Architecture
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ROCKY MOUNTAIN GROUP

Materials Testing
Forensic
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PAVEMENT DESIGN REPORT

Lorson Ranch East, Filing No. 1
El Paso County, Colorado

Approved, EN
08/29/2018 4:51:23 PM

PREPARED FOR:

Lorson Ranch Metropolitan District
212 N. Wahsatch Ave. Ste 301
Colorado Springs, CO

JOB NO. 162626

August 14, 2018

Respectfully Submitted,

RMG – Rocky Mountain Group

Kelli Zigler

Kelli Zigler
Project Geologist

Reviewed by,

RMG – Rocky Mountain Group

COLORADO LICENSED
GEOFF WEBSTER
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45046
PROFESSIONAL ENGINEER

Geoff Webster, P.E.
Sr. Geotechnical Project Manager

SF Number – 18-008

TABLE OF CONTENTS

GENERAL SITE AND PROJECT DESCTIPTION

Location

Lorson Ranch East Filing No. 1 is located east of Marksheffel Road and between Fontaine Boulevard to the north and Lorson Boulevard to the south in El Paso County, Colorado. The East Tributary of Jimmy Camp Creek forms the western boundary of the development, and Lamprey Drive borders on the east. 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. The streets considered below are classified as Residential Urban Local as shown on Sheet number C1.3 of the Typical Sections Plan for Lorson Ranch East Filing No. 1. Lamine Drive, Saco Drive, Weiser Drive, Matta Drive, Yuba Drive, Chaplin Drive, Nolin Drive, Rowley Drive, Aliso Drive, Pigeon Drive, Willapa Drive, and Skuna Drive all have a 50-foot wide Right- of-Way (ROW) and two 15-foot wide travel lanes.

The following streets are classified as Residential Urban Collectors. Lorson Boulevard with a 64-ft ROW and two 20-foot wide travel lanes between Stingray Drive (Meadows Filing No. 3) and Lamprey Drive; Lamprey Drive and Trappe Drive with 60-ft ROW's and two 18-foot wide travel lanes.

Fontaine Boulevard has been designed for the future urban designation of Principal Arterial, 4-lane, with a 100-foot ROW and two 24-foot wide travel lanes.

FIELD INVESTIGATION AND SUBSURFACE CONDITIONS

Drilling

The subsurface conditions on the site were investigated by drilling thirty-seven (37) 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 22.

Subsurface Materials

The subsurface materials encountered in the test borings consisted primarily of sandy lean clay. Combined bulk samples of the material classified as CL according to the Unified Classification System. For pavement design purposes bulk samples of the soil classified as A-6 and A-7 soil with varying Group Indices in accordance with the American Association of State Highway and Transportation Officials (ASSHTO) classification system. A-6 and A-7-6 soil typically has high fines (+200 sieve) content, and will require improvement to prepare it to provide adequate subgrade support. 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 for purposes of classification and to develop pertinent engineering properties. Swell/consolidation tests were performed to determine the expansive potential of the soil. A Summary of Laboratory Test Results is presented in Figure 23. Soil Classification Data are presented in Figures 24 through 31.

Swell potential evaluation based upon laboratory testing indicates the subgrade soil exhibited an average swell potential of 1.2 percent. Swell test results are presented in Figures 32 through 36.

California Bearing Ratio tests (CBR) were performed for each soil type. Combined bulk samples of A-6 soil, and combined bulk samples of A-7 soil, were tested separately to determine the optimum moisture-density relationship in accordance with ASTM D-698 (Standard Proctor compaction test). CBR tests were performed at varying densities with moisture content near optimum. At 95% of the maximum Standard Proctor Density, the CBR of the A-6 soil was 5.0, while the CBR of the A-7 sample was 4.7. Moisture-Density Relation Curves are presented in Figures 37 and 38. CBR Test Results are presented in Figures 39 through 42.

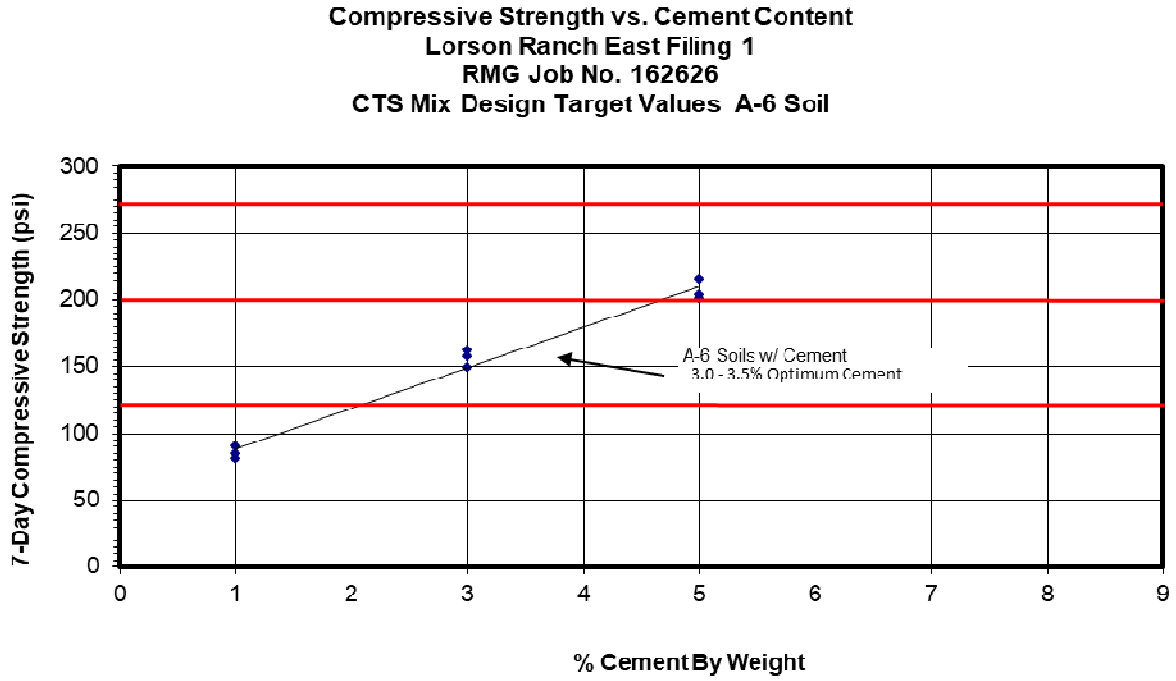
The developer intends to install a composite roadway section consisting of Hot Mix Asphalt over Cement-Treated Subgrade (CTS). RMG performed a Mix Design for this composite section for both soil types.

Specimens of soil composed of the A-6 subgrade materials and Portland Cement were prepared by varying the "percent cement by weight" at target values of 1, 3, and 5 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 A-6 compressive strengths are presented in the table below:

A-6 Soil Compressive Strength Calculations

CTS Puck	Age/Day	Cap & Plate	Area of Sample	Dial Reading	Load LBF	Total Load	PSI
1A	7	2.82	12.566	101	1021.8	1024.6	82
1B	7	2.82	12.566	112	1133.1	1135.9	90
1C	7	2.82	12.566	105	1062.3	1065.1	85
3A	7	2.82	12.566	185	1871.6	1874.5	149
3B	7	2.82	12.566	196	1982.9	1985.8	158
3C	7	2.82	12.566	201	2033.5	2036.3	162
5A	7	2.82	12.566	253	2559.6	2562.4	204
5B	7	2.82	12.566	249	2519.1	2522.0	201
5C	7	2.82	12.566	268	2711.4	2714.2	216

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 3.0 to 3.5 percent cement is recommended in all roadway sections to maintain strengths below the 275 psi threshold stipulated in the Engineering Criteria Manual. See CTS Graph below.

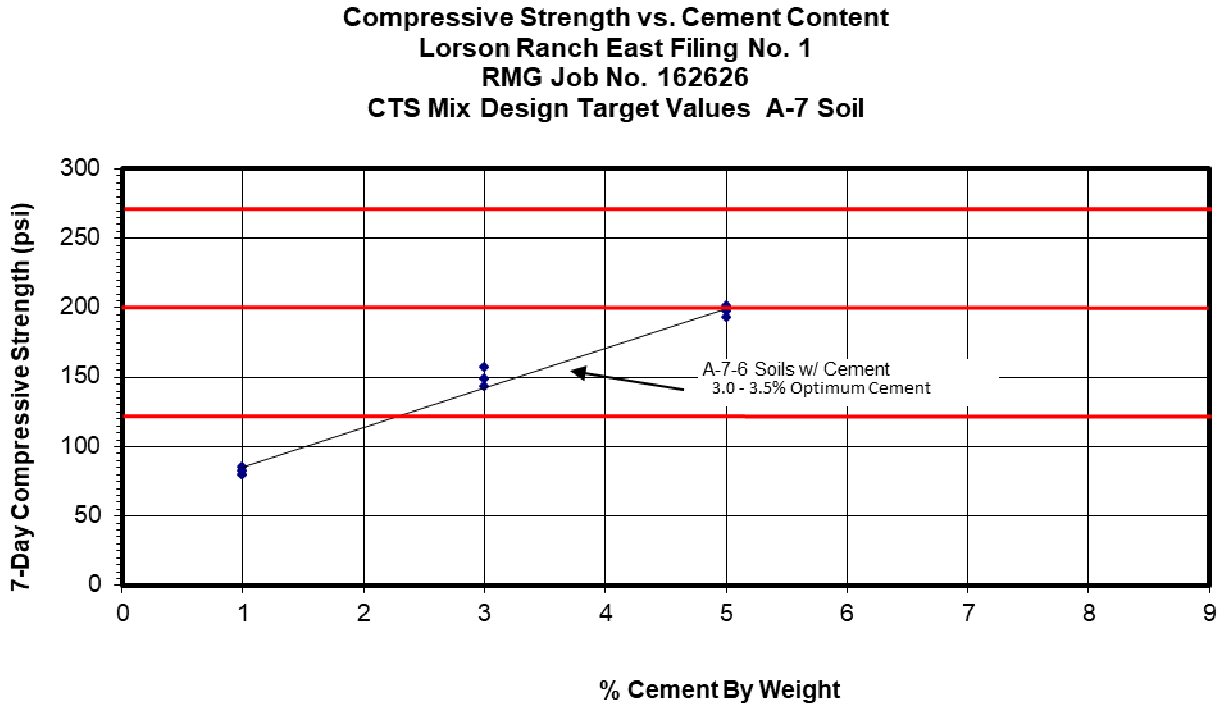


Specimens of soil composed of the A-7 subgrade materials and Portland Cement were prepared by varying the "percent cement by weight" at target values of 1, 3, and 5 percent cement. Three specimens (pucks) were prepared for each target cement value, compacted to 95% of the maximum Modified Proctor density 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 compressive strengths are presented in the table below:

A-7 Soil Compressive Strength Calculations

CTS Puck	Age/Day	Cap & Plate	Area of Sample	Dial Reading	Load LBF	Total Load	PSI
1A	7	2.82	12.566	98	991.5	994.3	79
1B	7	2.82	12.566	101	1021.8	1024.6	82
1C	7	2.82	12.566	105	1062.3	1065.1	85
3A	7	2.82	12.566	177	1790.7	1793.5	143
3B	7	2.82	12.566	183	1851.4	1854.2	148
3C	7	2.82	12.566	194	1962.7	1965.5	156
5A	7	2.82	12.566	244	2468.5	2471.4	197
5B	7	2.82	12.566	239	2418.0	2420.8	193
5C	7	2.82	12.566	249	2519.1	2522.0	201

The data values were then plotted as a function of "7-day Compressive Strength versus Percent Cement by Weight" (attached in Appendix A). 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 3.0 to 3.5percent cement is recommended in all roadway sections to maintain strengths below the 275 psi threshold stipulated in the Engineering Criteria Manual. See CTS Graph below.



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 A-7-6 soil. The CBR values for A-6 soil (5.0) and A-7 soil (4.7) compute an AASHTO Structural Number that is virtually the same value for each roadway designation. The recommended pavement sections shown on Figure 2.1 are supported by the calculations below.

Street Classification – Urban Principal Arterial, 4-lane

Section 1: CBR = 4.7

1) Fontaine Boulevard
   ESAL = 5,256,000 (Table D-2)
   Serviceability Index = 2.5 (Table D-1)

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

3) Subgrade
   M_r = CBR x 1500 = 4.7 x 1500 = 7,050 psi

4) Structural number (SN) = 4.20 (1993 AASHTO Empirical Equation, Appendix A)

5) Composite asphalt/base course section
   Minimum HMA thickness = D_1 = 5 inches (Table D-2)
   CTS thickness = $D_2 = \{SN – (D_1 \times a_1)\} / a_2 = \{4.20 – (5 \times 0.44)\} / 0.11 = 18.1$ inches

6) In accordance with El Paso County ECM, Section D.4, Paragraph F, *The base course thickness selected cannot exceed 2.5 times the HMA thickness selected.*
   Therefore, use Asphalt thickness = 6-inches and CTS thickness = 15 inches
   Check SN = (6 x 0.44) + (15 x 0.11) = 4.29 > 4.20 (Min. SN required) => OK

Street Classification – Residential Urban Collector

Section 2: CBR = 4.7

1) Lorson Boulevard, Lamprey Drive, Trappe Drive
   ESAL = 821,000 (Table D-2)
   Serviceability Index = 2.5 (Table D-1)

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

3) Subgrade
   M_r = CBR x 1500 = 4.7 x 1500 = 7,050 psi

4) Structural number (SN) = 3.20 (1993 AASHTO Empirical Equation, Appendix A)

5) Composite asphalt/base course section

Minimum HMA thickness = D_1 = 4 inches (Table D-2)
CTS thickness = D_2 = {SN – (D_1 x a_1)} / a_2 = {3.20 – (4 x 0.44)} / 0.11 = 13.1 inches

6) In accordance with El Paso County ECM, Section D.4, Paragraph F, *The base course thickness selected cannot exceed 2.5 times the HMA thickness selected.*
Therefore, use Asphalt thickness = 4.5-inches and CTS thickness = 11 inches
Check SN = (4.5 x 0.44) + (11 x 0.11) = 3.2 = 3.2 (Min. SN required) => OK

Street Classification – Residential Urban Local

Section 3, CBR = 4.7

Lamine Drive, Saco Drive, Weiser Drive, Matta Drive, Yuba Drive, Chaplin Drive, Nolin Drive, Rowley Drive, Aliso Drive, Pigeon Drive, Willapa Drive, and Skuna Drive
ESAL = 292,000 (Table D-2)
Serviceability Index = 2.0 (Table D-1)

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

3) Subgrade
M_r = CBR x 1500 = 4.7 x 1500 = 7,050 psi

4) Structural number (SN) = 2.6 (1993 AASHTO Empirical Equation, Appendix A)

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 = {2.6 – (3 x 0.44)} / 0.11 = 11.6 inches

6) In accordance with El Paso County ECM, Section D.4, Paragraph F, *The base course thickness selected cannot exceed 2.5 times the HMA thickness selected.*
Therefore, use Asphalt thickness = 4.5-inches and CTS thickness = 11-inches
Check SN = (4.5 x 0.44) + (11 x 0.11) = 3.2 > 2.6 (Min. SN required) => OK

Pavement Thickness

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

Recommended Pavement Sections

Streets	HMA (in)	CTS (in)
Fontaine Boulevard	6.0	15
Lorson Boulevard, Lamprey Drive, Trappe Drive	4.5	11
Lamine Drive, Saco Drive, Weiser Drive, Matta Drive, Yuba Drive, Chaplin Drive, Nolin Drive, Rowley Drive, Aliso Drive, Pigeon Drive, Willapa Drive, and Skuna Drive	4.5	11
Optimal CTS Percent Cement by Weight = 3.0 to 3.5%		

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 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 Lorson Ranch East, Filing No. 1 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 which 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 (3.0 to 3.5% 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 structure 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 which 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.

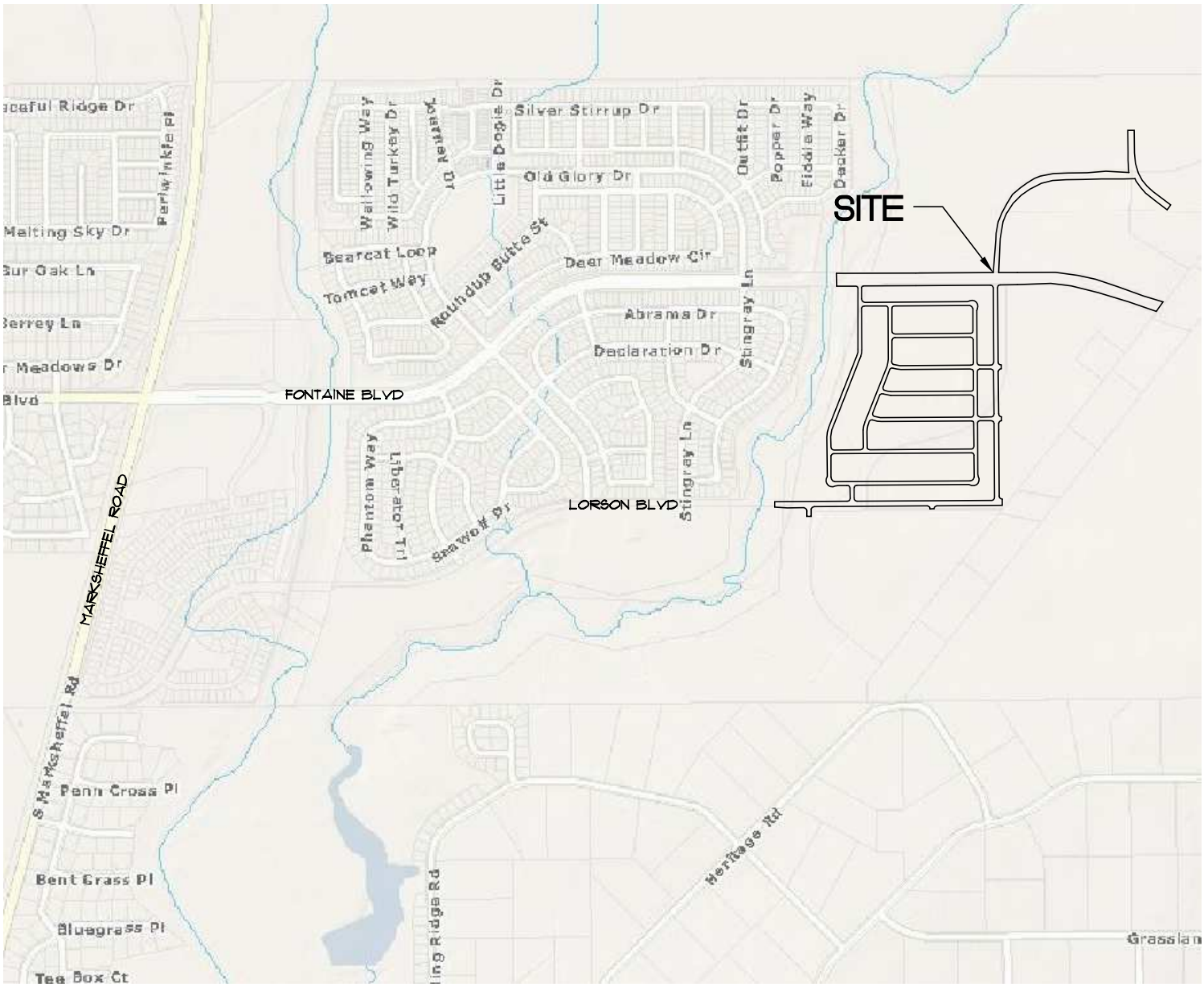
This report has been prepared for the exclusive use by the **Landhuis Company** for application as an aid in the design and construction of the proposed development in accordance with generally accepted geotechnical engineering practices. The analyses and recommendations in this report are based in part 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



REFERENCE
NOT TO SCALE

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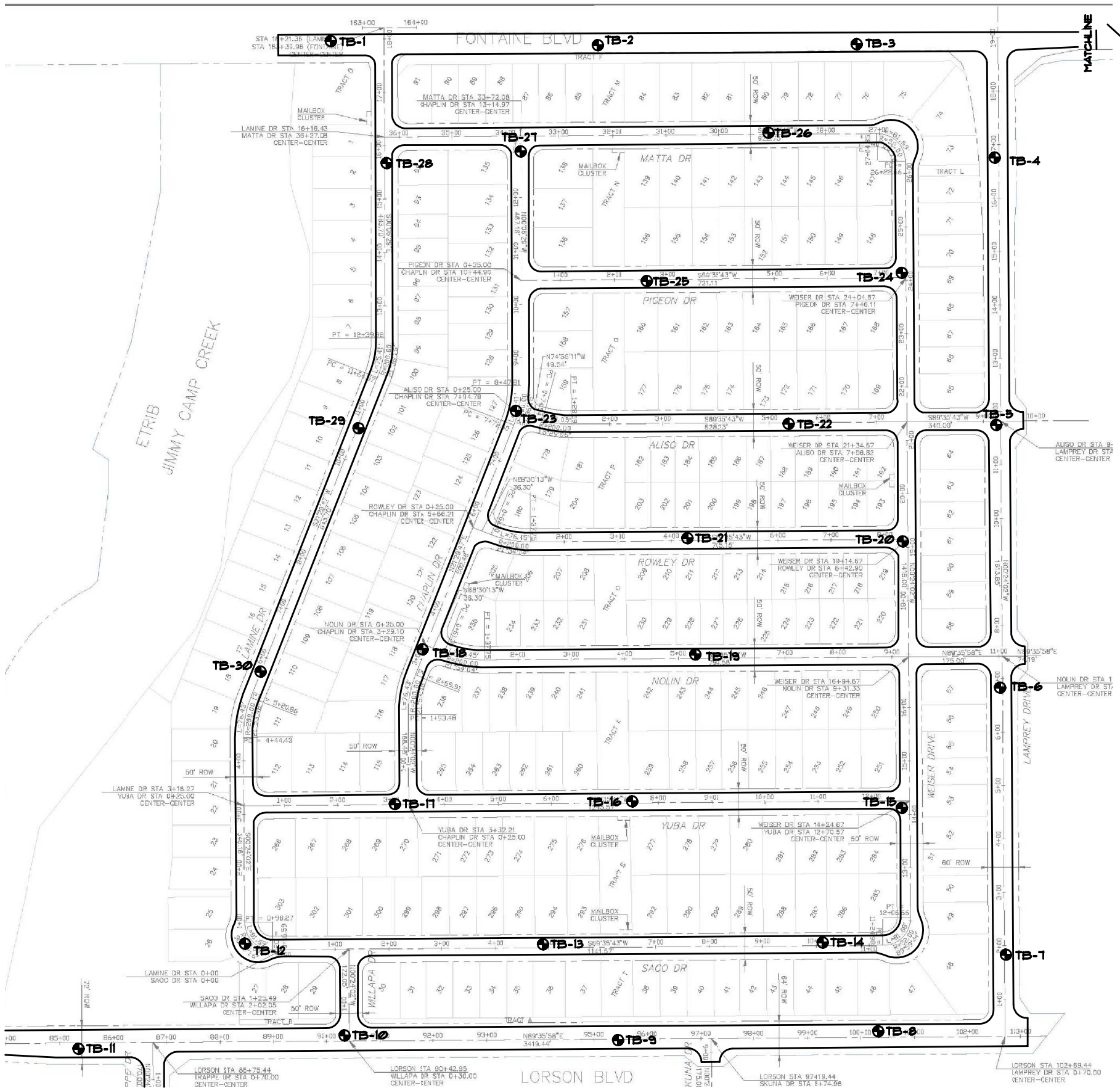
SITE VICINITY MAP

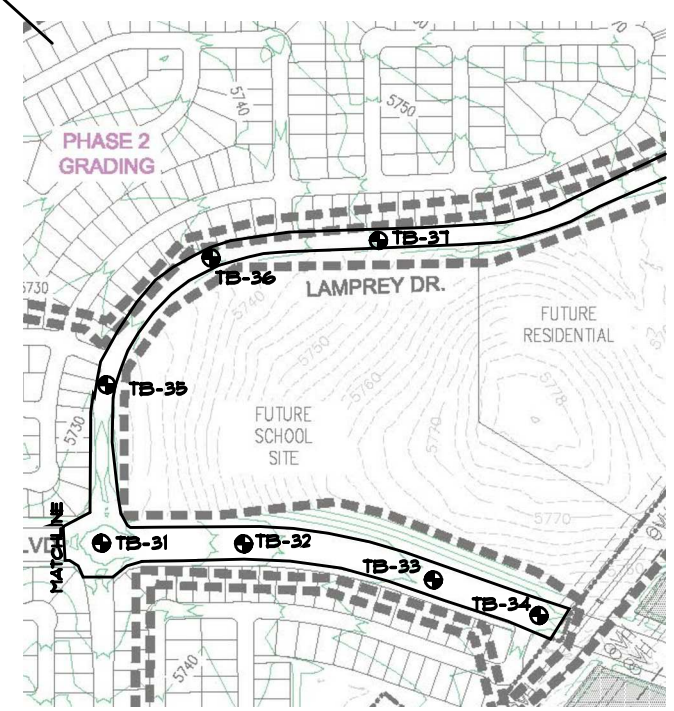
PAVEMENT DESIGN
LORSON RANCH EAST, FILING NO. 1
EL PASO COUNTY, CO
LORSON RANCH METROPOLITAN DISTRICT

JOB No. 162626

FIG No. 1

DATE 8-14-2018





NOT TO SCALE

● DENOTES APPROXIMATE LOCATION OF TEST BORINGS

BASE MAP PROVIDED BY: CORE ENGINEERING GROUP

JOB No. 162626

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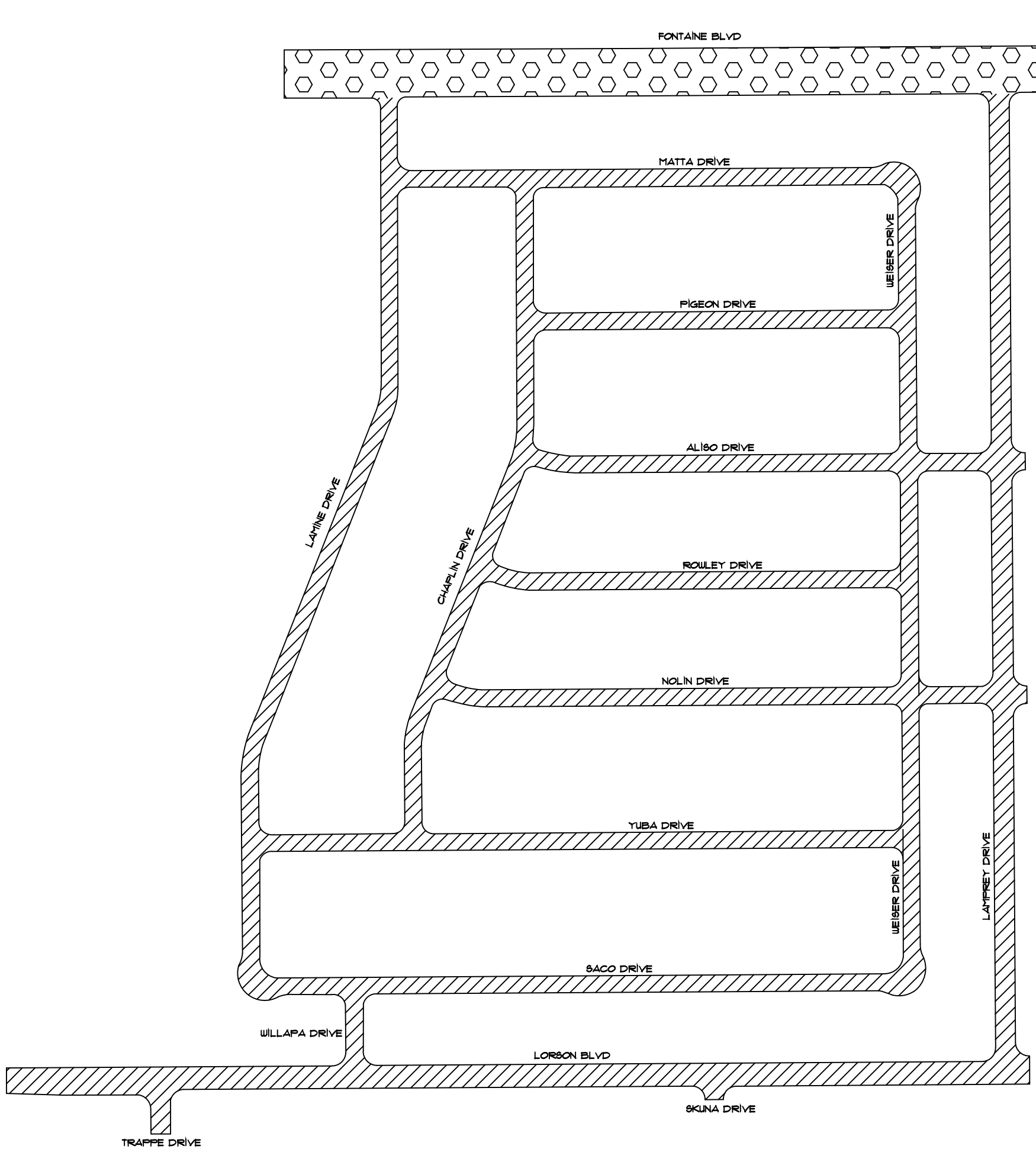
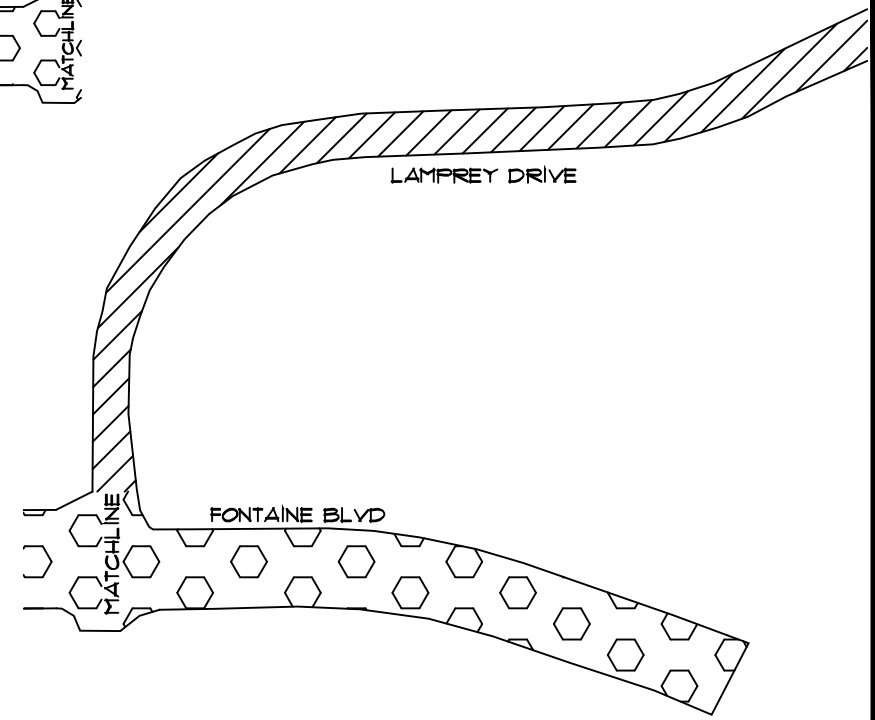
PAVEMENT DESIGN
LORSON RANCH EAST, FILING NO. 1
EL PASO COUNTY, CO
LORSON RANCH METROPOLITAN DISTRICT

ENGINEER:	GW
DRAWN BY:	BG
CHECKED BY:	GW
ISSUED:	8-14-18
REVISION:	DATE: / JOB #:
REVISION:	
REVISION:	

TEST BORING LOCATION PLAN

SHEET No.
FIG-2





6" HMA OVER 15" CTS

4.5" HMA OVER 11" CTS

NOT TO SCALE

JOB No. 162626

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Pueblo / Canon City:
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PAVEMENT DESIGN
LORSON RANCH EAST, FILING NO. 1
EL PASO COUNTY, CO
LORSON RANCH METROPOLITAN DISTRICT

ENGINEER:	GW
DRAWN BY:	BG
CHECKED BY:	GW
ISSUED:	8-14-1
REVISION:	DATE / JOB
REVISION:	
REVISION:	

PAVEMENT DESIGN

SHEET No.
FIG-2.1

SOILS DESCRIPTION


CLAYEY SAND


CLAYSTONE


FILL: SAND, SILTY TO CLAYEY


FILL: CLAY, SANDY


SANDY CLAY

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 (%)

ROCKY MOUNTAIN GROUP

Architectural
Structural
Forensics

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Materials Testing
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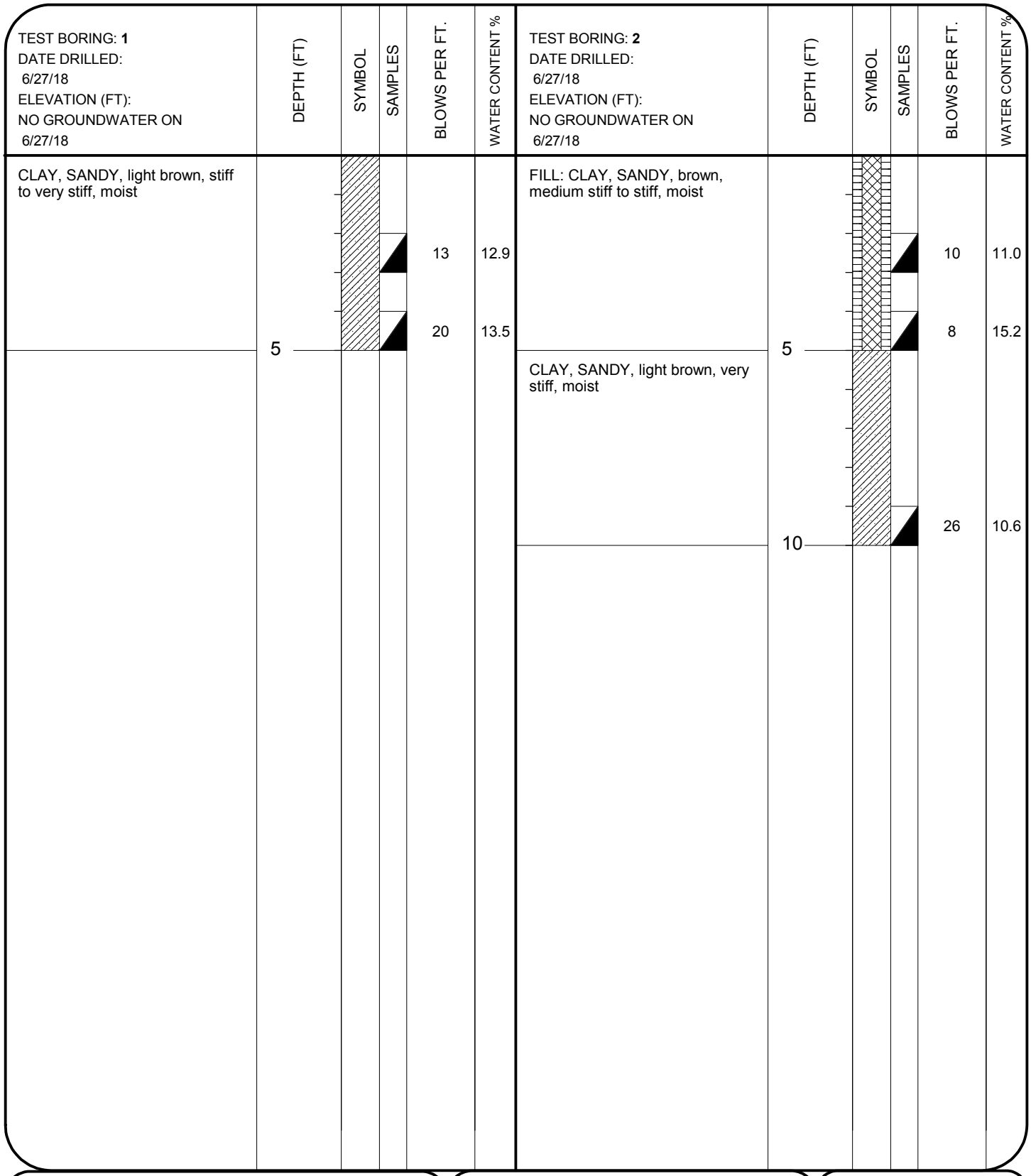
SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

EXPLANATION OF TEST BORING LOGS

JOB No. 162626

FIGURE No. 3

DATE 8/14/18



ROCKY MOUNTAIN GROUP

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SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

TEST BORING LOG

JOB No. 162626

FIGURE No. 4

DATE 8/14/18

TEST BORING: **3** DATE DRILLED: 6/27/18 ELEVATION (FT): NO GROUNDWATER ON 6/27/18	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: CLAY, SANDY, brown, stiff to very stiff, moist				11	13.2
				20	14.6
	5				

TEST BORING: **4** DATE DRILLED: 6/27/18 ELEVATION (FT): NO GROUNDWATER ON 6/27/18	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: CLAY, SANDY, brown, stiff, moist				17	13.3
CLAY, SANDY, brown, hard, moist				50/9"	14.1
	5				

ROCKY MOUNTAIN GROUP

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SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

TEST BORING LOG

JOB No. 162626

FIGURE No. 5

DATE 8/14/18

TEST BORING: **5** DATE DRILLED: 6/27/18 ELEVATION (FT): NO GROUNDWATER ON 6/27/18	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, light brown, very stiff, moist				25	6.2
				25	8.9
	5				

TEST BORING: **6** DATE DRILLED: 6/27/18 ELEVATION (FT): NO GROUNDWATER ON 6/27/18	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, brown, stiff, moist				18	6.2
				15	5.0
	5				

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TEST BORING LOG

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FIGURE No. 6

DATE 8/14/18

TEST BORING: **7** DATE DRILLED: 6/27/18 ELEVATION (FT): NO GROUNDWATER ON 6/27/18	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: CLAY, SANDY, brown, stiff, moist				12	11.3
CLAYSTONE, SANDY, light brown, medium hard, moist	5			40	12.5
	10			38	13.8

TEST BORING: **8** DATE DRILLED: 6/27/18 ELEVATION (FT): NO GROUNDWATER ON 6/27/18	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: CLAY, SANDY, light brown to brown, stiff, moist				11	15.1
CLAY, SANDY, light brown to brown, stiff, moist	5			10	6.7

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TEST BORING LOG

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FIGURE No. 7

DATE 8/14/18

TEST BORING: **9** DATE DRILLED: 6/27/18 ELEVATION (FT): NO GROUNDWATER ON 6/27/18	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: CLAY, SANDY, light brown, soft to medium stiff, moist				5	8.9
				4	11.1
	5				

TEST BORING: **10** DATE DRILLED: 6/27/18 ELEVATION (FT): NO GROUNDWATER ON 6/27/18	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: CLAY, SANDY, brown, stiff, moist				10	12.7
				8	17.3
	5				

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TEST BORING LOG

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FIGURE No. 8

DATE 8/14/18

TEST BORING: **11** DATE DRILLED: 6/27/18 ELEVATION (FT): NO GROUNDWATER ON 6/27/18	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: CLAY, SANDY, brown, stiff, moist					
				10	10.5
				11	14.7
	5				

TEST BORING: **12** DATE DRILLED: 6/27/18 ELEVATION (FT): NO GROUNDWATER ON 6/27/18	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: CLAY, SANDY, brown, stiff, moist					
				16	18.2
				16	10.9
	5				

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TEST BORING LOG

JOB No. 162626

FIGURE No. 9

DATE 8/14/18

TEST BORING: **13** DATE DRILLED: 6/27/18 ELEVATION (FT): NO GROUNDWATER ON 6/27/18	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: CLAY, SANDY, brown, stiff, moist				11	11.6
				16	13.2
	5				

TEST BORING: **14** DATE DRILLED: 6/27/18 ELEVATION (FT): NO GROUNDWATER ON 6/27/18	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: CLAY, SANDY, brown, very stiff, moist				17	12.6
				30	12.8
	5				

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TEST BORING LOG

JOB No. 162626

FIGURE No. 10

DATE 8/14/18

TEST BORING: **15** DATE DRILLED: 6/27/18 ELEVATION (FT): NO GROUNDWATER ON 6/27/18	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: CLAY, SANDY, brown, stiff, moist				12	8.5
CLAY, SANDY, brown, medium stiff, moist	5			9	9.9

TEST BORING: **16** DATE DRILLED: 6/27/18 ELEVATION (FT): NO GROUNDWATER ON 6/27/18	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: CLAY, SANDY, brown, stiff, moist				11	10.3
CLAY, SANDY, brown, very stiff, moist	5			24	8.4

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TEST BORING LOG

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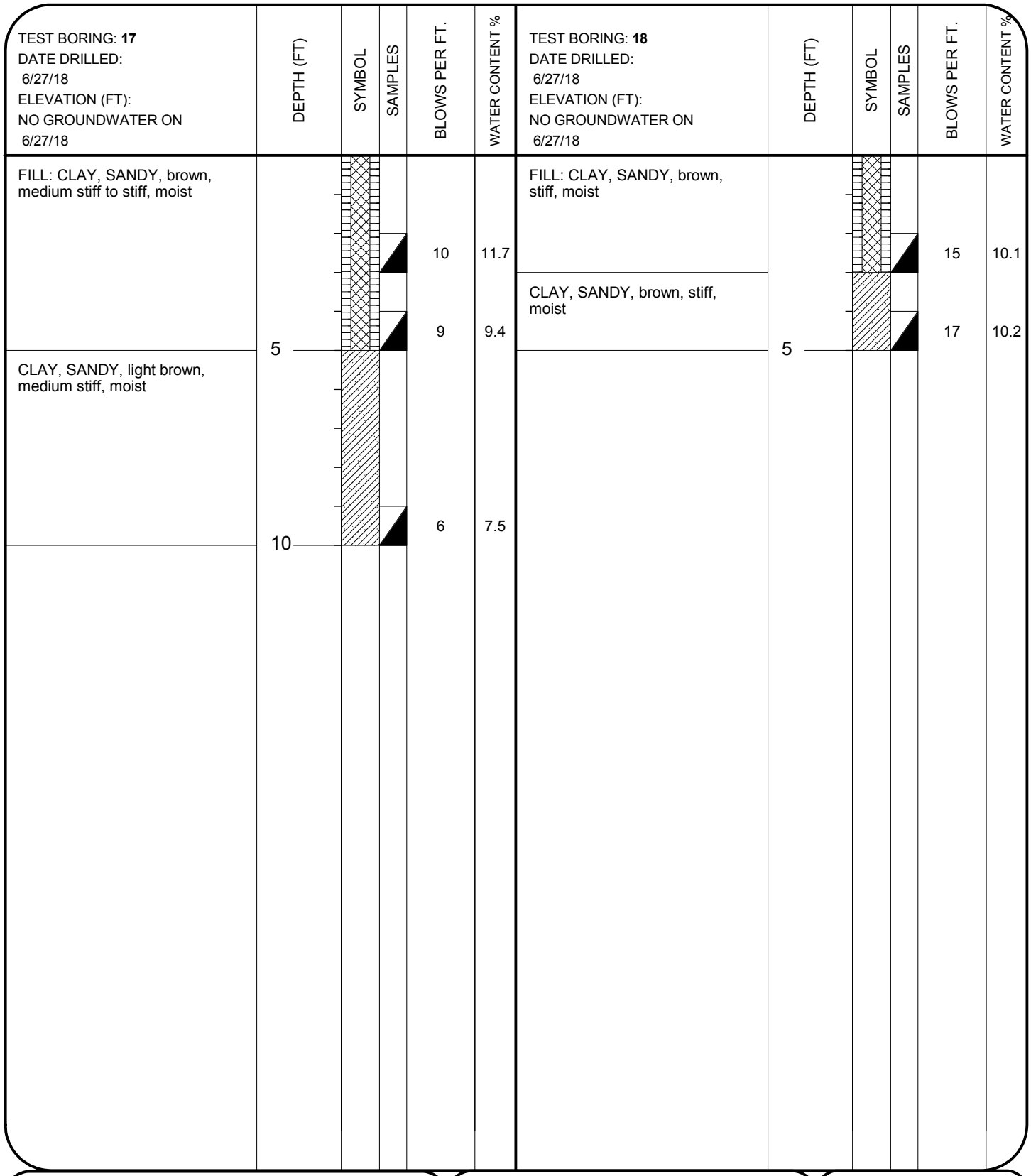
FIGURE No. 11

DATE 8/14/18



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TEST BORING LOG

JOB No. 162626

FIGURE No. 12

DATE 8/14/18

TEST BORING: **19** DATE DRILLED: 6/27/18 ELEVATION (FT): NO GROUNDWATER ON 6/27/18	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, brown, medium stiff, moist					
				8	9.3
				9	8.7
	5				

TEST BORING: **20** DATE DRILLED: 6/27/18 ELEVATION (FT): NO GROUNDWATER ON 6/27/18	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, brown, stiff, moist					
				12	7.9
				12	7.4
	5				

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TEST BORING LOG

JOB No. 162626

FIGURE No. 13

DATE 8/14/18

TEST BORING: **21** DATE DRILLED: 6/27/18 ELEVATION (FT): NO GROUNDWATER ON 6/27/18	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: CLAY, SANDY, brown, stiff, moist				13	8.5
CLAY, SANDY, brown, stiff to very stiff, moist	5			14	8.8
				28	5.1

TEST BORING: **22** DATE DRILLED: 6/27/18 ELEVATION (FT): NO GROUNDWATER ON 6/27/18	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: CLAY, SANDY, brown, stiff, moist				18	11.8
CLAY, SANDY, light brown, stiff, moist	5			18	9.2

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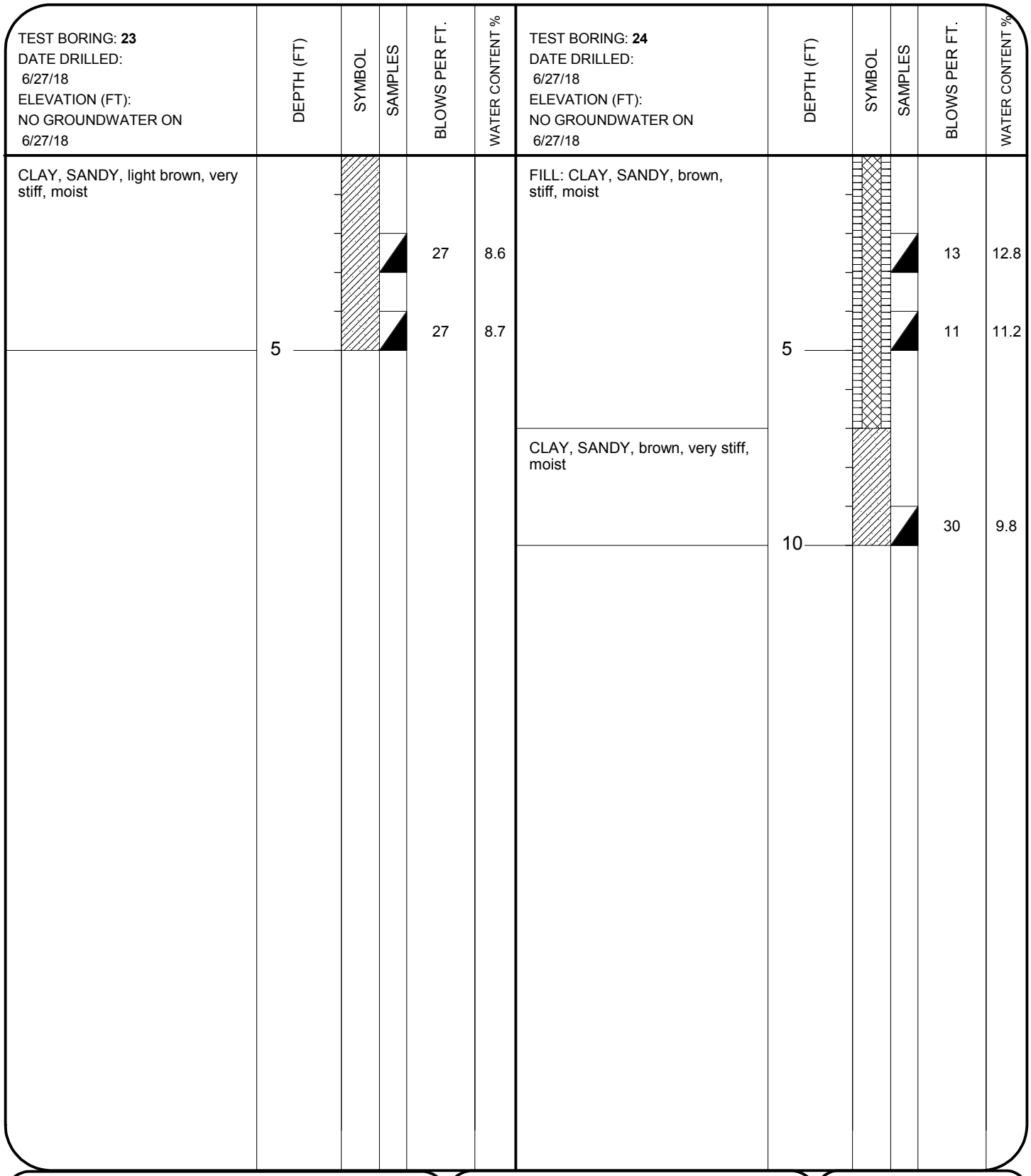
TEST BORING LOG

JOB No. 162626

FIGURE No. 14

DATE 8/14/18



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TEST BORING LOG

JOB No. 162626

FIGURE No. 15

DATE 8/14/18

TEST BORING: **25** DATE DRILLED: 6/27/18 ELEVATION (FT): NO GROUNDWATER ON 6/27/18	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: CLAY, SANDY, brown, stiff, moist				11	7.9
				12	7.3
	5				

TEST BORING: **26** DATE DRILLED: 6/27/18 ELEVATION (FT): NO GROUNDWATER ON 6/27/18	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: CLAY, SANDY, brown, stiff to very stiff, moist				19	15.9
				17	14.2
	5				

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TEST BORING LOG

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FIGURE No. 16

DATE 8/14/18

TEST BORING: **27** DATE DRILLED: 6/27/18 ELEVATION (FT): NO GROUNDWATER ON 6/27/18	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: CLAY, SANDY, light brown, moist					
CLAY, SANDY, light brown, very stiff, moist				21	7.7
				43	7.7
	5				

TEST BORING: **28** DATE DRILLED: 6/27/18 ELEVATION (FT): NO GROUNDWATER ON 6/27/18	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: CLAY, SANDY, light brown, moist					
CLAY, SANDY, light brown, medium stiff to stiff, moist				6	9.3
				15	8.9
	5				

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TEST BORING LOG

JOB No. 162626

FIGURE No. 17

DATE 8/14/18

TEST BORING: **29** DATE DRILLED: 6/27/18 ELEVATION (FT): NO GROUNDWATER ON 6/27/18	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: CLAY, SANDY, brown, stiff, moist				11	13.5
SAND, CLAYEY, light brown, loose, moist	5			8	5.0
	10			13	3.6

TEST BORING: **30** DATE DRILLED: 6/27/18 ELEVATION (FT): NO GROUNDWATER ON 6/27/18	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, brown, stiff to very stiff, moist				22	8.5
	5			16	8.8

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TEST BORING LOG

JOB No. 162626

FIGURE No. 18

DATE 8/14/18

TEST BORING: **31** DATE DRILLED: 8/6/18 ELEVATION (FT): NO GROUNDWATER ON 8/6/18	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, brown, stiff, moist					
				16	4.2
				7	10.2
	5				

TEST BORING: **32** DATE DRILLED: 8/6/18 ELEVATION (FT): NO GROUNDWATER ON 8/6/18	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, light brown, very stiff, moist					
				20	3.5
				23	9.3
	5				
				28	7.9

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TEST BORING LOG

JOB No. 162626

FIGURE No. 19

DATE 8/14/18

TEST BORING: **33** DATE DRILLED: 8/6/18 ELEVATION (FT): NO GROUNDWATER ON 8/6/18	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAYSTONE, SANDY, light brown to dark brown, firm to medium hard, moist				42	3.8
				50/7"	10.1
	5				

TEST BORING: **34** DATE DRILLED: 8/6/18 ELEVATION (FT): NO GROUNDWATER ON 8/6/18	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, light brown to dark brown, stiff to medium dense, moist				11	3.9
				7	9.3
	5				

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TEST BORING LOG

JOB No. 162626

FIGURE No. 20

DATE 8/14/18

TEST BORING: **35** DATE DRILLED: 8/6/18 ELEVATION (FT): NO GROUNDWATER ON 8/6/18	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, brown to dark brown, stiff, moist					
				13	7.3
				17	14.2
	5				

TEST BORING: **36** DATE DRILLED: 8/6/18 ELEVATION (FT): NO GROUNDWATER ON 8/6/18	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, brown, stiff to very stiff, moist					
				12	4.2
				19	7.3
	5				

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TEST BORING LOG

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FIGURE No. 21

DATE 8/14/18

TEST BORING: **37**
DATE DRILLED:
8/6/18
ELEVATION (FT):
NO GROUNDWATER ON
8/6/18

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, light brown to tan, medium stiff to very stiff, moist				
			9	2.6
5			17	10.1
			27	--

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TEST BORING LOG

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FIGURE No. 22

DATE 8/14/18

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 @ 150 psf	AASHTO Classification
1	2.0	12.9	95.8	34	18	1.0	2.3	60.2	- 0.4	A-6 (8)
1	4.0	13.5								
2	2.0	11.0		44	25	0.8	2.1	73.2		A-7-6 (17)
2	4.0	15.2								
2	9.0	10.6								
3	2.0	13.2		44	23	0.2	1.2	80.6		A-7-6 (19)
3	4.0	14.6								
4	2.0	13.3	94.1	47	26		0.6	79.9	1.7	A-7-6 (21)
4	4.0	14.1								
5	2.0	6.2		35	18	0.2	1.6	59.9		A-6 (8)
5	4.0	8.9								
6	2.0	6.2		39	17	0.2	1.0	74.0		A-6 (12)
6	4.0	5.0								
7	2.0	11.3	106.7	43	25	0.7	3.1	80.5	2.1	A-7-6 (19)
7	4.0	12.5								
7	9.0	13.8								
8	2.0	15.1		42	24	1.9	3.3	79.6		A-7-6 (19)
8	4.0	6.7								
9	2.0	8.9		38	22	0.5	1.3	71.7		A-6 (14)
9	4.0	11.1								
10	2.0	12.7		51	32	1.3	3.4	79.3		A-7-6 (25)
10	4.0	17.3								
11	2.0	10.5		49	31	0.4	1.0	82.8		A-7-6 (26)
11	4.0	14.7								
12	2.0	18.2	82.2	44	28	0.7	1.6	74.3	2.1	A-7-6 (19)
12	4.0	10.9								
13	2.0	11.6		38	22	0.3	1.2	70.7		A-6 (14)
13	4.0	13.2								
14	2.0	12.6		43	26	0.4	1.7	74.7		A-7-6 (18)
14	4.0	12.8								
15	2.0	8.5		34	17		0.8	61.4		A-6 (8)
15	4.0	9.9								
16	2.0	10.3	105.4	35	18	0.0	1.5	64.7	1.3	A-6 (9)
16	4.0	8.4								
17	2.0	11.7		35	17		1.2	61.5		A-6 (8)
17	4.0	9.4								
17	9.0	7.5								

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SUMMARY OF LABORATORY TEST RESULTS

JOB No. 162626
FIGURE No. 23

DATE 8/14/18

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 @ 150 psf	AASHTO Classification
18	2.0	10.1		35	20	0.0	1.3	61.4		A-6 (9)
18	4.0	10.2								
19	2.0	9.3		37	21	0.9	3.8	66.7		A-6 (12)
19	4.0	8.7								
20	2.0	7.9		37	24	0.3	7.9	70.2		A-6 (14)
20	4.0	7.4								
21	2.0	8.5		33	21		2.7	54.6		A-6 (8)
21	4.0	8.8								
21	9.0	5.1								
22	2.0	11.8	115.3	29	13		0.2	75.7	0.9	A-6 (8)
22	4.0	9.2								
23	2.0	8.6		35	19	0.3	2.1	67.7		A-6 (11)
23	4.0	8.7								
24	2.0	12.8		37	20	0.5	1.4	66.8		A-6 (11)
24	4.0	11.2								
24	9.0	9.8								
25	2.0	7.9	118.1	35	20	0.8	2.0	64.8	0.9	A-6 (10)
25	4.0	7.3								
26	2.0	15.9		45	28	1.0	2.1	82.1		A-7-6 (23)
26	4.0	14.2								
27	2.0	7.7		34	19	0.1	1.2	67.9		A-6 (10)
27	4.0	7.7								
28	2.0	9.3		40	23	0.8	1.5	66.6		A-6 (13)
28	4.0	8.9								
29	2.0	13.5	107.0	35	21	0.0	1.3	63.8	1.7	A-6 (10)
29	4.0	5.0								
29	9.0	3.6								
30	2.0	8.5		37	21	0.2	1.3	64.7		A-6 (11)
30	4.0	8.8								
31	2.0	4.2	123.8	39	23	2.5	3.4	85.0	0.9	A-6 (19)
31	4.0	10.2								
32	2.0	3.5		40	22	3.9	4.9	81.0		A-6 (17)
32	4.0	9.3								
32	9.0	7.9								
33	2.0	3.8		39	22	3.6	4.5	81.2		A-6 (17)
33	4.0	10.1								
34	2.0	3.9		39	22	0.2	0.9	78.8		A-6 (16)

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SUMMARY OF LABORATORY TEST RESULTS

JOB No. 162626
FIGURE No. 23

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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 @ 150 psf	AASHTO Classification
34	4.0	9.3								
35	2.0	7.3	120.2	47	27	0.3	1.2	77.2	1.2	A-7-6 (20)
35	4.0	14.2								
36	2.0	4.2		39	23	1.3	1.7	82.9		A-6 (18)
36	4.0	7.3								
37	2.0	2.6		41	21	0.4	0.8	83.8		A-7-6 (18)
37	4.0	10.1								
A-6 Proctor	0.0			35	20	0.0	1.4	63.4		A-6 (10)
A-7-6 Proctor	0.0			42	24	4.3	6.1	72.8		A-7-6 (16)

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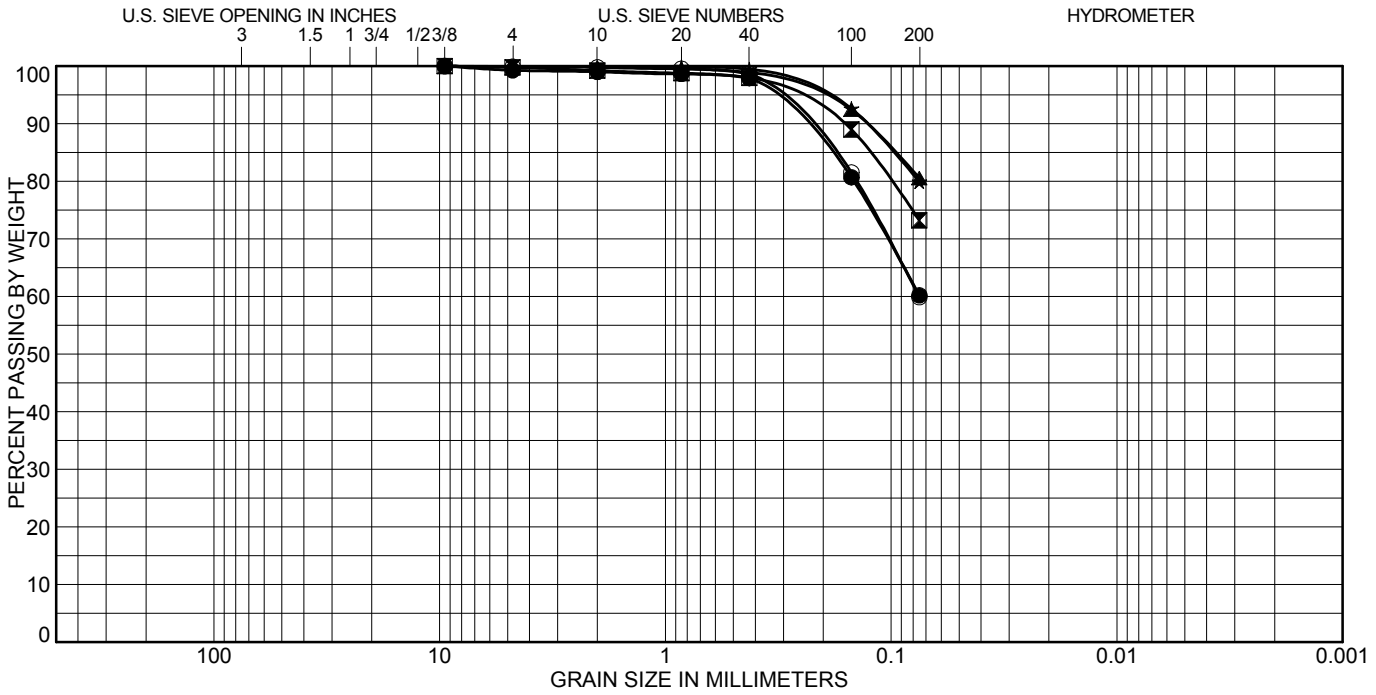
SUMMARY OF LABORATORY TEST RESULTS

JOB No. 162626
FIGURE No. 23
PAGE 3 OF 3
DATE 8/14/18



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Test Boring		Depth (ft)	Classification	LL	PL	PI
●	1	2.0	SANDY LEAN CLAY(CL)	34	16	18
⧓	2	2.0	LEAN CLAY with SAND(CL)	44	19	25
▲	3	2.0	LEAN CLAY with SAND(CL)	44	21	23
★	4	2.0	LEAN CLAY with SAND(CL)	47	21	26
⊙	5	2.0	SANDY LEAN CLAY(CL)	35	17	18

Test Boring		Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	1	2.0	0.7	39.1	60.2	
⧓	2	2.0	0.2	26.5	73.2	
▲	3	2.0		19.3	80.6	
★	4	2.0		20.0	79.9	
⊙	5	2.0	0.1	40.0	59.9	

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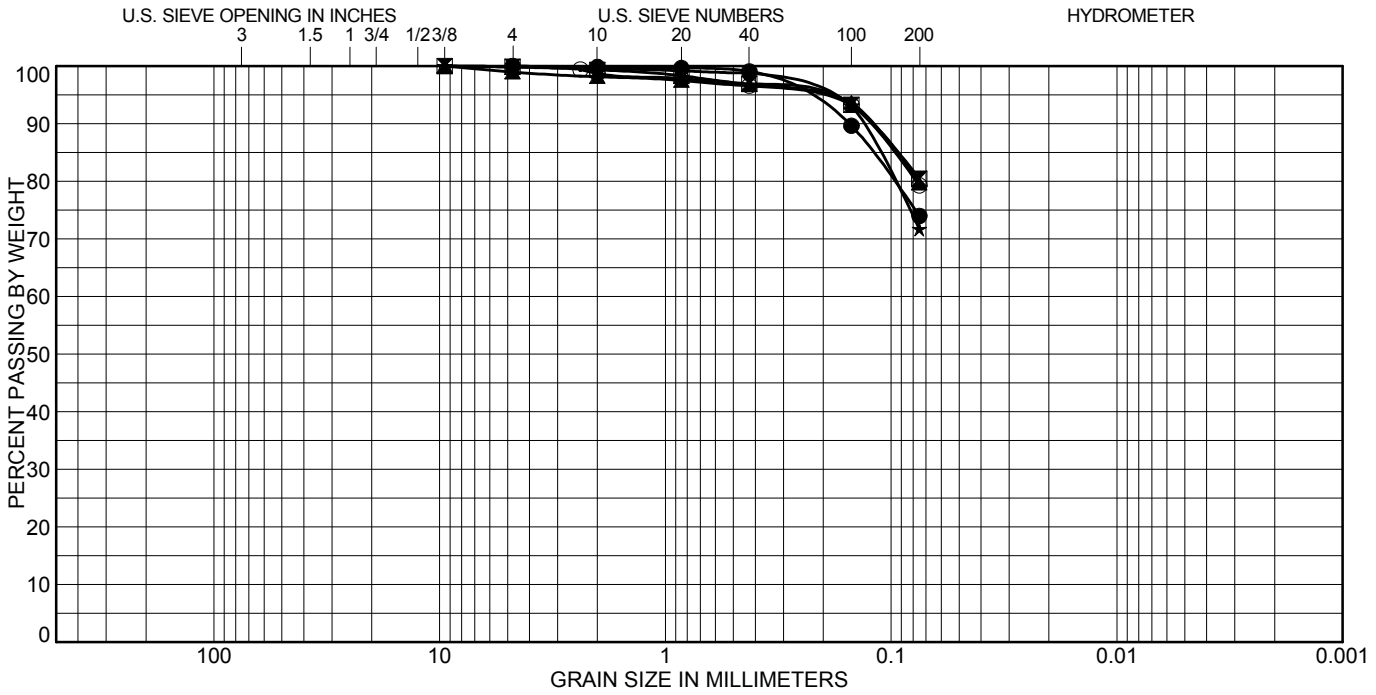
SOIL CLASSIFICATION DATA

JOB No. 162626

FIGURE No. 24

DATE 8/14/18



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Test Boring		Depth (ft)	Classification	LL	PL	PI
●	6	2.0	**LEAN CLAY with SAND(CL)**	39	22	17
⧓	7	2.0	**LEAN CLAY with SAND(CL)**	43	18	25
▲	8	2.0	**LEAN CLAY with SAND(CL)**	42	18	24
★	9	2.0	**LEAN CLAY with SAND(CL)**	38	16	22
⊙	10	2.0	**FAT CLAY with SAND(CH)**	51	19	32

Test Boring		Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	6	2.0	0.0	26.0	74.0	
⧓	7	2.0	0.1	19.4	80.5	
▲	8	2.0	1.0	19.3	79.6	
★	9	2.0	0.2	28.1	71.7	
⊙	10	2.0		20.1	79.3	

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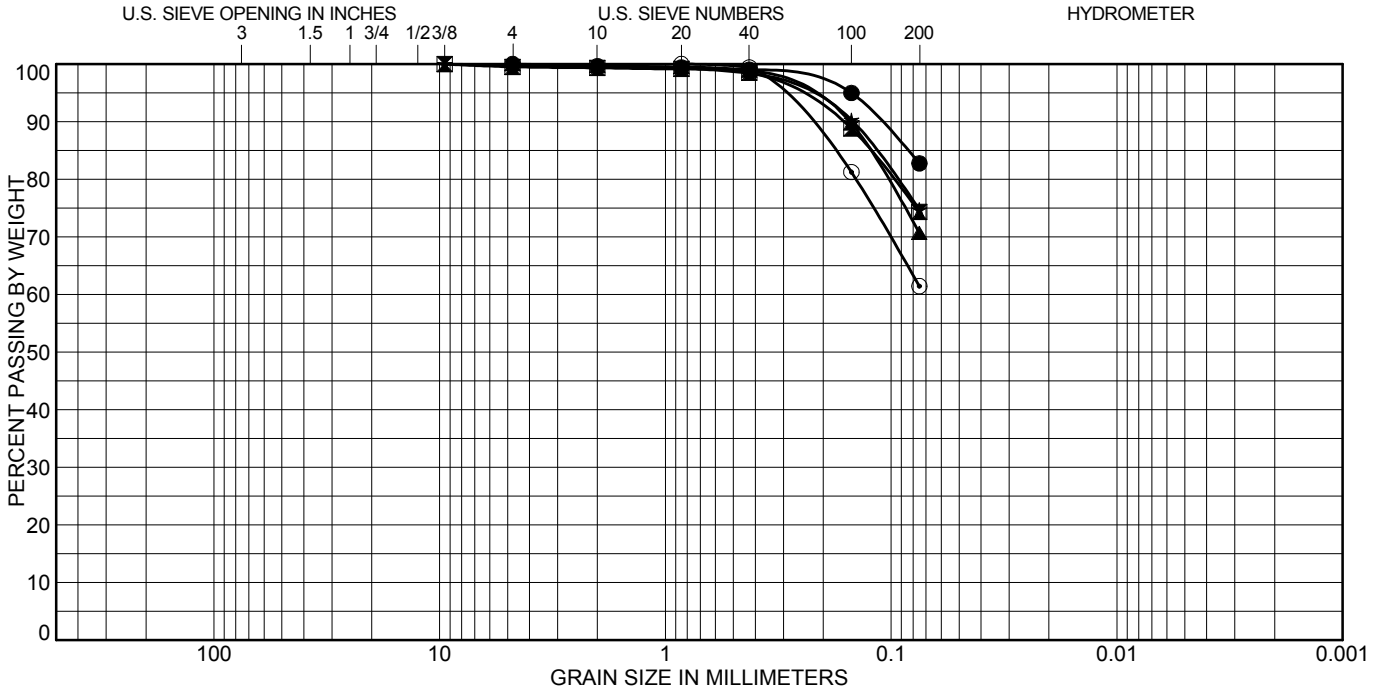
SOIL CLASSIFICATION DATA

JOB No. 162626

FIGURE No. 25

DATE 8/14/18



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Test Boring		Depth (ft)	Classification	LL	PL	PI
●	11	2.0	**LEAN CLAY with SAND(CL)**	49	18	31
⧓	12	2.0	**LEAN CLAY with SAND(CL)**	44	16	28
▲	13	2.0	**LEAN CLAY with SAND(CL)**	38	16	22
★	14	2.0	**LEAN CLAY with SAND(CL)**	43	17	26
⊙	15	2.0	**SANDY LEAN CLAY(CL)**	34	17	17

Test Boring		Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	11	2.0	0.0	17.2	82.8	
⧓	12	2.0	0.5	25.2	74.3	
▲	13	2.0	0.0	29.3	70.7	
★	14	2.0	0.2	25.0	74.7	
⊙	15	2.0	0.0	38.6	61.4	

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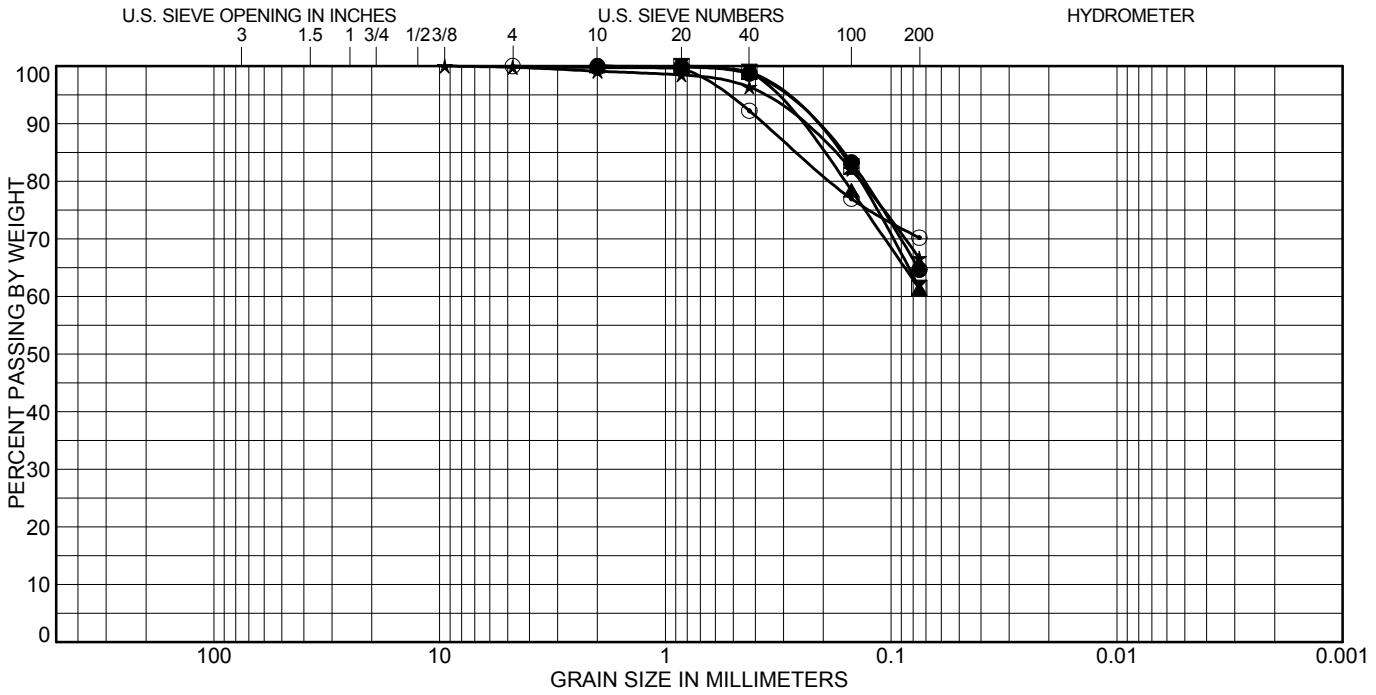
SOIL CLASSIFICATION DATA

JOB No. 162626

FIGURE No. 26

DATE 8/14/18



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Test Boring		Depth (ft)	Classification	LL	PL	PI
●	16	2.0	SANDY LEAN CLAY(CL)	35	17	18
⧓	17	2.0	SANDY LEAN CLAY(CL)	35	18	17
▲	18	2.0	SANDY LEAN CLAY(CL)	35	15	20
★	19	2.0	SANDY LEAN CLAY(CL)	37	16	21
⊙	20	2.0	LEAN CLAY with SAND(CL)	37	13	24

Test Boring		Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	16	2.0	0.0	35.3	64.7	
⧓	17	2.0	0.0	38.5	61.5	
▲	18	2.0	0.0	38.6	61.4	
★	19	2.0	0.2	33.1	66.7	
⊙	20	2.0	0.0	29.8	70.2	

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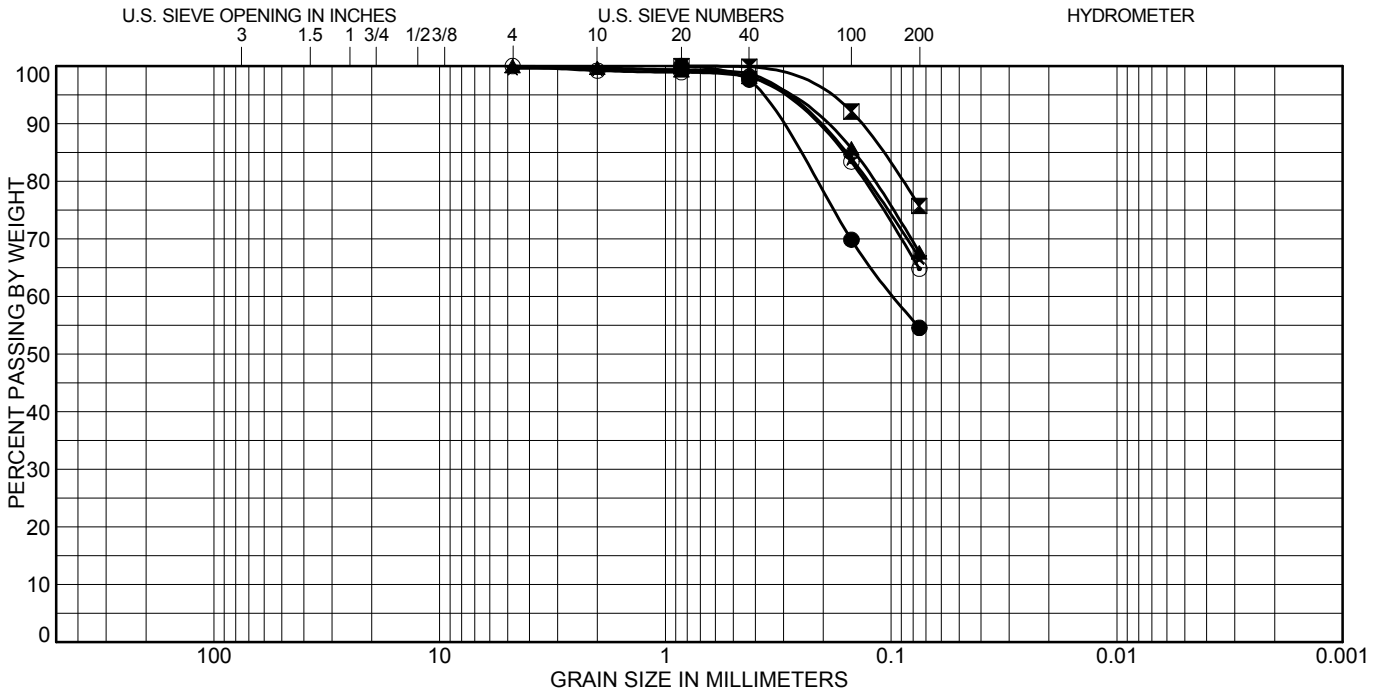
SOIL CLASSIFICATION DATA

JOB No. 162626

FIGURE No. 27

DATE 8/14/18



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Test Boring		Depth (ft)	Classification	LL	PL	PI
●	21	2.0	SANDY LEAN CLAY(CL)	33	12	21
⧓	22	2.0	LEAN CLAY with SAND(CL)	29	16	13
▲	23	2.0	SANDY LEAN CLAY(CL)	35	16	19
★	24	2.0	SANDY LEAN CLAY(CL)	37	17	20
⊙	25	2.0	SANDY LEAN CLAY(CL)	35	15	20

Test Boring		Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	21	2.0	0.0	45.4	54.6	
⧓	22	2.0	0.0	24.3	75.7	
▲	23	2.0	0.0	32.3	67.7	
★	24	2.0		32.9	66.8	
⊙	25	2.0	0.0	35.2	64.8	

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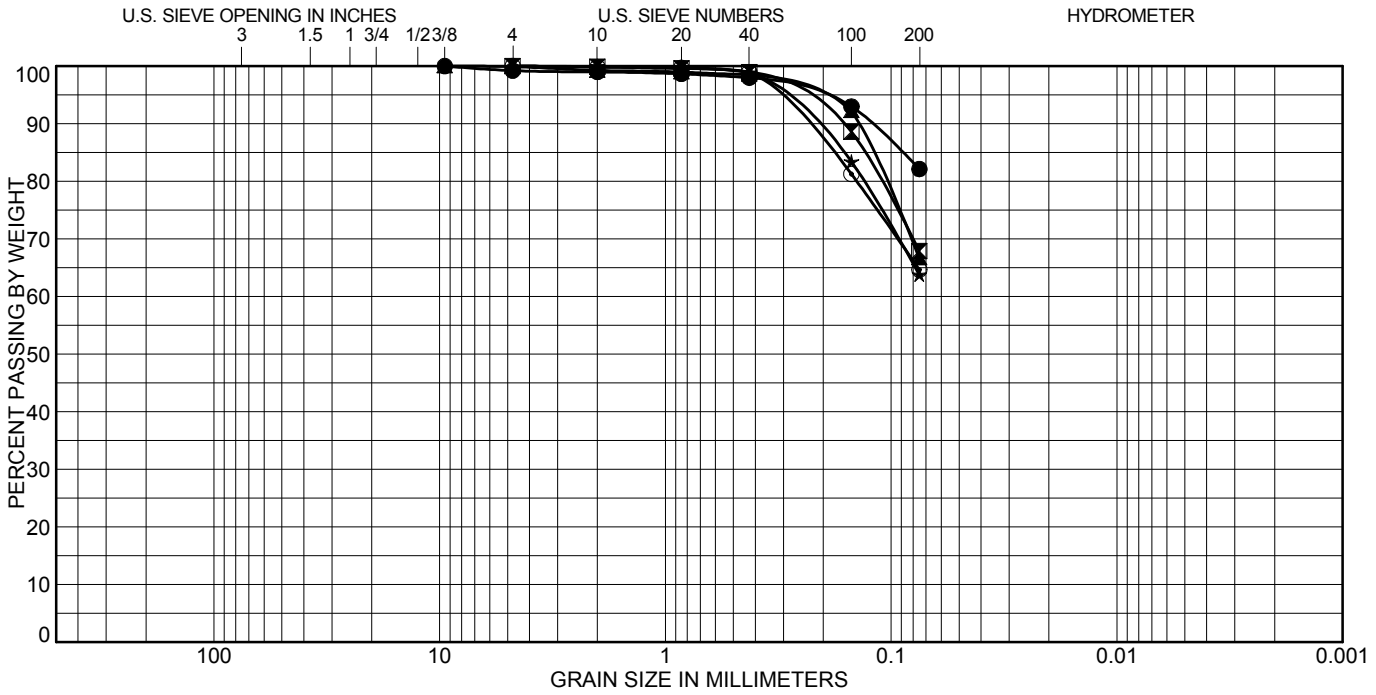
SOIL CLASSIFICATION DATA

JOB No. 162626

FIGURE No. 28

DATE 8/14/18



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Test Boring		Depth (ft)	Classification	LL	PL	PI
●	26	2.0	LEAN CLAY with SAND(CL)	45	17	28
⧓	27	2.0	SANDY LEAN CLAY(CL)	34	15	19
▲	28	2.0	SANDY LEAN CLAY(CL)	40	17	23
★	29	2.0	SANDY LEAN CLAY(CL)	35	14	21
⊙	30	2.0	SANDY LEAN CLAY(CL)	37	16	21

Test Boring		Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	26	2.0	0.8	17.1	82.1	
⧓	27	2.0	0.0	32.1	67.9	
▲	28	2.0	0.1	33.3	66.6	
★	29	2.0	0.0	36.2	63.8	
⊙	30	2.0	0.0	35.3	64.7	

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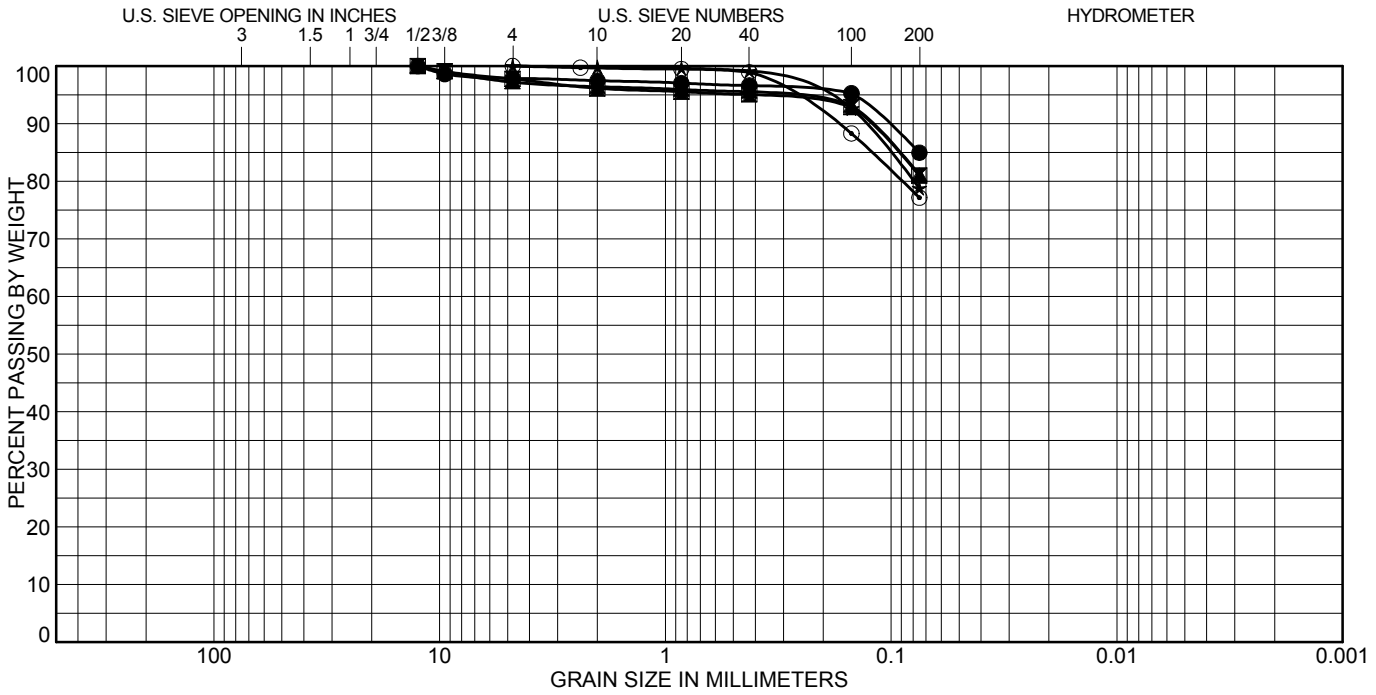
SOIL CLASSIFICATION DATA

JOB No. 162626

FIGURE No. 29

DATE 8/14/18



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Test Boring		Depth (ft)	Classification	LL	PL	PI
●	31	2.0	LEAN CLAY with SAND(CL)	39	16	23
⧓	32	2.0	LEAN CLAY with SAND(CL)	40	18	22
▲	33	2.0	LEAN CLAY with SAND(CL)	39	17	22
★	34	2.0	LEAN CLAY with SAND(CL)	39	17	22
⊙	35	2.0	LEAN CLAY with SAND(CL)	47	20	27

Test Boring		Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	31	2.0	2.1	12.9	85.0	
⧓	32	2.0	2.2	16.8	81.0	
▲	33	2.0	2.8	16.1	81.2	
★	34	2.0	0.0	21.2	78.8	
⊙	35	2.0	0.0	22.8	77.2	

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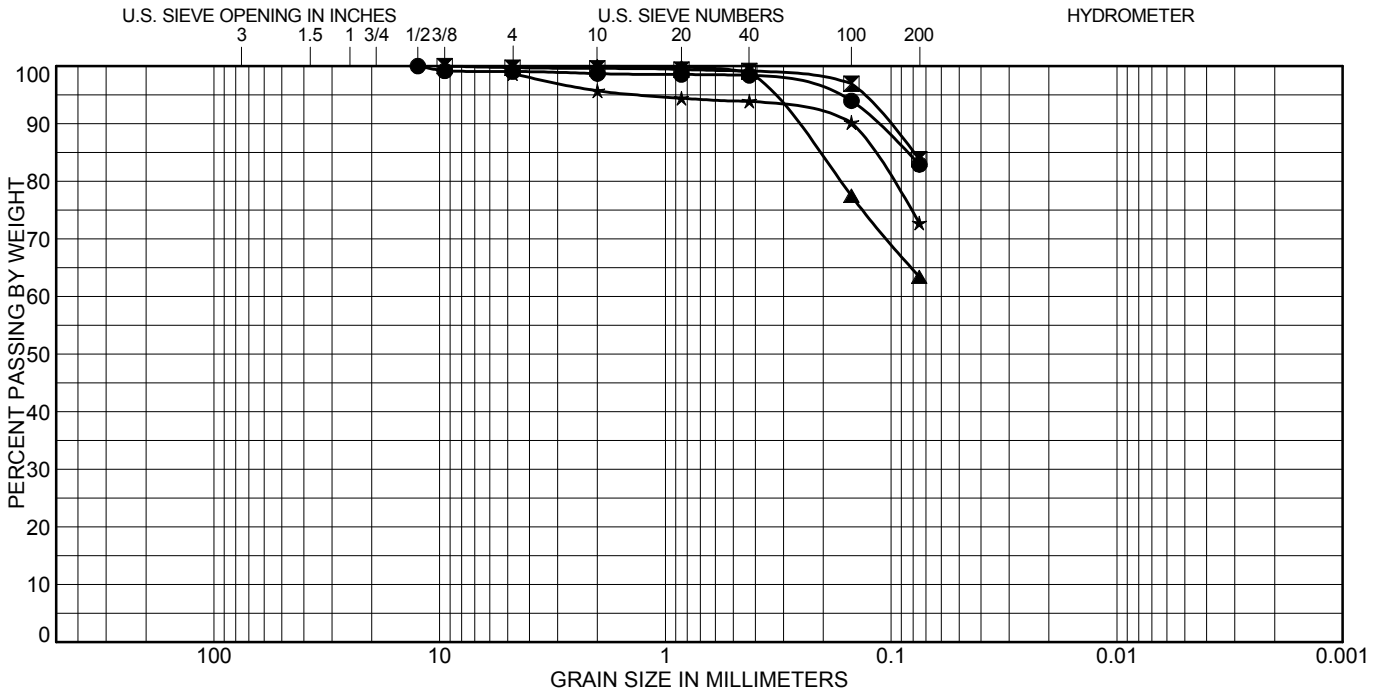
SOIL CLASSIFICATION DATA

JOB No. 162626

FIGURE No. 30

DATE 8/14/18



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Test Boring		Depth (ft)	Classification	LL	PL	PI
●	**36**	**2.0**	**LEAN CLAY with SAND(CL)**	**39**	**16**	**23**
⧓	**37**	**2.0**	**LEAN CLAY with SAND(CL)**	**41**	**20**	**21**
▲	**A-6 Proctor**	**0.0**	**SANDY LEAN CLAY(CL)**	**35**	**15**	**20**
★	**A-7-6 Proctor**	**0.0**	**LEAN CLAY with SAND(CL)**	**42**	**18**	**24**

Test Boring		Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	**36**	**2.0**	**1.0**	**16.1**	**82.9**	
⧓	**37**	**2.0**	**0.3**	**15.9**	**83.8**	
▲	**A-6 Proctor**	**0.0**	**0.0**	**36.6**	**63.4**	
★	**A-7-6 Proctor**	**0.0**		**25.9**	**72.8**	

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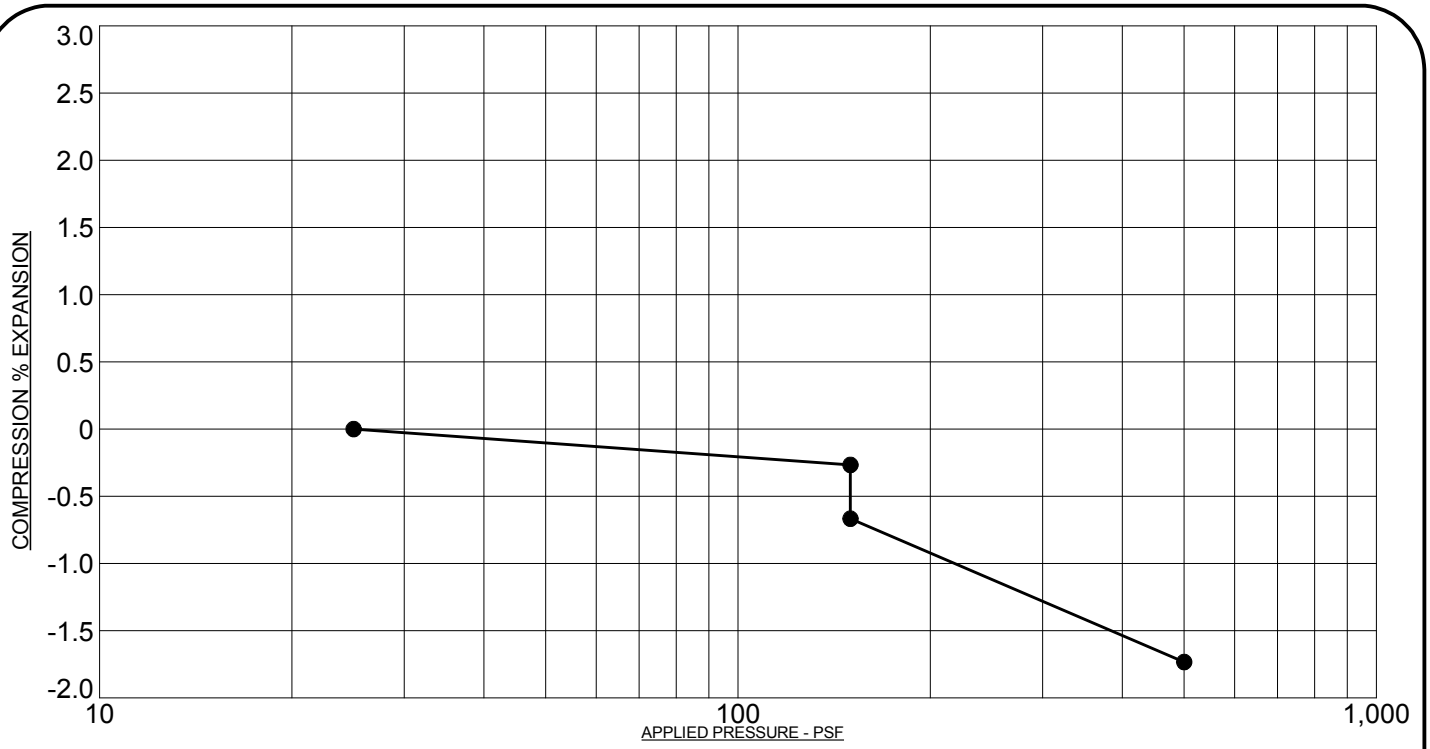
SOIL CLASSIFICATION DATA

JOB No. 162626

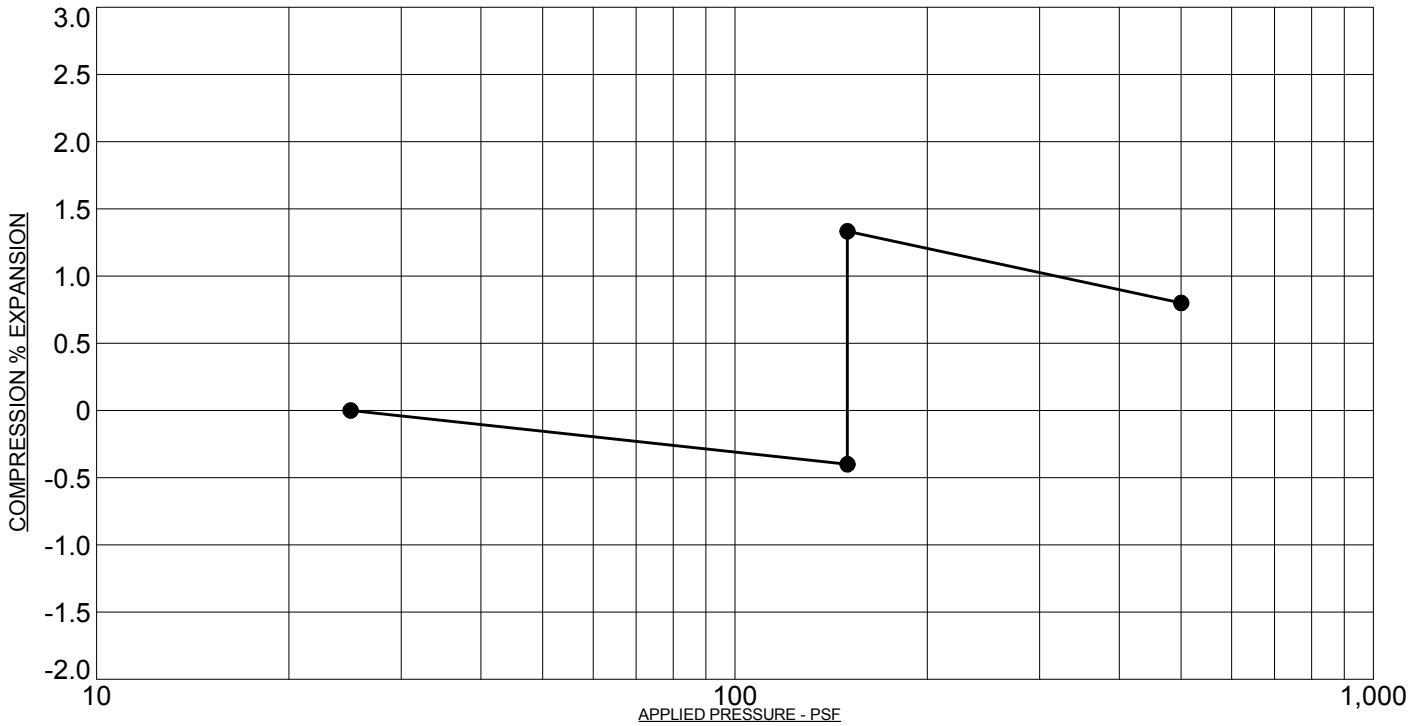
FIGURE No. 31

DATE 8/14/18



PROJECT: **Lorson Ranch East, Filing No. 1, El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 150 PSF

SAMPLE LOCATION: **1 @ 2 FT**
NATURAL DRY UNIT WEIGHT: **95.8 PCF**
NATURAL MOISTURE CONTENT: **12.9%**
PERCENT SWELL/COMPRESSION: **- 0.4**



PROJECT: **Lorson Ranch East, Filing No. 1, El Paso County, Colorado**
SAMPLE DESCRIPTION: **FILL: CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 150 PSF

SAMPLE LOCATION: **4 @ 2 FT**
NATURAL DRY UNIT WEIGHT: **94.1 PCF**
NATURAL MOISTURE CONTENT: **13.3%**
PERCENT SWELL/COMPRESSION: **1.7**

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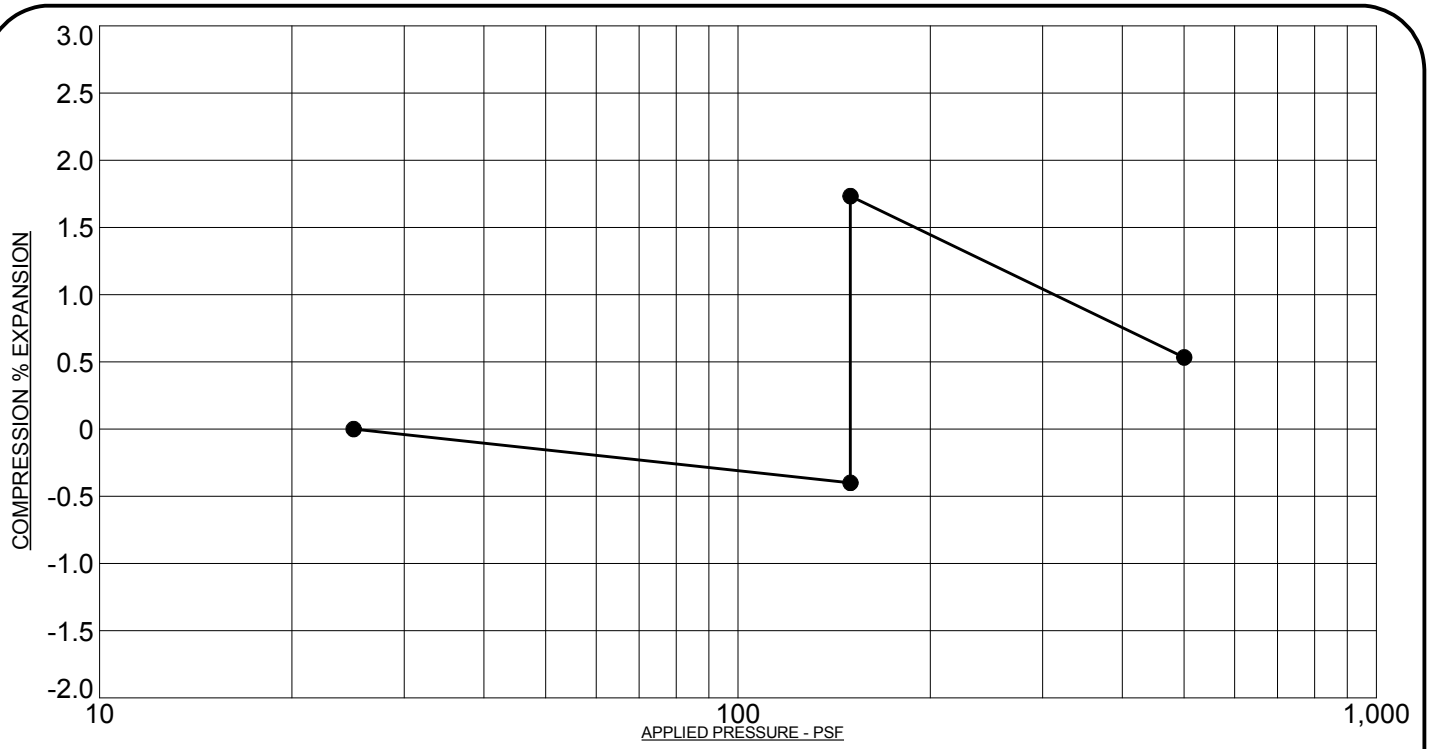
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 162626

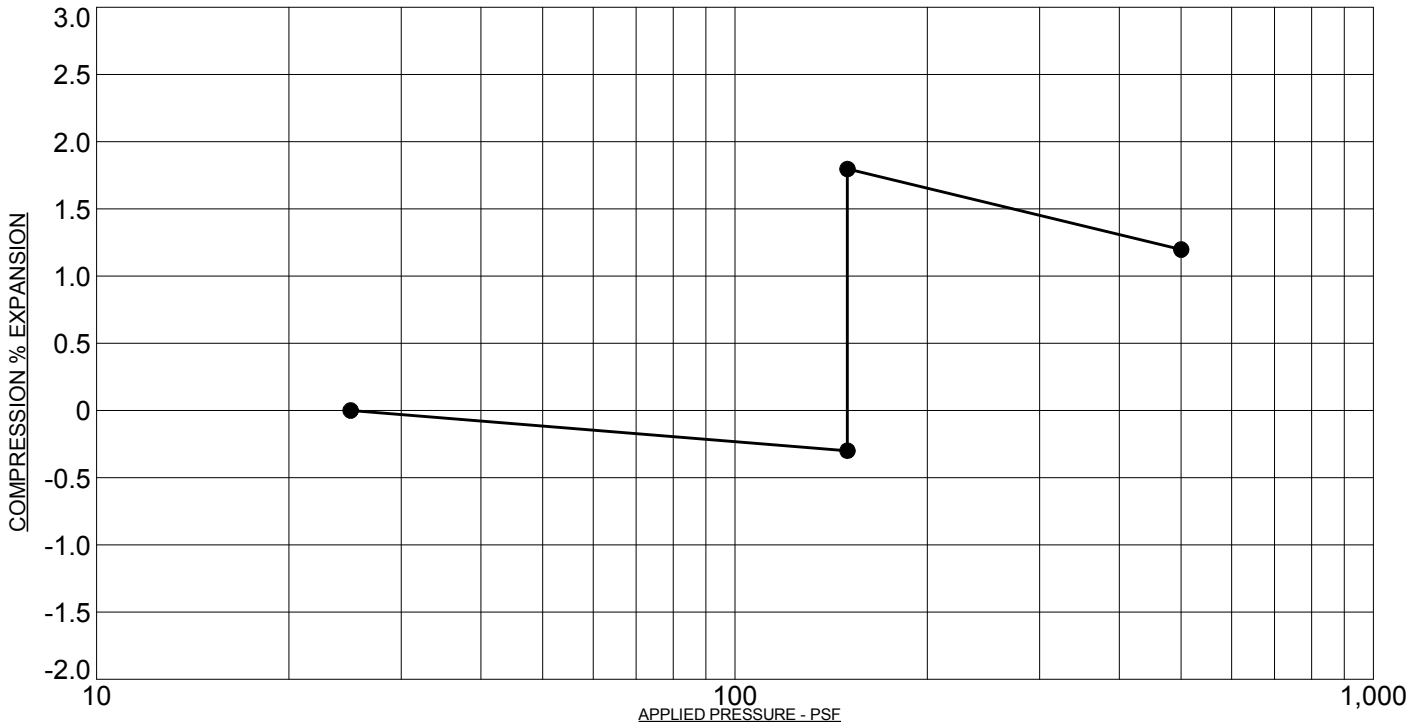
FIGURE No. 32

DATE 8/14/18



PROJECT: **Lorson Ranch East, Filing No. 1, El Paso County, Colorado**
SAMPLE DESCRIPTION: **FILL: CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 150 PSF

SAMPLE LOCATION: **7 @ 2 FT**
NATURAL DRY UNIT WEIGHT: **106.7 PCF**
NATURAL MOISTURE CONTENT: **11.3%**
PERCENT SWELL/COMPRESSION: **2.1**



PROJECT: **Lorson Ranch East, Filing No. 1, El Paso County, Colorado**
SAMPLE DESCRIPTION: **FILL: CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 150 PSF

SAMPLE LOCATION: **12 @ 2 FT**
NATURAL DRY UNIT WEIGHT: **82.2 PCF**
NATURAL MOISTURE CONTENT: **18.2%**
PERCENT SWELL/COMPRESSION: **2.1**

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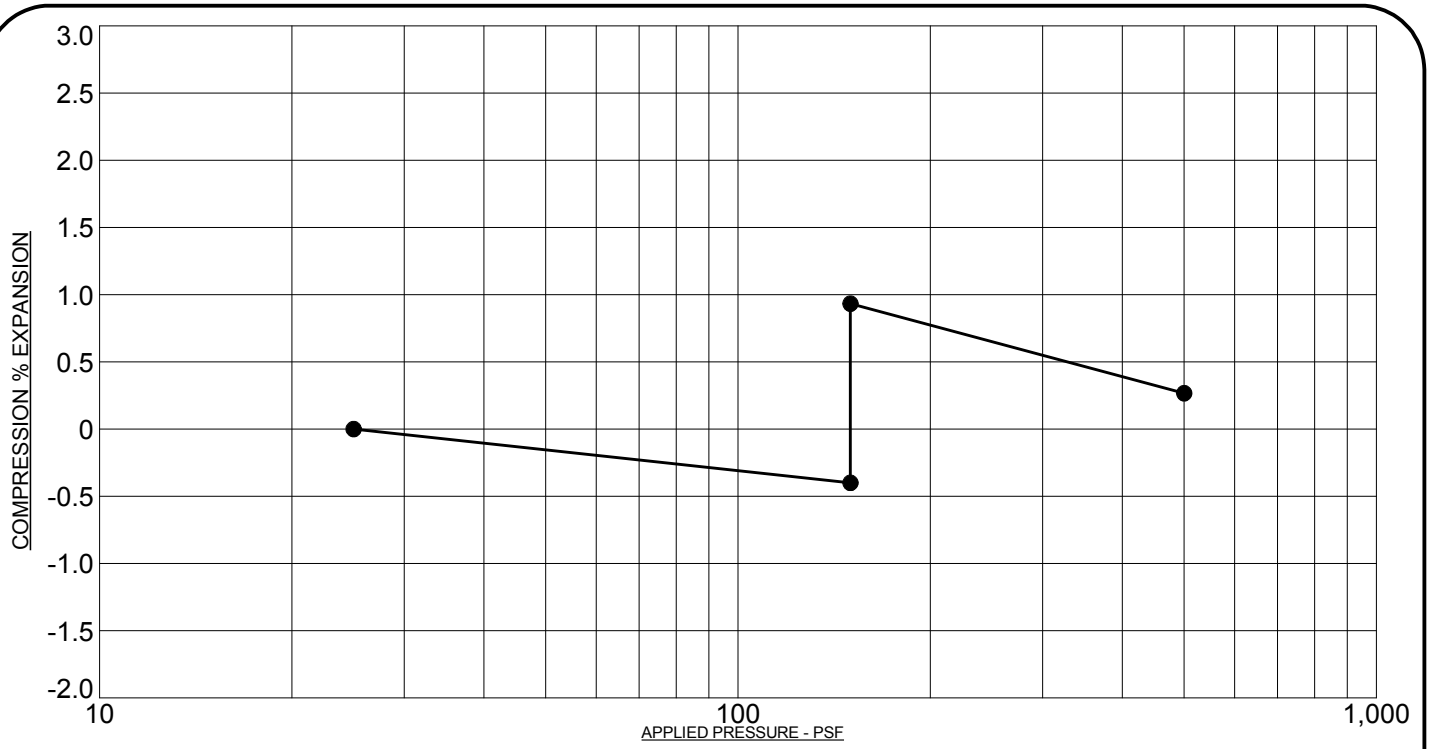
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 162626

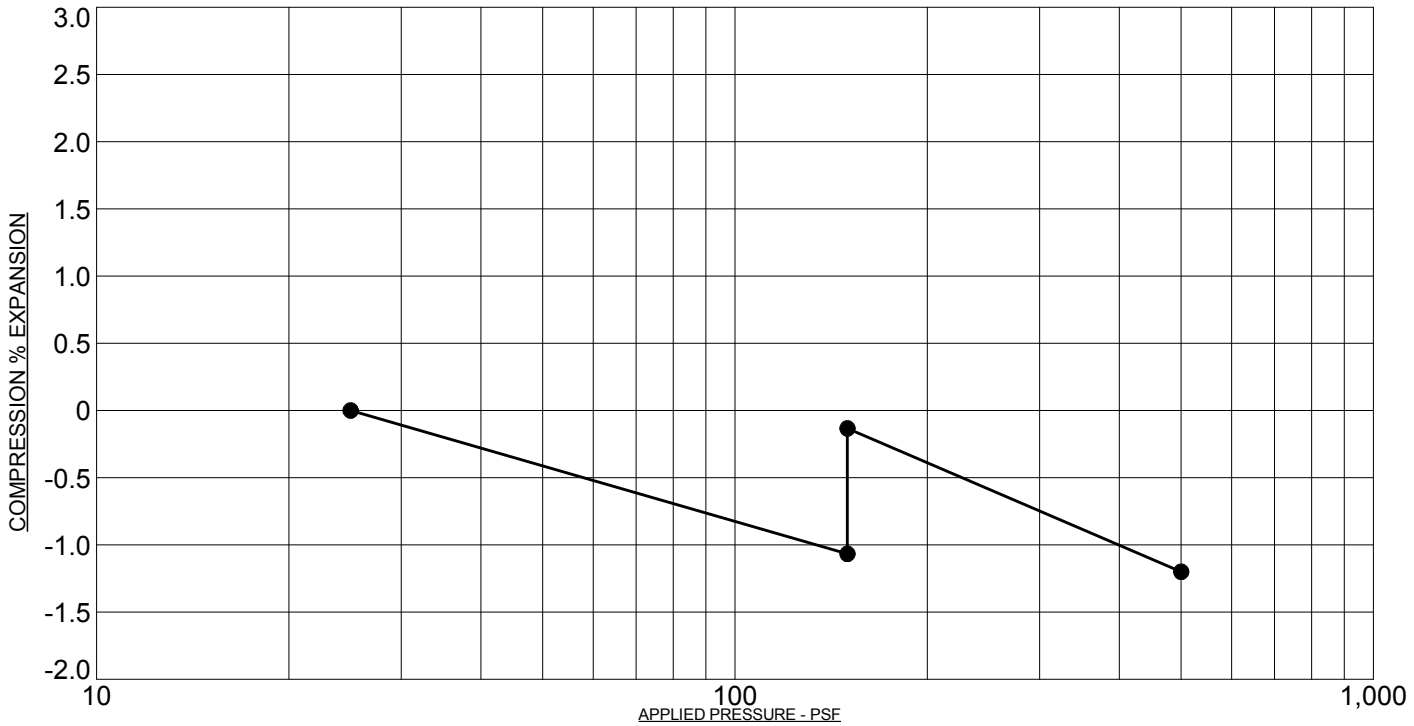
FIGURE No. 33

DATE 8/14/18



PROJECT: **Lorson Ranch East, Filing No. 1, El Paso County, Colorado**
SAMPLE DESCRIPTION: **FILL: CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 150 PSF

SAMPLE LOCATION: **16 @ 2 FT**
NATURAL DRY UNIT WEIGHT: **105.4 PCF**
NATURAL MOISTURE CONTENT: **10.3%**
PERCENT SWELL/COMPRESSION: **1.3**



PROJECT: **Lorson Ranch East, Filing No. 1, El Paso County, Colorado**
SAMPLE DESCRIPTION: **FILL: CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 150 PSF

SAMPLE LOCATION: **22 @ 2 FT**
NATURAL DRY UNIT WEIGHT: **115.3 PCF**
NATURAL MOISTURE CONTENT: **11.8%**
PERCENT SWELL/COMPRESSION: **0.9**

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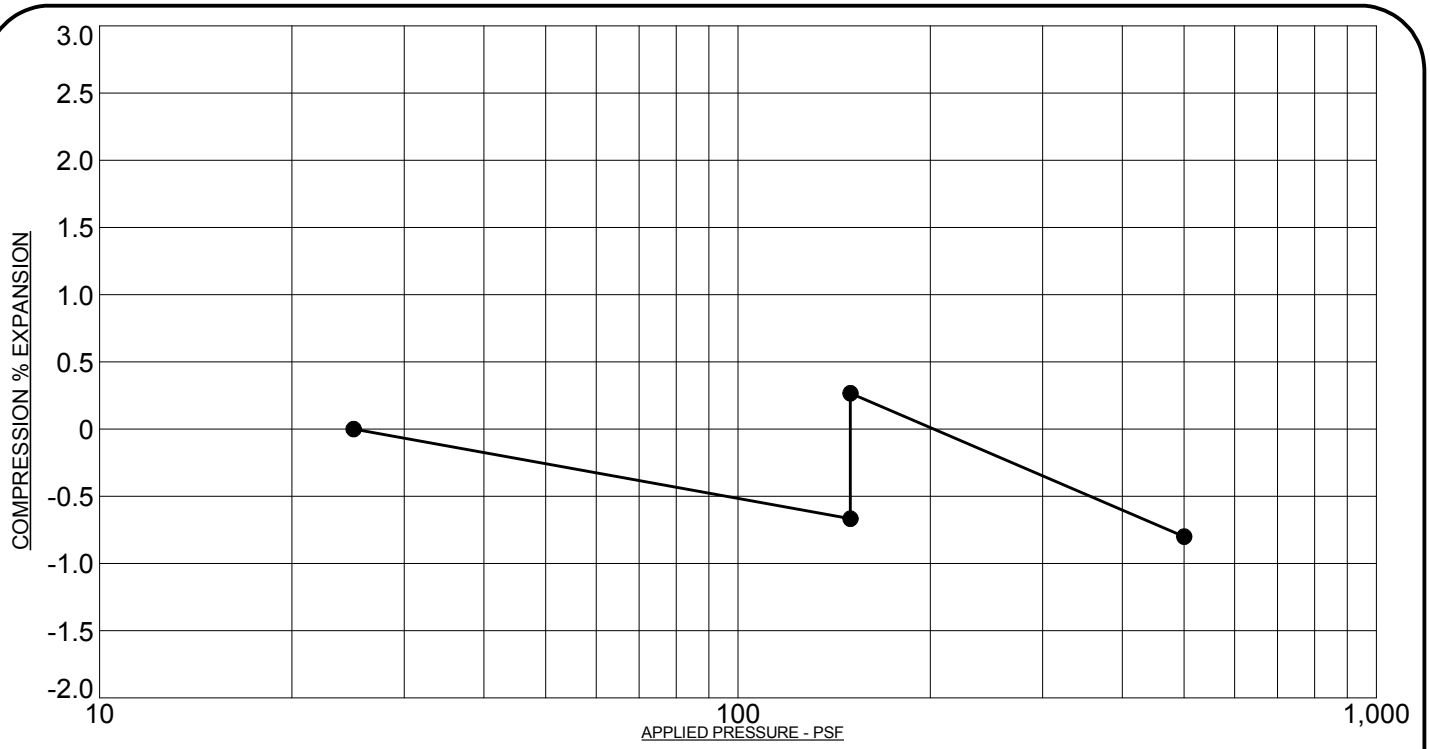
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 162626

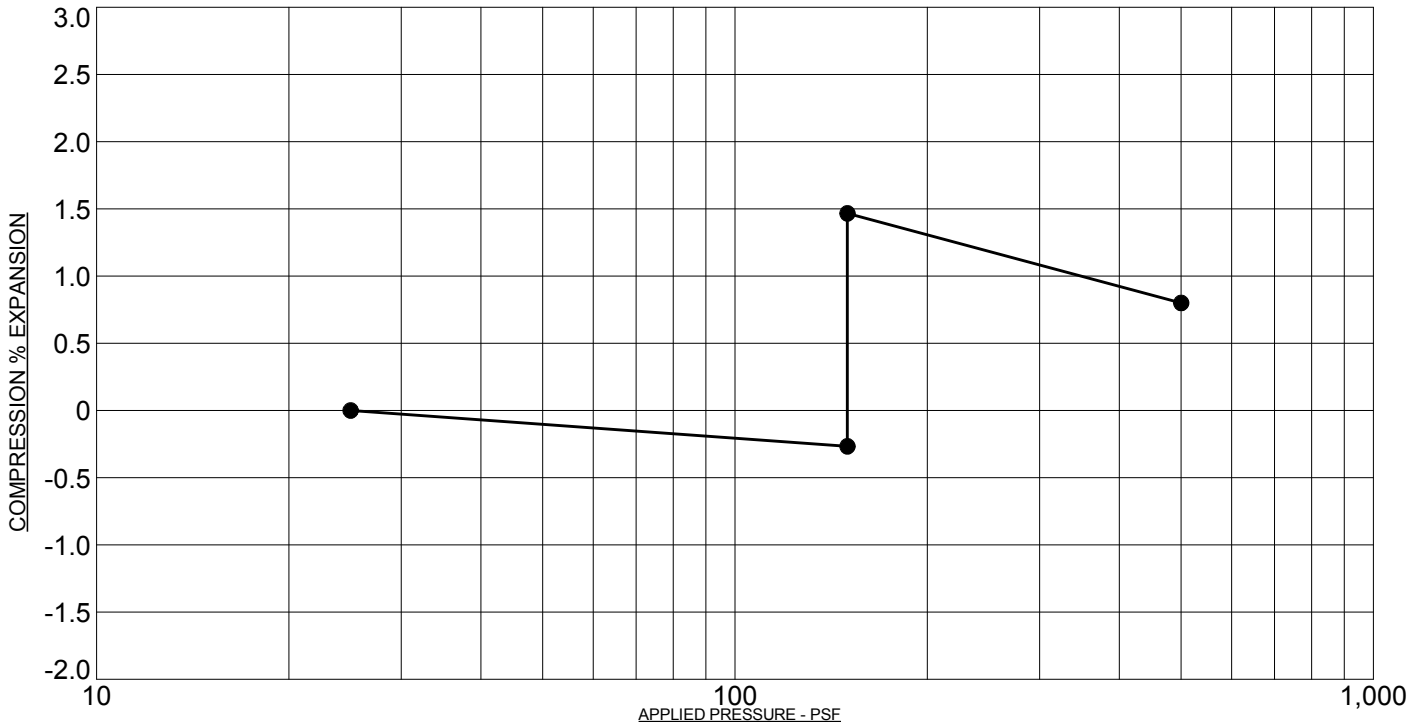
FIGURE No. 34

DATE 8/14/18



PROJECT: **Lorson Ranch East, Filing No. 1, El Paso County, Colorado**
SAMPLE DESCRIPTION: **FILL: CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 150 PSF

SAMPLE LOCATION: **25 @ 2 FT**
NATURAL DRY UNIT WEIGHT: **118.1 PCF**
NATURAL MOISTURE CONTENT: **7.9%**
PERCENT SWELL/COMPRESSION: **0.9**



PROJECT: **Lorson Ranch East, Filing No. 1, El Paso County, Colorado**
SAMPLE DESCRIPTION: **FILL: CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 150 PSF

SAMPLE LOCATION: **29 @ 2 FT**
NATURAL DRY UNIT WEIGHT: **107.0 PCF**
NATURAL MOISTURE CONTENT: **13.5%**
PERCENT SWELL/COMPRESSION: **1.7**

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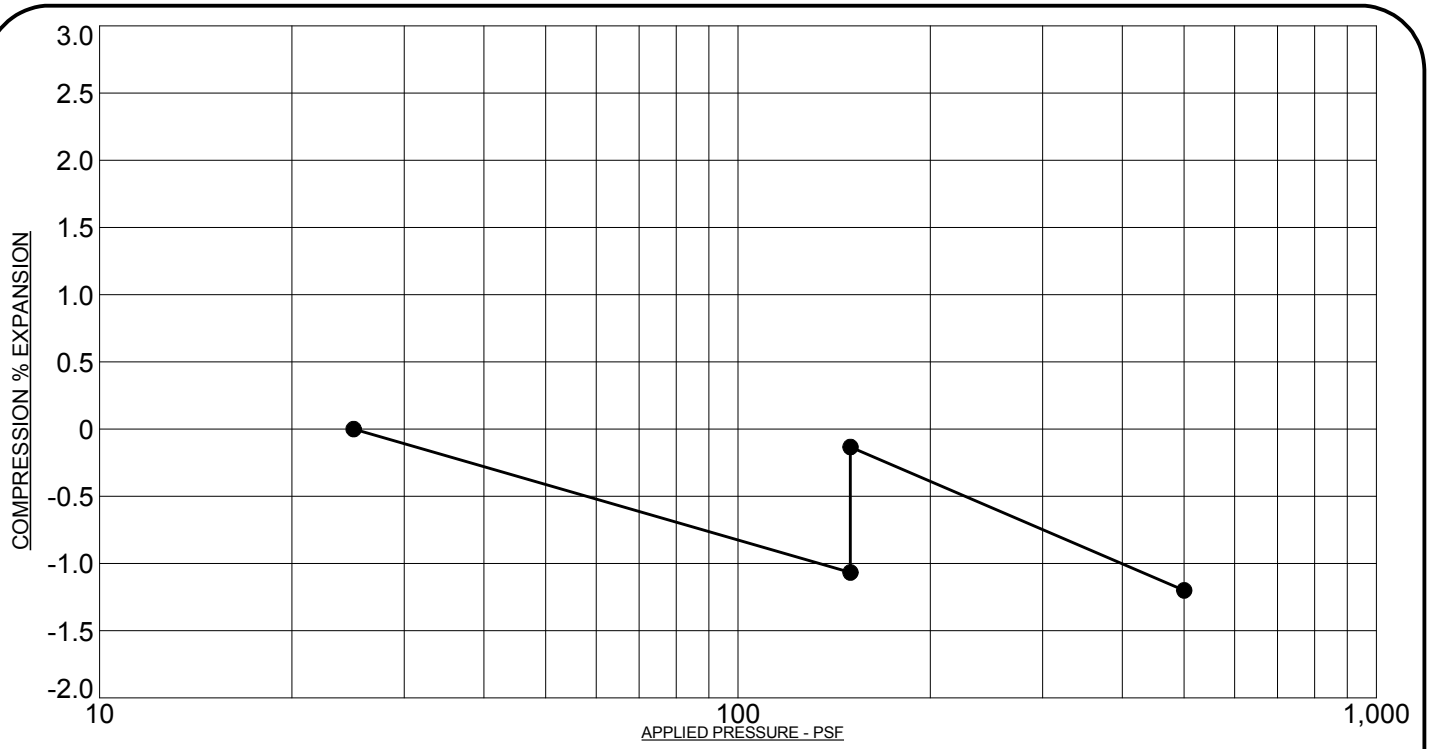
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 162626

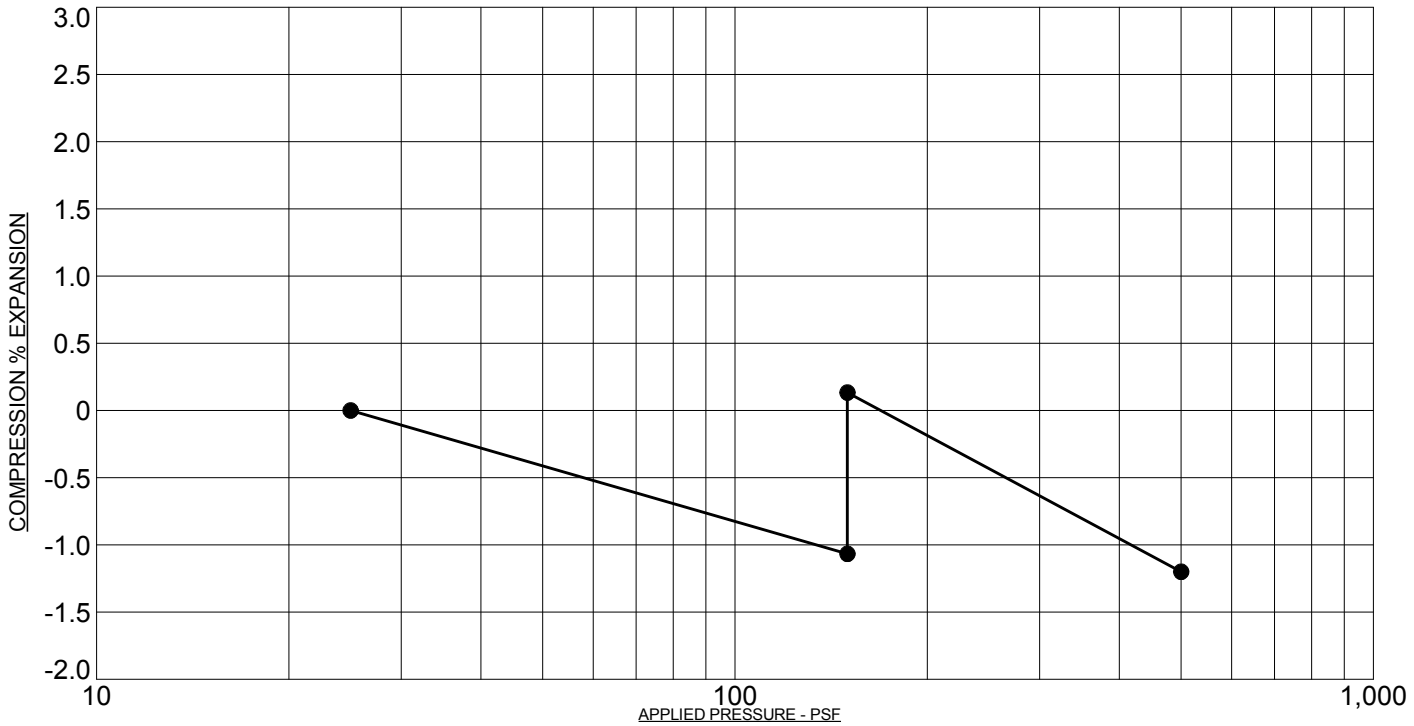
FIGURE No. 35

DATE 8/14/18



PROJECT: **Lorson Ranch East, Filing No. 1, El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 150 PSF

SAMPLE LOCATION: **31 @ 2 FT**
NATURAL DRY UNIT WEIGHT: **123.8 PCF**
NATURAL MOISTURE CONTENT: **4.2%**
PERCENT SWELL/COMPRESSION: **0.9**



PROJECT: **Lorson Ranch East, Filing No. 1, El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 150 PSF

SAMPLE LOCATION: **35 @ 2 FT**
NATURAL DRY UNIT WEIGHT: **120.2 PCF**
NATURAL MOISTURE CONTENT: **7.3%**
PERCENT SWELL/COMPRESSION: **1.2**

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SWELL/CONSOLIDATION TEST RESULTS

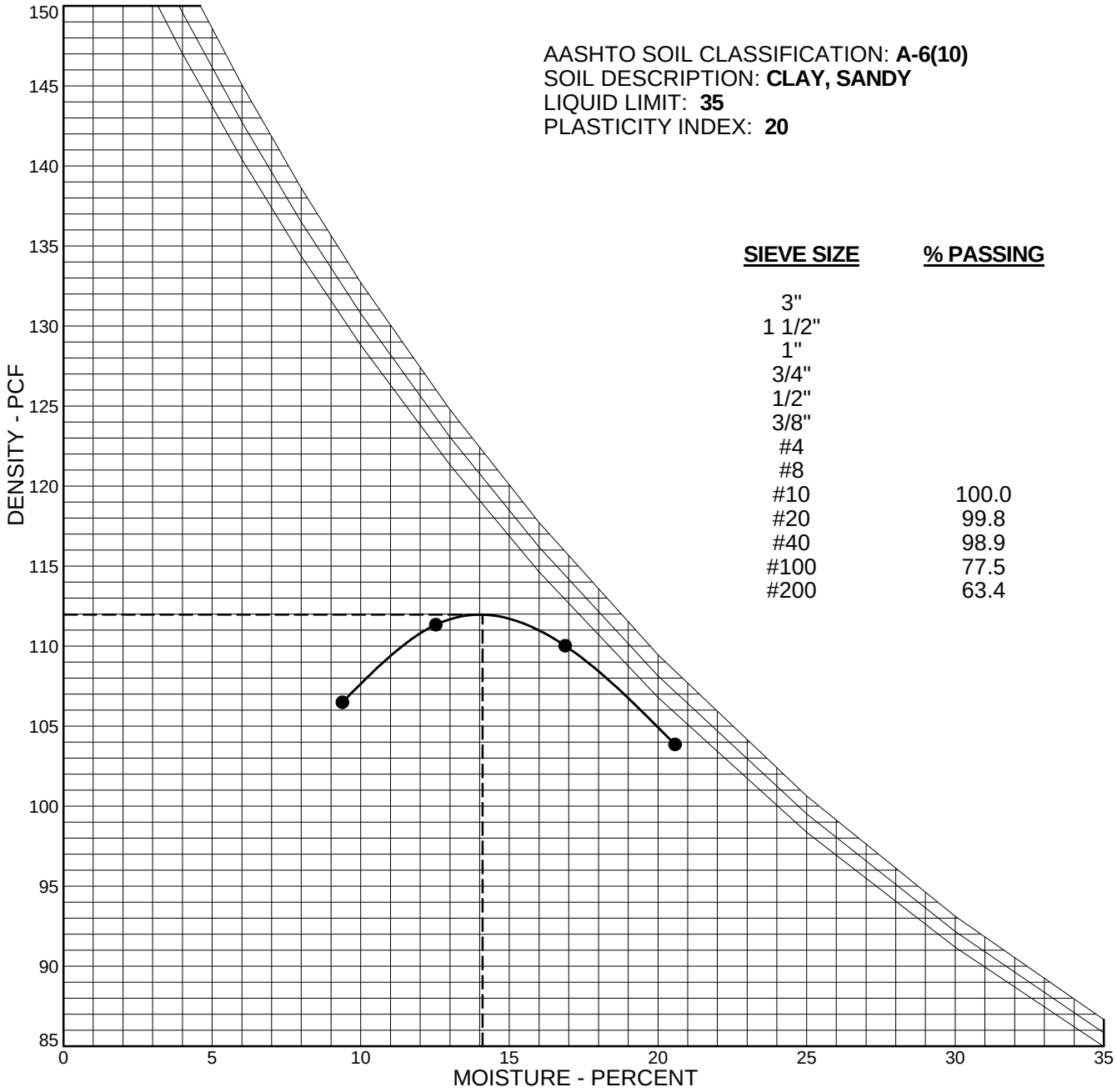
JOB No. 162626

FIGURE No. 36

DATE 8/14/18

CLIENT: **Lorson Ranch Metro District** SAMPLE NUMBER: **A-6 Proctor**

PROJECT: Lorson Ranch East, Filing No. 1, El Paso County, Colorado



AASHTO SOIL CLASSIFICATION: **A-6(10)**
SOIL DESCRIPTION: **CLAY, SANDY**
LIQUID LIMIT: **35**
PLASTICITY INDEX: **20**

SIEVE SIZE	% PASSING
3"	
1 1/2"	
1"	
3/4"	
1/2"	
3/8"	
#4	
#8	
#10	100.0
#20	99.8
#40	98.9
#100	77.5
#200	63.4

DESIGNATION **AASHTO T99**
MAX. DRY DENSITY **111.9 pcf**
OPTIMUM MOISTURE **14.1 %**
FRACTION USED **-4**
MOLD VOLUME **0.0326 cu.ft.**

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

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MOISTURE-DENSITY RELATION CURVE

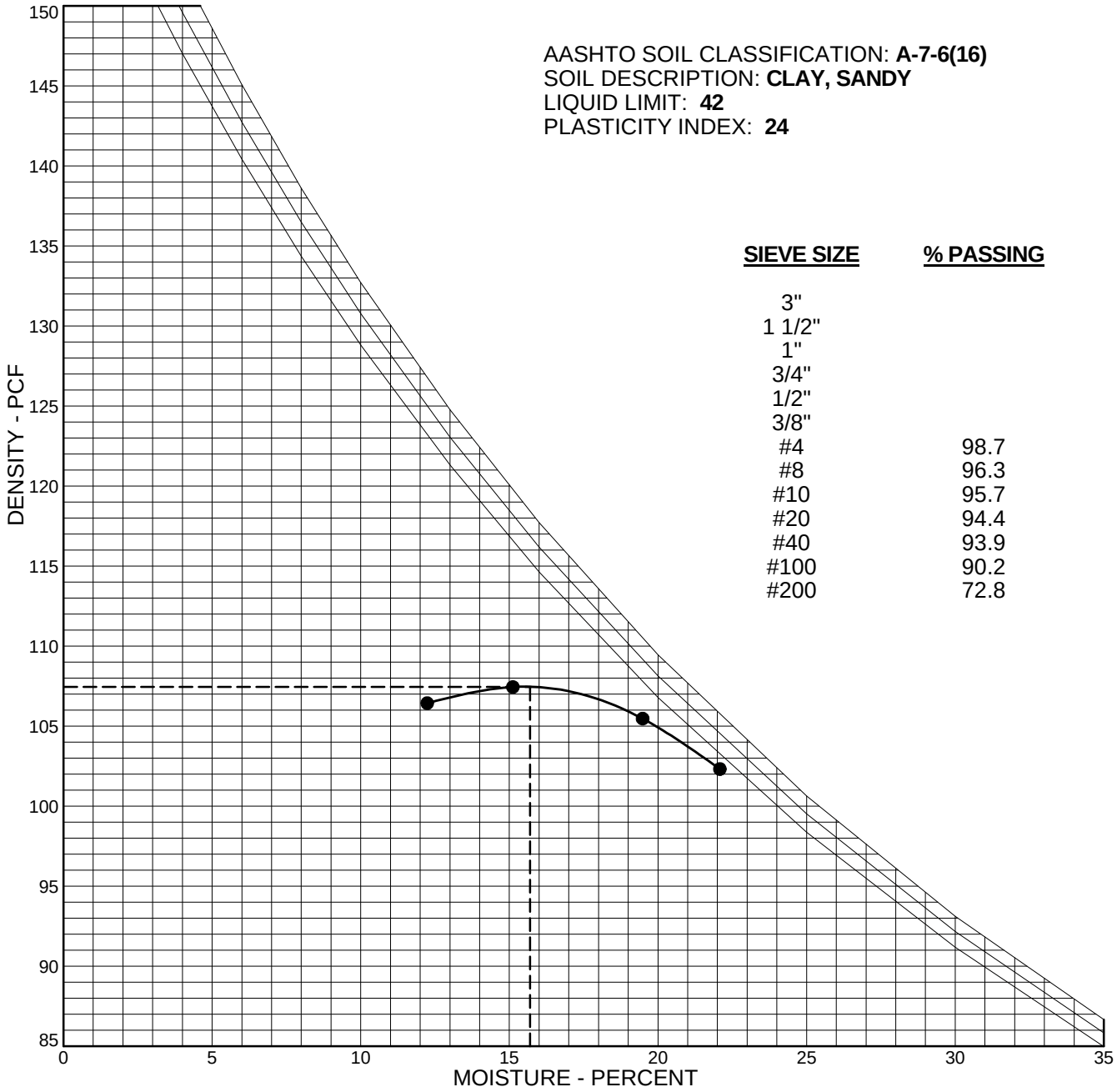
JOB No. 162626

FIGURE No. 37

DATE 8/14/18

CLIENT: **Lorson Ranch Metro District** SAMPLE NUMBER: **A-7-6 Proctor**

PROJECT: Lorson Ranch East, Filing No. 1, El Paso County, Colorado



AASHTO SOIL CLASSIFICATION: **A-7-6(16)**
SOIL DESCRIPTION: **CLAY, SANDY**
LIQUID LIMIT: **42**
PLASTICITY INDEX: **24**

SIEVE SIZE	% PASSING
3"	
1 1/2"	
1"	
3/4"	
1/2"	
3/8"	
#4	98.7
#8	96.3
#10	95.7
#20	94.4
#40	93.9
#100	90.2
#200	72.8

DESIGNATION **AASHTO T99**
MAX. DRY DENSITY **107.5 pcf**
OPTIMUM MOISTURE **15.7 %**
FRACTION USED **-4**
MOLD VOLUME **0.0326 cu.ft.**

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

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MOISTURE-DENSITY RELATION CURVE

JOB No. 162626

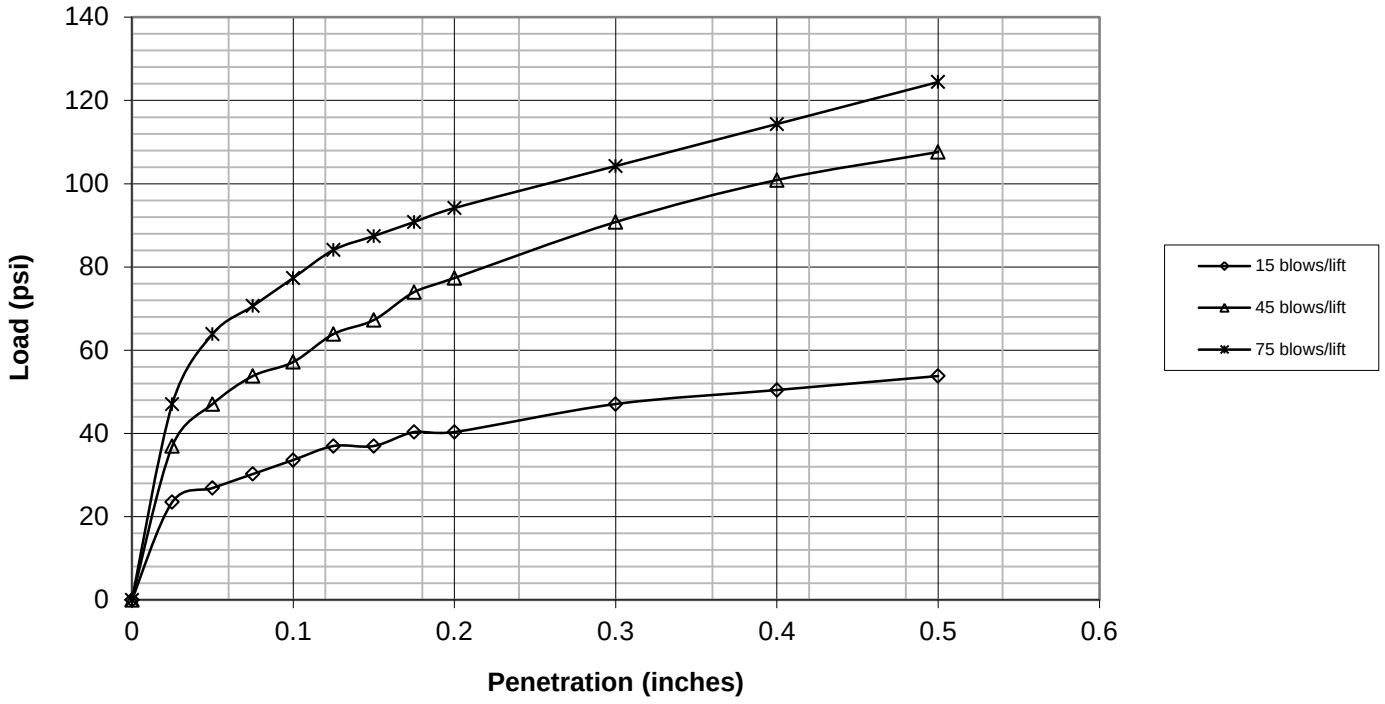
FIGURE No. 38

DATE 8/14/18

CALIFORNIA BEARING RATIO TEST RESULTS

PROJECT: Lorson Ranch East Filing No. 1
JOB NUMBER: 162626 TEST DATE: 7/24/2018
AASHTO A-6
SAMPLE NUMBER: CBR
SAMPLE LOCATION: Combination bulk sample from A-6 Test Borings
SOIL DESCRIPTION: Sandy Lean clay (CL)

	15 blows/lift	45 blows/lift	75 blows/lift
Penetration (in)	Load (psi)	Load (psi)	Load (psi)
0.000	0.0	0.0	0.0
0.025	23.5	37.0	47.1
0.050	26.9	47.1	63.9
0.075	30.3	53.8	70.6
0.100	33.6	57.2	77.3
0.125	37.0	63.9	84.1
0.150	37.0	67.3	87.4
0.175	40.4	74.0	90.8
0.200	40.4	77.3	94.2
0.300	47.1	90.8	104.3
0.400	50.4	100.9	114.3
0.500	53.8	107.6	124.4



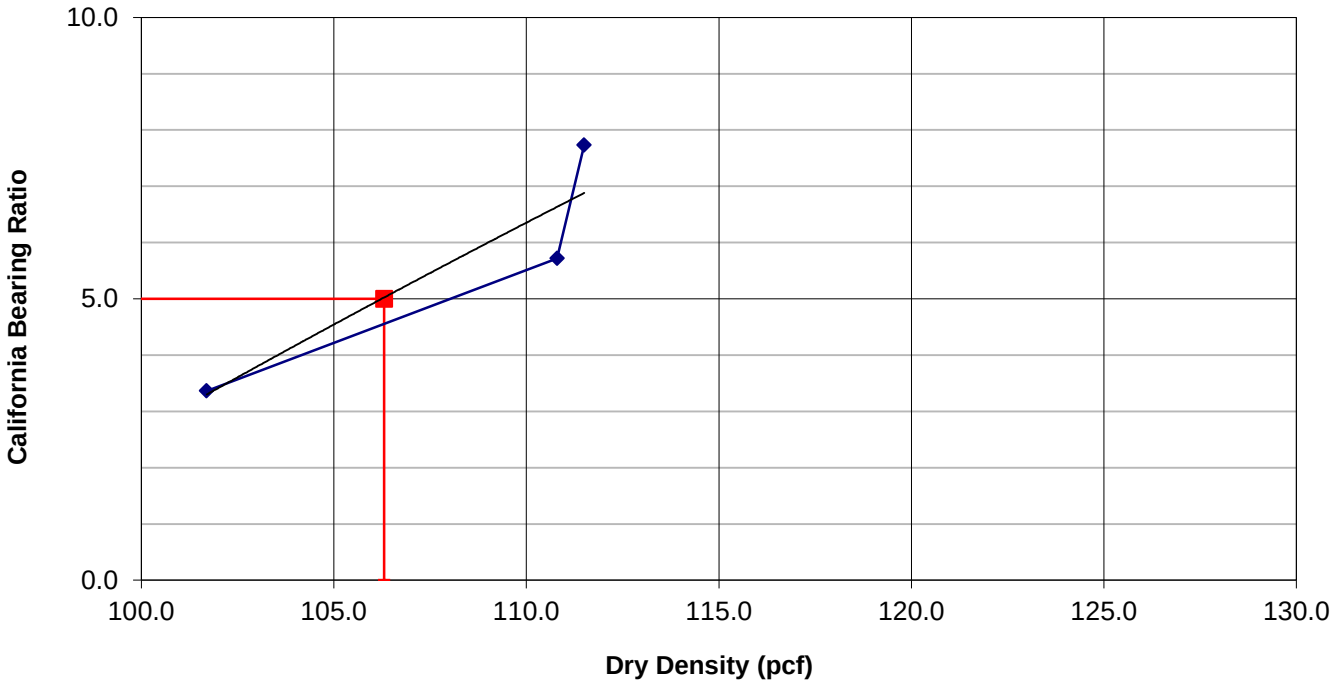
	15 blows/lift	45 blows/lift	75 blows/lift
Corrected Penetration (in)	Corrected Load (psi)	Corrected Load (psi)	Corrected Load (psi)
0.1	3.4	5.7	7.7
0.2	2.7	5.2	6.3

Figure No. 39

CALIFORNIA BEARING RATIO TEST RESULTS

PROJECT:	Lorson Ranch East Filing No. 1
JOB NUMBER:	162626 TEST DATE: 7/24/2018
AASHTO CLASSIFICATION:	A-6
SAMPLE NUMBER:	CBR
SAMPLE LOCATION:	Combination bulk sample from A-6 Test Borings
SOIL DESCRIPTION:	Sandy Lean clay (CL)

	15 blows/lift	45 blows/lift	75 blows/lift
Corrected California Bearing Ratio	3.4	5.7	7.7
Dry Density (pcf)	101.7	110.8	111.5
Percent Compaction	91	99	100
Percent Moisture After Soaking	15.4	11.6	12.7
Percent Expansion/Compression	0.0	0.0	0.0
Surcharge Weight (lbs)	12.60	12.62	12.60



California Bearing Ratio	**5.0**
Dry Density (pcf)	111.9
Percent Compaction	95.00%
Target Dry Density	106.3
Compaction Test Method	ASTM D-1557
Condition of sample	Soaked

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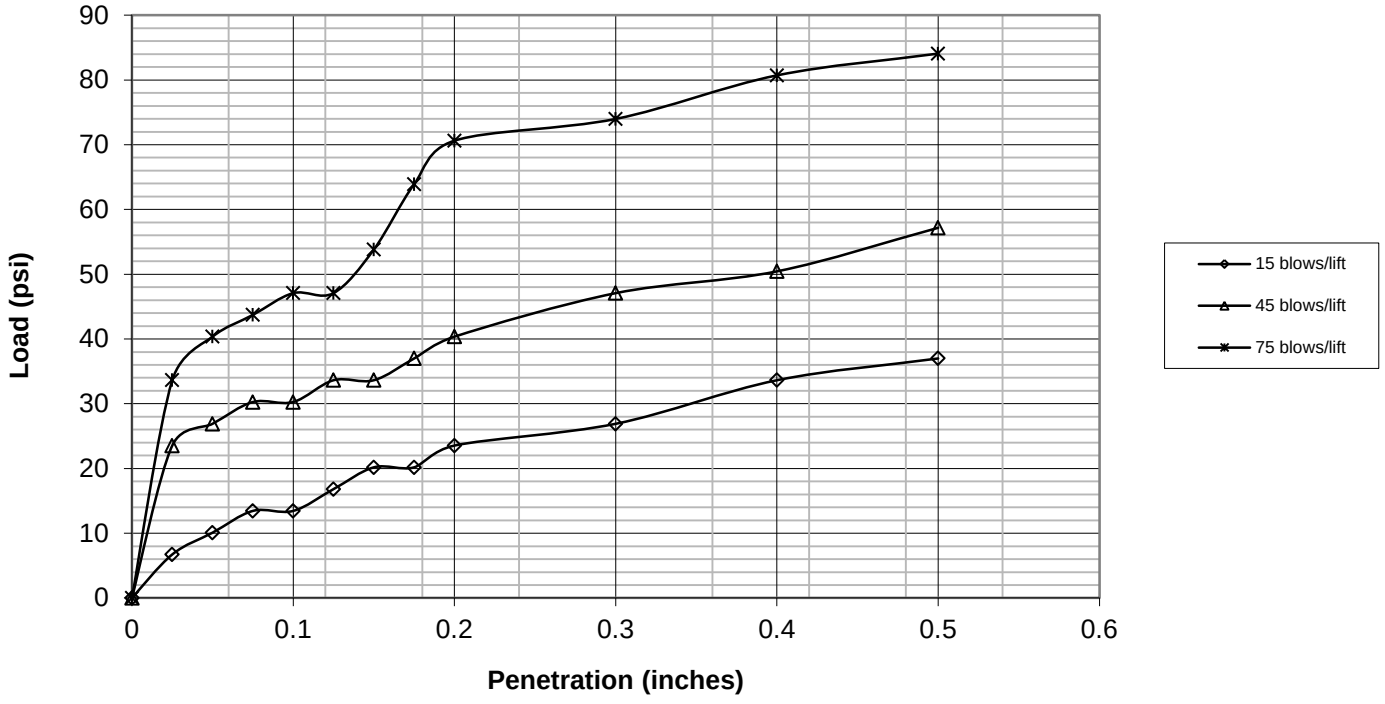
Figure No. 40

CALIFORNIA BEARING RATIO TEST RESULTS

PROJECT: Lorson Ranch East Filing No. 1
JOB NUMBER: 162626 TEST DATE: 7/24/2018
AASHTO A-7
SAMPLE NUMBER: CBR
SAMPLE LOCATION: Combination bulk sample from A-7 Test Borings
SOIL DESCRIPTION: Sandy Lean clay (CL)

	15 blows/lift	45 blows/lift	75 blows/lift
Penetration (in)	Load (psi)	Load (psi)	Load (psi)
0.000	0.0	0.0	0.0
0.025	6.7	23.5	33.6
0.050	10.1	26.9	40.4
0.075	13.5	30.3	43.7
0.100	13.5	30.3	47.1
0.125	16.8	33.6	47.1
0.150	20.2	33.6	53.8
0.175	20.2	37.0	63.9
0.200	23.5	40.4	70.6
0.300	26.9	47.1	74.0
0.400	33.6	50.4	80.7
0.500	37.0	57.2	84.1
	0		



	15 blows/lift	45 blows/lift	75 blows/lift
Corrected Penetration (in)	Corrected Load (psi)	Corrected Load (psi)	Corrected Load (psi)
0.1	1.3	3.0	4.7
0.2	1.6	2.7	4.7

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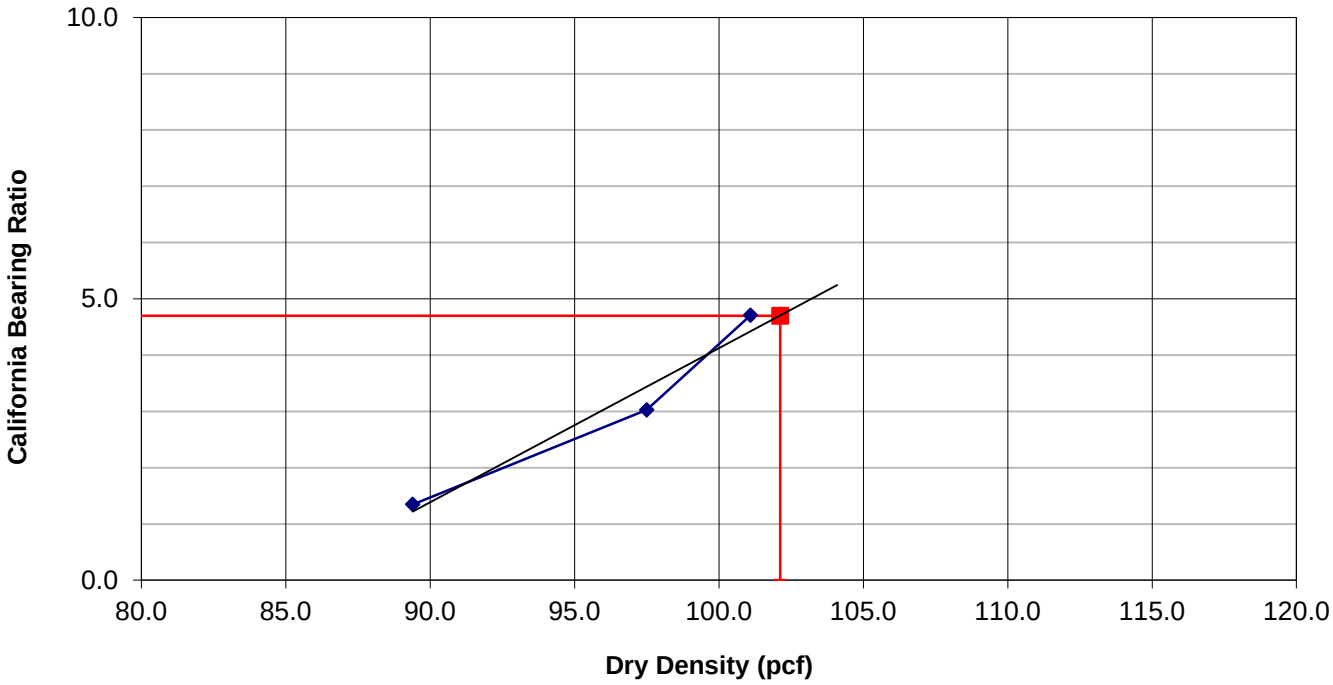
Figure No. 41

CALIFORNIA BEARING RATIO TEST RESULTS

PROJECT:	Lorson Ranch East Filing No. 1
JOB NUMBER:	162626 TEST DATE: 7/24/2018
AASHTO CLASSIFICATION:	A-7
SAMPLE NUMBER:	CBR
SAMPLE LOCATION:	Combination bulk sample from A-7 Test Borings
SOIL DESCRIPTION:	Sandy Lean clay (CL)

	15 blows/lift	45 blows/lift	75 blows/lift
Corrected California Bearing Ratio	1.3	3.0	4.7
Dry Density (pcf)	89.4	97.5	101.1
Percent Compaction	83	91	94
Percent Moisture After Soaking	15.3	15.6	14.4
Percent Expansion/Compression	0.0	0.0	0.0
Surcharge Weight (lbs)	12.60	12.61	12.65



California Bearing Ratio	**4.7**
Dry Density (pcf)	107.5
Percent Compaction	95.00%
Target Dry Density	102.1
Compaction Test Method	ASTM D-1557
Condition of sample	Soaked

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Figure No. 42

APPENDIX A

1993 AASHTO Empirical Equation for Flexible Pavements

Equation Solver | Variable Descriptions and Typical Values | Precautions

Type in data in the grey boxes and click the calculate button to see the output. To make additional calculations, change the desired input data and click the calculate button again. Click on the text descriptions of the input or output variables for more information.

INPUT

1. Loading

Total Design ESALs (W_{18}): 5256000

2. Reliability

Reliability Level in percent (R): 90

Combined Standard Error (S_0): 0.44

3. Serviceability

Initial Serviceability Index (p_i): 4.5

Terminal Serviceability Index (p_t): 2

4. Layer Parameters

Number of Base Layers: 0

	a	m	M_R	Min. Depth
Surface	0.44	1.0	N/A	0
Subgrade	N/A	N/A	7050	N/A

OUTPUT

1. Calculation Parameters

Standard Normal Deviate (z_R): -1.282

ΔPSI: 2.5

Design Structural Number (SN): 4.195

2. Layer Depths (to the nearest 1/2 inch)

Surface: 10

Total SN based on layer depths: 4.4

See Solution Details

Comments

Calculate

1993 AASHTO Empirical Equation for Flexible Pavements

Equation Solver | Variable Descriptions and Typical Values | Precautions

Type in data in the grey boxes and click the calculate button to see the output. To make additional calculations, change the desired input data and click the calculate button again. Click on the text descriptions of the input or output variables for more information.

INPUT

1. Loading

Total Design ESALs (W_{18}): 821000

2. Reliability

Reliability Level in percent (R): 85

Combined Standard Error (S_0): 0.44

3. Serviceability

Initial Serviceability Index (p_i): 4.5

Terminal Serviceability Index (p_t): 2

4. Layer Parameters

Number of Base Layers: 0

	a	m	M_R	Min. Depth
Surface	0.44	1.0	N/A	0
Subgrade	N/A	N/A	7050	N/A

OUTPUT

1. Calculation Parameters

Standard Normal Deviate (z_R): -1.037

ΔPSI: 2.5

Design Structural Number (SN): 3.195

2. Layer Depths (to the nearest 1/2 inch)

Surface: 7.5

Total SN based on layer depths: 3.3

See Solution Details

Comments

Calculate

1993 AASHTO Empirical Equation for Flexible Pavements

Equation Solver | Variable Descriptions and Typical Values | Precautions

Type in data in the grey boxes and click the calculate button to see the output. To make additional calculations, change the desired input data and click the calculate button again. Click on the text descriptions of the input or output variables for more information.

INPUT

1. Loading

Total Design ESALs (W_{18}): 292000

2. Reliability

Reliability Level in percent (R): 80

Combined Standard Error (S_0): 0.44

3. Serviceability

Initial Serviceability Index (p_i): 4.5

Terminal Serviceability Index (p_t): 2

4. Layer Parameters

Number of Base Layers: 0

	a	m	M_R	Min. Depth
Surface	0.44	1.0	N/A	0
Subgrade	N/A	N/A	7050	N/A

OUTPUT

1. Calculation Parameters

Standard Normal Deviate (z_R): -0.841

ΔPSI: 2.5

Design Structural Number (SN): 2.645

2. Layer Depths (to the nearest 1/2 inch)

Surface: 6.5

Total SN based on layer depths: 2.86

See Solution Details

Comments

Calculate