



**ENTECH**  
ENGINEERING, INC.

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

**SOIL, GEOLOGY, & GEOLOGIC HAZARD STUDY  
SADDLEHORN RANCH – FILING NO. 4  
CURTIS ROAD & JUDGE ORR ROAD  
EL PASO COUNTY, COLORADO**

Prepared for

**William Guman and Associates, LTD**  
731 North Weber Street, Suite 100  
Colorado Springs, Colorado 80903

Attn: William Guman

December 5, 2022

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Logan L. Langford, P.G.  
Geologist



Reviewed by:

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

LLL

Encl.

Entech Job No. 222006  
AAprojects/2022/222006 countysoil/geo

PCD Fil No. **SF236**

Ensure that all requirements of ECM Appendix C are met in the report, specifically regarding groundwater. Note that any exposed groundwater will be the responsibility of the developer or district to address, including any requirements of the Upper Black Squirrel Creek Groundwater Management District.

## TABLE OF CONTENTS

<b>1.0 SUMMARY</b> .....	<b>1</b>
<b>2.0 GENERAL SITE CONDITIONS AND PROJECT DESCRIPTION</b> .....	<b>2</b>
<b>3.0 SCOPE OF THE REPORT</b> .....	<b>3</b>
<b>4.0 FIELD INVESTIGATION</b> .....	<b>3</b>
<b>5.0 SOIL, GEOLOGY AND ENGINEERING GEOLOGY</b> .....	<b>4</b>
5.1 General Geology .....	4
5.2 Soil Conservation Survey.....	4
5.3 Site Stratigraphy.....	5
5.4 Soil Conditions .....	6
5.5 Groundwater .....	8
<b>6.0 ENGINEERING GEOLOGY – IDENTIFICATION AND MITIGATION OF GEOLOGIC HAZARDS</b> .....	<b>8</b>
6.1 Relevance of Geologic Conditions to Land Use Planning .....	12
<b>7.0 ROADWAY AND EMBANKMENT CONSTRUCTION RECOMMENDATIONS</b> .....	<b>13</b>
<b>8.0 ECONOMIC MINERAL RESOURCES</b> .....	<b>14</b>
<b>9.0 EROSION CONTROL</b> .....	<b>15</b>
<b>10.0 CLOSURE</b> .....	<b>16</b>
<b>BIBLIOGRAPHY</b> .....	<b>17</b>

### TABLES

- Table 1: Summary of Laboratory Test Results  
Table 2: Summary of Test Boring Results  
Table 3: Summary of Tactile Test Pits Results

### FIGURES

- Figure 1: Vicinity Map  
Figure 2: USGS Map  
Figure 3: Site Plan/Testing Location Map  
Figure 4: Soil Survey Map  
Figure 5: Falcon Quadrangle Geology Map  
Figure 6: Geology Map/Engineering Geology  
Figure 7: Floodplain Map  
Figure 8: Typical Perimeter Drain Details  
Figure 9: Underslab Drainage Layer (Capillary Break)  
Figure 10: Interceptor Drain Detail

APPENDIX A: Site Photographs

APPENDIX B: Test Boring Logs and Test Pit Logs

APPENDIX C: Laboratory Test Results

APPENDIX D: Test Boring & Test Pit Logs, Laboratory Testing Summary EEI Job No. 181823

APPENDIX E: Soil Survey Descriptions

## 1.0 SUMMARY

### ***Project Location***

The project site lies in portions northeast ¼ and southeast ¼ the of Section 3, Township 13 South, Range 64 West of the 6<sup>th</sup> Principal Meridian in El Paso County, Colorado. The site is located approximately 3 miles east of Falcon, Colorado, southeast of the intersection of Curtis Road and Judge Orr Road.

### ***Project Description***

The total project area is listed as 176 acres on the SWMP and 166 acres on the ESQCP. Verify and update so all match.

Total acreage involved in the project is approximately 162 acres. The proposed site development consists of forty-two (42) single-family rural residential lots. The development will be serviced by Saddlehorn Ranch Metropolitan water and individual on-site wastewater treatment systems.

### ***Scope of Report***

This report presents the results of our geologic evaluation, and treatment of engineering geologic hazard study.

### ***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 potentially expansive soils, hydrocompaction, loose/collapsible soils, shallow bedrock, floodplain, potentially seasonal shallow groundwater, seasonal shallow groundwater and areas of ponded water. 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 portions of the northeast ¼ and southeast ¼ the of Section 3, Township 13 South, Range 64 West of the 6<sup>th</sup> Principal Meridian in El Paso County, Colorado. The site is located approximately 3 miles east of Falcon, Colorado, southeast of Curtis Road and Judge Orr Road. The location of the site is as shown on the Vicinity Map, Figure 1.

The topography of the site varies from very gradually to moderately sloping generally to the south to southeast. Three drainages that are tributaries to Black Squirrel Creek bisect the overall Saddlehorn Ranch site, with the middle drainage located along the southern side of Filing 4, and the northern drainage is located within the northeastern portion of Filing No. 4. Steeper slopes are located along portions of some of the drainages on the site. The drainages in Filing No. 4 flow in a southeasterly direction through Filing No. 4 and are primarily located within drainage easements and open space tracts being avoided by the proposed lots. Water was not observed in the in Filing No. 4 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. Site photographs, taken September 28, 2022, are included in Appendix A.

The total project area is listed as 176 acres on the SWMP and 166 acres on the ESQCP. Verify and update so all match.

Total acreage involved in the proposed development is approximately 162 acres with forty-two (42) single-family rural residential lots, with designated open space and drainage easements. The proposed residential lots range from approximately 2.5 to 3.9 acres. The majority of the lots are approximately 2.5 acres in size. The area will be serviced by Saddlehorn Ranch Metropolitan water and individual on-site wastewater treatment systems. The proposed Site Plan/Testing Location Map is presented in Figure 3.

The site was previously investigated as part of a Preliminary Soils, Geology, Geologic Hazard and Wastewater Study, Entech Job No. 181823 (Reference 1). Four (4) test borings, and forty-five (45) tactile test pits were performed on the site to determine general suitability of the site for construction and the use of on-site wastewater treatment systems. The previous report/investigation was used as part of this investigation. More specifically one (1) test boring (TB-3), and nine (9) of the previous test pits were used as part of the Saddlehorn Ranch – Filing No. 4 investigation. Eight (8) additional test borings and one (1) test pit were completed for Saddlehorn Ranch – Filing No. 4. The Test Pit Logs are included in Appendix B, the Laboratory

Testing Results are included in Appendix C, and a Summary of the Laboratory Testing Results is presented in Table 1.

### **3.0 SCOPE OF THE REPORT**

The scope of the report includes 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. The site will be evaluated for individual on-site wastewater treatment systems in accordance with El Paso Land Development Code.

### **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 data 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 aerial 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 September 28, 2022.

Four (4) test borings, and forty-five (45) tactile test pits were previously performed on the site to verify general soil conditions and the suitability of the site for the use of on-site wastewater treatment systems (Reference 1). One Test Boring (TB-3), and nine (9) of the previous Test Pits (TP-22, TP-23, TP-28, TP-29, TP-30, TP-37, TP-38, TP-39, & TP-40) were used as part of the Saddlehorn Ranch – Filing No. 4 investigation. Eight (8) additional test borings and one (1) test pit were completed for Saddlehorn Ranch – Filing No. 4. The locations of the test pits are indicated on the Site Plan/Testing Location Map, Figure 3. The Test Pit Logs are included in Appendix B, the Laboratory Testing Results are included in Appendix C, and a Summary of the Laboratory Testing Results is presented in Table 1. 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 for classification purposes. Volume change testing was performed on selected samples using the FHA Swell Test and Swell/Consolidation Test, ASTM D-4546, in order to evaluate the expansion/consolidation potential of the soils. Soluble sulfate testing was performed on selected samples to determine the corrosive characteristics of the soils on concrete placed below ground. Results of the laboratory testing are included in Appendix C. The Laboratory Test Results are summarized in Tables 1 and 2.

## **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. Approximately 18 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 northwesterly direction (Reference 2). 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 man-made fill deposits, residual soils, eolian soils, 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 the site and as stream terrace deposits. The eolian soils were deposited by prevailing winds from the west and northwest. 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 3), previously the Soil Conservation Service (Reference 4) has mapped three soil types on the site (Figure 4). In general, they vary from loam, loamy sands, and sandy loam. The soils are described as follows:

<u>Type</u>	<u>Description</u>
8	Blakeland Loamy Sand, 1-9% slopes
19	Columbine Gravelly Sandy Loam, 0 to 3% slopes
29	Fluvaquentic Haplaquolls, nearly level

Complete descriptions of each soil type are presented in Appendix D. The soils have generally been described to typically have moderate to very rapid permeabilities. The majority of the soils have rapid permeabilities. Limitations described for the soils include the hazard of flooding on Soil Type Nos. 19 and 29. Soil Type No. 29 is mapped in the floodplain zone that is designated as open space. 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 Falcon Quadrangle Geology Map showing the site is presented in Figure 5 (Reference 5). The Geology Map prepared for the site is presented in Figure 6. Five mappable units were identified on the overall site which are described as follows:

- Qal Recent Alluvium – Post Piney Creek (Alluvium One) of Late Holocene Age:** These materials consist of water deposited sands located along some of the minor drainages across the site. The materials consist of silty to clayey sand and sandy clays.
  
- Qp Piney Creek Alluvium (Alluvium Two) of Early Holocene Age:** These materials consist of low stream-terrace deposits above the current stream channels. The materials typically consist of silty to well graded sand.
  
- Qb Broadway Alluvium (Alluvium Three) of Late Pleistocene Age:** These materials consist of middle steam terrace deposits. The materials typically consist of silty to clayey gravelly sands.
  
- Qes Eolian Sand of Quaternary Age:** These deposits are fine to medium grained soil deposited on the site by the action of prevailing winds from the west and northwest. They typically occur as large dune deposits or narrow ridges. These soils are typically

tan to brown in color and tend to have very uniform or well-sorted gradation. These materials tend to have a relatively high permeability and low density.

**Qes/Tkd Eolian Sand Deposits of Quaternary Age overlying 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 eolian sand and residual soil, undifferentiated. The eolian sands were deposited by the action of the prevailing winds. 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 Falcon Quadrangle* distributed by the Colorado Geological Survey in 2012 (Reference 5), and the *Geologic Map of the Pueblo 1<sup>0</sup> x 2<sup>0</sup> Quadrangle*, distributed by the US Geological Survey in 1978 (Reference 6). The Test Pits 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 Test Borings and Test Pits can be grouped into four general soil and rock types. The soils were classified using the Unified Soil Classification System (USCS). The test pit soils were also classified using the USDA Textural Soil Classification.

Soil Type 1 is a well-graded sand, slightly silty to silty sand and clayey to very clayey sand (SW, SM-SW, SM, SC). This material was encountered in all of the test pits and eight of the test borings. The sand was encountered at depths ranging from the existing surface to 4 feet, and extending to depths of 4 to 11 feet bgs. These soils were encountered at loose to medium dense states and at dry to moist conditions. Samples tested had 3 to 37 percent of the soil size particles passing the No. 200 Sieve. Atterberg Limits Testing resulted in liquid limits of 19 to 21 and plastic indexes of 3 to 4, and non-plastic results. FHA Swell Testing on select samples resulted in expansion pressures of 30 to 430 psf, indicating low expansion potentials.



Soil Type 2 is a sandy clay and very sandy silt (CL, ML). This material was encountered in Test Boring Nos. 7 and Test Pit 1A. The clays were encountered at depths ranging from the existing surface and extended to depths of 8 to 9 feet. The clay was encountered at firm consistencies and moist conditions. The samples tested had 61 to 88 percent of the soil size particles passing the No. 200 sieve. Atterberg Limits Testing resulted in liquid limits of 32 to 41 and plastic indexes of 10 to 18. Swell/Consolidation Testing resulted in a volume change of 0.8 percent, indicating a low expansion potential. Sulfate testing resulted in less than 0.01 percent soluble sulfate by weight, indicating the sandstone exhibits negligible potential for below grade concrete degradation due to sulfate attack.

Soil Type 3 is a silty to very silty sandstone and clayey to very clayey sandstone (SM, SM-SW, SC). This material was encountered in eight of the test borings and three of the test pits. The sandstone was encountered at depths ranging from 2.5 to 11 feet bgs and extended to termination of the test borings and pits (5 to 20 feet). The sandstone was encountered at dense to very dense states and moist conditions. Samples tested had 9 to 28 percent of the soil sized particles passing the No. 200 sieve. Atterberg Limits Testing resulted in non-plastic results. Highly expansive clayey sandstone and claystone are commonly interbedded in the sandstone in the area. Sulfate testing resulted in 0.01 percent soluble sulfate by weight, indicating the sandstone exhibits negligible potential for below grade concrete degradation due to sulfate attack.

Soil Type 4 is a very sandy claystone and very sandy siltstone (CL, ML). This material was encountered one of the test borings and test pits at 5 to 19 feet bgs and extended to the termination of the test borings and test pits (8 to 20 feet). The claystone and siltstone were encountered at hard consistencies and moist conditions. Samples tested had 57 to 59 percent of the soil size particles passing the No. 200 sieve. Atterberg Limits Testing resulted in a liquid limit of 41 and plastic index of 5. Swell/Consolidation Testing on a samples resulted in volume changes of 1.4, indicating a low to moderate expansion potential. FHA Swell Testing on a sample of the claystone resulted in an expansion pressure of 3160 psf, indicating a moderate to high expansion potential.

The Test Borings and Test Pit Logs are presented in Appendix B. Laboratory Test Results are presented in Appendix C. The Laboratory Test Results are summarized on Table 1.

## 5.5 Groundwater

Groundwater or signs of seasonal groundwater were encountered in all of the test borings and in five of the test pits within Filing No. 4 at depths ranging from 3.5 to 16 feet. Areas of seasonal and potentially seasonal shallow groundwater have been mapped in low-lying areas and in the drainages on the 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. Isolated sand layers within the variable soil profile, sometimes only a few feet in thickness and width, can carry water in the subsurface. Additionally, perched water conditions can occur on this site where water can flow through permeable sands overlying less permeable 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

Detailed mapping has been performed on this site to produce a 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:

### Hydrocompaction – Constraint

Areas in which hydrocompaction have been identified are acceptable as building sites. In areas identified for this hazard classification, however, we anticipate a potential for settlement upon saturation of these surficial soils. The low density, uniform grain sized, windblown sand deposits are particularly susceptible to this type of phenomenon.

Mitigation: The potential for settlement is directly related to saturation of the soils below the foundation areas. Therefore, good surface and subsurface drainage is extremely critical in these areas in order to minimize the potential for saturation of these soils. The ground surface around all permanent structures should be positively sloped away from the structure to all points, and water must not be allowed to stand or pond anywhere on the site. We recommend that the ground surface within 10 feet of the structures be sloped away with a minimum gradient of five percent.

If this is not possible on the upslope side of the structures, then a well-defined swale should be created to intercept the surface water and carry it quickly and safely around and away from the structures. Roof drains should be made to discharge well away from the structures and into areas of positive drainage. Where several structures are involved, the overall drainage design should be such that water directed away from one structure is not directed against an adjacent building. Planting and watering in the immediate vicinity of the structures, as well as general lawn irrigation, should be minimized.

#### Loose or Collapsible Soils – Constraint

Loose soils were encountered in several of the test pits and one of the test borings. These soils are typically encountered in areas mapped as eolian sand deposits. Other areas of loose soils could be encountered across the site. Any loose or collapsible soils encountered beneath foundations or floor slabs will require mitigation.

Mitigation: Any loose or collapsible soils encountered beneath foundations or floor slabs should be overexcavated, moisture-conditioned and recompacted. The soils should be recompacted to 95 percent of the soils maximum Modified Proctor Dry Density ASTM D-1557 at  $\pm 2$  percent of optimum moisture content. The reconditioned soils on this site should be observed and tested to verify adequate compaction. Areas requiring recompaction should be determined after additional investigation of each building site and during the excavation observations.

#### Expansive Soils – Constraint

Expansive soils were encountered in two test borings drilled and several 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 soils, 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. Overexcavation depths of 3 to 5 feet should be anticipated where expansive soils are encountered. 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 25 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.

### Shallow Bedrock

Bedrock was encountered in all the test borings and test pits at depths ranging from 2.5 to 11 feet. A Summary of the Depth to Bedrock is included in Table 2. Shallow bedrock will be encountered in some areas of this site, particularly those mapped as Qes/Tkd: eolian sands overlying the Dawson Formation. Where shallow claystone, sandstone, and siltstone are encountered, excavation/grading may be difficult requiring track-mounted excavators. Bedrock may be encountered cuts for roadways and utility excavations.

### Floodplain and Drainage Areas – Constraint

Portions of the site associated with tributaries of the Black Squirrel Creek drainage are mapped within a floodplain zone according to the FEMA Map No. 08041C0558G, dated December 7, 2018 (Figure 7, Reference 7). Areas of ponded water were observed in the central portion of the site near the windmill. The floodplain areas have been designated as open space and/or can be avoided by construction. Additionally, areas of seasonal and potentially 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 are low-lying areas along the drainage in the southern and northeastern portions of Filing 4 and in the low-lying areas and minor drainages across the site. These areas can likely be avoided or properly mitigated by development. Perched water conditions could be encountered across the entire site where water can flow within permeable sand layers overlying impermeable bedrock. These areas should be identified on an individual basis at the time of construction. Where perched water conditions are encountered, the mitigation recommendations for seasonal and potentially seasonal shallow groundwater should be followed. Foundations should maintain a minimum separation of 3 feet between the foundation grade and the maximum anticipated groundwater level. The floodplain should be avoided by construction unless site-specific floodplain determination and drainage studies are performed. These areas are discussed below.

sw, psw – Seasonal and Potentially Seasonal shallow groundwater areas: In these areas, we would anticipate the potential for periodically high subsurface moisture conditions, frost heave potential, and highly organic soils. Areas where perched water conditions are encountered should also follow these recommendations. Construction proposed in or adjacent to these areas, should follow these precautions:

Mitigation: In these locations, foundations are subject to severe frost heave and should penetrate to a sufficient depth so as to prevent the formation of ice lenses beneath foundations. At this location and elevation, a foundation depth for frost protection of 30-inches is recommended. In areas where high subsurface moisture conditions are anticipated periodically, a subsurface perimeter drain will be necessary to help prevent the seepage of water into areas below grade. A typical perimeter drain detail is presented in Figure 8. Any grading in these areas should be done in a manner that directs surface flow around construction to avoid areas of ponded water. Areas of organic material will require removal prior to any fill placement. Unstable soil conditions should be expected in areas of shallow groundwater. Where foundations approach the groundwater level, stabilization of the excavations utilizing shot rock may be necessary. Underslab drains or capillary breaks, and interceptor drains may be necessary to prevent intrusion of water into areas below grade. Typical drain details are presented in Figures 9 and 10.

w – Areas of ponded water: These are areas where water could potentially pool in low-lying areas of the drainages. According to the site plan, Figure 6 these areas are within designated as open space. Any areas of ponded water to be filled or regraded should have all soft organic soils removed prior to fill placement. All uncontrolled fill associated with the dams should be recompacted at a minimum of 95% of its maximum Modified Dry Density ASTM D-1557.

fp – Floodplain: Areas of the site have been mapped as floodplains according to the FEMA Map No. 08041C0558G (Figure 7, Reference 7). The physiographic floodplains on site have been mapped on the Engineering Geology Map (Figure 6). The floodplain areas have been designated as open space and area to be avoided by development. Any area within the FEMA floodplain area will require approval of the Drainage Report. Finished floor levels must be a minimum of one foot above the floodplain level. Structures should not block drainages. Specific floodplain locations and drainage studies are beyond the scope of this report.

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

We understand that the development will be rural residential lots utilizing municipal water and individual on-site wastewater treatment systems. 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 shallow groundwater areas on-site that can be avoided or properly mitigated during construction on each lot. Other hazards on site can be satisfactorily mitigated through proper engineering design and construction practices or avoidance.

The upper materials are typically at medium dense to dense states. Areas of loose soils were encountered that may require recompaction. The medium dense to dense granular soils encountered in the upper soil profiles of the test borings and test pits should provide good support for foundations. Loose soils, if encountered beneath foundations or slabs, will require removal and recompaction. Expansive soils, although sporadic, were encountered. Expansive clayey sandstone and claystone are 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. Expansive layers may also be encountered in the soil and bedrock on this site. Expansive soils, if encountered, will require special foundation design and/or overexcavation. These soils will not prohibit development.

Areas of seasonal and potentially seasonal shallow groundwater, ponded water, and floodplains exist on this site. The floodplains and areas of ponded water are to be avoided by development and preserved as open space in drainage easements. Finished floor levels must be a minimum of one foot above the floodplain level. Exact floodplain locations are beyond the scope of this report. According to the site plan (Figure 6), some of the minor drainages can be avoided or filled which will mitigate the hazard.

Areas of perched groundwater may be encountered on this site. Permeable sands exist on the site that may carry water in the subsurface perched on less permeable bedrock. Groundwater was encountered at depths ranging from 6 to 16 feet in the test borings (Reference 1). Fluctuation in groundwater conditions may occur due to variations in rainfall, soil conditions and development of surrounding areas. Foundations should maintain a minimum separation of 3 feet between the

foundation grade and the maximum anticipated groundwater level. Builders should be cognizant of the potential for the occurrence of subsurface water features during construction and deal with each individual problem as necessary at the time of construction. Subsurface drains may be necessary in some areas to prevent the intrusion of water below grade. Dewatering systems may be necessary in some areas where seepage and perched water occurs. Drain details are included in Figures 8 through 10. Unstable conditions should be expected where excavations approach the groundwater level. Stabilization using geofabric or shot rock may be necessary.

Areas of hydrocompaction have been identified on this site where there is the potential for settlement movements upon saturation of the surficial soils. Good surface and subsurface drainage are critical in these areas and the ground surface should be positively sloped away from structures at all points. Roof drains should be made to discharge well away from structures and planting and watering in the immediate vicinity of structures should be minimized.

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

## **7.0 ROADWAY AND EMBANKMENT CONSTRUCTION RECOMMENDATIONS**

In general, the site soils are suitable for the proposed roadways and embankments. Groundwater should be expected to be encountered in deeper cuts and along drainage areas. If excavations encroach on the groundwater level unstable soil conditions may be encountered. Excavation of saturated soils will be difficult with rubber-tired equipment. Stabilization using shot rock or geogrids may be necessary.

Any areas to receive fill should have all topsoil, organic material or debris removed. Prior to fill placement Entech should observe the subgrade. Fill must be properly benched and compacted to minimize potentially unstable conditions in slope areas. Fill slopes should be 3:1. The subgrade should be scarified and moisture conditioned to within 2% of optimum moisture content and compacted to a minimum of 95% of its maximum Modified Proctor Dry Density, ASTM D-1557, prior to placing new fill. Areas receiving fill may require stabilization with rock or fabric if shallow groundwater conditions are encountered.

New fill should be placed in thin lifts not to exceed 6 inches after compaction while maintaining at least 95% of its maximum Modified Proctor Dry Density, ASTM D-1557. These materials should be placed at a moisture content conducive to compaction, usually 0 to  $\pm 2\%$  of Proctor optimum moisture content. The placement and compaction of fill should be observed and tested by Entech during construction. Entech should approve any import materials prior to placing or hauling them to the site. Additional investigation will be required for pavement designs once roadway grading is completed and utilities are installed.

## 8.0 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 mapped with upland 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 mapped with alluvial fan: sand deposits, upland deposits: sand and probable aggregate resource, and valley fill: probable aggregate resource. According to the *Evaluation of Mineral and Mineral Fuel Potential* (Reference 10), the area of the site has been mapped as “Good” for industrial minerals. However, considering the 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 9), 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 9).

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.

## **9.0 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.

## **10.0 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 William Guman and Associates, Ltd 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.

## BIBLIOGRAPHY

1. Entech Engineering, Inc. revised date April 24, 2020. *Soil, Geology, Geologic Hazard and Wastewater Study, Saddlehorn Ranch Subdivision, El Paso County, Colorado*. Entech Job No. 181823.
2. Scott, G.R., Taylor, R.B, Epis, R.C., and Wobus, 1978. *Geologic Structure Map of the Pueblo 1° x 2° Quadrangle, South-Central Colorado*. Sheet 2. U.S. Geologic Survey. Map I-1022.
3. Natural Resource Conservation Service, September 23, 2016. *Web Soil Survey*. United States Department Agriculture, <http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>.
4. United States Department of Agriculture Soil Conservation Service. June 1981. *Soil Survey of El Paso County Area, Colorado*.
5. Morgan, Matthew L. and White, Jonathan L. 2012. *Geologic Map of the Falcon Quadrangle, El Paso and Elbert Counties, Colorado*. Colorado Geological Survey. Open-File Report 12-03.
6. Scott, G.R., Taylor, R.B, Epis, R.C., and Wobus. 1978. *Geologic Map of the Pueblo 1° x 2° Quadrangle, South-Central Colorado*. U.S. Geologic Survey. Map 1-1022.
7. Federal Emergency Management Agency. December 7, 2018. *Flood Insurance Rate Map for the City of Colorado Springs, Colorado*. Map Numbers 08041C0558G.
8. El Paso County Planning Development. December 1995. *El Paso County Aggregate Resource Evaluation Maps*.
9. Schwochow, S.D.; Shroba, R.R. and Wicklein, P.C. 1974. *Atlas of Sand, Gravel, and Quarry Aggregate Resources, Colorado Front Range Counties*. Colorado Geological Survey. Special Publication 5-B.
10. Keller, John W.; TerBest, Harry and Garrison, Rachel E. 2003. *Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands Administered by the Colorado State Land Board*. Colorado Geological Survey. Open-File Report 03-07.

## **TABLES**

## TABLE 1

### SUMMARY OF LABORATORY TEST RESULTS

CLIENT GUMAN AND ASSOC.  
PROJECT JUDGE ORR AND CURTIS ROAD  
JOB NO. 222006

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	5			37.3	21	4	0.04			SM	SAND, SILTY
1	5	5			20.0				30		SM	SAND, SILTY
1	6	2-3			12.5						SM	SAND, SILTY
2	7	5			60.9				170		ML	SILT, VERY SANDY
3	2	15			9.1	NV	NP	0.02			SM-SW	SANDSTONE, SLIGHTLY SILTY
3	3	15			28.1						SM	SANDSTONE, SILTY
3	8	10			8.4						SM-SW	SANDSTONE, SLIGHTLY SILTY
4	4	20	31.1	77.4	58.9	41	5			1.4	ML	SILTSTONE, VERY SANDY

**Table 2: Summary Test Boring Results**

<b>Test Boring No.</b>	<b>Depth to Bedrock (ft.)</b>	<b>Depth to Groundwater or Seasonally Occurring Groundwater (ft.)</b>
1	9	12
2	9	8.5
3	4	7
4	9	16
5	7	7.5
6	11	6
7	9	7
8	9	9
3*	9	12

\*- Test Boring from EEI Job No. 181823



Highlight areas where road cuts will require mitigation. Provide recommendations in the report.

**Table 3: Summary Tactile Test Pit Results**

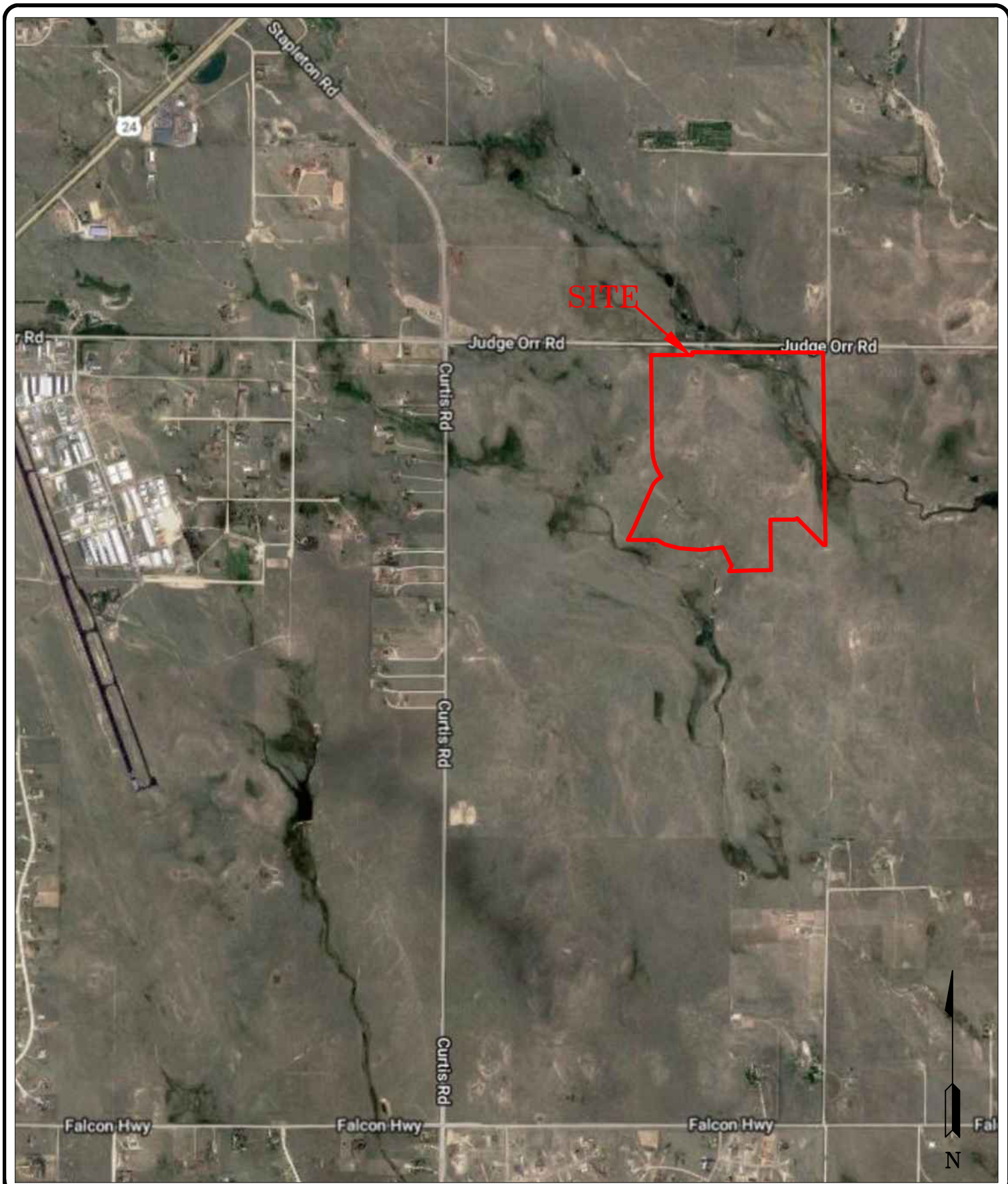

<b>Test Pit No.</b>	<b>USDA Soil Type</b>	<b>LTAR Value</b>	<b>Depth to Bedrock (ft.)</b>	<b>Depth to Groundwater or Seasonally Occurring Groundwater (ft.)</b>
1A	4A*	0.15	>8	5*
22**	2A	0.5	>8	>8
23**	4A*	0.15	2*	>8
28**	2A	0.5	>8	6.5
29**	2A	0.5	>8	>8
30**	4A*	0.15	4*	6.5
37**	3A*	0.3	>8	>8
38**	2A	0.5	>8	>8
39**	2A	0.5	>8	>8
40**	4A*	0.15	2.5*	3.5

\*- Conditions that will require an engineered OWTS

\*\* - Test Pits from EEI Job No. 181823

## FIGURES



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

VICINITY MAP  
SADDLEHORN RANCH FILING NO. 4  
CURTIS ROAD AND JUDGE ORR ROAD  
EL PASO COUNTY, CO.  
FOR: WILLIAM GUMAN AND ASSOCIATES, LTD

DRAWN: LLL	DATE: 11/8/22	CHECKED:	DATE:
---------------	------------------	----------	-------

JOB NO.:  
**222006**

FIG NO.:  
**1**



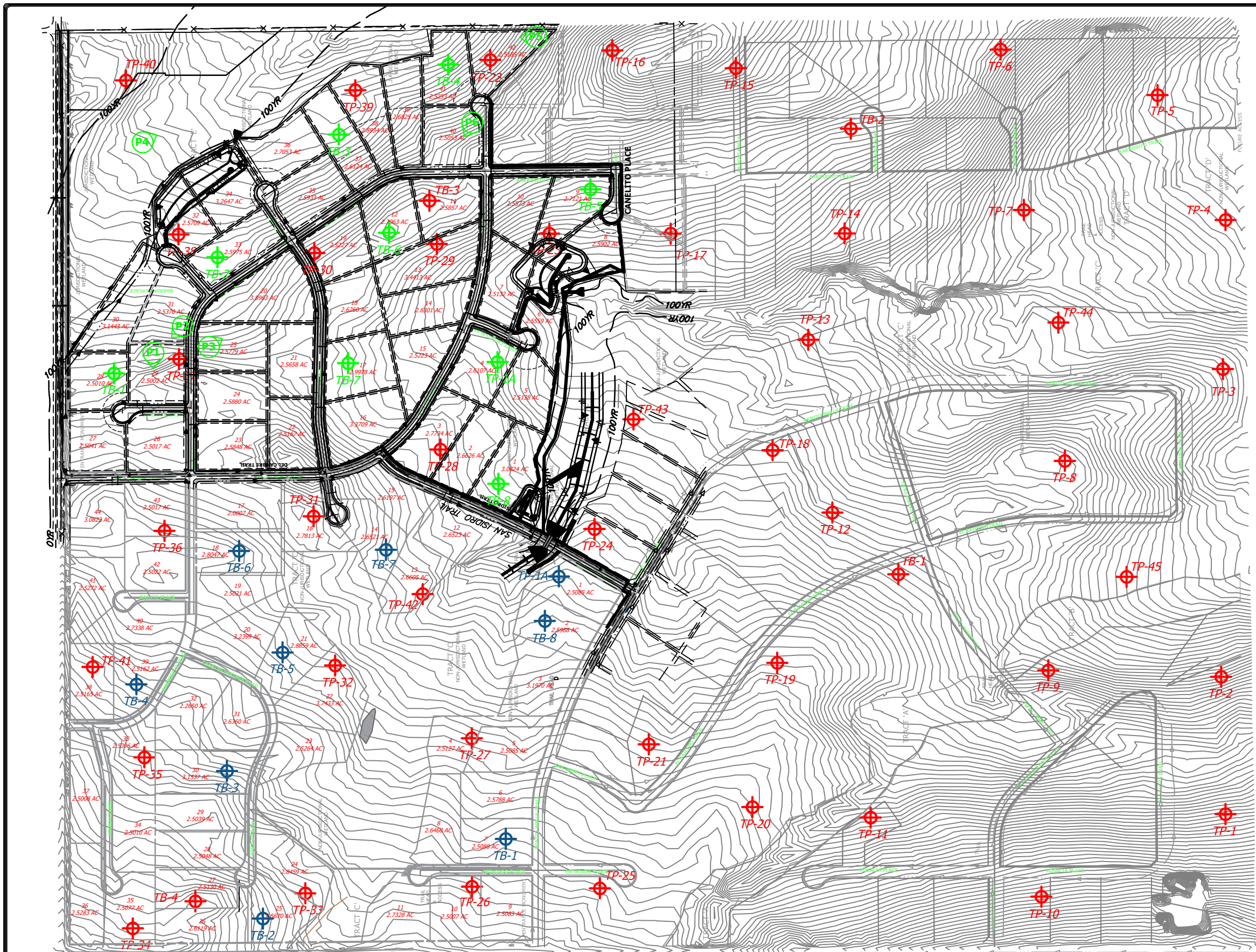
**ENTECH**  
ENGINEERING, INC.  
505 ELKTON DRIVE  
COLORADO SPRINGS, CO. 80907 (719) 531-5599

USGS MAP  
SADDLEHORN RANCH FILING NO. 4  
CURTIS ROAD AND JUDGE ORR ROAD  
EL PASO COUNTY, CO.  
FOR: WILLIAM GUMAN AND ASSOCIATES, LTD

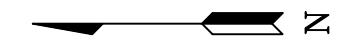
DRAWN: LLL	DATE: 11/8/22	CHECKED:	DATE:
---------------	------------------	----------	-------

JOB NO.:  
222006

FIG NO.:  
2



- LEGEND:**
- ⊕ TB- APPROXIMATE TEST BORING LOCATION AND NUMBER
  - ⊕ TP- APPROXIMATE TEST PIT LOCATION AND NUMBER
  - ⊕ - APPROXIMATE PHOTOGRAPH LOCATION AND NUMBER
  - ⊕ TB- APPROXIMATE TEST BORING LOCATION AND NUMBER (EEI JOB NO. 181823)
  - ⊕ TP- APPROXIMATE TEST PIT LOCATION AND NUMBER (EEI JOB NO. 181823)



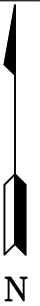
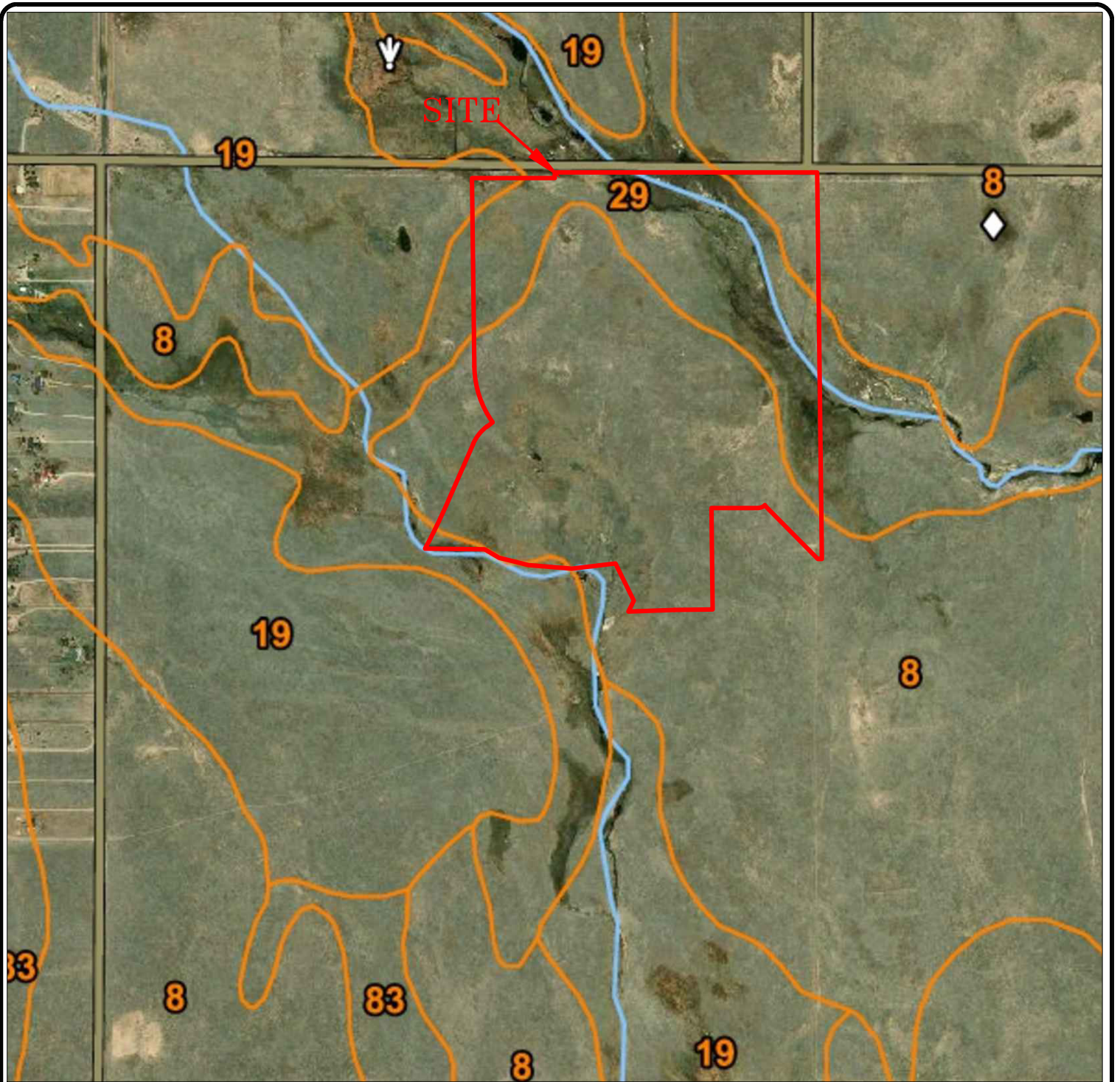
REVISION	BY

**ENTTECH**  
ENGINEERING, INC.

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

SITE PLAN/TEST BORING LOCATION MAP  
SADDLEHORN RANCH FILING NO. 4  
CURTIS ROAD AND JUDGE ORR ROAD  
EL PASO COUNTY, CO.  
FOR: WILLIAM GUMAN AND ASSOCIATES, LTD

DRAWN L.L.
CHECKED
DATE 11/8/22
SCALE AS SHOWN
JOB NO. 222006
FIGURE No. 3



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

SOIL SURVEY MAP  
 SADDLEHORN RANCH FILING NO. 4  
 CURTIS ROAD AND JUDGE ORR ROAD  
 EL PASO COUNTY, CO.  
 FOR: WILLIAM GUMAN AND ASSOCIATES, LTD

DRAWN:  
 LLL

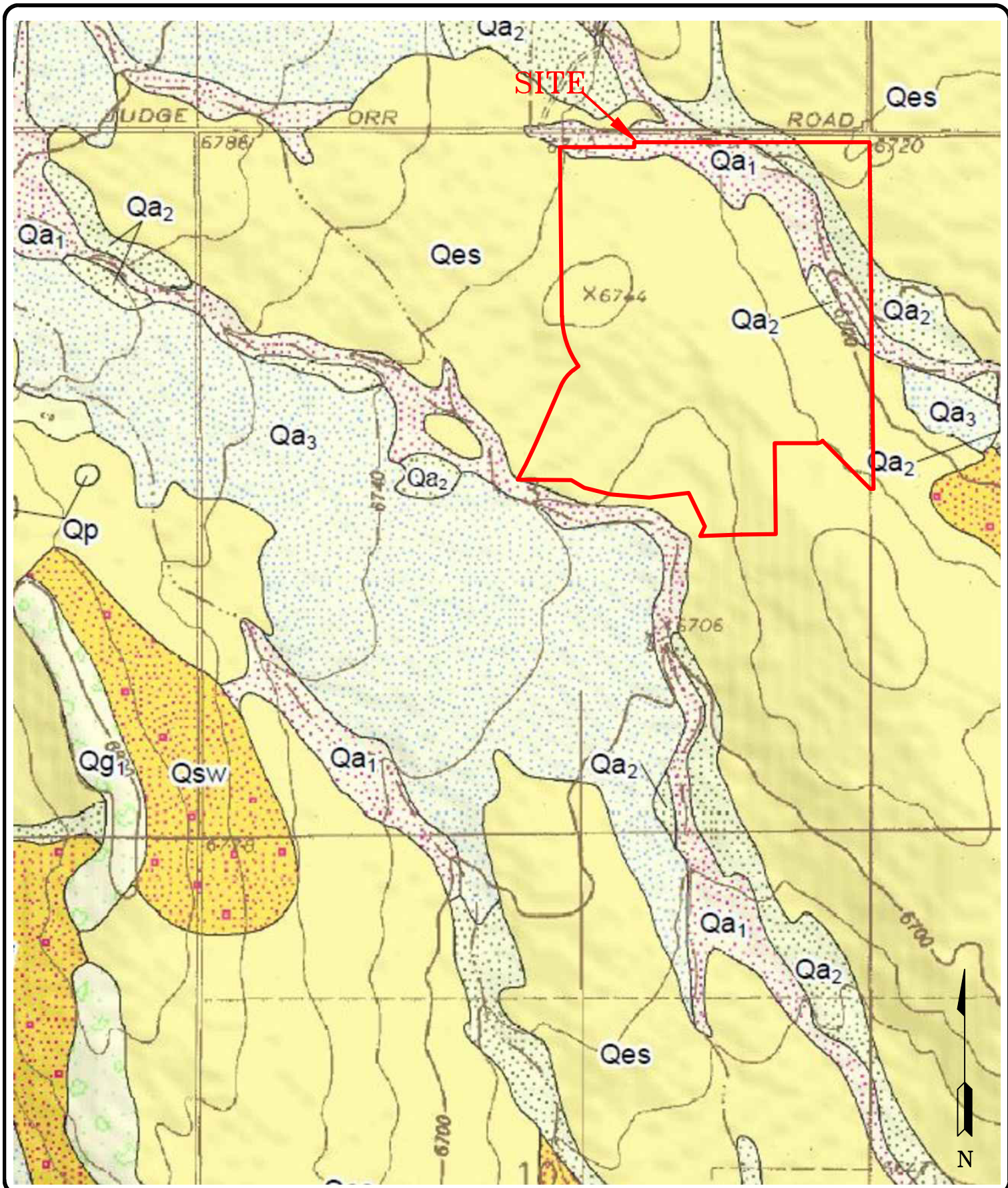
DATE:  
 11/8/22

CHECKED:

DATE:

JOB NO.:  
 222006

FIG NO.:  
 4



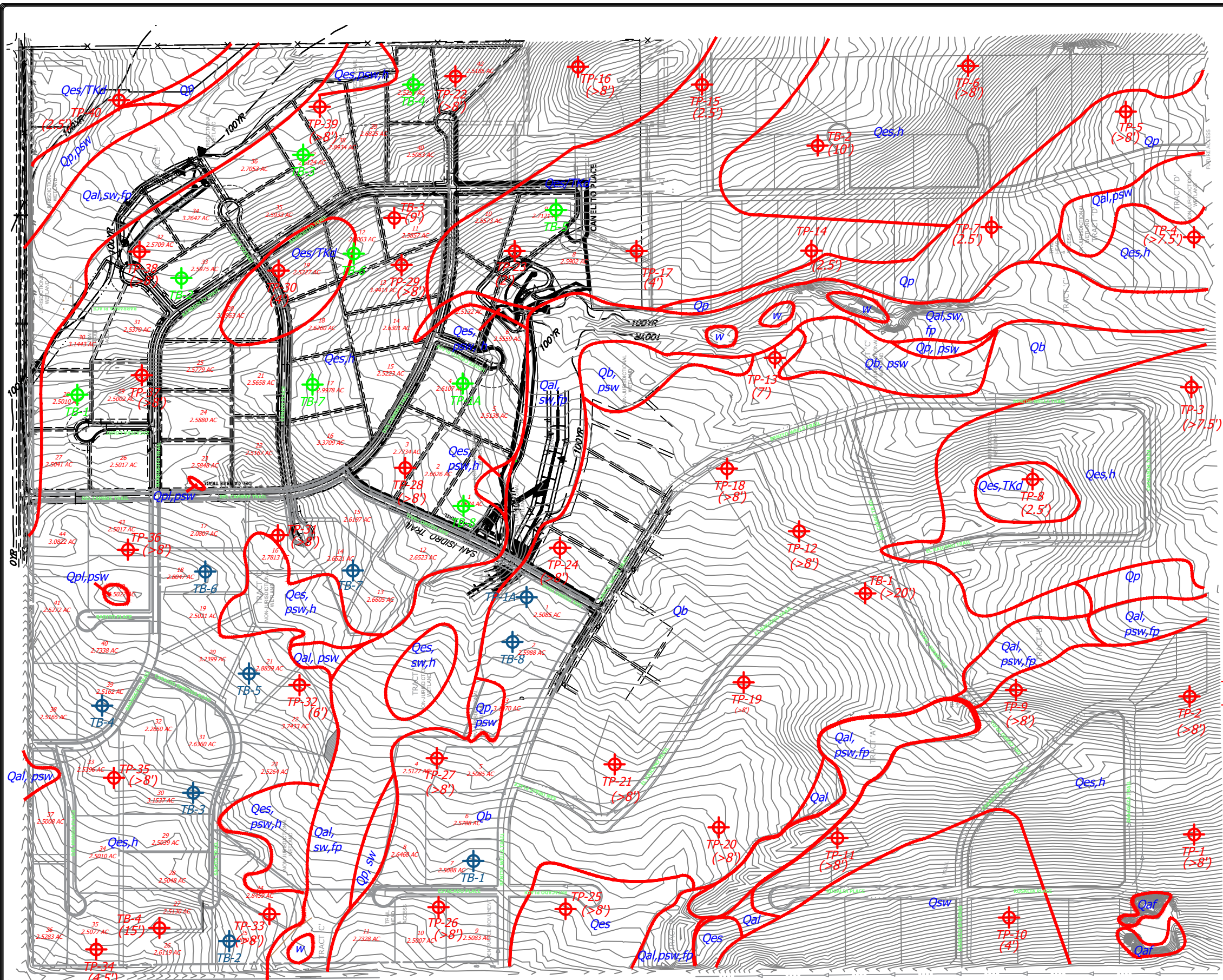
**ENTECH**  
ENGINEERING, INC.  
505 ELKTON DRIVE  
COLORADO SPRINGS, CO. 80907 (719) 531-5599

FALCON QUADRANGLE GEOLOGIC MAP  
SADDLEHORN RANCH FILING NO. 4  
CURTIS ROAD AND JUDGE ORR ROAD  
EL PASO COUNTY, CO.  
FOR: WILLIAM GUMAN AND ASSOCIATES, LTD

DRAWN: LLL	DATE: 11/8/22	CHECKED:	DATE:
---------------	------------------	----------	-------

JOB NO.:  
222006

FIG NO.:  
5



**LEGEND:**

- Qaf - Artificial Fill of Holocene Age: man made fill deposits
- Qal - Post Piney Creek (Alluvium One)-Recent Alluvium of Late Holocene Age: recent stream deposits
- Qpl - Playa Deposits of Holocene Age: blowouts in eolian sand that form seasonal ponds
- Qp - Piney Creek Alluvium (Alluvium Two) of Early Holocene Age: low stream terrace deposits above current stream channels
- Qb - Broadway Alluvium (Alluvium Three) of Late Pleistocene Age: stream terrace deposited sands
- Qes - Eolian Sand of Holocene to Late Pleistocene Age: wind blown sand deposits
- Qsw - Sheetwash of Holocene to Late Pleistocene Age: silty to clayey sand sheetwash deposits
- Qes/TKd - Sand Deposits of Quaternary Age Overlying Dawson Arkose Formation of Tertiary to Cretaceous Age: windblown sands and residual soil deposits overlying arkosic sandstone with interbedded siltstone and claystone
- h - hydrocompaction
- fp - floodplain
- psw - potentially seasonal shallow groundwater area
- sw - seasonal shallow groundwater area
- w - flowing / ponded water
- ⊕ TB - Approximate Test Boring Location
- ⊕ TP - Approximate Test Pit Location
- (6') - (Depth to bedrock in feet)

REVISION	BY

**ENTTECH**  
ENGINEERING, INC.

505 ELKTON DRIVE  
COLORADO SPRINGS, CO. 80907

(719) 531-5599

GEOLOGY/ENGINEERING GEOLOGY MAP  
SADDLEHORN RANCH FILING NO. 4  
CURTIS ROAD AND JUDGE ORR ROAD  
EL PASO COUNTY, CO.  
FOR: WILLIAM GUMAN AND ASSOCIATES, LTD

DRAWN L.L.
CHECKED
DATE 11/8/22
SCALE AS SHOWN
JOB NO. 222006
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.
- Base Flood Elevation line and value; elevation in feet\*
- Base Flood Elevation value where uniform within zone; elevation in feet\*

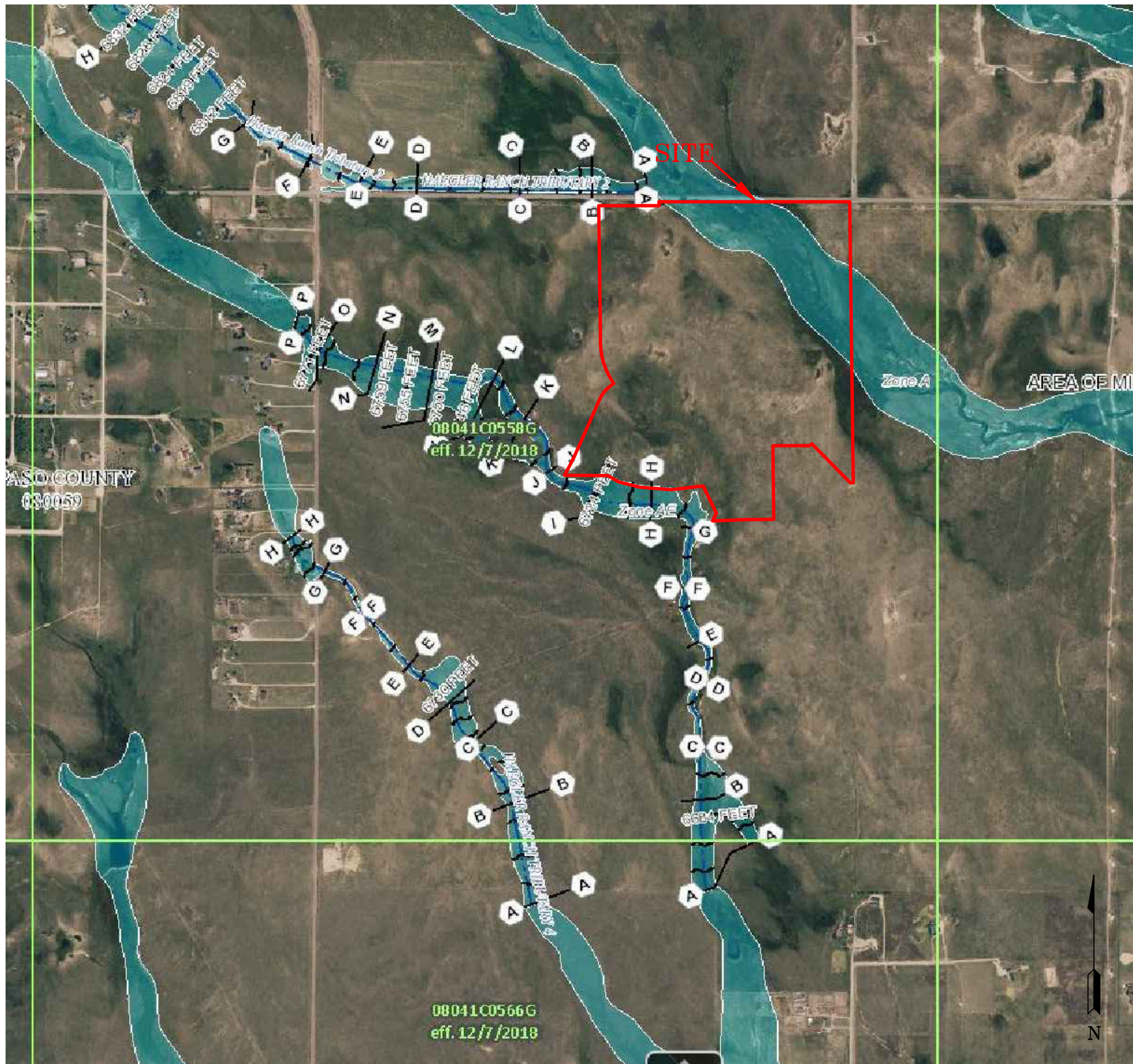
\*Referenced to the National Geodetic Vertical Datum of 1929

- Cross section line
- Transect line
- Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
- 1000-meter Universal Transverse Mercator grid tick values, zone 4
- 5000-foot grid tick values: Hawaii State Plane coordinate system, zone 3 (FIPSZONE 5103), Transverse Mercator projection
- Bench mark (see explanation in Notes to Users section of this FIRM panel)
- 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.

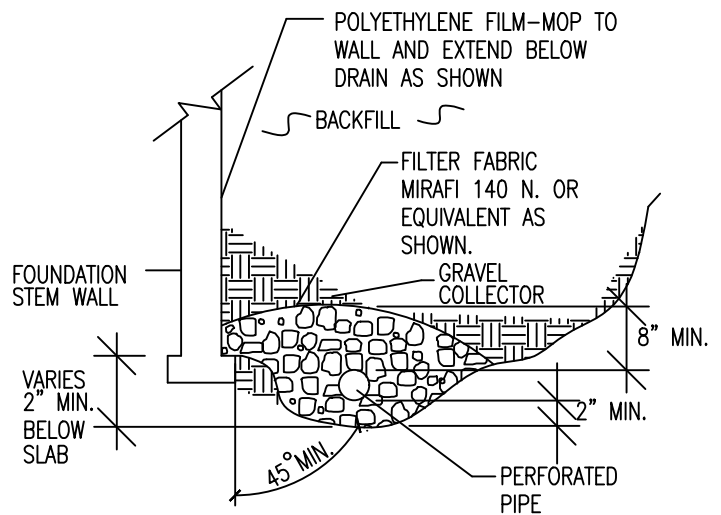
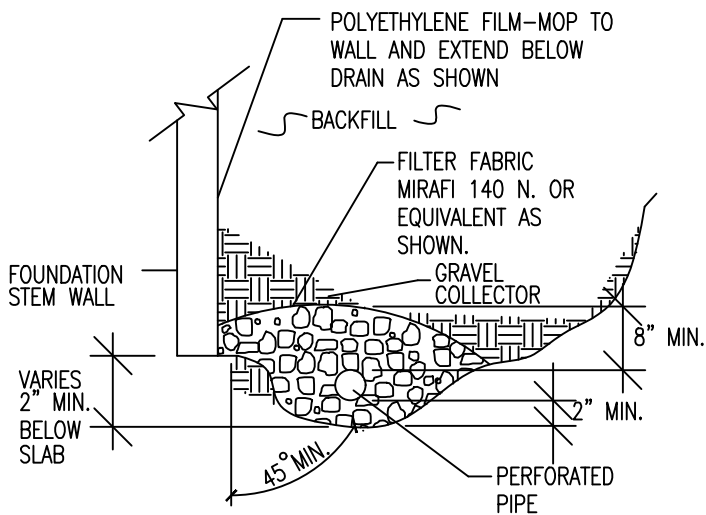


REVISION	BY

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

FLOODPLAIN MAP  
SADDLEHORN RANCH FILING NO. 4  
CURTIS ROAD AND JUDGE ORR ROAD  
EL PASO COUNTY, CO.  
FOR: WILLIAM GUMAN AND ASSOCIATES, LTD

DRAWN	L.L.
CHECKED	
DATE	11/8/22
SCALE	AS SHOWN
JOB NO.	222006
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 OUTFALL IS NOT AVAILABLE.



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

*PERIMETER DRAIN DETAIL*

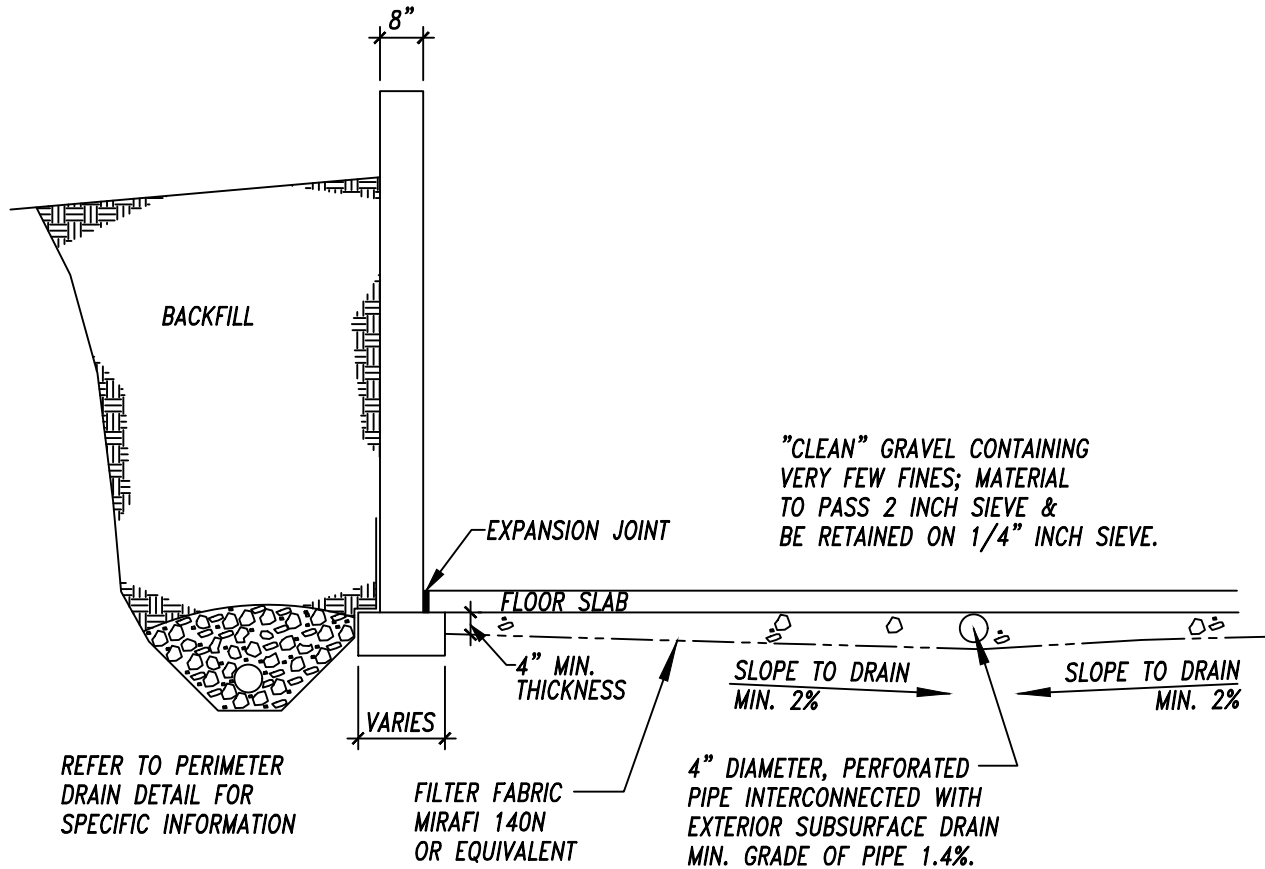
<b>DRAWN:</b>	<b>DATE:</b>	<b>DESIGNED:</b>	<b>CHECKED:</b>
---------------	--------------	------------------	-----------------

JOB NO.:  
 222006

FIG NO.:

8





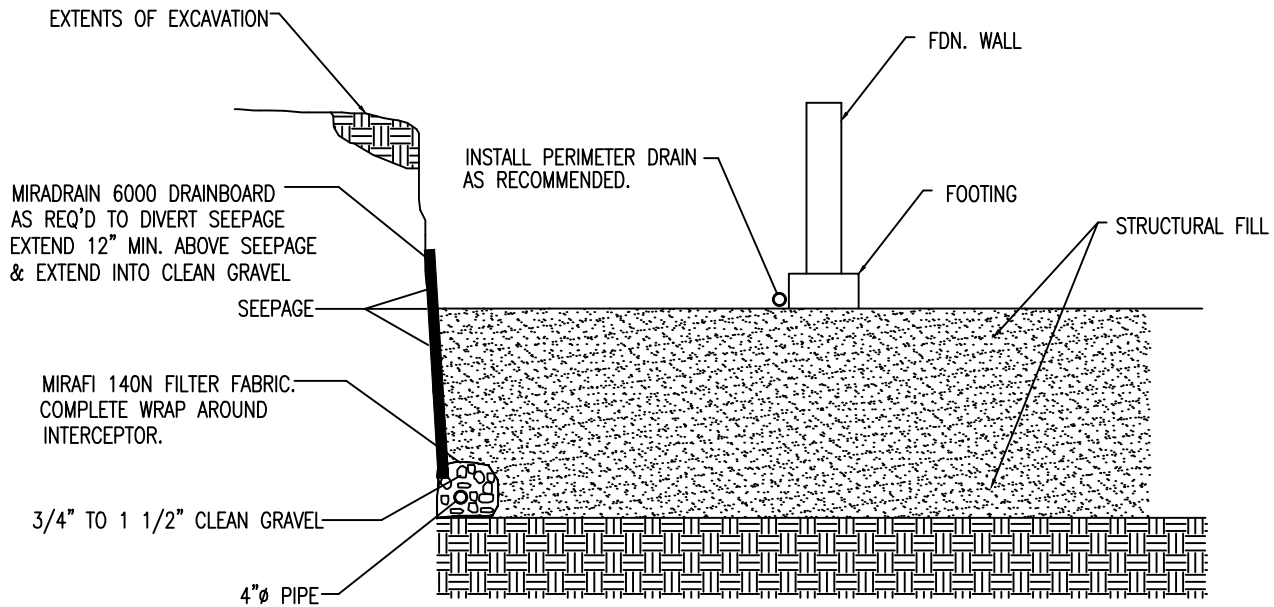
**ENTECH**  
**ENGINEERING, INC.**  
 505 ELKTON DRIVE  
 COLORADO SPRINGS, CO. 80907 (719) 531-5599

*TYP. UNDERSLAB DRAINAGE LAYER (CAPILLARY BREAK)*

DRAWN BY:	DATE DRAWN:	DESIGNED BY:	CHECKED:
-----------	-------------	--------------	----------

JOB NO.:  
 222006

FIG NO.:



NOTE:  
 EXTEND INTERCEPTOR DRAIN TO UNDERDRAIN OR TO SUMP.  
 BENCH DRAIN INTO NATIVE SOILS 12 INCHES MINIMUM.

**INTERCEPTOR DRAIN DETAIL**  
 N.T.S.



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

*INTERCEPTOR DRAIN DETAIL*

DRAWN BY:  
DPS

DATE DRAWN:

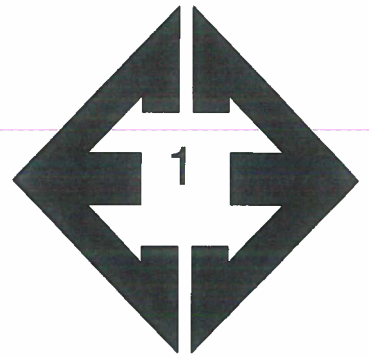
DATE

CHECKED:  
DPS

JOB NO.:  
222006

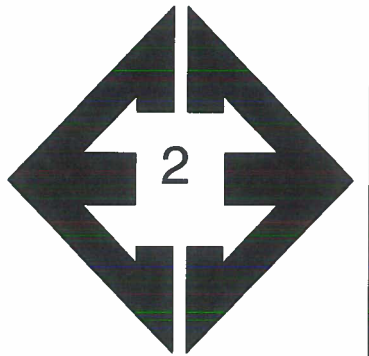
FIG. NO.:  
10

## **APPENDIX A: Site Photographs**



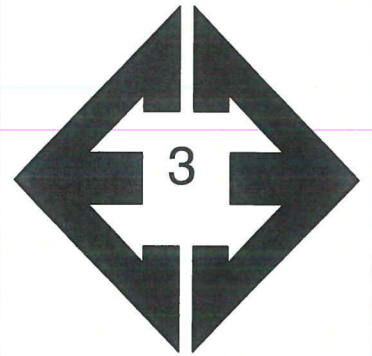
**Looking west from the  
northern portion of  
Filing No. 4.**

September 28, 2022



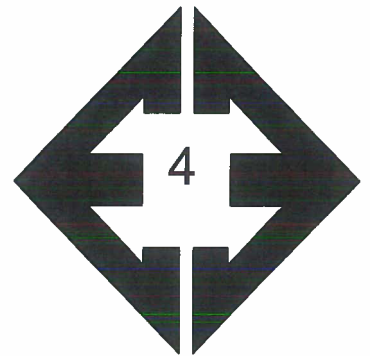
**Looking southeast  
from the northern  
portion of Filing No. 4.**

September 28, 2022



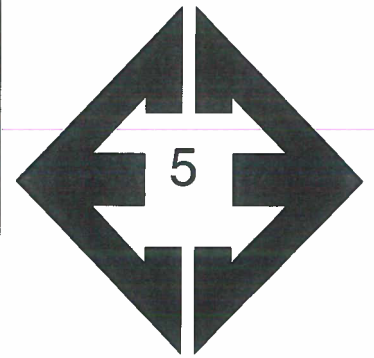
**Looking east from the  
northern portion of  
Filing No. 4.**

September 28, 2022



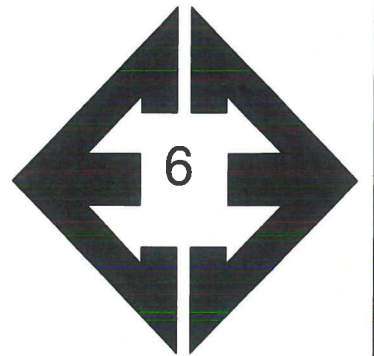
**Looking southeast  
from the northeastern  
portion of Filing No. 4.**

September 28, 2022



**Looking north from the  
southeastern portion  
of Filing No. 4.**

September 28, 2022



**Looking northwest  
from the southeastern  
portion of Filing No. 4.**

September 28, 2022

## **APPENDIX B: Test Boring & Test Pit Logs**

TEST BORING NO. 1  
 DATE DRILLED 10/10/2022  
 Job # 222006

TEST BORING NO. 2  
 DATE DRILLED 10/10/2022  
 CLIENT GUMAN AND ASSOC.  
 LOCATION JUDGE ORR AND CURTIS ROAD

REMARKS

REMARKS

WATER @ 12', 10/11/22

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

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



Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			11	6.1	1
5			10	7.3	1
10			50 8"	13.3	3
15			50 11"	14.5	3
20			50 6"	16.0	3

WATER @ 8.5', 10/11/22

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

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



Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			8	2.0	1
5			16	4.9	1
10			50 8"	11.9	3
15			50 11"	13.2	3
20			50 6"	14.3	3



**ENTECH**  
**ENGINEERING, INC.**

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:

DATE:

CHECKED:  
 LLL

DATE:  
 11/8/22

JOB NO.:  
 222006

FIG NO.:  
 B-1



TEST BORING NO. 3  
 DATE DRILLED 10/10/2022  
 Job # 222006

TEST BORING NO. 4  
 DATE DRILLED 10/10/2022  
 CLIENT GUMAN AND ASSOC.  
 LOCATION JUDGE ORR AND CURTIS ROAD

REMARKS

REMARKS

WATER @ 7', 10/11/22

WATER @ 16', 10/11/22

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

SAND, SILTY, FINE TO COARSE  
 GRAINED, TAN, LOOSE, DRY

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

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

WEATHERED ZONE

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
WATER @ 7', 10/11/22							WATER @ 16', 10/11/22						
SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, DRY				17	1.6	1	SAND, SILTY, FINE TO COARSE GRAINED, TAN, LOOSE, DRY				9	1.4	1
SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN TO GRAY BROWN, VERY DENSE TO DENSE, MOIST	5			50 10"	6.6	3		5		*		1.4	1
	10			50 7"	8.4	3	SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, VERY DENSE, MOIST	10			50 11"	7.3	3
	15			50	13.0	3		15			50 11"	13.4	3
WEATHERED ZONE	20			45	12.9	3	SILTSTONE, VERY SANDY, GRAY BROWN, STIFF, MOIST	20			28	28.2	4

\* - BULK SAMPLE TAKEN



**ENTECH**  
**ENGINEERING, INC.**

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:

DATE:

CHECKED:  
 LLL

DATE:  
 11/8/22

JOB NO.:  
 222006

FIG NO.:  
 B-2

TEST BORING NO. 5  
 DATE DRILLED 10/10/2022  
 Job # 222006

TEST BORING NO. 6  
 DATE DRILLED 10/10/2022  
 CLIENT GUMAN AND ASSOC.  
 LOCATION JUDGE ORR AND CURTIS ROAD

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
WATER @ 7.5', 10/11/22							WATER @ 6', 10/11/22						
SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, DRY TO MOIST	5			22	2.9	1	SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE TO DENSE, DRY TO VERY MOIST	5			25	1.2	1
	5			24	12.5	1		5		*	1.0	1	1
SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN TO GRAY BROWN, VERY DENSE, MOIST	10			50 9"	11.9	3	SANDSTONE, SILTY, FINE TO COARSE GRAINED, GRAY BROWN, VERY DENSE, MOIST	10			42	11.2	1
	15			50 10"	13.8	3		15			50 7"	12.8	3
	20			50 7"	18.4	3	* - BULK SAMPLE TAKEN	20			50 6"	22.4	3



**ENTECH**  
**ENGINEERING, INC.**

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**TEST BORING LOG**

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	11/8/22

JOB NO.:  
 222006

FIG NO.:  
 B-3

TEST BORING NO. 7  
 DATE DRILLED 10/10/2022  
 Job # 222006

TEST BORING NO. 8  
 DATE DRILLED 10/10/2022  
 CLIENT GUMAN AND ASSOC.  
 LOCATION JUDGE ORR AND CURTIS ROAD

REMARKS

REMARKS

WATER @ 7', 10/10/22

SILT, VERY SANDY, TAN, STIFF, MOIST

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

\* - BULK SAMPLE TAKEN

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			20	11.5	2
5			*	25.9	2
10			50 10"	10.2	3
15			*	13.5	3
20			*	21.5	3



WATER @ 9', 10/10/22

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

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

\* - BULK SAMPLE TAKEN

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			31	2.8	1
5			30	13.3	1
10			50 9"	17.4	3
15			50 7"	16.0	3
20			*	18.2	3



**ENTECH**  
**ENGINEERING, INC.**

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:

DATE:

CHECKED:  
 LLL

DATE:  
 11/8/22

JOB NO.:  
 222006

FIG NO.:

B-4

TEST PIT NO. 1A  
 DATE EXCAVATED 10/13/2022  
 Job # 222006

CLIENT LOCATION  
 GUMAN and ASSOCIATES  
 SADDLEHORN, FILING 4

REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type	REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type
redoximorphic features encountered at 5'-0"													
topsoil, sandy clay loam, brown, moist	1							1					
	2							2					
sandy clay loam, fine to coarse grained, brown, moist	3			gr	w	3A		3					
sandy clay, fine to medium grained, grayish brown, moist	4			ma		4A		4					
	5							5					
sandy clay loam, fine to coarse grained, brownish grey, moist	6			gr	w	2A		6					
	7							7					
	8							8					
	9							9					
	10							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



**ENTECH**  
**ENGINEERING, INC.**

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**TEST PIT LOG**

DRAWN:  
jhr

DATE:  
10/19/22

CHECKED:

DATE:

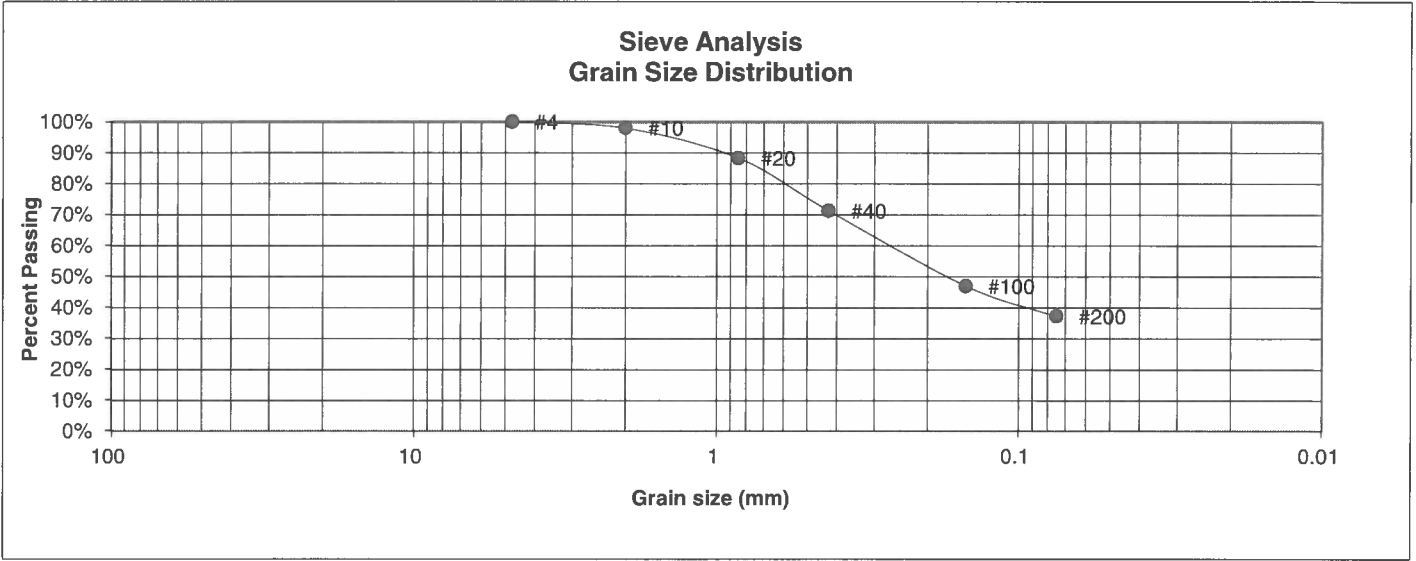
JOB NO.:  
222006

FIG NO.:

B-5

## **APPENDIX C: Laboratory Test Results**

UNIFIED CLASSIFICATION	SM	CLIENT	GUMAN AND ASSOC.
SOIL TYPE #	1	PROJECT	JUDGE ORR AND CURTIS ROAD
TEST BORING #	1	JOB NO.	222006
DEPTH (FT)	5	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	98.0%
20	88.3%
40	71.3%
100	47.0%
200	37.3%

Atterberg Limits	
Plastic Limit	17
Liquid Limit	21
Plastic Index	4

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**

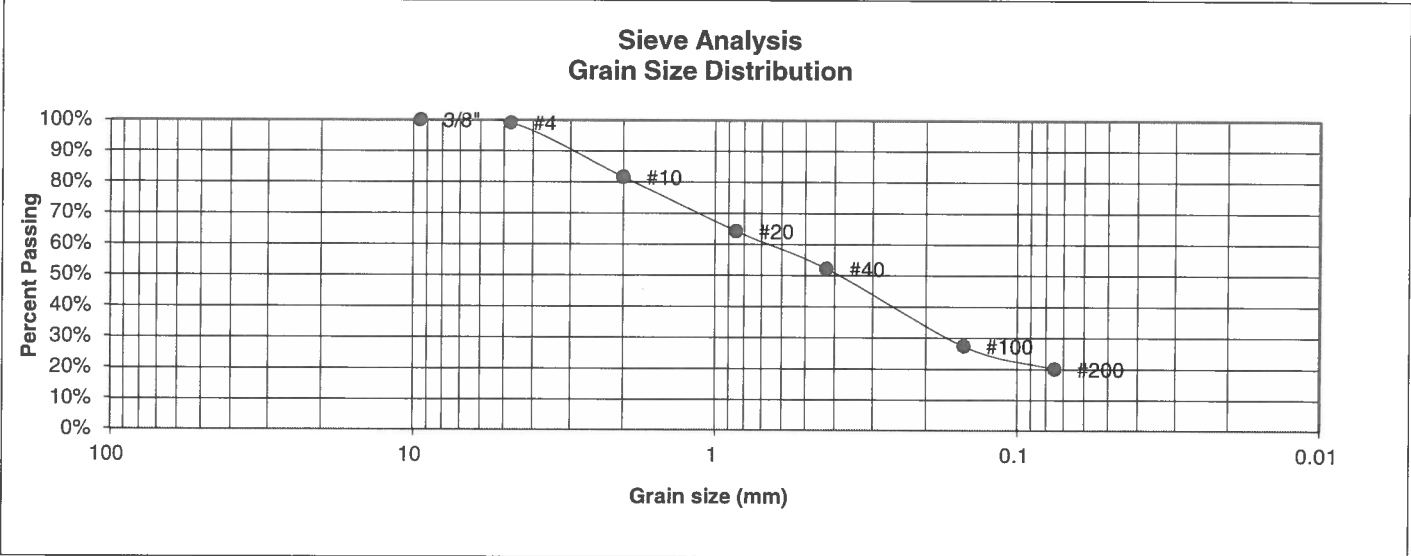
DRAWN:	DATE:	CHECKED:	DATE:
		LLL	11/8/22

JOB NO.:  
222006

FIG NO.:

C-1

<b>UNIFIED CLASSIFICATION</b>	SM	<b>CLIENT</b>	GUMAN AND ASSOC.
<b>SOIL TYPE #</b>	1	<b>PROJECT</b>	JUDGE ORR AND CURTIS ROAD
<b>TEST BORING #</b>	5	<b>JOB NO.</b>	222006
<b>DEPTH (FT)</b>	5	<b>TEST BY</b>	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.1%
10	81.6%
20	64.2%
40	52.2%
100	27.3%
200	20.0%

**Atterberg Limits**  
 Plastic Limit  
 Liquid Limit  
 Plastic Index

**Swell**  
 Moisture at start 18.1%  
 Moisture at finish 20.2%  
 Moisture increase 2.1%  
 Initial dry density (pcf) 87  
 Swell (psf) 30



**ENTECH  
ENGINEERING, INC.**

505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST  
RESULTS**

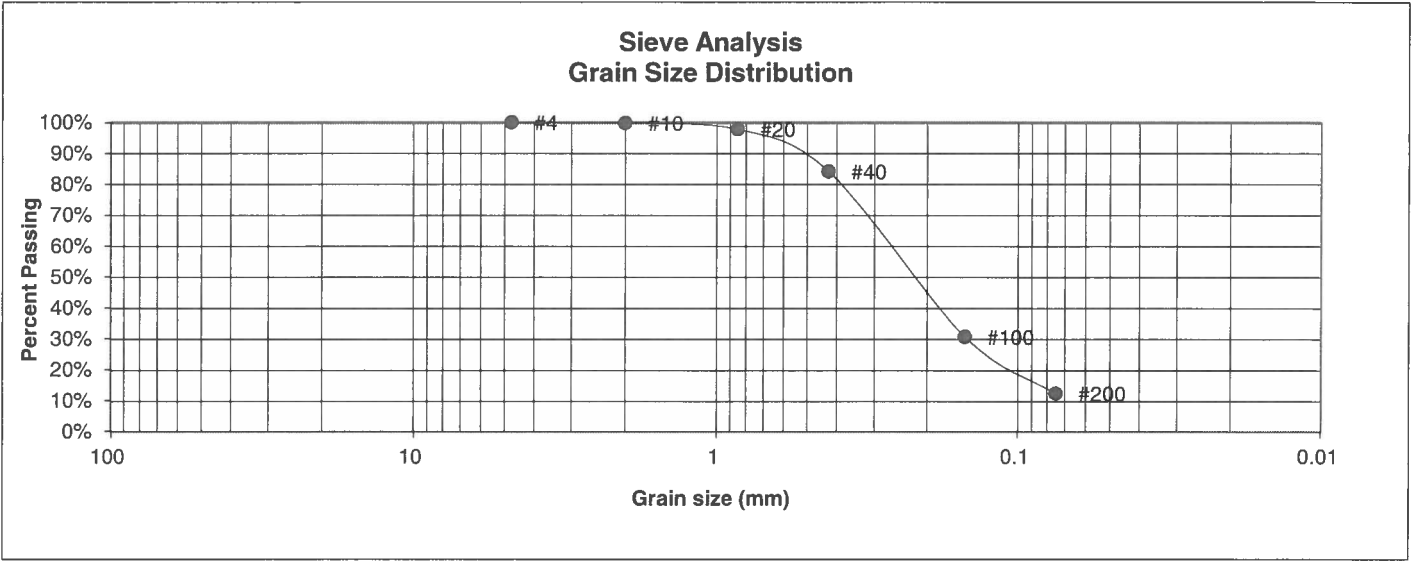
DRAWN:	DATE:	CHECKED: LLL	DATE: 11/8/22
--------	-------	-----------------	------------------

JOB NO.:  
222006

FIG NO.:

C-2

<u>UNIFIED CLASSIFICATION</u>	SM	<u>CLIENT</u>	GUMAN AND ASSOC.
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	JUDGE ORR AND CURTIS ROAD
<u>TEST BORING #</u>	6	<u>JOB NO.</u>	222006
<u>DEPTH (FT)</u>	2-3	<u>TEST BY</u>	BL



<u>U.S. Sieve #</u>	<u>Percent Finer</u>	<u>Atterberg Limits</u>
3"		Plastic Limit
1 1/2"		Liquid Limit
3/4"		Plastic Index
1/2"		
3/8"		
4	100.0%	<u>Swell</u>
10	99.8%	Moisture at start
20	97.8%	Moisture at finish
40	84.2%	Moisture increase
100	30.8%	Initial dry density (pcf)
200	12.5%	Swell (psf)



**ENTECH  
ENGINEERING, INC.**

505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST  
RESULTS**

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	11/8/22

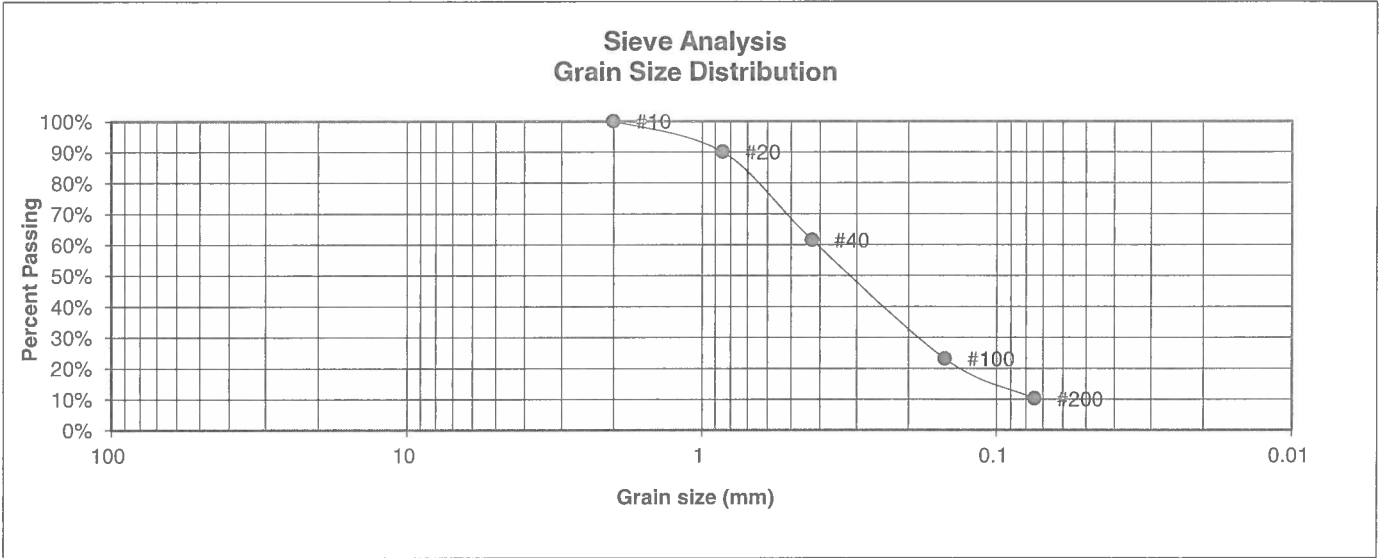
JOB NO.:  
222006

FIG NO.:

C-3



BORING NO.	TP-1	UNIFIED CLASSIFICATION	SM-SW	TEST BY	BL
DEPTH(ft)	3	AASHTO CLASSIFICATION		JOB NO.	222006
CLIENT	GUMAN AND ASSOCIATES				
PROJECT	SADDLEHORN, FILING 4				



U.S. Sieve #	Percent Finer	Atterberg Limits
3"		Plastic Limit
1 1/2"		Liquid Limit
3/4"		Plastic Index
1/2"		
3/8"		
4		<u>Swell</u>
10	100.0%	Moisture at start
20	90.0%	Moisture at finish
40	61.5%	Moisture increase
100	23.1%	Initial dry density (pcf)
200	10.2%	Swell (psf)



**ENTECH  
ENGINEERING, INC.**

505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

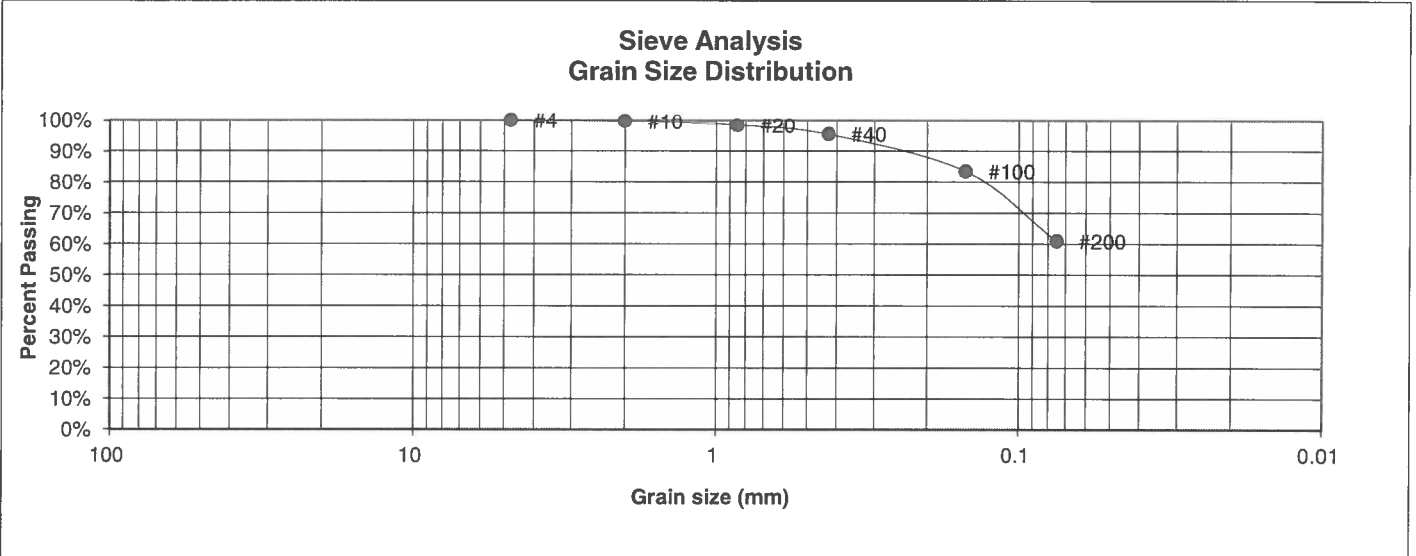
**LABORATORY TEST  
RESULTS**

DRAWN:	DATE:	CHECKED: <i>LLL</i>	DATE: <i>11/8/22</i>
--------	-------	------------------------	-------------------------

JOB NO.:  
222006

FIG NO.:  
*C-4*

UNIFIED CLASSIFICATION	ML	CLIENT	GUMAN AND ASSOC.
SOIL TYPE #	2	PROJECT	JUDGE ORR AND CURTIS ROAD
TEST BORING #	7	JOB NO.	222006
DEPTH (FT)	5	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.7%
20	98.4%
40	95.4%
100	83.4%
200	60.9%

Atterberg Limits  
 Plastic Limit  
 Liquid Limit  
 Plastic Index

<u>Swell</u>	
Moisture at start	17.6%
Moisture at finish	21.9%
Moisture increase	4.3%
Initial dry density (pcf)	95
Swell (psf)	170



**ENTECH  
ENGINEERING, INC.**

505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

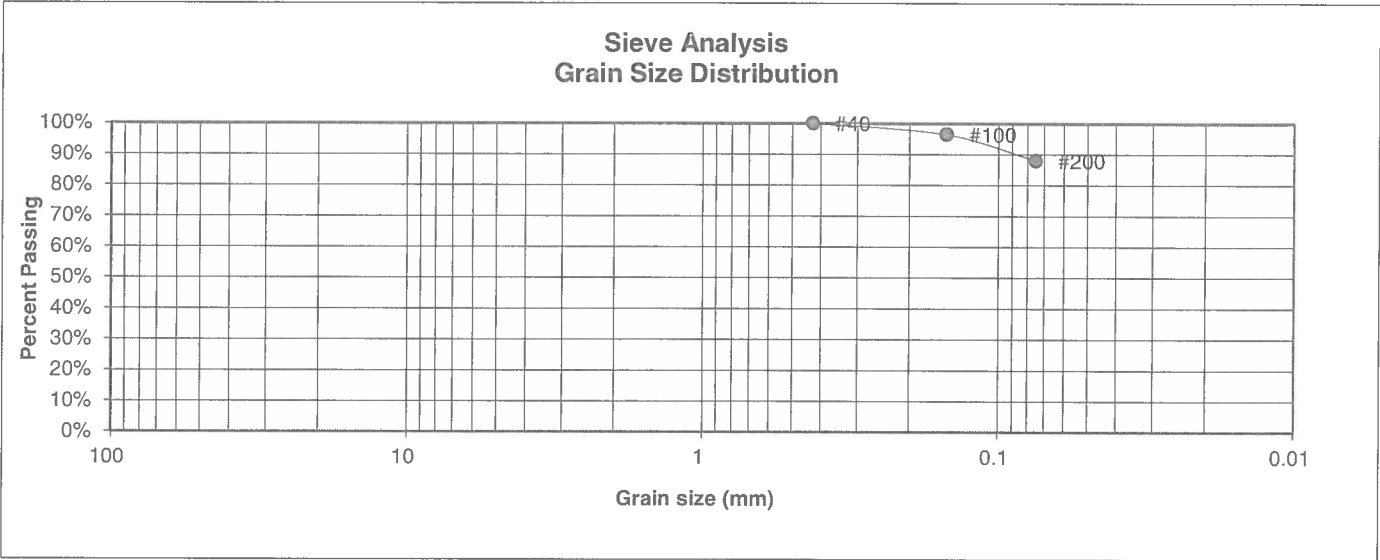
**LABORATORY TEST  
RESULTS**

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	11/8/22

JOB NO.:  
222006

FIG NO.:  
C-5

BORING NO.	TP-1	UNIFIED CLASSIFICATION	CL	TEST BY	BL
DEPTH(ft)	4	AASHTO CLASSIFICATION		JOB NO.	222006
CLIENT	GUMAN AND ASSOCIATES				
PROJECT	SADDLEHORN, FILING 4				



U.S. Sieve #	Percent Finer	Atterberg Limits
3"		Plastic Limit
1 1/2"		Liquid Limit
3/4"		Plastic Index
1/2"		
3/8"		
4		<u>Swell</u>
10		Moisture at start
20		Moisture at finish
40	100.0%	Moisture increase
100	96.5%	Initial dry density (pcf)
200	88.0%	Swell (psf)



**ENTECH  
ENGINEERING, INC.**

505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

### LABORATORY TEST RESULTS

DRAWN:

DATE:

CHECKED:  
*LLL*

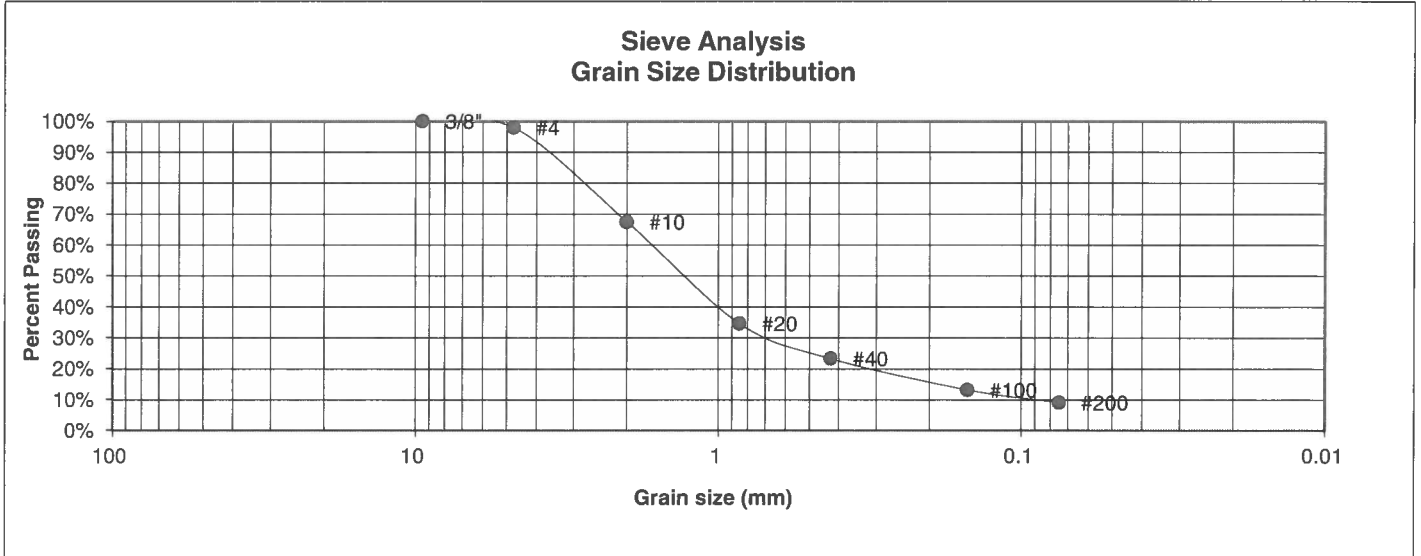
DATE:  
*11/8/22*

JOB NO.:  
222006

FIG NO.:

*C-6*

<b>UNIFIED CLASSIFICATION</b>	SM-SW	<b>CLIENT</b>	GUMAN AND ASSOC.
<b>SOIL TYPE #</b>	3	<b>PROJECT</b>	JUDGE ORR AND CURTIS ROAD
<b>TEST BORING #</b>	2	<b>JOB NO.</b>	222006
<b>DEPTH (FT)</b>	15	<b>TEST BY</b>	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	97.9%
10	67.5%
20	34.6%
40	23.3%
100	13.2%
200	9.1%

Atterberg Limits	
Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

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



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

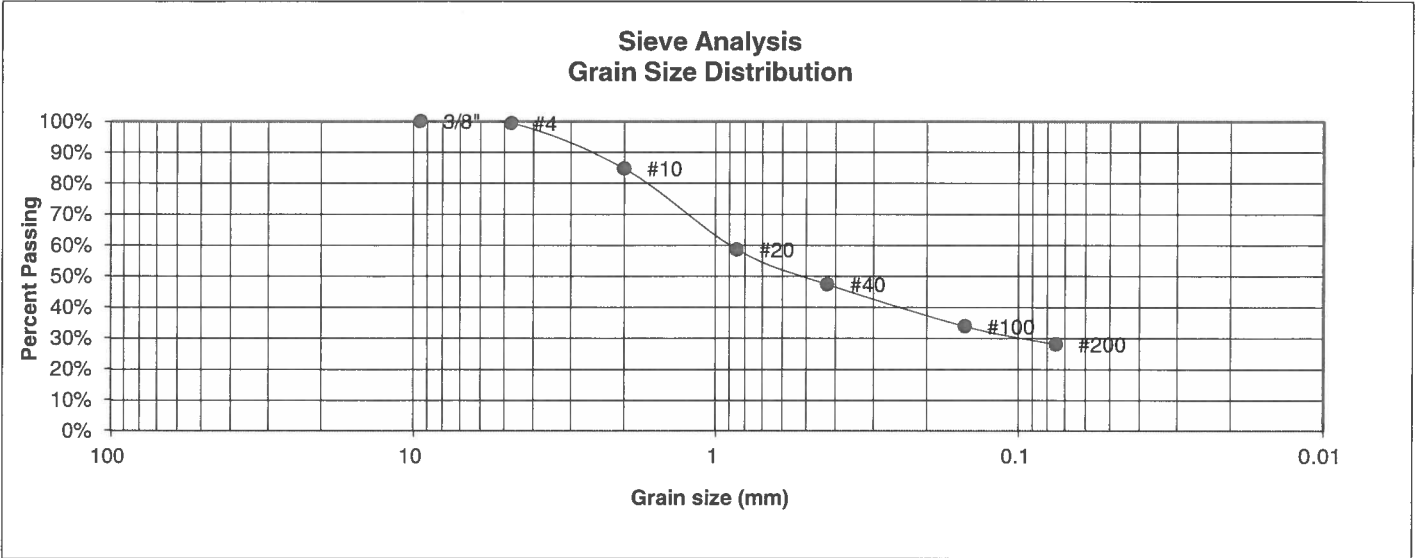
**LABORATORY TEST  
RESULTS**

DRAWN:	DATE:	CHECKED: <i>LLL</i>	DATE: <i>11/8/22</i>
--------	-------	------------------------	-------------------------

JOB NO.:  
222006

FIG NO.:  
*C-7*

UNIFIED CLASSIFICATION	SM	CLIENT	GUMAN AND ASSOC.
SOIL TYPE #	3	PROJECT	JUDGE ORR AND CURTIS ROAD
TEST BORING #	3	JOB NO.	222006
DEPTH (FT)	15	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.4%
10	84.8%
20	58.6%
40	47.4%
100	33.9%
200	28.1%

- 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**

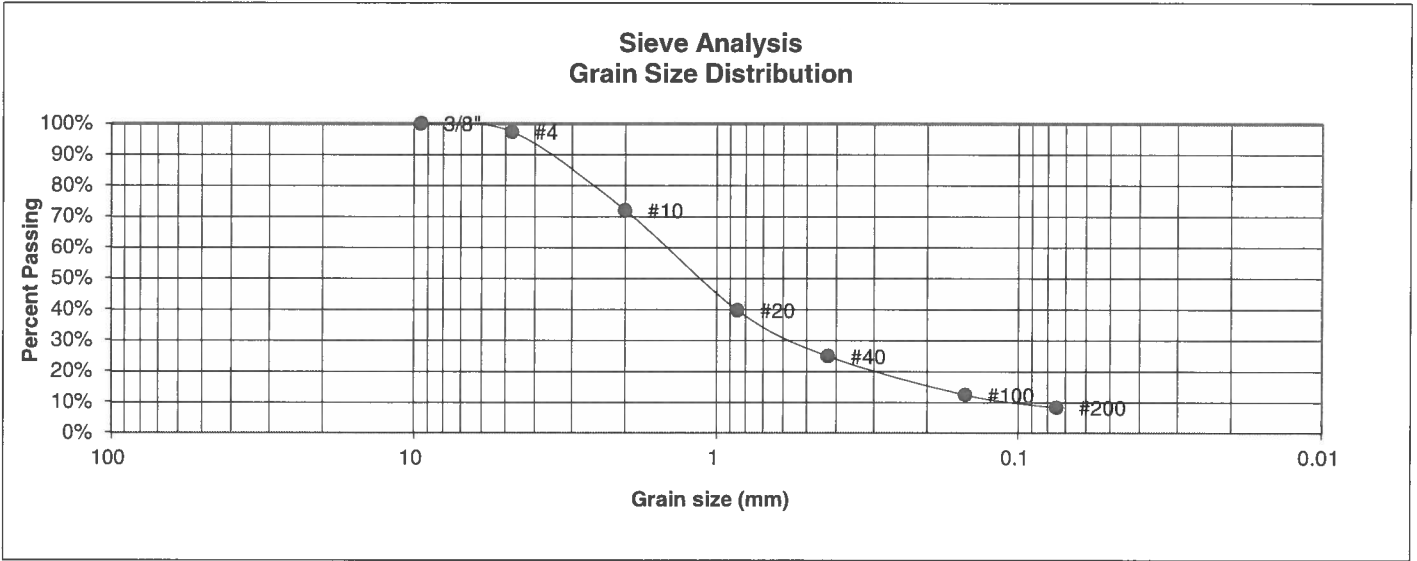
DRAWN:	DATE:	CHECKED: LLL	DATE: 11/8/22
--------	-------	-----------------	------------------

JOB NO.:  
222006

FIG NO.:

C-8

UNIFIED CLASSIFICATION	SM-SW	CLIENT	GUMAN AND ASSOC.
SOIL TYPE #	3	PROJECT	JUDGE ORR AND CURTIS ROAD
TEST BORING #	8	JOB NO.	222006
DEPTH (FT)	10	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	97.4%
10	72.0%
20	39.7%
40	24.9%
100	12.5%
200	8.4%

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.**

505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

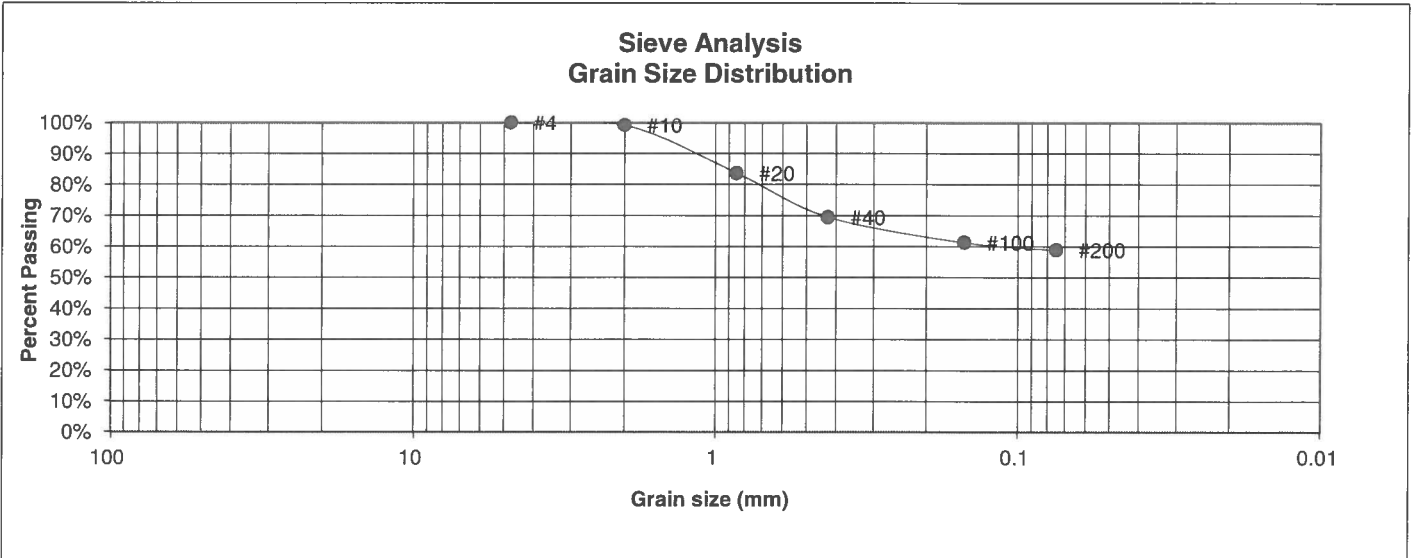
**LABORATORY TEST  
RESULTS**

DRAWN:	DATE:	CHECKED: LLL	DATE: 11/8/22
--------	-------	-----------------	------------------

JOB NO.:  
222006

FIG NO.:  
C-9

UNIFIED CLASSIFICATION	ML	CLIENT	GUMAN AND ASSOC.
SOIL TYPE #	4	PROJECT	JUDGE ORR AND CURTIS ROAD
TEST BORING #	4	JOB NO.	222006
DEPTH (FT)	20	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.2%
20	83.7%
40	69.4%
100	61.3%
200	58.9%

Atterberg Limits	
Plastic Limit	36
Liquid Limit	41
Plastic Index	5

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



**ENTECH  
ENGINEERING, INC.**

505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST  
RESULTS**

DRAWN:	DATE:	CHECKED: <i>LLL</i>	DATE: <i>11/8/22</i>
--------	-------	------------------------	-------------------------

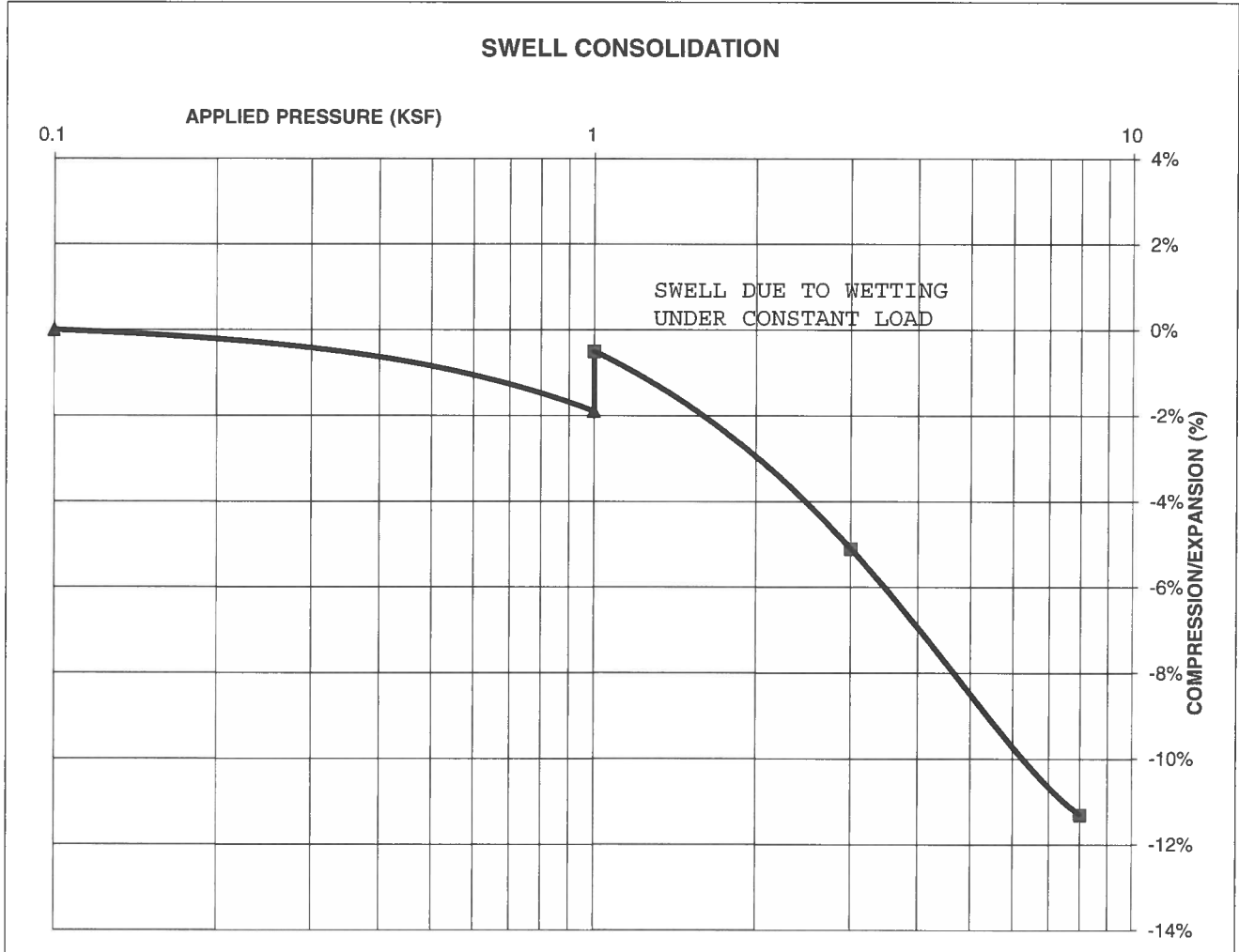
JOB NO.:  
222006

FIG NO.:  
*C-10*

**CONSOLIDATION TEST RESULTS**

TEST BORING #	4	DEPTH(ft)	20
DESCRIPTION	ML	SOIL TYPE	4
NATURAL UNIT DRY WEIGHT (PCF)			77
NATURAL MOISTURE CONTENT			31.1%
SWELL/CONSOLIDATION (%)			1.4%

JOB NO. 222006  
 CLIENT GUMAN AND ASSOC.  
 PROJECT JUDGE ORR AND CURTIS ROAD



**ENTECH**  
**ENGINEERING, INC.**

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**SWELL CONSOLIDATION  
 TEST RESULTS**

DRAWN:

DATE:

CHECKED:  
*LLL*

DATE:

*11/8/22*

JOB NO.:  
 222006

FIG NO.:

*C-11*





**APPENDIX D: Saddlehorn Ranch Subdivision, Test Boring & Test Pit  
Logs, Laboratory Testing Summary, Entech Job No. 181823**

**TABLE 1**

**SUMMARY OF LABORATORY TEST RESULTS FROM TEST BORINGS**

CLIENT WILLIAM GUMAN  
PROJECT CURTIS AND JUDGE ORR  
JOB NO. 181823

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			12.0	NV	NP	<0.01			SM	SAND, SILTY
1	2	5			13.8						SM	SAND, SILTY
1	4	2-3			3.2						SW	SAND
3	3	10			12.9	NV	NP	<0.01			SM	SANDSTONE, SILTY
4	4	20	21.4	104.2	52.5	NV	NP	<0.01		0.0	ML	SILTSTONE, VERY SANDY

**TABLE 2**

**SUMMARY OF LABORATORY TEST RESULTS FROM TEST PITS**

CLIENT GUMAN AND ASSOCIATES  
 PROJECT CURTIS RD AND JUGRE ORR RD  
 JOB NO. 181823

SOIL TYPE	TEST PIT 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	2	2-3			7.6						SM-SW	SAND, SLIGHTLY SILTY
1	3	5-6			9.8						SM-SW	SAND, SLIGHTLY SILTY
1	6	4-6			5.5						SM-SW	SAND, SLIGHTLY SILTY
1	9	2-3			26.5	24	9				SC	SAND, CLAYEY
1	11	5-6			10.4						SM-SW	SAND, SLIGHTLY SILTY
1	12	2-3			6.6						SM-SW	SAND, SLIGHTLY SILTY
1	13	5-6			30.3	25	11				SC	SAND, CLAYEY
1	15	2-3			27.5				820		SC	SAND, CLAYEY
1	18	5-6			1.6						SW	SAND
1	21	5-6			23.4						SC	SAND, CLAYEY
1	37	6-7			30.1	19	3		430		SM	SAND, SILTY
1	31	2-3			16.6						SM	SAND, SILTY
1	32	4-5			44.3						SC	SAND, VERY CLAYEY
1	33	2-3			4.3						SW	SAND
1	35	5-6			2.2						SW	SAND
1	36	2-3			8.2						SM-SW	SAND, SLIGHTLY SILTY
1	38	2-3			3.1						SW	SAND
1	39	5-6			12.4						SM	SAND, SILTY
2	1	7-8			70.3	49	31		1360		CL	CLAY, SANDY
2	4	2-3			56.4	26	12				CL	CLAY, VERY SANDY
2	5	7-8			69.6	32	19		880		CL	CLAY, SANDY
2	16	7-8			92.9				4420		CL	CLAY, SANDY
3	8	4-5			44.8	29	13				SC	SANDSTONE, VERY CLAYEY
3	10	5-6			16.6						SM	SANDSTONE, SILTY
3	17	5-6			12.6						SM	SANDSTONE, SILTY
3	34	5-6			16.9						SM	SANDSTONE, SILTY
3	40	5-6			13.9						SM	SANDSTONE, SILTY
4	7	6-7			91.8				2300		CL	CLAYSTONE, SANDY
4	14	4-5			76.1	47	23		3160		CL	CLAYSTONE, SANDY
4	23	5-6			57.0				450		CL	CLAYSTONE, VERY SANDY

TEST BORING NO. 3  
 DATE DRILLED 4/2/2019  
 Job # 181823

TEST BORING NO. 4  
 DATE DRILLED 4/2/2019  
 CLIENT WILLIAM GUMAN  
 LOCATION CURTIS AND JUDGE ORR

REMARKS

REMARKS

WATER @ 12', 4/3/19

WATER @ 14', 4/3/19

6" TOPSOIL, SAND, SILTY, FINE TO COARSE GRAINED, TAN, DENSE TO MEDIUM DENSE, MOIST TO WET

6" TOPSOIL, SAND, CLEAN TO SILTY, FINE TO COARSE GRAINED, TAN, LOOSE TO DENSE, MOIST

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

SILTSTONE, VERY SANDY, DARK GRAY, HARD, WET

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
0-5	*		44	7.3	1	0-5	*		7	2.6	1
5-10	*		41	8.6	1	5-10	*		10	2.3	1
10-15	*		50 9"	11.8	3	10-15	*		30	4.0	1
15-20	*		50 8"	11.7	3	15-20	*		32	9.6	1
20-25	*		50 6"	14.8	3	20-25	*		50 4"	21.3	4



**ENTECH**  
**ENGINEERING, INC.**

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**TEST BORING LOG**

DRAWN:

DATE:

CHECKED:  
 LLL

DATE:  
 4/12/19

JOB NO.:  
 181823

FIG NO.:

B-2

TEST PIT NO. 21  
 DATE EXCAVATED 1/23/2019  
 Job # 181823

TEST PIT NO. 22  
 DATE EXCAVATED 1/4/2019  
 CLIENT GUMAN AND ASSOCIATES, LTD  
 LOCATION CURTIS ROAD AND JUDGE ORR ROAD

REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type	REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type
topsoil sandy loam, brown	1						topsoil sandy loam, brown	1					
sandy loam, fine to medium grained, tan	2			gr	m	2	loamy sand, fine to coarse grained, tan	2			sg		1
loamy sand to sand, fine to coarse grained, tan	3			sg		1		3					
	4							4					
	5							5					
	6						sandy loam, fine to coarse grained, tan	6			gr	w	2A
	7							7					
	8							8					
	9							9					
	10							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



**ENTECH**  
**ENGINEERING, INC.**

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**TEST PIT LOG**

DRAWN:

DATE:

CHECKED:  
 LLL

DATE:  
 2/16/19

JOB NO.:

181823

FIG NO.:

B-13

TEST PIT NO. 23  
 DATE EXCAVATED 1/4/2019  
 Job # 181823

TEST PIT NO. 24  
 DATE EXCAVATED 1/23/2019  
 CLIENT GUMAN AND ASSOCIATES, LTD  
 LOCATION CURTIS ROAD AND JUDGE ORR ROAD

REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type	REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type
topsoil sandy clay loam, brown	1	[Symbol]		gr	w	3A	topsoil sandy loam, brown	1	[Symbol]		gr	w	2A
sandy clay loam, light brown	2	[Symbol]		ma		3A	sandy loam, fine to coarse grained, tan	2	[Symbol]		gr	w	2A
weathered silty sandstone, fine to coarse grained, grayish tan	3	[Symbol]		ma		3A	loamy sand to sand, fine to coarse grained, tan	3	[Symbol]		sg		1
	4	[Symbol]						4	[Symbol]				
weathered sandy claystone, gray brown	5	[Symbol]		ma		4A		5	[Symbol]				
	6	[Symbol]						6	[Symbol]				
	7	[Symbol]						7	[Symbol]				
	8	[Symbol]						8	[Symbol]				
	9	[Symbol]						9	[Symbol]				
	10	[Symbol]						10	[Symbol]				

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



**ENTECH  
 ENGINEERING, INC.**

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**TEST PIT LOG**

DRAWN:

DATE:

CHECKED:  
 LLL

DATE:  
 2/16/19

JOB NO.:  
 181823

FIG NO.:

B-14

TEST PIT NO. 27  
 DATE EXCAVATED 1/23/2019  
 Job # 181823

TEST PIT NO. 28  
 DATE EXCAVATED 1/23/2019  
 CLIENT GUMAN AND ASSOCIATES, LTD  
 LOCATION CURTIS ROAD AND JUDGE ORR ROAD

REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type	REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type
topsoil sandy loam, brown	1	[Symbol]		gr	w	2A	topsoil sandy loam, brown	1	[Symbol]		gr	w	2A
sandy loam, fine to coarse grained, light brown	2	[Symbol]					sandy loam, fine to coarse grained, light brown	2	[Symbol]				
loamy sand to sand, fine to coarse grained, tan	3	[Symbol]		sg		1	sand, fine to coarse grained, tan	3	[Symbol]		sg		1
	4	[Symbol]						4	[Symbol]				
	5	[Symbol]					*-groundwater at 6.5'	5	[Symbol]				
	6	[Symbol]						6	[Symbol]				
	7	[Symbol]						7	[Symbol]				
	8	[Symbol]						8	[Symbol]				
	9	[Symbol]						9	[Symbol]				
	10	[Symbol]						10	[Symbol]				

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



**ENTECH**  
**ENGINEERING, INC.**

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**TEST PIT LOG**

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	2/16/19

JOB NO.:  
 181823  
 FIG NO.:  
 B-16



TEST PIT NO. 29  
 DATE EXCAVATED 1/23/2019  
 Job # 181823

TEST PIT NO. 30  
 DATE EXCAVATED 1/23/2019  
 CLIENT GUMAN AND ASSOCIATES, LTD  
 LOCATION CURTIS ROAD AND JUDGE ORR ROAD

REMARKS

REMARKS

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

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



**ENTECH  
 ENGINEERING, INC.**

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**TEST PIT LOG**

DRAWN:

DATE:

CHECKED:  
 LLL

DATE:  
 2/16/19

JOB NO.:  
 181823

FIG NO.:  
 B-17

TEST PIT NO. 37  
 DATE EXCAVATED 1/4/2019  
 Job # 181823

TEST PIT NO. 38  
 DATE EXCAVATED 1/4/2019  
 CLIENT GUMAN AND ASSOCIATES, LTD  
 LOCATION CURTIS ROAD AND JUDGE ORR ROAD

REMARKS

REMARKS

REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type	REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type
topsoil sandy loam, brown	1	[Symbol]					topsoil sandy loam, brown	1	[Symbol]				
loamy sand, fine to coarse grained, tan	2	[Symbol]		sg		1	sandy loam, fine to coarse grained, tan	2	[Symbol]		gr	w	2A
	3	[Symbol]					loamy sand, fine to coarse grained, tan	3	[Symbol]		sg		1
	4	[Symbol]						4	[Symbol]				
	5	[Symbol]						5	[Symbol]				
sandy clay loam, gray	6	[Symbol]		gr	w	3A	sandy loam, fine to coarse grained, orangish tan	6	[Symbol]		gr	w	2A
	7	[Symbol]						7	[Symbol]				
	8	[Symbol]					*signs of seasonal occuring groundwater at 6.5'	8	[Symbol]				
	9	[Symbol]						9	[Symbol]				
	10	[Symbol]						10	[Symbol]				

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



**ENTECH  
 ENGINEERING, INC.**

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

TEST PIT LOG

DRAWN:

DATE:

CHECKED:  
 LLL

DATE:  
 2/16/19

JOB NO.:

181823

FIG NO.:

13-21

TEST PIT NO. 39  
 DATE EXCAVATED 1/4/2019  
 Job # 181823

TEST PIT NO. 40  
 DATE EXCAVATED 1/4/2019  
 CLIENT GUMAN AND ASSOCIATES, LTD  
 LOCATION CURTIS ROAD AND JUDGE ORR ROAD

REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type	REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type
topsoil sandy loam, brown	1	[Symbol]					topsoil sandy loam, brown	1	[Symbol]				
loamy sand, fine to coarse grained, tan	2	[Symbol]		sg		1	sandy loam, fine to coarse grained, tan	2	[Symbol]		gr	w	2A
	3	[Symbol]					weathered to formational clayey sandstone, tan to orangish tan	3	[Symbol]		ma		4A
	4	[Symbol]						4	[Symbol]				
sandy loam, fine to coarse grained, tan	5	[Symbol]		gr	w	2A	*-signs of seasonal occuring groundwater at 3.5'	5	[Symbol]				
	6	[Symbol]						6	[Symbol]				
	7	[Symbol]						7	[Symbol]				
	8	[Symbol]						8	[Symbol]				
	9	[Symbol]						9	[Symbol]				
	10	[Symbol]						10	[Symbol]				

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



**ENTECH  
 ENGINEERING, INC.**

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**TEST PIT LOG**

DRAWN:

DATE:

CHECKED:  
 LLL

DATE:  
 2/16/19

JOB NO:  
 181823

FIG NO:  
 B-22

## **APPENDIX E: Soil Survey Descriptions**

## El Paso County Area, Colorado

### 8—Blakeland loamy sand, 1 to 9 percent slopes

#### Map Unit Setting

*National map unit symbol:* 369v  
*Elevation:* 4,600 to 5,800 feet  
*Mean annual precipitation:* 14 to 16 inches  
*Mean annual air temperature:* 46 to 48 degrees F  
*Frost-free period:* 125 to 145 days  
*Farmland classification:* Not prime farmland

#### Map Unit Composition

*Blakeland and similar soils:* 98 percent  
*Minor components:* 2 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Blakeland

##### Setting

*Landform:* Flats, hills  
*Landform position (three-dimensional):* Side slope, talf  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Parent material:* Alluvium derived from sedimentary rock and/or eolian deposits derived from sedimentary rock

##### Typical profile

*A - 0 to 11 inches:* loamy sand  
*AC - 11 to 27 inches:* loamy sand  
*C - 27 to 60 inches:* sand

##### Properties and qualities

*Slope:* 1 to 9 percent  
*Depth to restrictive feature:* More than 80 inches  
*Drainage class:* Somewhat excessively drained  
*Runoff class:* 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:* None  
*Frequency of ponding:* None  
*Calcium carbonate, maximum content:* 5 percent  
*Available water supply, 0 to 60 inches:* Low (about 4.5 inches)

##### Interpretive groups

*Land capability classification (irrigated):* 3e  
*Land capability classification (nonirrigated):* 6e  
*Hydrologic Soil Group:* A  
*Ecological site:* R049XB210CO - Sandy Foothill  
*Hydric soil rating:* No

### **Minor Components**

#### **Other soils**

*Percent of map unit:* 1 percent

*Hydric soil rating:* No

#### **Pleasant**

*Percent of map unit:* 1 percent

*Landform:* Depressions

*Hydric soil rating:* Yes

## **Data Source Information**

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 20, Sep 2, 2022

## El Paso County Area, Colorado

### 19—Columbine gravelly sandy loam, 0 to 3 percent slopes

#### Map Unit Setting

*National map unit symbol:* 367p  
*Elevation:* 6,500 to 7,300 feet  
*Mean annual precipitation:* 14 to 16 inches  
*Mean annual air temperature:* 46 to 50 degrees F  
*Frost-free period:* 125 to 145 days  
*Farmland classification:* Not prime farmland

#### Map Unit Composition

*Columbine and similar soils:* 97 percent  
*Minor components:* 3 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Columbine

##### Setting

*Landform:* Fans, fan terraces, flood plains  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Parent material:* Alluvium

##### Typical profile

*A - 0 to 14 inches:* gravelly sandy loam  
*C - 14 to 60 inches:* very gravelly loamy sand

##### Properties and qualities

*Slope:* 0 to 3 percent  
*Depth to restrictive feature:* More than 80 inches  
*Drainage class:* Well 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:* None  
*Frequency of ponding:* None  
*Available water supply, 0 to 60 inches:* Very low (about 2.5 inches)

##### Interpretive groups

*Land capability classification (irrigated):* 4e  
*Land capability classification (nonirrigated):* 6e  
*Hydrologic Soil Group:* A  
*Ecological site:* R049XY214CO - Gravelly Foothill  
*Hydric soil rating:* No

#### Minor Components

##### Fluvaquentic haplaquolls

*Percent of map unit:* 1 percent

*Landform: Swales*  
*Hydric soil rating: Yes*

**Other soils**

*Percent of map unit: 1 percent*  
*Hydric soil rating: No*

**Pleasant**

*Percent of map unit: 1 percent*  
*Landform: Depressions*  
*Hydric soil rating: Yes*

## Data Source Information

Soil Survey Area: El Paso County Area, Colorado  
Survey Area Data: Version 20, Sep 2, 2022



## El Paso County Area, Colorado

### 29—Fluvaquentic Haplaquolls, nearly level

#### Map Unit Setting

*National map unit symbol:* 3681  
*Elevation:* 5,000 to 7,800 feet  
*Mean annual precipitation:* 13 to 15 inches  
*Mean annual air temperature:* 46 to 52 degrees F  
*Frost-free period:* 110 to 165 days  
*Farmland classification:* Not prime farmland

#### Map Unit Composition

*Fluvaquentic haplaquolls and similar soils:* 98 percent  
*Minor components:* 2 percent  
*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Fluvaquentic Haplaquolls

##### Setting

*Landform:* Marshes, flood plains, swales  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Parent material:* Alluvium

##### Typical profile

*A - 0 to 12 inches:* variable  
*C - 12 to 60 inches:* stratified very gravelly sand to loam

##### Properties and qualities

*Slope:* 0 to 2 percent  
*Depth to restrictive feature:* More than 80 inches  
*Drainage class:* Poorly drained  
*Runoff class:* Very high  
*Capacity of the most limiting layer to transmit water (Ksat):* Moderately high to high (0.20 to 6.00 in/hr)  
*Depth to water table:* About 0 to 24 inches  
*Frequency of flooding:* Frequent  
*Frequency of ponding:* None  
*Maximum salinity:* Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)  
*Available water supply, 0 to 60 inches:* Moderate (about 6.2 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 5w  
*Hydrologic Soil Group:* D  
*Ecological site:* R067BY029CO - Sandy Meadow  
*Hydric soil rating:* Yes

### **Minor Components**

#### **Haplaquolls**

*Percent of map unit:* 1 percent

*Landform:* Domes

*Hydric soil rating:* Yes

#### **Other soils**

*Percent of map unit:* 1 percent

*Hydric soil rating:* No

## **Data Source Information**

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 20, Sep 2, 2022