ENTECH
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# SOIL, GEOLOGY, & GEOLOGIC HAZARD STUDY
# ROLLIN RIDGE ESTATES
# HODGEN ROAD AND HIGHWAY 83 – SOUTHWEST CORNER
# EL PASO COUNTY, COLORADO

Per Drainage Criteria Manual chapter 11 Section 11.3.3. Provide recommendations for the foundation preparation and embankment construction for all permanent detention facilities.

Prepared for:

**Carl Turse**
17572 Colonial Park Drive
Monument, Colorado 80132

November 12, 2019

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Logan L. Langford, P.G.
Geologist

LLL/nc

Encl.

Entech Job No. 170837
AAprojects/2017/170837 countysoil/geo/ww

Reviewed by:

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

COLORADO LICENSED
JOSEPH COLLIN GOODE
23725
11/12/19
PROFESSIONAL ENGINEER

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# 1.0 SUMMARY

### *Project Location*

The project lies in a portion of the NE¼ of the NW¼ and the NW¼ of the NE¼ of Section 27, Township 11 South, Range 66 West of the 6th Principal Meridian in El Paso County, Colorado. The site is located approximately 4½ miles southeast of Monument, Colorado.

### *Project Description*

Total acreage involved in the project is approximately 57 acres. The proposed site development consists of sixteen single-family rural residential lots and three commercial lots. The development will utilize individual wells and on-site wastewater treatment systems.

### *Scope of Report*

This report presents the results of our geologic evaluation, treatment of engineering geologic hazard study for individual on-site wastewater treatment systems.

### *Land Use and Engineering Geology*

This site was found to be suitable for the proposed development. Areas were encountered where the geologic conditions will impose some constraints on development and land use. These include areas of artificial fill, expansive soils, and seasonal shallow groundwater areas. Based on the proposed development plan, it appears that these areas will have some impact on the development. These conditions will be discussed in greater detail in the report.

In general, it is our opinion that the development can be achieved if the observed geologic conditions on site are either avoided or properly mitigated. All recommendations are subject to the limitations discussed in the report.

## 2.0 GENERAL SITE CONDITIONS AND PROJECT DESCRIPTION

The site is located in a portion of the NE¼ of the NW¼ and the NW¼ of the NE¼ of Section 27, Township 11 South, Range 66 West of the 6th Principal Meridian in El Paso County, Colorado. The site is located approximately 4½ miles northeast of Monument, Colorado, southwest of Hodgen Road and Highway 83. The location of the site is as shown on the Vicinity Map, Figure 1.

The topography of the site consists of rolling hills that vary from gradually to moderately sloping generally to the northwest and northeast, with steep slopes along the man-made dam in the northeastern portion of the site. The drainages on site flow in northerly direction through the eastern portion of the site. Water was not observed in the pond or drainages at the time of this investigation. The site boundaries are indicated on the USGS Map, Figure 2. Previous land uses have included grazing and pasture land. The site contains primarily field grasses and weeds with areas of ponderosa pines in the southwestern and western portion of the site. An existing house is located on Lot 8 which will remain. Several pole barns are located around the area of the house and will be removed. An existing septic system and water well are located at the house. El Paso County Health Department records for the septic are included in Appendix F. Site photographs, taken June 27 and July 10, 2017, are included in Appendix A.

Total acreage involved in the proposed development is approximately 57 acres. Sixteen single-family rural residential lots are proposed and three commercial lots. The proposed lots are approximately 2.5 to 2.8 acres each. The area will be serviced by individual wells and on-site wastewater treatment systems. The proposed Development Plan/Test Boring Location Map is presented in Figure 3.

## 3.0 SCOPE OF THE REPORT

The scope of the report will include the following:

- A general geologic analysis utilizing published geologic data. Detailed site-specific mapping will be conducted to obtain general information in respect to major geographic and geologic features, geologic descriptions and their effects on the development of the property.

# 4.0 FIELD INVESTIGATION

Our field investigation consisted of the preparation of a geologic map of any bedrock features and significant surficial deposits. The Natural Resource Conservation Service (NRCS), previously the Soil Conservation Service (SCS) survey was also reviewed to evaluate the site. The position of mappable units within the subject property are shown on the Geologic Map. Our mapping procedures involved both field reconnaissance and measurements and air photo reconnaissance and interpretation. The same mapping procedures have also been utilized to produce the Geology/Engineering Geology Map which identified pertinent geologic conditions affecting development. The field mapping was performed by personnel of Entech Engineering, Inc. on July 10, 2017.

Two (2) percolation tests, and fourteen (14) test pits were performed on the site to determine general suitability of the site for the use of on-site wastewater treatment systems. Ten test pits were excavated in the three commercial lots for OWTS evaluations. The locations of the percolation tests, test borings, and test pits are indicated on the Development Plan/Test Boring Location Map, Figure 3. The Profile Hole and Test Pit Logs are presented in Appendix B. Results of this testing will be discussed later in this report.

Laboratory testing was also performed on some of the soils to classify and determine the soils engineering characteristics. Laboratory tests included grain-size analysis, ASTM D-422, and Atterberg Limits, ASTM D-4318. Results of the laboratory testing are included in Appendix C. A Summary of Laboratory Test Results is presented in Table 1.

# 5.0 SOIL, GEOLOGY AND ENGINEERING GEOLOGY

## *5.1 General Geology*

Physiographically, the site lies in the western portion of the Great Plains Physiographic Province along the Palmer Divide. Approximately 8 miles to the west is a major structural feature known as the Rampart Range Fault. This fault marks the boundary between the Great Plains Physiographic Province and the Southern Rocky Mountain Province. The site exists within the southeastern edge of a large structural feature known as the Denver Basin. Bedrock in the area tends to be very gently dipping in a northeasterly direction (Reference 1). The rocks in the area of the site are sedimentary in nature and typically Tertiary to Upper Cretaceous in age. The bedrock underlying the site consists of the Dawson Arkose Formation. Overlying this formation are unconsolidated deposits of residual soils, man-made, and alluvial soils of the Quaternary Age. The residual soils are produced by the in-situ action of weathering of the bedrock on site. The alluvial soils were deposited by water in the major drainages on site and as stream terraces on some of the ridge lines. Man-made soils exist as earthen dams and erosion berms. The site's stratigraphy will be discussed in more detail in Section 5.3.

## *5.2 Soil Conservation Survey*

The Natural Resource Conservation Service (Reference 2), previously the Soil Conservation Service (Reference 3) has mapped four soil types on the site (Figure 4). In general, they vary from gravelly loamy sand to sandy loam. The soils are described as follows:

| Type | Description |
|---|---|
| 21 | Cruckton Sandy Loam, 1-9% slopes |
| 28 | Ellicott Loamy Coarse Sand, 0-5% slopes |
| 41 | Kettle Gravelly Loamy Sands, 8-40% slopes |
| 68 | Peyton-Pring Complex, 3-8% slopes |

Complete descriptions of each soil type are presented in Appendix D. The soils have generally been described to typically have moderate to moderately rapid permeabilities. Roads may need to be designed to minimize frost-heave potential. Possible hazards with soil erosion are present on the site. The erosion potential can be controlled with vegetation. The majority of the soils have been described to have slight to moderate erosion hazards.

### *5.3 Site Stratigraphy*

The Monument Quadrangle Geology Map showing the site is presented in Figure 5 (Reference 4). The Geology Map prepared for the site is presented in Figure 6. Four mappable units were identified on this site which are described as follows:

**Qal** **Recent Alluvium of Holocene Age:** These are recent deposits that have been deposited along the drainage that exist on-site. These materials typically consist of silty to clayey sands and sandy clays. Some of these alluviums contain highly organic soils.

**Qaf** **Recent Artificial Fill of Holocene Age:** These are man-made fill deposits associated with erosion berms and earthen dams on-site.

**QTa** **Alluvium of Palmer Divide of Pleistocene Age:** These materials consist of water-deposited stream terrace deposits. They typically consist of silty to clayey sands with gravelly lenses and may contain areas of pebble and cobble lenses.

**Tkd** **Dawson Formation of Tertiary to Cretaceous Age:** The Dawson formation typically consists of arkosic sandstone with interbedded fine-grained sandstone, siltstone and claystone. Overlying this formation is a variable layer of residual soil. The residual soils were derived from the in-situ weathering of the bedrock materials on-site. These soils consisted of silty to clayey sands, sandy clays and sandy silts.

The soils listed above were mapped from site-specific mapping, the *Geologic Map of the Monument Quadrangle* distributed by the Colorado Geological Survey in 2003 (Reference 4), the *Geologic Map of the Colorado Springs-Castle Rock Area*, distributed by the US Geological Survey in 1979 (Reference 5), and the *Geologic Map of the Denver $1^0$ x $2^0$ Quadrangle*, distributed by the US Geological Survey in 1981 (Reference 6). The Test Pits and Profile Holes were also used in evaluating the site and are included in Appendix B. The Geology Map prepared for the site is presented in Figure 6.

### *5.4 Soil Conditions*

The soils encountered in the Profile Holes can be grouped into three general soil and rock types. The profile hole soils were classified using the Unified Soil Classification System (USCS). The soils encountered in the Test Pits can be grouped into three general soil types. The test pit soils were classified using the USDA Textural Soil Classification.

Soil Type 1 is a very sandy to sandy clay and silty clay loam (CL, ML). This material was encountered in both of the profile holes and in six of the test pits. The clay and silt soils were encountered at the existing surface and extended to depths ranging from 3 to 10 feet bgs. These soils were encountered at soft to firm states and at dry to moist conditions. Samples tested had 55 to 73 percent passing the No. 200 Sieve. FHA Swell Testing on a sample of sandy clay resulted in an expansion pressure of 430 psf, which is in the low expansion range.

Soil Type 2 is a clayey sand, sandy loam, and slightly silty to silty sand (SC, SM-SW). This material was encountered in Profile Hole No. 1 and in eight of the test pits. The sands were encountered at depths ranging from the existing surface grade to 3 feet and extended to depths ranging from 5 to 12 feet. The sands were encountered at medium dense to states and dry to moist conditions. Samples tested had 6 to 40 percent passing the No. 200 sieve. FHA Swell Testing on a sample of clayey sand resulted in an expansion pressure of 556 psf, which is in the low expansion range.

Soil Type 3 is a slightly silty to silty sandstone and clayey sandstone (SM-SW, SM, SC). This material was encountered in Profile Hole No. 2 and in eleven of the test pits. The sandstone was encountered at depths ranging from the 1 to 12 feet and extended to the termination of the profile hole (20 feet) and test pits (8 to 9 feet). The sandstone was encountered at dense to very dense states and moist conditions. Samples tested had 9 to 25 percent passing the No. 200 sieve. The sandstones are typically non-expansive, however; expansive clayey sandstone and claystone are common in the area.

The Test Boring Logs and the Profile Hole Logs are presented in Appendix B. Laboratory Test Results are presented in Appendix C. A Summary of Laboratory Test Results is presented in Table 1.

### *5.5 Groundwater*

Groundwater was not encountered in the profile holes which were drilled to 10 to 20 feet. Signs of seasonally occurring groundwater was observed in ten of the test pits at depths ranging from 5 to 8 feet. Areas of seasonal shallow groundwater and ponded water have been mapped in low-lying areas and in the drainage on-site. These areas are discussed in the following section. Fluctuation in groundwater conditions may occur due to variations in rainfall and other factors not readily apparent at this time.

It should be noted that in the sandy materials on site, some groundwater conditions might be encountered due to the variability in the soil profile. Isolated sand and gravel layers within the soils, sometimes only a few feet in thickness and width, can carry water in the subsurface. Groundwater may also flow on top of the underlying bedrock. Builders and planners should be cognizant of the potential for the occurrence of such subsurface water features during construction on-site and deal with each individual problem as necessary at the time of construction.

## 6.0 ENGINEERING GEOLOGY – IDENTIFICATION AND MITIGATION OF GEOLOGIC HAZARDS

As mentioned previously, detailed mapping has been performed on this site to produce an Geology/Engineering Geology Map (Figure 6). This map shows the location of various geologic conditions of which the developers should be cognizant during the planning, design and construction stages of the project. These hazards and the recommended mitigation techniques are as follows:

Artificial Fill
These are man-made fill deposits associated with erosion berms and the earthen dam on-site.

Mitigation: The earthen dam will be avoided by the development, and the small erosion berms can easily be removed or penetrated by foundations. Should any uncontrolled fill be encountered beneath foundations, removal and recompaction at 95% of its maximum Modified Proctor Dry Density, ASTM D-1557 will be required.

Expansive Soils

Expansive soils were encountered in the test borings drilled and test pits excavated on–site. Expansive claystone is commonly encountered within the Dawson Formation. These occurrences are typically sporadic; therefore, none have been indicated on the maps. These expansive, if encountered beneath foundations, can cause differential movement in the structure foundation. These occurrences should be identified and mitigated on an individual basis.

Mitigation: Should expansive soils be encountered beneath the foundation, mitigation will be necessary. Mitigation of expansive soils will require special foundation design. Overexcavation and replacement with non-expansive soils at a minimum of 95% of its maximum Modified Proctor Dry Density, ASTM D-1557 is a suitable mitigation, which is common in the area. Another alternative in areas of highly expansive soils is the use of drilled pier foundation systems. Typical minimum pier depths are on the order of 20 feet or more and require penetration into the bedrock material a minimum of 4 to 6 feet, depending upon building loads. Floor slabs on expansive soils should be expected to experience movement. Overexcavation and replacement has been successful in minimizing slab movements. The use of structural floors should be considered for basement construction on highly expansive clays. Final recommendations should be determined after additional investigation of each building site.

Floodplain and Seasonal Shallow Groundwater Area

Update reference to the latest FIRM Map

The site is not mapped within any floodplains according to the FEMA Map No. 08041CO285F, dated March 17, 1997 (Figure 7, Reference 7). Areas of seasonal shallow groundwater were observed across the site. In these areas, we would anticipate the potential for periodically high subsurface moisture conditions and frost heave potential. These areas lie within low-lying areas along the drainage in the eastern portion of the site and in the low-lying area in the northwest corner of the site, and the pond located in the northeastern portion of the site. Water was not observed in any of the drainages or the pond at the time of our site investigation. These areas can likely be avoided or properly mitigated by development. The potential exists for high groundwater levels during high moisture periods and should structures encroach on these areas the following precautions should be followed.

Mitigation: Foundations must have a minimum 30-inch depth for frost protection. In areas where high subsurface moisture conditions are anticipated periodically, subsurface perimeter drains are recommended to help prevent the intrusion of water into areas below grade. Typical drain details are presented in Figure 8. Any grading in these areas should be done to direct surface flow around construction to avoid areas of ponded water. All organic material would be completely removed prior to any fill placement. Specific drainage studies are beyond the scope of this report.

### *6.1 Relevance of Geologic Conditions to Land Use Planning*

As mentioned earlier in this report, we understand that the development will be rural residential and commercial. It is our opinion that the existing geologic and engineering geologic conditions will impose some minor constraints on the proposed development and construction. The most significant problems affecting development will be those associated with the drainages on site that can be avoided or properly mitigated during site grading. Other hazards on site may be satisfactorily mitigated through proper engineering design and construction practices.

The upper materials are typically at medium dense states and firm consistencies. The granular soils encountered in the upper soil profiles of the profile holes and test pits should provide good support for foundations. Expansive soils although sporadic were encountered. Expansive clayey sandstone and claystone is common in the Dawson Formation, and may require mitigation. Foundations anticipated for the site are standard spread footings possibly in conjunction with overexcavation in areas of expansive soils or loose soils. Areas containing arkosic sandstone will have high allowable bearing conditions. Difficult excavation should be anticipated in areas of shallow bedrock. Expansive layers may also be encountered in the soil and bedrock on this site. Areas of expansive soils encountered on site are sporadic; therefore, none have been indicated on the maps. Expansive soils, if encountered, will require special foundation design and/or overexcavation. These soils will not prohibit development.

Areas of seasonal shallow groundwater and potentially seasonal shallow groundwater were encountered on site. A pond and earthen dam are located in the northeastern portion of the site. Water was not observed in the pond or drainages on-site. Due to the size of the lots and the proposed development, these areas can be avoided by construction on the residential lots. Structures should not block drainages. Septic fields should not be located in these areas due to the potential for periodic high groundwater conditions.

Development of the commercial lots will likely require significant site grading. Based on the Development Plan (Figure, 3) the existing dam and pond will be removed, and a new detention pond constructed at the southeast corner of the proposed Cherry Crossing Court and Hodgen Road. All organic material will need to be completely removed prior to any fill placement in the area of the existing pond or drainages to receive fill during the site development.

In summary, development of the site can be achieved if the items mentioned above are mitigated. These items can be mitigated through proper design and construction or through avoidance. Investigation on each lot is recommended prior to construction.

## 7.0 ECONOMIC MINERAL RESOURCES

Some of the sandy materials on-site could be considered a low-grade sand resource. According to the *El Paso County Aggregate Resource Evaluation Map* (Reference 8), the area is not mapped with any aggregate deposits. According to the *Atlas of Sand, Gravel and Quarry Aggregate Resources, Colorado Front Range Counties* distributed by the Colorado Geological Survey (Reference 9), areas of the site are not mapped with any resources. According to the *Evaluation of Mineral and Mineral Fuel Potential* (Reference 10), the area of the site has been mapped as "Fair" for industrial minerals. However, considering the silty to clayey nature of much of these materials and abundance of similar materials through the region and the close proximity to developed land, they would be considered to have little significance as an economic resource.

According to *the Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands* (Reference 10), the site is mapped within the Denver Basin Coal Region. However, the area of the site has been mapped as "Poor" for coal resources. No active or inactive mines have been mapped in the area of the site. No metallic mineral resources have been mapped on the site (Reference 10).

The site has been mapped as "Fair" for oil and gas resources (Reference 10). No oil or gas fields have been discovered in the area of the site. The sedimentary rocks in the area may lack the geologic structure for trapping oil or gas; therefore, it may not be considered a significant resource. Hydraulic fracturing is a new method that is being used to extract oil and gas from rocks. It utilizes pressurized fluid to extract oil and gas from rocks that would not normally be

productive. The area of the site has not been explored to determine if the rocks underlying the site would be commercially viable utilizing hydraulic fracturing. The practice of hydraulic fracturing has come under review due to concerns about environmental impacts, health and safety.

## 8.0 EROSION CONTROL

The soil types observed on the site are mildly to highly susceptible to wind erosion, and moderately to highly susceptible to water erosion. A minor wind erosion and dust problem may be created for a short time during and immediately after construction. Should the problem be considered severe enough during this time, watering of the cut areas or the use of chemical palliative may be required to control dust. However, once construction has been completed and vegetation re-established, the potential for wind erosion should be considerably reduced.

With regard to water erosion, loosely compacted soils will be the most susceptible to water erosion, residually weathered soils and weathered bedrock materials become increasingly less susceptible to water erosion. For the typical soils observed on site, allowable velocities or unvegetated and unlined earth channels would be on the order of 3 to 4 feet/second, depending upon the sediment load carried by the water. Permissible velocities may be increased through the use of vegetation to something on the order of 4 to 7 feet/second, depending upon the type of vegetation established. Should the anticipated velocities exceed these values, some form of channel lining material may be required to reduce erosion potential. These might consist of some of the synthetic channel lining materials on the market or conventional riprap. In cases where ditch-lining materials are still insufficient to control erosion, small check dams or sediment traps may be required. The check dams will serve to reduce flow velocities, as well as provide small traps for containing sediment. The determination of the amount, location and placement of ditch linings, check dams and of the special erosion control features should be performed by or in conjunction with the drainage engineer who is more familiar with the flow quantities and velocities.

Cut and fill slope areas will be subjected primarily to sheetwash and rill erosion. Unchecked rill erosion can eventually lead to concentrated flows of water and gully erosion. The best means to combat this type of erosion is, where possible, the adequate re-vegetation of cut and fill slopes. Cut and fill slopes having gradients more than three (3) horizontal to one (1) vertical

become increasingly more difficult to revegetate successfully. Therefore, recommendations pertaining to the vegetation of the cut and fill slopes may require input from a qualified landscape architect and/or the Soil Conservation Service.

## 9.0 CLOSURE

It is our opinion that the existing geologic engineering and geologic conditions will impose some minor constraints on development and construction of the site. The majority of these conditions can be avoided by construction. Others can be mitigated through proper engineering design and construction practices. The proposed development and use is consistent with anticipated geologic and engineering geologic conditions.

It should be pointed out that because of the nature of data obtained by random sampling of such variable and non-homogeneous materials as soil and rock, it is important that we be informed of any differences observed between surface and subsurface conditions encountered in construction and those assumed in the body of this report. Individual investigations for building sites and septic systems will be required prior to construction. Construction and design personnel should be made familiar with the contents of this report. Reporting such discrepancies to Entech Engineering, Inc. soon after they are discovered would be greatly appreciated and could possibly help avoid construction and development problems.

This report has been prepared for Carl Turse, for application to the proposed project in accordance with generally accepted geologic soil and engineering practices. No other warranty expressed or implied is made.

We trust that this report has provided you with all the information that you required. Should you require additional information, please do not hesitate to contact Entech Engineering, Inc.

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# TABLES

# TABLE 1

## SUMMARY OF LABORATORY TEST RESULTS

CLIENT CARL TURSE
PROJECT ROLLIN RIDGE ESTATES
JOB NO. 170837

| SOIL TYPE | TEST BORING NO. | DEPTH (FT) | WATER (%) | DRY DENSITY (PCF) | PASSING NO. 200 SIEVE (%) | LIQUID LIMIT (%) | PLASTIC INDEX (%) | SULFATE (WT %) | FHA SWELL (PSF) | SWELL/ CONSOL (%) | UNIFIED CLASSIFICATION | SOIL DESCRIPTION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 2-3 | | | 55.0 | | | | | | CL | CLAY, VERY SANDY |
| 1 | TP-1 | 2-3 | | | 71.7 | | | | 430 | | CL | CLAY, SANDY |
| 1 | TP-1 | 5-6 | | | 56.0 | | | | | | ML | SILTY CLAY LOAM |
| 1 | TP-2 | 2-3 | | | 62.2 | | | | | | ML | SILTY CLAY LOAM |
| 1 | TP-3 | 2-3 | | | 63.2 | | | | | | ML | SILTY CLAY LOAM |
| 1 | TP-5 | 2-3 | | | 58.2 | | | | | | CL | CLAY, VERY SANDY |
| 1 | TP-10 | 6-8 | | | 54.5 | | | | | | CL | CLAY, VERY SANDY |
| 1 | TP-14 | 3-4 | | | 64.5 | | | | | | CL | CLAY, SANDY |
| 2 | 2 | 5 | | | 34.6 | | | | 556 | | SC | SAND, CLAYEY |
| 2 | TP-4 | 5-6 | | | 38.9 | | | | | | SC | SANDY LOAM |
| 2 | TP-5 | 6-8 | | | 6.0 | | | | | | SM-SW | SAND, SLIGHTLY SILTY |
| 2 | TP-6 | 3-8 | | | 41.7 | | | | | | SC | SAND, VERY CLAYEY |
| 2 | TP-11 | 4-6 | | | 26.4 | | | | | | SM | SAND, SILTY |
| 3 | 2 | 15 | | | 11.9 | | | | | | SM-SW | SANDSTONE, SLIGHTLY SILTY |
| 3 | TP-3 | 5-6 | | | 13.9 | | | | | | SC | SANDSTONE, CLAYEY |
| 3 | TP-7 | 6-8 | | | 8.8 | | | | | | SM-SW | SANDSTONE, SLIGHTLY SILTY |
| 3 | TP-8 | 6-8 | | | 14.3 | | | | | | SM | SANDSTONE, SILTY |
| 3 | TP-12 | 5-6 | | | 12.2 | | | | | | SM | SANDSTONE, SILTY |
| 3 | TP-13 | 1.5-8 | | | 25.4 | | | | | | SM | SANDSTONE, SILTY |

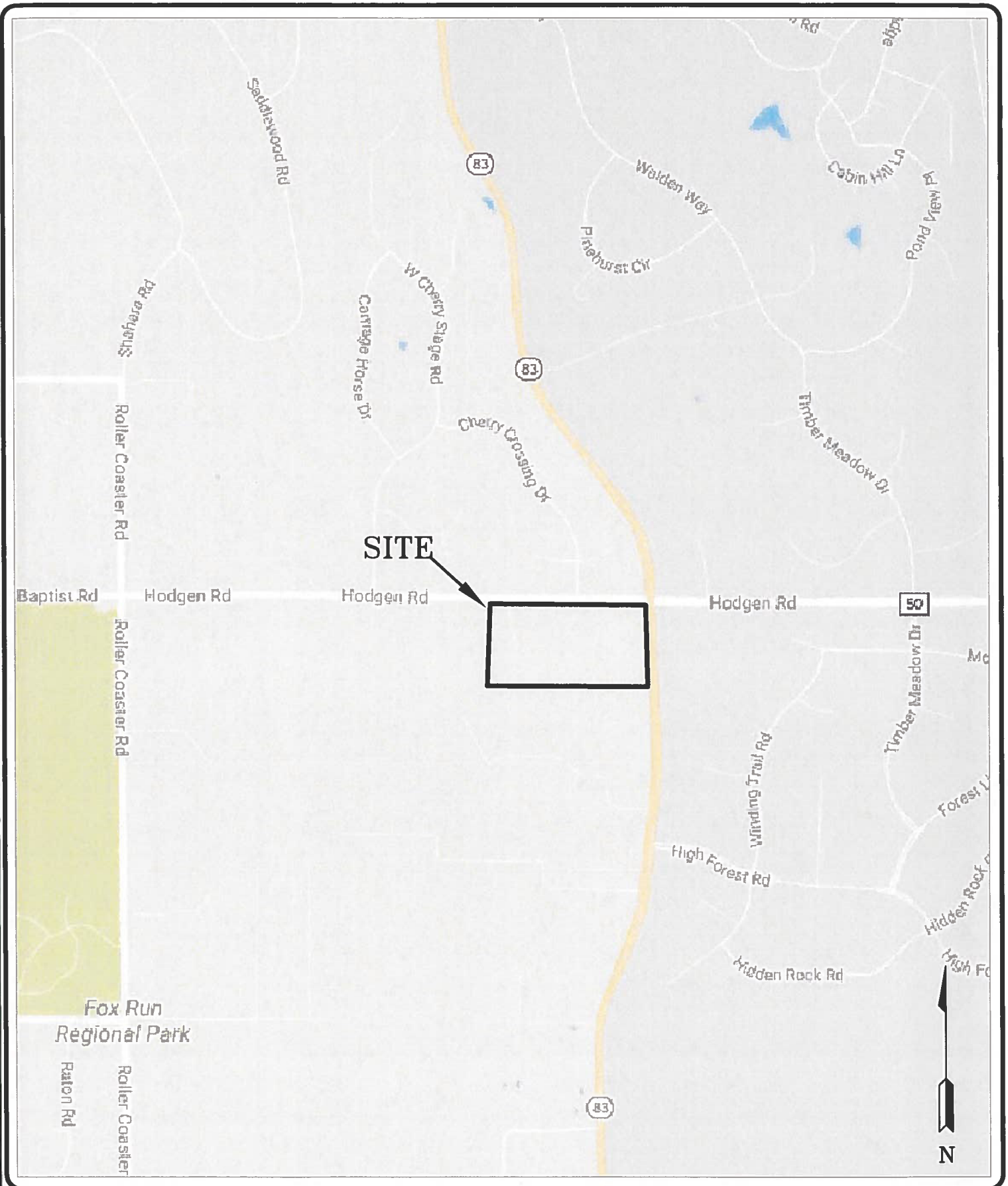
## Table 2: Summary of Percolation Test and Tactile Test Pit Results

| Percolation Test No. | Percolation Rate (min/in) | Depth to Bedrock (ft.) | Depth to Groundwater (ft.) |
|---|---|---|---|
| 1 | 67* | N/A | N/A |
| 2 | 76* | 12 | N/A |

| Test Pit No. | USDA Soil Type | LTAR Value | Depth to Bedrock (ft.) | Depth to Seasonally Occurring Groundwater (ft.) |
|---|---|---|---|---|
| 1 | 3 | 0.35 | N/A | N/A |
| 2 | 3 | 0.35 | N/A | N/A |
| 3 | 4A* | 0.15 | 5** | N/A |
| 4 | 2A | 0.50 | N/A | N/A |
| 5 | 3A* | 0.30 | 6** | 6 |
| 6 | 3A* | 0.30 | 8** | 8 |
| 7 | 3A* | 0.30 | 5** | 6.5 |
| 8 | 4* | 0.20 | 6** | 6 |
| 9 | 4A* | 0.15 | 6** | 6 |
| 10 | 4A* | 0.15 | 6** | 6 |
| 11 | 3A* | 0.30 | 5** | 5 |
| 12 | 3A* | 0.30 | 5** | 5 |
| 13 | 3A* | 0.30 | 1** | N/A |
| 14 | 3A* | 0.30 | 5** | 5 |

*- Conditions that will require an engineered OWTS
**- Sandstone highly weathered to formational (Dawson Formation)

# FIGURES

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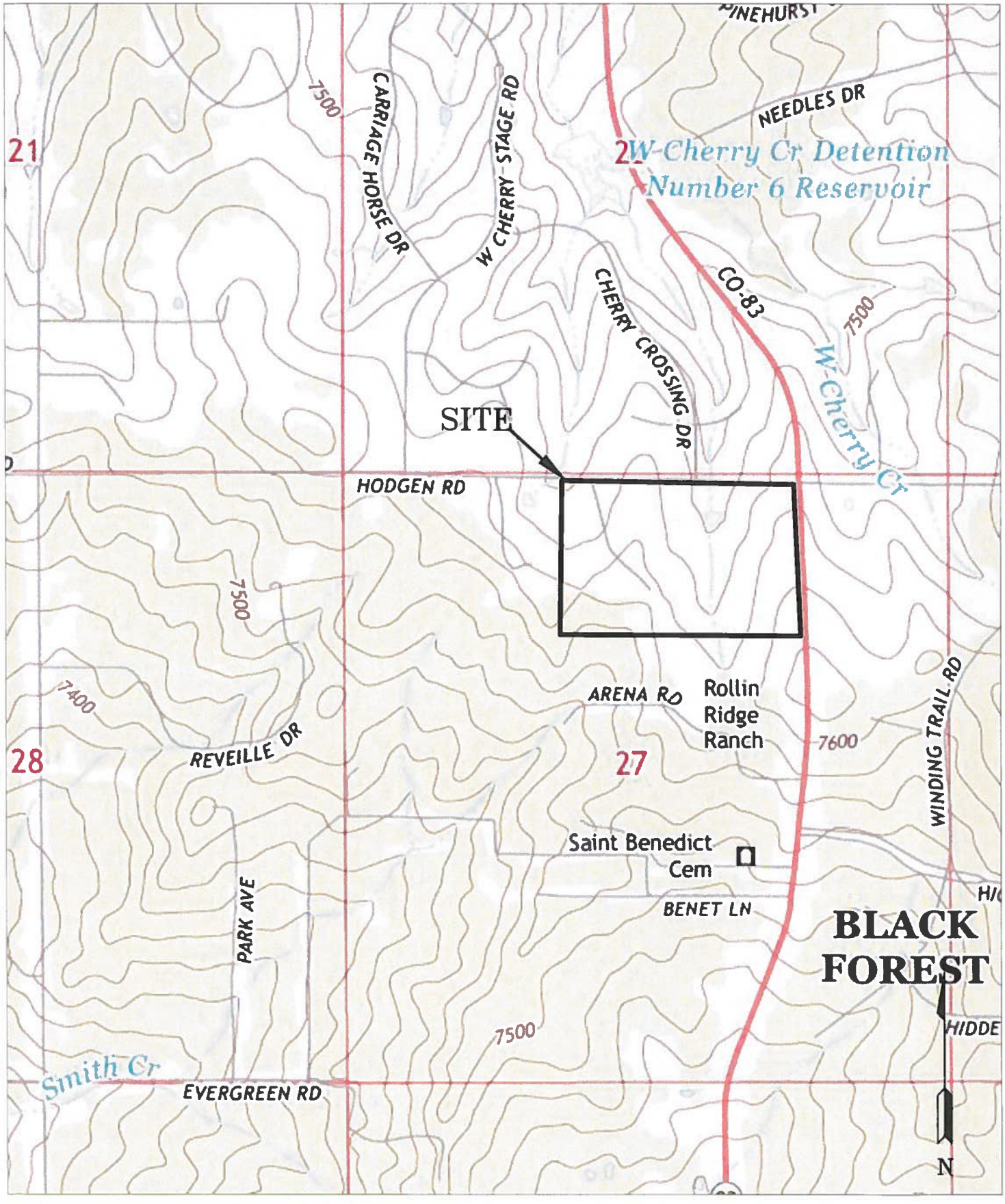
**VICINITY MAP**
**ROLLIN RIDGE ESTATES**
**HODGEN ROAD AND HIGHWAY 83**
**EL PASO COUNTY, CO.**
**FOR: CARL TURSE**

| DRAWN: | DATE: | CHECKED: | DATE: |
|---|---|---|---|
| LLL | 7/19/17 | | |

JOB NO.: 170837

FIG NO.: 1

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USGS MAP
ROLLIN RIDGE ESTATES
HODGEN ROAD AND HIGHWAY 83
EL PASO COUNTY, CO.
FOR: CARL TURSE

| DRAWN: | DATE: | CHECKED: | DATE: |
|---|---|---|---|
| LLL | 10/17/16 | | |

JOB NO.: 170837

FIG NO.: 2

HODGEN RD-PRINCIPAL ARTERIAL

N88°54'09"W 1088.19'

N01°38'38"E 20.08'

N88°53'52"W 85.40'

30'-1/2 ROW (EXIST'G)

EXIST'G CULVERT

90' TOTAL 1/2 ROW

60' ROW DEDICATION TO EL PASO CO

LANDSCAPED MEDIAL SEE ROAD P&P DETAIL

30' PERIMETER UTILITY ESMT

CHERRY CROSSING CT
60' ROW RURAL
RESIDENTIAL - ASPHALT

TRACT A
0.64 AC
DRAINAGE DETENTION

34' VEHICULAR ACCESS ESMT

LOT 1
2.5 AC

LOT 2
2.5 AC

LOT 3
2.6 AC (GR)
2.5 AC (NT)

LOT 4
2.5 AC

LOT 10
2.5 AC

LOT 18
1.93 AC
OFFICE / COMMERCIAL

LOT 19
2.22 AC
OFFICE / COMMERCIAL

LOT 17
1.50 AC
COMMERCIAL

30' DRAINAGE ESMT

30' DRAINAGE ESMT

SEE SHEETS 3 THROUGH 7 FOR DETAILS OF OFFICE/ COMMERCIAL AREA

34' VEHICULAR ACCESS ESMT

LOT 16
2.5 AC

LOT 15
2.5 AC

LOT 14
3.2 AC (GR)
2.5 AC (NT)

LOT 13
3.5 AC (GR)
2.5 AC (NT)

LOT 12
2.5 AC

LOT 11
2.5 AC

LOT 9
2.5 AC

LOT 8
3.8 AC (GR)
2.5 AC (NT)

LOT 7
3.2 AC (GR)
2.5 AC (NT)

LOT 6
3.3 AC (GR)
2.5 AC (NT)

LOT 5
2.5 AC

LAP WAI CT
60' ROW RURAL
RESIDENTIAL - ASPHALT

PARCEL NO. 6127000064
PARCEL NO. 6127000065

EXIST'G HOUSE TO REMAIN

STATE HIGHWAY NO 83

N02°28'37"W 870.52'

N00°34'26"W 392.85'

S00°06'40"E 1262.77'

S89°30'30"E 1984.04'

100' NO BUILD EASEMENT

100' NO BUILD EASEMENT

100' NO BUILD EASEMENT

PH-1 PH-2

TP-1 TP-2 TP-3 TP-4 TP-5 TP-6 TP-7 TP-8 TP-9 TP-10 TP-11 TP-12 TP-13 TP-14

P1 P2 P3 P4 P5 P6 P7 P8 P9 P10

PH- APPROXIMATE PROFILE HOLE LOCATION AND NUMBER

TP- APPROXIMATE TEST PIT LOCATION AND NUMBER

(P2) - APPROXIMATE TEST PIT LOCATION AND NUMBER

N

| REVISION | BY |
|---|---|
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |


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DEVELOPMENT PLAN/TEST BORING AND TEST PIT LOCATION MAP
ROLLIN RIDGE ESTATES
HODGEN ROAD AND HIGHWAY 83
EL PASO COUNTY, CO.
FOR: CARL TURSE

| | |
|---|---|
| DRAWN | LLL |
| CHECKED | |
| DATE | 10/27/17 |
| SCALE | AS SHOWN |
| JOB NO. | 170837 |
| FIGURE No. | 3 |

Not being reviewed as it is a tract for future development


N

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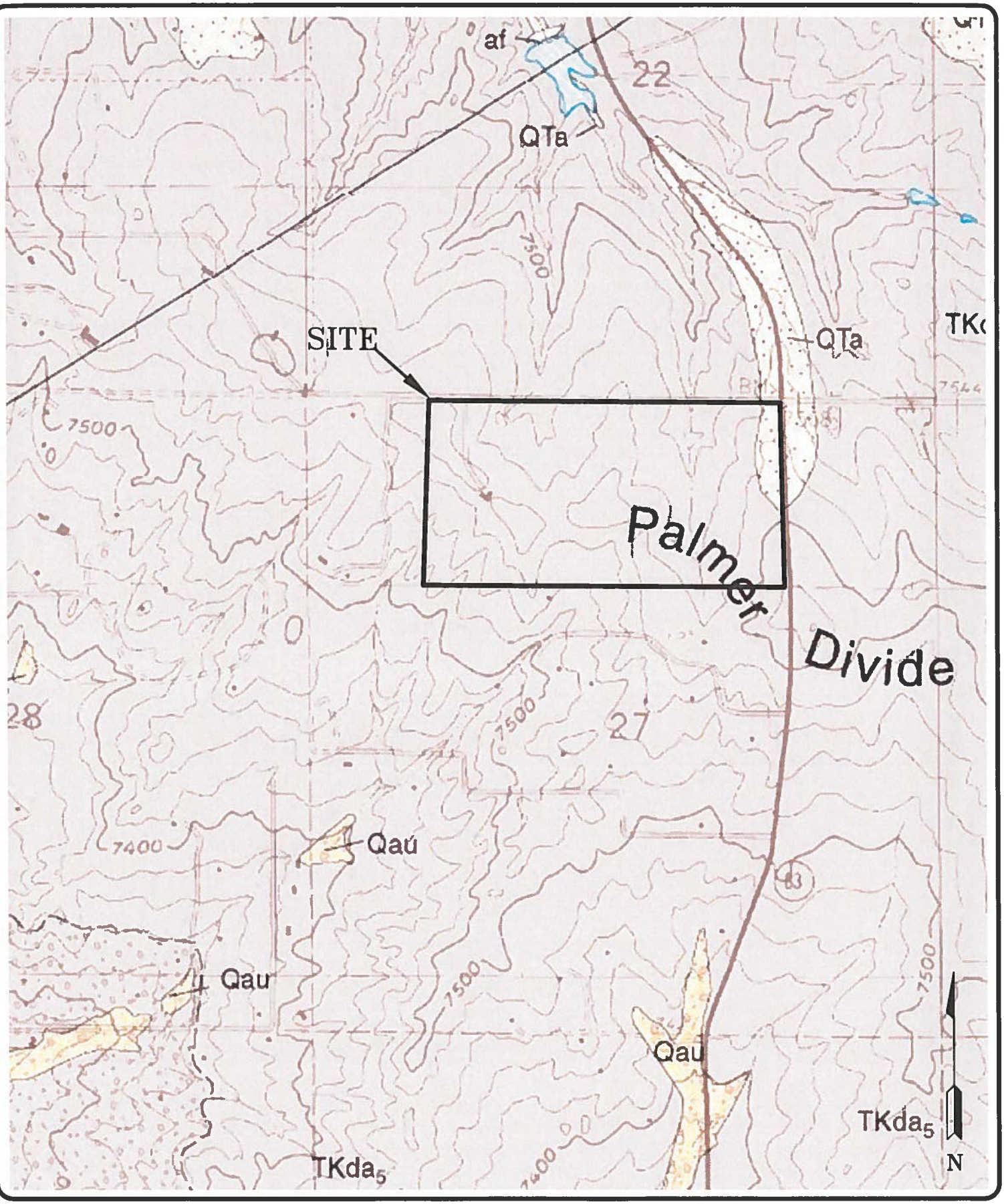
SCS MAP
ROLLIN RIDGE ESTATES
HODGEN ROAD AND HIGHWAY 83
EL PASO COUNTY, CO.
FOR: CARL TURSE

| DRAWN: | DATE: | CHECKED: | DATE: |
|---|---|---|---|
| LLL | 7/19/17 | | |

JOB NO.: 170837

FIG NO.: 4



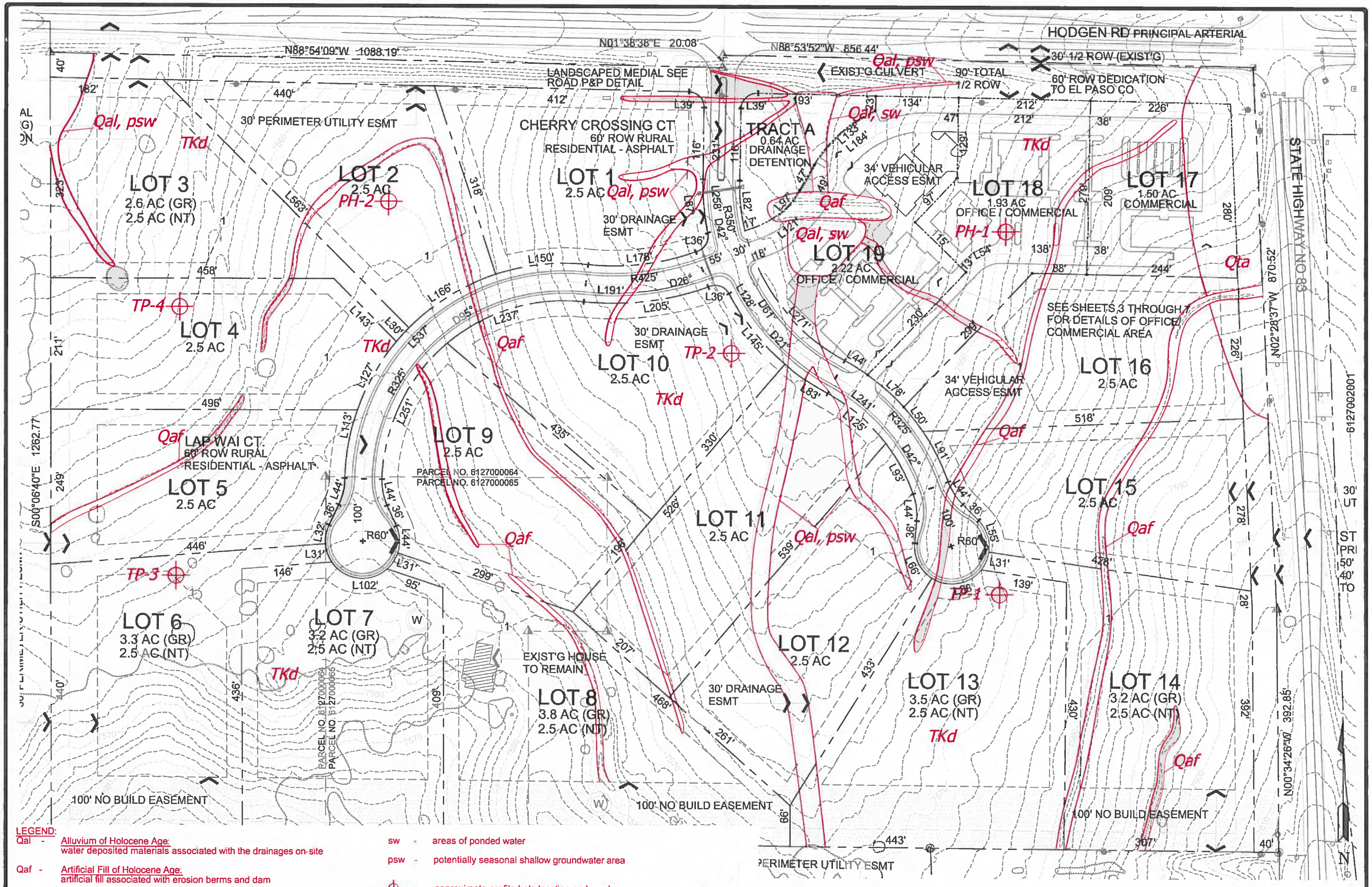

ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

MONUMENT QUADRANGLE GEOLOGIC MAP
ROLLIN RIDGE ESTATES
HODGEN ROAD AND HIGHWAY 83
EL PASO COUNTY, CO.
FOR: CARL TURSE

| DRAWN: | DATE: | CHECKED: | DATE: |
|---|---|---|---|
| LLL | 7/19/17 | | |

JOB NO.: 170837

FIG NO.: 5




LEGEND:

Qal - Alluvium of Holocene Age: water deposited materials associated with the drainages on-site

Qaf - Artificial Fill of Holocene Age: artificial fill associated with erosion berms and dam

Qta - Alluvium of Palmer Divide of Quaternary Age: water deposited materals along the Palmer Divide

TKda - Dawson Formation of Tertiary to Cretaceous Age: arkosic sandstone with interbedded fine-grained sandstone, siltstone and claystone

sw - areas of ponded water

psw - potentially seasonal shallow groundwater area

⊕ - approximate profile hole location and number

⊕ - approximate test pit location and number

| REVISION | BY |
|---|---|
| | |

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COLORADO SPRINGS, CO. 80907

GEOLOGY/ENGINEERING GEOLOGY MAP
ROLLIN RIDGE ESTATES
HODGEN ROAD AND HIGHWAY 83
EL PASO COUNTY, CO.
FOR: CARL TURSE

| | |
|---|---|
| DRAWN | LLL |
| CHECKED | |
| DATE | 10/26/17 |
| SCALE | AS SHOWN |
| JOB NO. | 170837 |
| FIGURE No. | 6 |

# LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

| | |
|---|---|
| ZONE A | No Base Flood Elevations determined. |
| ZONE AE | Base Flood Elevations determined. |
| ZONE AH | Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined. |
| ZONE AO | Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined. |
| ZONE AR | Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood. |
| ZONE A99 | Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined. |
| ZONE V | Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined. |
| ZONE VE | Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined. |

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

| | |
|---|---|
| ZONE X | Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood. |

OTHER AREAS

| | |
|---|---|
| ZONE X | Areas determined to be outside the 0.2% annual chance floodplain. |
| ZONE D | Areas in which flood hazards are undetermined, but possible. |

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

| | |
|---|---|
| | 1% annual chance floodplain boundary |
| | 0.2% annual chance floodplain boundary |
| | Floodway boundary |
| | Zone D boundary |
| | CBRS and OPA boundary |
| | Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities. |
| 513 | Base Flood Elevation line and value; elevation in feet* |
| (EL 987) | Base Flood Elevation value where uniform within zone; elevation in feet* |

*Referenced to the National Geodetic Vertical Datum of 1929

| | |
|---|---|
| A — A | Cross section line |
| 23 — 23 | Transect line |
| 97° 07' 30", 32° 22' 30" | Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere |
| 4278000 M | 1000-meter Universal Transverse Mercator grid tick values, zone 4 |
| 600000 FT | 5000-foot grid tick values: Hawaii State Plane coordinate system, zone 3 (FIPSZONE 5103), Transverse Mercator projection |
| DX5510 X | Bench mark (see explanation in Notes to Users section of this FIRM panel) |
| M 2 | Coastal Mile marker |

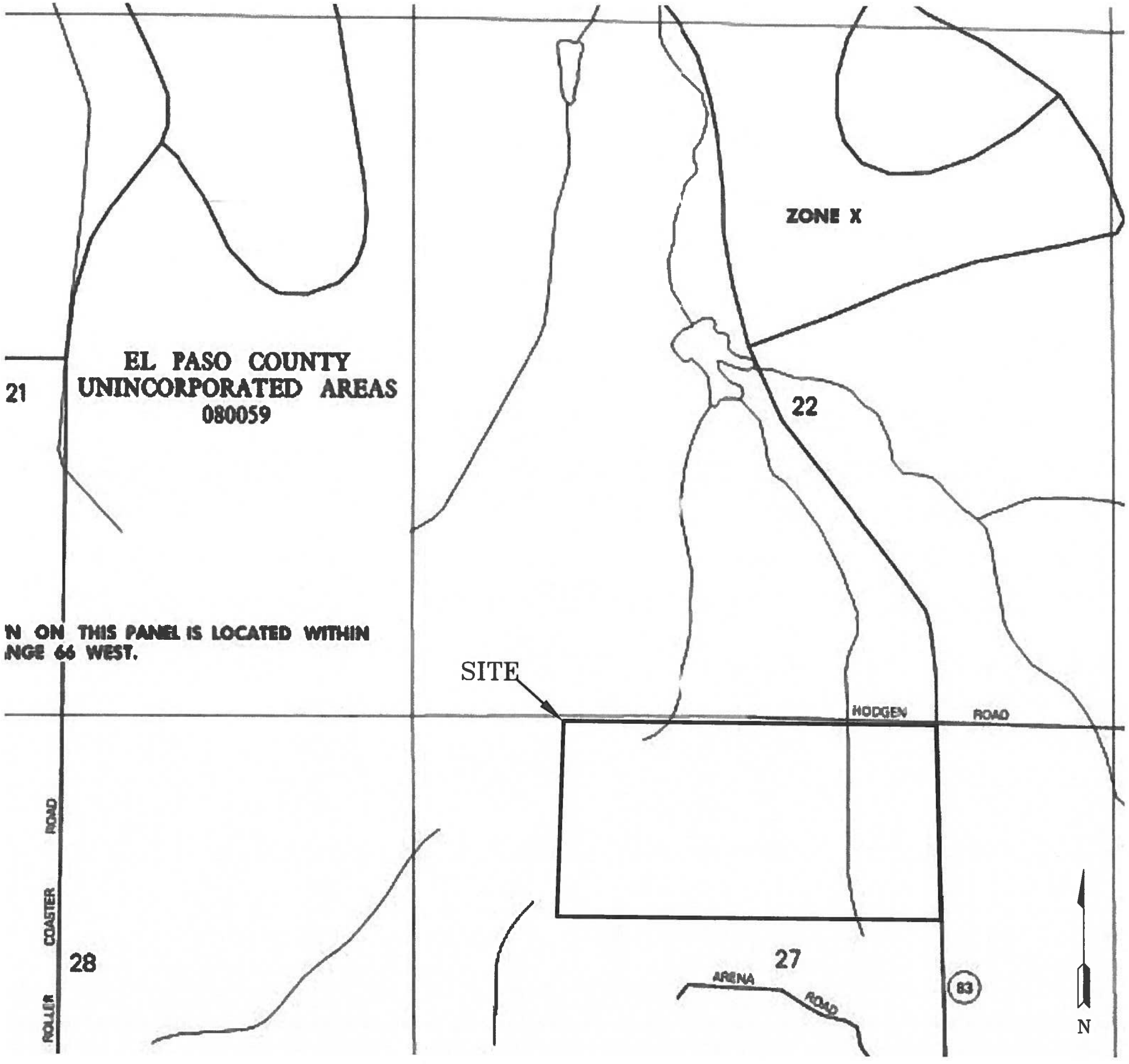
MAP REPOSITORY

Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
November 20, 2000

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

September 30, 2004 – to change Special Flood Hazard Areas, to update map format, to reflect revised shoreline and to incorporate previously issued Letters of Map Revision.




| REVISION | BY |
|---|---|
| | |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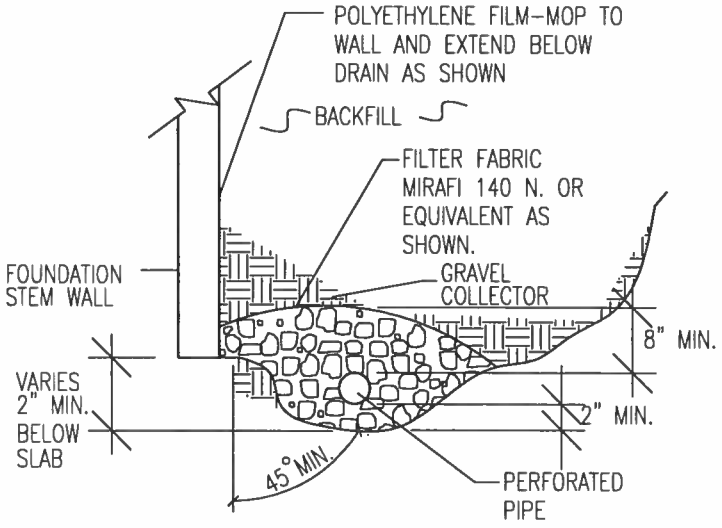
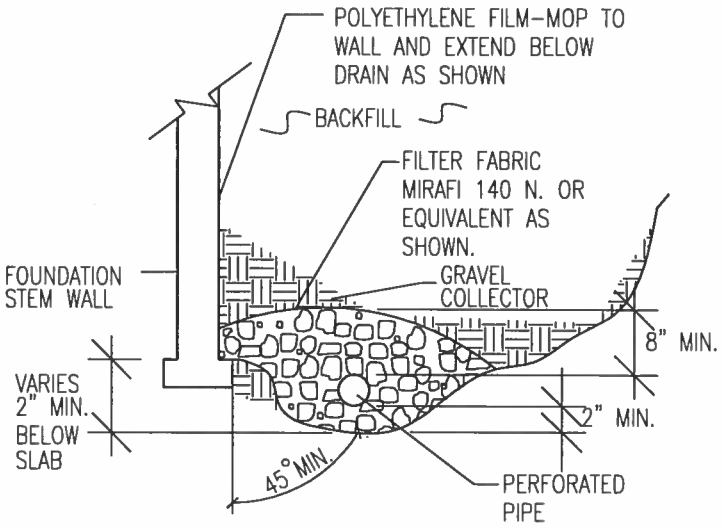
FLOODPLAIN MAP
ROLLIN RIDGE ESTATES
HODGEN ROAD AND HIGHWAY 83
EL PASO COUNTY, CO.
FOR: CARL TURSE

| | |
|---|---|
| DRAWN | LLL |
| CHECKED | |
| DATE | 7/19/17 |
| SCALE | AS SHOWN |
| JOB NO. | 170837 |
| FIGURE No. | 7 |




NOTES:

–GRAVEL SIZE IS RELATED TO DIAMETER OF PIPE PERFORATIONS–85% GRAVEL GREATER THAN 2x PERFORATION DIAMETER.

–PIPE DIAMETER DEPENDS UPON EXPECTED SEEPAGE. 4–INCH DIAMETER IS MOST OFTEN USED.

–ALL PIPE SHALL BE PERFORATED PLASTIC. THE DISCHARGE PORTION OF THE PIPE SHOULD BE NON–PERFORATED PIPE.

–FLEXIBLE PIPE MAY BE USED UP TO 8 FEET IN DEPTH, IF SUCH PIPE IS DESIGNED TO WITHSTAND THE PRESSURES. RIGID PLASTIC PIPE WOULD OTHERWISE BE REQUIRED.

–MINIMUM GRADE FOR DRAIN PIPE TO BE 1% OR 3 INCHES OF FALL IN 25 FEET.

–DRAIN TO BE PROVIDED WITH A FREE GRAVITY OUTFALL, IF POSSIBLE. A SUMP AND PUMP MAY BE USED IF GRAVITY OUT FALL IS NOT AVAILABLE.

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*PERIMETER DRAIN DETAIL*

| DRAWN: | DATE DRAWN: | DESIGNED BY: | CHECKED: |
|---|---|---|---|
| | | DS | LLL |

JOB NO.: 170837

FIG. NO.: 8

# APPENDIX A: Site Photographs

1

**Looking west from the southeastern portion of the site.**

June 27, 2017

2

**Looking southeast from Test Pit No. 1 in the southeastern portion of the site.**

June 27, 2017

Job No. 170837

3

**Looking southeast from the pond in the northeastern portion of the site.**

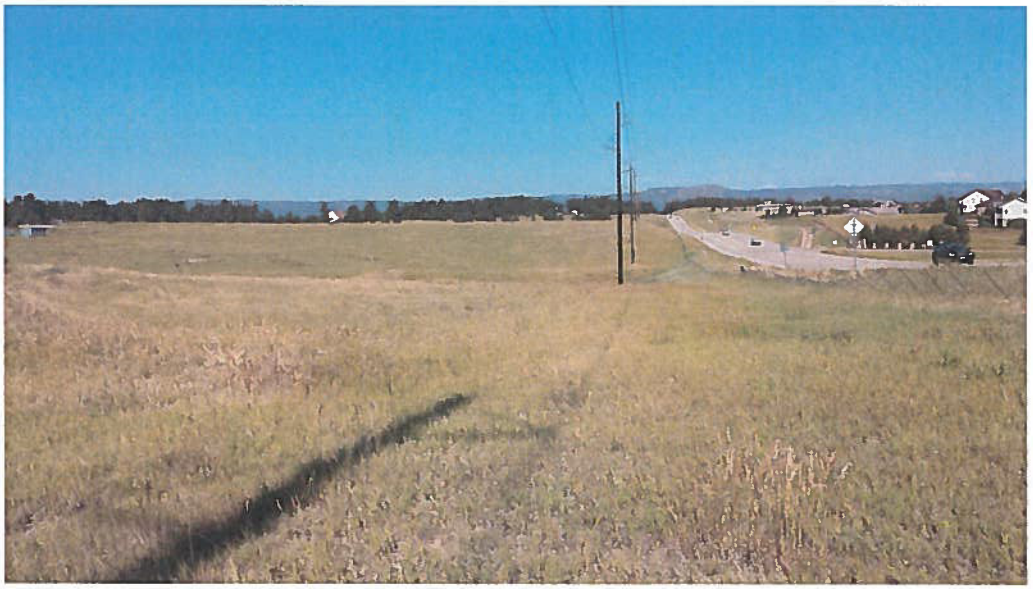
June 27, 2017

4

**Looking southwest from the northern portion of the site.**

June 27, 2017

Job No. 170837



5

**Looking west from the northeast corner of the site.**

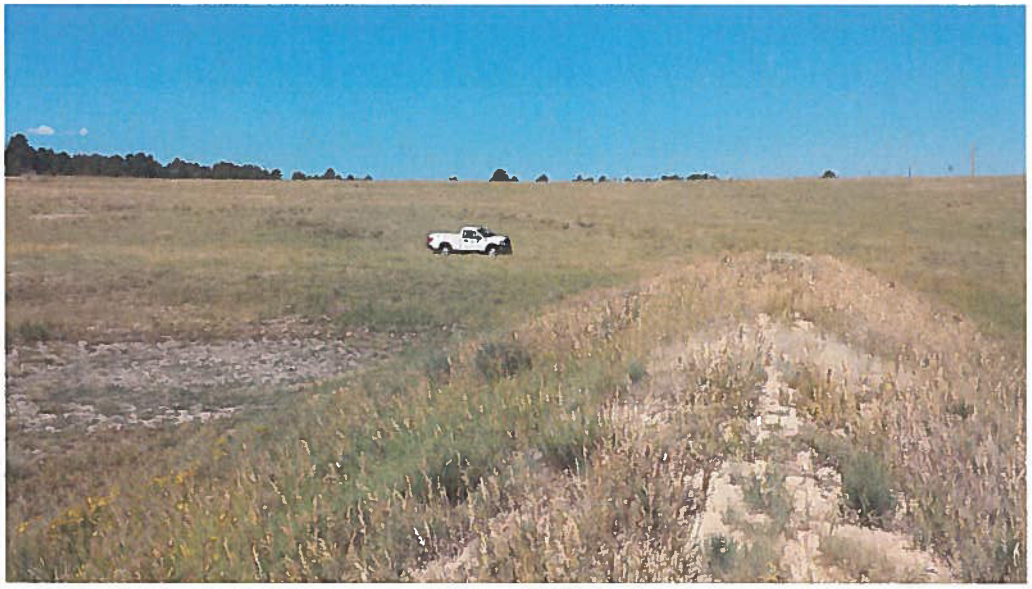
July 10, 2017

6

**Looking southwest from the northeast corner of the site.**

July 10, 2017

Job No. 170837



7

**Looking west along the dam located in the northeastern portion of the site.**

July 10, 2017

8

**Looking northwest from the northeastern portion of the site.**

July 10, 2017

Job No. 170837

9

**Looking northwest from the western portion of the site.**

July 10, 2017

10

**Looking south from the southwestern portion of the site.**

July 10, 2017

Job No. 170837

# APPENDIX B: Test Boring Logs from the Profile Holes and Test Pit Logs

PROFILE HOLE NO. 1
DATE DRILLED 7/10/2017
Job # 170837

REMARKS

DRY TO 9.5', 7/11/17

CLAY, SANDY, TAN, FIRM, MOIST

| Depth (ft) | Symbol | Samples | Blows per foot | Watercontent % | Soil Type |
|---|---|---|---|---|---|
| | | | 10 | 6.0 | 1 |
| 5 | | | 12 | 4.7 | 1 |
| 10 | | | 15 | 10.6 | 1 |
| 15 | | | | | |
| 20 | | | | | |

PROFILE HOLE NO. 2
DATE DRILLED 7/10/2017
CLIENT CARL TURSE
LOCATION ROLLIN RIDGE ESTATES

REMARKS

DRY TO 10', 7/10/17
CAVED TO 10', 7/11/17, DRY

CLAY, SANDY, TAN, SOFT, MOIST

SAND, CLAYEY, FINE TO COARSE GRAINED, TAN, DENSE, MOIST

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

* - WEATHERED ZONE

| Depth (ft) | Symbol | Samples | Blows per foot | Watercontent % | Soil Type |
|---|---|---|---|---|---|
| | | | 5 | 5.0 | 1 |
| 5 | | | 30 | 2.9 | 2 |
| 10 | | | 47 | 8.1 | 2 |
| 15 | | | 50 | 6.8 | 3 |
| 20 | | | 32* | 12.8 | 3 |

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**PROFILE HOLE LOG**

| DRAWN: | DATE: | CHECKED: | DATE: |
|---|---|---|---|
| | | LLL | 7/19/17 |

JOB NO.: 170837
FIG NO.: B-1

TEST PIT NO. 1
DATE EXCAVATED 6/27/2017
Job # 170837

| REMARKS | Depth (ft) | Symbol | Samples | Soil Structure Shape | Soil Structure Grade | USDA Soil Type |
|---|---|---|---|---|---|---|
| topsoil, silty clay loam, brown | 1 | | | gr | m | 3 |
| silty clay loam, brown | 2 | | | gr | m | 3 |
| | 3 | | | | | |
| | 4 | | | | | |
| | 5 | | | | | |
| | 6 | | | | | |
| | 7 | | | | | |
| | 8 | | | | | |
| | 9 | | | | | |
| | 10 | | | | | |

TEST PIT NO. 2
DATE EXCAVATED 6/27/2017
CLIENT CARL TURSE
LOCATION ROLLIN RIDGE ESTATES

| REMARKS | Depth (ft) | Symbol | Samples | Soil Structure Shape | Soil Structure Grade | USDA Soil Type |
|---|---|---|---|---|---|---|
| topsoil, silty clay loam, brown | 1 | | | gr | m | 3 |
| silty clay loam, light brown | 2 | | | gr | m | 3 |
| sandy loam, fine to medium grained, tan | 3 | | | gr | m | 2 |
| | 4 | | | | | |
| | 5 | | | | | |
| | 6 | | | | | |
| | 7 | | | | | |
| | 8 | | | | | |
| | 9 | | | | | |
| | 10 | | | | | |

Soil Structure Shape
granular - gr
platy - pl
blocky - bl
prismatic - pr
single grain - sg
massive - ma

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**TEST PIT LOG**

| DRAWN: | DATE: | CHECKED: | DATE: |
|---|---|---|---|
| | | LLL | 7/19/17 |

JOB NO.: 170837
FIG NO.: B-2

TEST PIT NO. 3
DATE EXCAVATED 6/27/2017
Job # 170837

| REMARKS | Depth (ft) | Symbol | Samples | Soil Structure Shape | Soil Structure Grade | USDA Soil Type |
|---|---|---|---|---|---|---|
| topsoil, silty clay loam, brown | 1 | | | gr | m | 3 |
| silty clay loam, orange-brown | 2 | | | gr | m | 3 |
| | 3 | | | | | |
| | 4 | | | | | |
| weathered clayey sandstone, fine to coarse grained, tan | 5 | | | ma | | 4A |
| | 6 | | | | | |
| | 7 | | | | | |
| | 8 | | | | | |
| | 9 | | | | | |
| | 10 | | | | | |

TEST PIT NO. 4
DATE EXCAVATED 6/27/2017
CLIENT CARL TURSE
LOCATION ROLLIN RIDGE ESTATES

| REMARKS | Depth (ft) | Symbol | Samples | Soil Structure Shape | Soil Structure Grade | USDA Soil Type |
|---|---|---|---|---|---|---|
| topsoil, sandy loam. Brown | 1 | | | gr | m | 2 |
| sandy loam, fine to medium grained, orange-brown | 2 | | | gr | m | 2 |
| | 3 | | | | | |
| | 4 | | | | | |
| sandy loam, fine to medium grained, orange-brown | 5 | | | gr | w | 2A |
| | 6 | | | | | |
| | 7 | | | | | |
| | 8 | | | | | |
| | 9 | | | | | |
| | 10 | | | | | |

Soil Structure Shape
granular - gr
platy - pl
blocky - bl
prismatic - pr
single grain - sg
massive - ma

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TEST PIT LOG

| DRAWN: | DATE: | CHECKED: | DATE: |
|---|---|---|---|
| | | LLL | 7/19/17 |

JOB NO.: 170837
FIG NO.: B-3

TEST PIT NO. 5
DATE EXCAVATED 9/18/2017
Job # 170837

| REMARKS | Depth (ft) | Symbol | Samples | Soil Structure Shape | Soil Structure Grade | USDA Soil Type |
|---|---|---|---|---|---|---|
| topsoil, sandy loam, brown | 1 | | | gr | m | 2 |
| sandy loam, fine to coarse grained, light brown | 2 | | | gr | m | 2 |
| | 3 | | | | | |
| | 4 | | | | | |
| | 5 | | | | | |
| | 6 | | | | | |
| weathered silty sandstone, fine to coarse grained, tan *signs of seasonally occurring groundwater at 6' | 7 | | | ma | | 3A |
| | 8 | | | | | |
| | 9 | | | | | |
| | 10 | | | | | |

TEST PIT NO. 6
DATE EXCAVATED 9/18/2017
CLIENT CARL TURSE
LOCATION ROLLIN RIDGE ESTATES

| REMARKS | Depth (ft) | Symbol | Samples | Soil Structure Shape | Soil Structure Grade | USDA Soil Type |
|---|---|---|---|---|---|---|
| topsoil, sandy loam, brown | 1 | | | gr | w | 2A |
| sandy loam, fine to coarse grained, light brown | 2 | | | gr | w | 2A |
| | 3 | | | | | |
| | 4 | | | | | |
| | 5 | | | | | |
| | 6 | | | | | |
| | 7 | | | | | |
| | 8 | | | | | |
| weathered silty sandstone, fine to coarse grained, buff *signs of seasonally occurring groundwater at 8' | 9 | | | ma | | 3A |
| | 10 | | | | | |

Soil Structure Shape
granular - gr
platy - pl
blocky - bl
prismatic - pr
single grain - sg
massive - ma

Soil Structure Grade
weak - w
moderate - m
strong - s
loose - l

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**TEST PIT LOG**

| DRAWN: | DATE: | CHECKED: | DATE: |
|---|---|---|---|
| | | LLL | 10/24/17 |

JOB NO.: 170837
FIG NO.: B-4

TEST PIT NO. 7
DATE EXCAVATED 9/18/2017
Job # 170837

| REMARKS | Depth (ft) | Symbol | Samples | Soil Structure Shape | Soil Structure Grade | USDA Soil Type |
|---|---|---|---|---|---|---|
| topsoil, sandy loam, brown | 1 | | | gr | m | 2 |
| sandy loam, fine to coarse grained, light brown | 2 | | | gr | m | 2 |
| | 3 | | | | | |
| | 4 | | | | | |
| | 5 | | | | | |
| weathered silty sandstone, fine to coarse grained, tan | 6 | | | ma | | 3A |
| *signs of seasonally occurring groundwater at 6.5' | 7 | | | | | |
| | 8 | | | | | |
| | 9 | | | | | |
| | 10 | | | | | |

TEST PIT NO. 8
DATE EXCAVATED 9/18/2017
CLIENT CARL TURSE
LOCATION ROLLIN RIDGE ESTATES

| REMARKS | Depth (ft) | Symbol | Samples | Soil Structure Shape | Soil Structure Grade | USDA Soil Type |
|---|---|---|---|---|---|---|
| topsoil, sandy clay, brown | 1 | | | gr | m | 4 |
| sandy clay, brown | 2 | | | gr | m | 4 |
| | 3 | | | | | |
| | 4 | | | | | |
| | 5 | | | | | |
| | 6 | | | | | |
| weathered silty sandstone, fine to coarse grained, tan | 7 | | | ma | | 3A |
| *signs of seasonally occurring groundwater at 6' | 8 | | | | | |
| | 9 | | | | | |
| | 10 | | | | | |

Soil Structure Shape
granular - gr
platy - pl
blocky - bl
prismatic - pr
single grain - sg
massive - ma

Soil Structure Grade
weak - w
moderate - m
strong - s
loose - l

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**TEST PIT LOG**

| DRAWN: | DATE: | CHECKED: | DATE: |
|---|---|---|---|
| | | LLL | 10/24/17 |

JOB NO.: 170837
FIG NO.: B-5

TEST PIT NO. 9
DATE EXCAVATED 9/18/2017
Job # 170837

| REMARKS | Depth (ft) | Symbol | Samples | Soil Structure Shape | Soil Structure Grade | USDA Soil Type |
|---|---|---|---|---|---|---|
| topsoil, sandy clay loam, brown | 1 | | | gr | m | 3 |
| sandy clay loam, light brown | 2 | | | gr | m | 3 |
| | 3 | | | | | |
| | 4 | | | | | |
| | 5 | | | | | |
| | 6 | | | | | |
| weathered very clayey sandstone, tan | 7 | | | ma | | 4A |
| *signs of seasonally occurring groundwater at 6' | 8 | | | | | |
| | 9 | | | | | |
| | 10 | | | | | |

TEST PIT NO. 10
DATE EXCAVATED 9/18/2017
CLIENT CARL TURSE
LOCATION ROLLIN RIDGE ESTATES

| REMARKS | Depth (ft) | Symbol | Samples | Soil Structure Shape | Soil Structure Grade | USDA Soil Type |
|---|---|---|---|---|---|---|
| topsoil, sandy clay loam, brown | 1 | | | gr | m | 3 |
| sandy clay loam, brown | 2 | | | gr | m | 3 |
| | 3 | | | | | |
| | 4 | | | | | |
| | 5 | | | | | |
| | 6 | | | | | |
| weathered very clayey sandstone, tan | 7 | | | ma | | 4A |
| *signs of seasonally occurring groundwater at 6' | 8 | | | | | |
| | 9 | | | | | |
| | 10 | | | | | |

Soil Structure Shape
granular - gr
platy - pl
blocky - bl
prismatic - pr
single grain - sg
massive - ma

Soil Structure Grade
weak - w
moderate - m
strong - s
loose - l

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**TEST PIT LOG**

| DRAWN: | DATE: | CHECKED: | DATE: |
|---|---|---|---|
| | | LLL | 10/24/17 |

JOB NO.: 170837
FIG NO.: B-6

TEST PIT NO. 11
DATE EXCAVATED 9/18/2017
Job # 170837

| REMARKS | Depth (ft) | Symbol | Samples | Soil Structure Shape | Soil Structure Grade | USDA Soil Type |
|---|---|---|---|---|---|---|
| topsoil, sandy loam, brown | 1 | | | gr | m | 2 |
| sandy loam, fine to coarse grained, light brown | 2 | | | gr | m | 2 |
| | 3 | | | | | |
| | 4 | | | | | |
| | 5 | | | | | |
| weathered silty sandstone, fine to coarse grained, tan *signs of seasonally occurring groundwater at 5' | 6 | | | ma | | 3A |
| | 7 | | | | | |
| | 8 | | | | | |
| | 9 | | | | | |
| | 10 | | | | | |

TEST PIT NO. 12
DATE EXCAVATED 9/18/2017
CLIENT CARL TURSE
LOCATION ROLLIN RIDGE ESTATES

| REMARKS | Depth (ft) | Symbol | Samples | Soil Structure Shape | Soil Structure Grade | USDA Soil Type |
|---|---|---|---|---|---|---|
| topsoil, sandy loam, brown | 1 | | | gr | m | 2 |
| sandy loam, fine to coarse grained, light brown | 2 | | | gr | m | 2 |
| | 3 | | | | | |
| | 4 | | | | | |
| | 5 | | | | | |
| weathered silty sandstone, fine to coarse grained, tan *signs of seasonally occurring groundwater at 5' | 6 | | | ma | | 3A |
| | 7 | | | | | |
| | 8 | | | | | |
| | 9 | | | | | |
| | 10 | | | | | |

Soil Structure Shape
granular - gr
platy - pl
blocky - bl
prismatic - pr
single grain - sg
massive - ma

Soil Structure Grade
weak - w
moderate - m
strong - s
loose - l

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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

**TEST PIT LOG**

| DRAWN: | DATE: | CHECKED: | DATE: |
|---|---|---|---|
| | | LLL | 10/24/17 |

JOB NO.: 170837
FIG NO.: B-7

TEST PIT NO. 13
DATE EXCAVATED 9/18/2017
Job # 170837

| REMARKS | Depth (ft) | Symbol | Samples | Soil Structure Shape | Soil Structure Grade | USDA Soil Type |
|---|---|---|---|---|---|---|
| topsoil, sandy loam, brown | 1 | | | gr | w | 2A |
| weathered to formational silty sandstone, fine to coarse grained, tan | 2 | | | ma | | 3A |
| | 3 | | | | | |
| | 4 | | | | | |
| | 5 | | | | | |
| | 6 | | | | | |
| | 7 | | | | | |
| | 8 | | | | | |
| | 9 | | | | | |
| | 10 | | | | | |

TEST PIT NO. 14
DATE EXCAVATED 9/18/2017
CLIENT CARL TURSE
LOCATION ROLLIN RIDGE ESTATES

| REMARKS | Depth (ft) | Symbol | Samples | Soil Structure Shape | Soil Structure Grade | USDA Soil Type |
|---|---|---|---|---|---|---|
| topsoil, sandy clay, brown | 1 | | | gr | m | 4 |
| sandy clay, brown | 2 | | | gr | m | 4 |
| | 3 | | | | | |
| | 4 | | | | | |
| | 5 | | | | | |
| weathered to formational silty sandstone, fine to coarse grained, tan *signs of seasonally occurring groundwater at 5' | 6 | | | ma | | 3A |
| | 7 | | | | | |
| | 8 | | | | | |
| | 9 | | | | | |
| | 10 | | | | | |

Soil Structure Shape
granular - gr
platy - pl
blocky - bl
prismatic - pr
single grain - sg
massive - ma

Soil Structure Grade
weak - w
moderate - m
strong - s
loose - l

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COLORADO SPRINGS, COLORADO 80907

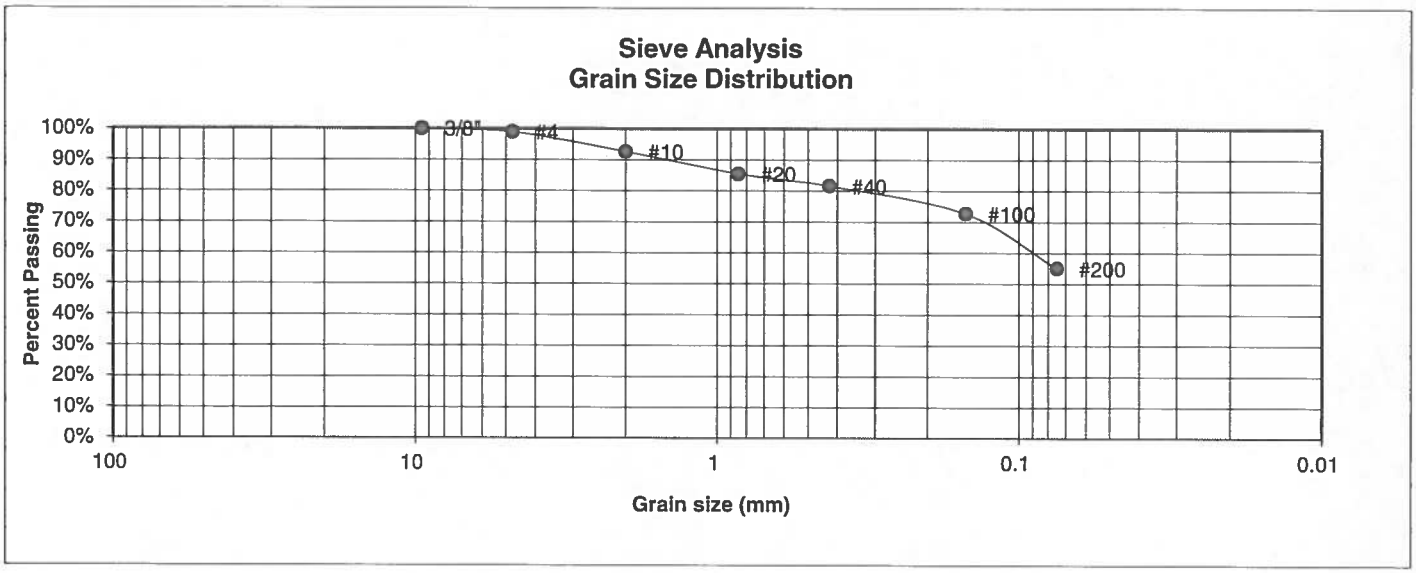
TEST PIT LOG

| DRAWN: | DATE: | CHECKED: | DATE: |
|---|---|---|---|
| | | LLL | 10/24/17 |

JOB NO.: 170837
FIG NO.: B-8

# APPENDIX C: Laboratory Test Results

| | | | |
|---|---|---|---|
| UNIFIED CLASSIFICATION | CL | CLIENT | CARL TURSE |
| SOIL TYPE # | 1 | PROJECT | ROLLIN RIDGE ESTATES |
| TEST BORING # | 1 | JOB NO. | 170837 |
| DEPTH (FT) | 2-3 | TEST BY | BL |




| U.S. Sieve # | Percent Finer |
|---|---|
| 3" | |
| 1 1/2" | |
| 3/4" | |
| 1/2" | |
| 3/8" | 100.0% |
| 4 | 98.9% |
| 10 | 92.7% |
| 20 | 85.5% |
| 40 | 81.6% |
| 100 | 72.7% |
| 200 | 55.0% |

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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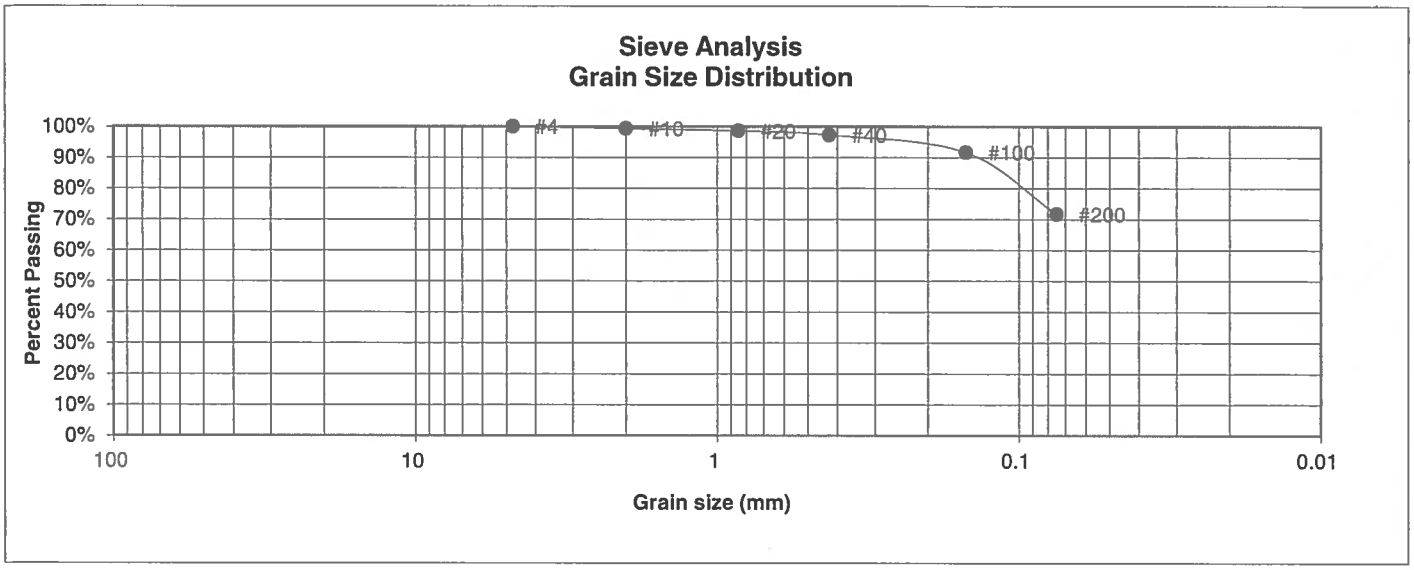
LABORATORY TEST RESULTS

| DRAWN: | DATE: | CHECKED: | DATE: |
|---|---|---|---|
| | | LLL | 10/25/17 |

JOB NO.: 170837

FIG NO.: C-1

| | | | |
|---|---|---|---|
| UNIFIED CLASSIFICATION | CL | CLIENT | CARL TURSE |
| SOIL TYPE # | 1 | PROJECT | ROLLIN RIDGE ESTATES |
| TEST BORING # | TP-1 | JOB NO. | 170837 |
| DEPTH (FT) | 2-3 | TEST BY | BL |




| U.S. Sieve # | Percent Finer |
|---|---|
| 3" | |
| 1 1/2" | |
| 3/4" | |
| 1/2" | |
| 3/8" | |
| 4 | 100.0% |
| 10 | 99.4% |
| 20 | 98.6% |
| 40 | 97.3% |
| 100 | 91.7% |
| 200 | 71.7% |

Atterberg Limits

Plastic Limit

Liquid Limit

Plastic Index

Swell

| | |
|---|---|
| Moisture at start | 8.4% |
| Moisture at finish | 20.9% |
| Moisture increase | 12.6% |
| Initial dry density (pcf) | 99 |
| Swell (psf) | 430 |

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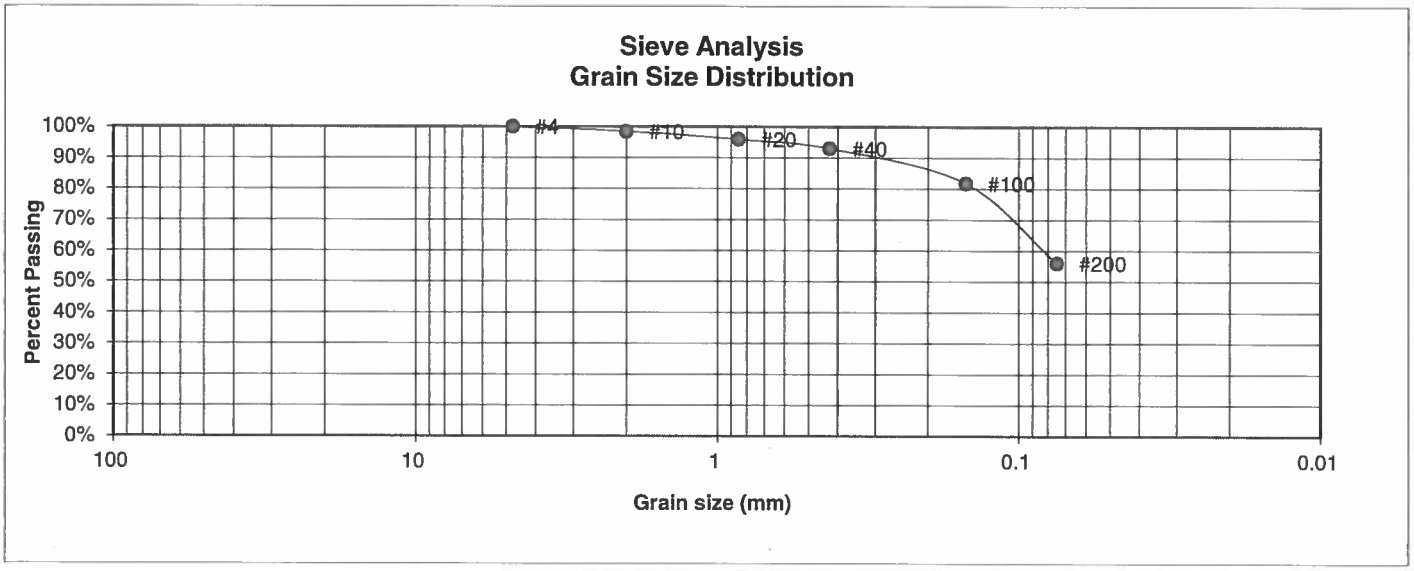
LABORATORY TEST RESULTS

| DRAWN: | DATE: | CHECKED: | DATE: |
|---|---|---|---|
| | | LLL | 10/25/17 |

JOB NO.: 170837

FIG NO.: C-2

| | | | |
|---|---|---|---|
| UNIFIED CLASSIFICATION | CL | CLIENT | CARL TURSE |
| SOIL TYPE # | 1 | PROJECT | ROLLIN RIDGE ESTATES |
| TEST BORING # | TP-1 | JOB NO. | 170837 |
| DEPTH (FT) | 5-6 | TEST BY | BL |




| U.S. Sieve # | Percent Finer |
|---|---|
| 3" | |
| 1 1/2" | |
| 3/4" | |
| 1/2" | |
| 3/8" | |
| 4 | 100.0% |
| 10 | 98.5% |
| 20 | 95.9% |
| 40 | 93.0% |
| 100 | 81.8% |
| 200 | 56.0% |

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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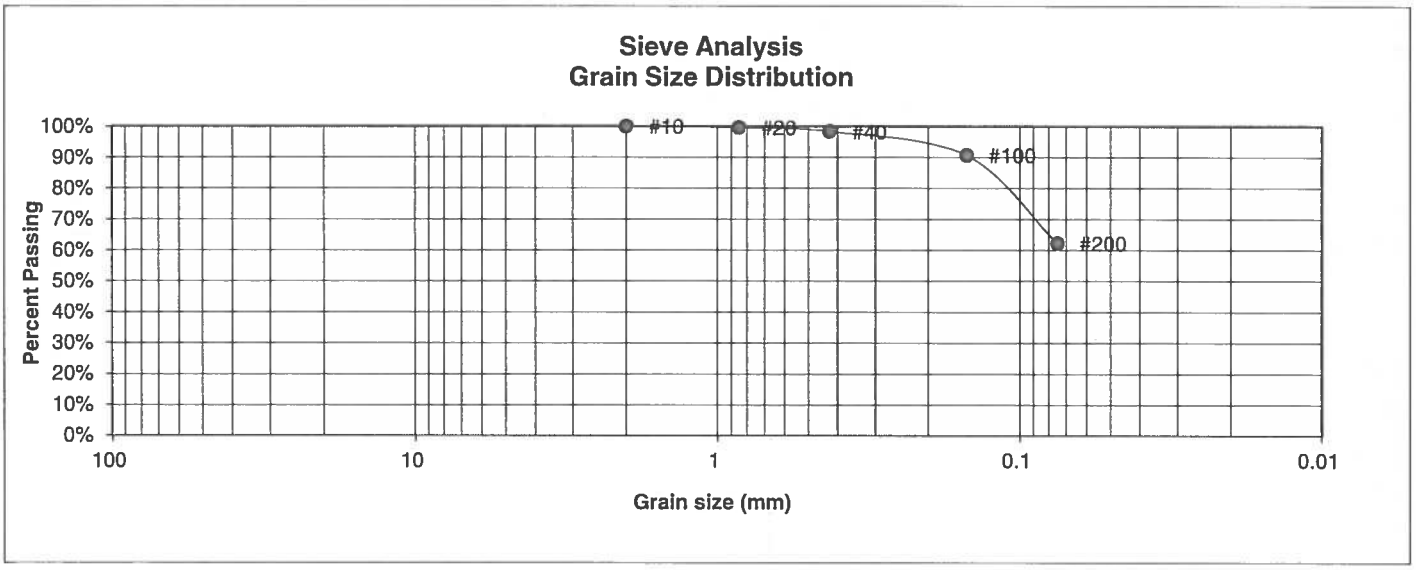
LABORATORY TEST RESULTS

| DRAWN: | DATE: | CHECKED: | DATE: |
|---|---|---|---|
| | | LLL | 10/25/17 |

JOB NO.: 170837

FIG NO.: L-3

| | | | |
|---|---|---|---|
| UNIFIED CLASSIFICATION | CL | CLIENT | CARL TURSE |
| SOIL TYPE # | 1 | PROJECT | ROLLIN RIDGE ESTATES |
| TEST BORING # | TP-2 | JOB NO. | 170837 |
| DEPTH (FT) | 2-3 | TEST BY | BL |




| U.S. Sieve # | Percent Finer |
|---|---|
| 3" | |
| 1 1/2" | |
| 3/4" | |
| 1/2" | |
| 3/8" | |
| 4 | |
| 10 | 100.0% |
| 20 | 99.6% |
| 40 | 98.3% |
| 100 | 90.7% |
| 200 | 62.2% |

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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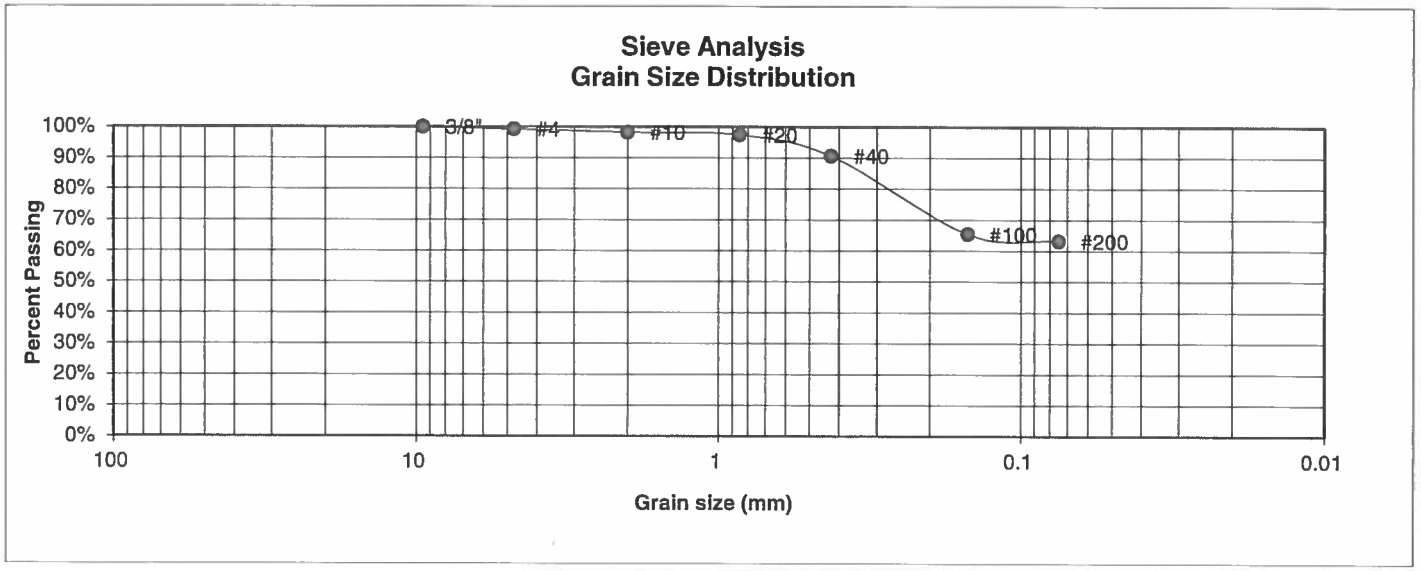
LABORATORY TEST RESULTS

| DRAWN: | DATE: | CHECKED: | DATE: |
|---|---|---|---|
| | | LLL | 10/25/17 |

JOB NO.: 170837

FIG NO.: C-4

| | | | |
|---|---|---|---|
| UNIFIED CLASSIFICATION | CL | CLIENT | CARL TURSE |
| SOIL TYPE # | 1 | PROJECT | ROLLIN RIDGE ESTATES |
| TEST BORING # | TP-3 | JOB NO. | 170837 |
| DEPTH (FT) | 2-3 | TEST BY | BL |




| U.S. Sieve # | Percent Finer |
|---|---|
| 3" | |
| 1 1/2" | |
| 3/4" | |
| 1/2" | |
| 3/8" | 100.0% |
| 4 | 99.3% |
| 10 | 98.3% |
| 20 | 97.4% |
| 40 | 90.6% |
| 100 | 65.4% |
| 200 | 63.2% |

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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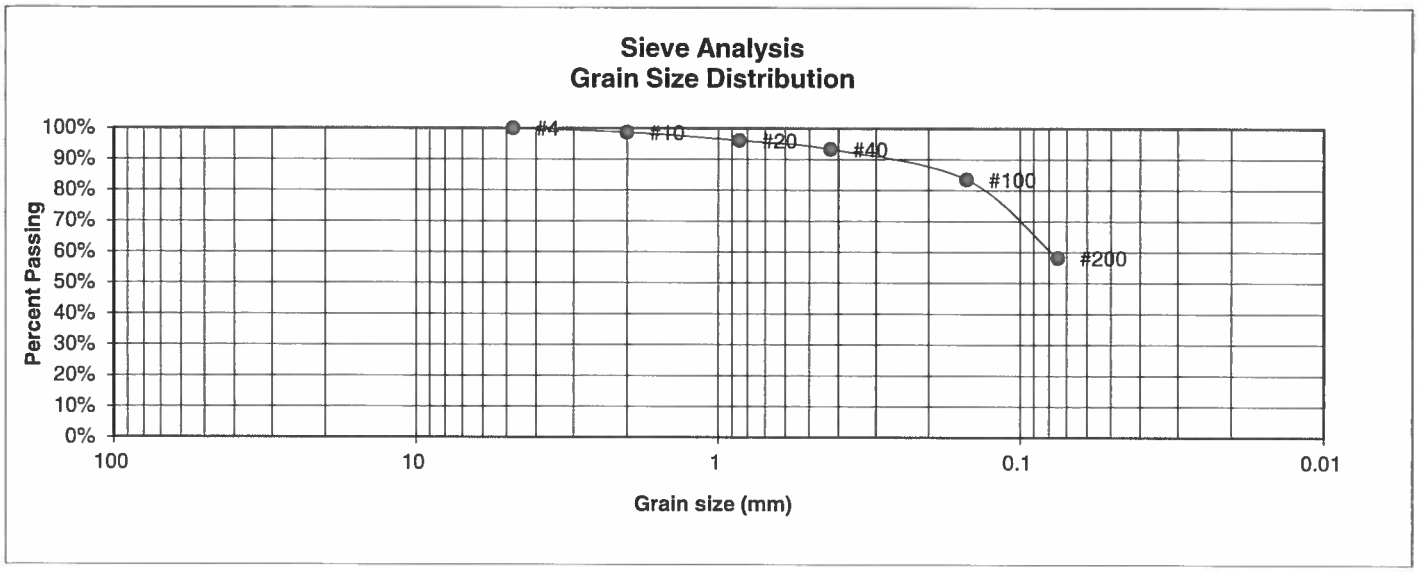
LABORATORY TEST RESULTS

| DRAWN: | DATE: | CHECKED: | DATE: |
|---|---|---|---|
| | | LLL | 10/25/17 |

JOB NO.: 170837

FIG NO.: L-5

| | | | |
|---|---|---|---|
| UNIFIED CLASSIFICATION | CL | CLIENT | CARL TURSE |
| SOIL TYPE # | 1 | PROJECT | ROLLIN RIDGE ESTATES |
| TEST BORING # | TP-5 | JOB NO. | 170837 |
| DEPTH (FT) | 2-3 | TEST BY | BL |




| U.S. Sieve # | Percent Finer |
|---|---|
| 3" | |
| 1 1/2" | |
| 3/4" | |
| 1/2" | |
| 3/8" | |
| 4 | 100.0% |
| 10 | 98.7% |
| 20 | 96.1% |
| 40 | 93.3% |
| 100 | 83.6% |
| 200 | 58.2% |

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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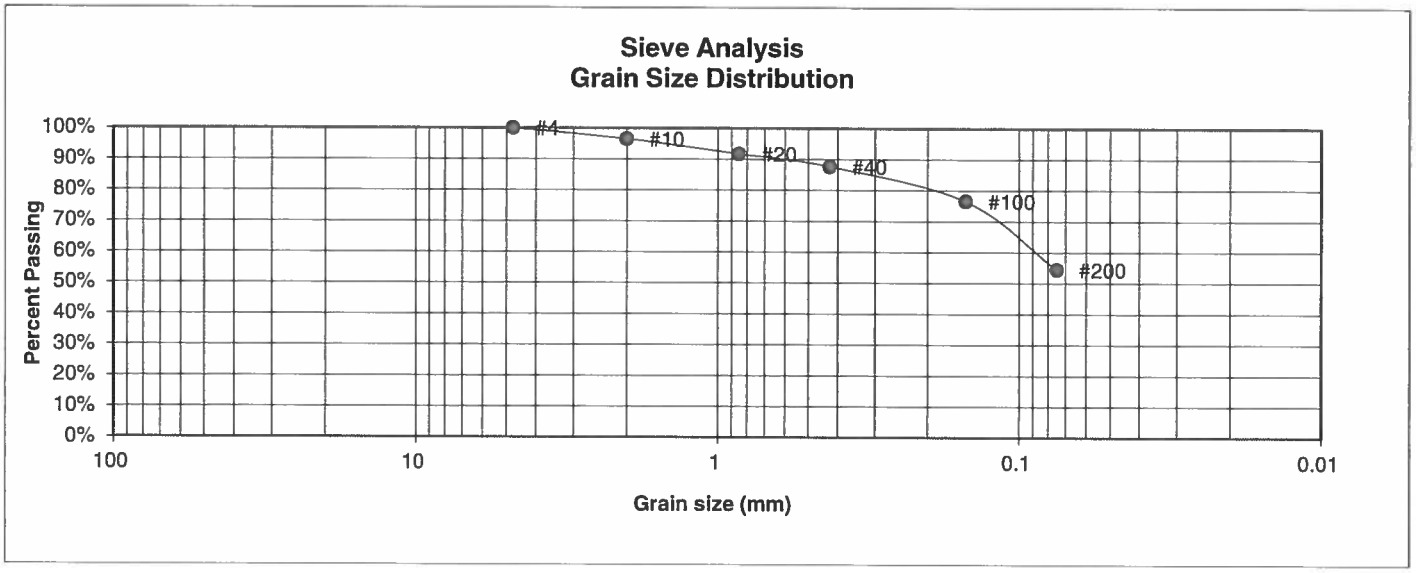
LABORATORY TEST RESULTS

| DRAWN: | DATE: | CHECKED: | DATE: |
|---|---|---|---|
| | | LLL | 10/25/17 |

JOB NO.: 170837

FIG NO.: L-6

| | | | |
|---|---|---|---|
| UNIFIED CLASSIFICATION | CL | CLIENT | CARL TURSE |
| SOIL TYPE # | 1 | PROJECT | ROLLIN RIDGE ESTATES |
| TEST BORING # | TP-10 | JOB NO. | 170837 |
| DEPTH (FT) | 6-8 | TEST BY | BL |




| U.S. Sieve # | Percent Finer |
|---|---|
| 3" | |
| 1 1/2" | |
| 3/4" | |
| 1/2" | |
| 3/8" | |
| 4 | 100.0% |
| 10 | 96.5% |
| 20 | 91.7% |
| 40 | 87.7% |
| 100 | 76.5% |
| 200 | 54.5% |

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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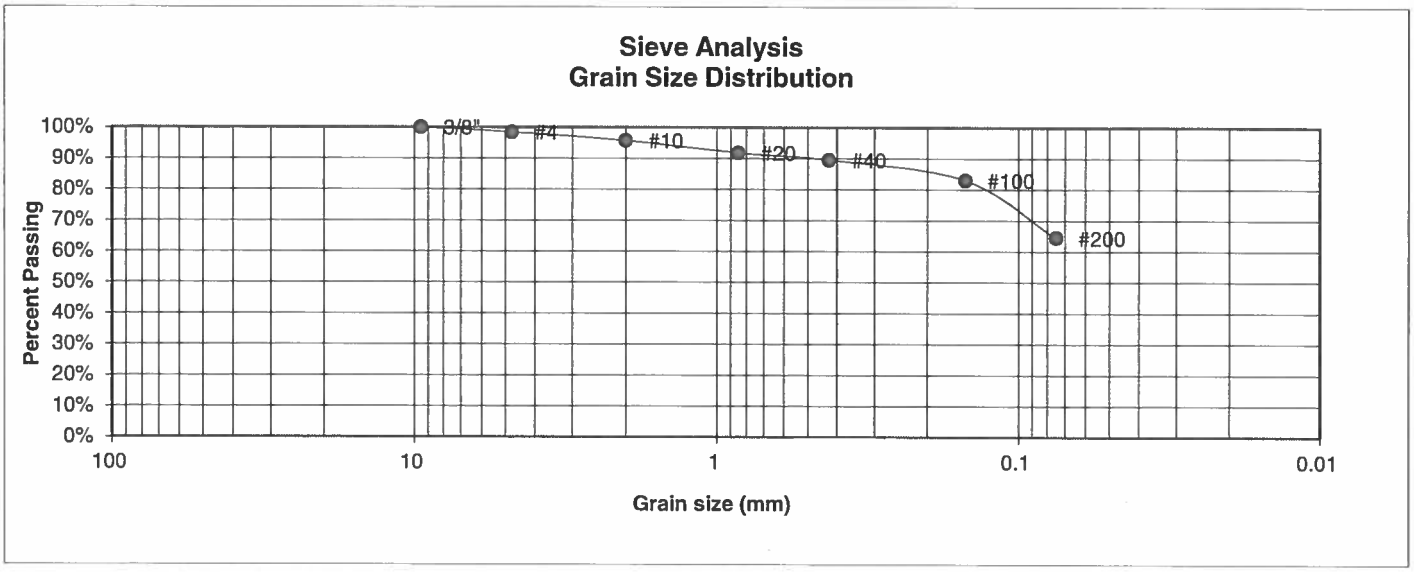
LABORATORY TEST RESULTS

| DRAWN: | DATE: | CHECKED: | DATE: |
|---|---|---|---|
| | | LLL | 10/25/17 |

JOB NO.: 170837

FIG NO.: C-7

| | | | |
|---|---|---|---|
| UNIFIED CLASSIFICATION | CL | CLIENT | CARL TURSE |
| SOIL TYPE # | 1 | PROJECT | ROLLIN RIDGE ESTATES |
| TEST BORING # | TP-14 | JOB NO. | 170837 |
| DEPTH (FT) | 3-4 | TEST BY | BL |




| U.S. Sieve # | Percent Finer |
|---|---|
| 3" | |
| 1 1/2" | |
| 3/4" | |
| 1/2" | |
| 3/8" | 100.0% |
| 4 | 98.5% |
| 10 | 95.7% |
| 20 | 91.8% |
| 40 | 89.6% |
| 100 | 83.0% |
| 200 | 64.5% |

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

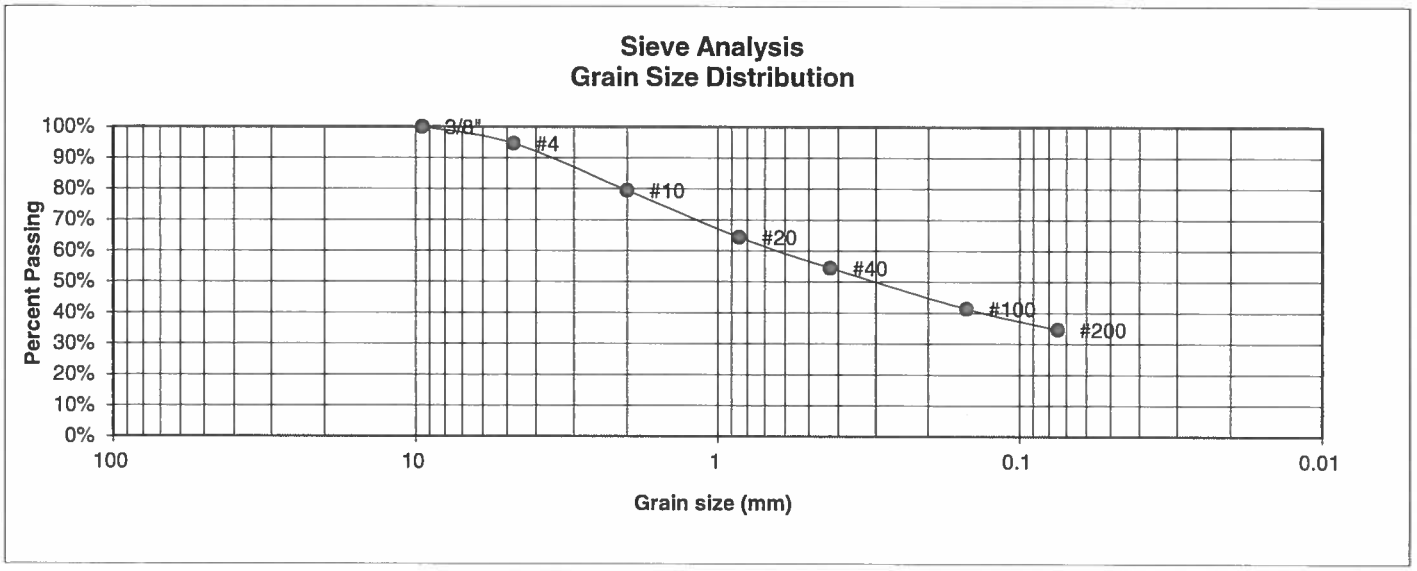
LABORATORY TEST RESULTS

| DRAWN: | DATE: | CHECKED: | DATE: |
|---|---|---|---|
| | | LLL | 10/25/17 |

JOB NO.: 170837

FIG NO.: C-8

| | | | |
|---|---|---|---|
| UNIFIED CLASSIFICATION | SC | CLIENT | CARL TURSE |
| SOIL TYPE # | 2 | PROJECT | ROLLIN RIDGE ESTATES |
| TEST BORING # | 2 | JOB NO. | 170837 |
| DEPTH (FT) | 5 | TEST BY | BL |




| U.S. Sieve # | Percent Finer |
|---|---|
| 3" | |
| 1 1/2" | |
| 3/4" | |
| 1/2" | |
| 3/8" | 100.0% |
| 4 | 94.7% |
| 10 | 79.5% |
| 20 | 64.4% |
| 40 | 54.5% |
| 100 | 41.4% |
| 200 | 34.6% |

Atterberg Limits

Plastic Limit

Liquid Limit

Plastic Index

Swell

| | |
|---|---|
| Moisture at start | 4.2% |
| Moisture at finish | 9.5% |
| Moisture increase | 5.3% |
| Initial dry density (pcf) | 211 |
| Swell (psf) | 556 |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COLORADO SPRINGS, COLORADO 80907

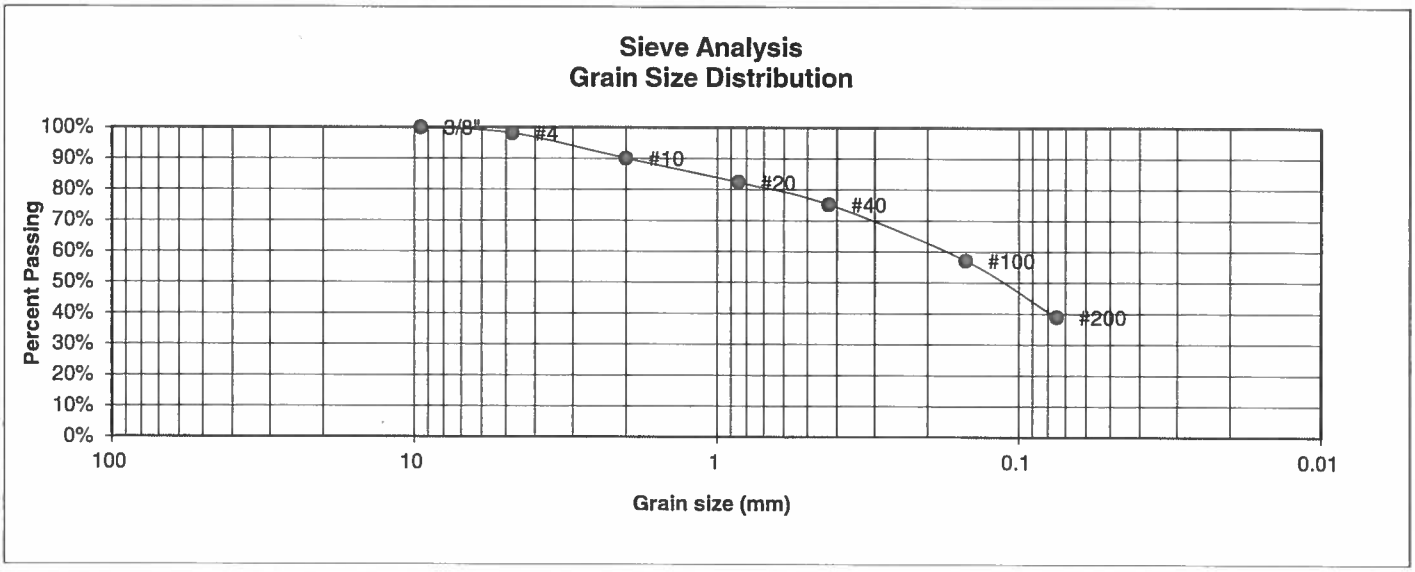

LABORATORY TEST RESULTS

| DRAWN: | DATE: | CHECKED: | DATE: |
|---|---|---|---|
| | | LLL | 10/25/17 |

JOB NO.: 170837

FIG NO.: C-9

| | | | |
|---|---|---|---|
| UNIFIED CLASSIFICATION | SC | CLIENT | CARL TURSE |
| SOIL TYPE # | 2 | PROJECT | ROLLIN RIDGE ESTATES |
| TEST BORING # | TP-4 | JOB NO. | 170837 |
| DEPTH (FT) | 5-6 | TEST BY | BL |




| U.S. Sieve # | Percent Finer |
|---|---|
| 3" | |
| 1 1/2" | |
| 3/4" | |
| 1/2" | |
| 3/8" | 100.0% |
| 4 | 98.2% |
| 10 | 90.1% |
| 20 | 82.3% |
| 40 | 75.2% |
| 100 | 57.1% |
| 200 | 38.9% |

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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LABORATORY TEST RESULTS

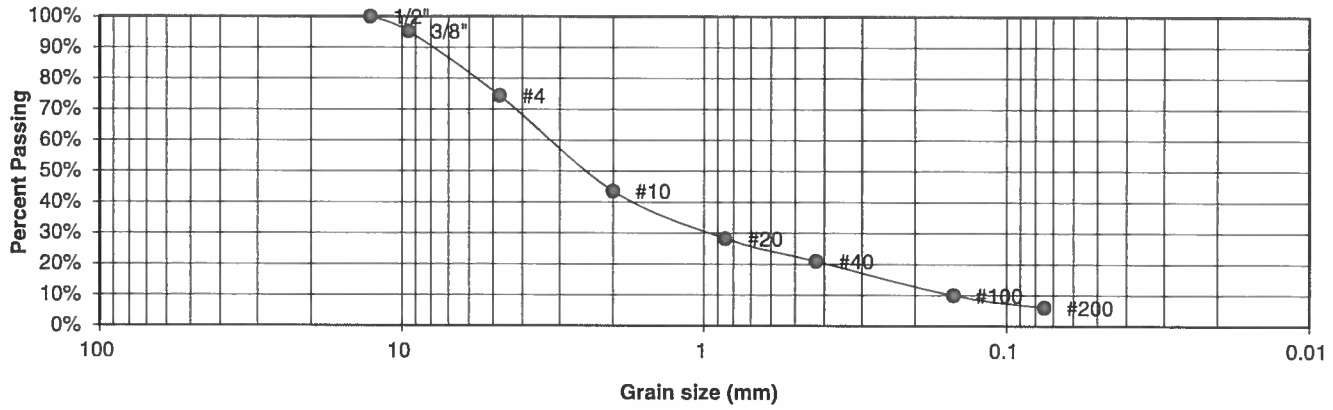
| DRAWN: | DATE: | CHECKED: | DATE: |
|---|---|---|---|
| | | LLL | 10/25/17 |

JOB NO.: 170837

FIG NO.: C-10

| | | | |
|---|---|---|---|
| UNIFIED CLASSIFICATION | SM-SW | CLIENT | CARL TURSE |
| SOIL TYPE # | 2 | PROJECT | ROLLIN RIDGE ESTATES |
| TEST BORING # | TP-5 | JOB NO. | 170837 |
| DEPTH (FT) | 6-8 | TEST BY | BL |

**Sieve Analysis**
**Grain Size Distribution**




| U.S. Sieve # | Percent Finer |
|---|---|
| 3" | |
| 1 1/2" | |
| 3/4" | |
| 1/2" | 100.0% |
| 3/8" | 95.2% |
| 4 | 74.4% |
| 10 | 43.6% |
| 20 | 28.2% |
| 40 | 20.9% |
| 100 | 10.0% |
| 200 | 6.0% |

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)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COLORADO SPRINGS, COLORADO 80907

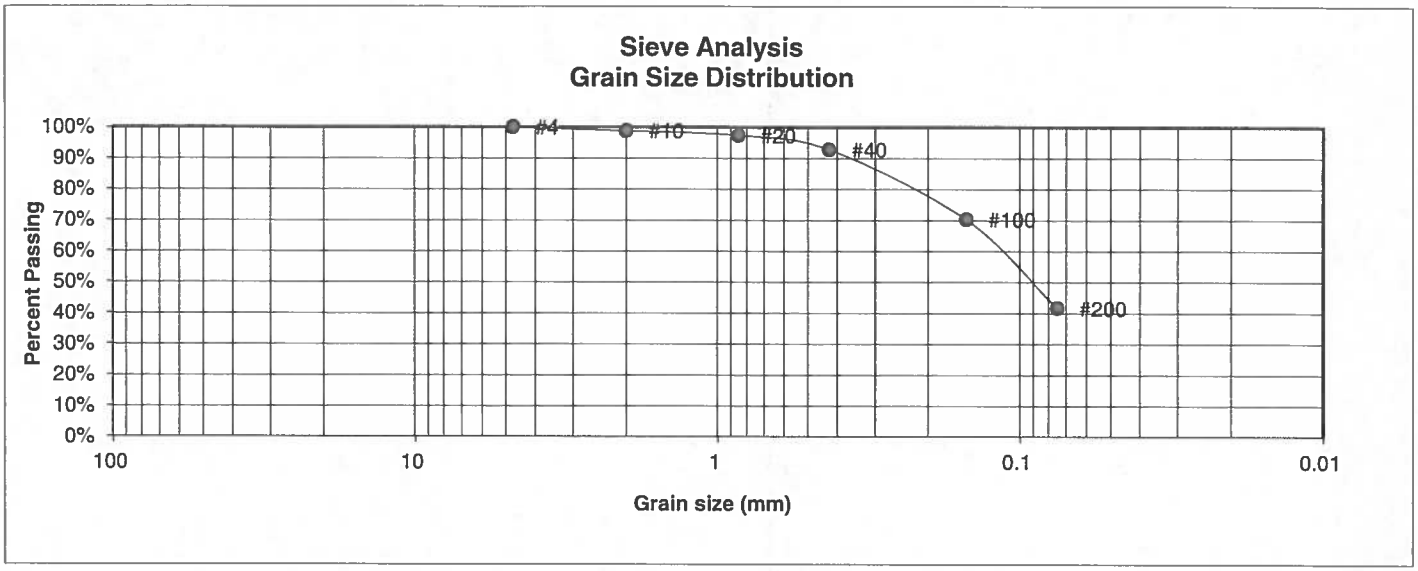

LABORATORY TEST RESULTS

| DRAWN: | DATE: | CHECKED: | DATE: |
|---|---|---|---|
| | | LLL | 10/25/17 |

JOB NO.: 170837

FIG NO.: L-11

| | | | |
|---|---|---|---|
| UNIFIED CLASSIFICATION | SC | CLIENT | CARL TURSE |
| SOIL TYPE # | 2 | PROJECT | ROLLIN RIDGE ESTATES |
| TEST BORING # | TP-6 | JOB NO. | 170837 |
| DEPTH (FT) | 3-8 | TEST BY | BL |




| U.S. Sieve # | Percent Finer |
|---|---|
| 3" | |
| 1 1/2" | |
| 3/4" | |
| 1/2" | |
| 3/8" | |
| 4 | 100.0% |
| 10 | 98.9% |
| 20 | 97.4% |
| 40 | 92.8% |
| 100 | 70.3% |
| 200 | 41.7% |

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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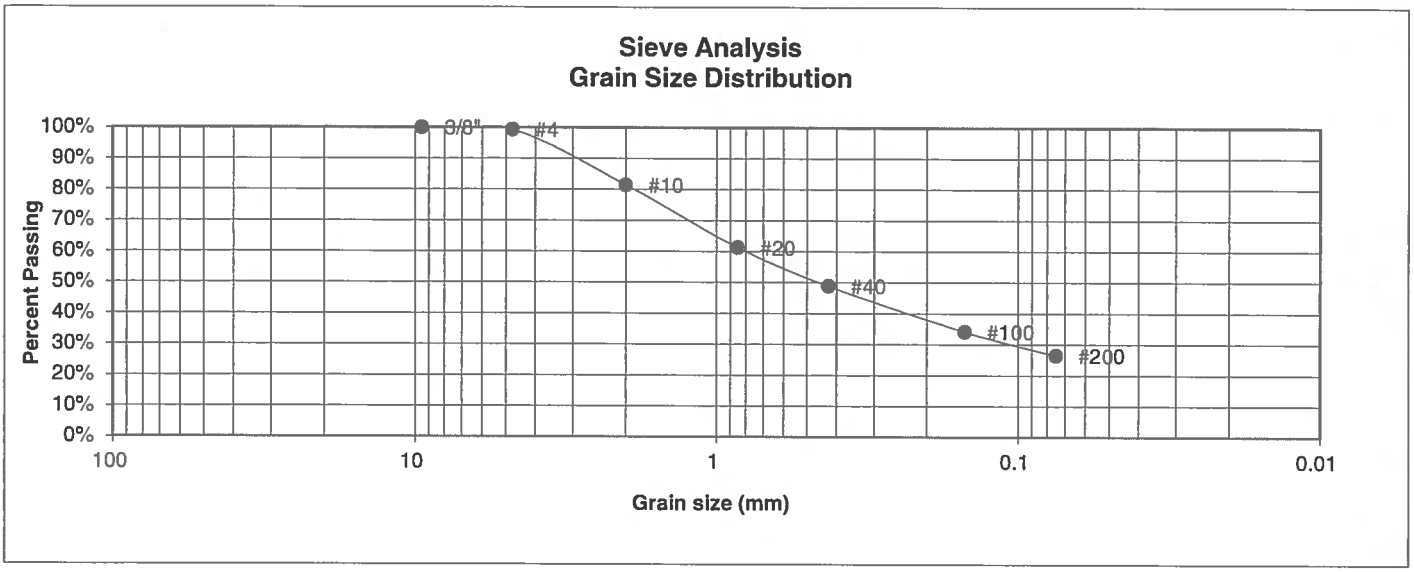
LABORATORY TEST RESULTS

| DRAWN: | DATE: | CHECKED: | DATE: |
|---|---|---|---|
| | | LLL | 10/25/17 |

JOB NO.: 170837

FIG NO.: C-12

| | | | |
|---|---|---|---|
| UNIFIED CLASSIFICATION | SM | CLIENT | CARL TURSE |
| SOIL TYPE # | 2 | PROJECT | ROLLIN RIDGE ESTATES |
| TEST BORING # | TP-11 | JOB NO. | 170837 |
| DEPTH (FT) | 4-6 | TEST BY | BL |




| U.S. Sieve # | Percent Finer |
|---|---|
| 3" | |
| 1 1/2" | |
| 3/4" | |
| 1/2" | |
| 3/8" | 100.0% |
| 4 | 99.2% |
| 10 | 81.5% |
| 20 | 61.3% |
| 40 | 48.8% |
| 100 | 34.2% |
| 200 | 26.4% |

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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


**ENTECH ENGINEERING, INC.**
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COLORADO SPRINGS, COLORADO 80907

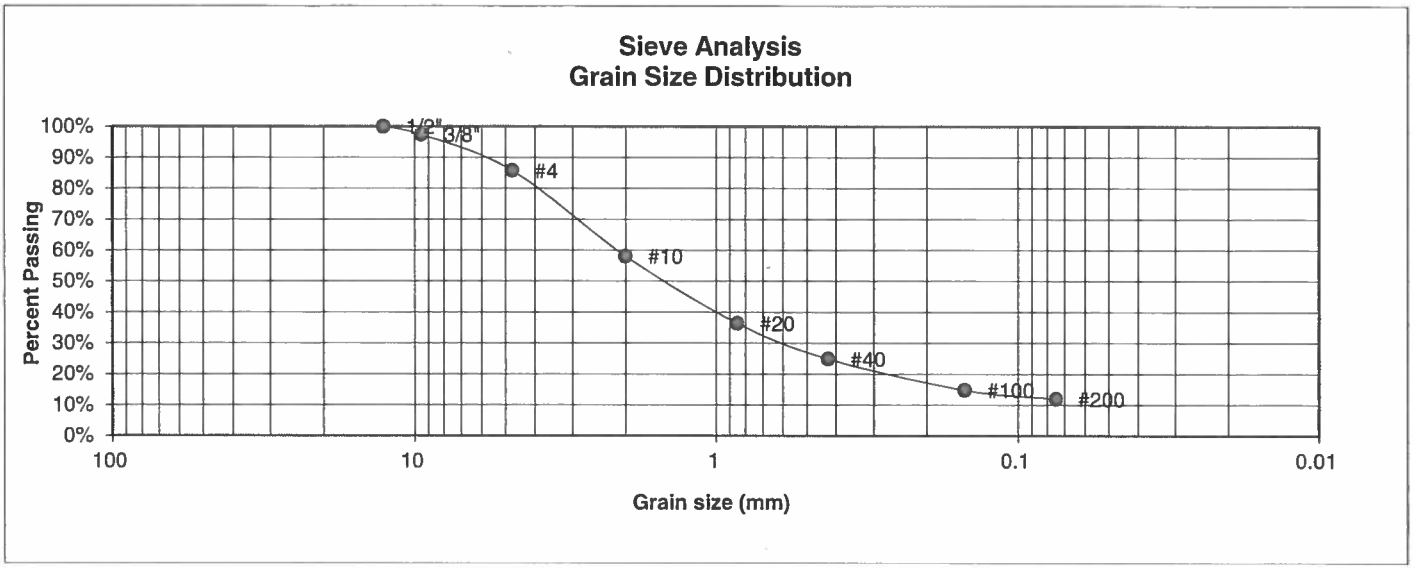

LABORATORY TEST RESULTS

| DRAWN: | DATE: | CHECKED: | DATE: |
|---|---|---|---|
| | | LLL | 10/25/17 |

JOB NO.: 170837

FIG NO.: C-13

| | | | |
|---|---|---|---|
| UNIFIED CLASSIFICATION | SM | CLIENT | CARL TURSE |
| SOIL TYPE # | 3 | PROJECT | ROLLIN RIDGE ESTATES |
| TEST BORING # | 2 | JOB NO. | 170837 |
| DEPTH (FT) | 15 | TEST BY | BL |




| U.S. Sieve # | Percent Finer |
|---|---|
| 3" | |
| 1 1/2" | |
| 3/4" | |
| 1/2" | 100.0% |
| 3/8" | 97.4% |
| 4 | 85.8% |
| 10 | 58.1% |
| 20 | 36.4% |
| 40 | 24.9% |
| 100 | 14.8% |
| 200 | 11.9% |

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

**ENTECH**
**ENGINEERING, INC.**
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

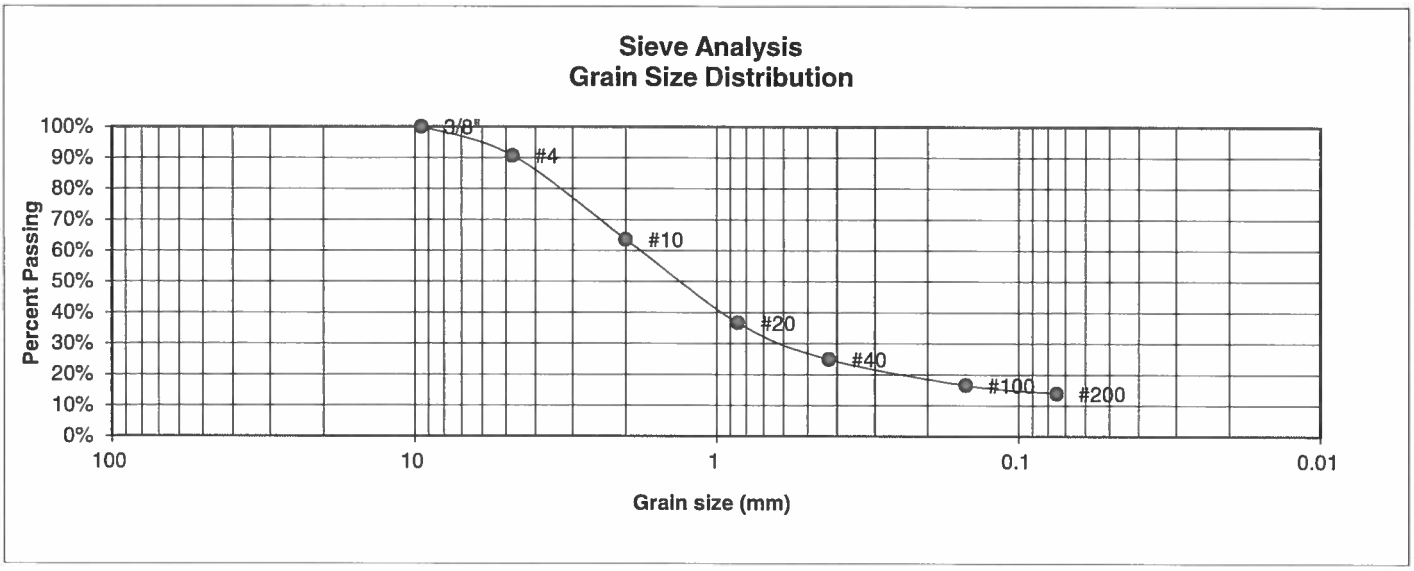
LABORATORY TEST RESULTS

| DRAWN: | DATE: | CHECKED: | DATE: |
|---|---|---|---|
| | | LLL | 10/25/17 |

JOB NO.: 170837

FIG NO.: C-14

| | | | |
|---|---|---|---|
| UNIFIED CLASSIFICATION | SM | CLIENT | CARL TURSE |
| SOIL TYPE # | 3 | PROJECT | ROLLIN RIDGE ESTATES |
| TEST BORING # | TP-3 | JOB NO. | 170837 |
| DEPTH (FT) | 5-6 | TEST BY | BL |




| U.S. Sieve # | Percent Finer |
|---|---|
| 3" | |
| 1 1/2" | |
| 3/4" | |
| 1/2" | |
| 3/8" | 100.0% |
| 4 | 90.7% |
| 10 | 63.6% |
| 20 | 36.7% |
| 40 | 24.9% |
| 100 | 16.6% |
| 200 | 13.9% |

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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COLORADO SPRINGS, COLORADO 80907

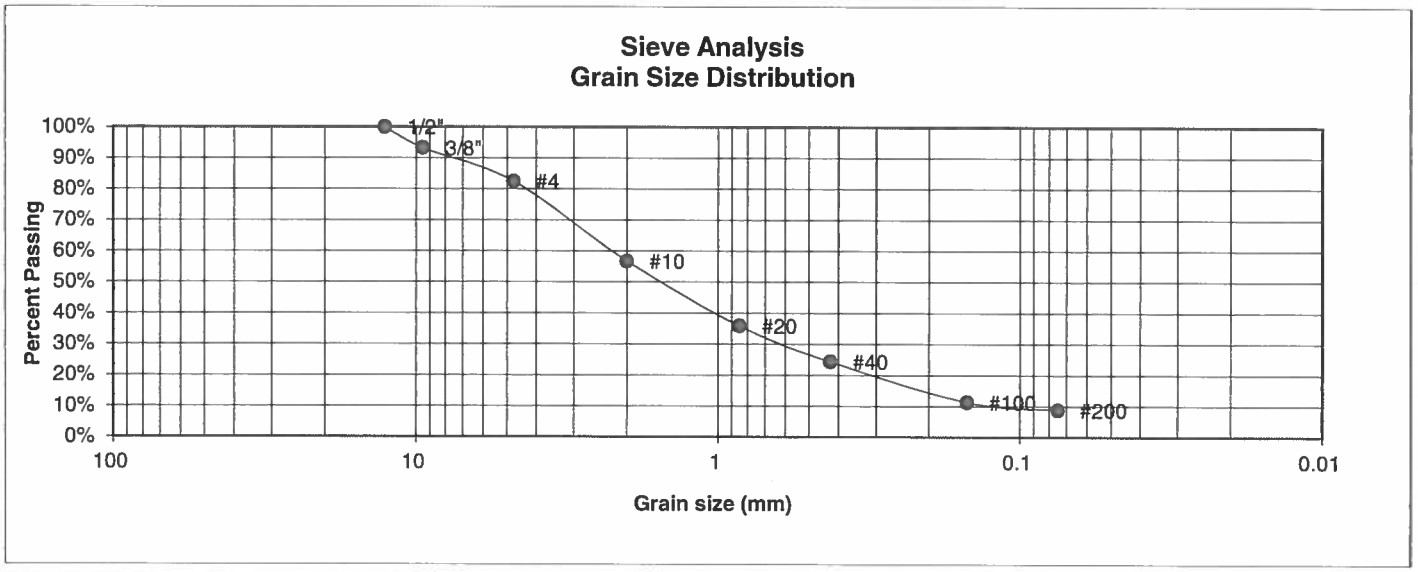
LABORATORY TEST RESULTS

| DRAWN: | DATE: | CHECKED: | DATE: |
|---|---|---|---|
| | | LLL | 10/25/17 |

JOB NO.: 170837

FIG NO.: C-15

| | | | |
|---|---|---|---|
| UNIFIED CLASSIFICATION | SM-SW | CLIENT | CARL TURSE |
| SOIL TYPE # | 3 | PROJECT | ROLLIN RIDGE ESTATES |
| TEST BORING # | TP-7 | JOB NO. | 170837 |
| DEPTH (FT) | 6-8 | TEST BY | BL |




| U.S. Sieve # | Percent Finer |
|---|---|
| 3" | |
| 1 1/2" | |
| 3/4" | |
| 1/2" | 100.0% |
| 3/8" | 93.2% |
| 4 | 82.5% |
| 10 | 56.8% |
| 20 | 35.9% |
| 40 | 24.3% |
| 100 | 11.3% |
| 200 | 8.8% |

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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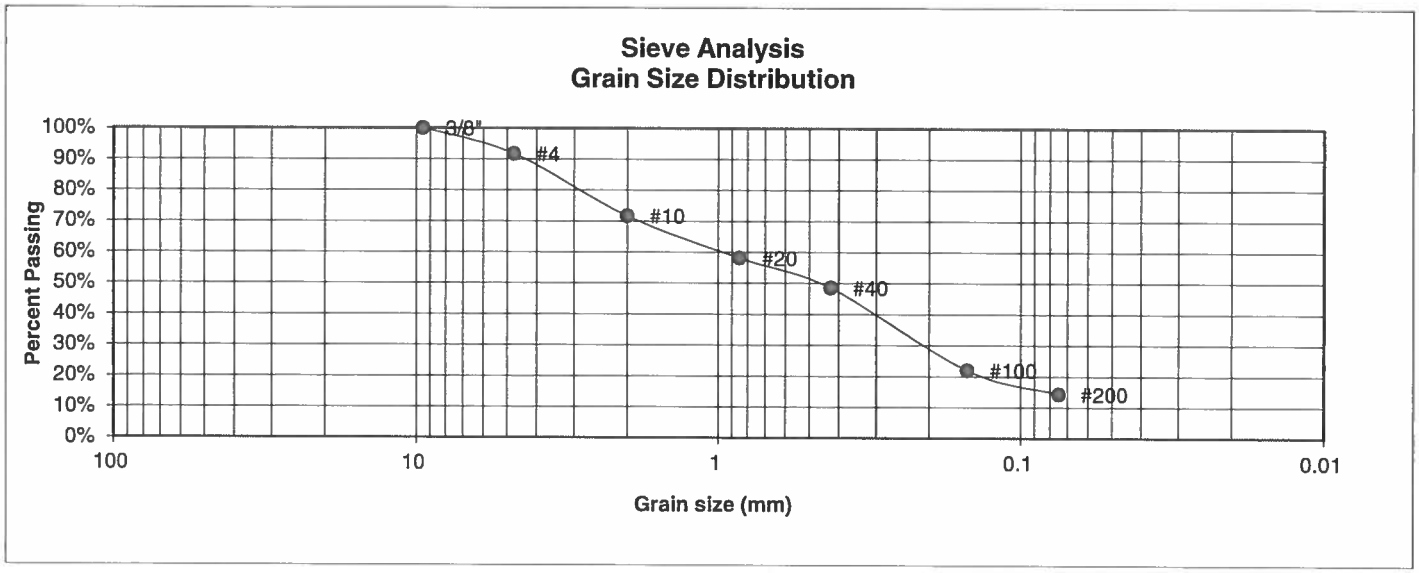
LABORATORY TEST RESULTS

| DRAWN: | DATE: | CHECKED: | DATE: |
|---|---|---|---|
| | | LLL | 10/25/17 |

JOB NO.: 170837

FIG NO.: L-16

| | | | |
|---|---|---|---|
| UNIFIED CLASSIFICATION | SM | CLIENT | CARL TURSE |
| SOIL TYPE # | 3 | PROJECT | ROLLIN RIDGE ESTATES |
| TEST BORING # | TP-8 | JOB NO. | 170837 |
| DEPTH (FT) | 6-8 | TEST BY | BL |




| U.S. Sieve # | Percent Finer |
|---|---|
| 3" | |
| 1 1/2" | |
| 3/4" | |
| 1/2" | |
| 3/8" | 100.0% |
| 4 | 91.7% |
| 10 | 71.7% |
| 20 | 58.1% |
| 40 | 48.5% |
| 100 | 22.0% |
| 200 | 14.3% |

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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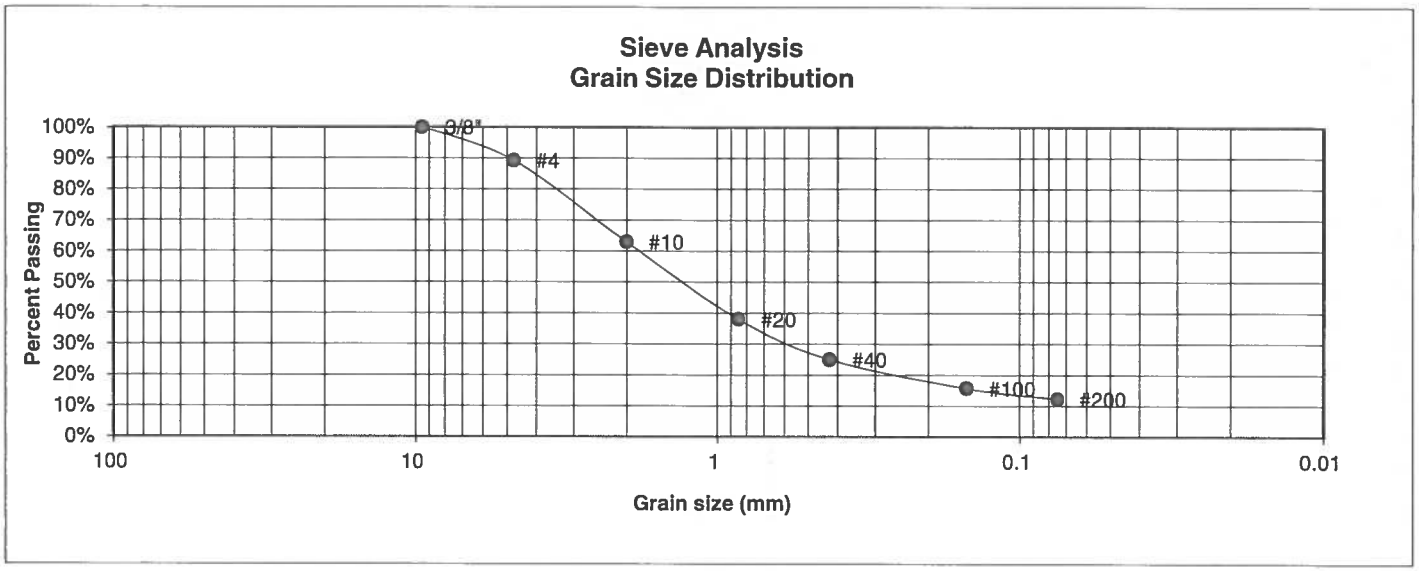
LABORATORY TEST RESULTS

| DRAWN: | DATE: | CHECKED: | DATE: |
|---|---|---|---|
| | | LLL | 10/25/17 |

JOB NO.: 170837

FIG NO.: L-17

| | | | |
|---|---|---|---|
| UNIFIED CLASSIFICATION | SM | CLIENT | CARL TURSE |
| SOIL TYPE # | 3 | PROJECT | ROLLIN RIDGE ESTATES |
| TEST BORING # | TP-12 | JOB NO. | 170837 |
| DEPTH (FT) | 5-6 | TEST BY | BL |




| U.S. Sieve # | Percent Finer |
|---|---|
| 3" | |
| 1 1/2" | |
| 3/4" | |
| 1/2" | |
| 3/8" | 100.0% |
| 4 | 89.2% |
| 10 | 62.9% |
| 20 | 38.0% |
| 40 | 25.0% |
| 100 | 15.7% |
| 200 | 12.2% |

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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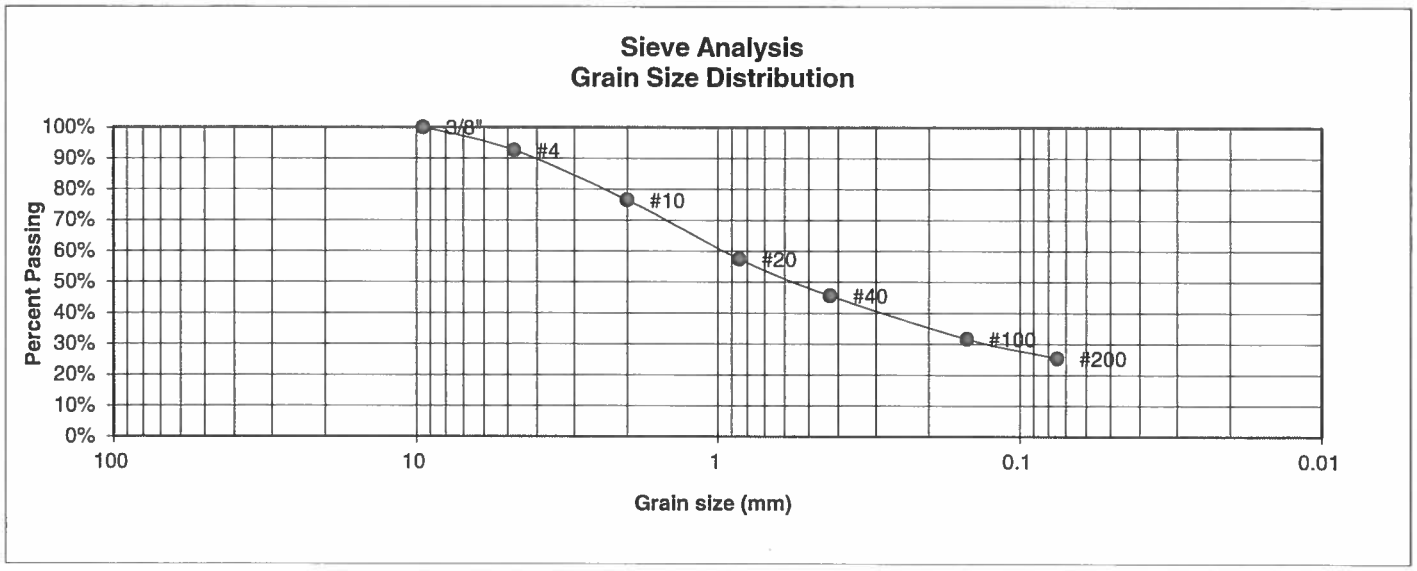
LABORATORY TEST RESULTS

| DRAWN: | DATE: | CHECKED: | DATE: |
|---|---|---|---|
| | | LLL | 10/25/17 |

JOB NO.: 170837

FIG NO.: L-18

| | | | |
|---|---|---|---|
| UNIFIED CLASSIFICATION | SM | CLIENT | CARL TURSE |
| SOIL TYPE # | 3 | PROJECT | ROLLIN RIDGE ESTATES |
| TEST BORING # | TP-13 | JOB NO. | 170837 |
| DEPTH (FT) | 1.5-8 | TEST BY | BL |




| U.S. Sieve # | Percent Finer |
|---|---|
| 3" | |
| 1 1/2" | |
| 3/4" | |
| 1/2" | |
| 3/8" | 100.0% |
| 4 | 92.6% |
| 10 | 76.5% |
| 20 | 57.5% |
| 40 | 45.6% |
| 100 | 31.7% |
| 200 | 25.4% |

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

| DRAWN: | DATE: | CHECKED: | DATE: |
|---|---|---|---|
| | | LLL | 10/25/17 |

JOB NO.: 170837

FIG NO.: C-19

# APPENDIX D: Soil Survey Descriptions

# El Paso County Area, Colorado

## 21—Cruckton sandy loam, 1 to 9 percent slopes

### Map Unit Setting

*National map unit symbol:* 367s
*Elevation:* 7,200 to 7,600 feet
*Mean annual precipitation:* 16 to 18 inches
*Mean annual air temperature:* 42 to 46 degrees F
*Frost-free period:* 110 to 120 days
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Cruckton and similar soils:* 85 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Cruckton

#### Setting

*Landform:* Flats, hills
*Landform position (three-dimensional):* Side slope, talf
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Alluvium derived from arkose

#### Typical profile

*A - 0 to 11 inches:* sandy loam
*Bt - 11 to 28 inches:* sandy loam
*C - 28 to 60 inches:* loamy coarse sand

#### Properties and qualities

*Slope:* 1 to 9 percent
*Depth to restrictive feature:* More than 80 inches
*Natural drainage class:* Well drained
*Runoff class:* Medium
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.60 to 2.00 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water storage in profile:* Low (about 5.9 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 4e
*Hydrologic Soil Group:* B
*Ecological site:* Sandy Divide (R049BY216CO)
*Hydric soil rating:* No

**Minor Components**

**Other soils**

*Percent of map unit:*
*Hydric soil rating:* No

# Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 14, Sep 23, 2016

# El Paso County Area, Colorado

## 28—Ellicott loamy coarse sand, 0 to 5 percent slopes

### Map Unit Setting

*National map unit symbol:* 3680
*Elevation:* 5,500 to 6,500 feet
*Mean annual precipitation:* 13 to 15 inches
*Mean annual air temperature:* 47 to 50 degrees F
*Frost-free period:* 125 to 145 days
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Ellicott and similar soils:* 85 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Ellicott

#### Setting

*Landform:* Flood plains, stream terraces
*Landform position (three-dimensional):* Tread
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Sandy alluvium

#### Typical profile

*A - 0 to 4 inches:* loamy coarse sand
*C - 4 to 60 inches:* stratified coarse sand to sandy loam

#### Properties and qualities

*Slope:* 0 to 5 percent
*Depth to restrictive feature:* More than 80 inches
*Natural drainage class:* Somewhat excessively drained
*Runoff class:* Very low
*Capacity of the most limiting layer to transmit water (Ksat):* High to very high (5.95 to 19.98 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* Frequent
*Frequency of ponding:* None
*Available water storage in profile:* Low (about 4.1 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 7w
*Hydrologic Soil Group:* A
*Ecological site:* Sandy Bottomland LRU's A & B (R069XY031CO)
*Other vegetative classification:* SANDY BOTTOMLAND (069AY031CO)
*Hydric soil rating:* No

**Minor Components**

**Fluvaquentic haplaquoll**
*Percent of map unit:*
*Landform:* Swales
*Hydric soil rating:* Yes

**Other soils**
*Percent of map unit:*
*Hydric soil rating:* No

**Pleasant**
*Percent of map unit:*
*Landform:* Depressions
*Hydric soil rating:* Yes

## Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 14, Sep 23, 2016

# El Paso County Area, Colorado

## 41—Kettle gravelly loamy sand, 8 to 40 percent slopes

### Map Unit Setting

*National map unit symbol:* 368h
*Elevation:* 7,000 to 7,700 feet
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Kettle and similar soils:* 85 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Kettle

#### Setting

*Landform:* Hills
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Sandy alluvium derived from arkose

#### Typical profile

*E - 0 to 16 inches:* gravelly loamy sand
*Bt - 16 to 40 inches:* gravelly sandy loam
*C - 40 to 60 inches:* extremely gravelly loamy sand

#### Properties and qualities

*Slope:* 8 to 40 percent
*Depth to restrictive feature:* More than 80 inches
*Natural drainage class:* Somewhat excessively drained
*Runoff class:* Medium
*Capacity of the most limiting layer to transmit water (Ksat):* High (2.00 to 6.00 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water storage in profile:* Low (about 3.4 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 7e
*Hydrologic Soil Group:* B
*Hydric soil rating:* No

### Minor Components

#### Other soils

*Percent of map unit:*
*Hydric soil rating:* No

**Pleasant**
*Percent of map unit:*
*Landform:* Depressions
*Hydric soil rating:* Yes

## Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 14, Sep 23, 2016

# El Paso County Area, Colorado

## 68—Peyton-Pring complex, 3 to 8 percent slopes

### Map Unit Setting

*National map unit symbol:* 369f
*Elevation:* 6,800 to 7,600 feet
*Farmland classification:* Not prime farmland

### Map Unit Composition

*Peyton and similar soils:* 40 percent
*Pring and similar soils:* 30 percent
*Estimates are based on observations, descriptions, and transects of the mapunit.*

### Description of Peyton

#### Setting

*Landform:* Hills
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Arkosic alluvium derived from sedimentary rock and/or arkosic residuum weathered from sedimentary rock

#### Typical profile

*A - 0 to 12 inches:* sandy loam
*Bt - 12 to 25 inches:* sandy clay loam
*BC - 25 to 35 inches:* sandy loam
*C - 35 to 60 inches:* sandy loam

#### Properties and qualities

*Slope:* 3 to 5 percent
*Depth to restrictive feature:* More than 80 inches
*Natural drainage class:* Well drained
*Runoff class:* Low
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high (0.20 to 0.60 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water storage in profile:* Moderate (about 7.3 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 4c
*Hydrologic Soil Group:* B
*Ecological site:* Sandy Divide (R049BY216CO)
*Hydric soil rating:* No

### Description of Pring

#### Setting

*Landform:* Hills
*Landform position (three-dimensional):* Side slope
*Down-slope shape:* Linear
*Across-slope shape:* Linear
*Parent material:* Arkosic alluvium derived from sedimentary rock

#### Typical profile

*A - 0 to 14 inches:* coarse sandy loam
*C - 14 to 60 inches:* gravelly sandy loam

#### Properties and qualities

*Slope:* 3 to 8 percent
*Depth to restrictive feature:* More than 80 inches
*Natural drainage class:* Well drained
*Runoff class:* Low
*Capacity of the most limiting layer to transmit water (Ksat):* High (2.00 to 6.00 in/hr)
*Depth to water table:* More than 80 inches
*Frequency of flooding:* None
*Frequency of ponding:* None
*Available water storage in profile:* Low (about 6.0 inches)

#### Interpretive groups

*Land capability classification (irrigated):* None specified
*Land capability classification (nonirrigated):* 3e
*Hydrologic Soil Group:* B
*Ecological site:* Loamy Park (R048AY222CO)
*Hydric soil rating:* No

### Minor Components

#### Other soils

*Percent of map unit:*
*Hydric soil rating:* No

#### Pleasant

*Percent of map unit:*
*Landform:* Depressions
*Hydric soil rating:* Yes

## Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 14, Sep 23, 2016

# Soils & Geology Report_V1.pdf Markup Summary

## Locked (3)

**Subject:** Text Box
**Page Label:** 1
**Lock:** Locked
**Author:** dsdlaforce
**Date:** 12/30/2019 9:30:07 AM
**Status:**
**Color:**
**Layer:**
**Space:**

Per Drainage Criteria Manual chapter 11 Section 11.3.3. Provide recommendations for the foundation preparation and embankment construction for all permanent detention facilities.

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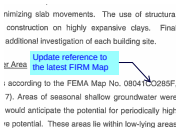


**Subject:** Callout
**Page Label:** 10
**Lock:** Locked
**Author:** dsdlaforce
**Date:** 12/30/2019 9:30:09 AM
**Status:**
**Color:**
**Layer:**
**Space:**

Update reference to the latest FIRM Map

---

**Subject:** Cloud+
**Page Label:** 22
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**Author:** dsdsevigny
**Date:** 12/30/2019 9:30:10 AM
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**Space:**

Not being reviewed as it is a tract for future development