



**ENTECH**  
ENGINEERING, INC.

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

**SOIL, GEOLOGY, AND GEOLOGIC HAZARD STUDY  
WINSOME SUBDIVISION – FILING NO. 3  
PORTIONS OF PARCEL NOS. 51000-00-497 & 51000-00-510  
17480 MERIDIAN ROAD NORTH  
EL PASO COUNTY, COLORADO**

Add a section regarding the pond embankment per DCM 11.3.3

Review #1 is unresolved.

**Winsome, LLC**  
1864 Woodmoor Drive, Suite 100  
Monument, Colorado 80132

**11.3.3 Embankment Structures**

The width of the top of the embankment structure shall be a minimum of 12 feet for embankments less than 25 feet in height. Also, side slopes on embankment structures will vary with materials types used and shall be designed to produce a stable and easily maintained structure. A slope stability analysis shall be required on all Class 1 structures.

An allowance for settlement shall also be factored into the design for all embankment structures. Consideration shall also be given to limiting excessive seepage through the embankment and foundation that may lead to embankment erosion and structure instability for all Class 1 structures.

May 21, 2021

A geotechnical analysis and report prepared by a Colorado Professional Engineer with recommendations for the foundation preparation and embankment construction shall be submitted to the City/County Engineer with the complete design analysis for all permanent detention facilities.

ENTECH ENGINEERING, INC.

Logan L. Langford, P.G.  
Geologist

Reviewed by



LLL

Encl.

Entech Job No. 2105  
AAprojects/2021/210539 coun

SF229

Review #1 is unresolved.

PCD Fil No. \_\_\_\_\_

**TABLE OF CONTENTS**

1.0 SUMMARY ..... 1  
2.0 GENERAL SITE CONDITIONS AND PROJECT DESCRIPTION ..... 2  
3.0 SCOPE OF THE REPORT ..... 3  
4.0 FIELD INVESTIGATION ..... 3  
5.0 SOIL, GEOLOGY AND ENGINEERING GEOLOGY ..... 4  
    5.1 General Geology ..... 4  
    5.2 Soil Conservation Survey ..... 4  
    5.3 Site Stratigraphy ..... 5  
    5.4 Soil Conditions ..... 6  
    5.5 Groundwater ..... 7  
6.0 ENGINEERING GEOLOGY – IDENTIFICATION AND MITIGATION OF GEOLOGIC HAZARDS ..... 8  
    6.1 Relevance of Geologic Conditions to Land Use Planning ..... 11  
7.0 ECONOMIC MINERAL RESOURCES ..... 13  
8.0 EROSION CONTROL ..... 14  
9.0 CLOSURE ..... 15  
BIBLIOGRAPHY ..... 16

**TABLES**

*Table 1: Summary of Laboratory Test Results*

*Table 2: Summary of Test Boring Results*

**FIGURES**

*Figure 1: Vicinity Map*

*Figure 2: USGS Map*

*Figure 3: Site Plan/Testing Location Map*

*Figure 4: Soil Survey Map*

*Figure 5: Eastonville Quadrangle Geology Map*

*Figure 6: Geology Map/Engineering Geology*

*Figure 7: Floodplain Map*

*Figure 8: Typical Perimeter Drain Details*

**APPENDIX A: Site Photographs**

**APPENDIX B: Test Boring Logs**

**APPENDIX C: Laboratory Test Results**

**APPENDIX D: Soil Survey Descriptions**

## 1.0 SUMMARY

### ***Project Location***

The project site lies in portions of the SE $\frac{1}{4}$  of Section 13, and portions of the NE $\frac{1}{4}$ , SE $\frac{1}{4}$ , and SW $\frac{1}{4}$  of Section 24, Township 11 South, Range 65 West of the 6<sup>th</sup> Principal Meridian in the northeastern portion of El Paso County, Colorado. The site is located approximately 12 miles east of Monument, Colorado, northwest of Hodgen Road and Meridian Road North.

### ***Project Description***

Total acreage involved in Filing No. 3 of the project is 349.47 acres. The proposed site development consists of Thirty-eight single-family rural residential lots, are proposed, and full spectrum detention ponds in the southeastern and southwestern portions of the site. The development will utilize individual wells and 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, downslope creep, potentially unstable slopes, potentially seasonal shallow groundwater, 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 portions of the SE¼ of Section 13, and portions of the NE¼, SE¼, and SW¼ of Section 24, Township 11 South, Range 65 West of the 6<sup>th</sup> Principal Meridian in the northeastern portion of El Paso County, Colorado. The site is located approximately 12 miles east of Monument, Colorado, northwest of Hodgen Road and Meridian Road North. 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 southeast, with moderately steep to steep slopes located along portions of the drainages on site. West Kiowa Creek bisects the site and is located to the northwest and north of phase one of the proposed subdivision. A tributary to West Kiowa Creek is located in the southern portion of Winsome Subdivision Filing No. 3. The drainages on site flow in a southerly, and northeasterly directions through the central portion of the site. Water was observed in the West Kiowa Creek drainage, and no water was observed in the minor 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. Site photographs, taken May 19, 2021, are included in Appendix A.

Total acreage involved in the proposed development is 349.47 acres. Thirty-eight single-family rural residential lots, and full spectrum detention ponds in the southeastern and southwestern portions of the site. The proposed residential lots vary in sizes from approximately 5 to 8 acres. The area will be serviced by individual wells and 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. 181459 (Reference 1). Five (5) test borings, and ten (10) tactile test pits were performed on the site to determine general suitability of the site for the use of on-site wastewater treatment systems. The previous report/investigation was used as part of this investigation. More specifically previous Test Pit Nos. (TP-1, TP-2 and TP-3) were used as part of the Winsome Subdivision Filing No. 3 investigation.

### **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.

### **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 April 1, 2021.

Six (6) test borings were drilled on the site to determine general suitability of the site for residential construction. The locations of the test borings are indicated on the Site Plan/Testing Location Map, Figure 3. The Test Boring 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. A Summary of Laboratory Test Results, Test Boring Logs from the previous investigation are included in Appendix D.

## 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, north of the Palmer Divide. Approximately 16 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 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 drainage on the site and as stream terrace deposits. Man-made soils exist as fill placed for temporary creek crossings, and fill associated with the embankment of detention Pond No. 3. 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 six 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>
1	Alamosa Loam, 1-3% slopes
15	Brussett Loam, 3 to 5% slopes
21	Cruckton Sandy Loam, 1 to 9% slopes
25	Elbeth Sandy Loam, 3 to 8% slopes
36	Holderness Loam, 8 to 15% slopes
92	Tomah-Crowfoot Loamy Sands, 3 to 8% slopes

Complete descriptions of each soil type are presented in Appendix D. The soils have generally been described to typically have slow to rapid permeabilities. The majority of the soils have moderate permeabilities. Limitations described for the soils include shrink-swell potential on Soil Type Nos. 25. 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 moderate erosion hazards.

### **5.3 Site Stratigraphy**

The Eastonville 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. Six mappable units were identified on this site which are described as follows:

- Qaf      Recent Artificial Fill of Holocene Age:** These are man-made fill deposits associated with temporary creek crossings, and the existing detention Pond No. 3 in the southeastern portion of Filing No. 3.
  
- Qp      Piney Creek Alluvium (Alluvium One and Two) of Early Holocene Age:** These materials consist of low stream-terrace deposits above the current stream channel. The materials typically consist of silty to well graded sand.
  
- Qb      Broadway Alluvium (Alluvium Three) of Late Pleistocene Age:** These materials consist of middle stream terrace deposits. The materials typically consist of silty to clayey gravelly sands.
  
- Qlo      Louviers Alluvium (Alluvium Four) Late Middle Pleistocene Age:** These materials consist of upper stream terrace deposits. The materials typically consist of light brown silty sands which contain an abundance of gravels.
  
- Qsw      Sheetwash Deposits of Holocene to Late Pleistocene Age:** These materials consist of silty to clayey sands with some cobbles and boulders. The material was deposited by the action of sheetwash and gravity.

**Qc/Tkd Colluvium 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 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 Eastonville Quadrangle* distributed by the Colorado Geological Survey in 2012 (Reference 4), and the *Geologic Map of the Denver 1<sup>o</sup> x 2<sup>o</sup> Quadrangle*, distributed by the US Geological Survey in 1981 (Reference 5). 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 Test Borings can be grouped into three general soil and rock types. The Test Boring soils were classified using the Unified Soil Classification System (USCS).

Soil Type 1 is a sandy clay (CL). This material was encountered in all of the test borings. The sand was encountered at the existing surface and extended to depths ranging from 1 to 4 feet, and to the termination of Test Boring No. 4 (20 feet). These soils were encountered at firm to very stiff consistencies and at moist conditions. Samples tested had 56 to 87 percent of the soil sized particles passing the No. 200 Sieve. Swell/Consolidation Testing resulted in a volume change of 2.9 percent, which indicates a moderate to high expansion potential.

Soil Type 2 is a silty to clayey sandstone (SM, SM-SW, SC). This material was encountered in five of the test borings at depths ranging from 2 to 8 feet extending to depths ranging from 15 to 20 feet. The sandstone was encountered at dense to very dense states and moist conditions. Samples tested had 23 to 48 percent of the soil sized particles passing the No. 200 sieve. Atterberg Limits Testing on samples of the sandstone resulted in a liquid limit of 25 and a plastic index of 10, and non-plastic results. Swell/Consolidation Testing resulted in a consolidation of 1.4 percent, indicating a low consolidation potential. Highly expansive clayey sandstone and claystone are commonly interbedded in the sandstone in the area. Sulfate testing on the

sandstone resulted in 0.00 to less than 0.01 percent soluble sulfate by weight, indicating negligible potential for below grade concrete degradation due to sulfate attack.

Soil Type 3 is a sandy claystone (CL). This material was encountered Test Boring No. 1 at 14 feet bgs and extended to the termination of the boring (20 feet). The claystone was encountered at hard consistencies and moist conditions. Samples tested had 64 to 67 percent of the soil sized particles passing the No. 200 sieve. Atterberg Limits Testing resulted in a liquid limit of 32 and a plastic index of 15. FHA Swell Testing resulted in an expansion pressure of 430 psf. Swell/Consolidation Testing resulted in a volume change of 2.5 percent. These results indicated low, and moderate to high expansion potentials.

The Test Boring 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. Laboratory Testing summary table, and Test Boring Logs from the original Soil Geology Study, Job No. 181495 are presented in Appendix D.

### ***5.5 Groundwater***

Groundwater was not encountered in test borings which were drilled to 15 to 20 feet. Areas of seasonal and potentially seasonal shallow groundwater have been mapped in low-lying areas and in the drainages on-site, and flowing water along West Kiowa Creek in the southern portion of Winsome Filing No. 3. 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 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:

### Artificial Fill – Constraint

These are man-made fill deposits associated with fill placed for temporary creek crossing in the southeastern portion of Filing No. 3, and the embankment for detention Pond No. 3 also located in the southeastern portion of the site. Artificial fill was not observed in areas that would affect proposed construction on the lots in Filing No. 3.

Mitigation: 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.

### Loose or Collapsible Soils - Constraint

Loose soils were encountered in one of the test borings. 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 2 to 3 feet, 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 during the excavation observation.

Expansive Soils – Constraint

Expansive soils were encountered in the test borings drilled 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. 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.

Slope Stability and Landslide Hazards

The majority of the slopes in the building areas on site are gently to moderately sloping and do not exhibit any past or potential unstable slopes or landslides. However, the steeply sloping areas along the drainage in the central portion of the site have been identified as potentially unstable slopes. Additionally, areas of downslope creep have been mapped on the site. These areas are identified on the Geology/Engineering Geology Map, Figure 6. The recommendations for these areas are as follows:

- Potentially Unstable Slope Area – Constraint

The area identified with this hazard is located along a portion of a minor drainage where cut banks have created potentially unstable slopes. Considerable care must be exercised in these areas not to create a condition which would tend to activate instability.

Mitigation: Building should be avoided in these areas. The lots most significantly affected by potentially unstable slopes are Lot 31 and 32. The structures on these lots should be set back a minimum of 30 feet from the crest of these slopes. The recommended setback lies within the proposed no build area. There is sufficient room on the lots to avoid this hazard. Proper control of drainage at both the surface above the slope and the subsurface is extremely important. Areas of ponded water at the surface should be avoided. Utility trenches, basement excavations and other subsurface features should not be permitted to become water traps which may promote saturation of the subsurface materials. Drainage should not be permitted over the potentially unstable slope but directed in a non-erosive manner away from the slope. Irrigation above these slopes should be kept to a minimum to prevent saturation of the subsurface soils. The use of xeriscape landscaping utilizing native plantings is recommended to reduce the need for irrigation.

- *Downslope Creep Area - Constraint*

The areas identified with this hazard includes some of the steeper slopes on site, particularly in the northwest portion of the site. In these areas, we would anticipate lateral and vertical movement of the near surface soils in the downslope direction. These areas are acceptable as building sites with the following constraints on construction.

Mitigation: Building is possible in these areas if the following engineering and construction mitigation steps are taken: This type of movement will increase lateral pressures against foundation walls on the uphill side of structures. The design of foundations in these areas should account for this additional pressure. Additionally, the foundation should be designed to withstand pressures where steeper areas slope away from the foundation. Tie beams and buttresses are recommended to stiffen the foundation system.

#### Floodplain and Drainage Areas – Constraint

Portions of the site associated with the West Kiowa Creek drainage are mapped within a floodplain zone according to the FEMA Map Nos. 08041CO310G and 08041CO350G, dated December 7, 2018 (Figure 7, Reference 6). Water was observed flowing in West Kiowa Creek; however, water was not observed in the minor drainages located within Filing No. 3. The floodplain areas have been designated as open space/drainage easements and/or can be avoided by construction and is located outside of Filing No. 3 of the development. 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 areas lie within low-lying areas along the minor drainages across Filing No. 3. Water was not observed in any of the minor drainages at the time of our site investigation. These areas can likely be avoided or properly mitigated by development. The floodplain should be avoided by construction unless site-specific floodplain determination and drainage studies are performed. The potential exists for high groundwater levels during high moisture periods and should structures encroach on these areas the following precautions should be followed. Additional investigation is recommended for the proposed bridges for Alamar Way and Twinkling Star Lane once plans have been finalized.

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. Some of the minor drainage swales can be avoided or regraded. The main drainage that bisects the site is designated as open space and will be avoided. Any grading in these areas should be done to direct surface flow around construction to avoid areas of ponded water. Finished floors must be located at least one foot above floodplain levels. Specific drainage studies and exact floodplain locations are beyond the scope of this report.

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

The development will consist of rural residential lots. It is our opinion that the existing geologic and engineering geologic conditions will impose some 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 construction on each lot. Other hazards on site may be satisfactorily mitigated through proper engineering design and construction practices or avoidance.

The upper materials are typically at medium dense to dense states. Shallow bedrock or very dense soils were encountered in all of the test borings. The medium dense to dense granular soils and shallow sandstone encountered in the upper soil profiles of the test borings will provide good support for foundations. Loose soils, if encountered beneath foundations or slabs, will require

removal and recompaction. Expansive soils, although sporadic, were encountered. Shallow bedrock was encountered in portions of the site. Expansive clayey sandstone and claystone are common in the Dawson Formation, and may require mitigation.

Foundations anticipated for the site are standard spread footings being on granular site soils or sandstone. Overexcavation in areas of expansive soils/claystone will be required. Areas of artificial fill, if encountered beneath foundations will require penetration or recompaction. 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.

A potentially unstable slope exists along portions of the site where the drainages have eroded cut banks. A 30-foot building setback is recommended from the crest of the potentially unstable slope. Septic fields should not be located within the building setback as well. The slopes primarily affect Lot 31 and 32. It appears there is sufficient room on the lots to avoid the potentially unstable slopes. Additionally, minor areas of downslope creep have been mapped on the site. Many of these areas can be avoided by construction, however, Lot 8 may be affected. These areas are acceptable as building sites with mitigation for the sloping conditions taken into consideration. Additional reinforcement may be necessary in the foundation to account for additional pressures due to sloping conditions. Tie-beams and/or buttresses may be necessary, depending on site conditions and grading plans.

Areas of seasonal shallow groundwater and potentially seasonal shallow groundwater were encountered on site. Additionally, the southern portion of Filing No. 3 has been mapped in a floodplain zone associated with West Kiowa Creek. The floodplain area is in the designated open space area and will be avoided by construction. The area north of the creek is not mapped within the floodplain zone (Figure 7, Reference 7). The floodplain areas have been designated as open space/drainage easements and/or can be avoided by construction and is located outside of Filing No. 3 of the development. 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 areas lie within low-lying areas along the minor drainages across the site north of West Kiowa Creek. Water was

not observed in any of the minor drainages at the time of our site investigation. Due to the size of the lots and the proposed development, the majority of these areas can be avoided by construction on the lots. Regrading can also mitigate some minor drainage swales on some of the lots. Structures should not block drainages. Any site grading should be done in such a manner as to not create areas of ponded water around structures or septic fields. Finished floor levels must be a minimum of one foot above the floodplain level. Septic fields should not be located in drainage areas due to the potential for periodic high groundwater conditions. Specific floodplain locations and drainage studies are beyond the scope of this report.

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 7), the area is mapped with floodplain, valley fill and upland deposits. According to the *Atlas of Sand, Gravel and Quarry Aggregate Resources, Colorado Front Range Counties* distributed by the Colorado Geological Survey (Reference 8), areas of the site are mapped with upland and floodplain deposits: sand and probable aggregate resource (U3, U4 and F4). According to the *Evaluation of Mineral and Mineral Fuel Potential* (Reference 9), 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 9). 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 Winsome, LLC 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 January 11, 2019. *Preliminary Soil, Geology, Geologic Hazard and Wastewater Study, Winsome Subdivision, Parcel No. 51000-00-493, El Paso County, Colorado*. Entech Job No. 181459.
2. Bryant, Bruce; McGrew, Laura W, and Wobus, Reinhard A. 1981. *Geologic Structure Map of the Denver 1° x 2° Quadrangle, North-Central Colorado*. Sheet 2. U.S. Geologic Survey. Map I-1163.
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 Barkmann, Peter E., 2012. *Geologic Map of the Eastonville Quadrangle, El Paso and Elbert Counties, Colorado*. Colorado Geological Survey. Open-File Report 12-03.
6. Bryant, Bruce; McGrew, Laura W. and Wobus, Reinhard A. 1981. *Geologic Map of the Denver 1° x 2° Quadrangle, North-Central Colorado*. U.S. Geologic Survey. Map 1-1163.
7. Federal Emergency Management Agency. December 7, 2018. *Flood Insurance Rate Maps for the City of Colorado Springs, Colorado*. Map Numbers 08041CO310G & 08041CO350G.
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**

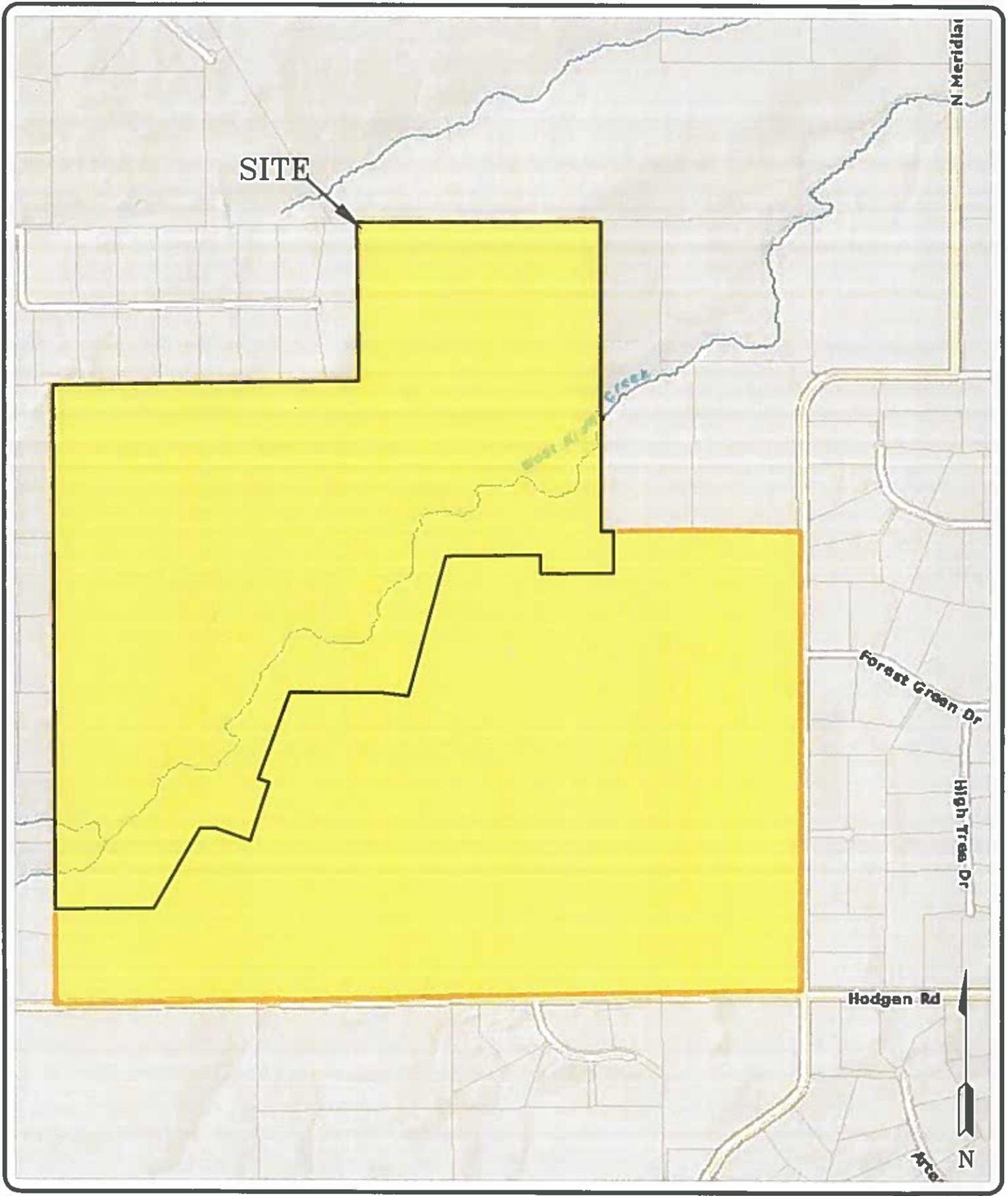
CLIENT WINSOME, LLC  
PROJECT HODGEN AND MERIDIAN  
JOB NO. 210539

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	4	10			56.1						CL	CLAY, VERY SANDY
1	6	2-3	9.7	107.6	86.7					2.9	CL	CLAY, SANDY
2	1	2-3	9.1	106.1	30.7	25	10	0.00		-1.4	SC	SANDSTONE, CLAYEY
2	1	5			23.1	NV	NP	<0.01			SM	SANDSTONE, SILTY
2	5	20			47.6						SC	SANDSTONE, VERY CLAYEY
3	2	10	10.4	126.3	67.3	32	15				CL	CLAYSTONE, SANDY
3	3	2-3			63.9				430		CL	CLAYSTONE, SANDY

**Table 2: Summary Test Boring Results**

<b>Test Boring No.</b>	<b>Depth to Bedrock (ft.)</b>	<b>Depth to Seasonally Occurring Groundwater (ft.)</b>
1	2	>15
2	2	>15
3	1	>15
4	>20	>20
5	2	>20
6	4	>15

## FIGURES



SITE

N Meridian

Washburn Creek

Forest Green Dr

High Trees Dr

Hodgen Rd

Arce

N



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

VICINITY MAP  
 WINSOME SUBDIVISION - FILING NO. 3  
 HODGEN ROAD & MERIDIAN ROAD  
 EL PASO COUNTY, CO.  
 FOR: WINSOME, LLC

DRAWN:  
 LLL

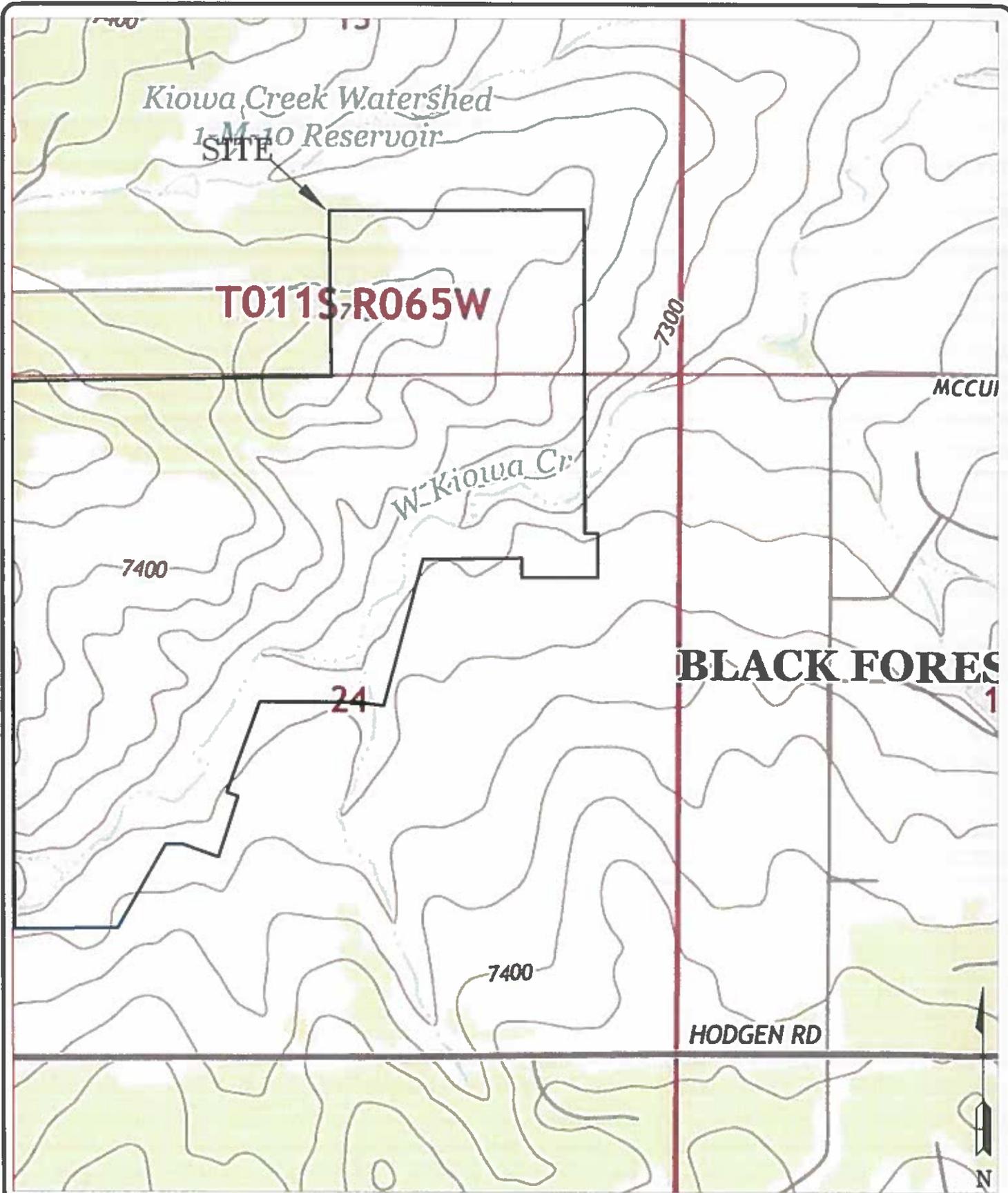
DATE:  
 5/18/21

CHECKED:

DATE:

JOB NO:  
 210539

FIG NO:  
 1



**ENTECH**  
ENGINEERING, INC.  
565 ELAKTON DRIVE  
COLORADO SPRINGS, CO. 80907 (719) 531-9399

USGS MAP  
WINSOME RANCH SUBDIVISION - FILING NO. 3  
HODGEN ROAD & MERIDIAN ROAD  
EL PASO COUNTY, CO.  
FOR: WINSOME, LLC

DRAWN:  
LLL

DATE:  
5/18/21

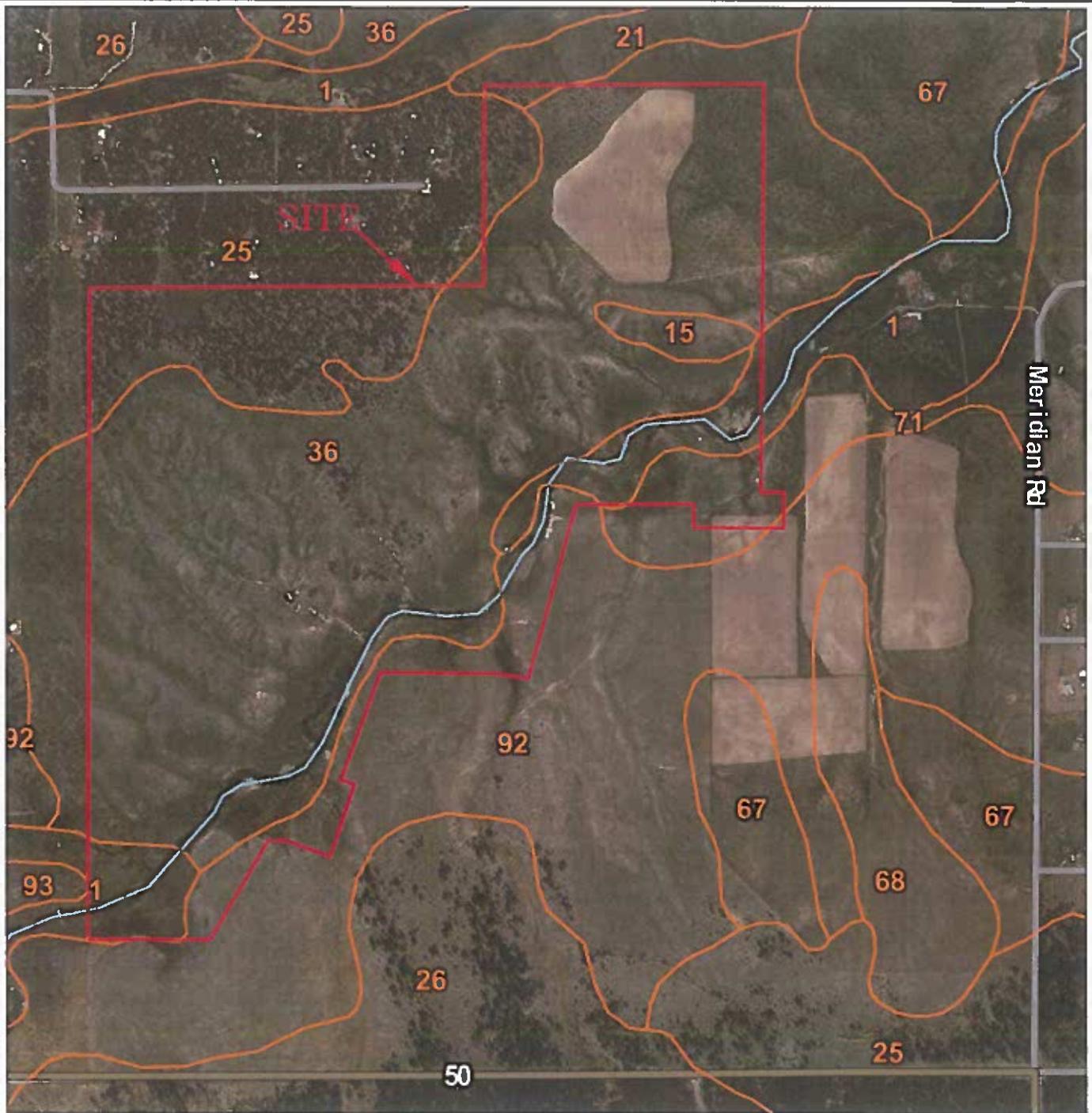
CHECKED:

DATE:

JOB NO.:  
210539

FIG NO.:  
2





Meridian Rd



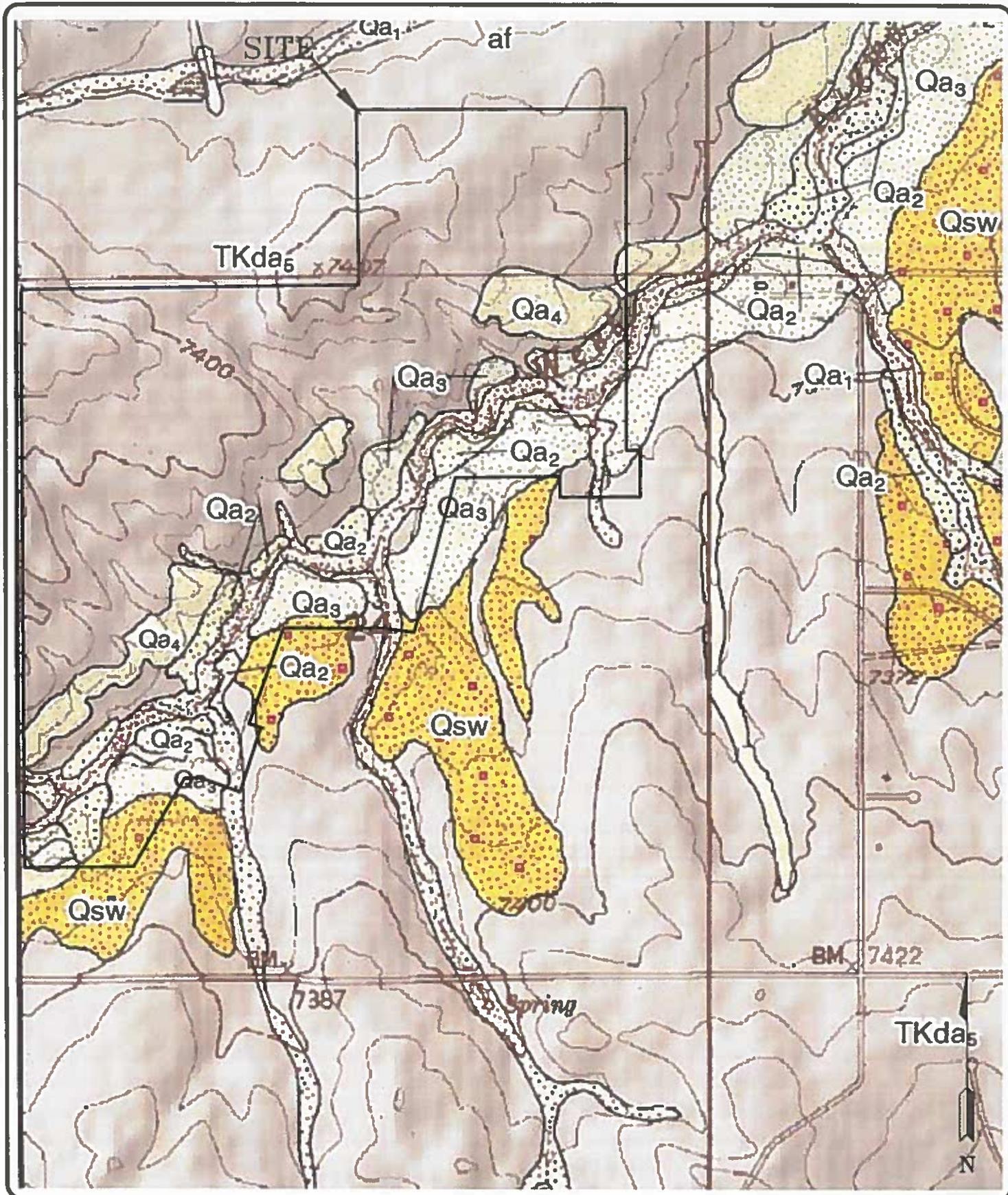
**ENTECH**  
**ENGINEERING, INC.**  
505 ELKTON DRIVE  
 COLORADO SPRINGS, CO. 80907 (719) 531-9999

**SOIL SURVEY MAP**  
**WINSOME SUBDIVISION - FILING NO. 3**  
**HODGEN ROAD & MERIDIAN ROAD**  
**EL PASO COUNTY, CO.**  
**FOR: WINSOME, LLC**

<b>DRAWN:</b> LLL	<b>DATE:</b> 5/18/21	<b>CHECKED:</b>	<b>DATE:</b>
----------------------	-------------------------	-----------------	--------------

**JOB NO.:**  
**210539**

**FIG NO.:**  
**4**



**ENTECH**  
**ENGINEERING, INC.**  
 505 ELKTON DRIVE  
 COLORADO SPRINGS, CO. 80907 (719) 531-3599

**EASTONVILLE QUADRANGLE GEOLOGIC MAP**  
**WINSOME SUBDIVISION - FILING NO. 3**  
**HODGEN ROAD & MERIDIAN ROAD**  
**EL PASO COUNTY, CO.**  
**FOR: WINSOME, LLC**

DRAWN:  
 LLL

DATE:  
 5/18/21

CHECKED:

DATE:

JOB NO.:  
 210539

FIG NO.:  
 5

REVISION	BY

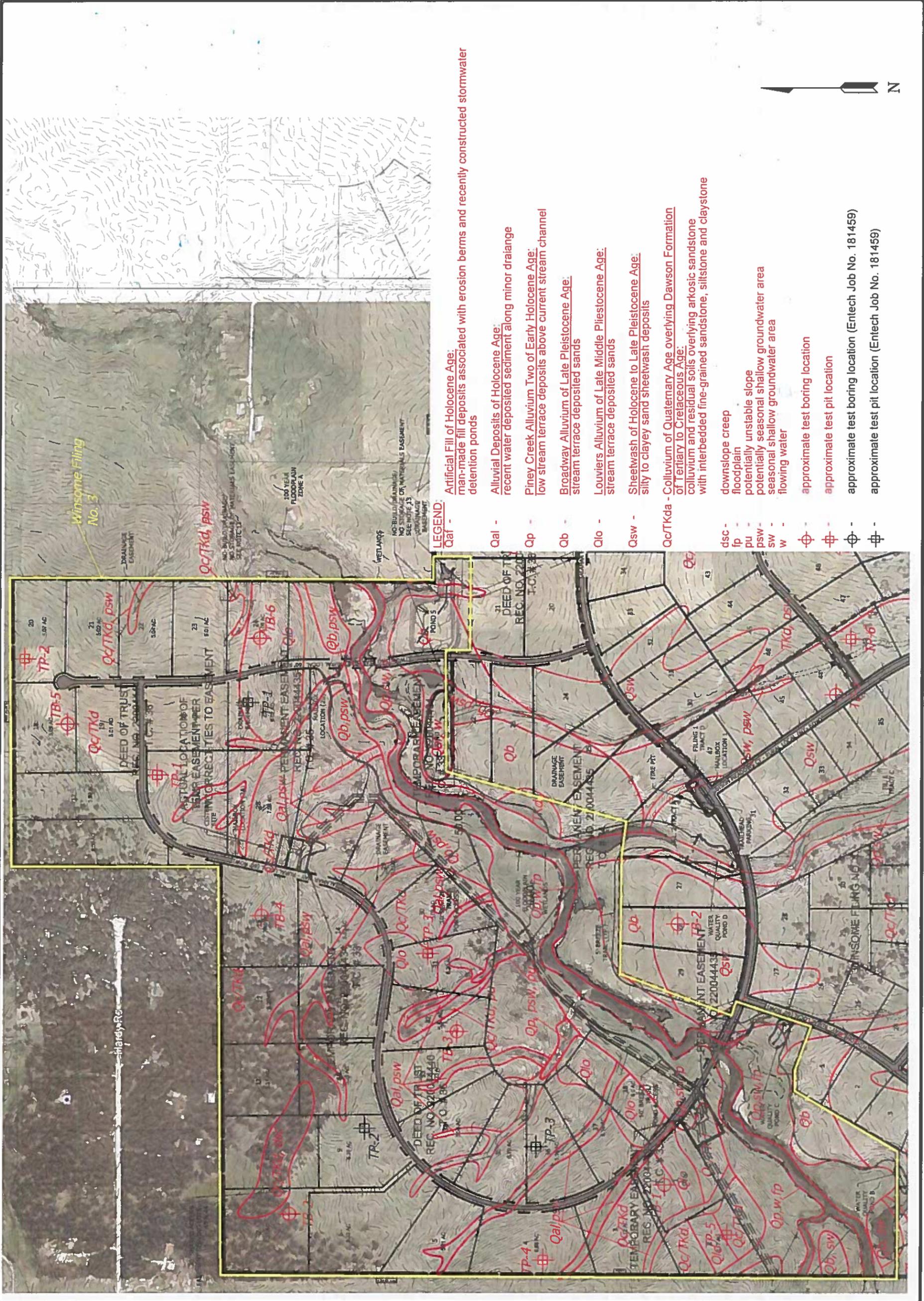
**ENTTECH**  
ENGINEERING, INC.

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



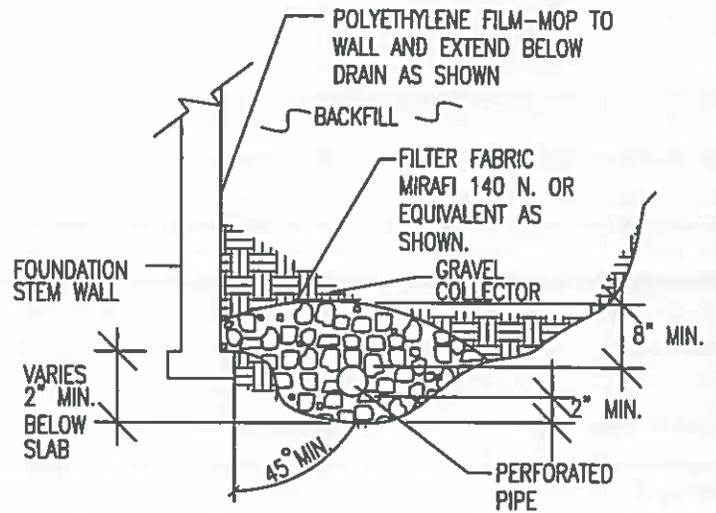
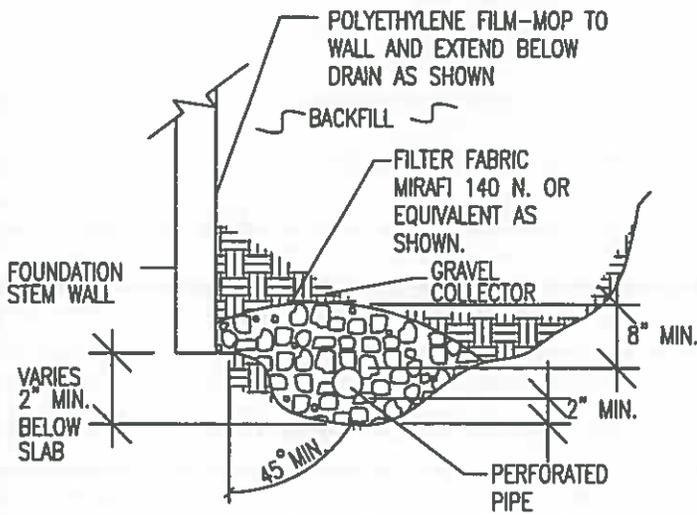
GEOLOGY/ENGINEERING GEOLOGY MAP  
WINSOME SUBDIVISION - FILING NO. 3  
HODGEN ROAD & MERIDIAN ROAD  
EL PASO COUNTY, CO.  
FOR: WINSOME, LLC

DATE	5/18/21
SCALE	AS SHOWN
JOB NO.	210839
FIGURE NO.	9
DRAWN	LLL
CHECKED	



- LEGEND:**
- Qal - Artificial Fill of Holocene Age: man-made fill deposits associated with erosion berms and recently constructed stormwater detention ponds
  - Qal - Alluvial Deposits of Holocene Age: recent water deposited sediment along minor drainage
  - Qp - Piney Creek Alluvium Two of Early Holocene Age: low stream terrace deposits above current stream channel
  - Qb - Broadway Alluvium of Late Pleistocene Age: stream terrace deposited sands
  - Qlo - Louviers Alluvium of Late Middle Pleistocene Age: stream terrace deposited sands
  - Qsw - Sheetwash of Holocene to Late Pleistocene Age: silty to clayey sand sheetwash deposits
  - QcTKda - Colluvium of Quaternary Age overlying Dawson Formation of Tertiary to Cretaceous Age: colluvium and residual soils overlying arkosic sandstone with interbedded fine-grained sandstone, siltstone and claystone
  - dsc - downslope creep
  - fp - floodplain
  - pu - potentially unstable slope
  - psw - potentially seasonal shallow groundwater area
  - sw - seasonal shallow groundwater area flowing water
  - ⊕ - approximate test boring location
  - ⊕ - approximate test pit location
  - ⊕ - approximate test boring location (Entech Job No. 181459)
  - ⊕ - approximate test pit location (Entech Job No. 181459)





**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.



**ENTECH**  
ENGINEERING, INC.  
545 ELKTON DRIVE  
COLORADO SPRINGS, CO. 80907 (719) 531-3599

*PERIMETER DRAIN DETAIL*

DRAWN:

DATE:

DESIGNED:

CHECKED:

OS

LLC

JOB NO.:

210539

FIG NO.:

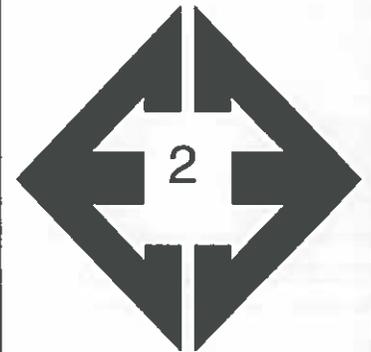
8

## **APPENDIX A: Site Photographs**



**Looking northwest  
from the eastern  
portion of Filing No. 2.**

May 19, 2021



**Looking west from the  
eastern portion of  
Filing No. 3.**

May 19, 2021



**Looking southwest  
from the west central  
portion of Filing No. 3.**

May 19, 2021



**Looking east from the  
central portion of  
Filing No. 3.**

May 19, 2021



**Looking north from the western side of Filing No. 3.**

May 19, 2021



**Looking east from the western side of Filing No. 3.**

May 19, 2021

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

TEST BORING NO. 1  
 DATE DRILLED 4/7/2021  
 Job # 210539

TEST BORING NO. 2  
 DATE DRILLED 4/7/2021  
 CLIENT WINSOME, LLC  
 LOCATION HODGEN AND MERIDIAN

REMARKS

DRY TO 15', 4/8/21  
 CLAY, SANDY, BROWN

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

SANDSTONE, CLAYEY, FINE TO COARSE GRAINED, BROWN, VERY DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
0					1
5			50 10"	6.8	2
5			50 7"	1.6	2
10			50 10"	6.5	2
15			50 6"	8.6	2
20					

REMARKS

DRY TO 15', 4/8/21

CLAY, SANDY, DARK BROWN

SANDSTONE, CLAYEY, FINE TO MEDIUM GRAINED, TAN, VERY DENSE, MOIST

CLAYSTONE, SANDY, BROWN, VERY STIFF, MOIST

SANDSTONE, CLAYEY, FINE TO MEDIUM GRAINED, TAN, VERY DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
0					1
5			50 10"	7.1	2
5			50 10"	7.6	2
10			48	10.7	3
15			50 5"	5.5	2
20					



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

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	5/18/21

JOB NO.:  
 210539

FIG NO.:  
 B-1

TEST BORING NO. 3  
 DATE DRILLED 4/7/2021  
 Job # 210539

TEST BORING NO. 4  
 DATE DRILLED 4/6/2021  
 CLIENT WINSOME, LLC  
 LOCATION HODGEN AND MERIDIAN

REMARKS

DRY TO 15', 4/8/21  
 CLAY, SANDY, BROWN  
 CLAYSTONE, SANDY, BROWN,  
 HARD, MOIST  
  
 SANDSTONE, CLAYEY, FINE  
 GRAINED, TAN, VERY DENSE,  
 MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
0					1
3			50 7"	8.1	3
5			50 6"	5.0	2
10			50 6"	4.3	2
15			50 5"	6.1	2
20					

REMARKS

DRY TO 20', 4/8/21  
 CLAY, VERY SANDY, TAN,  
 HARD TO VERY STIFF, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
0					
5			50	4.0	1
5			50	7.2	1
10			43	6.1	1
15			43	6.7	1
20			50 6"	5.4	1



**ENTECH**  
 ENGINEERING, INC.

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE:

LLC

5/18/21

JOB NO.  
 210539

FIG NO.  
 B-2

TEST BORING NO. 5  
 DATE DRILLED 4/7/2021  
 Job # 210539

TEST BORING NO. 6  
 DATE DRILLED 4/7/2021  
 CLIENT WINSOME, LLC  
 LOCATION HODGEN AND MERIDIAN

REMARKS

DRY TO 20', 4/8/21  
 CLAY, SANDY, BROWN

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

CLAYSTONE, SANDY, BROWN,  
 HARD, MOIST

SANDSTONE, VERY CLAYEY, FINE  
 TO MEDIUM GRAINED, GRAY  
 BROWN, VERY DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
0					1
5			50 8"	4.4	2
5			50 10"	7.2	2
10			50	8.7	2
15			50 6"	8.6	3
20			50 5"	3.9	2

REMARKS

DRY TO 15', 4/8/21

CLAY, SANDY, DARK BROWN,  
 STIFF, MOIST

CLAYSTONE, SANDY, BROWN,  
 HARD, MOIST

SANDSTONE, CLAYEY, FINE  
 TO COARSE GRAINED, TAN,  
 VERY DENSE, MOIST TO DRY

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
0					1
5			19	7.9	1
5			50 10"	5.2	3
10			50 8"	5.5	2
15			50 7"	2.1	2
20					



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

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:

DATE:

CHECKED:  
*LLK*

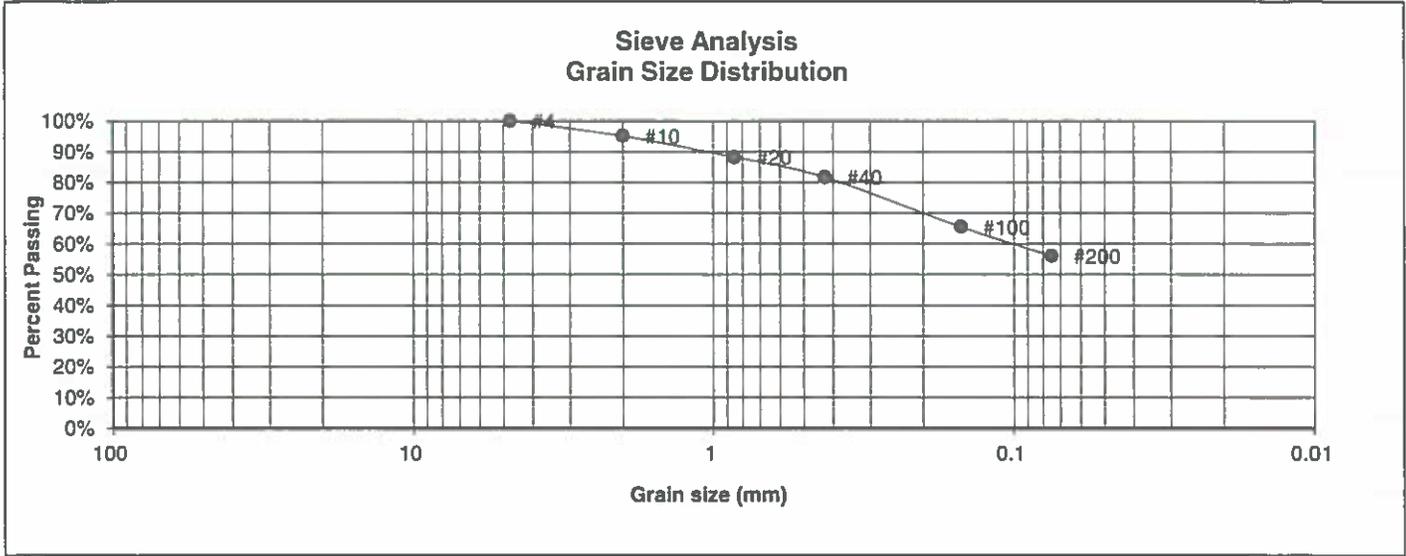
DATE:  
*5/18/21*

JOB NO:  
 210539

FIG NO:  
*B-3*

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

<u>UNIFIED CLASSIFICATION</u>	CL	<u>CLIENT</u>	WINSOME, LLC
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	HODGEN AND MERIDIAN
<u>TEST BORING #</u>	4	<u>JOB NO.</u>	210539
<u>DEPTH (FT)</u>	10	<u>TEST BY</u>	BL



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	95.1%
20	88.2%
40	81.7%
100	65.5%
200	56.1%

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

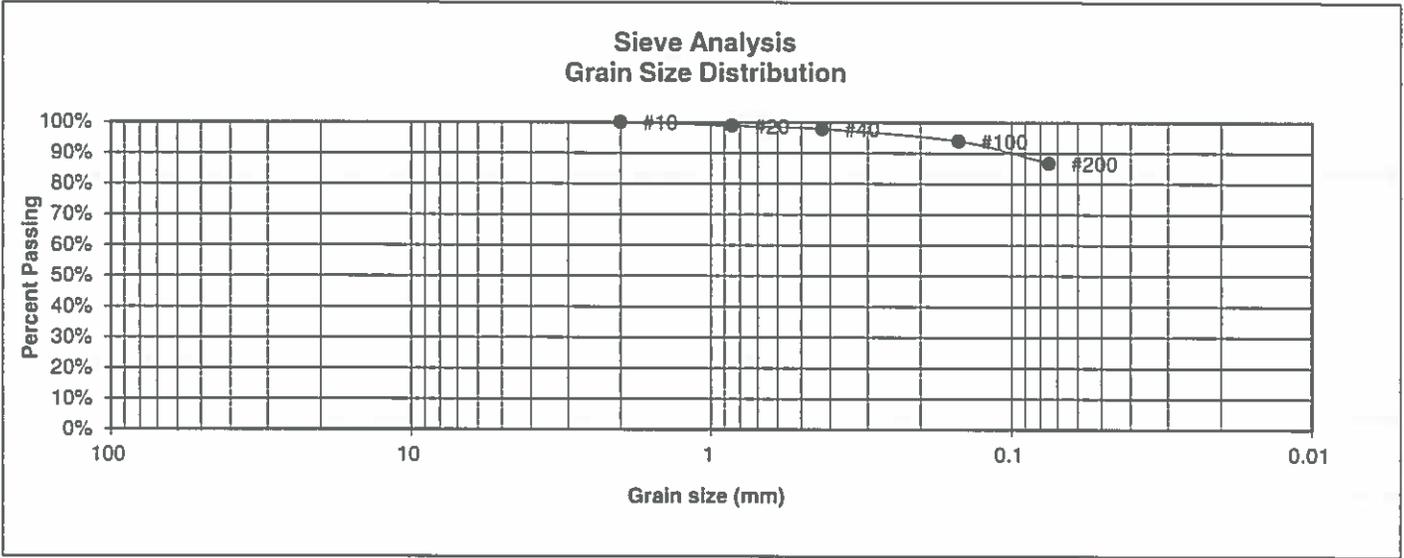
**LABORATORY TEST  
 RESULTS**

<u>DRAWN:</u>	<u>DATE:</u>	<u>CHECKED:</u> LL	<u>DATE:</u> 5/18/21
---------------	--------------	-----------------------	-------------------------

JOB NO.:  
210539

FIG NO.:  
C-1

<u>UNIFIED CLASSIFICATION</u>	CL	<u>CLIENT</u>	WINSOME, LLC
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	HODGEN AND MERIDIAN
<u>TEST BORING #</u>	6	<u>JOB NO.</u>	210539
<u>DEPTH (FT)</u>	2-3	<u>TEST BY</u>	BL



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	
10	100.0%
20	98.8%
40	97.8%
100	93.9%
200	86.7%

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

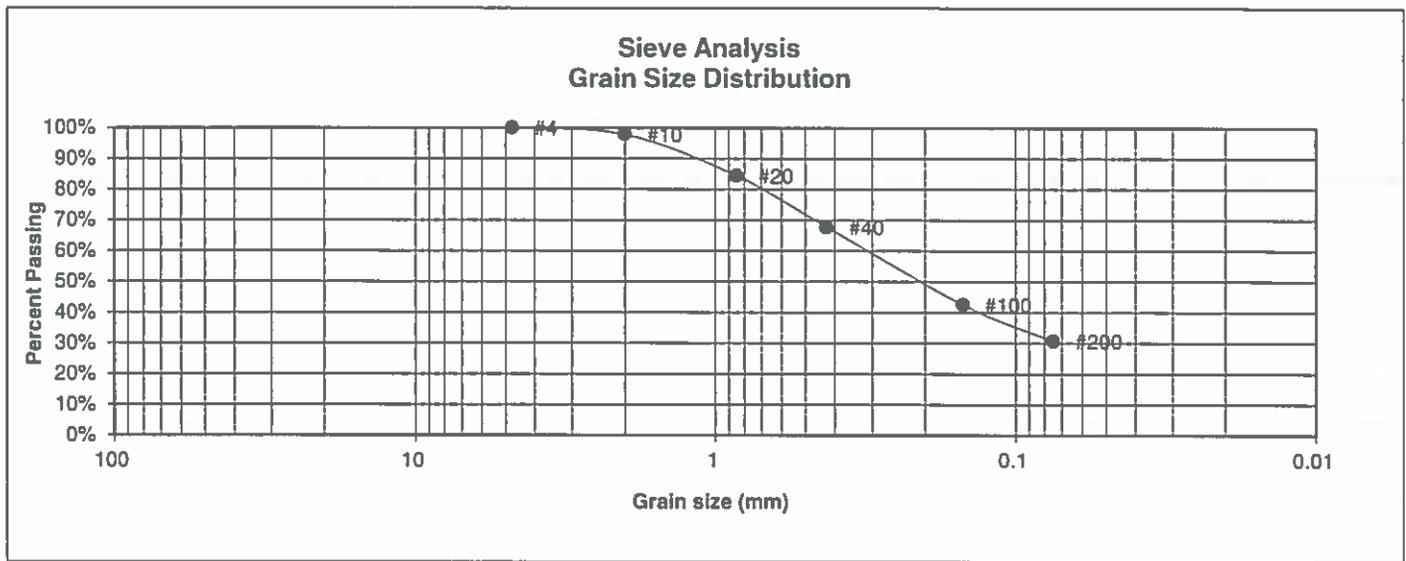
**LABORATORY TEST  
RESULTS**

<u>DRAWN:</u>	<u>DATE:</u>	<u>CHECKED:</u> LLL	<u>DATE:</u> 5/18/21
---------------	--------------	------------------------	-------------------------

JOB NO.:  
210539

FIG NO.:  
C-2

<u>UNIFIED CLASSIFICATION</u>	SC	<u>CLIENT</u>	WINSOME, LLC
<u>SOIL TYPE #</u>	2	<u>PROJECT</u>	HODGEN AND MERIDIAN
<u>TEST BORING #</u>	1	<u>JOB NO.</u>	210539
<u>DEPTH (FT)</u>	2-3	<u>TEST BY</u>	BL



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	97.9%
20	84.5%
40	67.7%
100	42.6%
200	30.7%

<u>Atterberg Limits</u>	
Plastic Limit	15
Liquid Limit	25
Plastic Index	10

<u>Swell</u>	
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**

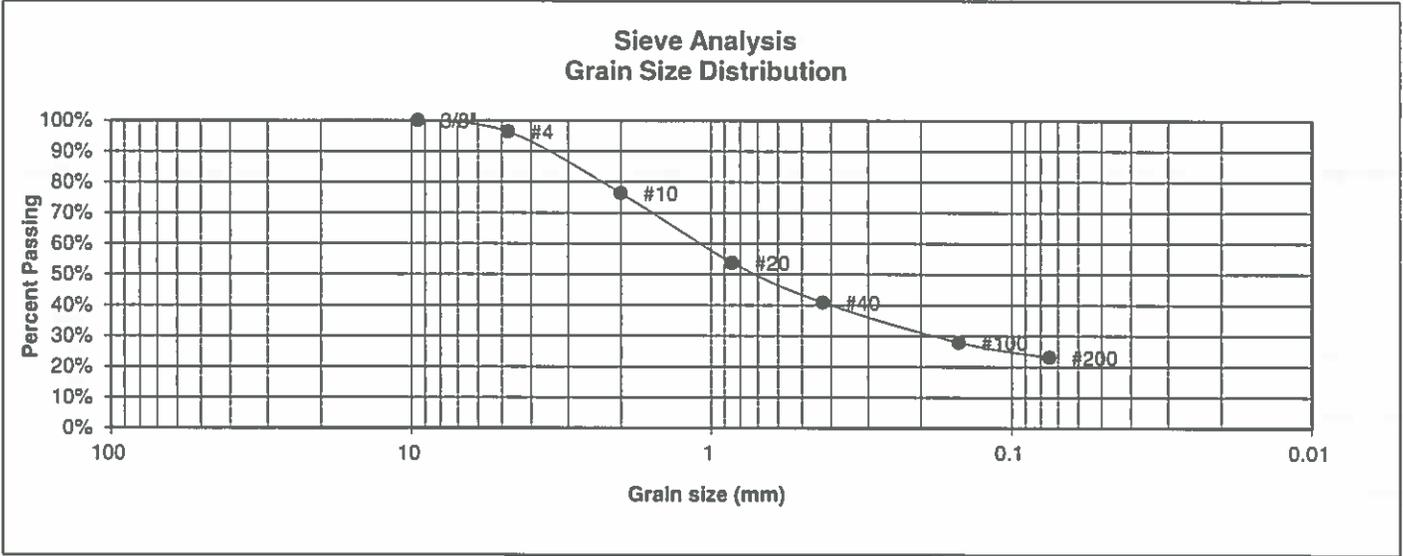
<u>DRAWN:</u>	<u>DATE:</u>	<u>CHECKED:</u> LLL	<u>DATE:</u> 5/18/21
---------------	--------------	------------------------	-------------------------

JOB NO:  
210539

FIG NO:

C-3

<u>UNIFIED CLASSIFICATION</u>	SM	<u>CLIENT</u>	WINSOME, LLC
<u>SOIL TYPE #</u>	2	<u>PROJECT</u>	HODGEN AND MERIDIAN
<u>TEST BORING #</u>	1	<u>JOB NO.</u>	210539
<u>DEPTH (FT)</u>	5	<u>TEST BY</u>	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	96.4%
10	76.4%
20	53.7%
40	40.8%
100	27.9%
200	23.1%

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

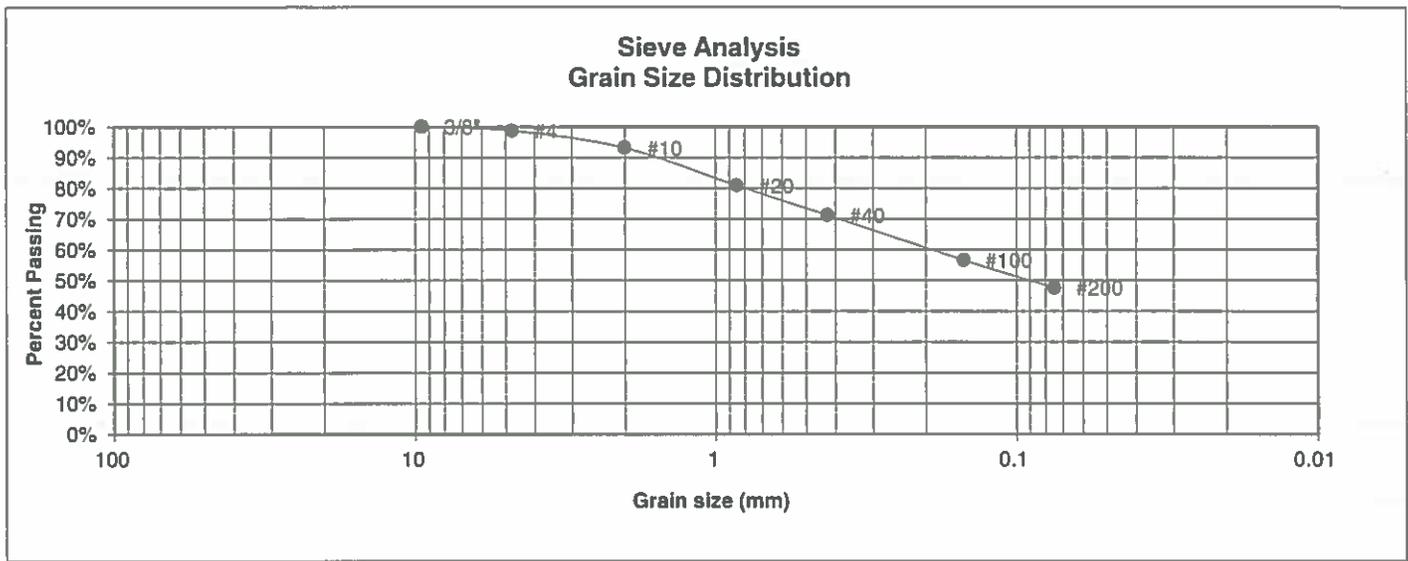
**LABORATORY TEST  
RESULTS**

DRAWN:	DATE:	CHECKED: LLL	DATE: 5/18/21
--------	-------	-----------------	------------------

JOB NO.:  
210539

FIG NO.:  
L-4

<u>UNIFIED CLASSIFICATION</u>	SC	<u>CLIENT</u>	WINSOME, LLC
<u>SOIL TYPE #</u>	2	<u>PROJECT</u>	HODGEN AND MERIDIAN
<u>TEST BORING #</u>	5	<u>JOB NO.</u>	210539
<u>DEPTH (FT)</u>	20	<u>TEST BY</u>	BL



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	98.7%
10	93.1%
20	80.9%
40	71.2%
100	56.6%
200	47.6%

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**

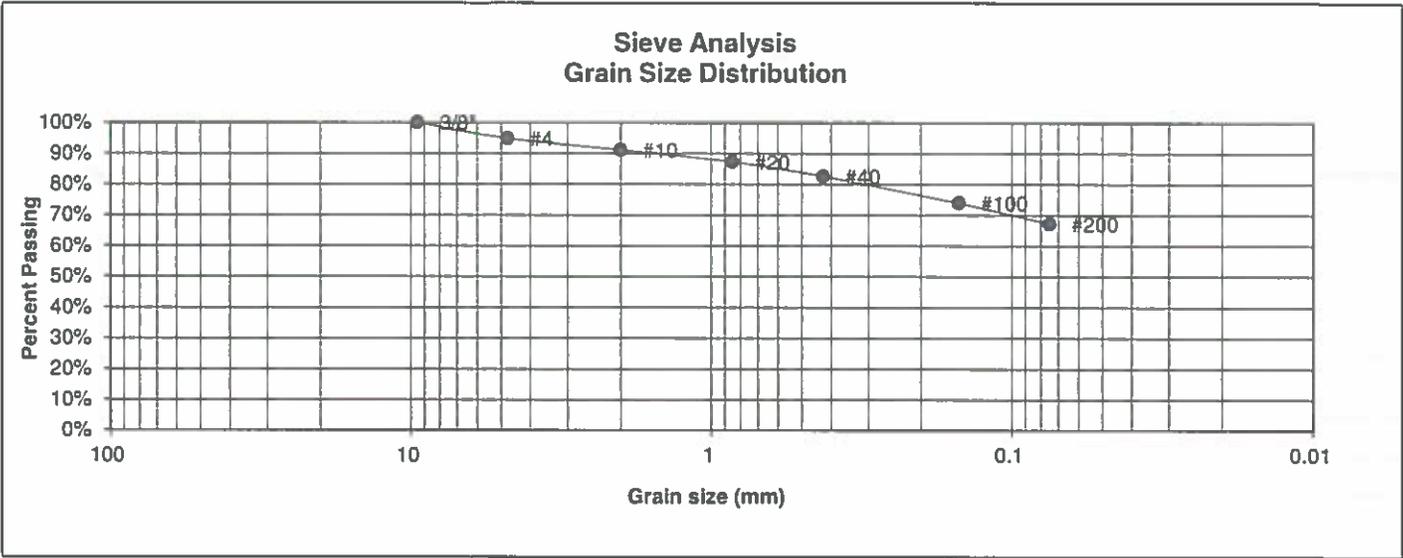
<u>DRAWN:</u>	<u>DATE:</u>	<u>CHECKED:</u> LLL	<u>DATE:</u> 5/18/21
---------------	--------------	------------------------	-------------------------

JOB NO:  
210539

FIG NO:  
C-5

**UNIFIED CLASSIFICATION** CL  
**SOIL TYPE #** 3  
**TEST BORING #** 2  
**DEPTH (FT)** 10

**CLIENT** WINSOME, LLC  
**PROJECT** HODGEN AND MERIDIAN  
**JOB NO.** 210539  
**TEST BY** BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	94.8%
10	91.1%
20	87.3%
40	82.6%
100	74.0%
200	67.3%

**Atterberg Limits**

Plastic Limit	17
Liquid Limit	32
Plastic Index	15

**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

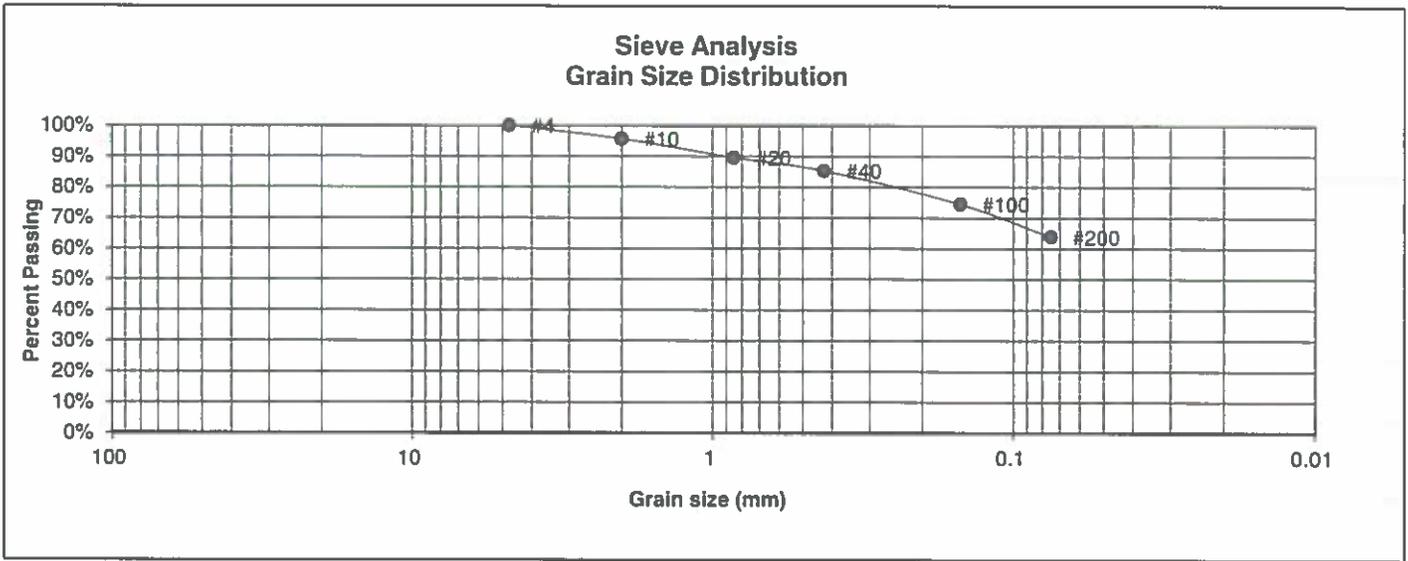
**LABORATORY TEST  
RESULTS**

DRAWN:	DATE:	CHECKED: LLL	DATE: 5/18/21
--------	-------	-----------------	------------------

JOB NO.:  
210539

FIG NO.:  
C-6

<u>UNIFIED CLASSIFICATION</u>	CL	<u>CLIENT</u>	WINSOME, LLC
<u>SOIL TYPE #</u>	3	<u>PROJECT</u>	HODGEN AND MERIDIAN
<u>TEST BORING #</u>	3	<u>JOB NO.</u>	210539
<u>DEPTH (FT)</u>	2-3	<u>TEST BY</u>	BL



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	95.7%
20	89.6%
40	85.3%
100	74.5%
200	63.9%

Atterberg Limits  
 Plastic Limit  
 Liquid Limit  
 Plastic Index

<u>Swell</u>	
Moisture at start	12.7%
Moisture at finish	21.7%
Moisture increase	9.0%
Initial dry density (pcf)	102
Swell (psf)	430



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

**LABORATORY TEST  
RESULTS**

<u>DRAWN:</u>	<u>DATE:</u>	<u>CHECKED:</u> LLL	<u>DATE:</u> 5/18/21
---------------	--------------	------------------------	-------------------------

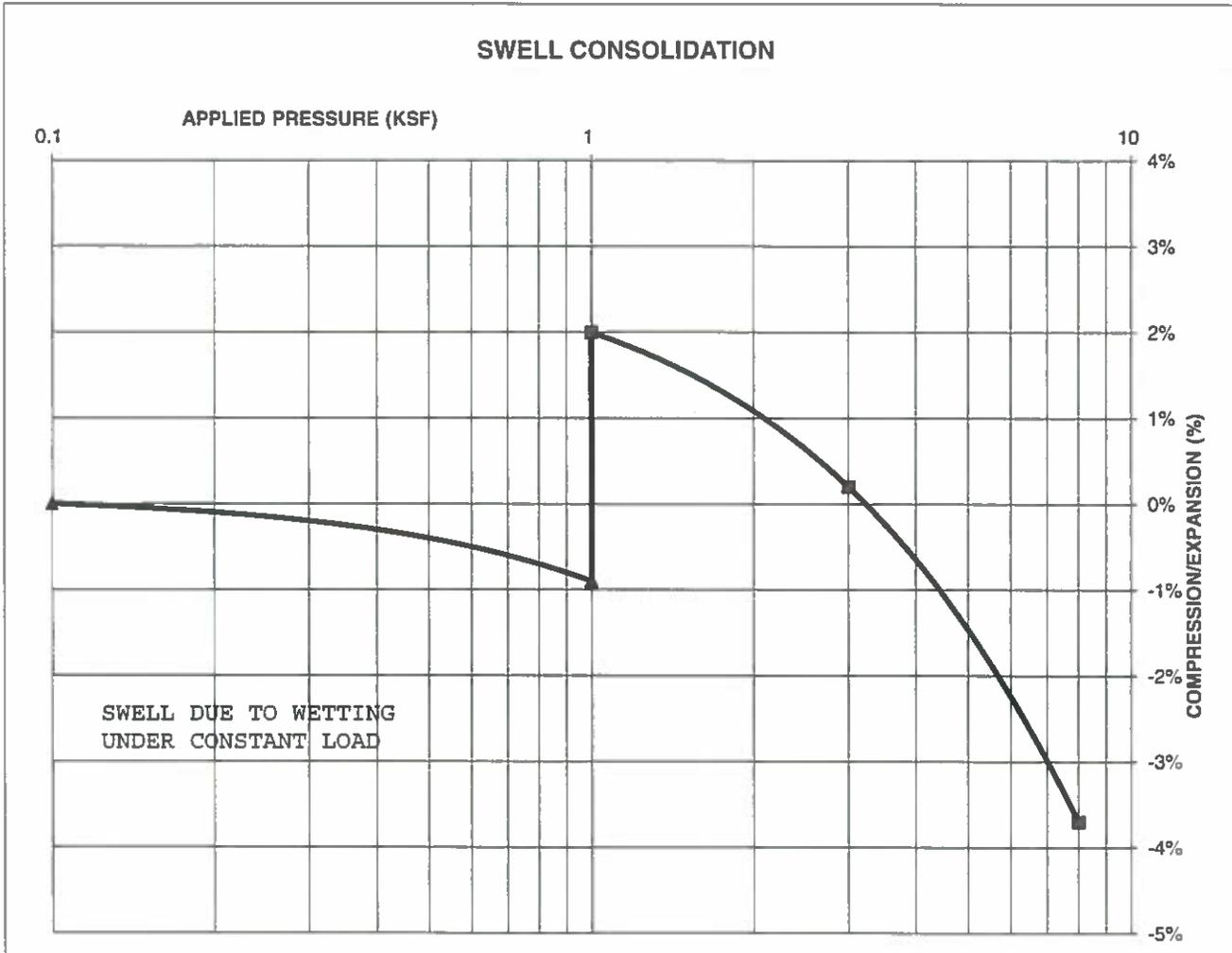
JOB NO.:  
210539

FIG NO.:  
C-7

**CONSOLIDATION TEST RESULTS**

TEST BORING #	6	DEPTH(ft)	2-3
DESCRIPTION	CL	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			108
NATURAL MOISTURE CONTENT			9.7%
SWELL/CONSOLIDATION (%)			2.9%

JOB NO. 210539  
 CLIENT WINSOME, LLC  
 PROJECT HODGEN AND MERIDIAN



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

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**SWELL CONSOLIDATION  
 TEST RESULTS**

DRAWN:

DATE:

CHECKED:

DATE:

LLL

5/18/21

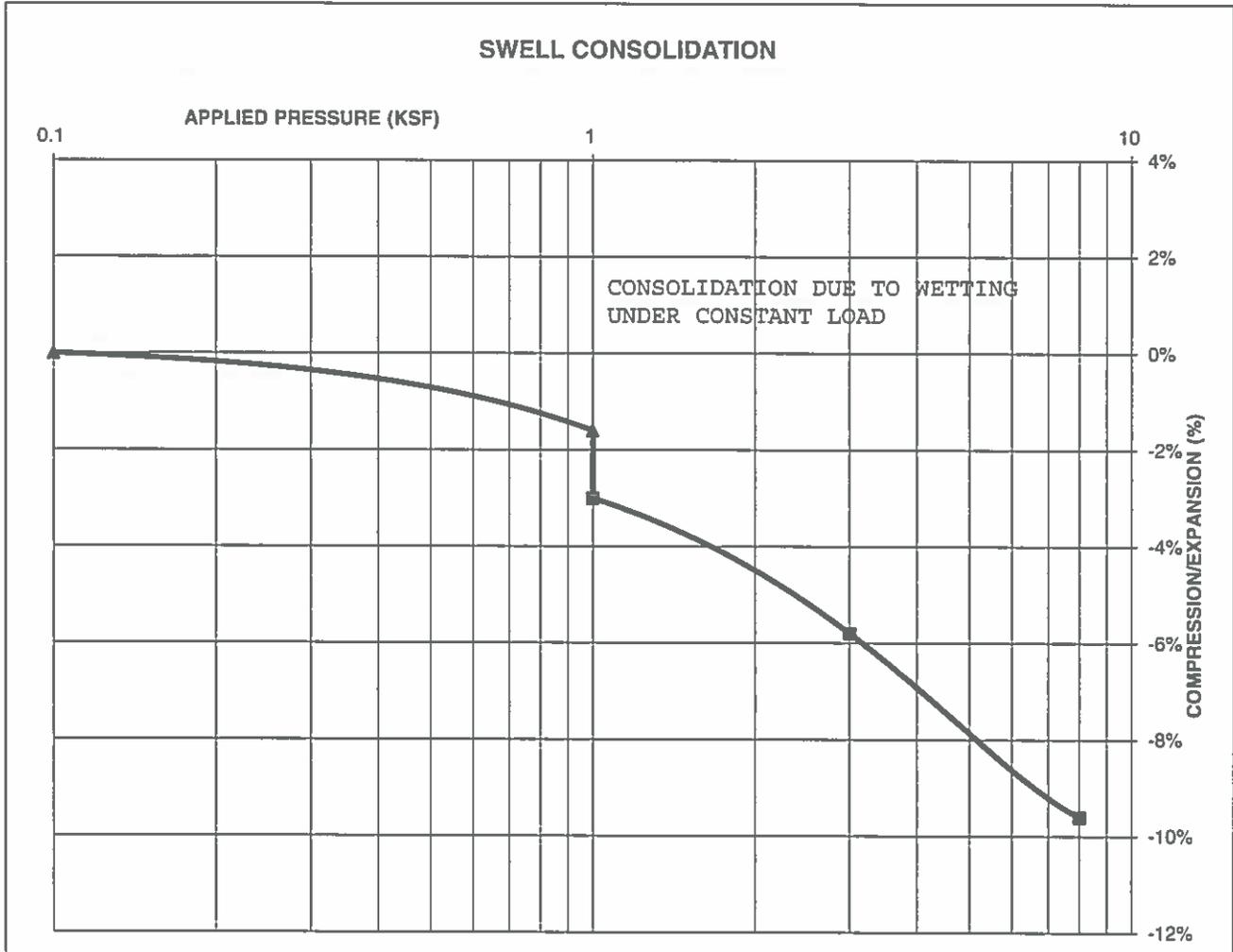
JOB NO.:  
 210539

FIG NO.:  
 C-B

**CONSOLIDATION TEST RESULTS**

TEST BORING #	1	DEPTH(ft)	2-3
DESCRIPTION	SC	SOIL TYPE	2
NATURAL UNIT DRY WEIGHT (PCF)			106
NATURAL MOISTURE CONTENT			9.1%
SWELL/CONSOLIDATION (%)			-1.4%

JOB NO. 210539  
 CLIENT WINSOME, LLC  
 PROJECT HODGEN AND MERIDIAN



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

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**SWELL CONSOLIDATION  
 TEST RESULTS**

DRAWN:

DATE:

CHECKED:  
 LLL

DATE:  
 5/18/21

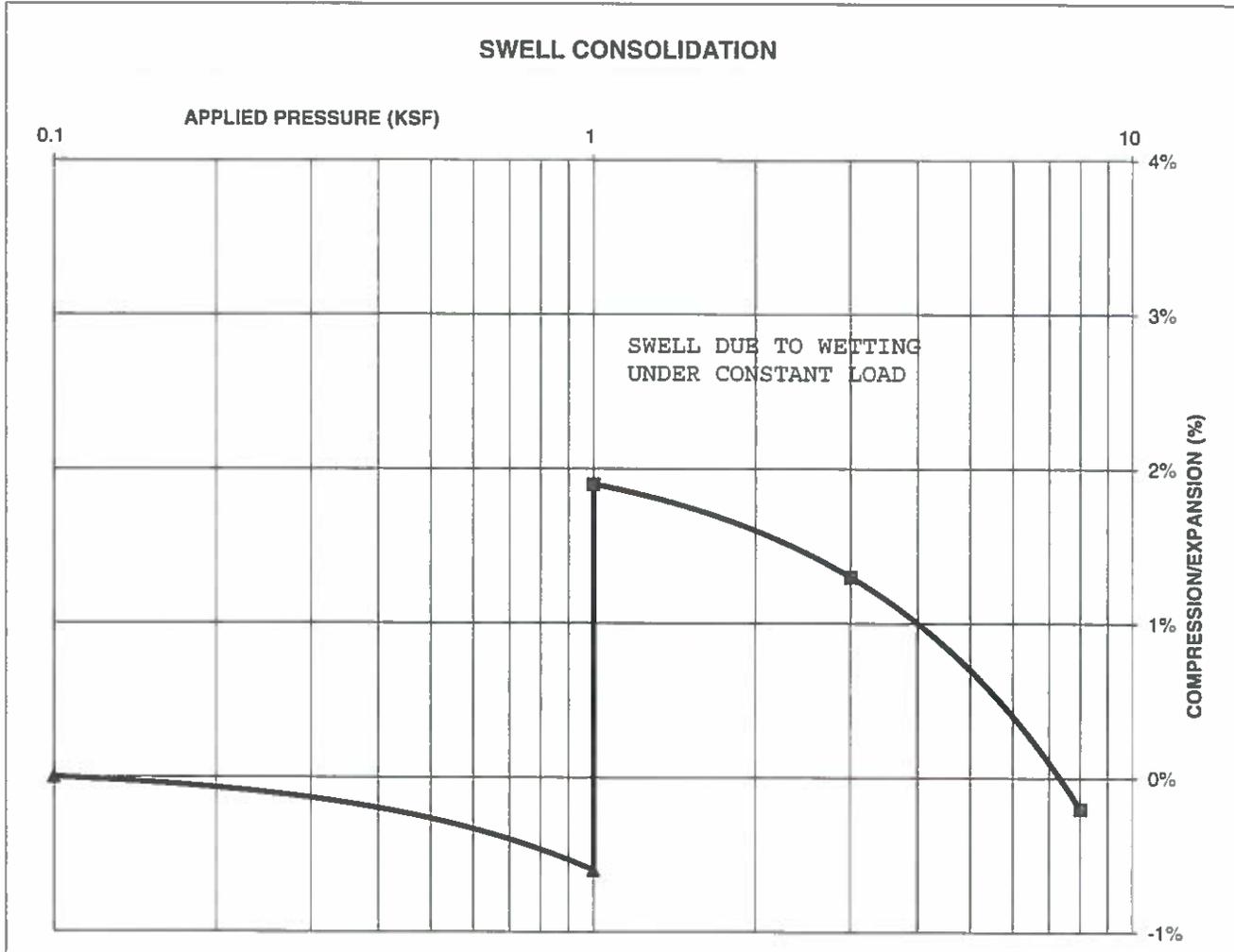
JOB NO:  
 210539

FIG NO:  
 C-9

**CONSOLIDATION TEST RESULTS**

TEST BORING #	2	DEPTH(ft)	10
DESCRIPTION	CL	SOIL TYPE	3
NATURAL UNIT DRY WEIGHT (PCF)			126
NATURAL MOISTURE CONTENT			10.4%
SWELL/CONSOLIDATION (%)			2.5%

JOB NO. 210539  
 CLIENT WINSOME, LLC  
 PROJECT HODGEN AND MERIDIAN



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

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**SWELL CONSOLIDATION  
 TEST RESULTS**

DRAWN:

DATE:

CHECKED:  
*LL*

DATE:  
 12/8/21

JOB NO.:  
 210539

FIG NO.:  
 C-10



## **APPENDIX D: Soil Survey Descriptions**

## El Paso County Area, Colorado

### 1—Alamosa loam, 1 to 3 percent slopes

#### Map Unit Setting

*National map unit symbol:* 3670

*Elevation:* 7,200 to 7,700 feet

*Farmland classification:* Prime farmland if irrigated and reclaimed of excess salts and sodium

#### Map Unit Composition

*Alamosa and similar soils:* 85 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Alamosa

##### Setting

*Landform:* Flood plains, fans

*Down-slope shape:* Linear

*Across-slope shape:* Linear

*Parent material:* Alluvium

##### Typical profile

*A - 0 to 6 inches:* loam

*Bt - 6 to 14 inches:* clay loam

*Btk - 14 to 33 inches:* clay loam

*Cg1 - 33 to 53 inches:* sandy clay loam

*Cg2 - 53 to 60 inches:* sandy loam

##### Properties and qualities

*Slope:* 1 to 3 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 (0.20 to 0.60 in/hr)

*Depth to water table:* About 12 to 18 inches

*Frequency of flooding:* NoneFrequent

*Frequency of ponding:* None

*Calcium carbonate, maximum content:* 5 percent

*Maximum salinity:* Very slightly saline to strongly saline (2.0 to 16.0 mmhos/cm)

*Available water capacity:* High (about 10.2 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 5w

*Hydrologic Soil Group:* D

*Ecological site:* R048AY241CO

*Hydric soil rating:* Yes

### **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 18, Jun 5, 2020

## El Paso County Area, Colorado

### 15—Brussett loam, 3 to 5 percent slopes

#### Map Unit Setting

*National map unit symbol:* 367k  
*Elevation:* 7,200 to 7,500 feet  
*Frost-free period:* 115 to 125 days  
*Farmland classification:* Prime farmland if irrigated

#### Map Unit Composition

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

#### Description of Brussett

##### Setting

*Landform:* Hills  
*Landform position (three-dimensional):* Side slope  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Parent material:* Eolian deposits

##### Typical profile

*A - 0 to 8 inches:* loam  
*BA - 8 to 12 inches:* loam  
*Bt - 12 to 26 inches:* clay loam  
*Bk - 26 to 60 inches:* silt loam

##### Properties and qualities

*Slope:* 3 to 5 percent  
*Depth to restrictive feature:* More than 80 inches  
*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  
*Calcium carbonate, maximum content:* 5 percent  
*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)  
*Available water capacity:* High (about 9.1 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 4e  
*Hydrologic Soil Group:* B  
*Ecological site:* R048AY222CO  
*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 18, Jun 5, 2020

## 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  
*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 capacity:* Low (about 5.9 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 4e  
*Hydrologic Soil Group:* B  
*Ecological site:* R049XB216CO - Sandy Divide  
*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 18, Jun 5, 2020

## El Paso County Area, Colorado

### 25—Elbeth sandy loam, 3 to 8 percent slopes

#### Map Unit Setting

*National map unit symbol:* 367x

*Elevation:* 7,300 to 7,600 feet

*Faerland classification:* Not prime farmland

#### Map Unit Composition

*Elbeth and similar soils:* 85 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Elbeth

##### Setting

*Landform:* Hills

*Landform position (three-dimensional):* Side slope

*Down-slope shape:* Linear

*Across-slope shape:* Linear

*Parent material:* Alluvium derived from arkose

##### Typical profile

*A - 0 to 3 inches:* sandy loam

*E - 3 to 23 inches:* loamy sand

*Bt - 23 to 68 inches:* sandy clay loam

*C - 68 to 74 inches:* sandy clay loam

##### Properties and qualities

*Slope:* 3 to 8 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Well drained

*Runoff class:* Medium

*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 capacity:* Moderate (about 7.1 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 4e

*Hydrologic Soil Group:* B

*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 18, Jun 5, 2020

## El Paso County Area, Colorado

### 36—Holderness loam, 8 to 15 percent slopes

#### Map Unit Setting

*National map unit symbol:* 3689

*Elevation:* 7,200 to 7,400 feet

*Farmland classification:* Not prime farmland

#### Map Unit Composition

*Holderness and similar soils:* 85 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Holderness

##### Setting

*Landform:* Hills

*Landform position (three-dimensional):* Side slope

*Down-slope shape:* Linear

*Across-slope shape:* Linear

*Parent material:* Loamy alluvium derived from arkose

##### Typical profile

*A - 0 to 9 inches:* loam

*Bt - 9 to 43 inches:* clay loam

*C - 43 to 60 inches:* gravelly sandy clay loam

##### Properties and qualities

*Slope:* 8 to 15 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Well drained

*Runoff class:* Medium

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately low to moderately high (0.06 to 0.20 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Calcium carbonate, maximum content:* 5 percent

*Maximum salinity:* Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

*Available water capacity:* High (about 9.6 inches)

##### Interpretive groups

*Land capability classification (irrigated):* 4e

*Land capability classification (nonirrigated):* 4e

*Hydrologic Soil Group:* C

*Ecological site:* R048AY222CO

*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 18, Jun 5, 2020

## El Paso County Area, Colorado

### 92—Tomah-Crowfoot loamy sands, 3 to 8 percent slopes

#### Map Unit Setting

*National map unit symbol:* 36b9

*Elevation:* 7,300 to 7,600 feet

*Farmland classification:* Not prime farmland

#### Map Unit Composition

*Tomah and similar soils:* 50 percent

*Crowfoot and similar soils:* 30 percent

*Estimates are based on observations, descriptions, and transects of the mapunit.*

#### Description of Tomah

##### Setting

*Landform:* Hills, alluvial fans

*Landform position (three-dimensional):* Side slope, crest

*Down-slope shape:* Linear

*Across-slope shape:* Linear

*Parent material:* Alluvium derived from arkose and/or residuum weathered from arkose

##### Typical profile

*A - 0 to 10 inches:* loamy sand

*E - 10 to 22 inches:* coarse sand

*C - 48 to 60 inches:* coarse sand

##### Properties and qualities

*Slope:* 3 to 8 percent

*Depth to restrictive feature:* More than 80 inches

*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 capacity:* Very low (about 2.0 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 4e

*Hydrologic Soil Group:* B

*Ecological site:* R049XB216CO - Sandy Divide

*Hydric soil rating:* No

#### Description of Crowfoot

##### Setting

*Landform:* Alluvial fans, hills

*Landform position (three-dimensional):* Side slope, crest  
*Down-slope shape:* Linear  
*Across-slope shape:* Linear  
*Parent material:* Alluvium

**Typical profile**

*A - 0 to 12 inches:* loamy sand  
*E - 12 to 23 inches:* sand  
*Bt - 23 to 36 inches:* sandy clay loam  
*C - 36 to 60 inches:* coarse sand

**Properties and qualities**

*Slope:* 3 to 8 percent  
*Depth to restrictive feature:* More than 80 inches  
*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 capacity:* Low (about 4.7 inches)

**Interpretive groups**

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 4e  
*Hydrologic Soil Group:* B  
*Ecological site:* R049XB216CO - Sandy Divide  
*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 18, Jun 5, 2020