ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, CO 80907
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April 5, 2021
Revised April 15, 2021

Tech Contractors
3575 Kenyon Street, Suite 200
San Diego, California 92110

Attn: Raul Guzman

Re: Pavement Recommendations - Revised
Rolling Hills at Meridian Ranch Filing No.1, Phase 1
El Paso County, Colorado

Dear Mr. Guzman:

As requested, Entech Engineering, Inc. has obtained samples of the subgrade soils from sections of the roadways in the Rolling Hills at Meridian Ranch, Filing No.1, Phase 1, in El Paso County, Colorado. Laboratory testing to determine the pavement support characteristics of the soils was performed. This letter presents the results of the laboratory testing and provides pavement recommendations for the roadways.

Project Description

The roadways in this project consist of sections of Lambert Road, Rolling Peaks Drive, Parkland Drive, Crooked Hill Drive, Valley Peak Drive, Summer Ridge Drive, and Bridge Way. The site layout and the locations of the test borings, drilled at approximate 500-foot intervals, are shown on the Test Boring Location Map, Figure 1.

Subgrade Conditions

Sixteen exploratory test borings were drilled in the roadways to depths of approximately 5 to 10 feet. The Boring Logs are presented in Appendix A. Sieve Analysis and Atterberg Limit testing were performed on the subgrade soil samples obtained from the test borings for the purpose of classification. Four soil types were encountered in the test borings. The soils encountered at subgrade depth consisted of two general soil types; Type 1; silty to clayey sand fill and Type 2; very sandy silt and very sandy clay. Soil Type 3 will be grouped into the Type 1 soil category due to their similar characteristics. Soil Type 4 was encountered at depths below the subgrade influence zone. This report evaluates and presents recommendations for Type 1 Soils for all of the roadway sections.

The Type 2 Soils were encountered at the anticipated subgrade depth in two of the test borings (Test Boring No.3 and 12). The Type 2 soils should be penetrated or be overexcavated and replaced with Type 1 soils. Mitigation recommendations to provide consistent subgrade materials will be provided later in this report. Sieve analyses performed on Type 1 soils indicated the percent passing the No. 200 sieve for the roadway subgrade soils ranged from approximately 10 to 33 percent. Atterberg Limit Tests performed on the samples resulted in Liquid Limits ranging from no-value to 31 and Plastic Indexes of non-plastic to 16. Soil Type 1 consisted of silty to clayey sand fill which classified as A-2-6, A-2-4, and A-1-b soils based on the AASHTO classification system. The Type 1 soils have good pavement support characteristics. Sulfate

testing of the subgrade indicated that the soils exhibit a negligible potential for sulfate attack. Ground water was not encountered in the test borings.

Swell testing was required on several samples of the site soils based on their Plastic Indexes. Volume changes of 0.2 to 0.8 percent and a consolidation of 0.1 percent were measured. Based on the low volume changes and consolidations, mitigation is not required. Laboratory test results are presented in Appendix B and are summarized on Table 1.

California Bearing Ratio (CBR) testing was performed on a sample of Soil Type 1 to determine the support characteristic of the subgrade soils for the roadway sections. The results of the CBR testing, are presented in Appendix B and summarized as follows:

Soil Type1 – Clayey Sand Fill

R @ 90% = 30.0
R @ 95% = 71.0
Use R = 50.0 for design

Classification Testing

Liquid Limit	31
Plasticity Index	16
Percent Passing 200	33.1
AASHTO Classification	A-2-6
Group Index	1
Unified Soils Classification	SC

Pavement Design

The CBR testing was used to determine pavement sections for this site. The pavement sections were determined utilizing the El Paso County "Pavement Design Criteria and Report". The following classifications and ESAL values were used for this portion of the filing. Crooked Hill Drive and the cul-de-sac portions of Summer Ridge Drive classify as local (low-volume) roadways, which use an 18k ESAL value of 36, 500 for design. Rolling Peaks Drive, Parkland Drive, Valley Peak Drive, the west portion of Summer Ridge Drive, and Bridge Way classify as local roads, which use an 18K ESAL value of 292,000 for design. Lambert Road classifies as a residential collector, which uses an 18K ESAL value of 821,000 for design. The roadway classifications are shown in Figure No. 1. Pavement alternatives for asphalt over aggregate basecourse and cement stabilized subgrade sections are provided. Design parameters used in the pavement analysis are as follows:

Reliability, Local Low Volume + Local	80%
Reliability, Collector	85%
Serviceability Index, Local Low Volume + Local	2.0
Serviceability Index, Collector	2.5
Resilient Modulus	13,168 psi
"R" Value Subgrade	50.0
Structural Coefficients:	
Hot Bituminous Pavement	0.44
Aggregate Base Course	0.11
Cement Stabilized Subgrade	0.12

Pavement calculations are attached in Appendix C. Pavement sections recommended for this phase of the filing are summarized as follows:

Pavement Sections – Soil Type 1

Local (low volume) – ESAL = 36,500
Crooked Hill Drive and Summer Ridge Drive cul-de-sac

Alternative	Asphalt (in)	Base Course (in)	Cement Stabilized Subgrade (in.)
1. Asphalt + Base Course	3.0*	4.0*	--
2. Asphalt + Cement Subgrade	4.0	--	8.0

Local – ESAL = 292,000
Rolling Peaks Drive, Parkland Drive, Valley Park Drive, Summer Ridge Drive, and Bridge Way

Alternative	Asphalt (in)	Base Course (in)	Cement Stabilized Subgrade (in.)
1. Asphalt + Base Course	3.0*	8.0*	--
2. Asphalt + Cement Subgrade	4.0	--	8.0

Residential Collector – ESAL = 821,000
Lambert Road

Alternative	Asphalt (in)	Base Course (in)	Cement Stabilized Subgrade (in.)
1. Asphalt + Base Course	4.0*	8.0*	--
2. Asphalt + Cement Subgrade	4.0	--	10.0

Full depth sections are not allowed.
* Minimum sections required by the El Paso County Pavement Design Criteria and Report.

Mitigation

El Paso County criteria requires mitigation of expansive soils for roadway subgrade that have a swell of 2 percent or greater with a 150 pound per square foot surcharge. The Type 2 soils exhibited low swell potentials which did not exceed the threshold. Due to the dissimilar support values of the Type 1 and the Type 2 soils, and the limited areas of the Type 2 soils, we recommend that they be penetrated or removed and replaced with suitable on-site Type 1 sand soils. It is anticipated that 12 to 24 inches of overexcavation and replacement will be required. The depths and extents of removal/overexcavation should be field determined by personnel of Entech Engineering Inc. The estimated location of the Type 2 soils is shown on Figure No. 1.

Roadway Construction - Full Depth Asphalt and Asphalt on Aggregate Base Course Alternatives

Prior to placement of the asphalt, the subgrade should be proofrolled and compacted to a minimum of 95 percent of its maximum Modified Proctor Dry Density, ASTM D-1557 at ± 2 percent of optimum moisture content. Any loose or soft areas should be removed and replaced with suitable materials. Base course materials should be compacted to a minimum of 95 percent of its maximum Modified Proctor Dry Density, ASTM D-1557 at ± 2 percent of optimum moisture content. Special attention should be given to areas adjacent to manholes, inlet structures and valves.

Roadway Construction – Cement Stabilized Subgrade Alternative

Prior to placement of the asphalt, the subgrade shall be stabilized by addition of cement to a depth of at least 8 to 10 inches, as determined by Roadway Classification. The depth of the required cement stabilized subgrade is shown in the previous table. The amount of cement applied shall be 2.0 percent (by weight) of the subgrade's maximum dry density as determined by the Modified Proctor Test (ASTM D-1557) based on laboratory cement stabilization testing. The cement should be spread evenly on the subgrade surface and be thoroughly mixed into the subgrade over the appropriate 8 or 10-inch depth such that a uniform blend of soil and cement is achieved. Prior to application or mixing of the cement, the upper 8 to 10 inches of subgrade should be thoroughly moisture conditioned to the soil's optimum water content or as much as 2 percent more than the optimum water content as necessary to provide a compactable soil condition. Densification of the cement-stabilized subgrade should be completed to obtain a compaction of at least 95 percent of the subgrade maximum dry density as determined by the Modified Proctor Test (ASTM D-1557). Satisfactory compaction of the subgrade shall occur within 90 minutes from the time of mixing the cement into the subgrade.

The following conditions shall be observed as part of the subgrade stabilization:

- Type I/II cement as supplied. A local supplier shall be used. All cement used for stabilization should come from the same source. If cement sources are changed a new laboratory mix design should be completed.

- Moisture conditioning of the subgrade and/or mixing of the cement into the subgrade shall not occur when soil temperatures are below 40°F. Cement treated subgrades should be maintained at a temperature of 40°F or greater until the subgrade has been compacted as required.

- Cement placement, cement mixing and compaction of the cement treated subgrade should be observed by a Soils Engineer. The Soils Engineer should complete in situ compaction tests and construct representative compacted specimens of the treated subgrade material for subsequent laboratory quality assurance testing.

- Pending the results of the field density testing, microfracturing of the stabilized subgrade will likely be required. Soil strengths in excess of 200 psi require microfracturing.

If significant grading is performed, the soils at subgrade may change. Modification to the pavement sections should be evaluated after site grading is completed.

In addition to the above guidance, the asphalt, cement, subgrade conditions, compaction of materials and roadway construction methods shall meet the El Paso County specifications.

We trust that this has provided you with the information you required. If you have any questions or need additional information, please do not hesitate to contact us.

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Daniel P. Stegman

DPS/am
Encl.

Entech Job No. 210527
AAprojects/2021/210527 pr-1r

Reviewed by:

Mark H. Hauschild, P.E.
Senior Engineer

TABLE

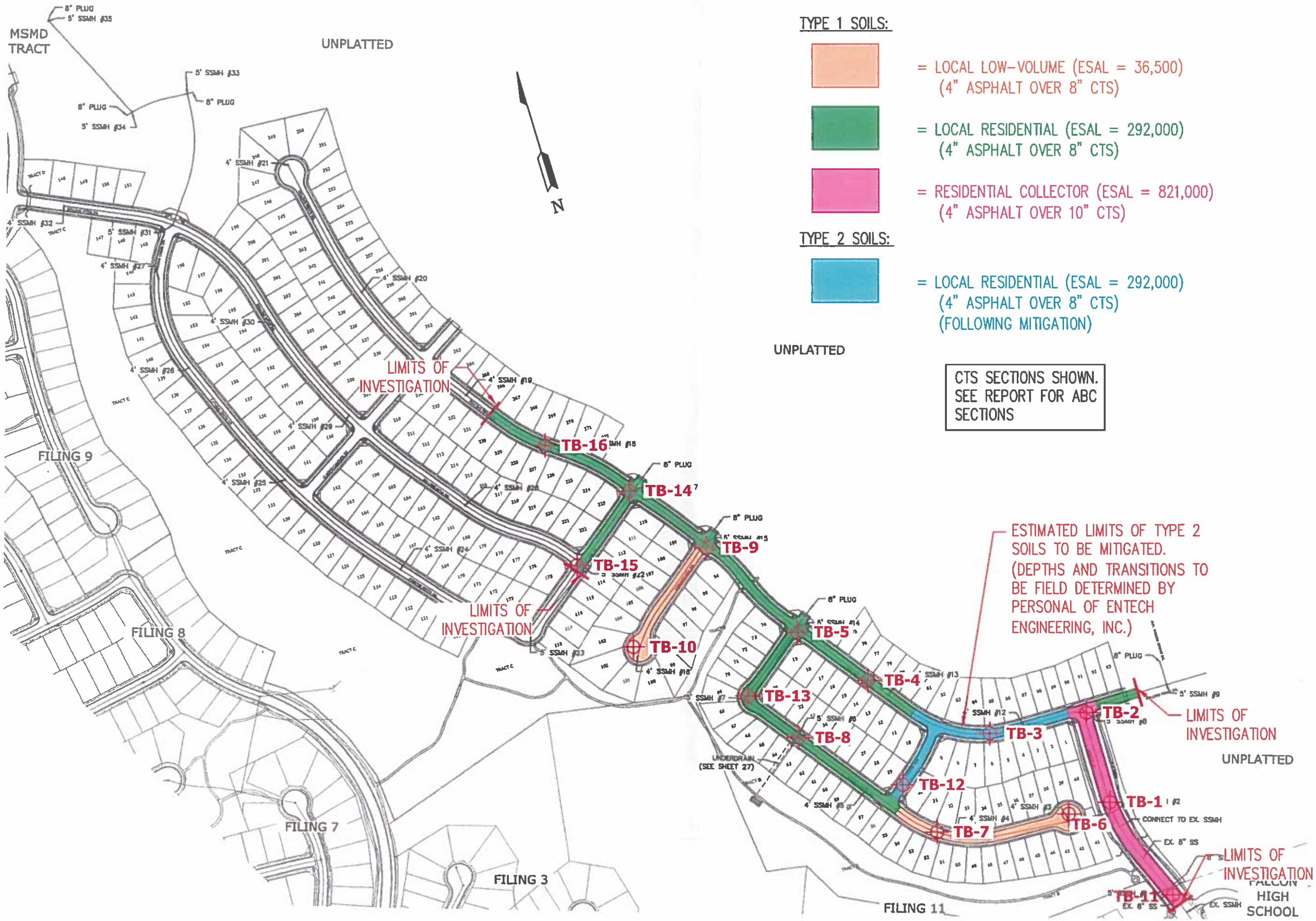
TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

CLIENT TECH CONTRACTORS
PROJECT ROLLING HILLS
JOB NO. 210527

SOIL TYPE	TEST BORING NO.	DEPTH (FT)	WATER (%)	DRY DENSITY (PCF)	PASSING NO. 200 SIEVE (%)	LIQUID LIMIT (%)	PLASTIC INDEX (%)	SULFATE (WT %)	AASHTO CLASS.	SWELL/ CONSOL (%)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION
1, CBR	4	0-3	8.5	120.2	33.1	31	16		A-2-6	0.7	SC	FILL, SAND, CLAYEY
1	2	1-2			20.6	NV	NP	<0.01	A-1-b		SM	FILL, SAND, SILTY
1	4	1-2	8.1	120.4	23.3	29	11		A-2-6	0.2	SC	FILL, SAND, CLAYEY
1	5	1-2	12.5	114.7	24.9	27	11		A-2-6	-0.1	SC	FILL, SAND, CLAYEY
1	7	1-2			17.1	NV	NP	<0.01	A-1-b		SM	FILL, SAND, SILTY
1	8	1-2			10.0	NV	NP		A-1-b		SM-SW	FILL, SAND, SLIGHTLY SILTY
1	9	1-2			15.3	NV	NP		A-1-b		SM	FILL, SAND, SILTY
1	10	1-2			12.1	NV	NP		A-1-b		SM	FILL, SAND, SILTY
1	11	1-2			17.7	NV	NP		A-1-b		SM	FILL, SAND, SILTY
1	13	1-2			12.0	NV	NP		A-1-b		SM	FILL, SAND, SILTY
1	14	1-2			22.0	NV	NP		A-1-b		SM	FILL,S AND, SILTY
1	15	1-2			17.9	NV	NP		A-1-b		SM	FILL, SAND, SILTY
1	16	1-2			23.6	31	12		A-2-6		SC	FILL, SAND, CLAYEY
2	3	1-2			52.4	29	9		A-4		CL	FILL, CLAY, VERY SANDY
2	12	1-2			57.2	NV	NP	0.00	A-4		ML	FILL, SILT, VERY SANDY
3	1	0-3			25.5	NV	NP		A-2-4		SM	SANDSTONE, SILTY
3	1	1-2			17.2	NV	NP		A-2-4		SM	SANDSTONE, SILTY
3	6	1-2			11.9	NV	NP		A-2-4		SM-SW	SANDSTONE, SLIGHTLY SILTY
3	5	10			19.3	NV	NP	<0.01	A-2-4		SM	SANDSTONE, SILTY
3	9	10			13.4	NV	NP		A-1-b		SM	SANDSTONE, SILTY
3	12	10	8.3	116.1	27.6	27	14	0.00	A-2-6	0.8	SC	SAND, CLAYEY
3	14	10			10.4	NV	NP		A-1-b		SM-SW	SAND, SLIGHTLY SILTY
4	2	10			44.1	30	13		A-6		SC	SANDSTONE, VERY CLAYEY

FIGURE



TYPE 1 SOILS:

= LOCAL LOW-VOLUME (ESAL = 36,500)
(4" ASPHALT OVER 8" CTS)

= LOCAL RESIDENTIAL (ESAL = 292,000)
(4" ASPHALT OVER 8" CTS)

= RESIDENTIAL COLLECTOR (ESAL = 821,000)
(4" ASPHALT OVER 10" CTS)

TYPE 2 SOILS:

= LOCAL RESIDENTIAL (ESAL = 292,000)
(4" ASPHALT OVER 8" CTS)
(FOLLOWING MITIGATION)

CTS SECTIONS SHOWN. SEE REPORT FOR ABC SECTIONS

TB- APPROXIMATE TEST BORING LOCATIONS AND NUMBERS

REVISION	BY

ENTECH ENGINEERING, INC.
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TEST BORING LOCATION MAP
ROLLING HILLS RANCH FILING 1
EL PASO COUNTY, CO
FOR: TECH CONTRACTORS

DRWN	JAC
CHECKED	DPS
DATE	03/31/21
SCALE	AS SHOWN
JOB NO.	210527
FIGURE No.	1

APPENDIX A: Test Boring Logs

TEST BORING NO. 1
DATE DRILLED 3/4/2021
Job # 210527

REMARKS

DRY TO 5', 3/4/21

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
					1	FILL 0-1', SAND, SILTY, BROWN
			50/8"	9.8	3	SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, VERY DENSE, MOIST
5			50/6"	3.9	3	
10						
15						
20						

TEST BORING NO. 2
DATE DRILLED 3/4/2021
CLIENT TECH CONSTACTORS
LOCATION ROLLING HILLS

REMARKS

DRY TO 10', 3/4/21

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
			22	8.4	1	FILL 0-4', SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST
5			50/6"	6.4	3	SANDSTONE, SILTY, FINE TO COARSE GRAINED, BROWN, VERY DENSE, MOIST
10			50/6"	10.7	4	SANDSTONE, VERY CLAYEY, FINE GRAINED, BROWN, VERY DENSE, MOIST
15						
20						

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE: 3/23/21

JOB NO. 210527
FIG NO. A- 1

TEST BORING NO. 3
DATE DRILLED 3/4/2021
Job # 210527

REMARKS

DRY TO 5', 3/4/21

FILL 0-5', CLAY, VERY SANDY, BROWN, STIFF, MOIST

FILL, SAND, SILTY, FINE TO COARSE GRAINED, BROWN, MEDIUM DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			23	7.8	2
5			15	4.9	1
10					
15					
20					

TEST BORING NO. 4
DATE DRILLED 3/4/2021
CLIENT TECH CONSTACTORS
LOCATION ROLLING HILLS

REMARKS

DRY TO 5', 3/4/21

FILL 0-5', SAND, CLAYEY, FINE TO MEDIUM GRAINED, TAN, MEDIUM DENSE TO DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			10	7.6	1
5			31	5.3	1
10					
15					
20					

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE: 3/23/21

JOB NO.: 210527
FIG NO.: A- 2

TEST BORING NO. 5
DATE DRILLED 3/4/2021
Job # 210527

REMARKS

DRY TO 10', 3/4/21

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			9	5.5	1
5			33	4.6	1
10			50/6"	7.1	3
15					
20					

FILL 0-5', SAND, CLAYEY, FINE TO COARSE GRAINED, TAN, LOOSE TO DENSE, MOIST

SANDSTONE, SILTY, FINE TO MEDIUM GRAINED, BROWN, VERY DENSE, MOIST

TEST BORING NO. 6
DATE DRILLED 3/4/2021
CLIENT TECH CONSTACTORS
LOCATION ROLLING HILLS

REMARKS

DRY TO 5', 3/4/21

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
					1
			50/7"	7.6	3
5			50/6"	5.4	3
10					
15					
20					

FILL 0-1', SAND, SILTY, BROWN SANDSTONE, SLIGHTLY SILTY TO SILTY, FINE TO COARSE GRAINED, BROWN, VERY DENSE, MOIST

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
			3/23/21

JOB NO.: 210527
FIG NO.: A- 3

TEST BORING NO. 7
DATE DRILLED 3/4/2021
Job # 210527

REMARKS

DRY TO 10', 3/4/21

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	Description
			9	6.6	1	FILL 0-10', SAND, SILTY TO VERY SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST
5			13	3.6	1	
10			11	5.0	1	
15						
20						

TEST BORING NO. 8
DATE DRILLED 3/4/2021
CLIENT TECH CONSTACTORS
LOCATION ROLLING HILLS

REMARKS

DRY TO 5', 3/4/21

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	Description
			14	6.0	1	FILL 0-5', SAND, SLIGHTLY SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE TO LOOSE, MOIST
5			6	4.6	1	
10						
15						
20						

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		DF	4/2/21

JOB NO: 210527
FIG NO: A- 4

TEST BORING NO. 9
DATE DRILLED 3/4/2021
Job # 210527

REMARKS

DRY TO 10', 3/4/21

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
			50/6"	5.8	1	FILL 0-4', SAND, SILTY, FINE TO COARSE GRAINED, TAN, VERY DENSE, MOIST
5			50	5.3	3	SANDSTONE, VERY SILTY, FINE GRAINED, TAN, VERY DENSE, MOIST
10			50/6"	3.5	3	SAND, SILTY, FINE TO COARSE GRAINED, TAN, VERY DENSE, MOIST
15						
20						

TEST BORING NO. 10
DATE DRILLED 3/4/2021
CLIENT TECH CONSTACTORS
LOCATION ROLLING HILLS

REMARKS

DRY TO 5', 3/4/21

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
			7	6.8	1	FILL 0-5', SAND, SILTY, FINE TO COARSE GRAINED, TAN, LOOSE TO MEDIUM DENSE, MOIST
5			18	3.0	1	
10						
15						
20						

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE: 3/23/21

JOB NO: 210527
FIG NO: A- 5

TEST BORING NO. 11
DATE DRILLED 3/16/2021
Job # 210527

REMARKS

DRY TO 5', 3/16/21

FILL 0-5', SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			28	6.5	1
5			25	6.3	1
10					
15					
20					

TEST BORING NO. 12
DATE DRILLED 3/16/2021
CLIENT TECH CONSTACTORS
LOCATION ROLLING HILLS

REMARKS

DRY TO 10', 3/16/21

FILL 0-5', SILT, VERY SANDY, TAN, STIFF, MOIST
FILL, SAND, SILTY, FINE TO COARSE GRAINED, TAN, DENSE, MOIST
SANDSTONE, CLAYEY, FINE TO MEDIUM GRAINED, BROWN, VERY DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			27	4.6	2
5			34	6.8	1
10			50/5"	8.6	3
15					
20					

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		DS	4/12/21

JOB NO. 210527
FIG NO. A- 6

TEST BORING NO. 13
DATE DRILLED 3/16/2021
Job # 210527

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 5', 3/16/21						
FILL 0-5', SAND, SILTY TO CLAYEY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST				10	7.3	1
	5			12	9.8	1
	10					
	15					
	20					

TEST BORING NO. 14
DATE DRILLED 3/16/2021
CLIENT TECH CONSTACTORS
LOCATION ROLLING HILLS

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 10', 3/16/21						
FILL 0-8', SAND, SILTY TO CLAYEY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST				11	9.6	1
	5			10	10.2	1
SANDSTONE, SLIGHTLY SILTY, FINE TO COARSE GRAINED, TAN, VERY DENSE, MOIST	10			50/6"	4.5	3
	15					
	20					

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		DJ	4/12/21

JOB NO.: 210527
FIG NO.: A-7

TEST BORING NO. 15
DATE DRILLED 3/16/2021
Job # 210527

REMARKS

DRY TO 5', 3/16/21

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
						FILL 0-5', SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST
			20	5.9	1	
5			24	6.5	1	
10						
15						
20						

TEST BORING NO. 16
DATE DRILLED 3/16/2021
CLIENT TECH CONSTACTORS
LOCATION ROLLING HILLS

REMARKS

DRY TO 5', 3/16/21

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
						FILL 0-5', SAND, CLAYEY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST
			19	7.9	1	
5			12	6.7	1	
10						
15						
20						

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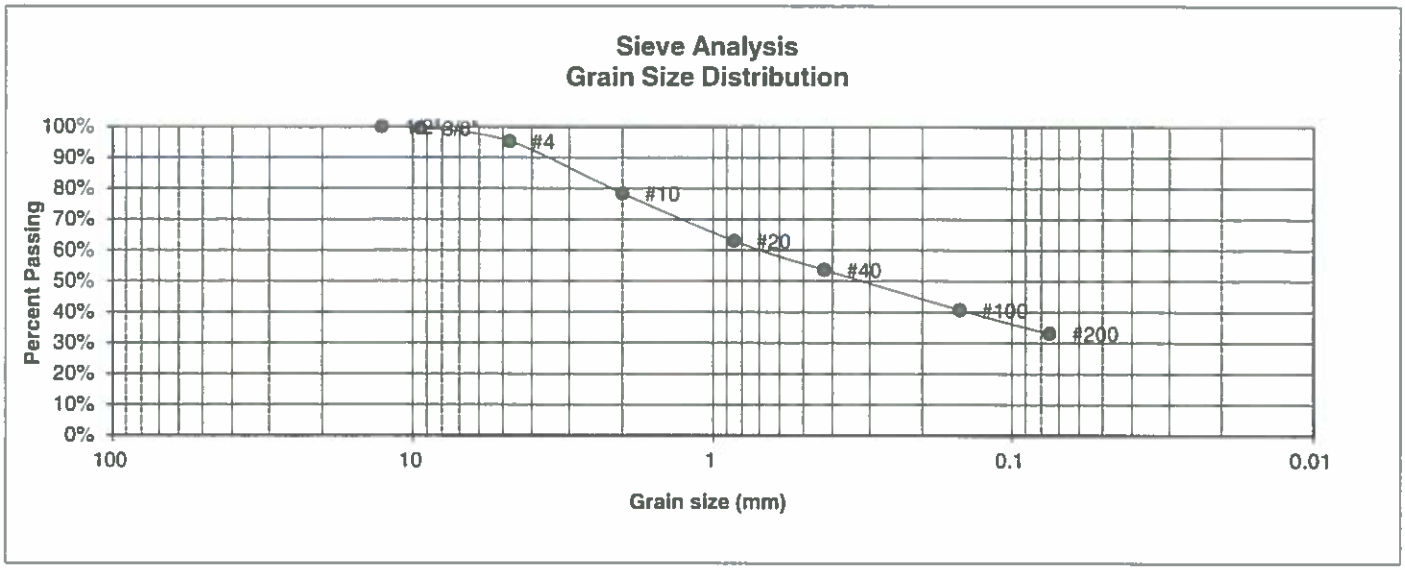
TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE: 3/23/21

JOB NO.: 210527
FIG NO.: A- 8

APPENDIX B: Laboratory Test Results

UNIFIED CLASSIFICATION	SC	CLIENT	TECH CONSTACTORS
SOIL TYPE #	1, CBR	PROJECT	ROLLING HILLS
TEST BORING #	4	JOB NO.	210527
DEPTH (FT)	0-3	TEST BY	BL
AASHTO CLASSIFICATION	A-2-6	GROUP INDEX	1



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	99.6%
4	95.2%
10	78.3%
20	63.0%
40	53.6%
100	40.7%
200	33.1%

Atterberg Limits	
Plastic Limit	16
Liquid Limit	31
Plastic Index	16

Swell	
Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	

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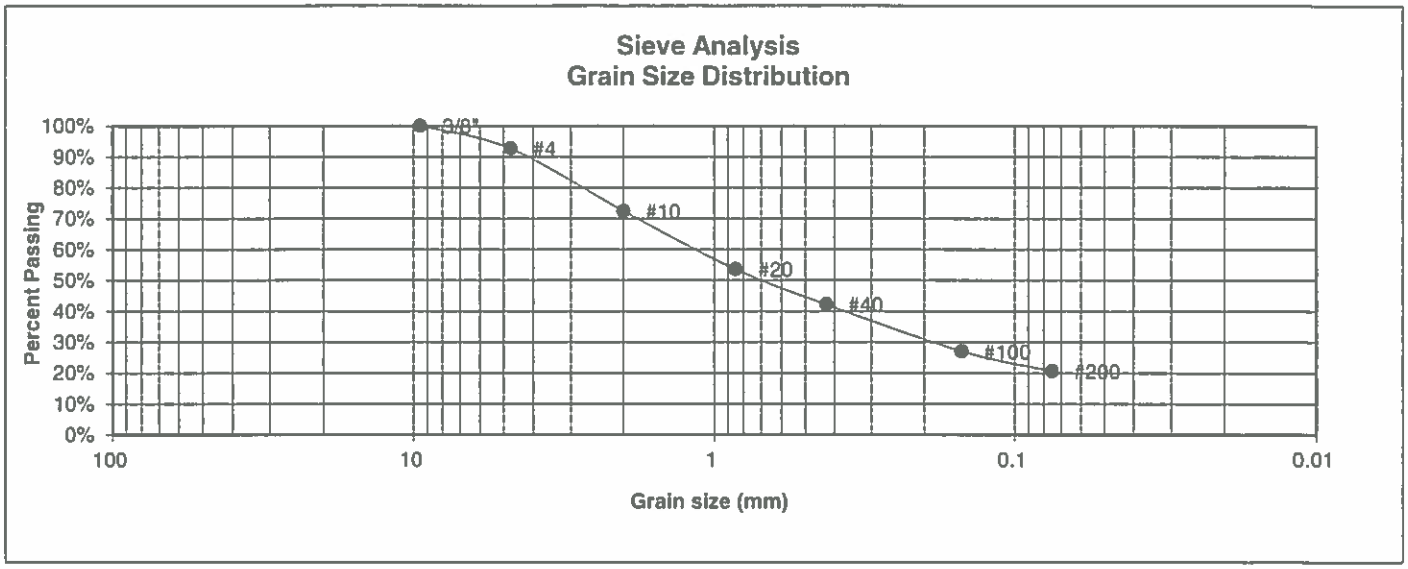
COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

DRAWN	DATE	CHECKED	DATE
			3/23/21

JOB NO.: 210527
FIG NO.: B-1

UNIFIED CLASSIFICATION	SM	CLIENT	TECH CONSTACTORS
SOIL TYPE #	1	PROJECT	ROLLING HILLS
TEST BORING #	2	JOB NO.	210527
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-1-b	GROUP INDEX	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	92.7%
10	72.4%
20	53.6%
40	42.2%
100	27.0%
200	20.6%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

Moisture at start

Moisture at finish

Moisture increase

Initial dry density (pcf)

Swell (psf)

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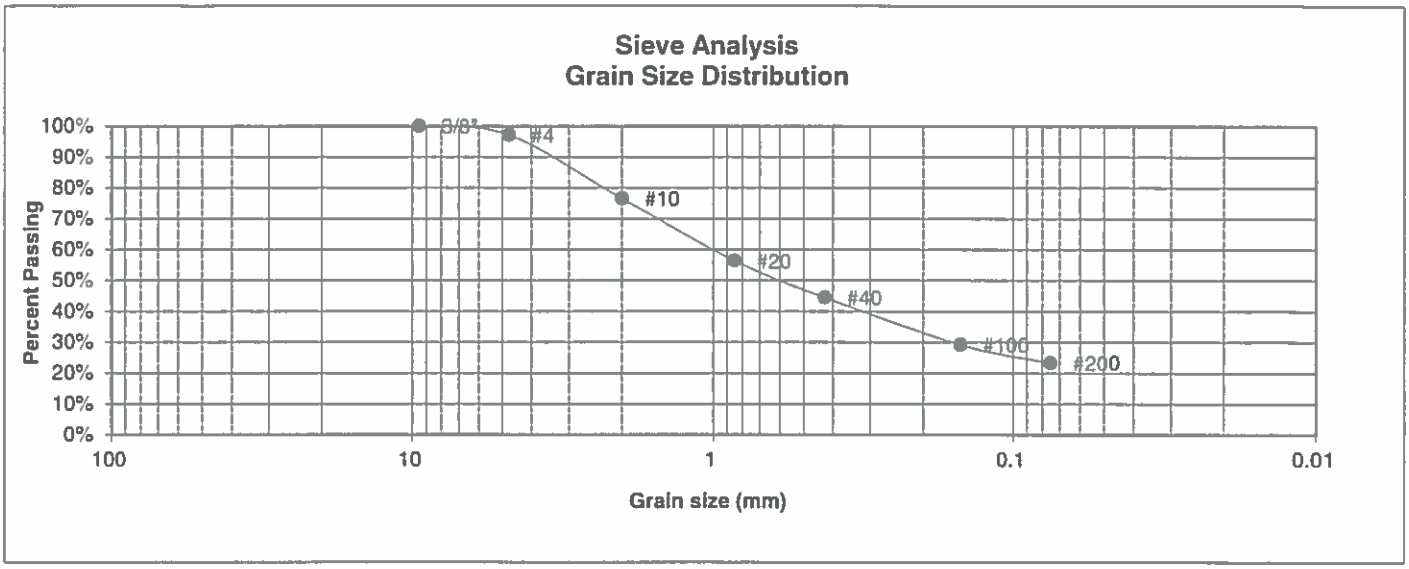
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE: 3/23/21

JOB NO.: 210527
FIG NO.: B-2

UNIFIED CLASSIFICATION	SC	CLIENT	TECH CONSTACTORS
SOIL TYPE #	1	PROJECT	ROLLING HILLS
TEST BORING #	4	JOB NO.	210527
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-2-6	GROUP INDEX	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	97.1%
10	76.5%
20	56.4%
40	44.5%
100	29.2%
200	23.3%

Atterberg Limits	
Plastic Limit	18
Liquid Limit	29
Plastic Index	11

Swell	
Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	

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LABORATORY TEST RESULTS

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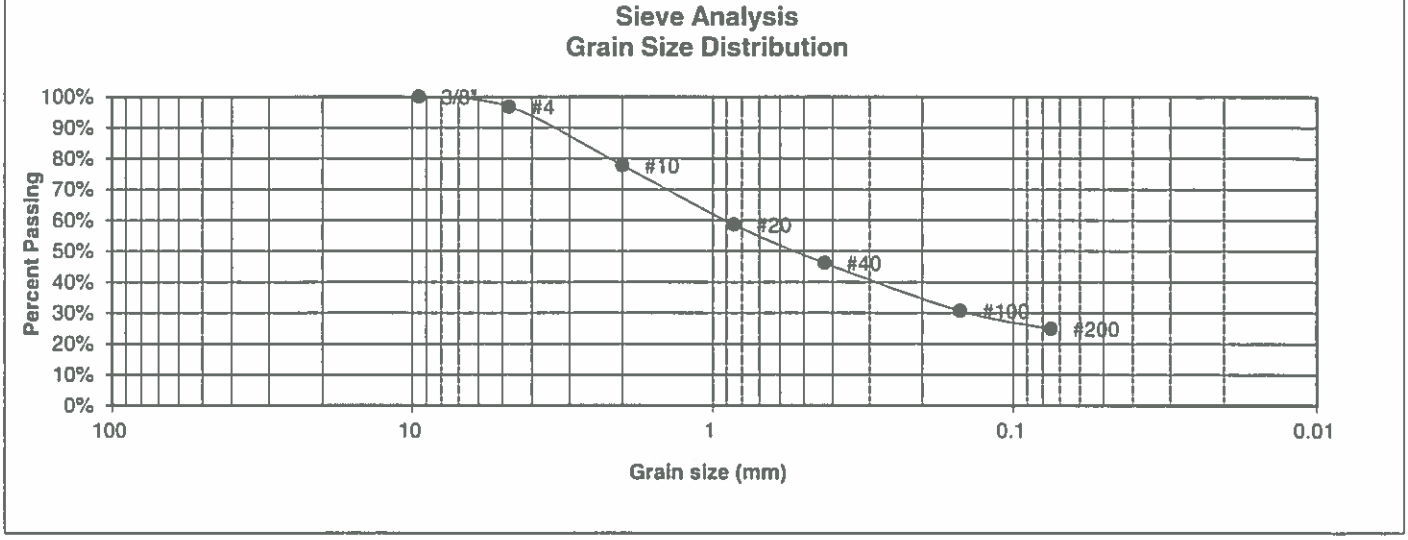
JOB NO.: 210527
FIG NO.: B-3

UNIFIED CLASSIFICATION	SC	CLIENT	TECH CONSTACTORS
SOIL TYPE #	1	PROJECT	ROLLING HILLS
TEST BORING #	5	JOB NO.	210527
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-2-6	GROUP INDEX	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	96.8%
10	77.8%
20	58.6%
40	46.2%
100	30.7%
200	24.9%

Atterberg Limits	
Plastic Limit	16
Liquid Limit	27
Plastic Index	11

Swell	
Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	

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LABORATORY TEST RESULTS

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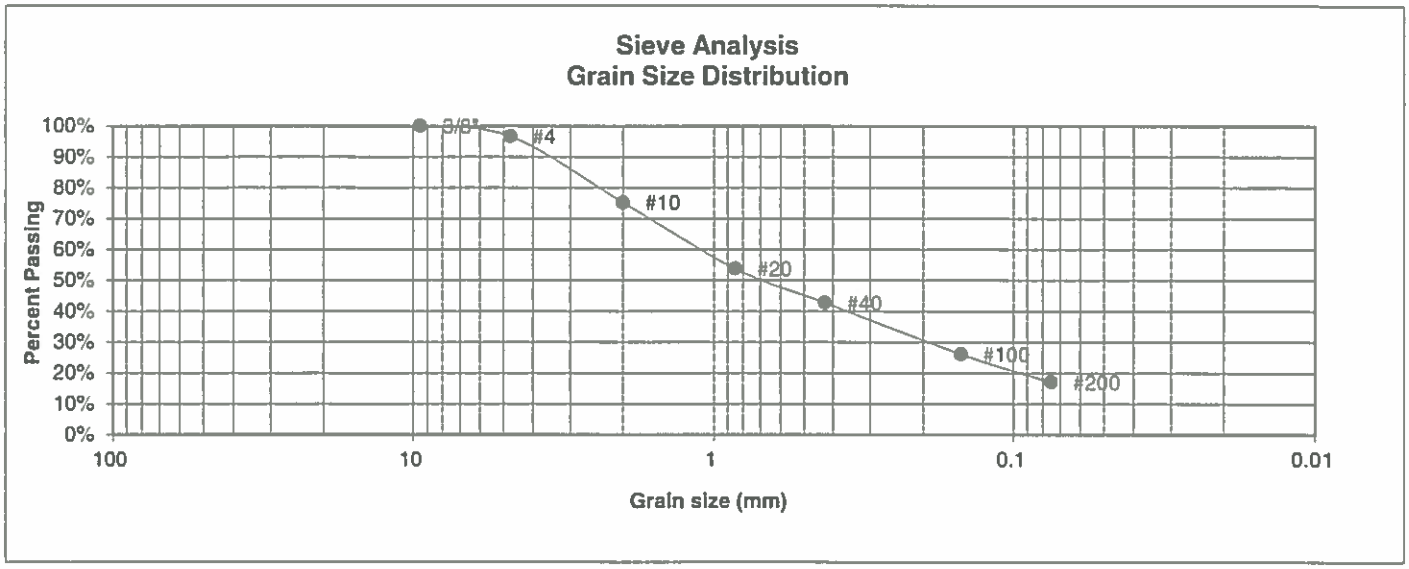
JOB NO.: 210527
FIG NO.: B-4

UNIFIED CLASSIFICATION	SM	CLIENT	TECH CONSTACTORS
SOIL TYPE #	1	PROJECT	ROLLING HILLS
TEST BORING #	7	JOB NO.	210527
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-1-b	GROUP INDEX	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	96.7%
10	75.3%
20	53.8%
40	42.8%
100	26.1%
200	17.1%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	

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LABORATORY TEST RESULTS

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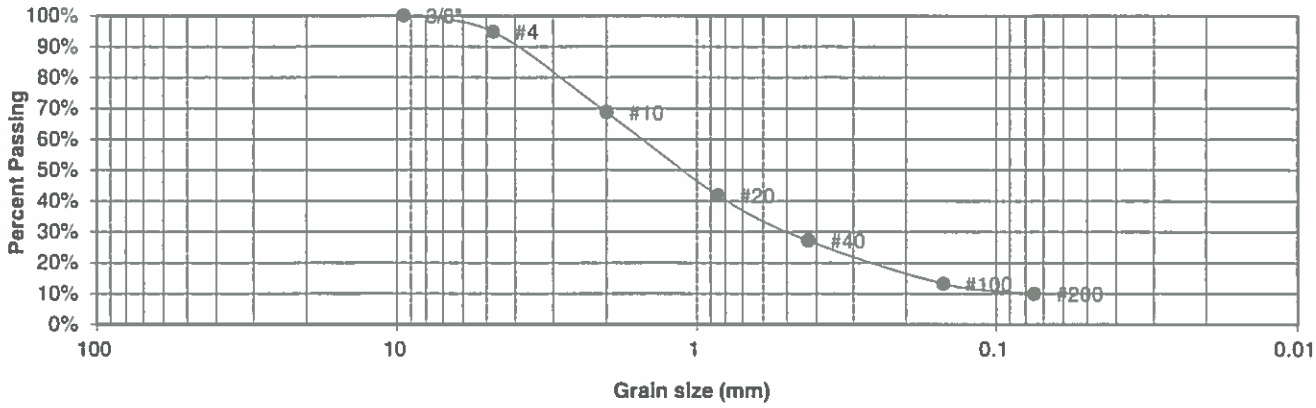
JOB NO.: 210527
FIG NO.: B-5

UNIFIED CLASSIFICATION	SM-SW	CLIENT	TECH CONSTACTORS
SOIL TYPE #	1	PROJECT	ROLLING HILLS
TEST BORING #	8	JOB NO.	210527
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-1-b	GROUP INDEX	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	94.9%
10	68.7%
20	41.8%
40	27.2%
100	13.2%
200	10.0%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

Moisture at start

Moisture at finish

Moisture increase

Initial dry density (pcf)

Swell (psf)

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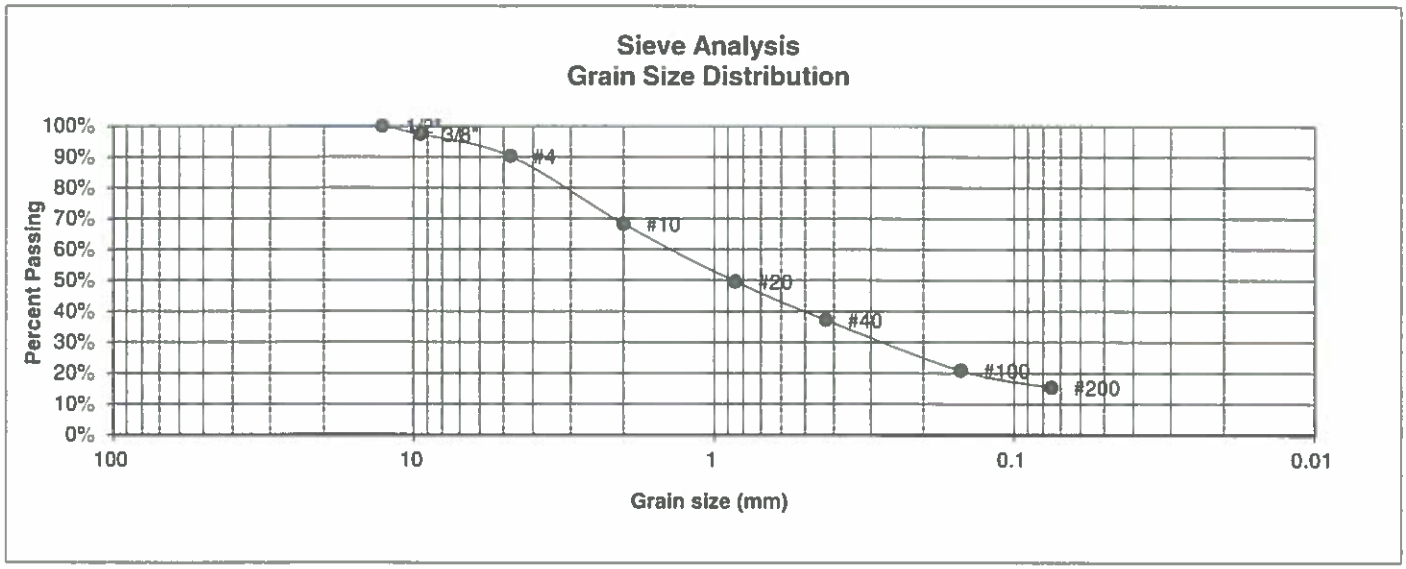
LABORATORY TEST RESULTS

DRAWN	DATE	CHECKED	DATE
			3/23/21

JOB NO: 210527
FIG NO: B-6

UNIFIED CLASSIFICATION	SM	CLIENT	TECH CONSTACTORS
SOIL TYPE #	1	PROJECT	ROLLING HILLS
TEST BORING #	9	JOB NO.	210527
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-1-b	GROUP INDEX	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	97.3%
4	90.2%
10	68.2%
20	49.6%
40	37.2%
100	20.8%
200	15.3%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	

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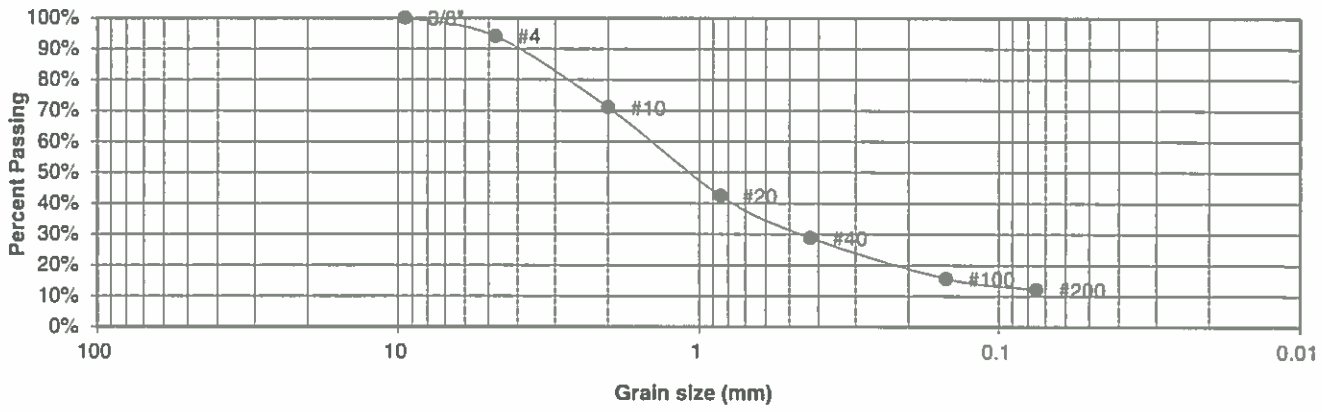
DRAWN:	DATE:	CHECKED:	DATE:
			3/23/21

JOB NO.: 210527
FIG NO.: B-7

UNIFIED CLASSIFICATION	SM	CLIENT	TECH CONSTACTORS
SOIL TYPE #	1	PROJECT	ROLLING HILLS
TEST BORING #	10	JOB NO.	210527
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-1-b	GROUP INDEX	0

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	94.1%
10	71.0%
20	42.5%
40	28.8%
100	15.6%
200	12.1%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	

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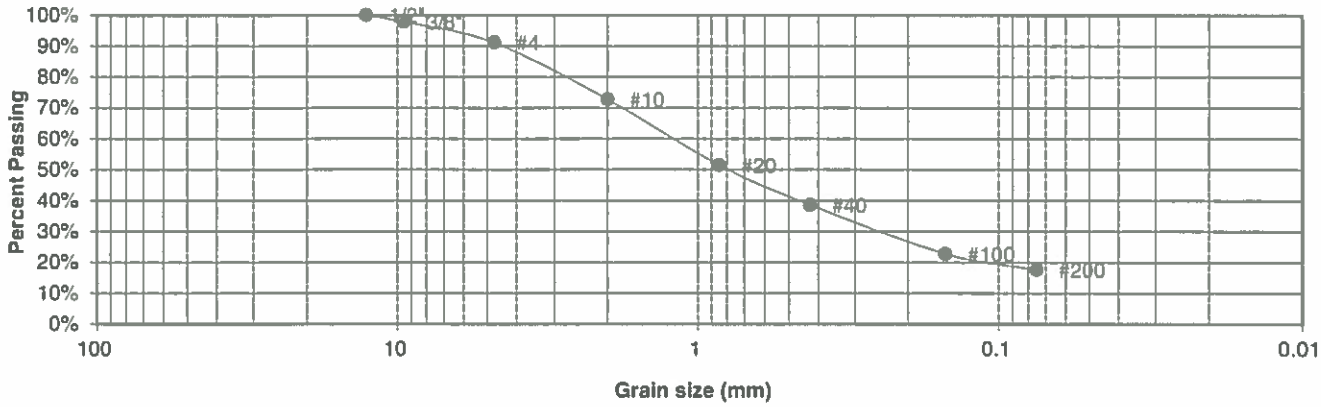
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			3/23/21

JOB NO.: 210527
FIG NO.: B-8

UNIFIED CLASSIFICATION	SM	CLIENT	TECH CONSTACTORS
SOIL TYPE #	1	PROJECT	ROLLING HILLS
TEST BORING #	11	JOB NO.	210527
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-1-b	GROUP INDEX	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	97.8%
4	91.2%
10	72.8%
20	51.5%
40	38.6%
100	22.8%
200	17.7%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

Moisture at start

Moisture at finish

Moisture increase

Initial dry density (pcf)

Swell (psf)

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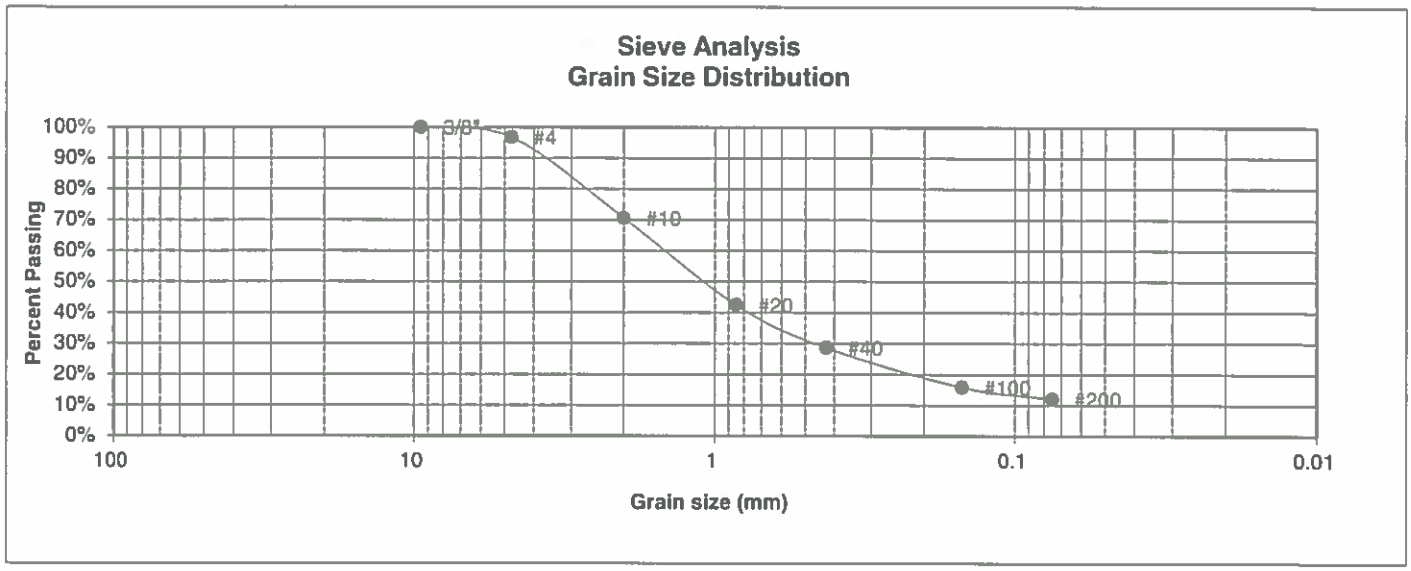
DRAWN:	DATE:	CHECKED:	DATE: 3/23/21

JOB NO. 210527
FIG NO. B-9

UNIFIED CLASSIFICATION	SM	CLIENT	TECH CONSTACTORS
SOIL TYPE #	1	PROJECT	ROLLING HILLS
TEST BORING #	13	JOB NO.	210527
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-1-b	GROUP INDEX	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	96.8%
10	70.6%
20	42.4%
40	28.6%
100	15.8%
200	12.0%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	

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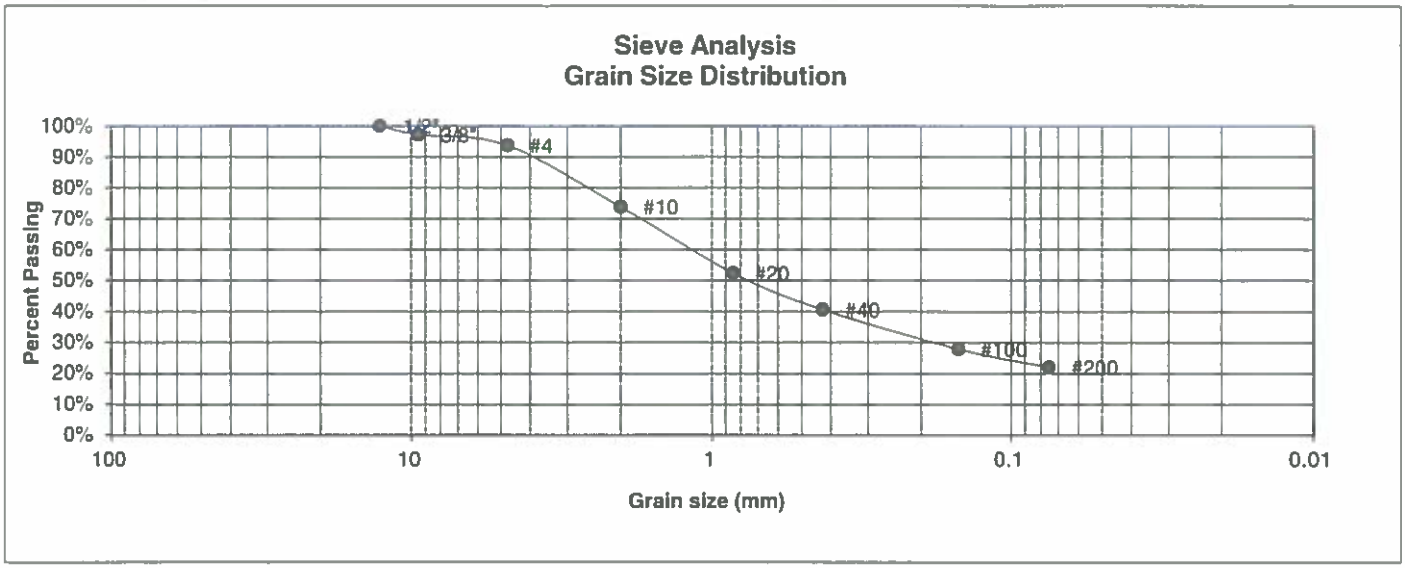
JOB NO.: 210527
FIG NO.: B-10

UNIFIED CLASSIFICATION	SM	CLIENT	TECH CONSTACTORS
SOIL TYPE #	I	PROJECT	ROLLING HILLS
TEST BORING #	I4	JOB NO.	210527
DEPTH (FT)	I-2	TEST BY	BL
AASHTO CLASSIFICATION	A-1-b	GROUP INDEX	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	97.2%
4	93.7%
10	73.8%
20	52.4%
40	40.6%
100	27.9%
200	22.0%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

Moisture at start

Moisture at finish

Moisture increase

Initial dry density (pcf)

Swell (psf)

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LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
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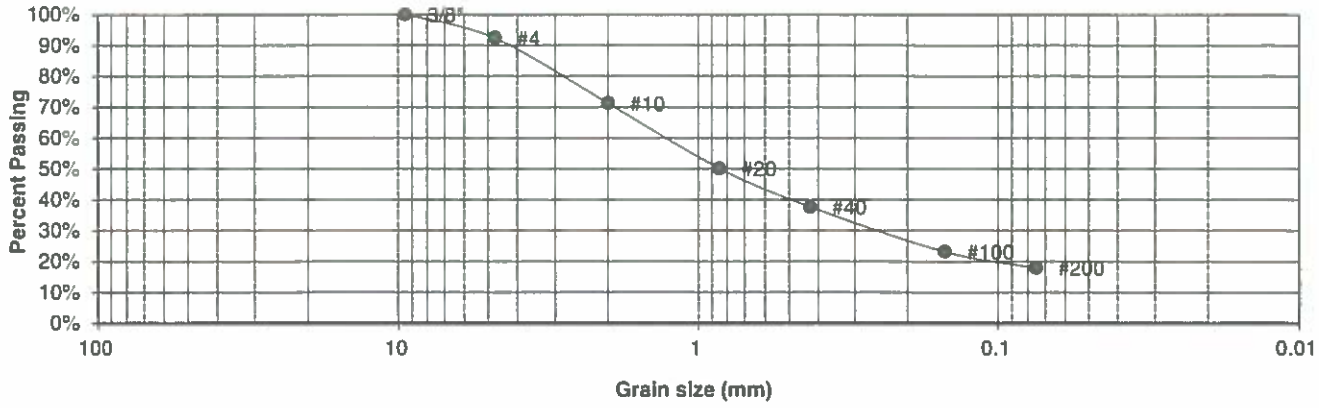
JOB NO.: 210527
FIG NO.: B-11

UNIFIED CLASSIFICATION	SM	CLIENT	TECH CONSTACTORS
SOIL TYPE #	1	PROJECT	ROLLING HILLS
TEST BORING #	15	JOB NO.	210527
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-1-b	GROUP INDEX	0

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	92.4%
10	71.2%
20	50.1%
40	37.7%
100	23.1%
200	17.9%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	

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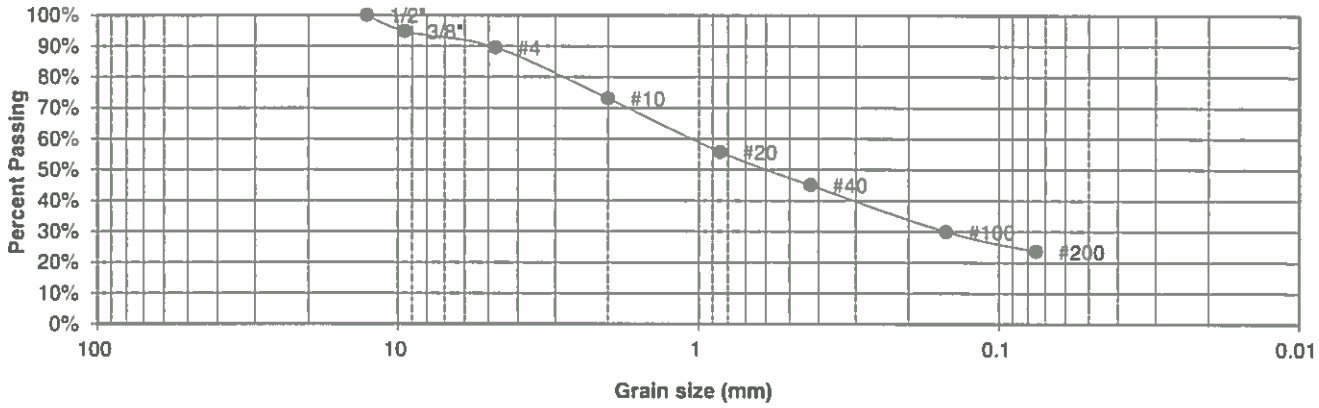
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE: 3/23/24

JOB NO.: 210527
FIG NO.: B-12

UNIFIED CLASSIFICATION	SC	CLIENT	TECH CONSTACTORS
SOIL TYPE #	1	PROJECT	ROLLING HILLS
TEST BORING #	16	JOB NO.	210527
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-2-6	GROUP INDEX	0

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	94.8%
4	89.5%
10	73.1%
20	55.7%
40	45.0%
100	29.9%
200	23.6%

Atterberg Limits

Plastic Limit	18
Liquid Limit	31
Plastic Index	12

Swell

Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	

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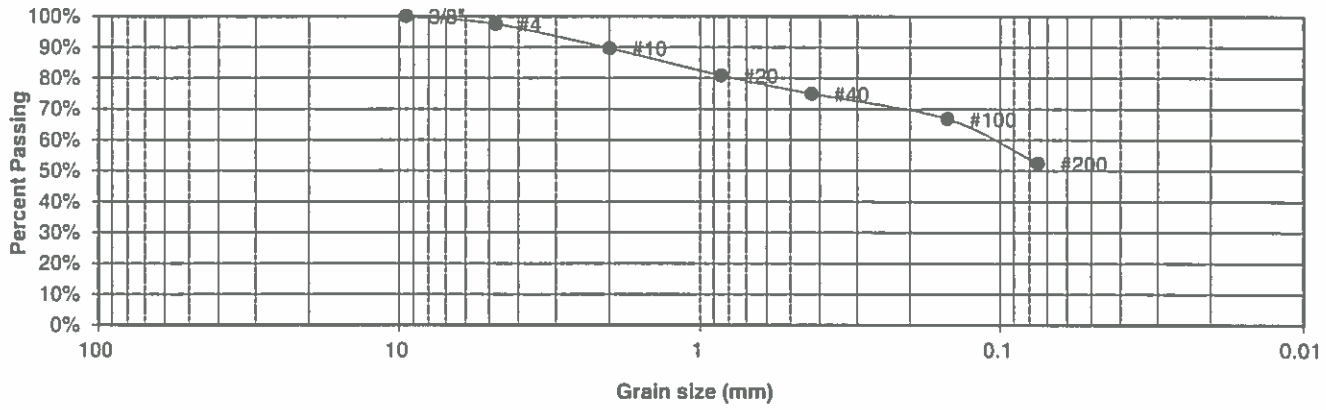
JOB NO.: 210527
FIG NO.: B-13

UNIFIED CLASSIFICATION	CL	CLIENT	TECH CONSTACTORS
SOIL TYPE #	2	PROJECT	ROLLING HILLS
TEST BORING #	3	JOB NO.	210527
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-4	GROUP INDEX	2

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	97.5%
10	89.6%
20	80.8%
40	74.9%
100	66.9%
200	52.4%

Atterberg Limits	
Plastic Limit	19
Liquid Limit	29
Plastic Index	9

Swell	
Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	

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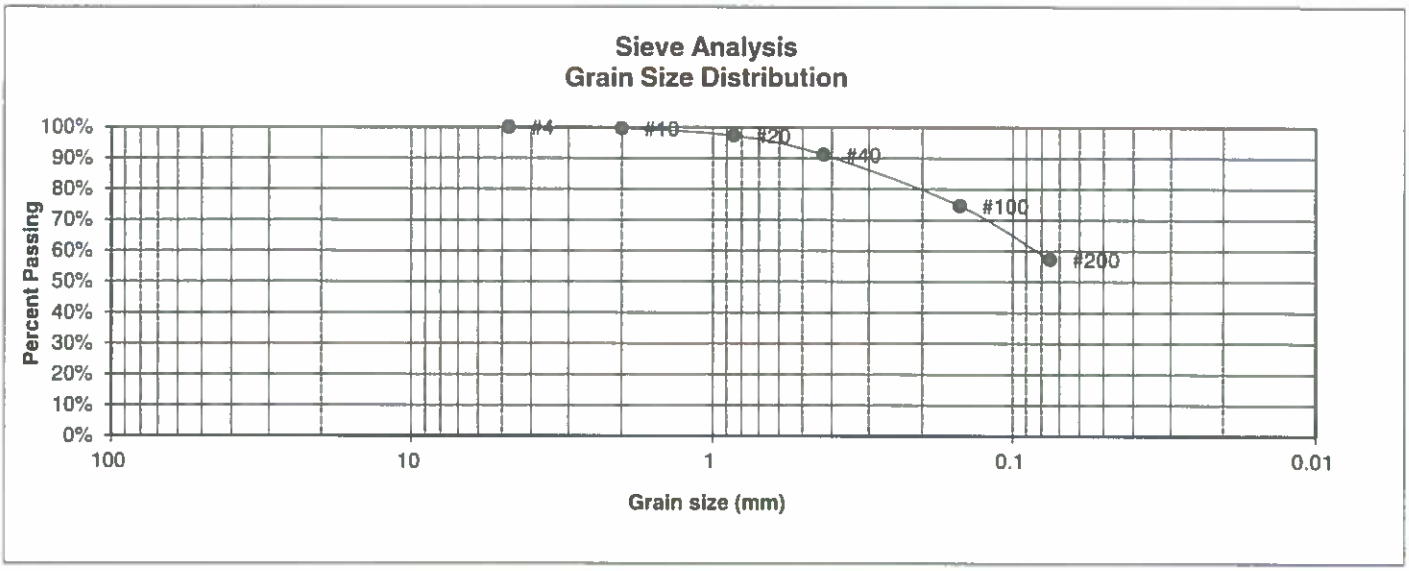
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE: 3/23/21

JOB NO.: 210527
FIG NO.: B-14

UNIFIED CLASSIFICATION	ML	CLIENT	TECH CONSTACTORS
SOIL TYPE #	2	PROJECT	ROLLING HILLS
TEST BORING #	12	JOB NO.	210527
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-4	GROUP INDEX	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.6%
20	97.3%
40	91.1%
100	74.6%
200	57.2%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	

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LABORATORY TEST RESULTS

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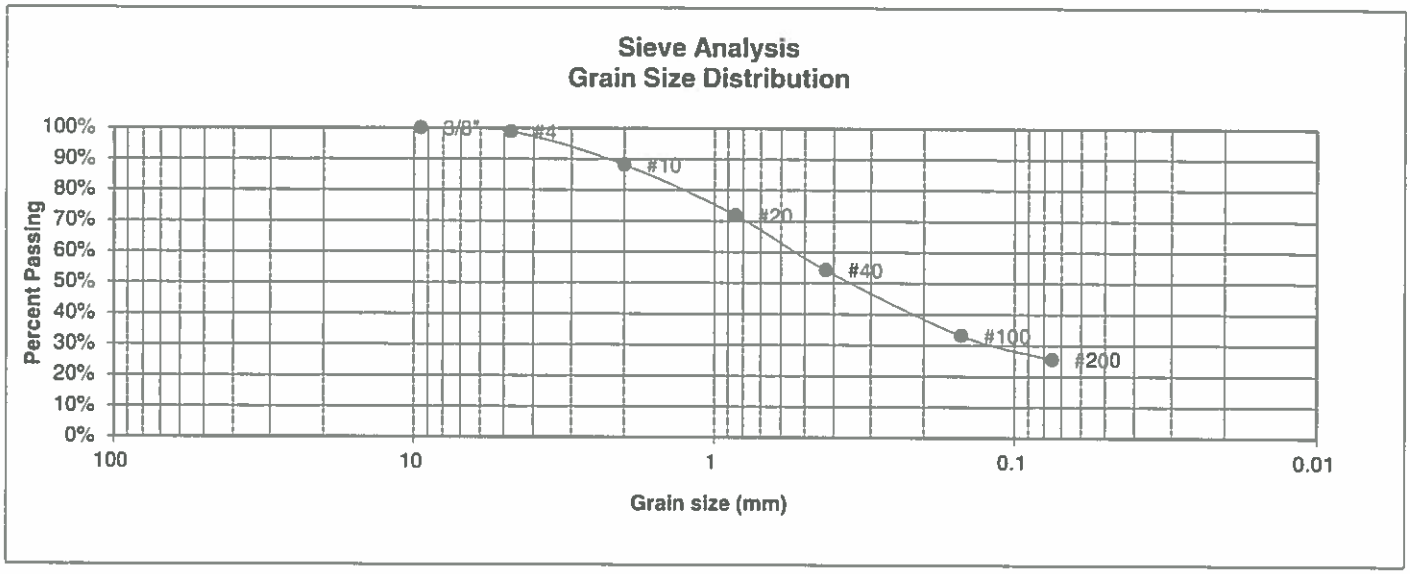
			3/23/21

JOB NO. 210527
FIG NO. B-15

UNIFIED CLASSIFICATION	SM	CLIENT	TECH CONSTACTORS
SOIL TYPE #	3	PROJECT	ROLLING HILLS
TEST BORING #	1	JOB NO.	210527
DEPTH (FT)	0-3	TEST BY	BL
AASHTO CLASSIFICATION	A-2-4	GROUP INDEX	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	98.9%
10	88.1%
20	71.9%
40	54.2%
100	33.2%
200	25.5%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

Moisture at start

Moisture at finish

Moisture increase

Initial dry density (pcf)

Swell (psf)

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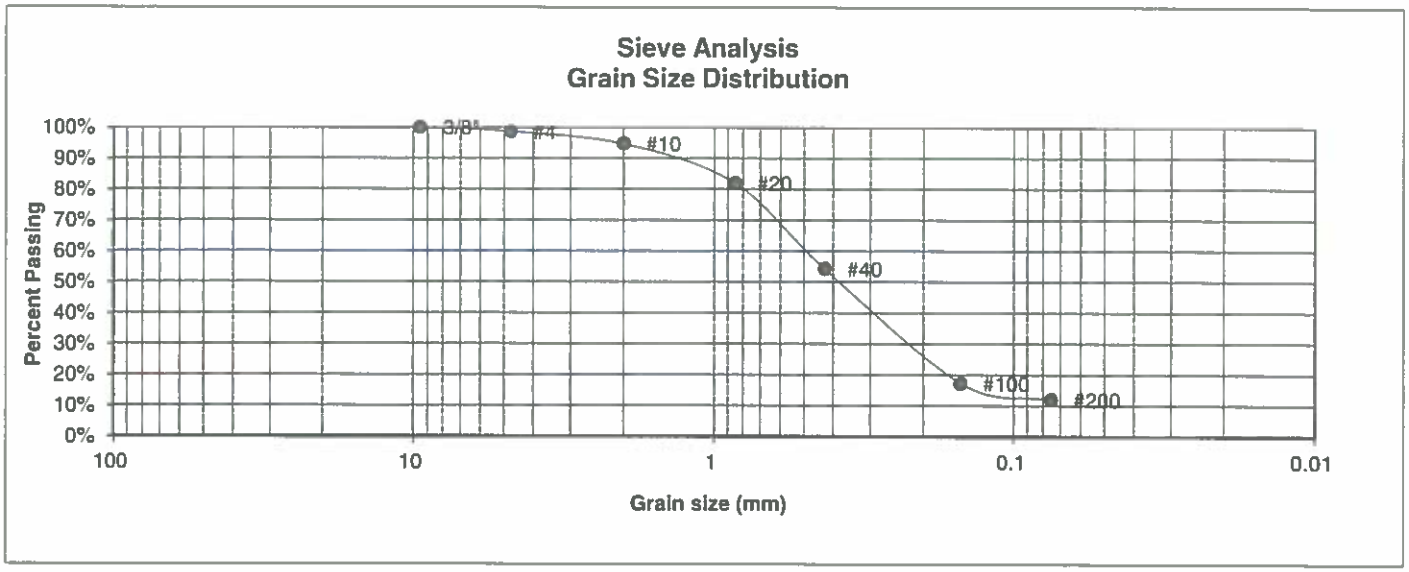
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE: 3/23/21

JOB NO: 210527
FIG NO: B-16

UNIFIED CLASSIFICATION	SM-SW	CLIENT	TECH CONSTACTORS
SOIL TYPE #	3	PROJECT	ROLLING HILLS
TEST BORING #	6	JOB NO.	210527
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-2-4	GROUP INDEX	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	98.6%
10	94.7%
20	81.9%
40	54.2%
100	17.2%
200	11.9%

Atterberg Limits	
Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell	
Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	

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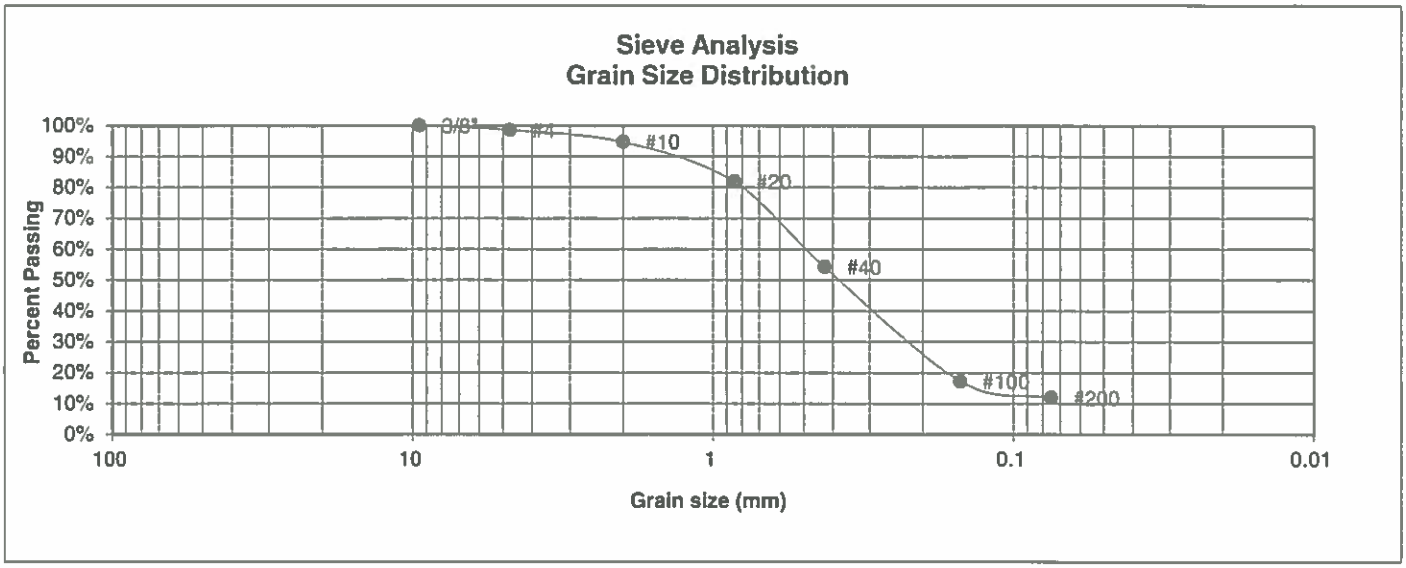
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	9/12/21

JOB NO.: 210527
FIG NO.: B-17

UNIFIED CLASSIFICATION	SM-SW	CLIENT	TECH CONSTACTORS
SOIL TYPE #	3	PROJECT	ROLLING HILLS
TEST BORING #	6	JOB NO.	210527
DEPTH (FT)	1-2	TEST BY	BL
AASHTO CLASSIFICATION	A-2-4	GROUP INDEX	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	98.6%
10	94.7%
20	81.9%
40	54.2%
100	17.2%
200	11.9%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	

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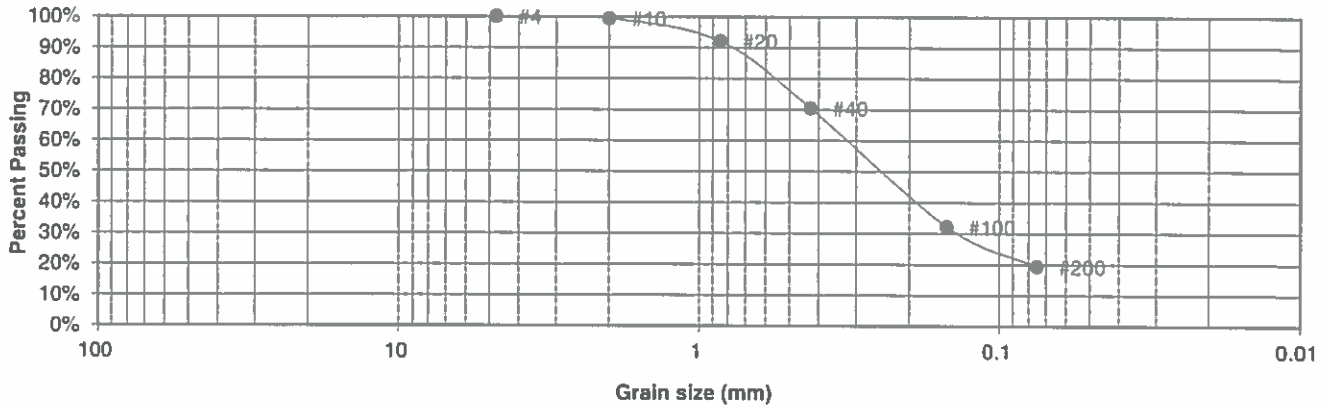
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	4/14/21

JOB NO.: 210527
FIG NO.: B-12

UNIFIED CLASSIFICATION	SM	CLIENT	TECH CONSTACTORS
SOIL TYPE #	3	PROJECT	ROLLING HILLS
TEST BORING #	5	JOB NO.	210527
DEPTH (FT)	10	TEST BY	BL
AASHTO CLASSIFICATION	A-2-4	GROUP INDEX	0

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.4%
20	92.1%
40	70.5%
100	32.2%
200	19.3%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	

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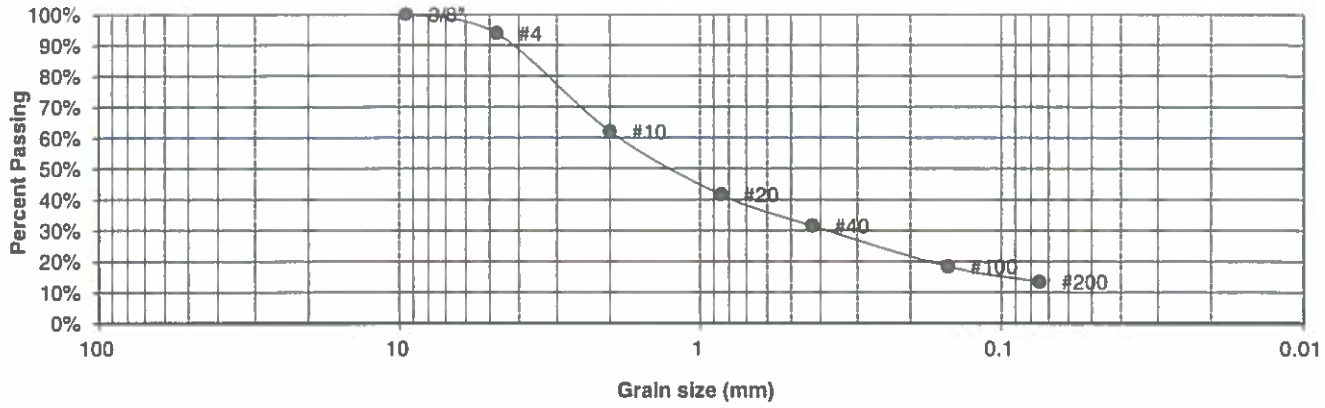
LABORATORY TEST RESULTS

DRAWN:	DATE	CHECKED	DATE:
			3/23/21

JOB NO.: 210527
FIG NO.: B-19

UNIFIED CLASSIFICATION	SM	CLIENT	TECH CONSTACTORS
SOIL TYPE #	3	PROJECT	ROLLING HILLS
TEST BORING #	9	JOB NO.	210527
DEPTH (FT)	10	TEST BY	BL
AASHTO CLASSIFICATION	A-1-b	GROUP INDEX	0

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	93.8%
10	62.1%
20	41.6%
40	31.5%
100	18.3%
200	13.4%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

Moisture at start

Moisture at finish

Moisture increase

Initial dry density (pcf)

Swell (psf)

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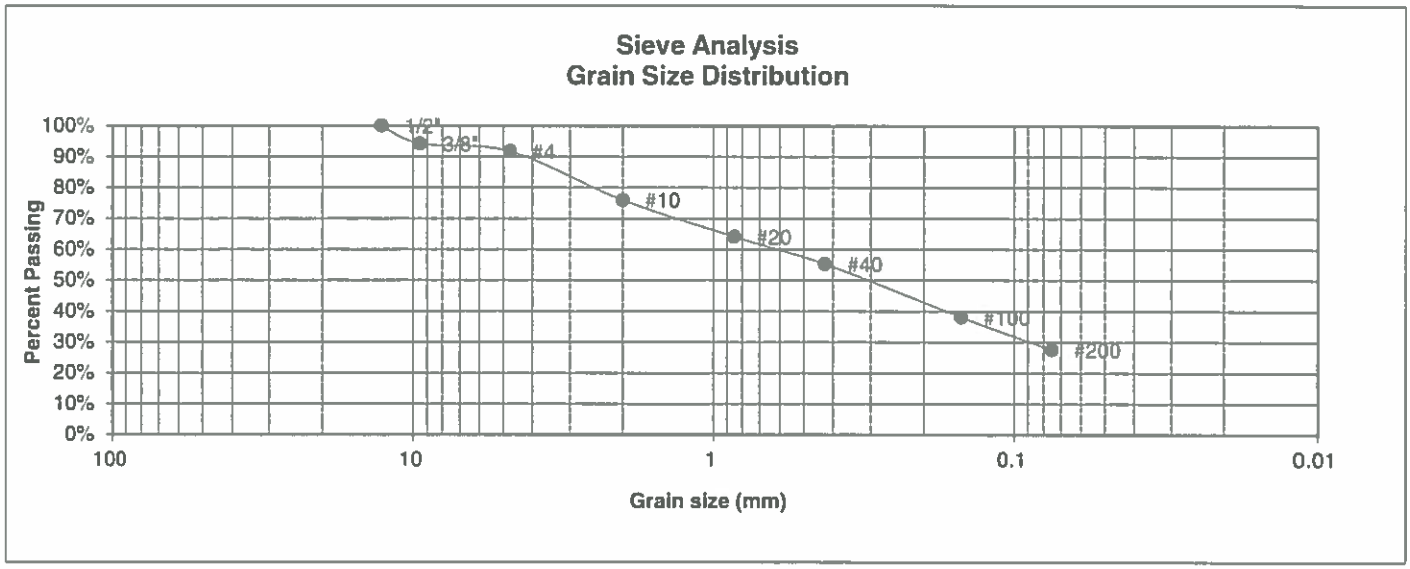
LABORATORY TEST RESULTS

DRAWN	DATE	CHECKED	DATE:
			5/23/21

JOB NO.: 210527
FIG NO.: B-28

UNIFIED CLASSIFICATION	SC	CLIENT	TECH CONSTACTORS
SOIL TYPE #	3	PROJECT	ROLLING HILLS
TEST BORING #	12	JOB NO.	210527
DEPTH (FT)	10	TEST BY	BL
AASHTO CLASSIFICATION	A-2-6	GROUP INDEX	1



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	94.2%
4	91.7%
10	75.9%
20	64.1%
40	55.3%
100	38.1%
200	27.6%

Atterberg Limits	
Plastic Limit	13
Liquid Limit	27
Plastic Index	14

Swell	
Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	

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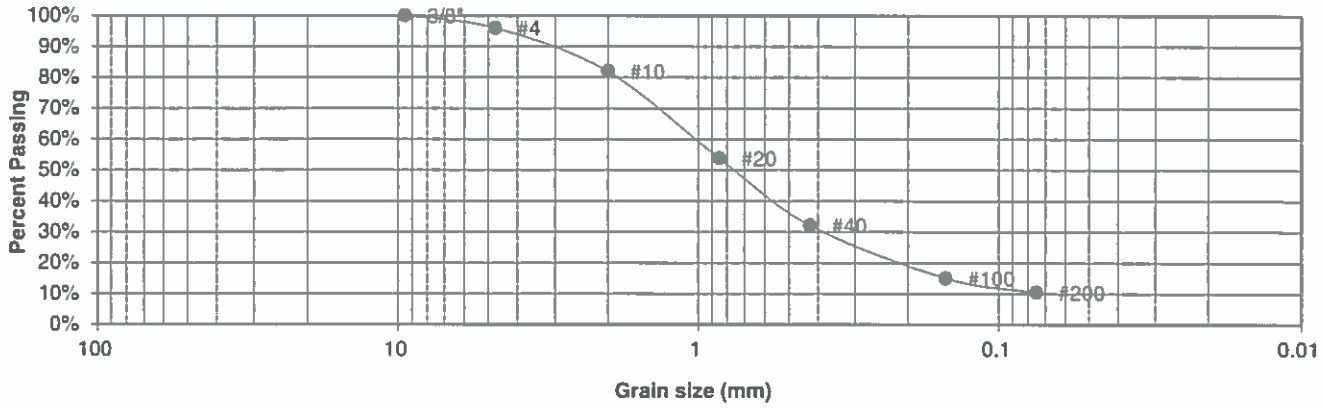
LABORATORY TEST RESULTS

DRAWN	DATE	CHECKED	DATE
			3/23/21

JOB NO.: 210527
FIG NO.: B-21

UNIFIED CLASSIFICATION	SM-SW	CLIENT	TECH CONSTACTORS
SOIL TYPE #	3	PROJECT	ROLLING HILLS
TEST BORING #	14	JOB NO.	210527
DEPTH (FT)	10	TEST BY	BL
AASHTO CLASSIFICATION	A-1-b	GROUP INDEX	0

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	96.0%
10	81.9%
20	53.8%
40	32.1%
100	15.0%
200	10.4%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

Moisture at start

Moisture at finish

Moisture increase

Initial dry density (pcf)

Swell (psf)

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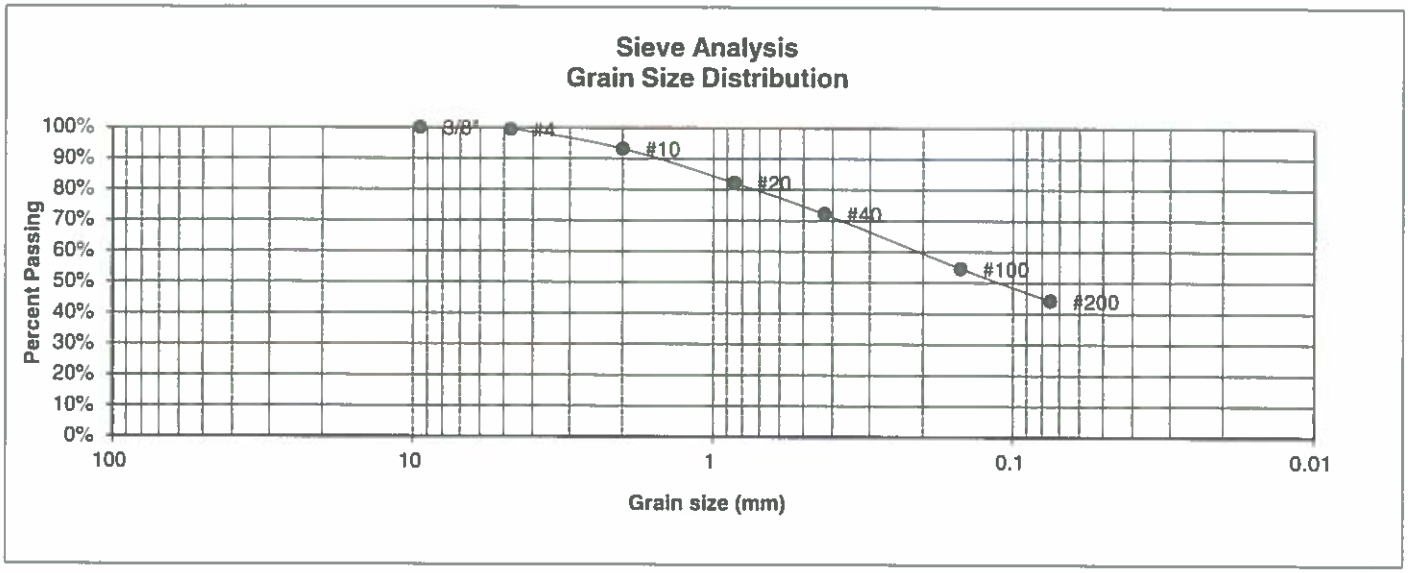
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE: 3/23/21

JOB NO.: 210527
FIG NO.: B-22

UNIFIED CLASSIFICATION	SC	CLIENT	TECH CONSTACTORS
SOIL TYPE #	4	PROJECT	ROLLING HILLS
TEST BORING #	2	JOB NO.	210527
DEPTH (FT)	10	TEST BY	BL
AASHTO CLASSIFICATION	A-6	GROUP INDEX	2



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.4%
10	93.2%
20	82.1%
40	72.2%
100	54.6%
200	44.1%

Atterberg Limits

Plastic Limit	18
Liquid Limit	30
Plastic Index	13

Swell

Moisture at start

Moisture at finish

Moisture increase

Initial dry density (pcf)

Swell (psf)

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LABORATORY TEST RESULTS

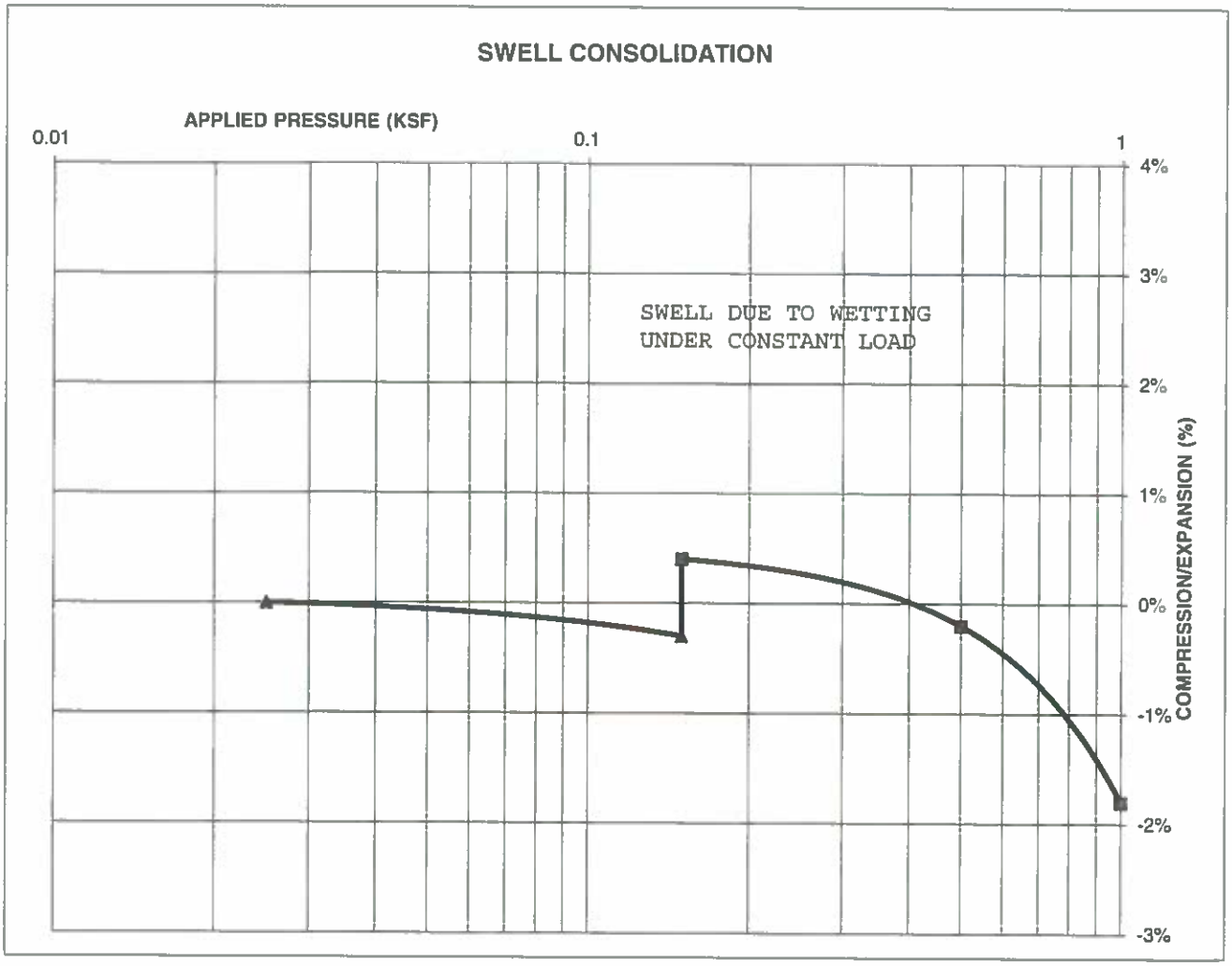
DRAWN:	DATE:	CHECKED:	DATE:
			3/23/21

JOB NO.: 210527
FIG NO.: B-23

CONSOLIDATION TEST RESULTS

TEST BORING #	4	DEPTH(ft)	0-3
DESCRIPTION	SC	SOIL TYPE	1, CBR
NATURAL UNIT DRY WEIGHT (PCF)			120
NATURAL MOISTURE CONTENT			8.5%
SWELL/CONSOLIDATION (%)			0.7%

JOB NO. 210527
CLIENT TECH CONSTACTORS
PROJECT ROLLING HILLS



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SWELL CONSOLIDATION
TEST RESULTS

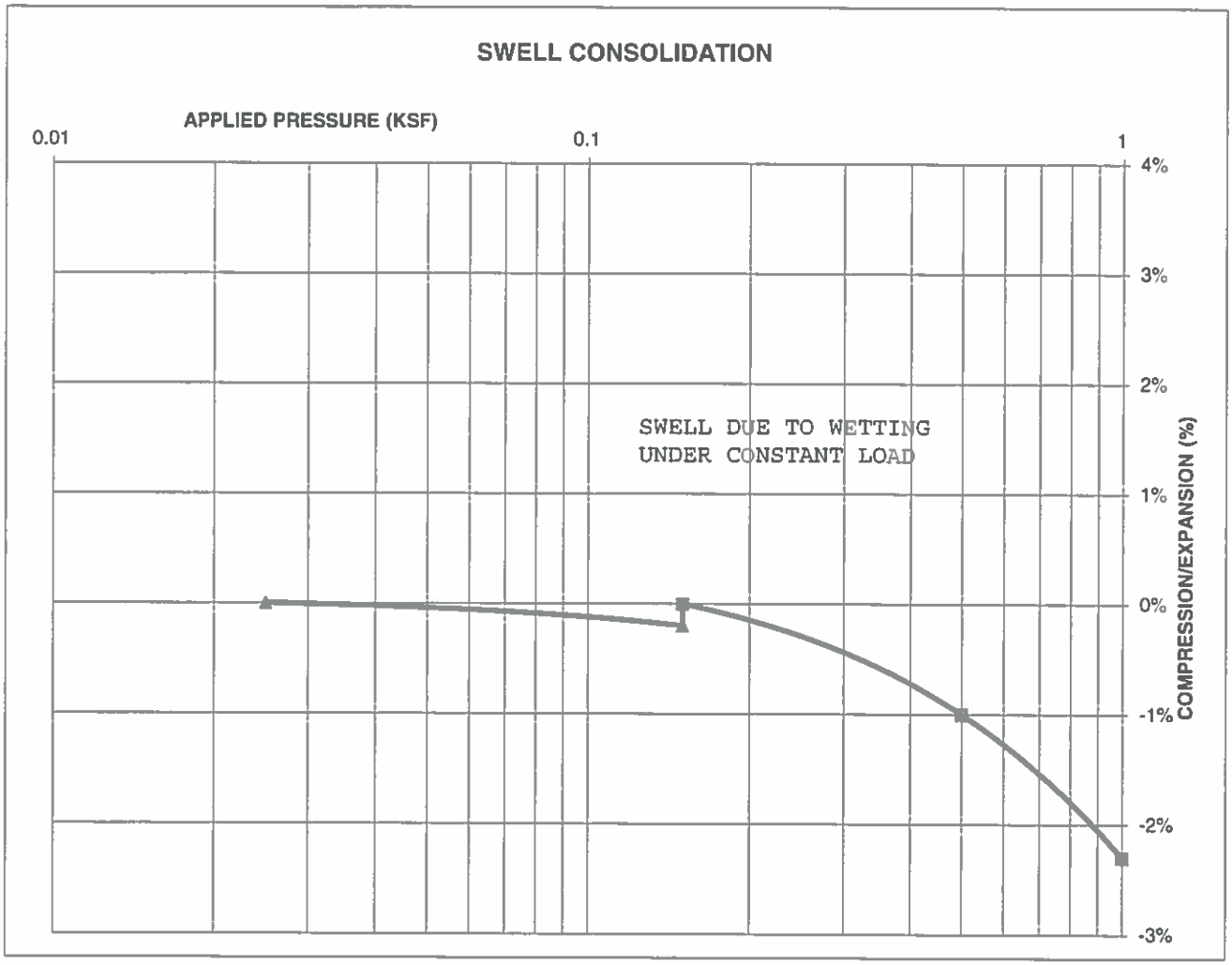
DRAWN:	DATE:	CHECKED:	DATE:
			3/23/21

JOB NO.: 210527
FIG NO.: B-24

CONSOLIDATION TEST RESULTS

TEST BORING #	4	DEPTH(ft)	1-2
DESCRIPTION	SC	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			120
NATURAL MOISTURE CONTENT			8.1%
SWELL/CONSOLIDATION (%)			0.2%

JOB NO. 210527
CLIENT TECH CONSTACTORS
PROJECT ROLLING HILLS



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SWELL CONSOLIDATION
TEST RESULTS

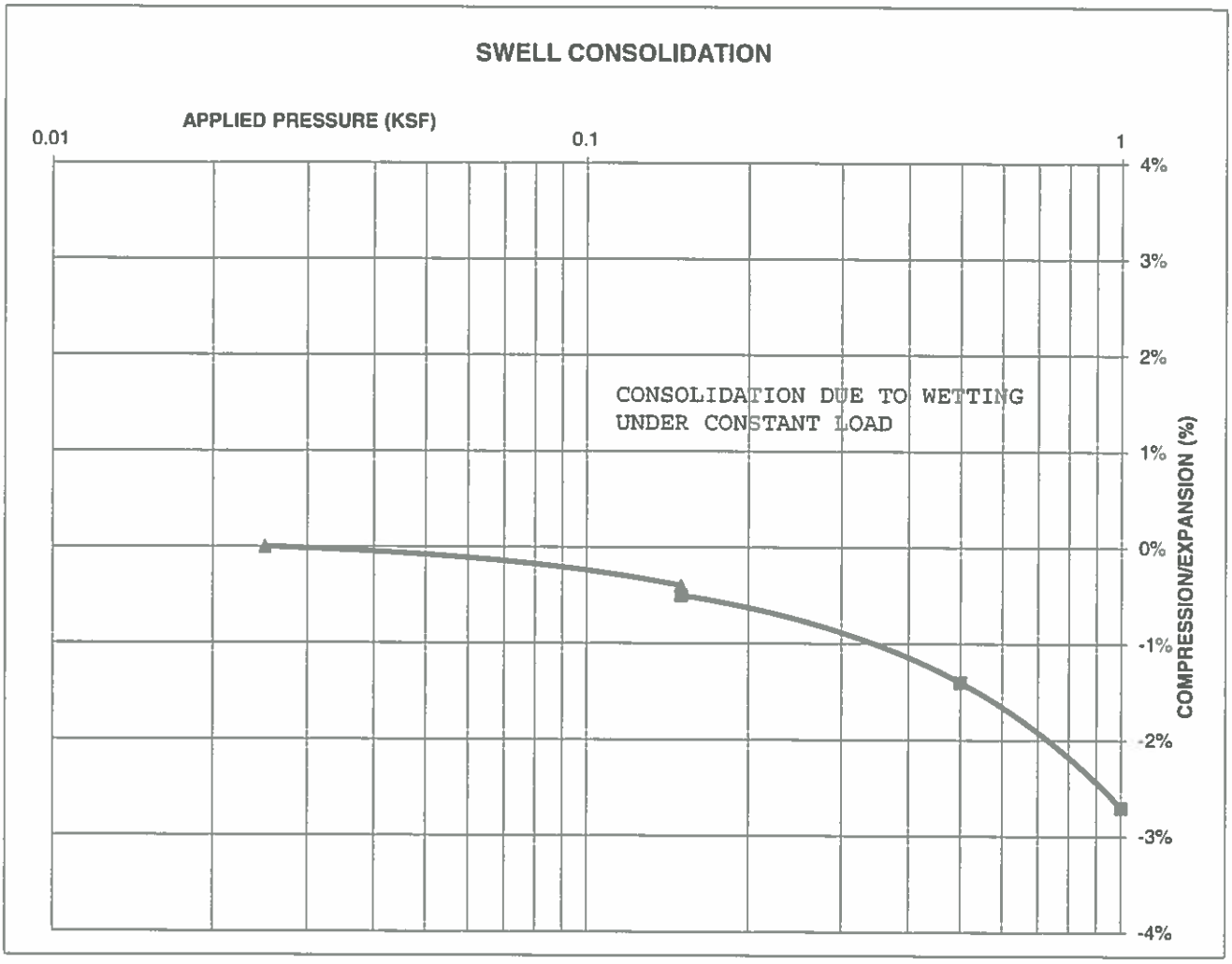
DRAWN:	DATE:	CHECKED:	DATE:
		A	3/23/21

JOB NO.: 210527
FIG NO.: B-25

CONSOLIDATION TEST RESULTS

TEST BORING #	5	DEPTH(ft)	1-2
DESCRIPTION	SC	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			115
NATURAL MOISTURE CONTENT			12.5%
SWELL/CONSOLIDATION (%)			-0.1%

JOB NO. 210527
CLIENT TECH CONSTACTORS
PROJECT ROLLING HILLS



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SWELL CONSOLIDATION
TEST RESULTS

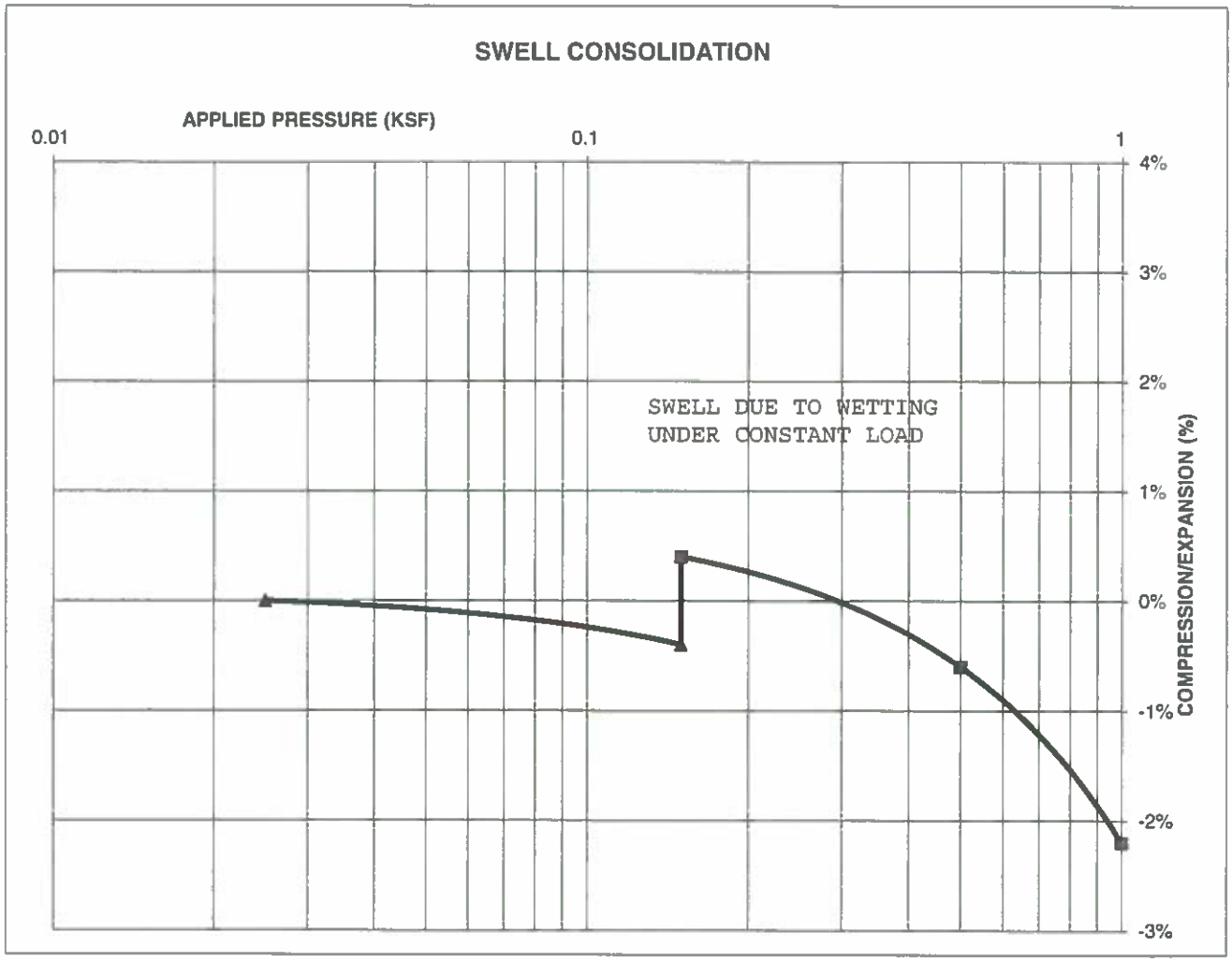
DRAWN:	DATE:	CHECKED:	DATE: 3/23/21

JOB NO.: 210527
FIG NO.: B-24

CONSOLIDATION TEST RESULTS

TEST BORING #	12	DEPTH(ft)	10
DESCRIPTION	SC	SOIL TYPE	3
NATURAL UNIT DRY WEIGHT (PCF)			116
NATURAL MOISTURE CONTENT			8.3%
SWELL/CONSOLIDATION (%)			0.8%

JOB NO. 210527
CLIENT TECH CONSTACTORS
PROJECT ROLLING HILLS



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SWELL CONSOLIDATION
TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			3/23/21

JOB NO.: 210527
FIG NO.: B-27

CLIENT	TECH CONSTACTORS	JOB NO.	210527
PROJECT	ROLLING HILLS	DATE	3/22/2021
LOCATION	ROLLING HILLS	TEST BY	BL

BORING NUMBER	DEPTH, (ft)	SOIL TYPE NUMBER	UNIFIED CLASSIFICATION	WATER SOLUBLE SULFATE, (wt%)
TB-2	1-2	1	SM	<0.01
TB-5	10	3	SM	<0.01
TB-7	1-2	1	SM	<0.01
TB-12	1-2	2	ML	0.00
TB-12	10	3	SC	0.00

QC BLANK PASS

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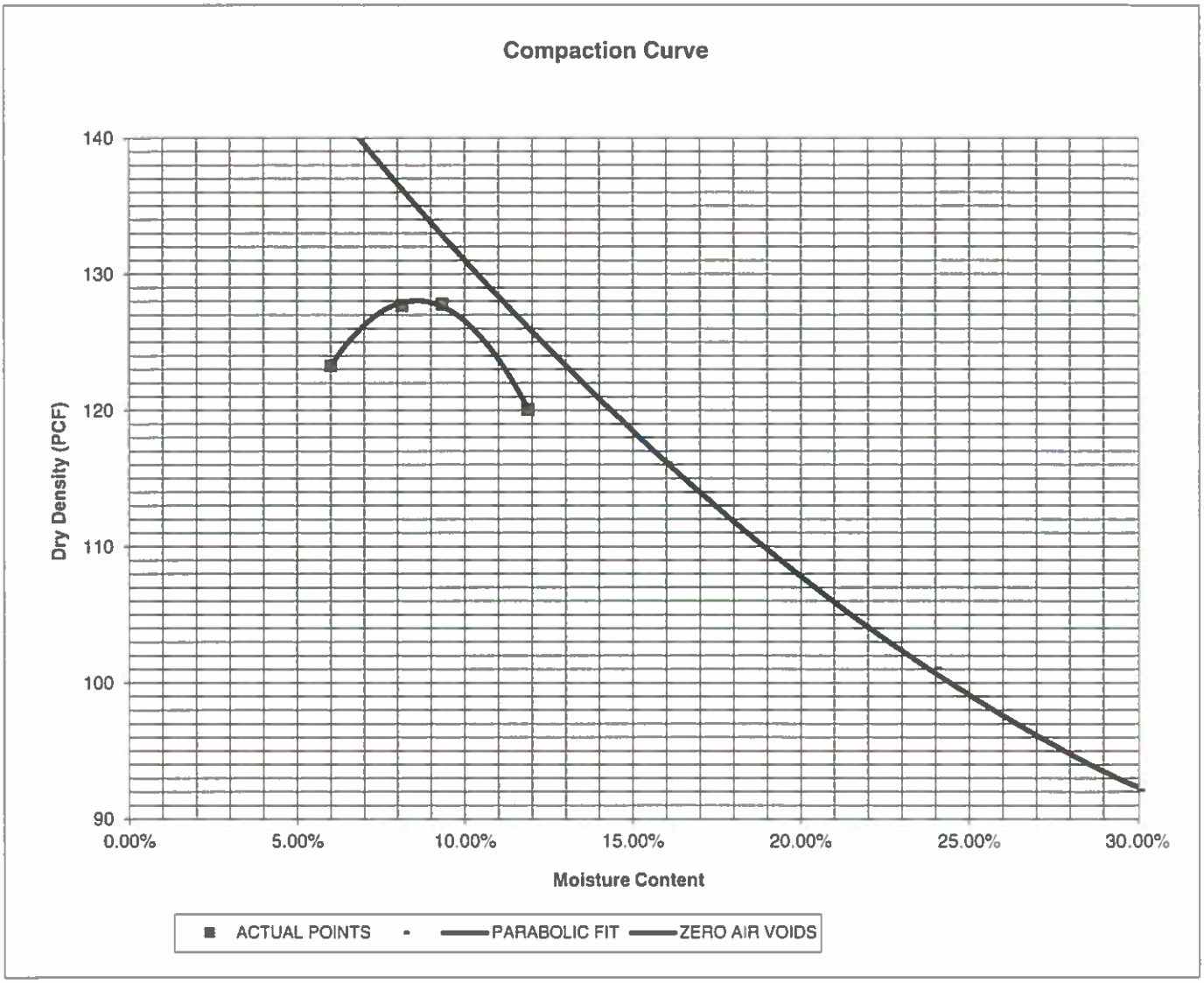
LABORATORY TEST
SULFATE RESULTS

DRAWN:	DATE:	CHECKED:	DATE: 3/23/21

JOB NO.: 210527
FIG NO.: B-28

PROJECT	ROLLING HILLS	CLIENT	TECH CONSTACTORS
SAMPLE LOCATION	TB-4 @ 0-3'	JOB NO.	210527
SOIL DESCRIPTION	FILL, SAND, CLAYEY	DATE	03/22/21

IDENTIFICATION	SC	COMPACTION TEST #	1
TEST DESIGNATION / METHOD	ASTM D-1557-A	TEST BY	BL
MAXIMUM DRY DENSITY (PCF)	128.1	OPTIMUM MOISTURE	8.6%



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MOISTURE DENSITY RELATION

DRAWN:	DATE:	CHECKED:	DATE:
			3/23/21

JOB NO.: 210527
FIG NO.: B-29

CBR TEST LOAD DATA

JOB NO: 210527
CLIENT: TECH CONSTACTORS
PROJECT: ROLLING HILLS
SOIL TYPE: 1

PISTON DIAMETER (cm)	PISTON AREA (in^2)
4.958	2.993

PENETRATION DEPTH (INCHES)	*10 BLOWS* MOLD # 1 LOAD(LBS) (LBS)	STRESS (PSI)	*25 BLOWS* MOLD # 2 LOAD(LBS) (LBS)	STRESS (PSI)	*56 BLOWS* MOLD # 3 LOAD(LBS) (LBS)	STRESS (PSI)
0.000	0	0.00	0	0.00	0	0.00
0.025	83	27.74	184	61.49	290	96.91
0.050	168	56.14	312	104.26	650	217.21
0.075	288	96.24	599	200.17	828	276.69
0.100	399	133.33	760	253.97	1126	376.27
0.125	416	139.01	892	298.08	1534	512.61
0.150	452	151.04	1129	377.28	1679	561.07
0.175	484	161.74	1275	426.06	1862	622.22
0.200	505	168.75	1577	526.98	2143	716.12
0.300	578	193.15	2037	680.70	3034	1013.86
0.400	633	211.53	2332	779.28	3569	1192.64
0.500	728	243.27	2677	894.57	4254	1421.55

FINAL MOISTURE CONTENT

	MOLD #	1	MOLD #	2	MOLD #	3
CAN #		348		356		352
WT. CAN		6.98		6.8		6.94
WT. CAN+WET		209		244.71		232.71
WT. CAN+DRY		183.99		219.21		213.29
WT. H20		25.01		25.5		19.42
WT. DRY SOIL		177.01		212.41		206.35
MOISTURE CONTENT		14.13%		12.01%		9.41%
WET DENSITY (PCF)		126.9		135.4		139.6
DRY DENSITY (PCF)		116.8		124.7		128.5
BEARING RATIO		13.33		25.40		37.63
90% OF DRY DENSITY	115.3					
95% OF DRY DENSITY	121.7					

BEARING RATIO AT 90% OF MAX	10.99	~ R VALUE	30
BEARING RATIO AT 95% OF MAX	20.80	~ R VALUE	71

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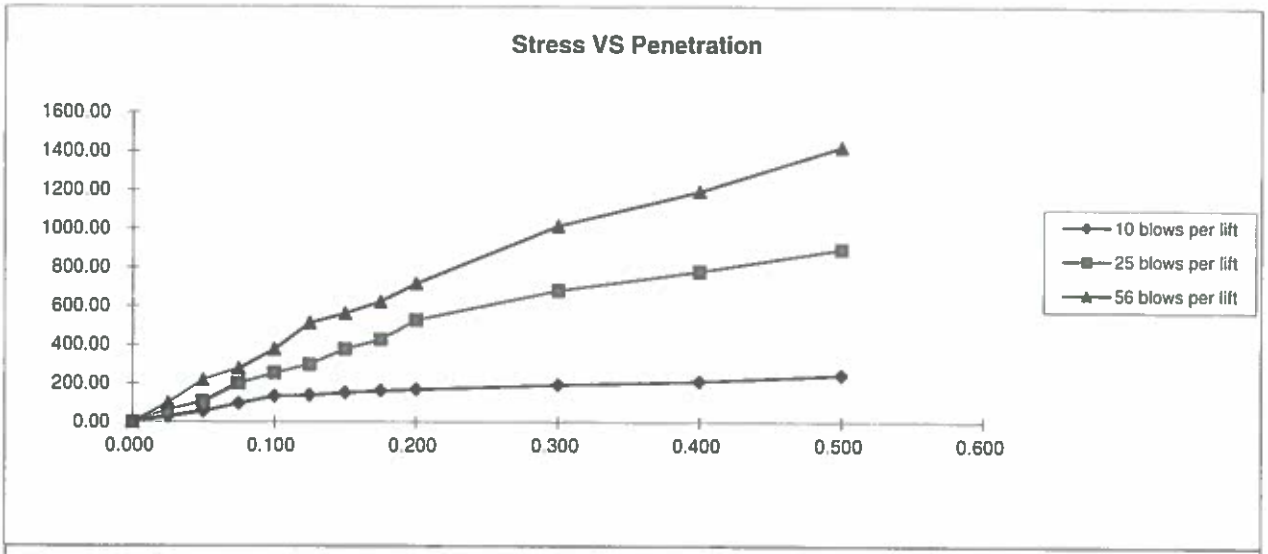
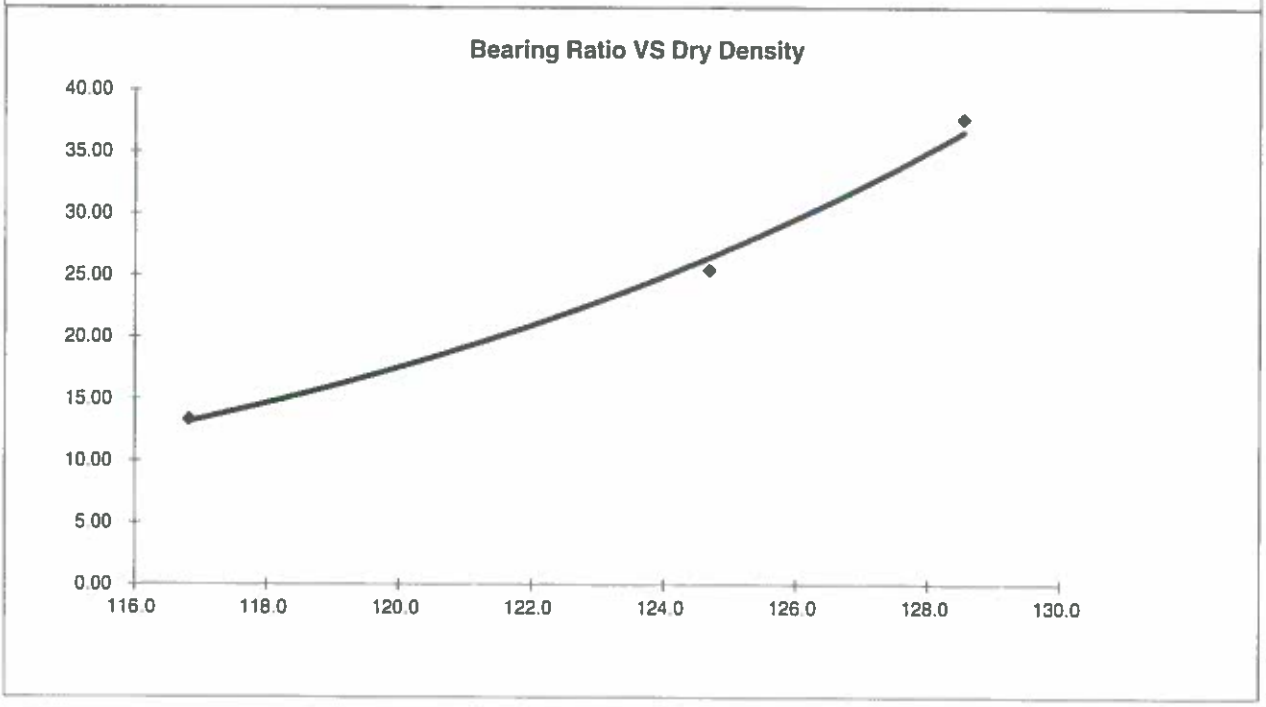
CBR TEST DATA

DRAWN:	DATE:	CHECKED:	DATE: 3/23/21

JOB NO.: 210527
FIG NO.: B-30





BEARING RATIO AT 90% OF MAX	10.99	~ R VALUE	30.00
BEARING RATIO AT 95% OF MAX	20.80	~ R VALUE	71.00

JOB NO: 210527
SOIL TYPE: 1

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CALIFORNIA BEARING RATIO

DRAWN:	DATE:	CHECKED:	DATE: 3/23/21

JOB NO: 210527
FIG NO: B-31

APPENDIX C: Pavement Design Calculations

FLEXIBLE PAVEMENT DESIGN

DESIGN DATA

ROLLING HILLS AT MERIDIAN RANCH FILING 1, PHASE 1
CROOKED HILL AND SUMMER RIDGE CUL-DE-SAC -LOCAL LOW-VOLUME

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL (W_{18}) =	36,500
Hveem Stabilometer (R Value) Results:	R =	50
Standard Deviation	S_o =	0.45
Loss in Serviceability	Δpsi =	2.0
Reliability	Reliability =	80
Reliability (z-statistic)	Z_R =	-0.84
Soil Resilient Modulus	M_R =	13168

Weighted Structural Number (WSN): → WSN = 1.46

DESIGN TABLES AND EQUATIONS

$S_1 = [(R - 5) / 11.29] + 3$

$M_R = 10^{[(S_1 + 18.72) / 6.24]}$

$k = M_R / 19.4$

Where:

M_R = resilient modulus (psi)

S_1 = the soil support value

R = R-value obtained from the Hveem stabilometer

CBR = California Bearing Ratio

Reliability (%)	Z_R (z-statistic)
80	-0.84
85	-1.04
90	-1.28
93	-1.48
94	-1.56
95	-1.65
96	-1.75
97	-1.88
98	-2.05
99	-2.33
99.9	-3.09
99.99	-3.75

$$\log_{10}W_{18} = Z_R * S_O + 9.36*\log_{10}(SN+1) - 0.20 + \frac{\log_{10}\left[\frac{\Delta PSI}{4.2 - 1.5}\right]}{0.40 + \frac{1094}{(SN+1)^{5.19}}} + 2.32*\log_{10}M_R - 8.07$$

Left	Right	Difference
4.56	4.56	0.0

Job No. 210527
Fig. No. C-1

DESIGN CALCULATIONS

DESIGN DATA

ROLLING HILLS AT MERIDIAN RANCH FILING 1, PHASE 1
CROOKED HILL AND SUMMER RIDGE CUL-DE-SAC -LOCAL LOW-VOLUME

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL =	36,500
Hveem Stabilometer (R Value) Results:	R =	50
Weighted Structural Number (WSN):	WSN =	1.46

DESIGN EQUATION

$$WSN = C_1D_1 + C_2D_2$$

C_1 = 0.44 Strength Coefficient - Hot Bituminous Asphalt
C_2 = 0.11 Strength Coefficient - Aggregate Base Course

D_1 = Depth of Asphalt (inches)
D_2 = Depth of Base Course (inches)

FOR FULL DEPTH ASPHALT SECTION (CURRENTLY NOT ALLOWED)

$D_1 = (WSN)/C_1$ = 3.3 inches of Full Depth Asphalt
Use 4.0 inches Full Depth

FOR ASPHALT + AGGREGATE BASE COURSE SECTION

Asphalt Thickness (t) = [3] inches
$D_2 = ((WSN) - (t)(C_1))/C_2$ = 1.3 inches of Aggregate
Base Course, use 4.0 inches

RECOMMENDED ALTERNATIVES

1. 3.0 inches of Asphalt + 4.0 inches of Aggregate Base Course, or
2. 4.0 inches of Full Depth Asphalt

Job No. 210527
Fig. No. C-2

DESIGN CALCULATIONS

CEMENT TREATED SECTIONS

DESIGN DATA:

ROLLING HILLS AT MERIDIAN RANCH FILING 1, PHASE 1
CROOKED HILL AND SUMMER RIDGE CUL-DE-SAC -LOCAL LOW-VOLUME

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL =	36,500
Hveem Stabilometer (R Value) Results:	R =	50
Weighted Structural Number (WSN):	WSN =	1.46

DESIGN EQUATION

$$WSN = C_1D_1 + C_2D_2$$

C_1 = 0.44 Strength Coefficient - Hot Bituminous Asphalt
C_2 = 0.12 Strength Coefficient - Cement Treated Subgrade.

D_1 = Depth of Asphalt (inches)
D_2 = Depth of Cement Treated Subgrade (inches)

FOR FULL DEPTH ASPHALT SECTION - (CURRENTLY NOT ALLOWED)

$D_1 = (WSN)/C_1$ = 3.3 inches of Full Depth Asphalt
Use 4.0 inches Full Depth

FOR ASPHALT + CEMENT TREATED SUBGRADE SECTION

Asphalt Thickness (t) = 4 inches
$D_2 = ((WSN) - (t)(C_1))/C_2$ = -2.5 inches
Use 8.0 inches of Cement Treated Subgrade.

RECOMMENDED ALTERNATIVES

1. 4.0 inches of Asphalt + 8 inches of Cement Treated Subgrade.
2. 4.0 inches of Full Depth Asphalt

Job No. 210527
Fig. No. C-3

FLEXIBLE PAVEMENT DESIGN

DESIGN DATA

ROLLING HILLS AT MERIDIAN RANCH FILING 1, PHASE 1
LOCAL RESIDENTIAL - SEE FIGURE 1 FOR SPECIFIC ROADS

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL (W_{18}) =	292,000
Hveem Stabilometer (R Value) Results:	R =	50
Standard Deviation	S_o =	0.45
Loss in Serviceability	Δpsi =	2.0
Reliability	Reliability =	80
Reliability (z-statistic)	Z_R =	-0.84
Soil Resilient Modulus	M_R =	13168

Weighted Structural Number (WSN): → WSN = 2.09

DESIGN TABLES AND EQUATIONS

$S_1 = [(R - 5) / 11.29] + 3$

$M_R = 10^{[(S_1 + 18.72) / 6.24]}$

$k = M_R / 19.4$

Where:

M_R = resilient modulus (psi)

S_1 = the soil support value

R = R-value obtained from the Hveem stabilometer

CBR = California Bearing Ratio

Reliability (%)	Z_R (z-statistic)
80	-0.84
85	-1.04
90	-1.28
93	-1.48
94	-1.56
95	-1.65
96	-1.75
97	-1.88
98	-2.05
99	-2.33
99.9	-3.09
99.99	-3.75

$$\log_{10}W_{18} = Z_R * S_O + 9.36*\log_{10}(SN+1) - 0.20 + \frac{\log_{10}\left[\frac{\Delta PSI}{4.2 - 1.5}\right]}{0.40 + \frac{1094}{(SN+1)^{5.19}}} + 2.32*\log_{10}M_R - 8.07$$

Left	Right	Difference
5.47	5.46	0.0

Job No. 210527
Fig. No. C-4

DESIGN CALCULATIONS

DESIGN DATA

ROLLING HILLS AT MERIDIAN RANCH FILING 1, PHASE 1
LOCAL RESIDENTIAL - SEE FIGURE 1 FOR SPECIFIC ROADS

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL =	292,000
Hveem Stabilometer (R Value) Results:	R =	50
Weighted Structural Number (WSN):	WSN =	2.09

DESIGN EQUATION

$$WSN = C_1D_1 + C_2D_2$$

C_1 = 0.44 Strength Coefficient - Hot Bituminous Asphalt
C_2 = 0.11 Strength Coefficient - Aggregate Base Course

D_1 = Depth of Asphalt (inches)
D_2 = Depth of Base Course (inches)

FOR FULL DEPTH ASPHALT SECTION (CURRENTLY NOT ALLOWED)

$D_1 = (WSN)/C_1$ = 4.8 inches of Full Depth Asphalt
Use 5.0 inches Full Depth

FOR ASPHALT + AGGREGATE BASE COURSE SECTION

Asphalt Thickness (t) = [3] inches
$D_2 = ((WSN) - (t)(C_1))/C_2$ = 7.0 inches of Aggregate
Base Course, use 8.0 inches

RECOMMENDED ALTERNATIVES

1. 3.0 inches of Asphalt + 8.0 inches of Aggregate Base Course, or
2. 5.0 inches of Full Depth Asphalt

Job No. 210527
Fig. No. C-5

DESIGN CALCULATIONS

CEMENT TREATED SECTIONS

DESIGN DATA:

ROLLING HILLS AT MERIDIAN RANCH FILING 1, PHASE 1
LOCAL RESIDENTIAL - SEE FIGURE 1 FOR SPECIFIC ROADS

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL =	292,000
Hveem Stabilometer (R Value) Results:	R =	50
Weighted Structural Number (WSN):	WSN =	2.09

DESIGN EQUATION

$$WSN = C_1D_1 + C_2D_2$$

C_1 = 0.44 Strength Coefficient - Hot Bituminous Asphalt
C_2 = 0.12 Strength Coefficient - Cement Treated Subgrade.

D_1 = Depth of Asphalt (inches)
D_2 = Depth of Cement Treated Subgrade (inches)

FOR FULL DEPTH ASPHALT SECTION - (CURRENTLY NOT ALLOWED)

$D_1 = (WSN)/C_1$ = 4.8 inches of Full Depth Asphalt
Use 5.0 inches Full Depth

FOR ASPHALT + CEMENT TREATED SUBGRADE SECTION

Asphalt Thickness (t) = 4 inches
$D_2 = ((WSN) - (t)(C_1))/C_2$ = 2.8 inches
Use 8.0 inches of Cement Treated Subgrade.

RECOMMENDED ALTERNATIVES

1. 4.0 inches of Asphalt + 8 inches of Cement Treated Subgrade.
2. 5.0 inches of Full Depth Asphalt

Job No. 210527
Fig. No. C-6

FLEXIBLE PAVEMENT DESIGN

DESIGN DATA

ROLLING HILLS AT MERIDIAN RANCH FILING 1, PHASE 1
RESIDENTIAL COLLECTOR - LAMBERT ROAD

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL (W_{18}) =	821,000
Hveem Stabilometer (R Value) Results:	R =	50
Standard Deviation	S_o =	0.45
Loss in Serviceability	Δpsi =	2.5
Reliability	Reliability =	85
Reliability (z-statistic)	Z_R =	-1.04
Soil Resilient Modulus	M_R =	13168

Weighted Structural Number (WSN): → WSN = 2.52

DESIGN TABLES AND EQUATIONS

$S_1 = [(R - 5) / 11.29] + 3$

$M_R = 10^{[(S_1 + 18.72) / 6.24]}$

$k = M_R / 19.4$

Where:

M_R = resilient modulus (psi)

S_1 = the soil support value

R = R-value obtained from the Hveem stabilometer

CBR = California Bearing Ratio

Reliability (%)	Z_R (z-statistic)
80	-0.84
85	-1.04
90	-1.28
93	-1.48
94	-1.56
95	-1.65
96	-1.75
97	-1.88
98	-2.05
99	-2.33
99.9	-3.09
99.99	-3.75

$$\log_{10}W_{18} = Z_R * S_O + 9.36*\log_{10}(SN+1) - 0.20 + \frac{\log_{10}\left[\frac{\Delta PSI}{4.2 - 1.5}\right]}{0.40 + \frac{1094}{(SN+1)^{5.19}}} + 2.32*\log_{10}M_R - 8.07$$

Left	Right	Difference
5.91	5.91	0.0

Job No. 210527
Fig. No. C-7

DESIGN CALCULATIONS

DESIGN DATA

ROLLING HILLS AT MERIDIAN RANCH FILING 1, PHASE 1
RESIDENTIAL COLLECTOR - LAMBERT ROAD

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL =	821,000
Hveem Stabilometer (R Value) Results:	R =	50
Weighted Structural Number (WSN):	WSN =	2.52

DESIGN EQUATION

$$WSN = C_1D_1 + C_2D_2$$

C_1 = 0.44 Strength Coefficient - Hot Bituminous Asphalt
C_2 = 0.11 Strength Coefficient - Aggregate Base Course

D_1 = Depth of Asphalt (inches)
D_2 = Depth of Base Course (inches)

FOR FULL DEPTH ASPHALT SECTION (CURRENTLY NOT ALLOWED)

$D_1 = (WSN)/C_1$ = 5.7 inches of Full Depth Asphalt
Use 6.0 inches Full Depth

FOR ASPHALT + AGGREGATE BASE COURSE SECTION

Asphalt Thickness (t) = [4] inches
$D_2 = ((WSN) - (t)(C_1))/C_2$ = 6.9 inches of Aggregate
Base Course, use 8.0 inches

RECOMMENDED ALTERNATIVES

1. 4.0 inches of Asphalt + 8.0 inches of Aggregate Base Course, or
2. 6.0 inches of Full Depth Asphalt

Job No. 210527
Fig. No. C-8

DESIGN CALCULATIONS

CEMENT TREATED SECTIONS

DESIGN DATA:

ROLLING HILLS AT MERIDIAN RANCH FILING 1, PHASE 1
RESIDENTIAL COLLECTOR - LAMBERT ROAD

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL =	821,000
Hveem Stabilometer (R Value) Results:	R =	50
Weighted Structural Number (WSN):	WSN =	2.52

DESIGN EQUATION

$$WSN = C_1D_1 + C_2D_2$$

C_1 = 0.44 Strength Coefficient - Hot Bituminous Asphalt
C_2 = 0.12 Strength Coefficient - Cement Treated Subgrade.

D_1 = Depth of Asphalt (inches)
D_2 = Depth of Cement Treated Subgrade (inches)

FOR FULL DEPTH ASPHALT SECTION - (CURRENTLY NOT ALLOWED)

$D_1 = (WSN)/C_1$ = 5.7 inches of Full Depth Asphalt
Use 6.0 inches Full Depth

FOR ASPHALT + CEMENT TREATED SUBGRADE SECTION

Asphalt Thickness (t) = 4 inches
$D_2 = ((WSN) - (t)(C_1))/C_2$ = 6.3 inches
Use 10.0 inches of Cement Treated Subgrade.

RECOMMENDED ALTERNATIVES

1. 4.0 inches of Asphalt + 10 inches of Cement Treated Subgrade.
2. 6.0 inches of Full Depth Asphalt

Job No. 210527
Fig. No. C-9