm sieve	1500 g (half of gallon resealable bag)
Conductivity (EC), saturated paste	ASA Mono. #9, Part 2, Method 10-3.3	Conductivity Meter	1500 g (half of gallon resealable bag)
Cyanide, Total	E335.2 (Sed.) Mod.	E335.4 (midi)	100 g (soil jar)
Cyanide, Weak Acid Dissociable	ASTM D2036 Mod.	NA	100 g (soil jar)
Cyanide, Free	ASA Mono. #9, Part 2, Method 10-2.3.1	Electrode Manufacturer's Instructions	100 g (soil jar)
Exchangeable Acidity	ASA Mono. #9, Part 2, Method 9-4.1	Titration	1500 g (half of gallon resealable bag)
Exchangeable Sodium Percentage (ESP)	Calculated from CEC, soluble sodium, & extractable sodium	E6010/E6020	1500 g (half of gallon resealable bag)
Lime as CaCO <sub>3</sub>	USDA Handbook 60, Method 23C	Titration	100 g (soil jar)
Lime Requirement, SMP Single Buffer	ASA Mono. #9, Part 2, Method 12-3.4.4	pH meter	100 g (soil jar)
Moisture (dry basis)	USDA Handbook 60, Method 26	NA	1500 g (half of gallon resealable bag)
<del>Net Acid Generating Potential (NAG)</del>	Field & Lab. Methods Applicable to Overburdens & Mine Spoil, Sobek, 1978 pp69-72	Titration	100 g (soil jar)
<del>Neutralization Potential</del>	USDA Handbook 60, Method 23C	NA	100 g (soil jar)
Nitrate as N (NO <sub>3</sub> + NO <sub>2</sub> )	ASA Mono #9, Part 2, Method 33-8.1	E353.2	100 g (soil jar)
Minimum Resistivity	-	California 643	1500 g (half of gallon resealable bag)



## SOILS

### 3. SOIL AND OVERBURDEN - NON-METALS

PARAMETER	DETECTION LIMIT	UNIT
Sample Preparation	-	-
Sample Crushing	-	-
Other extractions (Acetic Acid, HCl, DTPA, Water, etc.)	-	-
Acid-Base Potential	-	T CaCO <sub>3</sub> /1000 T
Acid Potential	0.01	T CaCO <sub>3</sub> /1000 T
Ammonia as N	1	mg/Kg
Available Lime Index	0.1	weight %
Base Saturation	0.1	%
Bicarbonate, Saturated Paste	0.01	meq/L
Bromide	0.5	mg/Kg
Bulk Density	0.01	g/cc
Calcium, Saturated Paste	0.1	meq/L
Calcium Oxide by Rapid Sugar Method	0.1	weight %
Carbon, Total	0.05	%
Cation Exchange Capacity	0.1	meq/100 g
Chloride	1	mg/Kg
Coarse Fragments + 10 mesh, 2 mm	2	%
Conductivity, paste extract	0.1	mmhos/cm
Exchange Sodium Percentage – includes CEC, soluble sodium, available sodium, saturation %	0.1	%
Exchangeable Acidity	1	meq/100 g
Fertilizer Recommendation	NA	NA
Lime	0.1	%
Lime Requirement, SMP Buffer Method	1	T CaCO <sub>3</sub> /1000 T
Loss on Ignition	0.1	%
Magnesium, Saturated Paste	0.1	meq/L
Moisture	0.1	%
Neutralization Potential	-	T CaCO <sub>3</sub> /1000 T
Net Acid Generating Potential with Peroxide (includes pH and EC after reaction)	1	T CaCO <sub>3</sub> /1000 T
Nitrate as N (NO <sub>3</sub> )	1	mg/Kg
Nitrogen, Total Kjeldahl (TKN)	1	mg/Kg
Nitrogen, Total (TKN+ NO <sub>3</sub> )	1	mg/Kg
Nitrogen, Organic (TKN – NH <sub>4</sub> )	1	mg/Kg
Organic Carbon	0.1	%
Organic Matter	0.1	%
pH, saturated paste	0.1	Std. units
Phosphorus Absorption Capacity	1	mg/Kg
Phosphorus, NaHCO <sub>3</sub> (Olsen)	1	mg/Kg
Phosphorus (Bray)	1	mg/Kg
Potassium	1	mg/Kg
Potassium, Saturated Paste	0.1	meq/L

# SOILS

## 3. SOIL AND OVERBURDEN - NON-METALS, continued

PARAMETER	DETECTION LIMIT	UNIT
SAR (includes Ca, Mg, Na)	0.01	unitless
Saturation Percentage	0.1	%
Sieve Analysis	0.1	%
Sodium, extractable	0.1	meq/100 g
Sodium, available	0.1	meq/100 g
Sodium, sat. paste	0.1	meq/L
Sulfate	1	mg/Kg
Sulfur Forms	0.01	%
Sulfur, Total	0.01	%
Texture (PSA) sand; silt, clay	1	%
Very Fine Sand	0.01	%
Water Holding Capacity	0.1	NA

## 4. SOIL AND OVERBURDEN - METALS

PARAMETER	DETECTION LIMIT, TOTALS	DETECTION LIMIT, EXTRACTABLES	UNITS
Total Metals Digestion (Method SW 3050)	-	-	NA
Total Metals Digestion, Mercury (Method SW 7471)	-	-	NA
Aluminum	5	0.1	mg/Kg
Arsenic	1	0.02	mg/Kg
Barium	1	0.1	mg/Kg
Beryllium	1	0.1	mg/Kg
Boron	1	0.1	mg/Kg
Cadmium	1	0.1	mg/Kg
Calcium	5	1	mg/Kg
Chromium	1	0.1	mg/Kg
Copper	1	0.1	mg/Kg
Iron	5	1	mg/Kg
Lead	1	0.1	mg/Kg
Magnesium	5	1	mg/Kg

# SOILS

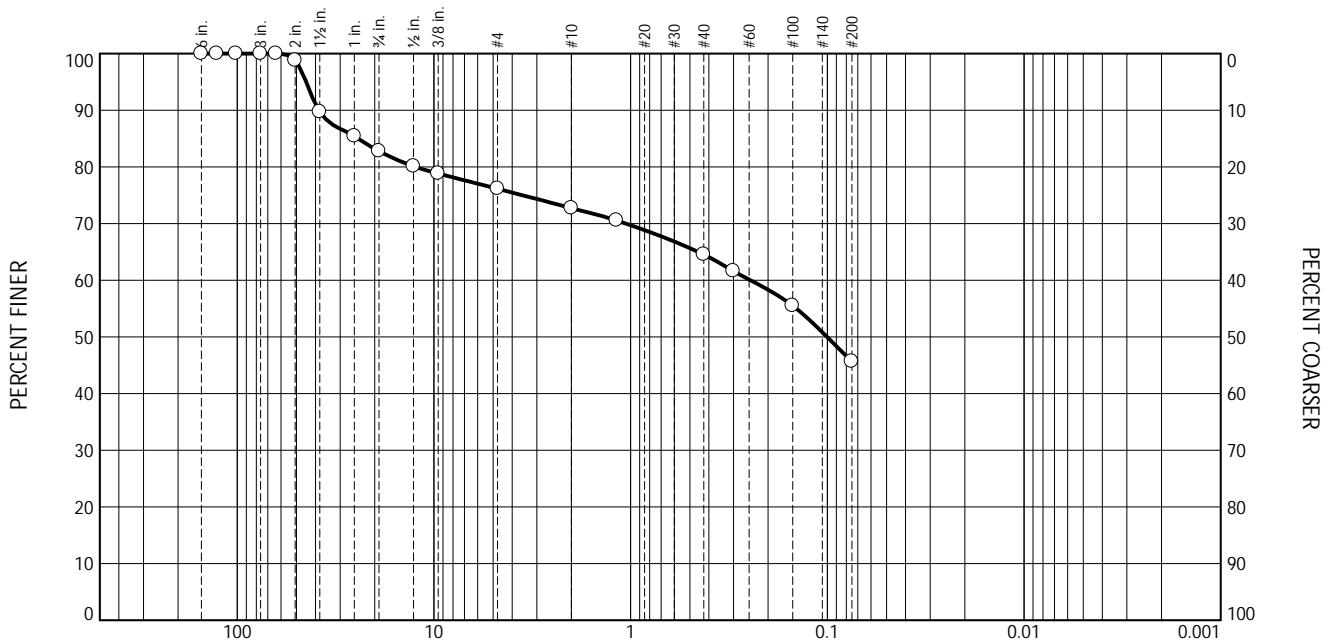
## 1. AGRICULTURAL SOILS

ANALYSIS PACKAGE	
<b>COMPLETE ANALYSIS (2 depths)</b>	
<del>Upper Depth (0-6")</del>	<del>pH, nitrate, sodium, sulfate, salt hazard (conductivity), texture, lime, potassium, organic matter, available phosphorus</del>
Lower Depth (6-24")	Nitrate, sulfate, and texture
<b>COMPLETE ANALYSIS - Lawns and Gardens (1 depth)</b>	
Upper Depth only (0-6")	pH, nitrate, sodium, sulfate, salt hazard (conductivity), texture, lime, potassium, organic matter, available phosphorus, calcium
<b>PARTIAL ANALYSIS (2 depths)</b>	
Upper Depth (0-6")	Nitrate, phosphorus, potassium, zinc(irrigated soils), sulfate (non-irrigated soils)
Lower Depth (6-24")	Nitrate
<b>GYPSUM APPLICATION PACKAGE (2 depths)</b>	pH, sodium, conductivity
<b>INDIVIDUAL SOIL PARAMETERS -- see page Soil -- 4-5</b>	

## 2. SOIL AND OVERBURDEN - ACID-BASE ACCOUNTING

ACID-BASE ACCOUNTING	DETECTION LIMIT	UNIT
<del>MODIFIED SOBEK METHOD, includes the following</del>	-	-
Neutralization Potential	1	T CaCO <sub>3</sub> /1000 T
Acid Potential (hot water wash)	1	T CaCO <sub>3</sub> /1000 T
Acid-Base Potential	1	T CaCO <sub>3</sub> /1000 T
Total Sulfur	0.01	%
Hot Water Soluble Sulfur	0.01	%
Cold HCl Soluble Sulfur	0.01	%
Hot HNO <sub>3</sub> Soluble Sulfur	0.01	%
Residual Sulfur	0.01	%
<b>SCHAFFER METHOD, includes the following:</b>	-	-
Neutralization Potential	1	T CaCO <sub>3</sub> /1000 T
Acid Potential (hot HCl wash)	1	T CaCO <sub>3</sub> /1000 T
Acid-Base Potential	1	T CaCO <sub>3</sub> /1000 T
Total Sulfur	0.01	%
Hot HCl Soluble Sulfur	0.01	%
Hot HNO <sub>3</sub> Soluble Sulfur	0.01	%
Residual Sulfur	0.01	%

# Particle Size Distribution Report



GRAIN SIZE - mm.

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	17.2	6.7	3.4	8.1	18.9	45.7	

Test Results (AASHTO T 27 & T 11)			
Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)
6	100.0		
5	100.0		
4	100.0		
3	100.0		
2.5	100.0		
2	98.8		
1.5	89.7		
1	85.4		
.75	82.8		
.5	80.1		
.375	78.8		
#4	76.1		
#10	72.7		
#16	70.5		
#40	64.6		
#50	61.6		
#100	55.5		
#200	45.7		

· (no specification provided)

### Material Description

BP-1

### Atterberg (ASTM D4318)

PL= 21 LL= 31 PI= 10

### Coefficients

D<sub>90</sub>= 38.6048 D<sub>85</sub>= 24.2940

D<sub>60</sub>= 0.2463 D<sub>50</sub>= 0.1004

D<sub>30</sub>=                      D<sub>15</sub>=

D<sub>10</sub>=

C<sub>u</sub>=                      C<sub>c</sub>=

### Sieve Test (AASHTO T 27 & T 11)

Test Date: 3/16/2022      Technician: Juan Romero

Test Notes

### Hydrometer Test

Test Date: \_\_\_\_\_ Technician: \_\_\_\_\_

Test Notes

### USCS (ASTM D2487)

SC

Date Sampled: 3/14/2022

Date Received: 3/14/2022

Checked By: Clay Hollowell

Title: PE

Location: BP-1  
Sample Number: S3409

Vine Laboratories

Denver, Colorado

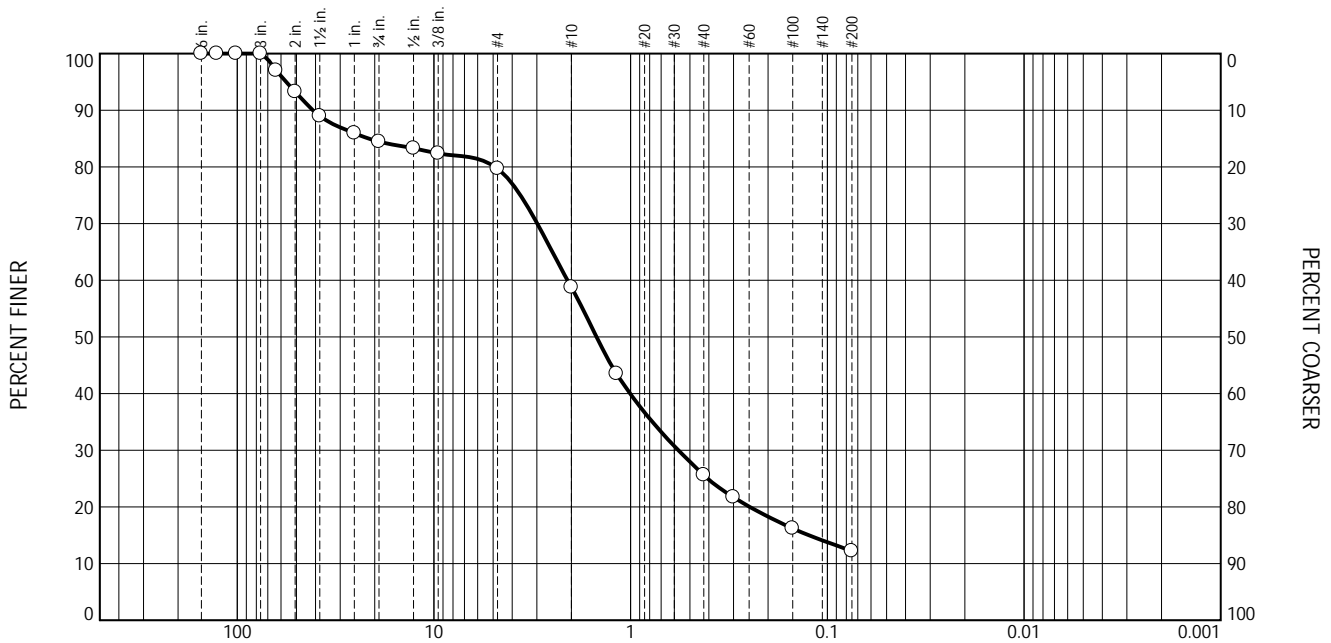
Client: Meridiam Partners

Project:

Project No: 22-5002

Figure

# Particle Size Distribution Report



GRAIN SIZE - mm.

% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	15.5	4.8	21.0	33.1	13.4	12.2	

Test Results (AASHTO T 27 & T 11)			
Sieve Size or Diam. (mm.)	Finer (%)	Spec.* (%)	Out of Spec. (%)
6	100.0		
5	100.0		
4	100.0		
3	100.0		
2.5	97.0		
2	93.3		
1.5	89.0		
1	85.9		
.75	84.5		
.5	83.3		
.375	82.4		
#4	79.7		
#10	58.7		
#16	43.5		
#40	25.6		
#50	21.7		
#100	16.2		
#200	12.2		

· (no specification provided)

### Material Description

BP-2

### Atterberg (ASTM D4318)

PL= 21 LL= 34 PI= 13

### Coefficients

D<sub>90</sub>= 41.2657 D<sub>85</sub>= 21.4571

D<sub>60</sub>= 2.0954 D<sub>50</sub>= 1.4917

D<sub>30</sub>= 0.5723 D<sub>15</sub>= 0.1243

D<sub>10</sub>=

C<sub>u</sub>=

C<sub>c</sub>=

### Sieve Test (AASHTO T 27 & T 11)

Test Date: 3/16/2022 Technician: Juan Romero

Test Notes

### Hydrometer Test

Test Date: \_\_\_\_\_ Technician: \_\_\_\_\_

Test Notes

### USCS (ASTM D2487)

SC

Date Sampled: 3/14/2022

Date Received: 3/14/2022

Checked By: Clay Hollowell

Title: PE

Location: BP-2  
Sample Number: S3410

Vine Laboratories

Denver, Colorado

Client: Meridiam Partners

Project:

Project No: 22-5002

Figure

Attachment 5

Seed Mix

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### Appendix 3 – Seed Mix

<b>Cunningham Hill Mine Reclamation Project Seed Mix 1</b>		
<b>Species</b>	<b>Drill seed rate pure live seed (lbs./acre)</b>	<b>Species Characteristics</b>
blue grama; <i>Bouteloua gracilis</i>	2.0	warm season
indian ricegrass; <i>Oryzopsis hymenoides</i>	1.0	warm season
sideoats grama; <i>Bouteloua curtipendula</i>	1.0	warm season
galleta; <i>Hilaria jamesii</i>	1.0	warm season
sand dropseed; <i>Sporobolus cryptandrus</i>	0.25	warm season
Great Basin wildrye; <i>Elymus cinereus</i>	2.0	cool season
purple prairie clover; <i>Petalostemum purpureum</i>	0.2	Forb
palmer penstemon; <i>Penstemon palmeri</i>	0.1	Forb
lewis flax; <i>Linum lewisii</i>	0.5	Forb
scarlet globemallow; <i>Sphaeralcea coccinea</i>	0.1	Forb
<b>TOTAL</b>	<b>8.15</b>	

<b>Cunningham Hill Mine Reclamation Project Seed Mix 2 for wetter and cooler site conditions</b>		
<b>Species</b>	<b>Drill seed rate pure live seed (lbs/acre)</b>	<b>Species Characteristics</b>
indian ricegrass; <i>Oryzopsis hymenoides</i>	2.0	cool season
lewis flax; <i>Linum lewisii</i>	0.5	Forb
purple prairie clover; <i>Pentalostemum purpureum</i>	0.5	Forb
Rocky Mountain penstemon ; <i>Penstemon strictus</i>	0.5	Forb
prairie coneflower; <i>Ratibida columnifera</i>	0.25	Forb
<b>TOTAL</b>	<b>6.25</b>	