

October 27, 2016
Revised October 4, 2018

SR Land, LLC
20 Boulder Crescent, 2nd Floor
Colorado Springs, CO 80903



ENTECH
ENGINEERING, INC.

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

Attn: Chaz Collins

Re: Pavement Recommendations – 3rd Revision
Sterling Ranch, Phase No. 1
El Paso County, Colorado



Dear Mr. Collins:

As requested, Entech Engineering, Inc. has obtained samples of the pavement subgrade soils from the Sterling Ranch, Phase No. 1 subdivision. This letter presents the results of the laboratory testing and pavement recommendations for the roadway sections.

Project Description

The roadways for this project consist of sections of Marksheffel Road, Sterling Ranch Road, Dines Boulevard, and Wheatland Drive in northeast Colorado Springs, Colorado. The internal roadways in the subdivision were not tested and are beyond the scope of this investigation. Subsurface Soil Investigation and laboratory testing was performed in order to determine the pavement support characteristics of the soils. The limits of this investigation and the approximate locations of the test borings are presented in the Site/Test Boring Location Map, Figure 1.

Subgrade Conditions

Nineteen test borings were drilled along the above referenced roadways to depths of approximately 5 and 10 feet below the existing subgrade surface. The Test Boring Logs are presented in Appendix A. Sieve Analyses and Atterberg Limit testing were performed on the soil samples obtained from the test borings for the purpose of classification. The percent passing the No. 200 sieve for the soils at subgrade depth ranged from approximately 7.1 to 70.1 percent. The soils at the subgrade depths mostly consisted of slightly silty to silty sand with areas of silty to clayey sand and sandy clay fill overlying native sandy clay. Some areas of sandy claystone and silty sandstone are present at subgrade depths. The subgrade soils are generally underlain with silty to clayey sand, sandy clay, silty sandstone and sandy claystone. Based on the results of the laboratory testing, four general subgrade soil types were determined for the roadway sections at subgrade depths; very sandy clay fill (Soil Type 2), silty to slightly silty sand (Soil Type 3), sandy clay, (Soil Type 4) and silty to clayey sandstone (Soil Type 5). The soils classify as A-6, A-2-4, A-7-6, and A-1-b, based on the AASHTO Classification System. Groundwater was not encountered in any of the test borings.

The A-6 soils required Swell/Consolidation testing to determine their expansive characteristics. Swell/Consolidation Tests resulted in volume changes ranging from 0.3 to 1.9 percent. The Swell Test results indicate mitigation of the expansive potential of the subgrade soils will not be required for the roadway classifications.

APPROVAL CONDITIONS:

**Marksheffel Road and Sterling Ranch Road are not approved at this time.

Asphalt millings are not approved at this time.

Wheatland Drive is not approved south/west of Dines Blvd.

SF 16-013

California Bearing Ratio (CBR) testing was performed on four samples of the subgrade soils. The results of the CBR and classification testing are presented as follows and in Appendix B and on Table 1, attached. Based on the results of the classification and CBR testing, the soils on this site exhibit poor to good pavement support characteristics. The results of the CBR testing, classification testing, and Swell/Consolidation tests are presented in Appendix B and are summarized as follows:

Soil Type 2 – Very Sandy Clay Fill

CBR #1

R @ 90% = 1.0

R @ 95% = 6.0

Use R = 6.0 for design*

Classification Testing

Liquid Limit	34
Plasticity Index	15
Percent Passing 200	50.3
AASHTO Classification	A-6
Group Index	5
Unified Soils Classification	CL

Soil Type 3 – Silty Sand

CBR #2

R @ 90% = 1.0

R @ 95% = 35.0

Use R = 35.0 for design**

Classification Testing

Liquid Limit	NV
Plasticity Index	NP
Percent Passing 200	24.1
AASHTO Classification	A-1-b
Group Index	0
Unified Soils Classification	SM

Soil Type 4 – Clayey Sand

CBR #3

R @ 90% = 1.0

R @ 95% = 10.0

Use R = 6.0 for design*

Classification Testing

Liquid Limit	33
Plasticity Index	15
Percent Passing 200	35.6
AASHTO Classification	A-6
Group Index	1
Unified Soils Classification	SC

Soil Type 5 – Silty Sandstone

CBR #4

R @ 90% = 73.0

R @ 95% = 83.0

Use R = 50 for design

Classification Testing

Liquid Limit	20
Plasticity Index	2
Percent Passing 200	21.1
AASHTO Classification	A-1-b
Group Index	0
Unified Soils Classification	SM

* Due to the similarity of the Soil Type 2 and Soil Type 4, an R-value of 6 will be used for design of the A-6 soils. The clayey Type 1 soils will be grouped into this category. The Type 6 soils will be grouped into the Type 2/4 category due to similarity of the soils.

** The Type 1 silty sand fill and Type 5 silty sandstone will be grouped into the Type 3 category due to the similarity of the soils.

Pavement Design

CBR testing was used to determine pavement sections for the roadway sections. Pavement sections were determined utilizing Pavement Design Criteria for the El Paso County. Marksheffel Road classifies as a 4-lane principal arterial, which uses an 18K ESAL value of 5,256,000 for design purposes. Sterling Ranch Road, Dines Boulevard, and Wheatland Drive classify as collectors, which uses a 18K ESAL value of 821,000 for design. Pavement sections were determined for asphalt supported on aggregate base course, asphalt millings, and on recycled concrete.

Design parameters used in the pavement analysis for the roadway section are as follows:

Reliability - Principal Arterial	90%
Reliability - Collectors	85%
Standard Deviation	0.45
Resilient Modulus –	
Soil Type 2/4	3,126 psi
Soil Type 3	8,065 psi
Δpsi	2.5
“R” Value Subgrade –	
Soil Type 2/4	6
Soil Type 3	35
Hot Bituminous Pavement	0.44
Aggregate Base Course	0.11
Asphalt Millings	0.07
Recycled Concrete	0.09

The pavement design nomographs and calculations are presented in Appendix C. Pavement section alternatives for the roadway sections are presented below. Any additional grading may result in subgrade soils with different support characteristics. The following pavement sections should be re-evaluated if additional grading is performed.

Marksheffel Road – Principal Arterial

Soil Type 3

<u>Composite Section</u>	<u>Asphalt (in)</u>	<u>Base Course (in)</u>	<u>Millings (in)</u>	<u>Recycled Conc. (in)</u>
1. Asphalt Over Base Course	5.0	-	-	-
2. Asphalt Over Base Course	-	12.5	-	-
3. Asphalt Over Asph. Millings	-	-	16.5	-
4. Asphalt Over Recycled Conc.	6.5	-	-	13.0

Sterling Ranch Road, Dines Boulevard, and Wheatland Drive – Collectors

Soil Type 3

<u>Composite Section</u>	<u>Asphalt (in)</u>	<u>Base Course (in)</u>	<u>Asph. Millings (in)</u>	<u>Recycled Conc. (in)</u>
1. Asphalt Over Base Course	4.5	9.5	-	-
2. Asphalt Over Asph. Millings	5.0	-	11.5	-
3. Asphalt Over Recycled Conc	5.0	-	-	9.0

Dines Boulevard – Collector

Soil Type 2/4

<u>Composite Section</u>	<u>Asphalt (in)</u>	<u>Base Course (in)</u>	<u>Asph. Millings (in)</u>	<u>Recycled Conc. (in)</u>
1. Asphalt Over Base Course	6.0	13.0	-	-
2. Asphalt Over Asph. Millings	6.5	-	17.5	-
3. Asphalt Over Recycled Conc	6.5	-	-	13.5

The estimated areas of anticipated different soil types are shown on Figure 1, but the specific areas of A-1-b and A-2-4 versus A-6 and A-7-6 soils should be identified in the field when the final subgrade is exposed. As an alternative to placing the thicker sections required in the areas of poorer subgrade support soils (A-6, and A-7-6), the subgrade soils in these areas may be removed to depth of 3 feet and replaced with good subgrade support soils (A-1-b, A-2-4, etc.) placed to meet El Paso County requirements. Suitable on-site soils may meet the criteria for good subgrade support soils, pending approval.

Marksheffel Road and Sterling Ranch Road are not approved at this time.

Asphalt millings are not approved at this time.+

Wheatland Drive is not approved south/west of Dines Blvd.

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Page Five

Roadway Construction

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 0 to 2 percent over optimum moisture content and proofrolled after properly compacted. Any loose or soft areas should be removed and replaced with suitable materials approved by Entech. Basecourse materials should be compacted to a minimum of 95% of its maximum Modified Proctor Dry Density, ASTM D-1557 at $\pm 2\%$ of optimum moisture content. Special attention should be given to areas adjacent to manholes, inlet structures and valves.

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

We trust that this report contains the information you require. If you have questions or need additional information, please contact us.

Respectfully Submitted,

ENTECH ENGINEERING, INC.


Stan C. Culp, P.E.
Senior Engineer

SCC/sc
Entech Job No. 160002
AAprojects/2016/160002/160002 pr_rev3



Reviewed by:


Joseph C. Goode, Jr., P.E.
President

TABLE

TABLE 1
SUMMARY OF LABORATORY TEST RESULTS

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002

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	14	1-2			13.1	NV	NP	0.01	A-1-b		SM	FILL, SAND, SLIGHTLY SILTY
2, CBR #1	1	0-3	13.5	107.5	50.3	34	15		A-6	1.9*	CL	FILL, CLAY, VERY SANDY
2	1	1-2	16.2	111.8	70.1	33	19	<0.01	A-6	0.7	CL	FILL, CLAY, SANDY
2	6	1-2	11.9	102.9	45.5	33	21		A-6	0.4	SC	FILL, SAND, VERY CLAYEY
3, CBR #2	5	0-3			24.1	NV	NP		A-1-b		SM	SAND, SILTY
3	2	1-2			7.1	NV	NP		A-1-b		SM-SW	SAND, SLIGHTLY SILTY
3	5	1-2			20.5	NV	NP		A-2-4		SM	SAND, SILTY
3	7	1-2			17.6	NV	NP	0.01	A-1-b		SM	SAND, SILTY
3	8	1-2			9.3	NV	NP		A-1-b		SM-SW	SAND, SLIGHTLY SILTY
3	9	1-2			12.5	NV	NP		A-1-b		SM	SAND, SILTY
3	9	0-3			15.4	NV	NP		A-1-b		SM	SAND, SILTY
3	10	1-2			20.6	NV	NP		A-2-4		SM	SAND, SILTY
3	12	1-2			15.4	NV	NP		A-1-b		SM	SAND, SILTY
3	15	1-2			12.3	NV	NP		A-1-b		SM	SAND, SILTY
3	16	1-2			16.0	NV	NP	0.01	A-1-b		SM	SAND, SILTY
3	16	0-3			20.2						SM	SAND, SILTY
3	17	1-2			21.7	NV	NP		A-1-b		SM	SAND, SILTY
3	18	1-2			8.0	NV	NP		A-1-b		SM-SW	SAND, SLIGHTLY SILTY
3	19	1-2			19.8	NV	NP		A-1-b		SM	SAND, SILTY
4, CBR #3	4	0-3	12.5	109.2	35.6	33	15		A-6	1.9*	SC	SAND, CLAYEY
4	4	1-2	19.8	92.1	64.6	41	27	<0.01	A-7-6	0.3	CL	CLAY, SANDY
4	9	5	19.8	104.3	74.2	48	27		A-7-6	1.0	CL	CLAY, SANDY
4	12	5	16.7	108.3	65.0	36	17		A-6	1.2	CL	CLAY, SANDY
4	15	5	17.6	108.8	67.0	35	19		A-6	1.4	CL	CLAY, SANDY
5, CBR #4	11	0-3			21.1	20	2		A-1-b		SM	SANDSTONE, SILTY
5	11	1-2			10.3	NV	NP		A-1-b		SM-SW	SANDSTONE, SLIGHTLY SILTY
5	13	1-2			16.0	NV	NP		A-1-b		SM	SANDSTONE, SILTY
5	8	5			11.0	NV	NP	<0.01	A-1-b		SM-SW	SANDSTONE, SLIGHTLY SILTY
5	2	5			21.0	NV	NP		A-1-b		SM	SANDSTONE, SILTY
5	1	10	10.3	110.5	18.5	34	15		A-2-6	1.3	SC	SANDSTONE, CLAYEY
5	7	10			10.0	NV	NP		A-1-b		SM-SW	SANDSTONE, SLIGHTLY SILTY
5	10	10			17.3	NV	NP		A-2-4		SM	SANDSTONE, SILTY
5	18	10			39.0	36	13		A-6		SC	SANDSTONE, VERY CLAYEY
6	3	1-2	17.2	103.3	54.3	34	14	<0.01	A-6	1.6	CL	CLAYSTONE, VERY SANDY
6	4	10	15.0	102.6	86.4	41	23		A-7-6	1.2	CL	CLAYSTONE, SANDY

* - Remolded samples based on standard proctor density

FIGURES

NOTE:
INTERIOR STREETS ARE
NOT INCLUDED IN THIS
INVESTIGATION.

WHEATLAND DRIVE
VOLLMER ROAD
WHEATLAND DRIVE
DINES BLVD
WHEATLAND DRIVE
BRARGATE PARKWAY

LIMITS OF INVESTIGATION
LIMITS OF INVESTIGATION
LIMITS OF INVESTIGATION
LIMITS OF INVESTIGATION

TB-1
TB-2
TB-3
TB-4
TB-10
TB-11
TB-12
TB-13

⊕ TB-2 - APPROXIMATE TEST BORING LOCATION AND NUMBER

SOIL TYPE 2/4 - COLLECTORS
SOIL TYPE 3 - COLLECTORS

**SECTION/SOIL TYPE TRANSITIONS ARE ESTIMATED AND MUST BE FIELD VERIFIED.

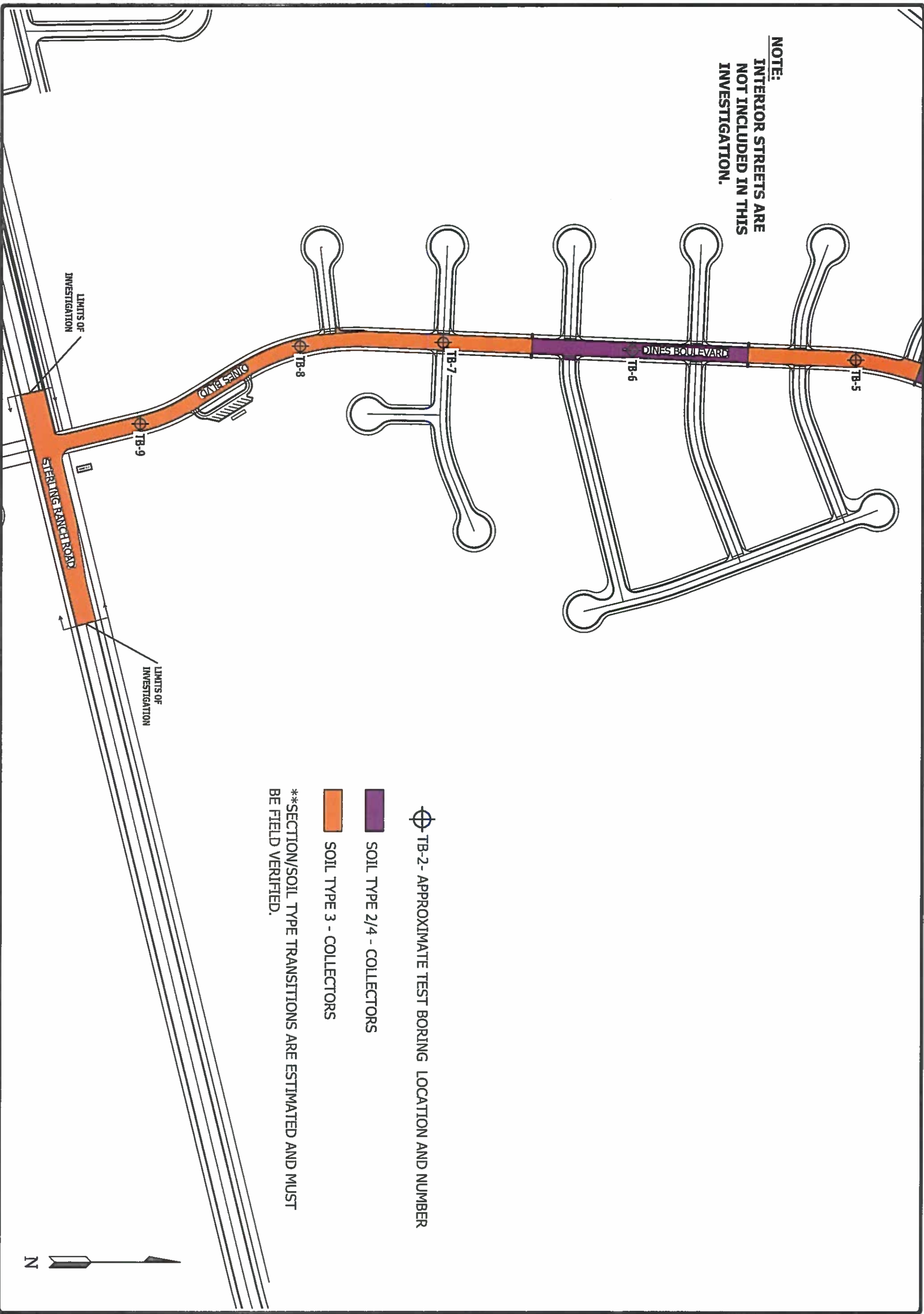
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ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

DAWN
TC/AL
CHECKED
DS
DATE
10/18/16
SCALE
NOT TO SCALE
JOB NO.
160002
MOORE, M.
1

NOTE:
INTERIOR STREETS ARE
NOT INCLUDED IN THIS
INVESTIGATION.



REVISION	BY



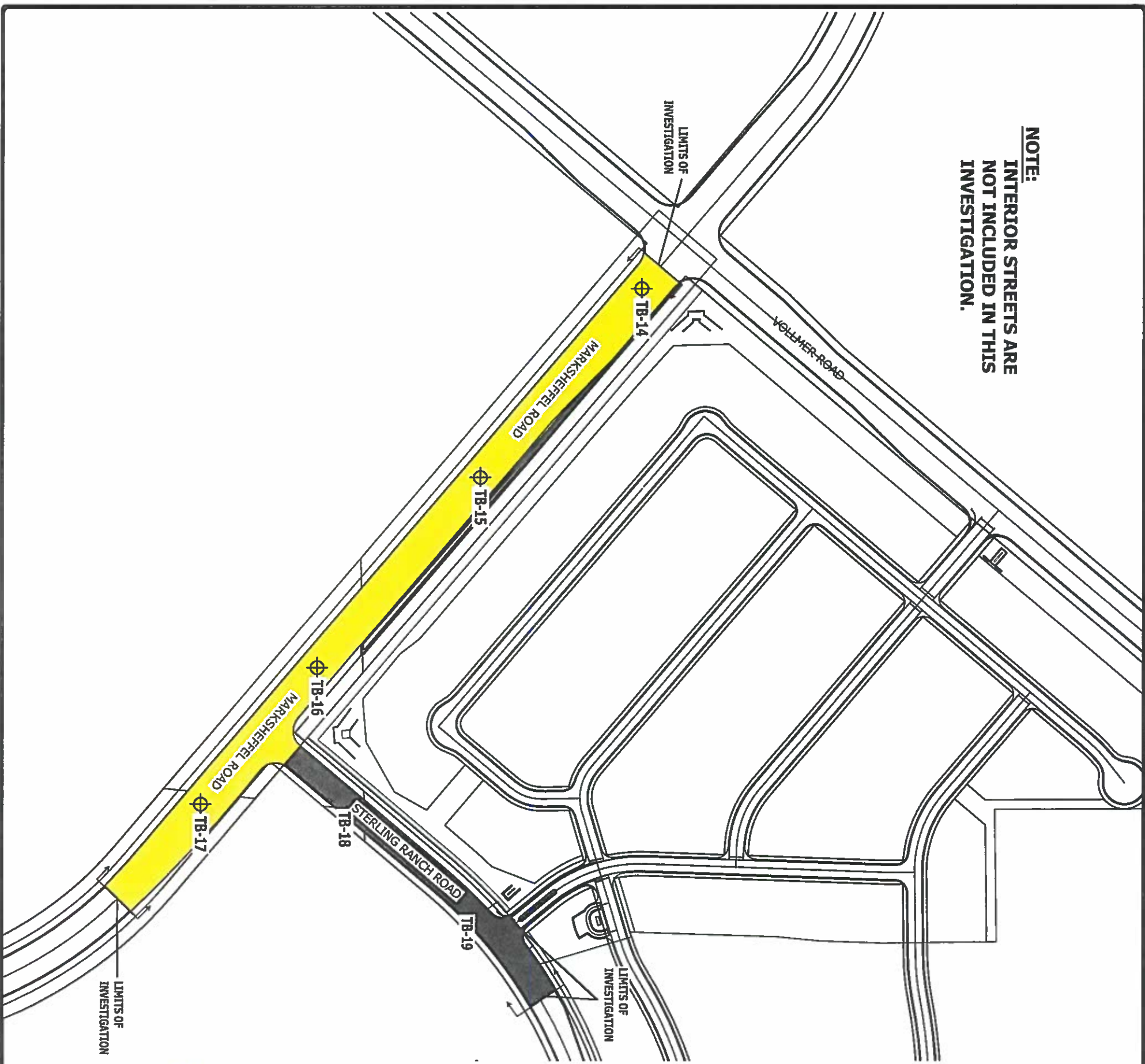
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505 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907

(719) 531-5599

SITE/TEST BORING LOCATION MAP
STERLING RANCH PHASE 1
COLORADO SPRINGS, CO.
FOR: SR LAND LLC

DATE	10/18/16
TC/AL	
CHECKED	
BY	
SCALE	10/18/16
NOT TO SCALE	
10/18/16	
1600002	
HOME INC.	
2	


NOTE:
INTERIOR STREETS ARE
NOT INCLUDED IN THIS
INVESTIGATION.



- ⊕ TB-2 - APPROXIMATE TEST BORING LOCATION AND NUMBER
- SOIL TYPE 3 - MAJOR ARTERIAL
- SOIL TYPE 3 - COLLECTOR

**SECTION/SOIL TYPE TRANSITIONS ARE ESTIMATED AND MUST BE FIELD VERIFIED.

REVISION	BY



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505 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

SITE/TEST BORING LOCATION MAP
STERLING RANCH PHASE 1
COLORADO SPRINGS, CO.
FOR: SR LAND LLC

DATE	10/18/16
BY	2217
NOT TO SCALE	100002
SCALE	100002
3	

APPENDIX A: Test Boring Logs

TEST BORING NO. 1
 DATE DRILLED 8/24/2016
 Job # 160002

TEST BORING NO. 2
 DATE DRILLED 8/24/2016
 CLIENT SR LAND, LLC
 LOCATION STERLING RANCH, FILING 1

REMARKS

DRY TO 10', 8/24/16

FILL 0-7', CLAY, VERY SANDY
 TO SANDY, BROWN, STIFF,
 MOIST

SANDSTONE, CLAYEY, FINE
 TO COARSE GRAINED, BROWN,
 VERY DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			19	10.6	2
5			15	12.9	2
10			50 11"	8.5	5
15					
20					

REMARKS

DRY TO 5', 8/24/16

SAND, SLIGHTLY SILTY, FINE
 TO COARSE GRAINED, TAN,
 MEDIUM DENSE, MOIST

WEATHERED SANDSTONE,
 SILTY, FINE TO COARSE
 GRAINED, BROWN, DENSE,
 MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			23	4.4	3
5			45	8.2	5
10					
15					
20					



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 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE:

h 10/4/16

JOB NO.:

160002

FIG NO.:

A-1

TEST BORING NO. 3
 DATE DRILLED 8/24/2016
 Job # 160002

TEST BORING NO. 4
 DATE DRILLED 8/24/2016
 CLIENT SR LAND, LLC
 LOCATION STERLING RANCH, FILING 1

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 5', 8/24/16						
SAND, SILTY, TAN						
CLAYSTONE, VERY SANDY,						
GRAY BROWN, HARD, MOIST						
	5			50	10.7	3
				9"		6
				50	14.2	6
				11"		
	10					
	15					
	20					

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 10', 8/24/16						
CLAY, SANDY TO SAND,						
CLAYEY, GRAY BROWN,						
STIFF, MOIST						
	5			17	15.6	4
				50	13.8	6
CLAYSTONE, SANDY, BROWN,						
HARD, MOIST						
	10			50	17.6	6
				11"		
	15					
	20					



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 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE:

8/24/16

JOB NO.:

160002

FIG NO.:

A-2

TEST BORING NO. 5
 DATE DRILLED 8/24/2016
 Job # 160002

TEST BORING NO. 6
 DATE DRILLED 8/24/2016
 CLIENT SR LAND, LLC
 LOCATION STERLING RANCH, FILING 1

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 5', 8/24/16						
SAND, SILTY, FINE GRAINED, TAN, MEDIUM DENSE, MOIST				17	9.8	3
	5			20	16.6	3
SAND, CLAYEY, FINE TO MEDIUM GRAINED, GRAY BROWN, MEDIUM DENSE, MOIST						
	10					
	15					
	20					

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 5', 8/24/16						
FILL 0-2', SAND, VERY CLAYEY, FINE TO COARSE GRAINED, BROWN, LOOSE, MOIST				7	17.5	2
SAND, CLAYEY, FINE TO COARSE GRAINED, GRAY BROWN, DENSE, MOIST	5			41	12.5	3
	10					
	15					
	20					



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TEST BORING LOG

DRAWN:

DATE:

CHECKED: *6*

DATE: 10/4/16

JOB NO:
 160002

FIG NO:

A-3

TEST BORING NO. 7
 DATE DRILLED 8/24/2016
 Job # 160002

TEST BORING NO. 8
 DATE DRILLED 8/24/2016
 CLIENT SR LAND, LLC
 LOCATION STERLING RANCH, FILING 1

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 10', 8/24/16						
SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST				20	9.8	3
	5			15	10.0	3
SANDSTONE, SLIGHTLY SILTY, FINE TO COARSE GRAINED, GRAY BROWN, VERY DENSE, MOIST	10			50 6"	12.6	5
	15					
	20					

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 5', 8/24/16						
SAND, SLIGHTLY SILTY, FINE TO COARSE GRAINED, GRAY BROWN, DENSE, MOIST				32	7.8	3
SANDSTONE, SLIGHTLY SILTY, FINE TO COARSE GRAINED, GRAY BROWN, VERY DENSE, MOIST	5			50 9"	10.7	5
	10					
	15					
	20					



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505 ELKTON DRIVE
 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE:

10/4/16

JOB NO.:

160002

FIG NO.:

A-4

TEST BORING NO. 9
 DATE DRILLED 8/24/2016
 Job # 160002

TEST BORING NO. 10
 DATE DRILLED 8/24/2016
 CLIENT SR LAND, LLC
 LOCATION STERLING RANCH, FILING 1

REMARKS

DRY TO 5', 8/24/16

SAND, SILTY, FINE TO COARSE
 GRAINED, TAN, MEDIUM DENSE,
 MOIST

CLAY, SANDY, BROWN, STIFF,
 MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			21	10.1	3
5			26	24.5	4
10					
15					
20					

REMARKS

DRY TO 10', 8/24/16

SAND, SILTY, FINE TO COARSE
 GRAINED, TAN, MEDIUM DENSE,
 MOIST

SANDSTONE, SILTY, FINE TO
 COARSE GRAINED, GRAY
 BROWN, VERY DENSE, MOIST

MEDIUM GRAINED LENSES

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			26	9.9	3
5			50 11"	9.8	5
10			50 6"	11.8	5
15					
20					



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505 ELKTON DRIVE
 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE:

8/24/16

JOB NO.:

160002

FIG NO.:

A5

TEST BORING NO. 11
 DATE DRILLED 8/24/2016
 Job # 160002

TEST BORING NO. 12
 DATE DRILLED 8/24/2016
 CLIENT SR LAND, LLC
 LOCATION STERLING RANCH, FILING 1

REMARKS

DRY TO 5', 8/24/16
 SAND, SILTY, TAN
 SANDSTONE, SLIGHTLY SILTY,
 FINE TO COARSE GRAINED,
 TAN, VERY DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			50	8.5	3
			50		5
			8"	9.1	5
10					
15					
20					

REMARKS

DRY TO 5', 8/24/16
 SAND, SILTY, FINE TO COARSE
 GRAINED, TAN, MEDIUM DENSE,
 MOIST
 CLAY, SANDY, BROWN, FIRM,
 MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			16	3.7	3
			11	21.4	4
10					
15					
20					



ENTECH
ENGINEERING, INC.

505 ELKTON DRIVE
 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE:

10/4/16

JOB NO:

160002

FIG NO:

A-6

TEST BORING NO. 13
 DATE DRILLED 9/8/2016
 Job # 160002

TEST BORING NO. 14
 DATE DRILLED 8/24/2016
 CLIENT SR LAND, LLC
 LOCATION STERLING RANCH, FILING 1

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 5', 9/8/16						
SAND, SILTY, TAN						
SANDSTONE, SILTY, FINE TO COARSE GRAINED, GRAY BROWN, VERY DENSE, MOIST						
	5			50 11"	9.8	3
				50 7"	7.8	5
	10					
	15					
	20					

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 10', 8/24/16						
FILL 0-4', POSS. FILL 4-7,						
SAND, SLIGHTLY SILTY, FINE TO COARSE GRAINED, BROWN, MEDIUM DENSE, MOIST				16	6.9	1
POSS. FILL, SAND, CLAYEY, FINE TO COARSE GRAINED, GRAY BROWN, MEDIUM DENSE, MOIST	5			19	9.5	1
SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST	10			26	3.3	3
	15					
	20					



ENTECH
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505 ELKTON DRIVE
 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE

10/4/16

JOB NO.:

160002

FIG NO.:

A-7

TEST BORING NO. 15
 DATE DRILLED 8/24/2016
 Job # 160002

TEST BORING NO. 16
 DATE DRILLED 8/24/2016
 CLIENT SR LAND, LLC
 LOCATION STERLING RANCH, FILING 1

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 5', 8/24/16 SAND, SILTY, FINE TO COARSE GRAINED, TAN, DENSE, MOIST				47	5.8	3
CLAY, SANDY, GRAY BROWN, STIFF, MOIST	5			22	12.1	4
	10					
	15					
	20					

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 5', 8/24/16 SAND, SILTY, FINE TO COARSE GRAINED, BROWN TO TAN, DENSE, MOIST				35	6.8	3
	5			31	4.4	3
	10					
	15					
	20					



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TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE:

[Signature] 10/4/16

JOB NO:

160002

FIG NO:

A-B

TEST BORING NO. 17
 DATE DRILLED 8/24/2016
 Job # 160002

TEST BORING NO. 18
 DATE DRILLED 8/24/2016
 CLIENT SR LAND, LLC
 LOCATION STERLING RANCH, FILING 1

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 5', 8/24/16						
SAND, SILTY, FINE TO COARSE GRAINED, GRAY BROWN, DENSE TO MEDIUM DENSE, MOIST	5			31	5.0	3
				20	9.2	3
	10					
	15					
	20					

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 10', 8/24/16						
SAND, SLIGHTLY SILTY, FINE TO COARSE GRAINED, TAN, LOOSE TO MEDIUM DENSE, MOIST	5			6	6.0	3
				10	7.6	3
SANDSTONE, VERY CLAYEY, FINE TO MEDIUM GRAINED, GRAY BROWN, VERY DENSE, MOIST	10			50 9"	9.2	5
	15					
	20					



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 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE

10/4/16

JOB NO.:

160002

FIG NO.:

A-9

TEST BORING NO. 19
DATE DRILLED 9/8/2016
Job # 160002

TEST BORING NO.
DATE DRILLED
CLIENT SR LAND, LLC
LOCATION STERLING RANCH, FILING 1

REMARKS

DRY TO 5', 9/8/16

SAND, SILTY, FINE TO COARSE
GRAINED, TAN, MEDIUM DENSE,
MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			11	7.4	3
5			11	6.5	3
10					
15					
20					

REMARKS

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



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TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE:

10/14/16

JOB NO.:

160002

FIG NO.:

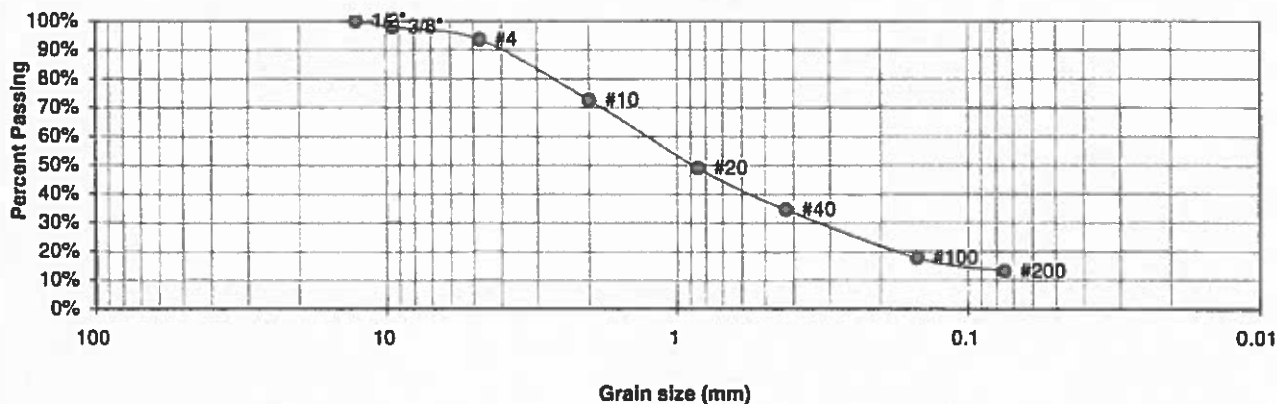
A-10

APPENDIX B: Laboratory Test Results

UNIFIED CLASSIFICATION SM
SOIL TYPE # 1
TEST BORING # 14
DEPTH (FT) 1-2
AASHTO CLASSIFICATION A-1-b

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002
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"	97.9%
4	93.5%
10	72.5%
20	49.0%
40	34.6%
100	17.7%
200	13.1%

**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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505 ELKTON DRIVE
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**LABORATORY TEST
RESULTS**

DRAWN:

DATE:

CHECKED: *W*

DATE:

10/4/10

JOB NO:

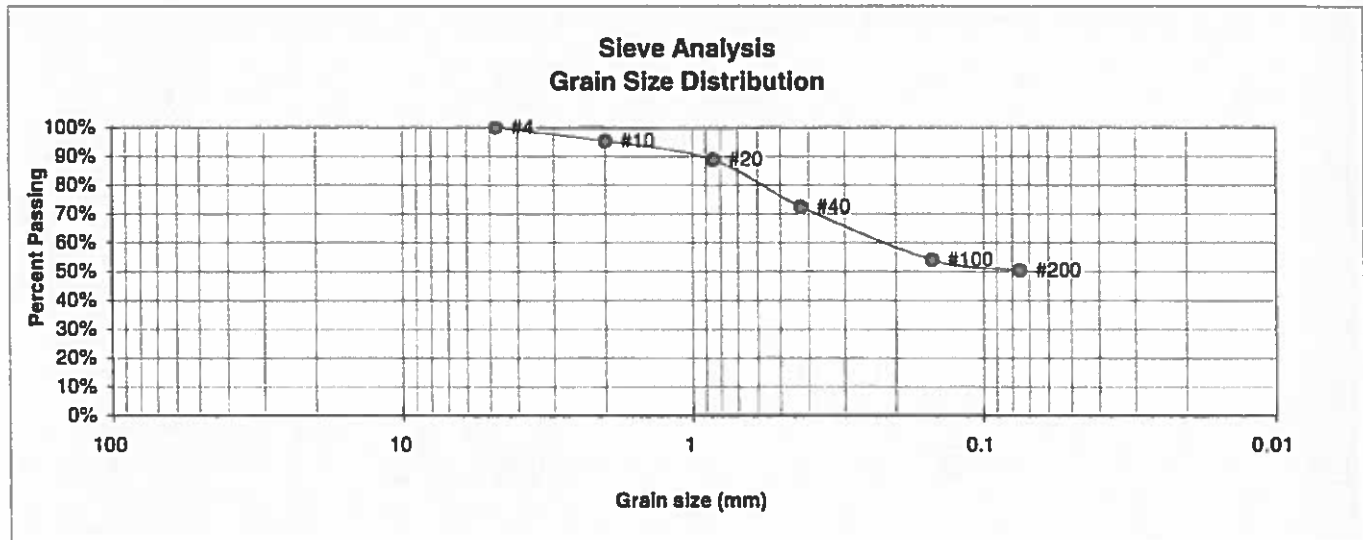
160002

FIG NO:

B-1

UNIFIED CLASSIFICATION CL
SOIL TYPE # 2, CBR #1
TEST BORING # 1
DEPTH (FT) 0-3
AASHTO CLASSIFICATION A-6

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002
TEST BY BL
GROUP INDEX 5



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	95.3%
20	88.8%
40	72.4%
100	54.0%
200	50.3%

**Atterberg
Limits**
 Plastic Limit 18
 Liquid Limit 34
 Plastic Index 15

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: <i>W</i>	DATE: 10/4/16
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JOB NO.:

160002

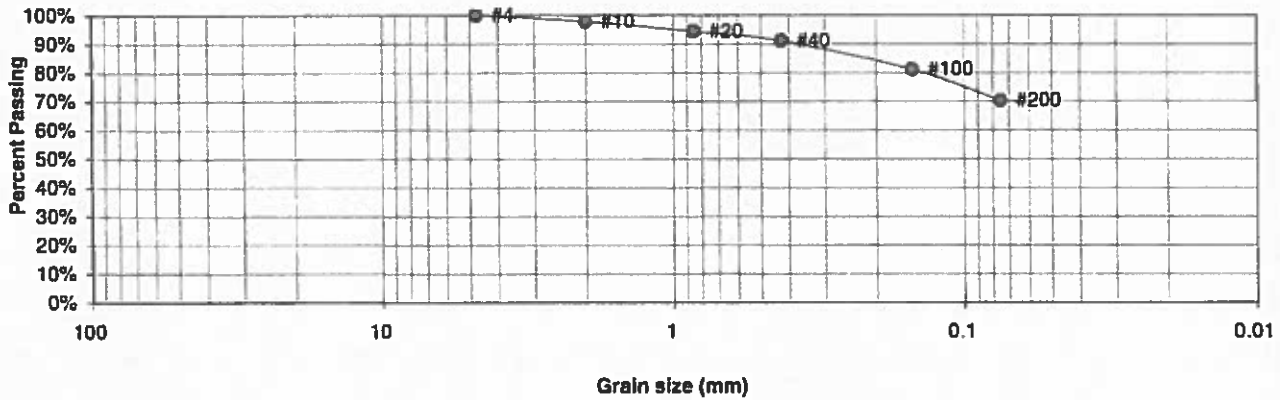
FIG NO.:

B-2

UNIFIED CLASSIFICATION CL
SOIL TYPE # 2
TEST BORING # 1
DEPTH (FT) 1-2
AASHTO CLASSIFICATION A-6

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002
TEST BY BL
GROUP INDEX 11

**Sieve Analysis
Grain Size Distribution**



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	97.9%
20	94.4%
40	91.1%
100	81.0%
200	70.1%

**Atterberg
Limits**
 Plastic Limit 14
 Liquid Limit 33
 Plastic Index 19

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



**ENTECH
ENGINEERING, INC.**

505 ELKTON DRIVE
 COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST
RESULTS**

DRAWN:	DATE:	CHECKED:	DATE:
		<i>BL</i>	10/4/16

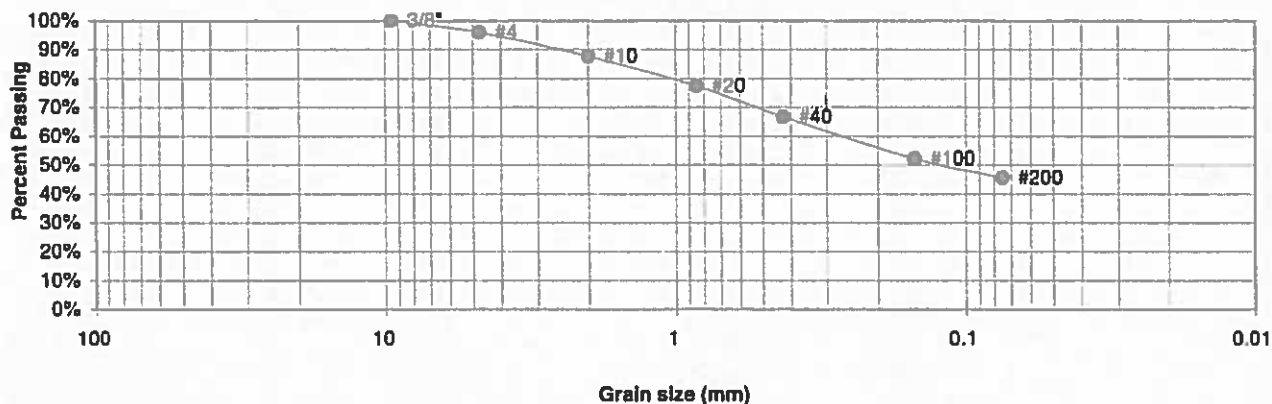
JOB NO.:
 160002
 FIG NO.:

B-3

UNIFIED CLASSIFICATION SC
SOIL TYPE # 2
TEST BORING # 6
DEPTH (FT) 1-2
AASHTO CLASSIFICATION A-6

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002
TEST BY BL
GROUP INDEX 5

**Sieve Analysis
Grain Size Distribution**



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	95.9%
10	87.7%
20	77.4%
40	66.6%
100	52.2%
200	45.5%

**Atterberg
Limits**
 Plastic Limit 12
 Liquid Limit 33
 Plastic Index 21

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



**ENTECH
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505 ELKTON DRIVE
 COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST
RESULTS**

DRAWN:

DATE:

CHECKED: *h*

DATE:

10/4/16

JOB NO.:

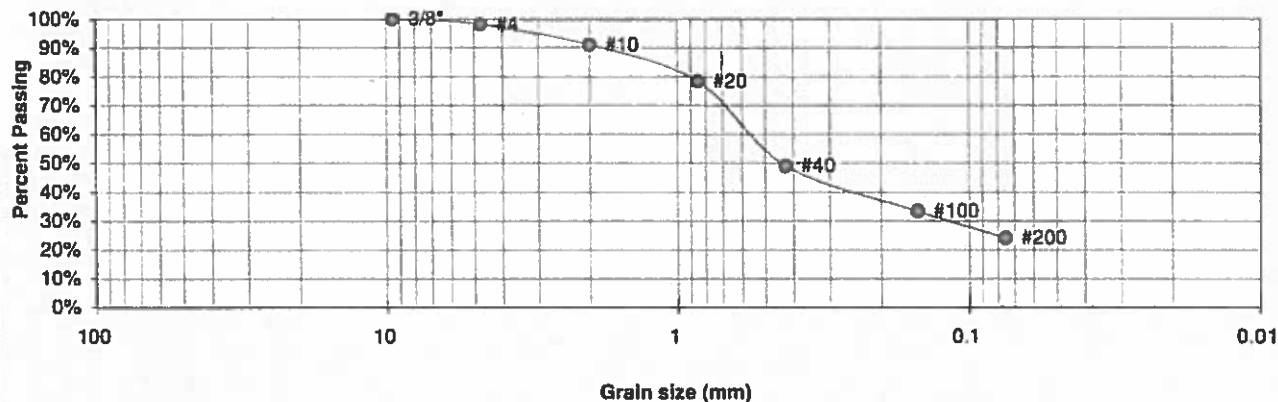
160002

FIG NO.:

B-1

UNIFIED CLASSIFICATION	SM	CLIENT	SR LAND, LLC
SOIL TYPE #	3, CBR #2	PROJECT	STERLING RANCH, FILING 1
TEST BORING #	5	JOB NO.	160002
DEPTH (FT)	0-3	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	98.1%
10	91.0%
20	78.3%
40	49.0%
100	33.3%
200	24.1%

**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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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST
RESULTS**

DRAWN:

DATE:

CHECKED:

DATE:

DS

10/24/16

JOB NO.:

160002

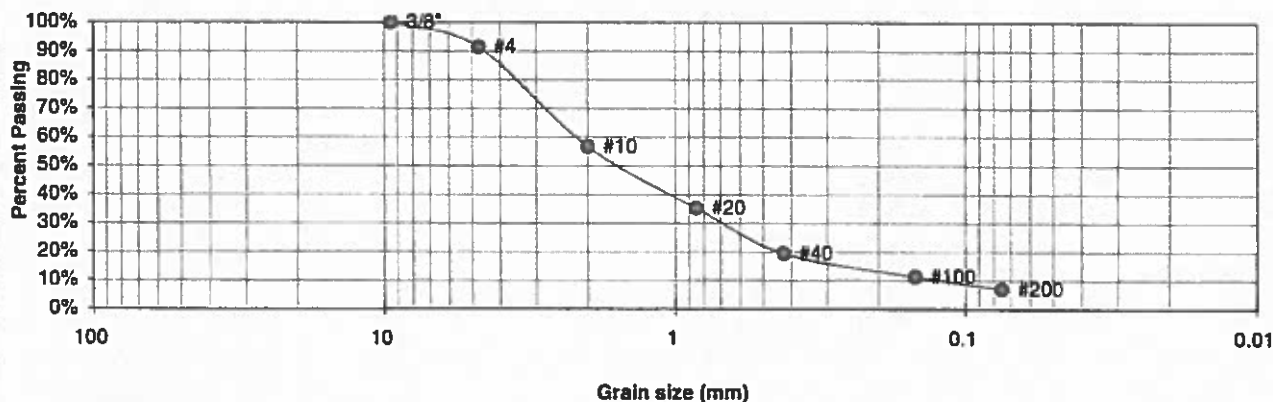
FIG NO.:

B-5

UNIFIED CLASSIFICATION SM-SW
SOIL TYPE # 3
TEST BORING # 2
DEPTH (FT) 1-2
AASHTO CLASSIFICATION A-1-b

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002
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	91.4%
10	56.7%
20	35.3%
40	19.4%
100	11.3%
200	7.1%

**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)



**ENTECH
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505 ELKTON DRIVE
 COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST
RESULTS**

DRAWN:	DATE:	CHECKED: <i>BL</i>	DATE: 10/4/16
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JOB NO.:

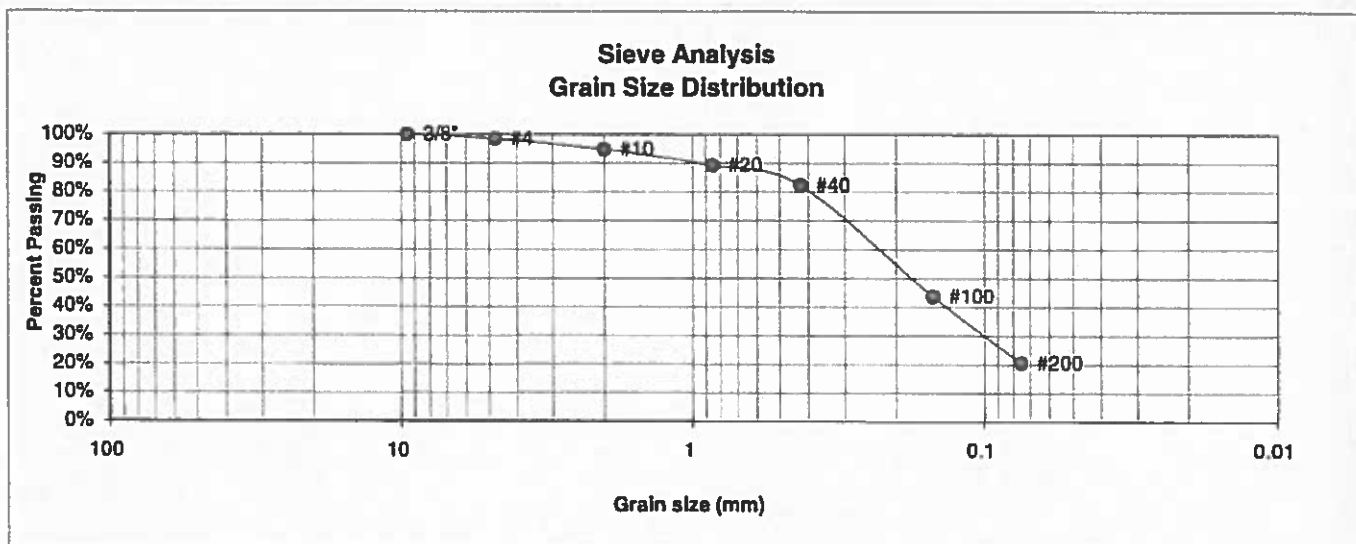
160002

FIG NO.:

BL

UNIFIED CLASSIFICATION SM
SOIL TYPE # 3
TEST BORING # 5
DEPTH (FT) 1-2
AASHTO CLASSIFICATION A-2-4

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002
TEST BY BL
GROUP INDEX 0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	98.3%
10	94.7%
20	89.2%
40	82.2%
100	43.6%
200	20.5%

**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)



**ENTECH
ENGINEERING, INC.**

505 ELKTON DRIVE
 COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST
RESULTS**

DRAWN:	DATE:	CHECKED: <i>h</i>	DATE: 10/4/16
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JOB NO.:

160002

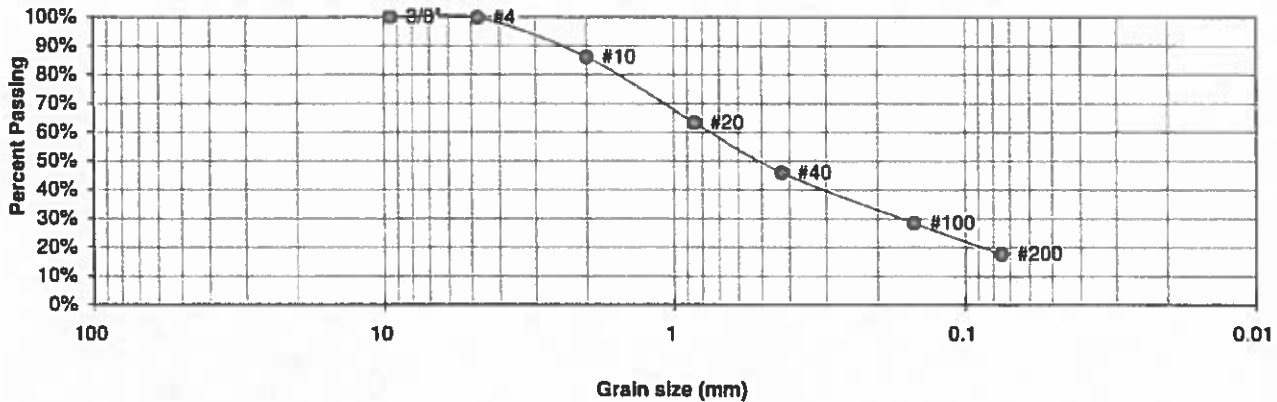
FIG NO.:

B-7

UNIFIED CLASSIFICATION SM
SOIL TYPE # 3
TEST BORING # 7
DEPTH (FT) 1-2
AASHTO CLASSIFICATION A-1-b

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002
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	99.7%
10	86.1%
20	63.2%
40	45.9%
100	28.3%
200	17.6%

**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)



**ENTECH
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505 ELKTON DRIVE
 COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST
RESULTS**

DRAWN:

DATE:

CHECKED:

DATE:

JOB NO.:

160002

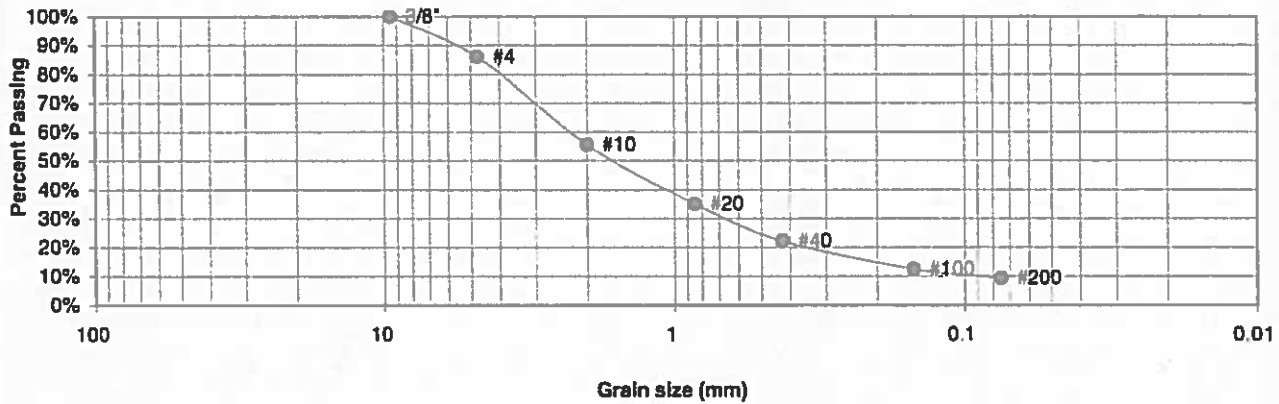
FIG NO.:

B-8

UNIFIED CLASSIFICATION SM-SW
SOIL TYPE # 3
TEST BORING # 8
DEPTH (FT) 1-2
AASHTO CLASSIFICATION A-1-b

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002
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	86.0%
10	55.5%
20	35.1%
40	22.2%
100	12.4%
200	9.3%

**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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505 ELKTON DRIVE
 COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST
RESULTS**

DRAWN:

DATE:

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DATE:

6/4/16

JOB NO.:

160002

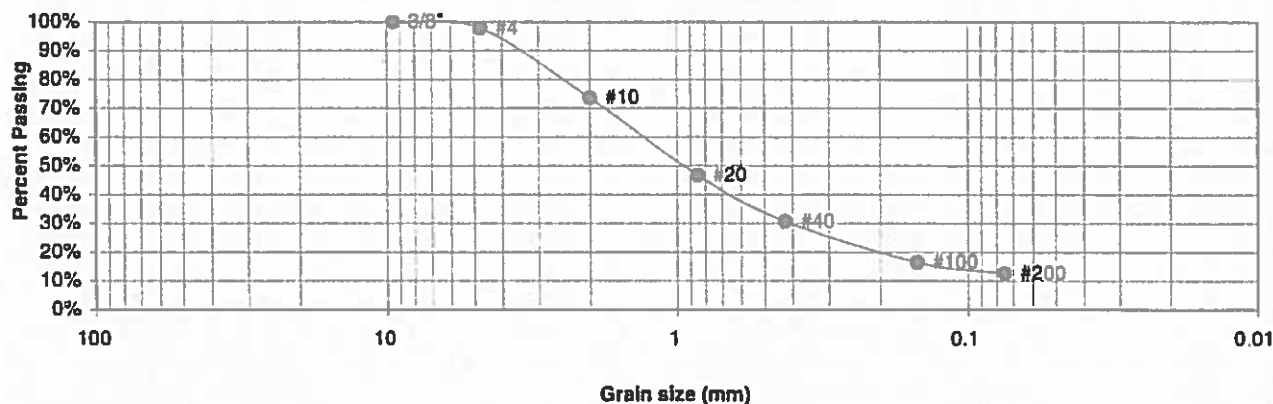
FIG NO.:

29

UNIFIED CLASSIFICATION SM
SOIL TYPE # 3
TEST BORING # 9
DEPTH (FT) 1-2
AASHTO CLASSIFICATION A-1-b

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002
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	97.7%
10	73.6%
20	46.7%
40	30.7%
100	16.5%
200	12.5%

**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)



**ENTECH
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505 ELKTON DRIVE
 COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST
RESULTS**

DRAWN:

DATE:

CHECKED: *W*

DATE:

10/4/16

JOB NO.:

160002

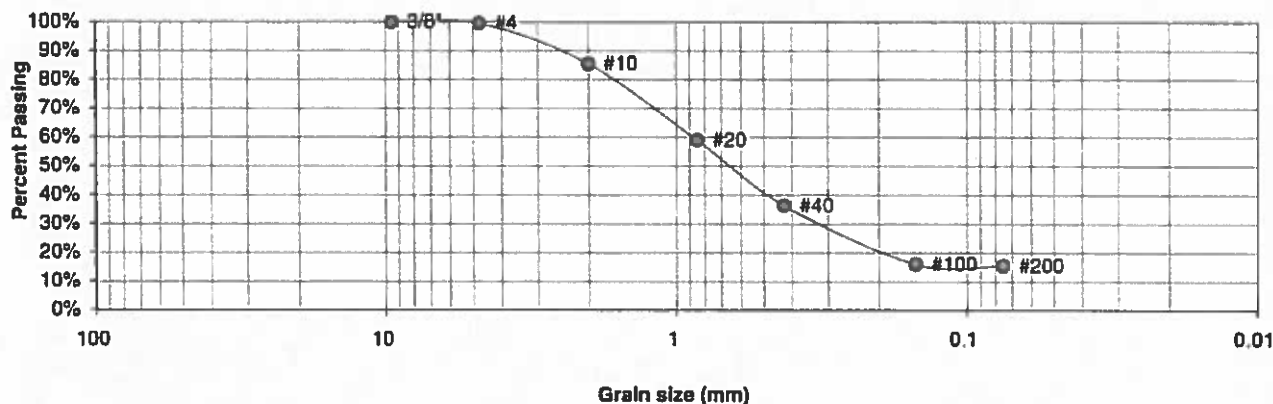
FIG NO.:

P-10

UNIFIED CLASSIFICATION SM
SOIL TYPE # 3
TEST BORING # 9
DEPTH (FT) 0-3
AASHTO CLASSIFICATION A-1-b

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002
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	99.4%
10	85.4%
20	59.0%
40	36.3%
100	16.0%
200	15.4%

**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)



**ENTECH
ENGINEERING, INC.**

505 ELKTON DRIVE
 COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST
RESULTS**

DRAWN:	DATE:	CHECKED: <i>h</i>	DATE: 10/4/16
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JOB NO.:

160002

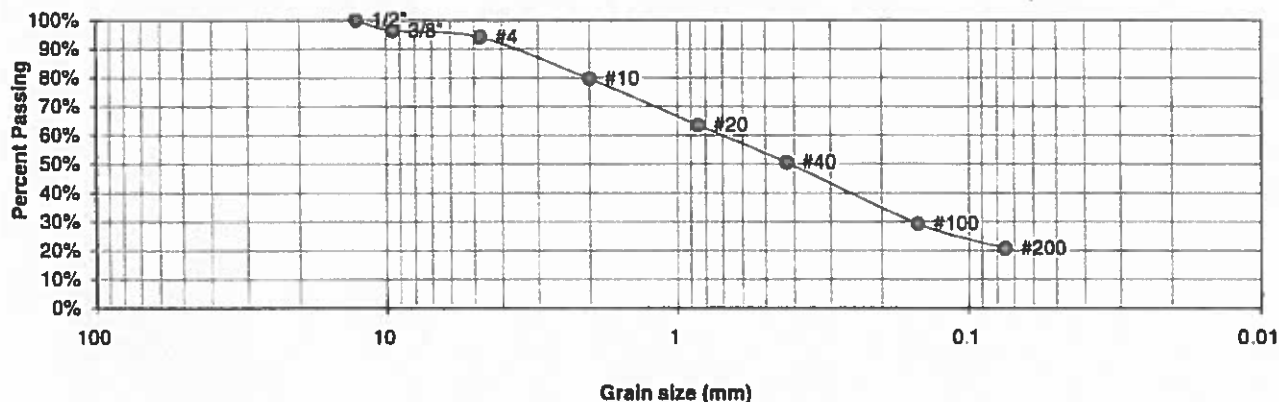
FIG NO.:

B-11

UNIFIED CLASSIFICATION SM
SOIL TYPE # 3
TEST BORING # 10
DEPTH (FT) 1-2
AASHTO CLASSIFICATION A-2-4

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002
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"	96.4%
4	94.1%
10	79.6%
20	63.5%
40	50.4%
100	29.2%
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)



**ENTECH
ENGINEERING, INC.**

505 ELKTON DRIVE
 COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST
RESULTS**

DRAWN:

DATE:

CHECKED: *BL*

DATE:

10/4/14

JOB NO.:

160002

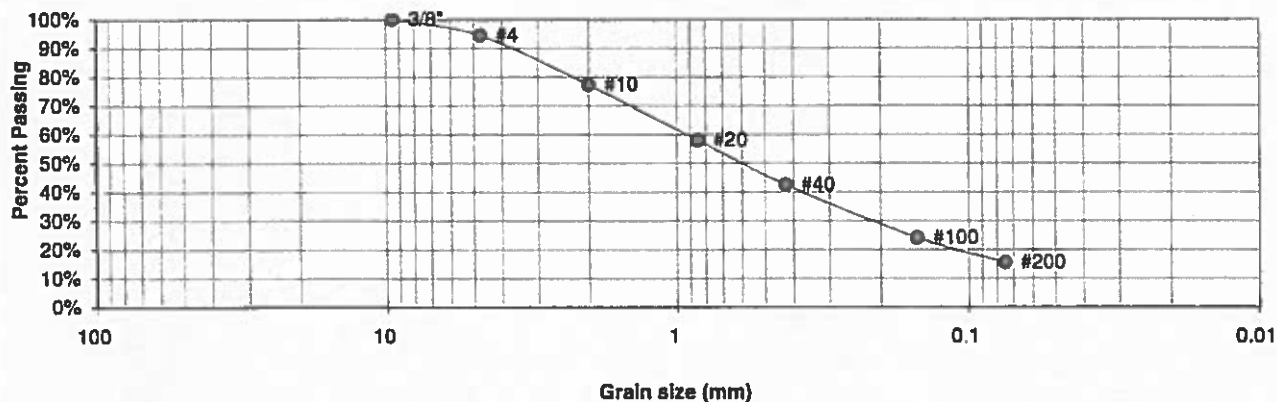
FIG NO.:

8-12

UNIFIED CLASSIFICATION SM
SOIL TYPE # 3
TEST BORING # 12
DEPTH (FT) 1-2
AASHTO CLASSIFICATION A-1-b

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002
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	94.5%
10	77.2%
20	58.0%
40	42.5%
100	24.1%
200	15.4%

**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)



**ENTECH
ENGINEERING, INC.**

505 ELKTON DRIVE
 COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST
RESULTS**

DRAWN:

DATE:

CHECKED: *BL*

DATE:

10/4/16

JOB NO.:

160002

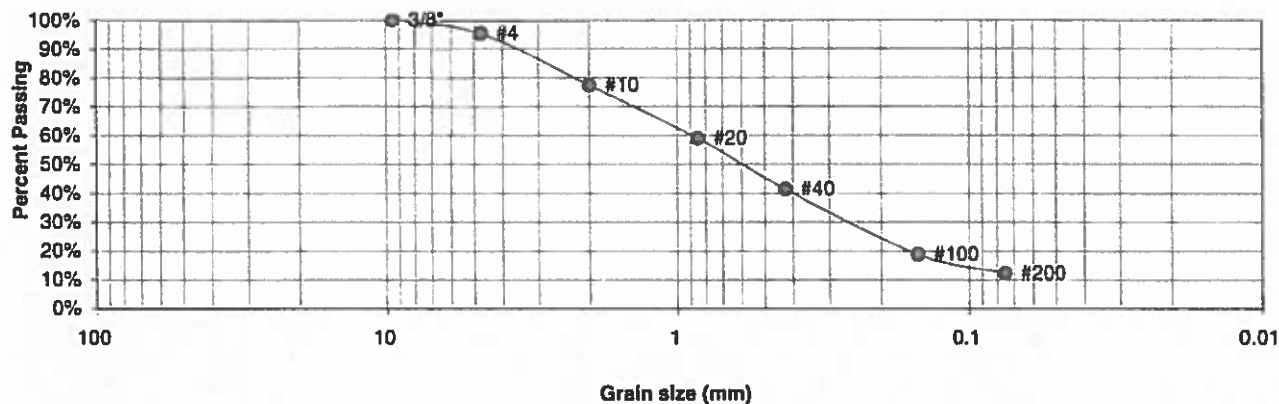
FIG NO.:

B-13

UNIFIED CLASSIFICATION SM
SOIL TYPE # 3
TEST BORING # 15
DEPTH (FT) 1-2
AASHTO CLASSIFICATION A-1-b

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002
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	95.5%
10	77.3%
20	58.9%
40	41.3%
100	18.8%
200	12.3%

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)



ENTECH
ENGINEERING, INC.

505 ELKTON DRIVE
 COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST
RESULTS

DRAWN:

DATE:

CHECKED: *BL*

DATE:

10/4/16

JOB NO.:

160002

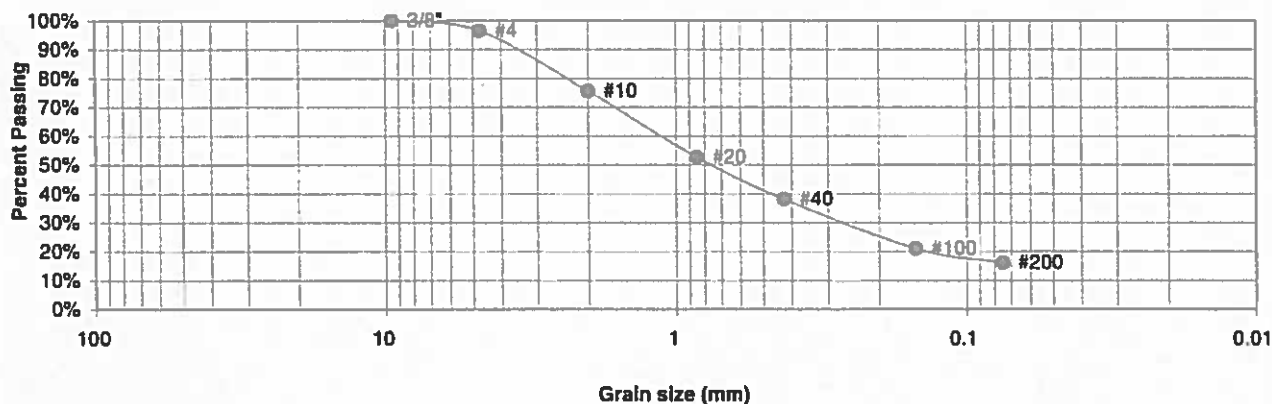
FIG NO.:

B-14

UNIFIED CLASSIFICATION SM
SOIL TYPE # 3
TEST BORING # 16
DEPTH (FT) 1-2
AASHTO CLASSIFICATION A-1-b

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002
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	75.5%
20	52.6%
40	38.2%
100	21.1%
200	16.0%

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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505 ELKTON DRIVE
 COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST
RESULTS**

DRAWN:

DATE:

CHECKED: *CR*

DATE:

10/4/16

JOB NO.:

160002

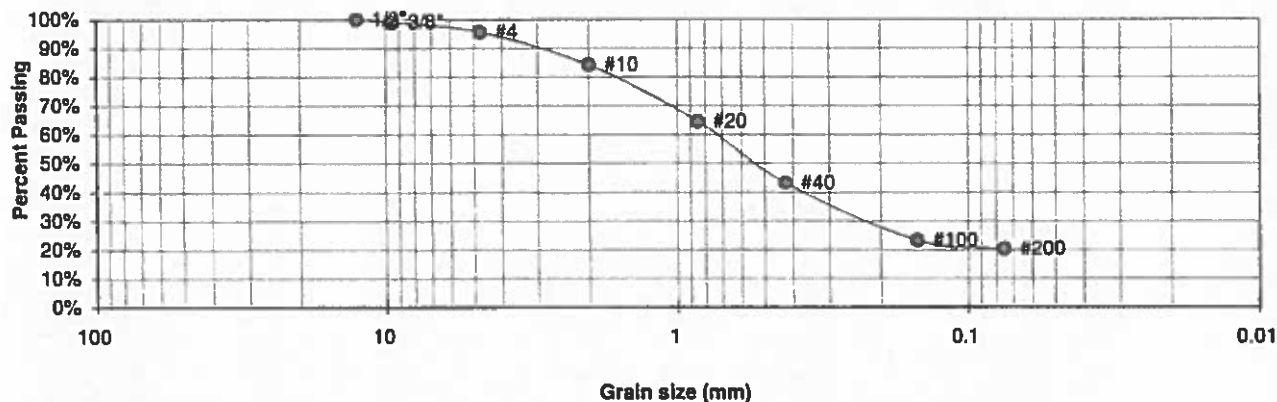
FIG NO.:

B-15

UNIFIED CLASSIFICATION SM
SOIL TYPE # 3
TEST BORING # 16
DEPTH (FT) 0-3
AASHTO CLASSIFICATION

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002
TEST BY BL
GROUP INDEX

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	99.0%
4	95.6%
10	84.2%
20	64.5%
40	43.2%
100	23.2%
200	20.2%

Atterberg
Limits
 Plastic Limit
 Liquid Limit
 Plastic Index

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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DATE:

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DATE:

10/4/16

JOB NO.:

160002

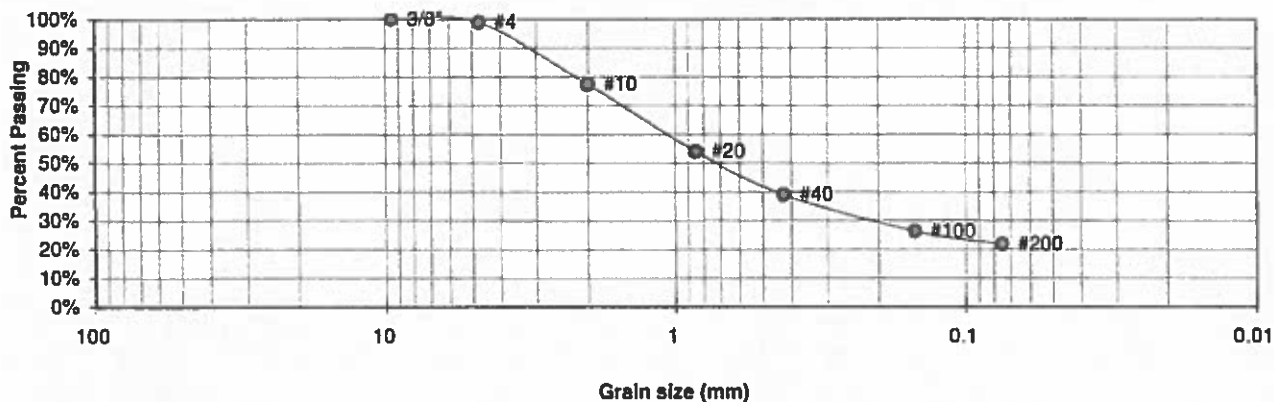
FIG NO.:

B-16

UNIFIED CLASSIFICATION SM
SOIL TYPE # 3
TEST BORING # 17
DEPTH (FT) 1-2
AASHTO CLASSIFICATION A-1-b

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002
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	98.9%
10	77.3%
20	53.9%
40	38.9%
100	26.3%
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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DATE:

10/4/16

JOB NO.:

160002

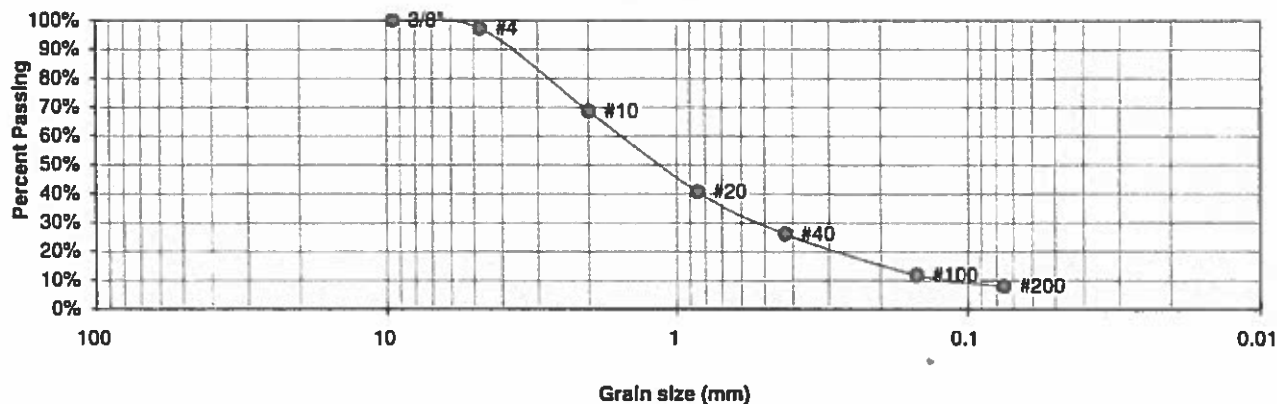
FIG NO.:

B-17

UNIFIED CLASSIFICATION SM-SW
SOIL TYPE # 3
TEST BORING # 18
DEPTH (FT) 1-2
AASHTO CLASSIFICATION A-1-b

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002
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	97.3%
10	68.6%
20	40.8%
40	26.1%
100	11.7%
200	8.0%

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

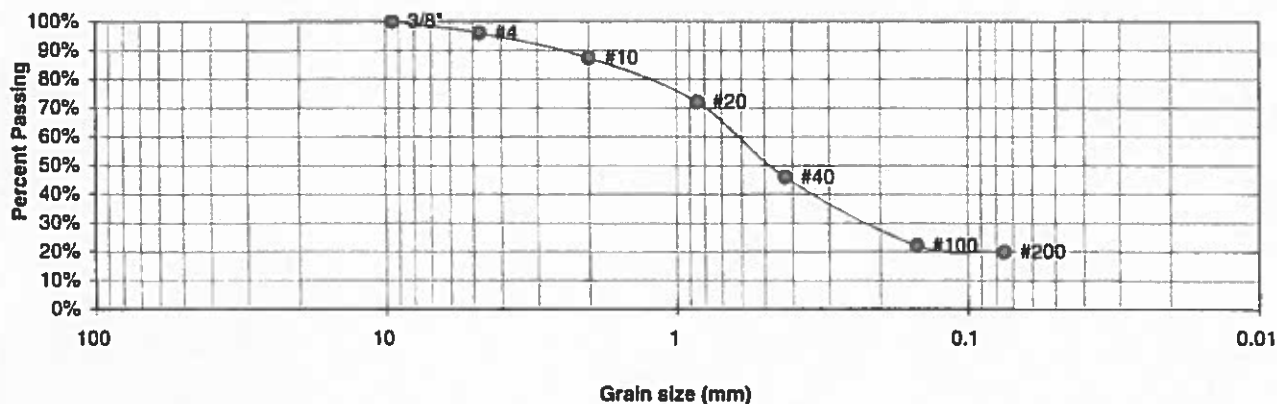
DRAWN:	DATE:	CHECKED: <i>W</i>	DATE: 10/4/16
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JOB NO.:
 160002
 FIG NO.:
 B-18

UNIFIED CLASSIFICATION SM
SOIL TYPE # 3
TEST BORING # 19
DEPTH (FT) 1-2
AASHTO CLASSIFICATION A-1-b

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002
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	96.0%
10	87.3%
20	72.0%
40	45.9%
100	22.0%
200	19.8%

**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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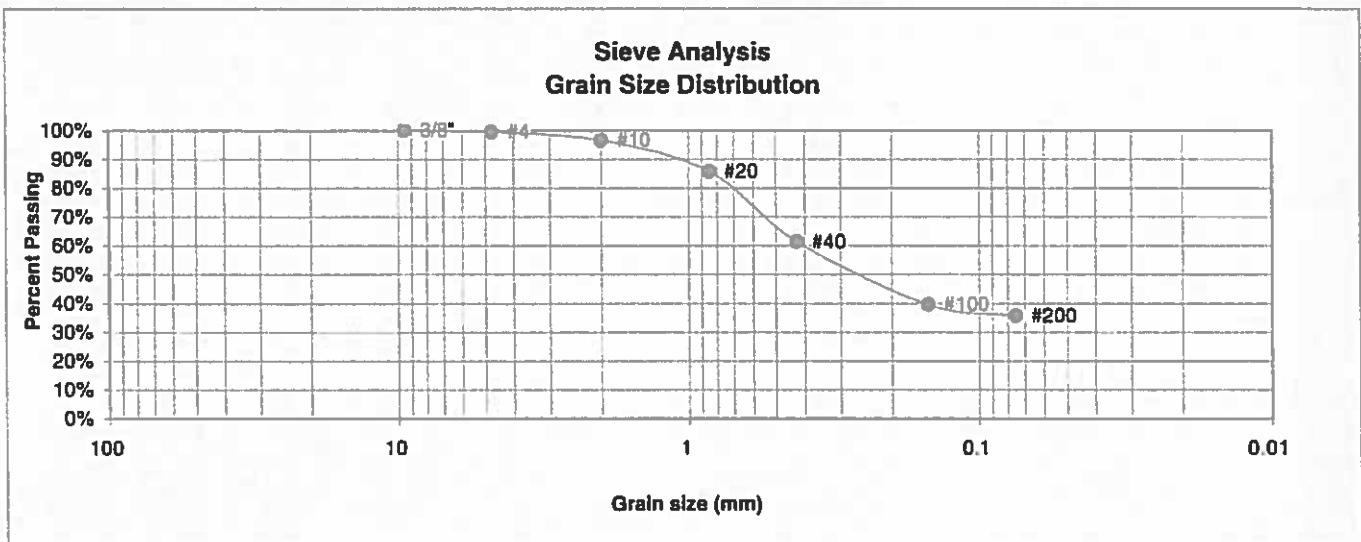
**LABORATORY TEST
RESULTS**

DRAWN:	DATE:	CHECKED: <i>W</i>	DATE: 6/4/16
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JOB NO:
 160002
 FIG NO:
 B-19

UNIFIED CLASSIFICATION SC
SOIL TYPE # 4, CBR #3
TEST BORING # 4
DEPTH (FT) 0-3
AASHTO CLASSIFICATION A-6

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002
TEST BY BL
GROUP INDEX 1



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.5%
10	96.6%
20	85.8%
40	61.3%
100	39.5%
200	35.6%

**Atterberg
Limits**
 Plastic Limit 18
 Liquid Limit 33
 Plastic Index 15

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



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**LABORATORY TEST
RESULTS**

DRAWN:

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DATE:

DS

10/10/16

JOB NO.:

160002

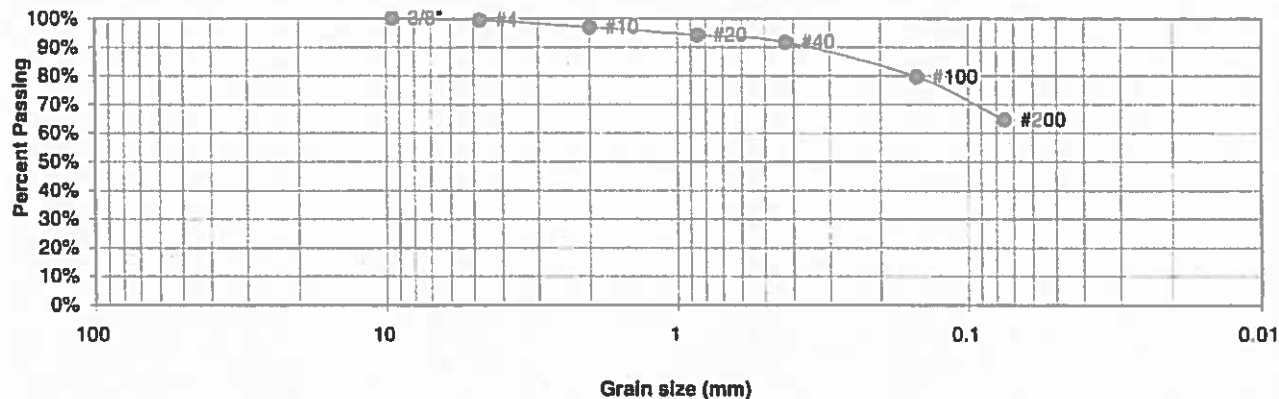
FIG NO.:

B-20

UNIFIED CLASSIFICATION CL
SOIL TYPE # 4
TEST BORING # 4
DEPTH (FT) 1-2
AASHTO CLASSIFICATION A-7-6

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002
TEST BY BL
GROUP INDEX 14

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.3%
10	96.9%
20	94.2%
40	91.7%
100	79.6%
200	64.6%

Atterberg
Limits
 Plastic Limit 14
 Liquid Limit 41
 Plastic Index 27

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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DATE:

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DATE:

D 9

10/26/10

JOB NO.:

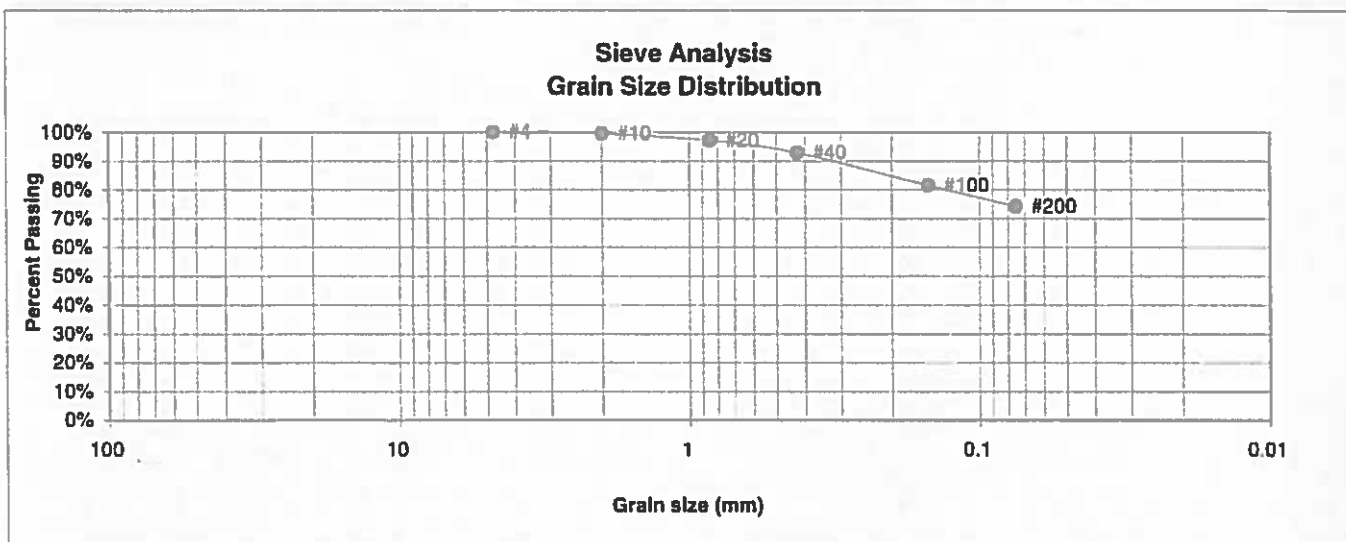
160002

FIG NO.:

B-21

UNIFIED CLASSIFICATION CL
SOIL TYPE # 4
TEST BORING # 9
DEPTH (FT) 5
AASHTO CLASSIFICATION A-7-6

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002
TEST BY BL
GROUP INDEX 20



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.5%
20	97.1%
40	92.8%
100	81.5%
200	74.2%

**Atterberg
Limits**
 Plastic Limit 21
 Liquid Limit 48
 Plastic Index 27

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



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**LABORATORY TEST
RESULTS**

DRAWN:

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CHECKED:

DATE:

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12/2/11

JOB NO.:

160002

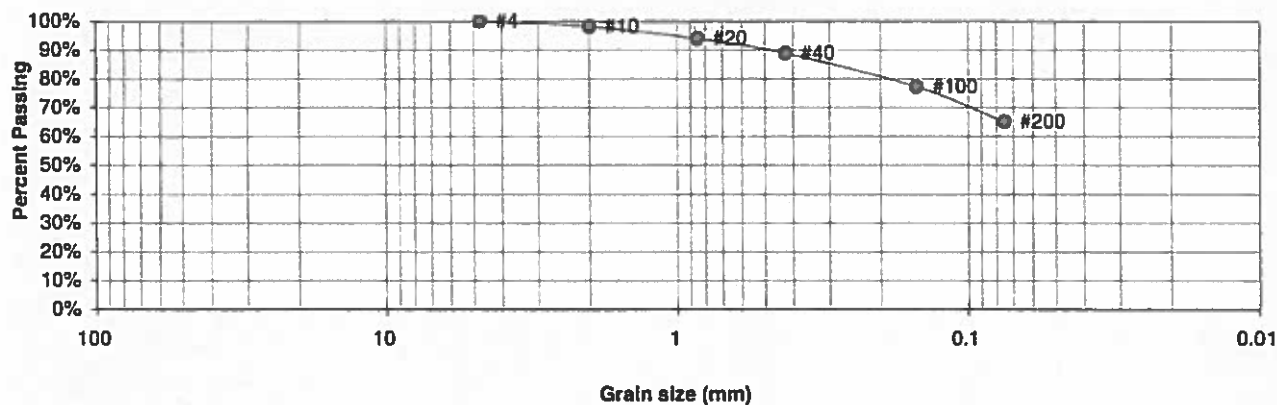
FIG NO.:

B-2

UNIFIED CLASSIFICATION CL
SOIL TYPE # 4
TEST BORING # 12
DEPTH (FT) 5
AASHTO CLASSIFICATION A-6

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002
TEST BY BL
GROUP INDEX 9

**Sieve Analysis
Grain Size Distribution**



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	98.2%
20	94.0%
40	88.8%
100	77.2%
200	65.0%

**Atterberg
Limits**
 Plastic Limit 19
 Liquid Limit 36
 Plastic Index 17

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.:

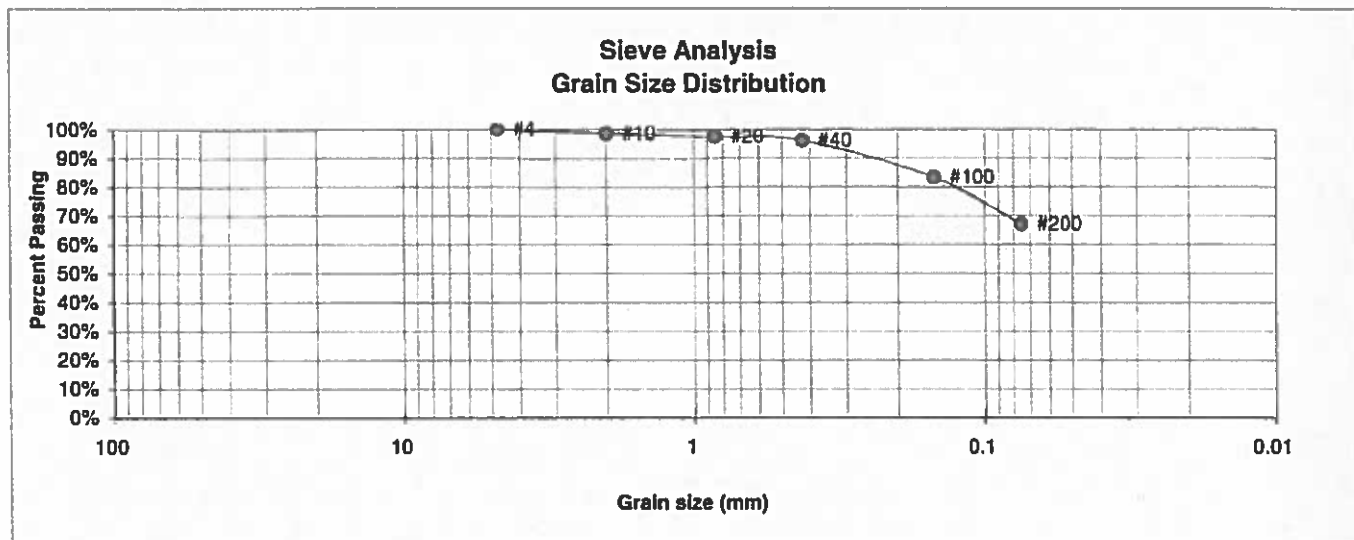
160002

FIG NO.:

B-23

UNIFIED CLASSIFICATION CL
SOIL TYPE # 4
TEST BORING # 15
DEPTH (FT) 5
AASHTO CLASSIFICATION A-6

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002
TEST BY BL
GROUP INDEX 10



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	98.6%
20	97.4%
40	96.1%
100	83.2%
200	67.0%

**Atterberg
Limits**
 Plastic Limit 16
 Liquid Limit 35
 Plastic Index 19

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



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RESULTS**

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DATE:

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160002

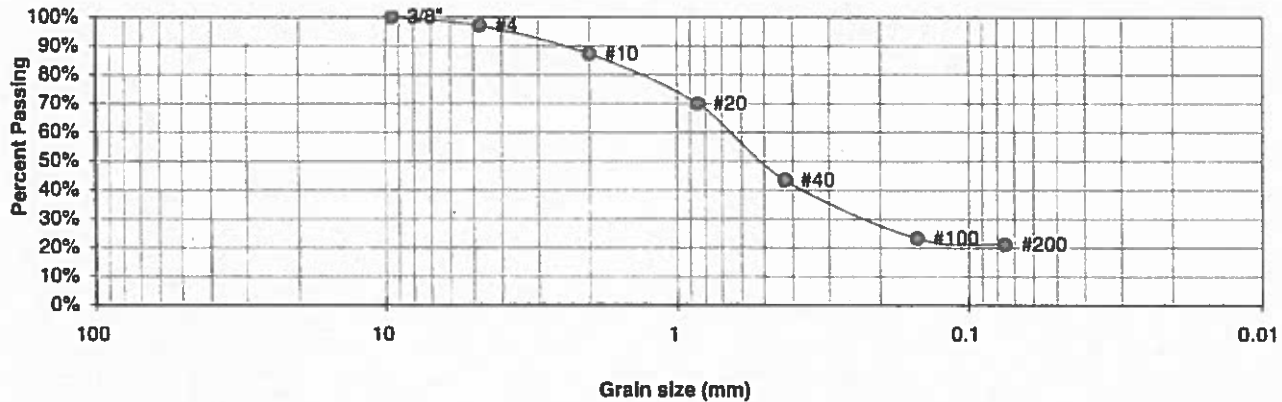
FIG NO.:

B24

UNIFIED CLASSIFICATION SM
SOIL TYPE # 5, CBR #4
TEST BORING # 11
DEPTH (FT) 0-3
AASHTO CLASSIFICATION A-1-b

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002
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	97.0%
10	87.2%
20	70.0%
40	43.4%
100	23.2%
200	21.1%

**Atterberg
Limits**
 Plastic Limit 19
 Liquid Limit 20
 Plastic Index 2

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



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**LABORATORY TEST
RESULTS**

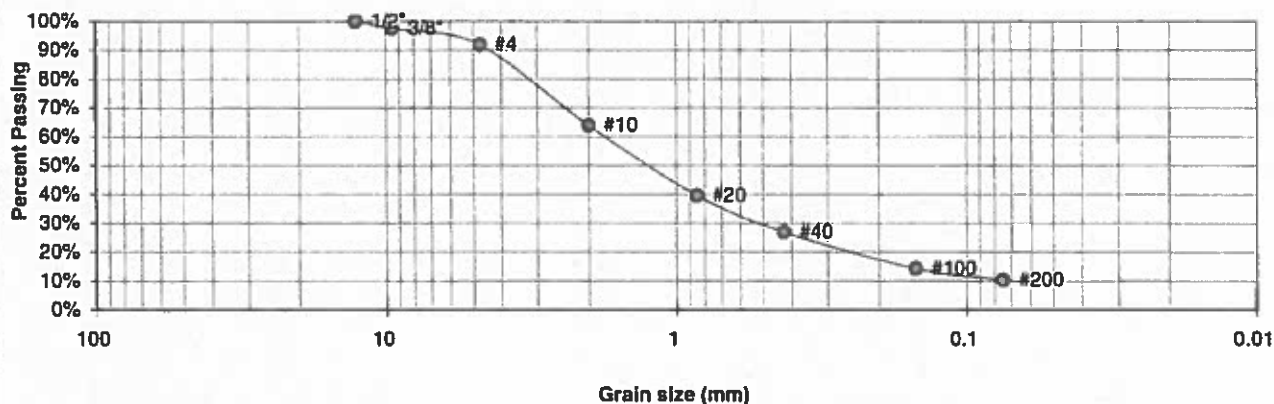
DRAWN:	DATE:	CHECKED:	DATE:
		DS	10/24/16

JOB NO.:
 160002
 FIG NO.:
 8-25

UNIFIED CLASSIFICATION SM-SW
SOIL TYPE # 5
TEST BORING # 11
DEPTH (FT) 1-2
AASHTO CLASSIFICATION A-1-b

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002
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"	97.6%
4"	91.9%
10"	63.9%
20"	39.6%
40"	26.9%
100"	14.3%
200"	10.3%

**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**

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JOB NO.:

160002

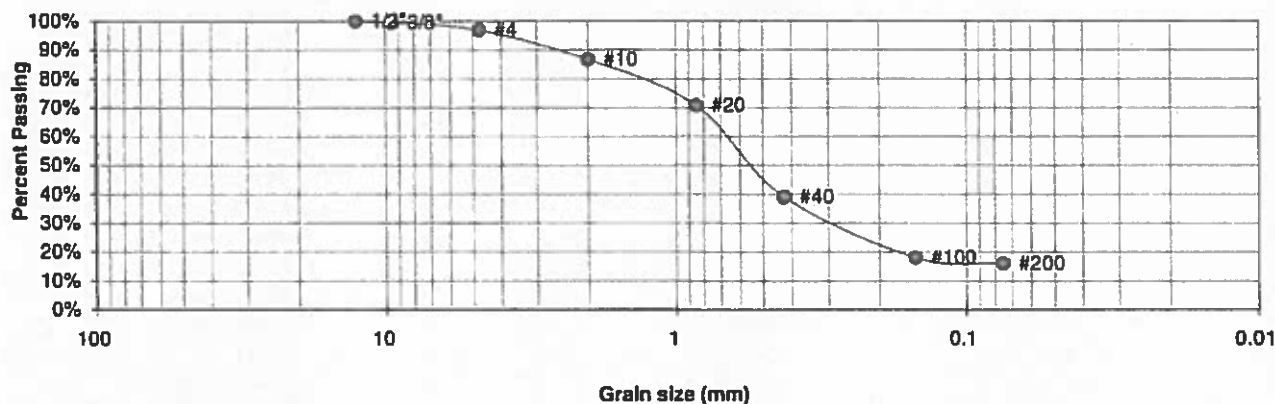
FIG NO.:

B-26

UNIFIED CLASSIFICATION SM
SOIL TYPE # 5
TEST BORING # 13
DEPTH (FT) 1-2
AASHTO CLASSIFICATION A-1-b

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002
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"	99.5%
4	96.9%
10	86.7%
20	70.7%
40	39.0%
100	18.1%
200	16.0%

**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**

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DATE:

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160002

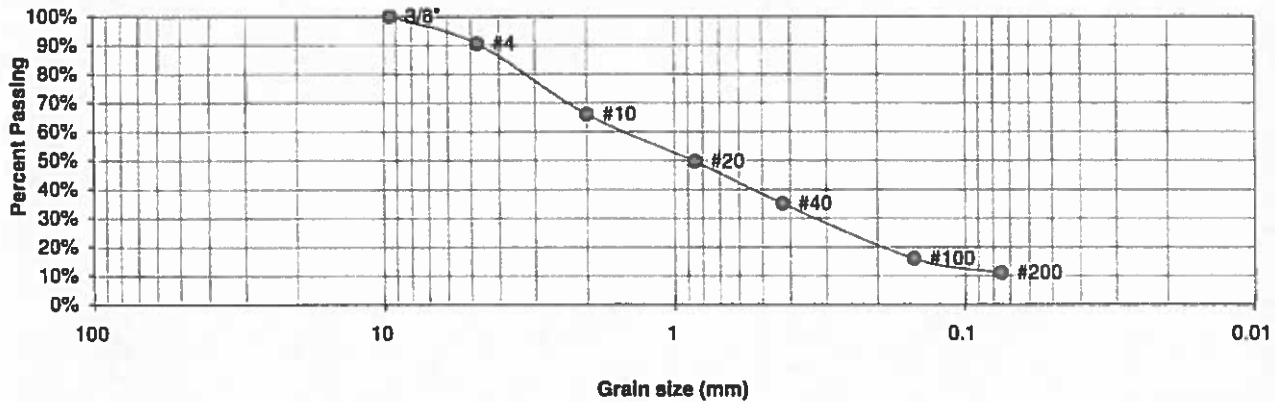
FIG NO.:

B-27

UNIFIED CLASSIFICATION SM-SW
SOIL TYPE # 5
TEST BORING # 8
DEPTH (FT) 5
AASHTO CLASSIFICATION A-1-b

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002
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	90.6%
10	66.1%
20	49.6%
40	35.0%
100	15.9%
200	11.0%

**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**

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DATE:

10/4/16

JOB NO.:

160002

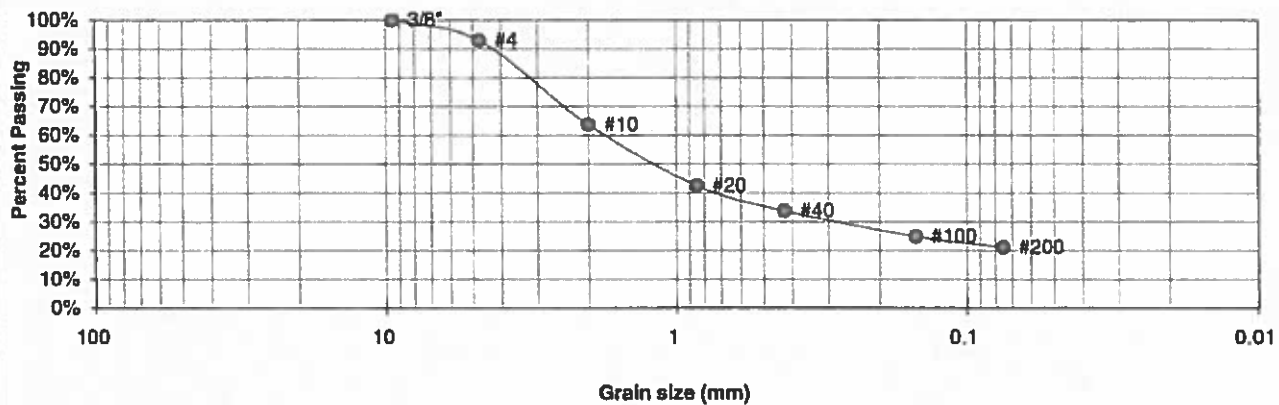
FIG NO.:

B20

UNIFIED CLASSIFICATION SM
SOIL TYPE # 5
TEST BORING # 2
DEPTH (FT) 5
AASHTO CLASSIFICATION A-1-b

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002
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	93.0%
10	63.6%
20	42.4%
40	33.7%
100	24.8%
200	21.0%

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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RESULTS

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JOB NO.:

160002

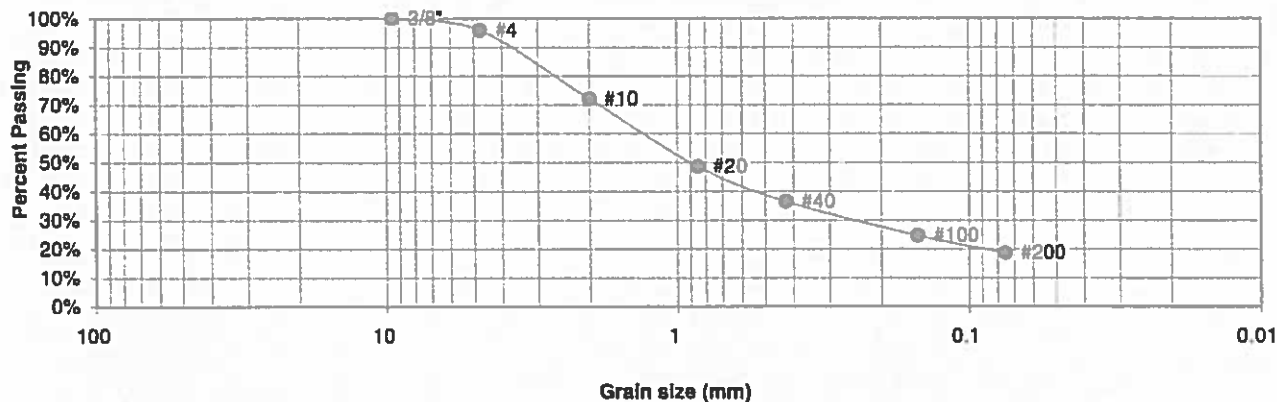
FIG NO.:

B-2A

UNIFIED CLASSIFICATION SC
SOIL TYPE # 5
TEST BORING # 1
DEPTH (FT) 10
AASHTO CLASSIFICATION A-2-6

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002
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	95.9%
10	72.1%
20	48.6%
40	36.4%
100	24.6%
200	18.5%

Atterberg
Limits
 Plastic Limit 19
 Liquid Limit 34
 Plastic Index 15

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 :

160002

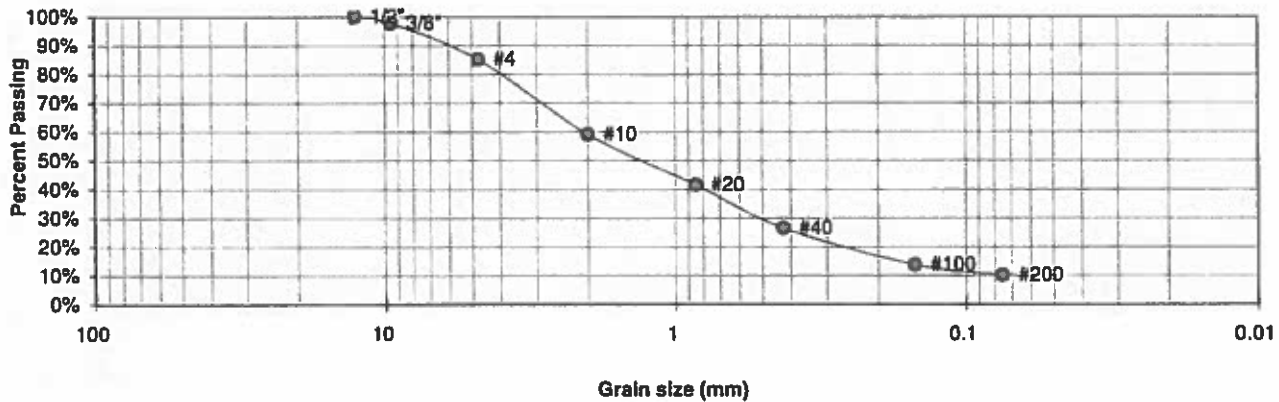
FIG NO :

8-30

UNIFIED CLASSIFICATION SM-SW
SOIL TYPE # 5
TEST BORING # 7
DEPTH (FT) 10
AASHTO CLASSIFICATION A-1-b

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002
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"	97.7%
4	85.2%
10	59.1%
20	41.5%
40	26.5%
100	13.7%
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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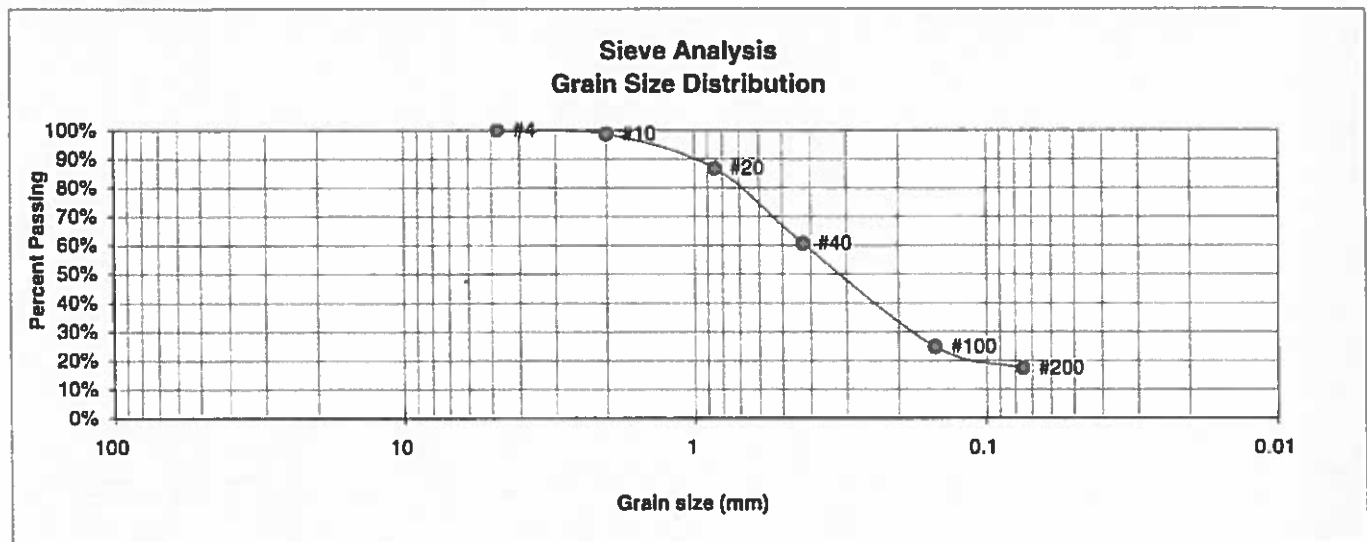
LABORATORY TEST
RESULTS

DRAWN:	DATE:	CHECKED: <i>W</i>	DATE: 10/4/16
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JOB NO.:
 160002
 FIG NO.:
 E-31

UNIFIED CLASSIFICATION SM
SOIL TYPE # 5
TEST BORING # 10
DEPTH (FT) 10
AASHTO CLASSIFICATION A-2-4

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002
TEST BY BL
GROUP INDEX 0



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	98.6%
20	86.7%
40	60.6%
100	24.7%
200	17.3%

**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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505 ELKTON DRIVE
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**LABORATORY TEST
RESULTS**

DRAWN:

DATE:

CHECKED: *W*

DATE:

10/4/16

JOB NO.:

160002

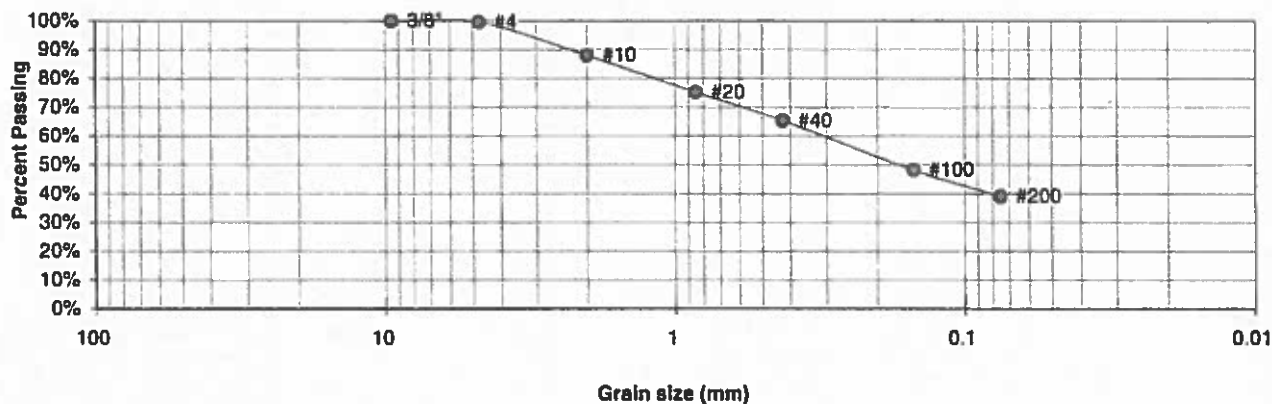
FIG NO.:

B-32

UNIFIED CLASSIFICATION SC
SOIL TYPE # 5
TEST BORING # 18
DEPTH (FT) 10
AASHTO CLASSIFICATION A-6

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002
TEST BY BL
GROUP INDEX 1

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.6%
10	88.0%
20	75.2%
40	65.3%
100	48.1%
200	39.0%

Atterberg
Limits
 Plastic Limit 23
 Liquid Limit 36
 Plastic Index 13

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



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RESULTS

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JOB NO.:

160002

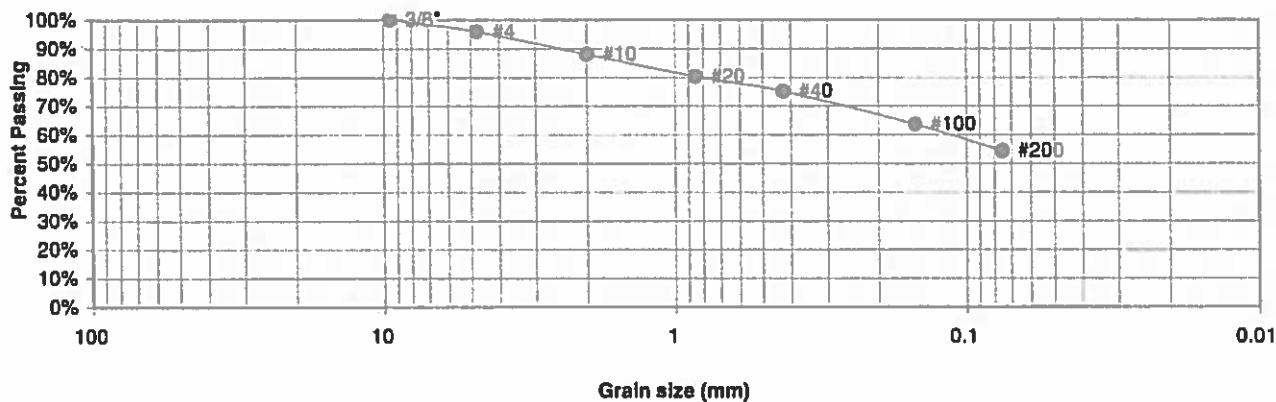
FIG NO.:

B-33

UNIFIED CLASSIFICATION CL
SOIL TYPE # 6
TEST BORING # 3
DEPTH (FT) 1-2
AASHTO CLASSIFICATION A-6

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002
TEST BY BL
GROUP INDEX 5

**Sieve Analysis
Grain Size Distribution**



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	95.9%
10	88.0%
20	80.3%
40	75.1%
100	63.5%
200	54.3%

**Atterberg
Limits**
 Plastic Limit 20
 Liquid Limit 34
 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:

10/4/10

JOB NO:

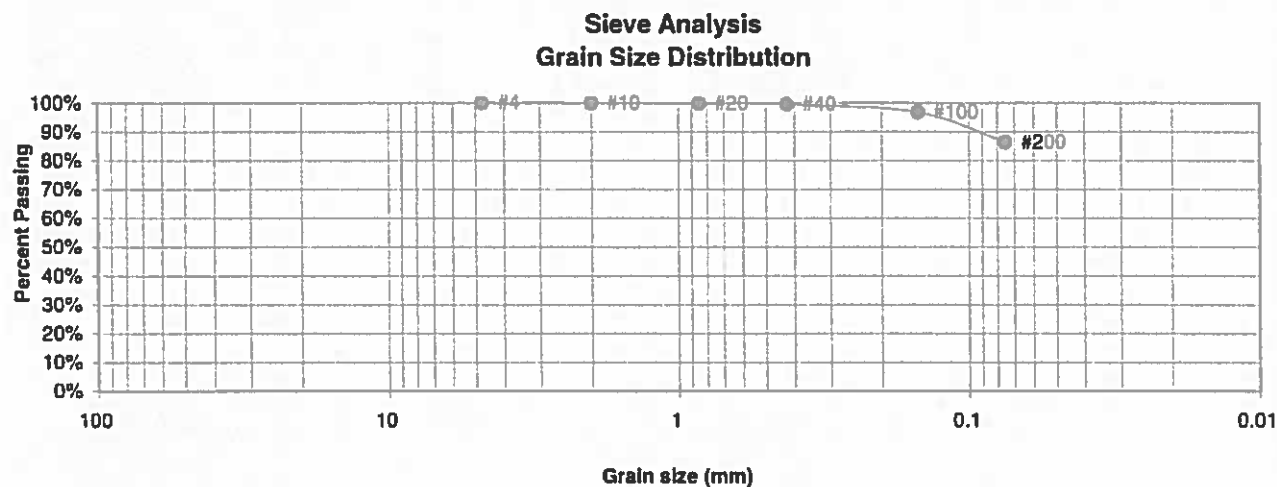
160002

FIG NO:

B-34

UNIFIED CLASSIFICATION CL
SOIL TYPE # 6
TEST BORING # 4
DEPTH (FT) 10
AASHTO CLASSIFICATION A-7-6

CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
JOB NO. 160002
TEST BY BL
GROUP INDEX 20



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.9%
20	99.7%
40	99.4%
100	96.8%
200	86.4%

**Atterberg
Limits**
 Plastic Limit 18
 Liquid Limit 41
 Plastic Index 23

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



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**LABORATORY TEST
RESULTS**

DRAWN:

DATE:

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DATE:

DS

16/24/14

JOB NO.:

160002

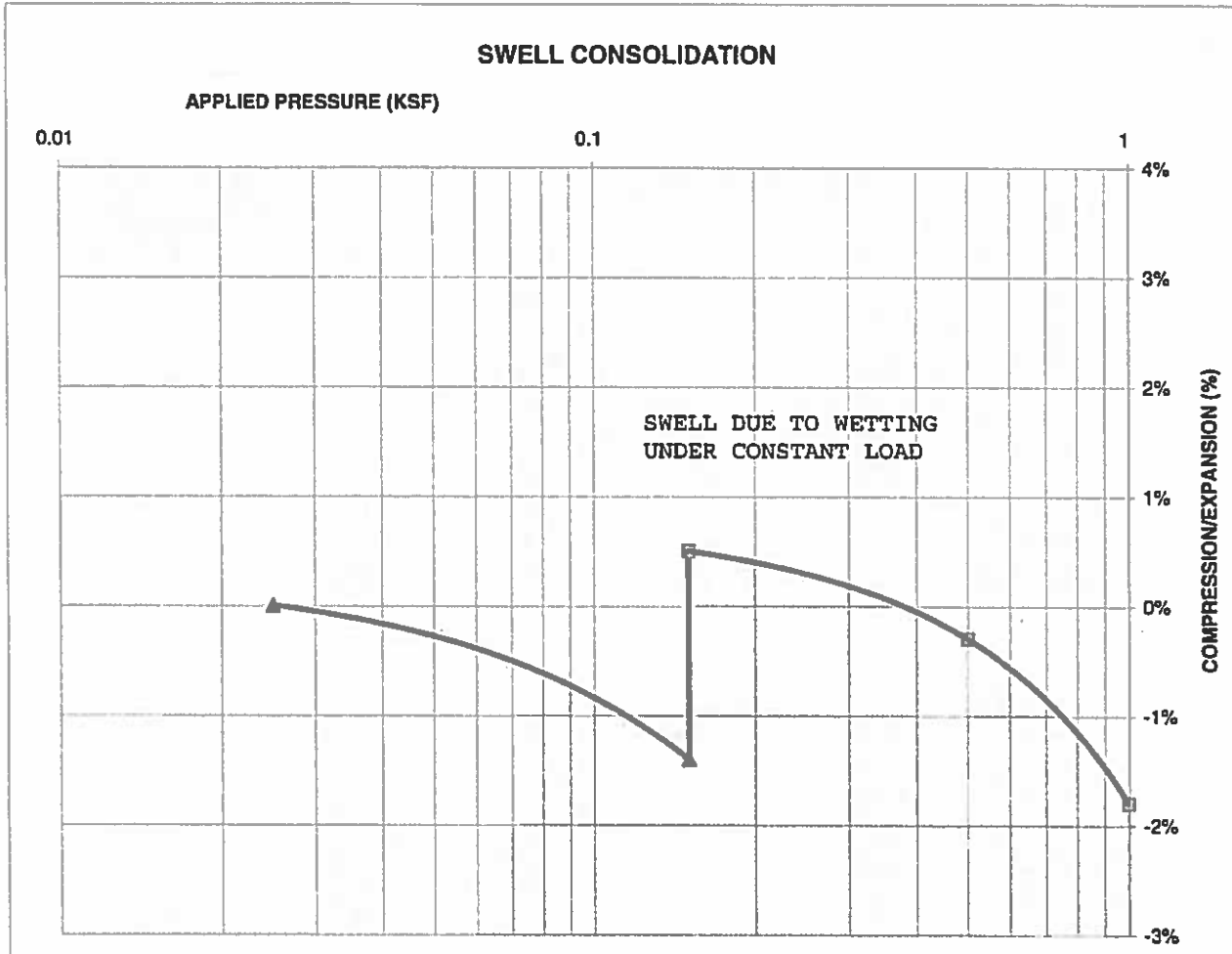
FIG NO.:

8-55

CONSOLIDATION TEST RESULTS

TEST BORING #	1	DEPTH(ft)	0-3
DESCRIPTION	CL	SOIL TYPE	2, CBR #1
NATURAL UNIT DRY WEIGHT (PCF)			108
NATURAL MOISTURE CONTENT			13.5%
SWELL/CONSOLIDATION (%)			1.9%

JOB NO.	160002
CLIENT	SR LAND, LLC
PROJECT	STERLING RANCH, FILING 1
REMOVED SAMPLE BASED ON STANDARD PROCTOR DENSITY	



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SWELL CONSOLIDATION TEST RESULTS

DRAWN:

DATE:

CHECKED: *[Signature]*

DATE:

10/4/16

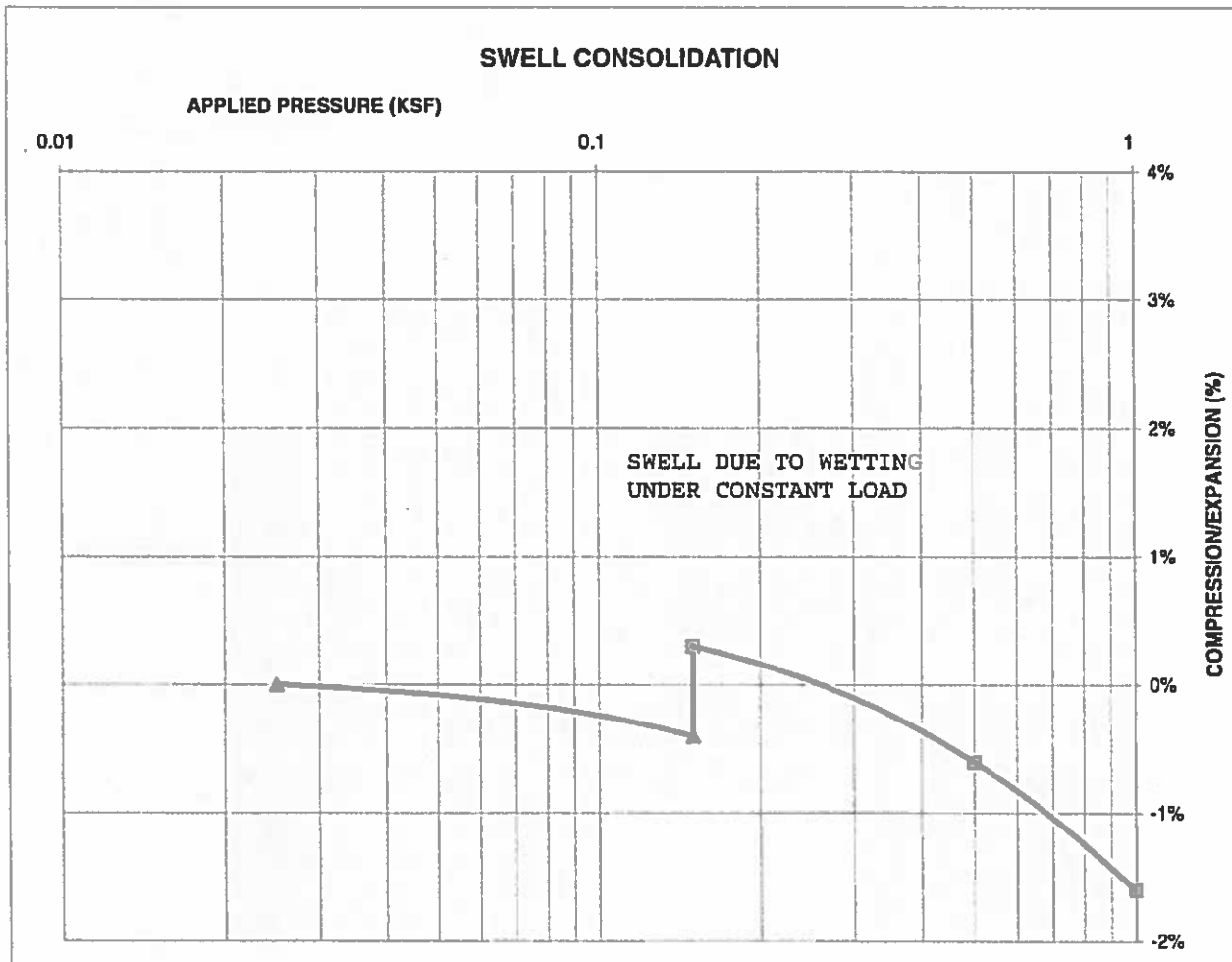
JOB NO.:
160002

FIG NO.:
B-36

CONSOLIDATION TEST RESULTS

TEST BORING #	1	DEPTH(ft)	1-2
DESCRIPTION	CL	SOIL TYPE	2
NATURAL UNIT DRY WEIGHT (PCF)	112		
NATURAL MOISTURE CONTENT	16.2%		
SWELL/CONSOLIDATION (%)	0.7%		

JOB NO. 160002
 CLIENT SR LAND, LLC
 PROJECT STERLING RANCH, FILING 1



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SWELL CONSOLIDATION TEST RESULTS

DRAWN:

DATE:

CHECKED: *[Signature]*

DATE: 10/4/16

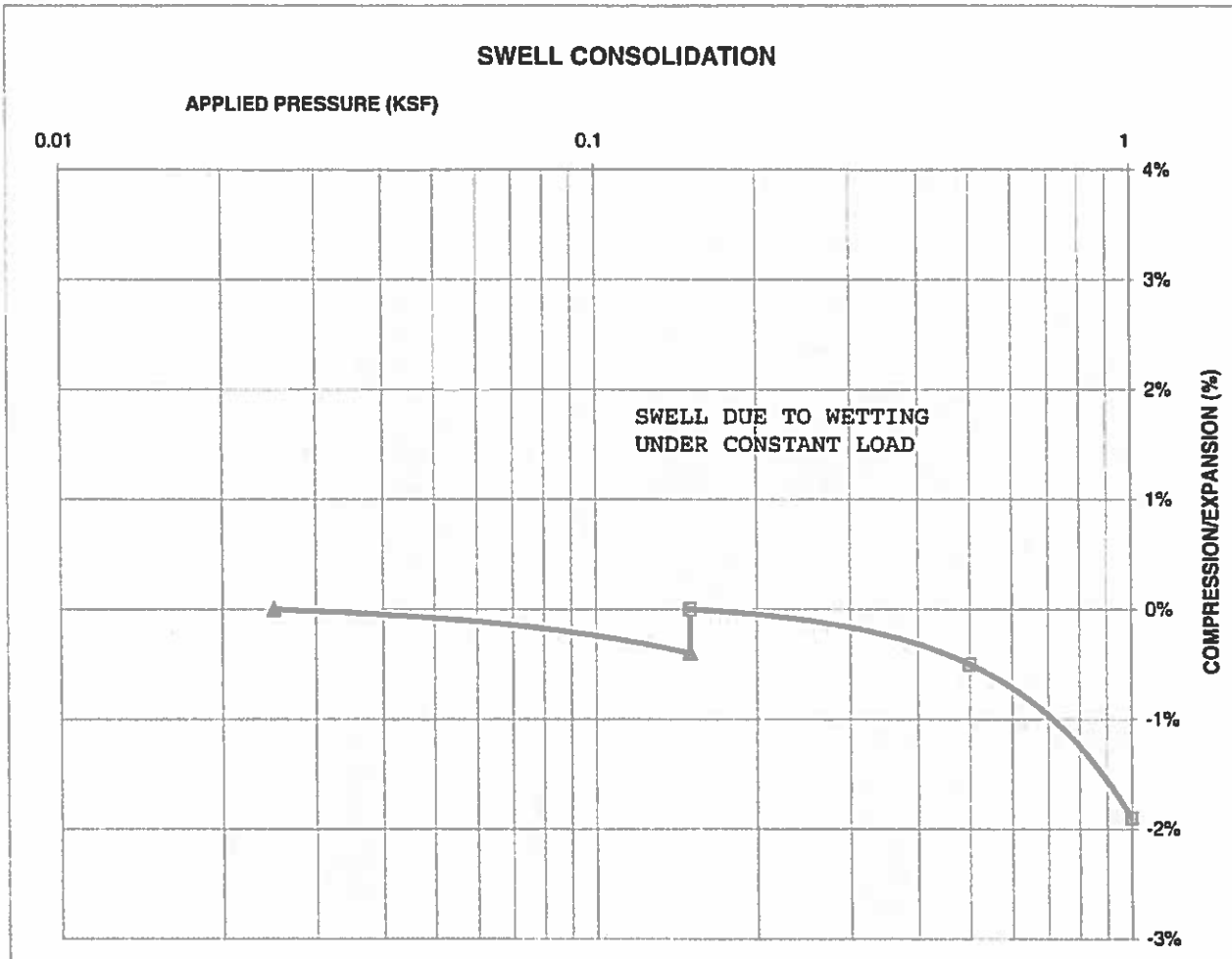
JOB NO.:
 160002

FIG NO.:
 B-37

CONSOLIDATION TEST RESULTS

TEST BORING #	6	DEPTH(ft)	1-2
DESCRIPTION	SC	SOIL TYPE	2
NATURAL UNIT DRY WEIGHT (PCF)	103		
NATURAL MOISTURE CONTENT	11.9%		
SWELL/CONSOLIDATION (%)	0.4%		

JOB NO. 160002
CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1



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SWELL CONSOLIDATION TEST RESULTS

DRAWN:

DATE:

CHECKED: *h*

DATE: 10/4/16

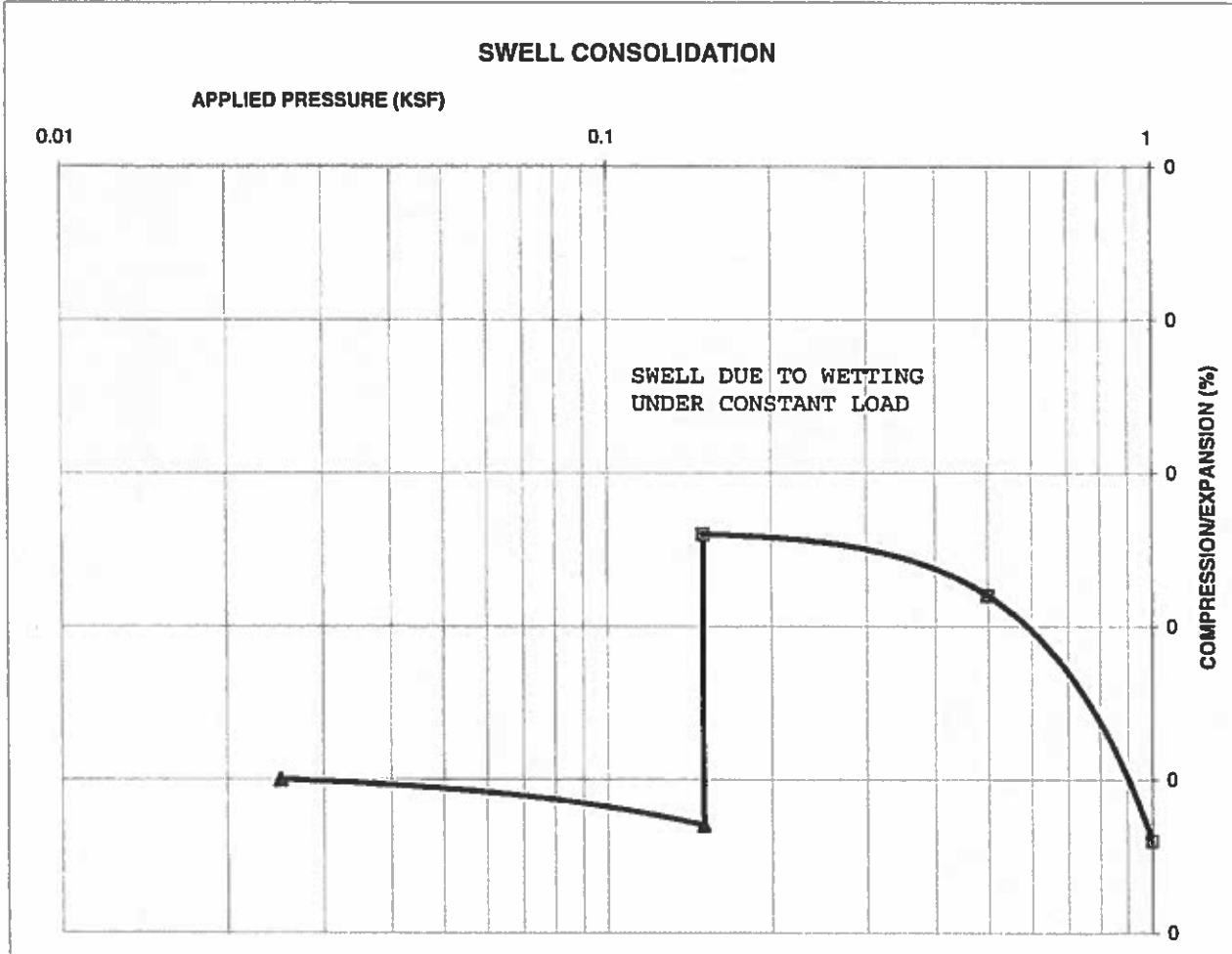
JOB NO.:
160002

FIG NO.:
B-38

CONSOLIDATION TEST RESULTS

TEST BORING #	4	DEPTH(ft)	0-3
DESCRIPTION	SC	SOIL TYPE	3, CBR #3
NATURAL UNIT DRY WEIGHT (PCF)			109
NATURAL MOISTURE CONTENT			12.5%
SWELL/CONSOLIDATION (%)			1.9%

JOB NO. 160002
CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1
 REMOLDED SAMPLE BASE ON
 STANDARD PROCTOR DENSITY



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SWELL CONSOLIDATION TEST RESULTS

DRAWN:

DATE:

CHECKED:

DATE:

10/4/16

JOB NO.:

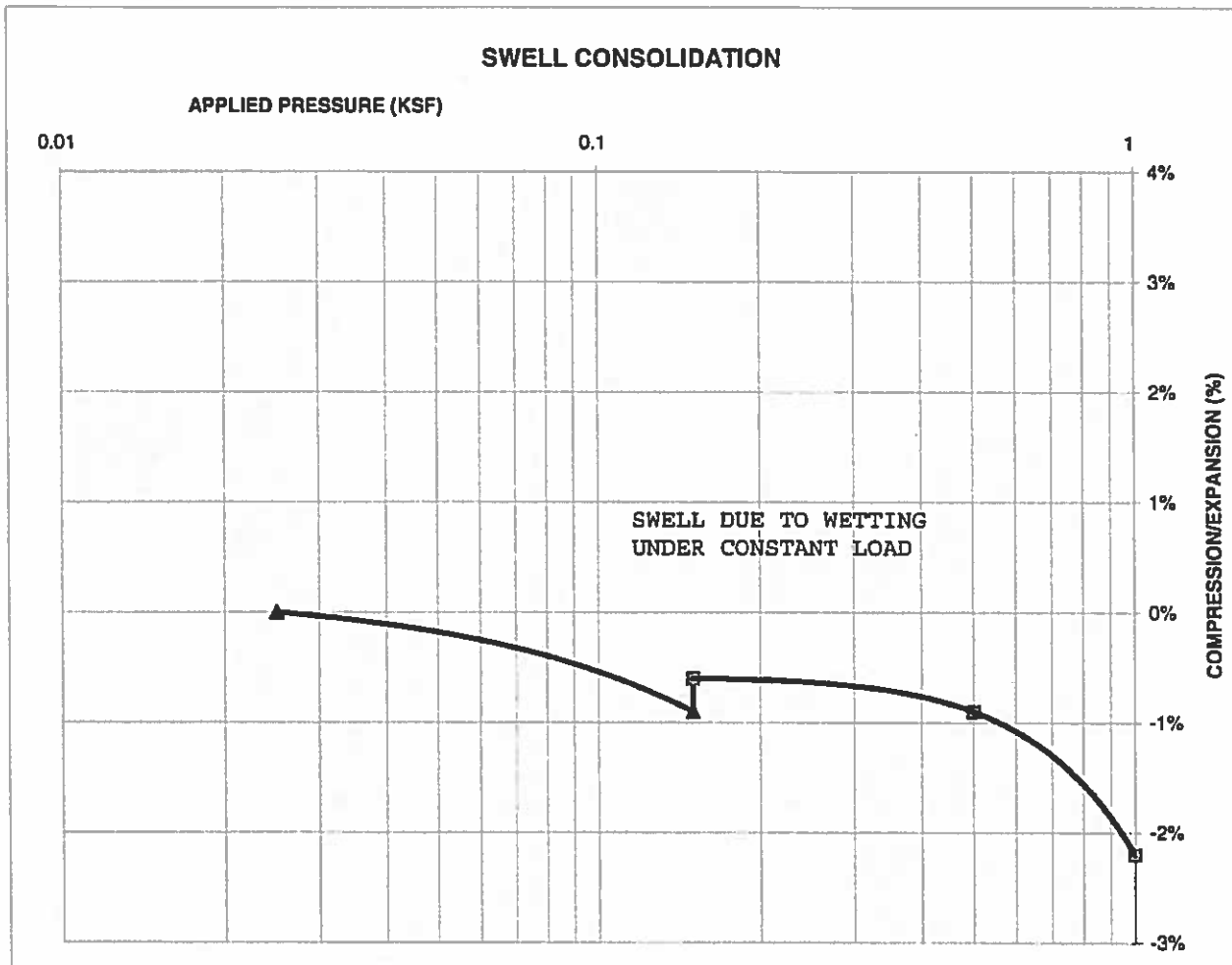
160002

FIG NO.:

8-39

TEST BORING #	4	DEPTH(ft)	1-2
DESCRIPTION	CL	SOIL TYPE	4
NATURAL UNIT DRY WEIGHT (PCF)			92
NATURAL MOISTURE CONTENT			19.8%
SWELL/CONSOLIDATION (%)			0.3%

JOB NO. 160002
CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1



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SWELL CONSOLIDATION TEST RESULTS

DATE: _____

CHECKED:

DATE _____

10/2/16

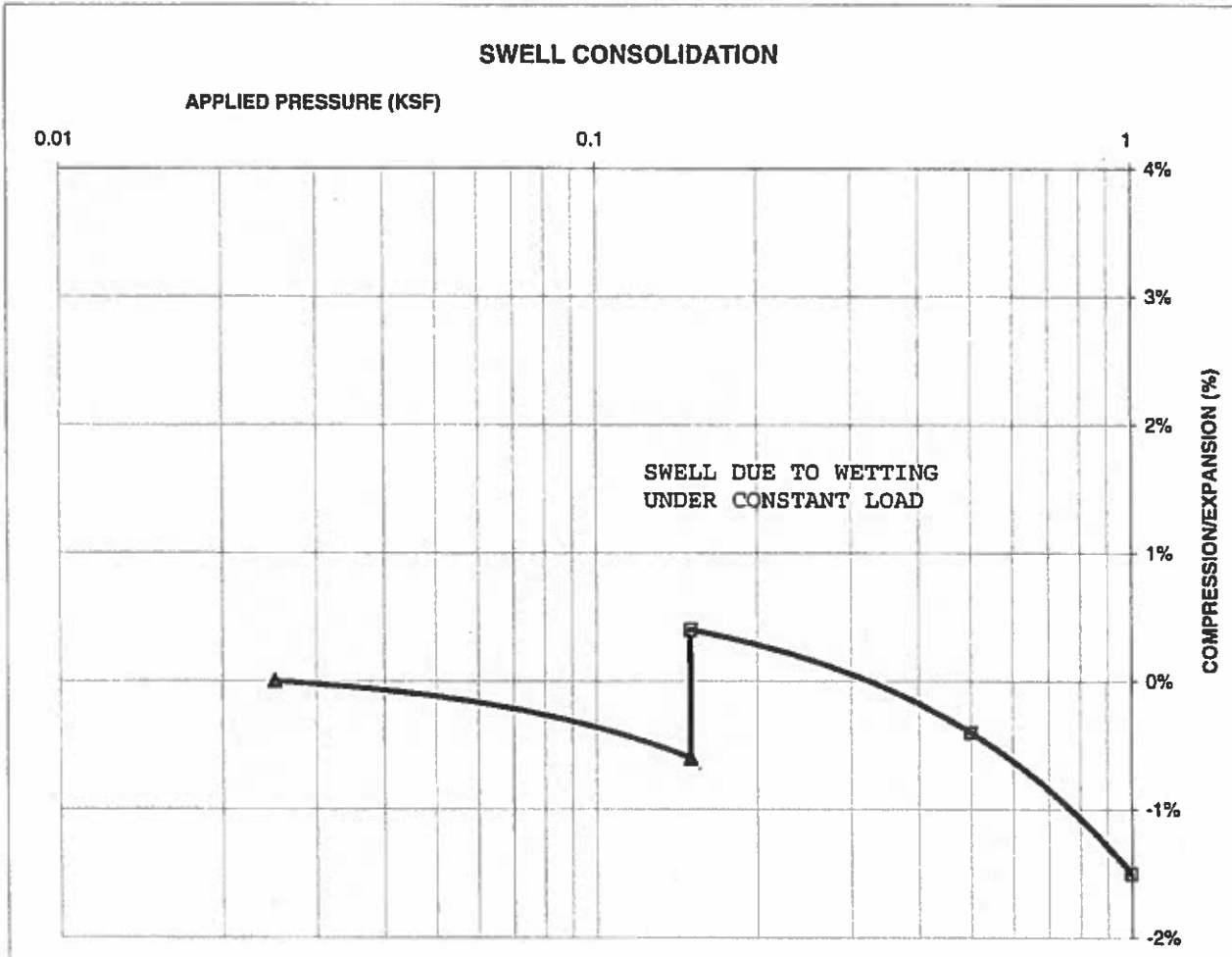
JOB NO.:
160002

FIG NO.:
B-40

CONSOLIDATION TEST RESULTS

TEST BORING #	9	DEPTH(ft)	5
DESCRIPTION	CL	SOIL TYPE	4
NATURAL UNIT DRY WEIGHT (PCF)			104
NATURAL MOISTURE CONTENT			19.8%
SWELL/CONSOLIDATION (%)			1.0%

JOB NO. 160002
 CLIENT SR LAND, LLC
 PROJECT STERLING RANCH, FILING 1



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SWELL CONSOLIDATION TEST RESULTS

DRAWN:

DATE:

CHECKED: *W*

DATE: 10/4/16

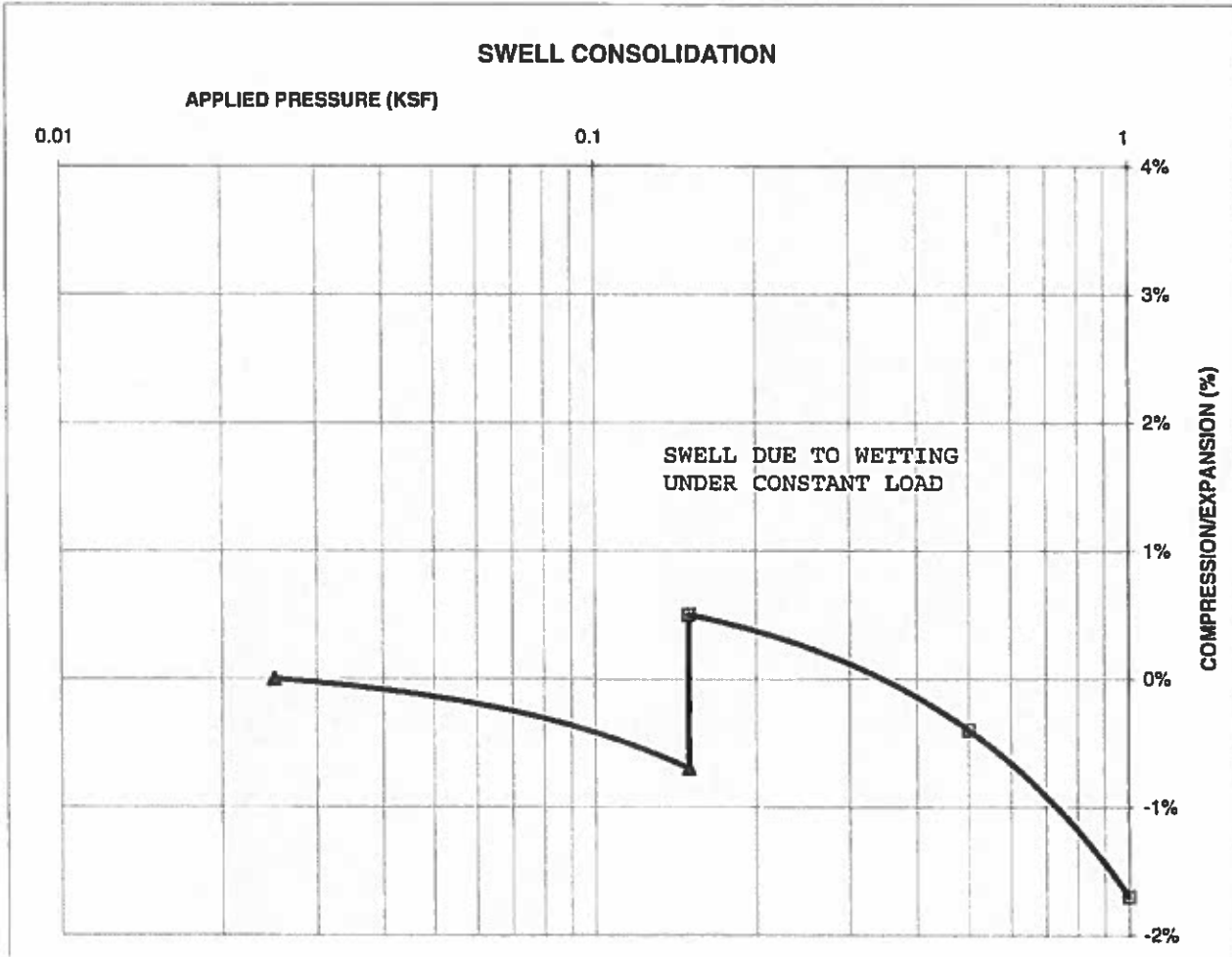
JOB NO.:
160002

FIG NO.:
B-41

CONSOLIDATION TEST RESULTS

TEST BORING #	12	DEPTH(ft)	5
DESCRIPTION	CL	SOIL TYPE	4
NATURAL UNIT DRY WEIGHT (PCF)	108		
NATURAL MOISTURE CONTENT	16.7%		
SWELL/CONSOLIDATION (%)	1.2%		

JOB NO. 160002
 CLIENT SR LAND, LLC
 PROJECT STERLING RANCH, FILING 1



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SWELL CONSOLIDATION TEST RESULTS

DRAWN:

DATE:

CHECKED: *W*

DATE: 6/4/16

JOB NO.:
160002

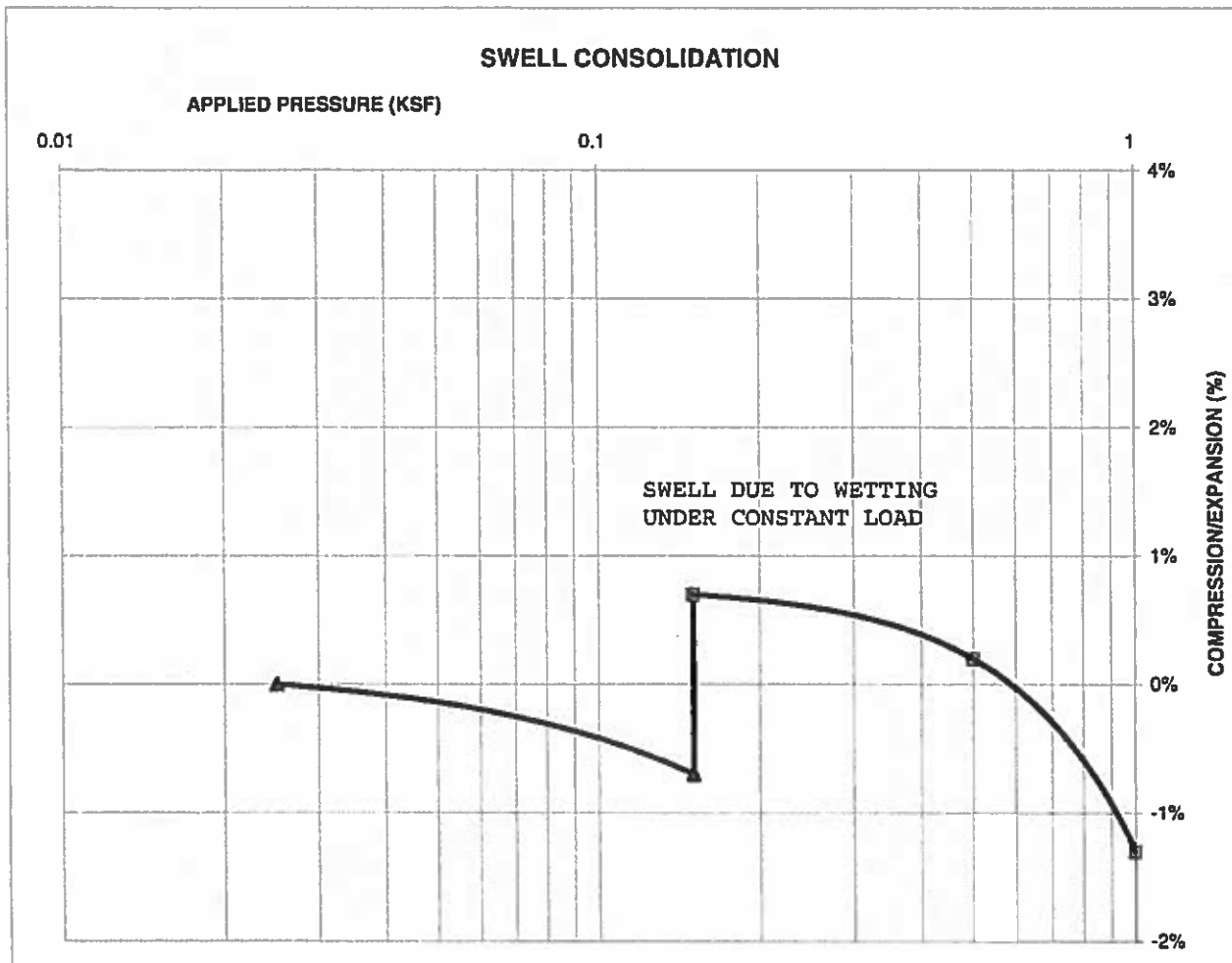
FIG NO.:

B-42

CONSOLIDATION TEST RESULTS

TEST BORING #	15	DEPTH(ft)	5
DESCRIPTION	CL	SOIL TYPE	4
NATURAL UNIT DRY WEIGHT (PCF)	109		
NATURAL MOISTURE CONTENT	17.6%		
SWELL/CONSOLIDATION (%)	1.4%		

JOB NO. 160002
CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1



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SWELL CONSOLIDATION TEST RESULTS

DRAWN:

DATE:

CHECKED: *[Signature]*

DATE: 10/4/16

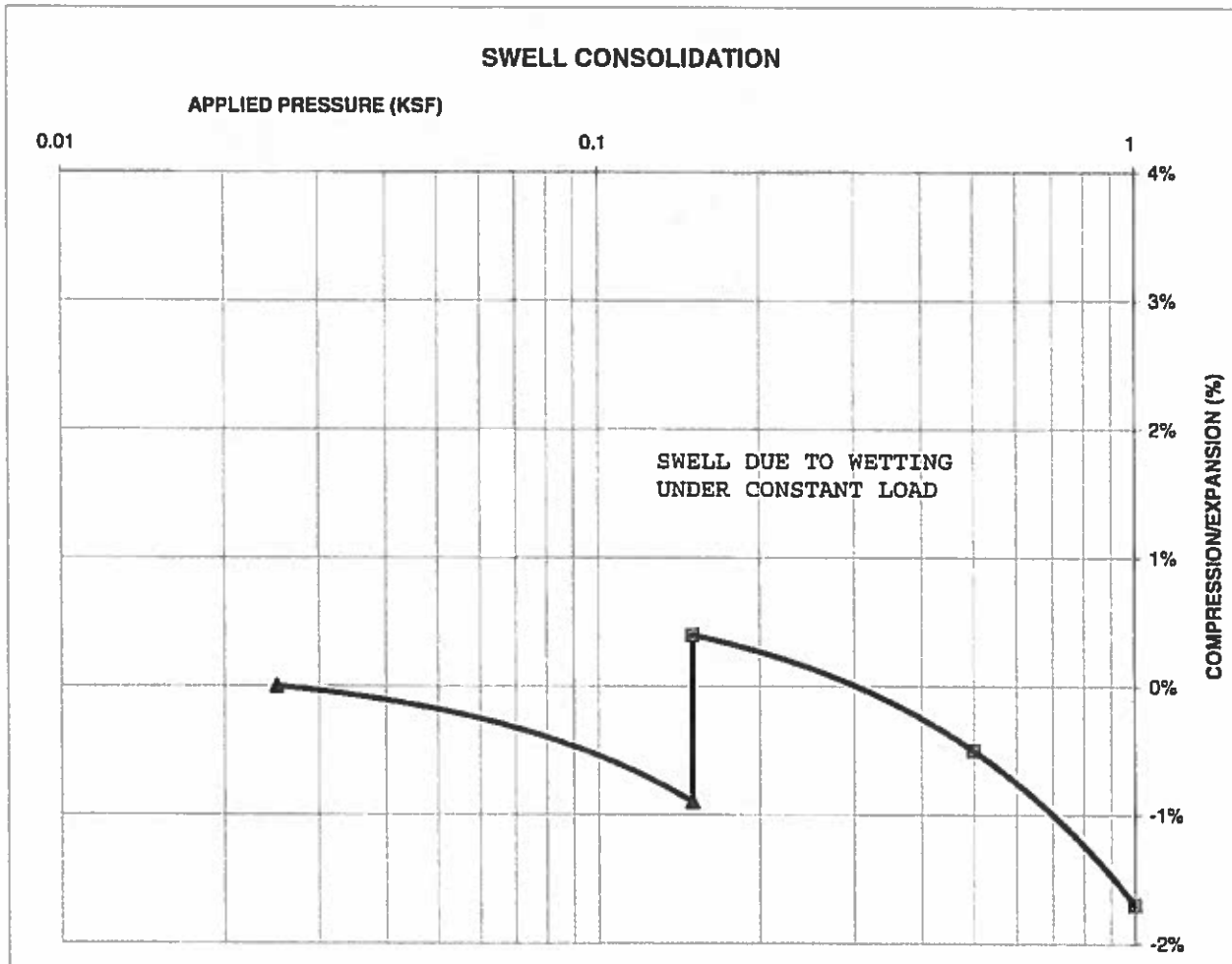
JOB NO.:
 160002

FIG NO.:
 B-43

CONSOLIDATION TEST RESULTS

TEST BORING #	1	DEPTH(ft)	10
DESCRIPTION	SC	SOIL TYPE	5
NATURAL UNIT DRY WEIGHT (PCF)			111
NATURAL MOISTURE CONTENT			10.3%
SWELL/CONSOLIDATION (%)			1.3%

JOB NO. 160002
CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1



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SWELL CONSOLIDATION TEST RESULTS

DRAWN:

DATE:

CHECKED: *[Signature]*

DATE:

11/4/16

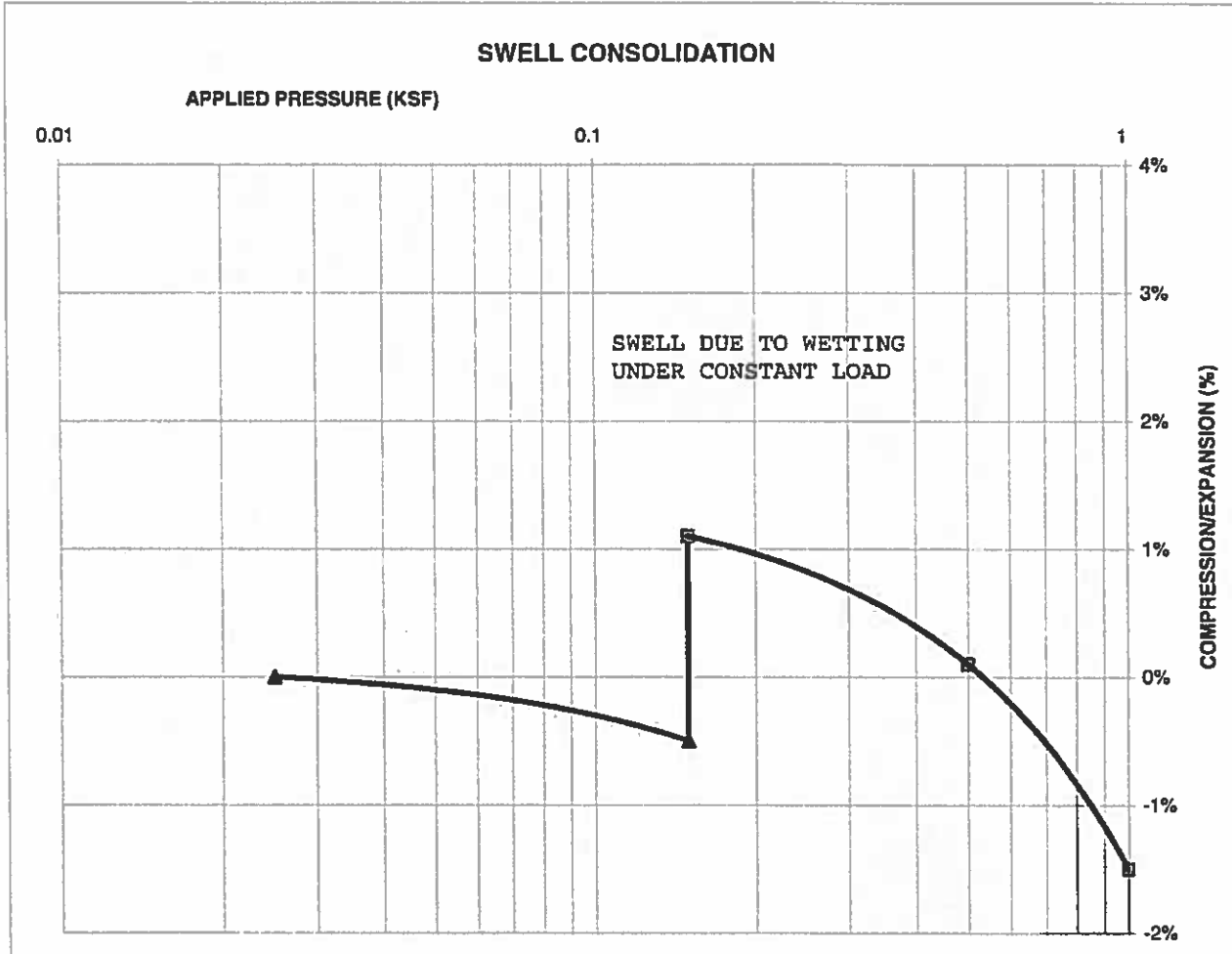
JOB NO.:
160002

FIG NO.:
B-44

CONSOLIDATION TEST RESULTS

TEST BORING #	3	DEPTH(ft)	1-2
DESCRIPTION	CL	SOIL TYPE	6
NATURAL UNIT DRY WEIGHT (PCF)	103		
NATURAL MOISTURE CONTENT	17.2%		
SWELL/CONSOLIDATION (%)	1.6%		

JOB NO. 160002
CLIENT SR LAND, LLC
PROJECT STERLING RANCH, FILING 1



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SWELL CONSOLIDATION TEST RESULTS

DRAWN:

DATE:

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DATE:

10/4/11

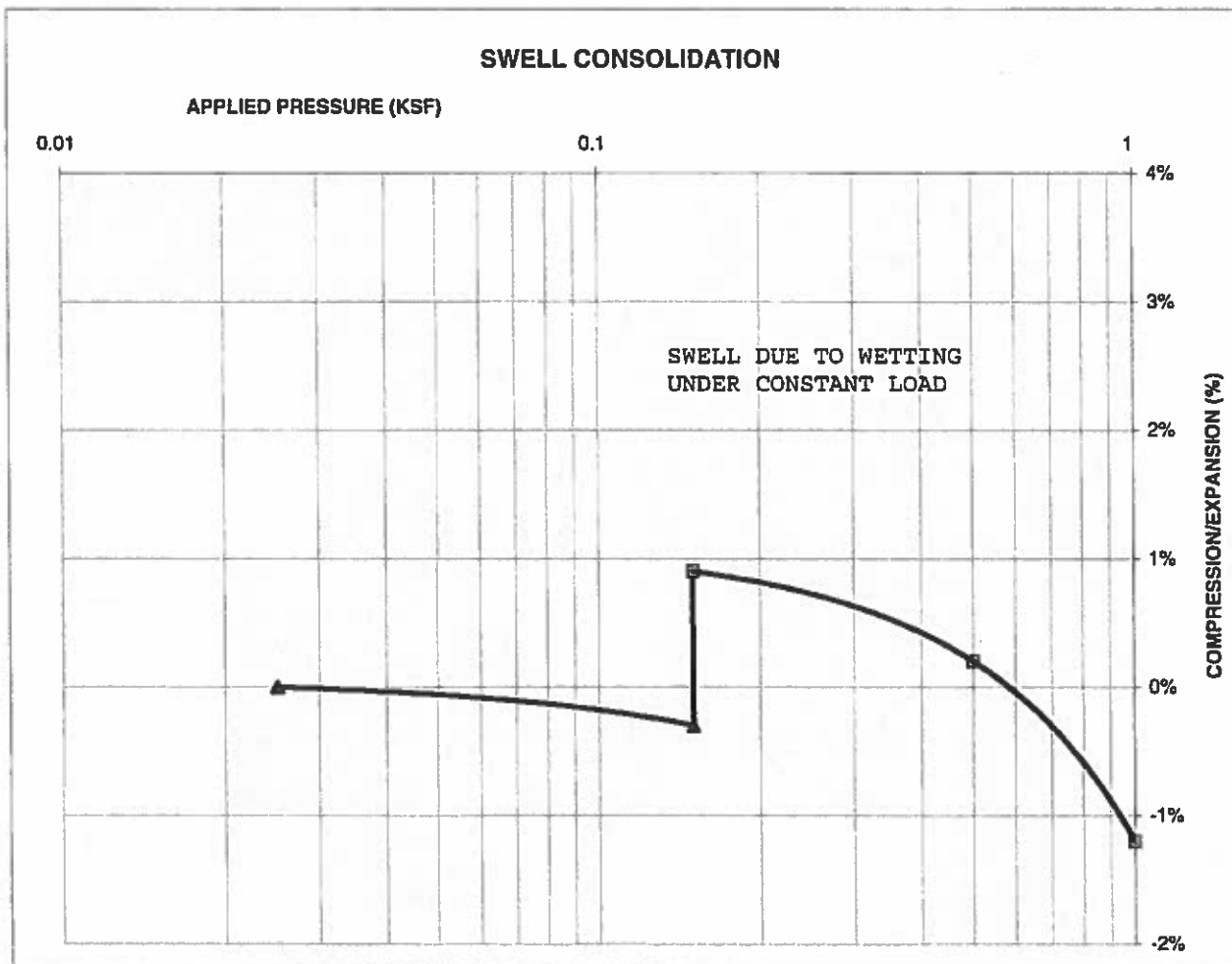
JOB NO.:
160002

FIG NO.:
B-45

CONSOLIDATION TEST RESULTS

TEST BORING #	4	DEPTH(ft)	10
DESCRIPTION	CL	SOIL TYPE	6
NATURAL UNIT DRY WEIGHT (PCF)			103
NATURAL MOISTURE CONTENT			15.0%
SWELL/CONSOLIDATION (%)			1.2%

JOB NO. 160002
 CLIENT SR LAND, LLC
 PROJECT STERLING RANCH, FILING 1



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SWELL CONSOLIDATION TEST RESULTS

DRAWN:

DATE:

CHECKED:

DATE:

DJ

1/2/02

JOB NO.:
160002

FIG NO.:

B-46

CLIENT	SR LAND, LLC	JOB NO.	160002
PROJECT	STERLING RANCH, FILING 1	DATE	9/25/2016
LOCATION	STERLING RANCH, FILING 1	TEST BY	BL

[illegible]

QC BLANK PASS



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LABORATORY TEST SULFATE RESULTS

DRAWN:

DATE: _____

CHECKED:

DATE: _____

JOB NO.:

160002

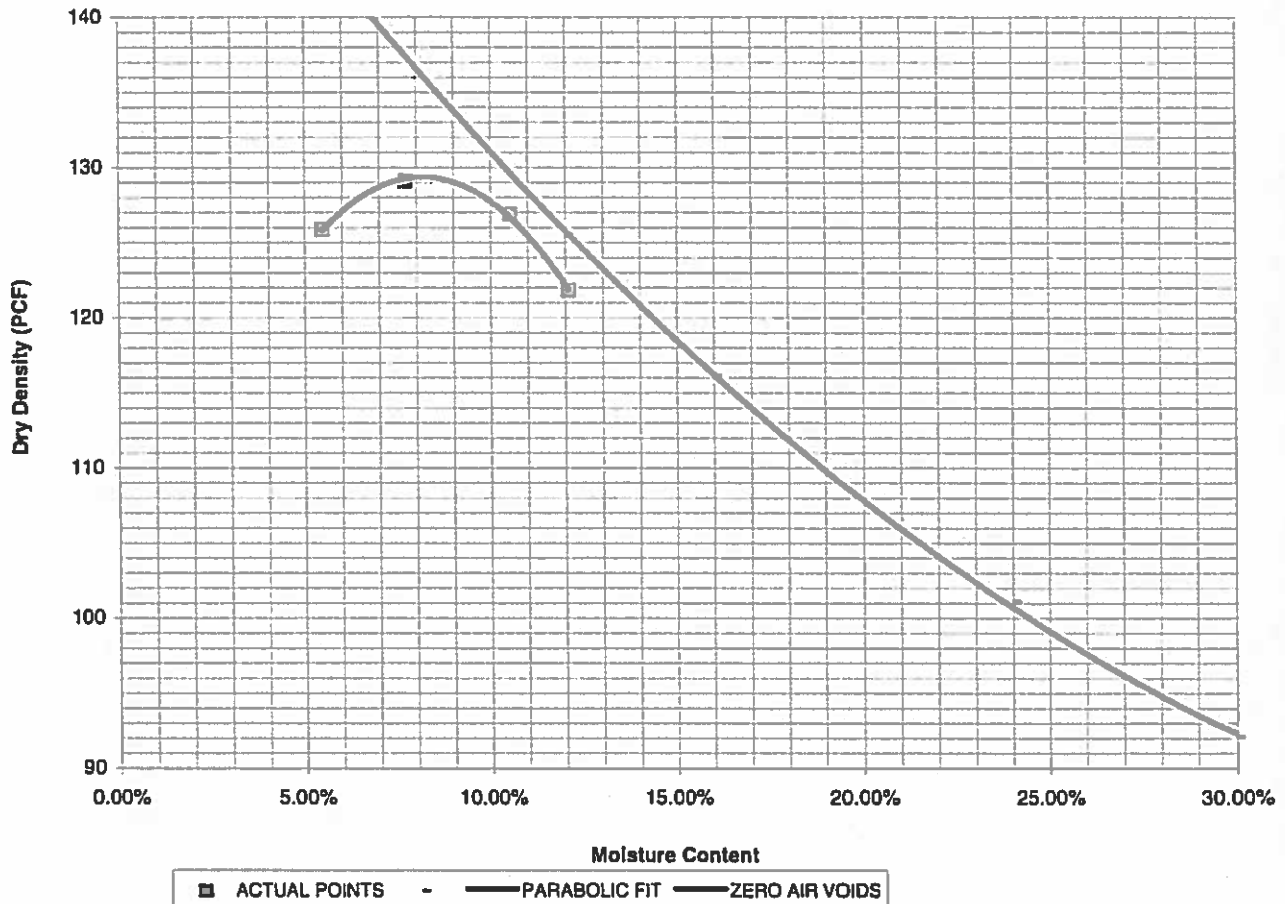
FIG NO.:

847

PROJECT	STERLING RANCH, FILING 1	CLIENT	SR LAND, LLC
SAMPLE LOCATION	TB-9 @ 0-3'	JOB NO.	160002
SOIL DESCRIPTION	SAND, SILTY, TAN	DATE	08/29/16

IDENTIFICATION	SM	COMPACTION TEST #	5, SOIL TYPE #3
TEST DESIGNATION / METHOD	ASTM D-1557-A	TEST BY	MS
MAXIMUM DRY DENSITY (PCF)	129.4	OPTIMUM MOISTURE	8.1%

Compaction Curve



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MOISTURE DENSITY RELATION

DRAWN:

DATE:

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DATE:

10/4/16

JOB NO.:

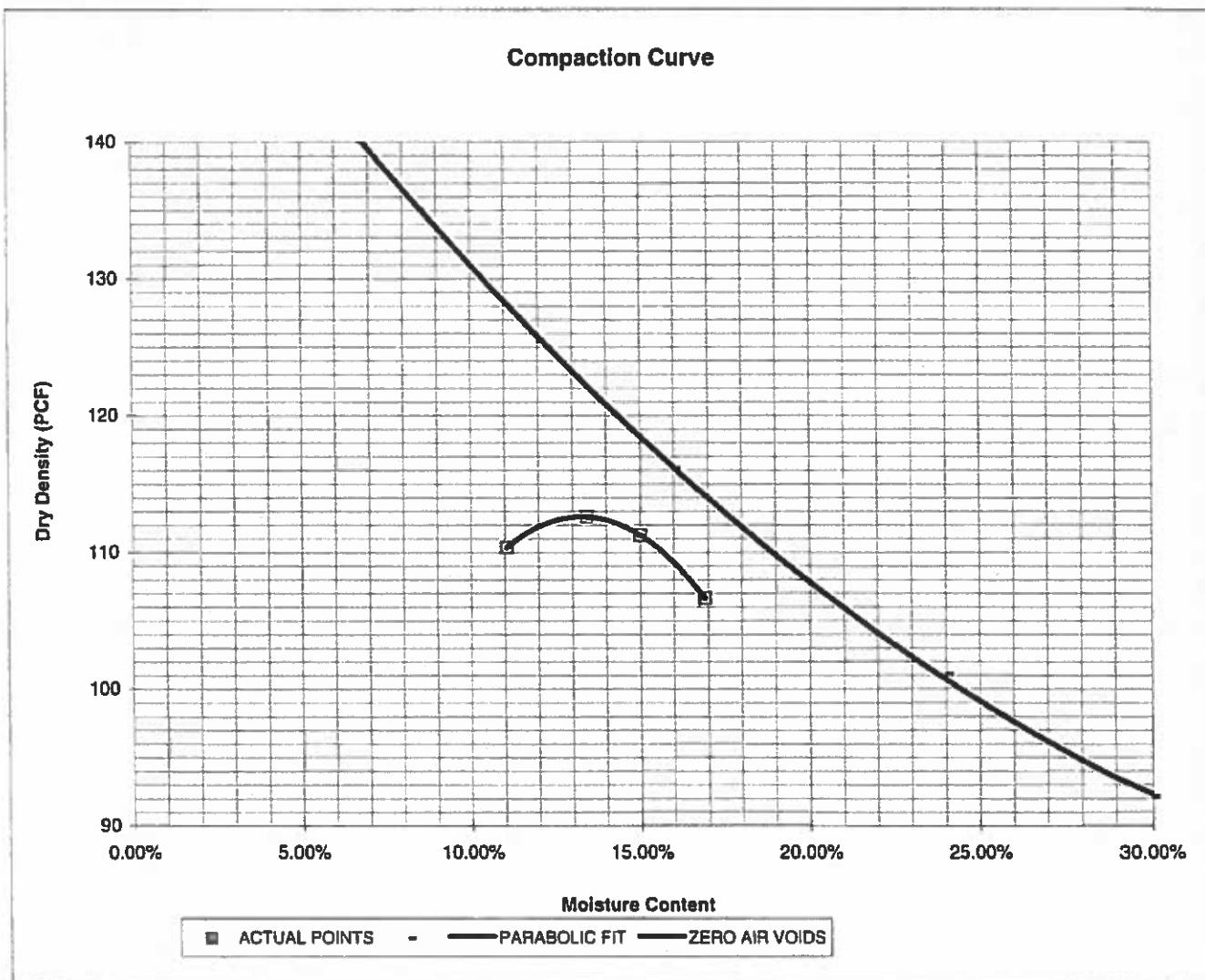
160002

FIG NO.:

B-4B

<u>PROJECT</u>	STERLING RANCH, FILING 1	<u>CLIENT</u>	SR LAND, LLC
<u>SAMPLE LOCATION</u>	TB-1 @ 0-3'	<u>JOB NO.</u>	160002
<u>SOIL DESCRIPTION</u>	FILL, CLAY, V. SANDY, BRN	<u>DATE</u>	09/01/16

<u>IDENTIFICATION</u>	CL	<u>COMPACTION TEST #</u>	1, SOIL TYPE #2
<u>TEST DESIGNATION / METHOD</u>	ASTM D-698-A	<u>TEST BY</u>	MS
<u>MAXIMUM DRY DENSITY (PCF)</u>	112.8	<u>OPTIMUM MOISTURE</u>	13.5%



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MOISTURE DENSITY RELATION

DRAWN:

DATE:

CHECKED: *[Signature]*

DATE: 10/4/16

JOB NO.:

160002

FIG NO.:

B-49

CBR TEST LOAD DATA

JOB NO: 160002
 CLIENT: SR LAND, LLC
 PROJECT: STERLING RANCH, FILING 1
 SOIL TYPE: 2, CBR #1

PISTON DIAMETER (cm) 4.958	PISTON AREA (in ²) 2.992509191						
PENETRATION DEPTH (INCHES)	10 BLOWS		25 BLOWS		56 BLOWS		
	MOLD # 15		MOLD # 9		MOLD # 12		
	LOAD(LBS)	STRESS (PSI)	LOAD(LBS)	STRESS (PSI)	LOAD(LBS)	STRESS (PSI)	
0.000	0	0.00	0	0.00	0	0.00	
0.025	27	9.02	37	12.36	42	14.04	
0.050	30	10.03	42	14.04	65	21.72	
0.075	33	11.03	47	15.71	73	24.39	
0.100	35	11.70	50	16.71	78	26.07	
0.125	38	12.70	55	18.38	88	29.41	
0.150	42	14.04	63	21.05	95	31.75	
0.175	43	14.37	68	22.72	100	33.42	
0.200	45	15.04	70	23.39	100	33.42	
0.300	43	14.37	70	23.39	106	35.42	
0.400	47	15.71	78	26.07	120	40.10	
0.500	52	17.38	85	28.40	130	43.44	

FINAL MOISTURE CONTENT

	MOLD # 15	MOLD # 9	MOLD # 12
CAN #	349	99	112
WT. CAN	6.61	6.75	9.29
WT. CAN+WET	164.88	187.67	198.93
WT. CAN+DRY	131.28	150.61	160.73
WT. H2O	33.6	37.06	38.2
WT. DRY SOIL	124.67	143.86	151.44
MOISTURE CONTENT	26.95%	25.76%	25.22%

WET DENSITY (PCF)	103.0	111.9	122.8
DRY DENSITY (PCF)	90.8	98.6	108.2

BEARING RATIO 1.17 1.67 2.61

90% OF DRY DENSITY 101.5
 95% OF DRY DENSITY 107.2

BEARING RATIO AT 90% OF MAX	1.96 ~ R VALUE	1
BEARING RATIO AT 95% OF MAX	2.51 ~ R VALUE	6



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CBR TEST DATA

DRAWN:

DATE:

CHECKED: *h*

DATE:

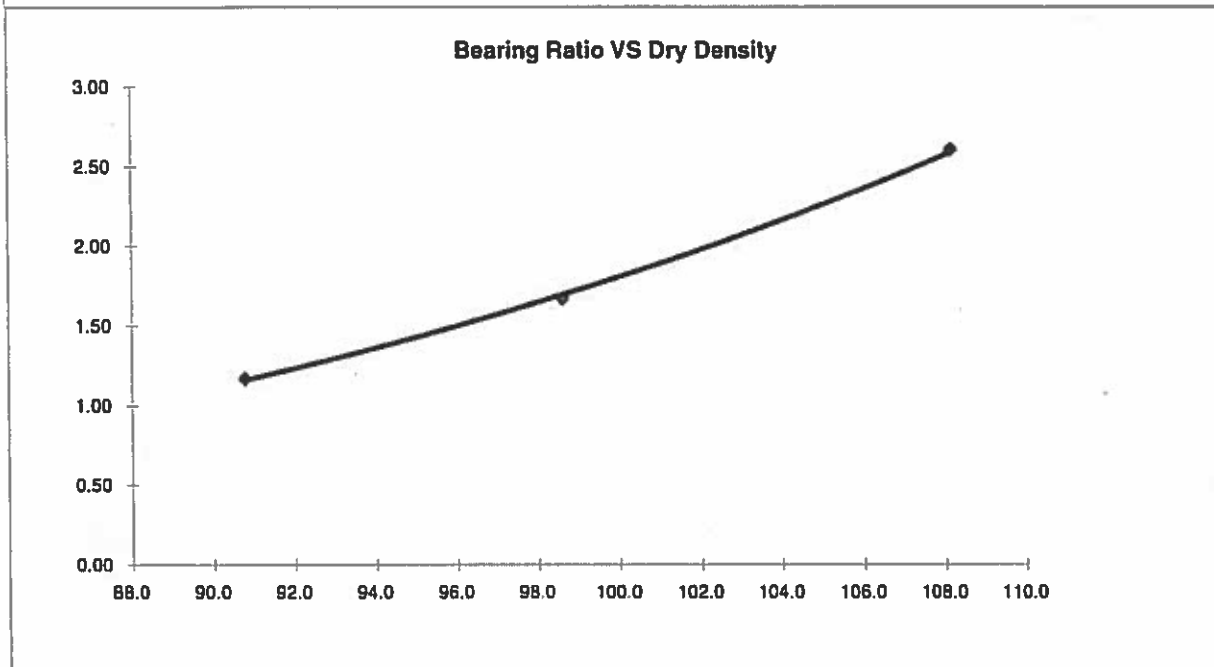
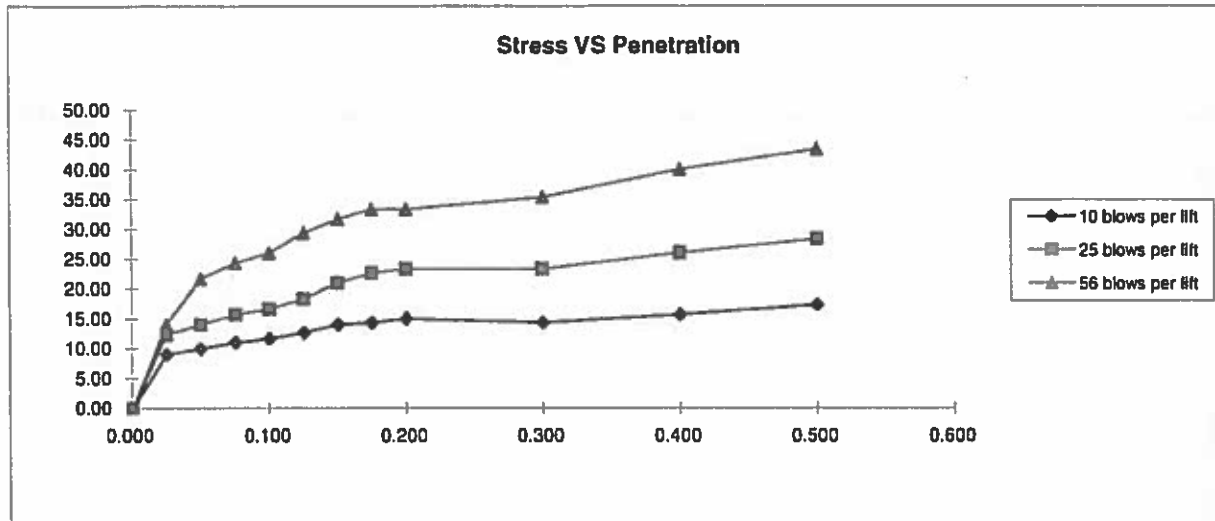
10/4/16

JOB NO.:

160002

FIG NO.:

B-50



BEARING RATIO AT 90% OF MAX	1.96 ~ R VALUE	1.00
BEARING RATIO AT 95% OF MAX	2.51 ~ R VALUE	6.00

JOB NO: 160002
SOIL TYPE: 2, CBR #1



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CALIFORNIA BEARING RATIO

DRAWN:

DATE:

CHECKED: *[Signature]*

DATE:

10/4/16

JOB NO:
160002

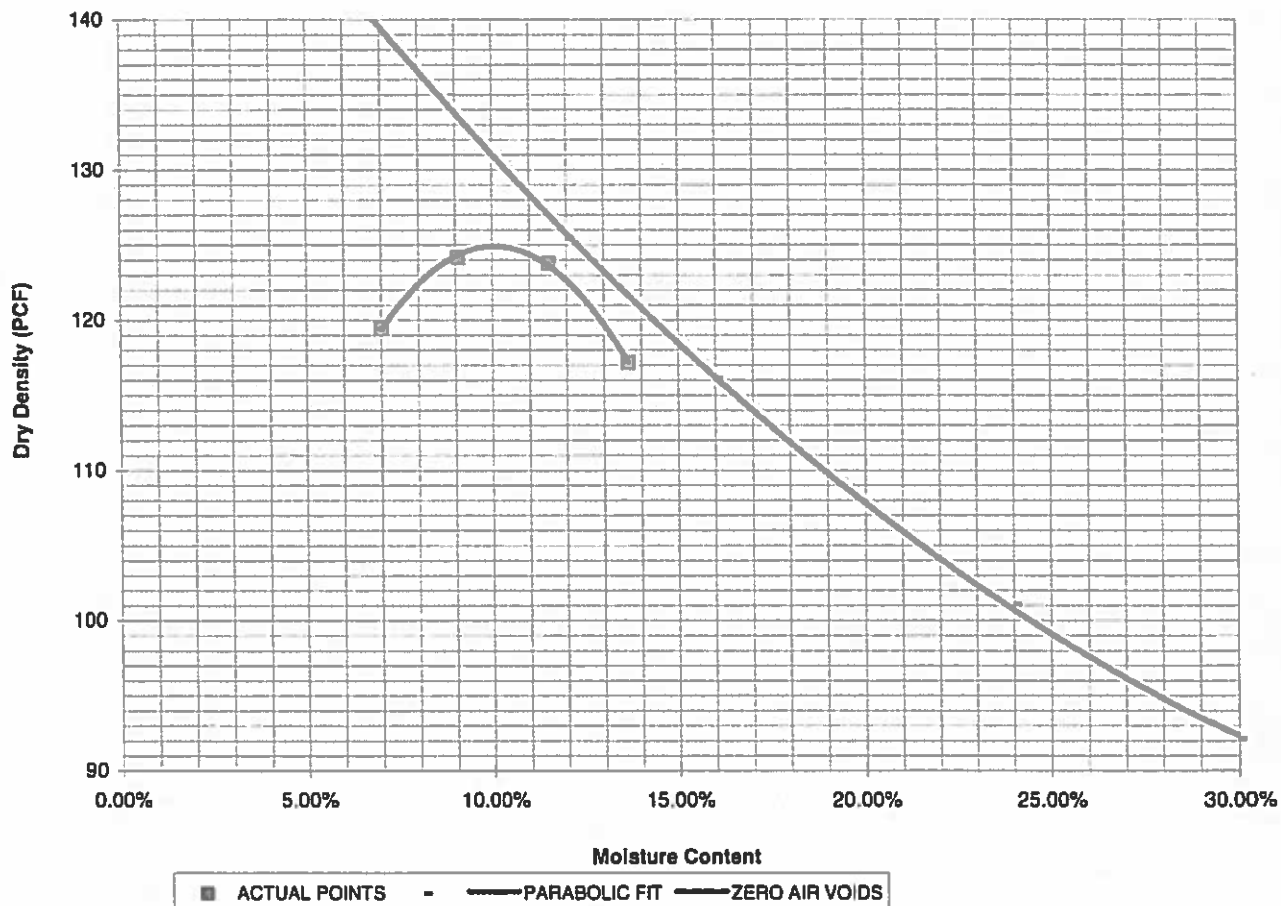
FIG NO:

B-51

<u>PROJECT</u>	STERLING RANCH, FILING 1	<u>CLIENT</u>	SR LAND, LLC
<u>SAMPLE LOCATION</u>	TB-5 @ 0-3'	<u>JOB NO.</u>	160002
<u>SOIL DESCRIPTION</u>	SAND, SILTY, BROWN	<u>DATE</u>	08/27/16

<u>IDENTIFICATION</u>	SM	<u>COMPACTION TEST #</u>	2, SOIL TYPE #3
<u>TEST DESIGNATION / METHOD</u>	ASTM D-1557-A	<u>TEST BY</u>	DC
<u>MAXIMUM DRY DENSITY (PCF)</u>	125	<u>OPTIMUM MOISTURE</u>	10.1%

Compaction Curve



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505 ELKTON DRIVE
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MOISTURE DENSITY RELATION

DRAWN:

DATE:

CHECKED: *[Signature]*

DATE:

10/4/16

JOB NO.:

160002

FIG NO.:

B-52

CBR TEST LOAD DATA

JOB NO: 160002
 CLIENT: SR LAND, LLC
 PROJECT: STERLING RANCH, FILING 1
 SOIL TYPE: 3, CBR #2

PISTON DIAMETER (cm) 4.958	PISTON AREA (in ²) 2.992509191						
PENETRATION DEPTH (INCHES)	10 BLOWS		25 BLOWS		56 BLOWS		
	MOLD # 5	MOLD # 4	MOLD # 4	MOLD # 11	MOLD # 11		
	LOAD(LBS) (LBS)	STRESS (PSI)	LOAD(LBS) (LBS)	STRESS (PSI)	LOAD(LBS) (LBS)	STRESS (PSI)	
0.000	0	0.00	0	0.00	0	0.00	
0.025	86	28.74	108	36.09	211	70.51	
0.050	120	40.10	316	105.60	336	112.28	
0.075	165	55.14	452	151.04	500	167.08	
0.100	206	68.84	580	193.82	645	215.54	
0.125	291	97.24	678	226.57	827	276.36	
0.150	371	123.98	823	275.02	1110	370.93	
0.175	425	142.02	939	313.78	1420	474.52	
0.200	691	230.91	1070	357.56	1663	555.72	
0.300	1319	440.77	1450	484.54	2657	887.88	
0.400	1806	603.51	2012	672.35	3506	1171.59	
0.500	2093	699.41	2911	972.76	4311	1440.60	

FINAL MOISTURE CONTENT

	MOLD # 5	MOLD # 4	MOLD # 11
CAN #	346	351	98
WT. CAN	6.89	6.84	6.98
WT. CAN+WET	116.98	121.64	82.66
WT. CAN+DRY	103.63	110.19	75.27
WT. H2O	13.35	11.45	7.39
WT. DRY SOIL	96.74	103.35	68.29
MOISTURE CONTENT	13.80%	11.08%	10.82%

WET DENSITY (PCF)	127.8	135.4	136.7
DRY DENSITY (PCF)	116.1	123.0	124.1

BEARING RATIO 6.88 19.38 21.55

90% OF DRY DENSITY 112.5
 95% OF DRY DENSITY 118.8

BEARING RATIO AT 90% OF MAX	1.00 - R VALUE	1
BEARING RATIO AT 95% OF MAX	11.72 - R VALUE	35



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CBR TEST DATA

DRAWN:

DATE:

CHECKED: *h*

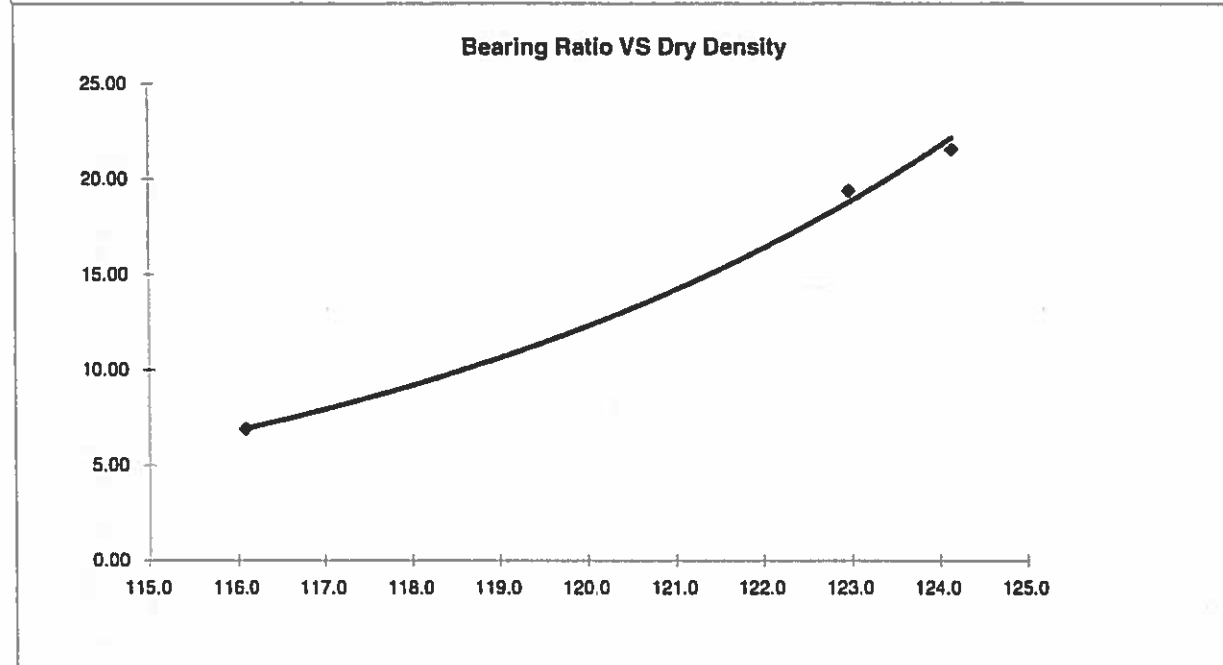
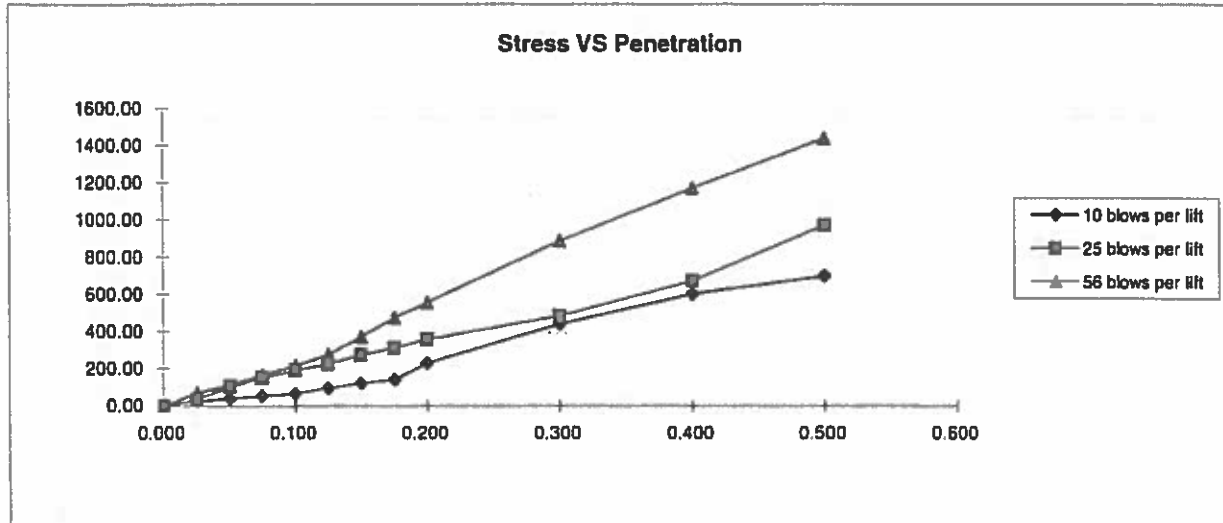
DATE:

10/4/16

JOB NO:
 160002

FIG NO:

B-53



BEARING RATIO AT 90% OF MAX	1.00 - R VALUE	1.00
BEARING RATIO AT 95% OF MAX	11.72 - R VALUE	35.00

JOB NO: 160002
SOIL TYPE: 3, CBR #2



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CALIFORNIA BEARING RATIO

DRAWN:

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DATE:

10/4/16

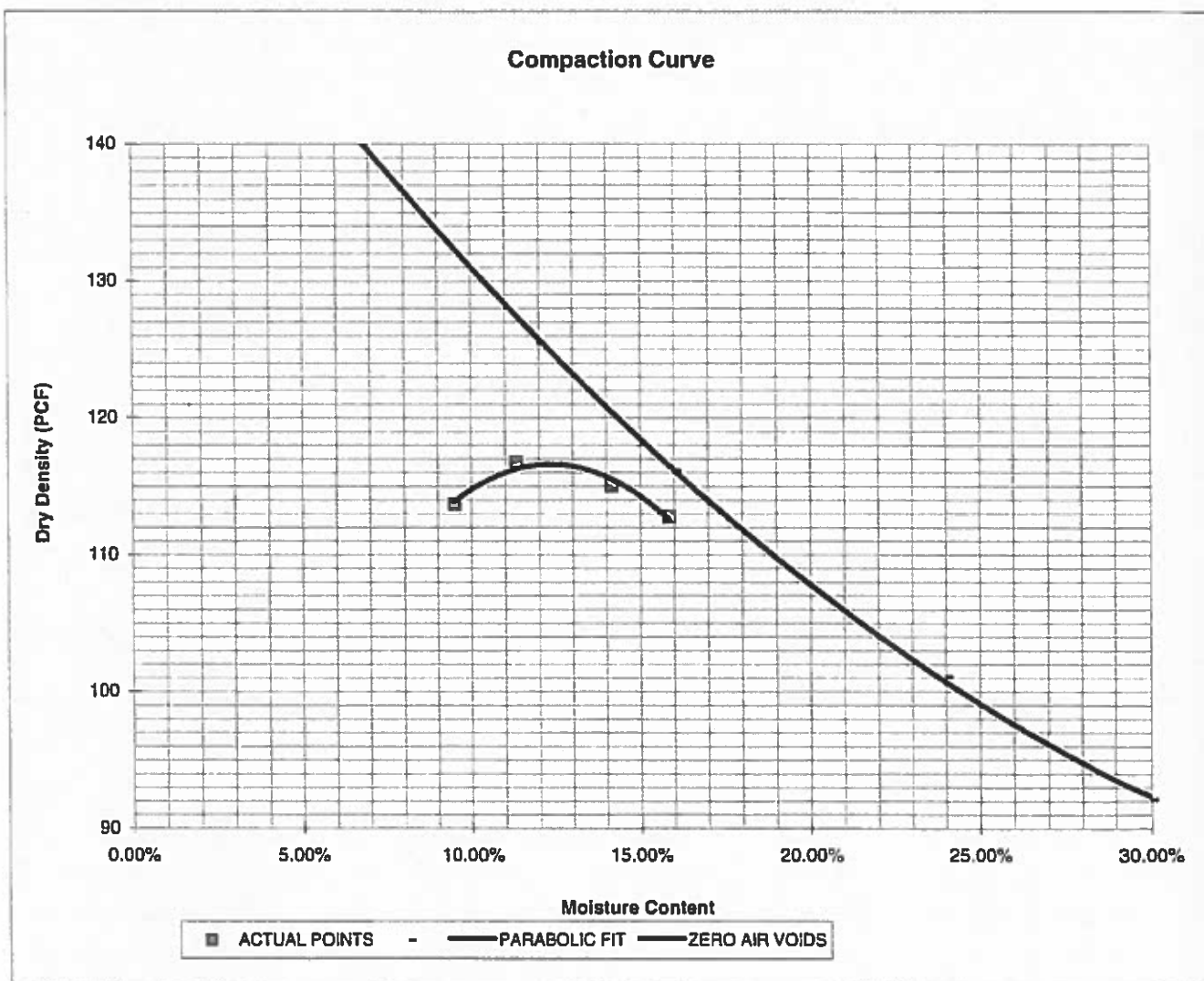
JOB NO:
160002

FIG NO:

891

<u>PROJECT</u>	STERLING RANCH, FILING 1	<u>CLIENT</u>	SR LAND, LLC
<u>SAMPLE LOCATION</u>	TB-4 @ 0-3'	<u>JOB NO.</u>	160002
<u>SOIL DESCRIPTION</u>	SAND, CLAYEY, BROWN	<u>DATE</u>	09/01/16

<u>IDENTIFICATION</u>	SC	<u>COMPACTION TEST #</u>	3, SOIL TYPE #3
<u>TEST DESIGNATION / METHOD</u>	ASTM D-698-A	<u>TEST BY</u>	MS
<u>MAXIMUM DRY DENSITY (PCF)</u>	116.8	<u>OPTIMUM MOISTURE</u>	12.1%



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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

MOISTURE DENSITY RELATION

DRAWN:

DATE:

CHECKED: *W*

DATE:

10/4/16

JOB NO.:

160002

FIG NO.:

B-55

CBR TEST LOAD DATA

JOB NO: 160002
 CLIENT: SR LAND, LLC
 PROJECT: STERLING RANCH, FILING 1
 SOIL TYPE: 3, CBR #3

PISTON DIAMETER (cm) 4.958	PISTON AREA (in ²) 2.992509191						
PENETRATION DEPTH (INCHES)	10 BLOWS		25 BLOWS		56 BLOWS		
	MOLD # 1		MOLD # 1		MOLD # 17		
	LOAD(LBS)	STRESS (PSI)	LOAD(LBS)	STRESS (PSI)	LOAD(LBS)	STRESS (PSI)	
0.000	0	0.00	0	0.00	0	0.00	
0.025	25	8.35	43	14.37	121	40.43	
0.050	30	10.03	63	21.05	156	52.13	
0.075	35	11.70	76	25.40	206	68.84	
0.100	40	13.37	83	27.74	231	77.19	
0.125	45	15.04	95	31.75	274	91.56	
0.150	50	16.71	106	35.42	337	112.61	
0.175	55	18.38	115	38.43	371	123.98	
0.200	60	20.05	121	40.43	401	134.00	
0.300	65	21.72	126	42.11	495	165.41	
0.400	70	23.39	143	47.79	575	192.15	
0.500	75	25.06	156	52.13	652	217.88	

FINAL MOISTURE CONTENT

	MOLD # 1	MOLD # 1	MOLD # 17
CAN #		352	106
WT. CAN		6.68	9.37
WT. CAN+WET		195.32	187.5
WT. CAN+DRY		165.2	162.85
WT. H2O	#VALUE!	30.12	24.65
WT. DRY SOIL	#VALUE!	158.52	153.48
MOISTURE CONTENT	#VALUE!	19.00%	16.06%

WET DENSITY (PCF)	114.6	117.3	127.5
DRY DENSITY (PCF)	102.2	104.6	113.7

BEARING RATIO 1.34 2.77 7.72

90% OF DRY DENSITY 102.4
 95% OF DRY DENSITY 108.1

BEARING RATIO AT 90% OF MAX	1.42 ~ R VALUE	1
BEARING RATIO AT 95% OF MAX	4.64 ~ R VALUE	10



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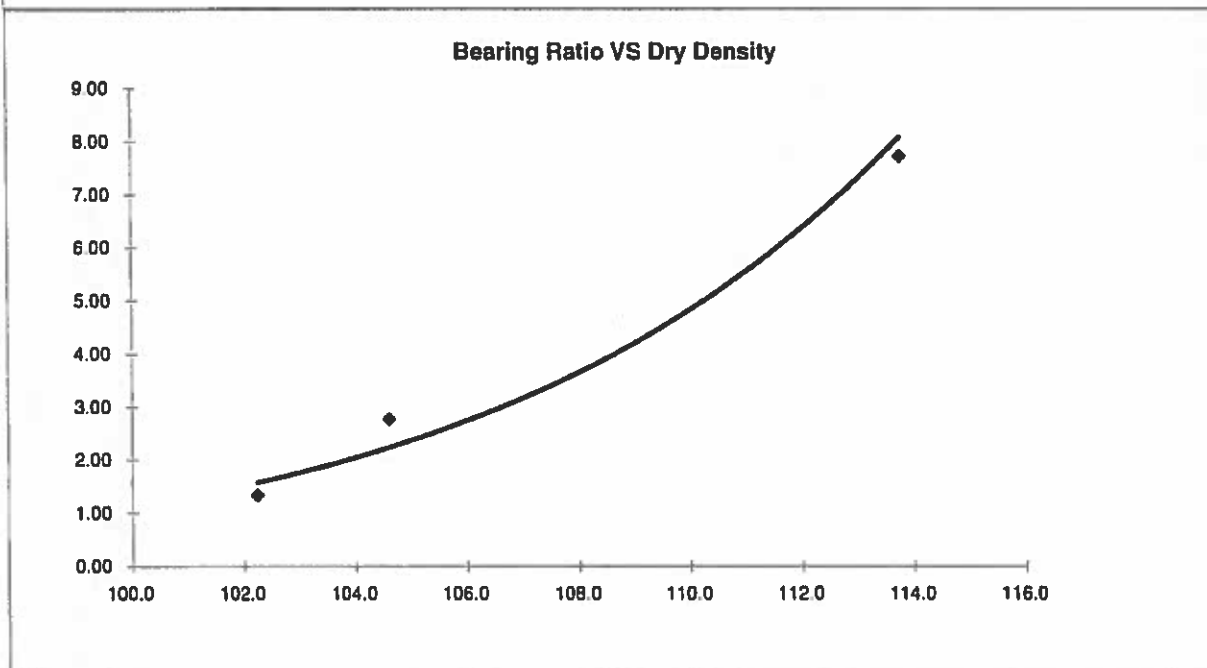
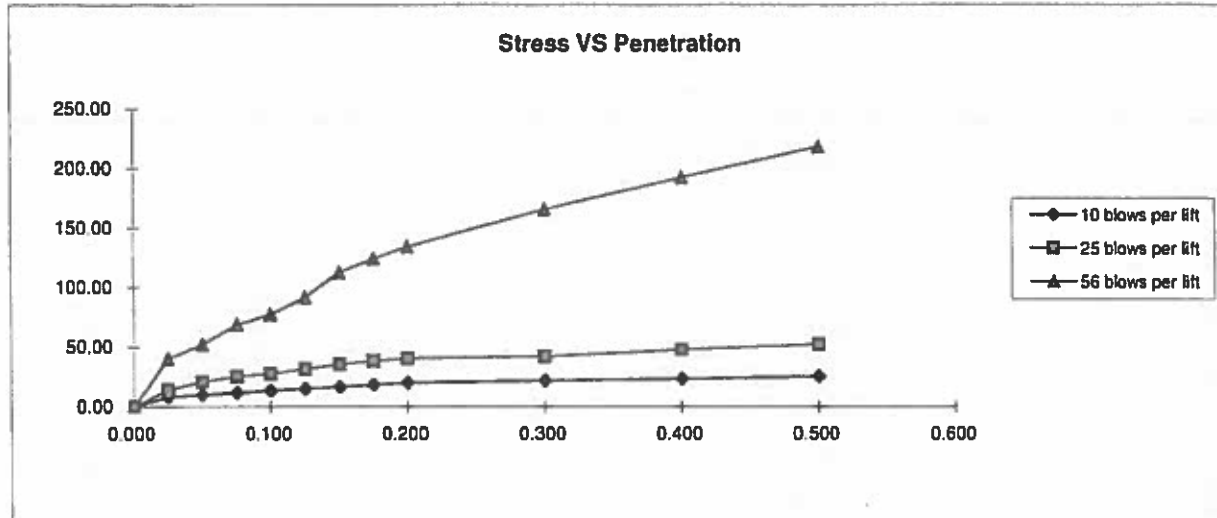
CBR TEST DATA

DRAWN: DATE: CHECKED: DATE: 10/4/16

JOB NO:
 160002

FIG NO:

B-52



BEARING RATIO AT 90% OF MAX	1.42 ~ R VALUE	1.00
BEARING RATIO AT 95% OF MAX	4.64 ~ R VALUE	10.00

JOB NO: 160002
 SOIL TYPE: 3, CBR #3

4



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CALIFORNIA BEARING RATIO

DRAWN:

DATE:

CHECKED: *[Signature]*

DATE:

10/4/16

JOB NO.:
 160002

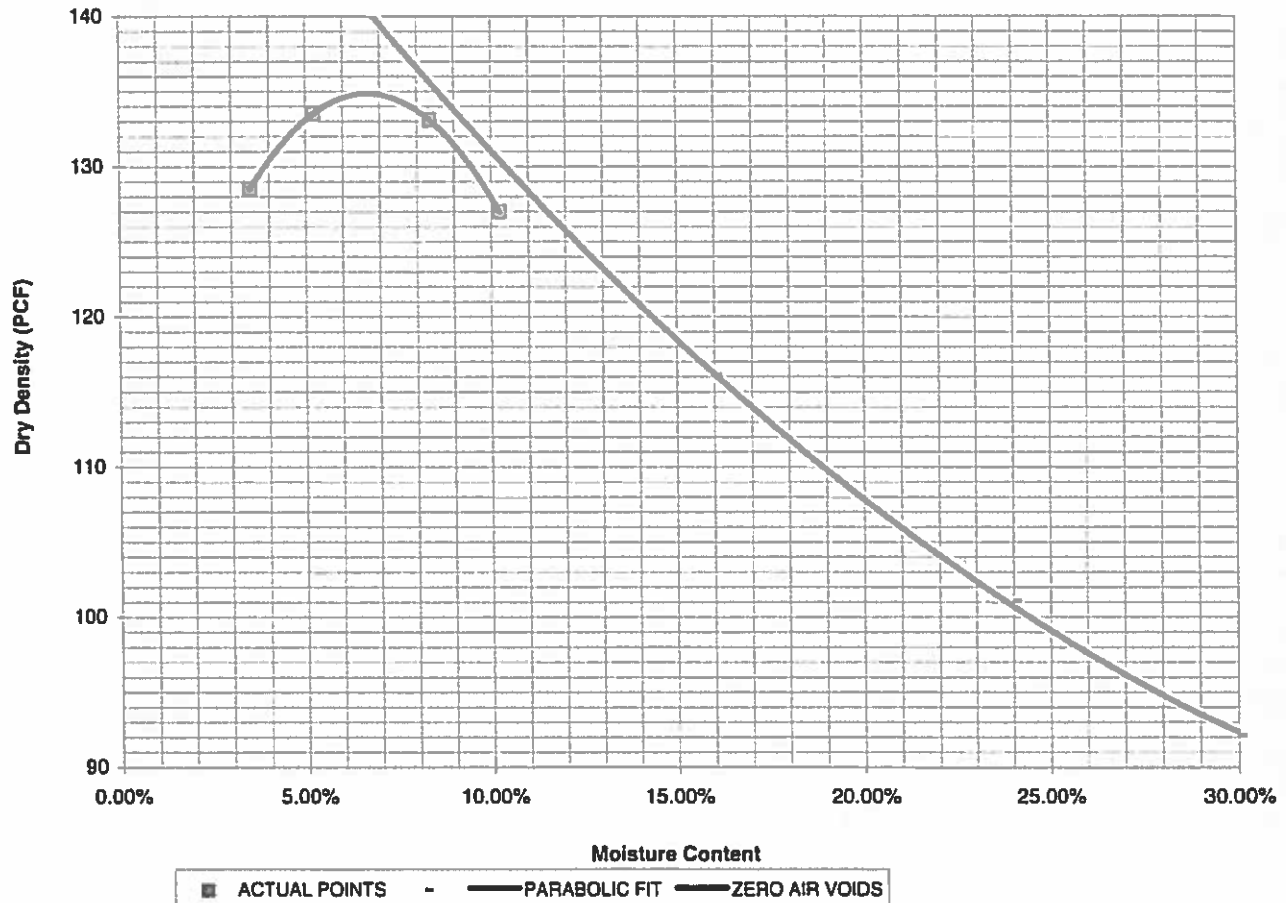
FIG NO.:

3-57

PROJECT	STERLING RANCH, FILING 1	CLIENT	SR LAND, LLC
SAMPLE LOCATION	TB-11 @ 0-3'	JOB NO.	160002
SOIL DESCRIPTION	SANDSTONE, SILTY, BROWN	DATE	08/29/16

IDENTIFICATION	SM	COMPACTION TEST #	4, SOIL TYPE #5
TEST DESIGNATION / METHOD	ASTM D-1557-A	TEST BY	MS
MAXIMUM DRY DENSITY (PCF)	134.9	OPTIMUM MOISTURE	6.8%

Compaction Curve



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MOISTURE DENSITY RELATION

DRAWN:

DATE:

CHECKED:

DATE:

h

10/4/16

JOB NO.:

160002

FIG NO.:

8-58

CBR TEST LOAD DATA

JOB NO: 160002
 CLIENT: SR LAND, LLC
 PROJECT: STERLING RANCH, FILING 1
 SOIL TYPE: 5, CBR #4

PISTON DIAMETER (cm) 4.958	PISTON AREA (in ²) 2.992509191						
PENETRATION DEPTH (INCHES)	10 BLOWS		25 BLOWS		56 BLOWS		
	MOLD # 2		MOLD # 10		MOLD # 1		
	LOAD(LBS) (LBS)	STRESS (PSI)	LOAD(LBS) (LBS)	STRESS (PSI)	LOAD(LBS) (LBS)	STRESS (PSI)	
0.000	0	0.00	0	0.00	0	0.00	
0.025	106	35.42	110	36.76	396	132.33	
0.050	173	57.81	326	108.94	1090	364.24	
0.075	204	68.17	505	168.75	1678	560.73	
0.100	234	78.20	630	210.53	2413	806.35	
0.125	263	87.89	798	266.67	3048	1018.54	
0.150	293	97.91	952	318.13	3625	1211.36	
0.175	320	106.93	1070	357.56	4154	1388.13	
0.200	342	114.29	1192	398.33	4535	1515.45	
0.300	391	130.66	1562	521.97	6000	2005.01	
0.400	445	148.70	1793	599.16			
0.500	495	165.41	2057	687.38			

FINAL MOISTURE CONTENT

	MOLD # 2	MOLD # 10	MOLD # 1
CAN #	350	307	342
WT. CAN	6.51	6.68	6.62
WT. CAN+WET	185.57	153.1	202.2
WT. CAN+DRY	162.58	136.67	185.59
WT. H2O	22.99	16.43	16.61
WT. DRY SOIL	156.07	129.99	178.97
MOISTURE CONTENT	14.73%	12.64%	9.28%

WET DENSITY (PCF)	120.8	129.0	137.0
DRY DENSITY (PCF)	113.1	120.8	128.3

BEARING RATIO 7.82 21.05 80.63

90% OF DRY DENSITY 121.4

95% OF DRY DENSITY 128.2

BEARING RATIO AT 90% OF MAX	26.12 - R VALUE	73
BEARING RATIO AT 95% OF MAX	79.62 - R VALUE	83



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CBR TEST DATA

DRAWN:

DATE:

CHECKED:

DATE:

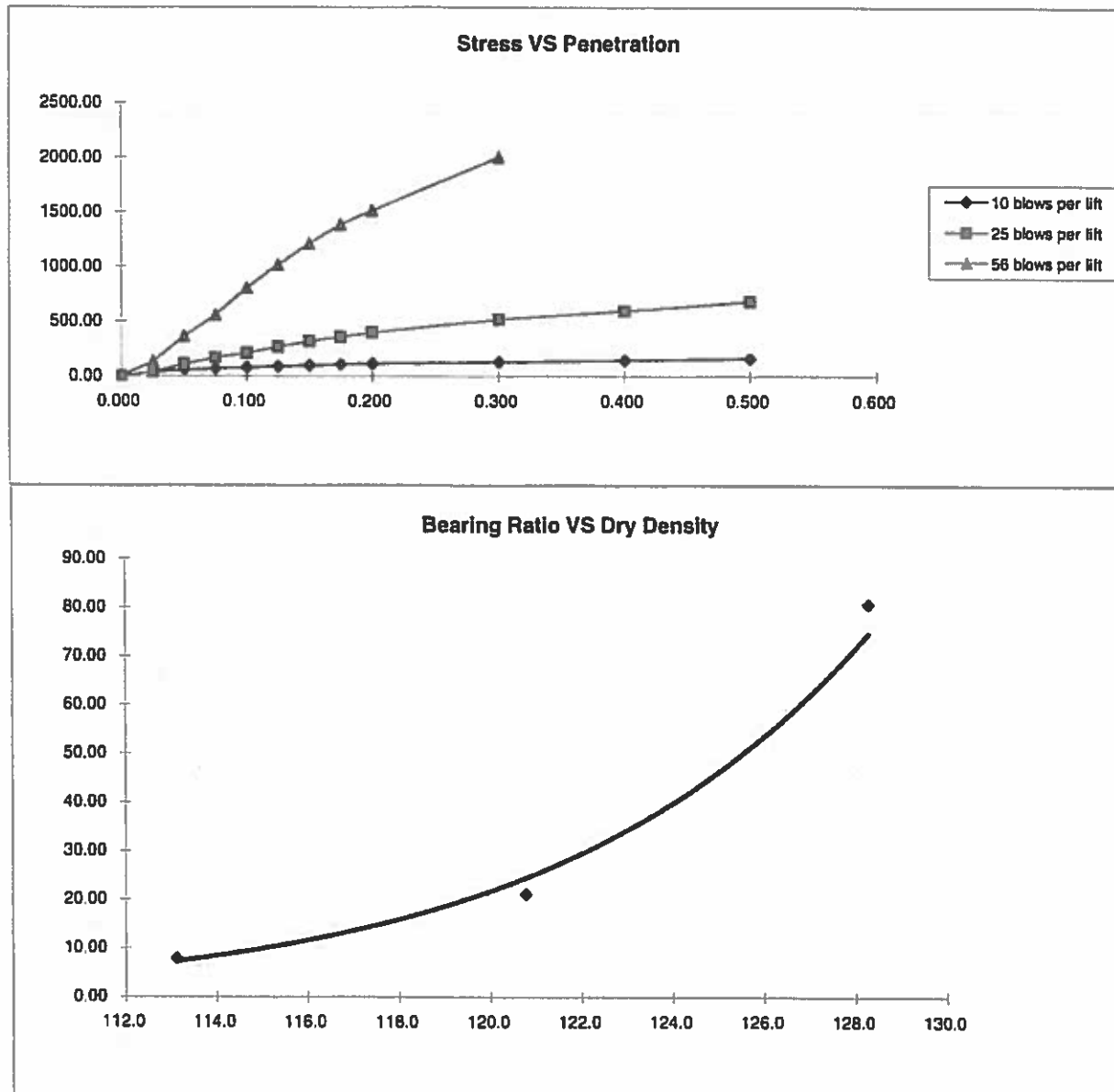
10/4/16

JOB NO.:

160002

FIG NO.:

B-59



BEARING RATIO AT 90% OF MAX	26.12 - R VALUE	73.00
BEARING RATIO AT 95% OF MAX	79.62 - R VALUE	83.00

JOB NO: 160002
SOIL TYPE: 5, CBR #4



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CALIFORNIA BEARING RATIO

DRAWN:

DATE:

CHECKED: *h*

DATE: 10/14/10

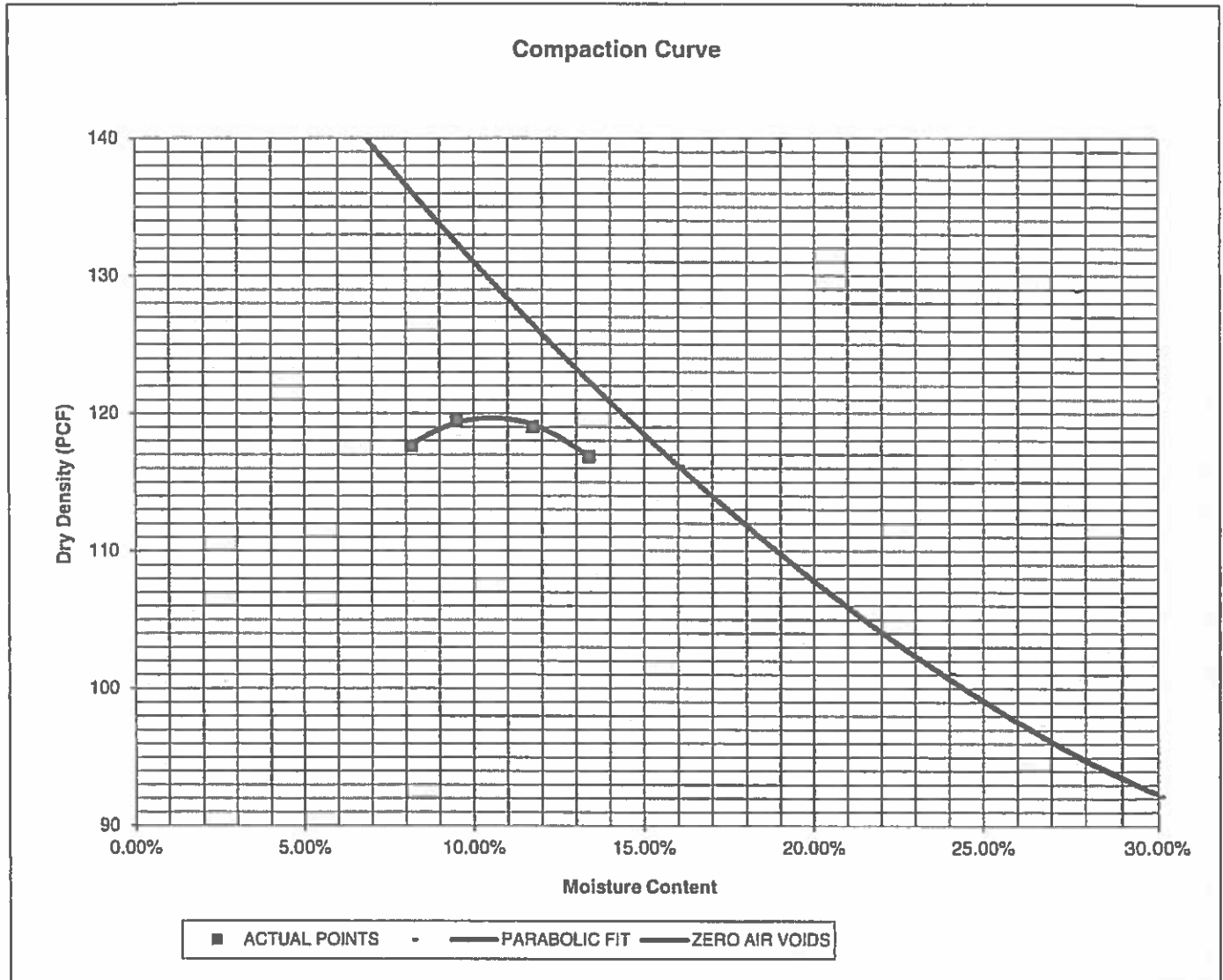
JOB NO:
160002

FIG NO:

B-60

<u>PROJECT</u>	STERLING RANCH	<u>CLIENT</u>	SR LAND, LLC
<u>SAMPLE LOCATION</u>	DELIVERED SAMPLE	<u>JOB NO.</u>	181607
<u>SOIL DESCRIPTION</u>	RECYCLED CONCRETE	<u>DATE</u>	09/25/18

<u>IDENTIFICATION</u>	SM-SW	<u>COMPACTION TEST #</u>	1
<u>TEST DESIGNATION / METHOD</u>	ASTM D-1557-C	<u>TEST BY</u>	DC
<u>MAXIMUM DRY DENSITY (PCF)</u>	119.8	<u>OPTIMUM MOISTURE</u>	9.5%



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MOISTURE DENSITY RELATION

DRAWN:

DATE:

CHECKED:

DATE:

JOB NO.:

160002

FIG NO.:

B-61

CBR TEST LOAD DATA

JOB NO: 181607
 CLIENT: SR LAND, LLC
 PROJECT: STERLING RANCH
 SOIL TYPE: 1

PISTON DIAMETER (cm) 4.958	PISTON AREA (in ²) 2.99250919						
		10 BLOWS		25 BLOWS		56 BLOWS	
PENETRATION DEPTH (INCHES)		MOLD # 11 LOAD(LBS) (LBS)	STRESS (PSI)	MOLD # 15 LOAD(LBS) (LBS)	STRESS (PSI)	MOLD # 12 LOAD(LBS) (LBS)	STRESS (PSI)
0.000		0	0.00	0	0.00	0	0.00
0.025		68	22.72	130	43.44	174	58.15
0.050		214	71.51	399	133.33	555	185.46
0.075		399	133.33	756	252.63	1040	347.53
0.100		614	205.18	1227	410.02	1636	546.70
0.125		812	271.34	1623	542.35	2164	723.14
0.150		975	325.81	2070	691.73	2627	877.86
0.175		1257	420.05	2213	739.51	3085	1030.91
0.200		1450	484.54	2599	868.50	3598	1202.34
0.300		2311	772.26	4303	1437.92	5871	1961.90
0.400		2661	889.22	4647	1552.88	6000	2005.01
0.500		3290	1099.41	5421	1811.52		

FINAL MOISTURE CONTENT

	MOLD # 11	MOLD # 15	MOLD # 12
CAN #	100	117	98
WT. CAN	9.68	9.52	6.92
WT. CAN+WET	132.47	148.47	124.25
WT. CAN+DRY	117.83	135.47	114.81
WT. H2O	14.64	13	9.44
WT. DRY SOIL	108.15	125.95	107.89
MOISTURE CONTENT	13.54%	10.32%	8.75%

WET DENSITY (PCF)	120.0	125.1	130.4
DRY DENSITY (PCF)	109.6	114.3	119.1

BEARING RATIO 20.52 41.00 54.67

90% OF DRY DENSITY 107.8
 95% OF DRY DENSITY 113.8

BEARING RATIO AT 90% OF MAX	13.00 ~ R VALUE	40
BEARING RATIO AT 95% OF MAX	38.98 ~ R VALUE	74



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CBR TEST DATA

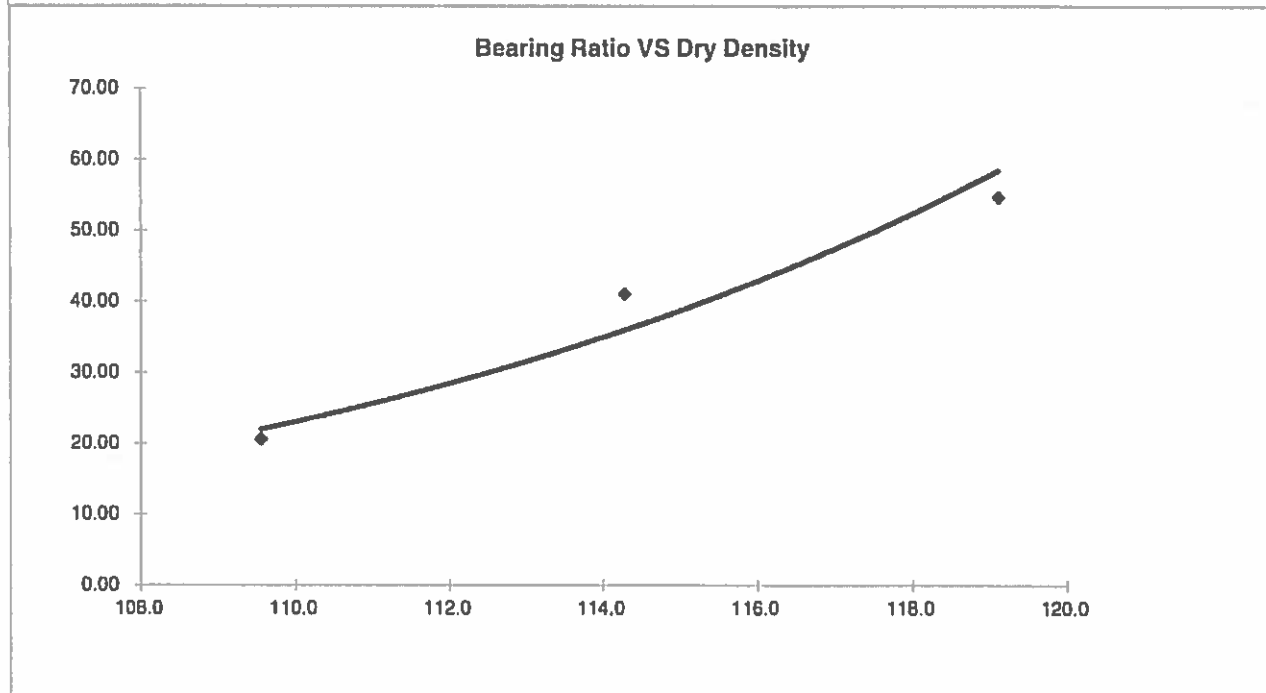
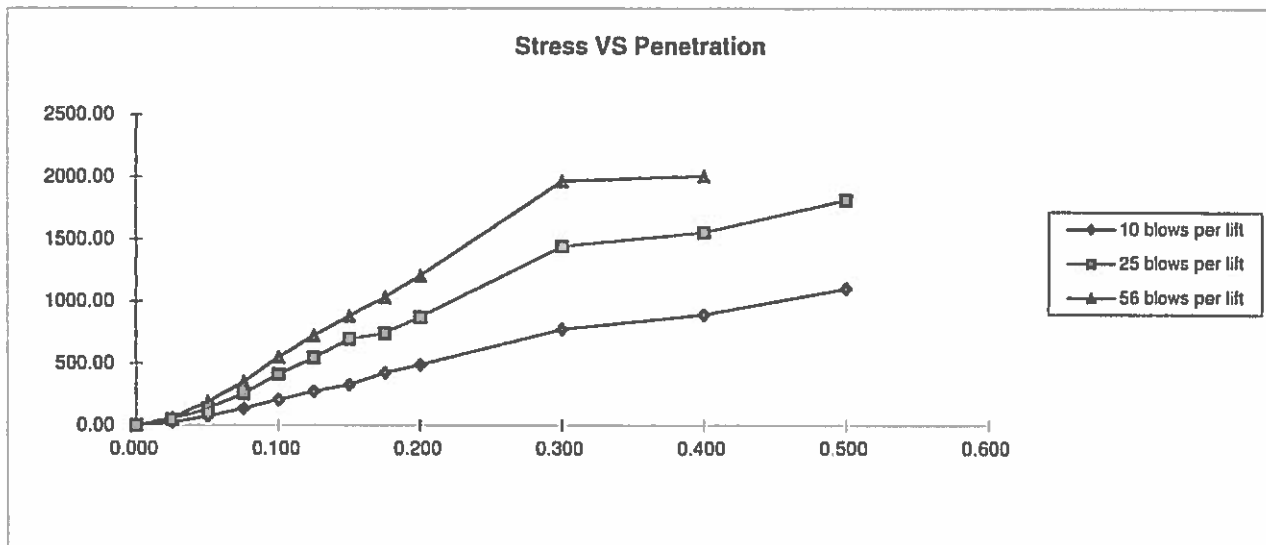
DRAWN: DATE: CHECKED: DATE:

JOB NO.:

160002

FIG NO.:

B-62



BEARING RATIO AT 90% OF MAX	13.00 ~ R VALUE	40.00
BEARING RATIO AT 95% OF MAX	38.98 ~ R VALUE	74.00

JOB NO: 181607
SOIL TYPE: 1



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CALIFORNIA BEARING RATIO

DRAWN:

DATE:

CHECKED:

DATE:

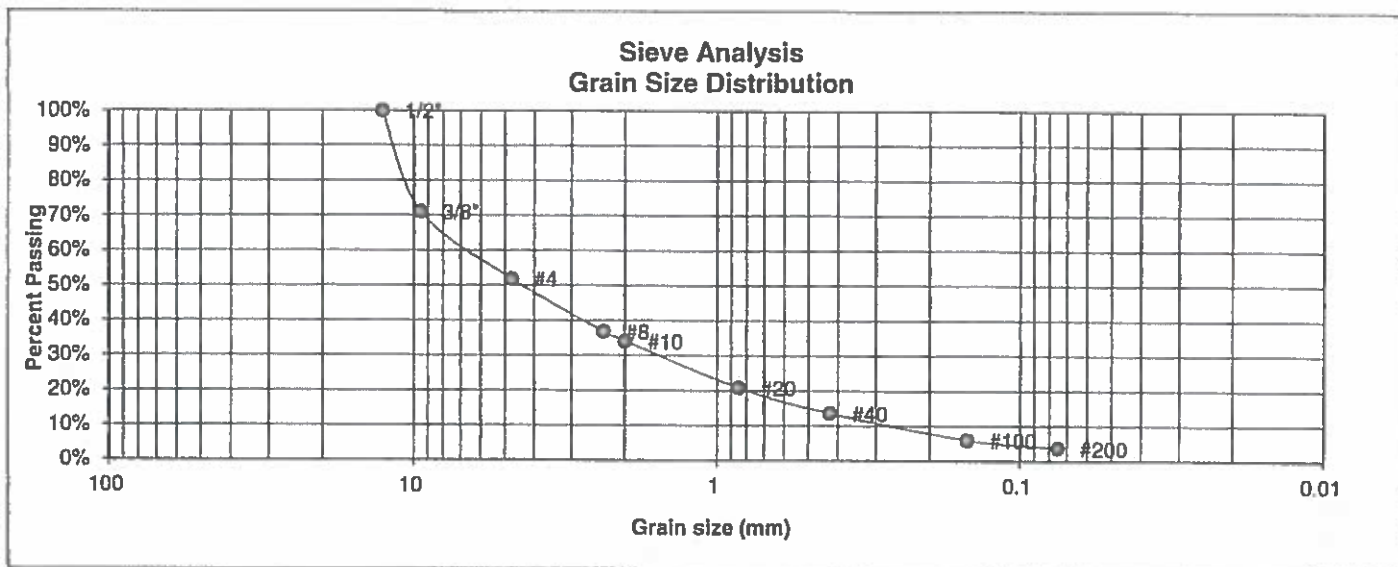
JOB NO:

160002

FIG NO:

B-63

SOIL TYPE #	1	UNIFIED CLASSIFICATION	SM-SW	TEST BY	BL
CLIENT	SR LAND, LLC	AASHTO CLASSIFICATION		JOB NO.	181607
PROJECT	STERLING RANCH, RECYCLED CONCRETE			DATE	9/28/18



U.S. Sieve #	Percent Finer	CLASS 2	CLASS 5	CLASS 6
3"				
1 1/2"		100		
1"		95-100		
3/4"			100	
1/2"	100.0%			
3/8"	71.1%			
4	51.9%			
8	36.9%		30-70	30-65
10	34.1%			25-55
20	20.9%			
40	13.6%			
100	6.0%			
200	3.7%	3-15	3-15	3-12

Atterberg
Limits
Plastic Limit
Liquid Limit
Plastic Index

35 max 30 max 30 max
6 max 6 max 6 max

FHA 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:

JOB NO.:

160002

FIG. NO.:

B-64

APPENDIX C: Pavement Design Calculations

FLEXIBLE PAVEMENT DESIGN

DESIGN DATA

SR LAND, LLC - MARKSHEFFEL ROAD - SOIL TYPE 3
MAJOR ARTERIAL - 4 LANE

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL (W_{18}) =	5,256,000
Hveem Stabilometer (R Value) Results:	R =	35
Standard Deviation	S_o =	0.45
Loss in Serviceability	Δpsi =	2.5
Reliability	Reliability =	90
Reliability (z-statistic)	Z_R =	-1.28
Soil Resilient Modulus	M_R =	8065

Weighted Structural Number (WSN): → WSN = 4.01

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

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

Left	Right	Difference
6.72	6.72	0.0

Job No. 160002
Fig. No. C-1

DESIGN CALCULATIONS

DESIGN DATA

SR LAND, LLC - MARKSHEFFEL ROAD - SOIL TYPE 3

MAJOR ARTERIAL - 4 LANE

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL = 5,256,000
Hveem Stabilometer (R Value) Results:	R = 35
Weighted Structural Number (WSN):	WSN = 4.01

DESIGN EQUATION

$$WSN = C_1 D_1 + C_2 D_2$$

$C_1 = 0.44$ 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

$$D_1 = (WSN)/C_1 = 9.1 \text{ inches of Full Depth Asphalt}$$

Use 9.5 inches Full Depth

FOR ASPHALT + AGGREGATE BASE COURSE SECTION

Asphalt Thickness (t) = inches

$$D_2 = ((WSN) - (t)(C_1))/C_2 = 16.5 \text{ inches of Aggregate}$$

Base Course, use 16.5 inches

Asphalt Thickness (t) = inches

$$D_2 = ((WSN) - (t)(C_1))/C_2 = 12.5 \text{ inches of Aggregate}$$

Base Course, use 12.5 inches

RECOMMENDED ALTERNATIVES

1. 5.0 inches of Asphalt + 16.5 inches of Aggregate Base Course, or
1. 6.0 inches of Asphalt + 12.5 inches of Aggregate Base Course, or
2. 9.5 inches of Asphalt

Job No. 160002

Fig. No. C-2

FLEXIBLE PAVEMENT DESIGN

DESIGN DATA

SR LAND, LLC - MARKSHEFFEL ROAD - SOIL TYPE 3
MAJOR ARTERIAL - 4 LANE

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL (W_{18}) =	5,256,000
Hveem Stabilometer (R Value) Results:	R =	35
Standard Deviation	S_o =	0.45
Loss in Serviceability	$\Delta\psi$ =	2.5
Reliability	Reliability =	90
Reliability (z-statistic)	Z_R =	-1.28
Soil Resilient Modulus	M_R =	8065

Weighted Structural Number (WSN): ➔ WSN = 4.01

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

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

Left	Right	Difference
6.72	6.72	0.0

Job No. 160002

Fig. No. C-3

DESIGN CALCULATIONS

DESIGN DATA

SR LAND, LLC - MARKSHEFFEL ROAD - SOIL TYPE 3

MAJOR ARTERIAL - 4 LANE

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL = 5,256,000
Hveem Stabilometer (R Value) Results:	R = 35
Weighted Structural Number (WSN):	WSN = 4.01

DESIGN EQUATION

$$WSN = C_1 D_1 + C_2 D_2$$

$C_1 = 0.44$ Strength Coefficient - Hot Bituminous Asphalt

$C_2 = 0.07$ Strength Coefficient - Asphalt Millings

D_1 = Depth of Asphalt (inches)

D_2 = Depth of Asphalt Millings (inches)

FOR FULL DEPTH ASPHALT SECTION

$$D_1 = (WSN)/C_1 = 9.1 \text{ inches of Full Depth Asphalt}$$

Use 9.5 inches Full Depth

FOR ASPHALT + AGGREGATE BASE COURSE SECTION

Asphalt Thickness (t) = 6.5 inches

$$D_2 = ((WSN) - (t)(C_1))/C_2 = 16.5 \text{ inches of Asphalt Millings}$$

Asphalt Millings, use 16.5 inches

RECOMMENDED ALTERNATIVES

1. 6.5 inches of Asphalt + 16.5 inches of Asphalt Millings, or
2. 9.5 inches of Asphalt

Job No. 160002

Fig. No. C-4

FLEXIBLE PAVEMENT DESIGN

DESIGN DATA

SR LAND, LLC - MARKSHEFFEL ROAD - SOIL TYPE 3
MAJOR ARTERIAL - 4 LANE

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL (W_{18}) =	5,256,000
Hveem Stabilometer (R Value) Results:	R =	35
Standard Deviation	S_o =	0.45
Loss in Serviceability	$\Delta\psi$ =	2.5
Reliability	Reliability =	90
Reliability (z-statistic)	Z_R =	-1.28
Soil Resilient Modulus	M_R =	8065

Weighted Structural Number (WSN): WSN = 4.01

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

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

Left	Right	Difference
6.72	6.72	0.0

Job No. 160002
Fig. No. C-5

DESIGN CALCULATIONS

DESIGN DATA

SR LAND, LLC - MARKSHEFFEL ROAD - SOIL TYPE 3

MAJOR ARTERIAL - 4 LANE

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL = 5,256,000
Hveem Stabilometer (R Value) Results:	R = 35
Weighted Structural Number (WSN):	WSN = 4.01

DESIGN EQUATION

$$WSN = C_1 D_1 + C_2 D_2$$

$C_1 = 0.44$ Strength Coefficient - Hot Bituminous Asphalt

$C_2 = 0.09$ Strength Coefficient - Recycled Concrete

D_1 = Depth of Asphalt (inches)

D_2 = Depth of Recycled Concrete (inches)

FOR FULL DEPTH ASPHALT SECTION

$D_1 = (WSN)/C_1 = 9.1$ inches of Full Depth Asphalt
Use 9.5 inches Full Depth

FOR ASPHALT + AGGREGATE BASE COURSE SECTION

Asphalt Thickness (t) = 6.5 inches

$D_2 = ((WSN) - (t)(C_1))/C_2 = 12.8$ inches of Recycled Concrete
Recycled Concrete, use 13.0 inches

RECOMMENDED ALTERNATIVES

1. 6.5 inches of Asphalt + 13.0 inches of Recycled Concrete, or
2. 9.5 inches of Asphalt

Job No. 160002

Fig. No. C-6

FLEXIBLE PAVEMENT DESIGN

DESIGN DATA

SR LAND, LLC - SOIL TYPE 3
COLLECTORS

Equivalent (18 kip) Single Axle Load Applications (ESAL):

Hveem Stabilometer (R Value) Results:

Standard Deviation

Loss in Serviceability

Reliability

Reliability (z-statistic)

Soil Resilient Modulus

ESAL (W_{18}) =	821,000
R =	35
S_o =	0.45
$\Delta\psi$ =	2.5
Reliability =	85
Z_R =	-1.04
M_R =	8065

Weighted Structural Number (WSN): WSN = 2.98

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

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

Left	Right	Difference
5.91	5.91	0.0

Job No. 160002

Fig. No. C-7

DESIGN CALCULATIONS

DESIGN DATA

SR LAND, LLC - SOIL TYPE 3

COLLECTORS

Equivalent (18 kip) Single Axle Load Applications (ESAL):

ESAL = 821,000

Hveem Stabilometer (R Value) Results:

R = 35

Weighted Structural Number (WSN):

WSN = 2.98

DESIGN EQUATION

$$WSN = C_1 D_1 + C_2 D_2$$

$C_1 = 0.44$ 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

$D_1 = (WSN)/C_1 = 6.8$ inches of Full Depth Asphalt

Use 7.0 inches Full Depth

FOR ASPHALT + AGGREGATE BASE COURSE SECTION

Asphalt Thickness (t) = 4.5 inches

$D_2 = ((WSN) - (t)(C_1))/C_2 = 9.1$ inches of Aggregate

Base Course, use 9.5 inches

RECOMMENDED ALTERNATIVES

1. 4.5 inches of Asphalt + 9.5 inches of Aggregate Base Course, or
2. 7.0 inches of Asphalt

Job No. 160002

Fig. No. C-8

FLEXIBLE PAVEMENT DESIGN

DESIGN DATA

SR LAND, LLC - SOIL TYPE 3
COLLECTORS

Equivalent (18 kip) Single Axle Load Applications (ESAL):

Hveem Stabilometer (R Value) Results:

Standard Deviation

Loss in Serviceability

Reliability

Reliability (z-statistic)

Soil Resilient Modulus

ESAL (W_{18}) =	821,000
R =	35
S_o =	0.45
$\Delta\psi$ =	2.5
Reliability =	85
Z_R =	-1.04
M_R =	8065

Weighted Structural Number (WSN):  WSN = 2.98

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

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

Left	Right	Difference
5.91	5.91	0.0

Job No. 160002

Fig. No. C-9

DESIGN CALCULATIONS

DESIGN DATA

SR LAND, LLC - SOIL TYPE 3
COLLECTORS

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL = 821,000
Hveem Stabilometer (R Value) Results:	R = 35
Weighted Structural Number (WSN):	WSN = 2.98

DESIGN EQUATION

$$WSN = C_1 D_1 + C_2 D_2$$

$C_1 = 0.44$ Strength Coefficient - Hot Bituminous Asphalt

$C_2 = 0.07$ Strength Coefficient - Asphalt Millings

D_1 = Depth of Asphalt (inches)

D_2 = Depth of Asphalt Millings (inches)

FOR FULL DEPTH ASPHALT SECTION

$D_1 = (WSN)/C_1 = 6.8$ inches of Full Depth Asphalt
Use 7.0 inches Full Depth

FOR ASPHALT + AGGREGATE BASE COURSE SECTION

Asphalt Thickness (t) = 5 inches

$D_2 = ((WSN) - (t)(C_1))/C_2 = 11.1$ inches of Asphalt Millings
Asphalt Millings, use 11.5 inches

RECOMMENDED ALTERNATIVES

1. 5.0 inches of Asphalt + 11.5 inches of Asphalt Millings, or
2. 7.0 inches of Asphalt

Job No. 160002

Fig. No. C-10

FLEXIBLE PAVEMENT DESIGN

DESIGN DATA

SR LAND, LLC - SOIL TYPE 3
COLLECTORS

Equivalent (18 kip) Single Axle Load Applications (ESAL):

Hveem Stabilometer (R Value) Results:

Standard Deviation

Loss in Serviceability

Reliability

Reliability (z-statistic)

Soil Resilient Modulus

ESAL (W_{18}) =	821,000
R =	35
S_o =	0.45
Δpsi =	2.5
Reliability =	85
Z_R =	-1.04
M_R =	8065

Weighted Structural Number (WSN): WSN = 2.98

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. 160002
Fig. No. C-11

DESIGN CALCULATIONS

DESIGN DATA

SR LAND, LLC - SOIL TYPE 3
COLLECTORS

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL = 821,000
Hveem Stabilometer (R Value) Results:	R = 35
Weighted Structural Number (WSN):	WSN = 2.98

DESIGN EQUATION

$$WSN = C_1 D_1 + C_2 D_2$$

$C_1 = 0.44$ Strength Coefficient - Hot Bituminous Asphalt

$C_2 = 0.09$ Strength Coefficient - Recycled Concrete

D_1 = Depth of Asphalt (inches)

D_2 = Depth of Recycled Concrete (inches)

FOR FULL DEPTH ASPHALT SECTION

$D_1 = (WSN)/C_1 = 6.8$ inches of Full Depth Asphalt
Use 7.0 inches Full Depth

FOR ASPHALT + AGGREGATE BASE COURSE SECTION

Asphalt Thickness (t) = 5 inches

$D_2 = ((WSN) - (t)(C_1))/C_2 = 8.7$ inches of Recycled Concrete
Recycled Concrete, use 9.0 inches

RECOMMENDED ALTERNATIVES

1. 5.0 inches of Asphalt + 9.0 inches of Recycled Concrete, or
2. 7.0 inches of Asphalt

Job No. 160002

Fig. No. C-12

FLEXIBLE PAVEMENT DESIGN

DESIGN DATA

SR LAND, LLC - SOIL TYPES 2/4
COLLECTORS

Equivalent (18 kip) Single Axle Load Applications (ESAL):

Hveem Stabilometer (R Value) Results:

Standard Deviation

Loss in Serviceability

Reliability

Reliability (z-statistic)

Soil Resilient Modulus

ESAL (W_{18}) =	821,000
R =	6
S_o =	0.45
$\Delta\psi$ =	2.5
Reliability =	85
Z_R =	-1.04
M_R =	3126

Weighted Structural Number (WSN):



WSN = 4.07

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
5.91	5.91	0.0

Job No. 160002

Fig. No. C-13

DESIGN CALCULATIONS

DESIGN DATA

SR LAND, LLC - SOIL TYPES 2/4
COLLECTORS

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL = 821,000
Hveem Stabilometer (R Value) Results:	R = 6
Weighted Structural Number (WSN):	WSN = 4.07

DESIGN EQUATION

$$WSN = C_1 D_1 + C_2 D_2$$

$C_1 = 0.44$ 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

$D_1 = (WSN)/C_1 = 9.2$ inches of Full Depth Asphalt
Use 9.5 inches Full Depth

FOR ASPHALT + AGGREGATE BASE COURSE SECTION

Asphalt Thickness (t) = 6 inches

$D_2 = ((WSN) - (t)(C_1))/C_2 = 13.0$ inches of Aggregate
Base Course, use 13.0 inches

RECOMMENDED ALTERNATIVES

1. 6.0 inches of Asphalt + 13.0 inches of Aggregate Base Course, or
3. 9.5 inches of Asphalt

Job No. 160002

Fig. No. C-14

FLEXIBLE PAVEMENT DESIGN

DESIGN DATA

SR LAND, LLC - SOIL TYPES 2/4
COLLECTORS

Equivalent (18 kip) Single Axle Load Applications (ESAL):

Hveem Stabilometer (R Value) Results:

Standard Deviation

Loss in Serviceability

Reliability

Reliability (z-statistic)

Soil Resilient Modulus

ESAL (W_{18}) =	821,000
R =	6
S_o =	0.45
$\Delta\psi$ =	2.5
Reliability =	85
Z_R =	-1.04
M_R =	3126

Weighted Structural Number (WSN): WSN = 4.07

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
5.91	5.91	0.0

Job No. 160002

Fig. No. C-15

DESIGN CALCULATIONS

DESIGN DATA

SR LAND, LLC - SOIL TYPES 2/4
COLLECTORS

Equivalent (18 kip) Single Axle Load Applications (ESAL):

ESAL = 821,000

Hveem Stabilometer (R Value) Results:

R = 6

Weighted Structural Number (WSN):

WSN = 4.07

DESIGN EQUATION

$$WSN = C_1 D_1 + C_2 D_2$$

$C_1 = 0.44$ Strength Coefficient - Hot Bituminous Asphalt

$C_2 = 0.07$ Strength Coefficient - Asphalt Millings

D_1 = Depth of Asphalt (inches)

D_2 = Depth of Asphalt Millings (inches)

FOR FULL DEPTH ASPHALT SECTION

$$D_1 = (WSN)/C_1 = 9.2 \text{ inches of Full Depth Asphalt}$$

Use 9.5 inches Full Depth

FOR ASPHALT + AGGREGATE BASE COURSE SECTION

Asphalt Thickness (t) = 6.5 inches

$$D_2 = ((WSN) - (t)(C_1))/C_2 = 17.2 \text{ inches of Asphalt Millings}$$

Asphalt Millings, use 17.5 inches

RECOMMENDED ALTERNATIVES

1. 6.5 inches of Asphalt + 17.5 inches of Asphalt Millings, or
2. 9.5 inches of Asphalt

Job No. 160002

Fig. No. C-16

FLEXIBLE PAVEMENT DESIGN

DESIGN DATA

SR LAND, LLC - SOIL TYPES 2/4
COLLECTORS

Equivalent (18 kip) Single Axle Load Applications (ESAL):

Hveem Stabilometer (R Value) Results:

Standard Deviation

Loss in Serviceability

Reliability

Reliability (z-statistic)

Soil Resilient Modulus

ESAL (W_{18}) = 821,000

R = 6

S_o = 0.45

$\Delta\psi$ = 2.5

Reliability = 85

Z_R = -1.04

M_R = 3126

Weighted Structural Number (WSN):  WSN = 4.07

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
5.91	5.91	0.0

Job No. 160002

Fig. No. C-17

DESIGN CALCULATIONS

DESIGN DATA

SR LAND, LLC - SOIL TYPES 2/4
COLLECTORS

Equivalent (18 kip) Single Axle Load Applications (ESAL):	ESAL = 821,000
Hveem Stabilometer (R Value) Results:	R = 6
Weighted Structural Number (WSN):	WSN = 4.07

DESIGN EQUATION

$$WSN = C_1 D_1 + C_2 D_2$$

$C_1 = 0.44$ Strength Coefficient - Hot Bituminous Asphalt

$C_2 = 0.09$ Strength Coefficient - Recycled Concrete

D_1 = Depth of Asphalt (inches)

D_2 = Depth of Recycled Concrete (inches)

FOR FULL DEPTH ASPHALT SECTION

$D_1 = (WSN)/C_1 = 9.2$ inches of Full Depth Asphalt
Use 9.5 inches Full Depth

FOR ASPHALT + AGGREGATE BASE COURSE SECTION

Asphalt Thickness (t) = 6.5 inches

$D_2 = ((WSN) - (t)(C_1))/C_2 = 13.4$ inches of Recycled Concrete
Recycled Concrete, use 13.5 inches

RECOMMENDED ALTERNATIVES

1. 6.5 inches of Asphalt + 13.5 inches of Recycled Concrete, or
2. 9.5 inches of Asphalt

Job No. 160002

Fig. No. C-18