



Geotechnical Engineering Services Report

**Falcon Marketplace Roadways  
East Woodmen Road & Meridian Road  
Falcon, Colorado**

Prepared for

Evergreen Devco, Inc.  
1873 South Bellaire Street, Suite 1106  
Denver, CO 80222

Prepared by

Professional Service Industries, Inc.  
1070 W. 124<sup>th</sup> Avenue #800  
Westminster, CO 80234

September 29, 2020  
Revised January 8, 2021

PSI Project No. 05322095

EPC project number SF 19-001



Evergreen Devco, Inc.  
1873 South Bellaire Street, Suite 1106  
Denver, Colorado 80222

Attention: Ms. Dana Dragon

Subject: Geotechnical Engineering Services Report  
**Falcon Marketplace Roadways**  
East Woodmen Road & Meridian Road  
Falcon, Colorado  
PSI Project No. 05322095

Dear Ms. Dragon,

Professional Service Industries, Inc. (PSI), an Intertek Company, performed the geotechnical engineering services that you requested. PSI provided its services in general accordance with PSI Proposal No. 0532-318959 dated August 13, 2020 and the Agreement for Consulting Services with Evergreen Devco, Inc. dated September 8, 2020.

PSI thanks you for choosing us as your consultant for this project. Please contact us at 303.424.5578 if you have any questions or we may be of further service.

Respectfully Submitted,

For Professional Service Industries, Inc.

Beau Pearl, E.I.  
Staff Engineer

Reviewed by: Lloyd Lasher, P.E.  
Principal Consultant

Kyle R. Duitsman, P.E.  
Site Manager





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LEGEND

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# **1 PROJECT INFORMATION**

## **1.1 PROJECT AUTHORIZATION**

Professional Service Industries, Inc. (PSI), an Intertek Company, has completed a geotechnical exploration for the proposed roadways of the planned Falcon Marketplace Development located at the northwest corner of East Woodmen Road and Meridian Road in Falcon, Colorado. The services were authorized by Ms. Dana Dragon with Evergreen Devco, Inc., by the Agreement for Consulting Services dated September 8, 2020.

## **1.2 PROJECT DESCRIPTION**

Project information was provided via email from Mr. Adam Smith with Leon Capital Group. The email included a Utility Service plan showing proposed roads in the development, drawn by Drexel, Barrell & Co., dated 9/6/2018, a preliminary grading plan dated 1/17/2017, and a preliminary geotechnical report performed by Ground Engineering dated 8/25/2015. Based upon changes requested by El Paso County Engineer, Elizabeth Nijkamp, we have updated the report to include multiple pavement sections for different ESALs.

Based on an email from the El Paso County engineer (Ms. Elizabeth Nijkamp), we understand the development roadways are to be classified as an Urban Non-Residential Collector. Based upon multiple pavement thicknesses we have included pavement designs based on an ESAL of 1,404,100 and 2,280,644. Our design is in general accordance with the El Paso County Engineering Criteria Manual (ECM). We understand the roads have been graded to final subgrade elevations. The required pavement sections have been indicated on the site boring location map (Figure 2). The magenta indicates the 2,280,644 ESALs and 1,404,100 ESAL are indicated in light blue

In addition, PSI is currently performing construction materials testing services for this project under a separate contract. This includes testing associated with site grading of roads and utility backfill.

The geotechnical recommendations presented in this report are based on the provided project information and the subsurface materials described in this report. If any of the noted information is incorrect, please inform PSI in writing so that we may amend the recommendations presented in this report as appropriate. PSI will not be responsible for the implementation of its recommendations when it is not notified of changes in the project.

## **1.3 PURPOSE AND SCOPE OF SERVICES**

The purpose of this study was to explore the subsurface conditions along the proposed access roads by drilling, sampling and testing materials supporting the pavements. The subsurface information was obtained from ten (10) auger borings, Standard Penetration testing and sampling. A total of ten (10) soil test borings were advanced within the proposed roadway areas to a depth of five (5) or ten (10) feet below the existing/final site grade. The borings were marked in the field by PSI personnel at the approximate boring locations shown on the Boring Plan (Figure 2) in the appendix of this report. Borings were placed in accessible areas, due to utility placement within the roadways (as directed by the on-site contractor).

Borings were advanced using a conventional, truck-mounted drill rig advancing solid-stem augers. PSI performed penetration tests in the borings at approximately 1, 4, 7 and 9-feet below existing grade. A modified California Barrel Sampler was used for sampling. The boreholes were backfilled with the soil cuttings upon completion.

Our scope of services did not include an environmental assessment for determining the presence or absence of wetlands, or hazardous or toxic materials in the soil, bedrock, surface water, groundwater, or air on or below, or around this site. Any statements in this report or on the boring logs regarding odors, colors, and unusual or suspicious items or conditions are strictly for informational purposes. Prior to development of this site, an environmental assessment is advisable. No assessment of the current building or pavements was performed as a part of our scope of services.

## **2 SITE AND SUBSURFACE CONDITIONS**

### **2.1 SITE AND LOCATION DESCRIPTION**

The site lies at the northwest corner of Meridian Road and East Woodmen Road in Falcon, Colorado. The site has been vacant and appears to have been relatively unchanged since prior to 1999 (the oldest available image). We understand current development began around May 2020. A creek once traversed the site from northeast to southwest through center of site but was generally outside the area of the proposed roadways.

### **2.2 SUBSURFACE CONDITIONS AND GEOLOGIC SETTING**

All references to depth of the various materials encountered are from the existing grade at the time of drilling (September 15, 2020).

From existing/final grade, PSI generally encountered silty sand or poorly graded sand with silt soils to the termination depths of the borings in the majority of the borings. The sandy soils may be described as light brown to dark brown, fine to coarse grained sand, moist, and generally loose to dense. Bedrock (sandstone) was encountered approximately 7 ½ feet below grade in Boring B6, which contained fine grained sand and was light brown with yellow, gray, and iron staining. Clay soils were encountered in Boring B2 at a depth of 4-feet to the termination depth of 5-feet. The Clay soil can be described as moist, gray-brown, and generally medium stiff. Apparent fill materials were observed in Borings B7, B9, and B10 performed in the northeast portion of the site. To a depth of approximately 1-foot below existing grade. The apparent fill material contains sand and clay and dark brown in color. The fill sampled at Boring B7 had an organic odor.

The above subsurface descriptions are of a generalized nature to highlight the major subsurface stratification and lithology. The boring logs included in the Appendix should be reviewed for specific information at the boring locations. These records include soil descriptions, stratifications, penetration resistances, locations of the samples and laboratory test data. The stratifications shown on the boring logs represent the conditions only at the actual boring locations. Variations may occur and should be expected between boring locations. The stratifications represent the approximate boundary between subsurface materials and the actual transition may be gradual. Water level information obtained during field operations, if any, is also shown on the boring logs. The samples that were not altered by laboratory testing will be retained for sixty (60) days from the date of this report and then discarded without notice.

## **2.3 GROUNDWATER INFORMATION**

Groundwater was not observed during drilling operations; however, PSI has performed multiple groundwater readings at the site from existing monitoring wells. Based on those readings we understand water levels may be approximately 6 to 15 feet below existing grade. It should be noted that it is possible for the groundwater table to fluctuate during the year depending upon climatic and rainfall conditions and changes to surface topography and drainage patterns. Discontinuous zones of perched water may also exist, or develop, within the overburden materials subsequent to the construction of the proposed development. The groundwater levels present in this report are the levels that were measured at the time of our field activities. We recommend the contractor determine the groundwater level prior to construction and assess any potential impacts.

# **3 EVALUATION AND RECOMMENDATIONS**

## **3.1 GEOTECHNICAL DISCUSSION**

The following design recommendations have been developed based on the previously described project characteristics and subsurface conditions encountered. If there are any changes in the project criteria, including project location on the site, a review must be made by PSI to determine if any modifications in the recommendations will be required. The findings of such a review should be presented in a supplemental report. Once final design plans and specifications are available, a general review by PSI is recommended to check that the conditions idealized in the project description are correct and that the earthwork and foundation recommendations are properly interpreted and implemented.

Apparent fill materials were encountered to depths of approximately 1-foot below current grades in Borings B7, B9, and B10 performed in the northeast corner of the site. Due to the sandy, silty nature of the on-site soils, swell potential is believed to be low at this site. Therefore, a proofroll to identify loose areas of soils should be performed prior to placement of new fill or pavement sections. Where soils appear to be inconsistent, the upper 12-inches of soils should be reworked and replaced as moisture conditioned and recompacted structural fill. The subgrade type varied in some areas, therefore a proofroll must be performed to identify areas that pump, rut or deflect. Those areas will need to be reworked and stabilized prior to paving.

Utilities have been installed below the drive lanes. Care should be taken to inspect the bedding material to prevent water transmission to the surrounding soils.

## **3.2 SITE PREPARATION**

Deleterious materials and debris (if encountered) should be removed and disposed of offsite. Once properly cleared, we recommend the soils at the site be prepared as follows:

Where proposed road subgrades have been graded and consist of silty sand/poorly graded sand, we recommend the subgrade be proofrolled prior to placement of new pavement to identify areas of loose soils and provide a consistent subgrade. If areas have yet to be graded or where apparent fill was observed, the existing soils should be over-excavated to a depth that is no less than 12-inches, mixed, and

replaced as moisture conditioned and recompacted fill. Following replacement of structural fill, the subgrade should be proofrolled to identify areas of loose soils.

Areas of soft/saturated soils may require additional overexcavation, geogrid, and/or rock to stabilize the subgrade. The subgrade type varied in some areas, therefore a proofroll must be performed to identify areas that pump, rut or deflect. Those areas will need to be reworked and stabilized prior to paving.

### **General Soil Preparation**

Unless otherwise specified, fill material should be compacted to at least 95 percent of the maximum dry unit weight as determined by the Standard Proctor Test (ASTM D 698). For fill depths in excess of 5 feet, compaction should be 100 percent maximum dry unit weight. Each lift of compacted fill should be tested for density by a representative of the geotechnical engineer prior to placement of subsequent lifts. Fill soils should be moisture conditioned to a range from optimum moisture content to four percent above optimum moisture content. Fill material should be placed in maximum eight-inch loose lifts.

A sample(s) of the proposed backfill soil(s) should be obtained for moisture density relationship (proctor test) three to four days prior to backfilling operations to expedite compaction and moisture content testing by the materials testing service provider.

Weather conditions in the site area are typically dry in the summer and early fall. Precipitation in the form of snowfall is common from October through March. While grading can be inhibited for short periods during and following times of precipitation, grading can generally be conducted year-round. The major factor that must be considered during the winter months is ground freezing. During extended periods of sub-freezing weather, it can be difficult to properly moisture condition and compact soils. Grading must be conducted during the warmer parts of the day in freezing weather.

### **Structural Fill**

Based on PSI's field and laboratory data, it is our opinion that the majority of the on-site overburden soils and apparent fill soils will be suitable for re-use as backfill soils and for use as structural fill, provided the material is properly mixed, moisture conditioned and compacted. Bedrock materials, if encountered, should NOT be reused as structural fill. If material such as construction debris, trash, or other undesirable material is encountered during construction, they should be removed off site.

Imported structural fill, if required, should be free of organic or other deleterious materials, have a liquid limit less than 30, a plasticity index less than 10, and meet the following gradation outlined below. This structural fill criteria is intended as a general guideline. Imported structural fill materials should have a swell potential of less than 1 percent when compacted to 95 percent of maximum dry unit weight (MDUW) and at 2 percent below optimum moisture content (OMC) and tested under a swell test surcharge of 500 psf. The MDUW and OMC should be determined by ASTM D698 (Standard Proctor).

<b><u>Screen Size</u></b>	<b><u>Percent Passing</u></b>
2 Inch	100
#4	50 – 100
#200	10 – 30

Imported fill material proposed for use on this site that does not meet these criteria should be submitted to the project geotechnical engineer for evaluation and approval. The geotechnical engineer should evaluate the proposed import fill prior to purchase and delivery. Fine-grained soils used for fill require close moisture content control and careful placement by the contractor to achieve the recommended degree of compaction and to address swell potential and settlement issues.

### 3.3 PAVEMENT RECONSTRUCTION RECOMMENDATIONS

Based upon the soils encountered, PSI has used a Resilient Modulus ( $M_R$ ) of 5,850 psi, for design of the proposed pavement sections, which correlates to an approximate R-value of 29. The value should be confirmed prior to construction. Pavements will be designed to the minimum asphalt depth for this soil type.

Based on an email from the El Paso County engineer (Ms. Elizabeth Nijkamp), we understand the development roadways have been classified as an Urban Non-Residential Collector. Therefore, we have based our calculations on 1,404,100 ESALs and 2,280,644 ESALs. Our design is in general accordance with the El Paso County Engineering Criteria Manual (ECM). We have also used the following design criteria; a 20-year design life, a Pavement Serviceability Index (PSI) of 2.5 and a Reliability of 85 percent. The required pavement sections have been indicated on the site boring location map (Figure 2). The magenta indicates the 2,280,644 ESALs and 1,404,100 ESAL are indicated in light blue

Minimum pavement section options are provided for asphalt over aggregate base course (composite), and rigid (Portland Cement Concrete) pavement. Based on this information for the subject pavement, the following minimum pavement sections were determined, as presented in the following table.

Pavement Area	Composite Section	Full-Depth Portland Cement Concrete
Urban Non-Residential Collector ESALs = 1,404,100	5½ inches Asphalt over 10½ inches Aggregate Base Course	7 inches
Urban Non-Residential Collector ESALs = 2,280,644	6½ inches Asphalt over 10½ inches Aggregate Base Course	7½ inches

#### 3.3.1 FLEXIBLE PAVEMENT

Allowances for proper drainage and proper material selection of base materials are important factors for performance of asphaltic pavements. Ruts and birdbaths in asphalt pavement allow for quick deterioration of the pavement primarily due to saturation of the underlying base and subgrade.

Hot bituminous pavement should meet the requirements as detailed for SuperPave Mixtures in Colorado Department of Transportation Standard Specifications for Road and Bridge Construction. Material meeting the Colorado Department of Transportation requirements for Grading SX (½ inch nominal) for top lift, and

Grading S (¾ inch nominal) for the lower layers is recommended. In addition, the following are presented as general guidelines for properties of asphaltic concrete.

<b>Falcon Marketplace Roadways</b>	
Asphalt Cement	PG 58-28 or PG 64-22
Asphalt Content	As per mix design
Percent Air Voids	3½

The minimal layer thickness shall be 2 inches and each layer should be a minimum of 2 times the aggregate size. Asphalt material should be obtained from an approved mix design stating the SuperPave Mixture properties, including optimum asphalt content, job mix formula, and recommended mixing and placing temperatures. Materials and construction methods should be in accordance with the latest edition of the Pikes Peak Region Asphalt Specification, the El Paso County ECM, and CDOT Standard Specifications for Road and Bridge Construction Section 403.

### **3.3.2 AGGREGATE BASE COURSE**

If aggregate base course is used as part of the pavement section, the materials should conform to CDOT requirements for Class 6 aggregate base course per Table 703-2 and construction methods should conform to Section 304 of the Colorado Department of Transportation Standard Specifications for Road and Bridge Construction and the El Paso County ECM.

### **3.3.3 RIGID PAVEMENT**

The use of concrete for on-site pavements may be considered by the owner. Should concrete pavement be utilized, the concrete should be properly reinforced and jointed and should be constructed from a concrete mixture, which has a 28-day minimum laboratory compressive strength of 3,750 psi. We recommend a maximum water cement ratio of 0.45 and an air-entrainment specification of 5 percent (±1.5 percent) be followed. Expansion joints should be sealed with a polyurethane sealant so that moisture infiltration into the subgrade soils and resultant concrete deterioration at the joints is reduced. Materials and construction methods should be in accordance with the CDOT Standard Specifications for Road and Bridge Construction Section 403 and the El Paso County ECM.

### **3.3.4 PAVEMENT DRAINAGE AND MAINTENANCE**

Pavement subgrades should be sloped to provide rapid surface drainage during and after construction. Water allowed to pond on or adjacent to pavement areas could saturate the subgrade or pavement section and cause premature deterioration of pavements, and removal and replacement may be required. Periodic maintenance of the pavement should be anticipated. This should include sealing of cracks and joints and by maintaining proper surface drainage to avoid ponding of water on or near the pavement area.

## **4 CONSTRUCTION CONSIDERATIONS**

It is recommended that PSI be retained to provide observation and testing of construction activities involved in the foundations, earthwork, and related activities of this project. PSI cannot accept any responsibility for any conditions which deviated from those described in this report, nor for the performance of the foundations if not engaged to provide construction observation and testing for this project.

### **4.1 MOISTURE SENSITIVE SOILS/WEATHER CONCERNS**

The soils encountered at this site are expected to be sensitive to disturbances caused by construction traffic and changes in moisture content. During wet weather periods, increases in the moisture content of the soil can cause significant reduction in the soil strength and support capabilities. In addition, soils which become wet may be slow to dry and thus significantly retard the progress of grading and compaction activities. It will, therefore, be advantageous to perform earthwork and subgrades construction activities during dry weather.

### **4.2 DRAINAGE AND WATER CONCERNS**

Water should not be allowed to collect in the excavations or on prepared subgrade of the construction area either during or after construction. Undercut or excavated areas should be sloped toward one corner to facilitate removal of any collected rainwater, groundwater, or surface runoff. Positive site surface drainage should be provided to reduce infiltration of surface water. The grades should be sloped and surface water should be collected and discharged such that water is not permitted to infiltrate the backfill areas.

Groundwater was not encountered at the time the field exploration was performed. However, it is possible that seasonal variations will cause fluctuations. Additionally, water may be encountered in discontinuous zones within the overburden. Any water accumulation should be removed from excavations by pumping. Should excessive and uncontrolled amounts of seepage occur, the Geotechnical Engineer should be consulted.

### **4.3 EXCAVATIONS**

In Federal Register, Volume 54, No. 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, part 1926, Subpart P". This document was issued to better ensure the safety of workmen entering trenches or excavations. It is mandated by this federal regulation that excavations, whether they be utility trenches, basement excavation or footing excavations, be constructed in accordance with the new OSHA guidelines. It is our understanding that these regulations are being strictly enforced and if they are not closely followed the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's "responsible person", as defined in 29 CFR Part 1926,

should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

We are providing this information solely as a service to our client. PSI does not assume responsibility for construction site safety or the contractor's or other parties' compliance with local, state, and federal safety or other regulations.

## **5 REPORT LIMITATIONS**

The recommendations submitted, in this report, are based on the subsurface information obtained by PSI and a preliminary site plan furnished by the Client. If there are any revisions to the plans for this project, or if deviations from the subsurface conditions noted in this report are encountered during construction, PSI should be notified immediately to determine if changes in the foundation recommendations are required. If PSI is not notified of such changes, PSI will not be responsible for the impact of those changes on the project.

The Geotechnical Engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional Geotechnical Engineering practices in the local area. No other warranties are implied or expressed.

After the plans and specifications are more complete, the Geotechnical Engineer should be retained and provided the opportunity to review the final design plans and specifications to check that our engineering recommendations have been properly incorporated into the design documents. At that time, it may be necessary to submit supplementary recommendations. If PSI is not retained to perform these functions, PSI will not be responsible for the impact of those conditions on the project. This report has been prepared for the exclusive use of Evergreen Devco, Inc., for the specific application to the Falcon Marketplace Access Roads at the northwest corner of East Woodmen Road and Meridian Road in Falcon, Colorado.



Taken From Google Earth

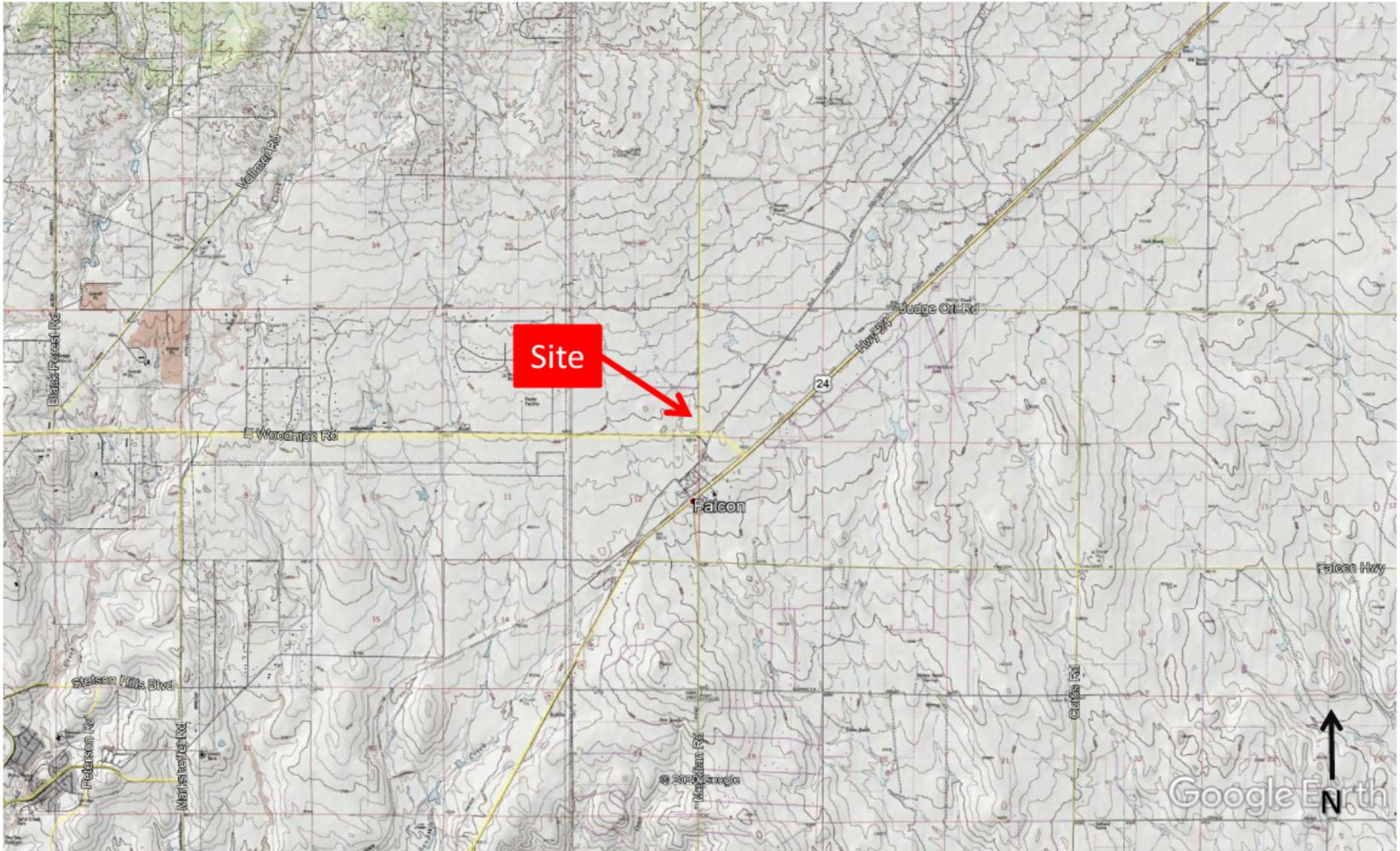


Falcon Marketplace

JOB NO. 5322095

Site Vicinity Map

FIGURE NO. 1a



Taken From USGS Map -



Falcon Marketplace

JOB NO. 5322095

Site Vicinity Map

FIGURE NO. 1b

● 1,404,100 ESALs *ACT A*  
SUB-REGIONAL POND SW4

● 2,280,644 ESALs

Thicker pavement section should extend to this location.

Thicker pavement section should extend to this location.

Google Earth

E Woodmen Rd  
2020 Google

Indicates Approximate location of Boring

Taken from Proposal Documentation

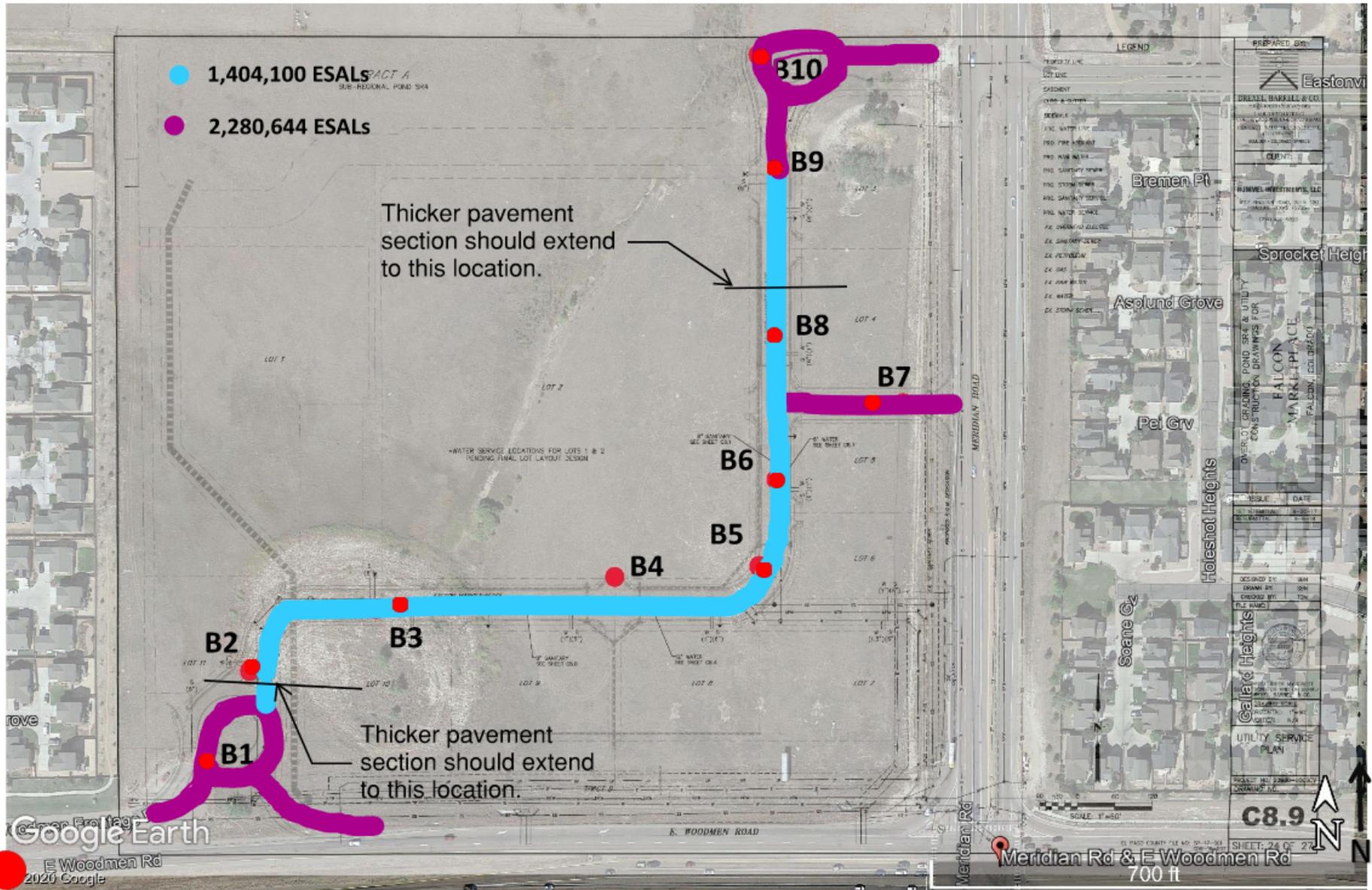
intertek  
psi

Falcon Marketplace

JOB NO. 5322095

Boring Location Map

FIGURE NO. 2



700 ft

FIGURE: 3

DATE STARTED: 9/15/20	DRILL COMPANY: Dakota Drilling	<b>BORING B 1</b>
DATE COMPLETED: 9/15/20	DRILLER: RR      LOGGED BY: BP	
COMPLETION DEPTH: 5.0 ft	DRILL RIG: CME-55	<b>Water</b> <input type="checkbox"/> While Drilling      Not Observed <input type="checkbox"/> Upon Completion      Not Observed <input type="checkbox"/> Delay      N/A
BENCHMARK: N/A	DRILLING METHOD: Solid Stem Auger	<b>BORING LOCATION:</b> See Figure 2
ELEVATION: N/A	SAMPLING METHOD: Modified California	
LATITUDE: 38.9418°	HAMMER TYPE: Manual	
LONGITUDE: -104.6093°	EFFICIENCY: N/A	
STATION: N/A      OFFSET: N/A	REVIEWED BY: KD	
REMARKS:		

Elevation (feet)	Depth (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	STANDARD PENETRATION TEST DATA N in blows/ft ⊙ Moisture, % × Moisture      ◻ PL ⊕ LL	STRENGTH, tsf ▲ Qu      * Qp	Additional Remarks
0						<b>SILTY SAND</b> - Fine to coarse grained sand, moist, brown/dark brown, medium dense	SM			
	1			1	12		9-8 N=17			DD = 103 pcf Non-Plastic
						<b>POORLY GRADED SAND WITH SILT</b> - Fine to coarse grained sand, moist, light brown, loose	SP-SM			
	2			2	12		7-4 N=11			DD = 82 pcf GRAD: -200 = 11.6% SP-SM
5										

	Professional Service Industries, Inc. 1070 West 124th Avenue, Suite 800 Westminster, CO 80234 Telephone: (303) 424-5578	PROJECT NO.: 05322095
		PROJECT: Falcon Marketplace Roads
		LOCATION: Meridian & Woodmen Falcon, CO

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 4

DATE STARTED: 9/15/20	DRILL COMPANY: Dakota Drilling	<b>BORING B 2</b>
DATE COMPLETED: 9/15/20	DRILLER: RR    LOGGED BY: BP	
COMPLETION DEPTH: 5.0 ft	DRILL RIG: CME-55	<b>Water</b> <input type="checkbox"/> While Drilling    Not Observed <input type="checkbox"/> Upon Completion    Not Observed <input type="checkbox"/> Delay    N/A
BENCHMARK: N/A	DRILLING METHOD: Solid Stem Auger	<b>BORING LOCATION:</b> See Figure 2
ELEVATION: N/A	SAMPLING METHOD: Modified California	
LATITUDE: 38.9418°	HAMMER TYPE: Manual	
LONGITUDE: -104.6093°	EFFICIENCY: N/A	
STATION: N/A    OFFSET: N/A	REVIEWED BY: KD	
REMARKS:		

Elevation (feet)	Depth (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ⊙ × Moisture    ◻ PL ⊕ LL ▲ Qu    * Qp	Additional Remarks
0						<b>SILTY SAND</b> - Fine to coarse grained sand, moist, dark brown, medium dense				
				1	12		SM			DD = 112 pcf -200 = 16.9%
				2	12	<b>CLAY</b> - Fine grained sand, moist, gray-brown, medium stiff	CL			DD = 96 pcf -200 = 85.5%
5										



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 Telephone: (303) 424-5578

PROJECT NO.: 05322095  
 PROJECT: Falcon Marketplace Roads  
 LOCATION: Meridian & Woodmen  
 Falcon, CO

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 5

DATE STARTED: 9/15/20	DRILL COMPANY: Dakota Drilling	<b>BORING B 3</b>
DATE COMPLETED: 9/15/20	DRILLER: RR      LOGGED BY: BP	
COMPLETION DEPTH: 4.0 ft	DRILL RIG: CME-55	<b>Water</b> ▽ While Drilling      Not Observed
BENCHMARK: N/A	DRILLING METHOD: Solid Stem Auger	▼ Upon Completion      Not Observed
ELEVATION: N/A	SAMPLING METHOD: Modified California	▽ Delay                      N/A
LATITUDE: 38.9418°	HAMMER TYPE: Manual	<b>BORING LOCATION:</b>
LONGITUDE: -104.6093°	EFFICIENCY: N/A	See Figure 2
STATION: N/A      OFFSET: N/A	REVIEWED BY: KD	
REMARKS:		

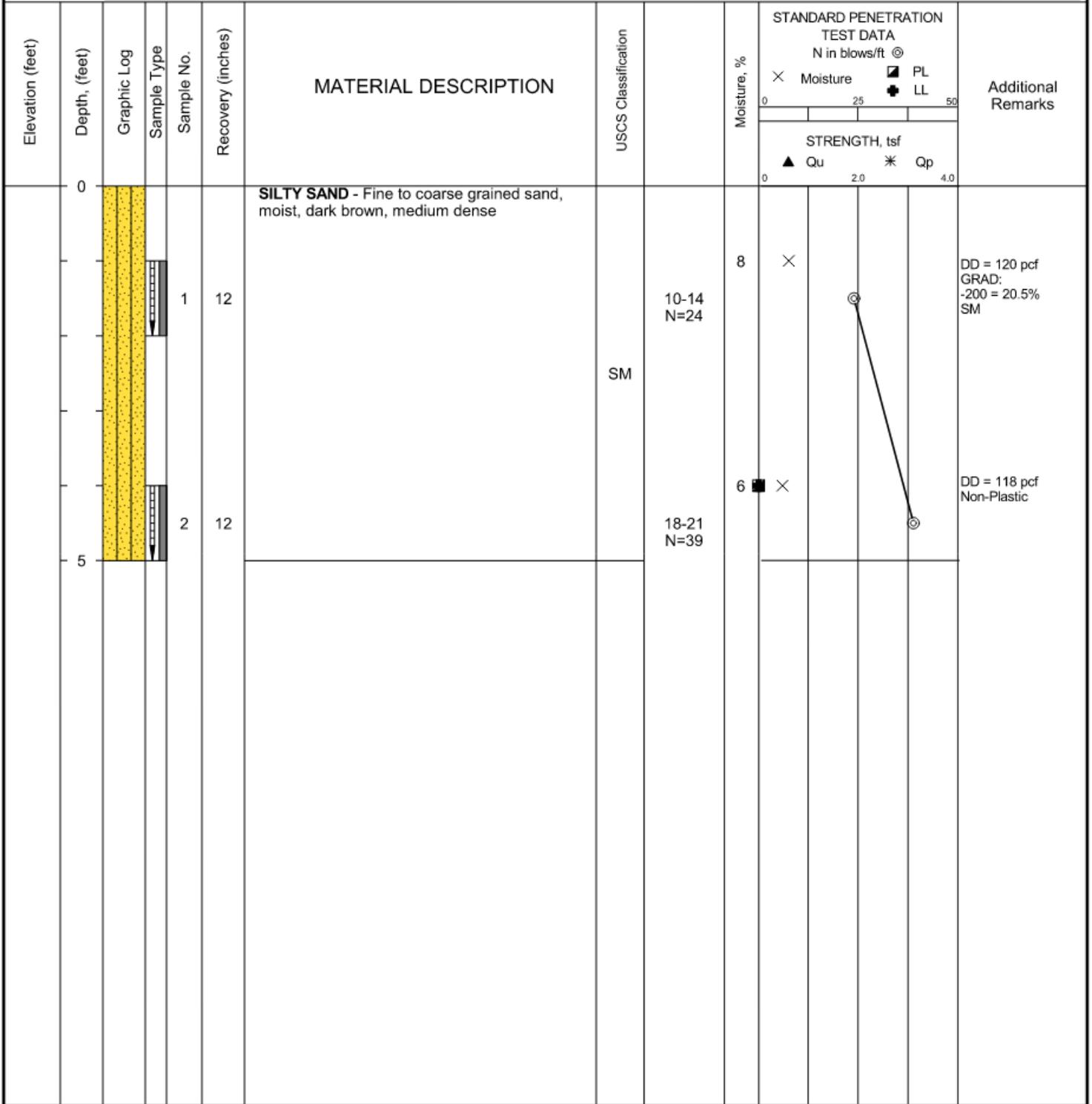
Elevation (feet)	Depth (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ⊙	Additional Remarks
0		[Graphic Log]		1	12	<b>SILTY SAND</b> - Fine to coarse grained sand, moist, dark brown, medium dense	SM	8	× Moisture      ⊙ PL ⊕ LL ▲ Qu      * Qp	DD = 122 pcf GRAD: -200 = 21.9% SM
						Reclaimed water line at 4'; boring terminated				

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		PROJECT: Falcon Marketplace Roads
		LOCATION: Meridian & Woodmen
		Falcon, CO

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 6

DATE STARTED: 9/15/20	DRILL COMPANY: Dakota Drilling	<b>BORING B 4</b>
DATE COMPLETED: 9/15/20	DRILLER: RR      LOGGED BY: BP	
COMPLETION DEPTH: 5.0 ft	DRILL RIG: CME-55	<b>Water</b> <input type="checkbox"/> While Drilling      Not Observed <input type="checkbox"/> Upon Completion      Not Observed <input type="checkbox"/> Delay      N/A
BENCHMARK: N/A	DRILLING METHOD: Solid Stem Auger	<b>BORING LOCATION:</b> See Figure 2
ELEVATION: N/A	SAMPLING METHOD: Modified California	
LATITUDE: 38.9418°	HAMMER TYPE: Manual	
LONGITUDE: -104.6093°	EFFICIENCY: N/A	
STATION: N/A      OFFSET: N/A	REVIEWED BY: KD	
REMARKS:		



	Professional Service Industries, Inc. 1070 West 124th Avenue, Suite 800 Westminster, CO 80234 Telephone: (303) 424-5578	PROJECT NO.: 05322095
		PROJECT: Falcon Marketplace Roads
		LOCATION: Meridian & Woodmen
		Falcon, CO

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 7

DATE STARTED: 9/15/20	DRILL COMPANY: Dakota Drilling	<b>BORING B 5</b>
DATE COMPLETED: 9/15/20	DRILLER: RR      LOGGED BY: BP	
COMPLETION DEPTH: 5.0 ft	DRILL RIG: CME-55	<b>Water</b> ▽ While Drilling      Not Observed
BENCHMARK: N/A	DRILLING METHOD: Solid Stem Auger	▼ Upon Completion      Not Observed
ELEVATION: N/A	SAMPLING METHOD: Modified California	▽ Delay                      N/A
LATITUDE: 38.9418°	HAMMER TYPE: Manual	<b>BORING LOCATION:</b>
LONGITUDE: -104.6093°	EFFICIENCY: N/A	See Figure 2
STATION: N/A      OFFSET: N/A	REVIEWED BY: KD	
<b>REMARKS:</b>		

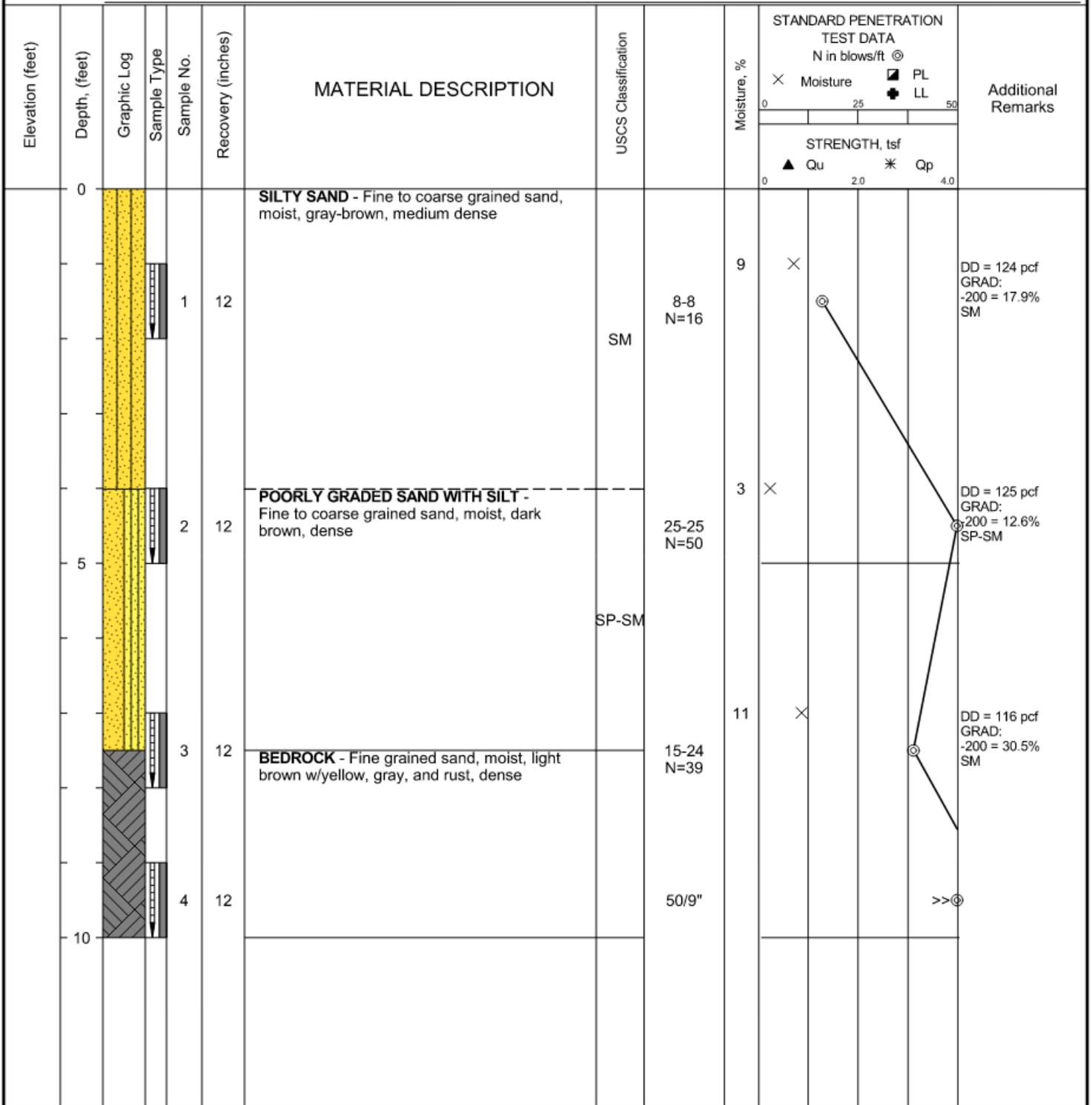
Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	Moisture, %	STANDARD PENETRATION TEST DATA N in blows/ft ⊙	Additional Remarks	
								× Moisture      ⊠ PL ⊕ LL			
									STRENGTH, tsf ▲ Qu      * Qp		
0						<b>SILTY SAND</b> - Fine to coarse grained sand, moist, brown/dark brown, medium dense					
				1	12		SM	8	×	⊙	DD = 127 pcf -200 = 17.3%
				2	12			6	×	⊙	DD = 117 pcf -200 = 15.8%
5											

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		Falcon, CO

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 8

DATE STARTED: 9/15/20	DRILL COMPANY: Dakota Drilling	<b>BORING B 6</b>
DATE COMPLETED: 9/15/20	DRILLER: RR      LOGGED BY: BP	
COMPLETION DEPTH: 10.0 ft	DRILL RIG: CME-55	<b>Water</b> <input type="checkbox"/> While Drilling      Not Observed <input type="checkbox"/> Upon Completion      Not Observed <input type="checkbox"/> Delay      N/A
BENCHMARK: N/A	DRILLING METHOD: Solid Stem Auger	<b>BORING LOCATION:</b> See Figure 2
ELEVATION: N/A	SAMPLING METHOD: Modified California	
LATITUDE: 38.9418°	HAMMER TYPE: Manual	
LONGITUDE: -104.6093°	EFFICIENCY: N/A	
STATION: N/A      OFFSET: N/A	REVIEWED BY: KD	
REMARKS:		



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FIGURE: 9

DATE STARTED: 9/15/20	DRILL COMPANY: Dakota Drilling	<b>BORING B 7</b>
DATE COMPLETED: 9/15/20	DRILLER: RR    LOGGED BY: BP	
COMPLETION DEPTH: 5.0 ft	DRILL RIG: CME-55	Water <input type="checkbox"/> While Drilling    Not Observed
BENCHMARK: N/A	DRILLING METHOD: Solid Stem Auger	<input checked="" type="checkbox"/> Upon Completion    Not Observed
ELEVATION: N/A	SAMPLING METHOD: Modified California	<input checked="" type="checkbox"/> Delay    N/A
LATITUDE: 38.9418°	HAMMER TYPE: Manual	<b>BORING LOCATION:</b>
LONGITUDE: -104.6093°	EFFICIENCY: N/A	See Figure 2
STATION: N/A    OFFSET: N/A	REVIEWED BY: KD	
REMARKS:		

Elevation (feet)	Depth (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	Moisture, %	STRENGTH, tsf	Additional Remarks
0						APPARENT FILL - Dark brown, odorous				
				1	12	SILTY SAND - Fine to coarse grained sand, moist, brown, medium dense	SM	10-15 N=25		DD = 125 pcf -200 = 19.8%
				2	12	POORLY GRADED SAND WITH SILT - Fine to coarse grained sand, moist, light brown, medium dense	SP-SM	9-14 N=23		-200 = 13.7%
5										



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 Falcon, CO

FIGURE: 10

DATE STARTED: 9/15/20	DRILL COMPANY: Dakota Drilling	<b>BORING B 8</b>
DATE COMPLETED: 9/15/20	DRILLER: RR      LOGGED BY: BP	
COMPLETION DEPTH: 5.0 ft	DRILL RIG: CME-55	<b>Water</b> ▽ While Drilling      Not Observed
BENCHMARK: N/A	DRILLING METHOD: Solid Stem Auger	▼ Upon Completion      Not Observed
ELEVATION: N/A	SAMPLING METHOD: Modified California	▽ Delay                      N/A
LATITUDE: 38.9418°	HAMMER TYPE: Manual	<b>BORING LOCATION:</b>
LONGITUDE: -104.6093°	EFFICIENCY: N/A	See Figure 2
STATION: N/A      OFFSET: N/A	REVIEWED BY: KD	
REMARKS:		

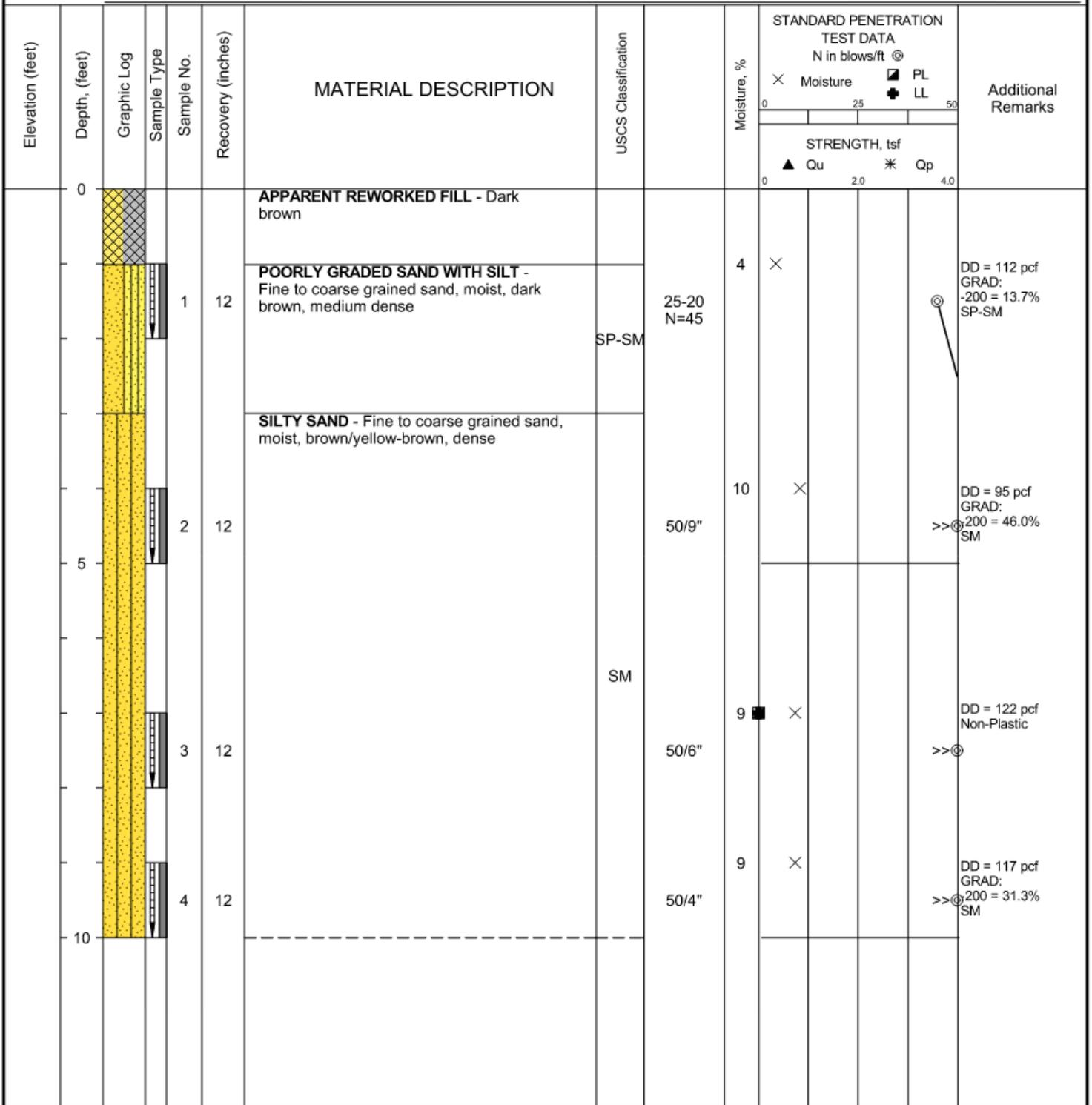
Elevation (feet)	Depth (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	Moisture, %	STRENGTH, tsf	Additional Remarks
0						<b>SILTY SAND</b> - Fine to coarse grained sand, moist, dark brown, dense				
				1	12		SM	4		DD = 108 pcf -200 = 16.7% ->>⊕
				2	12	<b>POORLY GRADED SAND WITH SILT</b> - Fine to coarse grained sand, moist, brown, dense	SP-SM	5		DD = 121 pcf -200 = 14.8% ->>⊕
5										

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		PROJECT: Falcon Marketplace Roads
		LOCATION: Meridian & Woodmen
		Falcon, CO

The stratification lines represent approximate boundaries. The transition may be gradual.

FIGURE: 11

DATE STARTED: 9/15/20	DRILL COMPANY: Dakota Drilling	<b>BORING B 9</b>
DATE COMPLETED: 9/15/20	DRILLER: RR    LOGGED BY: BP	
COMPLETION DEPTH: 10.0 ft	DRILL RIG: CME-55	Water <input type="checkbox"/> While Drilling    Not Observed
BENCHMARK: N/A	DRILLING METHOD: Solid Stem Auger	<input type="checkbox"/> Upon Completion    Not Observed
ELEVATION: N/A	SAMPLING METHOD: Modified California	<input type="checkbox"/> Delay    N/A
LATITUDE: 38.9418°	HAMMER TYPE: Manual	<b>BORING LOCATION:</b>
LONGITUDE: -104.6093°	EFFICIENCY: N/A	See Figure 2
STATION: N/A    OFFSET: N/A	REVIEWED BY: KD	
REMARKS:		



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Westminster, CO 80234  
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PROJECT NO.: 05322095  
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LOCATION: Meridian & Woodmen  
Falcon, CO

FIGURE: 12

DATE STARTED: 9/15/20	DRILL COMPANY: Dakota Drilling	<b>BORING B10</b>
DATE COMPLETED: 9/15/20	DRILLER: RR    LOGGED BY: BP	
COMPLETION DEPTH: 5.0 ft	DRILL RIG: CME-55	Water <input type="checkbox"/> While Drilling    Not Observed
BENCHMARK: N/A	DRILLING METHOD: Solid Stem Auger	<input type="checkbox"/> Upon Completion    Not Observed
ELEVATION: N/A	SAMPLING METHOD: Modified California	<input type="checkbox"/> Delay    N/A
LATITUDE: 38.9418°	HAMMER TYPE: Manual	<b>BORING LOCATION:</b>
LONGITUDE: -104.6093°	EFFICIENCY: N/A	See Figure 2
STATION: N/A    OFFSET: N/A	REVIEWED BY: KD	
REMARKS:		

Elevation (feet)	Depth (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	USCS Classification	Moisture, %	STRENGTH, tsf	Additional Remarks
0						APPARENT REWORKED FILL - Dark brown				
				1	12	POORLY GRADED SAND WITH SILT - Fine to coarse grained sand, moist, light brown, medium dense	15-17 N=32  SP-SM	8	<input type="checkbox"/> Moisture <input type="checkbox"/> PL <input type="checkbox"/> LL	DD = 122 pcf -200 = 14.9%
				2	12		10-15 N=25	5	<input type="checkbox"/> Qu <input type="checkbox"/> Qp	DD = 116 pcf -200 = 13.9%
5										



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LOCATION: Meridian & Woodmen  
Falcon, CO

# KEY TO SYMBOLS



Apparent Fill



USCS Silty Sand



USCS Poorly-graded Sand with Silt



USCS Low Plasticity Clay



Bedrock

SSA = Solid Stem Auger

HSA = Hollow Stem Auger

CFA = Continuous Flight Auger

SPT = Standard Penetration Test

MC - Modified California Sampler

SS = Split-spoon Sampler

ST = Shelby Tube Sampler

RC = Rock Core

DD = Dry Density

MC = Moisture Content

LL = Liquid Limit

PL = Plastic Limit

-200 = Percent Passing the  
No. 200 Sieve (%)S(250) = Swell under 250 psf  
surcharge pressure (%)S(500) = Swell under 500 psf  
surcharge pressure (%)S(1000) = Swell under 1000 psf  
surcharge pressure (%)Qu = Unconfined Compressive  
Strength

RQD = Rock Quality Designation

REC'D = Rock Core Recovery Percentage

PID = Photo Ionic Detector (ppm)

The borings were advanced into the ground using 4-inch solid stem augers. At regular intervals throughout the boring depths, soil samples were obtained with either a 1.4-inch I.D., 2.0-inch O.D., split-spoon sampler or a 2.0-inch I.D., 2.4-inch O.D. Modified California sampler. The samplers were first seated 6-inches to penetrate any loose cuttings and then driven an additional foot where possible with blows of a 140-pound hammer falling 30-inches. The number of hammer blows required to drive the sampler each 6-inch increment is recorded in the field. The penetration resistance "N-value" is redesignated as the number of hammer blows required to drive the sampler the final foot and, when properly evaluated, is an index to cohesion for clays and relative density for sands. N-values recorded on the boring logs are uncorrected. The split-spoon sampling procedures used during this exploration are in general accordance with ASTM Designation D 1586.

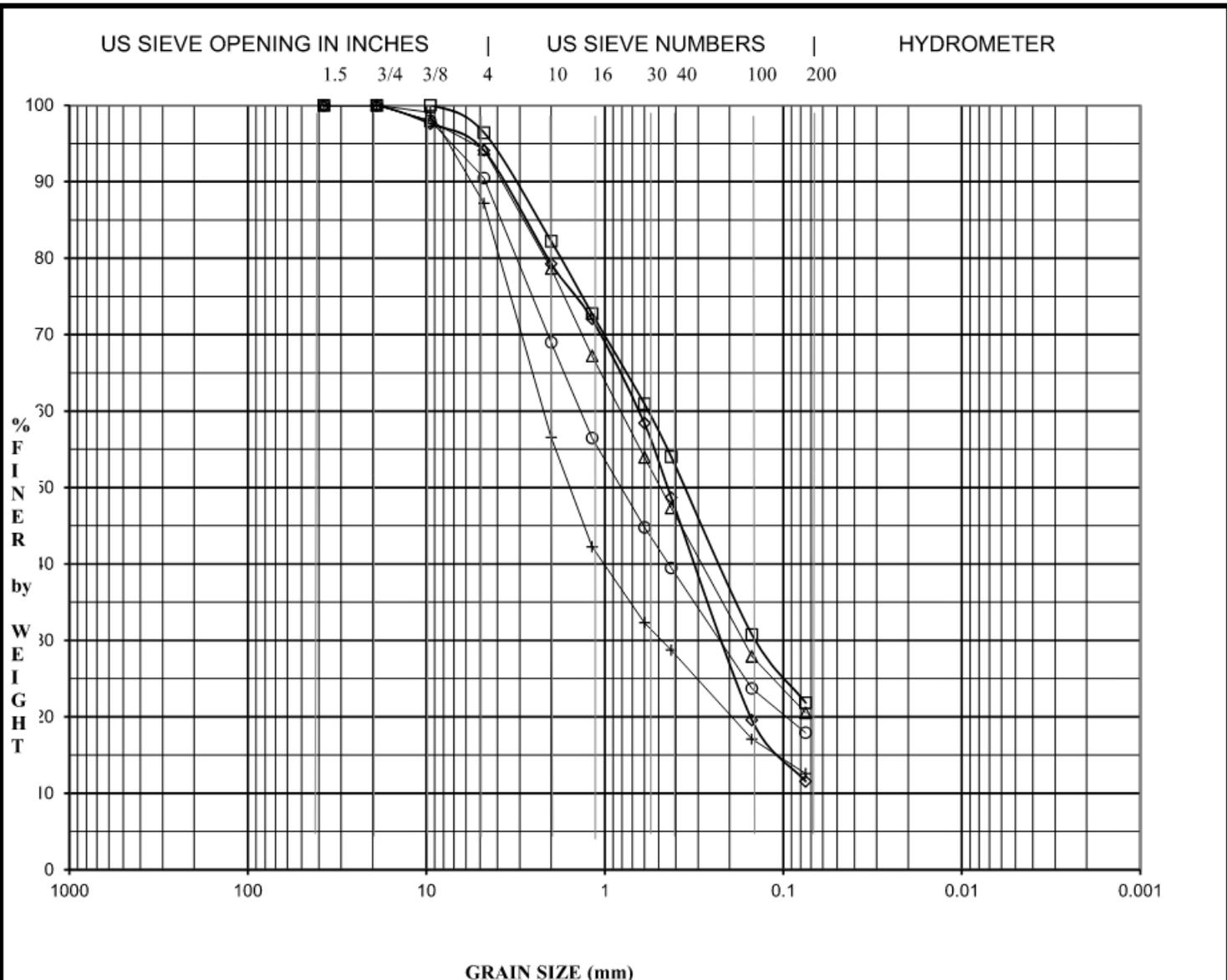


Professional Service Industries, Inc.  
1070 West 124th Avenue, Suite 800  
Westminster, CO 80234  
Telephone: (303) 424-5578  
Fax: (303) 423-5625

PSI Job No.: 05322095  
Project: Falcon Marketplace Roads  
Location: Meridian & Woodmen  
Falcon, CO

## **Appendix A**

### Laboratory Test Results

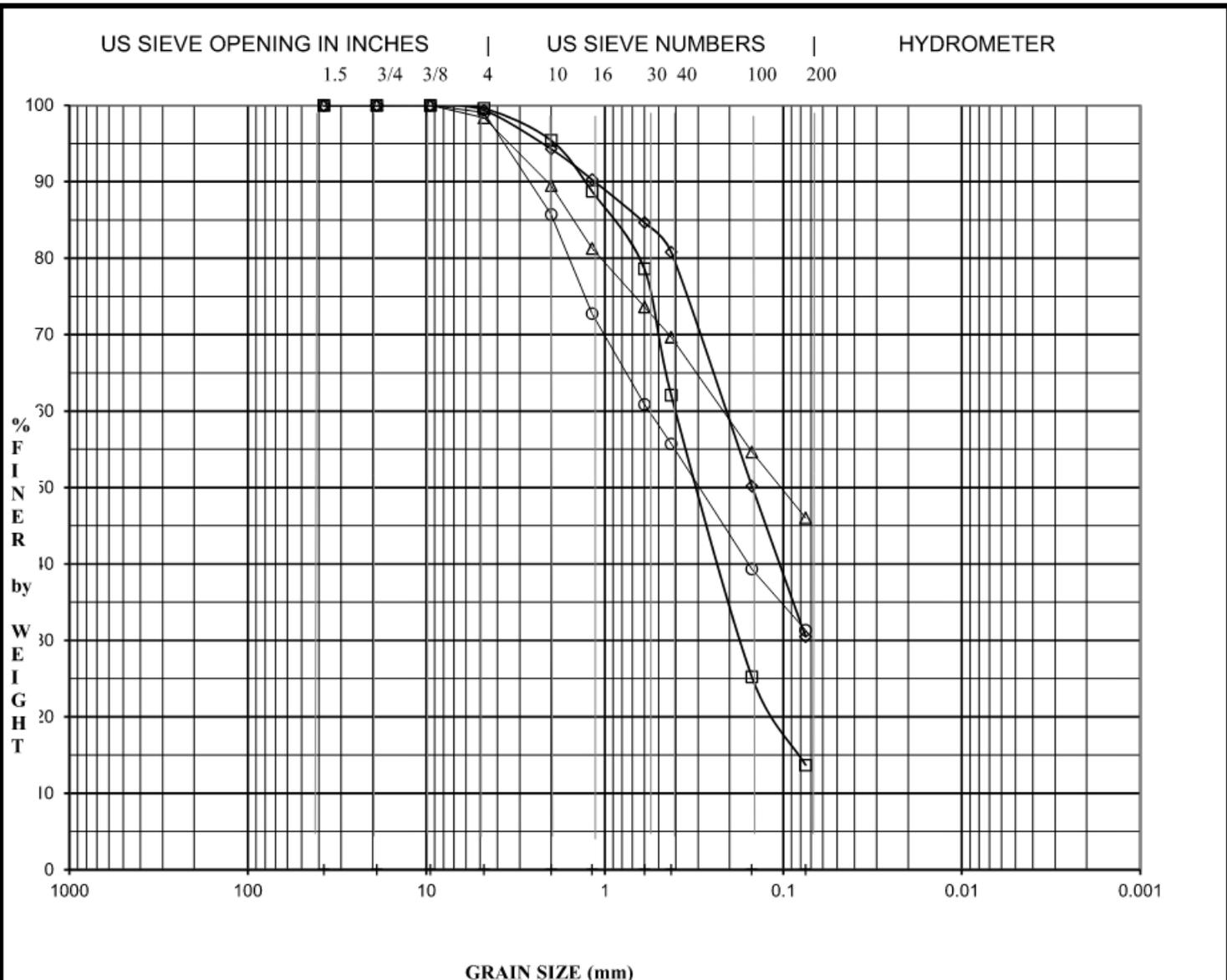


COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	CRS	MED	FINE	

Specimen I.D.	Description	USCS	AASHTO	Group Index	LL	PI	PL
◇ B1 @ 4 FEET	Poorly Graded Sand with Silt	SP-SM	A-1-b	0	NP	NP	NP
□ B3 @ 1 FEET	Silty Sand	SM	A-2-4	0	NP	NP	NP
△ B4 @ 1 FEET	Silty Sand	SM	A-1-b	0	NP	NP	NP
○ B6 @ 1 FEET	Silty Sand	SM	A-1-b	0	NP	NP	NP
+ B6 @ 4 FEET	Silty Sand	SM	A-1-b	0	NP	NP	NP

Specimen I.D.	D100	D60	D30	D10	Cc	Cu	%Gravel	%Sand	%Silt&Clay
◇ B1 @ 4 FEET	19.00	0.67	0.248				6	83	12
□ B3 @ 1 FEET	9.50	0.58	0.144				4	75	22
△ B4 @ 1 FEET	19.00	0.86	0.180				6	74	21
○ B6 @ 1 FEET	19.00	1.41	0.260				10	73	18
+ B6 @ 4 FEET	19.00	2.31	0.487				13	75	13

	Falcon Marketplace	JOB NO. 5322095
	GRADATION CURVES	FIGURE NO. A1



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	CRS	MED	FINE	

Specimen I.D.	Description	USCS	AASHTO	Group Index	LL	PI	PL
◇ B6 @ 7 FEET	Silty Sand	SM	A-2-4	0	NP	NP	NP
□ B9 @ 1 FEET	Silty Sand	SM	A-2-4	0	NP	NP	NP
△ B9 @ 4 FEET	Silty Sand	SM	A-4	0	NP	NP	NP
○ B9 @ 10 FEET	Silty Sand	SM	A-2-4	0	NP	NP	NP
+							

Specimen I.D.	D100	D60	D30	D10	Cc	Cu	%Gravel	%Sand	%Silt&Clay
◇ B6 @ 7 FEET	9.50	0.24					1	69	30
□ B9 @ 1 FEET	9.50	0.41	0.186				0	86	14
△ B9 @ 4 FEET	9.50	0.25					2	52	46
○ B9 @ 10 FEET	9.50	0.57					1	68	31
+									

	Falcon Marketplace	JOB NO. 5322095
	GRADATION CURVES	FIGURE NO. A2

**REPORT OF MOISTURE DENSITY RELATIONSHIP OF SOIL**

Tested For: Evergreen Devco, Inc.

Project Name: Falcon Marketplace

Sample Date: September 18, 2020

Project No. 05322095-1

Report No. 1

Sample No. 1

Sample Source: 1

Sample Classification: A-2-4 ( 0 ) SM Silty SAND

General Description:

Test Method: ASTM D698 Method B

Rammer: Manual

Method of Preparation: Dry

Atterberg Limits (AASHTO T-89/T-90)

LL: NL PL: NP PI: NP

Specific Gravity: 2.65 Estimate

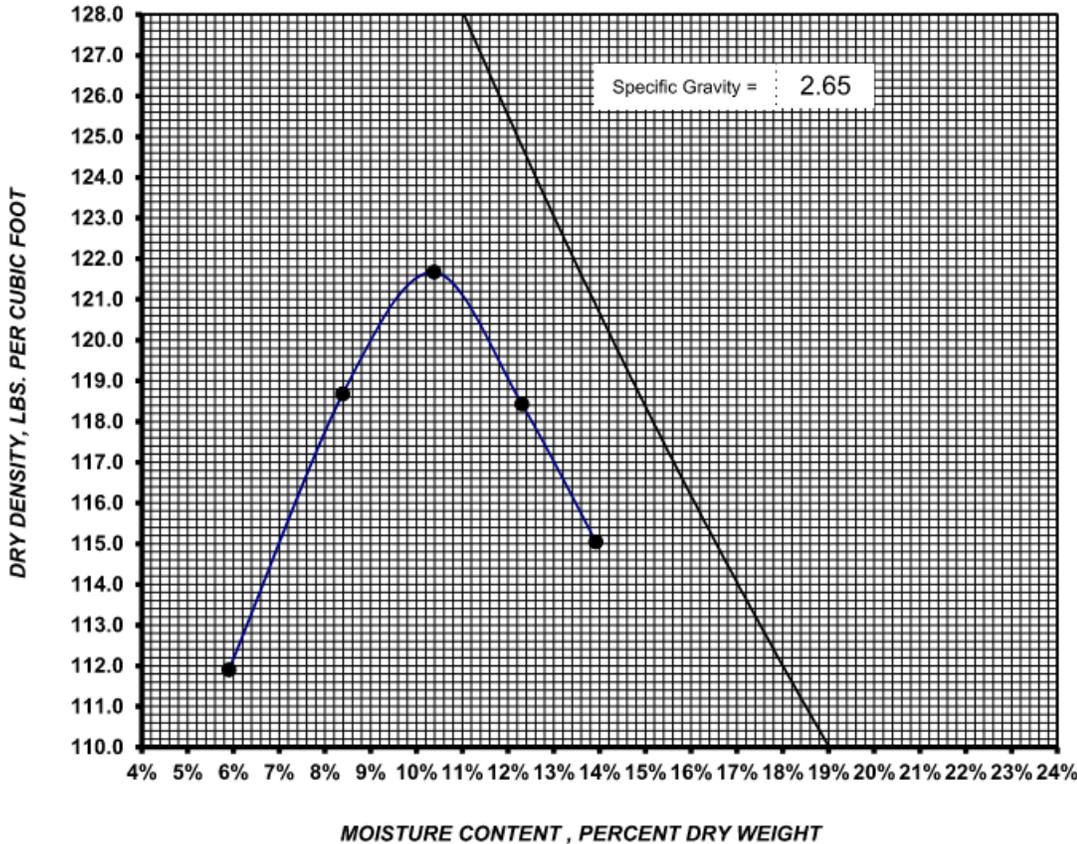
Maximum Dry Density (pcf): 121.7

Optimum Moisture Content (%): 10.4

**Grain Size Analysis**

(ASTM C136 and/ or C117)

Sieve Size	Percent Passing
3"	100
3"	100
1 1/2"	100
3/4"	100
1/2"	100
3/8"	100
No. 4	98
No. 8	89
No. 10	84
No. 16	79
No. 30	67
No. 40	59
No. 50	51
No. 100	34
No. 200	25



Respectfully Submitted,  
**Professional Service Industries, Inc.**

Remarks:

Lab Tech: TH

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## **Appendix B**

Pavement Design

# WinPAS

Pavement Thickness Design According to  
**1993 AASHTO Guide for Design of Pavements Structures**  
American Concrete Pavement Association

## Flexible Design Inputs

Project Name: Falcon Marketplace  
Route:  
Location: Falcon, Colorado  
Owner/Agency:  
Design Engineer:

## Flexible Pavement Design/Evaluation

Structural Number	3.58	Subgrade Resilient Modulus	5,850.00 psi
Total Flexible ESALs	1,404,100	Initial Serviceability	4.50
Reliability	85.00 percent	Terminal Serviceability	2.00
Overall Standard Deviation	0.45		

## Layer Pavement Design/Evaluation

Layer Material	Layer Coefficient	Drainage Coefficient	Layer Thickness	Layer SN
Asphalt Cement Concrete	0.44	1.00	5.50	2.42
Graded Stone Base	0.11	1.00	10.50	1.16
			$\Sigma$ SN	3.58

# WinPAS

Pavement Thickness Design According to  
**1993 AASHTO Guide for Design of Pavements Structures**  
American Concrete Pavement Association

## Flexible Design Inputs

Project Name: Falcon Marketplace  
Route: Falcon Market Place  
Location: Falcon, Colorado  
Owner/Agency:  
Design Engineer: New Roadways within the Falcon Marketplace Develop

## Flexible Pavement Design/Evaluation

<b>Structural Number</b>	3.96	<b>Subgrade Resilient Modulus</b>	5,850.00 psi
<b>Total Flexible ESALs</b>	2,280,644	<b>Initial Serviceability</b>	4.50
<b>Reliability</b>	85.00 percent	<b>Terminal Serviceability</b>	2.00
<b>Overall Standard Deviation</b>	0.45		

## Layer Pavement Design/Evaluation

Layer Material	Layer Coefficient	Drainage Coefficient	Layer Thickness	Layer SN
Asphalt Cement Concrete	0.44	1.00	6.00	2.64
Graded Stone Base	0.12	1.00	10.50	1.26
			$\Sigma$ SN	3.90