CESARE, INC.
Geotechnical Engineers & Construction Materials Consultants

November 16, 2017

Timberline HOA
c/o Mr. Grant Benton
Crested Butte Lodging and Property Management
P.O. Box 5013
Mount Crested Butte, CO 81225

Subject: Proposed Retaining Wall Rehabilitation
Subsurface Data Report
Timberline HOA
32 Hunter Hill Road
Mount Crested Butte, Colorado
Project No. 17.5052

Dear Mr. Benton:

Cesare, Inc. (Cesare) performed field exploration and laboratory analysis of a timber crib retaining wall at the entrance to the Timberline HOA property. Cesare understands that the purpose of this portion of our study was to gain information regarding the geotechnical conditions underlying the site in order to provide a basis for evaluating alternative repair procedures. Our scope of work consisted of drilling and sampling the soils at two locations at the site, and performing laboratory classification testing on selected samples. This letter presents the results of the field exploration, a baseline assessment of the geotechnical conditions encountered at the site, and a brief discussion of potential repair alternatives.

1. PROJECT DESCRIPTION

The existing timber crib retaining wall system is one to two tiers, varying in total height from about 6 to 16 feet. It is located east of the entrance road to the condominium complex. The retaining system is over 30 years old, and exhibits warping and sagging, indicating it is near the end of its useful life. The specifics regarding the system's original construction are unknown. These types of walls typically consist of cells constructed of square timbers (cribs) filled with coarse aggregate up to cobble and boulder size particles. The configuration creates a gravity retaining wall to resist slope failure related forces. Over time, the timber rots, reducing the cells' ability to contain the rock and resist the slope failure forces.

2. SITE CONDITIONS

The general project site is located on the western flank of Mount Crested Butte, near its toe. The general area slopes moderately to steeply downwards to the northwest.

The retaining system supports a vertical face excavated from the original slope along the eastern side of a parking and drive area for the Timberline Condominiums. A residence is located above the system. The original residence was constructed prior to 1999, with an addition constructed between

2012 and 2014. The ground surface above the crib wall slopes upwards to the residence.

The topography varies between the parking lot/drive and the retained slope. The parking lot/drive is relatively flat with a gentle longitudinal slope downward to the southwest, and paved with hot mix asphalt (HMA). The ground slopes up moderately from the top of the retaining system to the residence pad and its drive. The retaining system ranges from about 6 to 16 feet high. Based on a site survey provided to us, there is an estimated 20 feet of relief between the top of the retaining system to the residence pad. The slope above the wall is covered with a sparse growth of native grasses.

3. INVESTIGATION

Cesare explored subsurface conditions by drilling two borings at the locations indicated in Figure 1. The borings were advanced using a Simco 2800 drill rig equipped with 4 inch diameter, continuous flight, solid stem auger. We sampled the subsoils at frequent intervals using a modified California sampler driven into the soil by dropping a 140 pound hammer through a free fall of 30 inches. The modified California sampler is a 2.5 inch outside diameter by 2 inch inside diameter device lined with thin brass tubes to recover relatively undisturbed samples. The procedure to drive the sampler into the soil and to record the number of blows required to do so is known as a penetration test. The number of blows required for the sampler to penetrate 12 inches gives an indication of the consistency or relative density of the soils encountered. We completed Boring B-1 as a temporary piezometer for short term groundwater monitoring.

Cesare obtained bedrock cores below the soils using NQ wireline coring equipment. NQ equipment includes drill steel and a core barrel comprised of an inner and outer barrel. The drill steel is thin walled pipe threaded at both ends that is connected, as necessary, to reach coring depths. The outer core barrel is larger diameter than the drill steel, with a cutting edge on the bottom that cuts an annular space 3 inches in outside diameter and 1-7/8 inches inside diameter. The inner barrel is a metal tube that is held stationary inside the outer barrel and holds the core sample as it is cut from the rock mass. The inner core barrel is retrieved from the outer core barrel by a thin cable attached to it without removing the outer barrel. During coring, the recovered core was continuously logged, wrapped in plastic sheeting, and stored in partitioned core boxes. Photographs of the cores are presented in Appendix B. Results of the penetration tests and locations of sampling are presented on the Boring Logs, including the Key to Symbols, Figure 2.

4. LABORATORY TESTING

Cesare's field geologist returned the samples to the Cesare laboratory where a professional engineer visually classified and appropriate testing assigned to specific samples to evaluate pertinent engineering properties. The laboratory tests included 11 gradation analysis tests and Atterberg limits tests, respectively, to evaluate grain size distribution and plasticity of selected samples. We performed a moisture/density relationship (Proctor) test on a bulk sample to evaluate compaction characteristics. We performed two remolded direct shear tests to evaluate the overburden soils' strength characteristics. We also performed 4 unconfined compression tests on selected core samples to evaluate the bedrock in situ strength. The test results are presented in Table 1, Summary of Laboratory Test Results.

5. SUBSURFACE CONDITIONS

Cesare's borings indicate fill is present in the upper 2 to 4 feet. The underlying native soil generally consists of clayey sands interbedded with lesser amounts of clayey sand and clayey gravel. The soil extends to depths of about 25 and 14 feet below the ground surface in Borings B-1 and B-2, respectively. We encountered a latite boulder in B-1 and claystone bedrock in B-2 at these depths. We encountered Mancos Shale bedrock below these materials at depths of about 30-1/2 feet in B-1 and 20 feet in B-2. The Mancos Shale bedrock extended to the remaining depths explored.

Cesare described the fill as clayey sands with gravel, medium dense to dense, slightly moist to moist, and dark brown in color. We described the clayey sands as occasional to with gravels, very loose to very dense, moist to wet, and brown in color. We described the clays as sandy, lean, occasional gravel, hard, moist, and brown in color. We described the claystone as weathered to hard, slightly moist to moist, and gray in color. We described the Mancos Shale as metamorphosed, thickly bedded, slightly to highly fractured, slightly weathered to fresh, very hard, and light to dark gray in color.

Cesare encountered groundwater during drilling at depths of 16 feet in both borings. We measured groundwater at depths of about 11 feet in Boring B-1 and 14 feet in Boring B-2 the day after drilling. We measured groundwater at about 10-1/2 feet in B-1, 32 days after drilling. A more complete description of the subsoil and groundwater is shown in Figure 2.

These observations represent conditions at the time of field exploration and may not be indicative of other times or other locations. Groundwater can be expected to fluctuate with various seasonal and weather conditions, and with any change in water application.

6. PREVIOUS STUDIES

Buckhorn Geotech (Buckhorn) performed a preliminary geotechnical evaluation in 2014[1] for the addition to the residence located above the crib wall system. Buckhorn drilled four borings for this project, of which B1 and B2 were in the area of the addition to the residence. These borings extended to depths of 49 and 34 feet, respectively. In B2, their auger reportedly refused on hard Mancos Shale at the final depth. They reported geotechnical conditions included clayey, silty, sandy, gravel with some cobbles or shale fragments to depths of 44 and 6 feet in Borings B1 and B2, respectively. Below these soils, they reported silty clay with gravel and little sand, transitioning to hard shale that extended to depth explored of 49 feet in B1. In B2, they reported sandy clay with some silt and gravel and few cobbles to 28-1/2 feet, and hard shale below the clay extending to the remaining depth explored of 34 feet.

Although the Buckhorn logs indicate the granular soils were primarily gravel, their laboratory results indicated these soils were primarily sand. These laboratory results were similar to the Cesare's laboratory results and materials we encountered. Buckhorn's data from their report, consisting of their boring logs and laboratory results, are presented in Appendix C.

[1] Preliminary Geotechnical Report, Johnson Residence Addition and Driveway, 32 Hunter Hll Road, Mt. Crested Butte, Colorado; Prepared by: Buckhorn Geotech; Prepared for: Kim and Matt Johnson, Dated: August 15, 2014.

7. DISCUSSION

The clayey sand overburden ranges from very loose to very dense. The very loose zone encountered is below the highest portion of the retaining system. This zone is the slope's limiting strength, and would preclude removing the retaining system to construct another retaining system without risking slope movement. Some exterior bracing or "sister wall" would be an appropriate repair. When they deteriorate, these timber crib walls are often stabilized with post-tensioned soil anchors extending through the crib system and into the native soils behind. A shotcrete facing is often applied after anchor installation.

Other systems can be considered, such as soldier pile and lagging, or a gravity wall against the existing system. The soldier piles will not be able to penetrate the boulders encountered in Boring B-1. A gravity wall would reduce the drive and parking area.

If you have any questions or comments regarding this information, please feel free to contact us.

Sincerely,
CESARE, INC.

Jonathan A. Crystal, P.E.
Staff Engineer

Darin R. Duran, P.E.
Principal, Geotechnical Engineering Manager

JAC2/ksm

Attachments

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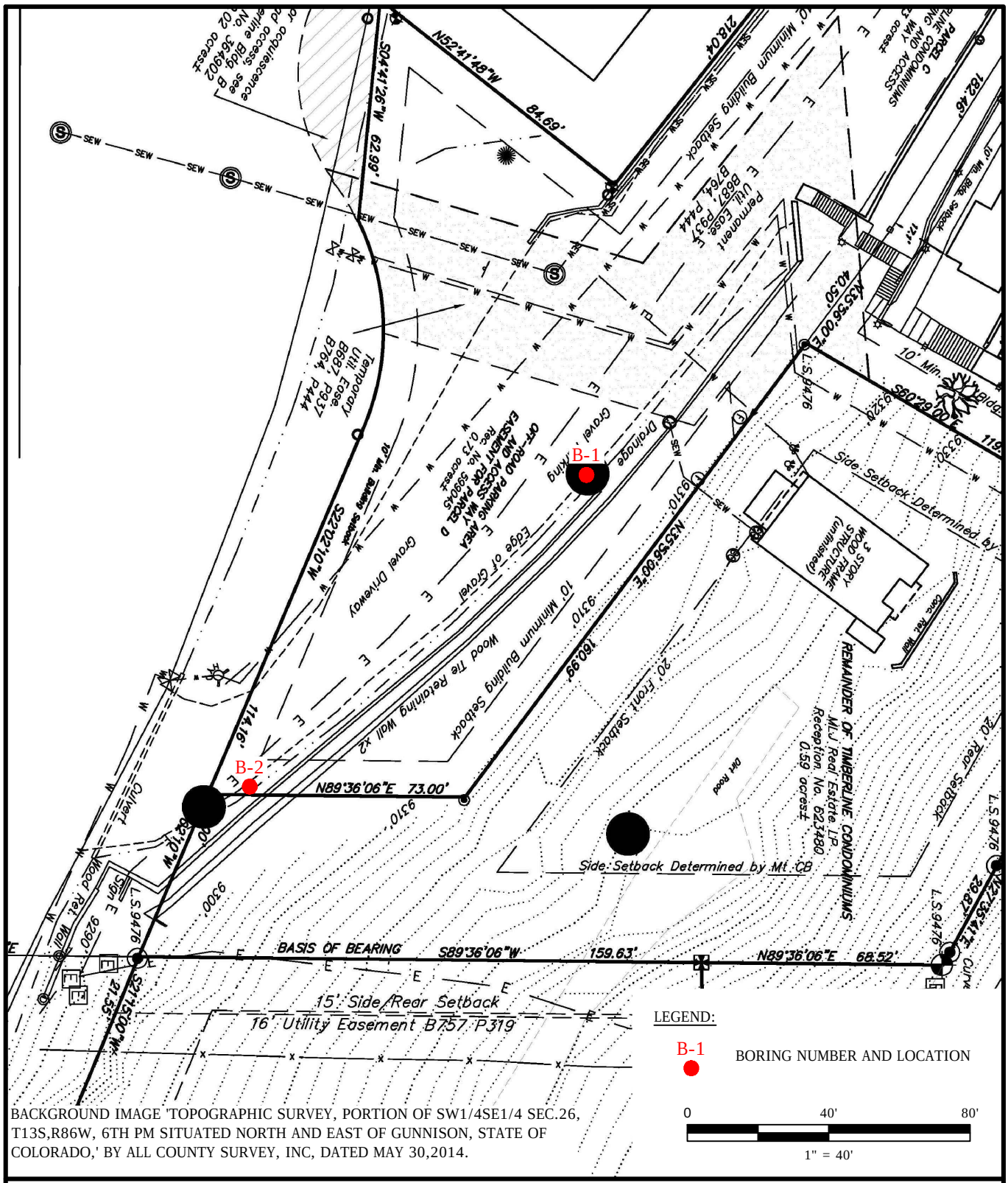
TABLE 1
Summary of Laboratory Test Results
Timberline HOA
Project No. 17.5052

Sample Location		Natural Dry Density (pcf)	Natural Moisture Content (%)	Standard Proctor (ASTM D698)		Gradation			Atterberg Limits		Direct Shear				Unconfined Compression (ksf)	Material Type
Boring/ Test Pit	Depth (feet)			Maximum Dry Density (pcf)	Optimum Moisture Content (%)	Gravel (%)	Sand (%)	Silt/ Clay (%)	Liquid Limit (%)	Plasticity Index (%)	ϕ_{peak} (degrees)	C_{peak} (psf)	ϕ_{ult} (degrees)	C_{ult} (psf)		
B-1	4		12.0			16	47	37.2	33	18						SAND, clayey, with gravel (SC,A-6(2))
B-1	14		15.4			15	40	44.6	28	16						SAND, clayey, with gravel (SC,A-6(3))
B-1	24		9.6			31	34	35.4	30	17						SAND, clayey, with gravel (SC,A-6(1))
B-1	0 to 5		5.1			10	42	48.4	33	21						SAND, clayey (SC,A-6(6))
B-1	5 to 10	114.9*	11.0*	120.2	11.7	14	31	46.6	35	24	25.6	1,111	20.5	1,251		SAND, clayey (SC,A-6(6))
B-1	10 to 18.5		6.7			7	32	57.2	34	22						CLAY, sandy, lean (CL,A-6(9))
B-1	34.5 to 35.5	156.7	1.1**												198.3	MANCOS SHALE
B-1	39.5 to 41.5	157.4	1.5**												207.5	MANCOS SHALE
B-2	5		11.0			36	32	32.1	28	16						GRAVEL, clayey, with sand (GC,A-2-6(1))
B-2	9		11.3			18	57	25.2	29	17						SAND, clayey, with gravel (SC,A-6(0))
B-2	14		7.7			1	22	76.9	32	18						CLAYSTONE: CLAY, lean, with sand CL,A-6(12))
B-2	14 to 19	117.8*	14.1*				38	61.7	30	15	32.2	804	31.8	453		CLAYSTONE: CLAY, lean, sandy (CL,A-6(6))
B-2	19		13.1			7	16	77.3	35	20						CLAYSTONE: CLAY, sandy, lean (CL,A-6(14))
B-2	29 to 30	158.7	2.4**												141.1	MANCOS SHALE
B-2	32 to 33	158.9	2.0**												495.8	MANCOS SHALE

* Average of tested points
** Air drying occurred prior to testing.

W:\2017\Summit\17.5000\17.5052.C Timberline HOA Retaining Wall Repair\ACAD\Boring Location Map.dwg 11/9/2017 12:34 PM



BACKGROUND IMAGE 'TOPOGRAPHIC SURVEY, PORTION OF SW1/4SE1/4 SEC.26, T13S,R86W, 6TH PM SITUATED NORTH AND EAST OF GUNNISON, STATE OF COLORADO,' BY ALL COUNTY SURVEY, INC, DATED MAY 30,2014.

FIGURE 1
Boring Location Map

PROJECT NO:	17.5052		
PROJECT NAME:	Timberline HOA		
DRAWN BY:	FPS	CHECKED BY:	JAC2
DWG DATE:	11.09.17	REV. DATE:	--

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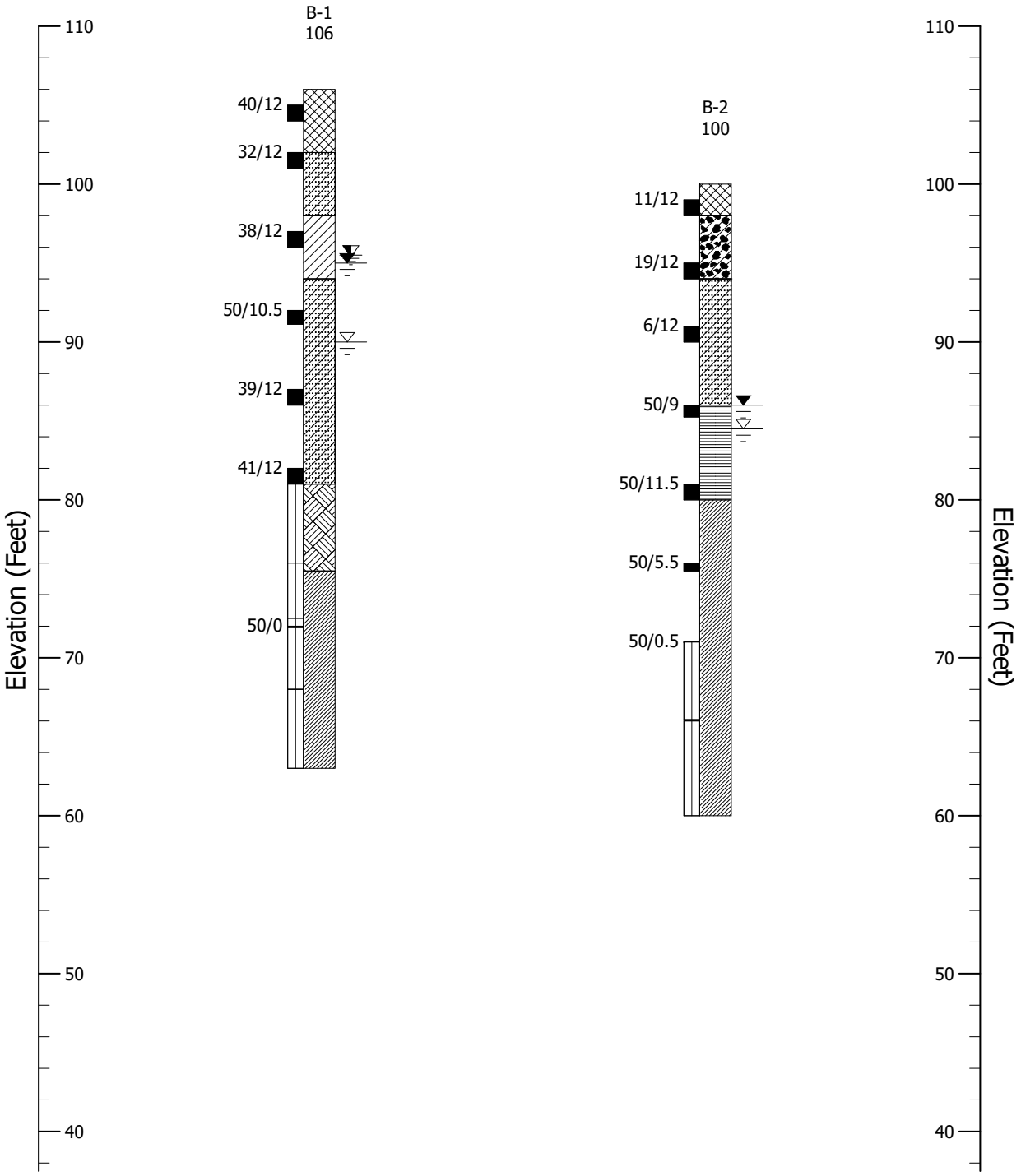

FIGURE 2

Boring Logs

PROJECT NO:	17.5052
PROJECT NAME:	Timberline HOA
DWG DATE:	11/10/2017

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KEY TO SYMBOLS

Symbol	Description
Strata symbols	
	FILL: SAND, clayey, with gravel, medium dense to dense, slightly moist to moist, dark brown (SC, A-6).
	SAND, clayey, occasional to with gravels, very loose to very dense, moist to wet, brown (SC, A-6).
	GRAVEL, clayey, with sand, medium dense, moist, brown (GC, A 2-6).
	CLAY, sandy, lean, occasional gravel, hard, moist, brown (CL, A6).
	LATITE BOULDER
	MANCOS SHALE, weathered to hard, slightly moist to moist, gray.
	MANCOS SHALE, metamorphosed, thickly bedded, slightly to highly fractured, slightly weathered to fresh, very hard, light to dark gray.
Misc. Symbols	
	Water level during drilling

Symbol	Description
	Water level 1 day after drilling.
	Water level 32 days after drilling.
Soil Samplers	
	Modified California sample
	Rock core

Notes:

1. 40/12 indicates 40 blows with a 140-pound hammer falling 30 inches were required to drive a modified California barrel sampler 12 inches.

2. Exploratory borings B-1 and B-2 were drilled on September 25 and 26, 2017 using a Simcode 2800 drill rig equipped with 4-inch diameter continuous flight solid stem auger in the soils. Cesare used rotary wash methods with NQ wireline in the very hard bedrock.

3. Relative elevations of borings B-1 and B-2 were determined by Cesare, Inc. using a hand level.

4. Groundwater was encountered at depths of 16 feet below ground surface in both borings during drilling. Cesare installed a temporary monitoring well in boring B-1 on September 25, 2017. Groundwater was measured at depths of 11 feet and 14 feet below ground surface in borings B-1 and B-2, respectively, one day after drilling. For safety purposes, boring B-2 was backfilled at the completion of the field study. We subsequently measured groundwater at a depth of 10-1/2 feet in B-1 on October 27, 2017.

5. Contacts between soil units are approximate and may be gradational.

6. These logs are subject to the limitations, conclusions, and recommendations in this report.
Project No. 17.5052.

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APPENDIX A

Laboratory Test Results

CESARE, INC.
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DIRECT SHEAR (ASTM D3080)

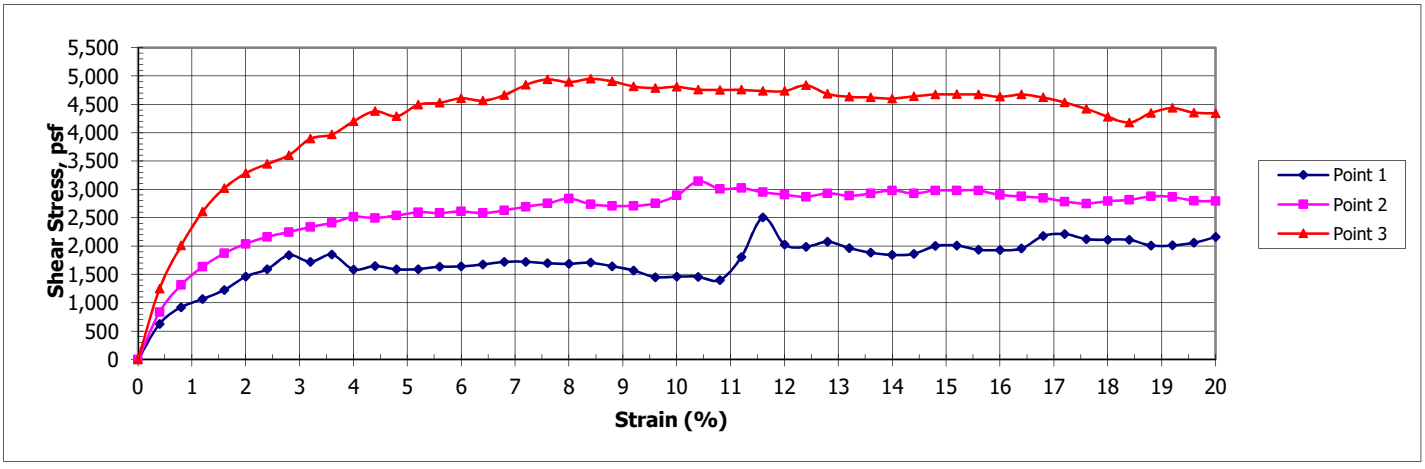
Project Name:	Timberline HOA	Date:	10/16/17
Project No.:	17.5052	Tested By:	G. Hoyos
Lab ID:	1721378	Checked By:	J. Crystal
Sample:	B-1 at 5 to 10'	Specific Gravity (SpG):	
Visual Description:	Clay, sandy, brown	SpG Assumed (yes or no):	
Remarks:			
Inundated (yes or no):	Yes	Sample Type (ring or box):	Ring

Direct Shear Data Summary

	Sample No.	Water Content (%)	Dry Density (pcf)	Saturation (%)	Void Ratio	Diameter/ Width (in.)	Height (in.)
Initial	1	10.9	115.0	0.0	-1.00	2.50	0.87
	2	11.3	114.6	0.0	-1.00	2.50	0.87
	3	10.8	115.2	0.0	-1.00	2.50	0.87

	Sample No.	Water Content (%)	Dry Density (pcf)	Saturation (%)	Void Ratio	Diameter/ Width (in.)	Height (in.)
At Test	1	18.3	120.6	0.0	-1.00	2.50	0.83
	2	16.3	123.4	0.0	-1.00	2.50	0.81
	3	15.4	124.3	0.0	-1.00	2.50	0.81

Normal Stress (psf)	Peak Shear Stress (psf)	Peak Shear Strain (%)	Ultimate Shear Stress (psf)	Ultimate Shear Strain (%)	Strain Rate (in./min.)
2000	2074	12.8	2011	19.0	0.0002
4000	3022	11.2	2871	19.0	0.0002
8000	4949	8.4	4391	19.0	0.0002



REMARKS:

CESARE, INC.
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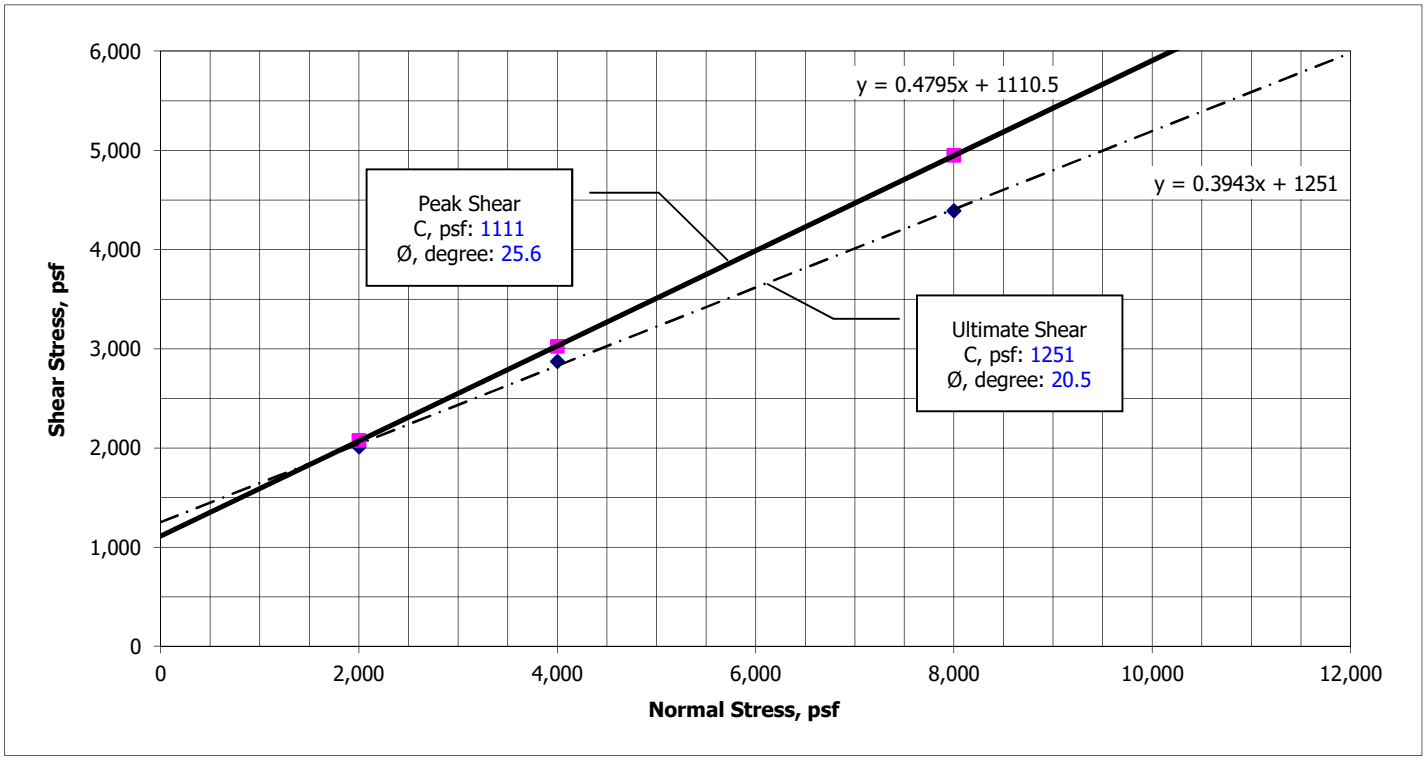
DIRECT SHEAR (ASTM D3080)

Project Name:	Timberline HOA	Date:	10/16/17
Project No.:	17.5052	Tested By:	G. Hoyos
Lab ID:	1721378	Checked By:	J. Crystal

Sample:	B-1 at 5 to 10'
Visual Description:	Clay, sandy, brown

Direct Shear Tangents



REMARKS:

CESARE, INC.
Geotechnical Engineers & Construction Materials Consultants

DIRECT SHEAR (ASTM D3080)

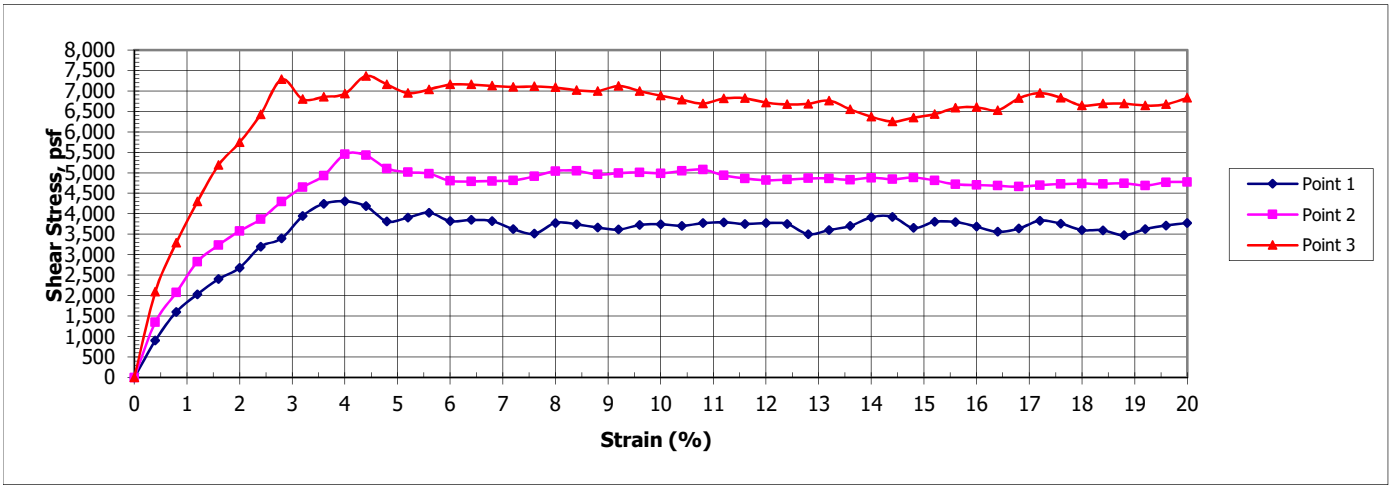
Project Name:	Timberline HOA	Date:	10/29/17
Project No.:	17.5052	Tested By:	G. Hoyos
Lab ID:	1721425	Checked By:	J. Crystal
Sample:	B-2 at 14 to 19'	Specific Gravity (SpG):	
Visual Description:	CLAYSTONE, sandy, dark brown	SpG Assumed (yes or no):	
Remarks:			
Inundated (yes or no):	Yes	Sample Type (ring or box):	Ring

Direct Shear Data Summary

	Sample No.	Water Content (%)	Dry Density (pcf)	Saturation (%)	Void Ratio	Diameter/ Width (in.)	Height (in.)
Initial	1	14.3	117.5	0.0	-1.00	2.50	0.87
	2	14.1	117.8	0.0	-1.00	2.50	0.87
	3	13.8	118.0	0.0	-1.00	2.50	0.87

	Sample No.	Water Content (%)	Dry Density (pcf)	Saturation (%)	Void Ratio	Diameter/ Width (in.)	Height (in.)
At Test	1	16.6	124.6	0.0	-1.00	2.50	0.82
	2	16.3	126.6	0.0	-1.00	2.50	0.81
	3		130.0	0.0	-1.00	2.50	0.79

Normal Stress (psf)	Peak Shear Stress (psf)	Peak Shear Strain (%)	Ultimate Shear Stress (psf)	Ultimate Shear Strain (%)	Strain Rate (in./min.)
5000	4025	5.6	3597	20.0	0.0002
7000	5104	4.8	4729	20.0	0.0002
10000	7155	4.8	6686	20.0	0.0002



REMARKS:

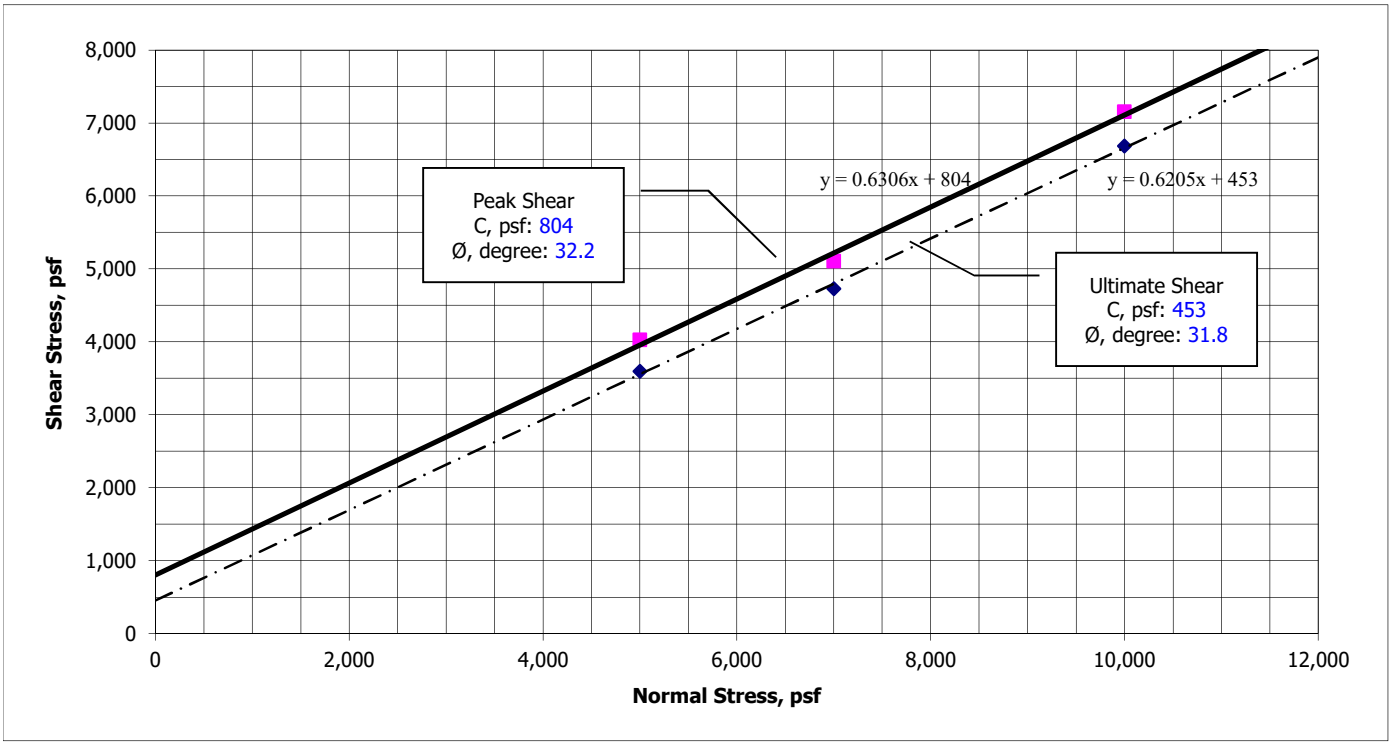
CESARE, INC.
Geotechnical Engineers & Construction Materials Consultants

DIRECT SHEAR (ASTM D3080)

Project Name:	Timberline HOA	Date:	10/29/17
Project No.:	17.5052	Tested By:	G. Hoyos
Lab ID:	1721425	Checked By:	J. Crystal

Sample:	B-2 at 14 to 19'
Visual Description:	CLAYSTONE, sandy, dark brown

Direct Shear Tangents



REMARKS:

CESARE, INC.
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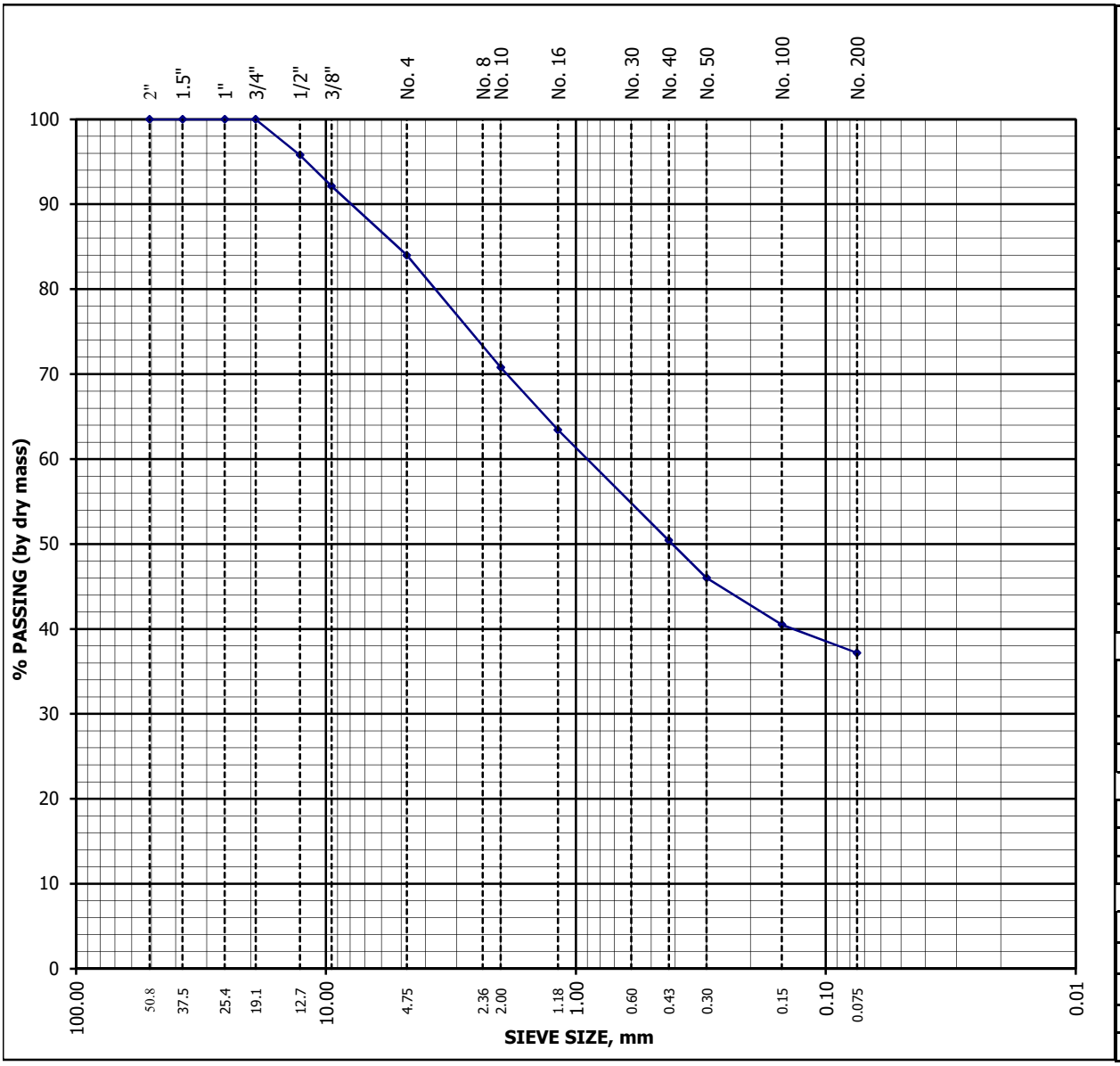
GRADATION PLOT - SOIL & AGGREGATE

Project Number:	17.5052, Crested Butte Lodging	Date:	10-Oct-17
Project Name:	Timberline HOA	Technician:	J. Weinerth
Lab ID Number:	1721335	Reviewer:	0
Sample Location:	B-1 at 4'		
Visual Description:	SAND, clayey, with gravel		

AASHTO M 145 Classification: **A-6** **Group Index:** **2**

Unified Soil Classification System (ASTM D 2487): **(SC)** **Clayey sand with gravel**



Sieve Size	% Passing
2"	
1.5"	
1"	
3/4"	100
1/2"	96
3/8"	92
#4	84
#8	
#10	71
#16	63
#30	
#40	50
#50	46
#100	41
#200	37.2

Moisture (M) & Density (D)	
M, %:	12.0
D, pcf:	

LL	33
PL	15
PI	18

D_{60}	
D_{30}	
D_{10}	
Cu	
Cc	

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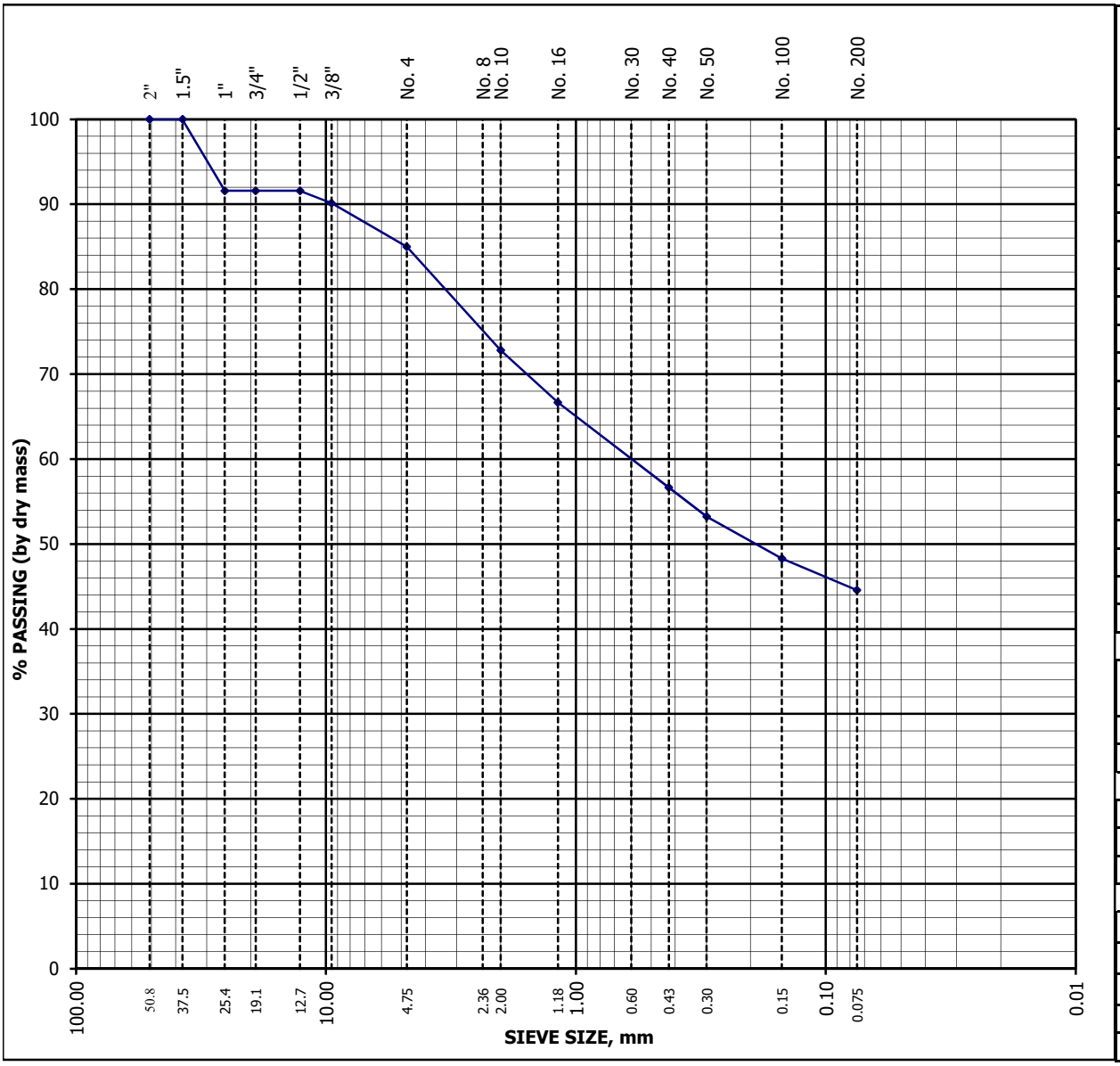
Geotechnical Engineers & Construction Materials Consultants

GRADATION PLOT - SOIL & AGGREGATE

Project Number:	17.5052, Crested Butte Lodging	Date:	4-Oct-17
Project Name:	Timberline HOA	Technician:	H. Purdom
Lab ID Number:	1721336	Reviewer:	0
Sample Location:	B-1 at 14'		
Visual Description:	CLAY, sandy, with gravel, brown		

AASHTO M 145 Classification: **A-6** **Group Index:** **3**

Unified Soil Classification System (ASTM D 2487): **(SC)** **Clayey sand, with gravel**



Sieve Size	% Passing
2"	
1.5"	100
1"	92
3/4"	92
1/2"	92
3/8"	90
#4	85
#8	
#10	73
#16	67
#30	
#40	57
#50	53
#100	48
#200	44.6

Moisture (M) & Density (D)	
M, %:	15.4
D, pcf:	

LL	28
PL	12
PI	16

D_{60}	
D_{30}	
D_{10}	
Cu	
Cc	

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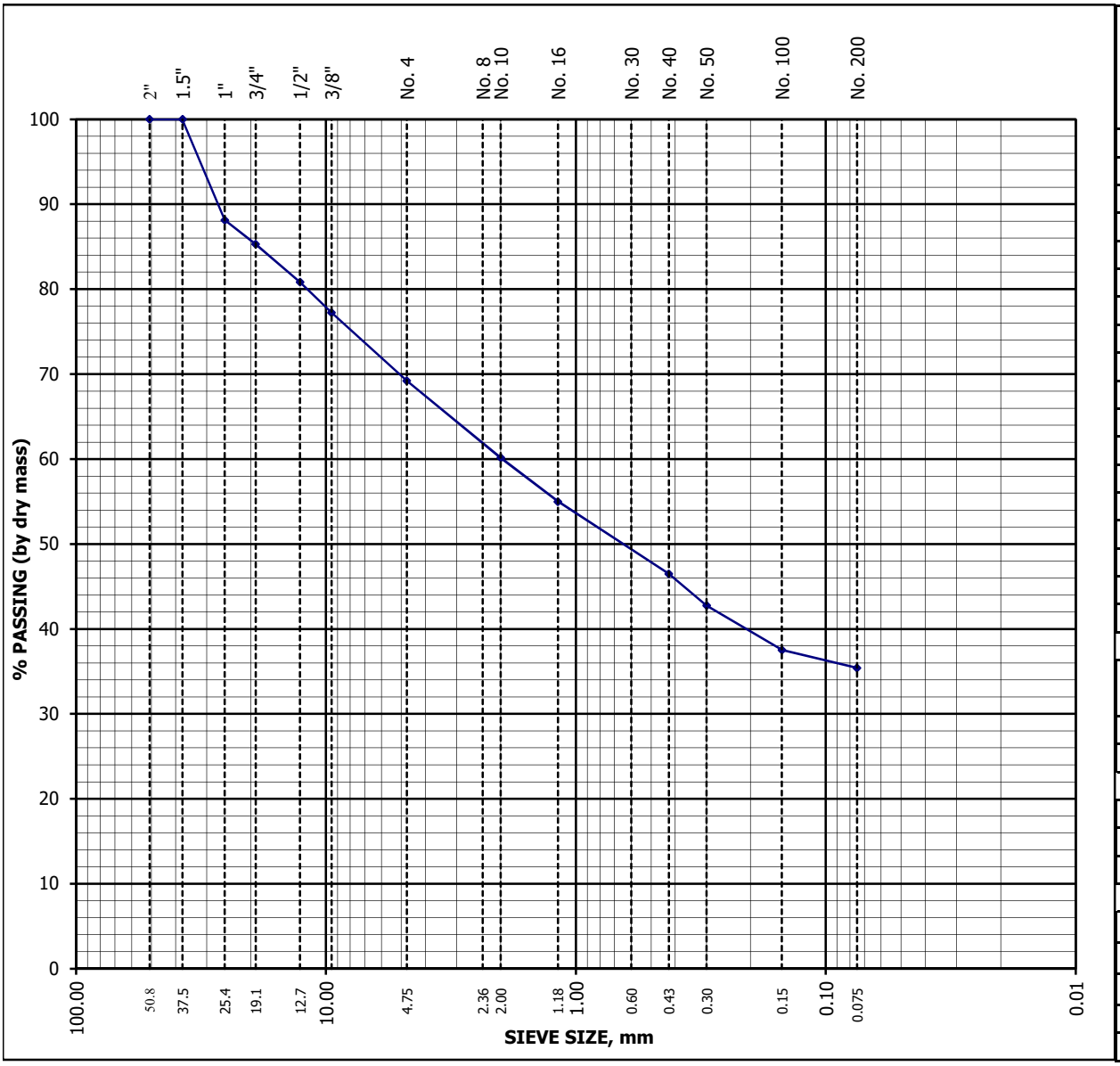
GRADATION PLOT - SOIL & AGGREGATE

Project Number:	17.5052, Crested Butte Lodging	Date:	4-Oct-17
Project Name:	Timberline HOA	Technician:	H. Purdom
Lab ID Number:	1721337	Reviewer:	0
Sample Location:	B-1 at 24'		
Visual Description:	CLAY, sandy, with gravel, dark gray		

AASHTO M 145 Classification: **A-6** **Group Index:** **1**

Unified Soil Classification System (ASTM D 2487): **(SC)** **Clayey sand with gravel**



Sieve Size	% Passing
2"	
1.5"	100
1"	88
3/4"	85
1/2"	81
3/8"	77
#4	69
#8	
#10	60
#16	55
#30	
#40	46
#50	43
#100	38
#200	35.4

Moisture (M) & Density (D)	
M, %:	9.6
D, pcf:	

LL	30
PL	13
PI	17

D_{60}	
D_{30}	
D_{10}	
Cu	
Cc	

CESARE, INC.
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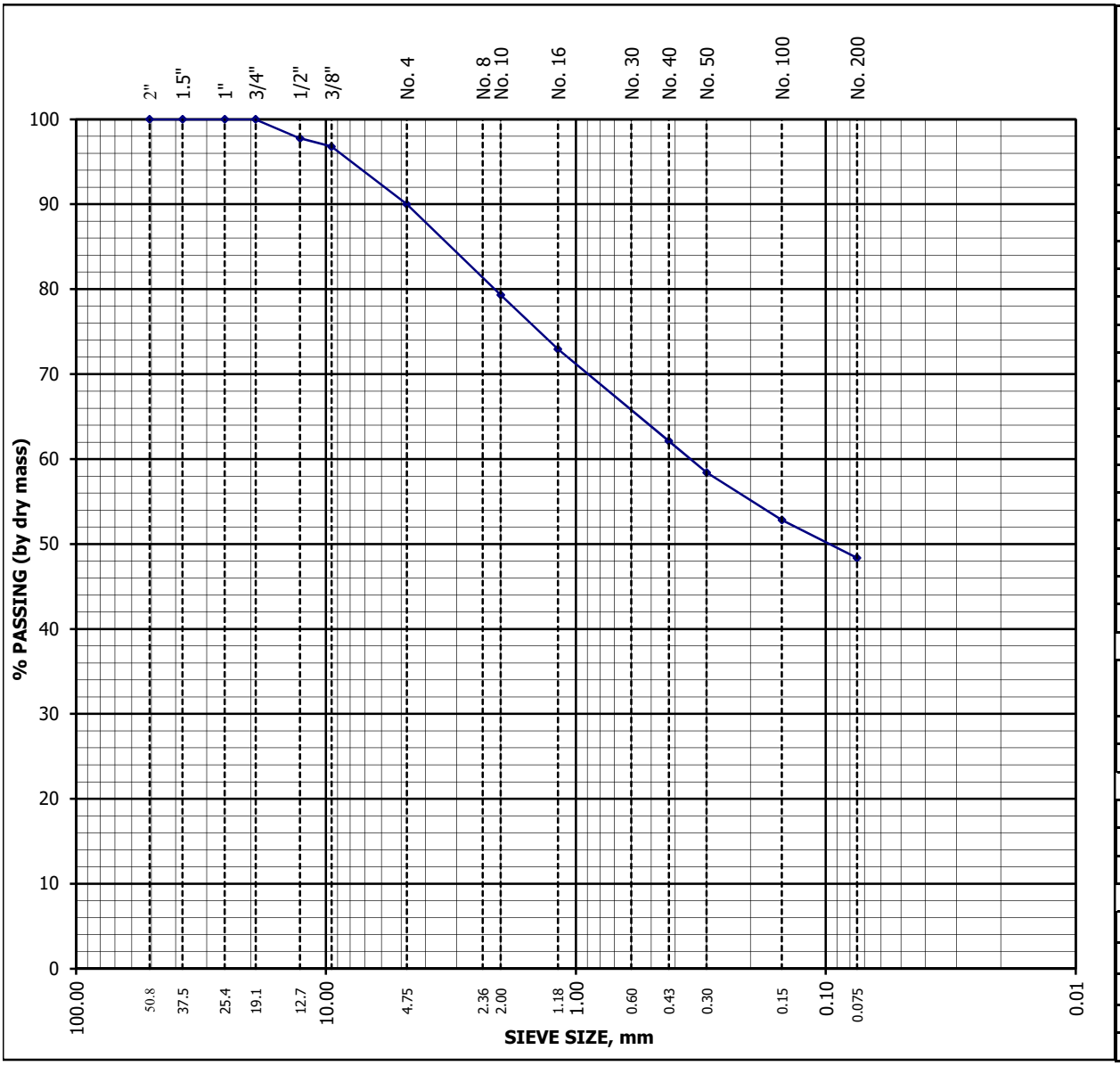
GRADATION PLOT - SOIL & AGGREGATE

Project Number:	17.5052, Crested Butte Lodging	Date:	4-Oct-17
Project Name:	Timberline HOA	Technician:	H. Purdom
Lab ID Number:	1721338	Reviewer:	0
Sample Location:	B-1 at 0' to 5'		
Visual Description:	CLAY, sandy, brown		

AASHTO M 145 Classification: **A-6** **Group Index:** **6**

Unified Soil Classification System (ASTM D 2487): **(SC) Clayey sand**



Sieve Size	% Passing
2"	
1.5"	
1"	
3/4"	100
1/2"	98
3/8"	97
#4	90
#8	
#10	79
#16	73
#30	
#40	62
#50	58
#100	53
#200	48.4

Moisture (M) & Density (D)	
M, %:	5.1
D, pcf:	

LL	33
PL	12
PI	21

D_{60}	
D_{30}	
D_{10}	
Cu	
Cc	

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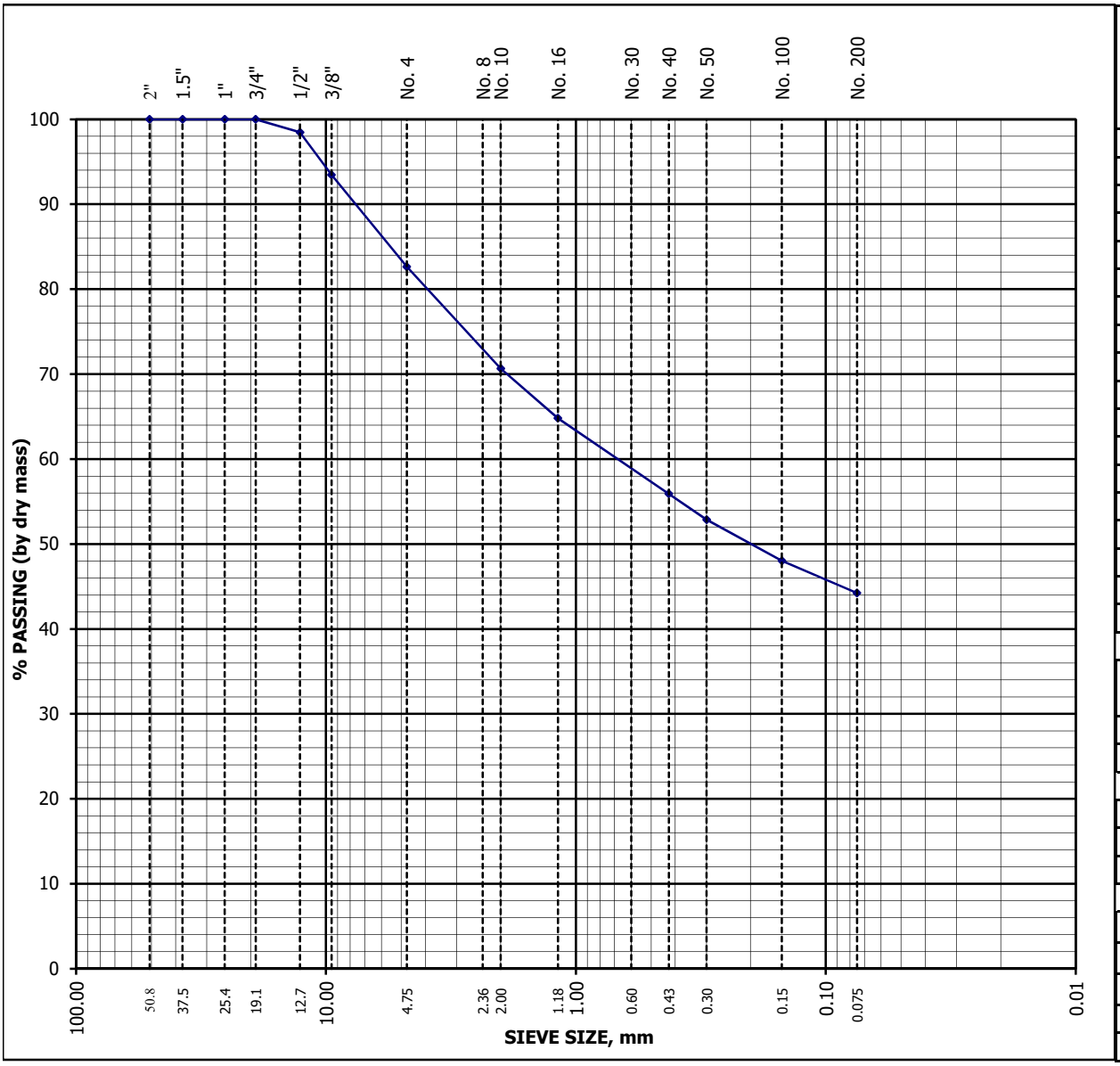
Geotechnical Engineers & Construction Materials Consultants

GRADATION PLOT - SOIL & AGGREGATE

Project Number:	17.5052, Crested Butte Lodging	Date:	4-Oct-17
Project Name:	Timberline HOA	Technician:	G. Hoyos
Lab ID Number:	1721339	Reviewer:	0
Sample Location:	B-1 at 5' to 10'		
Visual Description:	SAND, clayey, with gravel, brown		

AASHTO M 145 Classification: **A-6** **Group Index:** **4**

Unified Soil Classification System (ASTM D 2487): **(SC)** **Clayey sand with gravel**



Sieve Size	% Passing
2"	
1.5"	
1"	
3/4"	100
1/2"	98
3/8"	93
#4	83
#8	
#10	71
#16	65
#30	
#40	56
#50	53
#100	48
#200	44.2

Moisture (M) & Density (D)	
M, %:	6.4
D, pcf:	

LL	33
PL	14
PI	19

D_{60}	
D_{30}	
D_{10}	
Cu	
Cc	

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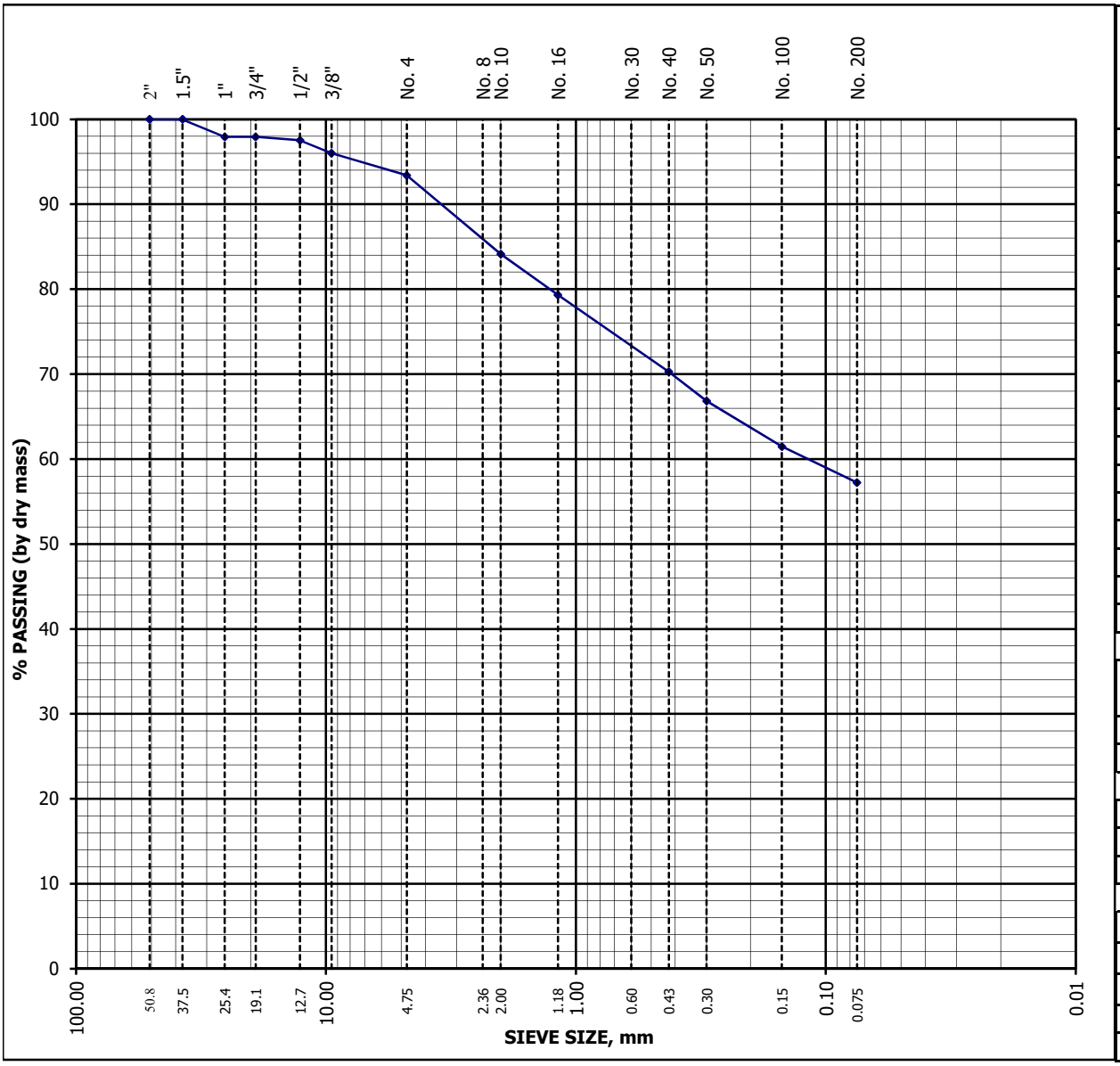
GRADATION PLOT - SOIL & AGGREGATE

Project Number:	17.5052, Crested Butte Lodging	Date:	4-Oct-17
Project Name:	Timberline HOA	Technician:	G. Hoyos
Lab ID Number:	1721340	Reviewer:	0
Sample Location:	B-1 at 10' to 18.5'		
Visual Description:	CLAY, sandy, brown		

AASHTO M 145 Classification: **A-6** **Group Index:** **9**

Unified Soil Classification System (ASTM D 2487): **(CL)** **Sandy lean clay**



Sieve Size	% Passing
2"	
1.5"	100
1"	98
3/4"	98
1/2"	98
3/8"	96
#4	93
#8	
#10	84
#16	79
#30	
#40	70
#50	67
#100	61
#200	57.2

Moisture (M) & Density (D)	
M, %:	6.7
D, pcf:	

LL	34
PL	12
PI	22

D_{60}	
D_{30}	
D_{10}	
Cu	
Cc	

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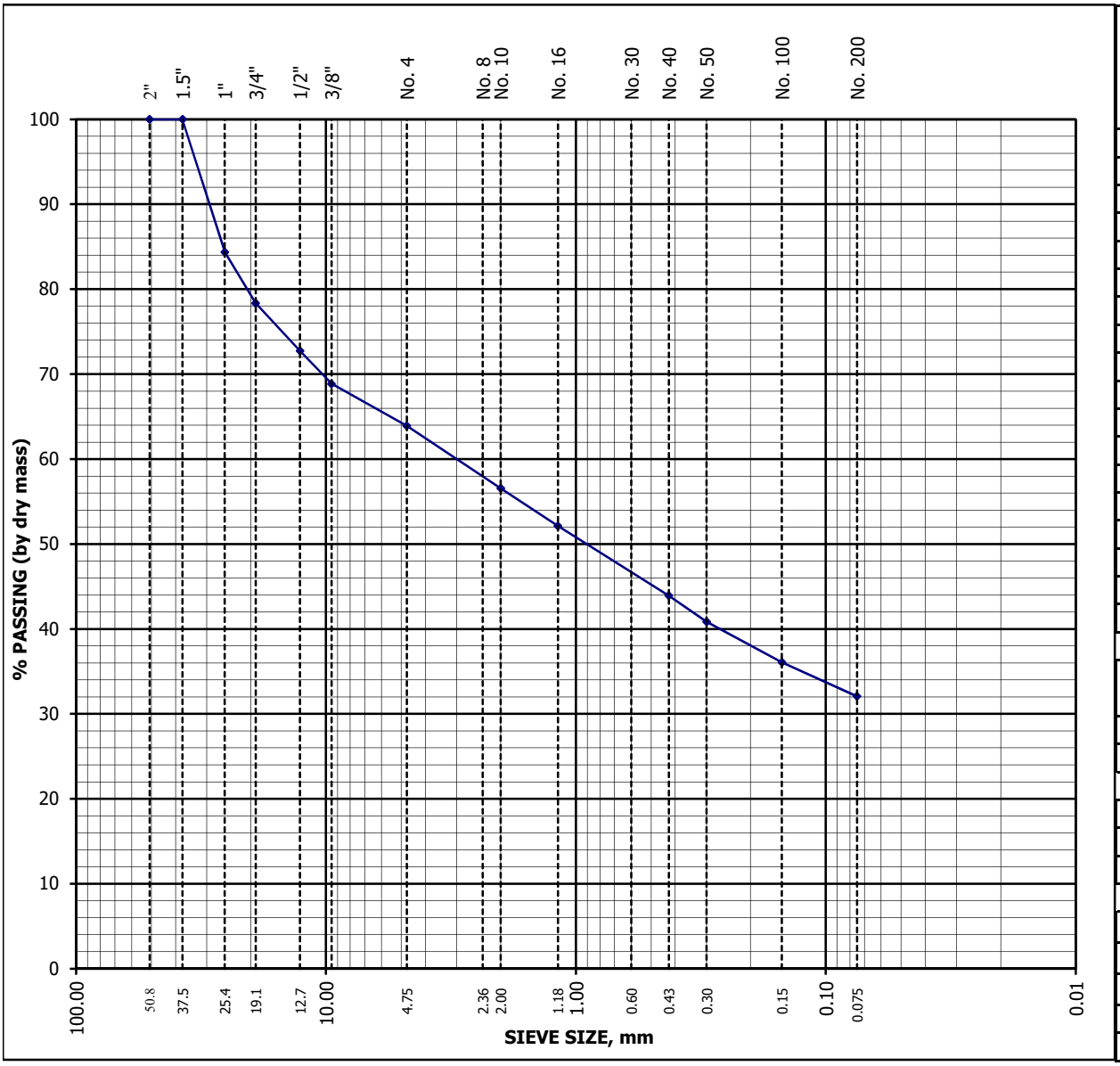
GRADATION PLOT - SOIL & AGGREGATE

Project Number:	17.5052, Crested Butte Lodging	Date:	4-Oct-17
Project Name:	Timberline HOA	Technician:	H. Purdom
Lab ID Number:	1721343	Reviewer:	0
Sample Location:	B-2 at 5'		
Visual Description:	GRAVEL, clayey, with sand, brown		

AASHTO M 145 Classification: **A-2-6** **Group Index:** **1**

Unified Soil Classification System (ASTM D 2487): **(GC)** **Clayey gravel with sand**



Sieve Size	% Passing
2"	
1.5"	100
1"	84
3/4"	78
1/2"	73
3/8"	69
#4	64
#8	
#10	57
#16	52
#30	
#40	44
#50	41
#100	36
#200	32.1

Moisture (M) & Density (D)	
M, %:	11.0
D, pcf:	

LL	28
PL	12
PI	16

D_{60}	
D_{30}	
D_{10}	
Cu	
Cc	

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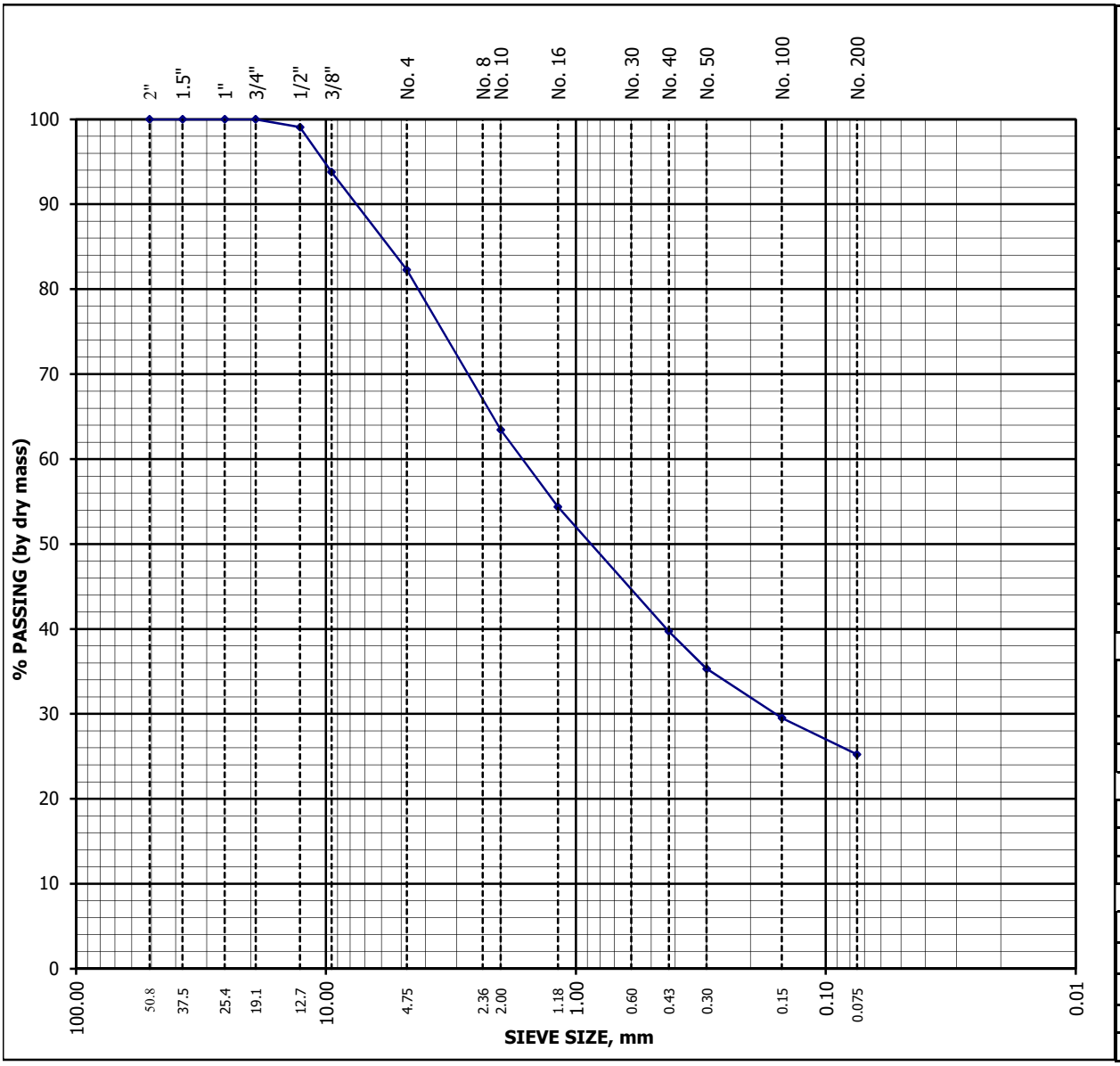
GRADATION PLOT - SOIL & AGGREGATE

Project Number:	17.5052, Crested Butte Lodging	Date:	4-Oct-17
Project Name:	Timberline HOA	Technician:	G. Hoyos
Lab ID Number:	1721344	Reviewer:	0
Sample Location:	B-2 at 9'		
Visual Description:	SAND, clayey, with gravel, brown		

AASHTO M 145 Classification: **A-2-6** **Group Index:** **(0)**

Unified Soil Classification System (ASTM D 2487): **(SC)** **Clayey sand with gravel**



Sieve Size	% Passing
2"	
1.5"	
1"	
3/4"	100
1/2"	99
3/8"	94
#4	82
#8	
#10	63
#16	54
#30	
#40	40
#50	35
#100	30
#200	25.2

Moisture (M) & Density (D)	
M, %:	11.3
D, pcf:	

LL	29
PL	12
PI	17

D_{60}	
D_{30}	
D_{10}	
Cu	
Cc	

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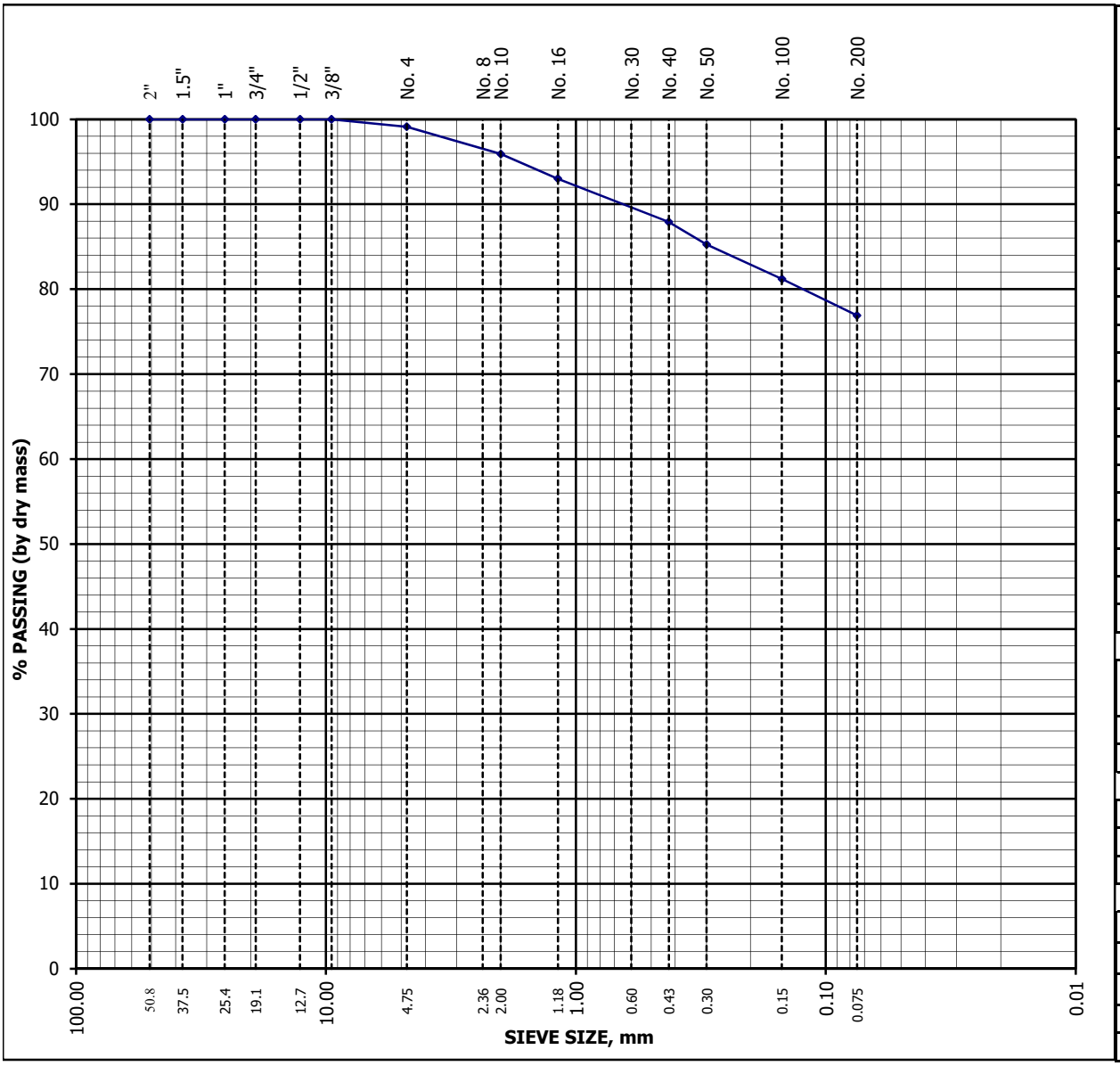
GRADATION PLOT - SOIL & AGGREGATE

Project Number:	17.5052, Crested Butte Lodging	Date:	4-Oct-17
Project Name:	Timberline HOA	Technician:	J. Holiman
Lab ID Number:	1721345	Reviewer:	0
Sample Location:	B-2 at 14'		
Visual Description:	CLAYSTONE: CLAY, with sand, brown		

AASHTO M 145 Classification: **A-6** **Group Index:** **12**

Unified Soil Classification System (ASTM D 2487): **(CL)** **Lean clay with sand**



Sieve Size	% Passing
2"	
1.5"	
1"	
3/4"	
1/2"	
3/8"	100
#4	99
#8	
#10	96
#16	93
#30	
#40	88
#50	85
#100	81
#200	76.9

Moisture (M) & Density (D)	
M, %:	7.7
D, pcf:	

LL	32
PL	14
PI	18

D_{60}	
D_{30}	
D_{10}	
Cu	
Cc	

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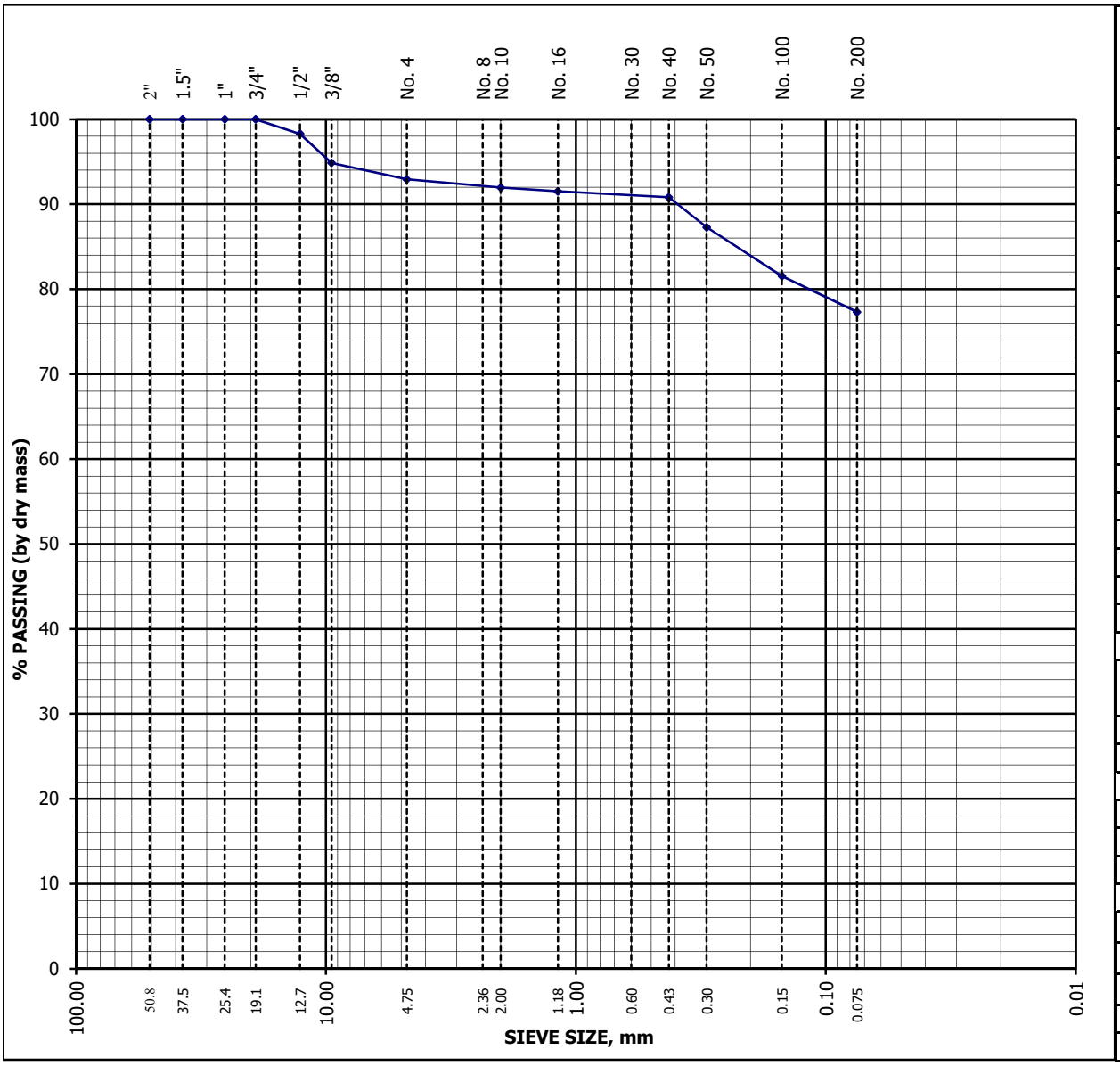
GRADATION PLOT - SOIL & AGGREGATE

Project Number:	17.5052, Crested Butte Lodging	Date:	4-Oct-17
Project Name:	Timberline HOA	Technician:	G. Hoyos
Lab ID Number:	1721346	Reviewer:	0
Sample Location:	B-2 at 19'		
Visual Description:	CLAYSTONE: CLAY, with sand, dark gray		

AASHTO M 145 Classification: **A-6** **Group Index:** **14**

Unified Soil Classification System (ASTM D 2487): **(CL)** **Lean clay with sand**



Sieve Size	% Passing
2"	
1.5"	
1"	
3/4"	100
1/2"	98
3/8"	95
#4	93
#8	
#10	92
#16	92
#30	
#40	91
#50	87
#100	82
#200	77.3

Moisture (M) & Density (D)	
M, %:	13.1
D, pcf:	

LL	35
PL	15
PI	20

D_{60}	
D_{30}	
D_{10}	
Cu	
Cc	

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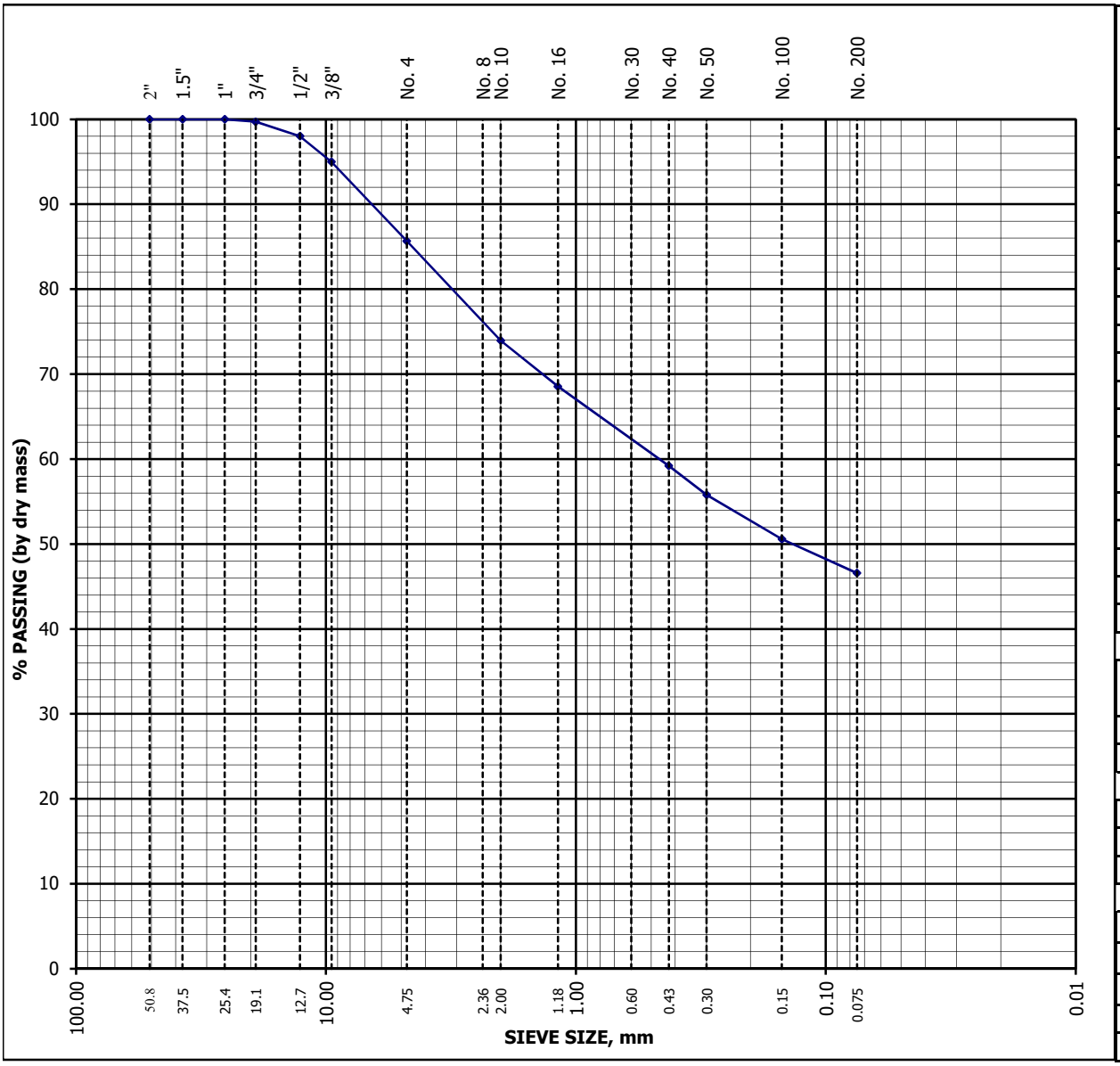
GRADATION PLOT - SOIL & AGGREGATE

Project Number:	17.5052, Crested Butte Lodging	Date:	11-Oct-17
Project Name:	Timberline HOA	Technician:	JLH
Lab ID Number:	1721378	Reviewer:	0
Sample Location:	B-1 at 5' to 10'		
Visual Description:	SAND, clayey, brown		

AASHTO M 145 Classification: **A-6** **Group Index:** **6**

Unified Soil Classification System (ASTM D 2487): **(SC) Clayey sand**



Sieve Size	% Passing
2"	
1.5"	
1"	100
3/4"	100
1/2"	98
3/8"	95
#4	86
#8	
#10	74
#16	69
#30	
#40	59
#50	56
#100	51
#200	46.6

Moisture (M) & Density (D)	
M, %:	3.3
D, pcf:	

LL	35
PL	11
PI	24

D_{60}	
D_{30}	
D_{10}	
Cu	
Cc	

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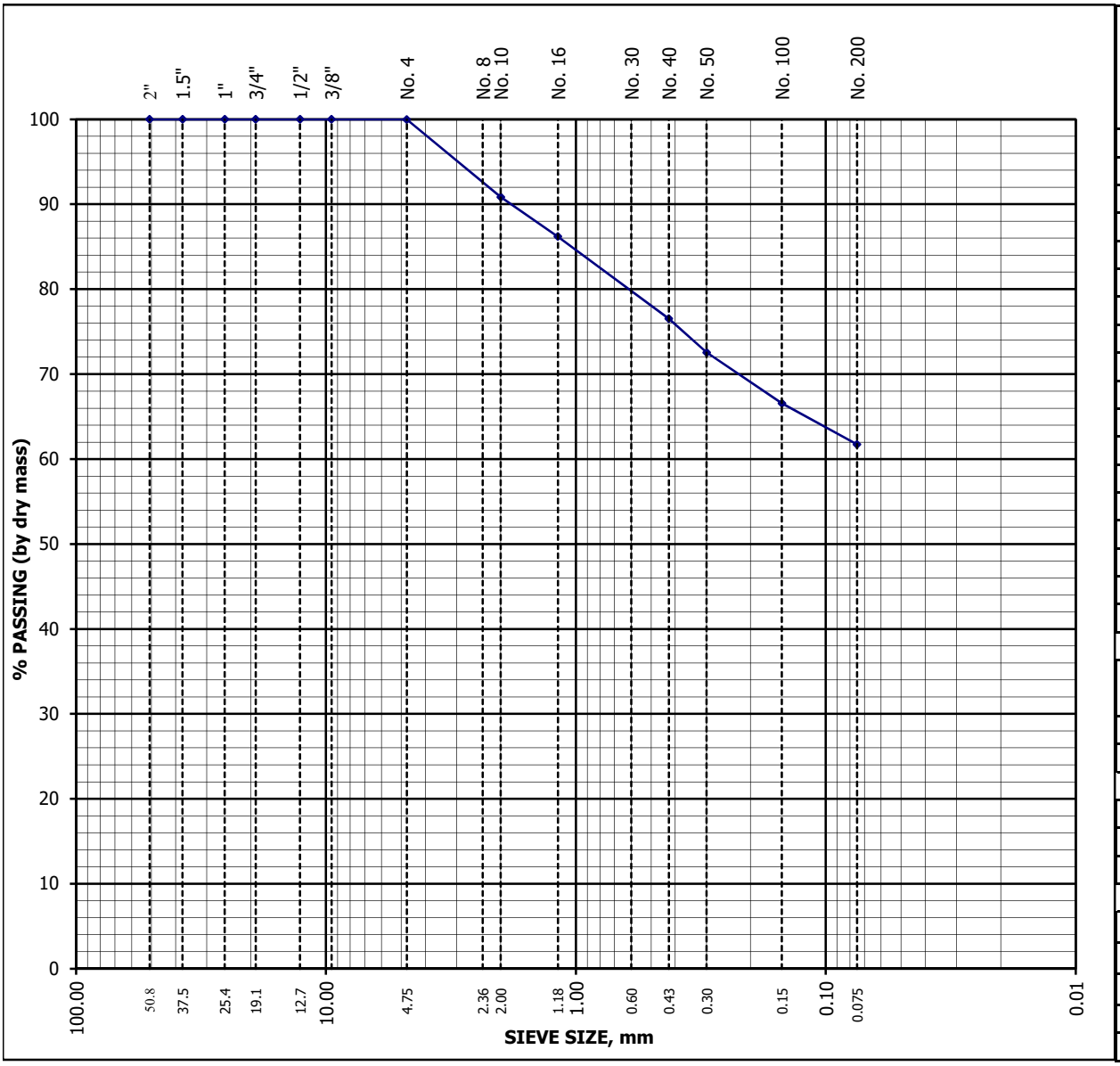
GRADATION PLOT - SOIL & AGGREGATE

Project Number:	17.5052, Crested Butte Lodging	Date:	6-Nov-17
Project Name:	Timberline HOA	Technician:	G. Hoyos
Lab ID Number:	1721425	Reviewer:	J. Crystal
Sample Location:	B-2 at 14' to 19'		
Visual Description:	CLAYSTONE: CLAY, sandy, dark brown		

AASHTO M 145 Classification: **A-6** **Group Index:** **6**

Unified Soil Classification System (ASTM D 2487): **(CL)** **Sandy lean clay**



Sieve Size	% Passing
2"	
1.5"	
1"	
3/4"	
1/2"	
3/8"	
#4	100
#8	
#10	91
#16	86
#30	
#40	77
#50	73
#100	67
#200	61.7

Moisture (M) & Density (D)	
M, %:	13.8
D, pcf:	

LL	30
PL	15
PI	15

D_{60}	
D_{30}	
D_{10}	
Cu	
Cc	

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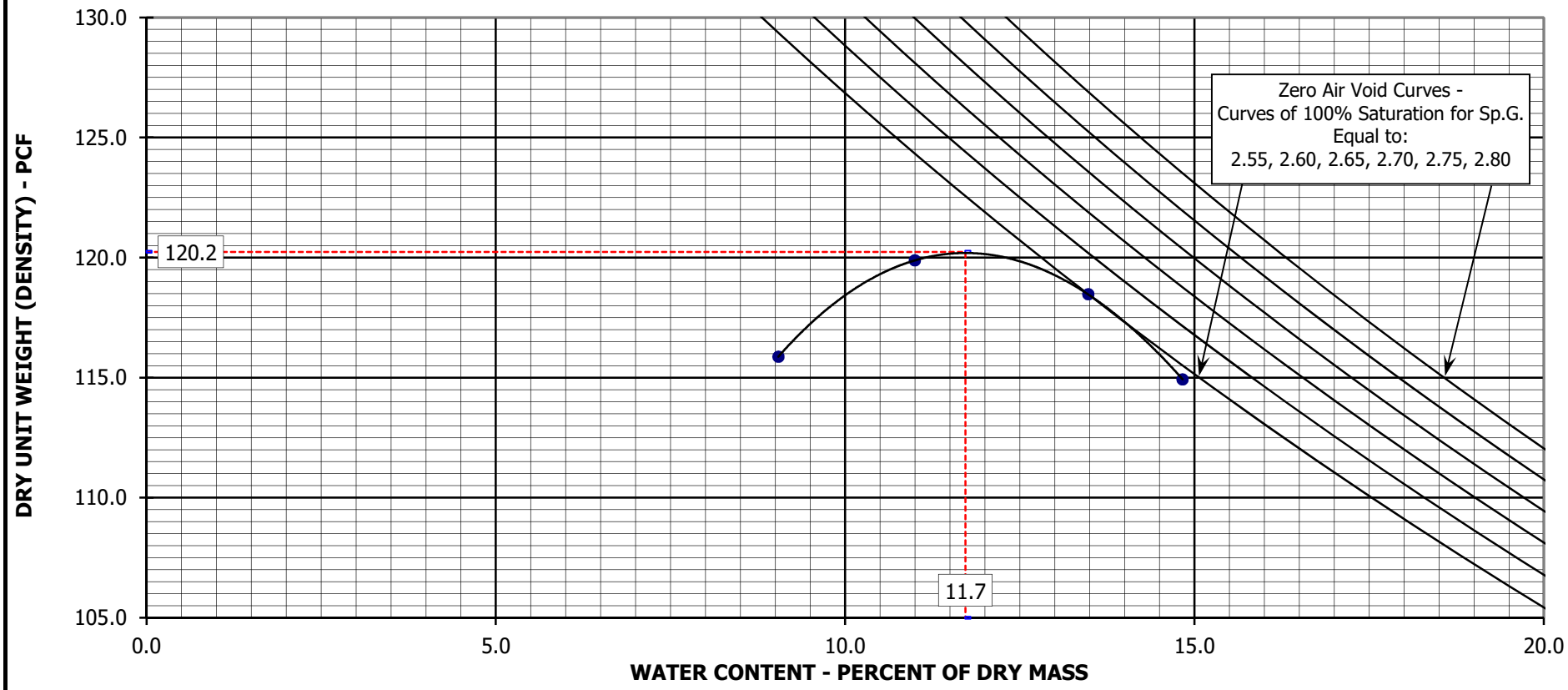
ASTM/AASHTO Compaction
Test Procedure Designation: ASTM D698 (Standard)
Method: B

Laboratory Maximum Dry Unit Weight (Density): 120.2 pcf
Laboratory Optimum Moisture Content (OMC): 11.7 %



Sample Location	Elev. or Depth, ft	LL	PL	PI	-#200, %	Soil Description & Classification
B-1 at 5-10'		35	11	24	47	Visual: CLAY, sandy, with gravel, brown AASHTO: A-6(6) USCS: (CL) Sandy lean clay

Moisture/Density Relationship (Proctor) Test

Project Number: 17.5052, Crested Butte Lodging
Project Name: Timberline HOA
Drawn By: A. Wright — Tested by: G. Hoyos
Checked By: — Date: 12-Oct-17
Date: 16-Oct-17 — Lab ID Number: 1721378

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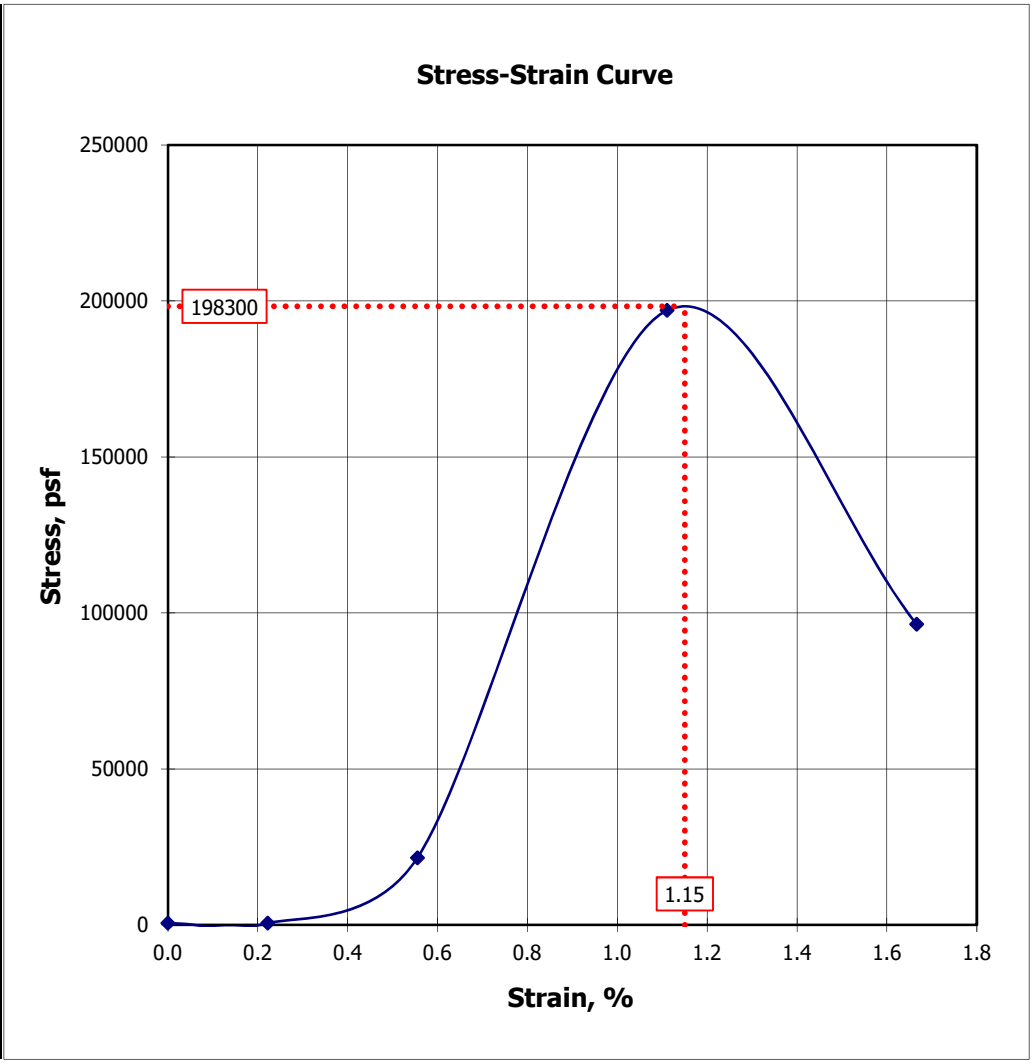
UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOIL (ASTM D2166)

Project No.:	17.5052, Crested Butte Lodging			Hole:	B-1
Project Name:	Timberline HOA			Depth:	34.5' to 35.5
Date:	4-Oct-17	Lab Tech:	G. Hoyos	Visual Description of Sample:	
Lab ID:	1721341	Checked By:	0	Rock core	

Unconfined Compressive Strength (q_u):	**198,300**	**psf**	**Density (pcf):**	156.7
Shear Strength (S_u):	**99,150**	**psf**	**Moisture:**	1.1

Axial Strain (%)	Axial Stress (psf)
0.0	526.9
0.2	525.8
0.6	21484.5
1.1	196970.7
1.7	96377.8



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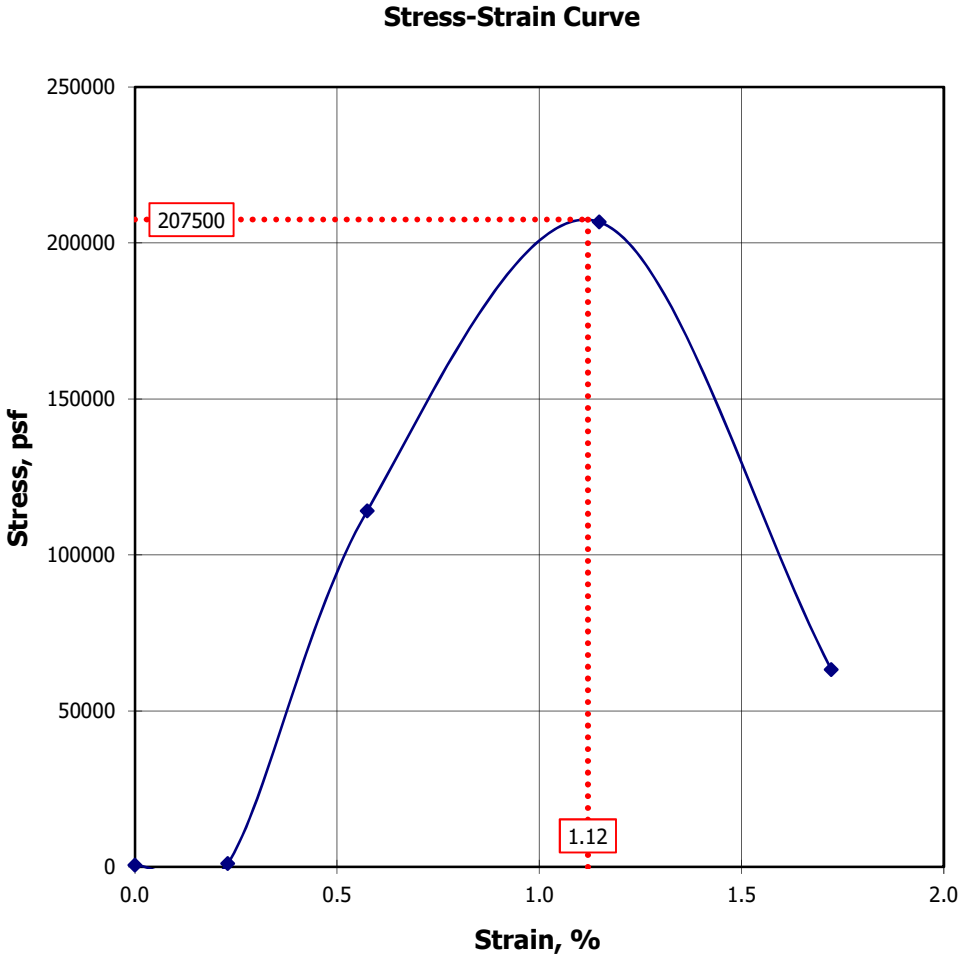
UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOIL (ASTM D2166)

Project No.:	17.5052, Crested Butte Lodging			Hole:	B-1
Project Name:	Timberline HOA			Depth:	39.5' to 41.5'
Date:	4-Oct-17	Lab Tech:	G. Hoyos	Visual Description of Sample:	
Lab ID:	1721342	Checked By:	0	Rock core	

Unconfined Compressive Strength (q_u):	**207,500**	**psf**	**Density (pcf):**	157.4
Shear Strength (S_u):	**103,750**	**psf**	**Moisture:**	1.5

Axial Strain (%)	Axial Stress (psf)
0.0	536.3
0.2	1070.1
0.6	114107.2
1.1	206752.1
1.7	63246.7



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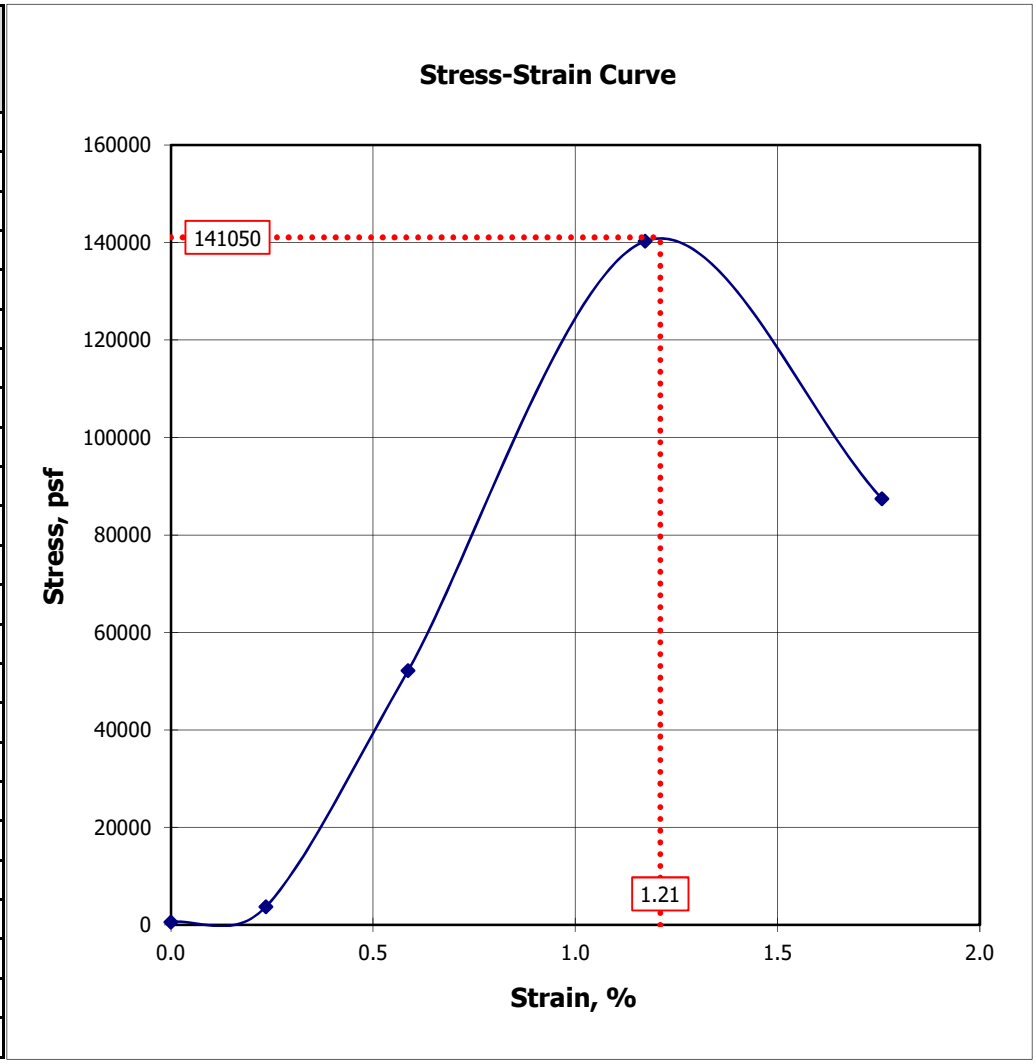
UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOIL (ASTM D2166)

Project No.:	17.5052, Crested Butte Lodging			Hole:	B-2
Project Name:	Timberline HOA			Depth:	29' to 30'
Date:	4-Oct-17	Lab Tech:	G. Hoyos	Visual Description of Sample:	
Lab ID:	1721347	Checked By:	0	Rock Core	

Unconfined Compressive Strength (q_u):	**141,050**	**psf**	**Density (pcf):**	158.7
Shear Strength (S_u):	**70,525**	**psf**	**Moisture:**	2.4

Axial Strain (%)	Axial Stress (psf)
0.0	529.6
0.2	3698.4
0.6	52121.7
1.2	140265.4
1.8	87406.2



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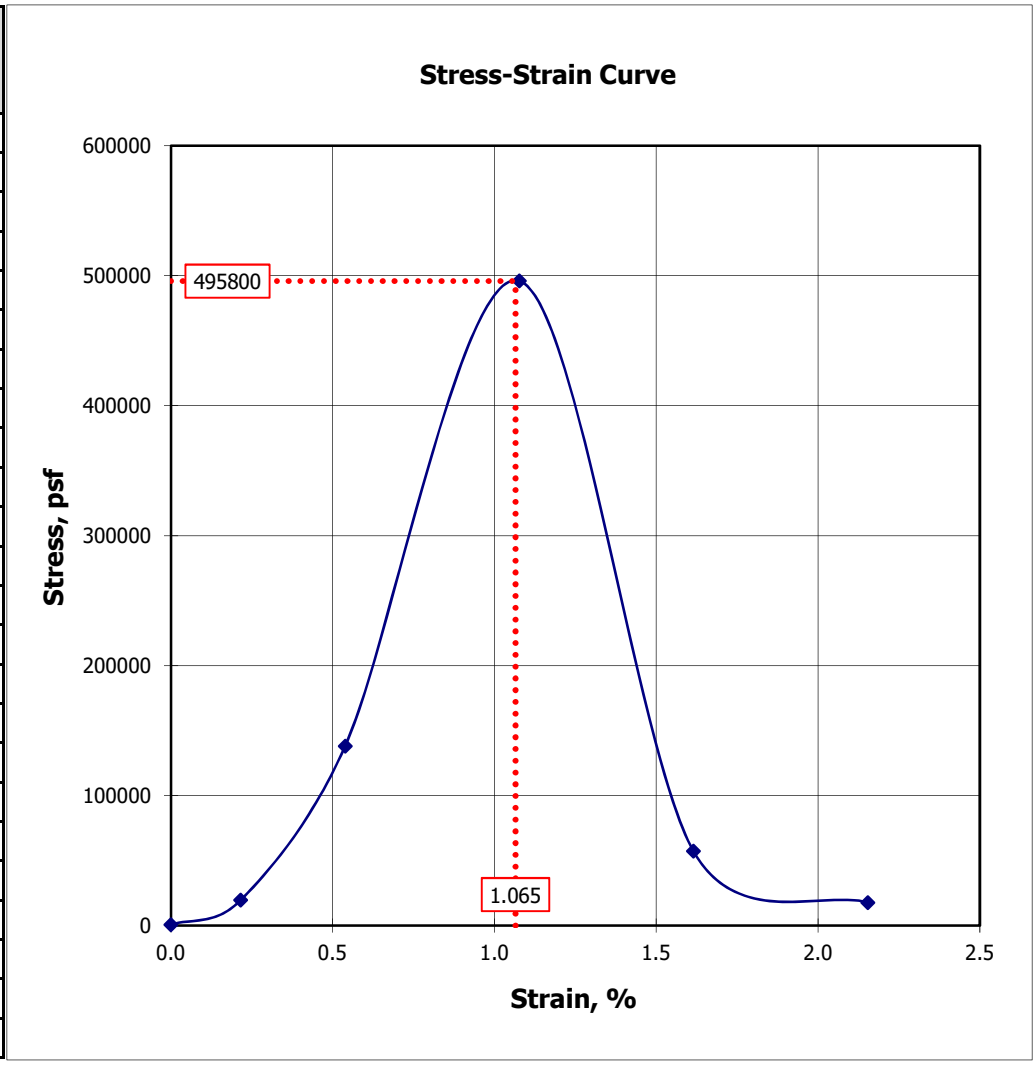
UNCONFINED COMPRESSIVE STRENGTH OF COHESIVE SOIL (ASTM D2166)

Project No.:	17.5052, Crested Butte Lodging			Hole:	B-2
Project Name:	Timberline HOA			Depth:	32' to 33'
Date:	4-Oct-17	Lab Tech:	G. Hoyos	Visual Description of Sample:	
Lab ID:	1721348	Checked By:	0	Rock core	

Unconfined Compressive Strength (q_u):	**495,800**	**psf**	**Density (pcf):**	158.9
Shear Strength (S_u):	**247,900**	**psf**	**Moisture:**	2.0

Axial Strain (%)	Axial Stress (psf)
0.0	527.7
0.2	19482.6
0.5	138036.0
1.1	495910.4
1.6	57108.7
2.2	17555.2



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APPENDIX B

Photographs of Cores

Photo 1. View of Boring B1 from 30 to 32 feet.

Photo 2. View of Boring B-1 from 44 to 43 feet and Boring B-2 from 29 to 35.5 feet.

Photo 3. View of Boring B-2 from 35.5 to 40 feet.

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APPENDIX C

Data from Buckhorn Report

SITE PLAN

Map source: Jennifer Hartman, Sunlit Architecture

MAP NUMBER 2 OF 2	FIELD STAFF	KR
	DRAFTING STAFF	KR
	FIELD DATE	7/1/14
	PROJECT #	14-158-GEO

Johnson addition and driveway
32 Hunter Hill Road
Mt. Crested Butte, Colorado

BUCKHORN GEOTECH
Civil, Structural, and Geotechnical Engineers, Inc.
222 South Park Avenue
Montrose, Colorado 81401
Phone (970) 249-6828 Fax (970) 249-0945

Log of Borehole #1 (BH#1)

BOREHOLE LOCATION: Near southwest addition corner, see Site Plan

DRILLING COMPANY: HRL | DRILL RIG: CME55 LC

SAMPLER: California Split Spoon & Standard Split Spoon | DRILL STEM: 4.5" Solid Stem

DEPTH (ft) / WATER LEVEL	GRAPHIC	SAMPLE	SAMPLE #	FIELD BLOW COUNTS	FIELD "N" VALUE (BPF)	SPT "N" VALUE (BPF)	SUBSURFACE DESCRIPTION	FIELD & LABORATORY TEST RESULTS
							medium brown, reddish brown, gray brown, damp to moist, loose to moderately dense to dense (variable) clayey, silty, sandy, GRAVEL with some cobbles (0-21.0')	
5		ST	DS1	3,4,12	16	16		DS1 @4-5.5' (SC) LL=26 PL=14 PI=12 gravel=25.9 sand=37.3% silt=19.3% clay=17.5% MC=12.8%
10 ▽		ST	DS2	4,3,4	7	7	groundwater @10-12' on July 2, 2014 12-14' no gravel & cobbles	
15 ▽		CA	DS3	12,15,15,15	30	21	groundwater @14.5' after drilling	DS3 @14-16' LL=27 PL=15 PI=12 MC=11.3%
20 ▽		CA	DS4	17,19,12,19	31	22		
		CA	DS5	8,9,18,50/1"	27	19	groundwater @20' during drilling	
25		ST	DS6	19,50	>50	>50	variable, damp to moist, clayey, silty, sandy, GRAVEL and cobbles with few shale fragments (21.0-44.0')	
30		CA	DS7	21,20,25	45	32		
35		CA	DS8	16,27,29	56	39		
40		CA	DS9	20,24,34	58	40		
45								

continue on pg 2

Borehole Log 1 of 4	Field Staff: KR Drafting Staff: JLH Field Date: 7/1/2014 Project #: 14-158-GEO	Johnson 32 Hunter Hill Rd Mt. Crested Butte, Colorado	BUCKHORN GEOTECH Civil, Structural & Geotechnical Engineers 222 So. Park Ave. Montrose, Colorado 81401 970-249-6828 Fax. No. 970-249-0945 www.buckhorngeo.com

Log of Borehole #1 (BH#1)

BOREHOLE LOCATION: Near southwest car-port corner, see Site Plan

DRILLING COMPANY: HRL | DRILL RIG: CME55 LC

SAMPLER: California Split Spoon & Standard Split Spoon | DRILL STEM: 4.5" Solid Stem

DEPTH (ft) / WATER LEVEL	GRAPHIC	SAMPLE	SAMPLE #	FIELD BLOW COUNTS	FIELD "N" VALUE (BPF)	SPT "N" VALUE (BPF)	SUBSURFACE DESCRIPTION	FIELD & LABORATORY TEST RESULTS
45		CA	DS10	50/3"	>50	>50	dark gray, moist, very stiff, silty clay with gravel and little sand, transitions to highly fractured hard SHALE (44.0-49.1')	
		ST	DS11	50/1"	>50	>50		
50							end of borehole @49.1' in hard Mancos Shale	

Borehole Log 1 of 4	Field Staff: KR Drafting Staff: JLH Field Date: 7/1/2014 Project #: 14-158-GEO	Johnson 32 Hunter Hill Rd Mt. Crested Butte, Colorado	BUCKHORN GEOTECH Civil, Structural & Geotechnical Engineers 222 So. Park Ave. Montrose, Colorado 81401 970-249-6828 Fax. No. 970-249-0945 www.buckhorngeo.com

Log of Borehole #2 (BH#2)

BOREHOLE LOCATION: see Site Plan

DRILLING COMPANY: HRL | DRILL RIG: CME55 LC

SAMPLER: California Split Spoon & Standard Split Spoon | DRILL STEM: 4.5" Solid Stem

DEPTH (ft) WATER LEVEL	GRAPHIC	SAMPLE	SAMPLE #	FIELD BLOW COUNTS	FIELD "N" VALUE (BPF)	SPT "N" VALUE (BPF)	SUBSURFACE DESCRIPTION	FIELD & LABORATORY TEST RESULTS
0							damp, sandy GRAVEL with some silt and clay and few cobbles (0-6.0')	
10		ST	DS12	19,17,10,12	27	27		
15							medium to dark brown, moist, sandy CLAY with some silt and gravel and few cobbles (6.0-28.5')	
▽							groundwater @18' on July 2, 2014	
20		CA	DS13	10,7,12,11	19	13	more cobble @21.0'	DS13 @19-21' (SC) LL=29 PL=15 PI=14 gravel=19.8% sand=33.8% silt=23.6% clay=22.8% MC=16.1% UCS=1930psf Sh=960psf
30		ST	DS14	50/6"	>50	>50		
							hard highly fractured shale with some silt and clay (28.5-34.2')	
		ST	DS15	50/2"	>50	>50		
35							end of borehole @34.2' in hard Mancos Shale, no groundwater	
40								
45								

Borehole Log 2 of 4	Field Staff: KR Drafting Staff: JLH Field Date: 7/1/2014 Project #: 14-158-GEO	Johnson 32 Hunter Hill Rd Mt. Crested Butte, Colorado	BUCKHORN GEOTECH Civil, Structural & Geotechnical Engineers 222 So. Park Ave. Montrose, Colorado 81401 970-249-6828 Fax. No. 970-249-0945 www.buckhorngeo.com

Log of Borehole #3 (BH#3)

BOREHOLE LOCATION: Near driveway entrance, uphill side, see Site Plan

DRILLING COMPANY: HRL | DRILL RIG: CME55 LC

SAMPLER: California Split Spoon & Standard Split Spoon | DRILL STEM: 4.5" Solid Stem

DEPTH (ft) WATER LEVEL	GRAPHIC	SAMPLE	SAMPLE #	FIELD BLOW COUNTS	FIELD "N" VALUE (BPF)	SPT "N" VALUE (BPF)	SUBSURFACE DESCRIPTION	FIELD & LABORATORY TEST RESULTS
5		ST	DS16	8,8	N/A		medium brown, damp to moist, clayey SAND with gravel and silt to sandy CLAY with silt and gravel (0-36.0')	
10		CA	DS17	9,7,8,11	15	11		DS17 @9-11' LL=29 PL=15 PI=14 MC=15.4%
15		ST	DS18	6,5,6,11	11	11		
20								
25		ST	DS19	22,13,15,22	28	28		
30								
35							end of borehole @36.0' no bedrock, no groundwater	
40								
45								

Borehole Log 3 of 4	Field Staff: KR Drafting Staff: JLH Field Date: 7/1/2014 Project #: 14-158-GEO	Johnson 32 Hunter Hill Rd Mt. Crested Butte, Colorado	BUCKHORN GEOTECH Civil, Structural & Geotechnical Engineers 222 So. Park Ave. Montrose, Colorado 81401 970-249-6828 Fax. No. 970-249-0945 www.buckhorngeo.com

Log of Borehole #4 (BH#4)

BOREHOLE LOCATION: Near driveway entrance, downhilll side of existing driveway, see Site Plan

DRILLING COMPANY: HRL | DRILL RIG: CME55 LC

SAMPLER: California Split Spoon & Standard Split Spoon | DRILL STEM: 4.5" Solid Stem

DEPTH (ft) WATER LEVEL	GRAPHIC	SAMPLE	SAMPLE #	FIELD BLOW COUNTS	FIELD "N" VALUE (BPF)	SPT "N" VALUE (BPF)	SUBSURFACE DESCRIPTION	FIELD & LABORATORY TEST RESULTS
0							damp to moist, sandy CLAY with some silt & gravel & occasional cobbles	
5								
10								
15								
20								
25								
30		ST	DS20	50/0.5"	>50	>50	end of borehole @33.0' no bedrock, no groundwater	
35								
40								
45								

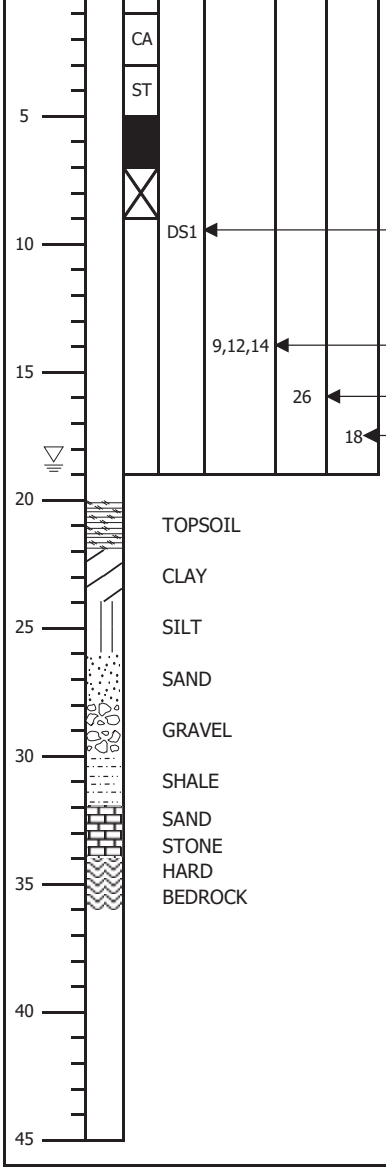
Borehole Log 4 of 4	Field Staff: KR Drafting Staff: JLH Field Date: 7/1/2014 Project #: 14-158-GEO	Johnson 32 Hunter Hill Rd Mt. Crested Butte, Colorado	BUCKHORN GEOTECH Civil, Structural & Geotechnical Engineers 222 So. Park Ave. Montrose, Colorado 81401 970-249-6828 Fax. No. 970-249-0945 www.buckhorngeo.com

BOREHOLE LOG KEY

BOREHOLE LOCATION:

DRILLING COMPANY: DRILL RIG:

SAMPLER DRILL STEM:



drive sample, California sampler

drive sample, standard sampler

core sample

bulk sample, obtained from augers

Sample identifier: DS = Drive sample
BS = Bulk sample from augers
CS = Core sample
GS = Grab sample

Blows required to drive sampler 6" three times; first 6" is considered to be the "seating" drive

Indicates 26 blows required to drive the sampler 12 inches

Indicates blows/foot (BPF) using a 140-lb hammer falling 30"

free water depth at time of drilling

Unified Soil Classification System (ASTM D-2487)

CL = lean clay to sandy/gravelly lean clay
ML = silt to sandy/gravelly silt
CH = high plasticity clay to sandy/gravelly high plasticity clay
MH = high elasticity silt to sandy/gravelly high elasticity silt
SW = well-graded sand or well-graded sand with gravel
SP = poorly graded sand or poorly graded sand with gravel
SM = silty sand to silty sand with gravel
SC = clayey sand to clayey sand with gravel
GW = well-graded gravel or well-gravel with sand
GP = poorly graded gravel or poorly graded gravel with sand
GM = silty gravel or silty gravel with sand
GC = clayey gravel or clayey gravel with sand

Rock Weathering Classification

W1 = Fresh
W2 = Slightly weathered
W3 = Moderately weathered
W4 = Highly weathered
W5 = Completely weathered
W6 = Residual soil, no structure
RQD = Rock Quality Designation

Intact Rock Strength Classification

R0 = Extremely weak rock, 35-150 psi
R1 = Very weak rock, 150-725 psi
R2 = Weak rock, 725-3,625 psi
R3 = Medium strong rock, 3,625-7,250 psi
R4 = Strong rock, 7,250-14,500 psi
R5 = Very strong rock, 14,500-36,000 psi
R6 = Extremely strong rock, >36,000 psi

FIELD & LABORATORY TEST RESULTS

Notes in this column indicate tests performed and test results:

DD: dry density, pcf
MC: moisture content, %
LL: liquid limit
PL: plastic limit
PI: plasticity index
GF: gravel fraction, %
SF: sand fraction, %
Fines: silt/clay, %
Sh: Shear resistance
P: Penetration resistance
CBR: California Bearing Ratio
SP: swelling pressure
TM: total movement
UCS: unconfined compressive strength
psf: pounds per square foot
pcf: pounds per cubic foot
psi: pounds per square inch

N value	Relative density
sands (non-cohesive soils)	
0-4	very loose
4-10	loose
10-30	medium
30-50	dense
>50	very dense
clays (cohesive soils)	
<2	very soft
2-4	soft
4-8	medium
8-15	stiff
15-30	very stiff
>30	hard

Borehole Log	Field Staff	Borehole Log Key	BUCKHORN GEOTECH Civil, Structural & Geotechnical Engineers 222 So. Park Ave. Montrose, Colorado 81401 970-249-6828 Fax. No. 970-249-0945 www.buckhorngeo.com
	Drafting Staff		
	Field Date		
of	Project #		

FIELD SOIL IDENTIFICATION TERMS

RELATIVE DENSITY OF COHESIONLESS SOILS

DESCRIPTION	FIELD IDENTIFICATION	N VALUE
Very Loose	Easily penetrated with hand shovel	0 – 4
Loose	Easily penetrated with 1/2" rebar pushed by hand; easily excavated with hand shovel	4 – 10
Moderately Dense	Easily penetrated with 1/2" rebar driven with 5 lb. hammer; difficult to excavate with hand shovel	10 – 30
Dense	Penetrated 1 ft. with driven rebar; must be loosened with pick to excavate	30 – 50
Very Dense	Penetrated only a few inches with driven rebar; very difficult to excavate even with pick	>50

CONSISTENCY OF COHESIVE SOILS

DESCRIPTION	FIELD IDENTIFICATION	UNDRAINED SHEAR STRENGTH (psf)	N VALUE (Approx.)
Very Soft	Extrudes between fingers when squeezed	<250	0 – 2
Soft	Moulded by light finger pressure	250 – 500	2 – 4
Firm	Moulded by strong finger pressure	500 – 1000	4 – 8
Stiff	Indented by thumb	1000 – 2000	8 – 15
Very Stiff	Indented by thumbnail	2000 – 4000	15 – 30
Hard	Difficult to indent with thumbnail	>4000	>30

SOIL CONSTITUENTS

MODIFIER	trace	little	some	–ey or –y	and
% (by weight)	0 – 5	5 – 12	12 – 20	20 – 30	> 30

SHEET 1 OF 1	FIELD STAFF DRAFTING STAFF FIELD DATE PROJECT #	SOIL IDENTIFICATION TERMS	BUCKHORN GEOTECH Civil, Structural & Geotechnical Engineers 222 So. Park Ave. Montrose, Colorado 81401 970-249-6828 Fax. No. 970-249-0945 www.buckhorngeo.com

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Sieve / Hydrometer Analysis and Atterberg Limits

Project Name	Johnson	Date	7/14/2014
Project Location	32 Hunter Hill Rd.	Project #	14-158-GEO
Client	Johnson	Sample by	KR
Sample Location	BH#1 @4-5.5'	Tested by	SJ
Sample #	DS1		

Hydrometer Analysis

ASTM D422

Sieve	Opening (mm)	% Passing
3"	76.2	100.0
3/4"	19.1	95.7
3/8"	9.5	83.3
#4	4.75	74.1
#10	2.0	64.2
#40	0.425	50.1
#200	0.075	36.8

Atterberg Limits

ASTM D4318

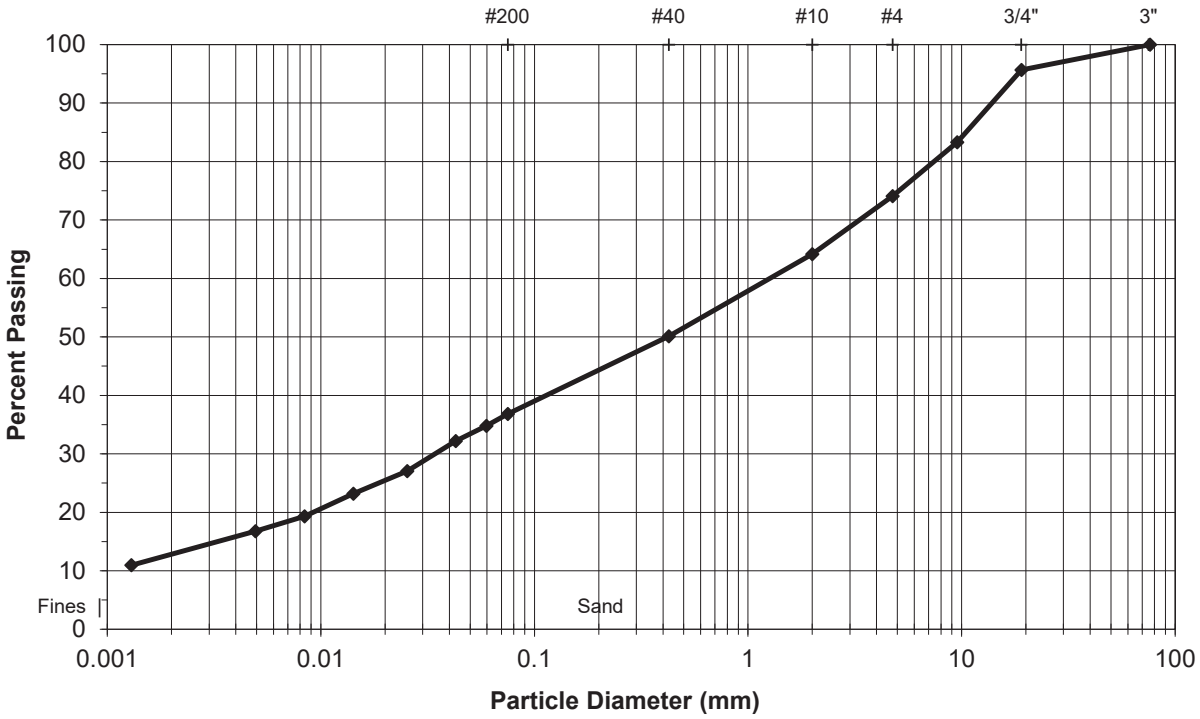
Liquid Limit (LL)	26
Plastic Limit (PL)	14
Plasticity Index (PI)	12

CL = Clay

Natural Moisture Content (%) = 12.8%

Soil Description: brown to reddish brown clayey SAND with gravel

USCS Classification: SC



Clay	Silt	Fine	Medium	Coarse	Fine	Coarse
FINES		SAND			GRAVEL	

% Clay = 17.5 % Silt = 19.3 % Sand = 37.3 % Gravel = 25.9

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Sieve / Hydrometer Analysis and Atterberg Limits

Project Name	Johnson	Date	7/14/2014
Project Location	32 Hunter Hill Rd.	Project #	14-158-GEO
Client	Johnson	Sample by	KR
Sample Location	BH#2 @19-21'	Tested by	SJ
Sample #	DS13		

Hydrometer Analysis

ASTM D422

Sieve	Opening (mm)	% Passing
3"	76.2	100.0
3/4"	19.1	92.7
3/8"	9.5	85.8
#4	4.75	80.2
#10	2.0	71.9
#40	0.425	57.7
#200	0.075	46.4

Atterberg Limits

ASTM D4318

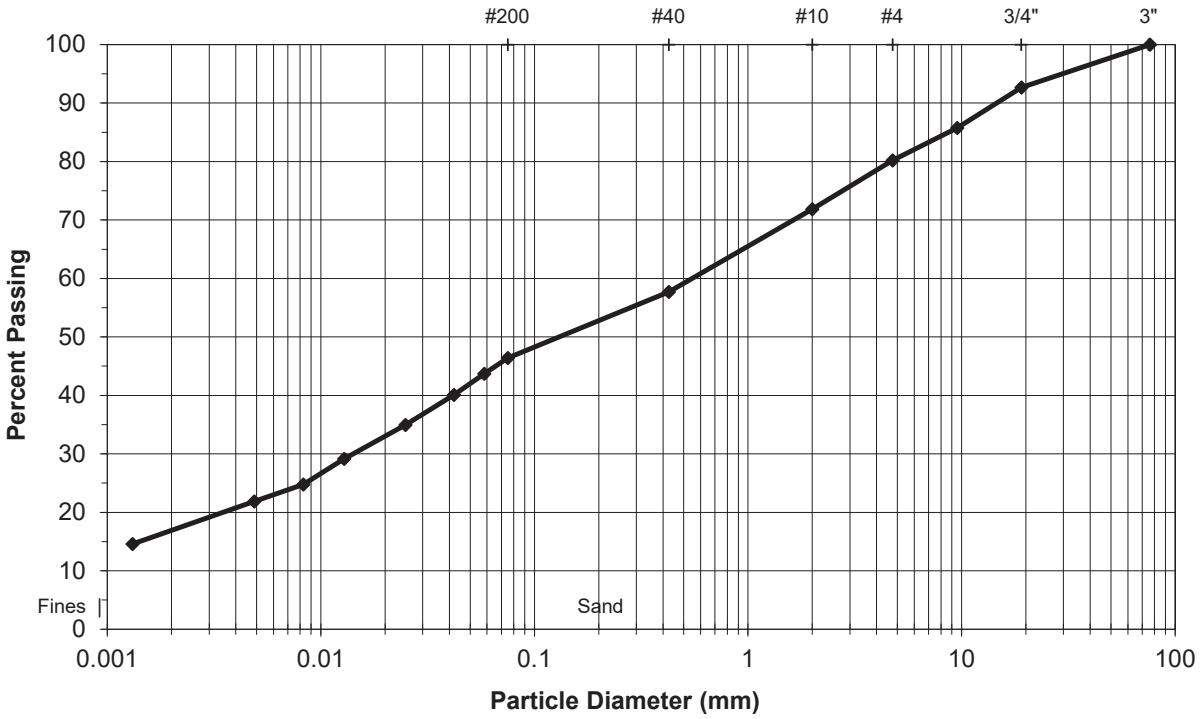
Liquid Limit (LL)	29
Plastic Limit (PL)	15
Plasticity Index (PI)	14

CL = Clay

Natural Moisture Content (%) = 16.1%

Soil Description: brown clayey SAND with gravel

USCS Classification: SC



Clay	Silt	Fine	Medium	Coarse	Fine	Coarse
FINES		SAND			GRAVEL	

% Clay = 22.8 % Silt = 23.6 % Sand = 33.8 % Gravel = 19.8

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Atterberg Limits

ASTM D4318

Project Name	Johnson	Date	7/16/2014
Project Location	32 Hunter Hill Rd.	Project #	14-158-GEO
Client	Johnson	Sample by	KR
Sample Location	BH#1 @14-16'	Tested by	LC/BK
Sample #	DS3		
Soil Description	brown CLAY with sand and gravel	ASTM D2488	

Liquid Limit (LL) 27

Plastic Limit (PL) 15

Plasticity Index (PI) 12

CL = Clay

Natural Moisture Content 11.3%

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Atterberg Limits

ASTM D4318

Project Name	Johnson	Date	7/16/2014
Project Location	32 Hunter Hill Rd.	Project #	14-158-GEO
Client	Johnson	Sample by	KR
Sample Location	BH#3 @9-11'	Tested by	LC/BK
Sample #	DS17		
Soil Description	reddish brown sandy CLAY with gravel	ASTM D2488	

Liquid Limit (LL) 29

Plastic Limit (PL) 15

Plasticity Index (PI) 14

CL = Clay

Natural Moisture Content 15.4%

Fines | Sand

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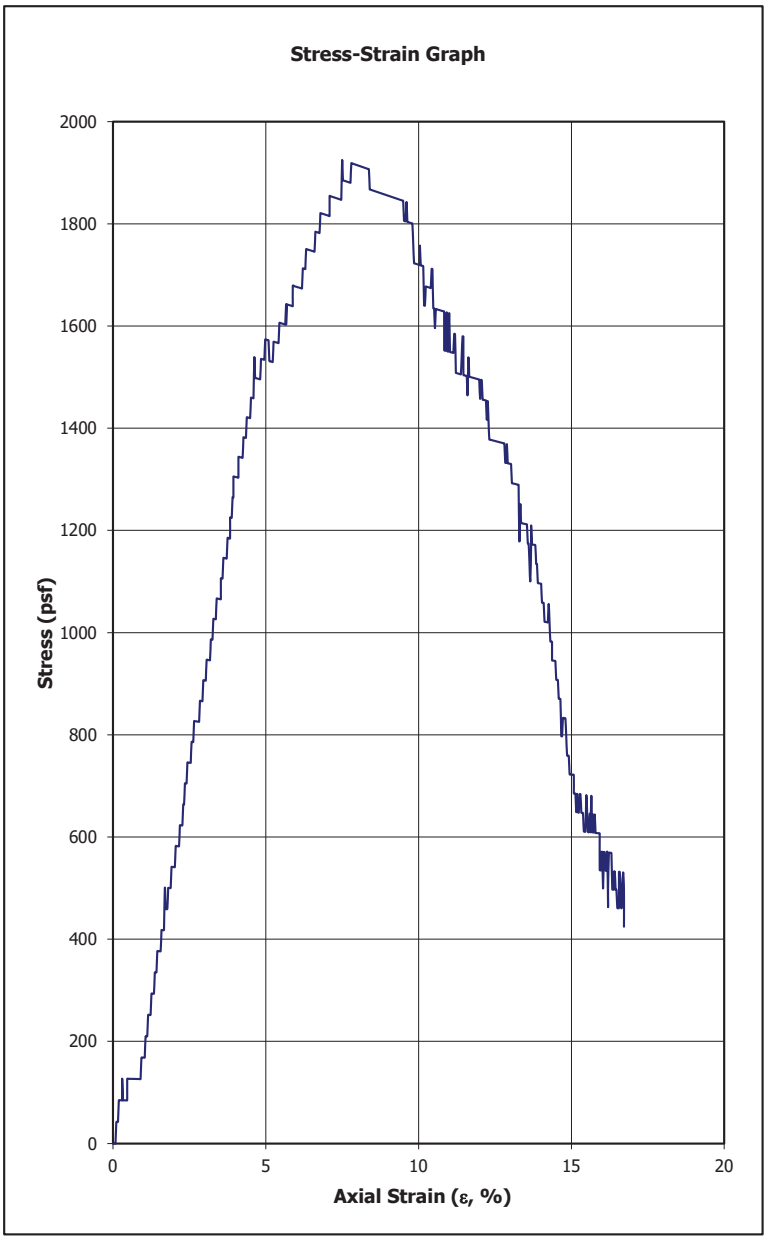
Unconfined Compressive Strength of Cohesive Soil

ASTM D 2166

Project Name	Johnson	Test Date	7/17/2014
Project Location	32 Hunter Hill Rd.	Project #	14-158-GEO
Client	Johnson	Sample by	KR
Test location	BH#2 @19-21'	Tested by	SJ
Sample #	DS13		
Soil Description	brown CLAY with some gravel		(ASTM D 2487)

Test Remarks: band of black SHALE approx. 1/4" thick halfway down length of sample; rock approx. 1" in diameter at failure point.



Test Results

Strain Rate = 1.5%/min.
Strain at Failure = 7.5%
Unconfined Compressive Strength = 1930 psf
Estimated Un-Drained Shear Strength = 960 psf
Sample moisture content = 11.8%, taken after testing