Attachment 4

Geotechnical Laboratory Data

SUMMARY RESULTS - CCR
DOMINION BREMO POWER STATION CCR POND CLOSURE
SUMMARY OF SOIL DATA

Sample Identification	Sample Type	Sample Depth	Soil Classi-fication	Natural Moisture %	75.1 Atterberg Limits				Grain Size Distribution			Compaction		pH Soil	Gs	Unit Weight		Permeability (cm/sec)	Soil Resistivity		Additional Tests Conducted (See Notes)
					L.L.	P.L.	P.I.	L.I.	% Finer No. 4 Sieve	% Finer No. 200 Sieve	% Finer .005 mm	Maximum Dry Density (lb/cuft)	Optimum Moisture %			Moisture %	Dry (pcf)		Moisture (%)	Minimum (ohms-cm)	
EB-01 UD-01	UD	2.5-4.5'		57.0	-	-	-	-	-	-	-	-	-	-	-	57.0	39.2	-	-	-	-
EB-01 S-2	Jar	8.5-10.5'		49.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EB-01 S-3	Jar	13.5-15.5'		62.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EB-01 S-4	Jar	18.5-20.5'		73.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EB-01A UD-02	UD	23.9-26.1'	-	94.6	-	-	-	-	-	-	-	-	-	-	-	94.6	31.8	-	-	-	-
EB-01 S-6	Jar	28.5-30.5'		87.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EB-01 S-7	Jar	33.5-35.5'		21.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EB-01A S-8	Jar	38.3-40.3'		30.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EB-01A S-9	Jar/Bag	43.3-45.3'	(ML)	107.7	-	-	-	-	100.0	77.8	6.5	-	-	-	2.07	-	-	-	-	-	-
EB-02 Bulk-01	Bulk	0.0-10.0'	-	46.3	-	-	-	-	-	-	-	64.9	43.6	-	-	-	-	-	-	-	-
EB-02 S-3	Jar/Bag	8.5-10.5'	(ML)	21.2	-	-	-	-	100.0	97.4	4.7	-	-	-	2.14	-	-	-	-	-	-
EB-02 S-5	Jar	18.5-20.5'		21.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EB-02 S-6	Jar	23.5-25.5'		20.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EB-02 S-7	Jar	28.5-30.5'		67.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EB-02 UD-01	UD	33.0-35.0'	(ML)	124.9	-	-	-	-	100.0	77.1	7.5	-	-	-	2.10	124.9	35.9	-	-	-	C
EB-02 UD-01	UD	33.0-35.0'	-	116.1	-	-	-	-	-	-	-	-	-	-	-	116.1	22.4	-	-	-	DS
EB-02 S-8	Jar	35.0-37.0'		86.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EB-02 S-9	Jar/Bag	38.5-40.5'	(ML)	152.4	-	-	-	-	100.0	78.5	7.0	-	-	-	-	-	-	-	-	-	-
EB-02 UD-02	UD	43.0-45.0'	(ML)	127.3	-	-	-	-	100.0	91.3	11.0	-	-	-	2.10	127.3	34.2	-	-	-	C
EB-02 UD-02	UD	43.0-45.0'	(ML)	136.5	-	-	-	-	-	-	-	-	-	-	2.10	136.5	32.9	-	-	-	C - 24-hr
EB-03 S-3	Jar	8.7-10.7'		42.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EB-03 S-4	Jar	13.7-15.7'		53.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EB-03 UD-01	UD	18.6-20.6	-	78.5	-	-	-	-	-	-	-	-	-	-	-	78.5	48.7	-	-	-	-
EB-03 S-5	Jar	20.6-22.6'		85.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

ABBREVIATIONS: LIQUID LIMIT (LL)
PLASTIC LIMIT (PL)
PLASTICITY INDEX (PI)
LIQUIDITY INDEX (LI)
SPECIFIC GRAVITY (Gs)
MOISTURE (Mc)

NOTES: T = TRIAXIAL TEST
U = UNCONFINED COMPRESSION TEST
C = CONSOLIDATION TEST
DS = DIRECT SHEAR TEST
O = ORGANIC CONTENT
P = pH

SUMMARY RESULTS - CCR (CONTINUED)
DOMINION BREMO POWER STATION CCR POND CLOSURE
SUMMARY OF SOIL DATA

Sample Identification	Sample Type	Sample Depth	Soil Classi-fication	Natural Moisture %	Atterberg Limits				Grain Size Distribution			Compaction		pH Soil	Gs	Unit Weight		Permeability (cm/sec)	Soil Resistivity		Additional Tests Conducted (See Notes)
					L.L.	P.L.	P.I.	L.I.	% Finer No. 4 Sieve	% Finer No. 200 Sieve	% Finer .005 mm	Maximum Dry Density (lb/cuft)	Optimum Moisture %			Moisture %	Dry (pcf)		Moisture (%)	Minimum (ohms-cm)	
EB-03 S-6	Jar	23.7-25.7'		109.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EB-03 S-7	Jar	28.7-30.7'		80.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EB-03 S-8	Jar/Bag	33.7-35.7'	(ML)	69.6	-	-	-	-	100.0	90.3	7.5	-	-	-	-	-	-	-	-	-	-
EB-03 S-9	Jar	38.7-40.7'		125.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EB-03 S-10	Jar	43.7-45.7'		110.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EB-03 S-11	Jar	48.7-50.7		162.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EB-05 S-3	Jar/Bag	8.5-10.5'	(ML)	38.6	-	-	-	-	100.0	71.8	18.0	-	-	-	-	-	-	-	-	-	-
EB-05 S-6	Jar/Bag	23.5-25.5'	(ML)	148.7	-	-	-	-	100.0	53.0	7.5	-	-	-	-	-	-	-	-	-	-
EB-05 S-9	Jar/Bag	38.5-40.5'	(ML)	109.1	-	-	-	-	100.0	62.9	6.5	-	-	-	-	-	-	-	-	-	-
EB-05 10A	Jar	43.5-45.5'		92.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EB-5 S-11	Jar/Bag	48.5-50.5'	(ML)	103.8	-	-	-	-	100.0	50.5	3.9	-	-	8.7	-	-	-	-	-	-	-
EB-5 S-12	Jar	53.5-55.5	-	22.9	NP	NP	NP	NP	-	-	-	-	-	-	-	-	-	-	-	-	-
EB-5 S-12	Bag	53.5-55.5	-	69.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	54.0	2,400	-
NB-02 Bulk-01	Bulk/Bag	0.0-7.5'	-	71.1	-	-	-	-	-	-	-	65.9	44.6								
NB-02 S-3	Jar	8.5-10.5'		72.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NB-02 S-4	Jar	13.5-15.5'	ML	66.4	NP	NP	NP	NP	100.0	75.8	6.5	-	-	-	-	-	-	-	-	-	-
NB-02 S-5	Jar	18.8-20.5		76.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NB-02 S-5&7	Jar/Bag	18.5-35.5'	-	70.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	55.1	3,200	-
NB-02 UD-01	UD	25.5-27.5'	(MH)	53.2	-	-	-	-	100.0	93.4	16.0	-	-	-	2.21	53.2	62.4	-	-	-	C
NB-02 UD-01	-	-	-	39.9	-	-	-	-	-	-	-	-	-	-	-	39.9	65.3	2.1E-04	-	-	-
NB-02 S-6	Jar	27.0-29.0'	-	59.0	-	-	-	-	-	-	-	-	-	-	2.16	-	-	-	-	-	-
NB-02 S-7	Jar	33.5-35.5'		69.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NB-02 S-8	Jar	38.5-40.5'	-	70.3	NP	NP	NP	NP	-	-	-	-	-	-	-	-	-	-	-	-	-
NB-02 S-9	Jar/Bag	43.5-45.5'	ML	83.6	NP	NP	NP	NP	100.0	87.1	20.5	-	-	8.6	-	-	-	-	-	-	-

ABBREVIATIONS: LIQUID LIMIT (LL)
PLASTIC LIMIT (PL)
PLASTICITY INDEX (PI)
LIQUIDITY INDEX (LI)
SPECIFIC GRAVITY (Gs)
MOISTURE (Mc)

NOTES: T = TRIAXIAL TEST
U = UNCONFINED COMPRESSION TEST
C = CONSOLIDATION TEST
DS = DIRECT SHEAR TEST
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P = pH

SUMMARY RESULTS - CCR (CONTINUED)
DOMINION BREMO POWER STATION CCR POND CLOSURE
SUMMARY OF SOIL DATA

Sample Identification	Sample Type	Sample Depth	Soil Classi-fication	Natural Moisture %	Atterberg Limits				Grain Size Distribution			Compaction		pH Soil	Gs	Unit Weight		Permeability (cm/sec)	Soil Resistivity		Additional Tests Conducted (See Notes)
					L.L.	P.L.	P.I.	L.I.	% Finer No. 4 Sieve	% Finer No. 200 Sieve	% Finer .005 mm	Maximum Dry Density (lb/cuft)	Optimum Moisture %			Moisture %	Dry (pcf)		Moisture (%)	Minimum (ohms-cm)	
NB-02 S-10	Jar	48.5-50.5'		91.0																	
NB-02 UD-02	UD	53.5-55.5'	(SM)	158.2	-	-	-	-	100.0	48.5	5.0	-	-	-	2.08	158.2	29.4	-	-	-	C
NB-02 UD-02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	79.4	53.0	-	-	-	T-CU w/pp
NB-02 S-11	Jar	55.5-57.5'	-	89.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NB-02 S-12	Jar	63.5-65.5'	-	98.0	-	-	-	-	-	-	-	-	-	-	2.06	-	-	-	-	-	-
NB-02 UD-03	UD	68.5-70.5'	(MH)	101.5	-	-	-	-	-	-	-	-	-	-	2.13	101.5	41.7	-	-	-	C
NB-02 UD-03	-	-	-	103.1	NP	NP	NP	NP	-	-	-	-	-	-	-	103.1	43.4	2.5E-04	-	-	-
NB-02 S-13	Jar	70.5-72.5'	-	86.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NB-02 S-14A	Jar	78.5-80.5'	-	141.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NP-01 GB-01	Jar	1.5-3.9'	-	86.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NP-07 GB-01	Jar	0.0-4.7'	-	72.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WP-01 Bulk-01	Bulk/Bag	0.5-2.0'	-	110.8	-	-	-	-	-	-	-	53.2	50.0	-	-	-	-	-	-	-	(1)
WP-02 Bulk-01	Bulk	0.5-1.5'	-	42.1	-	-	-	-	-	-	-	82.4	28.6	-	-	-	-	-	-	-	-
WP-02 Bulk-02	Bulk	1.5-2.0'	-	50.4	-	-	-	-	100.0	65.9	4.0	-	-	8.5	-	-	-	-	51.0	5,100	-

ABBREVIATIONS: LIQUID LIMIT (LL)
PLASTIC LIMIT (PL)
PLASTICITY INDEX (PI)
LIQUIDITY INDEX (LI)
SPECIFIC GRAVITY (Gs)
MOISTURE (Mc)

NOTES: T = TRIAXIAL TEST
U = UNCONFINED COMPRESSION TEST
C = CONSOLIDATION TEST
DS = DIRECT SHEAR TEST
O = ORGANIC CONTENT
P = pH
(1) = Conducted a check plug on material

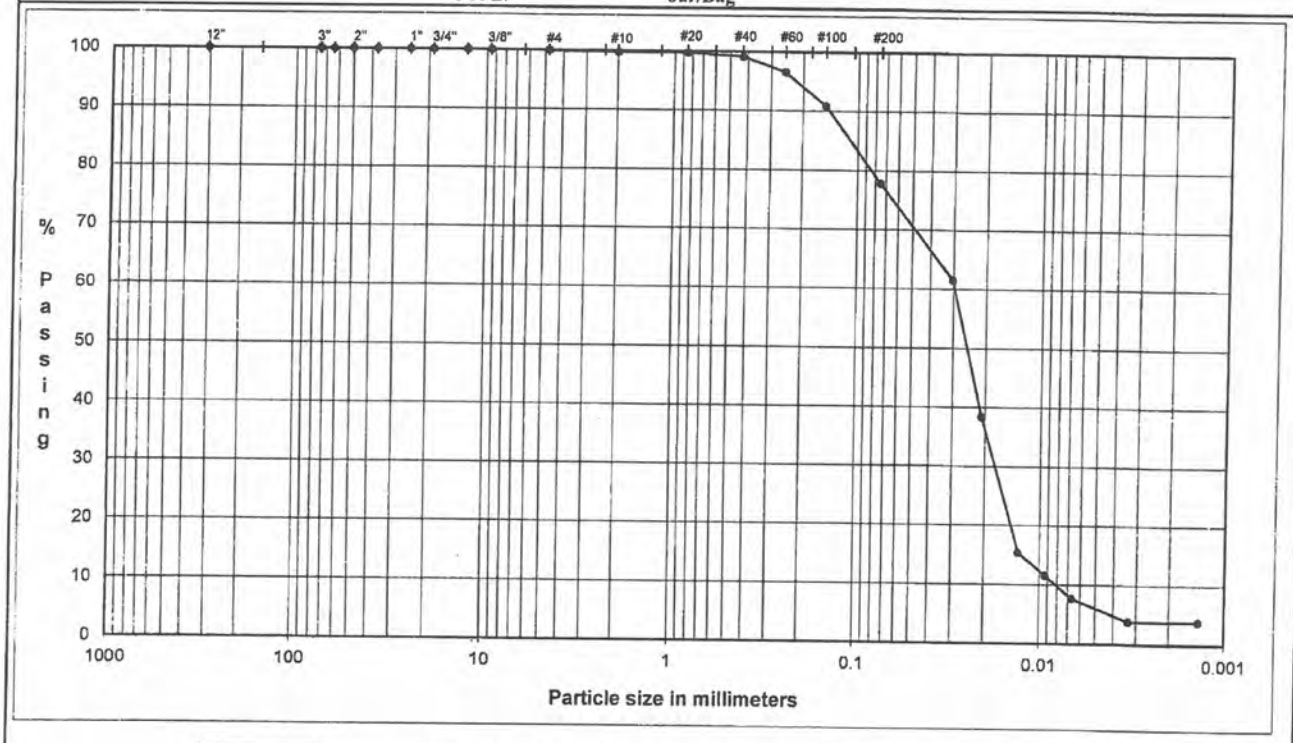
APRIL 2015

1520347

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: DOMINION/BREMO ASH POND CLOSURE/VA
SAMPLE ID: EB-1 S-9 Depth: 43.3-45.3'
TYPE: Jar/Bag



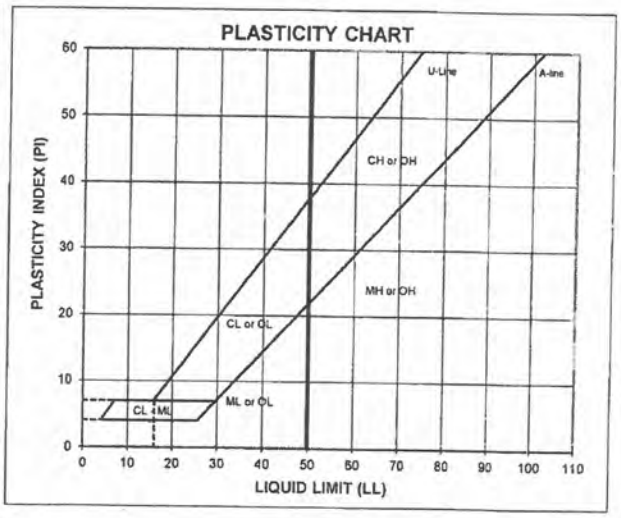
COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.0
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.0
0.50"	12.7	100.0		
0.375"	9.5	100.0		
#4	4.8	100.0	Fine Gravel	0.0
#10	2.00	99.7	Coarse Sand	0.3
#20	0.85	99.7		
#40	0.43	99.1	Medium Sand	0.6
#60	0.25	96.6		
#100	0.15	90.8		
#200	0.075	77.8	Fine Sand	21.3

Hydrometer Analysis

(mm)	%Finer		
0.030	61.5		
0.021	38.4		
0.013	15.4	Fines	
0.0093	11.5	Silt or Clay	77.8
0.0067	7.7		
0.0033	3.8		
0.0014	3.8		



ATTERBERG LIMITS
Method -B (Dry preparation)

M_c	LL	PL	PI	LI
107.7				

LL (oven-dried)	
< 0.75 - ORGANIC (OL-OH)	

DESCRIPTION: FLY ASH - sandy SILT, fine to coarse; dark gray.

USCS: (ML)

TECH	TJ/CG
DATE	4/10/15
CHECK	DA
REVIEW	AWM
APPROVE	[signature]

Golder Associates Inc.

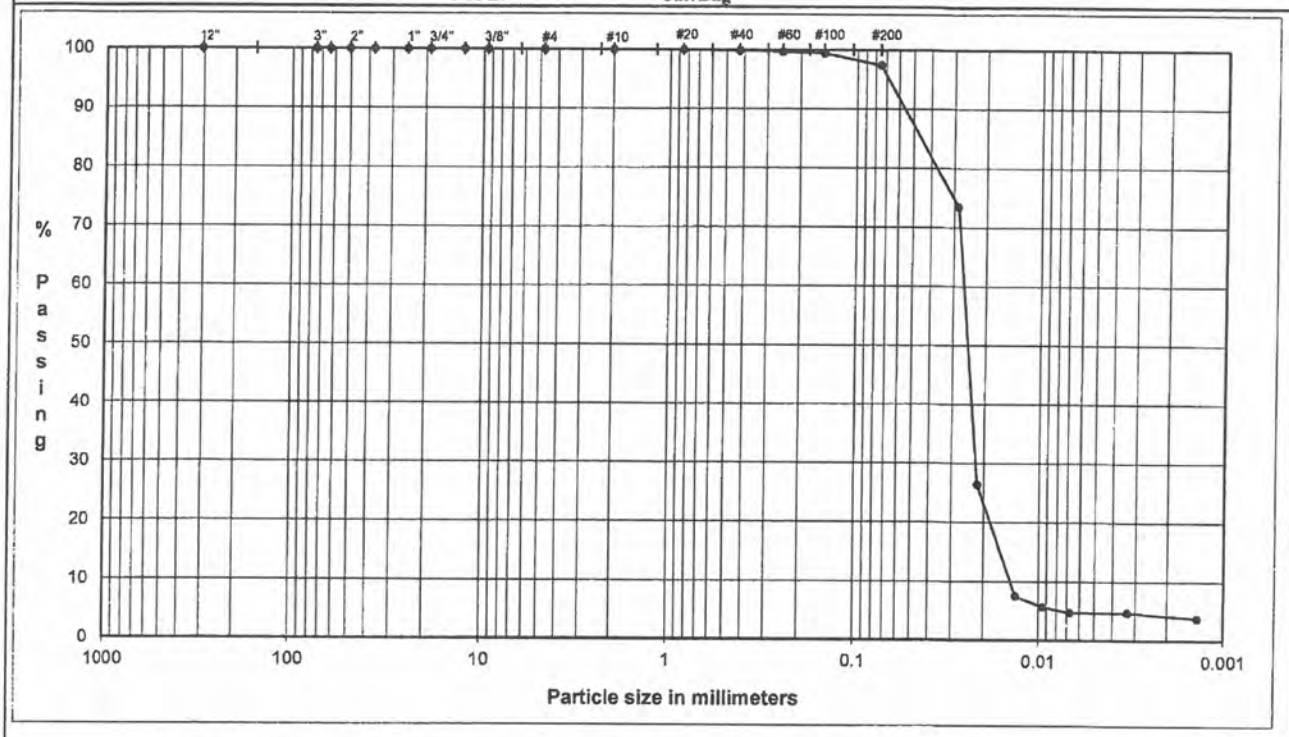
APRIL 2015

1520347

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: DOMINION/BREMO ASH POND CLOSURE/VA
SAMPLE ID: EB-2 S-3 Depth: 8.5-10.5'
TYPE: Jar/Bag



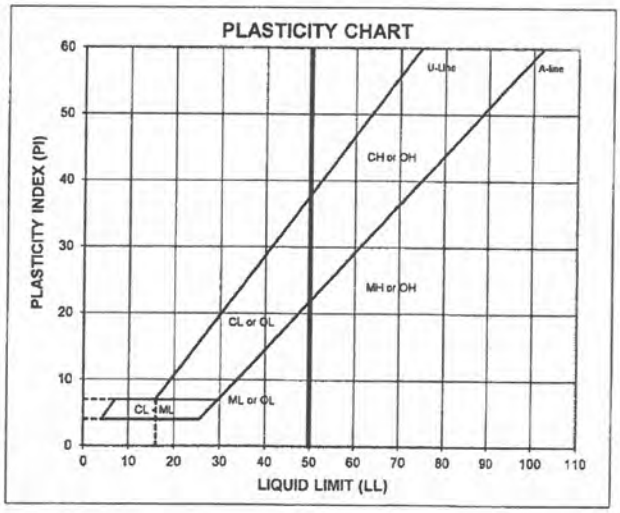
COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.0
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.0
0.50"	12.7	100.0		
0.375"	9.5	100.0		
#4	4.8	100.0	Fine Gravel	0.0
#10	2.00	100.0	Coarse Sand	0.0
#20	0.85	100.0		
#40	0.43	99.9	Medium Sand	0.1
#60	0.25	99.7		
#100	0.15	99.4		
#200	0.075	97.4	Fine Sand	2.5

Hydrometer Analysis

(mm)	%Finer		
0.028	73.4		
0.022	26.4		
0.013	7.5	Fines	
0.0095	5.6	Silt or Clay	97.4
0.0068	4.7		
0.0033	4.7		
0.0014	3.8		



ATTERBERG LIMITS

Method -B (Dry preparation)

M_c	LL	PL	PI	LI
21.2				

LL (oven-dried)	
< 0.75 = ORGANIC (OL/OH)	

DESCRIPTION: FLY ASH - SILT, trace fine to medium sand; dark gray.

USCS: (ML)

TECH	TJ/CG
DATE	4/10/15
CHECK	
REVIEW	
APPROVE	

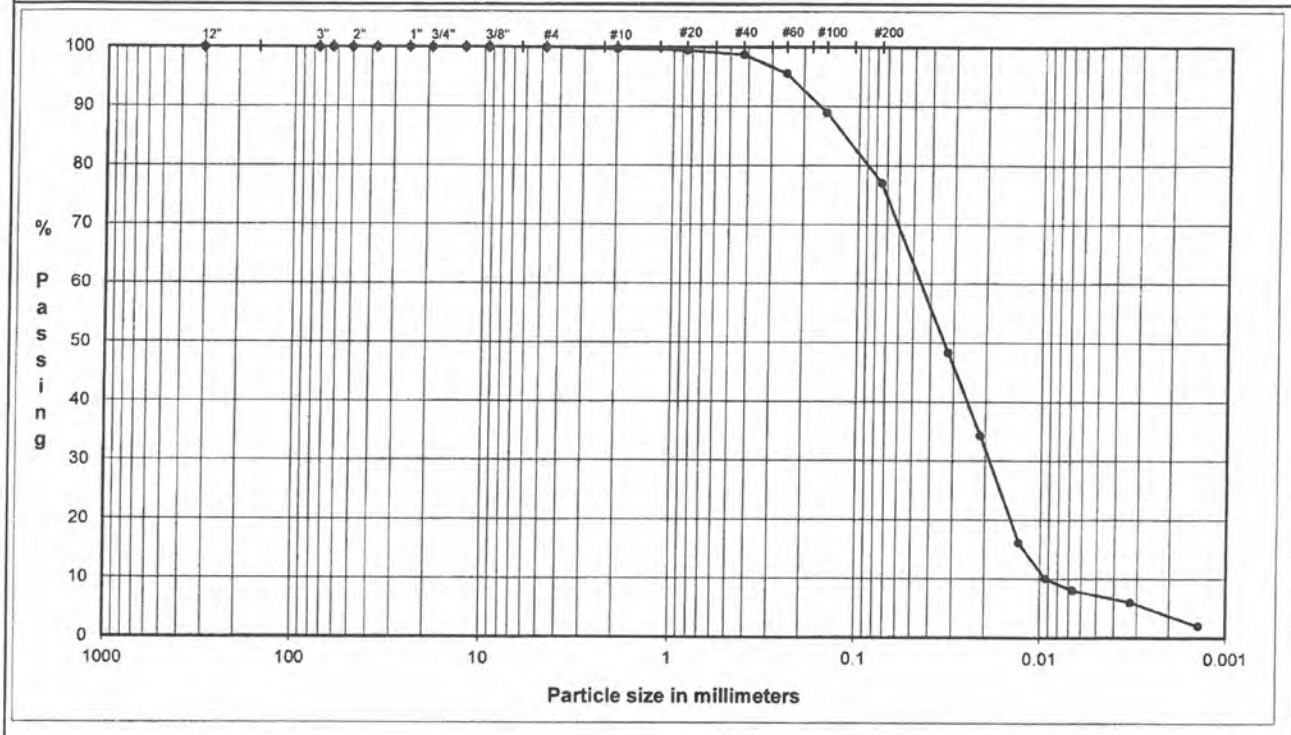
Golder Associates Inc.

APRIL 2015 1520347

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: DOMINION/BREMO ASH POND CLOSURE/VA
SAMPLE ID: EB-02 UD-01 Depth: 33.0-35.0'
TYPE: UD



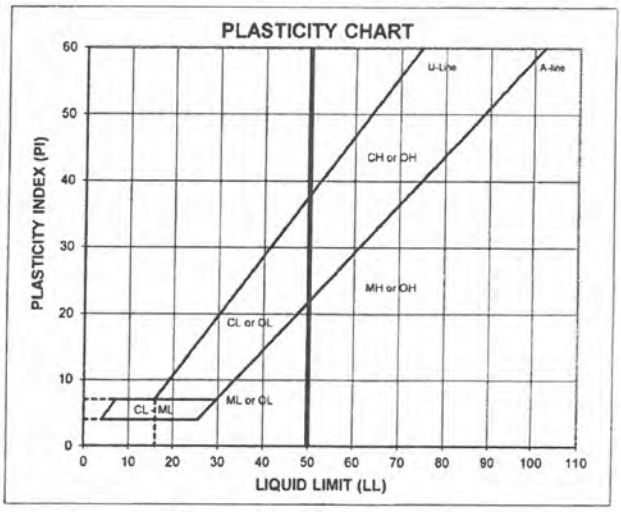
COBBLES	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.0
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.0
0.50"	12.7	100.0		
0.375"	9.5	100.0		
#4	4.8	100.0	Fine Gravel	0.0
#10	2.00	99.7	Coarse Sand	0.3
#20	0.85	99.5		
#40	0.43	98.7	Medium Sand	1.0
#60	0.25	95.5		
#100	0.15	88.9		
#200	0.075	77.1	Fine Sand	21.7

Hydrometer Analysis

(mm)	%Finer		
0.032	48.4		
0.021	34.3		
0.013	16.1	Fines	
0.0094	10.1	Silt or Clay	77.1
0.0067	8.1		
0.0033	6.0		
0.0014	2.0		



ATTERBERG LIMITS
Method -B (Dry preparation)

M_f	LL	PL	PI	LI
124.9				

LL (oven-dried) < 0.75 = ORGANIC (OL/OH)

DESCRIPTION: FLY ASH; SILT, and fine to coarse sand; gray.

USCS: (MH)

TECH	CG/TJ
DATE	4/7/15
CHECK	
REVIEW	
APPROVE	

Golder Associates Inc.

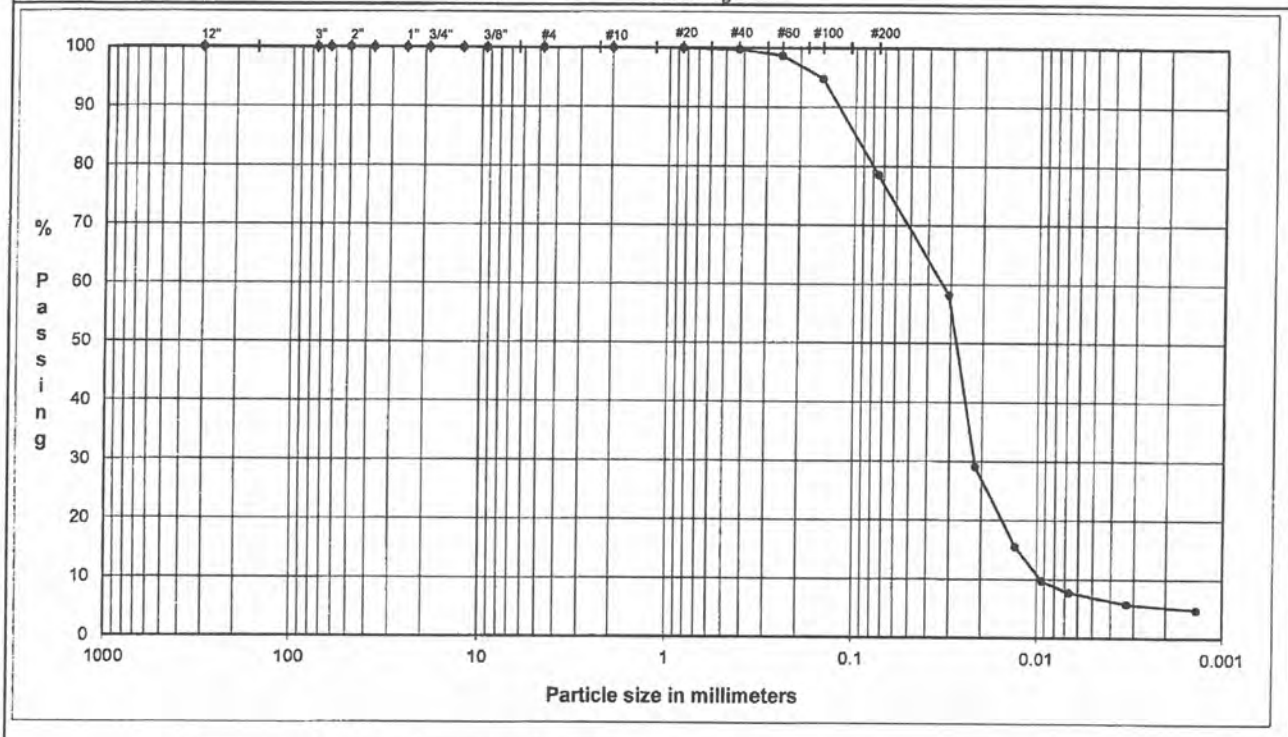
APRIL 2015

1520347

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: DOMINION/BREMO ASH POND CLOSURE/VA
SAMPLE ID: EB-2 S-9 Depth: 38.5-40.5'
TYPE: Jar/Bag



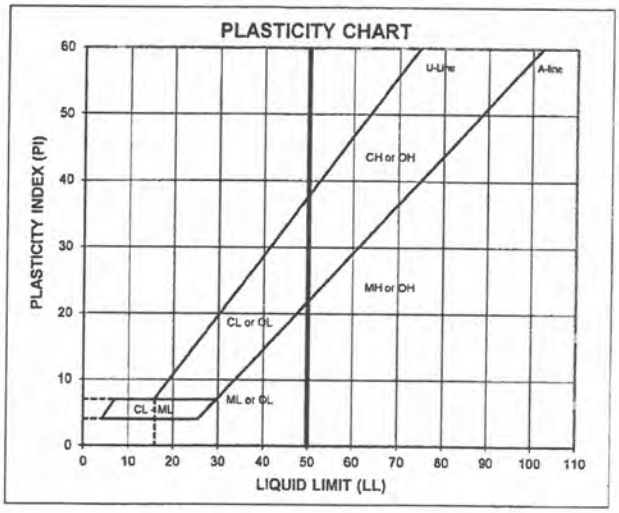
COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.0
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.0
0.50"	12.7	100.0		
0.375"	9.5	100.0		
#4	4.8	100.0	Fine Gravel	0.0
#10	2.00	100.0	Coarse Sand	0.0
#20	0.85	100.0		
#40	0.43	99.7	Medium Sand	0.3
#60	0.25	98.7		
#100	0.15	94.8		
#200	0.075	78.5	Fine Sand	21.2

Hydrometer Analysis

(mm)	%Finer		
0.031	58.2		
0.022	29.1		
0.013	15.5	Fines	
0.0094	9.7	Silt or Clay	78.5
0.0067	7.8		
0.0033	5.8		
0.0014	4.9		



ATTERBERG LIMITS

Method -B (Dry preparation)

M.	LL	PL	PI	LI
152.4				

LL (oven-dried)	
< 0.75 = ORGANIC (OL/OH)	

DESCRIPTION: FLY ASH - sandy SILT, fine to medium sand; dark gray.

USCS: (ML)

TECH	TJ/CG
DATE	4/10/15
CHECK	
REVIEW	
APPROVE	

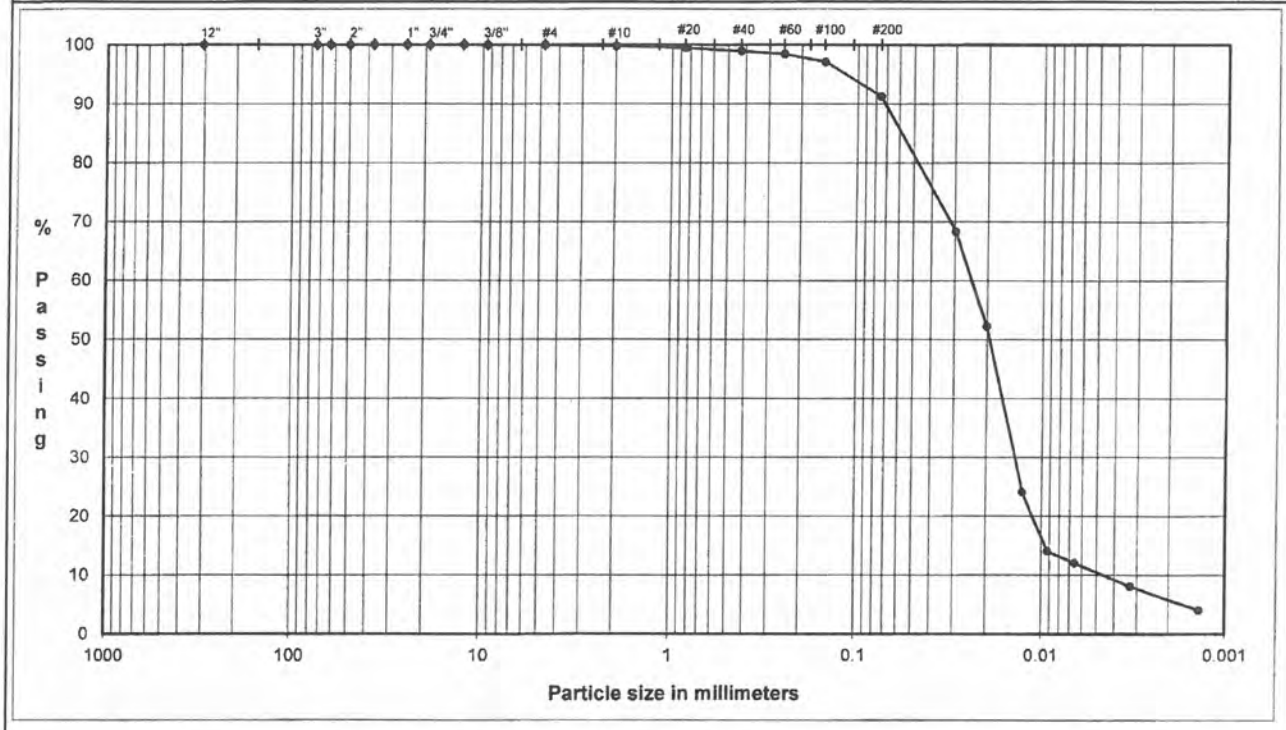
Golder Associates Inc.

APRIL 2015 1520347

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **DOMINION/BREMO ASH POND CLOSURE/VA**
SAMPLE ID: **EB-02 UD-02** Depth: **43.0-45.0'**
TYPE: **UD**



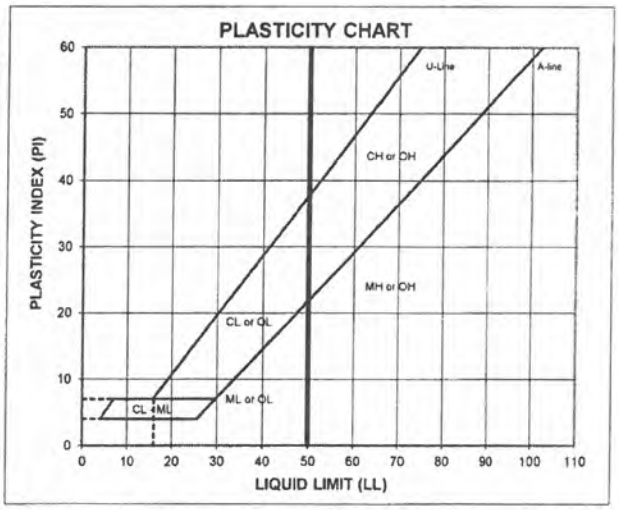
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.0
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.0
0.50"	12.7	100.0		
0.375"	9.5	100.0		
#4	4.8	100.0	Fine Gravel	0.0
#10	2.00	99.8	Coarse Sand	0.2
#20	0.85	99.4		
#40	0.43	99.0	Medium Sand	0.8
#60	0.25	98.4		
#100	0.15	97.1		
#200	0.075	91.3	Fine Sand	7.7

Hydrometer Analysis

(mm)	%Finer		
0.030	68.4		
0.020	52.3		
0.013	24.1	Fines	
0.0093	14.1	Silt or Clay	91.3
0.0066	12.1		
0.0033	8.0		
0.0014	4.0		



ATTERBERG LIMITS

Method -B (Dry preparation)

M_c	LL	PL	PI	LI
127.3				

LL (oven-dried)	
< 0.75 = ORGANIC (OL/OH)	

DESCRIPTION: FLY ASH- SILT, some fine to coarse sand; gray.

USCS: (MH)

TECH	CG/TJ
DATE	4/7/15
CHECK	
REVIEW	
APPROVE	

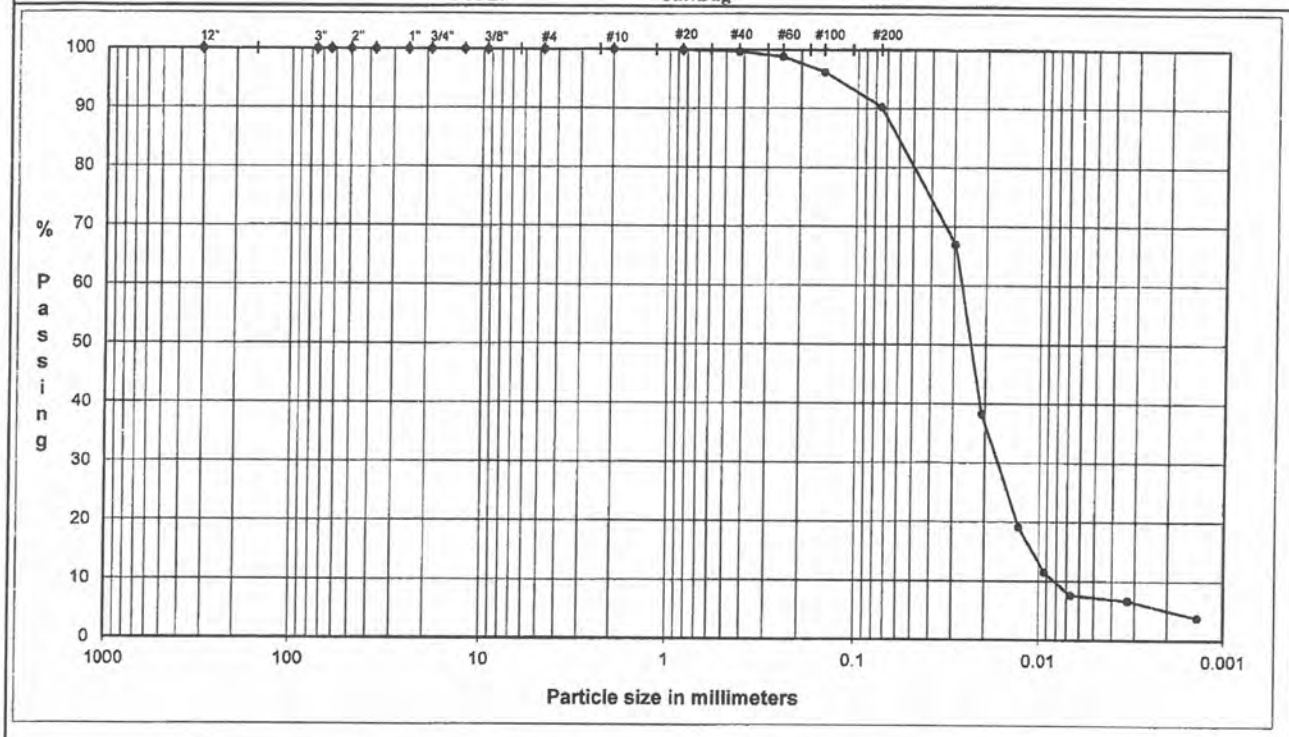
Golder Associates Inc.

APRIL 2015 1520347

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: DOMINION/BREMO ASH POND CLOSURE/VA
SAMPLE ID: EB-3 S-8 Depth: 33.7-35.7'
TYPE: Jar/Bag



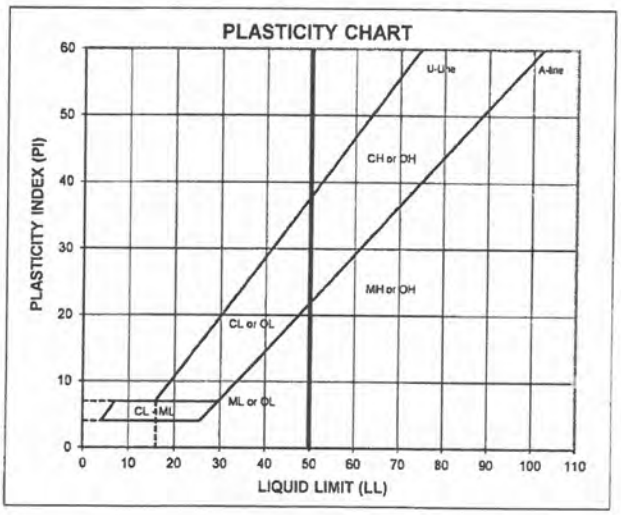
COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.0
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.0
0.50"	12.7	100.0		
0.375"	9.5	100.0		
#4	4.8	100.0	Fine Gravel	0.0
#10	2.00	100.0	Coarse Sand	0.0
#20	0.85	99.9		
#40	0.43	99.7	Medium Sand	0.3
#60	0.25	98.8		
#100	0.15	96.2		
#200	0.075	90.3	Fine Sand	9.4

Hydrometer Analysis

(mm)	%Finer		
0.030	67.0		
0.021	38.3		
0.013	19.1	Fines	
0.0093	11.5	Silt or Clay	90.3
0.0067	7.7		
0.0033	6.7		
0.0014	3.8		



ATTERBERG LIMITS

Method -B (Dry preparation)

M_c	LL	PL	PI	LI
69.6				

LL (oven-dried) ____
<0.75 = ORGANIC (OL/OH) ____

DESCRIPTION: FLY ASH - SILT, some fine to medium sand; dark gray.

USCS: (ML)

TECH	TJ/CG
DATE	4/10/15
CHECK	DR
REVIEW	HWM
APPROVE	

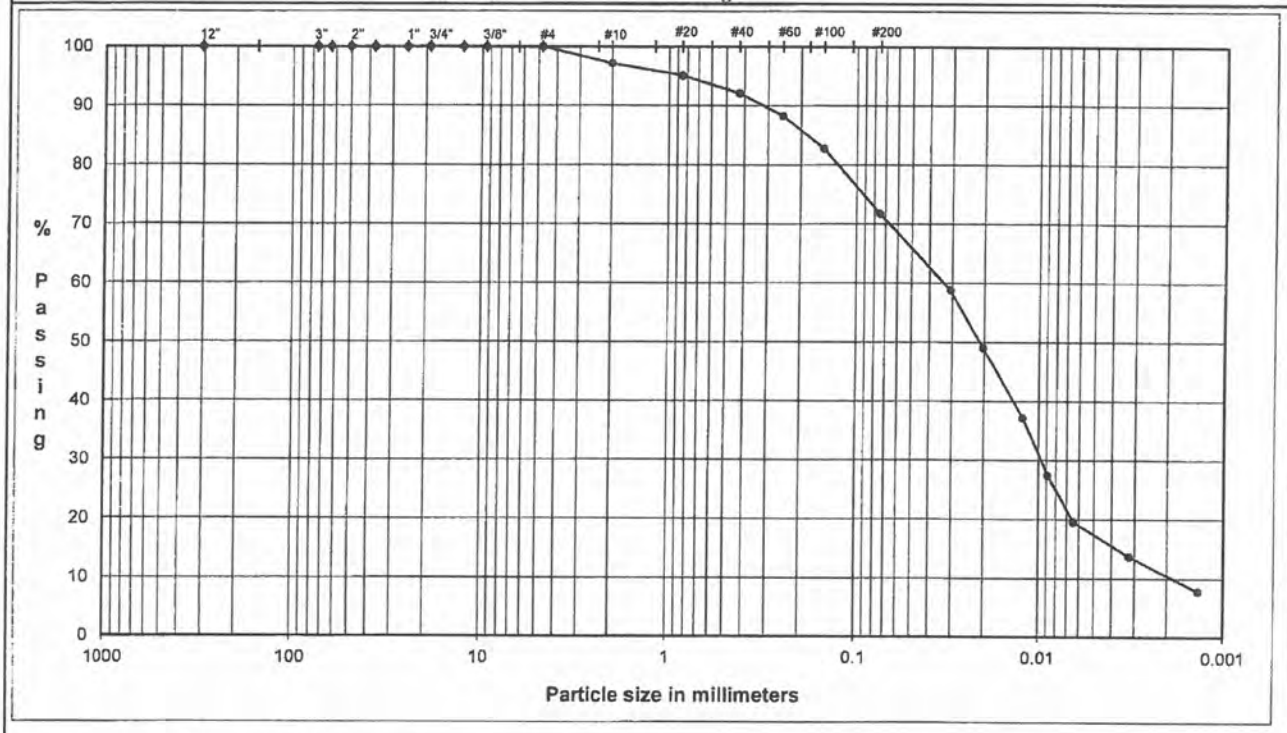
Golder Associates Inc.

APRIL 2015 1520347

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: DOMINION/BREMO ASH POND CLOSURE/VA
SAMPLE ID: EB-5 S-3 Depth: 8.5-10.5'
TYPE: Jar/Bag



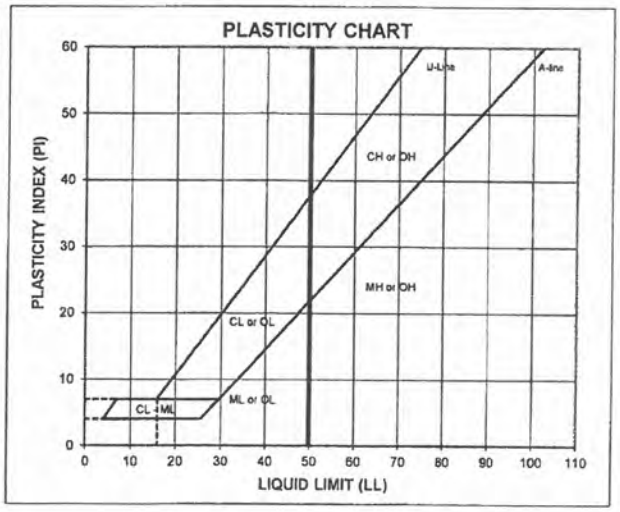
COBBLES	GRAVEL: Coarse	GRAVEL: Fine	SAND: Coarse	SAND: Medium	SAND: Fine	FINES: Silt or Clay

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.0
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.0
0.50"	12.7	100.0		
0.375"	9.5	100.0		
#4	4.8	100.0	Fine Gravel	0.0
#10	2.00	97.2	Coarse Sand	2.8
#20	0.85	95.1		
#40	0.43	92.1	Medium Sand	5.1
#60	0.25	88.3		
#100	0.15	82.7		
#200	0.075	71.8	Fine Sand	20.3

Hydrometer Analysis

(mm)	%Finer		
0.031	58.8		
0.020	49.0		
0.012	37.3	Fines	
0.0089	27.5	Silt or Clay	71.8
0.0065	19.6		
0.0032	13.7		
0.0014	7.8		



ATTERBERG LIMITS
Method -B (Dry preparation)

M_c	LL	PL	PI	LI
38.6				

LL (oven-dried)	
0.75 = ORGANIC (OL/OH)	

DESCRIPTION: FLY ASH - sandy SILT, fine to coarse; dark gray and red.

USCS: (ML)

TECH	TJ/CG
DATE	4/10/15
CHECK	
REVIEW	
APPROVE	

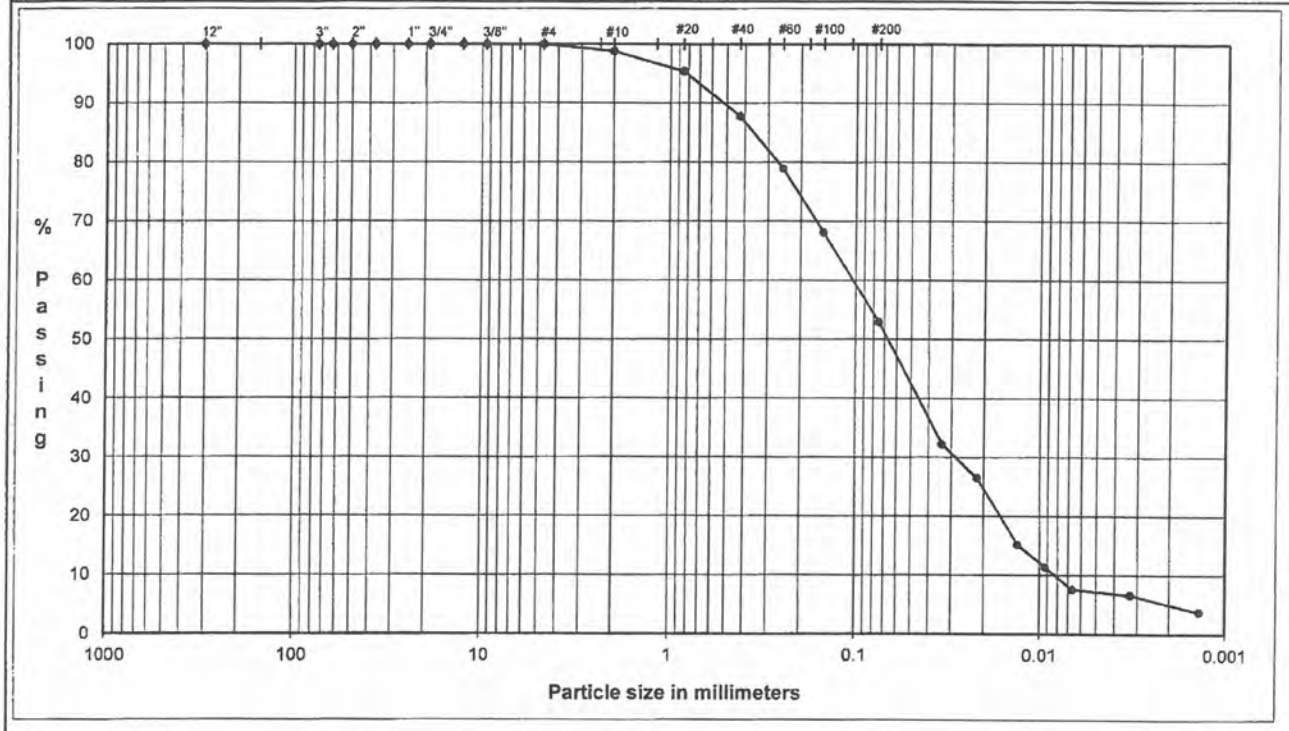
Golder Associates Inc.

APRIL 2015 1520347

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: DOMINION/BREMO ASH POND CLOSURE/VA
SAMPLE ID: EB-5 S-6 Depth: 23.5-25.5'
TYPE: Jar/Bag



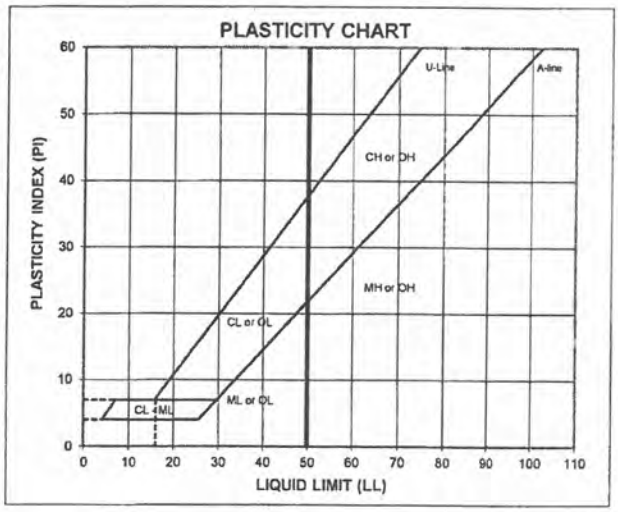
COBBLES	GRAVEL: Coarse	GRAVEL: Fine	SAND: Coarse	SAND: Medium	SAND: Fine	FINES: Silt or Clay

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.0
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.0
0.50"	12.7	100.0		
0.375"	9.5	100.0		
#4	4.8	100.0	Fine Gravel	0.0
#10	2.00	98.8	Coarse Sand	1.2
#20	0.85	95.4		
#40	0.43	87.7	Medium Sand	11.0
#60	0.25	78.9		
#100	0.15	68.1		
#200	0.075	53.0	Fine Sand	34.8

Hydrometer Analysis

(mm)	%Finer		
0.034	32.2		
0.022	26.6		
0.013	15.2	Fines	
0.0093	11.4	Silt or Clay	53.0
0.0067	7.6		
0.0033	6.6		
0.0014	3.8		



ATTERBERG LIMITS
Method -B (Dry preparation)

M_c	LL	PL	PI	LI
148.7				

LL (oven-dried)	
< 0.75 = ORGANIC (OL/OH)	

DESCRIPTION: FLY ASH - SILT and fine to coarse SAND; dark gray.

USCS: (ML)

TECH	TJ/CG
DATE	4/10/15
CHECK	
REVIEW	
APPROVE	

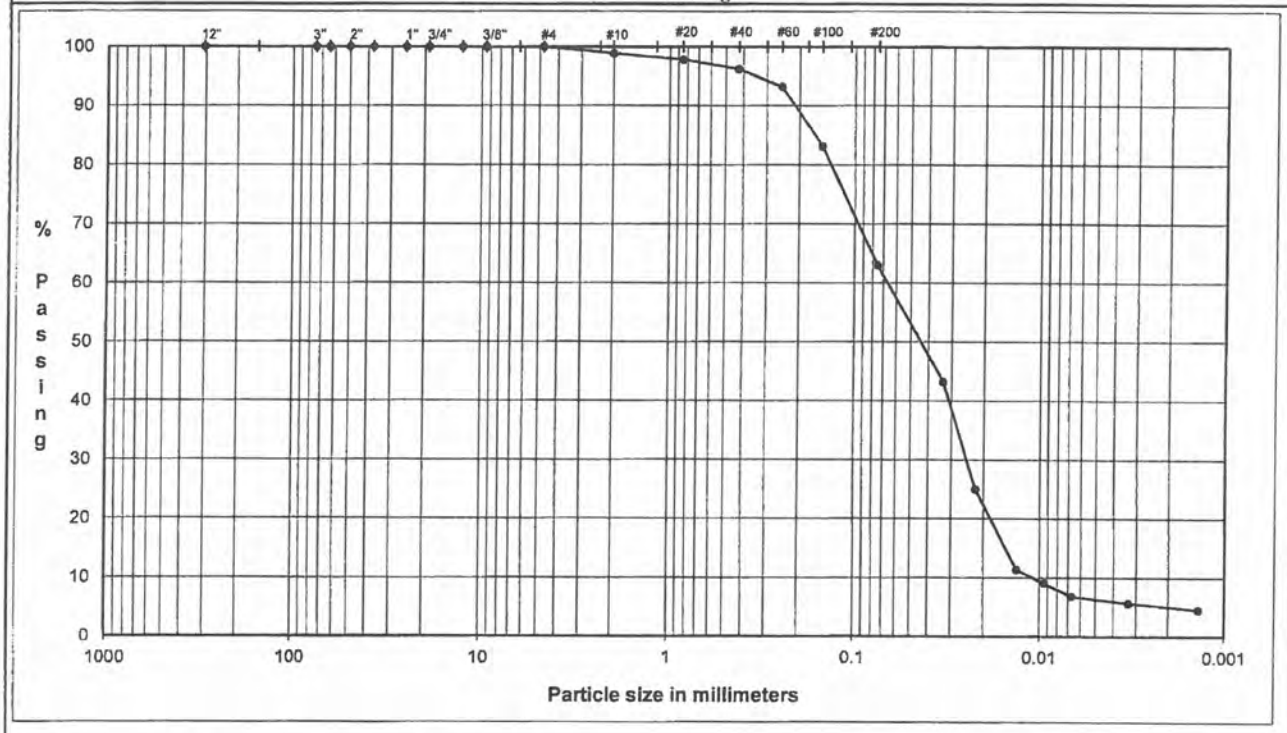
Golder Associates Inc.

APRIL 2015 1520347

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: DOMINION/BREMO ASH POND CLOSURE/VA
SAMPLE ID: EB-5 S-9 Depth: 38.5-40.5'
TYPE: Jar/Bag



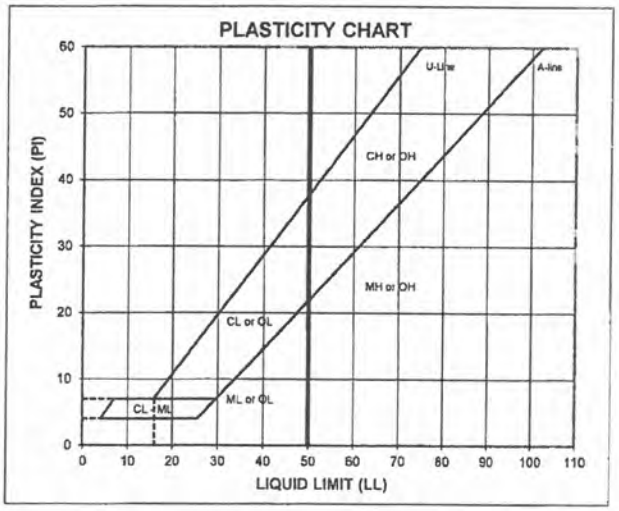
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.0
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.0
0.50"	12.7	100.0		
0.375"	9.5	100.0		
#4	4.8	100.0	Fine Gravel	0.0
#10	2.00	98.9	Coarse Sand	1.1
#20	0.85	97.8		
#40	0.43	96.2	Medium Sand	2.6
#60	0.25	93.2		
#100	0.15	83.1		
#200	0.075	62.9	Fine Sand	33.3

Hydrometer Analysis

(mm)	%Finer		
0.033	43.2		
0.022	25.0		
0.013	11.4	Fines	
0.0095	9.1	Silt or Clay	62.9
0.0067	6.8		
0.0033	5.7		
0.0014	4.5		



ATTERBERG LIMITS
Method -B (Dry preparation)

M,	LL	PL	PI	LI
109.1				

LL (oven-dried)	
0.75 = ORGANIC (OL/OH)	

DESCRIPTION: FLY ASH - SILT and fine to coarse SAND; dark gray.

USCS: (ML)

TECH	TJ/CG
DATE	4/10/15
CHECK	JA
REVIEW	
APPROVE	

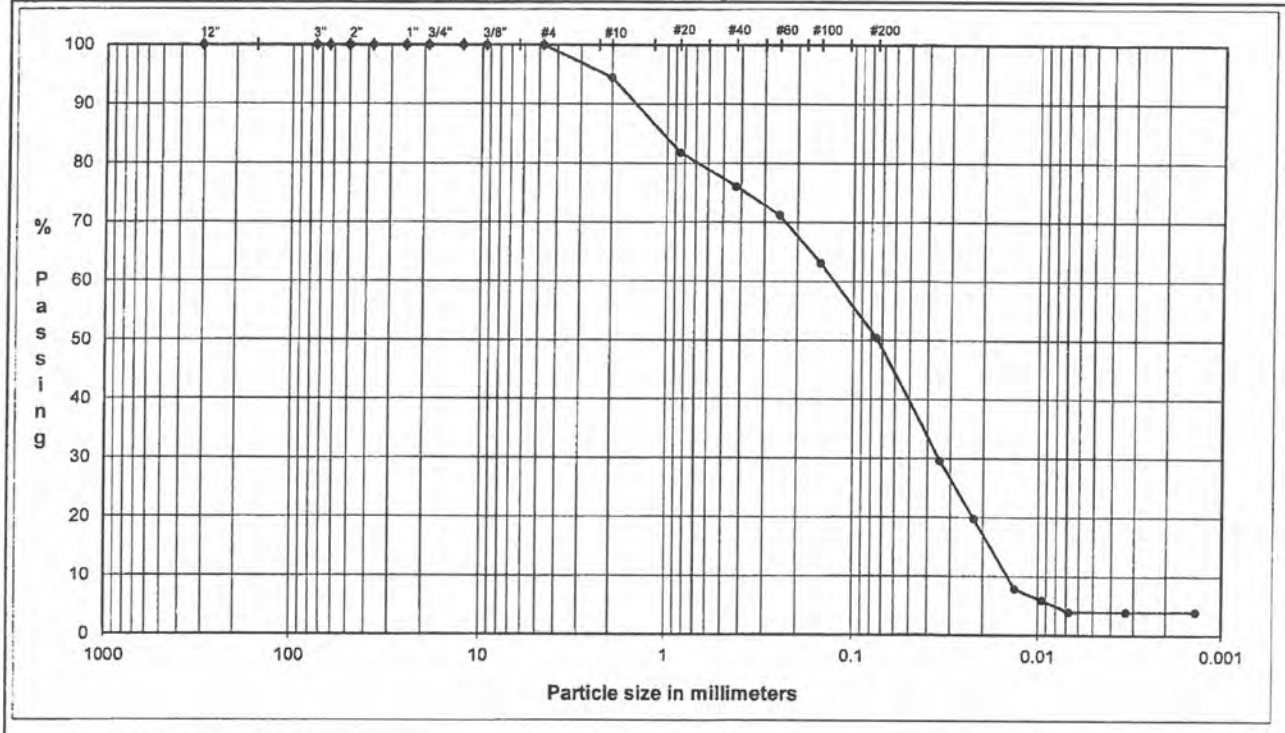
Golder Associates Inc.

APRIL 2015 1520347

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: DOMINION/BREMO ASH POND CLOSURE/VA
SAMPLE ID: EB-5 S-11 Depth: 48.5-50.5'
TYPE: Jar/Bag



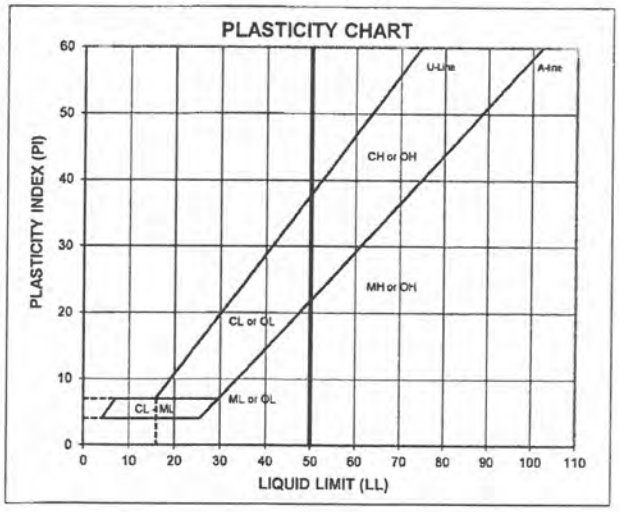
COBBLES	GRAVEL: Coarse	GRAVEL: Fine	SAND: Coarse	SAND: Medium	SAND: Fine	FINES: Silt or Clay

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.0
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.0
0.50"	12.7	100.0		
0.375"	9.5	100.0		
#4	4.8	100.0	Fine Gravel	0.0
#10	2.00	94.5	Coarse Sand	5.5
#20	0.85	81.8		
#40	0.43	76.1	Medium Sand	18.4
#60	0.25	71.3		
#100	0.15	63.0		
#200	0.075	50.5	Fine Sand	25.6

Hydrometer Analysis

(mm)	%Finer		
0.034	29.6		
0.022	19.7		
0.013	7.9	Fines	
0.0095	5.9	Silt or Clay	50.5
0.0068	3.9		
0.0033	3.9		
0.0014	3.9		



ATTERBERG LIMITS
Method -B (Dry preparation)

M_n	LL	PL	PI	LI
103.8				

LL (oven-dried) ____
0.75 = ORGANIC (OL/OH) ____

DESCRIPTION: FLY ASH - SILT and fine to coarse SAND; dark gray.

USCS: (ML)

TECH	TJ/CG
DATE	4/10/15
CHECK	DA
REVIEW	
APPROVE	

Golder Associates Inc.

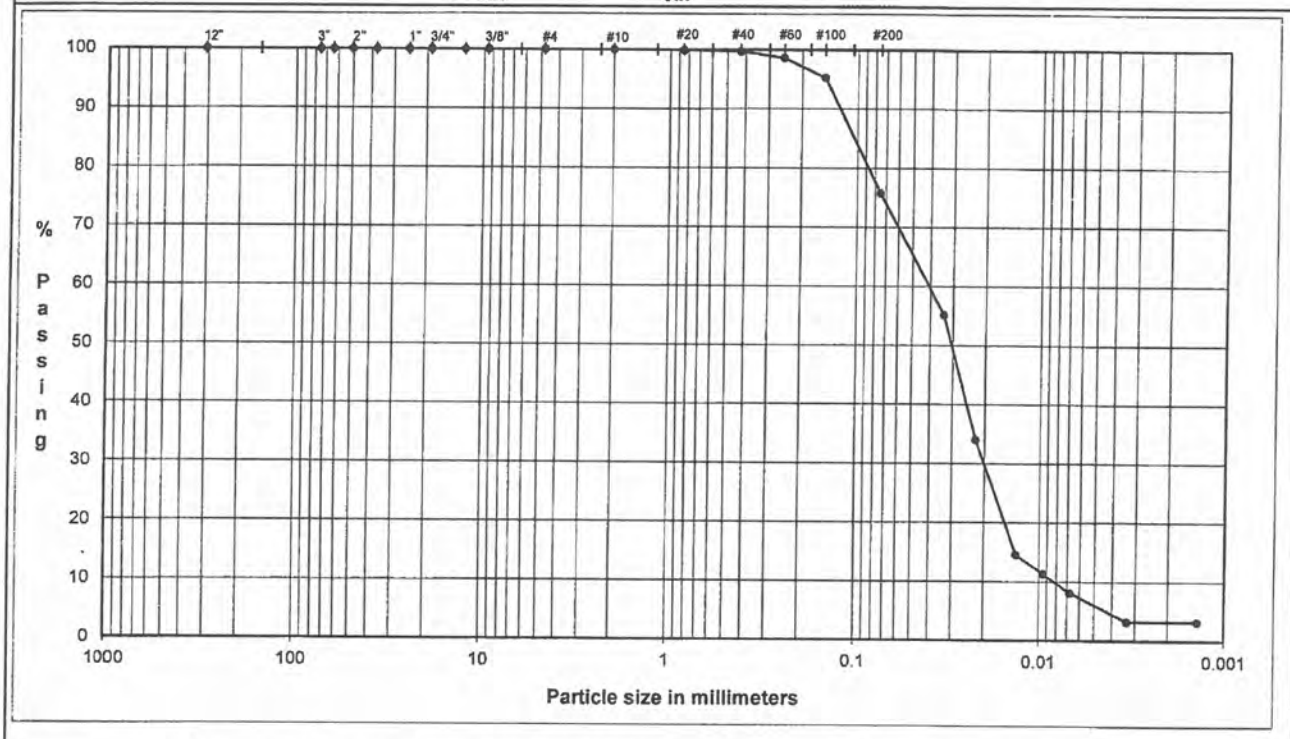
APRIL 2015

1520347

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: DOMINION/BREMO ASH POND CLOSURE/VA
SAMPLE ID: NB-02 S-4 Depth: 13.5-15.5'
TYPE: Jar



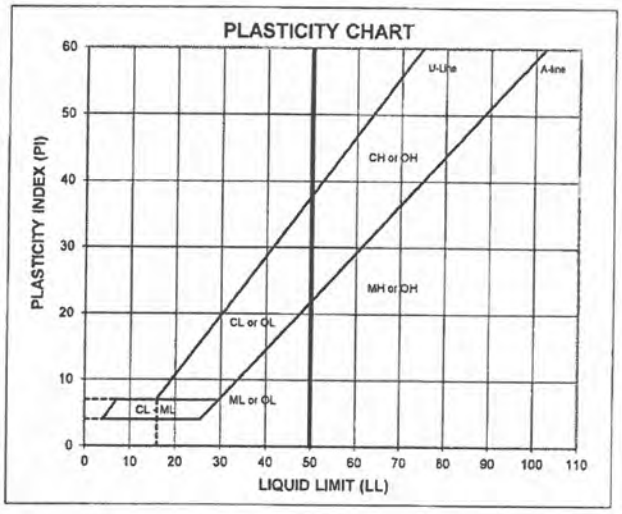
COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.0
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.0
0.50"	12.7	100.0		
0.375"	9.5	100.0		
#4	4.8	100.0	Fine Gravel	0.0
#10	2.00	100.0	Coarse Sand	0.0
#20	0.85	99.9		
#40	0.43	99.7	Medium Sand	0.3
#60	0.25	98.6		
#100	0.15	95.3		
#200	0.075	75.8	Fine Sand	24.0

Hydrometer Analysis

(mm)	%Finer		
0.034	55.2		
0.022	34.1		
0.013	14.6	Fines	
0.0095	11.4	Silt or Clay	75.8
0.0068	8.1		
0.0033	3.2		
0.0014	3.2		



ATTERBERG LIMITS

Method -B (Dry preparation)

M_c	LL	PL	PI	LI
66.4	NP	NP	NP	NP

LL (oven-dried) / 0.75 = ORGANIC (OL/OH)

DESCRIPTION: FLY ASH - sandy SILT, fine to medium; dark gray.

USCS: ML

TECH	CG/TJ
DATE	4/20/15
CHECK	
REVIEW	
APPROVE	

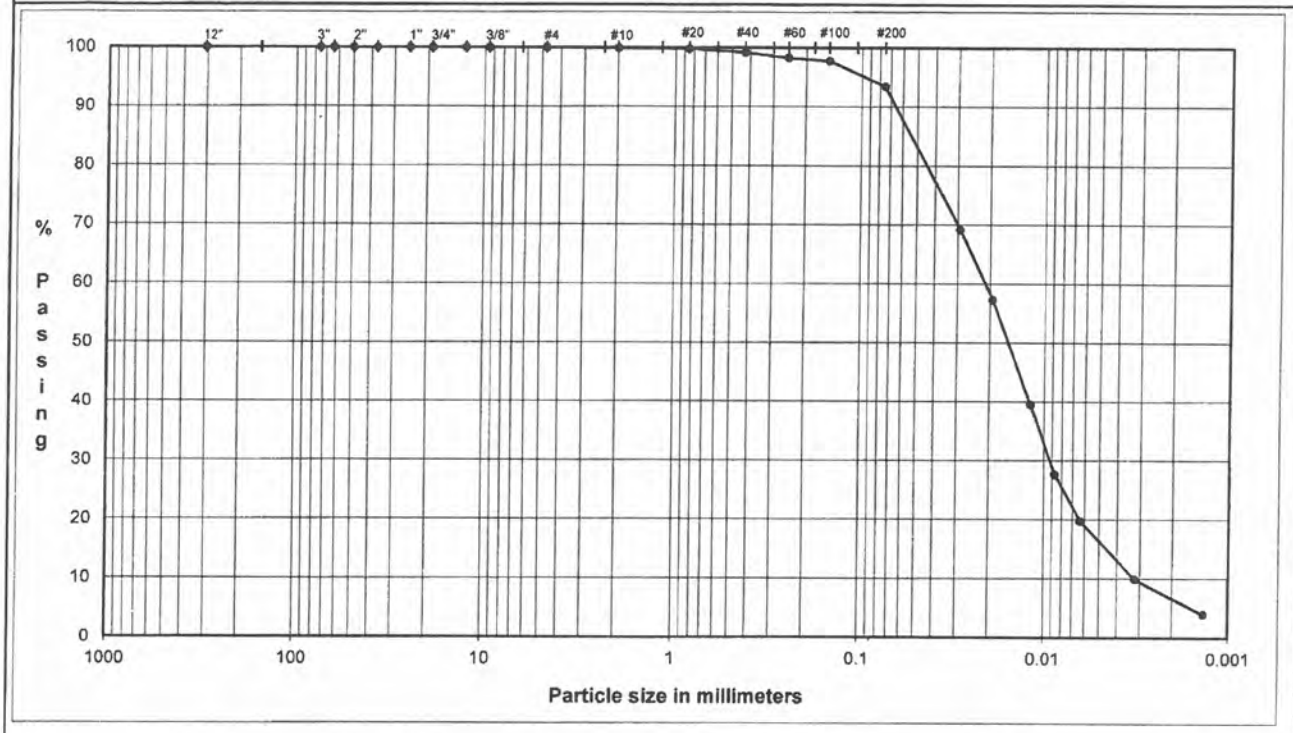
Golder Associates Inc.

APRIL 2015 1520347

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: **DOMINION/BREMO ASH POND CLOSURE/VA**
SAMPLE ID: **NB-02** **UD-01** Depth: **25.5-27.5'**
TYPE: **UD**



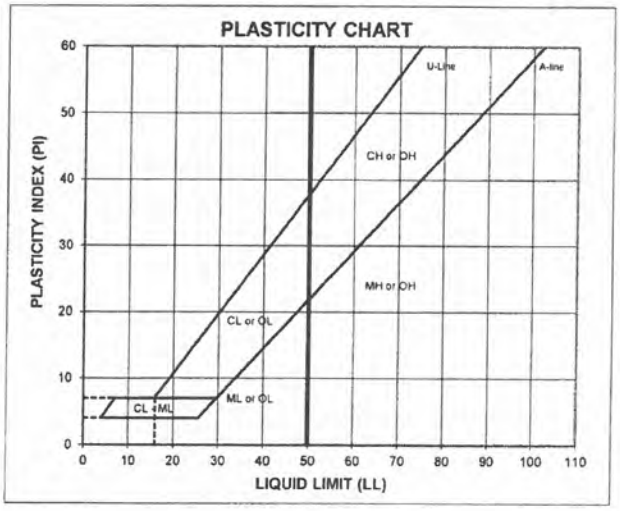
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.0
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.0
0.50"	12.7	100.0		
0.375"	9.5	100.0		
#4	4.8	100.0	Fine Gravel	0.0
#10	2.00	99.9	Coarse Sand	0.1
#20	0.85	99.8		
#40	0.43	99.2	Medium Sand	0.7
#60	0.25	98.3		
#100	0.15	97.8		
#200	0.075	93.4	Fine Sand	5.8

Hydrometer Analysis

(mm)	%Finer		
0.029	69.2		
0.019	57.3		
0.012	39.5	Fines	
0.0088	27.7	Silt or Clay	93.4
0.0064	19.8		
0.0032	9.9		
0.0014	4.0		



ATTERBERG LIMITS

Method -B (Dry preparation)

M_c	LL	PL	PI	LI
53.2				

LL (oven-dried)	
< 0.75 = ORGANIC (OL/OH)	

DESCRIPTION: FLY ASH- SILT, some fine to coarse sand; gray.

USCS: (MH)

TECH	TJ
DATE	4/8/15
CHECK	
REVIEW	
APPROVE	

Golder Associates Inc.

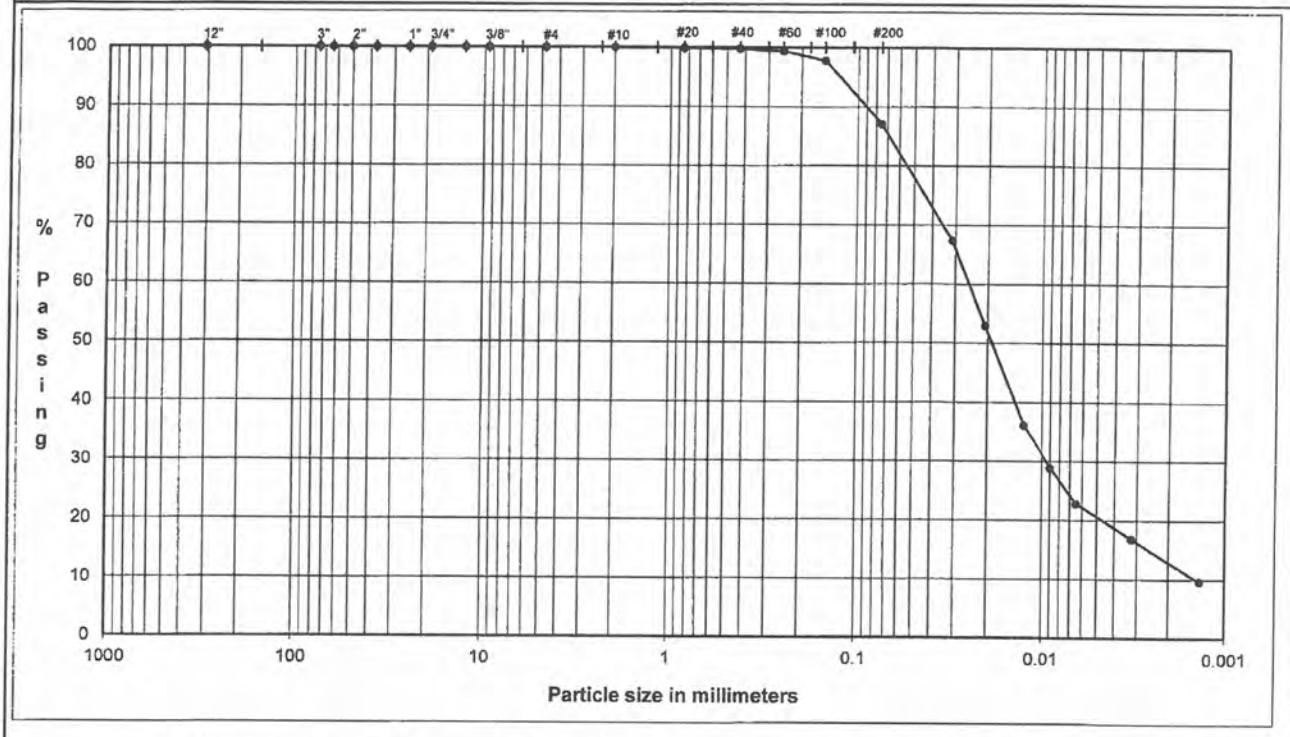
APRIL 2015

1520347

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: DOMINION/BREMO ASH POND CLOSURE/VA
SAMPLE ID: NB-02 S-9 Depth: 43.5-45.5'
TYPE: Jar



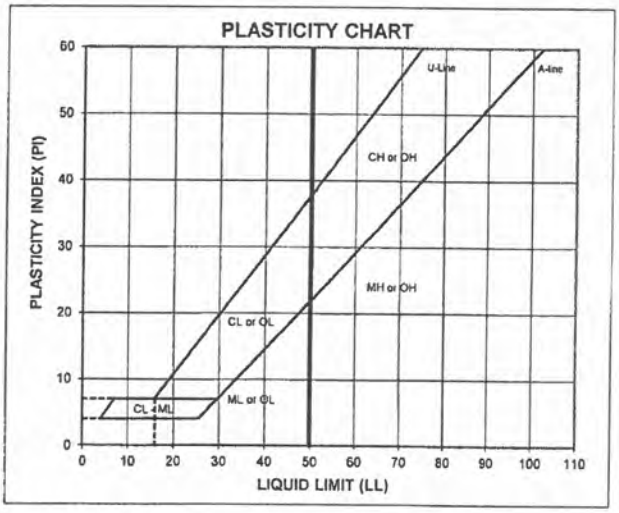
COBBLES	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.0
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.0
0.50"	12.7	100.0		
0.375"	9.5	100.0		
#4	4.8	100.0	Fine Gravel	0.0
#10	2.00	100.0	Coarse Sand	0.0
#20	0.85	99.9		
#40	0.43	99.8	Medium Sand	0.2
#60	0.25	99.4		
#100	0.15	97.8		
#200	0.075	87.1	Fine Sand	12.7

Hydrometer Analysis

(mm)	%Finer		
0.031	67.4		
0.021	52.9		
0.013	36.1	Fines	
0.0090	28.9	Silt or Clay	87.1
0.0065	22.9		
0.0032	16.8		
0.0014	9.6		



ATTERBERG LIMITS

Method -B (Dry preparation)

M_c	LL	PL	PI	LI
83.6	NP	NP	NP	NP

LL (oven-dried)
0.75 = ORGANIC (OL/OH)

DESCRIPTION: FLY ASH - sandy SILT, fine to medium; dark gray.

USCS: ML

TECH	CG/TJ
DATE	4/21/15
CHECK	DA
REVIEW	DWM
APPROVE	

Golder Associates Inc.

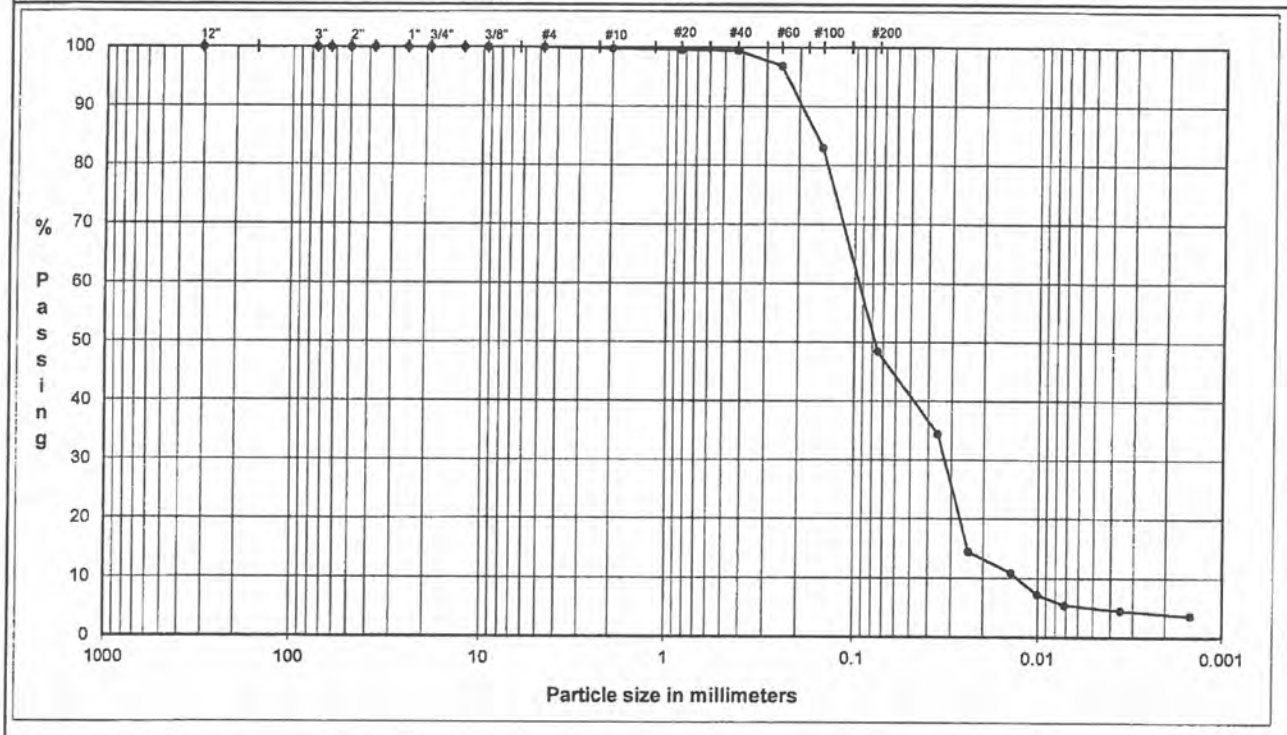
APRIL 2015

1520347

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: DOMINION/BREMO ASH POND CLOSURE/VA
SAMPLE ID: NB-02 UD-02 Depth: 53.5-55.5'
TYPE: UD



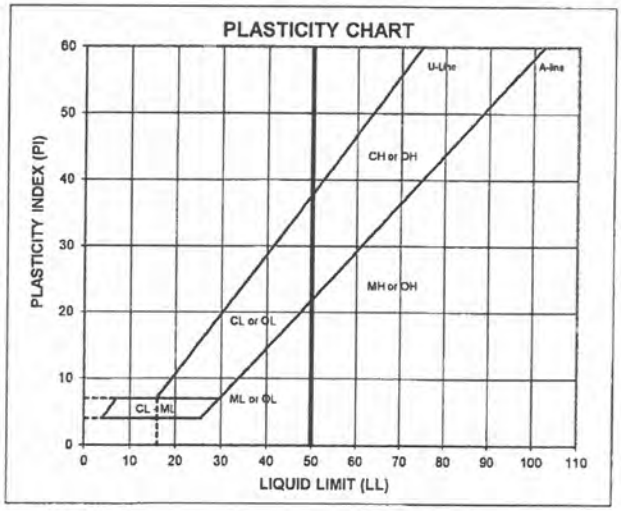
COBBLES	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.0
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.0
0.50"	12.7	100.0		
0.375"	9.5	100.0		
#4	4.8	100.0	Fine Gravel	0.0
#10	2.00	99.8	Coarse Sand	0.2
#20	0.85	99.6		
#40	0.43	99.5	Medium Sand	0.3
#60	0.25	96.9		
#100	0.15	83.0		
#200	0.075	48.5	Fine Sand	51.0

Hydrometer Analysis

(mm)	%Finer		
0.036	34.4		
0.024	14.5		
0.014	10.9	Fines	
0.0101	7.2	Silt or Clay	48.5
0.0072	5.4		
0.0035	4.5		
0.0015	3.6		



ATTERBERG LIMITS
Method -B (Dry preparation)

M_c	LL	PL	PI	LI
158.2				

LL (oven-dried) < 0.75 = ORGANIC (OL/OH)

DESCRIPTION: FLY ASH - fine to coarse SAND and SILT; gray.

USCS: (SM)

TECH	TJ/TH
DATE	4/13/15
CHECK	
REVIEW	
APPROVE	

Golder Associates Inc.

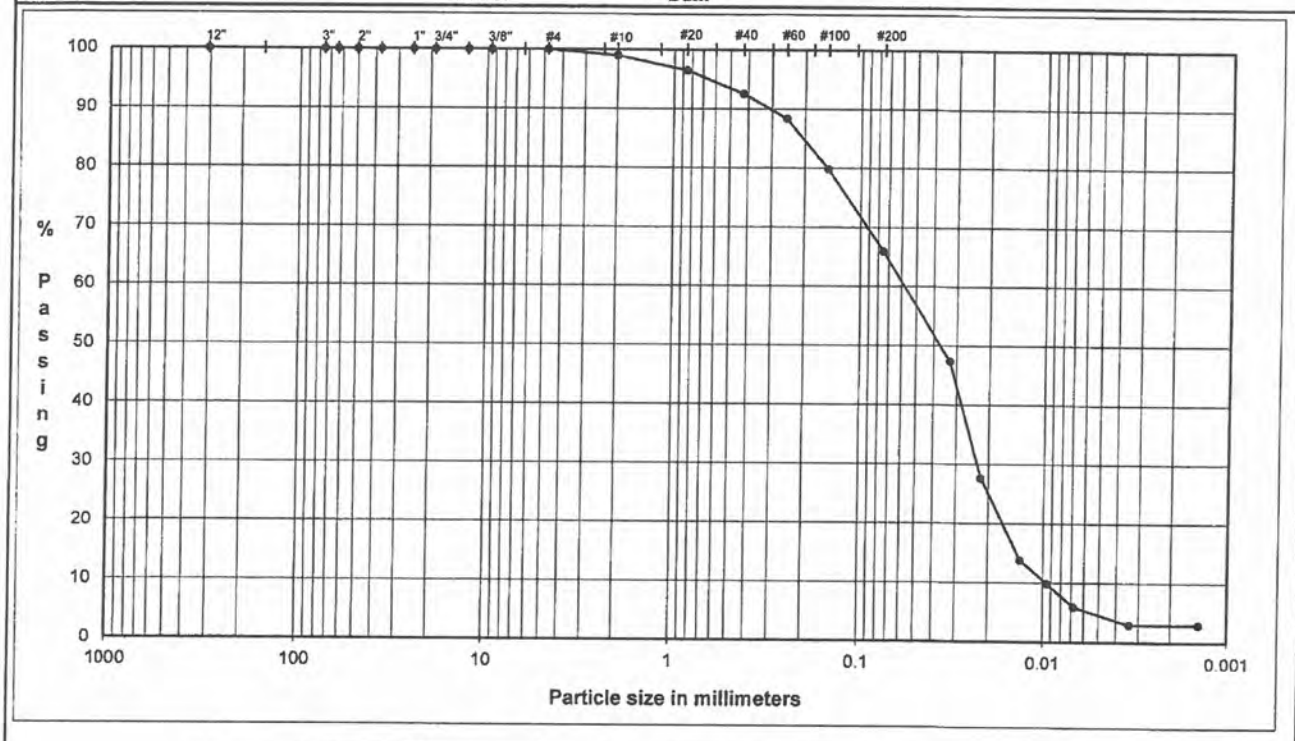
APRIL 2015

1520347

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: DOMINION/BREMO ASH POND CLOSURE/VA
SAMPLE ID: WP-02 Bulk-02 Depth: 1.5 - 2.0'
TYPE: Bulk



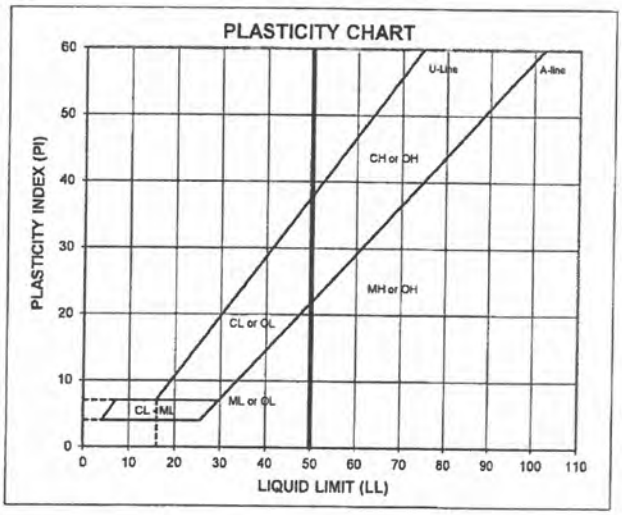
COBBLES	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.0
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.0
0.50"	12.7	100.0		
0.375"	9.5	100.0		
#4	4.8	100.0	Fine Gravel	0.0
#10	2.00	99.0	Coarse Sand	1.0
#20	0.85	96.5		
#40	0.43	92.6	Medium Sand	6.4
#60	0.25	88.4		
#100	0.15	79.8		
#200	0.075	65.9	Fine Sand	26.6

Hydrometer Analysis

(mm)	%Finer		
0.033	47.4		
0.022	27.7		
0.013	13.8	Fines	
0.0095	9.9	Silt or Clay	65.9
0.0068	5.9		
0.0034	3.0		
0.0014	3.0		



ATTERBERG LIMITS
Method -B (Dry preparation)

M_c	LL	PL	PI	LI
50.4				

LL (oven-dried)	
· 0.75 = ORGANIC (OL/OH)	

DESCRIPTION: FLY ASH - sandy SILT, fine to coarse; dark gray.

USCS: (ML)

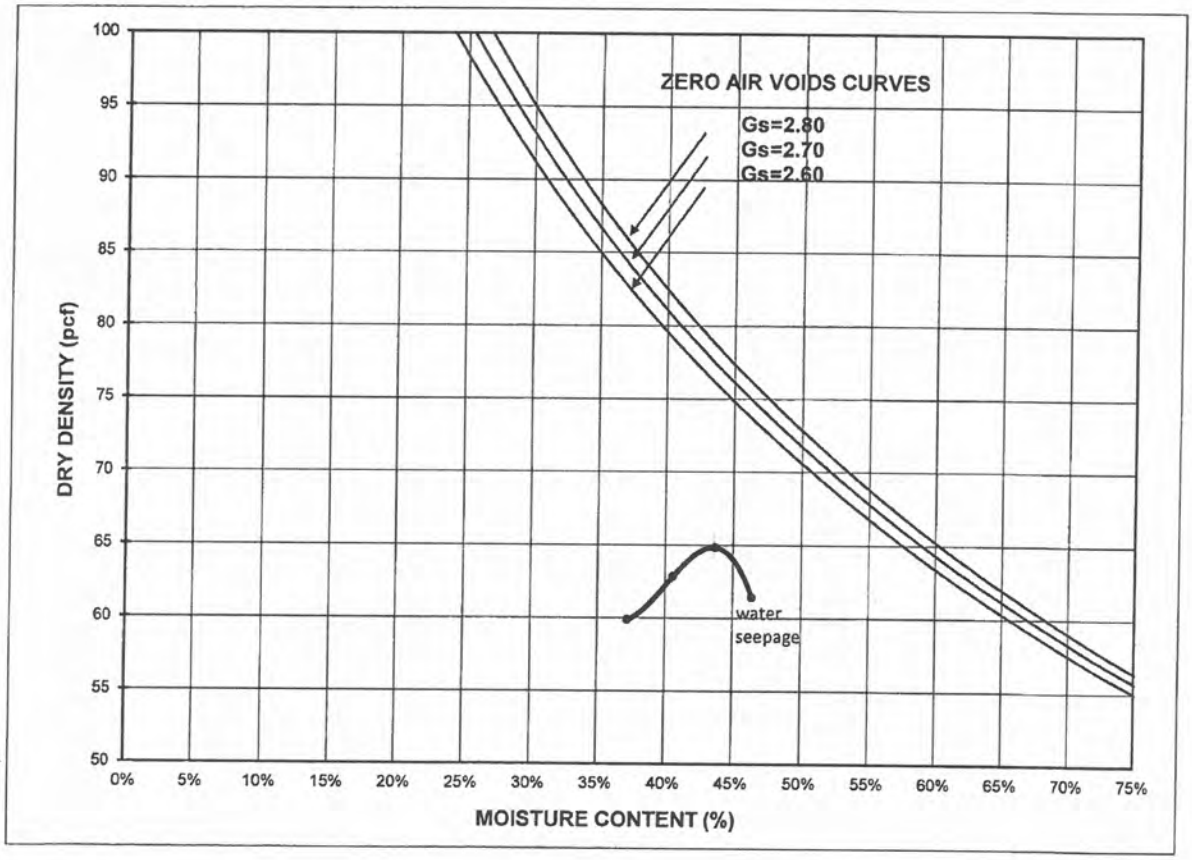
TECH	CG
DATE	4/16/15
CHECK	
REVIEW	
APPROVE	

Golder Associates Inc.

MOISTURE / DRY DENSITY CURVE
ASTM D 698 Method A

Mechanical	Standard	Moist Method

PROJECT NAME: DOMINION/BREMO ASH POND CLOSURE/VA
PROJECT NUMBER: 1520347
SAMPLE ID: EB-02 Bulk-01 DEPTH: - SAMPLE TYPE: Bulk



COMPACTION POINTS		
Specimen Number	Dry Density (pcf)	Moisture Content (%)
1	59.9	37.2%
2	62.9	40.6%
3	64.8	43.7%
4	61.4	46.4%

Maximum Dry Density (pcf)	64.9
Optimum Moisture (%)	43.6
Corrected Maximum Dry Density (pcf)	
Corrected Optimum Moisture (%)	
As-Received Moisture Content	46.3%
% Retained on # 4 sieve	
% Retained on 3/8" sieve	
% Retained on 3/4" sieve	

DESCRIPTION FLY ASH; gray.

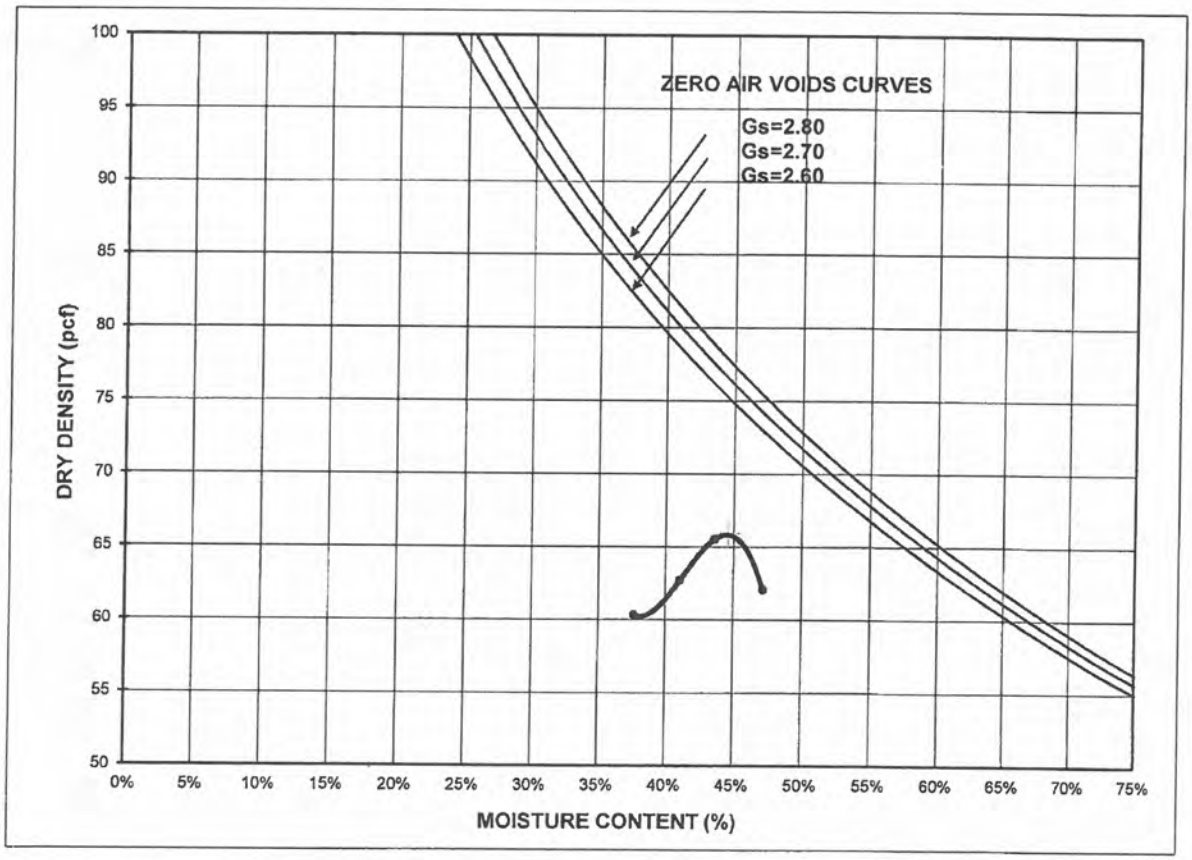
USCS -

CHECK
REVIEW
APPROVE

MOISTURE / DRY DENSITY CURVE
ASTM D 698 Method A

Mechanical	Standard	Moist Method

PROJECT NAME: DOMINION/BREMO ASH POND CLOSURE/VA
PROJECT NUMBER: 1520347
SAMPLE ID: NB-02 Bulk-01 DEPTH: 0.0-7.5' SAMPLE TYPE: Bulk



COMPACTION POINTS		
Specimen Number	Dry Density (pcf)	Moisture Content (%)
1	60.3	37.7%
2	62.7	41.1%
3	65.5	43.6%
4	62.1	47.2%

Maximum Dry Density (pcf)	65.9
Optimum Moisture (%)	44.6
Corrected Maximum Dry Density (pcf)	
Corrected Optimum Moisture (%)	
As-Received Moisture Content	47.3%
% Retained on # 4 sieve	
% Retained on 3/8" sieve	
% Retained on 3/4" sieve	

DESCRIPTION FLY ASH; gray.

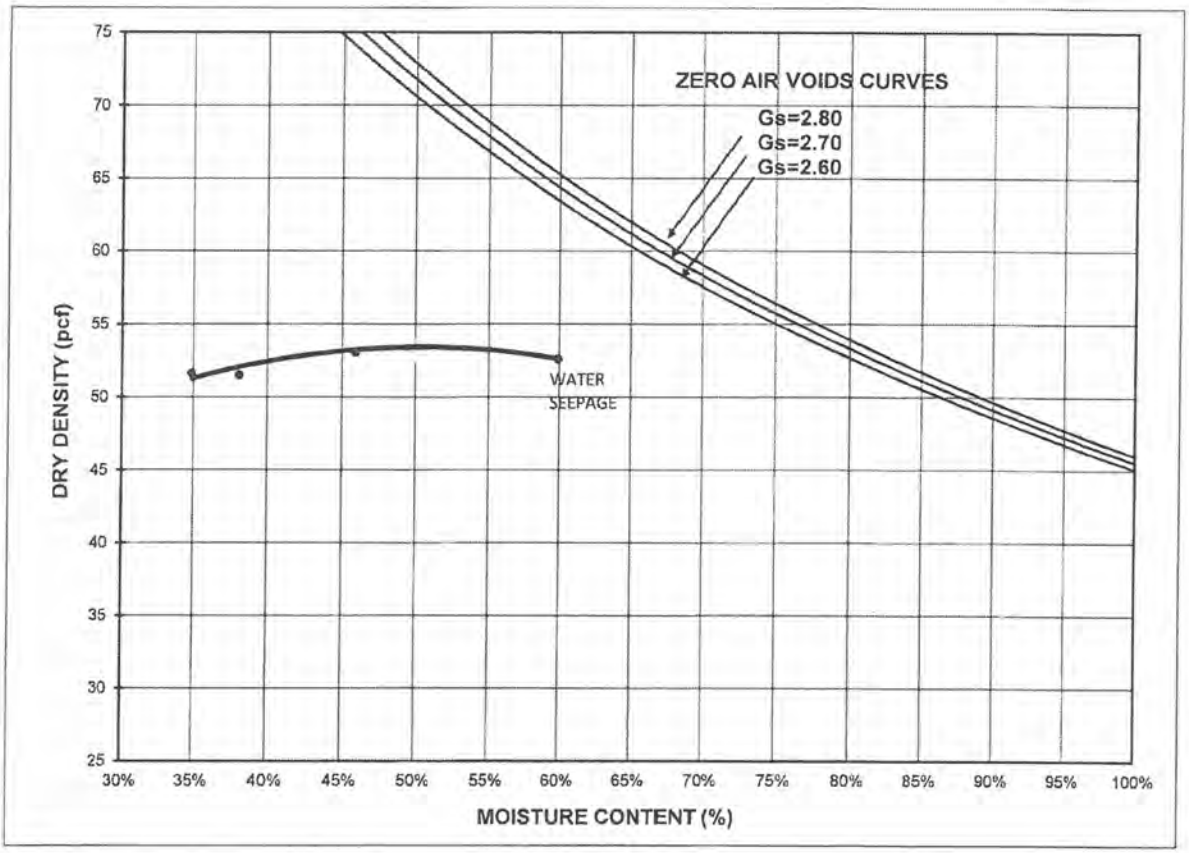
USCS -

CHECK
REVIEW
APPROVE

MOISTURE / DRY DENSITY CURVE
ASTM D 698 Method A

Mechanical	Standard	Moist Method

PROJECT NAME: DOMINION/BREMO ASH POND CLOSURE/VA
PROJECT NUMBER: 1520347
SAMPLE ID: WP-01 Bulk-01 DEPTH: 0.5 - 2.0' SAMPLE TYPE: Bulk



COMPACTION POINTS		
Specimen Number	Dry Density (pcf)	Moisture Content (%)
1	51.6	34.9%
2	51.5	38.2%
3	53.1	45.9%
4	52.6	59.9%

Maximum Dry Density (pcf)	53.2
Optimum Moisture (%)	50.0
Corrected Maximum Dry Density (pcf)	
Corrected Optimum Moisture (%)	
As-Received Moisture Content	87.7%
% Retained on # 4 sieve	
% Retained on 3/8" sieve	
% Retained on 3/4" sieve	

DESCRIPTION FLY ASH; gray.

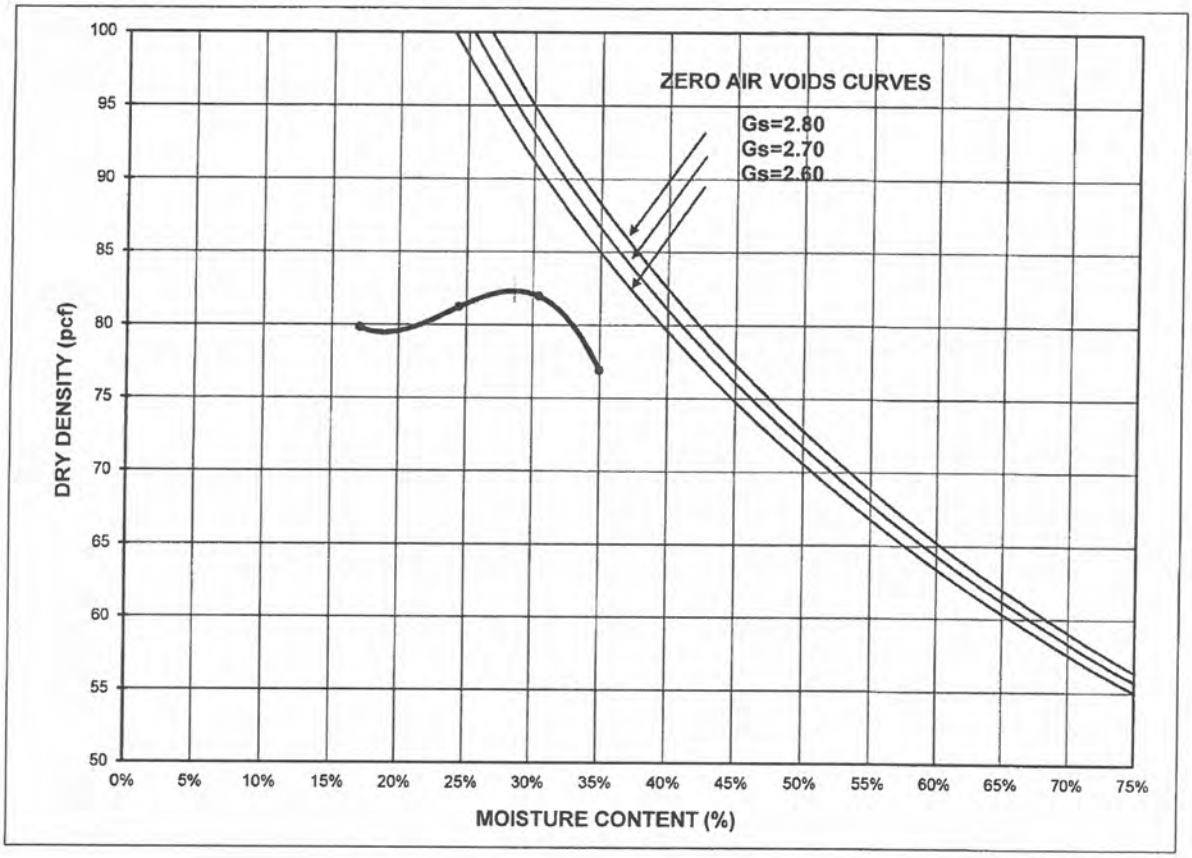
USCS -

CHECK
REVIEW
APPROVE

MOISTURE / DRY DENSITY CURVE
ASTM D 698 Method A

Mechanical	Standard	Moist Method

PROJECT NAME: DOMINION/BREMO ASH POND CLOSURE/VA
PROJECT NUMBER: 1520347
SAMPLE ID: WP-02 Bulk-01 DEPTH: 0.5 - 1.5' SAMPLE TYPE: Bulk



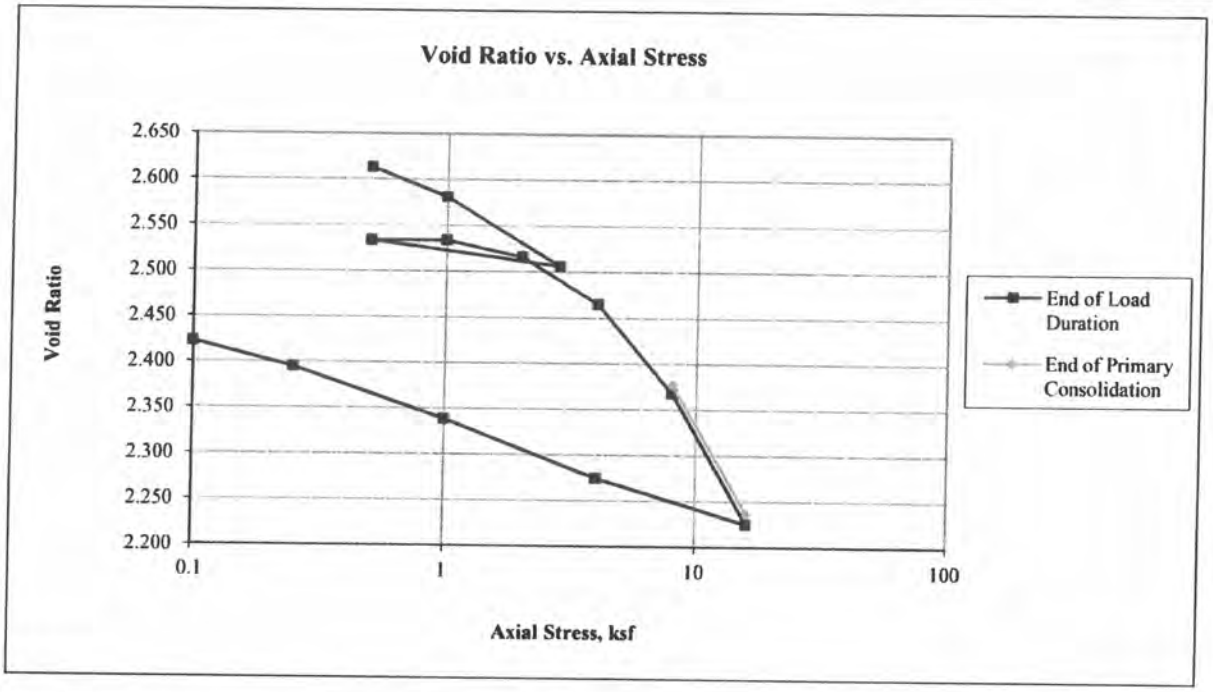
COMPACTION POINTS		
Specimen Number	Dry Density (pcf)	Moisture Content (%)
1	79.8	17.1%
2	81.2	24.4%
3	82.0	30.5%
4	76.9	35.0%

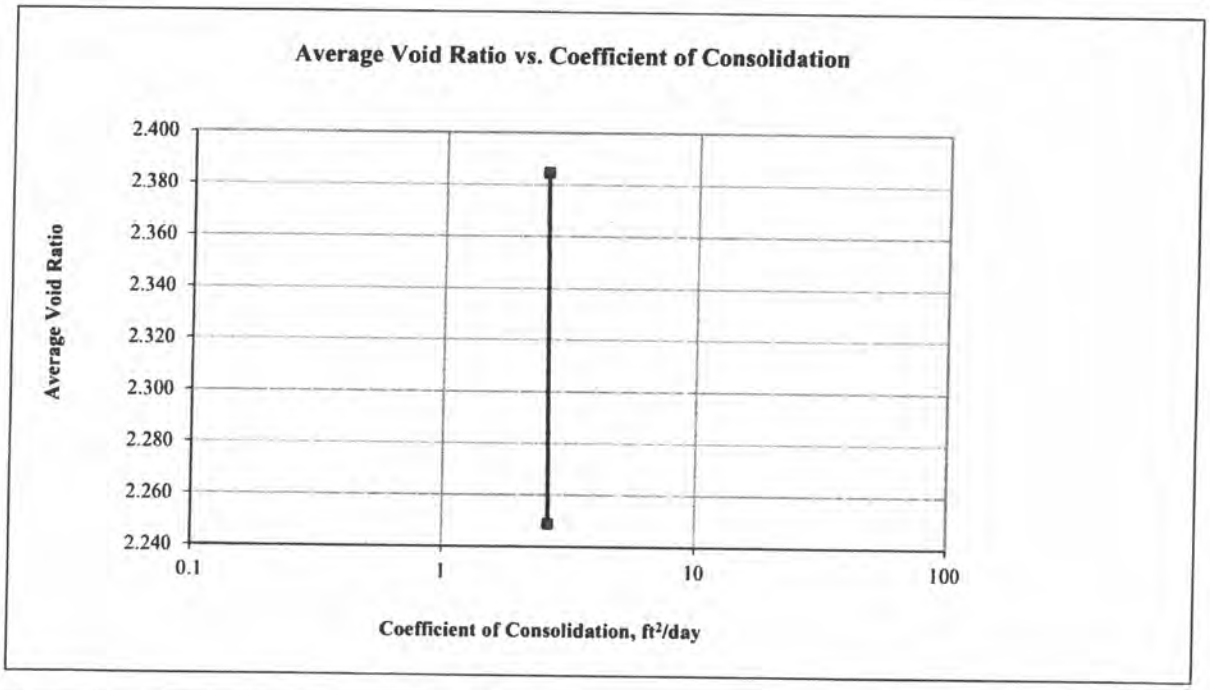
Maximum Dry Density (pcf)	82.4
Optimum Moisture (%)	28.6
Corrected Maximum Dry Density (pcf)	
Corrected Optimum Moisture (%)	
As-Received Moisture Content	42.1%
% Retained on # 4 sieve	
% Retained on 3/8" sieve	
% Retained on 3/4" sieve	

DESCRIPTION FLY ASH; gray.

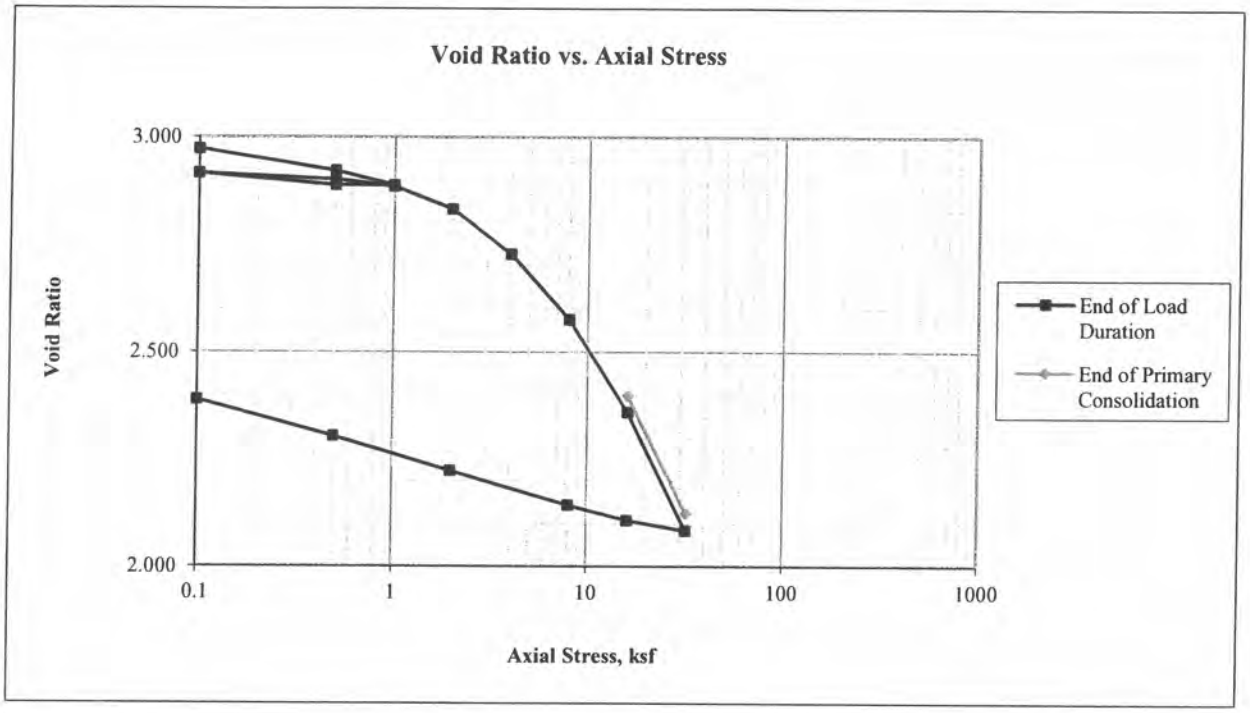
USCS -

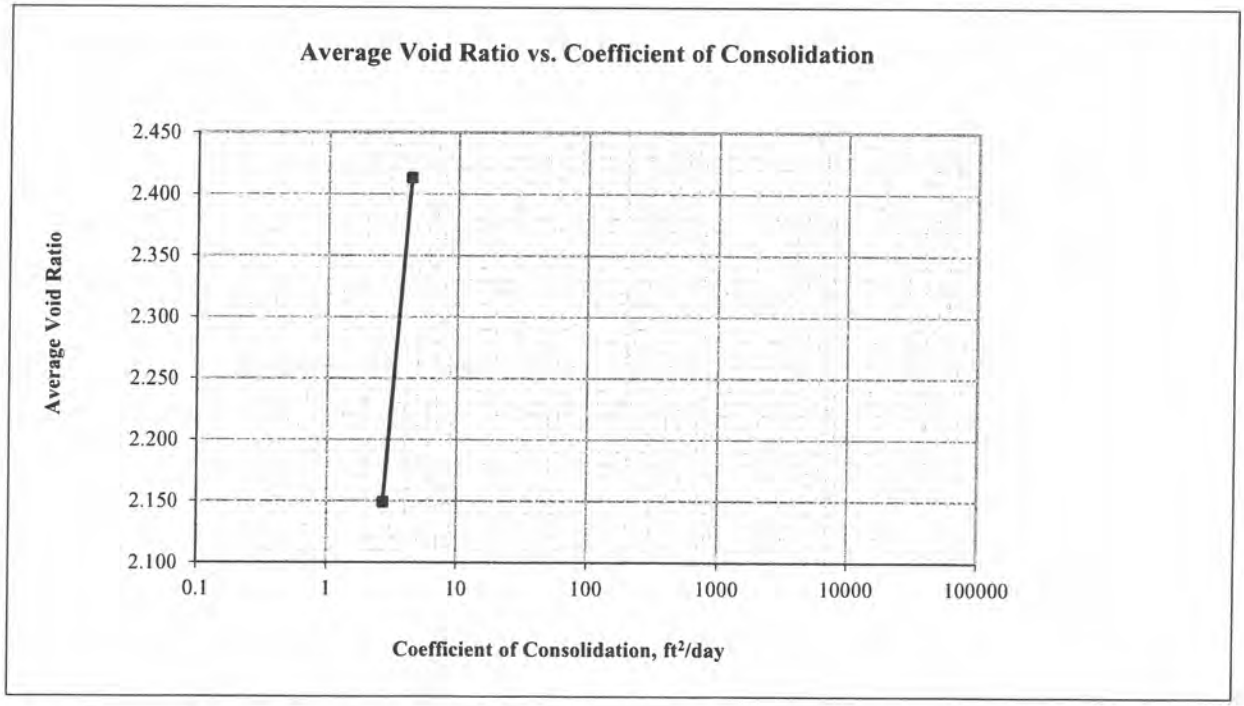
CHECK
REVIEW
APPROVE



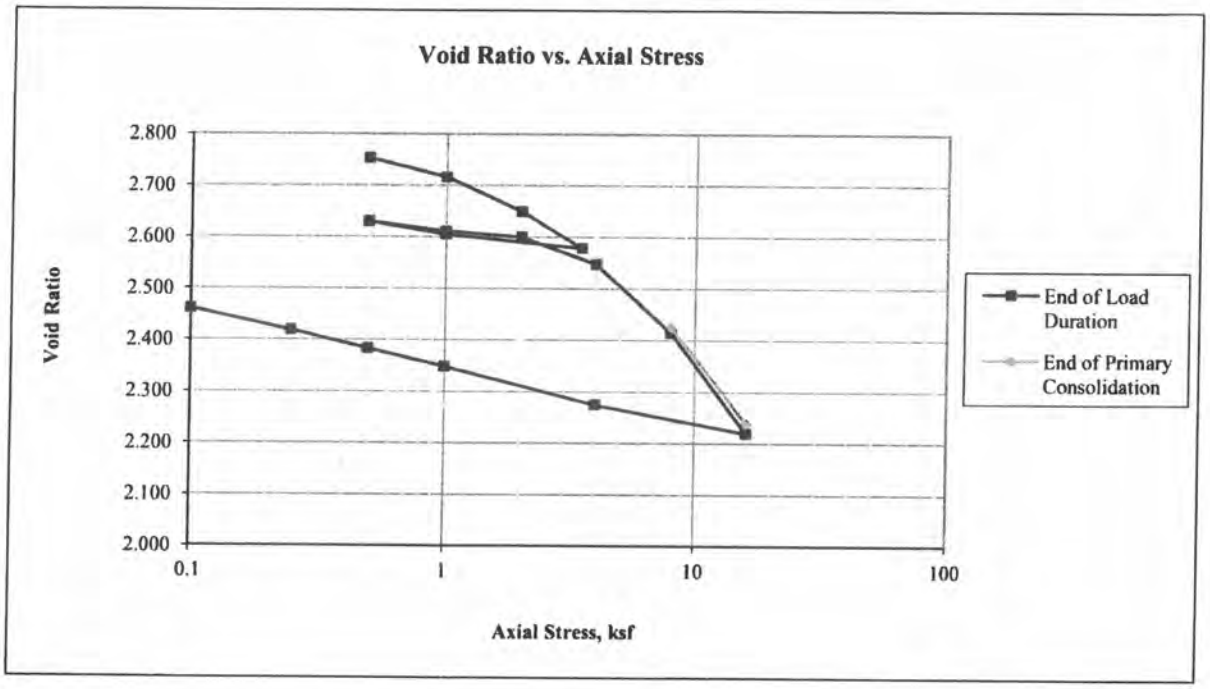


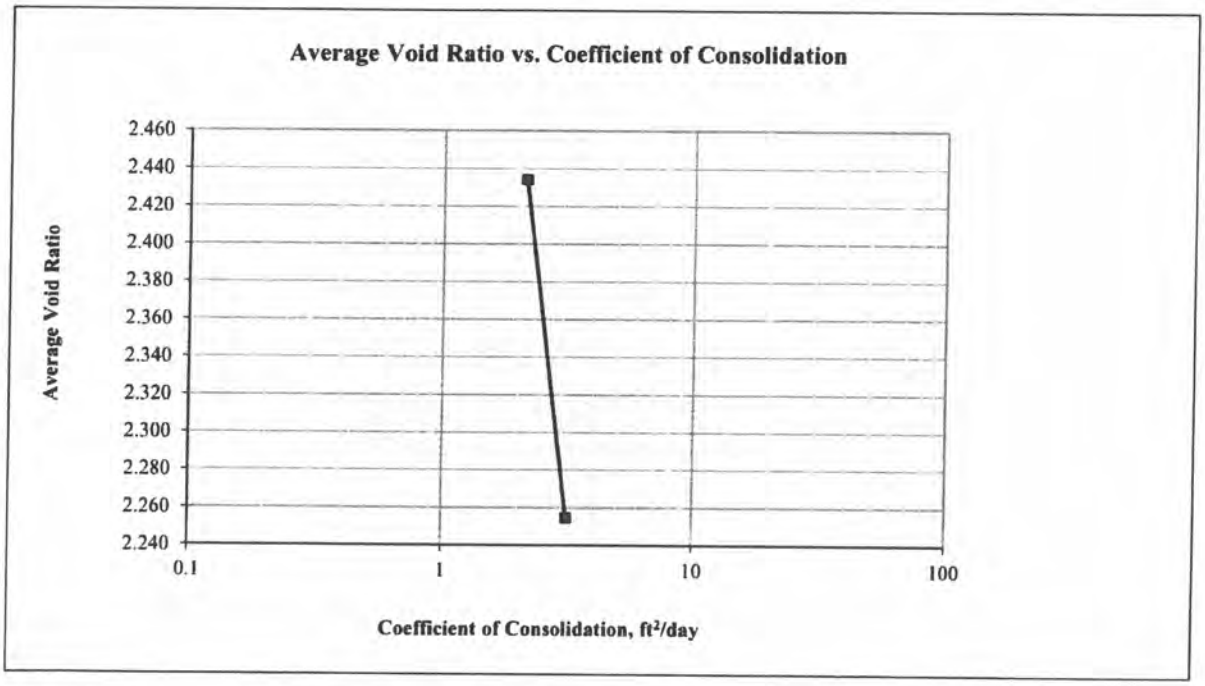
Golder Associates Inc. **Atlanta, Georgia**	**Title:** **ASTM D2435** **ONE-DIMENSIONAL CONSOLIDATION TEST REPORT** **CONSOLIDATION PLOTS**				
Job Short Title: **DOMINION/BREMO ASH POND CLOSURE/VA**					
Sample: **EB-2 UD-01 33.0-35.0'**	**Technician:** **TH**	**Reviewed:**	**Start Date:** **4/6/2015**	**Job Number:** **1520347**	**Figure:** **2**



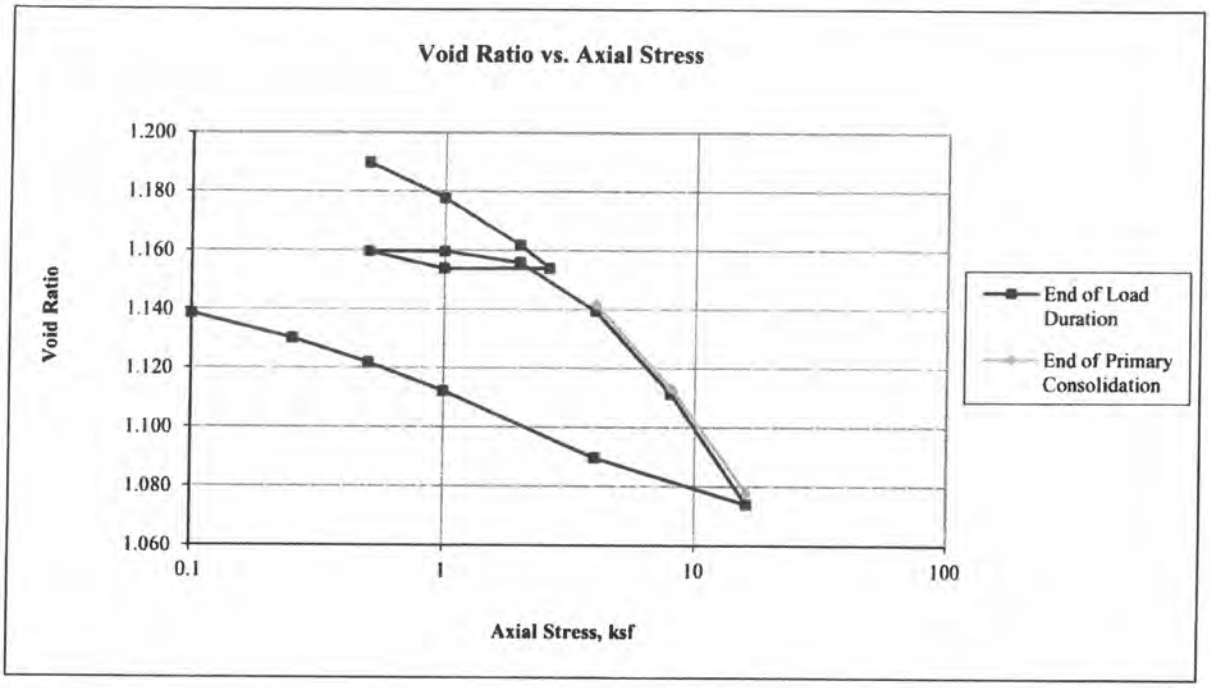


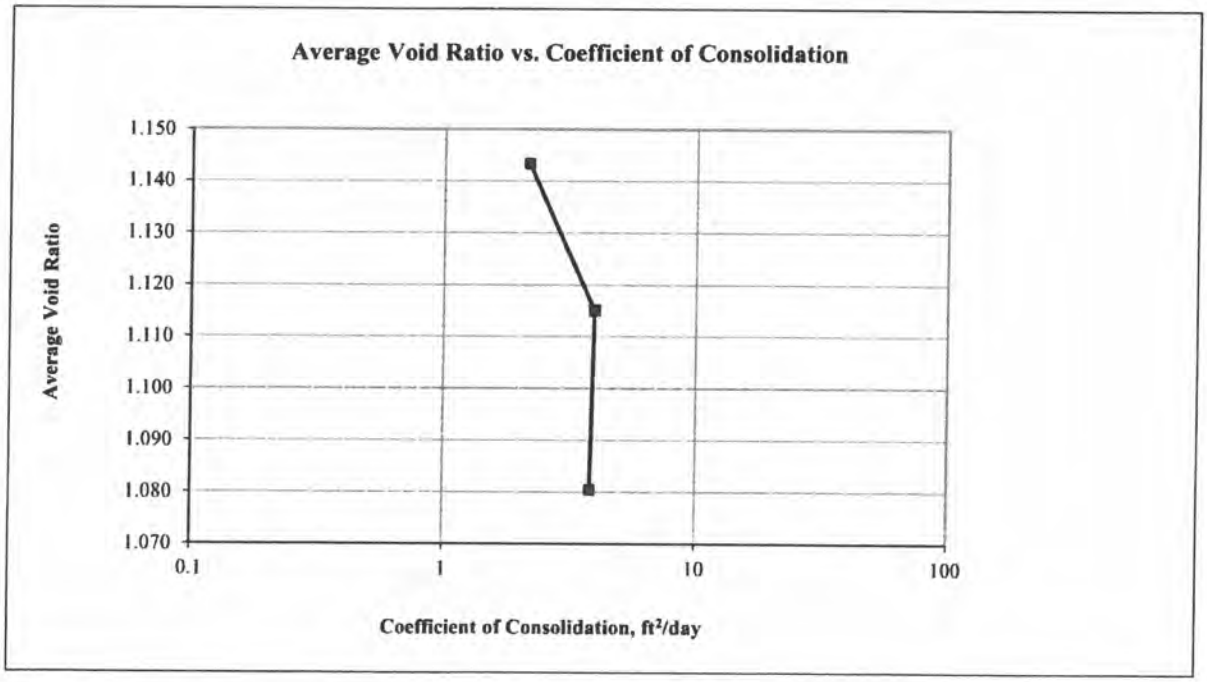
Golder Associates Inc. **Atlanta, Georgia**	**Title:** **ASTM D2435** **ONE-DIMENSIONAL CONSOLIDATION TEST REPORT** **CONSOLIDATION PLOTS**				
Job Short Title: **DOMINION/BREMO ASH POND CLOSURE/VA**					
Sample: **EB-02 UD-02 43-45'**	**Technician:** **PWM/TH**	**Reviewed:**	**Start Date:** **4/29/2015**	**Job Number:** **1520347**	**Figure:** **2**



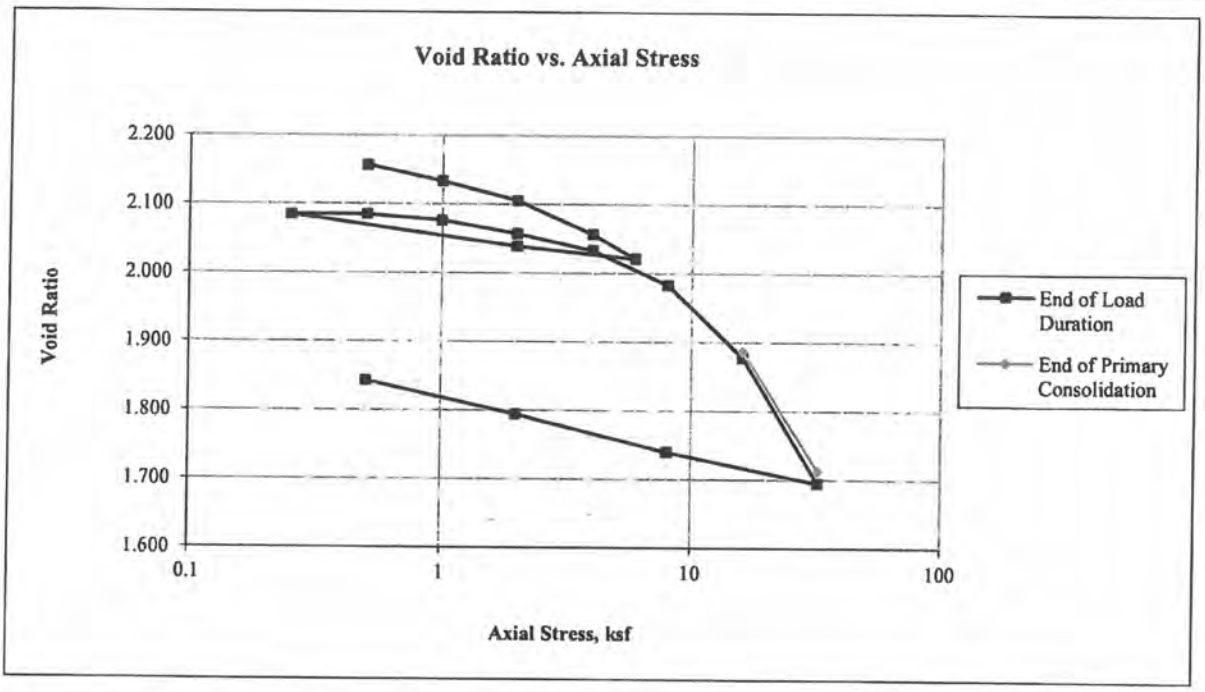


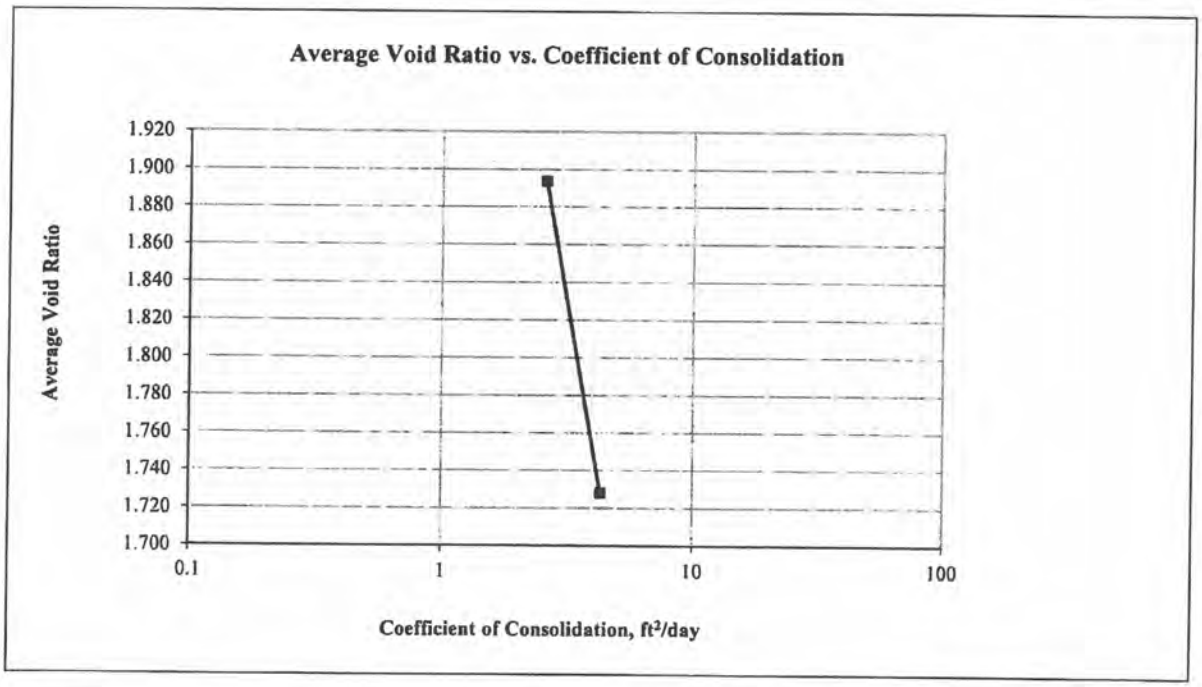
Golder Associates Inc. **Atlanta, Georgia**	**Title:** **ASTM D2435** **ONE-DIMENSIONAL CONSOLIDATION TEST REPORT** **CONSOLIDATION PLOTS**				
Job Short Title: **DOMINION/BREMO ASH POND CLOSURE/VA**					
Sample: **EB-02 UD-02 43.0-45.0'**	**Technician:** **TH**	**Reviewed:**	**Start Date:** **4/7/2015**	**Job Number:** **1520347**	**Figure:** **2**



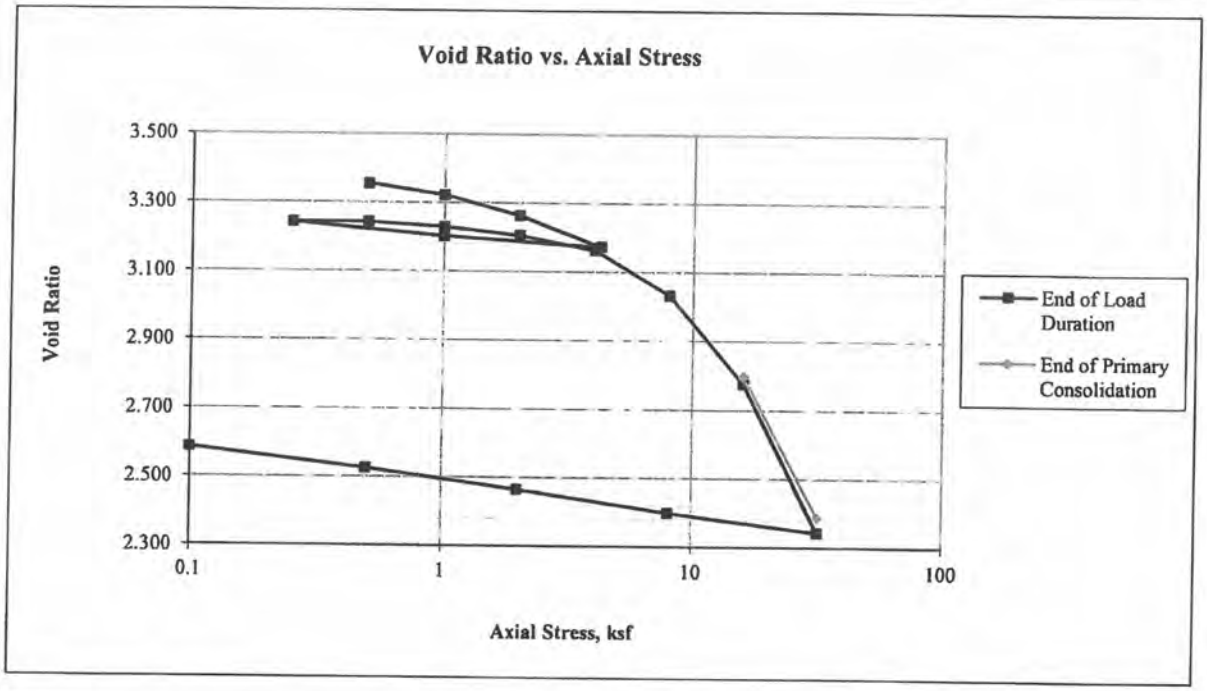


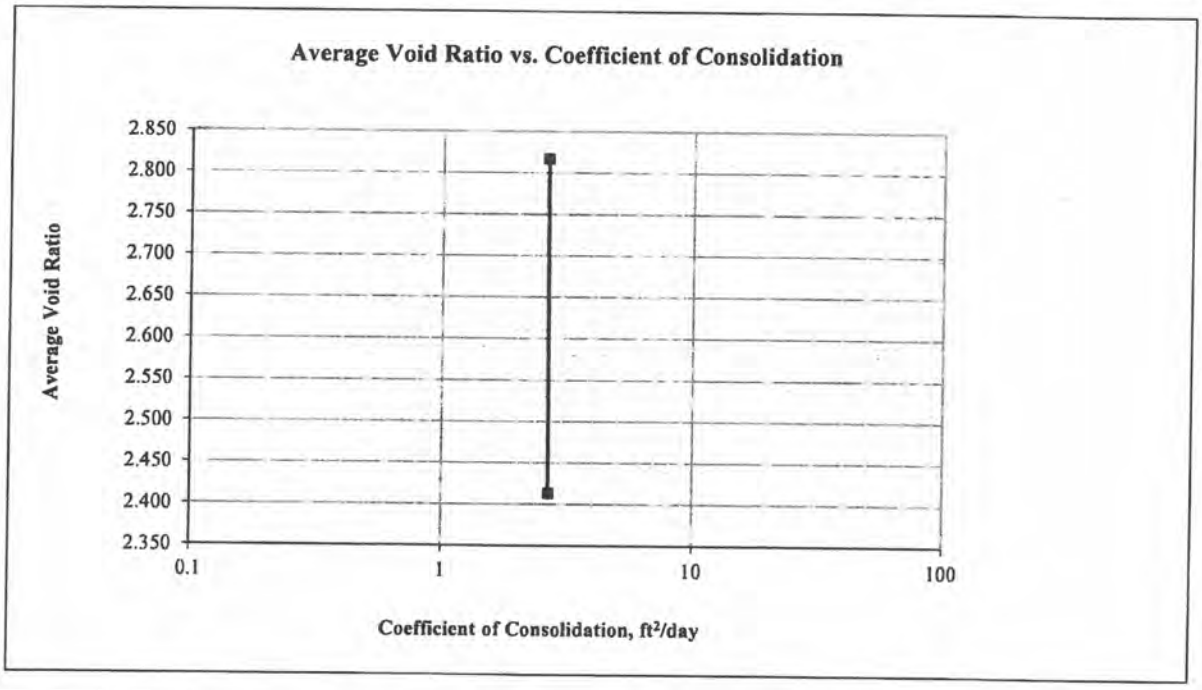
Golder Associates Inc. **Atlanta, Georgia**	**Title:** **ASTM D2435** **ONE-DIMENSIONAL CONSOLIDATION TEST REPORT** **CONSOLIDATION PLOTS**				
Job Short Title: **DOMINION/BREMO ASH POND CLOSURE/VA**					
Sample: **NB-02 UD-01 25.5-27.5'**	**Technician:** **TH**	**Reviewed:**	**Start Date:** **4/9/2015**	**Job Number:** **1520347**	**Figure:** **2**





Golder Associates Inc. **Atlanta, Georgia**	**Title:** **ASTM D2435** **ONE-DIMENSIONAL CONSOLIDATION TEST REPORT** **CONSOLIDATION PLOTS**				
Job Short Title: **DOMINION/BREMO ASH POND CLOSURE/VA**					
Sample: **NB-02 UD-03 68.5-70.5'**	**Technician:** **TH**	**Reviewed:**	**Start Date:** **4/12/2015**	**Job Number:** **1520347**	**Figure:** **2**





Golder Associates Inc. **Atlanta, Georgia**	**Title:** **ASTM D2435** **ONE-DIMENSIONAL CONSOLIDATION TEST REPORT** **CONSOLIDATION PLOTS**				
Job Short Title: **DOMINION/BREMO ASH POND CLOSURE/VA**					
Sample: **NB-02 UD-02 53.5-55.5'**	**Technician:** **TH**	**Reviewed:**	**Start Date:** **4/9/2015**	**Job Number:** **1520347**	**Figure:** **2**

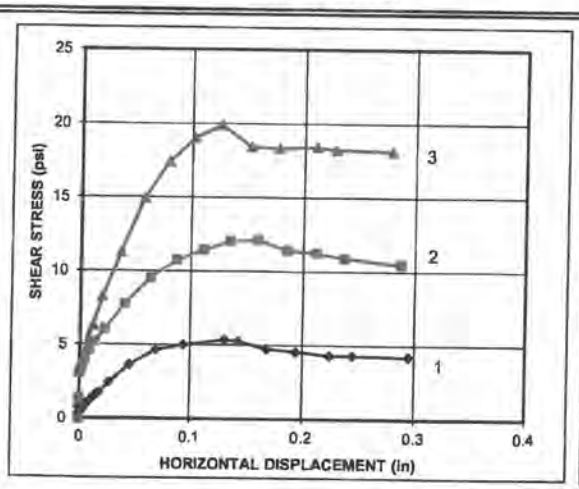
APRIL 2014

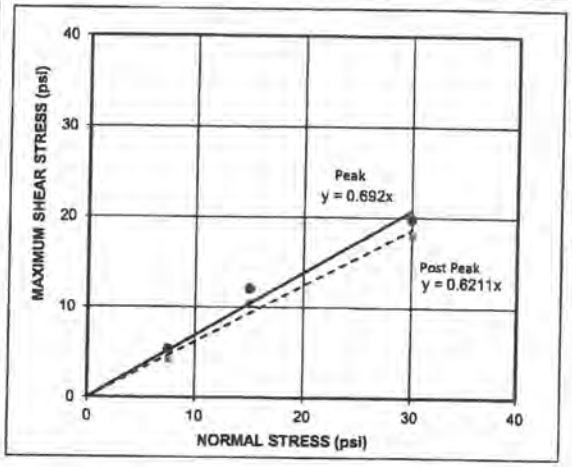
1520347

DIRECT SHEAR

ASTM D 3080

PROJECT NAME: DOMINION/BREMO ASH POND CLOSURE/VA
PROJECT NUMBER: 1520347
SAMPLE ID: EB-02 UD-01 **Depth:** 33.0-35.9'





Peak		
φ =	34.7	°
C=	0.0	psi

Post Peak		
φ =	31.8	°
C=	0.0	psi

SPECIMEN 1	
Normal Stress (psi)	7.5
t50 (minutes)	0.16
SPEED mm/min	0.036
Sample Diameter (in)	2.50
Moisture Content (%)	116.1
Wet Density (pcf)	48.4
Dry Density (pcf)	22.4
Void Ratio	4.854
Saturation (%)	50

HORIZONTAL DISPLACEMENT (in)	SHEAR STRESS (psi)
0.000	0.0
0.000	0.3
0.003	0.6
0.000	0.8
0.007	0.9
0.009	1.1
0.013	1.4
0.018	1.8
0.027	2.5
0.046	3.7
0.070	4.7
0.094	5.0
0.132	5.4
0.144	5.3
0.169	4.8
0.195	4.6
0.225	4.3
0.245	4.3
0.295	4.3

5.4
Max Shear Stress

SPECIMEN 2	
Normal Stress (psi)	15
t50 (minutes)	0.23
SPEED mm/min	0.036
Sample Diameter (in)	2.50
Moisture Content (%)	116.1
Wet Density (pcf)	52.6
Dry Density (pcf)	24.4
Void Ratio	4.381
Saturation (%)	56

HORIZONTAL DISPLACEMENT (in)	SHEAR STRESS (psi)
0.000	0.0
0.000	1.4
0.000	3.1
0.002	3.3
0.004	3.7
0.005	3.9
0.010	4.6
0.014	5.2
0.023	6.1
0.041	7.8
0.064	9.5
0.087	10.7
0.112	11.4
0.136	12.0
0.161	12.1
0.187	11.4
0.212	11.2
0.237	10.9
0.288	10.5

12.1
Max Shear Stress

SPECIMEN 3	
Normal Stress (psi)	30
t50 (minutes)	0.23
SPEED mm/min	0.036
Sample Diameter (in)	2.50
Moisture Content (%)	116.1
Wet Density (pcf)	50.3
Dry Density (pcf)	23.3
Void Ratio	4.630
Saturation (%)	53

HORIZONTAL DISPLACEMENT (in)	SHEAR STRESS (psi)
0.000	0.0
0.000	1.3
0.000	3.2
0.002	3.7
0.003	4.2
0.005	4.5
0.008	5.5
0.013	6.3
0.020	8.3
0.037	11.2
0.058	14.9
0.080	17.4
0.103	19.0
0.127	19.9
0.153	18.4
0.179	18.3
0.211	18.4
0.229	18.2
0.279	18.2

19.9
Max Shear Stress

REMARKS Sample run inundated.

DESCRIPTION FLY ASH - sandy SILT, fine to coarse sand; gray.

USCS (MH)

TECH	TH
DATE	4/14/15
CHECK	CWM
REVIEW	
APROVE	JBm

Golder Associates Inc.

Boring or Test Pit: NB-2	Boring or Test Pit:	Boring or Test Pit:
Sample: UD-02	Sample:	Sample:
Depth: 53.5-55.5 ft	Depth:	Depth:
Point No.: 1	Point No.:	Point No.:

Initial								
Length =	6.132	in	Length =	5.883		Length =	5.713	
Diameter =	2.787	in	Diameter =	2.724		Diameter =	2.764	
Wet Mass =	2.059	lb	Wet Mass =			Wet Mass =		
Area =	6.100	in^2	Area =			Area =		
Volume =	37.408	in^3	Volume =			Volume =		
Specific Gravity =	2.08	(ASTM D854)	Specific Gravity =			Specific Gravity =		
Dry Mass of Solids =	1.147	lb	Dry Mass of Solids =			Dry Mass of Solids =		
Moisture Content =	79.4%		Moisture Content =			Moisture Content =		
Wet Unit Weight =	95.1	pcf	Wet Unit Weight =			Wet Unit Weight =		
Dry Unit Weight =	53.0	pcf	Dry Unit Weight =			Dry Unit Weight =		
Void Ratio =	1.45		Void Ratio =			Void Ratio =		
Percent Saturation =	114%		Percent Saturation =			Percent Saturation =		

After Consolidation			After Consolidation			After Consolidation		
Length =	5.883	in	Length =	5.713	in	Length =	5.573	in
Diameter =	2.724	in	Diameter =	2.764	in	Diameter =	2.799	in
Area =	5.827		Area =	6.000		Area =	6.151	in^2 (Method B)
Volume =	34.280		Volume =	34.280		Volume =	34.280	in^3
Moisture Content =			Moisture Content =			Moisture Content =	59.7%	
Wet Unit Weight =			Wet Unit Weight =			Wet Unit Weight =	92.3	pcf
Dry Unit Weight =			Dry Unit Weight =			Dry Unit Weight =	57.8	pcf
Void Ratio =			Void Ratio =			Void Ratio =	1.24	
Percent Saturation =			Percent Saturation =			Percent Saturation =	100%	

B Parameter =	1.00		B Parameter =	--		B Parameter =	--	
Shear Rate =	0.093%	/min.	Shear Rate =	0.094%	/min.	Shear Rate =	0.098%	/min.
t_{50} =	0.2	min.	t_{50} =	0.2	min.	t_{50} =	0.1	min.
Strain at Failure =	2.9%		Strain at Failure =	5.4%		Strain at Failure =	12.4%	

Cell Pressure =	76.9	psi	Cell Pressure =	83.8	psi	Cell Pressure =	97.6	psi
Back Pressure =	70.0	psi	Back Pressure =	70.0	psi	Back Pressure =	70.0	psi
Confining Pressure =	6.9	psi	Confining Pressure =	13.8	psi	Confining Pressure =	27.6	psi

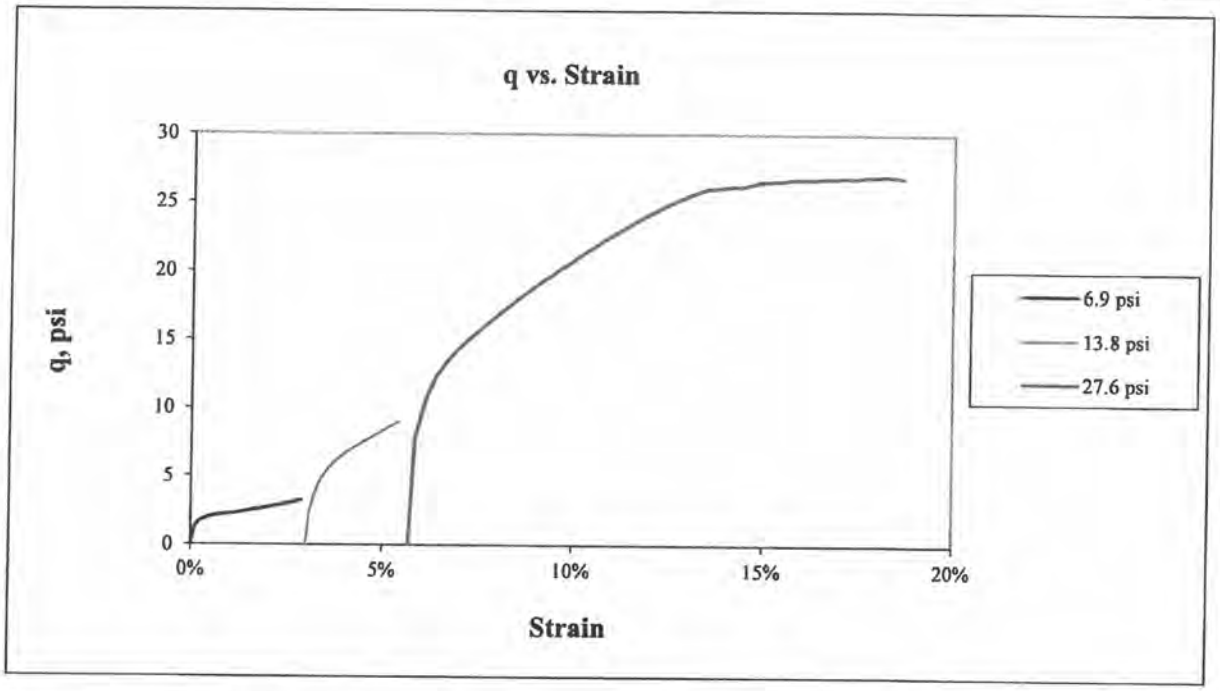
Notes: Sample description: (SM) FLY ASH - fine to coarse SAND and SILT; gray.

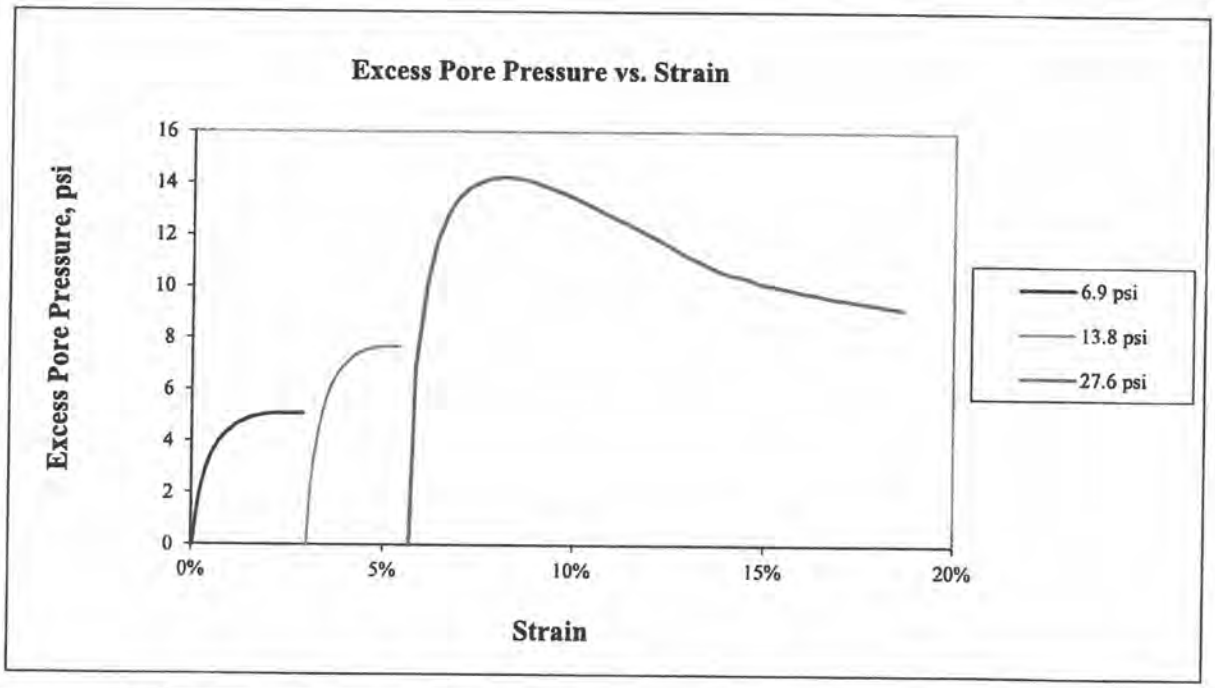
Atterberg limits: LL = - PL = - PI = - (ASTM D4318)

Percent finer: 3/4 in. = 100.0% No. 4 = 100.0% No. 200 = 48.5% (ASTM D422, refer to separate report for gradation curve)

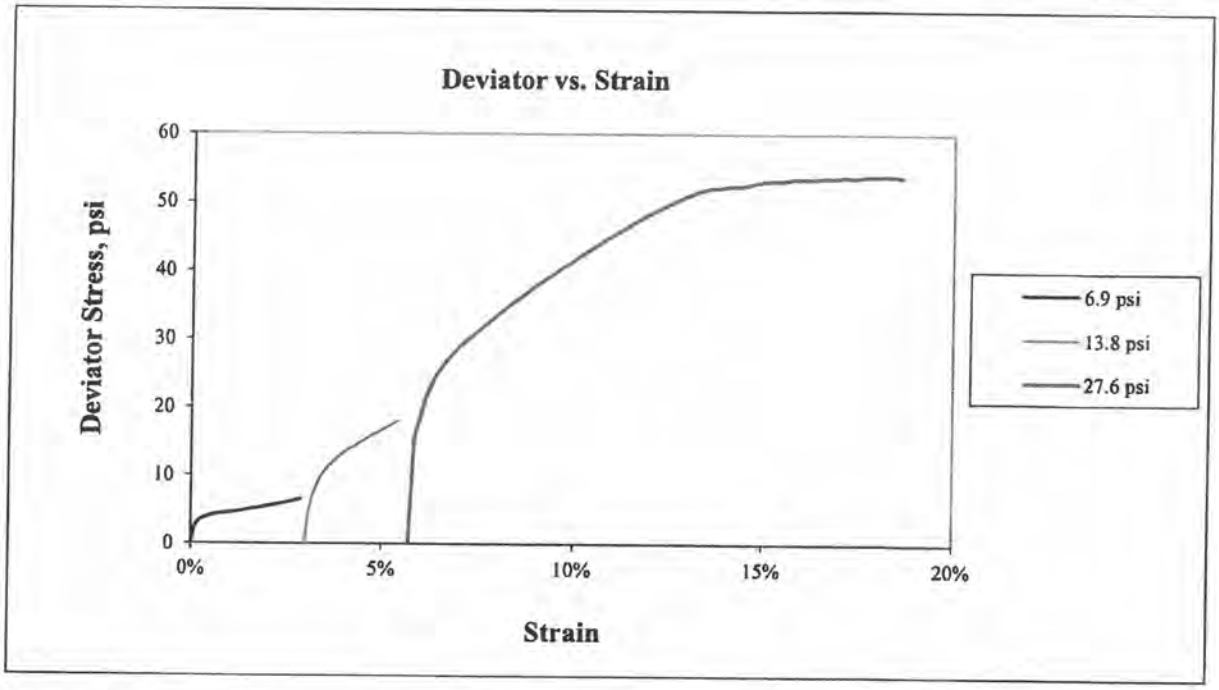
Specimen type:	X	Intact		Reconstituted
Moisture from:		Cuttings	X	Entire specimen
Saturation method:	X	Wet		Dry
Failure criterion:	X	$(\sigma'_1/\sigma'_3)_{max}$		$(\sigma'_1-\sigma'_3)_{max}$ ____ % strain
Membrane effect:	X	Corrected		Not Corrected

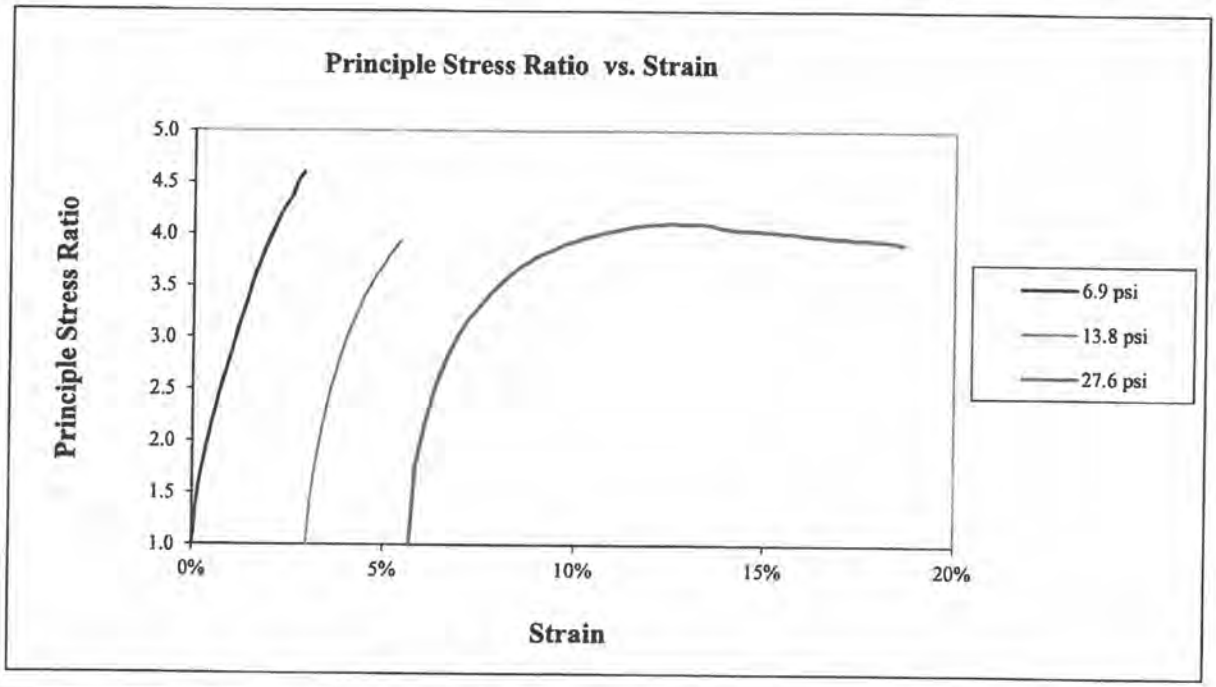
Golder Associates Inc. **Atlanta, Georgia**	**Title:** **MODIFIED (Multi-Stage) - ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **SAMPLE AND TEST DATA**				
Job Short Title: **DOMINION/BREMO ASH POND CLOSURE/VA**					
Sample: NB-2 UD-02 53.5-55.5'	**Technician:** SDM/TH **Check:** PWM	**Reviewed:** **Approved:**	**Start Date:** 4/21/2015	**Job Number:** 1520347	**Figure:** 1



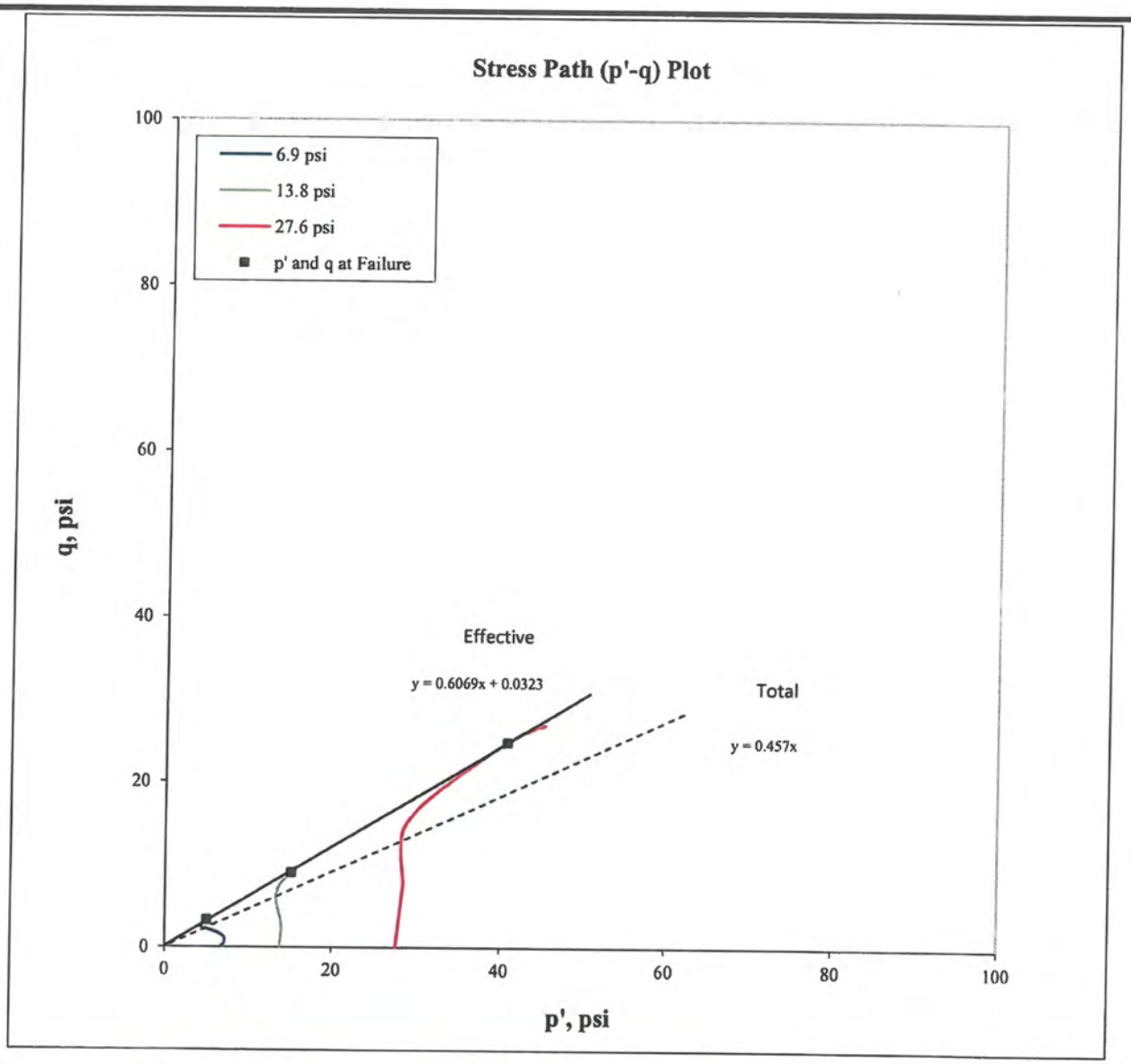


Golder Associates Inc. **Atlanta, Georgia**	**Title:** **MODIFIED (Multi-Stage) - ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **q AND EXCESS PORE PRESSURE PLOTS**				
Job Short Title: **DOMINION/BREMO ASH POND CLOSURE/VA**					
Sample: **NB-2 UD-02 53.5-55.5'**	**Technician:** **SDM/TH** **Check:** IWM	**Reviewed:** **Approved:**	**Start Date:** **4/21/2015**	**Job Number:** **1520347**	**Figure:** **2**





Golder Associates Inc. **Atlanta, Georgia**	**Title:** **MODIFIED (Multi-Stage) - ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **q AND EXCESS PORE PRESSURE PLOTS**				
Job Short Title: **DOMINION/BREMO ASH POND CLOSURE/VA**					
Sample: **NB-2 UD-02 53.5-55.5'**	**Technician:** **SDM/TH** **Check:** MWM	**Reviewed:** **Approved:**	**Start Date:** **4/21/2015**	**Job Number:** **1520347**	**Figure:** **3**



Confining Pressure (psi)	p at failure (psi)	p' at failure (psi)	q at failure (psi)
6.9	10.2	5.1	3.3
13.8	22.8	15.2	9.0
27.6	52.4	40.8	24.8

Effective

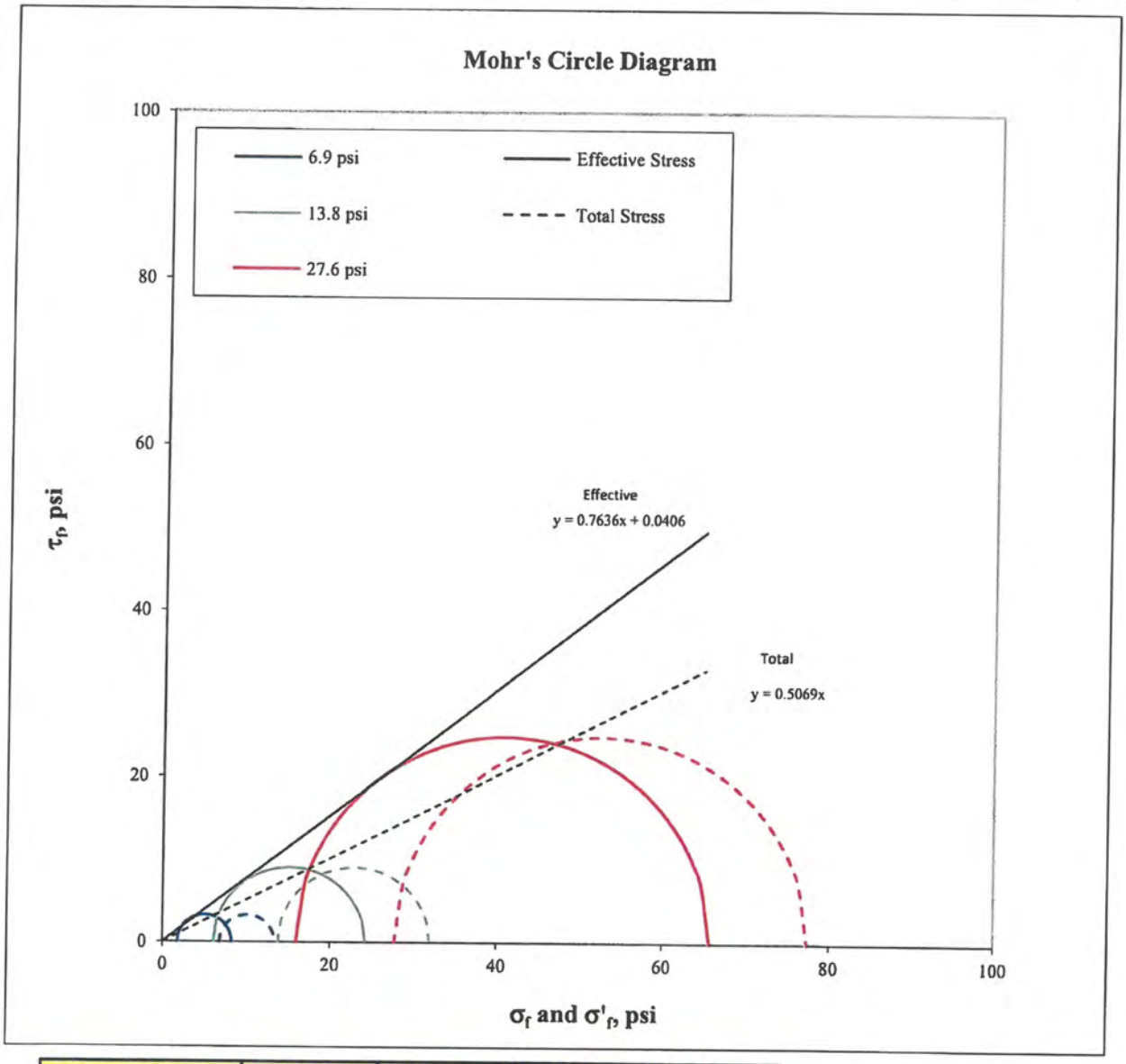
α' =	31.3	degree
a' =	0.0	psi

Total

α =	24.3	degree
a =	0.0	psi

Note: The laboratory testing relates only to the sample tested. GAI neither accepts responsibility for nor makes claims to the final use and purpose of the material.

Golder Associates Inc. **Atlanta, Georgia**	**Title:** **MODIFIED (Multi-Stage) - ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **STRESS PATH PLOT**				
Job Short Title: **DOMINION/BREMO ASH POND CLOSURE/VA**					
Sample: **NB-2 UD-02 53.5-55.5'**	**Technician:** **SDM/TH** **Check:**	**Reviewed:** **Approved:**	**Start Date:** **4/21/2015**	**Job Number:** **1520347**	**Figure:** **4**



Confining Pressure (psi)	σ'_1 at failure (psi)	σ'_3 at failure (psi)	σ_1 at failure (psi)	σ_3 at failure (psi)
6.9	8.3	1.8	13.4	6.9
13.8	24.2	6.1	31.8	13.8
27.6	65.6	15.9	77.3	27.6

Effective

ϕ' = 37.4 degree

c' = 0.0 psi

Total

ϕ = 26.9 degree

c = 0.0 psi

Note: The laboratory testing relates only to the sample tested. GAI neither accepts responsibility for nor makes claims to the final use and purpose of the material.

Golder Associates Inc. Atlanta, Georgia	Title: MODIFIED (Multi-Stage) - ASTM D4767 CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT MOHR'S CIRCLE DIAGRAM				
Job Short Title: DOMINION/BREMO ASH POND CLOSURE/VA					
Sample: NB-2 UD-02 53.5-55.5'	Technician: SDM/TH Check:	Reviewed: Approved:	Start Date: 4/21/2015	Job Number: 1520347	Figure: 5

Golder Associates Inc. **Atlanta, Georgia**	**Title:** **MODIFIED (Multi-Stage) - ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **SPECIMEN PHOTOGRAPH - Single Specimen**				
Job Short Title: **DOMINION/BREMO ASH POND CLOSURE/VA**					
Sample: **NB-2 UD-02 53.5-55.5'**	**Technician:** **SDM/TH** **Check:**	**Reviewed:** **Approved:**	**Start Date:** **4/21/2015**	**Job Number:** **1520347**	**Figure:** **6**

SUMMARY RESULTS - NATURAL SOILS
DOMINION BREMO POWER STATION CCR POND CLOSURE
SUMMARY OF SOIL DATA

Sample Identification	Sample Type	Sample Depth	Soil Classi-fication	Natural Moisture %	Atterberg Limits				Grain Size Distribution			Compaction		pH Soil	Gs	Unit Weight		Permeability (cm/sec)	Soil Resistivity		Additional Tests Conducted (See Notes)
					L.L.	P.L.	P.I.	L.I.	% Finer No. 4 Sieve	% Finer No. 200 Sieve	% Finer .005 mm	Maximum Dry Density (lb/cuft)	Optimum Moisture %			Moisture %	Dry (pcf)		Moisture (%)	Minimum (ohms-cm)	
EB-01A S-10	Jar	48.5-50.6'		26.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EB-04 S-4	Jar/Bag	13.0-15.0'	(ML)	25.0	NP	NP	NP	NP	-	80.3	-	-	-	-	-	-	-	-	-	-	-
EB-04 S-6	Jar	23.0-25.0'	-	28.8	32	20	12	0.77	-	-	-	-	-	-	-	-	-	-	-	-	-
EB-4 S-8	Jar	33.0-35.0'	-	22.2	24	17	7	0.73	-	-	-	-	-	-	-	-	-	-	-	-	-
NB-02 S-15	Jar	83.5-84.8'	-	6.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NZ-1 S-3	Bag	8.5-10.5'	(SM)	17.9	-	-	-	-	92.5	30.4	-	-	-	-	-	-	-	-	-	-	-
NZ-1 S-8	Jar/Bag	33.5-35.5'	SM	23.6	32	27	5	-0.73	99.1	31.9	-	-	-	-	-	-	-	-	-	-	-
NZ-1 S-13	Jar/Bag	58.5-60.5'	(SM)	13.5	-	-	-	-	93.1	31.5	-	-	-	-	-	-	-	-	-	-	-
NZ-1 S-18	Jar/Bag	83.5-85.5'	(SM)	17.6	-	-	-	-	96.3	39.2	-	-	-	-	-	-	-	-	-	-	-
NZ-1 S-24	Jar/Bag	113.5-115.5'	ML	28.0	43	28	15	-0.02	98.4	59.1	-	-	-	-	-	-	-	-	-	-	-
NZ-2 S-6	Jar/Bag	23.6-25.6'	(SM)	19.6	-	-	-	-	98.1	37.5	-	-	-	-	-	-	-	-	-	-	-
NZ-2 S-10	Jar/Bag	43.6-45.6'	SM	25.3	35	32	3	-2.26	99.2	35.9	-	-	-	-	-	-	-	-	-	-	-
NZ-2 S-14	Jar	63.6-65.6'	(SM)	21.1	-	-	-	-	96.2	33.5	-	-	-	-	-	-	-	-	-	-	-
NZ-2 S-19	Bag	88.6-90.6'	ML	29.3	46	35	11	-0.46	99.8	53.3	-	-	-	-	-	-	-	-	-	-	-
NZ-2 S-23	Bag	108.6-110.6'	CL	26.8	42	26	16	0.04	98.8	50.8	-	-	-	-	-	-	-	-	-	-	-
WB-1 S-3	Bag	8.5-10.5'	CL	22.8	41	24	17	-0.10	-	82.8	-	-	-	-	-	-	-	-	-	-	-
WB-1 UD-1	UD	20.6-21.9'	ML	22.9	36	25	11	-0.20	100.0	89.5	-	-	-	-	2.72	22.9	103.3	-	-	-	T-CU w/pp
WB-1 S-6	Jar	23.5-25.5'	-	26.2	28	20	8	0.78	-	-	-	-	-	-	-	-	-	-	-	-	-
WB-1 S-8	Bag	33.5-35.5'	(CL)	24.9	-	-	-	-	99.8	67.7	-	-	-	-	-	-	-	-	-	-	-
WB-2 S-4	Jar	13.5-15.5'	-	23.3	35	23	12	0.00	-	-	-	-	-	-	-	-	-	-	-	-	-
WB-2 S-7	Bag	28.5-30.5'	CL	21.7	28	19	9	0.33	-	58.8	-	-	-	-	-	-	-	-	-	-	-

ABBREVIATIONS: LIQUID LIMIT (LL)
PLASTIC LIMIT (PL)
PLASTICITY INDEX (PI)
LIQUIDITY INDEX (LI)
SPECIFIC GRAVITY (Gs)
MOISTURE (Mc)

NOTES: T = TRIAXIAL TEST
U = UNCONFINED COMPRESSION TEST
C = CONSOLIDATION TEST
DS = DIRECT SHEAR TEST
O = ORGANIC CONTENT
P = pH

Golder Associates Inc.

SUMMARY RESULTS- NATURAL SOILS
DOMINION BREMO POWER STATION CCR POND CLOSURE
SUMMARY OF SOIL DATA (GOLDER 2014 INVESTIGATION)

Sample Identification	Sample Type	Sample Depth	Soil Classi-fication	Natural Moisture %	Atterberg Limits				Grain Size Distribution			Compaction		pH Soil	Gs	Unit Weight		Permeability (cm/sec)	Soil Resistivity		Additional Tests Conducted (See Notes)
					L.L.	P.L.	P.I.	L.I.	% Finer No. 4 Sieve	% Finer No. 200 Sieve	% Finer .005 mm	Maximum Dry Density (lb/cuft)	Optimum Moisture %			Moisture %	Dry (pcf)		Moisture (%)	Minimum (ohms-cm)	
B-1 S-08	Bag	33.5-35	CL	24.1	41	23	18.0	0.05	100.0	95.2	50.0	-	-	-	-	-	-	-	-	-	
B-2 UD-01	Tube	8-10	CL	22.1	38	25	13.0	-0.22	100.0	82.0	45.0	-	-	-	2.76	22.1	103.0	-	-	-	T-CU w/pp
B-3 UD-01	Tube	16-18	CL-ML	24.7	19	15	4	2.14	100.0	51.1	27.5	-	-	-	2.71	24.70	101.3	-	-	-	T-CU w/pp
B-4 S-03	Bag	8.5-10	CL	12.2	32	22	10	-0.95	100.0	69.4	40.0	-	-	-	-	-	-	-	-	-	-
B-5 S-03B	Bag	9-10	ML	30.1	44	33	11	-0.25	94.1	66.7	30.0	-	-	-	-	-	-	-	-	-	-

ABBREVIATIONS: LIQUID LIMIT (LL)
PLASTIC LIMIT (PL)
PLASTICITY INDEX (PI)
LIQUIDITY INDEX (LI)
SPECIFIC GRAVITY (Gs)
MOISTURE (Mc)

NOTES: T = TRIAXIAL TEST
U = UNCONFINED COMPRESSION TEST
C = CONSOLIDATION TEST
DS = DIRECT SHEAR TEST
O = ORGANIC CONTENT
P = pH

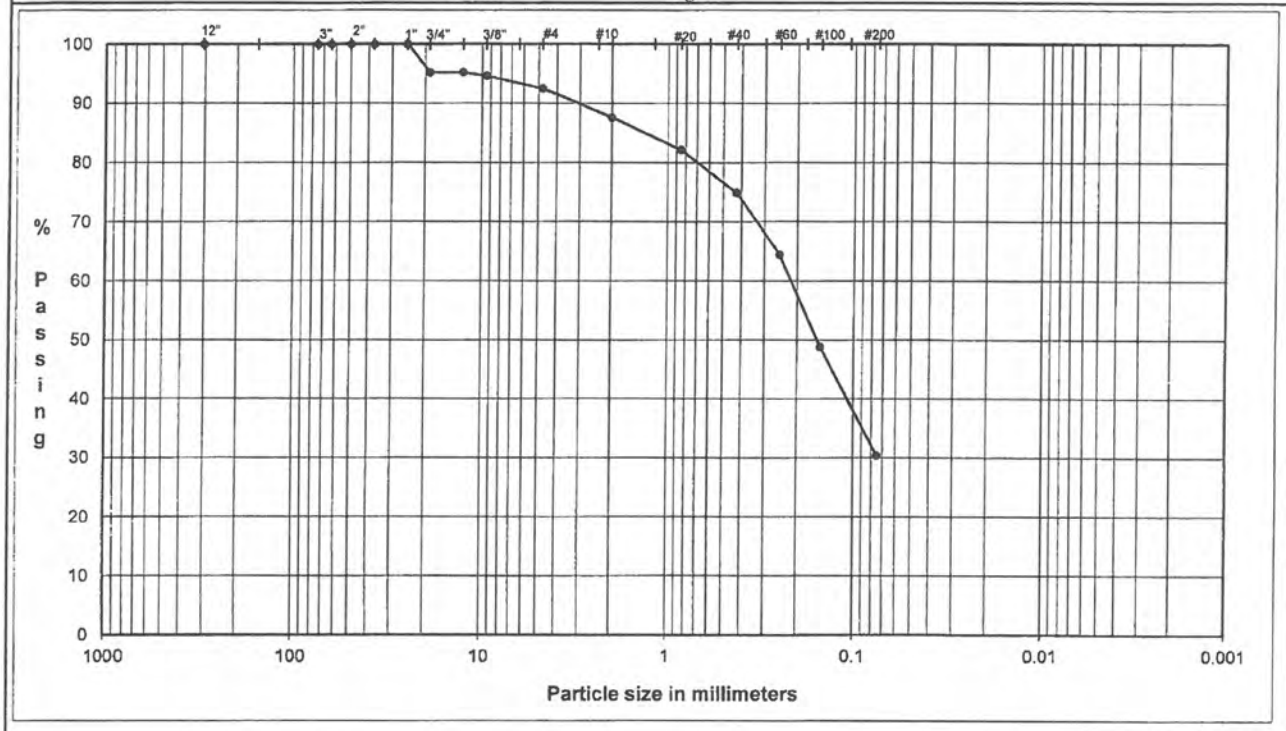
Golder Associates Inc.

APRIL 2015 1520347

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D6913, D4318

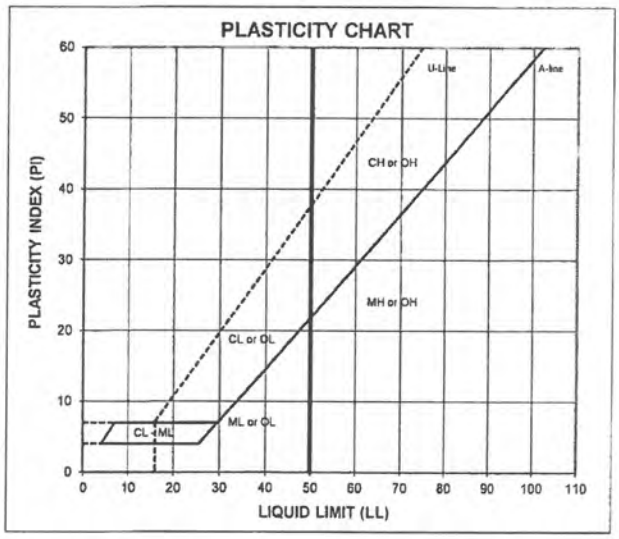
PROJECT NAME: DOMINION/BREMO ASH POND CLOSURE/VA
SAMPLE ID: NZ-1 S-3 Depth: 8.5-10.5'
TYPE: Bag



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.0
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	95.2	Coarse Gravel	4.8
0.50"	12.7	95.2		
0.375"	9.5	94.6		
#4	4.8	92.5	Fine Gravel	2.7
#10	2.00	87.6	Coarse Sand	4.9
#20	0.85	82.1		
#40	0.43	74.8	Medium Sand	12.7
#60	0.25	64.5		
#100	0.15	48.8		
#200	0.075	30.4	Fine Sand	44.4
			Fines	30.4



ATTERBERG LIMITS
Method -B (Dry preparation)

M_c	LL	PL	PI	LI
17.9				

LL (oven-dried)
< 0.75 = ORGANIC (OL/OH)

DESCRIPTION: SILTY SAND, fine to coarse, some fine to coarse gravel; yellowish brown and red, micaceous.

USCS: (SM)

TECH	TJ/CG
DATE	4/13/15
CHECK	DA
REVIEW	
APPROVE	

Golder Associates Inc.

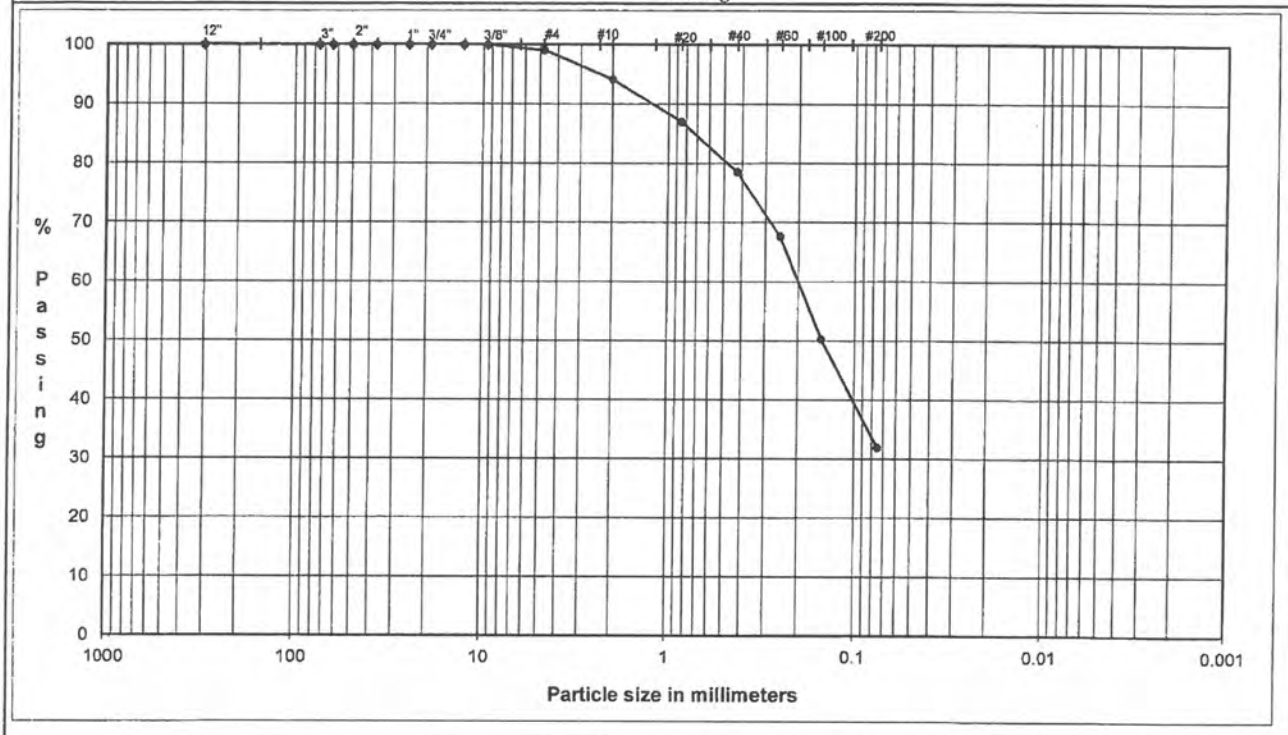
APRIL 2015

1520347

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D6913, D4318

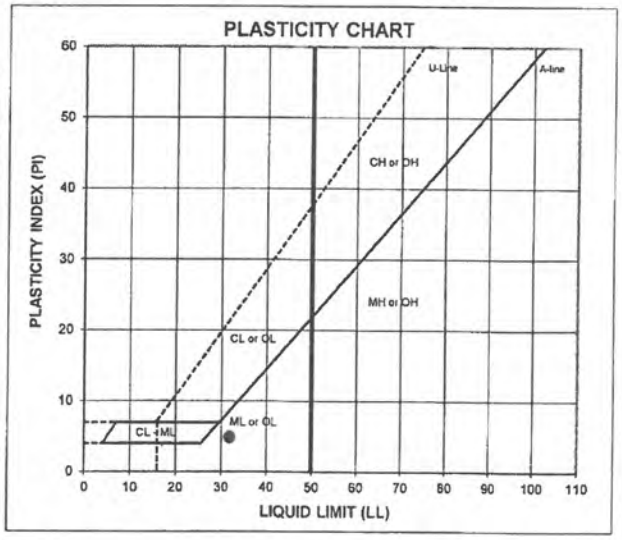
PROJECT NAME: DOMINION/BREMO ASH POND CLOSURE/VA
SAMPLE ID: NZ-1 S-8 Depth: 33.5-35.5'
TYPE: Jar/Bag



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.0
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.0
0.50"	12.7	100.0		
0.375"	9.5	100.0		
#4	4.8	99.1	Fine Gravel	0.9
#10	2.00	94.1	Coarse Sand	5.0
#20	0.85	87.0		
#40	0.43	78.5	Medium Sand	15.6
#60	0.25	67.6		
#100	0.15	50.2		
#200	0.075	31.9	Fine Sand	46.6
			Fines	31.9



ATTERBERG LIMITS
Method -B (Dry preparation)

M_c	LL	PL	PI	LI
23.6	32	27	5	-0.73

DESCRIPTION: SILTY SAND, fine to coarse, trace fine gravel; yellowish brown, micaceous.

USCS: SM

LL (oven-dried) / < 0.75 = ORGANIC (OL/OH)

TECH	TJ/CG
DATE	4/13/15
CHECK	
REVIEW	
APPROVE	

Golder Associates Inc.

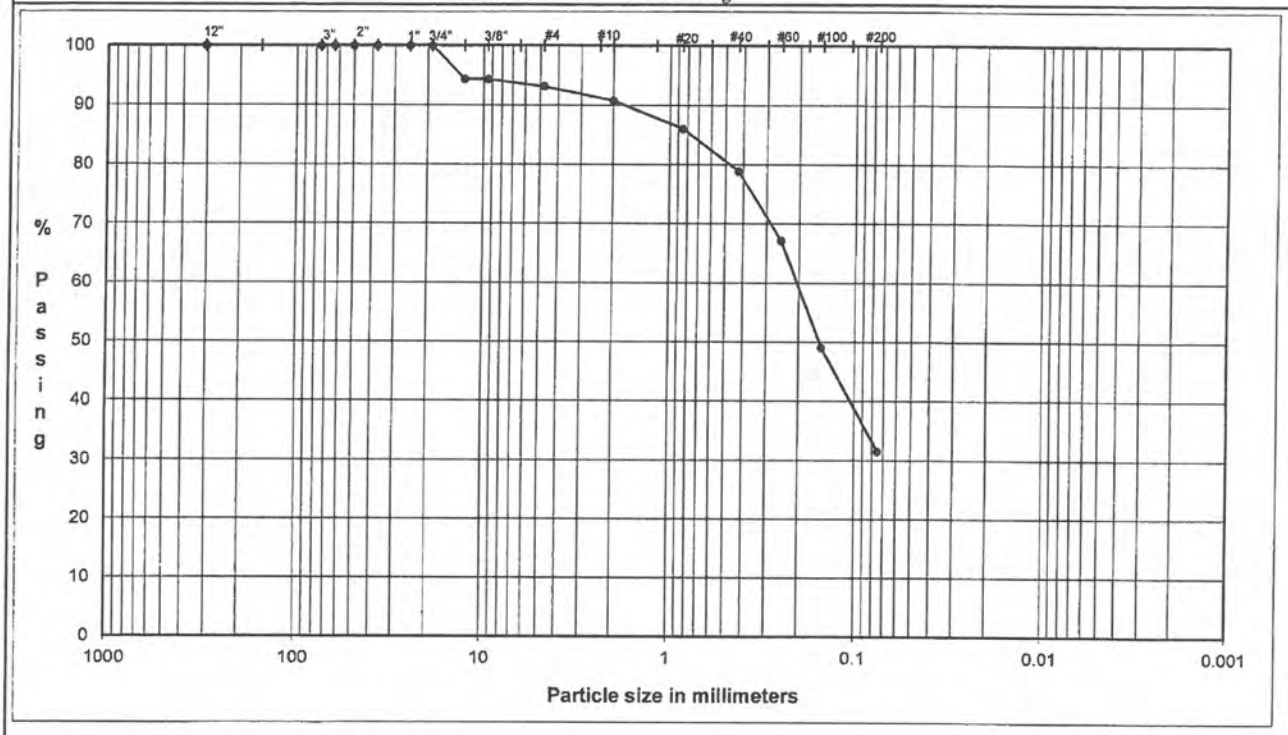
APRIL 2015

1520347

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D6913, D4318

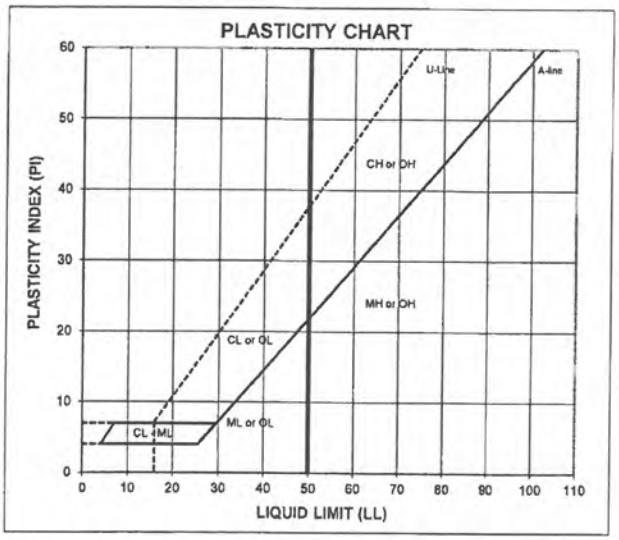
PROJECT NAME: DOMINION/BREMO ASH POND CLOSURE/VA
SAMPLE ID: NZ-1 S-13 Depth: 58.5-60.5'
TYPE: Jar/Bag



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.0
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.0
0.50"	12.7	94.4		
0.375"	9.5	94.4		
#4	4.8	93.1	Fine Gravel	6.9
#10	2.00	90.8	Coarse Sand	2.4
#20	0.85	86.0		
#40	0.43	78.9	Medium Sand	11.9
#60	0.25	67.2		
#100	0.15	49.0		
#200	0.075	31.5	Fine Sand	47.3
			Fines	31.5



ATTERBERG LIMITS
Method -B (Dry preparation)

M_c	LL	PL	PI	LI
13.5				

LL (oven-dried) / 0.75 = ORGANIC (OL/OH)

DESCRIPTION: SILTY SAND, fine to coarse, some fine gravel; yellowish brown, micaceous.

USCS: (SM)

TECH	TJ/CG
DATE	4/13/15
CHECK	DA
REVIEW	
APPROVE	

Golder Associates Inc.

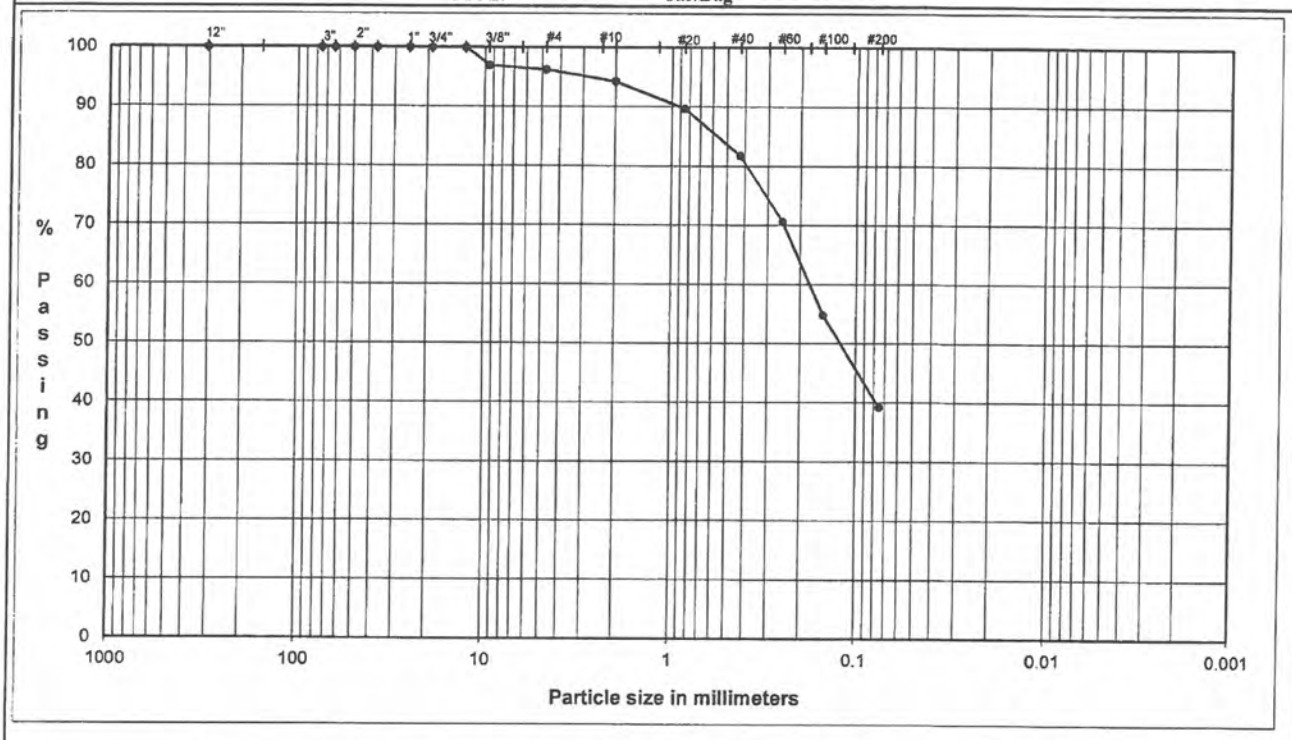
APRIL 2015

1520347

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D6913, D4318

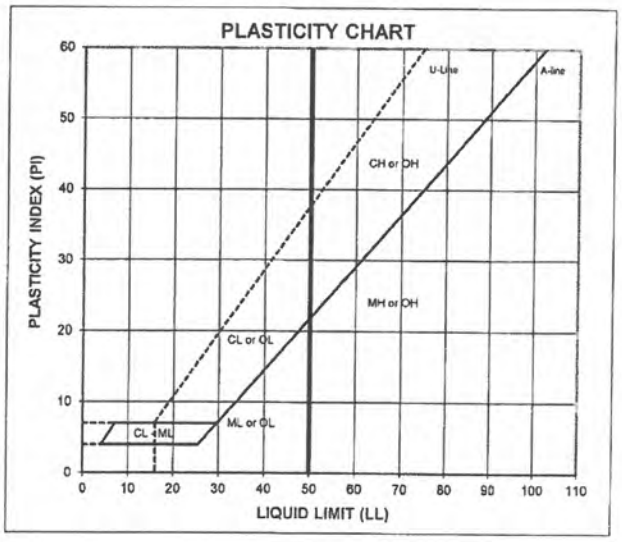
PROJECT NAME: DOMINION/BREMO ASH POND CLOSURE/VA
SAMPLE ID: NZ-1 S-18 Depth: 83.5-85.5'
TYPE: Jar/Bag



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.0
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.0
0.50"	12.7	100.0		
0.375"	9.5	96.9		
#4	4.8	96.3	Fine Gravel	3.7
#10	2.00	94.3	Coarse Sand	2.0
#20	0.85	89.6		
#40	0.43	81.8	Medium Sand	12.5
#60	0.25	70.6		
#100	0.15	54.8		
#200	0.075	39.2	Fine Sand	42.5
			Fines	39.2



ATTERBERG LIMITS
Method -B (Dry preparation)

M_c	LL	PL	PI	LI
17.6				

LL (oven-dried) / < 0.75 = ORGANIC (OL/OH)

DESCRIPTION: fine to coarse SAND and CLAYEY SILT, trace fine gravel; yellowish brown and gray, micaceous.

USCS: (SM)

TECH	TJ/CG
DATE	4/13/15
CHECK	DA
REVIEW	
APPROVE	

Golder Associates Inc.

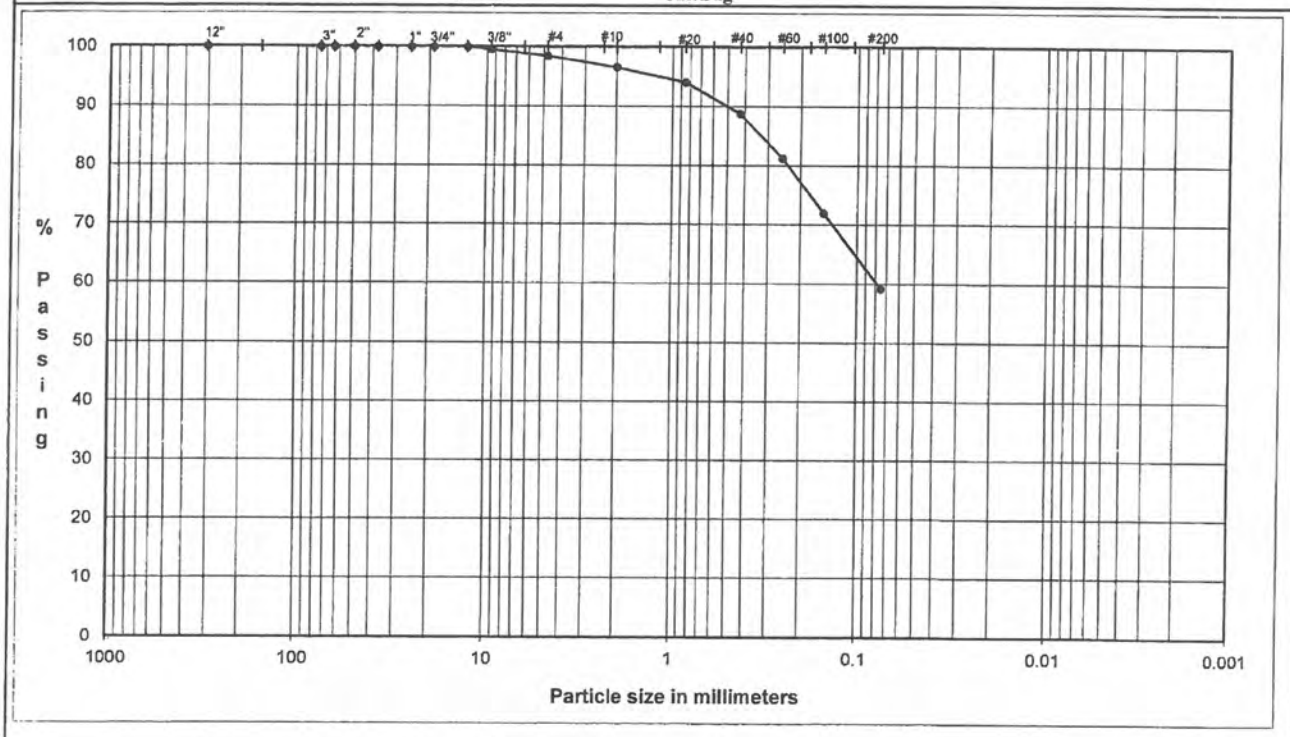
APRIL 2015

1520347

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D6913, D4318

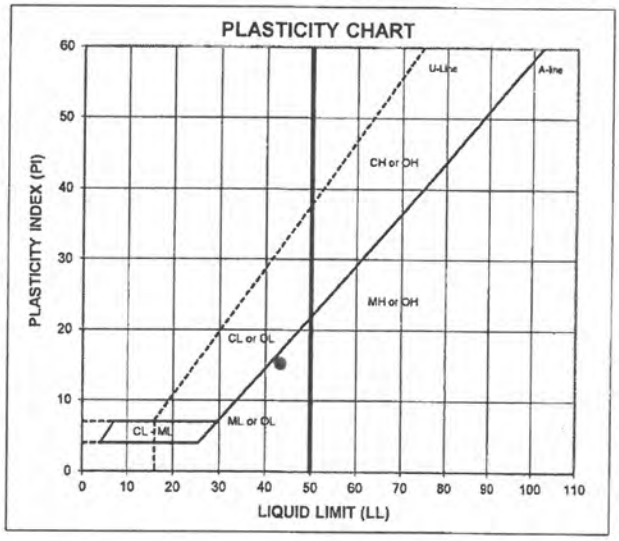
PROJECT NAME: DOMINION/BREMO ASH POND CLOSURE/VA
SAMPLE ID: NZ-1 S-24 Depth: 113.5-115.5'
TYPE: Jar/Bag



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.0
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.0
0.50"	12.7	100.0		
0.375"	9.5	99.6		
#4	4.8	98.4	Fine Gravel	1.6
#10	2.00	96.6	Coarse Sand	1.9
#20	0.85	94.0		
#40	0.43	88.7	Medium Sand	7.8
#60	0.25	81.2		
#100	0.15	71.9		
#200	0.075	59.1	Fine Sand	29.6
			Fines	59.1



ATTERBERG LIMITS
Method -B (Dry preparation)

M_c	LL	PL	PI	LI
28.0	43	28	15	-0.02

DESCRIPTION: CLAYEY SILT and fine to coarse SAND, trace fine gravel; yellowish brown and red, micaceous.

USCS: ML

LL (oven-dried) / 0.75 = ORGANIC (OL/OH)

TECH	TJ/CG
DATE	4/13/15
CHECK	
REVIEW	
APPROVE	

Golder Associates Inc.

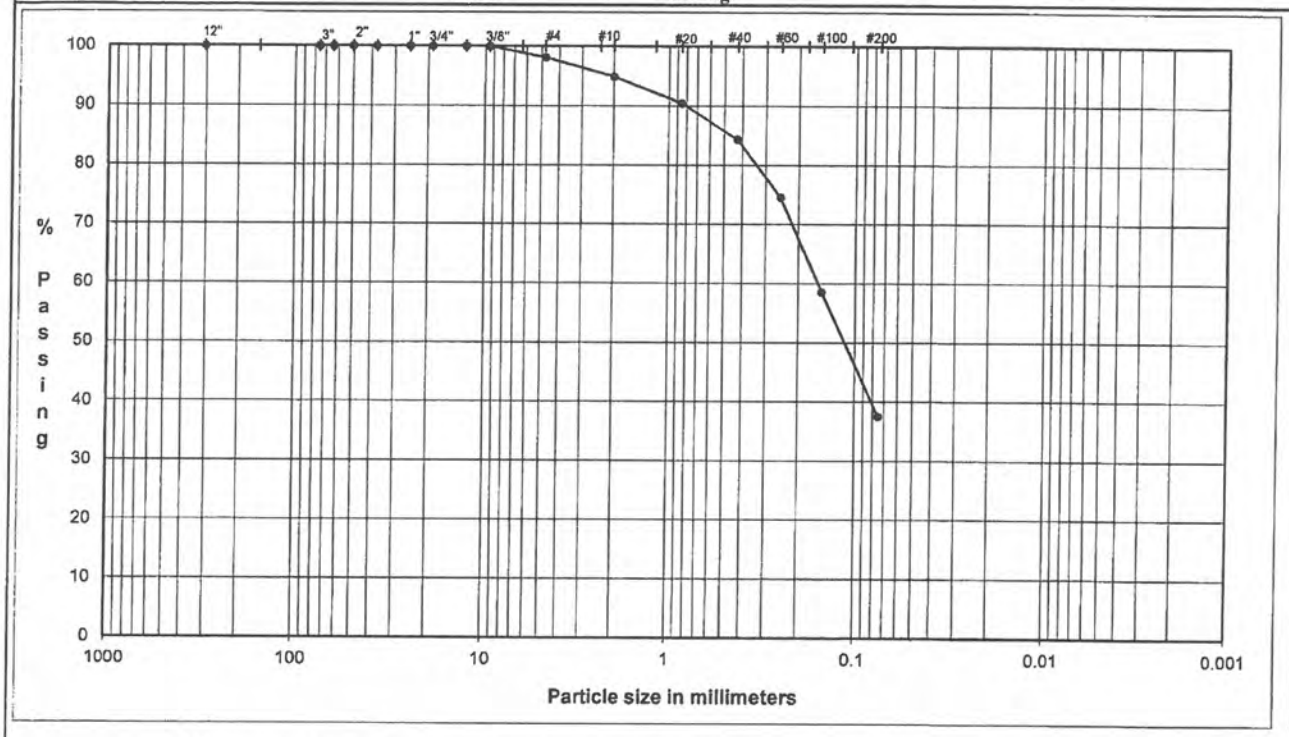
APRIL 2015

1520347

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D6913, D4318

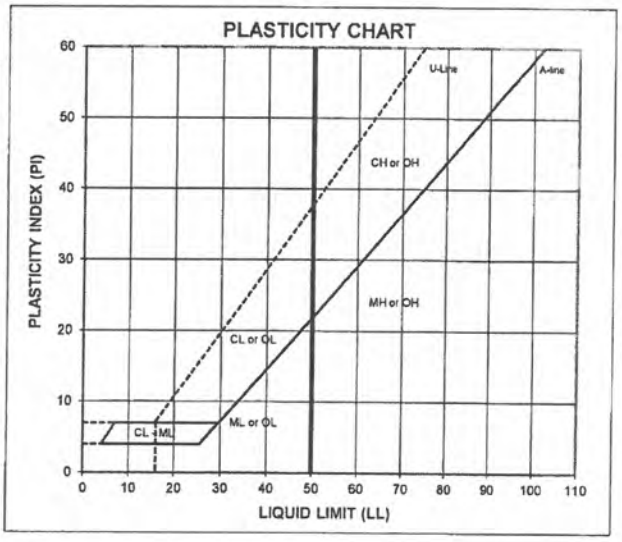
PROJECT NAME: DOMINION/BREMO ASH POND CLOSURE/VA
SAMPLE ID: NZ-2 S-6 Depth: 23.6-25.6'
TYPE: Jar/Bag



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.0
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.0
0.50"	12.7	100.0		
0.375"	9.5	100.0		
#4	4.8	98.1	Fine Gravel	1.9
#10	2.00	94.9	Coarse Sand	3.2
#20	0.85	90.5		
#40	0.43	84.4	Medium Sand	10.6
#60	0.25	74.5		
#100	0.15	58.5		
#200	0.075	37.5	Fine Sand	46.8
			Fines	37.5



ATTERBERG LIMITS
Method -B (Dry preparation)

M_c	LL	PL	PI	LI
19.6				

LL (oven-dried)
0.75 = ORGANIC (OL/OH)

DESCRIPTION: fine to coarse SAND and CLAYEY SILT, trace fine gravel; yellowish brown and gray, micaceous.

USCS: (SM)

TECH	TJ/CG
DATE	4/13/15
CHECK	
REVIEW	
APPROVE	

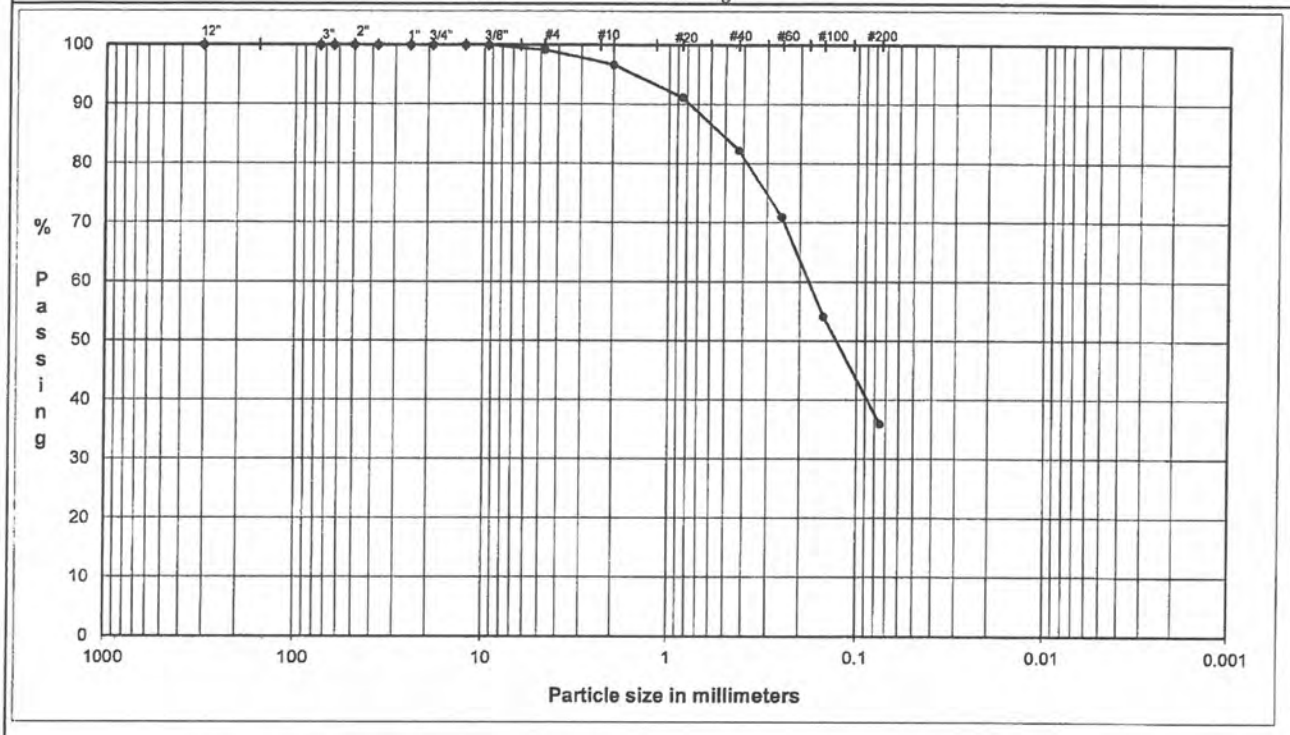
Golder Associates Inc.

APRIL 2015 1520347

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D6913, D4318

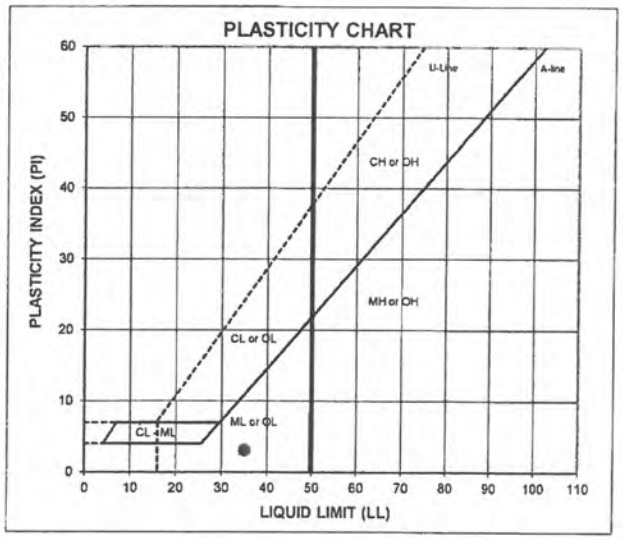
PROJECT NAME: DOMINION/BREMO ASH POND CLOSURE/VA
SAMPLE ID: NZ-2 S-10 Depth: 43.6-45.6'
TYPE: Jar/Bag



COBBLES	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.0
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.0
0.50"	12.7	100.0		
0.375"	9.5	100.0		
#4	4.8	99.2	Fine Gravel	0.8
#10	2.00	96.7	Coarse Sand	2.5
#20	0.85	91.1		
#40	0.43	82.3	Medium Sand	14.4
#60	0.25	70.9		
#100	0.15	54.1		
#200	0.075	35.9	Fine Sand	46.3
			Fines	35.9



ATTERBERG LIMITS
Method -B (Dry preparation)

M_c	LL	PL	PI	LI
25.3	35	32	3	-2.26

DESCRIPTION: fine to coarse SAND and CLAYEY SILT, trace fine gravel; yellowish brown and red, micaceous.

USCS: SM

LL (oven-dried) < 0.75 = ORGANIC (OL/OH)

TECH	TJ/CG
DATE	4/13/15
CHECK	DA
REVIEW	
APPROVE	

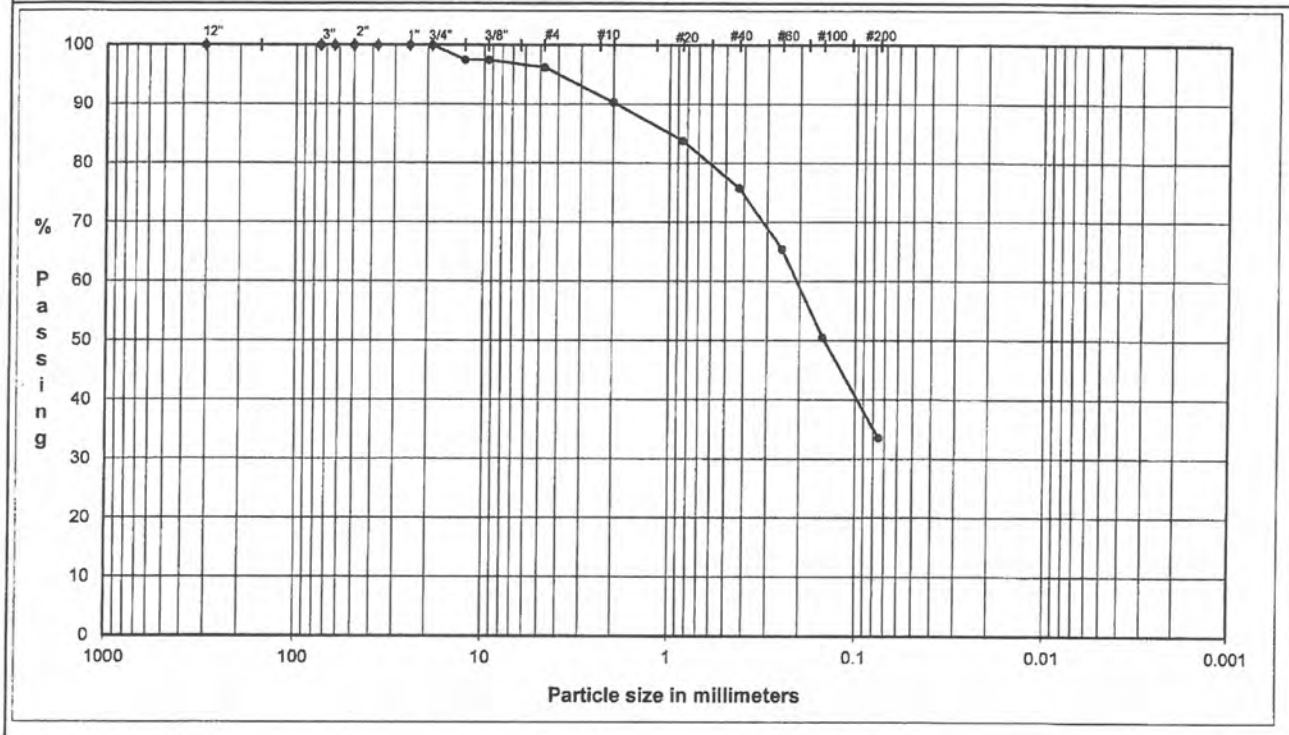
Golder Associates Inc.

APRIL 2015 1520347

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D6913, D4318

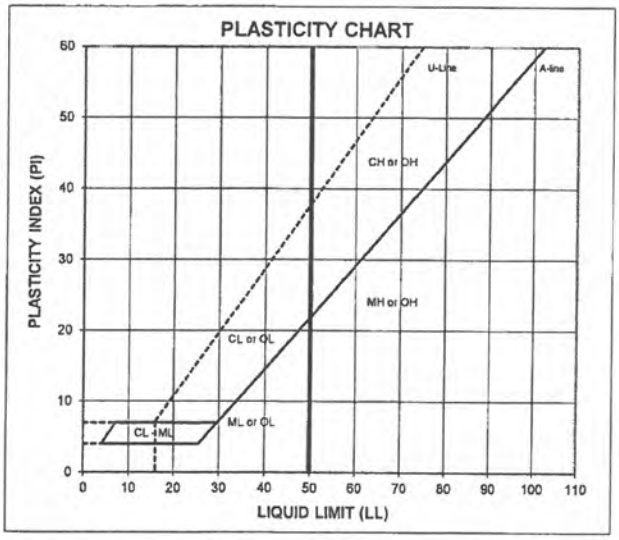
PROJECT NAME: DOMINION/BREMO ASH POND CLOSURE/VA
SAMPLE ID: NZ-2 S-14 Depth: 63.6-65.6'
TYPE: Jar



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.0
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.0
0.50"	12.7	97.5		
0.375"	9.5	97.5		
#4	4.8	96.2	Fine Gravel	3.8
#10	2.00	90.3	Coarse Sand	5.9
#20	0.85	83.8		
#40	0.43	75.8	Medium Sand	14.6
#60	0.25	65.4		
#100	0.15	50.5		
#200	0.075	33.5	Fine Sand	42.2
			Fines	33.5



ATTERBERG LIMITS
Method -B (Dry preparation)

M_c	LL	PL	PI	LI
21.1				

LL (oven-dried)
- 0.75 = ORGANIC (OL/OH)

DESCRIPTION: SILTY SAND, fine to coarse, trace fine gravel; yellowish brown, micaceous.
USCS: (SM)

TECH	TJ/CG
DATE	4/13/15
CHECK	DA
REVIEW	
APPROVE	

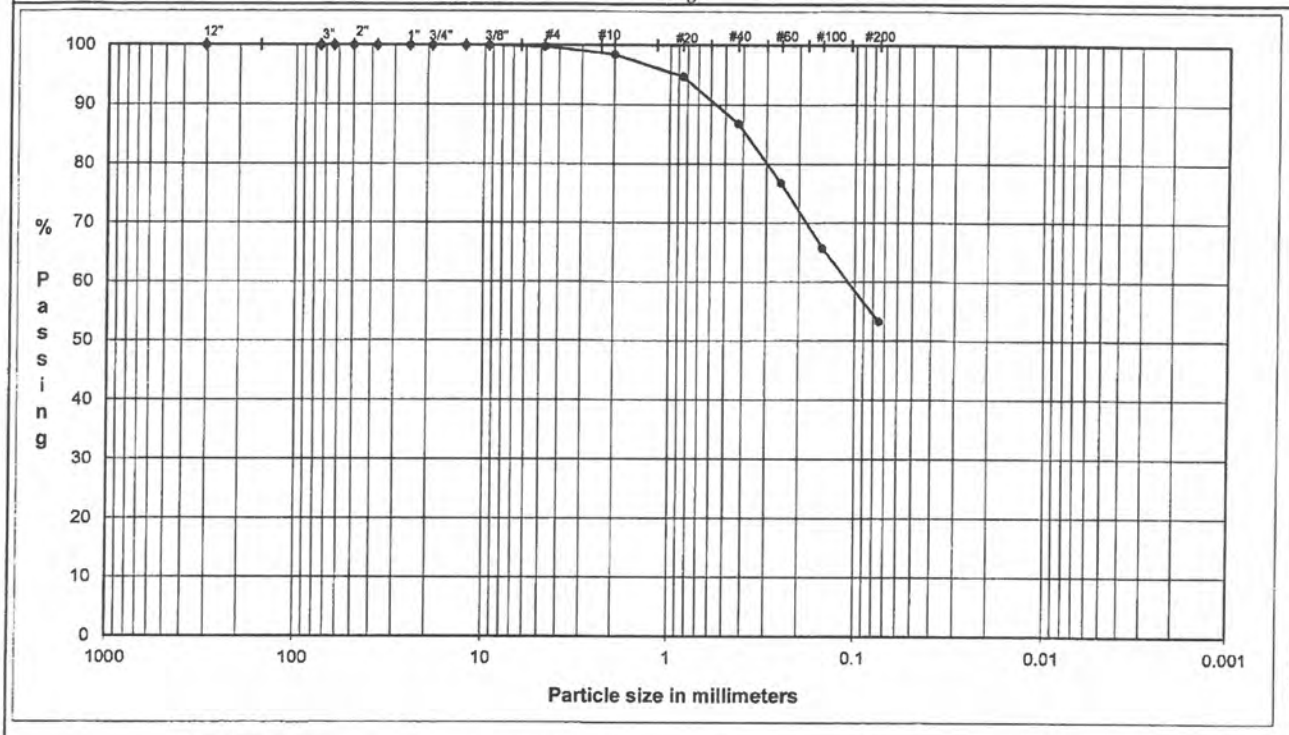
Golder Associates Inc.

APRIL 2015 1520347

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D6913, D4318

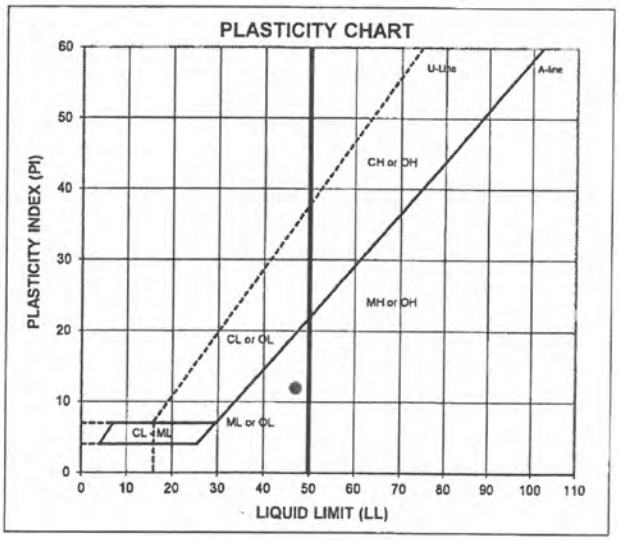
PROJECT NAME: DOMINION/BREMO ASH POND CLOSURE/VA
SAMPLE ID: NZ-2 S-19 Depth: 88.6-90.6'
TYPE: Bag



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.0
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.0
0.50"	12.7	100.0		
0.375"	9.5	100.0		
#4	4.8	99.8	Fine Gravel	0.2
#10	2.00	98.5	Coarse Sand	1.3
#20	0.85	94.7		
#40	0.43	86.8	Medium Sand	11.6
#60	0.25	76.8		
#100	0.15	65.8		
#200	0.075	53.3	Fine Sand	33.5
			Fines	53.3



ATTERBERG LIMITS
Method -B (Dry preparation)

M_c	LL	PL	PI	LI
29.3	47	35	12	-0.46

DESCRIPTION: CLAYEY SILT and fine to coarse SAND, trace fine gravel; reddish brown, yellow, and gray, micaceous.

USCS: ML

LL (oven-dried) / < 0.75 = ORGANIC (OL/OH)

TECH	TJ/CG
DATE	4/13/15
CHECK	
REVIEW	
APPROVE	

Golder Associates Inc.

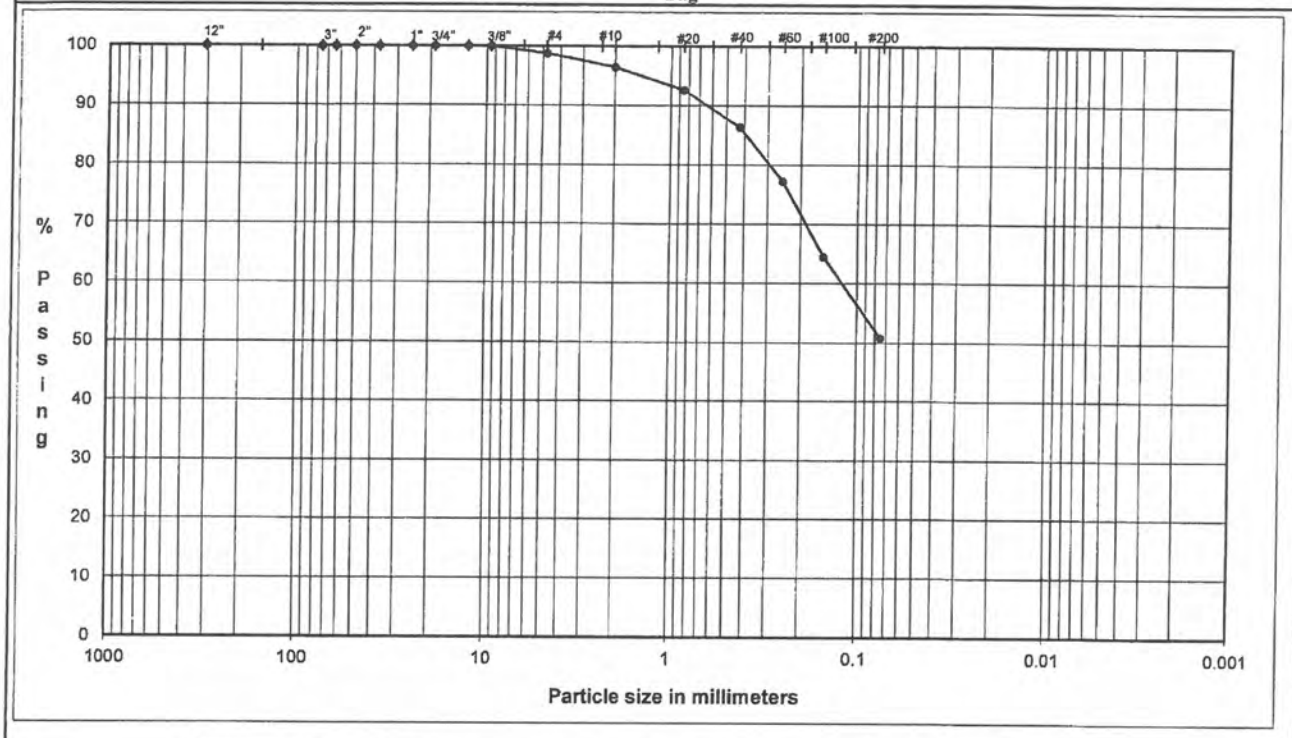
APRIL 2015

1520347

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D6913, D4318

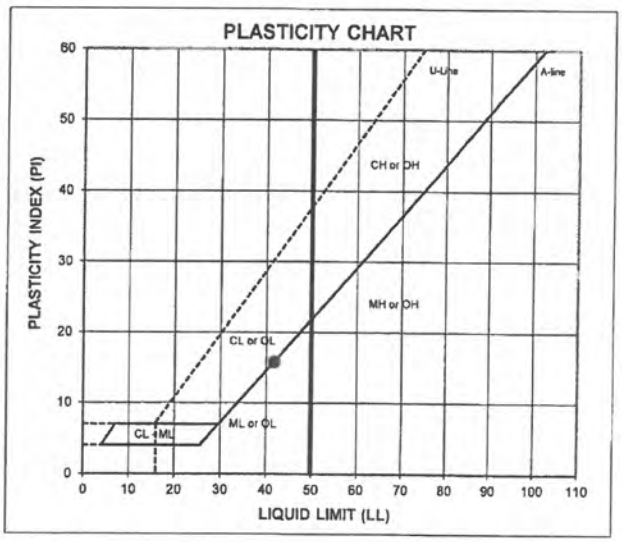
PROJECT NAME: DOMINION/BREMO ASH POND CLOSURE/VA
SAMPLE ID: NZ-2 S-23 Depth: 108.6-110.6'
TYPE: Bag



COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.0
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.0
0.50"	12.7	100.0		
0.375"	9.5	100.0		
#4	4.8	98.8	Fine Gravel	1.2
#10	2.00	96.5	Coarse Sand	2.3
#20	0.85	92.6		
#40	0.43	86.4	Medium Sand	10.1
#60	0.25	77.3		
#100	0.15	64.4		
#200	0.075	50.8	Fine Sand	35.6
			Fines	50.8



ATTERBERG LIMITS
Method -B (Dry preparation)

M_c	LL	PL	PI	LI
26.8	42	26	16	0.04

DESCRIPTION: SILTY CLAY and fine to coarse SAND, trace fine gravel; yellowish brown, micaceous.

USCS: CL

LL (oven-dried)
< 0.75 = ORGANIC (OL/OH)

TECH	TJ/CG
DATE	4/13/15
CHECK	DA
REVIEW	
APPROVE	

Golder Associates Inc.

APRIL 2015

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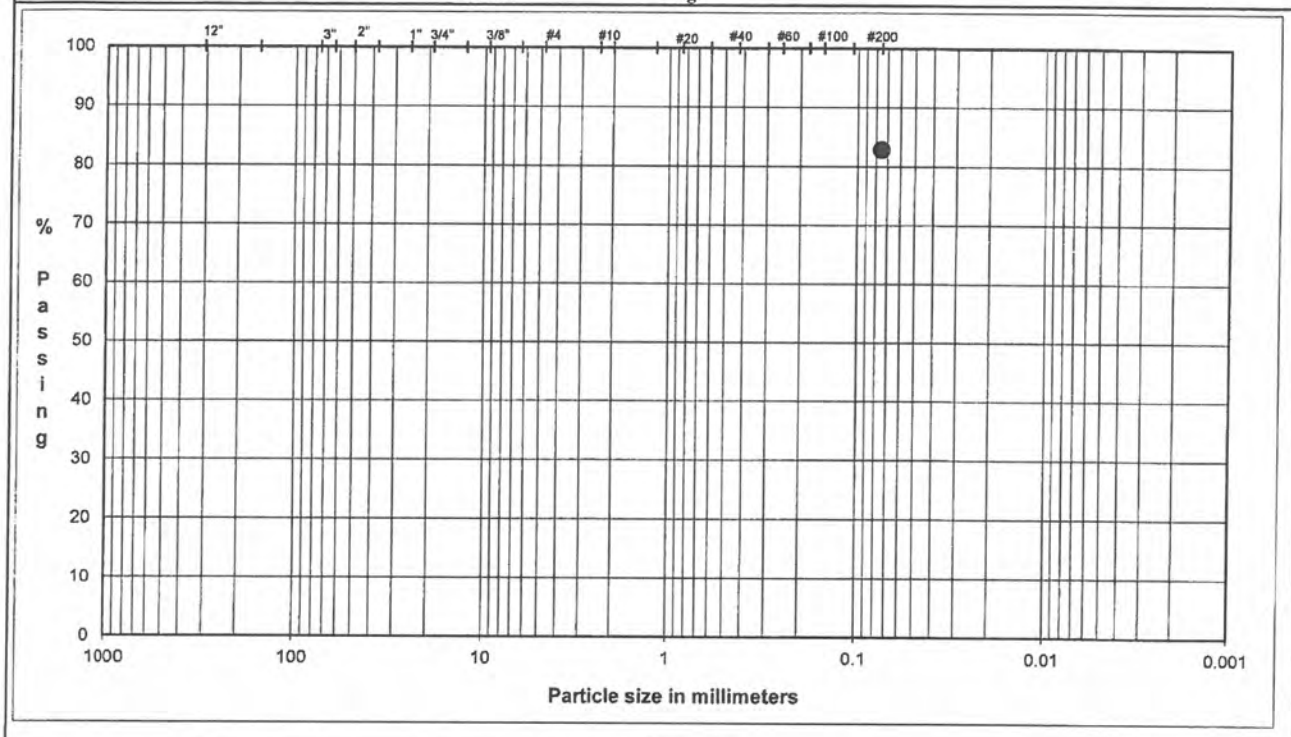
PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D1140, D4318

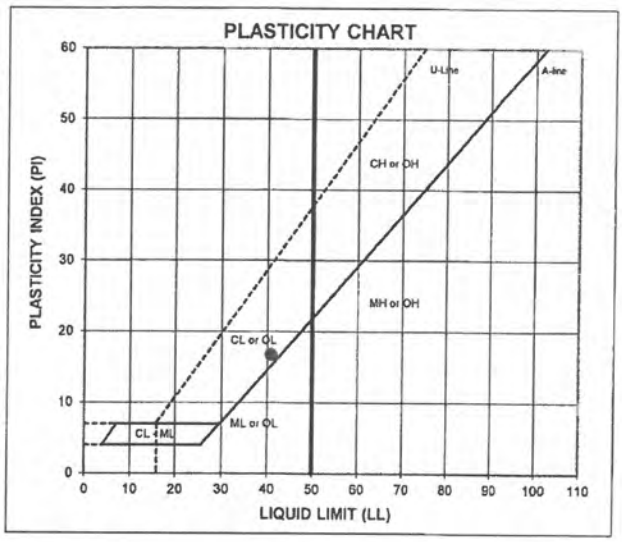
PROJECT NAME: DOMINION/BREMO ASH POND CLOSURE/VA
SAMPLE ID: WB-1 S-3 Depth: 8.5-10.5'
TYPE: Bag



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	(mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8			
3.0"	75.0		Cobbles	
2.5"	63.5			
2.0"	50.0			
1.5"	37.5			
1.0"	25.0			
0.75"	19.0		Coarse Gravel	
0.50"	12.7			
0.375"	9.5			
#4	4.8		Fine Gravel	
#10	2.00		Coarse Sand	
#20	0.85			
#40	0.43		Medium Sand	
#60	0.25			
#100	0.15			
#200	0.075	82.8	Fine Sand	
			Fines	82.82



ATTERBERG LIMITS

Method -B (Dry preparation)

M_c	LL	PL	PI	LI
22.8	41	24	17	-0.10

DESCRIPTION: sandy SILTY CLAY; dark yellowish brown.

USCS: CL

LL (oven-dried) / LL (oven-dried) / 0.75 = ORGANIC (OL/OH)

TECH	TJ/CG
DATE	4/13/15
CHECK	
REVIEW	
APPROVE	

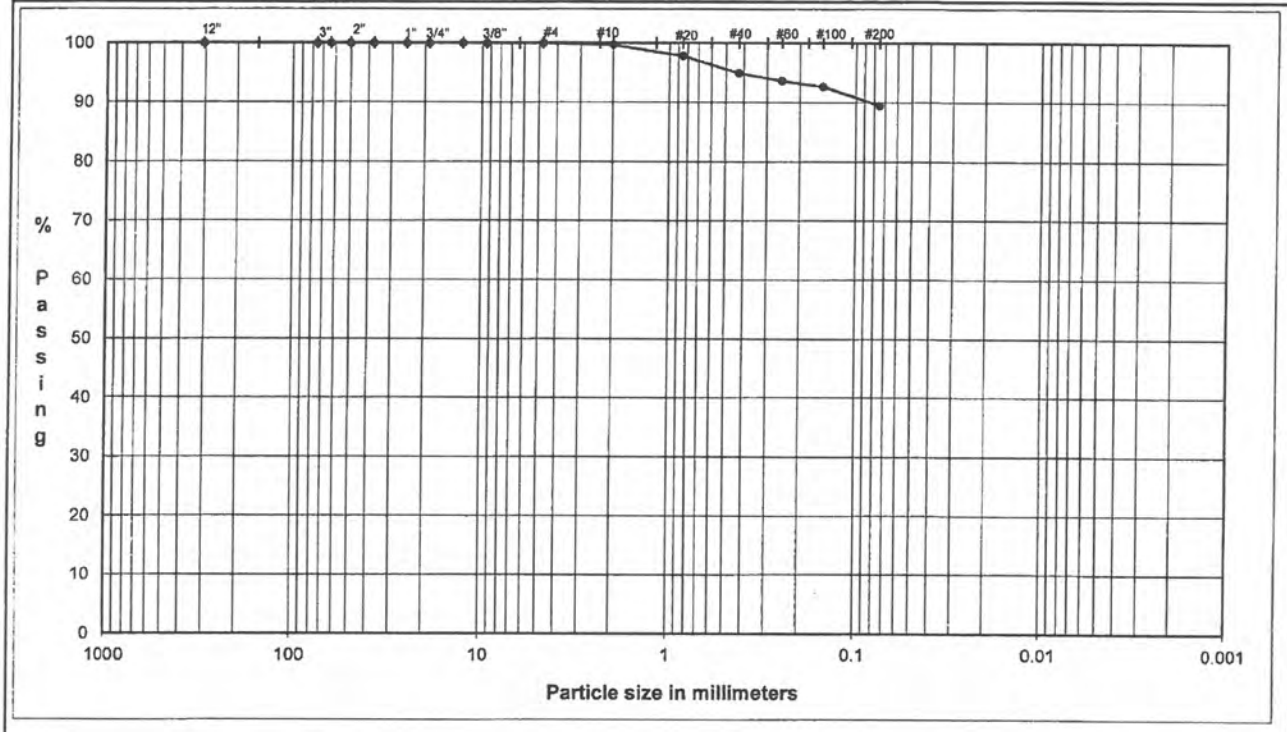
Golder Associates Inc.

APRIL 2015 1520347

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D6913, D4318

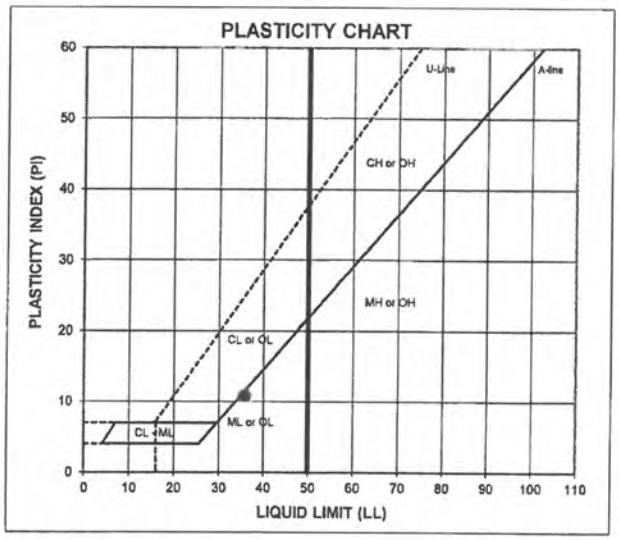
PROJECT NAME: DOMINION/BREMO ASH POND CLOSURE/VA
SAMPLE ID: WB-1 UD-1 Depth: 20.6-21.9'
TYPE: UD



	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.0
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.0
0.50"	12.7	100.0		
0.375"	9.5	100.0		
#4	4.8	100.0	Fine Gravel	0.0
#10	2.00	99.7	Coarse Sand	0.3
#20	0.85	97.8		
#40	0.43	94.9	Medium Sand	4.8
#60	0.25	93.7		
#100	0.15	92.7		
#200	0.075	89.5	Fine Sand	5.5
			Fines	89.5



ATTERBERG LIMITS
Method -B (Dry preparation)

M_c	LL	PL	PI	LI
22.9	36	25	11	-0.20

DESCRIPTION: CLAYEY SILT, some fine to coarse sand; reddish brown and gray.

USCS: ML

LL (oven-dried) / 0.75 = ORGANIC (OL/OH)

TECH	TH/TJ
DATE	4/13/15
CHECK	DA
REVIEW	
APPROVE	

Golder Associates Inc.

APRIL 2015

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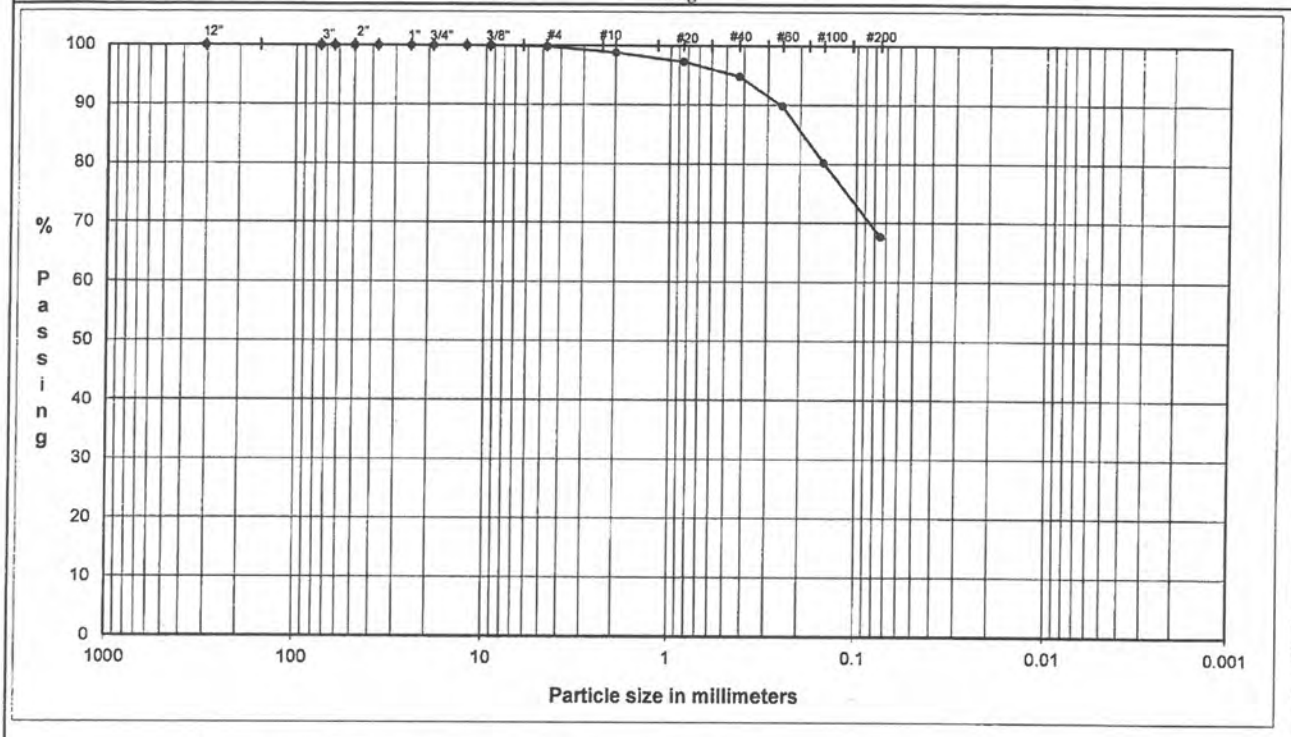
PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D6913, D4318

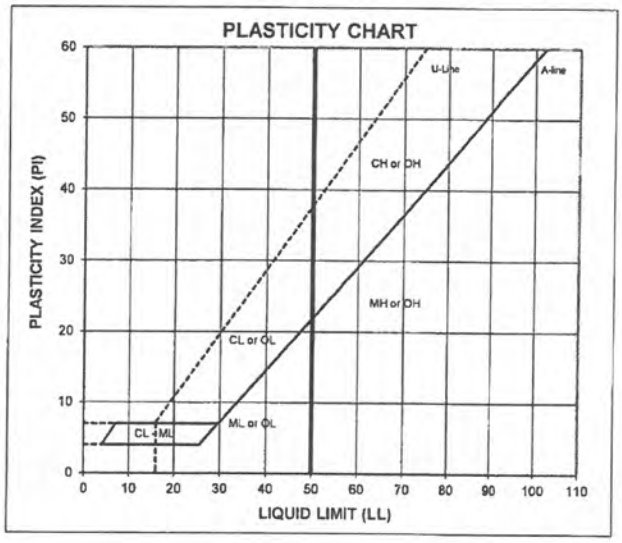
PROJECT NAME: DOMINION/BREMO ASH POND CLOSURE/VA
SAMPLE ID: WB-1 S-8 Depth: 33.5-35.5'
TYPE: Bag



COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.0
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.0
0.50"	12.7	100.0		
0.375"	9.5	100.0		
#4	4.8	99.8	Fine Gravel	0.2
#10	2.00	98.8	Coarse Sand	1.0
#20	0.85	97.3		
#40	0.43	94.8	Medium Sand	4.0
#60	0.25	89.8		
#100	0.15	80.2		
#200	0.075	67.7	Fine Sand	27.1
			Fines	67.7



ATTERBERG LIMITS
Method -B (Dry preparation)

M_c	LL	PL	PI	LI
24.9				

LL (oven-dried) < 0.75 – ORGANIC (OL/OH)

DESCRIPTION: sandy SILTY CLAY, fine to coarse, trace fine gravel; dark yellowish brown and gray, micaceous.

USCS: (CL)

TECH	TJ/CG
DATE	4/13/15
CHECK	
REVIEW	
APPROVE	

Golder Associates Inc.

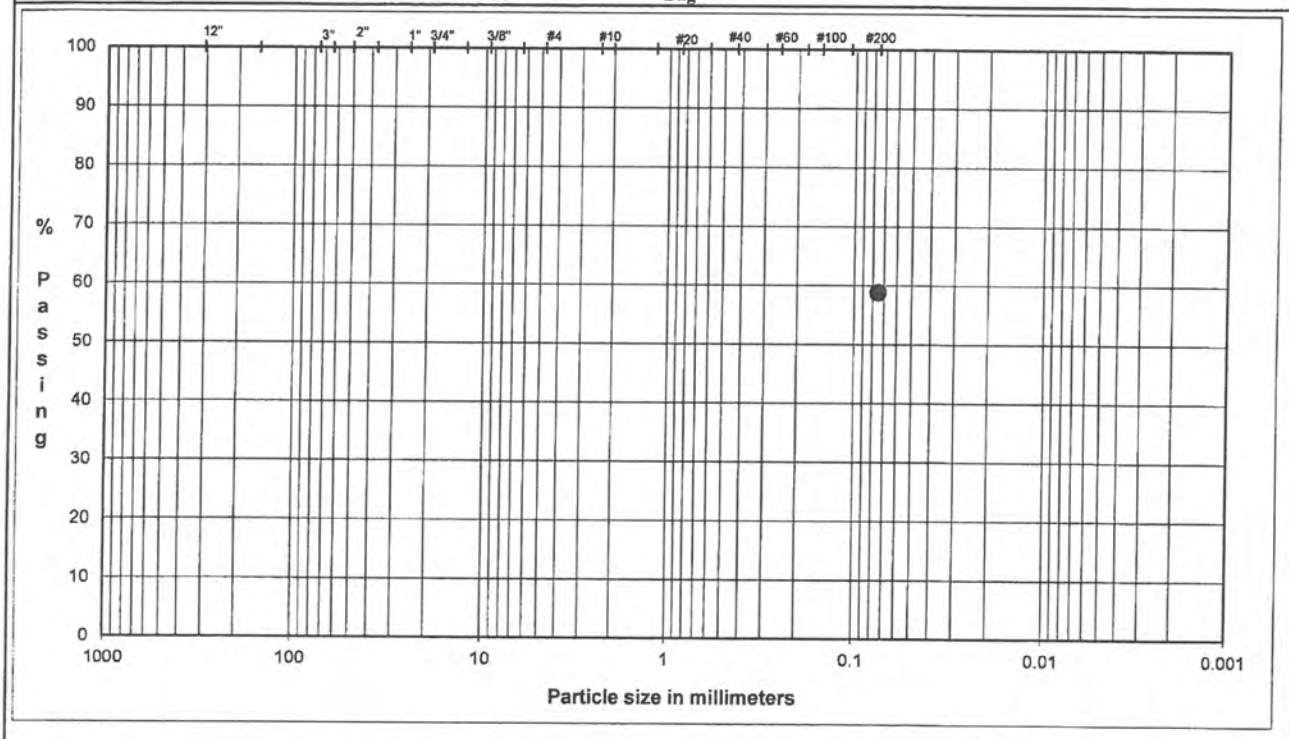
APRIL 2015

1520347

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D1140, D4318

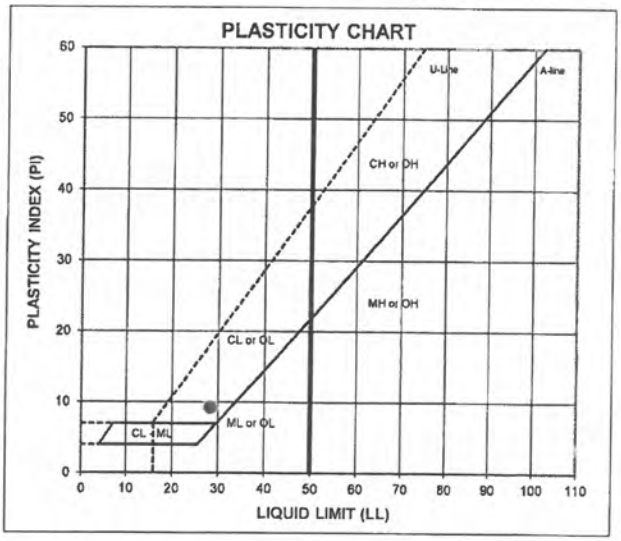
PROJECT NAME: DOMINION/BREMO ASH POND CLOSURE/VA
SAMPLE ID: WB-2 S-7 Depth: 28.5-30.5'
TYPE: Bag



COBBLES	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	(mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8			
3.0"	75.0		Cobbles	
2.5"	63.5			
2.0"	50.0			
1.5"	37.5			
1.0"	25.0			
0.75"	19.0		Coarse Gravel	
0.50"	12.7			
0.375"	9.5			
#4	4.8		Fine Gravel	
#10	2.00		Coarse Sand	
#20	0.85			
#40	0.43		Medium Sand	
#60	0.25			
#100	0.15			
#200	0.075	58.8	Fine Sand	
			Fines	58.82



ATTERBERG LIMITS

Method -B (Dry preparation)

M_c	LL	PL	PI	LI
21.7	28	19	9	0.33

DESCRIPTION: SILTY CLAY and SAND; dark yellowish brown and gray.

USCS: CL

LL (oven-dried) / < 0.75 ~ ORGANIC (OL-OH)

TECH	TJ/CG
DATE	4/13/15
CHECK	
REVIEW	
APPROVE	

Golder Associates Inc.

Boring or Test Pit: WB-1	Boring or Test Pit:	Boring or Test Pit:
Sample: UD-1	Sample:	Sample:
Depth: 20.6-21.9 ft	Depth:	Depth:
Point No.: 1	Point No.:	Point No.:

Initial							
Length =	5.944	in	Length =	5.911	Length =	5.825	
Diameter =	2.855	in	Diameter =	2.821	Diameter =	2.842	
Wet Mass =	2.796	lb	Wet Mass =		Wet Mass =		
Area =	6.402	in^2	Area =		Area =		
Volume =	38.052	in^3	Volume =		Volume =		
Specific Gravity =	2.72	(ASTM D854)	Specific Gravity =		Specific Gravity =		
Dry Mass of Solids =	2.275	lb	Dry Mass of Solids =		Dry Mass of Solids =		
Moisture Content =	22.9%		Moisture Content =		Moisture Content =		
Wet Unit Weight =	127.0	pcf	Wet Unit Weight =		Wet Unit Weight =		
Dry Unit Weight =	103.3	pcf	Dry Unit Weight =		Dry Unit Weight =		
Void Ratio =	0.64		Void Ratio =		Void Ratio =		
Percent Saturation =	97%		Percent Saturation =		Percent Saturation =		

After Consolidation			After Consolidation			After Consolidation		
Length =	5.911	in	Length =	5.825	in	Length =	5.742	in
Diameter =	2.821	in	Diameter =	2.842	in	Diameter =	2.862	in
Area =	6.249		Area =	6.342		Area =	6.433	in^2 (Method B)
Volume =	36.940		Volume =	36.940		Volume =	36.940	in^3
Moisture Content =			Moisture Content =			Moisture Content =	21.8%	
Wet Unit Weight =			Wet Unit Weight =			Wet Unit Weight =	129.6	pcf
Dry Unit Weight =			Dry Unit Weight =			Dry Unit Weight =	106.4	pcf
Void Ratio =			Void Ratio =			Void Ratio =	0.59	
Percent Saturation =			Percent Saturation =			Percent Saturation =	100%	

B Parameter =	0.99		B Parameter =	--		B Parameter =	--	
Shear Rate =	0.025%	/min.	Shear Rate =	0.037%	/min.	Shear Rate =	0.031%	/min.
t_{50} =	13.9	min.	t_{50} =	10.0	min.	t_{50} =	12.3	min.
Strain at Failure =	1.5%		Strain at Failure =	2.9%		Strain at Failure =	8.3%	

Cell Pressure =	77.4	psi	Cell Pressure =	84.8	psi	Cell Pressure =	99.6	psi
Back Pressure =	70.0	psi	Back Pressure =	70.0	psi	Back Pressure =	70.0	psi
Confining Pressure =	7.4	psi	Confining Pressure =	14.8	psi	Confining Pressure =	29.6	psi

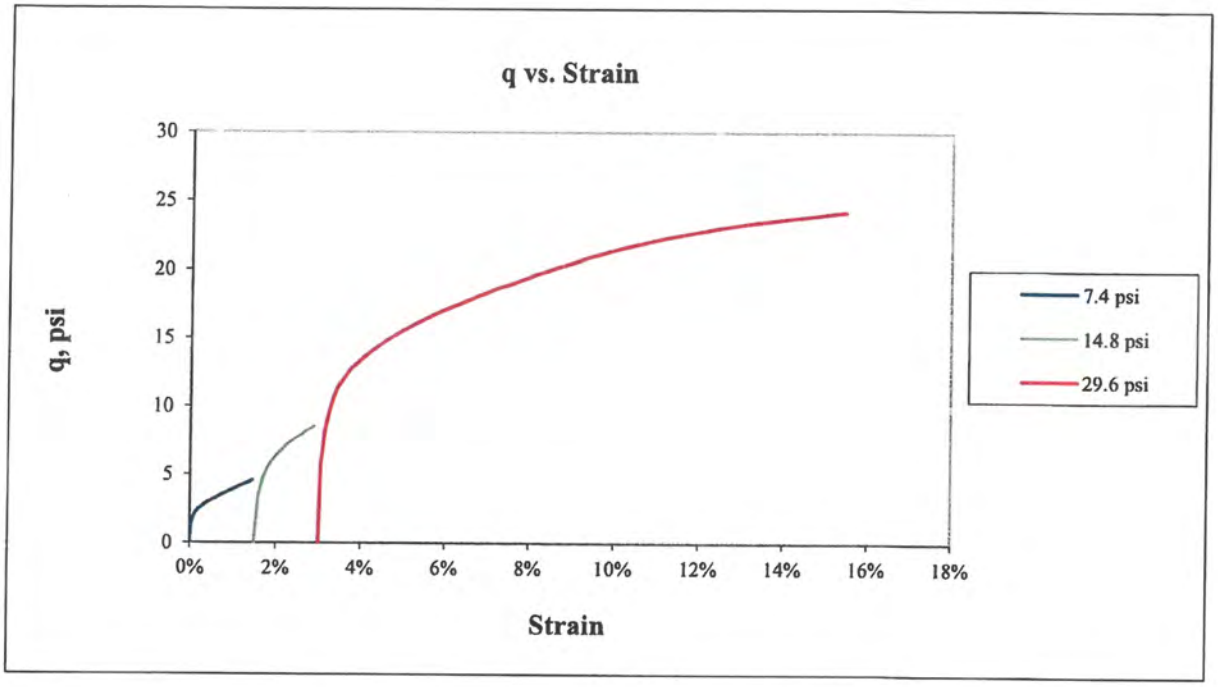
Notes: Sample description: (ML) CLAYEY SILT, some fine to coarse sand; reddish brown and gray.

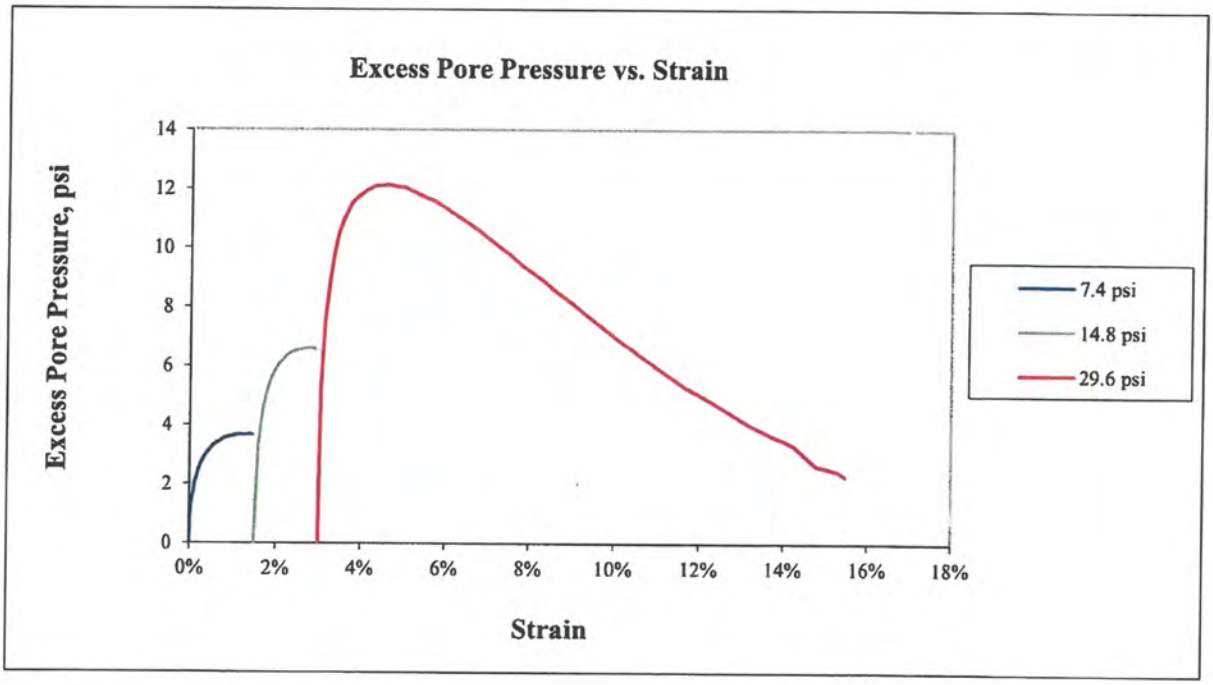
Atterberg limits: LL = 36 PL = 25 PI = 11 (ASTM D4318)

Percent finer: 3/4 in. = 100.0% No. 4 = 100.0% No. 200 = 89.5% (ASTM D422, refer to separate report for gradation curve)

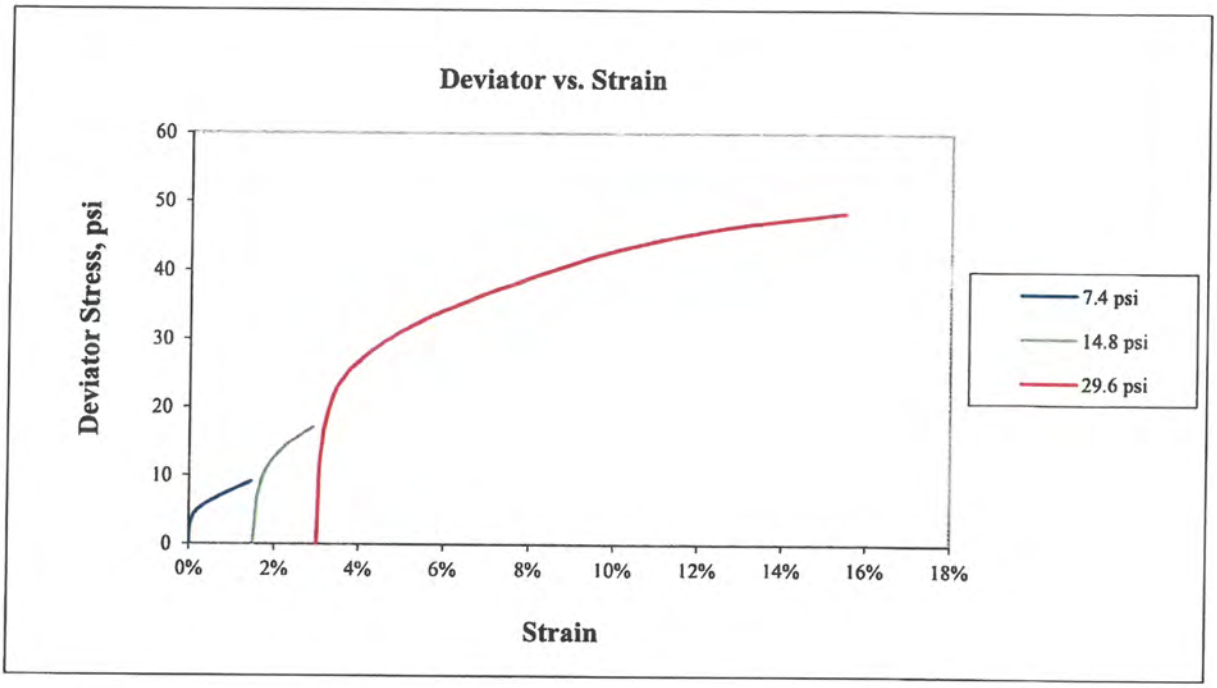
Specimen type:	X	Intact		Reconstituted
Moisture from:		Cuttings	X	Entire specimen
Saturation method:	X	Wet		Dry
Failure criterion:	X	$(\sigma'_1/\sigma'_3)_{max}$		$(\sigma'_1-\sigma'_3)_{max}$ [ ] % strain
Membrane effect:	X	Corrected		Not Corrected

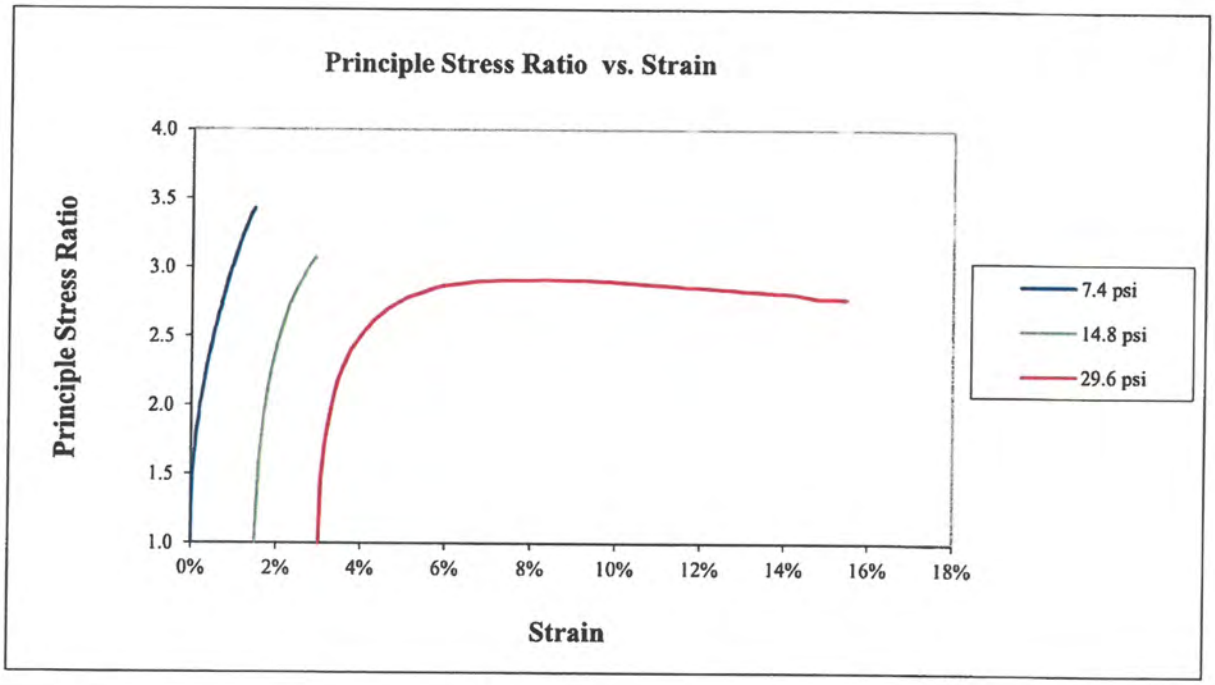
Golder Associates Inc. **Atlanta, Georgia**	**Title:** **MODIFIED (Multi-Stage) - ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **SAMPLE AND TEST DATA**				
Job Short Title: **DOMINION/BREMO ASH POND CLOSURE/VA**					
Sample: **WB-1 UD-01 20.6-21.9'**	**Technician:** **SDM/TH** **Check:**	**Reviewed:** **Approved:**	**Start Date:** **4/22/2015**	**Job Number:** **1520347**	**Figure:** **1**



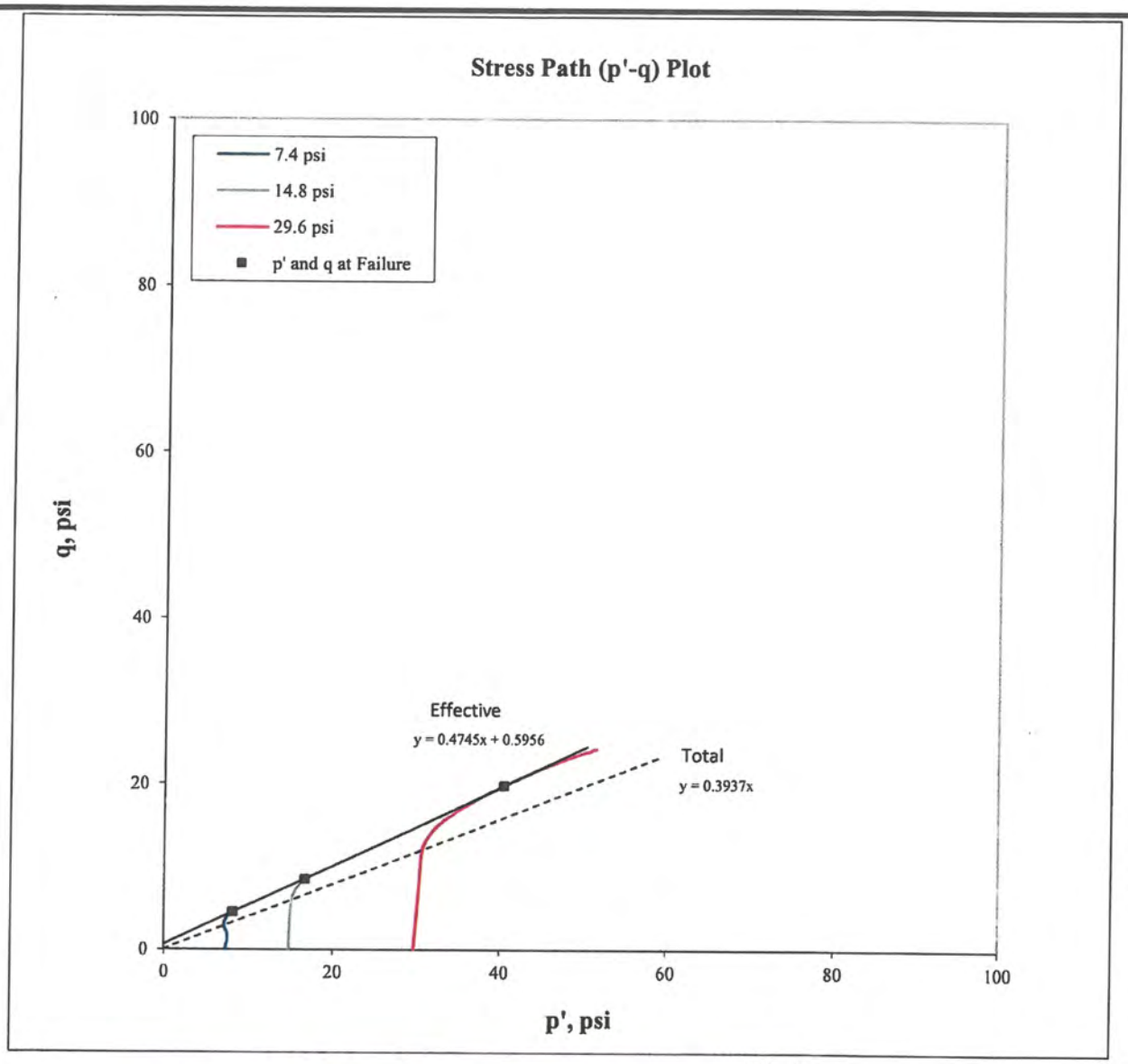


Golder Associates Inc. **Atlanta, Georgia**	**Title:** **MODIFIED (Multi-Stage) - ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **q AND EXCESS PORE PRESSURE PLOTS**				
Job Short Title: **DOMINION/BREMO ASH POND CLOSURE/VA**					
Sample: **WB-1 UD-01 20.6-21.9'**	**Technician:** **SDM/TH** **Check:**	**Reviewed:** **Approved:**	**Start Date:** **4/22/2015**	**Job Number:** **1520347**	**Figure:** **2**





Golder Associates Inc. **Atlanta, Georgia**	**Title:** **MODIFIED (Multi-Stage) - ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **q AND EXCESS PORE PRESSURE PLOTS**				
Job Short Title: **DOMINION/BREMO ASH POND CLOSURE/VA**					
Sample: **WB-1 UD-01 20.6-21.9'**	**Technician:** **SDM/TH** **Check:**	**Reviewed:** **Approved:**	**Start Date:** **4/22/2015**	**Job Number:** **1520347**	**Figure:** **3**



Confining Pressure (psi)	p at failure (psi)	p' at failure (psi)	q at failure (psi)
7.4	11.9	8.3	4.5
14.8	23.3	16.7	8.5
29.6	49.4	40.5	19.8

Effective

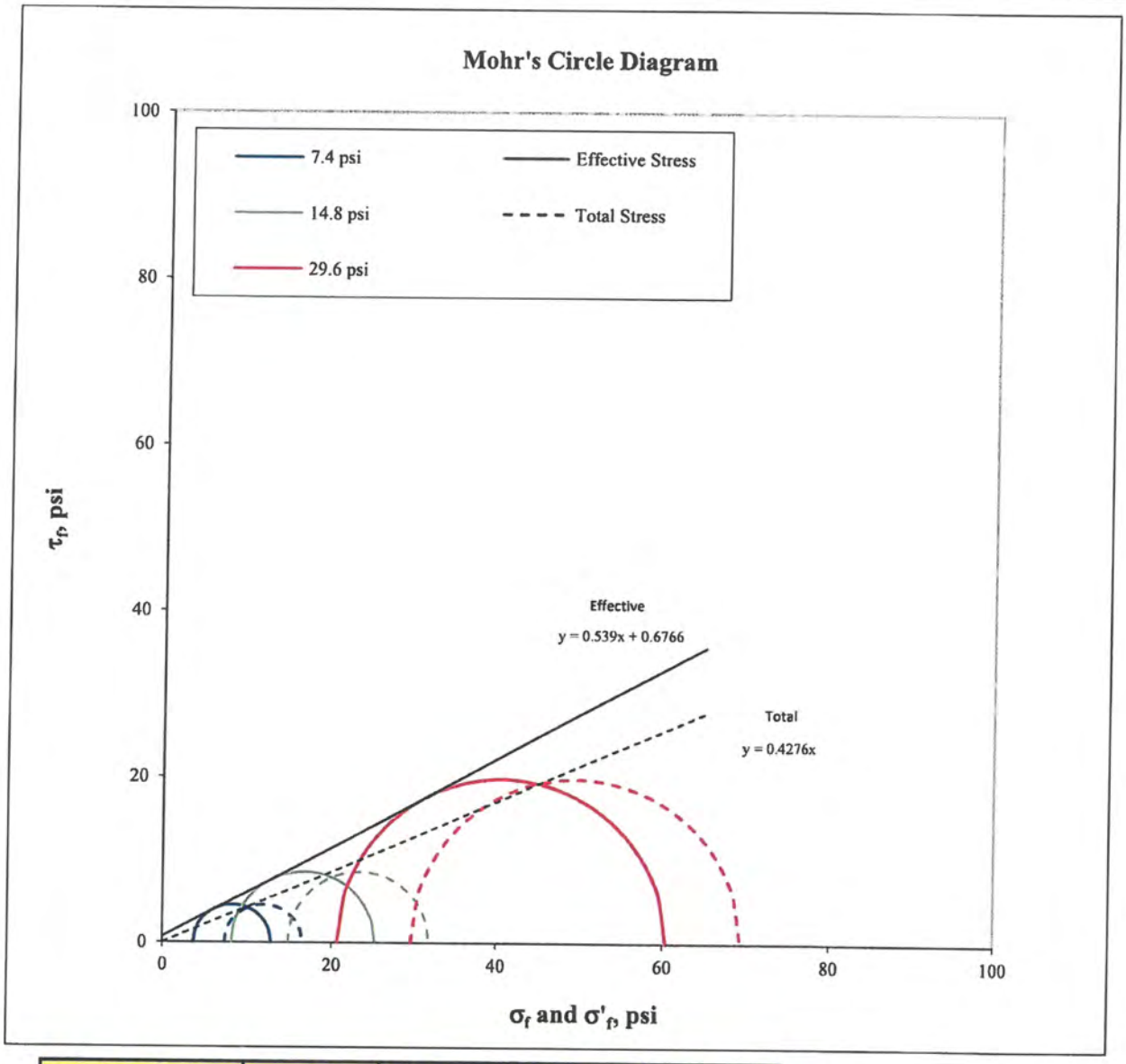
α' =	25.4	degree
a' =	0.6	psi

Total

α =	21.5	degree
a =	0.0	psi

Note: The laboratory testing relates only to the sample tested. GAI neither accepts responsibility for nor makes claims to the final use and purpose of the material.

Golder Associates Inc. **Atlanta, Georgia**	**Title:** **MODIFIED (Multi-Stage) - ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **STRESS PATH PLOT**				
Job Short Title: **DOMINION/BREMO ASH POND CLOSURE/VA**					
Sample: **WB-1 UD-01 20.6-21.9'**	**Technician:** **SDM/TH** **Check:** TWM	**Reviewed:** **Approved:**	**Start Date:** **4/22/2015**	**Job Number:** **1520347**	**Figure:** **4**



Confining Pressure (psi)	σ'_1 at failure (psi)	σ'_3 at failure (psi)	σ_1 at failure (psi)	σ_3 at failure (psi)
7.4	12.8	3.7	16.5	7.4
14.8	25.2	8.2	31.8	14.8
29.6	60.3	20.7	69.2	29.6

Effective

ϕ' =	28.3	degree
c' =	0.7	psi

Total

ϕ =	23.2	degree
c =	0.0	psi

Note: The laboratory testing relates only to the sample tested. GAI neither accepts responsibility for nor makes claims to the final use and purpose of the material.

Golder Associates Inc. Atlanta, Georgia	Title: MODIFIED (Multi-Stage) - ASTM D4767 CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT MOHR'S CIRCLE DIAGRAM				
Job Short Title: DOMINION/BREMO ASH POND CLOSURE/VA					
Sample: WB-1 UD-01 20.6-21.9'	Technician: SDM/TH Check: AWM	Reviewed: Approved:	Start Date: 4/22/2015	Job Number: 1520347	Figure: 5

Golder Associates Inc. **Atlanta, Georgia**	**Title:** **MODIFIED (Multi-Stage) - ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **SPECIMEN PHOTOGRAPH - Single Specimen**				
Job Short Title: **DOMINION/BREMO ASH POND CLOSURE/VA**					
Sample: **WB-1 UD-01 20.6-21.9'**	**Technician:** **SDM/TH** **Check:**	**Reviewed:** **Approved:**	**Start Date:** **4/22/2015**	**Job Number:** **1520347**	**Figure:** **6**

GOLDER 2014 INVESTIGATION LAB SUMMARY RESULTS

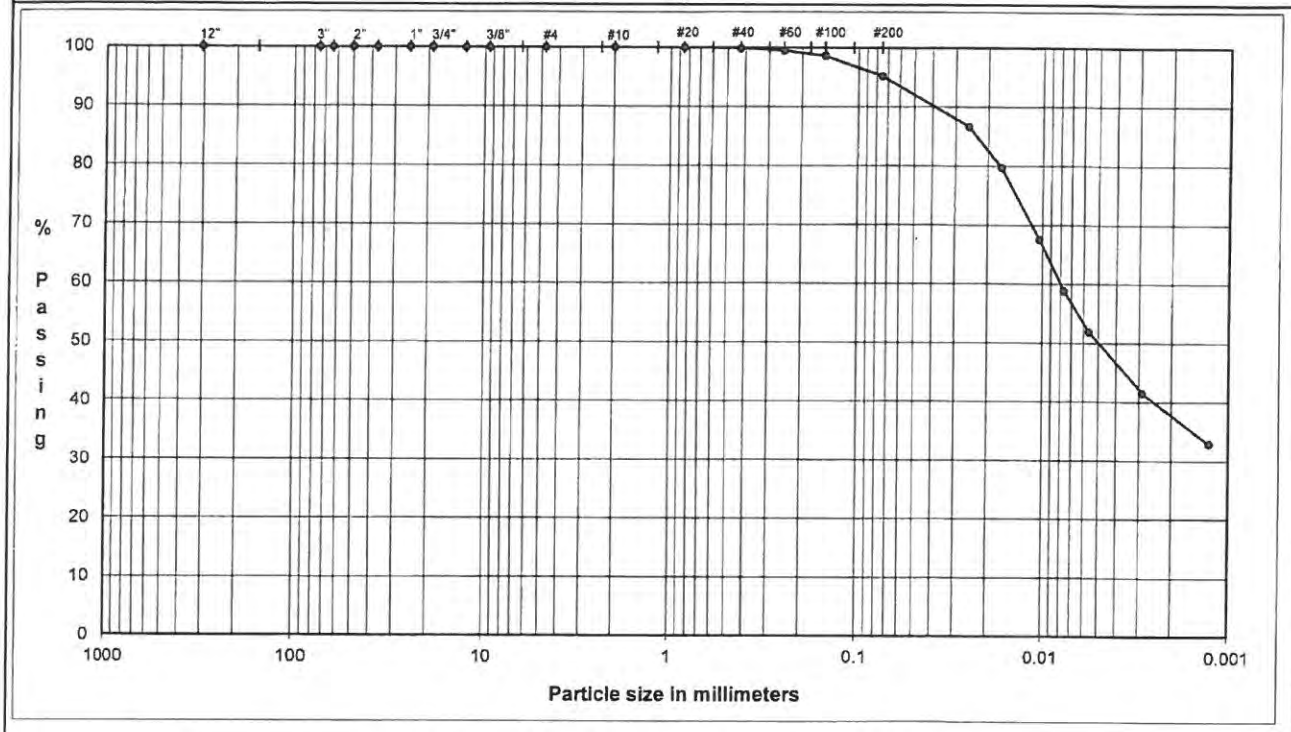
SEPTEMBER 2014

1411086

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: DOMINION/BREMO EAST ASH POND/VA
SAMPLE ID: B-1 S-08 Depth: 33.5-35.0'
TYPE: Jar



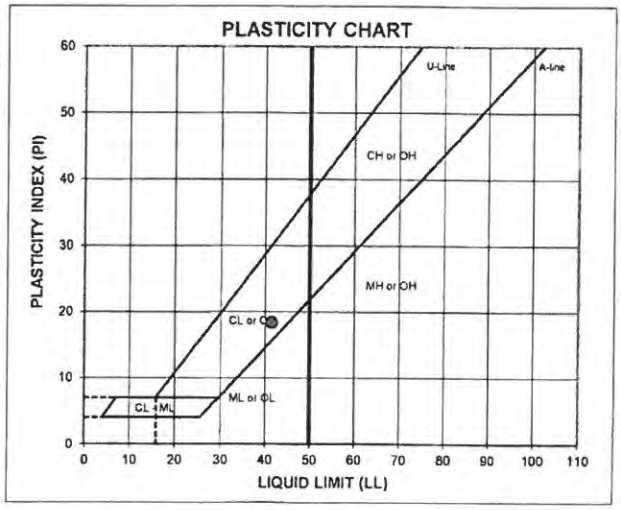
COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.0
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.0
0.50"	12.7	100.0		
0.375"	9.5	100.0		
#4	4.8	100.0	Fine Gravel	0.0
#10	2.00	100.0	Coarse Sand	0.0
#20	0.85	100.0		
#40	0.43	99.9	Medium Sand	0.1
#60	0.25	99.5		
#100	0.15	98.6		
#200	0.075	95.2	Fine Sand	4.7

Hydrometer Analysis

(mm)	%Finer		
0.025	86.6		
0.017	79.7		
0.010	67.6	Fines	
0.0077	58.9	Silt or Clay	95.2
0.0056	52.0		
0.0029	41.6		
0.0013	32.9		



ATTERBERG LIMITS

Method -B (Dry preparation)

M_c	LL	PL	PI	LI
24.1	41	23	18	0.05

LL (oven-dried) / < 0.75 = ORGANIC (OL/OH)

DESCRIPTION: SILTY CLAY, trace fine to medium sand; brown.

USCS: CL

TECH	FT/TJ/TW
DATE	9/3/14
CHECK	
REVIEW	
APPROVE	

Golder Associates Inc.

SEPTEMBER 2014

1411086

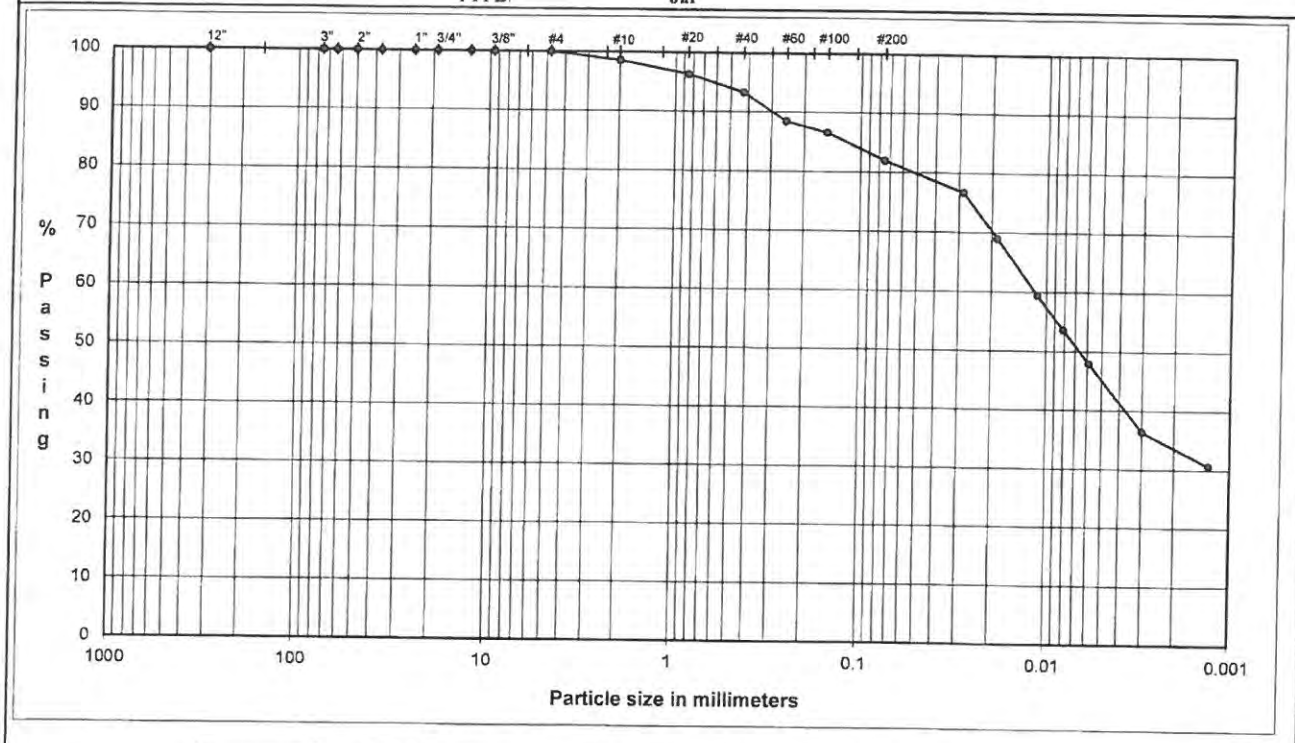
PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: DOMINION/BREMO EAST ASH POND/VA

SAMPLE ID: B-2 UD-01 Depth: 8.0-10.0'

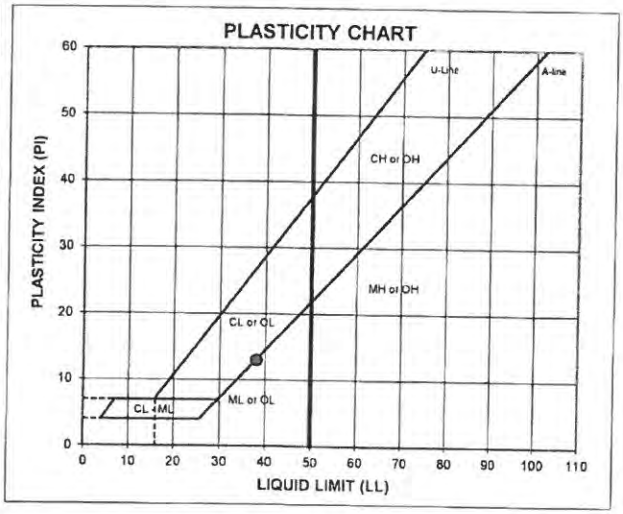
TYPE: Jar



COBBLES	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.0
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.0
0.50"	12.7	100.0		
0.375"	9.5	100.0		
#4	4.8	100.0	Fine Gravel	0.0
#10	2.00	98.6	Coarse Sand	1.4
#20	0.85	96.3		
#40	0.43	93.3	Medium Sand	5.3
#60	0.25	88.5		
#100	0.15	86.6		
#200	0.075	82.0	Fine Sand	11.3



Hydrometer Analysis

(mm)	%Finer		
0.028	76.7		
0.019	69.1		
0.011	59.5	Fines	
0.0081	53.7	Silt or Clay	82.0
0.0059	48.0		
0.0030	36.4		
0.0013	30.7		

ATTERBERG LIMITS

Method -B (Dry preparation)

M_c	LL	PL	PI	LI
22.1	38	25	13	-0.22

LL (oven-dried) / 0.75 = ORGANIC (OL/OH)

DESCRIPTION: sandy SILTY CLAY, fine to coarse; brown.

USCS: CL

TECH	TJ/FT
DATE	9/3/14
CHECK	
REVIEW	
APPROVE	

Golder Associates Inc.

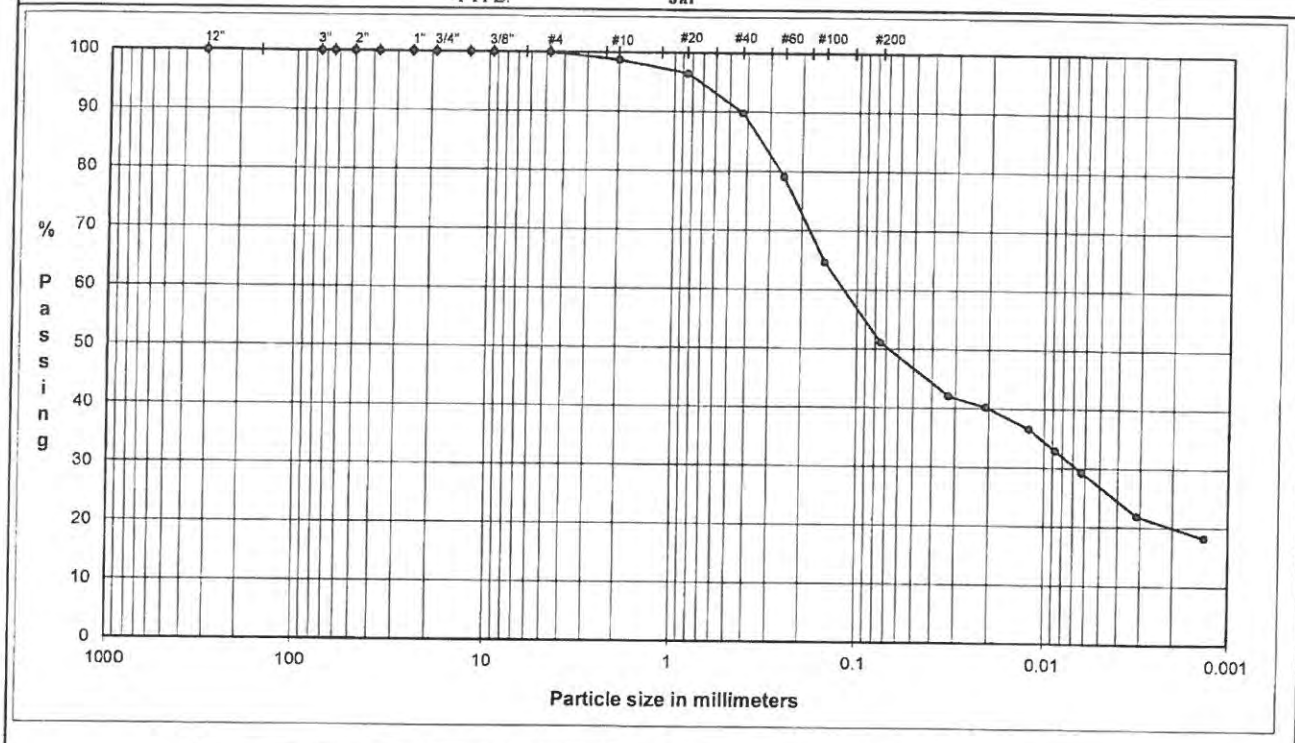
SEPTEMBER 2014

1411086

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: DOMINION/BREMO EAST ASH POND/VA
SAMPLE ID: B-3 UD-01 Depth: 16.0-18.0'
TYPE: Jar



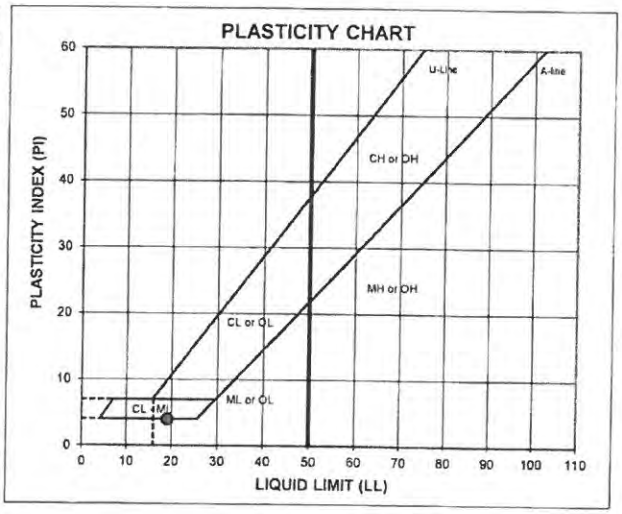
COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.0
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.0
0.50"	12.7	100.0		
0.375"	9.5	100.0		
#4	4.8	100.0	Fine Gravel	0.0
#10	2.00	98.7	Coarse Sand	1.3
#20	0.85	96.5		
#40	0.43	89.9	Medium Sand	8.9
#60	0.25	79.1		
#100	0.15	64.7		
#200	0.075	51.1	Fine Sand	38.7

Hydrometer Analysis

(mm)	%Finer		
0.033	42.1		
0.021	40.3		
0.012	36.6	Fines	
0.0087	33.0	Silt or Clay	51.1
0.0063	29.3		
0.0031	22.0		
0.0013	18.3		



ATTERBERG LIMITS

Method -B (Dry preparation)

M_r	LL	PL	PI	LI
24.7	19	15	4	2.14

LL (oven-dried) / 0.75 = ORGANIC (OL/OH)

DESCRIPTION: SILTY CLAY to CLAYEY SILT and fine to coarse SAND; brown.

USCS: CL-ML

TECH	TJ/FT
DATE	9/3/14
CHECK	DA
REVIEW	[illegible]
APPROVE	[illegible]

Golder Associates Inc.

SEPTEMBER 2014

1411086

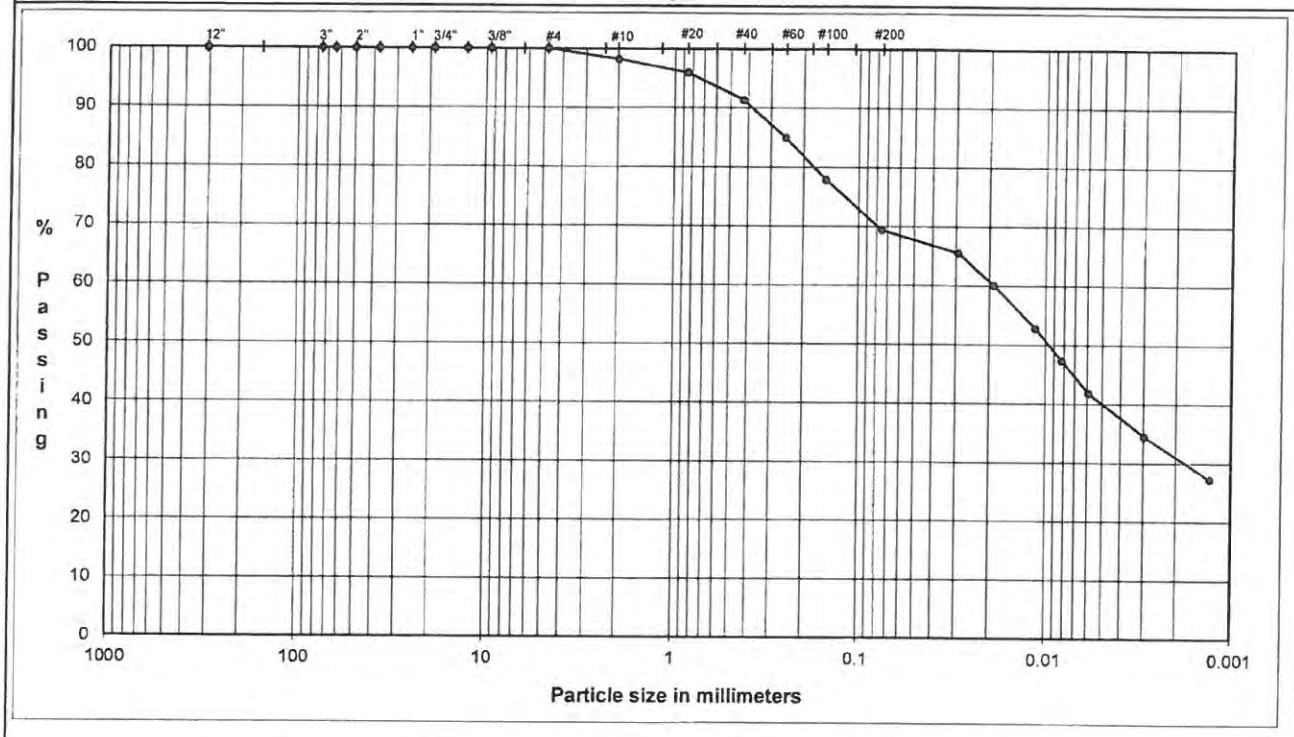
PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: DOMINION/BREMO EAST ASH POND/VA

SAMPLE ID: B-4 S-03 Depth: 8.5-10.0'

TYPE: Jar



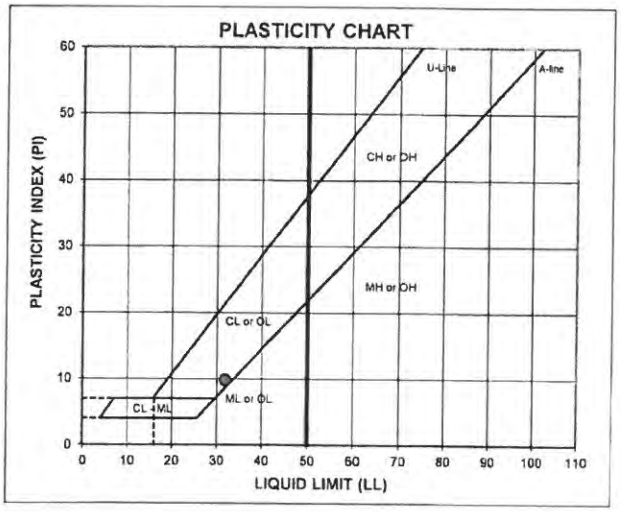
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
COBBLES	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.0
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.0
0.50"	12.7	100.0		
0.375"	9.5	100.0		
#4	4.8	100.0	Fine Gravel	0.0
#10	2.00	98.2	Coarse Sand	1.8
#20	0.85	95.9		
#40	0.43	91.3	Medium Sand	6.9
#60	0.25	85.0		
#100	0.15	77.9		
#200	0.075	69.4	Fine Sand	21.9

Hydrometer Analysis

(mm)	%Finer		
0.029	65.6		
0.019	60.1		
0.011	52.8	Fines	
0.0082	47.3	Silt or Clay	69.4
0.0059	41.9		
0.0030	34.6		
0.0013	27.3		



ATTERBERG LIMITS

Method -B (Dry preparation)

M_c	LL	PL	PI	LI
12.2	32	22	10	-0.95

LL (oven-dried) / LL (oven-dried) ÷ 0.75 = ORGANIC (OL/OH)

DESCRIPTION: sandy SILTY CLAY, fine to coarse; grayish brown.

USCS: CL

TECH	TJ/FT
DATE	9/3/14
CHECK	
REVIEW	
APPROVE	

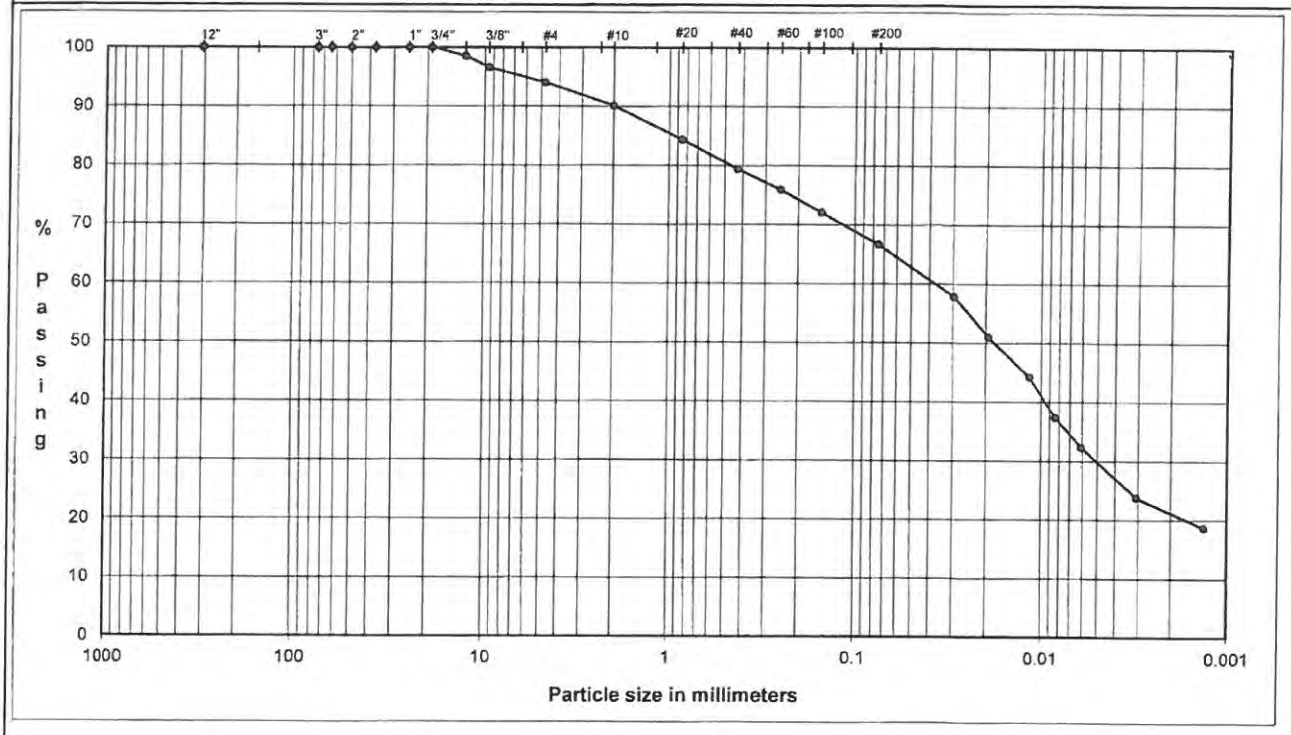
Golder Associates Inc.

SEPTEMBER 2014 1411086

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D421, D422, D4318

PROJECT NAME: DOMINION/BREMO EAST ASH POND/VA
SAMPLE ID: B-5 S-03B Depth: 9.0-10.0
TYPE: Jar



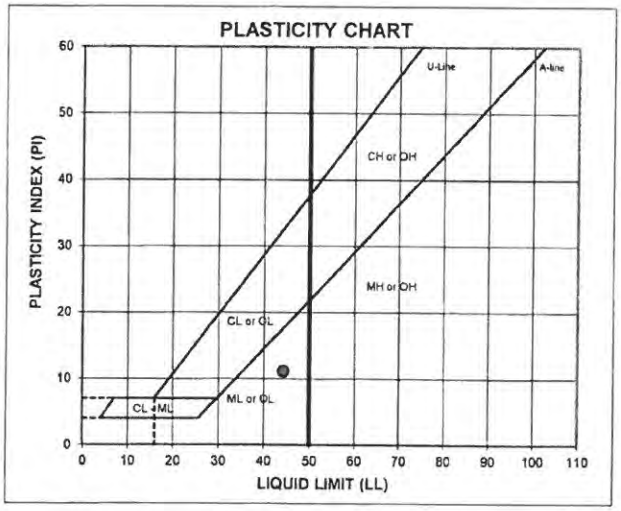
COBBLES	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay
	GRAVEL		SAND			FINES

U.S. Standard Sieves Sizes and Numbers

	Particle Size (mm)	% Passing	Particle Size Classification	Percentage
12.0"	304.8	100.0		
3.0"	75.0	100.0	Cobbles	0.0
2.5"	63.5	100.0		
2.0"	50.0	100.0		
1.5"	37.5	100.0		
1.0"	25.0	100.0		
0.75"	19.0	100.0	Coarse Gravel	0.0
0.50"	12.7	98.6		
0.375"	9.5	96.6		
#4	4.8	94.1	Fine Gravel	5.9
#10	2.00	90.1	Coarse Sand	3.9
#20	0.85	84.4		
#40	0.43	79.4	Medium Sand	10.7
#60	0.25	75.9		
#100	0.15	72.0		
#200	0.075	66.7	Fine Sand	12.7

Hydrometer Analysis

(mm)	%Finer		
0.030	57.9		
0.019	51.1		
0.012	44.3	Fines	
0.0084	37.4	Silt or Clay	66.7
0.0061	32.3		
0.0031	23.8		
0.0013	18.7		



ATTERBERG LIMITS
Method -B (Dry preparation)

M_c	LL	PL	PI	LI
30.1	44	33	11	-0.25

LL (oven-dried) / 0.75 = ORGANIC (OL/OH)

DESCRIPTION: sandy CLAYEY SILT, fine to coarse, some fine gravel; dark gray and brown.

USCS: ML

TECH	AK/TW/TJ/FT
DATE	9/3/14
CHECK	
REVIEW	
APPROVE	

Golder Associates Inc.

Boring or Test Pit:	B-2		Boring or Test Pit:	B-2		Boring or Test Pit:	B-2	
Sample:	UD-01		Sample:	UD-01		Sample:	UD-01	
Depth:	8.0-10.0'	ft	Depth:	8.0-10.0'	ft	Depth:	8.0-10.0'	ft
Point No.:	1		Point No.:	2		Point No.:	3	

Initial			Initial			Initial		
Length =	5.931	in	Length =	5.911	in	Length =	5.977	in
Diameter =	2.858	in	Diameter =	2.860	in	Diameter =	2.860	in
Wet Mass =	2.775	lb	Wet Mass =	2.726	lb	Wet Mass =	2.827	lb
Area =	6.415	in^2	Area =	6.424	in^2	Area =	6.424	in^2
Volume =	38.049	in^3	Volume =	37.974	in^3	Volume =	38.398	in^3
Specific Gravity =	2.76	(ASTM D854)	Specific Gravity =	2.76	(ASTM D854)	Specific Gravity =	2.76	(ASTM D854)
Dry Mass of Solids =	2.291	lb	Dry Mass of Solids =	2.222	lb	Dry Mass of Solids =	2.309	lb
Moisture Content =	21.1%		Moisture Content =	22.7%		Moisture Content =	22.4%	
Wet Unit Weight =	126.0	pcf	Wet Unit Weight =	124.1	pcf	Wet Unit Weight =	127.2	pcf
Dry Unit Weight =	104.1	pcf	Dry Unit Weight =	101.1	pcf	Dry Unit Weight =	103.9	pcf
Void Ratio =	0.65		Void Ratio =	0.70		Void Ratio =	0.65	
Percent Saturation =	90%		Percent Saturation =	90%		Percent Saturation =	95%	

After Consolidation			After Consolidation			After Consolidation		
Length =	5.930	in	Length =	5.910	in	Length =	5.958	in
Diameter =	2.859	in	Diameter =	2.855	in	Diameter =	2.866	in
Area =	6.421	in^2 (Method B)	Area =	6.403	in^2 (Method B)	Area =	6.452	in^2 (Method B)
Volume =	38.079	in^3	Volume =	37.843	in^3	Volume =	38.440	in^3
Moisture Content =	23.6%		Moisture Content =	25.1%		Moisture Content =	23.7%	
Wet Unit Weight =	128.5	pcf	Wet Unit Weight =	127.0	pcf	Wet Unit Weight =	128.4	pcf
Dry Unit Weight =	104.0	pcf	Dry Unit Weight =	101.5	pcf	Dry Unit Weight =	103.8	pcf
Void Ratio =	0.65		Void Ratio =	0.69		Void Ratio =	0.65	
Percent Saturation =	100%		Percent Saturation =	100%		Percent Saturation =	100%	

B Parameter =	1.00		B Parameter =	0.99		B Parameter =	0.97	
Shear Rate =	0.102%	/min.	Shear Rate =	0.102%	/min.	Shear Rate =	0.043%	/min.
t_{50} =	0.46	min.	t_{50} =	2.10	min.	t_{50} =	9.57	min.
Strain at Failure =	1.8%		Strain at Failure =	4.2%		Strain at Failure =	2.5%	

Cell Pressure =	84.0	psi	Cell Pressure =	88.0	psi	Cell Pressure =	96.0	psi
Back Pressure =	80.0	psi	Back Pressure =	80.0	psi	Back Pressure =	80.0	psi
Confining Pressure =	4.0	psi	Confining Pressure =	8.0	psi	Confining Pressure =	16.0	psi

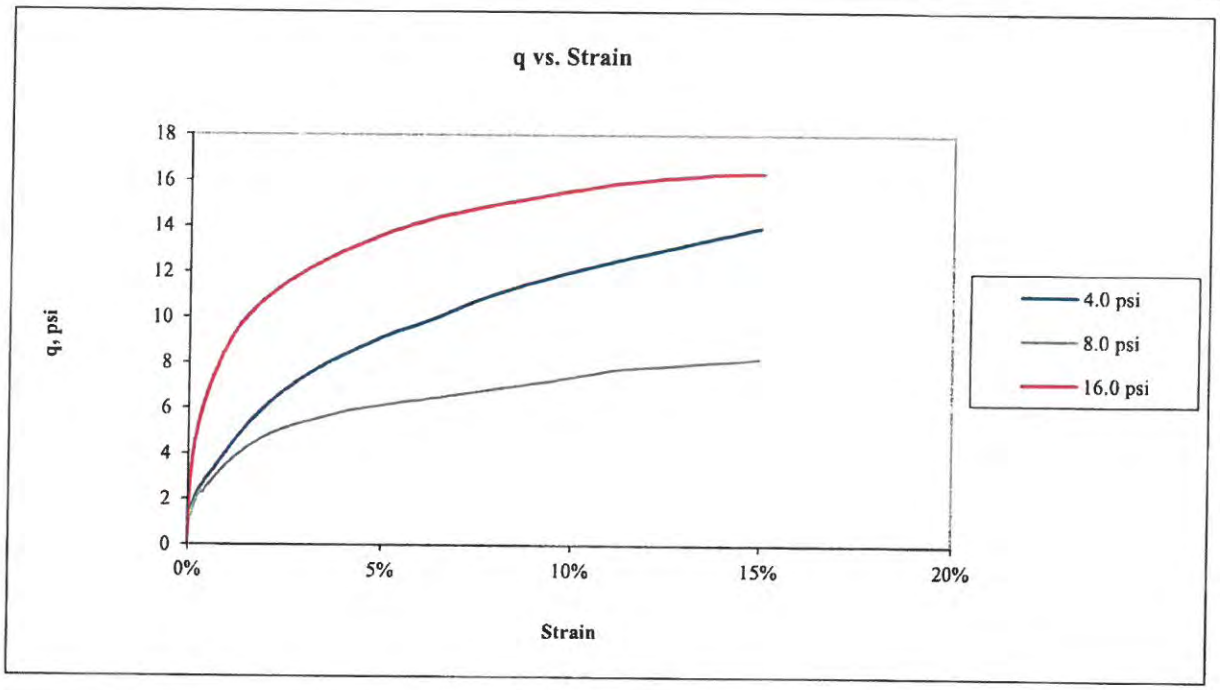
Notes: Sample description: (CL) sandy SILTY CLAY, fine to coarse; brown.

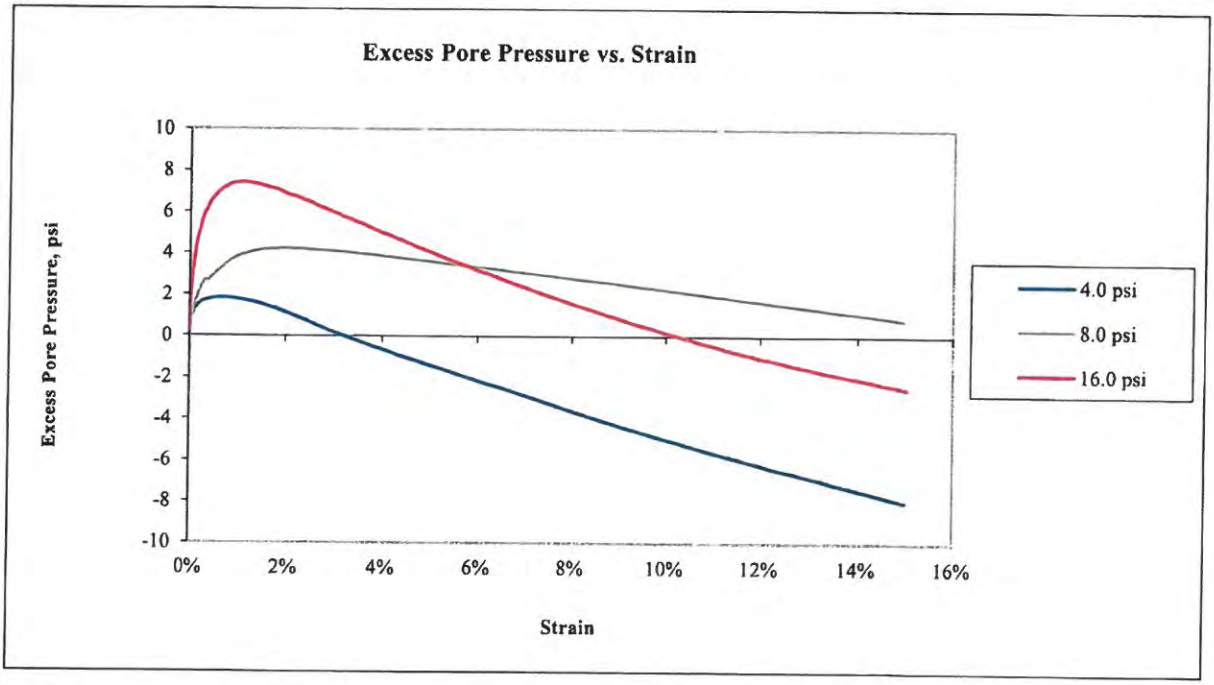
Atterberg limits: LL = 38 PL = 25 PI = 13 (ASTM D4318)

Percent finer: 3/4 in. = 100% No. 4 = 100% No. 200 = 82% (ASTM D422, refer to separate report for gradation curve)

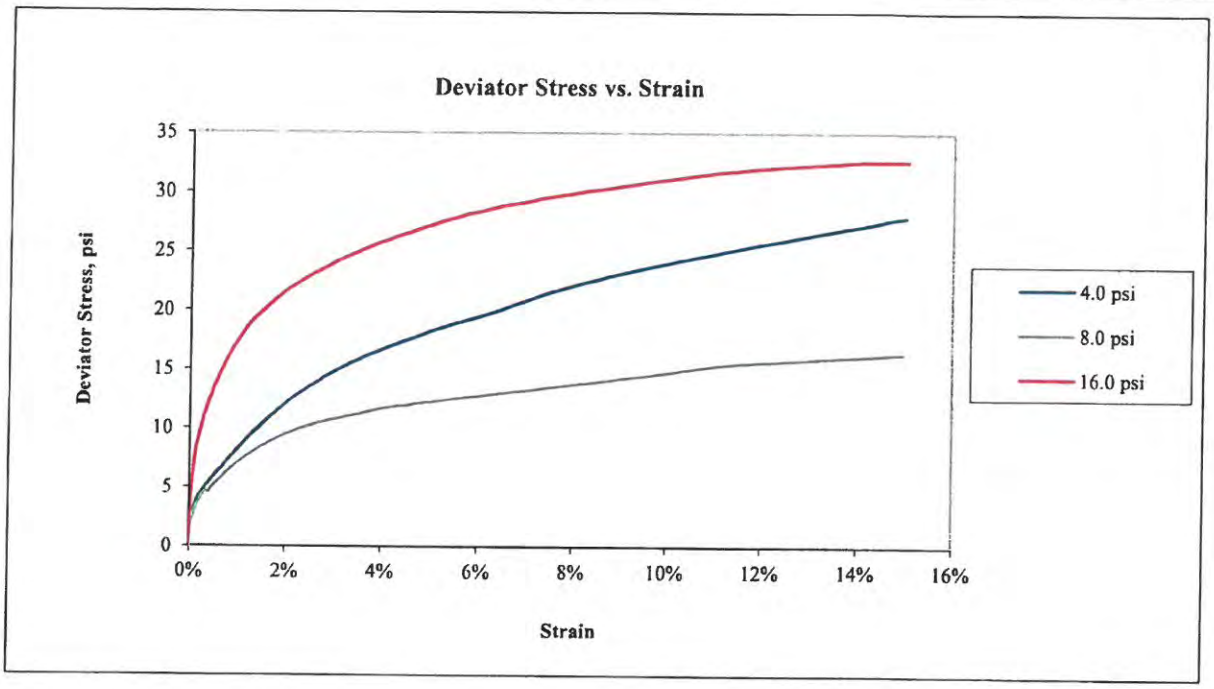
Specimen type:	X	Intact		Reconstituted
Moisture from:		Cuttings	X	Entire specimen
Saturation method:	X	Wet		Dry
Failure criterion:	X	$(\sigma'_1/\sigma'_3)_{max}$		$(\sigma'_1-\sigma'_3)_{max}$ [ ] % strain
Membrane effect:	X	Corrected		Not Corrected

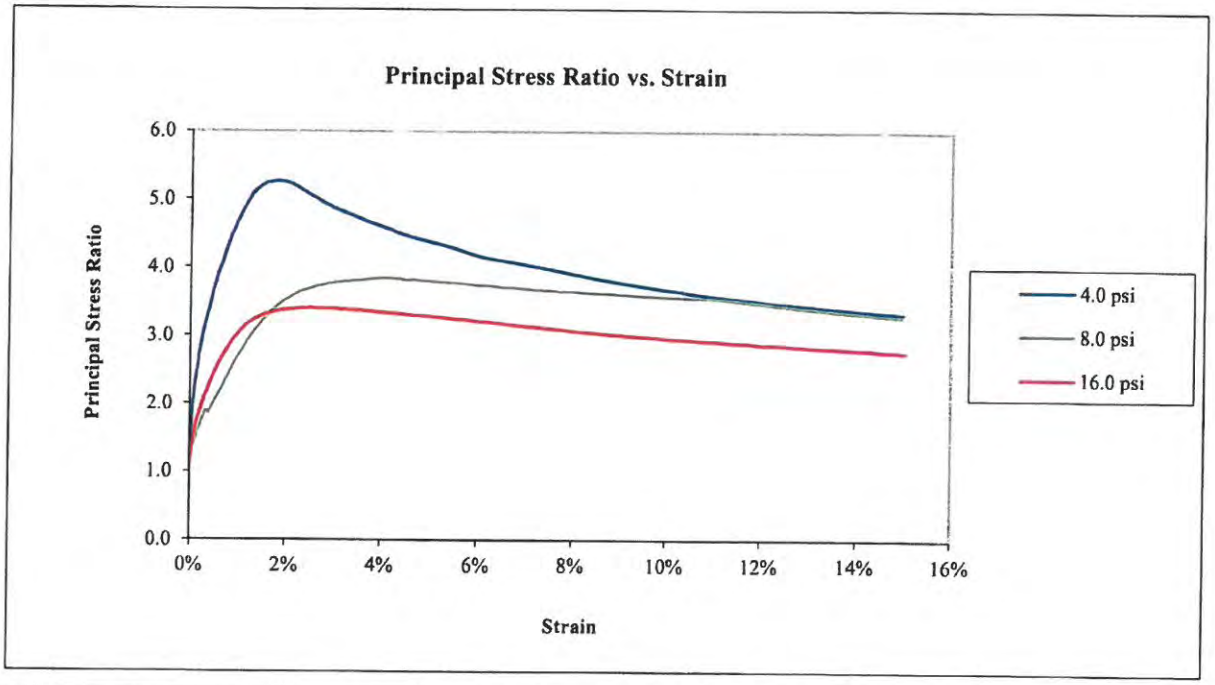
Golder Associates Inc. **Atlanta, Georgia**	**Title:** **ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **SAMPLE AND TEST DATA**				
Job Short Title: **DOMINION/BREMO EAST ASH POND/VA**					
Sample: **B-2, UD-01, 8.0-10.0'**	**Technician:** **TW/SDM** **Check:** AWH	**Reviewed:** **Approved:**	**Start Date:** **9/5/2014**	**Job Number:** **1411086**	**Figure:** **1**



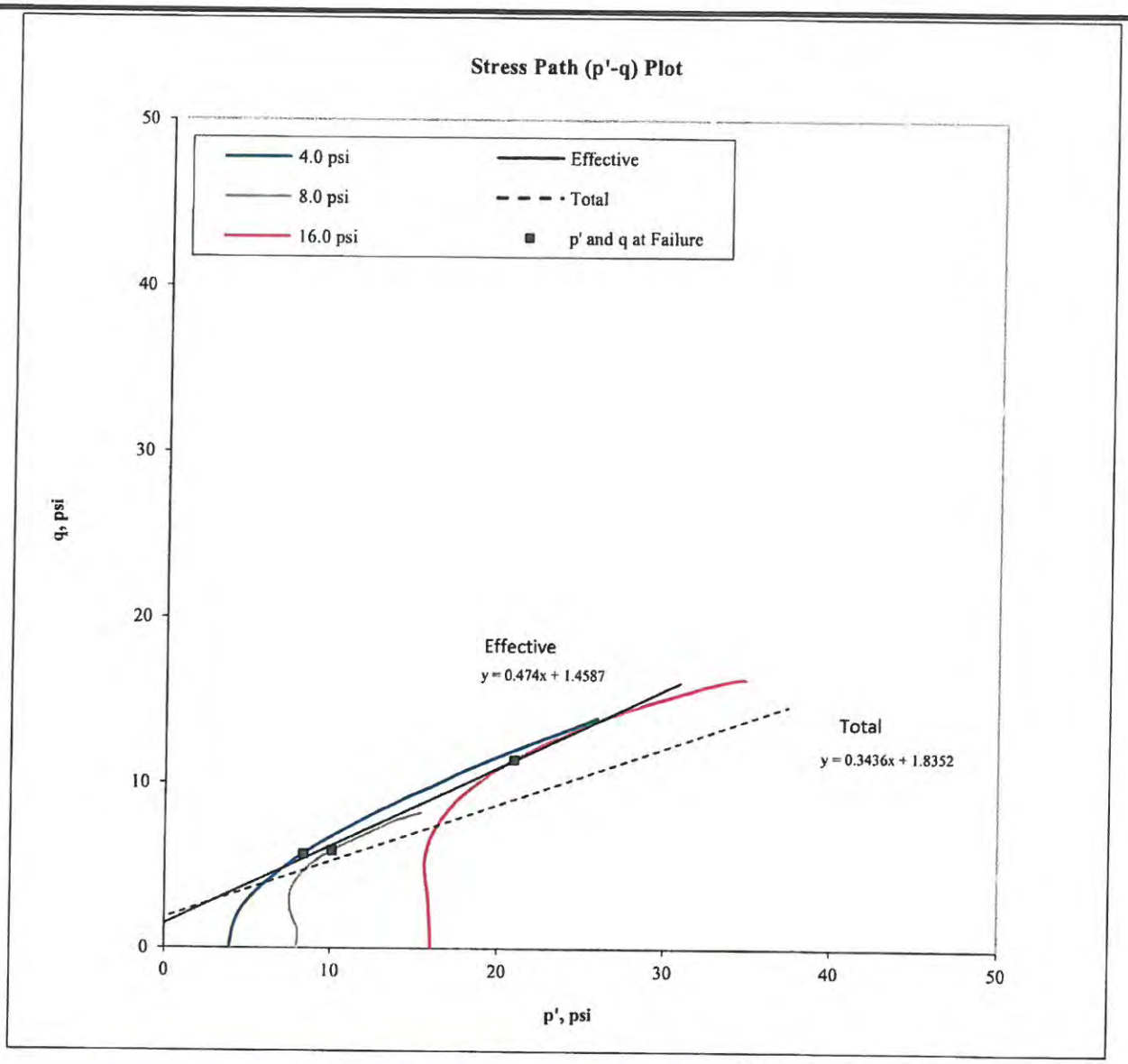


Golder Associates Inc. **Atlanta, Georgia**	**Title:** **ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **q AND EXCESS PORE PRESSURE PLOTS**				
Job Short Title: **DOMINION/BREMO EAST ASH POND/VA**					
Sample: **B-2, UD-01, 8.0-10.0'**	**Technician:** **TW/SDM** **Check:** AWM	**Reviewed:** RDP **Approved:**	**Start Date:** **9/5/2014**	**Job Number:** **1411086**	**Figure:** **2**





Golder Associates Inc. **Atlanta, Georgia**	**Title:** **ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **DEVIATOR STRESS AND PRINCIPAL STRESS RATIO PLOT**				
Job Short Title: **DOMINION/BREMO EAST ASH POND/VA**					
Sample: **B-2, UD-01, 8.0-10.0'**	**Technician:** **TW/SDM** **Check:** [illegible]	**Reviewed:** [illegible] **Approved:**	**Start Date:** **9/5/2014**	**Job Number:** **1411086**	**Figure:** **3**



Confining Pressure (psi)	p at failure (psi)	p' at failure (psi)	q at failure (psi)
4.0	9.7	8.4	5.7
8.0	13.9	10.1	5.9
16.0	27.4	20.9	11.4

Effective

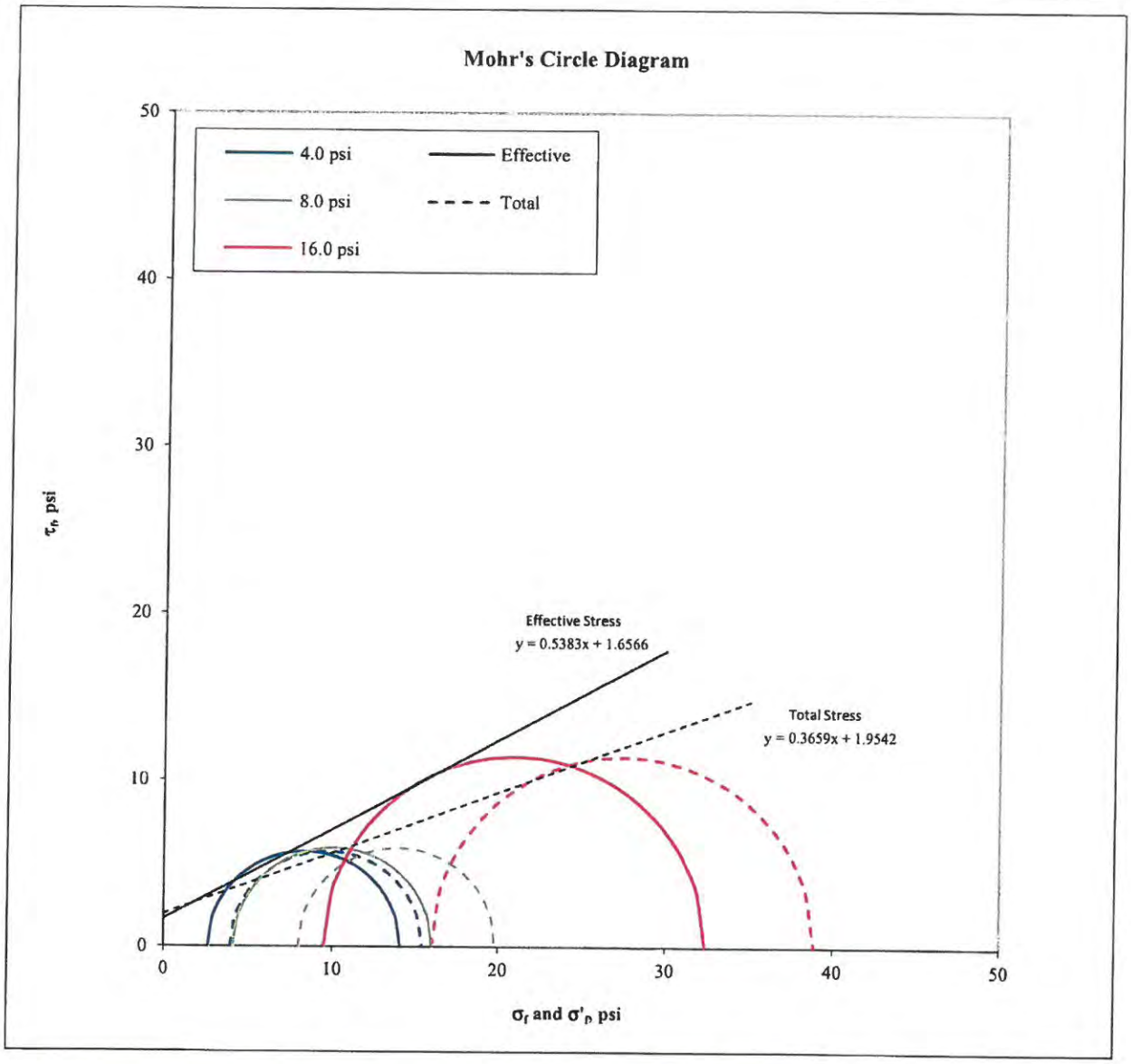
α' =	25.4	degree
a' =	1.5	psi

Total

α =	19.0	degree
a =	1.8	psi

Note: The laboratory testing relates only to the sample tested. GAI neither accepts responsibility for nor makes claims to the final use and purpose of the material.

Golder Associates Inc. **Atlanta, Georgia**	**Title:** **ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **STRESS PATH PLOT**				
Job Short Title: **DOMINION/BREMO EAST ASH POND/VA**					
Sample: **B-2, UD-01, 8.0-10.0'**	**Technician:** **TW/SDM** **Check:**	**Reviewed:** **Approved:**	**Start Date:** **9/5/2014**	**Job Number:** **1411086**	**Figure:** **4**



Confining Pressure (psi)	σ'_1 at failure (psi)	σ'_3 at failure (psi)	σ_1 at failure (psi)	σ_3 at failure (psi)
4.0	14.1	2.7	15.4	4.0
8.0	16.0	4.2	19.8	8.0
16.0	32.4	9.5	38.8	16.0

Effective

ϕ' = 28.3 degree

c' = 1.7 psi

Total

ϕ = 20.1 degree

c = 2.0 psi

Note: The laboratory testing relates only to the sample tested. GAI neither accepts responsibility for nor makes claims to the final use and purpose of the material.

Golder Associates Inc. **Atlanta, Georgia**	**Title:** **ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **MOHR'S CIRCLE DIAGRAM**				
Job Short Title: **DOMINION/BREMO EAST ASH POND/VA**					
Sample: **B-2, UD-01, 8.0-10.0'**	**Technician:** **TW/SDM** **Check:**	**Reviewed:** **Approved:**	**Start Date:** **9/5/2014**	**Job Number:** **1411086**	**Figure:** **5**

4.0 psi

8.0 psi

16.0 psi

Golder Associates Inc. **Atlanta, Georgia**	Title: ASTM D4767 CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT SPECIMENS PHOTOGRAPH - 4.0 8.0 16.0 psi				
Job Short Title: DOMINION/BREMO EAST ASH POND/VA					
Sample: B-2, UD-01, 8.0-10.0'	Technician: TW/SDM Check:	Reviewed: Approved:	Start Date: 9/5/2014	Job Number: 1411086	Figure: 6

Boring or Test Pit: B-3	Boring or Test Pit:	Boring or Test Pit:
Sample: UD-01	Sample:	Sample:
Depth: 16.0-18.0 ft	Depth:	Depth:
Point No.: 1	Point No.:	Point No.:

Initial								
Length =	5.938	in	Length =	5.918		Length =	5.878	
Diameter =	2.853	in	Diameter =	2.806		Diameter =	2.816	
Wet Mass =	2.776	lb	Wet Mass =			Wet Mass =		
Area =	6.393	in^2	Area =			Area =		
Volume =	37.961	in^3	Volume =			Volume =		
Specific Gravity =	2.71	(ASTM D854)	Specific Gravity =			Specific Gravity =		
Dry Mass of Solids =	2.226	lb	Dry Mass of Solids =			Dry Mass of Solids =		
Moisture Content =	24.7%		Moisture Content =			Moisture Content =		
Wet Unit Weight =	126.4	pcf	Wet Unit Weight =			Wet Unit Weight =		
Dry Unit Weight =	101.3	pcf	Dry Unit Weight =			Dry Unit Weight =		
Void Ratio =	0.67		Void Ratio =			Void Ratio =		
Percent Saturation =	101%		Percent Saturation =			Percent Saturation =		

After Consolidation			After Consolidation			After Consolidation		
Length =	5.918	in	Length =	5.878	in	Length =	5.779	in
Diameter =	2.806	in	Diameter =	2.816	in	Diameter =	2.687	in
Area =			Area =			Area =	5.669	in^2 (Method B)
Volume =			Volume =			Volume =	32.764	in^3
Moisture Content =			Moisture Content =			Moisture Content =	16.2%	
Wet Unit Weight =			Wet Unit Weight =			Wet Unit Weight =	136.3	pcf
Dry Unit Weight =			Dry Unit Weight =			Dry Unit Weight =	117.4	pcf
Void Ratio =			Void Ratio =			Void Ratio =	0.44	
Percent Saturation =			Percent Saturation =			Percent Saturation =	100%	

B Parameter =	1.00		B Parameter =	--		B Parameter =	--	
Shear Rate =	0.023%	/min.	Shear Rate =	0.015%	/min.	Shear Rate =	0.012%	/min.
t_{50} =	16.9	min.	t_{50} =	47.0	min.	t_{50} =	39.5	min.
Strain at Failure =	1.1%		Strain at Failure =	2.4%		Strain at Failure =	8.3%	

Cell Pressure =	87.0	psi	Cell Pressure =	95.0	psi	Cell Pressure =	110.0	psi
Back Pressure =	80.0	psi	Back Pressure =	80.0	psi	Back Pressure =	80.0	psi
Confining Pressure =	7.0	psi	Confining Pressure =	15.0	psi	Confining Pressure =	30.0	psi

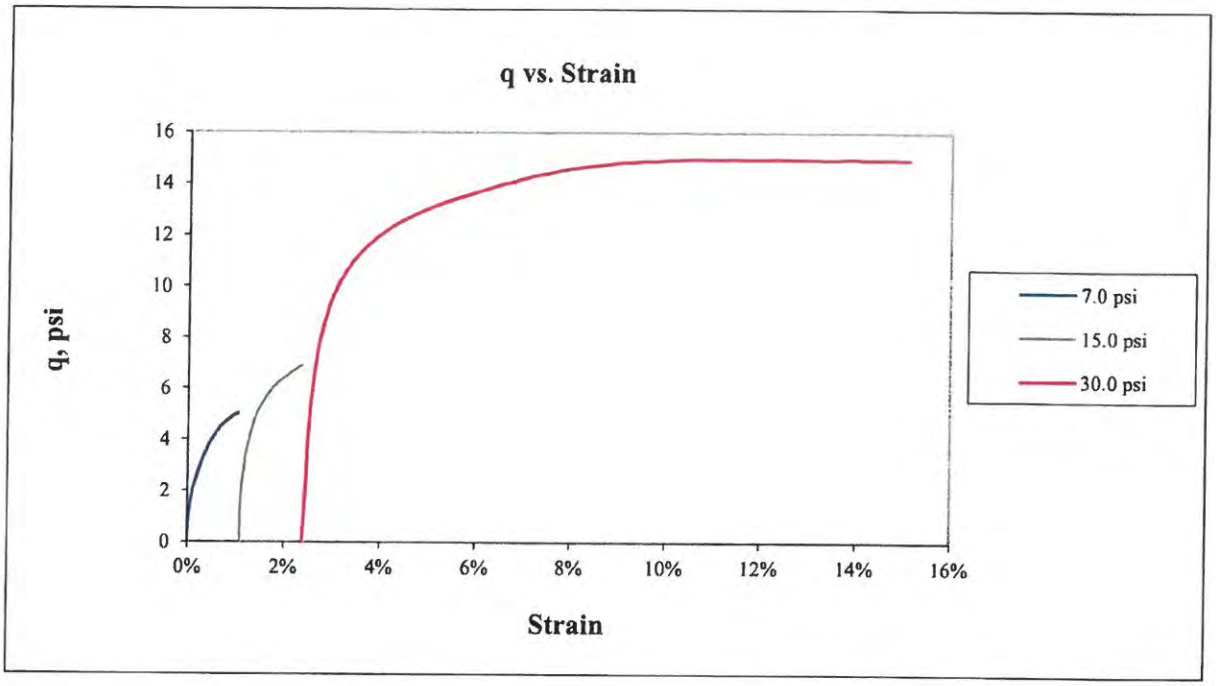
Notes: Sample description: (CL-ML) SILTY CLAY to CLAYEY SILT and fine to coarse SAND; brown.

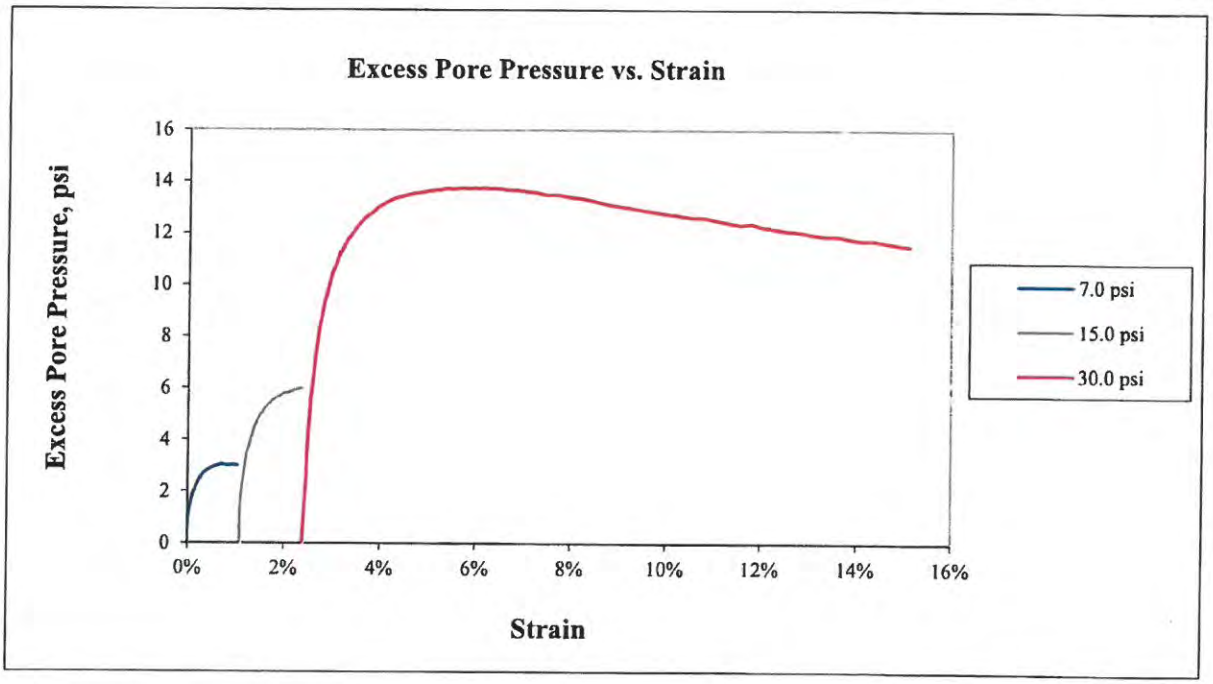
Atterberg limits: LL = 19 PL = 15 PI = 4 (ASTM D4318)

Percent finer: 3/4 in. = 100.0% No. 4 = 100.0% No. 200 = 51.1% (ASTM D422, refer to separate report for gradation curve)

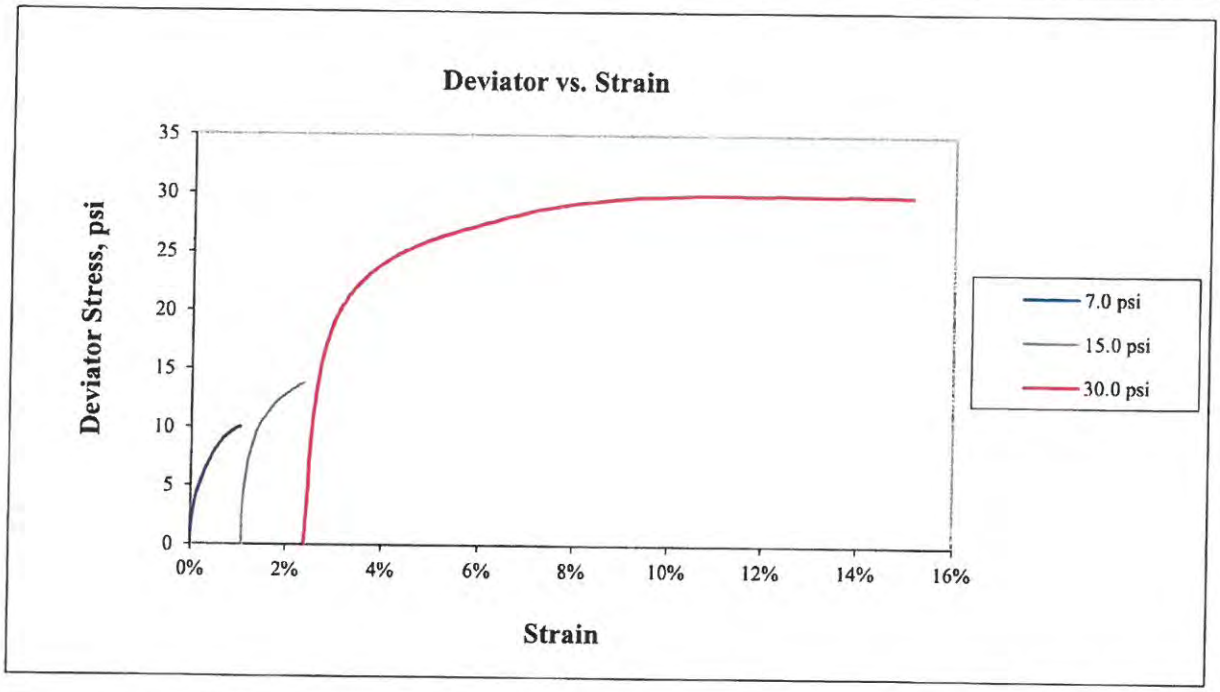
Specimen type:	X	Intact		Reconstituted
Moisture from:		Cuttings	X	Entire specimen
Saturation method:	X	Wet		Dry
Failure criterion:	X	$(\sigma'_1/\sigma'_3)_{max}$		$(\sigma'_1-\sigma'_3)_{max}$ [ ] % strain
Membrane effect:	X	Corrected		Not Corrected

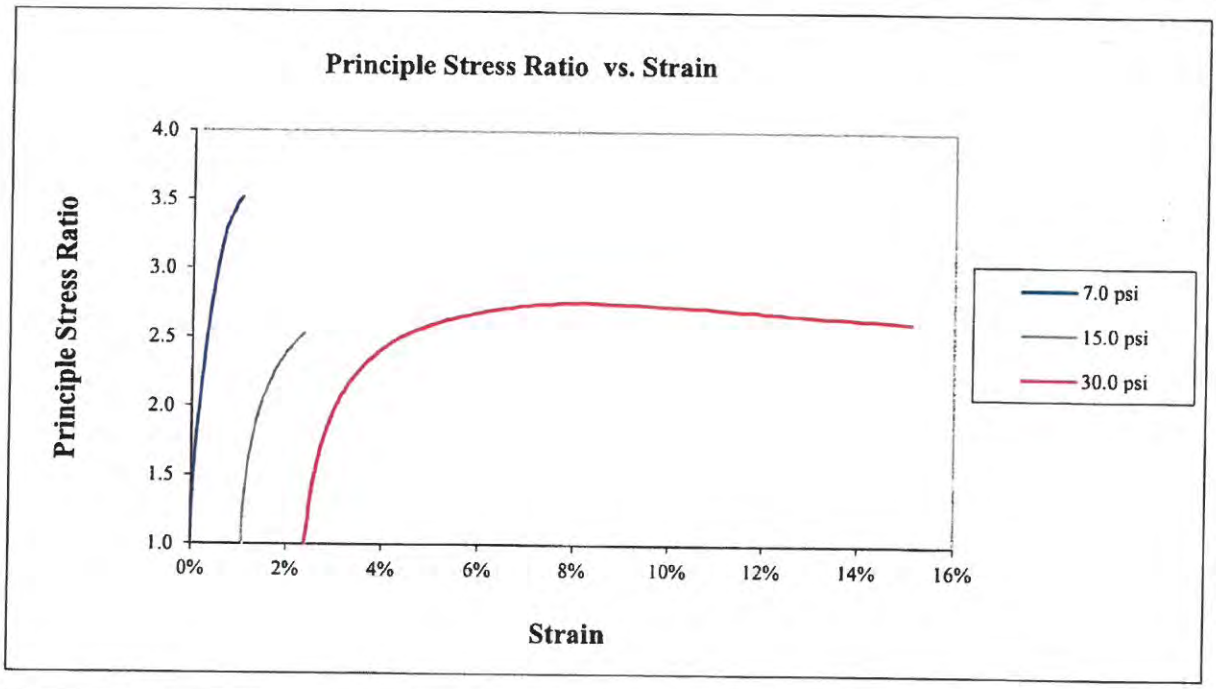
Golder Associates Inc. **Atlanta, Georgia**	**Title:** **MODIFIED (Multi-Stage) - ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **SAMPLE AND TEST DATA**				
Job Short Title: **DOMINION/BREMO EAST ASH POND/VA**					
Sample: **B-3 UD-01 16.0-18.0'**	**Technician:** **SDM/TW** **Check:**	**Reviewed:** **Approved:**	**Start Date:** **9/8/2014**	**Job Number:** **1411086**	**Figure:** **1**



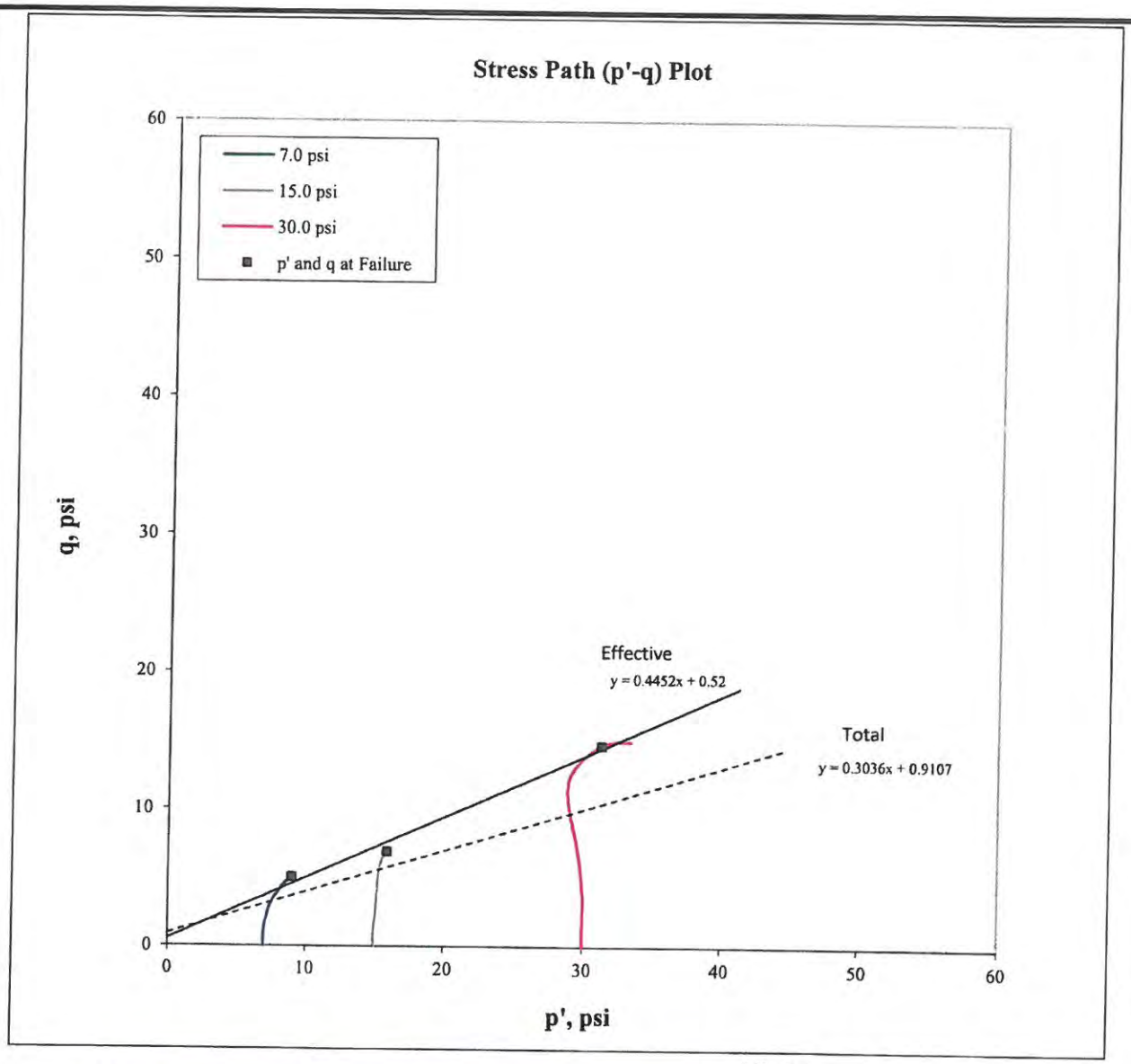


Golder Associates Inc. **Atlanta, Georgia**	**Title:** **MODIFIED (Multi-Stage) - ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **q AND EXCESS PORE PRESSURE PLOTS**				
Job Short Title: **DOMINION/BREMO EAST ASH POND/VA**					
Sample: **B-3 UD-01 16.0-18.0'**	**Technician:** **SDM/TW** **Check:**	**Reviewed:** **Approved:**	**Start Date:** **9/8/2014**	**Job Number:** **1411086**	**Figure:** **2**





Golder Associates Inc. **Atlanta, Georgia**	**Title:** **MODIFIED (Multi-Stage) - ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **q AND EXCESS PORE PRESSURE PLOTS**				
Job Short Title: **DOMINION/BREMO EAST ASH POND/VA**					
Sample: **B-3 UD-01 16.0-18.0'**	**Technician:** **SDM/TW** **Check:**	**Reviewed:** **Approved:**	**Start Date:** **9/8/2014**	**Job Number:** **1411086**	**Figure:** **3**



Confining Pressure (psi)	p at failure (psi)	p' at failure (psi)	q at failure (psi)
7.0	12.0	9.0	5.0
15.0	21.9	15.9	6.9
30.0	44.7	31.3	14.7

Effective

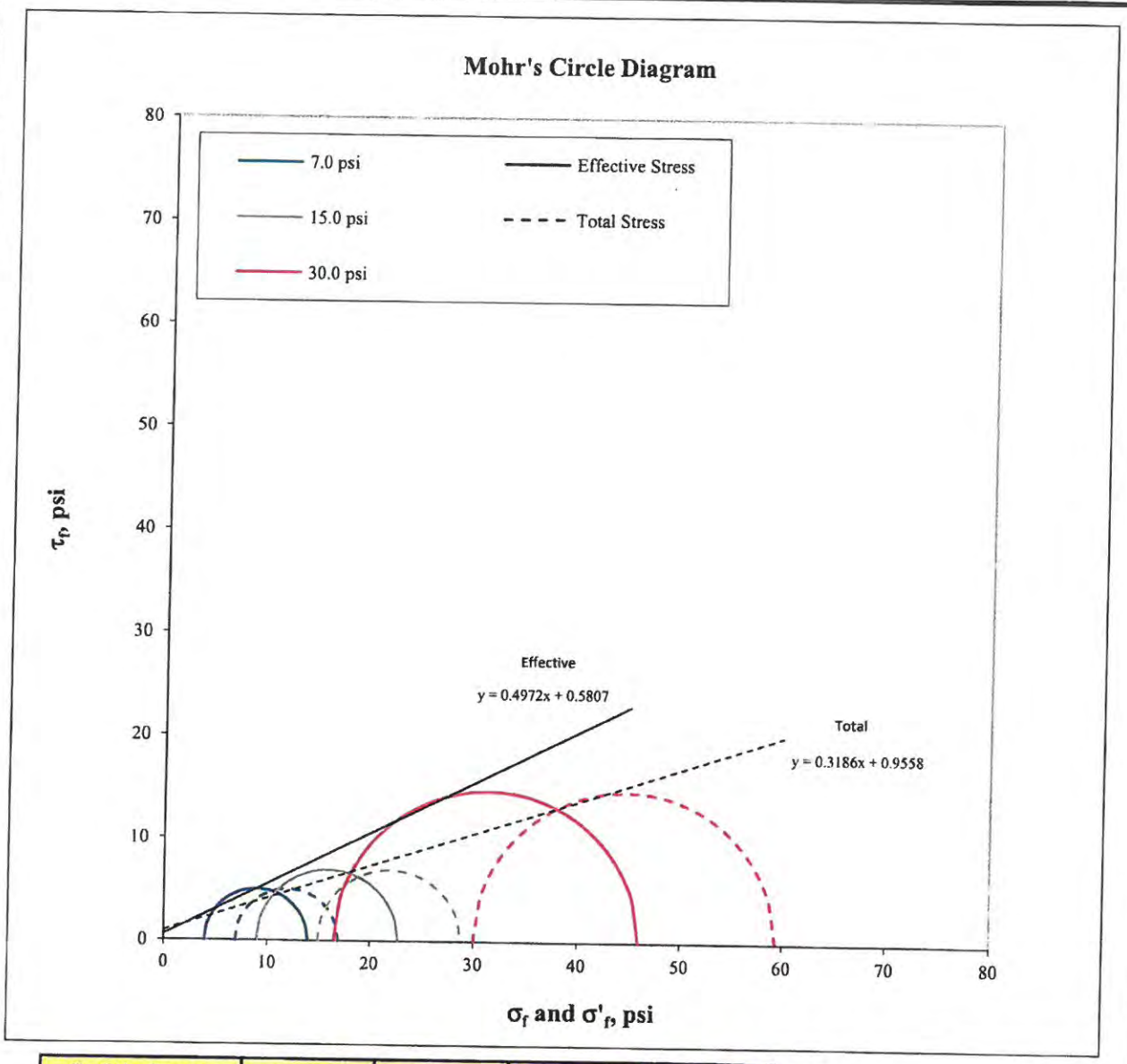
α' =	24.0	degree
a' =	0.5	psi

Total

α =	16.9	degree
a =	0.9	psi

Note: The laboratory testing relates only to the sample tested. GAI neither accepts responsibility for nor makes claims to the final use and purpose of the material.

Golder Associates Inc. **Atlanta, Georgia**	**Title:** **MODIFIED (Multi-Stage) - ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **STRESS PATH PLOT**				
Job Short Title: **DOMINION/BREMO EAST ASH POND/VA**					
Sample: **B-3 UD-01 16.0-18.0'**	**Technician:** **SDM/TW** **Check:** TWM	**Reviewed:** PAP **Approved:** PAP	**Start Date:** **9/8/2014**	**Job Number:** **1411086**	**Figure:** **4**



Confining Pressure (psi)	σ'_1 at failure (psi)	σ'_3 at failure (psi)	σ_1 at failure (psi)	σ_3 at failure (psi)
7.0	14.0	4.0	17.0	7.0
15.0	22.8	9.0	28.8	15.0
30.0	46.0	16.6	59.3	30.0

Effective

ϕ' = 26.4 degree

c' = 0.6 psi

Total

ϕ = 17.7 degree

c = 1.0 psi

Note: The laboratory testing relates only to the sample tested. GAI neither accepts responsibility for nor makes claims to the final use and purpose of the material.

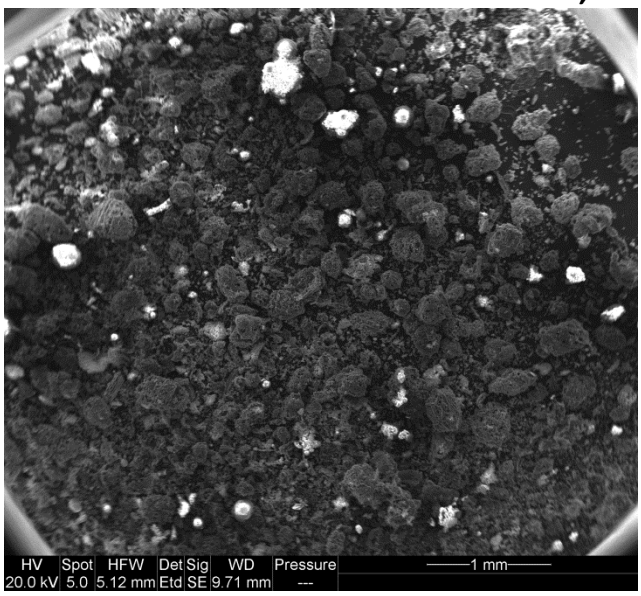
Golder Associates Inc. **Atlanta, Georgia**	**Title:** **MODIFIED (Multi-Stage) - ASTM D4767** **CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT** **MOHR'S CIRCLE DIAGRAM**				
Job Short Title: **DOMINION/BREMO EAST ASH POND/VA**					
Sample: **B-3 UD-01 16.0-18.0'**	**Technician:** **SDM/TW** **Check:** MWM	**Reviewed:** PDP **Approved:** PDP	**Start Date:** **9/8/2014**	**Job Number:** **1411086**	**Figure:** **5**

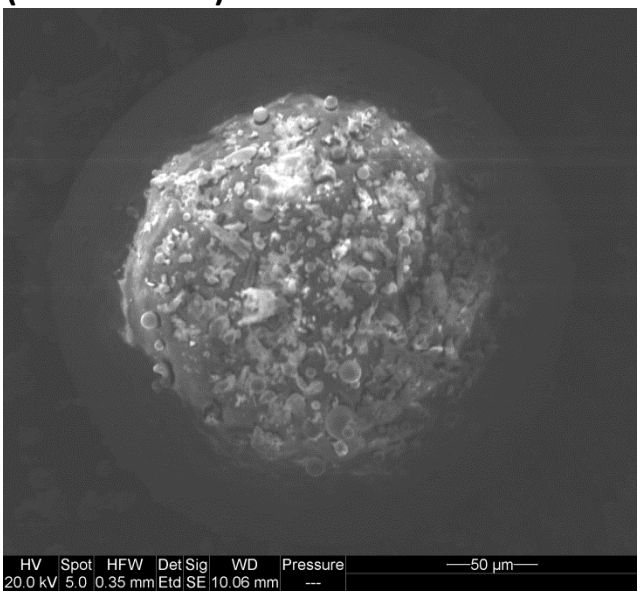
Golder Associates Inc. **Atlanta, Georgia**	Title: MODIFIED (Multi-Stage) - ASTM D4767 CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST REPORT SPECIMEN PHOTOGRAPH - Single Specimen				
Job Short Title: DOMINION/BREMO EAST ASH POND/VA					
Sample: B-3 UD-01 16.0-18.0'	Technician: SDM/TW Check: TWM	Reviewed: Approved:	Start Date: 9/8/2014	Job Number: 1411086	Figure: 6

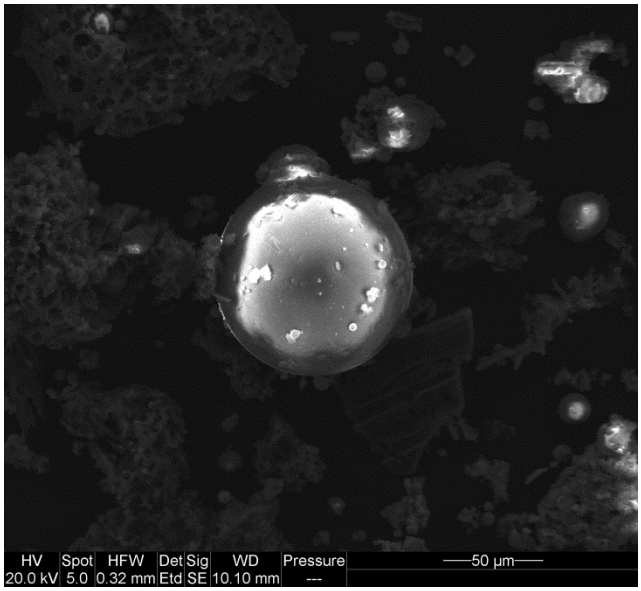
Attachment 5

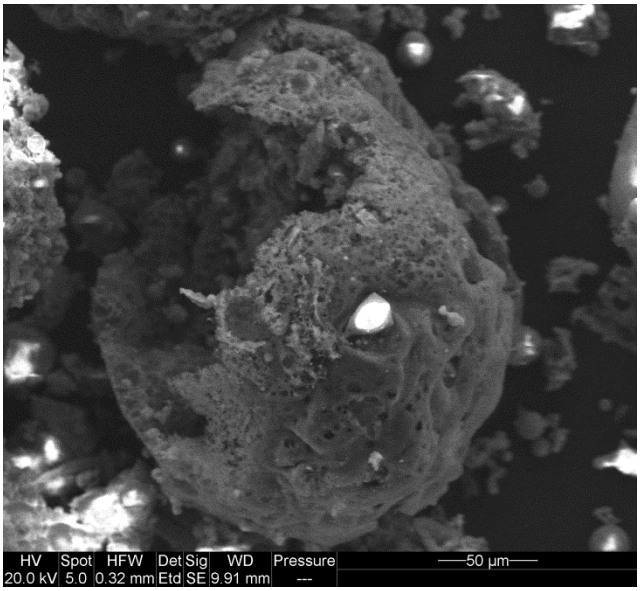
SEM Imagery

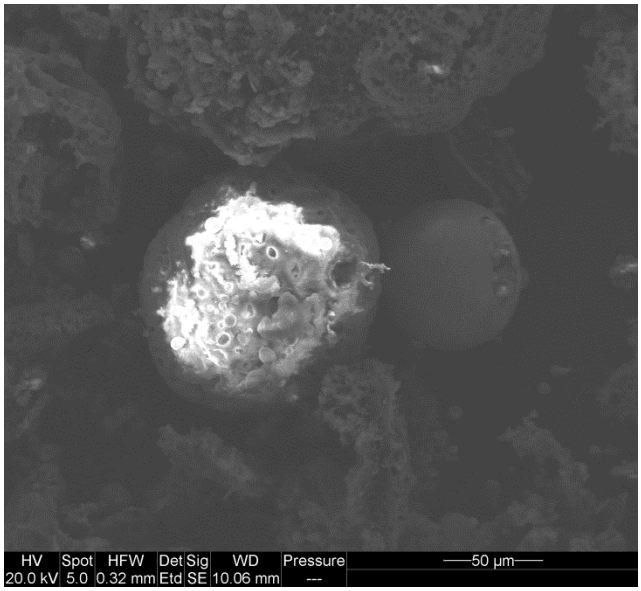
EB-05 S-09, 39 ft-bgs (c. 1970-1975)

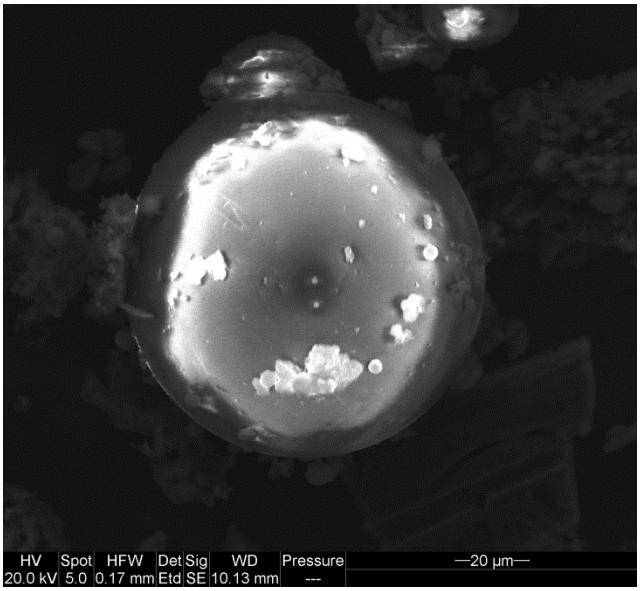




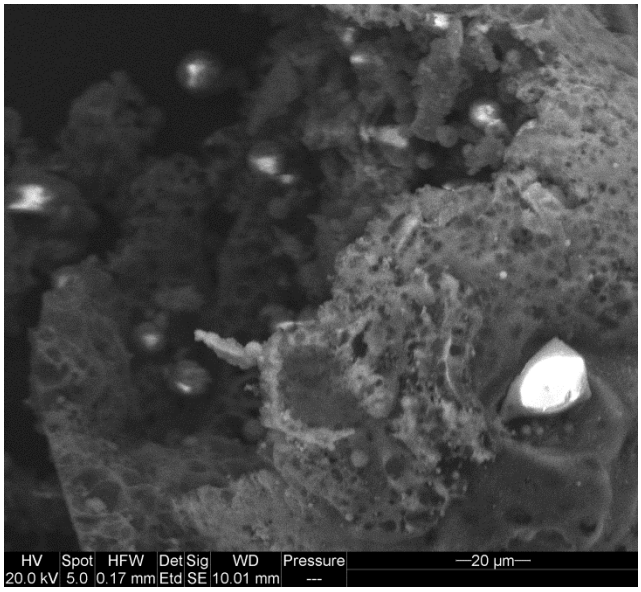


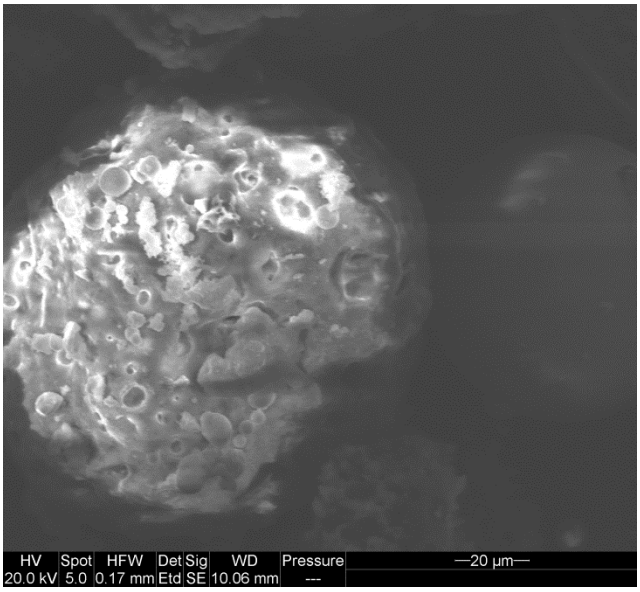


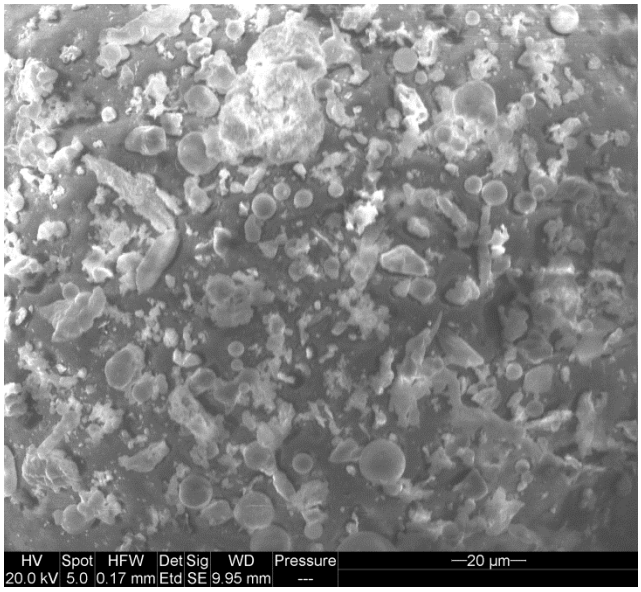


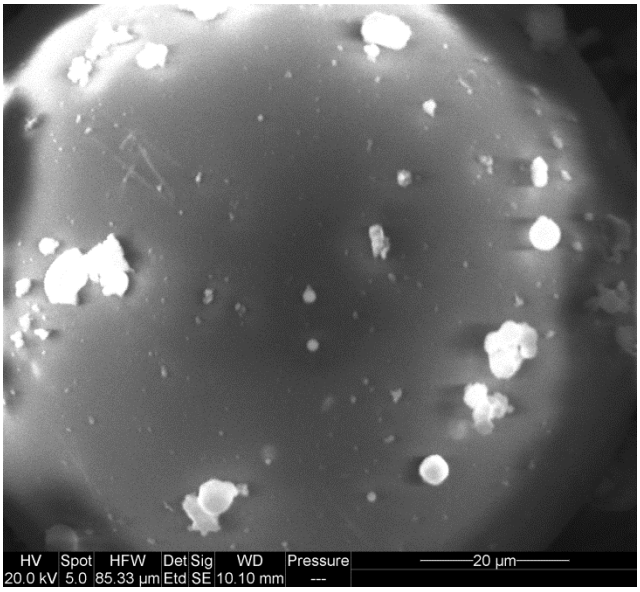


EB-05 S-09, 39 ft-bgs (c. 1970-1975)

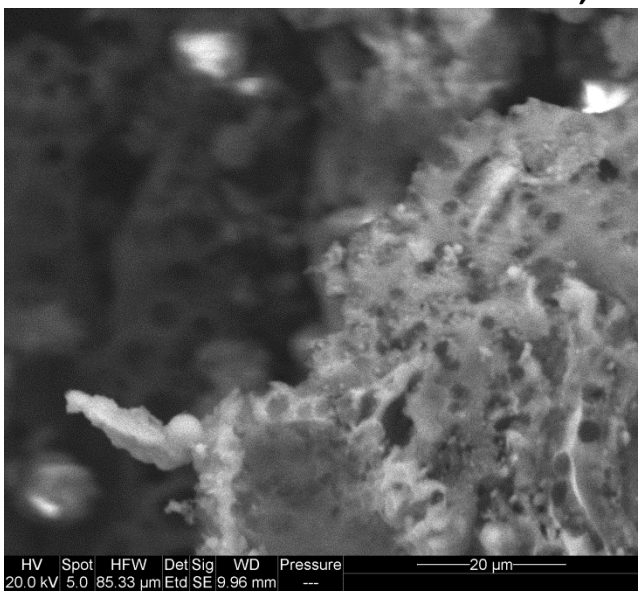


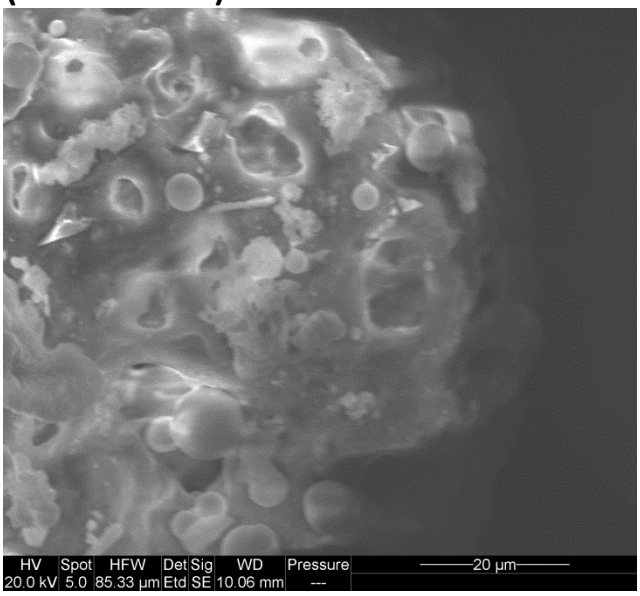


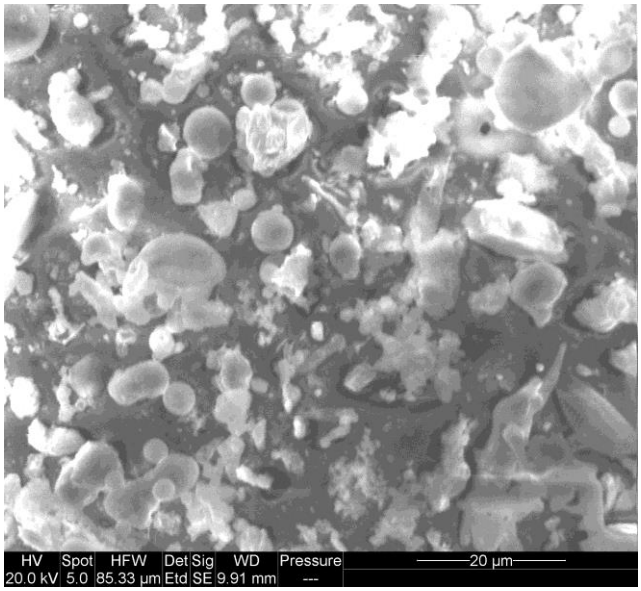




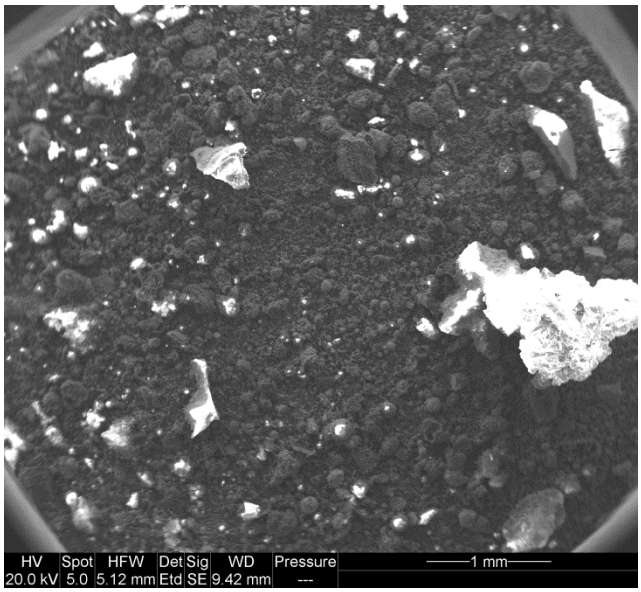
EB-05 S-09, 39 ft-bgs (c. 1970-1975)

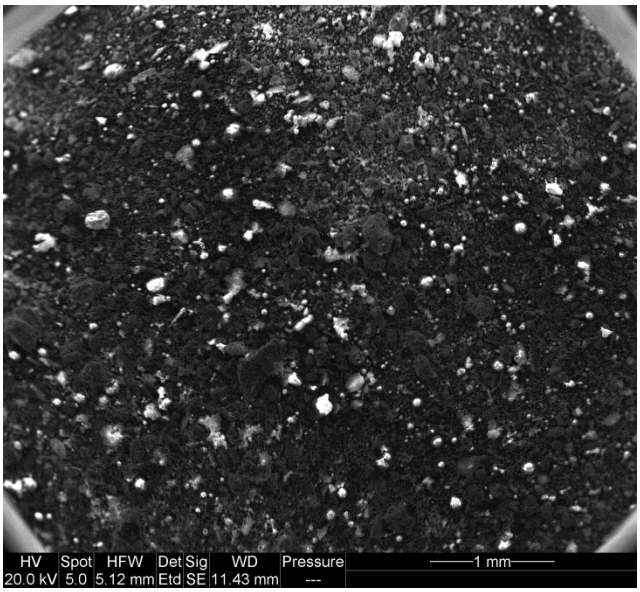


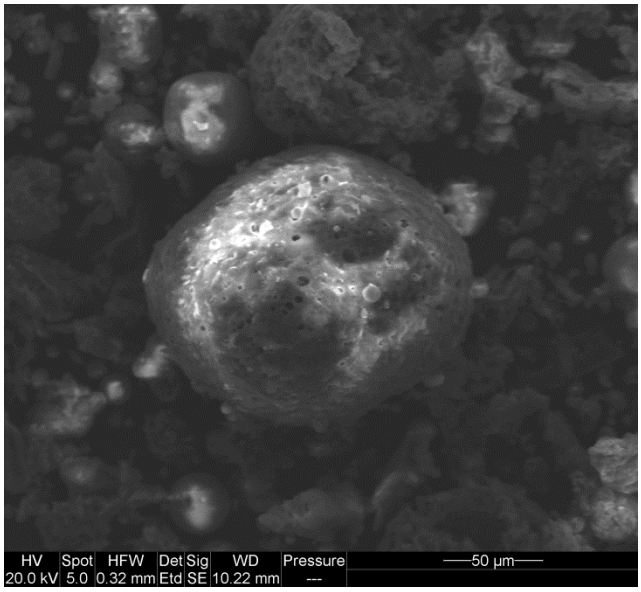


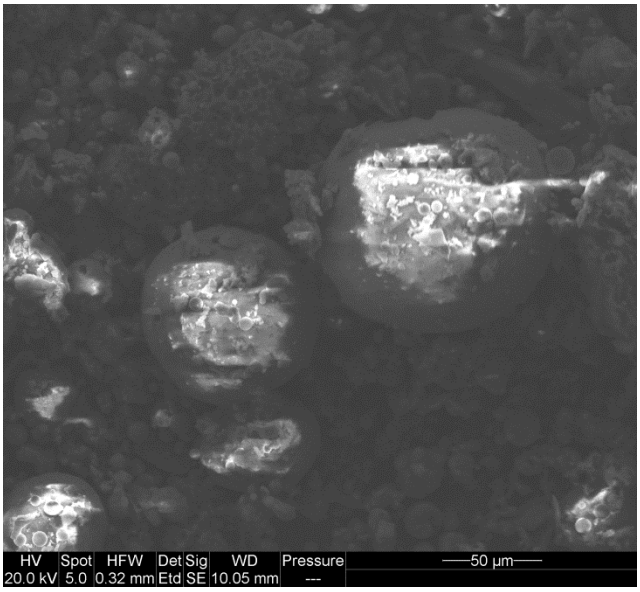


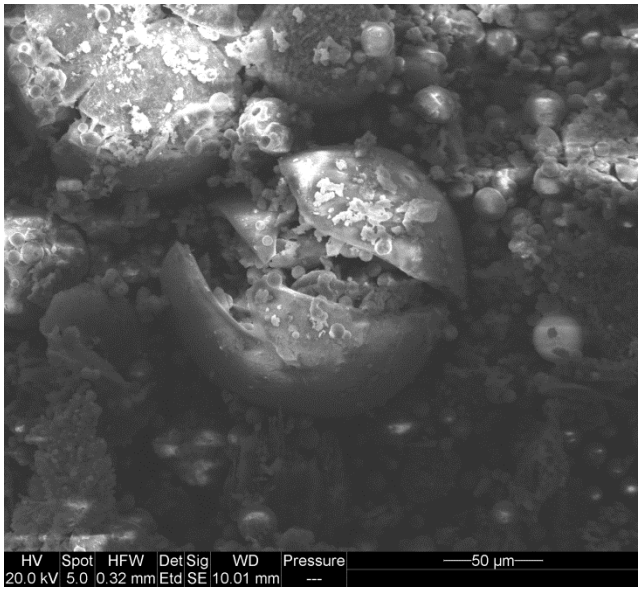
EB-05 S-10A&B, 44 ft-bgs (c. 1970-1975)

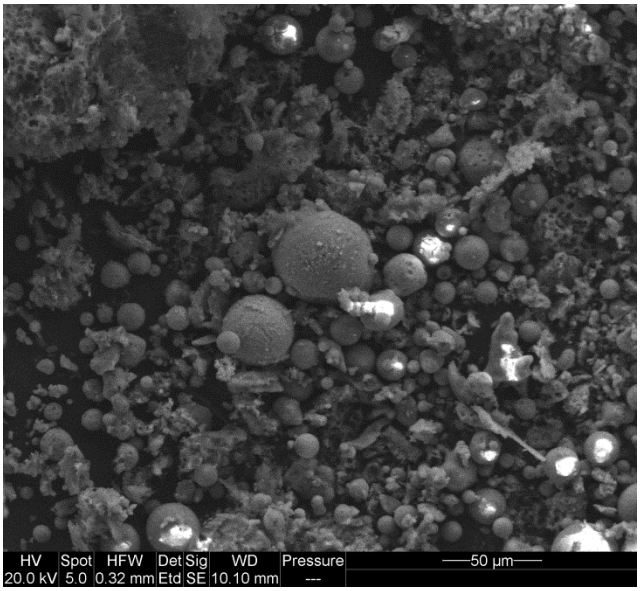




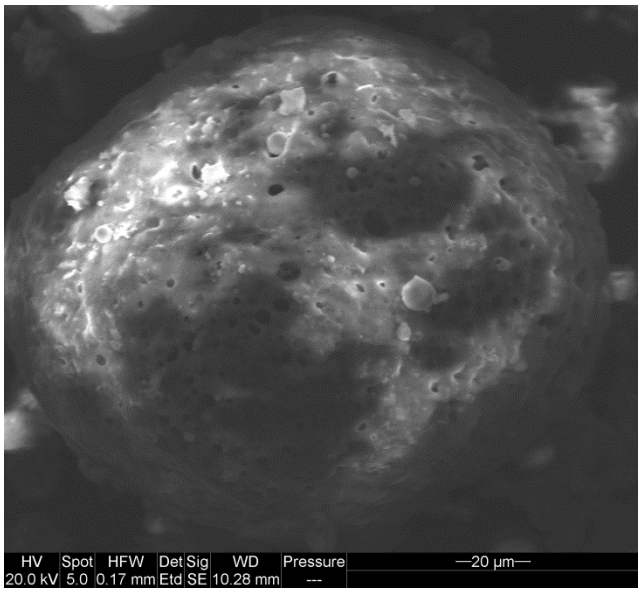


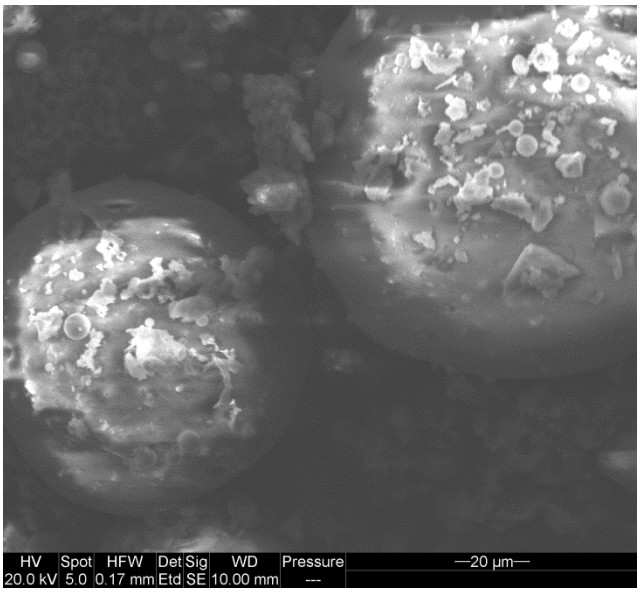


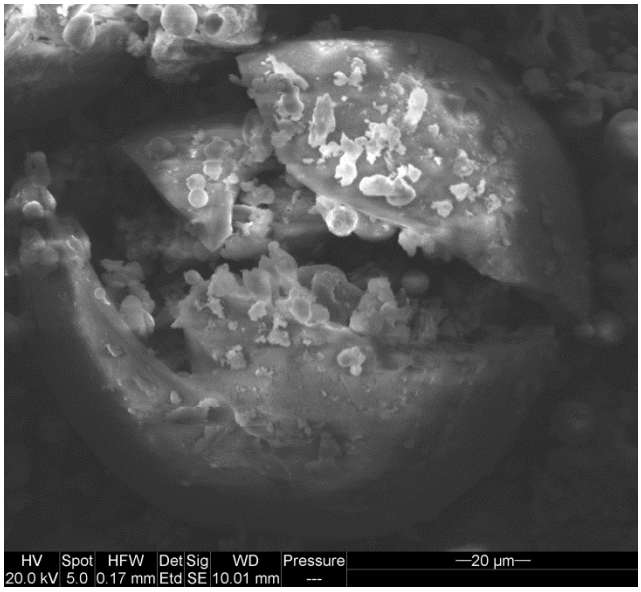


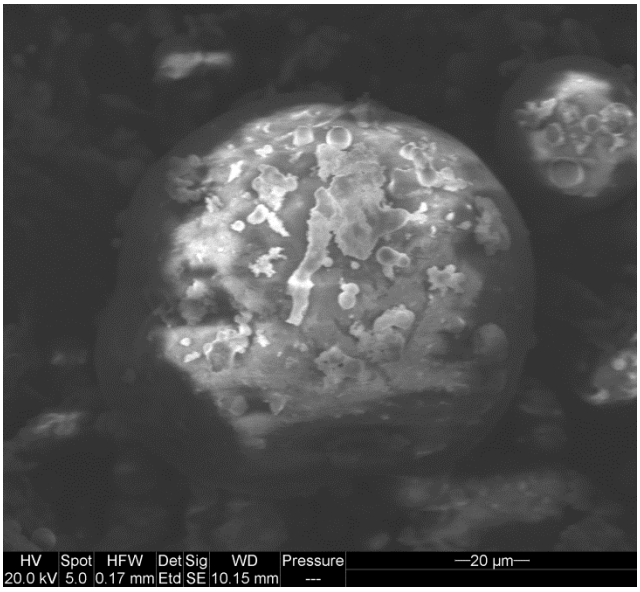


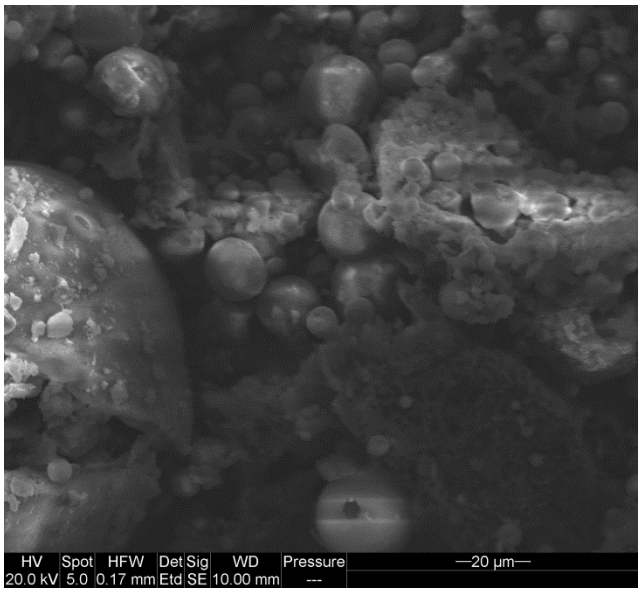
EB-05 S-10A&B, 44 ft-bgs (c. 1970-1975)

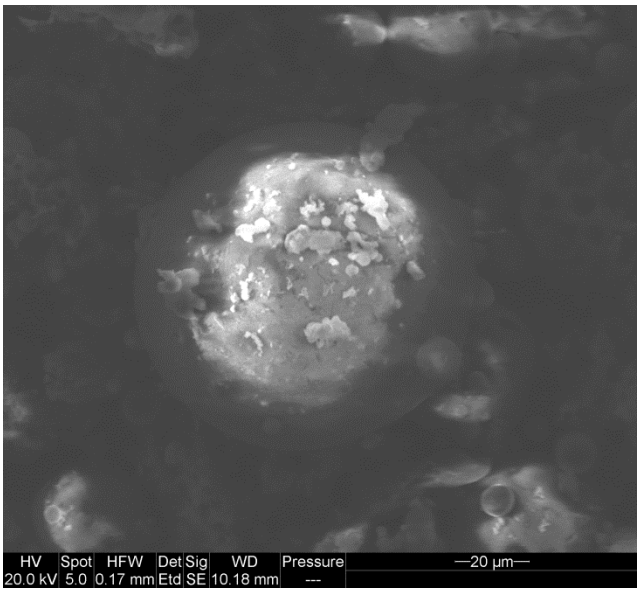




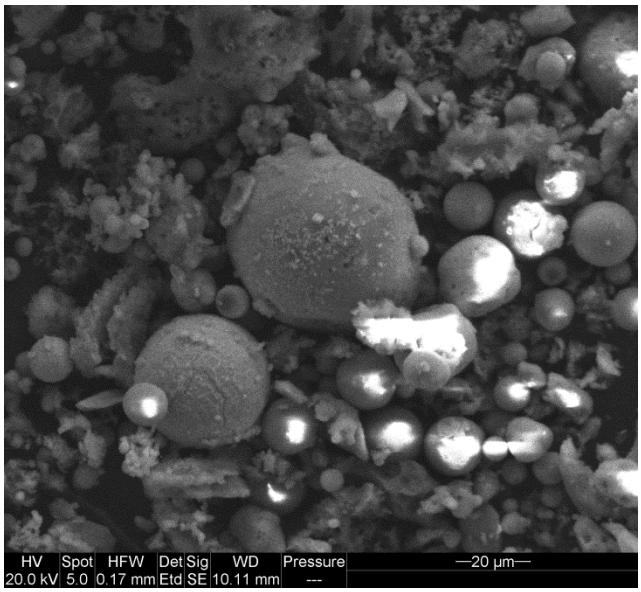


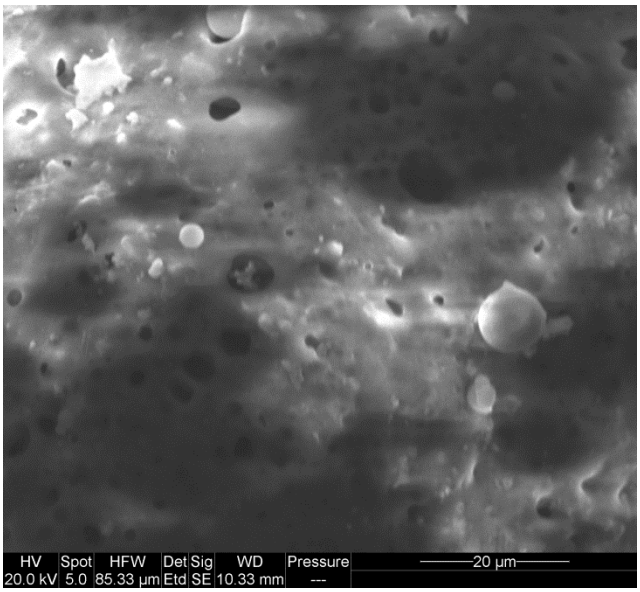


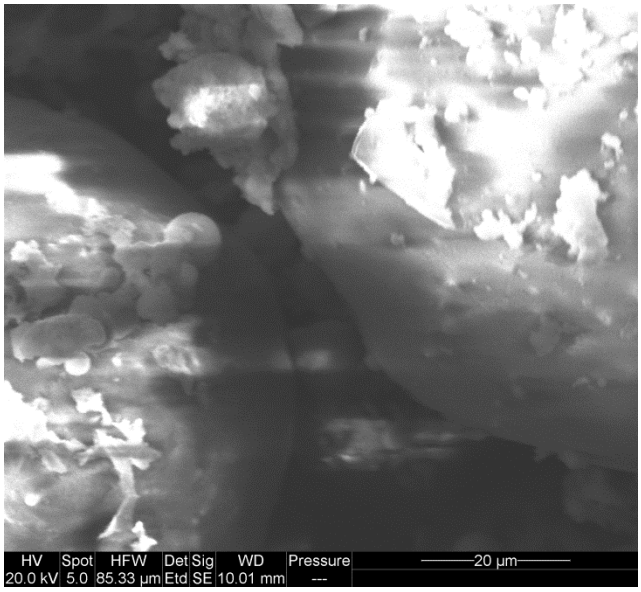


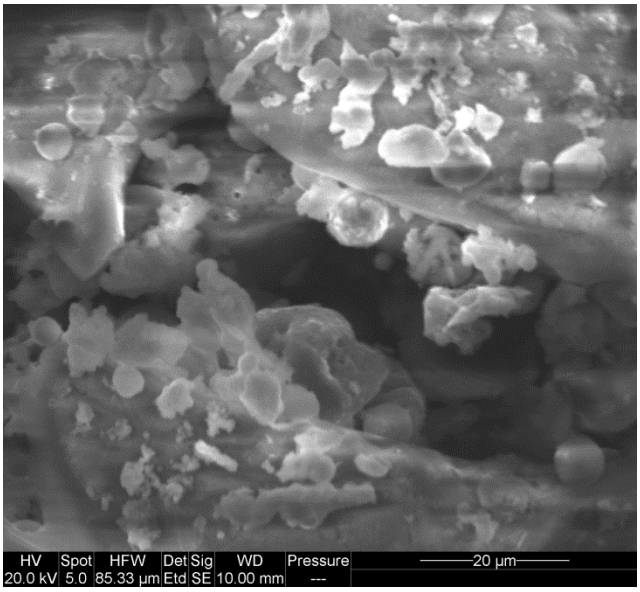


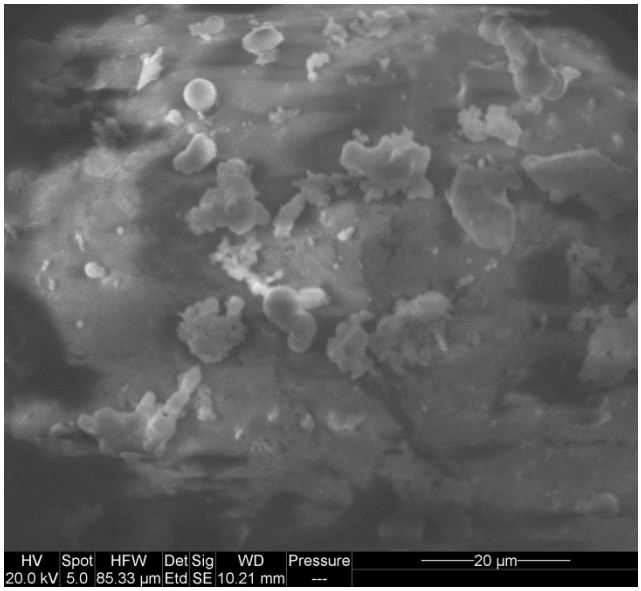
EB-05 S-10A&B, 44 ft-bgs (c. 1970-1975)

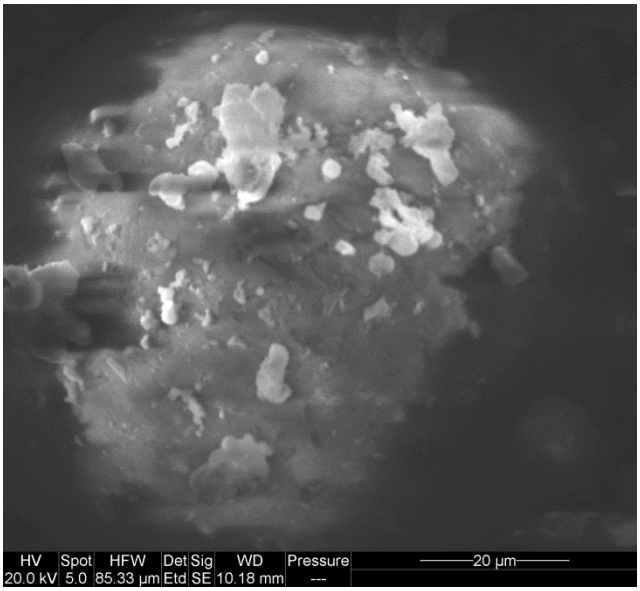




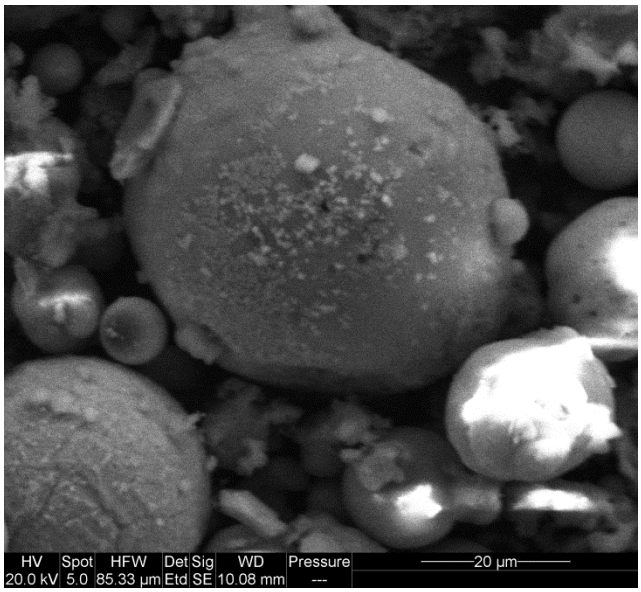


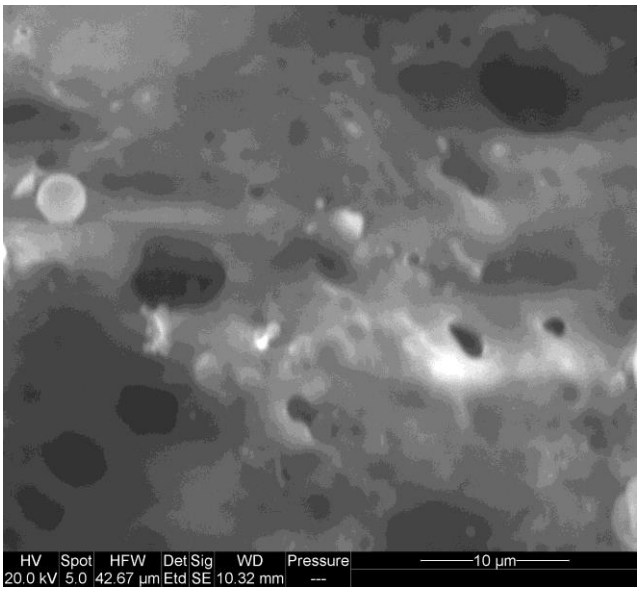




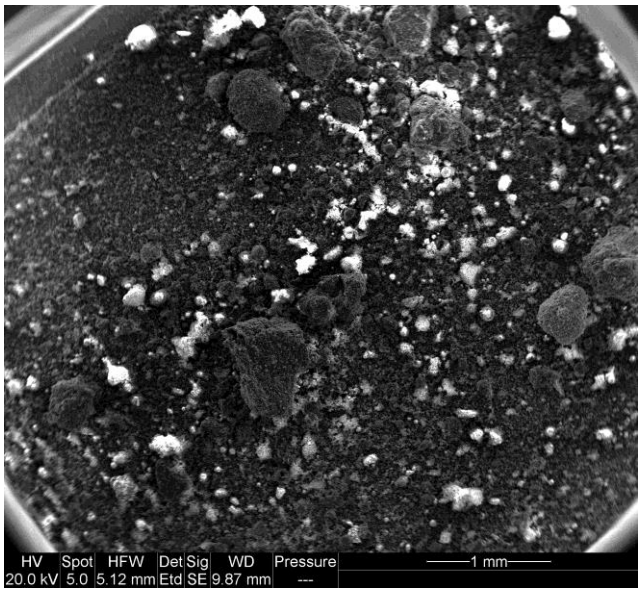


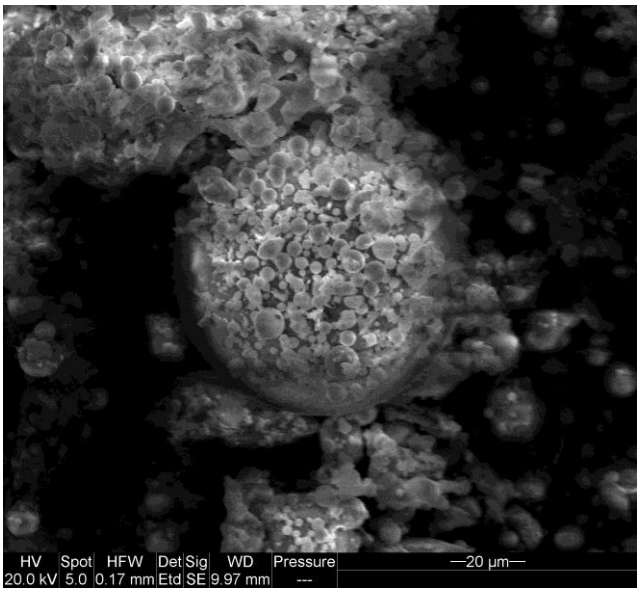
EB-05 S-10A&B, 44 ft-bgs (c. 1970-1975)

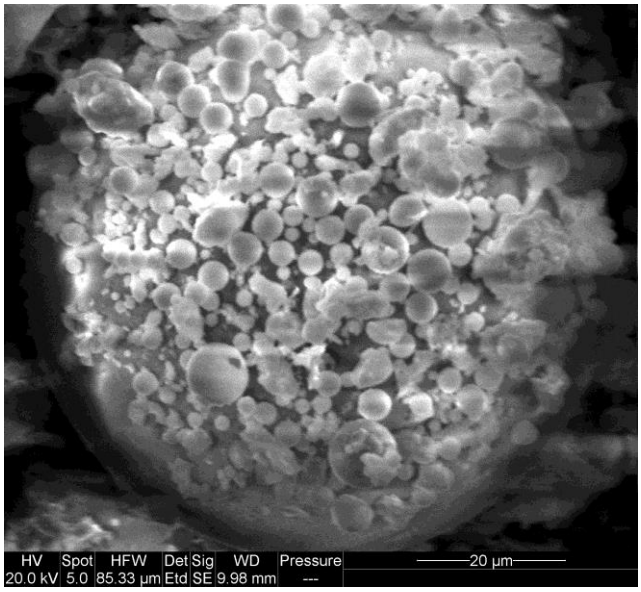


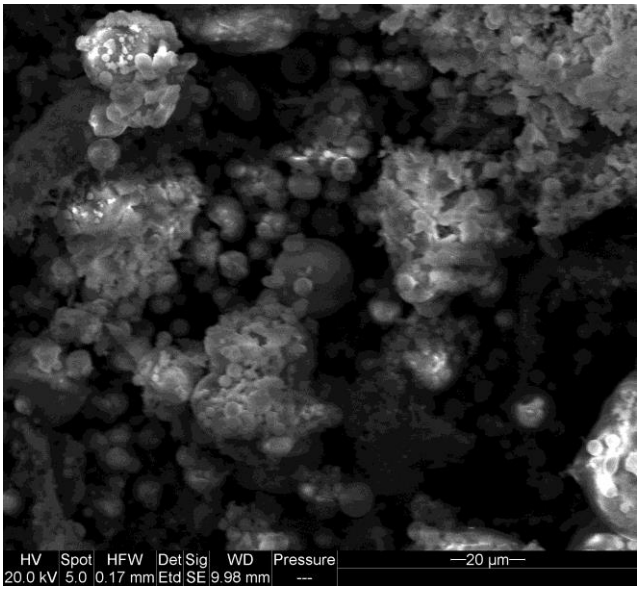


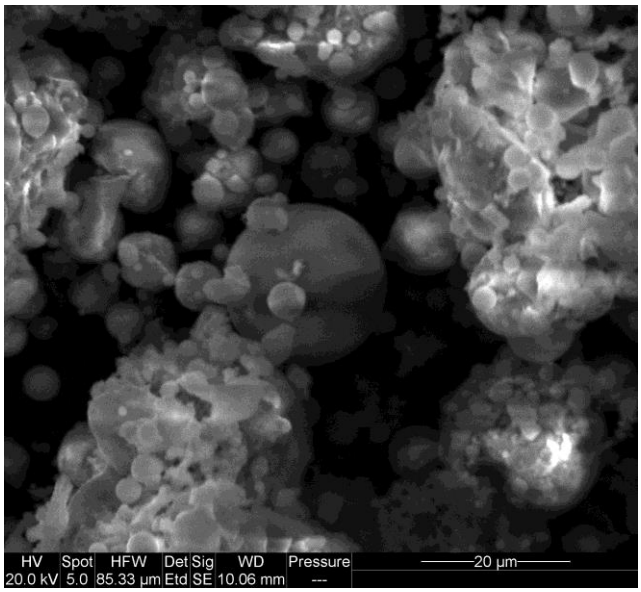
NB-02 S-10, 44 ft-bgs (c. 1985-1995)

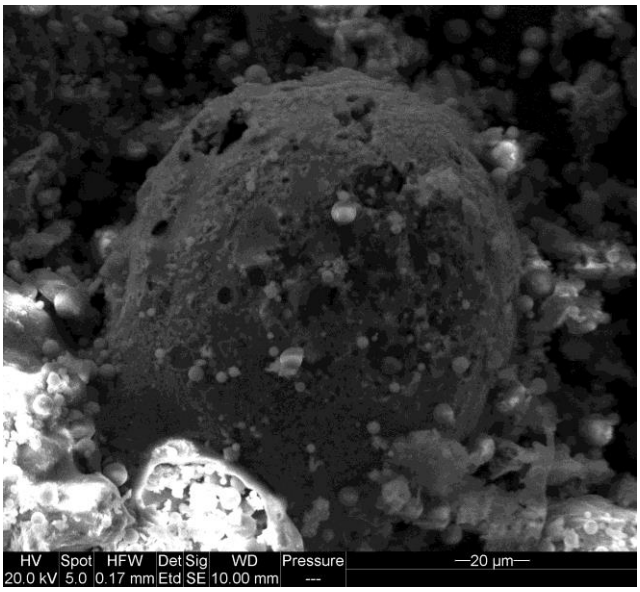




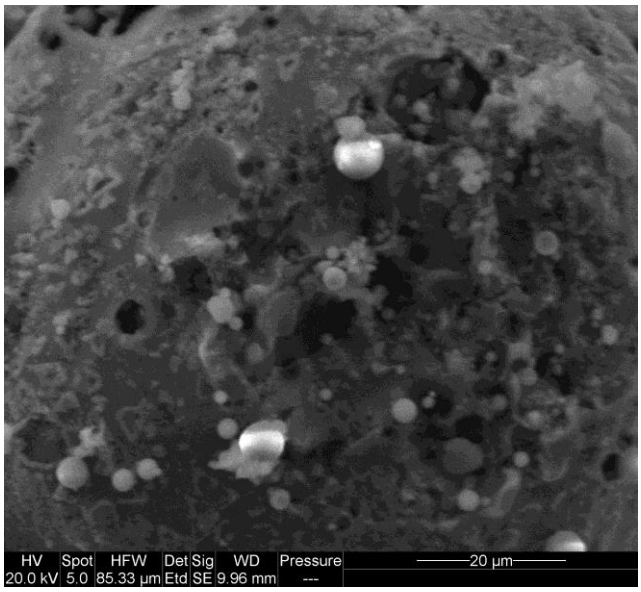




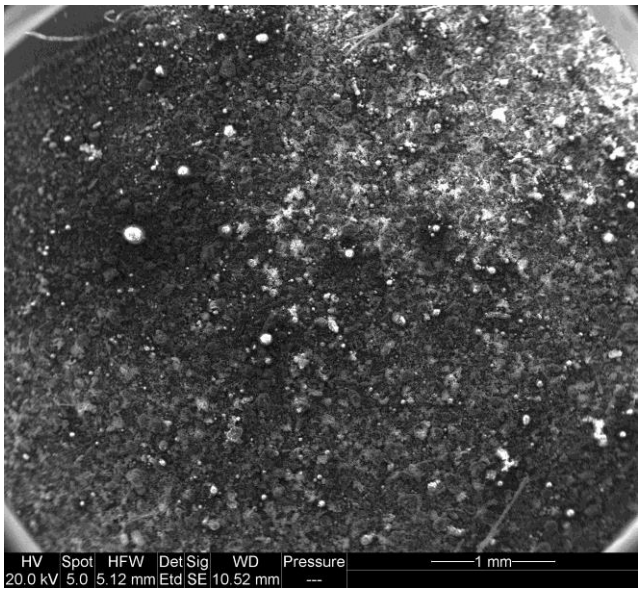


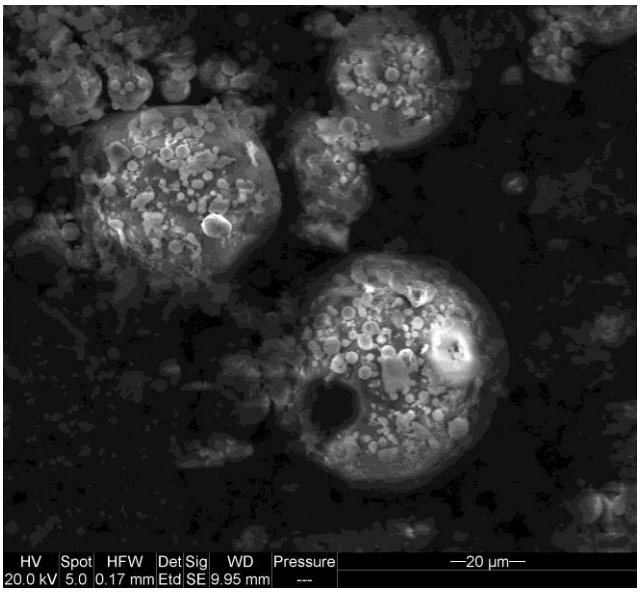


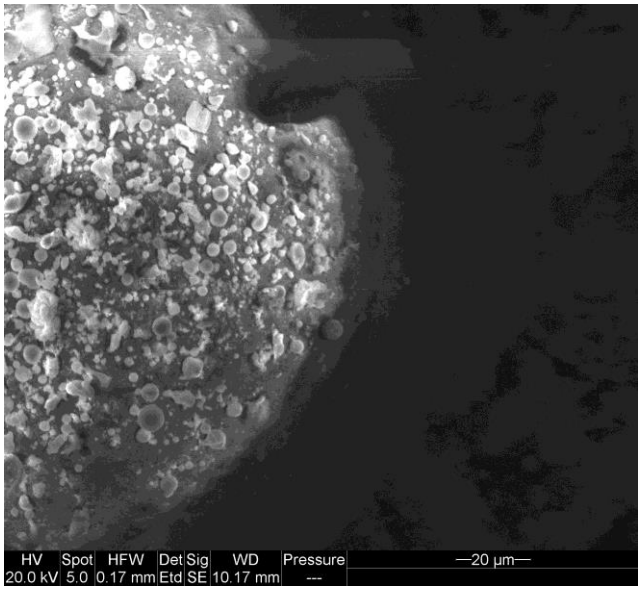
NB-02 S-10, 44 ft-bgs (c. 1985-1995)

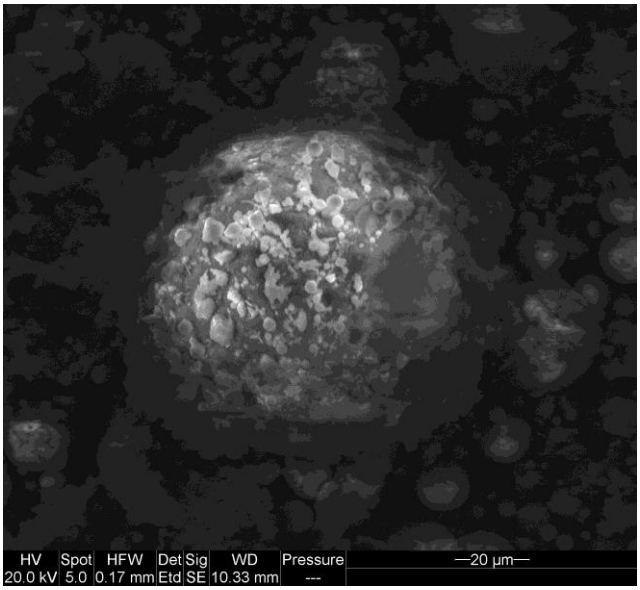


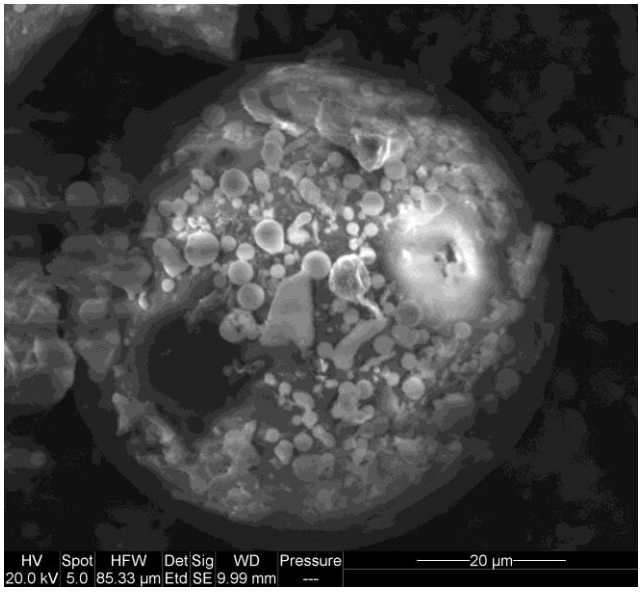
NB-02 S-8, 38 – 40 ft (c. 1985-1995)

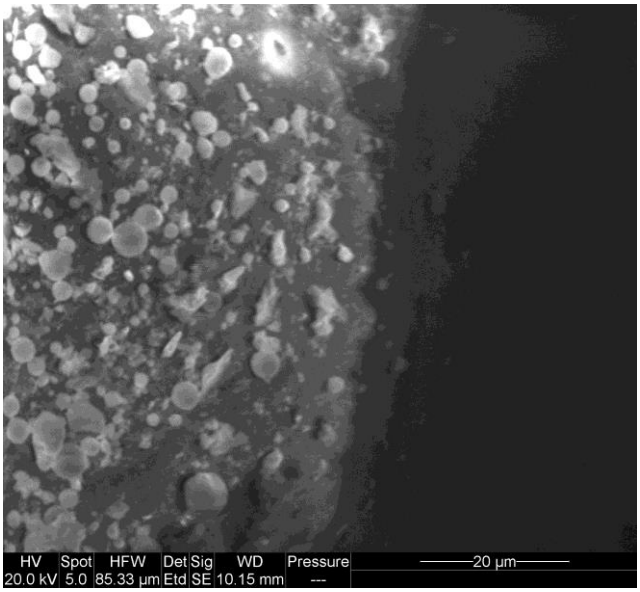




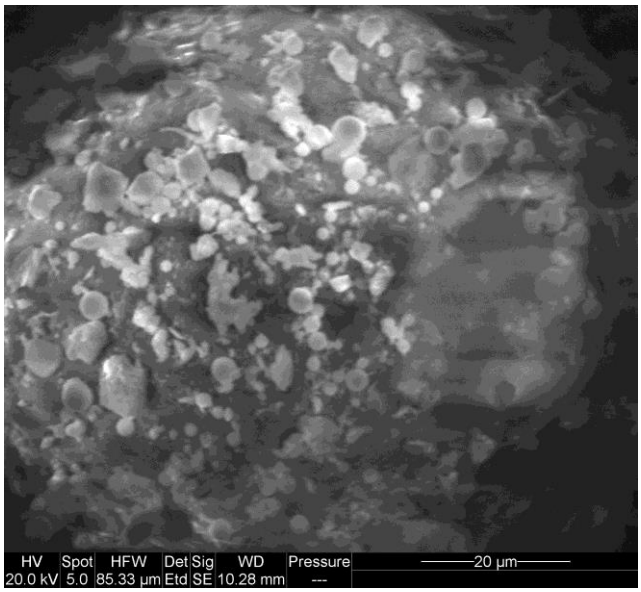


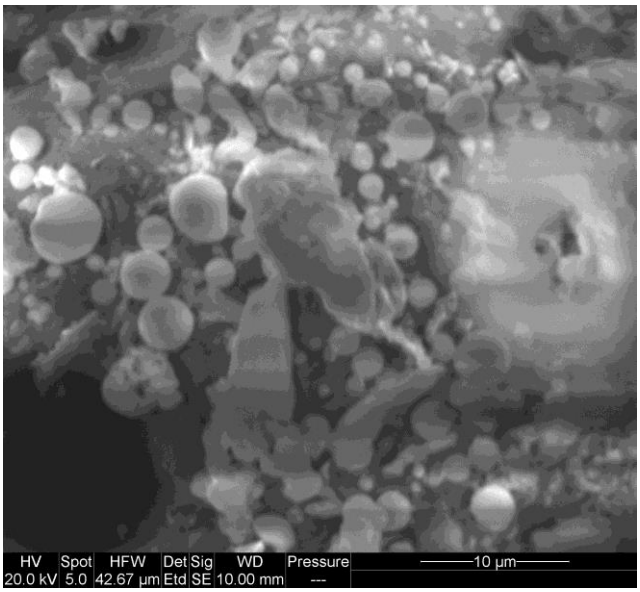


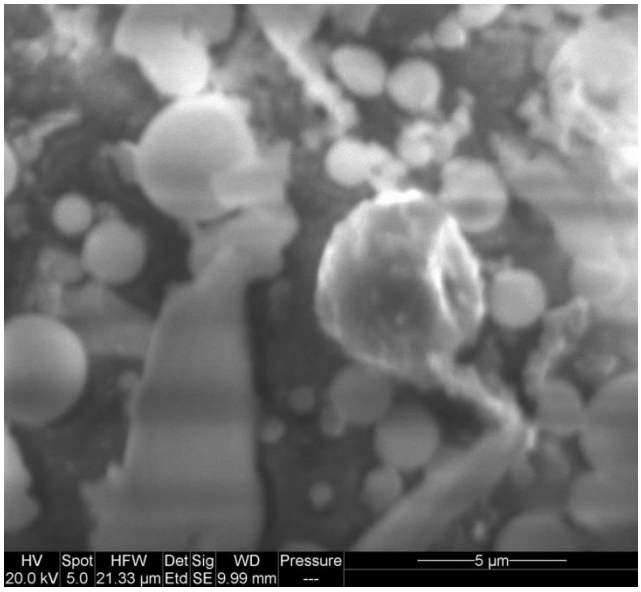




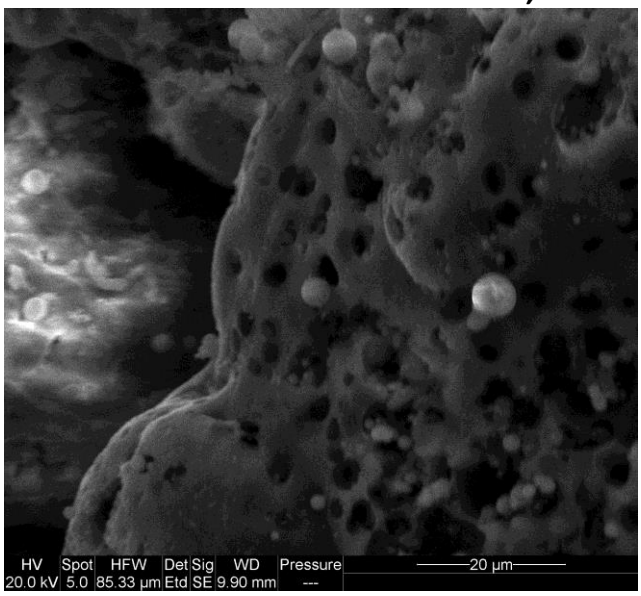
NB-02 S-8, 38 – 40 ft (c. 1985-1995)

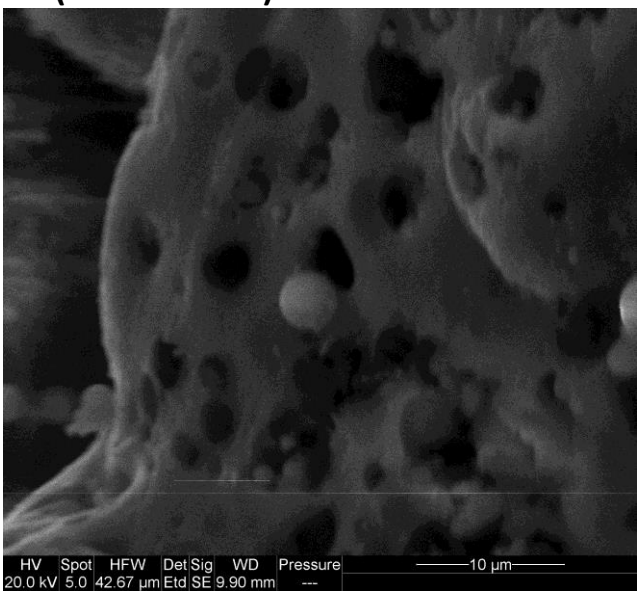


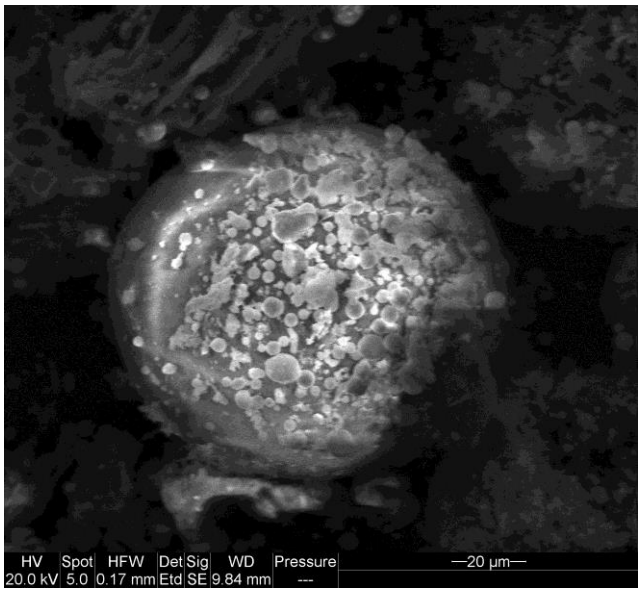


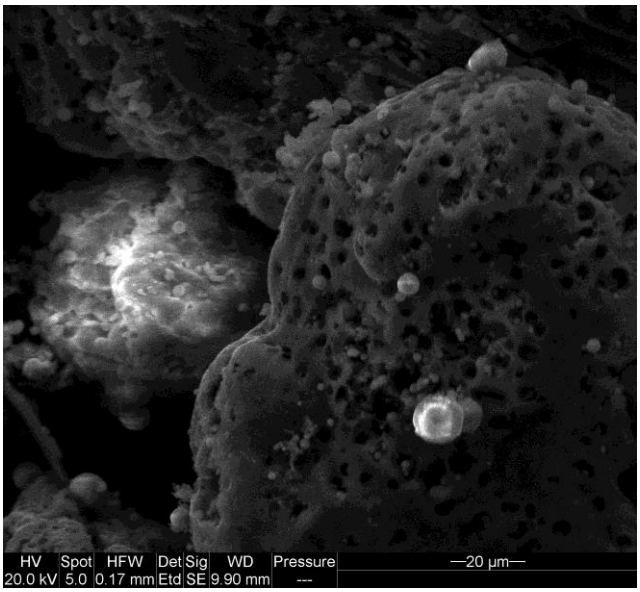


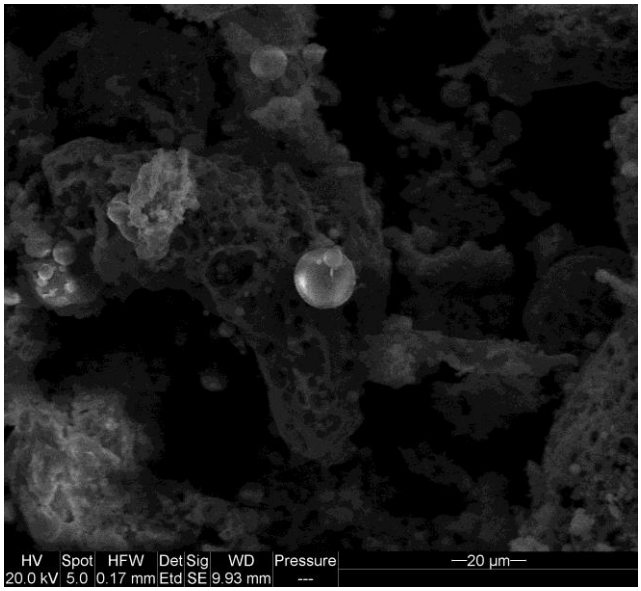
WP-01 S-1, 0.5 – 2.0 ft (c. 2010-2015)

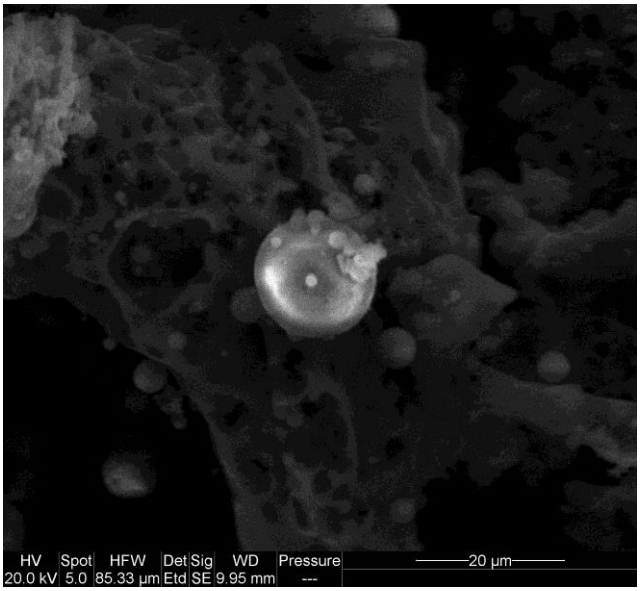




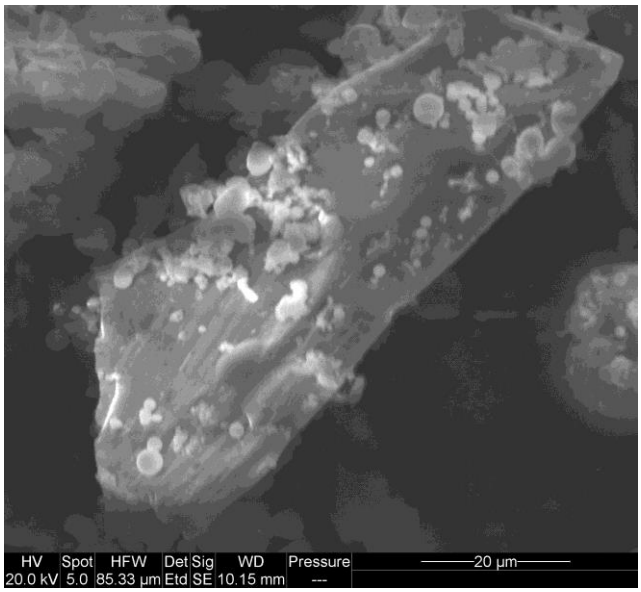


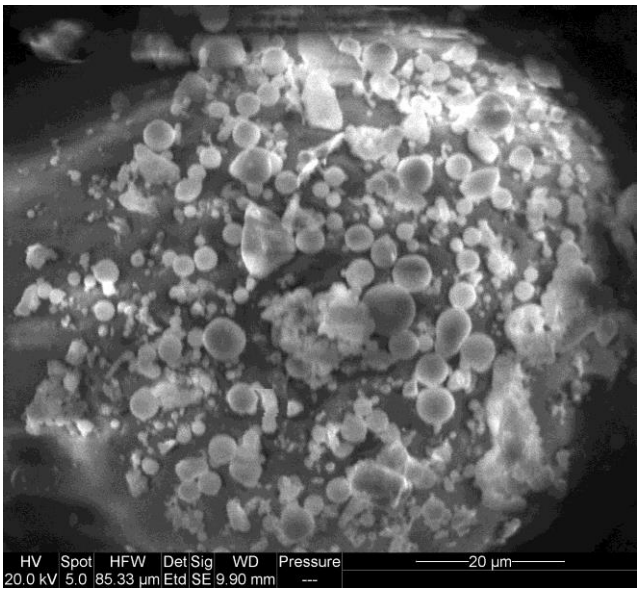


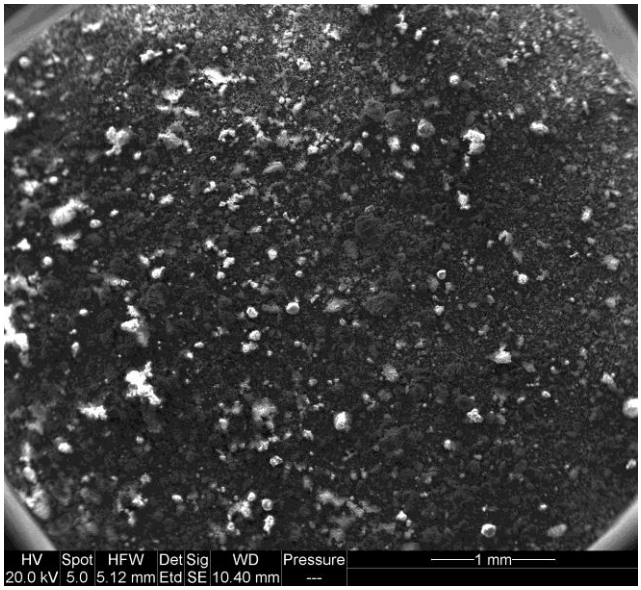


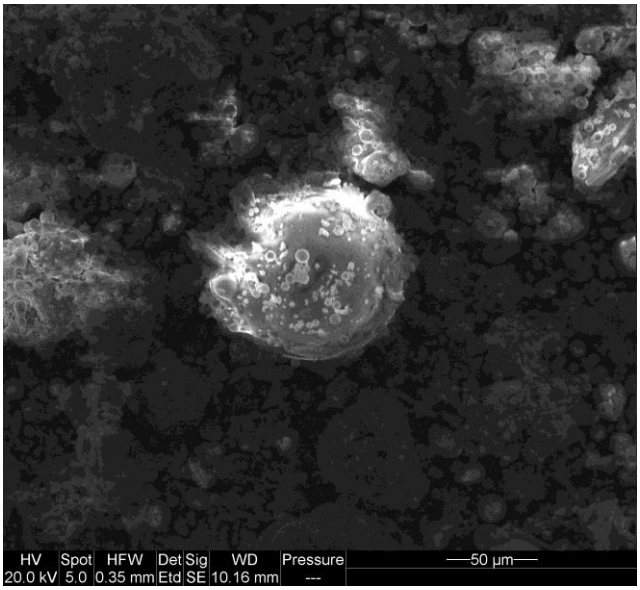


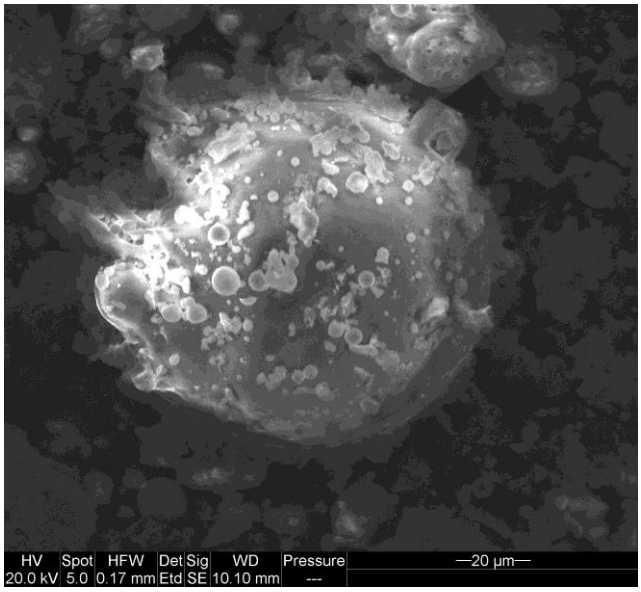
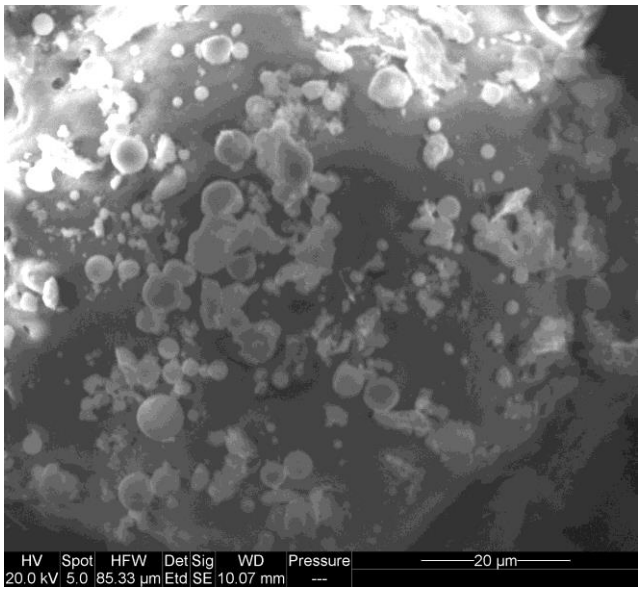
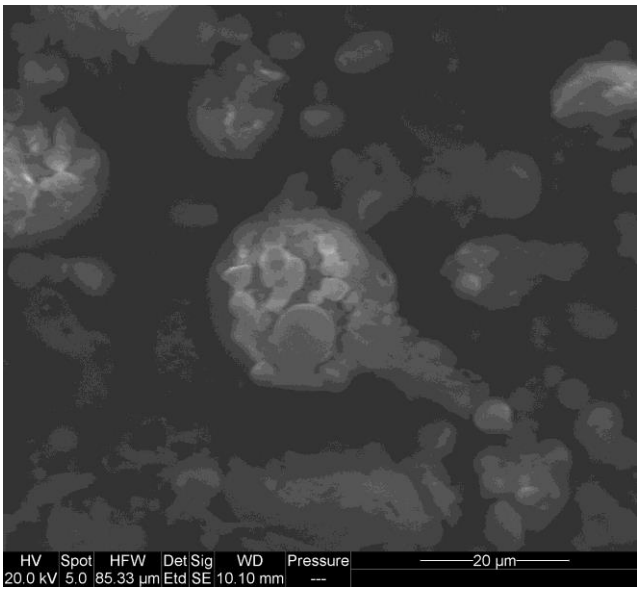
WP-02, 0.5-2.0 ft (c. 2010-2015)











WP-02, 0.5-2.0 ft (c. 2010-2015)