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CTS PAVEMENT DESIGN REPORT

Paint Brush Hills, Filing No. 14
El Paso County, Colorado

PREPARED FOR:

Landhuis Company
212 N. Wahsatch Ave. Ste 301
Colorado Springs, CO

JOB NO. 179012

October 20, 2021

Respectfully Submitted,

RMG – Rocky Mountain Group

Nathan Malefyt
Staff Geologist

Reviewed by,

RMG – Rocky Mountain Group

COLORADO REGISTERED
ANTHONY P. MUNGER
10/20/21
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PROFESSIONAL ENGINEER

Tony Munger, P.E.
Geotechnical Project Manager

SF Number 2024

TABLE OF CONTENTS

GENERAL SITE AND PROJECT DESCTIPTION

Location

Paint Brush Hills, Filing No. 14 is located north of Londonderry Drive and east of Meridian Road in El Paso County, Colorado. The location of the site is shown on the Site Vicinity Map, Figure 1.

Existing Conditions

At the time of our field investigation, the proposed streets were close to grade and utility mains and services had been installed. Curb and gutter had not been installed.

Project Description

This Pavement Design Report was performed to determine the subsurface conditions present along the roadway alignments, and to develop recommendations for the design and construction of the proposed flexible pavements.

The proposed streets included in this investigation are shown on Figure 2. Devoncove Drive, Keynes Drive, Kingsbury Drive, Country Manor Drive, Hartwood Drive, Grace Manor Drive, and the western part of Waterloo Drive are classified as Residential Urban Local streets with 50-foot wide Right-of-Ways and two 15-foot wide travel lanes. The eastern portion of Waterloo Drive and Finsbury Court are classified as Residential Urban Local (Low Volume) streets with 50-foot wide Right-of Ways, and two 15-foot wide travel lanes.

FIELD INVESTIGATION AND SUBSURFACE CONDITIONS

Drilling

The subsurface conditions on the site were investigated by drilling twenty-three (23) exploratory test borings at maximum 500-foot spacing along the roadways. The approximate locations of the test borings are presented in the Test Boring Location Plan, Figure 2.

The test borings were advanced with a power-driven, continuous-flight auger drill rig to depths of about 5 to 10-feet below the existing ground surface. Samples were obtained in general accordance with ASTM D-3550 utilizing a 2½-inch OD modified California sampler. Representative bulk samples of subsurface materials were obtained from each boring at a depth of approximately 0 to 2-feet below the existing ground surface. An Explanation of Test Boring Logs is presented in Figure 3. The Test Boring Logs are presented in Figures 4 through 15.

Subsurface Materials

The subsurface materials encountered in the test borings consisted primarily of clayey sand. Combined bulk samples of the material classified as SC according to the Unified Classification System. For pavement design, the soil classified in accordance with the American Association of State Highway and Transportation Officials (ASSHTO) classification system as A-1 and A-2 soils with varying Group Indices. A-1 and A-2 soils typically have low fines (+200 sieve) content. Subgrade improvement recommendations are included herein.

Groundwater

Groundwater was not encountered in the test borings at the time of drilling. Groundwater is not expected to affect the construction of the pavements. Fluctuations in groundwater and subsurface moisture conditions may occur due to variations in precipitation and other factors not readily apparent at this time. Development of the property and adjacent properties may also affect groundwater levels.

LABORATORY TESTING

Laboratory Testing

The moisture content for the recovered samples was obtained in the laboratory. Grain-size analysis and Atterberg Limits tests were performed on selected samples to classify the soil and to develop pertinent engineering properties. A Summary of Laboratory Test Results is presented in Figure 16. Soil Classification Data are presented in Figures 17 through 21.

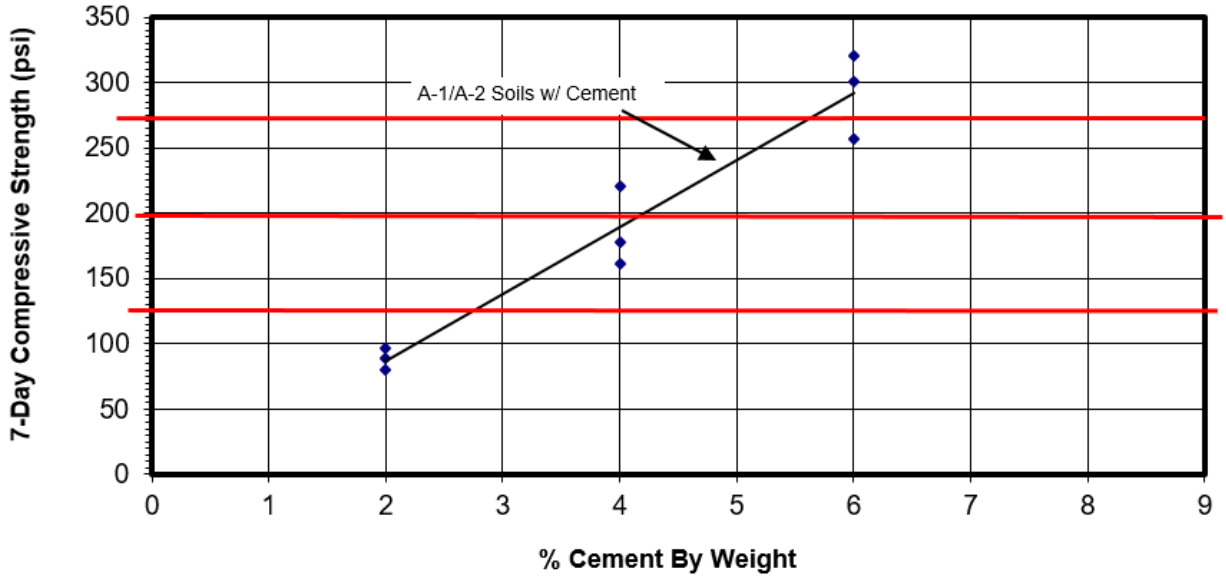
California Bearing Ratio tests (CBR) were performed. A Combined bulk sample of the A-1 and A-2 soils was tested to determine the optimum moisture-density relationship in accordance with ASTM D-1557 (Modified Proctor compaction test). CBR tests were performed at varying densities with moisture content near optimum. At 95% of the maximum Modified Proctor Density, the CBR was 1.8. The Moisture-Density Relation Curve is presented in Figure 22. CBR Test Results are presented in Figures 23 and 24.

The developer intends to install a composite roadway section consisting of Hot Mix Asphalt over Cement-Treated Subgrade (CTS). RMG performed a Mix Design for this composite section.

A bulk specimen of soil composed of the A-1 and A-2 subgrade materials and Portland Cement were prepared by varying the “percent cement by weight” at target values of 2, 4, and 6 percent cement. Three specimens (pucks) were prepared for each target cement value, compacted to 95% of the maximum Modified Proctor density and cured in a saturated condition for 7-days. The compressive strength of each specimen was then determined upon completion of the 7-day curing process. The soil compressive strengths are presented in Appendix A.

The data values were then plotted as a function of "7-day Compressive Strength versus Percent Cement by Weight". In accordance with the El Paso County Engineering Criteria Manual, the target "percent cement by weight" was selected to obtain strengths in the lower Strength Coefficient (SC) categories (SC = 0.11, 125-200 psi; SC = 0.12, 200-275 psi). A target SC = 0.11 is used for CTS soil in the pavement design procedure presented below. Based upon an evaluation of the test data, a target range of 5.25 percent cement is recommended in all roadway sections. If field strengths exceed the 275-psi threshold stipulated in the Engineering Criteria Manual, micro-fracturing will be required.

Compressive Strength vs. Cement Content
Project Name A-1/A-2 Soil
RMG Job No. 179012
CTS Mix Design Target Values



PAVEMENT DESIGN

The discussion presented below is based on the subsurface conditions encountered in the test borings, laboratory test results and the project characteristics previously described. If the subsurface conditions are different from those described in this report or the project characteristics change, RMG should be retained to review our recommendations and modify them, if necessary. The conclusions and recommendations presented in this report should be verified by RMG during construction.

The pavement design was performed in accordance with the El Paso County Engineering Criteria Manual, Appendix D. Pavement design parameters and design calculations are presented below

utilizing the CBR value for the combined bulk sample. The recommended pavement sections shown on Figure 2.1 are supported by the calculations below.

Street Classification – Residential Urban Local (Low Volume)

1) Finsbury Court and the eastern portion of Waterloo Drive
   ESAL = 36,500 (Table D-2)
   Serviceability Index = 2.0 (Table D-1)
   Reliability = 80% (Table D-1)

2) Strength coefficients (Table D-3)
   Asphalt (HMA): $a_1 = 0.44$
   Cement Stabilized Subgrade (CTS): $a_2 = 0.11$

3) Subgrade
   M_r = CBR x 1500 = 16.3 x 1500 = 24,450 psi

4) Structural number (SN) = 1.11 (Flexible Pvm't Calculation Per Nomograph)

5) Composite asphalt/base course section
   Minimum HMA thickness = D_1 = 3 inches (Table D-2)
   CTS thickness = $D_2 = \{SN – (D_1 \times a_1)\} / a_2 = \{1.11 – (3 \times 0.44)\} / 0.11 = -1.91$ inches

6) In accordance with El Paso County ECM, Table D-2, the minimum composite section is 3 inches HMA over 4 inches of base.
   Therefore, use Asphalt thickness = 3-inches and CTS thickness = 4-inches
   Check SN = (3 x 0.44) + (4 x 0.11) = 1.76 > 1.11 (Min. SN required) => OK

Street Classification – Residential Urban Local

1) Devoncove Drive, Keynes Drive, Kingsbury Drive, Country Manor Drive, Hartwood Drive, Grace Manor Drive, and the western portion of Waterloo Drive
   ESAL = 292,000 (Table D-2)
   Serviceability Index = 2.0 (Table D-1)
   Reliability = 80% (Table D-1)

2) Strength coefficients (Table D-3)
   Asphalt (HMA): $a_1 = 0.44$
   Cement Stabilized Subgrade (CTS): $a_2 = 0.11$

3) Subgrade
   M_r = CBR x 1500 = 16.3 x 1500 = 24,450 psi

4) Structural number (SN) = 1.64 (Flexible Pvm't Calculation Per Nomograph)

5) Composite asphalt/base course section

Minimum HMA thickness = D_1 = 3 inches (Table D-2)

CTS thickness = D_2 = {SN – (D_1 x a_1)} / a_2 = {1.64 – (3 x 0.44)} / 0.11 = 2.91 inches

6) In accordance with El Paso County ECM, Table D-2, the minimum composite section is 3 inches HMA over 8 inches of base.

Therefore, use Asphalt thickness = 3-inches and CTS thickness = 8-inches

Check SN = (3 x 0.44) + (8 x 0.11) = 2.2 > 1.64 (Min. SN required) => OK

Pavement Thickness

Based on the soil types and the design calculations, the recommended pavement sections are presented below and on Figure 2.1.

Recommended Pavement Sections

Streets	HMA (in)	CTS (in)
Finsbury Court and eastern portion of Waterloo Drive	3	4
Devoncove Drive, Keynes Drive, Kingsbury Drive, Country Manor Drive, Hartwood Drive, Grace Manor Drive, and the western portion of Waterloo Drive	3	8
Optimal CTS Percent Cement by Weight = 5.25%		

Pavement Materials

Pavement materials should be selected, prepared, and placed in accordance with El Paso County specifications and the *Pikes Peak Region Asphalt Paving Specifications*. Tests should be performed in accordance with the applicable procedures presented in the specifications.

Soil Mitigation

The PDCM notes that mitigation measures may be required for expansive soils, shallow ground water, subgrade instability, etc. Based on the AASHTO classification of the soils in the subdivision and laboratory swell testing, the subgrade soils evaluated for this pavement design are expected to exhibit nil to low expansive potential. Groundwater or wet and unstable soils were

not encountered in the borings. Therefore, special mitigation measures do not appear to be necessary for subgrade preparation.

Subgrade Preparation

Subgrade for Paint Brush Hills, Filing No. 14, shall be Cement Treated Subgrade (CTS) composed of a mixture of local soil, water, and Portland cement compacted at optimum moisture. Prior to CTS construction, the existing soil should be proof-rolled to a firm and unyielding condition. Areas that deform under wheel loads should be removed and replaced. The soil should then be scarified, pulverized, mixed with cement and water, compacted, finished and cured in lengths that allow the full roadway width to be completed in not more than 4-hours from the time that cement is exposed to water.

The quantity of cement shall be by weight as a percentage of the dry weight of the soil as specified herein (5.25% optimum), and should be applied uniformly on the soil to create a cement and water mixture for the full design width and depth. Mixing should be continuous until the mixture is at optimum moisture and ready for compacting and finishing. Compaction should begin within 30 minutes of mixing. CTS should be maintained in a moist condition during the curing process, and all traffic except for necessary construction equipment should be kept off the CTS for a minimum of 7 days or until the final pavement layers are placed.

CTS testing shall be in accordance with the El Paso County Engineering Criteria Manual. CTS compressive strength test results shall be submitted to the County prior to the placement of the asphalt, in part to confirm the requirement for micro fracturing (MF). Micro fracturing of the CTS shall be performed when 7-day compressive strength test results indicate CTS strength in excess of 275 psi. The subgrade should be kept in a moist cured condition for 48 to 72 hours before any micro fracturing is performed by a heavy (12-ton) steel drum vibratory roller operating at maximum amplitude. After satisfactory completion of micro fracturing, the subgrade should continue to be moist cured by sprinkling or other means.

Surface Drainage

Surface drainage is important for the satisfactory performance of pavement. Wetting of the subgrade soils or base course will cause a loss of strength that can result in pavement distress. Surface drainage should provide for efficient removal of storm-water runoff. Water should not pond on the pavement or at the edges of the pavement.

Subgrade Observations and Testing

The pavement thicknesses presented above assume pavement construction is completed in accordance with El Paso County specifications and the *Pikes Peak Region Asphalt Paving Specifications*. RMG should be present at the site during subgrade preparation, placement of fill, and construction of pavements to perform site observations and testing.

CLOSING

This report has been prepared for the exclusive purpose of providing geotechnical engineering information and recommendations for development described in this report. RMG should be retained to review the final construction documents prior to construction to verify our findings, conclusions and recommendations have been appropriately implemented.

This report has been prepared for the exclusive use by the **Landhuis Company** for application as an aid in the design and construction of the proposed development in accordance with generally accepted geotechnical engineering practices. The analyses and recommendations in this report are based in part upon data obtained from test borings, site observations and the information presented in referenced reports. The nature and extent of variations may not become evident until construction. If variations then become evident, RMG should be retained to review the recommendations presented in this report considering the varied condition, and either verify or modify them in writing.

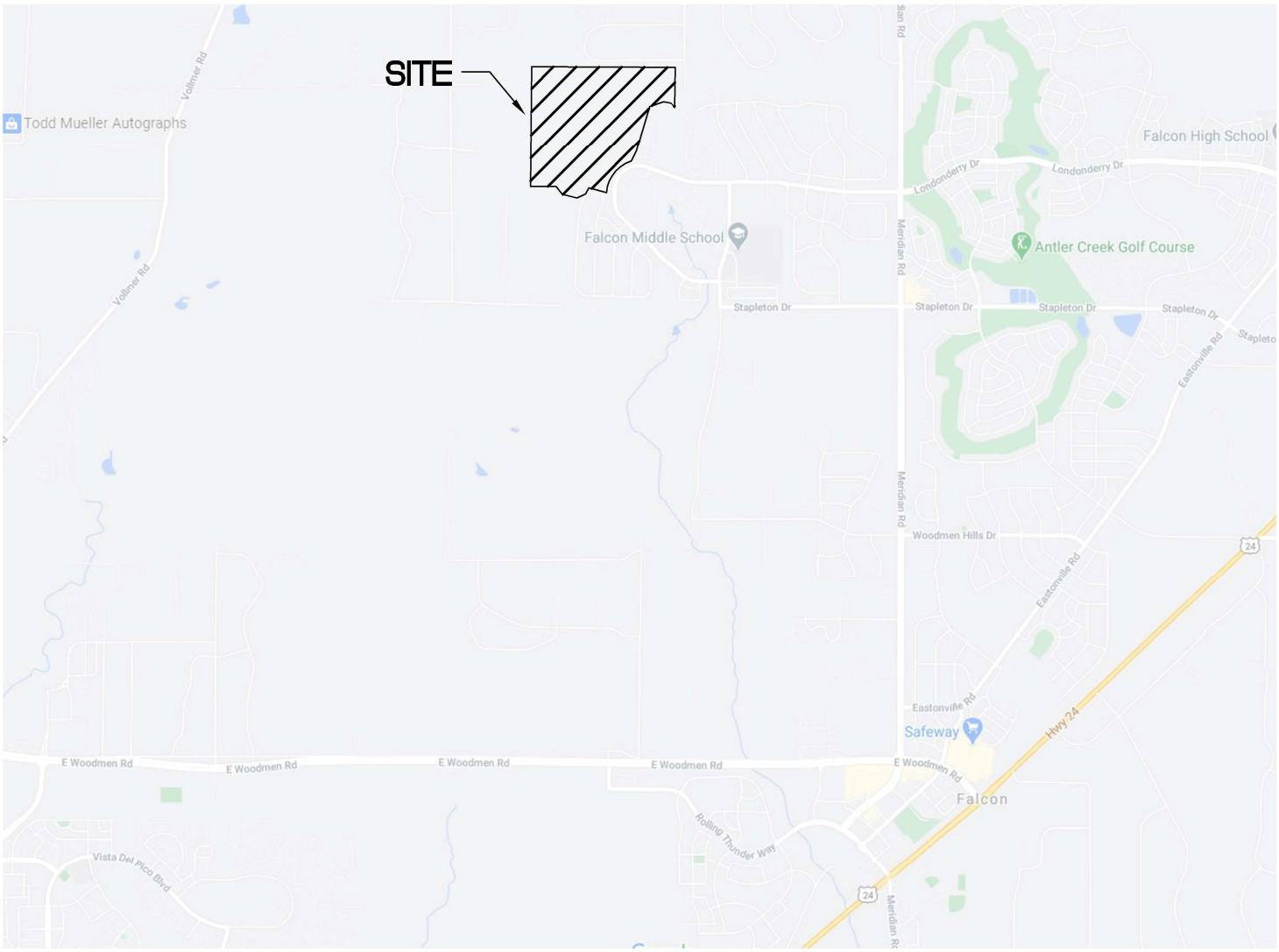
Our professional services were performed using that degree of care and skill ordinarily exercised, under similar circumstances, by geotechnical engineers practicing in this or similar localities. RMG does not warrant the work of regulatory agencies or other third parties supplying information which may have been used during the preparation of this report. No warranty, express or implied is made by the preparation of this report. Third parties reviewing this report should draw their own conclusions regarding site conditions and specific construction techniques to be used on this project.

The scope of services for this project does not include, either specifically or by implication, environmental assessment of the site or identification of contaminated or hazardous materials or conditions. Development of recommendations for the mitigation of environmentally related conditions, including but not limited to biological or toxicological issues, are beyond the scope of this report. If the Client desires investigation into the potential for such contamination or conditions, other studies should be undertaken.

If we can be of further assistance in discussing the contents of this report or analysis of the proposed development, from a geotechnical engineering point-of-view, please feel free to contact us.

FIGURES

APPENDIX A



NOT TO SCALE

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SITE VICINITY MAP

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FIG No. 1

DATE 10-20-2021

0 100 200 300 400 500

DENOTES APPROXIMATE LOCATION OF TEST BORINGS

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Pueblo / Canon City:
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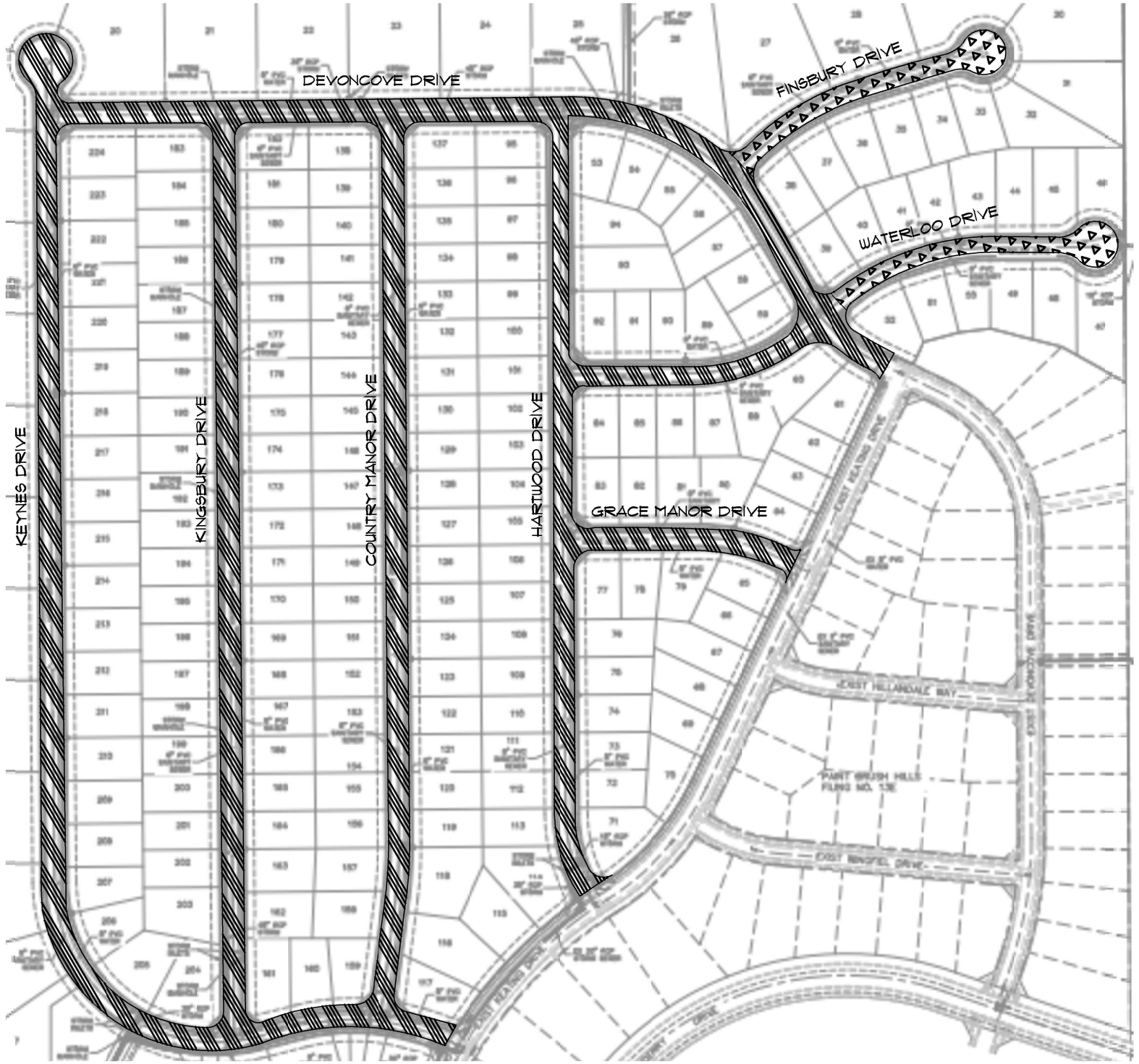
EL PASO COUNTY, COLORADO
LANHUIS COMPANY

ENGINEER:	TM
DRAWN BY:	NM
CHECKED BY:	TM
ISSUED:	10-20-2021

TEST BORING LAYOUT PLAN

SHEET No.
FIG-2



3" OF HMA
OVER
8" OF CTS

3" OF HMA
OVER
4" OF CTS

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DRAWN BY:	NM
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PAVEMENT DESIGN

SHEET No.
FIG-2.1

SOILS DESCRIPTION


CLAYEY SAND


CLAYSTONE


FILL: SAND, SILTY TO CLAYEY


SANDSTONE

UNLESS NOTED OTHERWISE, ALL LABORATORY
TESTS PRESENTED HEREIN WERE PERFORMED BY:
RMG - ROCKY MOUNTAIN GROUP
2910 AUSTIN BLUFFS PARKWAY
COLORADO SPRINGS, COLORADO

SYMBOLS AND NOTES


XX — STANDARD PENETRATION TEST - MADE BY DRIVING A SPLIT-BARREL SAMPLER INTO THE SOIL BY DROPPING A 140 LB. HAMMER 30", IN GENERAL ACCORDANCE WITH ASTM D-1586. NUMBER INDICATES NUMBER OF HAMMER BLOWS PER FOOT (UNLESS OTHERWISE INDICATED).


XX — UNDISTURBED CALIFORNIA SAMPLE - MADE BY DRIVING A RING-LINED SAMPLER INTO THE SOIL BY DROPPING A 140 LB. HAMMER 30", IN GENERAL ACCORDANCE WITH ASTM D-3550. NUMBER INDICATES NUMBER OF HAMMER BLOWS PER FOOT (UNLESS OTHERWISE INDICATED).


FREE WATER TABLE


DEPTH AT WHICH BORING CAVED


BULK — DISTURBED BULK SAMPLE


AUG — AUGER "CUTTINGS"

4.5 — WATER CONTENT (%)

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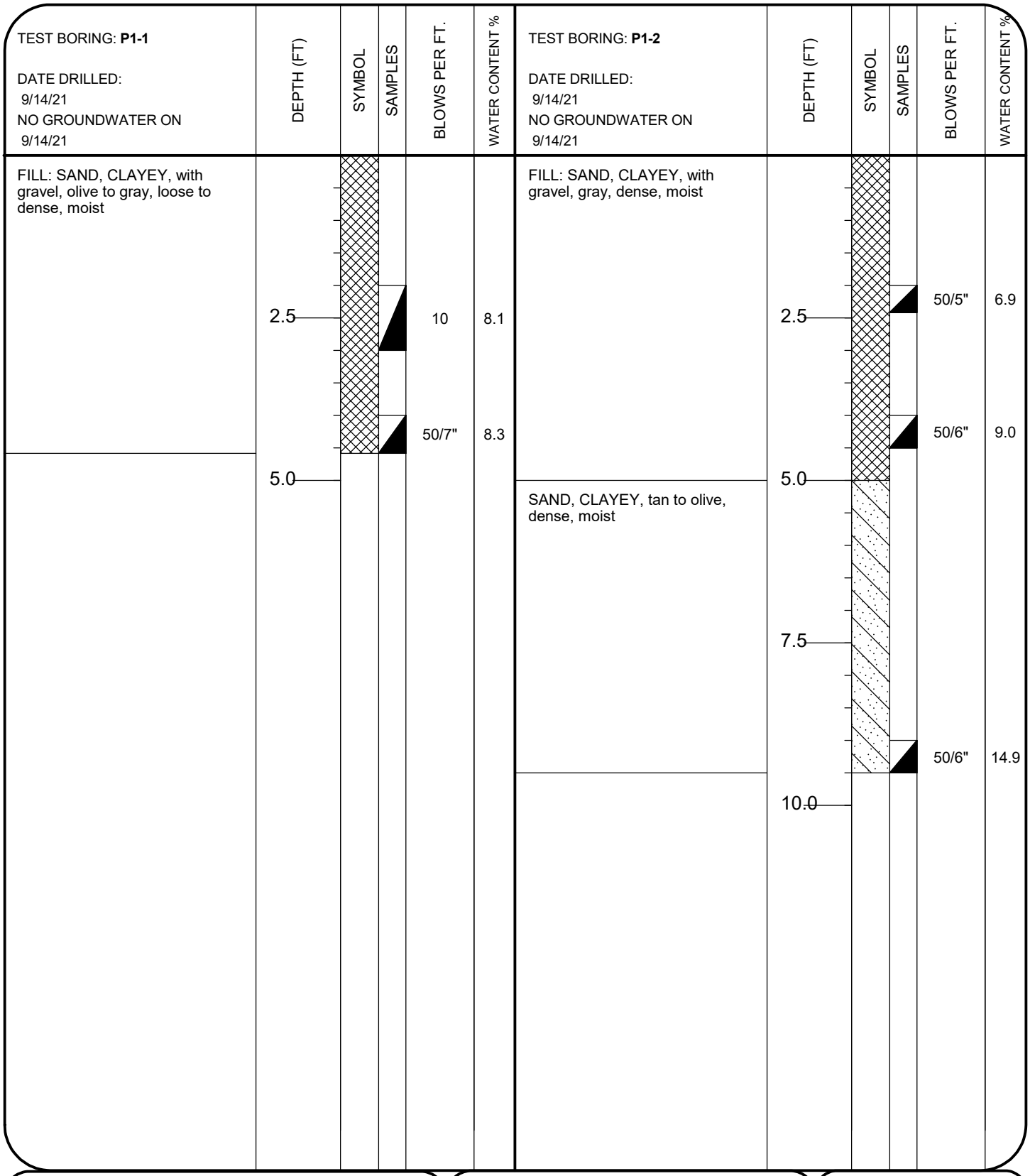
EXPLANATION OF TEST BORING LOGS

JOB No. 179012

FIGURE No. 3

DATE Oct/20/2021



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TEST BORING LOG

JOB No. 179012

FIGURE No. 4

DATE Oct/20/2021

TEST BORING: **P1-3**

DATE DRILLED:
9/14/21
NO GROUNDWATER ON
9/14/21

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	FILL: SAND, CLAYEY, with gravel, brown to olive, dense, moist			
2.5			50/6"	6.2
			50/7"	7.8
5.0				

TEST BORING: **P1-4**

DATE DRILLED:
9/14/21
NO GROUNDWATER ON
9/14/21

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	FILL: SAND, CLAYEY, dark brown, medium dense, moist			
2.5			21	13.8
			29	7.1
5.0				

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TEST BORING LOG

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FIGURE No. 5

DATE Oct/20/2021

TEST BORING: **P1-5** DATE DRILLED: 9/14/21 NO GROUNDWATER ON 9/14/21	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: SAND, CLAYEY, with gravel, brown to olive, loose, moist	2.5			12	8.0
SAND, CLAYEY, tan to olive, loose, moist	5.0			17	13.4

TEST BORING: **P1-6** DATE DRILLED: 9/14/21 NO GROUNDWATER ON 9/14/21	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: SAND, CLAYEY, with gravel, olive to gray, medium dense, moist	2.5			33	12.6
SANDSTONE, CLAYEY, with gravel, gray, medium hard, moist	5.0			50/8"	12.4

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TEST BORING LOG

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FIGURE No. 6

DATE Oct/20/2021

TEST BORING: **P1-7**

DATE DRILLED:
9/14/21
NO GROUNDWATER ON
9/14/21

FILL: SAND, CLAYEY, with gravel, dark brown, medium dense, moist

SANDSTONE, CLAYEY, with gravel, tan, hard, moist

DEPTH (FT)	BLOWS PER FT.	WATER CONTENT %
2.5	35	11.0
5.0	34	10.1
7.5	50/6"	3.7
10.0		

TEST BORING: **P1-8**

DATE DRILLED:
9/14/21
NO GROUNDWATER ON
9/14/21

SANDSTONE, CLAYEY, with gravel, brown to dark brown, hard to very hard, moist

DEPTH (FT)	BLOWS PER FT.	WATER CONTENT %
2.5	50/5"	4.1
5.0	50/6"	7.5

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TEST BORING LOG

JOB No. 179012

FIGURE No. 7

DATE Oct/20/2021

TEST BORING: **P1-9** DATE DRILLED: 9/14/21 NO GROUNDWATER ON 9/14/21	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: SAND, CLAYEY, with gravel, olive, loose, moist	2.5			18	9.8
SANDSTONE, CLAYEY, with gravel, tan, very hard, moist	5.0			50/4"	5.1

TEST BORING: **P2-1** DATE DRILLED: 9/14/21 NO GROUNDWATER ON 9/14/21	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SAND, CLAYEY, with gravel, brown, loose, moist	2.5			18	10.3
	5.0			15	9.4

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TEST BORING LOG

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FIGURE No. 8

DATE Oct/20/2021

TEST BORING: **P2-2** DATE DRILLED: 9/14/21 NO GROUNDWATER ON 9/14/21	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SANDSTONE, CLAYEY, with gravel, brown, medium hard to very hard, moist	2.5			50/8"	5.6
				50/5"	7.2
	5.0				

TEST BORING: **P2-3** DATE DRILLED: 9/14/21 NO GROUNDWATER ON 9/14/21	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SANDSTONE, CLAYEY, with gravel, brown, medium hard to very hard, moist	2.5			50/10"	7.1
				50/5"	7.8
	5.0				

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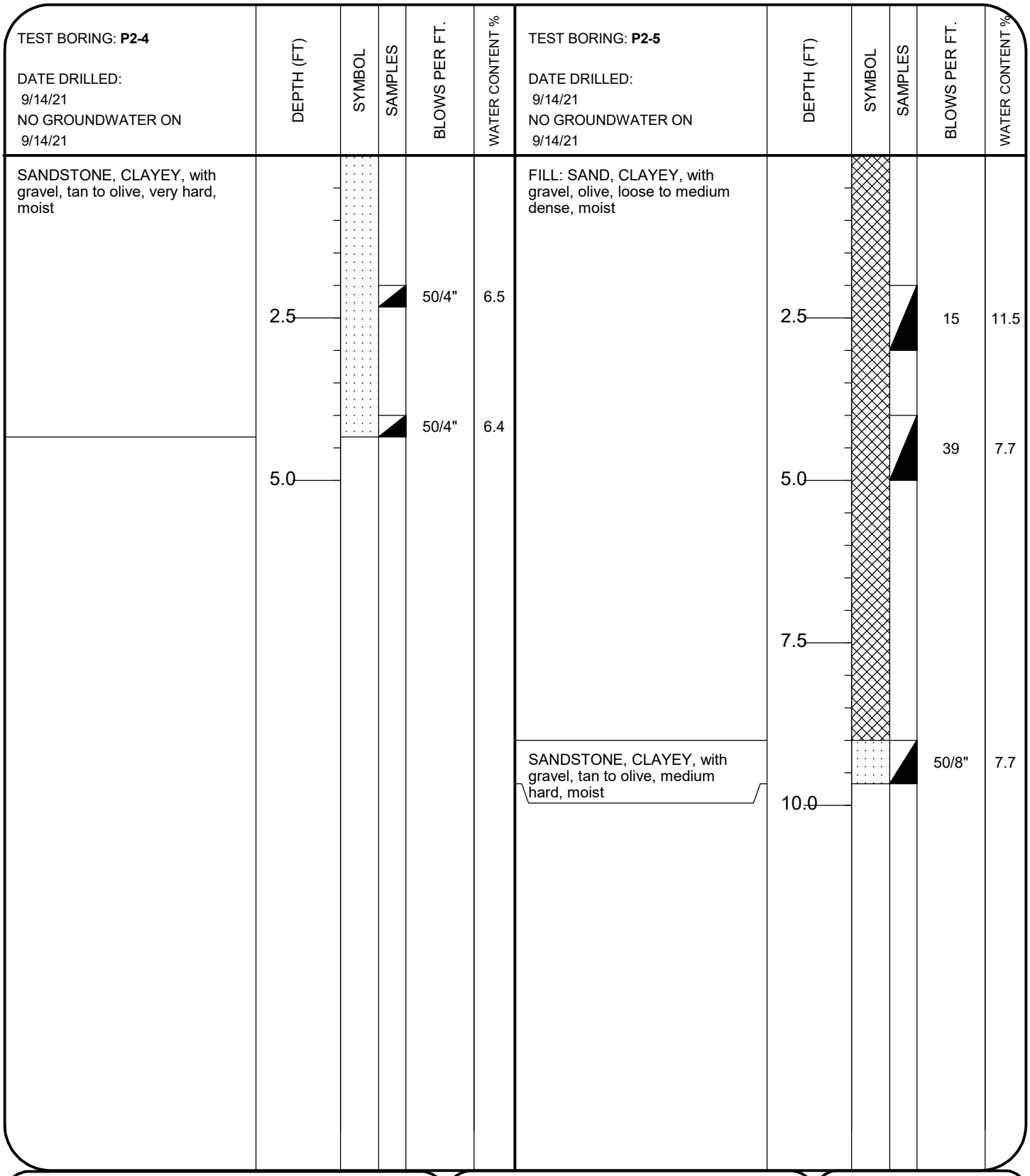
FIGURE No. 9

DATE Oct/20/2021



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TEST BORING LOG

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FIGURE No. 10

DATE Oct/20/2021

TEST BORING: **P2-6** DATE DRILLED: 9/14/21 NO GROUNDWATER ON 9/14/21	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: SAND, CLAYEY, with gravel, olive, loose to dense, moist	2.5			17	7.4
				50/10"	7.6
	5.0				

TEST BORING: **P2-7** DATE DRILLED: 9/15/21 NO GROUNDWATER ON 9/15/21	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: SAND, CLAYEY, with gravel, brown to olive, loose, moist	2.5			9	6.1
				16	8.8
	5.0				

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FIGURE No. 11

DATE Oct/20/2021

TEST BORING: **P2-8**

DATE DRILLED:
9/15/21
NO GROUNDWATER ON
9/15/21

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	FILL: SAND, CLAYEY, with gravel, brown to olive, loose to medium dense, moist			
2.5			12	11.6
			19	8.8
5.0				
7.5				
	CLAYSTONE, SANDY, gray, medium hard, moist			
			50/7"	15.8
10.0				

TEST BORING: **P2-9**

DATE DRILLED:
9/15/21
NO GROUNDWATER ON
9/15/21

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
	FILL: SAND, CLAYEY, with gravel, brown to olive, medium dense, moist			
2.5			19	7.9
			24	9.5
5.0				

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TEST BORING LOG

JOB No. 179012

FIGURE No. 12

DATE Oct/20/2021

TEST BORING: **P2-10** DATE DRILLED: 9/15/21 NO GROUNDWATER ON 9/15/21	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: SAND, CLAYEY, with gravel, brown to olive, loose to medium dense, moist	2.5			18	4.6
				40	7.4
	5.0				

TEST BORING: **P2-11** DATE DRILLED: 9/15/21 NO GROUNDWATER ON 9/15/21	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: SAND, CLAYEY, with gravel, olive to gray, loose, moist	2.5			11	5.2
				7	12.9
	5.0				

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TEST BORING LOG

JOB No. 179012

FIGURE No. 13

DATE Oct/20/2021

TEST BORING: **P2-12** DATE DRILLED: 9/15/21 NO GROUNDWATER ON 9/15/21	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: SAND, CLAYEY, with gravel, brown to olive, loose to medium dense, moist	2.5			15	7.9
				20	5.9
	5.0				

TEST BORING: **P2-13** DATE DRILLED: 9/15/21 NO GROUNDWATER ON 9/15/21	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: SAND, CLAYEY, with gravel, brown, dense, moist	2.5			50/8"	7.3
				50/9"	8.0
	5.0				

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TEST BORING LOG

JOB No. 179012

FIGURE No. 14

DATE Oct/20/2021

TEST BORING: **P2-14**

DATE DRILLED:
9/15/21
NO GROUNDWATER ON
9/15/21

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: SAND, CLAYEY, with gravel, brown to olive, loose, moist				
2.5			16	20.2
SANDSTONE, CLAYEY, with gravel, gray, medium hard, moist			50	5.9
5.0				
7.5			50/8"	6.1
10.0				

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TEST BORING LOG

JOB No. 179012

FIGURE No. 15

DATE Oct/20/2021

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.10 Sieve	% Retained No.40 Sieve	% Passing No. 200 Sieve	% Swell @ 100 psf	AASHTO Classification
P1-1	2.0	8.1		37	22	24.0	50.7	24.8		A-2-6 (1)
P1-1	4.0	8.3								
P1-2	2.0	6.9		35	21	30.6	58.9	20.8		A-2-6 (1)
P1-2	4.0	9.0								
P1-2	9.0	14.9								
P1-3	2.0	6.2		29	9	33.2	62.9	18.7		A-2-4 (0)
P1-3	4.0	7.8								
P1-4	2.0	13.8		31	15	28.7	56.8	22.4		A-2-6 (0)
P1-4	4.0	7.1								
P1-5	2.0	8.0		30	13	24.4	55.8	18.9		A-2-6 (0)
P1-5	4.0	13.4								
P1-6	2.0	12.6		29	13	32.2	57.3	24.3		A-2-6 (0)
P1-6	4.0	12.4								
P1-7	2.0	11.0		32	21	22.4	53.4	19.2		A-2-6 (0)
P1-7	4.0	10.1								
P1-7	9.0	3.7								
P1-8	2.0	4.1		33	21	32.7	62.3	15.8		A-2-6 (0)
P1-8	4.0	7.5								
P1-9	2.0	9.8		30	9	33.1	62.3	17.3		A-2-4 (0)
P1-9	4.0	5.1								
P2-1	2.0	10.3		33	20	33.2	61.7	18.7		A-2-6 (0)
P2-1	4.0	9.4								
P2-2	2.0	5.6		29	17	31.7	60.7	19.3		A-2-6 (0)
P2-2	4.0	7.2								
P2-3	2.0	7.1		NP	NP	30.5	62.5	15.2		A-1-b (0)
P2-3	4.0	7.8								
P2-4	2.0	6.5		NP	NP	24.9	57.3	10.0		A-1-b (0)
P2-4	4.0	6.4								
P2-5	2.0	11.5		33	21	31.4	62.6	19.2		A-2-6 (0)
P2-5	4.0	7.7								
P2-5	9.0	7.7								
P2-6	2.0	7.4		29	15	36.8	69.1	14.2		A-2-6 (0)
P2-6	4.0	7.6								
P2-7	2.0	6.1		30	16	26.6	59.5	21.0		A-2-6 (0)
P2-7	4.0	8.8								
P2-8	2.0	11.6		32	20	24.3	48.0	28.2		A-2-6 (1)
P2-8	4.0	8.8								

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SUMMARY OF LABORATORY TEST RESULTS

JOB No. 179012
FIGURE No. 16

DATE Oct/20/2021

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.10 Sieve	% Retained No.40 Sieve	% Passing No. 200 Sieve	% Swell @ 100 psf	AASHTO Classification
P2-8	9.0	15.8								
P2-9	2.0	7.9		31	21	30.7	61.3	18.2		A-2-6 (0)
P2-9	4.0	9.5								
P2-10	2.0	4.6		37	21	38.9	72.0	12.6		A-2-6 (0)
P2-10	4.0	7.4								
P2-11	2.0	5.2		30	16	30.7	58.0	20.9		A-2-6 (0)
P2-11	4.0	12.9								
P2-12	2.0	7.9		31	16	33.8	64.2	15.8		A-2-6 (0)
P2-12	4.0	5.9								
P2-13	2.0	7.3		42	26	45.2	74.7	10.8		A-2-7 (0)
P2-13	4.0	8.0								
P2-14	2.0	20.2		31	17	27.9	56.9	20.3		A-2-6 (0)
P2-14	4.0	5.9								
P2-14	9.0	6.1								

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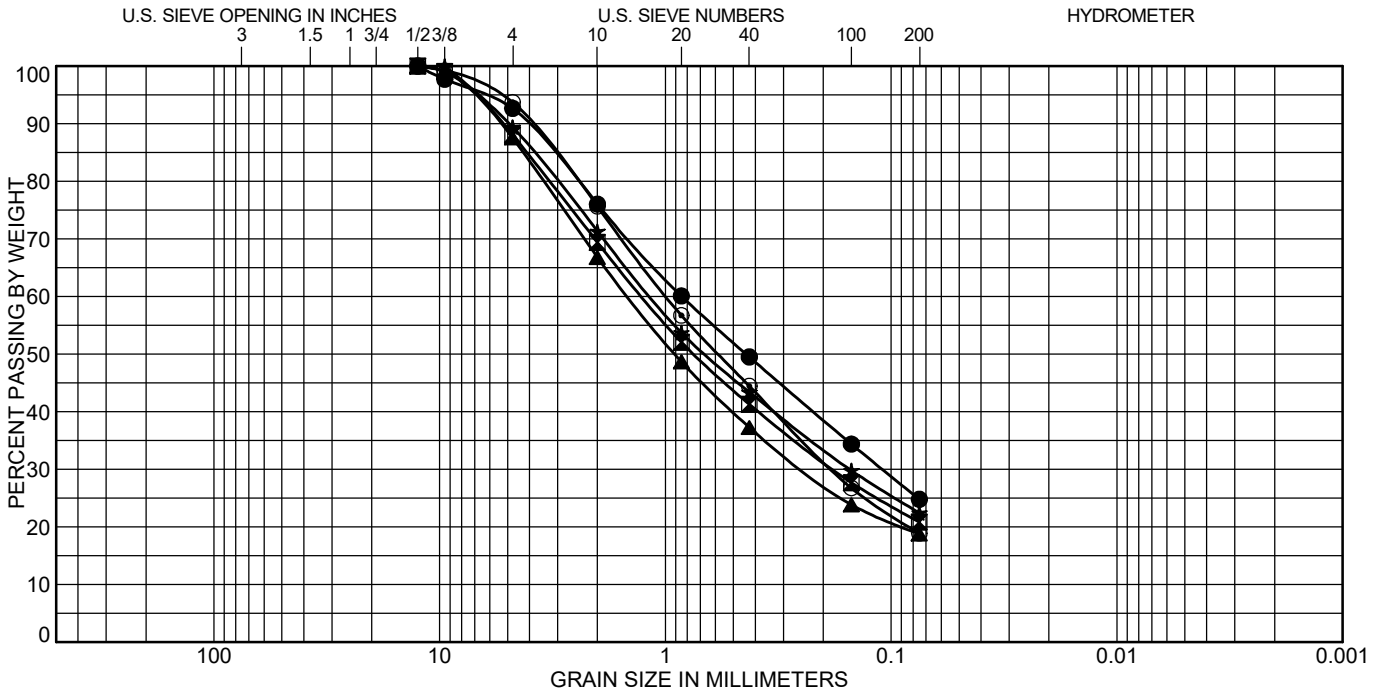
SUMMARY OF LABORATORY TEST RESULTS

JOB No. 179012
FIGURE No. 16

DATE Oct/20/2021



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	**P1-1**	**2.0**	**CLAYEY SAND(SC)**	**37**	**15**	**22**
⧓	**P1-2**	**2.0**	**CLAYEY SAND(SC)**	**35**	**14**	**21**
▲	**P1-3**	**2.0**	**CLAYEY SAND(SC)**	**29**	**20**	**9**
★	**P1-4**	**2.0**	**CLAYEY SAND(SC)**	**31**	**16**	**15**
⊙	**P1-5**	**2.0**	**CLAYEY SAND(SC)**	**30**	**17**	**13**

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	**P1-1**	**2.0**	**7.3**	**67.9**	**24.8**	
⧓	**P1-2**	**2.0**	**11.9**	**67.2**	**20.8**	
▲	**P1-3**	**2.0**	**12.5**	**68.8**	**18.7**	
★	**P1-4**	**2.0**	**10.6**	**67.0**	**22.4**	
⊙	**P1-5**	**2.0**	**6.3**	**74.8**	**18.9**	

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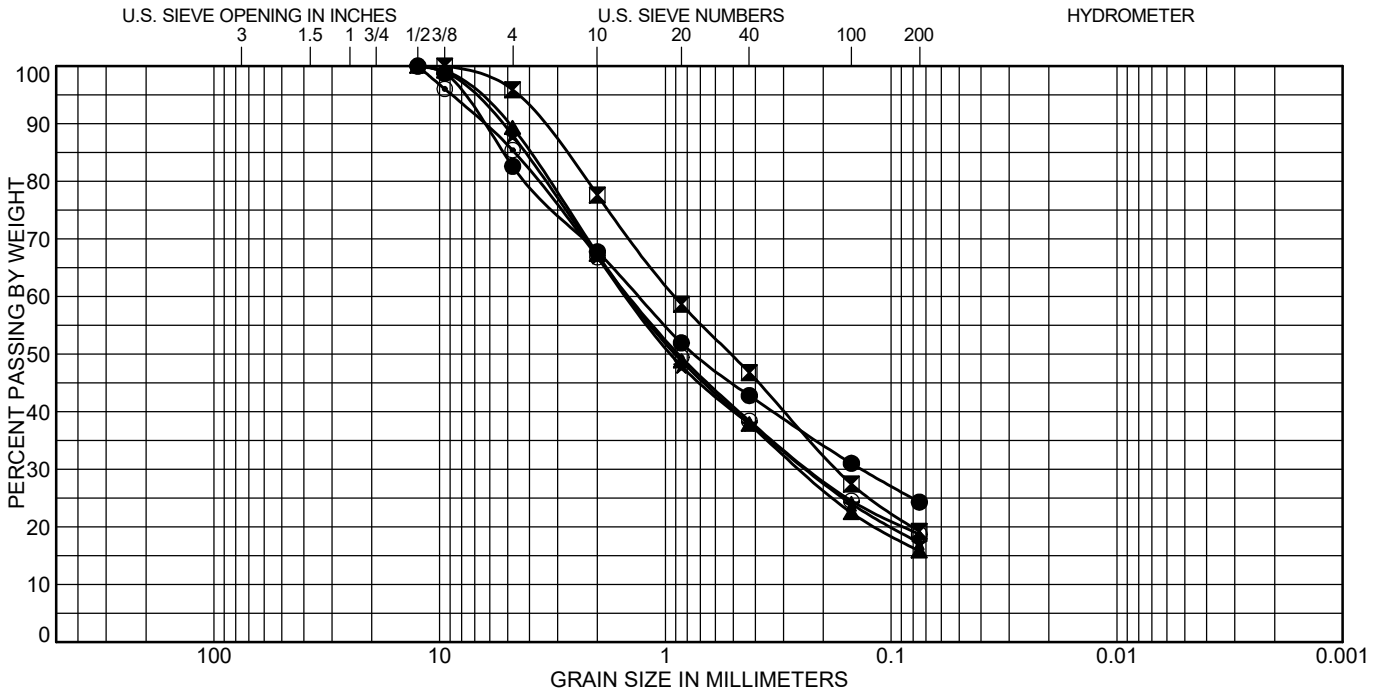
SOIL CLASSIFICATION DATA

JOB No. 179012

FIGURE No. 17

DATE Oct/20/2021



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	**P1-6**	**2.0**	**CLAYEY SAND with GRAVEL(SC)**	**29**	**16**	**13**
⧓	**P1-7**	**2.0**	**CLAYEY SAND(SC)**	**32**	**11**	**21**
▲	**P1-8**	**2.0**	**CLAYEY SAND(SC)**	**33**	**12**	**21**
★	**P1-9**	**2.0**	**CLAYEY SAND(SC)**	**30**	**21**	**9**
⊙	**P2-1**	**2.0**	**CLAYEY SAND(SC)**	**33**	**13**	**20**

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	**P1-6**	**2.0**	**17.4**	**58.3**	**24.3**	
⧓	**P1-7**	**2.0**	**4.1**	**76.7**	**19.2**	
▲	**P1-8**	**2.0**	**10.6**	**73.5**	**15.8**	
★	**P1-9**	**2.0**	**12.0**	**70.7**	**17.3**	
⊙	**P2-1**	**2.0**	**14.6**	**66.7**	**18.7**	

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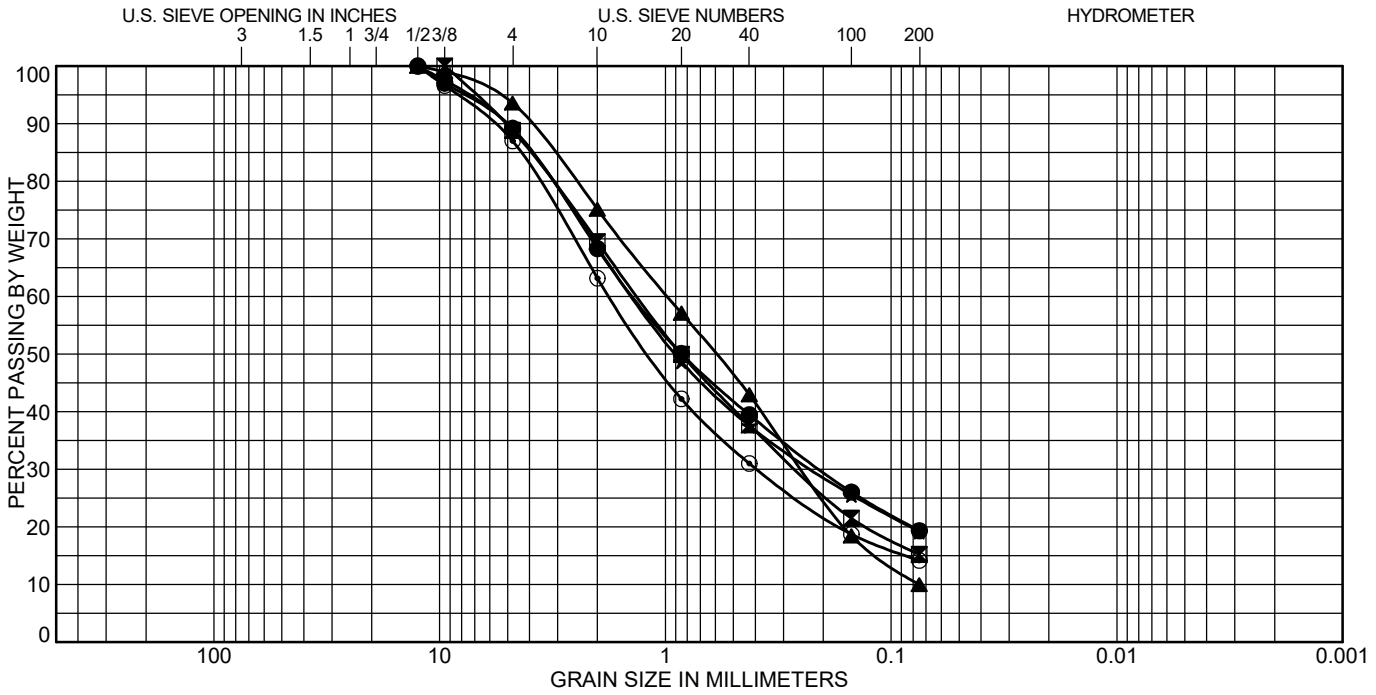
SOIL CLASSIFICATION DATA

JOB No. 179012

FIGURE No. 18

DATE Oct/20/2021



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	**P2-2**	**2.0**	**CLAYEY SAND(SC)**	**29**	**12**	**17**
⧓	**P2-3**	**2.0**	**SILTY SAND(SM)**	**NP**	**NP**	**NP**
▲	**P2-4**	**2.0**	**POORLY GRADED SAND with SILT(SP-SM)**	**NP**	**NP**	**NP**
★	**P2-5**	**2.0**	**CLAYEY SAND(SC)**	**33**	**12**	**21**
⊙	**P2-6**	**2.0**	**CLAYEY SAND(SC)**	**29**	**14**	**15**

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	**P2-2**	**2.0**	**10.8**	**69.9**	**19.3**	
⧓	**P2-3**	**2.0**	**11.2**	**73.6**	**15.2**	
▲	**P2-4**	**2.0**	**6.4**	**83.6**	**10.0**	
★	**P2-5**	**2.0**	**10.9**	**69.9**	**19.2**	
⊙	**P2-6**	**2.0**	**13.0**	**72.8**	**14.2**	

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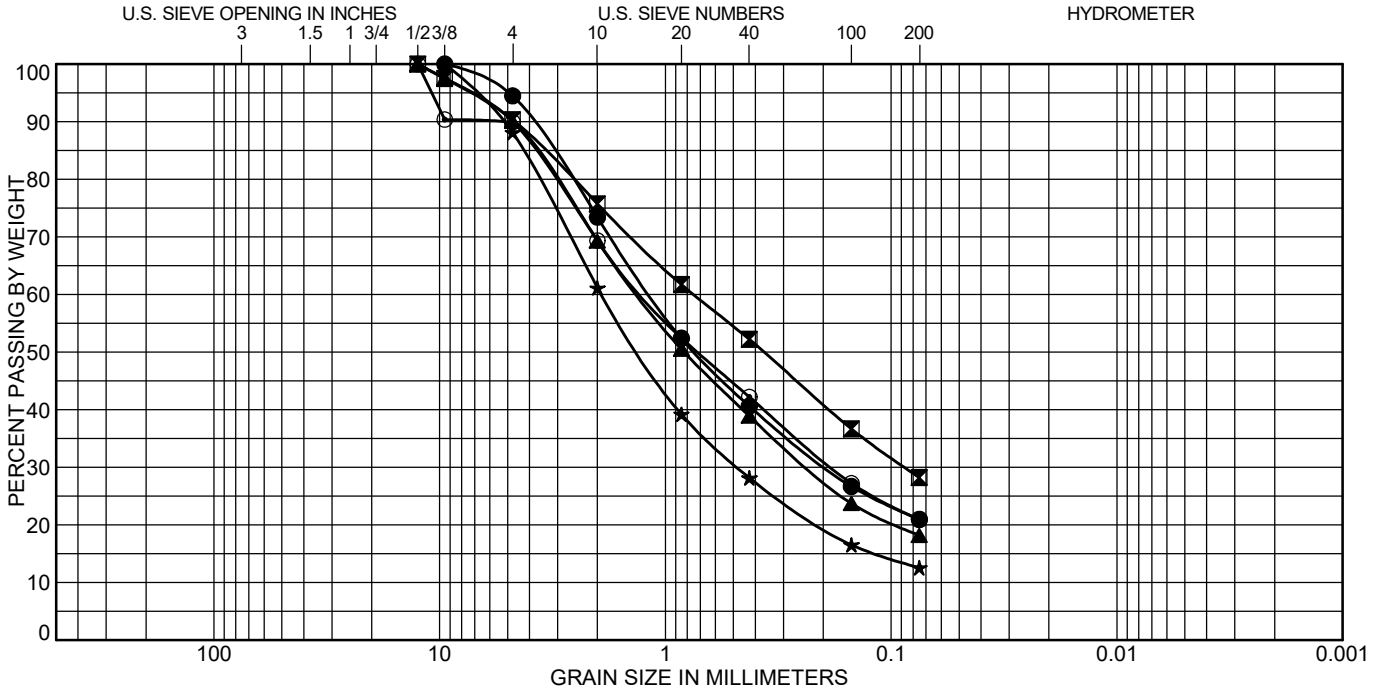
SOIL CLASSIFICATION DATA

JOB No. 179012

FIGURE No. 19

DATE Oct/20/2021



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	**P2-7**	**2.0**	**CLAYEY SAND(SC)**	**30**	**14**	**16**
⧓	**P2-8**	**2.0**	**CLAYEY SAND(SC)**	**32**	**12**	**20**
▲	**P2-9**	**2.0**	**CLAYEY SAND(SC)**	**31**	**10**	**21**
★	**P2-10**	**2.0**	**CLAYEY SAND(SC)**	**37**	**16**	**21**
⊙	**P2-11**	**2.0**	**CLAYEY SAND(SC)**	**30**	**14**	**16**

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	**P2-7**	**2.0**	**5.5**	**73.5**	**21.0**	
⧓	**P2-8**	**2.0**	**9.7**	**62.1**	**28.2**	
▲	**P2-9**	**2.0**	**10.0**	**71.9**	**18.2**	
★	**P2-10**	**2.0**	**11.9**	**75.5**	**12.6**	
⊙	**P2-11**	**2.0**	**10.1**	**69.0**	**20.9**	

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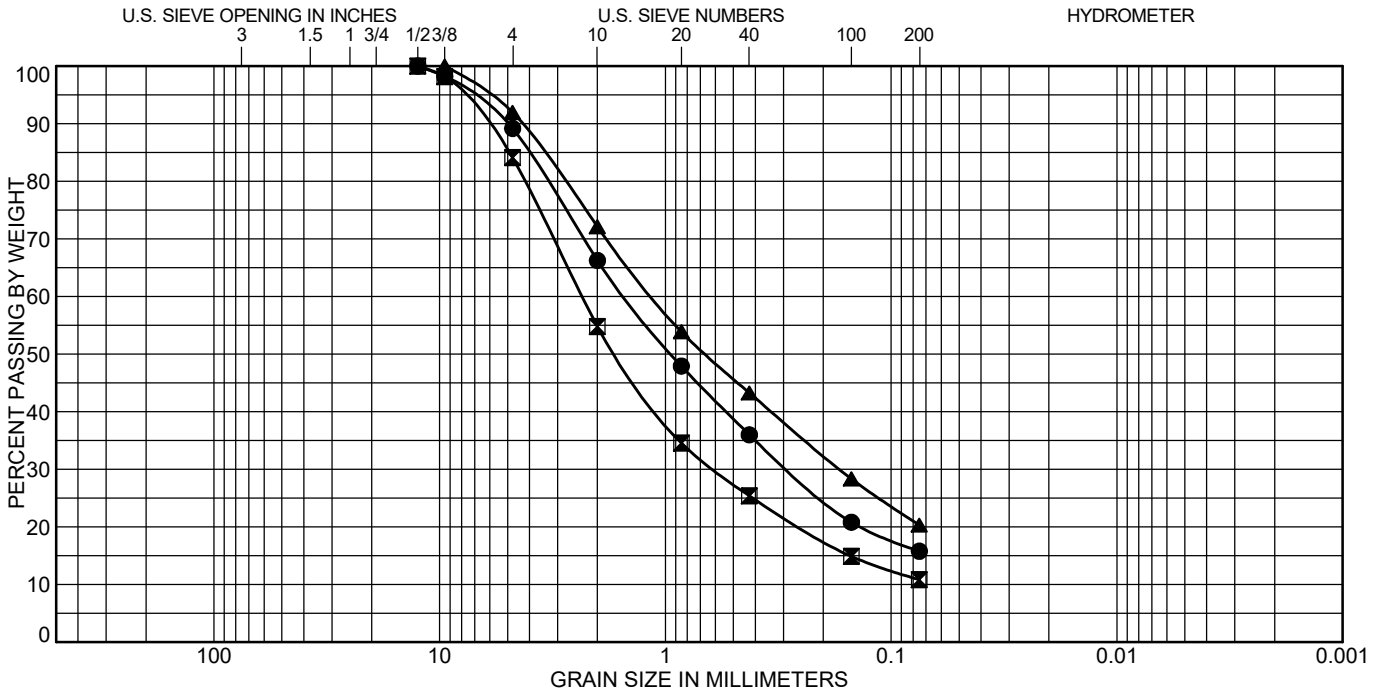
SOIL CLASSIFICATION DATA

JOB No. 179012

FIGURE No. 20

DATE Oct/20/2021



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	**P2-12**	**2.0**	**CLAYEY SAND(SC)**	**31**	**15**	**16**
⧓	**P2-13**	**2.0**	**WELL-GRADED SAND with CLAY and GRAVEL(SW-SC)**	**42**	**16**	**26**
▲	**P2-14**	**2.0**	**CLAYEY SAND(SC)**	**31**	**14**	**17**

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	**P2-12**	**2.0**	**10.8**	**73.4**	**15.8**	
⧓	**P2-13**	**2.0**	**15.9**	**73.3**	**10.8**	
▲	**P2-14**	**2.0**	**8.0**	**71.7**	**20.3**	

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SOIL CLASSIFICATION DATA

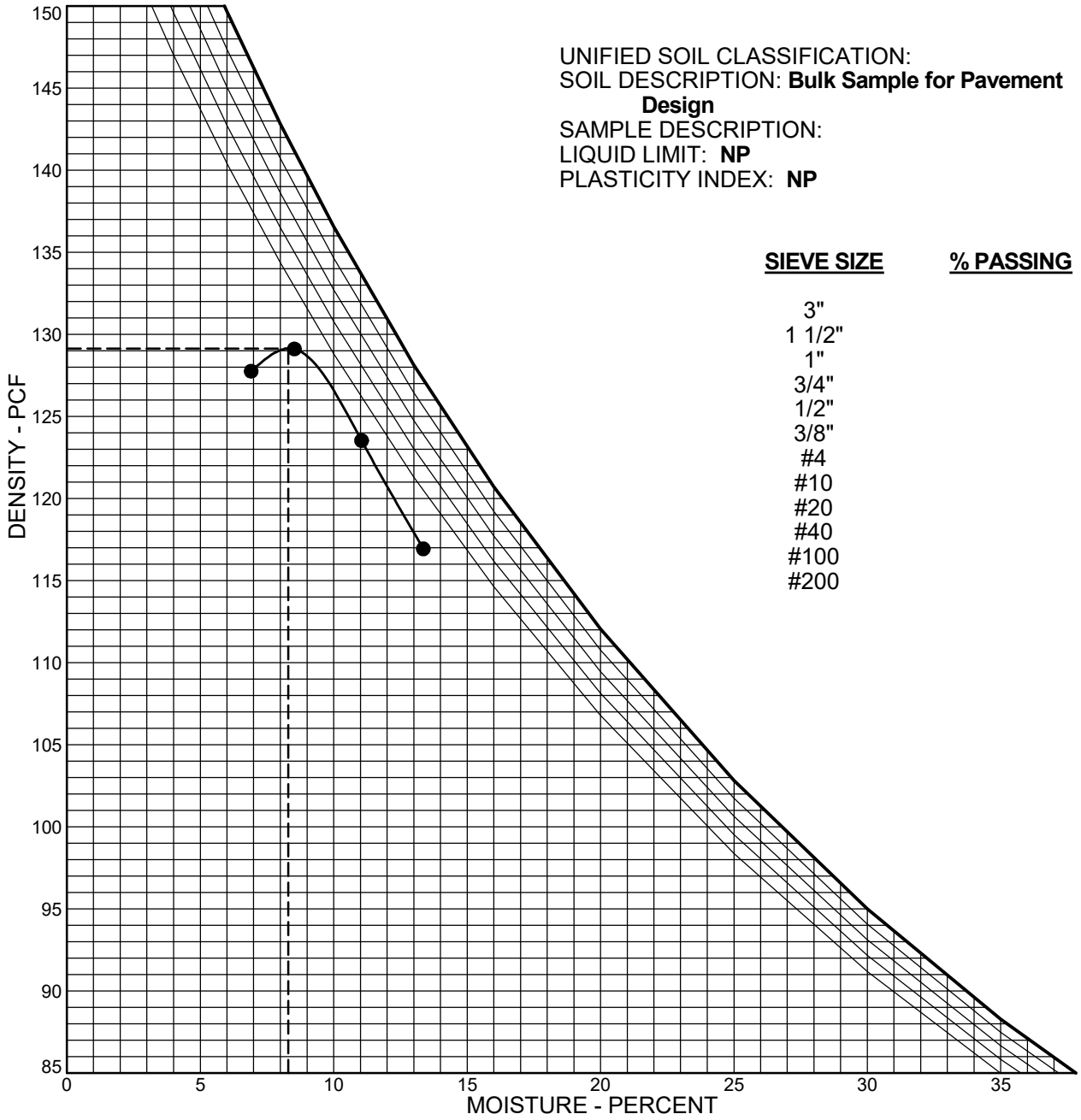
JOB No. 179012

FIGURE No. 21

DATE Oct/20/2021

CLIENT: Landhuis Company **SAMPLE NUMBER:** Bulk Sample - All Lots

PROJECT: **Paint Brush Hills, Filing No. 14 El Paso County, Colorado**



UNIFIED SOIL CLASSIFICATION:
SOIL DESCRIPTION: **Bulk Sample for Pavement Design**
SAMPLE DESCRIPTION:
LIQUID LIMIT: **NP**
PLASTICITY INDEX: **NP**

SIEVE SIZE	% PASSING
3"	
1 1/2"	
1"	
3/4"	
1/2"	
3/8"	
#4	
#10	
#20	
#40	
#100	
#200	

DESIGNATION **ASTM D-1557A**
MAX. DRY DENSITY **129.2 pcf**
OPTIMUM MOISTURE **8.3 %**
FRACTION USED **#4**
MOLD VOLUME **0.0333 cu.ft.**

NOTE: ZERO AIR VOIDS CURVES PLOTTED FOR:
Gs = 2.60
Gs = 2.65
Gs = 2.70
Gs = 2.75
Gs = 2.80

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MOISTURE-DENSITY RELATION CURVE

JOB No. 179012

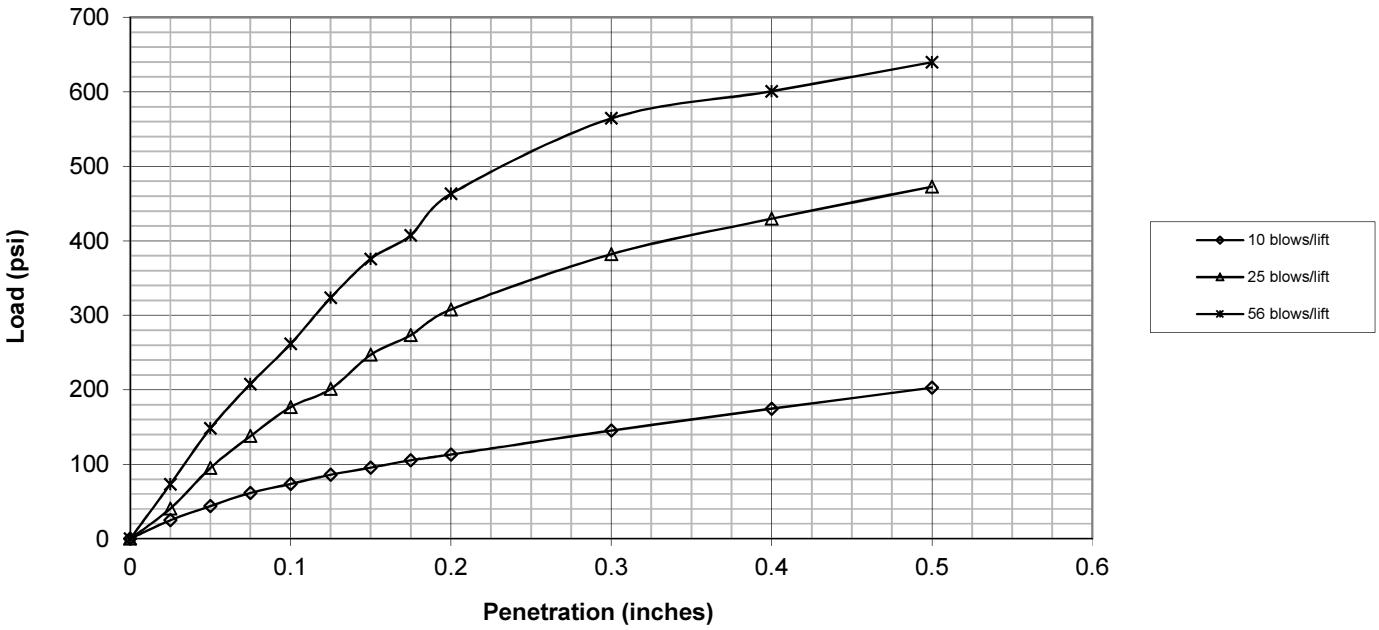
FIGURE No. 22

DATE Oct/20/2021

CALIFORNIA BEARING RATIO TEST RESULTS

Project: Paint Brush Hills
Job No.: 179012
AASHTO Classification" A-1, A-2
Sample Number: CBR
Sample Location: Combined Bulk Sample
Soil Description: Silty and Clayey Sand

Penetration (in)	10 blows/lift Load (psi)	25 blows/lift Load (psi)	56 blows/lift Load (psi)
0.000	0.0	0.0	0.0
0.025	24.8	40.5	73.3
0.050	43.8	95.0	148.2
0.075	61.6	137.8	207.7
0.100	73.6	176.6	261.6
0.125	86.0	201.1	323.5
0.150	95.3	246.9	375.7
0.175	105.4	273.3	407.5
0.200	113.1	307.8	463.0
0.300	145.2	382.0	564.4
0.400	174.6	429.5	600.8
0.500	202.7	472.7	639.6



	Corrected Penetration (in)	Corrected Load (psi)
10 blows/lift	0.100	7.4
25 blows/lift	0.100	17.7
56 blows/lift	0.100	26.2

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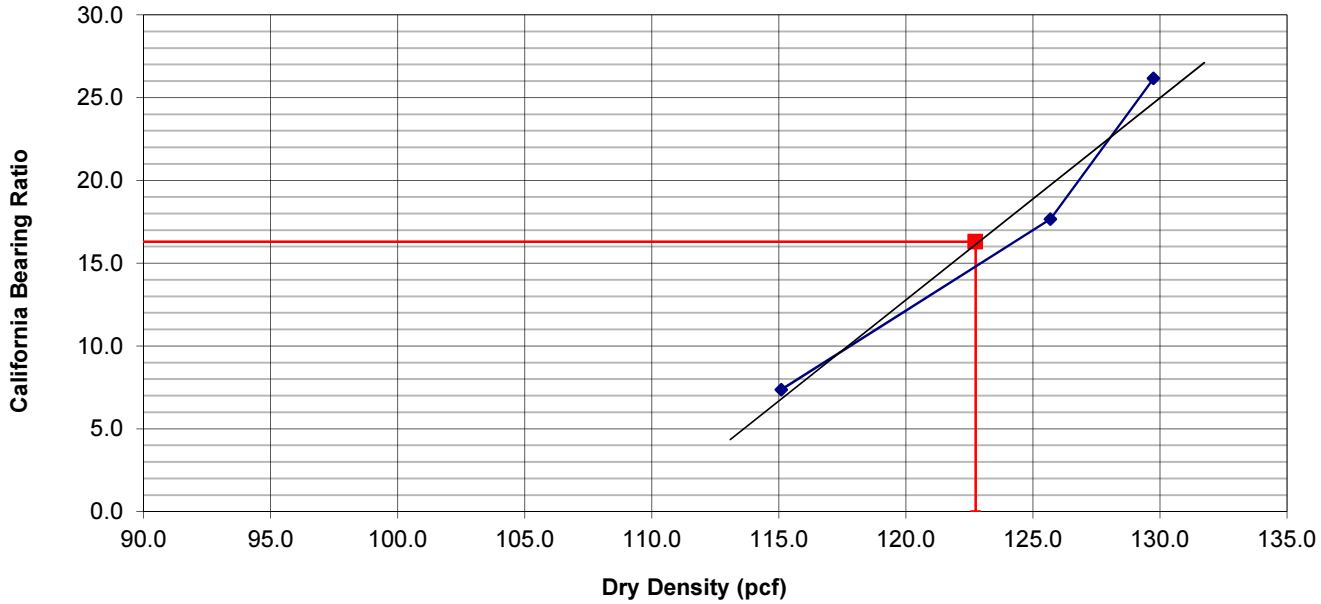
Figure No. 23

CALIFORNIA BEARING RATIO TEST RESULTS

Project: Paint Brush Hills
Job No.: 179012
AASHTO Classification" A-1, A-2
Sample Number: CBR
Sample Location: Combined Bulk Sample
Soil Description: Silty and Clayey Sand

	10 blows/lift	25 blows/lift	56 blows/lift
Corrected California Bearing Ratio	7.4	17.7	26.2
Dry Density (pcf)	115.1	125.7	129.7
Percent Compaction	89	97	100
Percent Moisture After Soaking	12.7	12.2	10.9
Percent Expansion (+) / Compression (-)	2.5%	0.5%	0.2%
Surcharge Weight (lbs)	12.60	12.60	12.60



California Bearing Ratio	**16.3**
Dry Density (pcf)	129.2
Percent Compaction	95%
Target Dry Density	122.7
Compaction Test Method	ASTM D-1557
Condition of sample	Soaked

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Figure No. 24