

December 21, 2021



ENTECH
ENGINEERING, INC.

505 ELKTON DRIVE
COLORADO SPRINGS, CO 80907
PHONE (719) 531-5599
FAX (719) 531-5238

Proterra Properties
1864 Woodmoor Drive, Suite 100
Monument, CO 80132

Attn: Joe DesJardin

Re: Pavement Recommendations
Winsome Subdivision, Filing No. 2
El Paso County, Colorado

APPROVED *
Engineering Department

01/05/2022 9:47:48 AM

dsdnijkamp

**EPC Planning & Community
Development Department**

*Source of recycled concrete must be approved prior to use.

Dear Mr. DesJardin:

As requested, Entech Engineering, Inc. has obtained samples of the pavement subgrade soils for portions of the roadways at the above referenced subdivision. Laboratory testing to determine the pavement support characteristics of the soils was performed. This letter presents the results of the laboratory testing and pavement recommendations for these roadways.

Project Description

The project will consist of paving of the roadways within Filing No. 2 of the above noted subdivision. This design is valid for sections of Twinkling Star Lane, Alamar Way, Rambling Road, Woodridge Terrace, Early Light Drive and Flapjack Lane in the Winsome Subdivision, Filing No. 2 in El Paso County, Colorado. Subsurface Soil Investigation and laboratory testing were performed to determine the pavement support characteristics of the soils. The filing layout and the locations of the test borings are shown on the Test Boring Location Map, Figure 1.

Subgrade Conditions

Nineteen exploratory test borings were drilled in the roadways to depths of 5 to 10 feet. The borings were spaced at 500 feet intervals, maximum. The Boring Logs are presented in Appendix A. The majority of the soils on this site consist of a thin layer of base course overlying silty to clayey to very clayey sand and sandstone. Base course has been placed in portions of the roads. Three to six inches of base course was measured in the test borings. The base course depths in each test boring is identified on the Test Boring Logs.

The soils on this site have similar testing characteristics so all soil types were grouped together into one soil type, Soil Type 1. Sieve Analysis and Atterberg Limit testing were performed on the soil samples obtained from the test borings for the purpose of classification. Sieve analyses performed indicated the percent passing the No. 200 sieve for the soils at subgrade depth ranged from approximately 9 to 43 percent. Atterberg Limit Tests resulted in Liquid Limits ranging from no value to 24 and 31 percent with Plastic Indexes ranging from non-plastic and 6 to 16 percent. The soils classified as A-1-b, A-2-4, A-2-6 and A-6 soils, based on the AASHTO classification system, which typically provide fair to good support characteristics. Groundwater was not encountered in the test borings. Water-soluble sulfate tests indicated a negligible potential for sulfate attack.

Swell testing was performed on two samples of the subgrade soils which had Plastic Indexes over 10. Swell/Consolidation Tests conducted on the soils exhibited a volume change of 0.8 percent each. El Paso County requires mitigation of expansive soils for roadway subgrade that

El Paso County File No. SF-2115

has a swell of 2 percent or greater with a 150 pound per square foot surcharge. The soils tested are below the levels in which mitigation is required.

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

Soil Type 1 – Silty Sand

R @ 90% = 35.0

R @ 95% = 74.0

Use R = 50.0 for design

Classification Testing

Liquid Limit	NV
Plasticity Index	NP
Percent Passing 200	28.2
AASHTO Classification	A-2-4
Group Index	0
Unified Soils Classification	SM

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”. Twinkling Star Lane, Flapjack Lane, and the cul-de-sac on Early Light Drive classify as rural local (cul-de-sac), which use an 18k ESAL value of 36,500 to determine the pavement sections. Alamar Way, Early Light Drive, Rambling Road, and Woodbridge Terrace classify as rural local roads, which used an 18k ESAL value of 109,500 for design. Pavement sections for asphalt over aggregate base course or over recycled concrete base course sections are provided. Design parameters used in the pavement analysis are as follows:

Reliability	80%
Serviceability Index	2.0
Rural Local cul-de-sac	2.0
Rural Local	2.5
Resilient Modulus	13,168 psi
"R" Value Subgrade	50
Structural Coefficients:	
Hot Bituminous Pavement	0.44
Aggregate Base Course	0.11
Recycled Concrete Base Course	0.11

Pavement calculations are attached in Appendix C. Pavement sections recommended for the site are summarized as follows:

**Pavement Sections – Twinkling Star Lane, Flapjack Lane, and
Early Light Drive cul-de-sac
Rural Local Road (cul-de-sac)
Soil Type 1, R = 50.0**

<u>Alternatives</u>	<u>Asphalt (in)</u>	<u>Aggregate Basecourse (in)</u>	<u>Recycled Concrete (in)</u>
1 – Asphalt Over Basecourse	3.0	4.0	—
2 – Asphalt Over Recycled Concrete	3.0	—	4.0

**Pavement Sections – Alamar Way, Early Light Drive, Rambling Road,
and Woodridge Terrace
Rural Local Road
Soil Type 1, R = 50.0**

<u>Alternatives</u>	<u>Asphalt (in)</u>	<u>Aggregate Basecourse (in)</u>	<u>Recycled Concrete (in)</u>
1 – Asphalt Over Basecourse	4.0	6.0	—
2 – Asphalt Over Recycled Concrete	4.0	—	6.0

* Minimum sections required per the El Paso County "Pavement Design Criteria and Report".

Roadway Construction - Asphalt on Base Course or Recycled Concrete Alternatives

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

Approximately 3 to 6 inches of base course was encountered the test borings. The existing base course may be suitable for use as the composite base layer materials as it exists. The suitability and depths of the base course should be field observed and evaluated for its suitability. Contaminated base course is not acceptable for use as the base course layer material.

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, recycled concrete, subgrade conditions, compaction of materials and roadway construction methods shall meet the El Paso County specifications.

Proterra Properties
Pavement Recommendations
Winsome Subdivision, Filing No. 2
El Paso County, Colorado
Page 4

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



Reviewed by:



Mark H. Hauschild, P.E.
Senior Engineer

DPS/bs

Encl.

Entech Job No. 212745
AAprojects/2021/212745 pr

TABLE

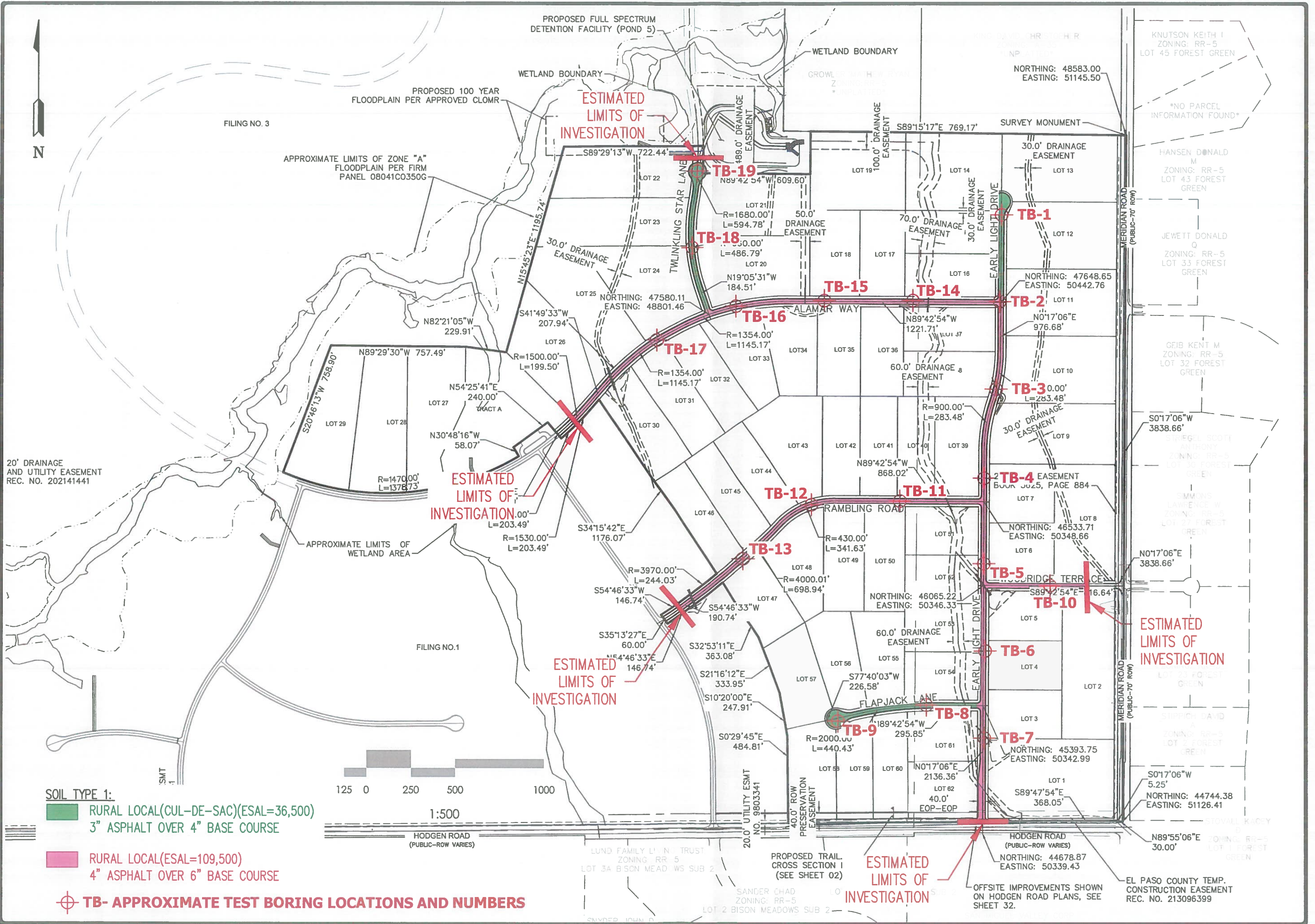
TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

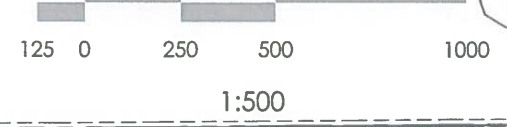
CLIENT: PROTERRA PROPERTIES
 PROJECT: WINSOME, FILING 2
 JOB NO.: 212745

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	15	0-3			28.2	NV	NP		A-2-4		SM	SAND, SILTY
1	12	0-3			12.7	NV	NP		A-1-b		SM	SAND, SILTY
1	1	1-2			17.4	NV	NP		A-2-4		SM	SAND, SILTY
1	2	1-2			32.7	24	8		A-2-4		SC	SAND, CLAYEY
1	3	1-2			27.6	31	6	0.00	A-2-4		SM	SAND, SILTY
1	4	1-2			21.7	NV	NP		A-1-b		SM	SAND, SILTY
1	5	1-2			19.7	NV	NP		A-2-4		SM	SAND, SILTY
1	11	1-2			19.4	NV	NP		A-2-4		SM	SAND, SILTY
1	13	1-2			29.8	NV	NP	<0.01	A-2-4		SM	SAND, SILTY
1	14	1-2			20.3	NV	NP		A-1-b		SM	SAND, SILTY
1	15	1-2			17.0	NV	NP		A-1-b		SM	SAND, SILTY
1	16	1-2			11.8	NV	NP		A-1-b		SM-SW	SAND, SLIGHTLY SILTY
1	17	1-2			13.4	NV	NP		A-1-b		SM	SAND, SILTY
1	18	1-2			8.8	NV	NP		A-1-b		SM-SW	SAND, SLIGHTLY SILTY
1	19	1-2			33.1	NV	NP		A-2-4		SM	SAND, SILTY
1	6	1-2			34.9	NV	NP		A-2-4		SM	SAND, SILTY
1	7	1-2	11.2	113.9	34.5	31	12		A-2-6	0.8	SC	SAND, CLAYEY
1	9	1-2			34.7	NV	NP		A-2-4		SM	SAND, VERY SILTY
2	4	10			28.7	NV	NP	<0.01	A-2-4		SM	SANDSTONE, SILTY
2	10	1-2			29.1	NV	NP		A-2-4		SM	SANDSTONE, SILTY
2	12	1-2			15.3	NV	NP		A-1-b		SM	SANDSTONE, SILTY
3	8	1-2	11.3	113.5	42.6	31	16	<0.01	A-6	0.8	SC	SANDSTONE, VERY CLAYEY

FIGURE



- SOIL TYPE 1:**
- RURAL LOCAL(CUL-DE-SAC)(ESAL=36,500)
3" ASPHALT OVER 4" BASE COURSE
 - RURAL LOCAL(ESAL=109,500)
4" ASPHALT OVER 6" BASE COURSE
 - TB- APPROXIMATE TEST BORING LOCATIONS AND NUMBERS**



REVISION	BY

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COLORADO SPRINGS, CO 80907

TEST BORING LOCATION MAP
WINSOME, FILING 2
COLORADO SPRINGS, CO
For: PROTERRA PROPERTIES

DRAWN	JAC
CHECKED	DS
DATE	11/12/21
SCALE	1:500
JOB NO.	212745
FIGURE NO.	1

APPENDIX A: Test Boring Logs

TEST BORING NO. 1
 DATE DRILLED 10/22/2021
 Job # 212745

TEST BORING NO. 2
 DATE DRILLED 10/22/2021
 CLIENT PROTERRA PROPERTIES
 LOCATION WINSOME, FILING 2

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 10', 10/22/21 6" BASE COURSE, SAND, SILTY, FINE TO COARSE GRAINED, BROWN, DENSE TO MEDIUM DENSE, MOIST TO DRY	5			36	18.8	1	DRY TO 5', 10/22/21 6" BASE COURSE, SAND, CLAYEY, FINE TO MEDIUM GRAINED, BROWN, MEDIUM DENSE TO DENSE, DRY TO MOIST	5			20	1.6	1
	5			11	2.3	1		5			32	5.7	1
	10			31	6.5	1		10					
	15							15					
	20							20					



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TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE:

DS

11/23/21

JOB NO.:
 212745

FIG NO.:
 A- 1

TEST BORING NO. 3
 DATE DRILLED 10/22/2021
 Job # 212745

TEST BORING NO. 4
 DATE DRILLED 10/22/2021
 CLIENT PROTERRA PROPERTIES
 LOCATION WINSOME, FILING 2

REMARKS

REMARKS

DRY TO 5', 10/22/21

6" BASE COURSE, SAND, SILTY,
 FINE TO COARSE GRAINED,
 BROWN, DENSE TO MEDIUM
 DENSE, MOIST TO DRY

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5	[Symbol]		41	4.5	1
5	[Symbol]		20	2.7	1

DRY TO 10', 10/22/21

3" BASE COURSE, SAND, SILTY,
 FINE TO COARSE GRAINED,
 BROWN, MEDIUM DENSE, DRY

SANDSTONE, SILTY, FINE TO
 COARSE GRAINED, TAN, VERY
 DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5	[Symbol]		27	1.1	1
5	[Symbol]		50 8"	6.5	2
10	[Symbol]		50	10.7	2



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TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE:

DS

11/23/21

JOB NO.:
 212745

FIG NO.:
 A- 2

TEST BORING NO. 5
 DATE DRILLED 10/22/2021
 Job # 212745

TEST BORING NO. 6
 DATE DRILLED 10/22/2021
 CLIENT PROTERRA PROPERTIES
 LOCATION WINSOME, FILING 2

REMARKS

DRY TO 5', 10/22/21
 3" BASE COURSE, SAND, SILTY,
 FINE TO COARSE GRAINED,
 BROWN, DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			32	6.6	1
5			40	3.5	1

REMARKS

DRY TO 5', 10/22/21
 3" BASE COURSE, SAND, SILTY,
 FINE TO MEDIUM GRAINED, TAN,
 MEDIUM DENSE TO DENSE,
 MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			29	5.1	1
5			33	4.6	1



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TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE:

ES 11/25/21

JOB NO.:
 212745

FIG NO.:
 A- 3

TEST BORING NO. 7
 DATE DRILLED 10/22/2021
 Job # 212745

TEST BORING NO. 8
 DATE DRILLED 10/22/2021
 CLIENT PROTERRA PROPERTIES
 LOCATION WINSOME, FILING 2

REMARKS

DRY TO 5', 10/22/21
 3" BASE COURSE, SAND, CLAYEY,
 FINE GRAINED, TAN, MEDIUM
 DENSE TO DENSE, MOIST TO
 DRY

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5	[Symbol]		26	5.6	1
5	[Symbol]		31	1.0	1
10					
15					
20					

REMARKS

DRY TO 5', 10/22/21
 6" BASE COURSE, SANDSTONE,
 VERY CLAYEY, FINE GRAINED,
 BROWN TO TAN, VERY DENSE,
 MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5	[Symbol]		50 11"	5.6	3
5	[Symbol]		50 11"	8.3	3
10					
15					
20					



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TEST BORING LOG

DRAWN: DATE: CHECKED: DATE: 10/22/21

JOB NO.:
212745

FIG NO.:
A- 4

TEST BORING NO. 9
 DATE DRILLED 10/22/2021
 Job # 212745

TEST BORING NO. 10
 DATE DRILLED 10/22/2021
 CLIENT PROTERRA PROPERTIES
 LOCATION WINSOME, FILING 2

REMARKS						REMARKS					
Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 10', 10/22/21 6" BASE COURSE, SAND, SILTY, FINE TO MEDIUM GRAINED, BROWN TO TAN, MEDIUM DENSE, TO DENSE, DRY TO VERY MOIST						DRY TO 5', 10/22/21 3" BASE COURSE, SAND, SILTY, TAN SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, VERY DENSE, DRY TO MOIST					
5	[Symbol]		17	0.5	1	5	[Symbol]		50	1.2	1
			42	1.7	1	5	[Symbol]		10"		2
			35	18.7	1	5	[Symbol]		50	3.5	2
						9"					



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TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE:

D.S.

11/22/21

JOB NO.:
 212745

FIG NO.:
 A-5

TEST BORING NO. 11
 DATE DRILLED 10/22/2021
 Job # 212745

TEST BORING NO. 12
 DATE DRILLED 10/22/2021
 CLIENT PROTERRA PROPERTIES
 LOCATION WINSOME, FILING 2

REMARKS

DRY TO 5', 10/22/21

3" BASE COURSE, SAND, SILTY,
 FINE TO COARSE GRAINED, TAN,
 VERY DENSE TO MEDIUM DENSE,
 MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5	[Symbol]		50	5.6	1
5	[Symbol]		23	4.7	1
10					
15					
20					

REMARKS

DRY TO 10', 10/22/21

5" BASE COURSE, SAND, SILTY,
 TAN
 SANDSTONE, SILTY, FINE TO
 COARSE GRAINED, TAN, VERY
 DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5	[Symbol]		50	3.2	2
5	[Symbol]		11"		
5	[Symbol]		50	8.5	2
10	[Symbol]		50	7.5	2
10	[Symbol]		9"		
15					
20					



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TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE:

DS

11/23/21

JOB NO.:
 212745

FIG NO.:
 A-6

TEST BORING NO. 13
 DATE DRILLED 10/22/2021
 Job # 212745

TEST BORING NO. 14
 DATE DRILLED 10/22/2021
 CLIENT PROTERRA PROPERTIES
 LOCATION WINSOME, FILING 2

REMARKS						REMARKS					
Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 5', 10/22/21 4" BASE COURSE, SAND, SILTY, FINE TO COARSE GRAINED, BROWN, MEDIUM DENSE, MOIST						DRY TO 5', 10/22/21 6" BASE COURSE, SAND, SILTY, FINE TO COARSE GRAINED, BROWN TO TAN, DENSE TO MEDIUM DENSE, MOIST					
5	[Symbol]		27	7.8	1	5	[Symbol]		43	6.2	1
5	[Symbol]		25	8.6	1	5	[Symbol]		27	3.6	1
10						10					
15						15					
20						20					



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 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE:

11/23/21

JOB NO.:
 212745

FIG NO.:
 A-9

TEST BORING NO. 15
 DATE DRILLED 10/22/2021
 Job # 212745

TEST BORING NO. 16
 DATE DRILLED 10/22/2021
 CLIENT PROTERRA PROPERTIES
 LOCATION WINSOME, FILING 2

REMARKS

DRY TO 5', 10/22/21

5" BASE COURSE, SAND, SILTY,
 FINE TO COARSE GRAINED,
 BROWN TO TAN, VERY DENSE TO
 DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			50 9"	4.9	1
5			30	6.5	1
10			45	5.9	1
15					
20					

REMARKS

DRY TO 5', 10/22/21

4" BASE COURSE, SAND,
 SLIGHTLY SILTY, FINE TO COARSE
 GRAINED, BROWN, DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			43	5.5	1
5			39	10.6	1
10					
15					
20					



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TEST BORING LOG

DRAWN: DATE: CHECKED: DATE: 11/23/21

JOB NO.:
 212745

FIG NO.:
 A-16

TEST BORING NO. 17
 DATE DRILLED 10/22/2021
 Job # 212745

TEST BORING NO. 18
 DATE DRILLED 10/22/2021
 CLIENT PROTERRA PROPERTIES
 LOCATION WINSOME, FILING 2

REMARKS

DRY TO 5', 10/22/21

3" BASE COURSE, SAND, SILTY,
 FINE TO COARSE GRAINED,
 BROWN TO TAN, VERY DENSE TO
 MEDIUM DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			50 10"	4.2	1
5			20	3.9	1
10					
15					
20					

REMARKS

DRY TO 5', 10/22/21

4" BASE COURSE, SAND,
 SLIGHTLY SILTY, FINE TO COARSE
 GRAINED, BROWN, DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			40	7.1	1
5			36	3.9	1
10					
15					
20					



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TEST BORING LOG

DRAWN:

DATE:

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DATE:

11/22/21

JOB NO.:
 212745

FIG NO.:
 A-11

TEST BORING NO. 19
 DATE DRILLED 10/22/2021
 Job # 212745

TEST BORING NO.
 DATE DRILLED
 CLIENT PROTERRA PROPERTIES
 LOCATION WINSOME, FILING 2

REMARKS

REMARKS

DRY TO 10', 10/22/21
 6" BASE COURSE, SAND, SILTY,
 FINE TO COARSE GRAINED,
 BROWN TO TAN, DENSE, MOIST
 TO DRY

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			30	9.2	1	5					
10			33	1.6	1	10					
15			43	2.6	1	15					
20						20					



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505 ELKTON DRIVE
 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE:

DS

11/23/21

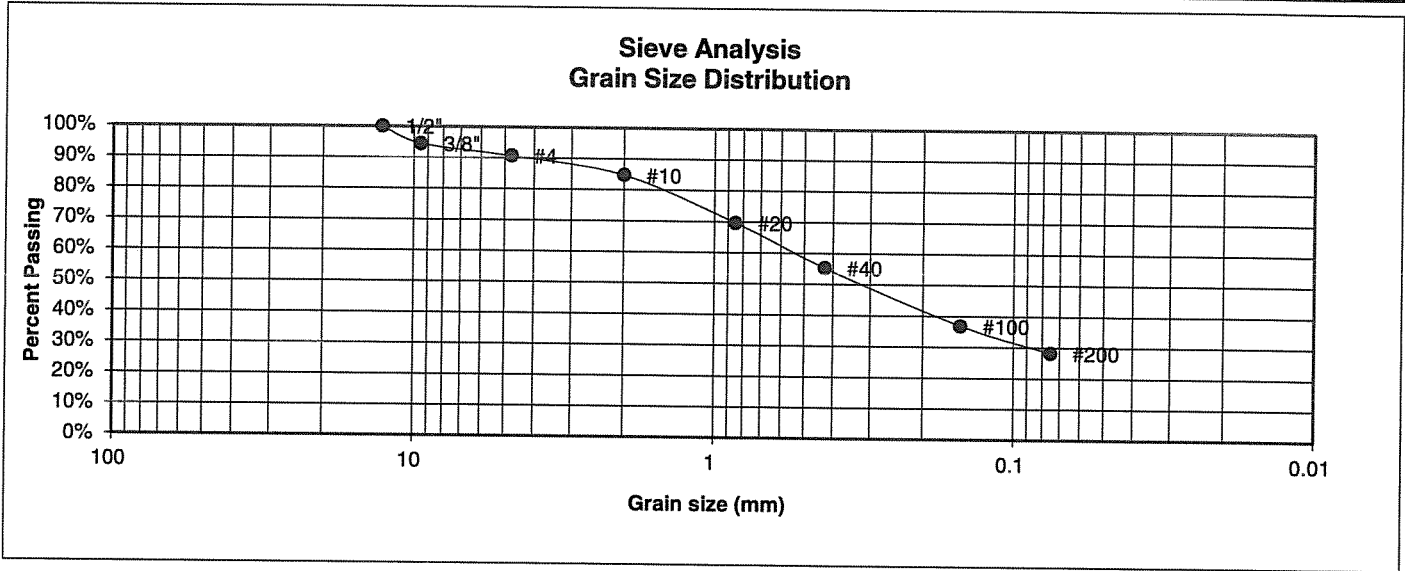
JOB NO.:
 212745

FIG NO.:

A-12

APPENDIX B: Laboratory Test Results

UNIFIED CLASSIFICATION	SM	CLIENT	PROTERRA PROPERTIES
SOIL TYPE #	1, CBR	PROJECT	WINSOME, FILING 2
TEST BORING #	15	JOB NO.	212745
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"	100.0%
3/8"	94.4%
4	90.7%
10	84.7%
20	69.6%
40	55.3%
100	36.8%
200	28.2%

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)	



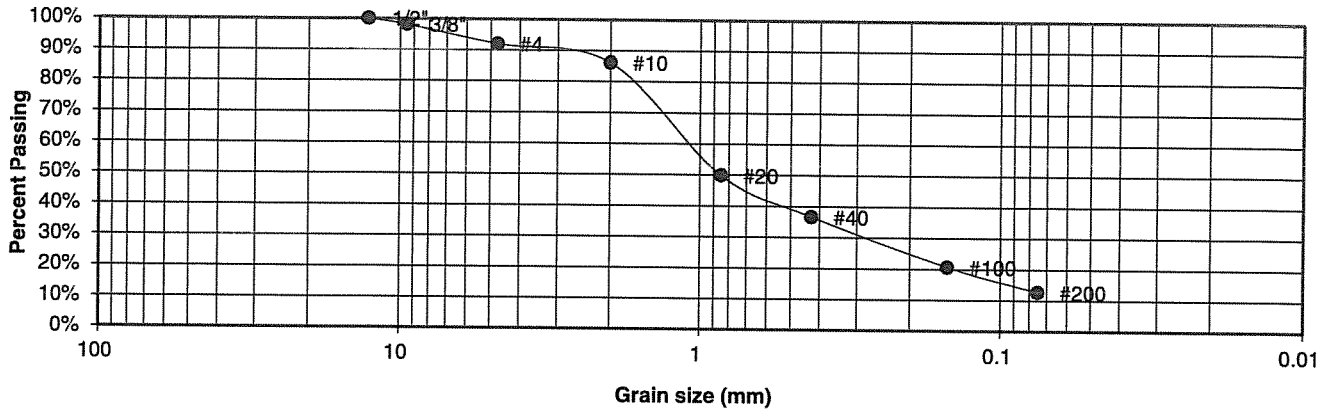
LABORATORY TEST RESULTS			
DRAWN:	DATE:	CHECKED:	DATE:
		DS	11/27/21

JOB NO.:	212745
FIG NO.:	B-1

UNIFIED CLASSIFICATION SM
SOIL TYPE # 1
TEST BORING # 12
DEPTH (FT) 0-3
AASHTO CLASSIFICATION A-1-b

CLIENT PROTERRA PROPERTIES
PROJECT WINSOME, FILING 2
JOB NO. 212745
TEST BY BL
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"	98.1%
4	91.9%
10	86.1%
20	49.9%
40	36.6%
100	20.7%
200	12.7%

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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**LABORATORY TEST
RESULTS**

DRAWN:	DATE:	CHECKED:	DATE:
		DS	11/23/21

JOB NO.:

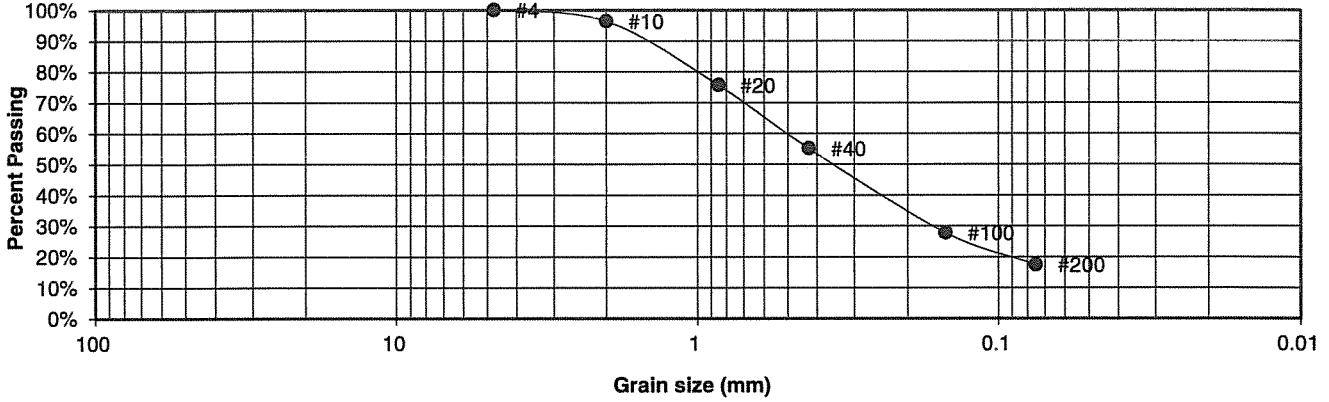
212745
FIG NO.:

B-2

UNIFIED CLASSIFICATION SM
SOIL TYPE # 1
TEST BORING # 1
DEPTH (FT) 1-2
AASHTO CLASSIFICATION A-2-4

CLIENT PROTERRA PROPERTIES
PROJECT WINSOME, FILING 2
JOB NO. 212745
TEST BY BL
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	96.4%
20	75.7%
40	55.1%
100	27.8%
200	17.4%

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

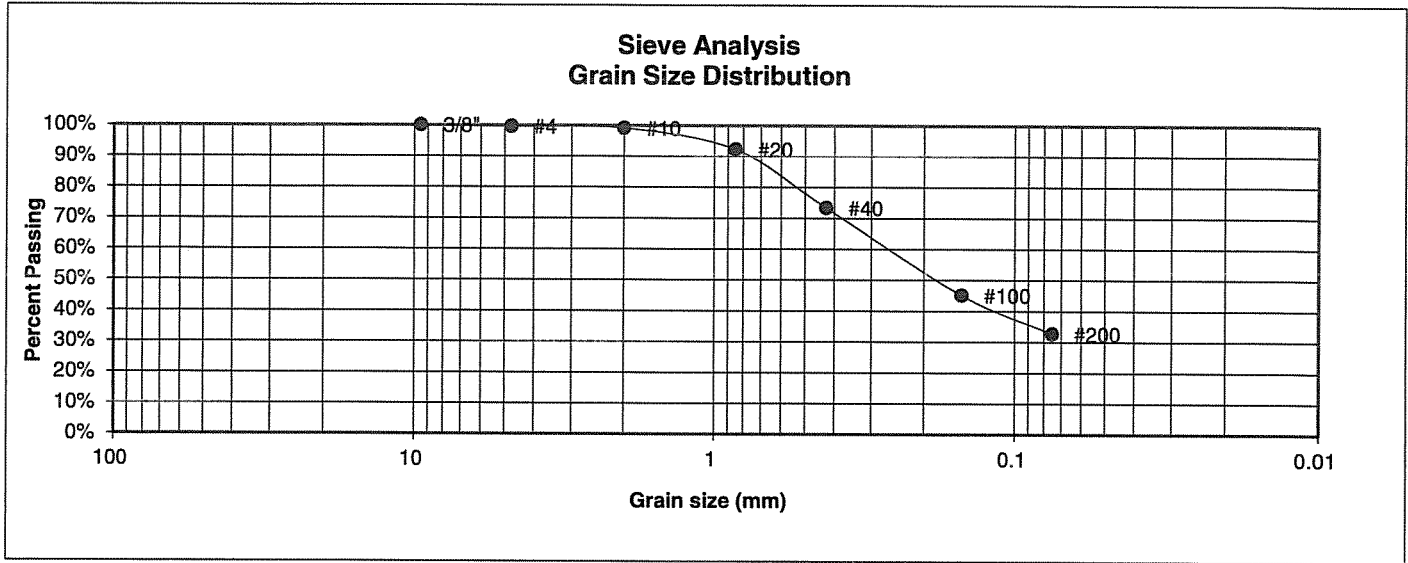
DRAWN:	DATE:	CHECKED: DS	DATE: 11/29/21
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JOB NO.:

212745
FIG NO.:

B-3

<u>UNIFIED CLASSIFICATION</u>	SC	<u>CLIENT</u>	PROTERRA PROPERTIES
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	WINSOME, FILING 2
<u>TEST BORING #</u>	2	<u>JOB NO.</u>	212745
<u>DEPTH (FT)</u>	1-2	<u>TEST BY</u>	BL
<u>AASHTO CLASSIFICATION</u>	A-2-4	<u>GROUP INDEX</u>	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.6%
10	99.1%
20	92.2%
40	73.4%
100	45.1%
200	32.7%

Atterberg Limits	
Plastic Limit	16
Liquid Limit	24
Plastic Index	8

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: <i>DS</i>	DATE: <i>11/23/21</i>
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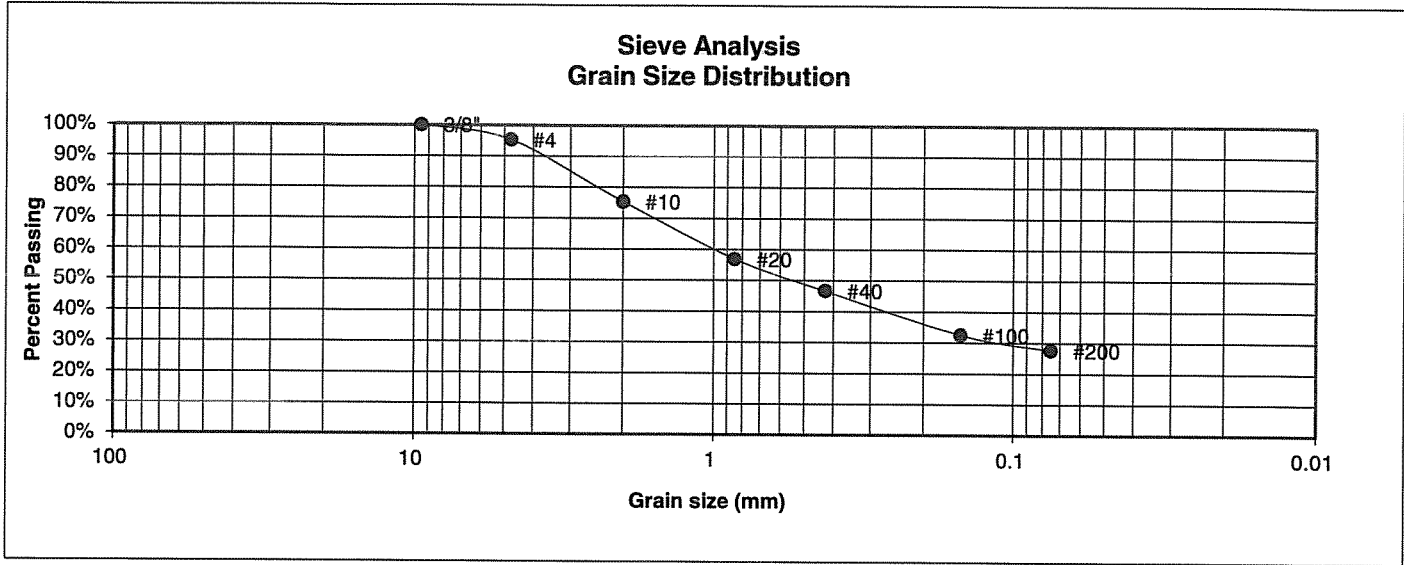
JOB NO.:

212745

FIG NO.:

B-4

<u>UNIFIED CLASSIFICATION</u>	SM	<u>CLIENT</u>	PROTERRA PROPERTIES
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	WINSOME, FILING 2
<u>TEST BORING #</u>	3	<u>JOB NO.</u>	212745
<u>DEPTH (FT)</u>	1-2	<u>TEST BY</u>	BL
<u>AASHTO CLASSIFICATION</u>	A-2-4	<u>GROUP INDEX</u>	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	95.3%
10	75.3%
20	56.9%
40	46.7%
100	32.5%
200	27.6%

Atterberg Limits	
Plastic Limit	25
Liquid Limit	31
Plastic Index	6

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



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**LABORATORY TEST
RESULTS**

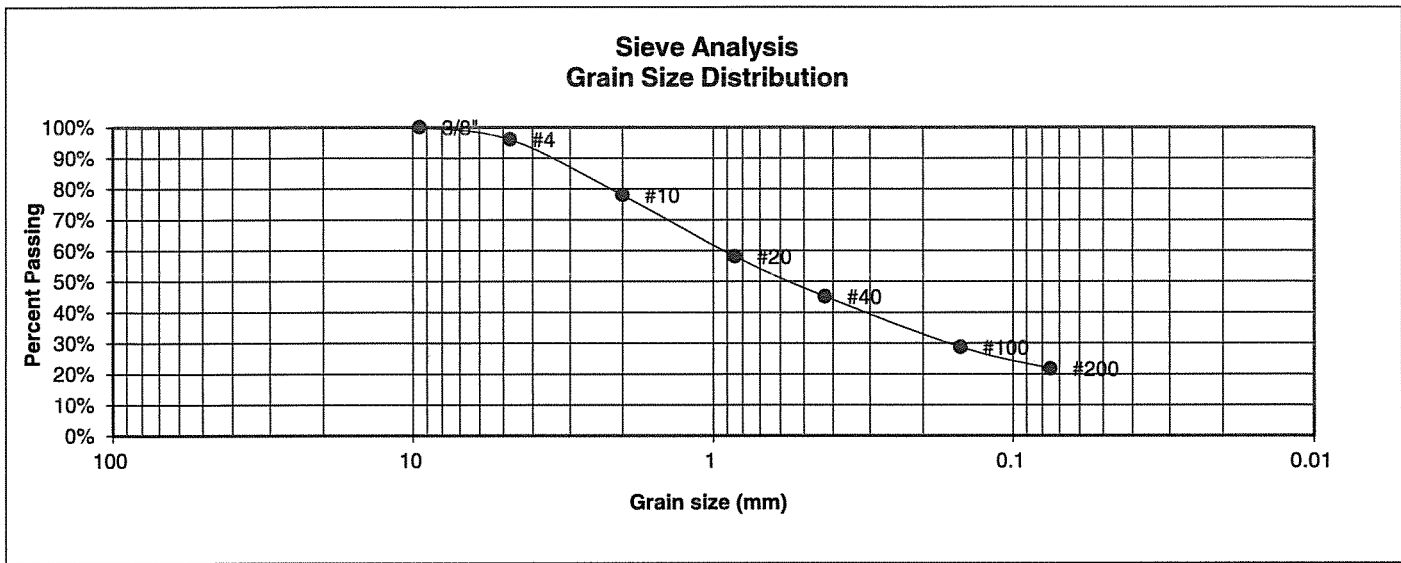
DRAWN:	DATE:	CHECKED:	DATE:
		DS	11/23/21

JOB NO.:

212745
FIG NO.:

B-5

UNIFIED CLASSIFICATION	SM	CLIENT	PROTERRA PROPERTIES
SOIL TYPE #	1	PROJECT	WINSOME, FILING 2
TEST BORING #	4	JOB NO.	212745
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	96.1%
10	78.0%
20	58.1%
40	45.2%
100	28.7%
200	21.7%

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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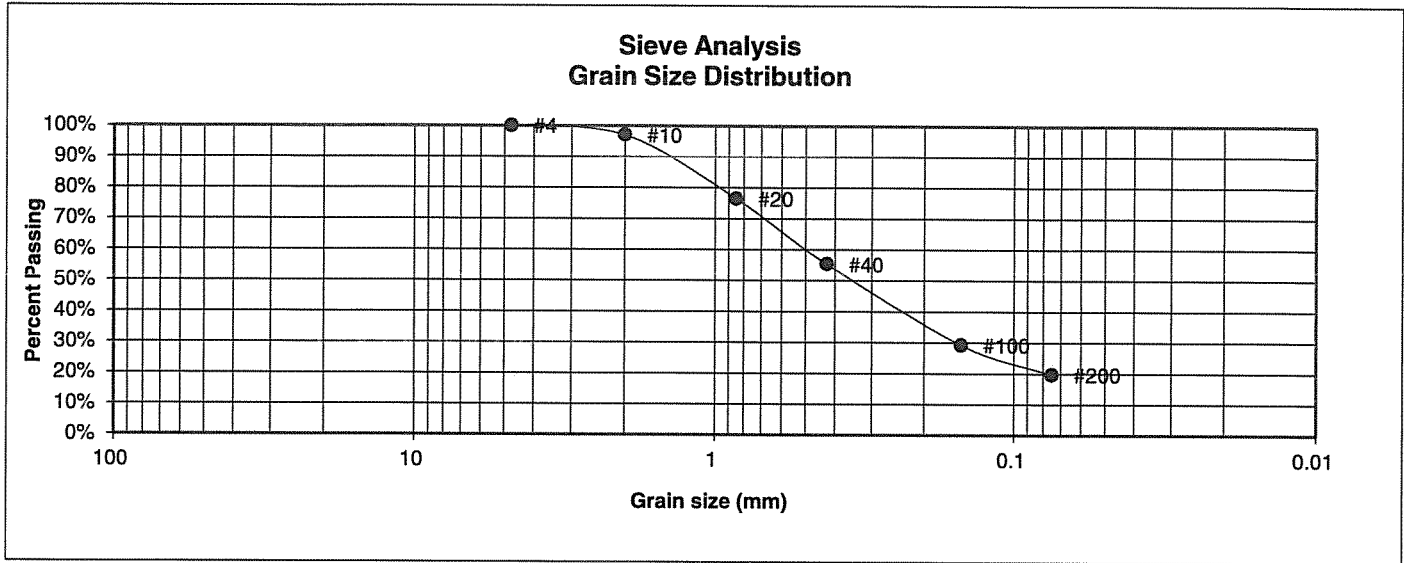
**LABORATORY TEST
RESULTS**

DRAWN:	DATE:	CHECKED:	DATE:
		DS	11/23/21

JOB NO.:

212745
FIG NO.:
B-6

<u>UNIFIED CLASSIFICATION</u>	SM	<u>CLIENT</u>	PROTERRA PROPERTIES
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	WINSOME, FILING 2
<u>TEST BORING #</u>	5	<u>JOB NO.</u>	212745
<u>DEPTH (FT)</u>	1-2	<u>TEST BY</u>	BL
<u>AASHTO CLASSIFICATION</u>	A-2-4	<u>GROUP INDEX</u>	0



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	97.1%
20	76.5%
40	55.3%
100	29.2%
200	19.7%

<u>Atterberg Limits</u>	
Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

<u>Swell</u>	
Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	



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**LABORATORY TEST
RESULTS**

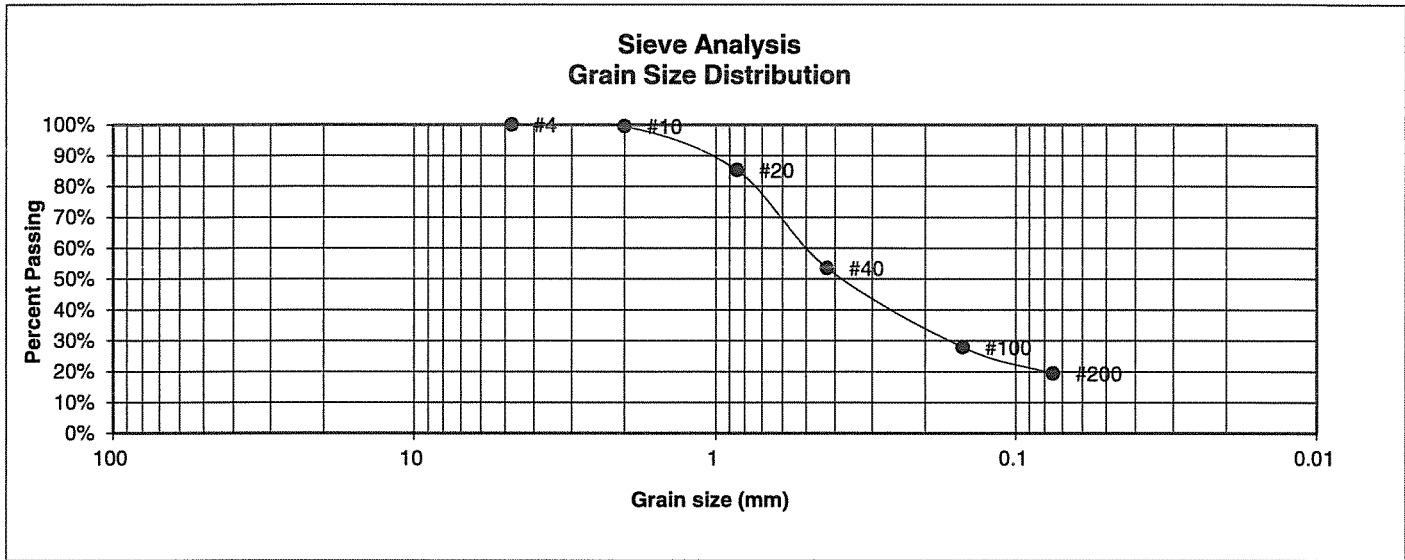
DRAWN:	DATE:	CHECKED:	DATE:
		DS	11/23/21

JOB NO.:

212745
FIG NO.:

B-7

<u>UNIFIED CLASSIFICATION</u>	SM	<u>CLIENT</u>	PROTERRA PROPERTIES
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	WINSOME, FILING 2
<u>TEST BORING #</u>	11	<u>JOB NO.</u>	212745
<u>DEPTH (FT)</u>	1-2	<u>TEST BY</u>	BL
<u>AASHTO CLASSIFICATION</u>	A-2-4	<u>GROUP INDEX</u>	0



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.5%
20	85.3%
40	53.5%
100	27.9%
200	19.4%

<u>Atterberg Limits</u>	
Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP
<u>Swell</u>	
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	11/23/21

JOB NO.:

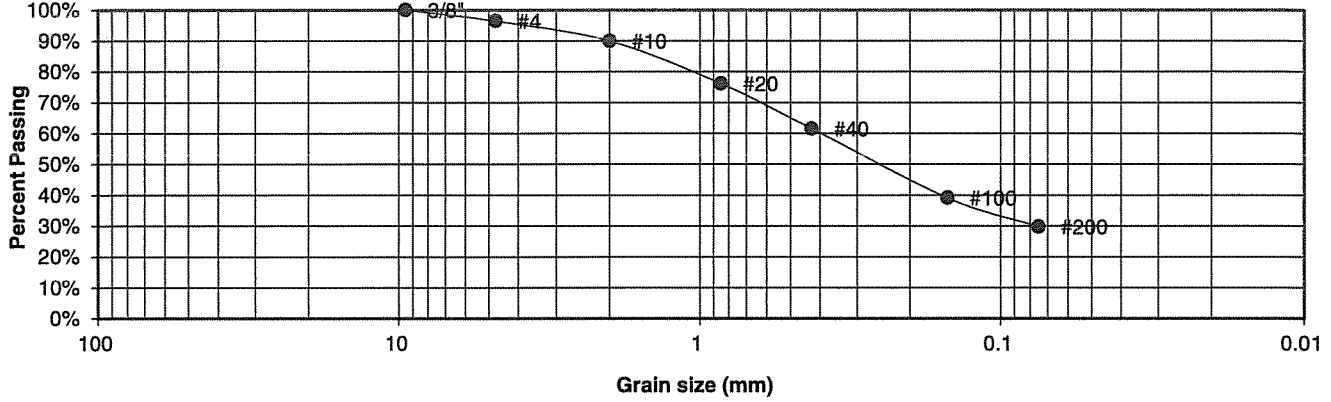
212745
FIG NO.:

9-8

UNIFIED CLASSIFICATION SM
 SOIL TYPE # 1
 TEST BORING # 13
 DEPTH (FT) 1-2
 AASHTO CLASSIFICATION A-2-4

CLIENT PROTERRA PROPERTIES
 PROJECT WINSOME, FILING 2
 JOB NO. 212745
 TEST BY BL
 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	96.5%
10	90.0%
20	76.2%
40	61.5%
100	39.1%
200	29.8%

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: D3	DATE: 11/23/21
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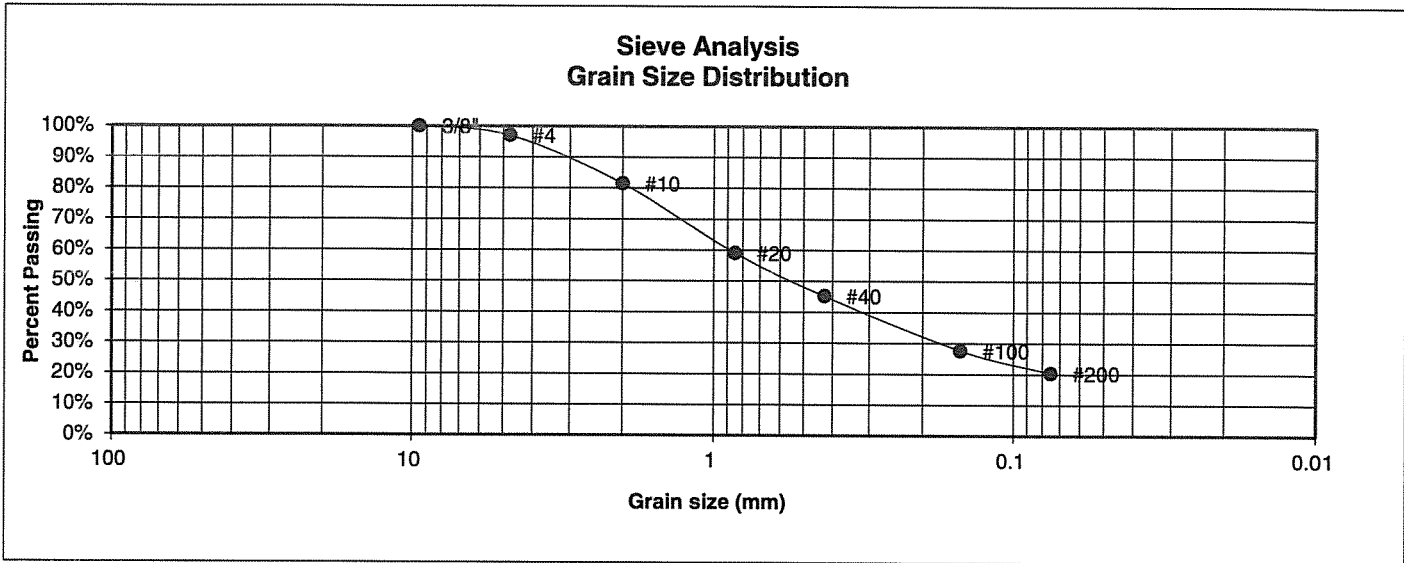
JOB NO.:

212745

FIG NO.:

B-9

UNIFIED CLASSIFICATION	SM	CLIENT	PROTERRA PROPERTIES
SOIL TYPE #	1	PROJECT	WINSOME, FILING 2
TEST BORING #	14	JOB NO.	212745
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	97.0%
10	81.5%
20	59.1%
40	45.2%
100	27.6%
200	20.3%

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)	



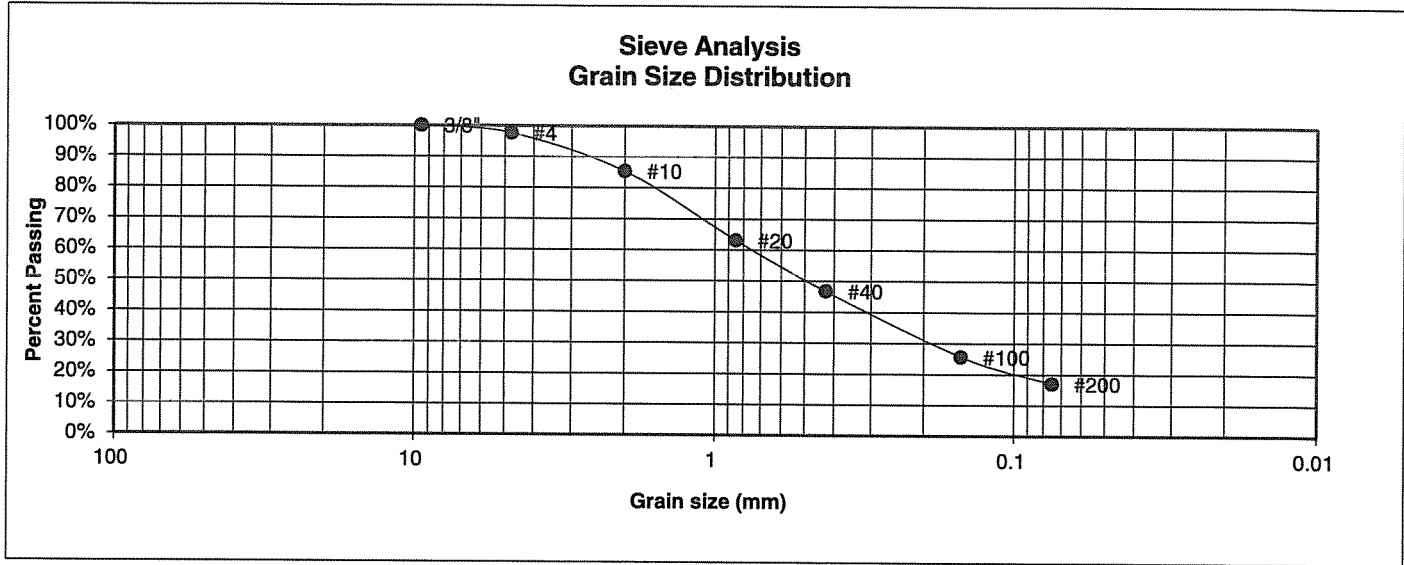
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**LABORATORY TEST
RESULTS**

DRAWN:	DATE:	CHECKED: Ds	DATE: 11/23/21
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JOB NO.:
212745
FIG NO.:
B-10

<u>UNIFIED CLASSIFICATION</u>	SM	<u>CLIENT</u>	PROTERRA PROPERTIES
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	WINSOME, FILING 2
<u>TEST BORING #</u>	15	<u>JOB NO.</u>	212745
<u>DEPTH (FT)</u>	1-2	<u>TEST BY</u>	BL
<u>AASHTO CLASSIFICATION</u>	A-1-b	<u>GROUP INDEX</u>	0



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	97.6%
10	85.4%
20	63.1%
40	46.8%
100	25.6%
200	17.0%

<u>Atterberg Limits</u>	
Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

<u>Swell</u>	
Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	



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**LABORATORY TEST
RESULTS**

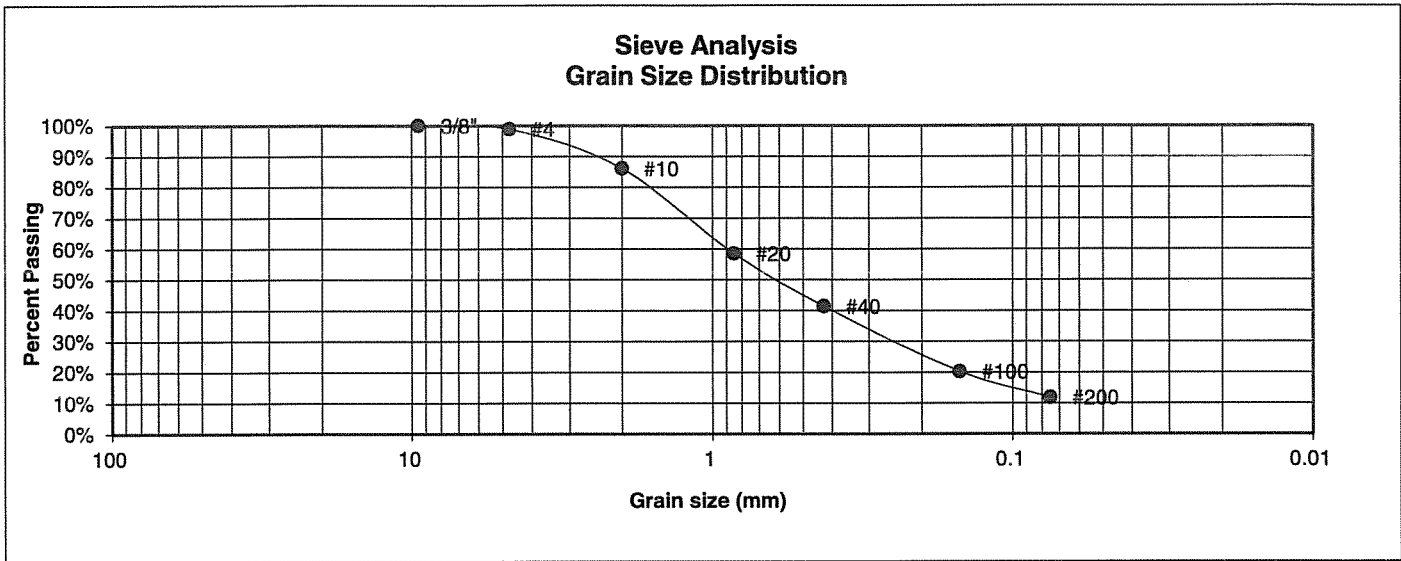
<u>DRAWN:</u>	<u>DATE:</u>	<u>CHECKED:</u>	<u>DATE:</u>
		DJ	11/22/21

JOB NO.:

212745
FIG NO.:

B-11

UNIFIED CLASSIFICATION	SM-SW	CLIENT	PROTERRA PROPERTIES
SOIL TYPE #	1	PROJECT	WINSOME, FILING 2
TEST BORING #	16	JOB NO.	212745
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	98.9%
10	86.2%
20	58.5%
40	41.4%
100	20.3%
200	11.8%

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**

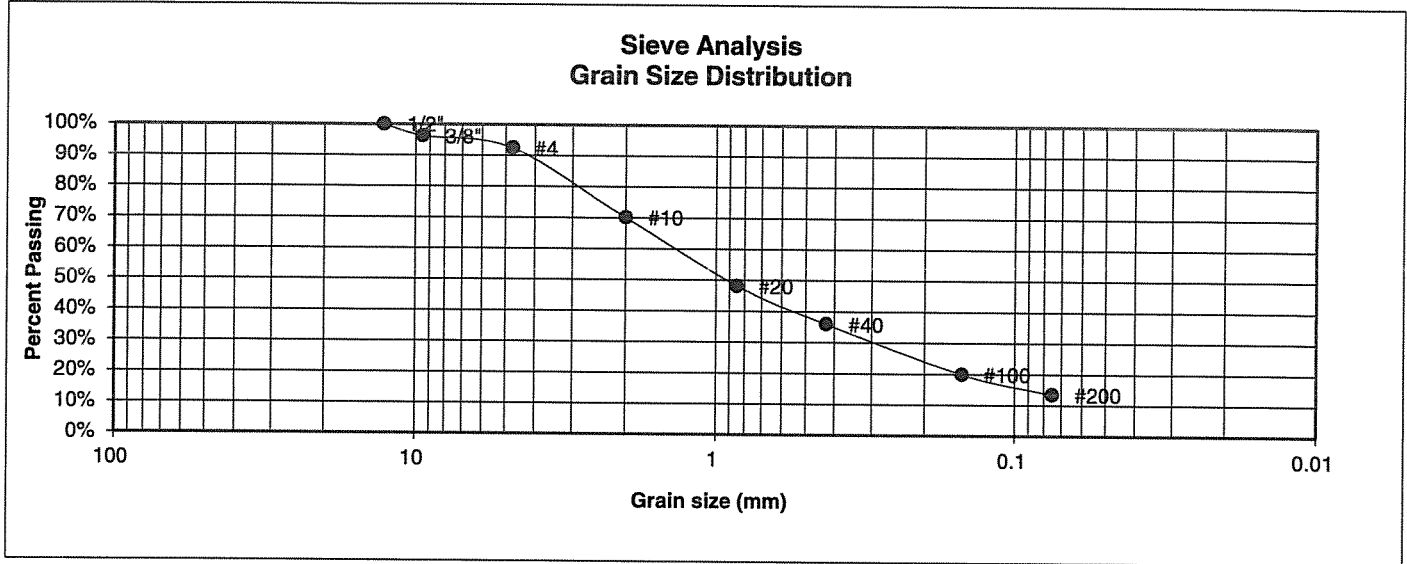
DRAWN:	DATE:	CHECKED:	DATE:
		DS	11/23/21

JOB NO.:

212745
FIG NO.:

B-12

<u>UNIFIED CLASSIFICATION</u>	SM	<u>CLIENT</u>	PROTERRA PROPERTIES
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	WINSOME, FILING 2
<u>TEST BORING #</u>	17	<u>JOB NO.</u>	212745
<u>DEPTH (FT)</u>	1-2	<u>TEST BY</u>	BL
<u>AASHTO CLASSIFICATION</u>	A-1-b	<u>GROUP INDEX</u>	0



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	96.2%
4	92.4%
10	70.1%
20	48.2%
40	35.9%
100	19.9%
200	13.4%

<u>Atterberg Limits</u>	
Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

<u>Swell</u>	
Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	



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**LABORATORY TEST
RESULTS**

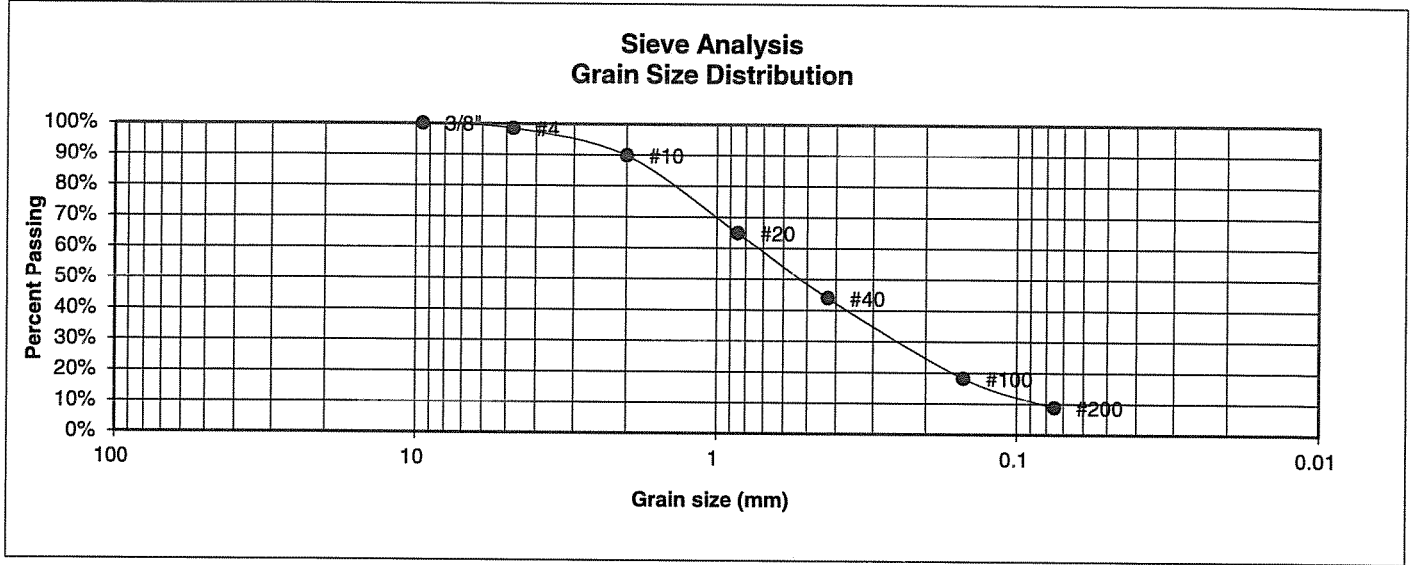
DRAWN:	DATE:	CHECKED:	DATE:
		DS	11/23/21

JOB NO.:

212745
FIG NO.:

B-13

<u>UNIFIED CLASSIFICATION</u>	SM-SW	<u>CLIENT</u>	PROTERRA PROPERTIES
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	WINSOME, FILING 2
<u>TEST BORING #</u>	18	<u>JOB NO.</u>	212745
<u>DEPTH (FT)</u>	1-2	<u>TEST BY</u>	BL
<u>AASHTO CLASSIFICATION</u>	A-1-b	<u>GROUP INDEX</u>	0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	98.5%
10	89.8%
20	64.8%
40	43.9%
100	18.1%
200	8.8%

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)



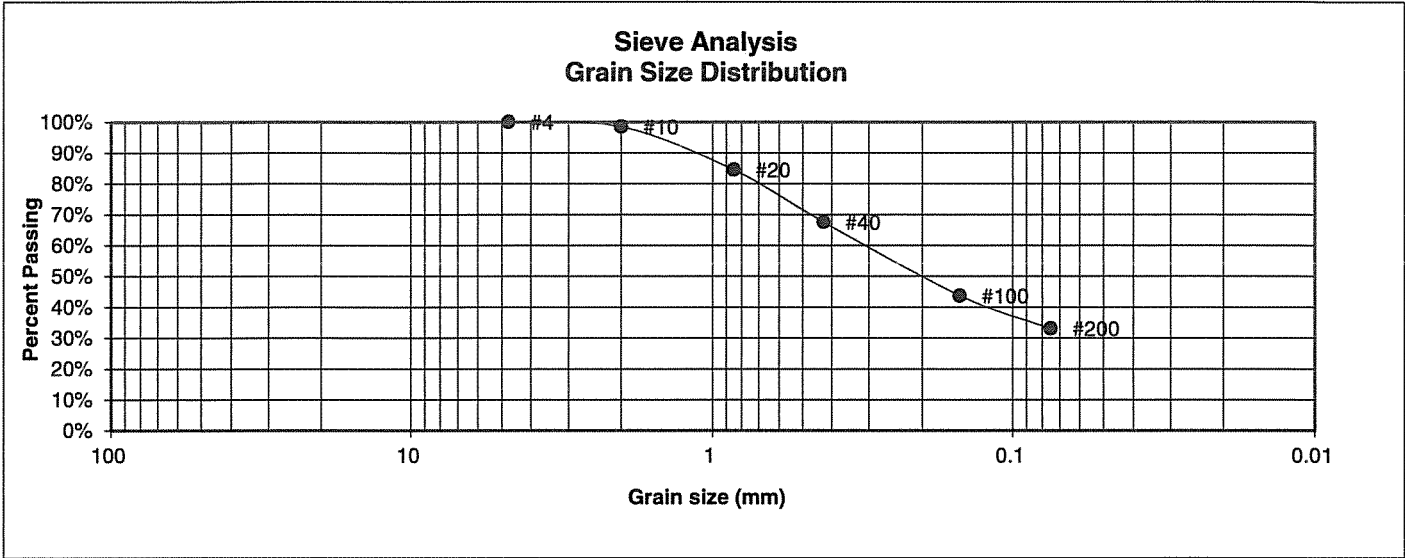
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**LABORATORY TEST
RESULTS**

DRAWN:	DATE:	CHECKED:	DATE:
		DS	11/23/21

JOB NO.:
212745
FIG NO.:
B-06

UNIFIED CLASSIFICATION	SM	CLIENT	PROTERRA PROPERTIES
SOIL TYPE #	1	PROJECT	WINSOME, FILING 2
TEST BORING #	19	JOB NO.	212745
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"	
4	100.0%
10	98.5%
20	84.5%
40	67.6%
100	43.7%
200	33.1%

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**

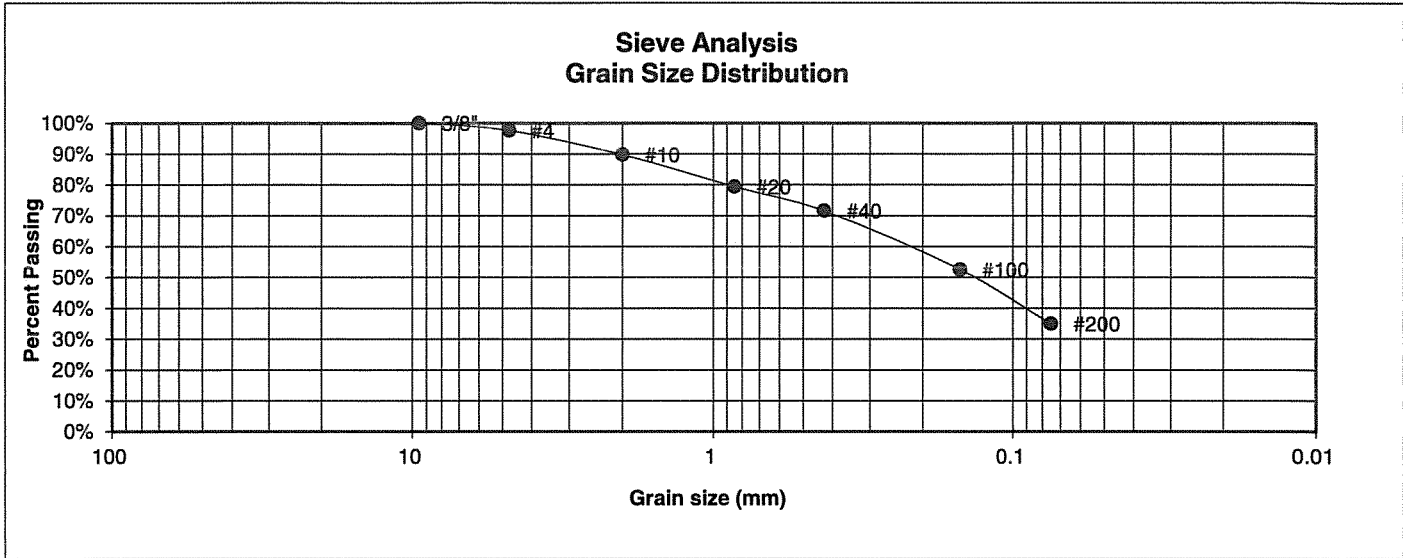
DRAWN:	DATE:	CHECKED:	DATE:
		DS	11/2/21

JOB NO.:

212745
FIG NO.:

B-15

UNIFIED CLASSIFICATION	SM	CLIENT	PROTERRA PROPERTIES
SOIL TYPE #	1	PROJECT	WINSOME, FILING 2
TEST BORING #	6	JOB NO.	212745
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	97.7%
10	89.8%
20	79.4%
40	71.5%
100	52.5%
200	34.9%

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**

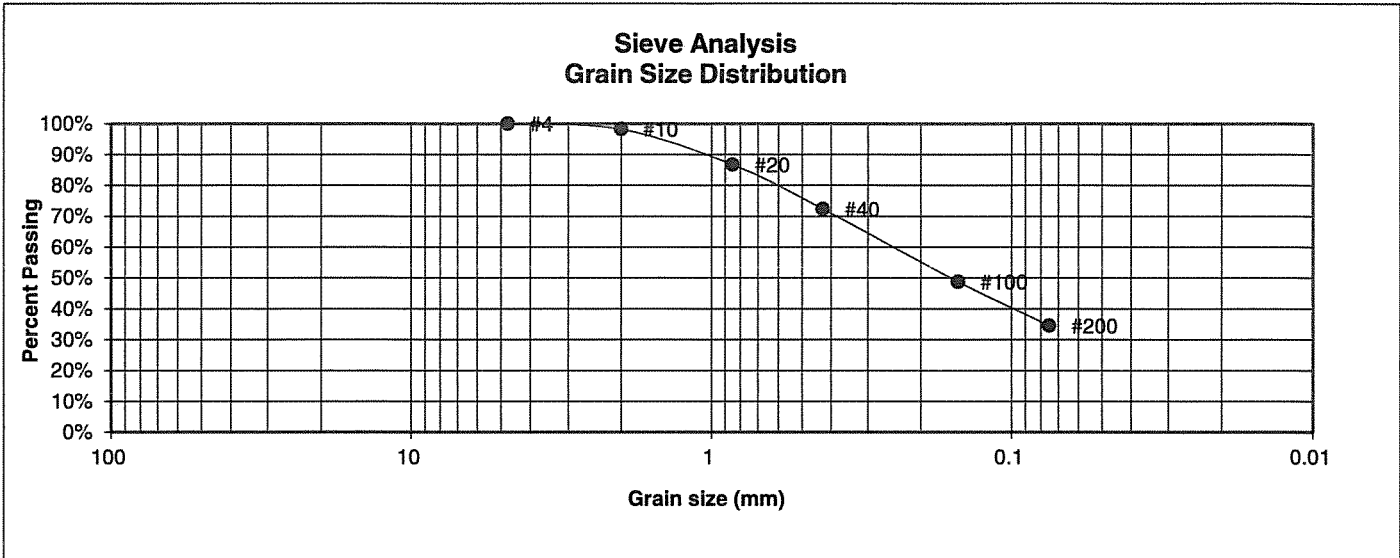
DRAWN:	DATE:	CHECKED:	DATE:
		DS	12-1-21

JOB NO.:

212745
FIG NO.:

B-16

UNIFIED CLASSIFICATION	SC	CLIENT	PROTERRA PROPERTIES
SOIL TYPE #	1	PROJECT	WINSOME, FILING 2
TEST BORING #	7	JOB NO.	212745
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"	
4	100.0%
10	98.2%
20	86.7%
40	72.3%
100	48.7%
200	34.5%

Atterberg Limits	
Plastic Limit	20
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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**LABORATORY TEST
RESULTS**

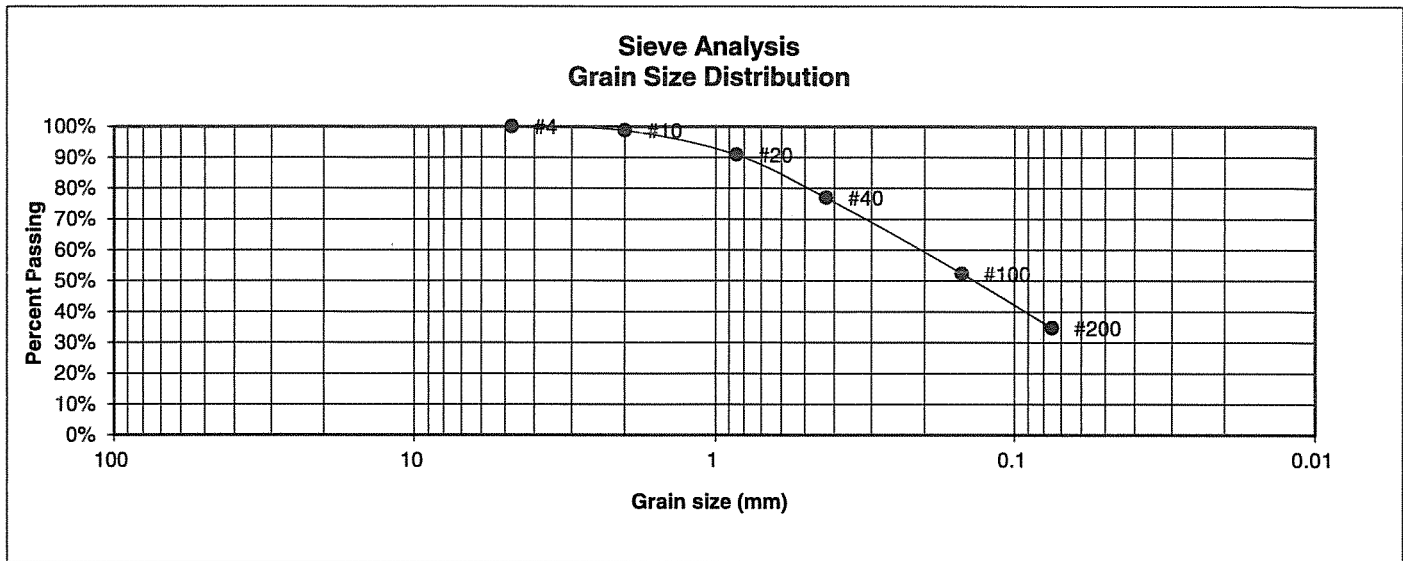
DRAWN:	DATE:	CHECKED:	DATE:
		<i>DS</i>	12/1/21

JOB NO.:

212745
FIG NO.:

B-17

UNIFIED CLASSIFICATION	SM	CLIENT	PROTERRA PROPERTIES
SOIL TYPE #	1	PROJECT	WINSOME, FILING 2
TEST BORING #	9	JOB NO.	212745
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"	
4	100.0%
10	98.7%
20	90.9%
40	77.0%
100	52.3%
200	34.7%

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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**LABORATORY TEST
RESULTS**

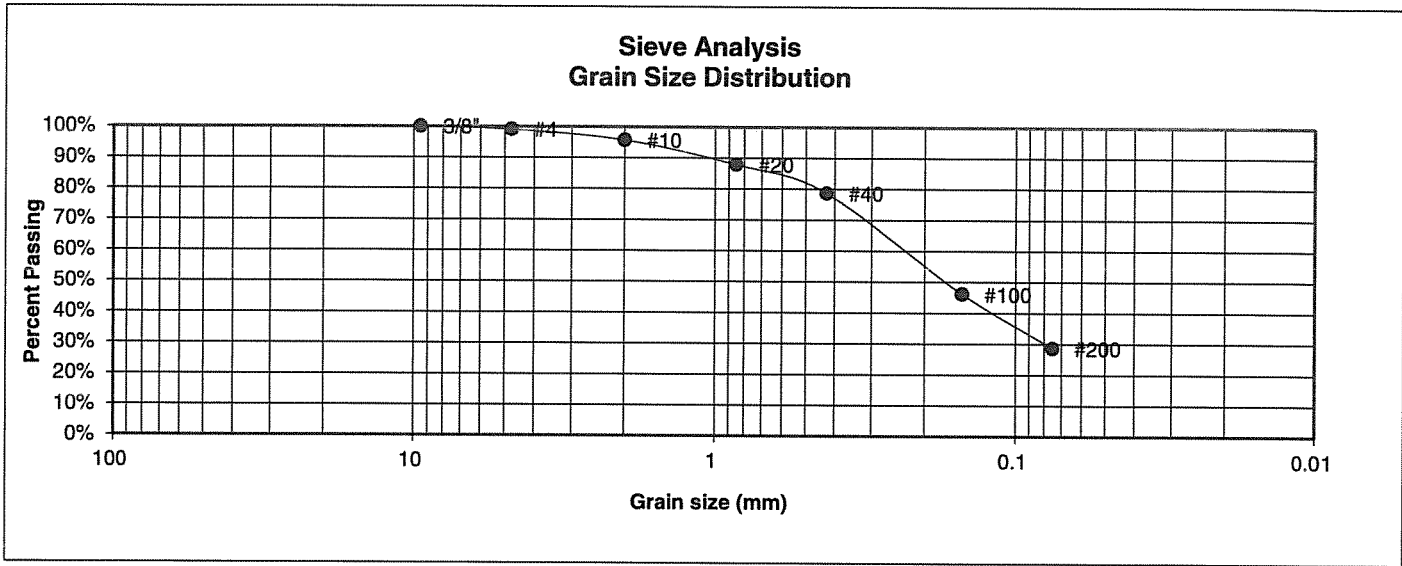
DRAWN:	DATE:	CHECKED:	DATE:
		DS	12/1/21

JOB NO.:

212745
FIG NO.:

B-18

<u>UNIFIED CLASSIFICATION</u>	SM	<u>CLIENT</u>	PROTERRA PROPERTIES
<u>SOIL TYPE #</u>	2	<u>PROJECT</u>	WINSOME, FILING 2
<u>TEST BORING #</u>	4	<u>JOB NO.</u>	212745
<u>DEPTH (FT)</u>	10	<u>TEST BY</u>	BL
<u>AASHTO CLASSIFICATION</u>	A-2-4	<u>GROUP INDEX</u>	0



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.0%
10	95.7%
20	87.9%
40	78.7%
100	46.1%
200	28.7%

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)



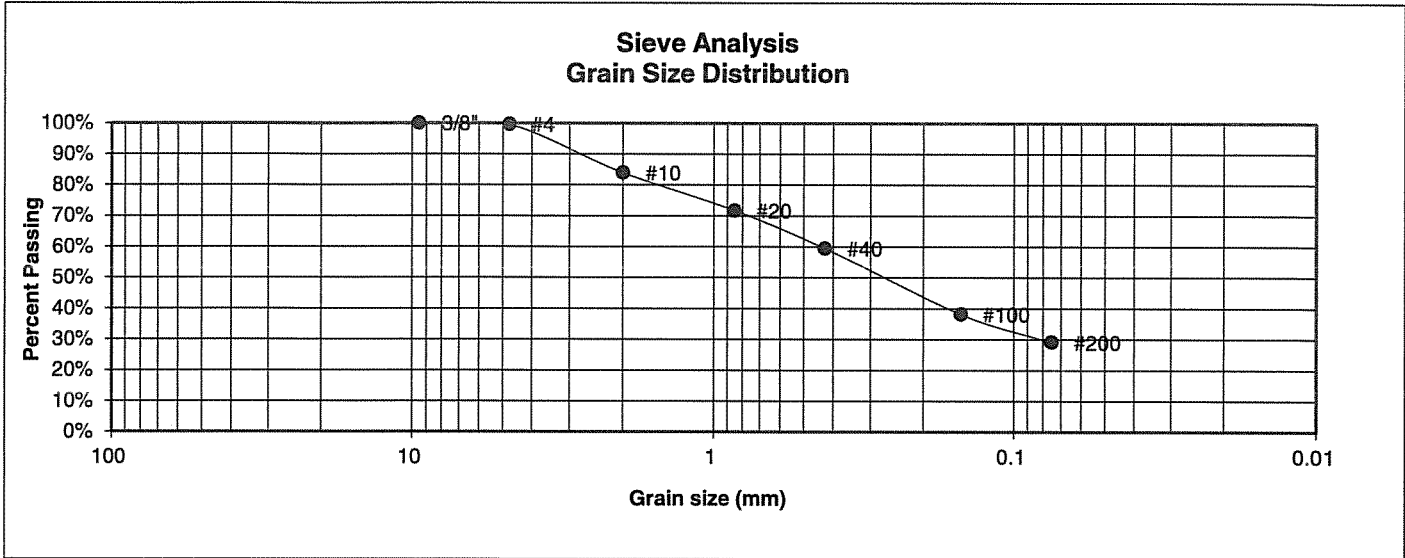
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 505 ELKTON DRIVE
 COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		DS	11/23/21

JOB NO.:
 212745
 FIG NO.:
 B-19

<u>UNIFIED CLASSIFICATION</u>	SM	<u>CLIENT</u>	PROTERRA PROPERTIES
<u>SOIL TYPE #</u>	2	<u>PROJECT</u>	WINSOME, FILING 2
<u>TEST BORING #</u>	10	<u>JOB NO.</u>	212745
<u>DEPTH (FT)</u>	1-2	<u>TEST BY</u>	BL
<u>AASHTO CLASSIFICATION</u>	A-2-4	<u>GROUP INDEX</u>	0



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.6%
10	83.9%
20	71.7%
40	59.5%
100	38.1%
200	29.1%

<u>Atterberg Limits</u>	
Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

<u>Swell</u>	
Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	



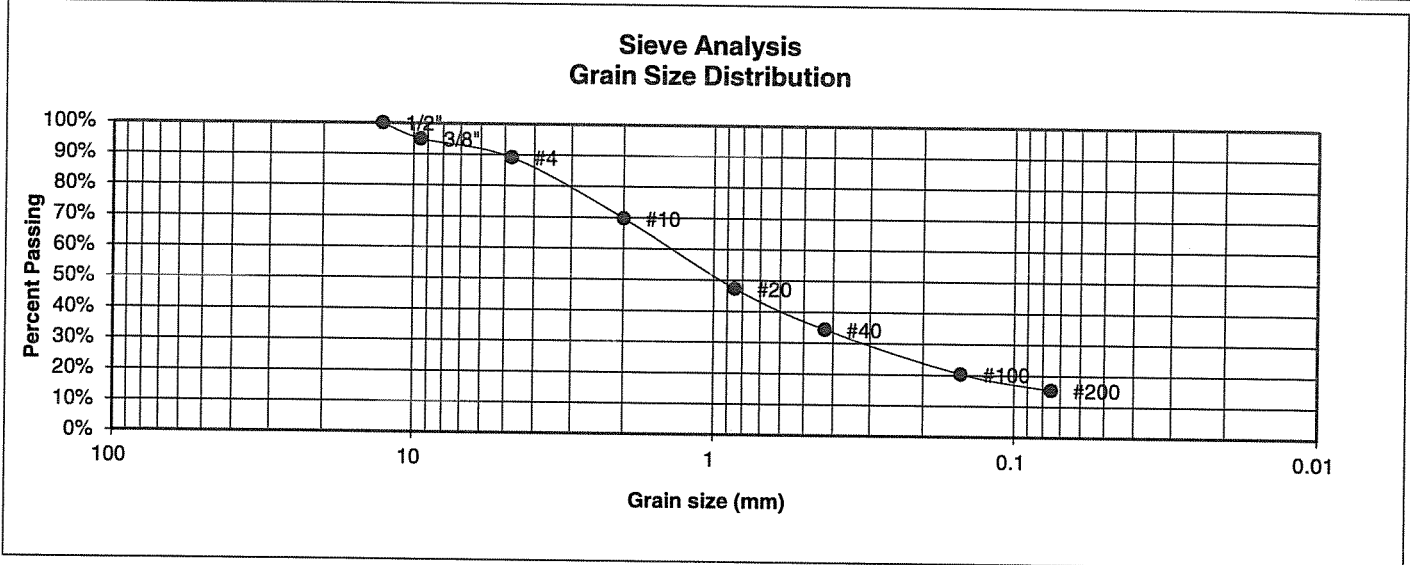
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**LABORATORY TEST
RESULTS**

DRAWN:	DATE:	CHECKED: DS	DATE: 11/22/21
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JOB NO.:
212745
FIG NO.:
B-20

UNIFIED CLASSIFICATION	SM	CLIENT	PROTERRA PROPERTIES
SOIL TYPE #	2	PROJECT	WINSOME, FILING 2
TEST BORING #	12	JOB NO.	212745
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"	95.0%
4	89.1%
10	69.7%
20	47.3%
40	34.3%
100	20.3%
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)	



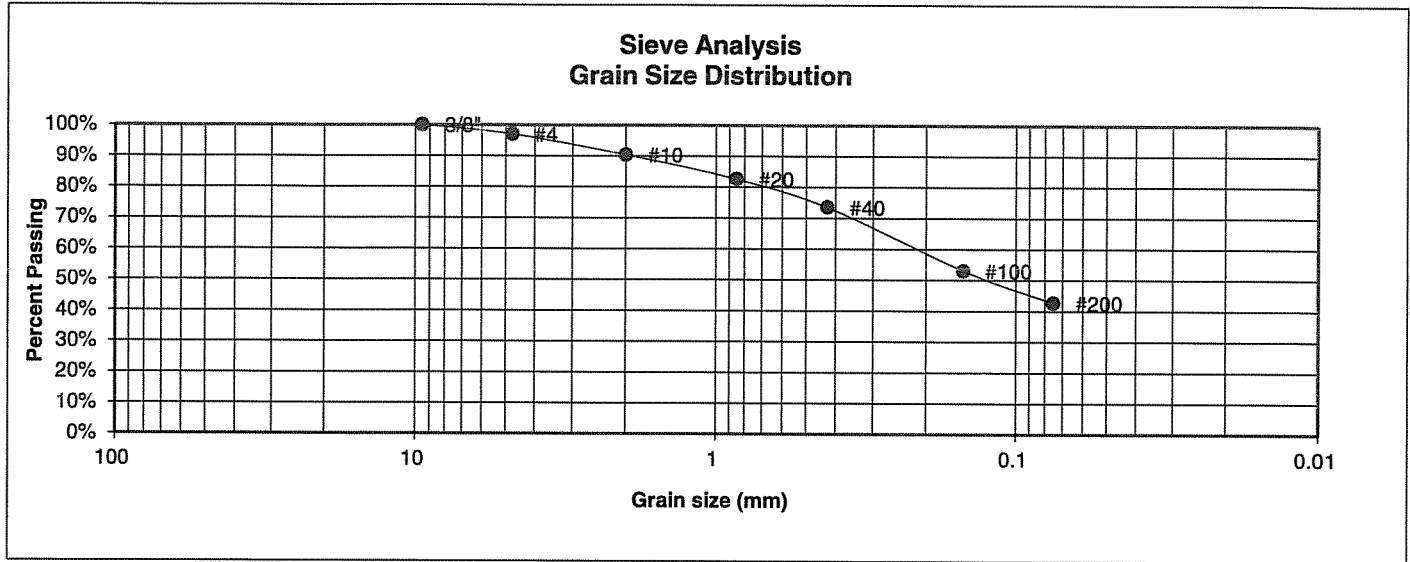
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**LABORATORY TEST
RESULTS**

DRAWN:	DATE:	CHECKED:	DATE:
		DS	11/23/21

JOB NO.:
212745
FIG NO.:
B-21

<u>UNIFIED CLASSIFICATION</u>	SC	<u>CLIENT</u>	PROTERRA PROPERTIES
<u>SOIL TYPE #</u>	3	<u>PROJECT</u>	WINSOME, FILING 2
<u>TEST BORING #</u>	8	<u>JOB NO.</u>	212745
<u>DEPTH (FT)</u>	1-2	<u>TEST BY</u>	BL
<u>AASHTO CLASSIFICATION</u>	A-6	<u>GROUP INDEX</u>	1



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	97.0%
10	90.4%
20	82.6%
40	73.5%
100	53.0%
200	42.6%

<u>Atterberg Limits</u>	
Plastic Limit	15
Liquid Limit	31
Plastic Index	16

<u>Swell</u>	
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	12/1/21

JOB NO.:

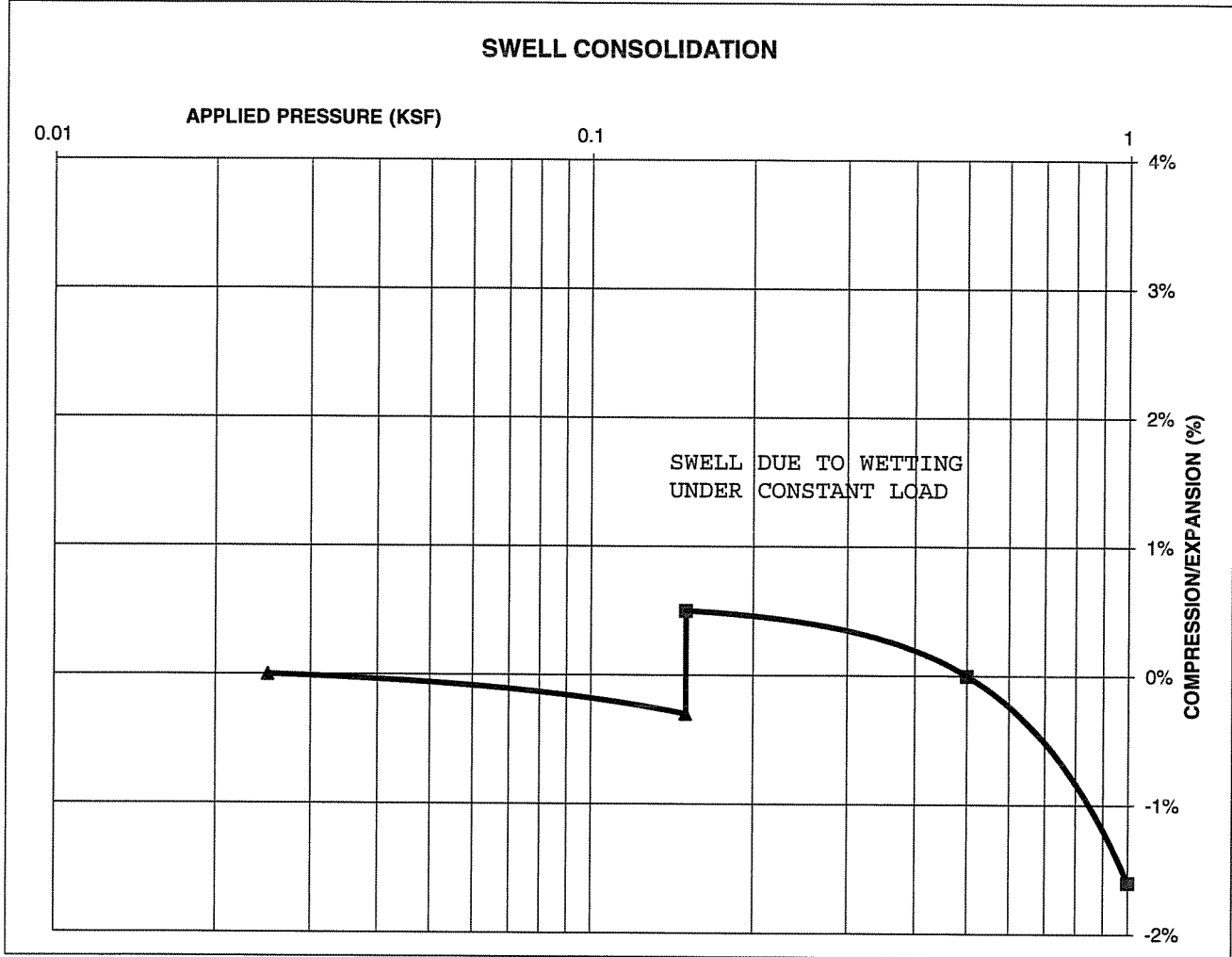
212745
FIG NO.:

622

CONSOLIDATION TEST RESULTS

TEST BORING #	7	DEPTH(ft)	1-2
DESCRIPTION	SC	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			114
NATURAL MOISTURE CONTENT			11.2%
SWELL/CONSOLIDATION (%)			0.8%

JOB NO. 212745
 CLIENT PROTERRA PROPERTIES
 PROJECT WINSOME, FILING 2



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**SWELL CONSOLIDATION
TEST RESULTS**

DRAWN:

DATE:

CHECKED:

DATE:

DS 12/1/21

JOB NO.:

212745

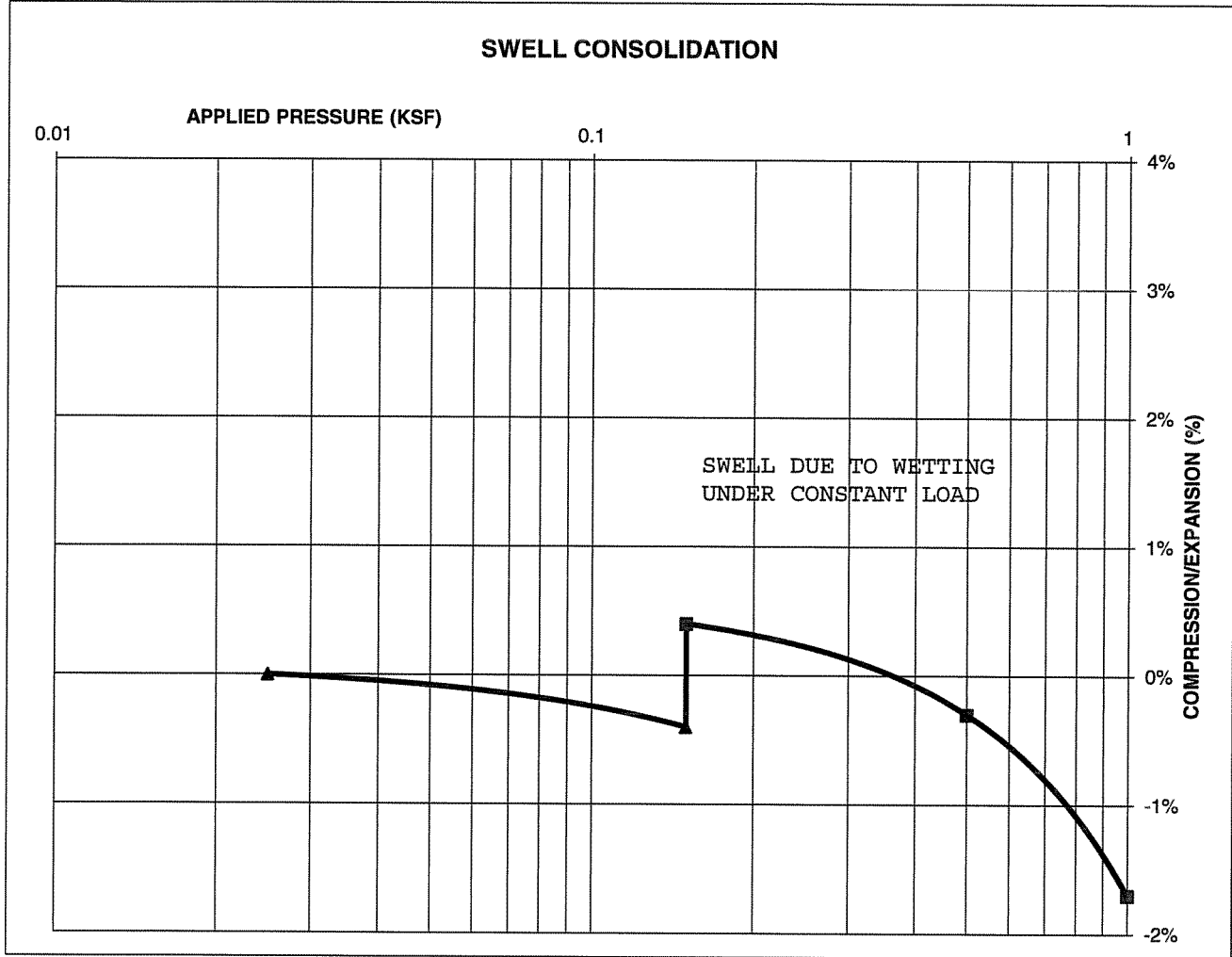
FIG NO.:

B-23

CONSOLIDATION TEST RESULTS

TEST BORING #	8	DEPTH(ft)	1-2
DESCRIPTION	SC	SOIL TYPE	3
NATURAL UNIT DRY WEIGHT (PCF)	114		
NATURAL MOISTURE CONTENT	11.3%		
SWELL/CONSOLIDATION (%)	0.8%		

JOB NO. 212745
 CLIENT PROTERRA PROPERTIES
 PROJECT WINSOME, FILING 2



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**SWELL CONSOLIDATION
 TEST RESULTS**

DRAWN:

DATE:

CHECKED:

DATE:

DS

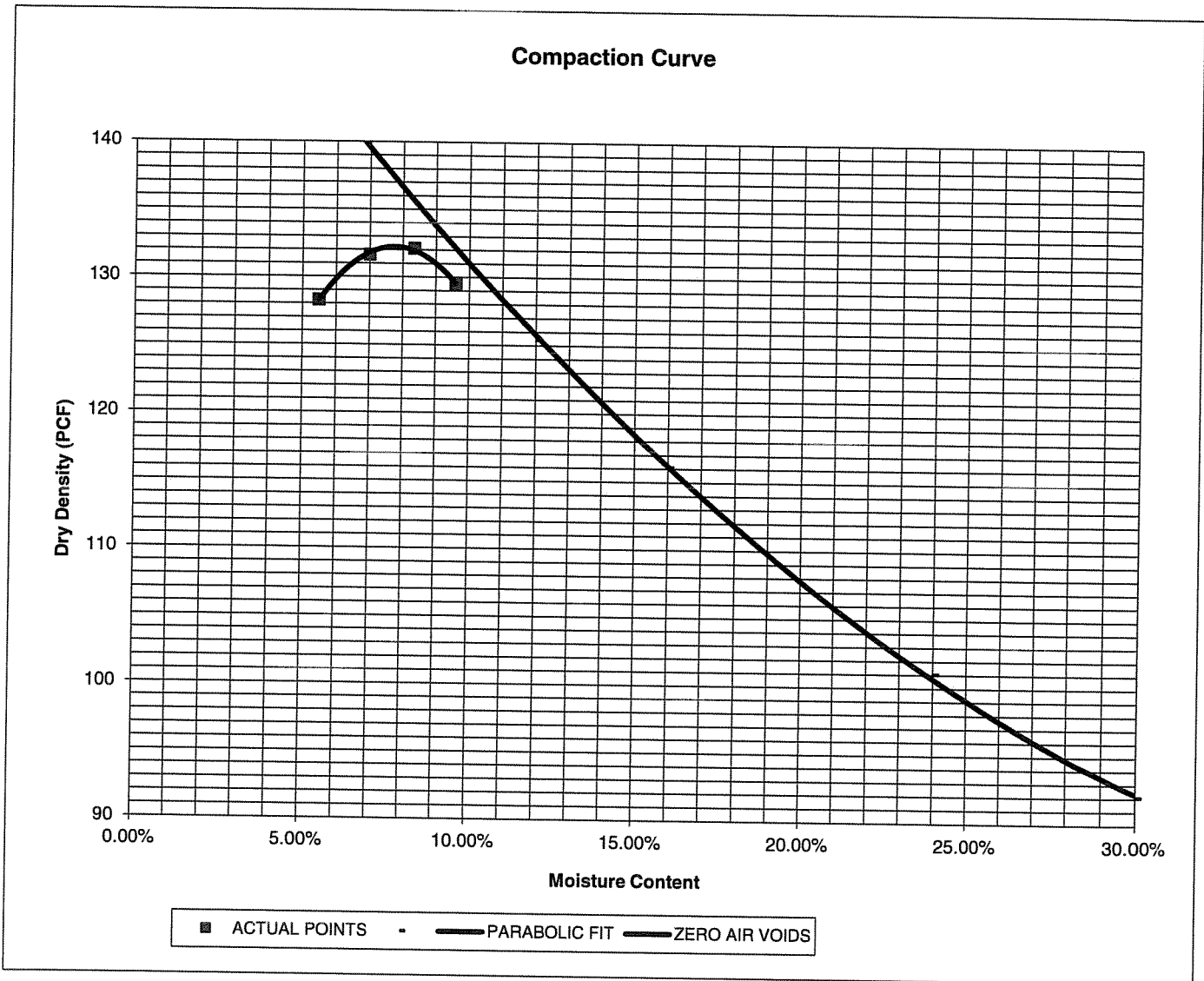
12/1/14

JOB NO.:
 212745

FIG NO.:
B-24

PROJECT	WINSOME, FILING 2	CLIENT	PROTERRA PROPERTIES
SAMPLE LOCATION	TB-15 @ 0-3'	JOB NO.	212745
SOIL DESCRIPTION	SAND, SILTY, BROWN	DATE	10/28/21

IDENTIFICATION	SM	COMPACTION TEST #	1
TEST DESIGNATION / METHOD	ASTM D-1557-A	TEST BY	BC
MAXIMUM DRY DENSITY (PCF)	132.1	OPTIMUM MOISTURE	7.9%



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MOISTURE DENSITY RELATION

DRAWN:	DATE:	CHECKED: <i>DS</i>	DATE: <i>11/22/21</i>
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JOB NO.:
212745
FIG NO.:
B-26

CBR TEST LOAD DATA

JOB NO: 212745
 CLIENT: PROTERRA PROPERTIES
 PROJECT: WINSOME, FILING 2
 SOIL TYPE: 1

PISTON		PISTON		10 BLOWS		25 BLOWS		56 BLOWS	
DIAMETER (cm)		AREA (in ²)		MOLD # 1		MOLD # 2		MOLD # 3	
DEPTH (INCHES)		LOAD(LBS)	STRESS (PSI)	LOAD(LBS)	STRESS (PSI)	LOAD(LBS)	STRESS (PSI)	LOAD(LBS)	STRESS (PSI)
4.958		2.993							
0.000		0	0.00	0	0.00	0	0.00	0	0.00
0.025		345	115.29	206	68.84	642	214.54		
0.050		415	138.68	377	125.98	1037	346.53		
0.075		457	152.71	460	153.72	1336	446.45		
0.100		520	173.77	645	215.54	1689	564.41		
0.125		590	197.16	775	258.98	2186	730.49		
0.150		666	222.56	896	299.41	2665	890.56		
0.175		726	242.61	1015	339.18	3090	1032.58		
0.200		806	269.34	1213	405.35	3752	1253.80		
0.300		947	316.46	1565	522.97	4853	1621.72		
0.400		1122	374.94	1879	627.90	5473	1828.90		
0.500		1307	436.76	2197	734.17	6000	2005.01		

FINAL MOISTURE CONTENT

	MOLD # 1	MOLD # 2	MOLD # 3
CAN #	349	340	117
WT. CAN	8.64	8.54	8.44
WT. CAN+WET	189.88	183.44	134.41
WT. CAN+DRY	167.66	164.51	121.03
WT. H2O	22.22	18.93	13.38
WT. DRY SOIL	159.02	155.97	112.59
MOISTURE CONTENT	13.97%	12.14%	11.88%

WET DENSITY (PCF)	131.3	133.5	140.2
DRY DENSITY (PCF)	121.7	123.7	129.9

BEARING RATIO 17.38 21.55 56.44

90% OF DRY DENSITY 118.9
 95% OF DRY DENSITY 125.5

BEARING RATIO AT 90% OF MAX	11.78 ~ R VALUE	35
BEARING RATIO AT 95% OF MAX	31.49 ~ R VALUE	74

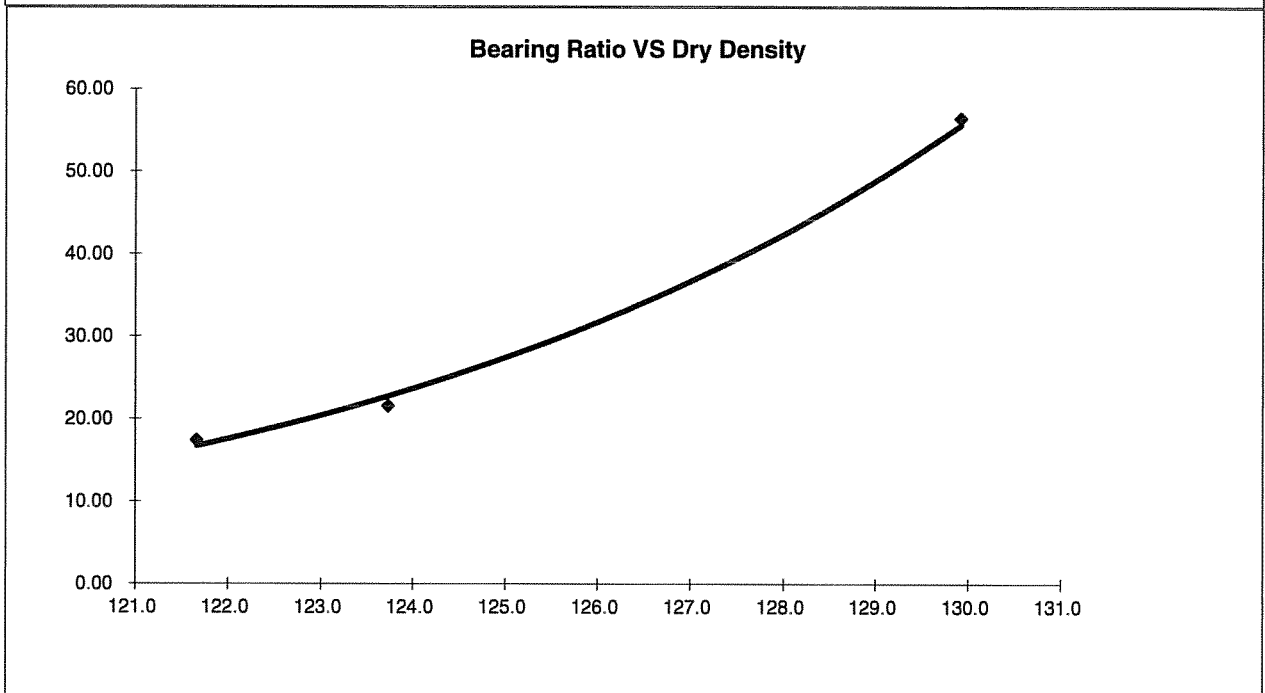
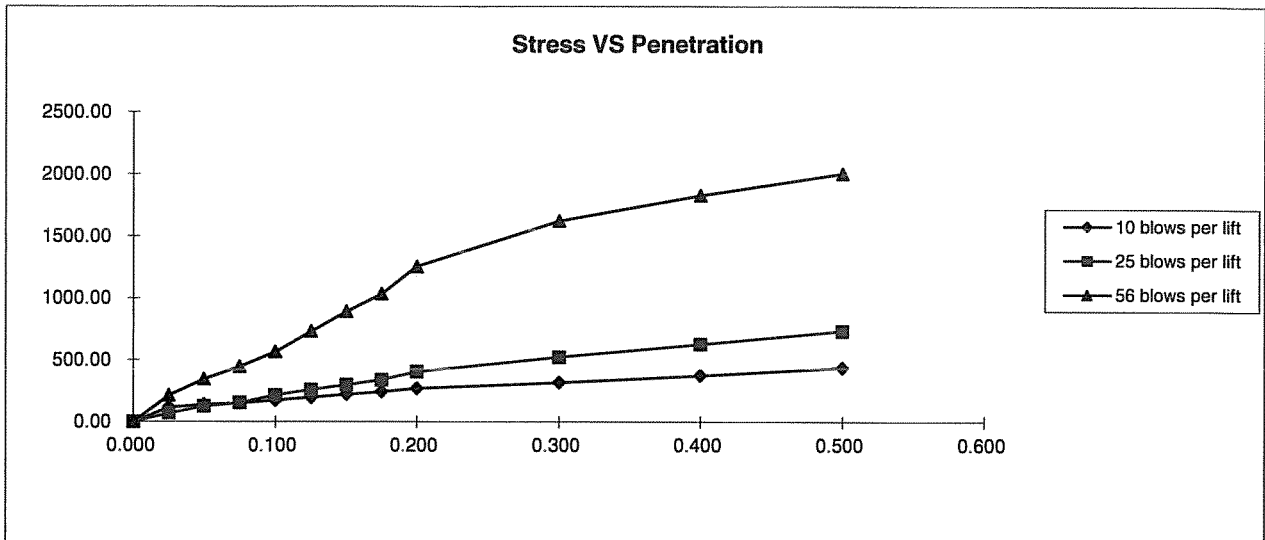


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CBR TEST DATA

DRAWN:	DATE:	CHECKED:	DATE:
		TS	11/23/21

JOB NO.: 212745
 FIG NO.: B-27



BEARING RATIO AT 90% OF MAX	11.78 ~ R VALUE	35.00
BEARING RATIO AT 95% OF MAX	31.49 ~ R VALUE	74.00

JOB NO: 212745
SOIL TYPE: 1



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CALIFORNIA BEARING RATIO

DRAWN:

DATE:

CHECKED:

DATE:

DS

11/23/21

JOB NO.:

212745

FIG NO.:

B-28

APPENDIX C: Pavement Design Calculations

FLEXIBLE PAVEMENT DESIGN

DESIGN DATA

WINSOME SUBDIVISION - PHASE 2
SOIL TYPE 1 - RURAL LOCAL (CUL-DE-SAC)

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	$\Delta\psi$ =	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

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

Left	Right	Difference
4.56	4.56	0.0

Job No. 212745

Fig. No. C-1

DESIGN CALCULATIONS

DESIGN DATA

WINSOME SUBDIVISION - PHASE 2
SOIL TYPE 1 - RURAL LOCAL (CUL-DE-SAC)
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 N/A inches Full Depth

FOR ASPHALT + AGGREGATE BASE COURSE SECTION

Asphalt Thickness (t) = inches

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

RECOMMENDED ALTERNATIVES

1. 3.0 inches of Asphalt + 4.0 inches of Aggregate Base Course, or
2. N/A inches of Asphalt

Job No. 212745

Fig. No. C-2

DESIGN CALCULATIONS

RECYCLED CONCRETE

DESIGN DATA

WINSOME SUBDIVISION - FILING 2
RURAL LOCAL (CUL-DE-SAC)

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 - Recycled Concrete

$D_1 =$ 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 N/A inches Full Depth

FOR ASPHALT + RECYCLED CONCRETE BASE COURSE SECTION

Asphalt Thickness (t) = inches

$D_2 = ((WSN) - (t)(C_1))/C_2 = 1.3$ inches of Recycled Concrete
Base Course, use 4.0 inches

RECOMMENDED ALTERNATIVES

1. 3.0 inches of Asphalt + 4.0 inches of Recycled Concrete Base Course, or
2. N/A inches of Asphalt

Job No. 212745

Fig. No. C-3

FLEXIBLE PAVEMENT DESIGN

DESIGN DATA

WINSOME SUBDIVISION - FILING 2
SOIL TYPE 1 - RURAL LOCAL

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL (W_{18}) =	109,500
Hveem Stabilometer (R Value) Results:	R =	50
Standard Deviation	S_o =	0.45
Loss in Serviceability	$\Delta\psi$ =	2.5
Reliability	Reliability =	80
Reliability (z-statistic)	Z_R =	-0.84
Soil Resilient Modulus	M_R =	13168

Weighted Structural Number (WSN): ➔ WSN = 1.77

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

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

Left	Right	Difference
5.04	5.04	0.0

Job No. 212745

Fig. No. C-4

DESIGN CALCULATIONS

DESIGN DATA

WINSOME SUBDIVISION - FILING 2

SOIL TYPE 1 - RURAL LOCAL

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL = 109,500
Hveem Stabilometer (R Value) Results:	R = 50
Weighted Structural Number (WSN):	WSN = 1.77

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)

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

FOR ASPHALT + AGGREGATE BASE COURSE SECTION

Asphalt Thickness (t) = inches

$D_2 = ((WSN) - (t)(C_1))/C_2 = 0.1$ inches of Aggregate
Base Course, use 6.0

RECOMMENDED ALTERNATIVES

1. 4.0 inches of Asphalt + 6.0 inches of Aggregate Base Course, or
2. N/A inches of Asphalt

Job No. 212745

Fig. No. C-5

DESIGN CALCULATIONS

RECYCLED CONCRETE

DESIGN DATA

WINSOME SUBDIVISION - FILING 2

RURAL LOCAL (CUL-DE-SAC)

Equivalent (18 kip) Single Axle Load Applications (ESAL): ESAL = 109,500

Hveem Stabilometer (R Value) Results: R = 50

Weighted Structural Number (WSN): WSN = 1.77

DESIGN EQUATION

$$WSN = C_1D_1 + C_2D_2$$

$C_1 = 0.44$ Strength Coefficient - Hot Bituminous Asphalt

$C_2 = 0.11$ Strength Coefficient - Recycled Concrete

$D_1 =$ Depth of Asphalt (inches)

$D_2 =$ Depth of Base Course (inches)

FOR FULL DEPTH ASPHALT SECTION (CURRENTLY NOT ALLOWED)

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

Use N/A inches Full Depth

FOR ASPHALT + RECYCLED CONCRETE BASE COURSE SECTION

Asphalt Thickness (t) = inches

$D_2 = ((WSN) - (t)(C_1))/C_2 = 0.1$ inches of Recycled Concrete

Base Course, use 6.0 inches

RECOMMENDED ALTERNATIVES

1. 4.0 inches of Asphalt + 6.0 inches of Recycled Concrete Base Course, or
2. N/A inches of Asphalt

Job No. 212745

Fig. No. C-6