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**SOIL, GEOLOGY, GEOLOGIC HAZARD STUDY  
FLYING HORSE NORTH  
SKETCH PLAN  
EL PASO COUNTY, COLORADO**

Prepared for

**Flying Horse Development, LLC**  
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Respectfully Submitted,  
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**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 ..... 5

    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 ROADWAY AND EMBANKMENT CONSTRUCTION RECOMMENDATIONS.....13**

**8.0 ECONOMIC MINERAL RESOURCES.....14**

**9.0 EROSION CONTROL.....15**

**10.0 CLOSURE .....16**

**BIBLIOGRAPHY .....17**

TABLES

Table 1: Summary of Laboratory Test Results from Test Borings

Table 2: Summary of Laboratory Tests Results from Test Pits

Table 3: Summary of Depth to Bedrock and Groundwater

FIGURES

Figure 1: Vicinity Map

Figure 2: USGS Map

Figure 3: Site Plan/ Test Boring Location Map

Figure 4: Sketch Plan

Figure 5: Soil Survey Map

Figure 6: Black Forest and Monument Quadrangles Geology Maps

Figure 7: Geology/Engineering Geology Map

Figure 8: Perimeter Drain Detail

Figure 9: Floodplain Map

Figure 10: Lateral Pressure Diagram

APPENDIX A: Site Photographs

APPENDIX B: Test Boring Logs and Laboratory Test Results

APPENDIX C: Test Pit Logs and Laboratory Test Results

APPENDIX D: Profile Hole Logs and Laboratory Test Results from Entech Job No. 160118/141588

APPENDIX E: Soil Survey Descriptions

**SOIL, GEOLOGY, GEOLOGIC HAZARD STUDY,  
FLYING HORSE NORTH  
SKETCH PLAN  
EL PASO COUNTY, COLORADO**

**1.0 SUMMARY**

***Project Location***

The project consists of Section 36, Township 11 South, Range 66 West and portions of Sections 30 and 31, Township 11 South, Range 65 West of the 6<sup>th</sup> Principal Meridian in El Paso County, Colorado. The site is located approximately 4 miles southeast of Monument, Colorado.

***Project Description***

Total acreage involved in the Flying Horse North Sketch Plan project is 912.5 acres. The proposed site development consists of single-family residential estate lots, low to high density lots, commercial golf club, hotel, fitness center, potential fire station, detention ponds, open space, parks and trail system. A total of 1,571 units are proposed. The development will utilize Cherokee Water and Sanitation will provide water and sewer.

***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 seasonal and potentially seasonal shallow groundwater areas, drainage areas, areas of ponded water, floodplain, erosion, artificial fill, expansive soils, and areas of downslope creep. 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 consists of Section 36, Township 11 South, Range 66 West and portions of Sections 30 and 31, Township 11 South, Range 65 West of the 6<sup>th</sup> Principal Meridian in El Paso County, Colorado. The site is located approximately 4 miles southwest of Monument, Colorado, at the east end of Stagecoach Road between Highway 83 and Black Forest Road. The location of the site is as shown on the Vicinity Map, Figure 1.

The topography of the site varies from gently to moderately sloping generally to the northeast and southwest off a ridge line that bisects the site with some steeper slopes along drainages in the western portion of the site. The ridge line that bisects the site is associated with the Palmer Divide. The drainages on site flow in westerly and northerly directions through the property. No water was observed flowing in these the drainages at the time of this investigation, however, areas of ponded water were observed behind several earthen dams. The site boundaries are indicated on the USGS Map, Figure 2. Previous land uses have included grazing and pasture land. Flying Horse North Filing No. 1 has been mostly developed and the golf course has been completed. The site contains primarily field grasses and weeds in the eastern portions of the site with areas of ponderosa pine tree coverage in the western portions of the site. Site photographs are included in Appendix A. The locations and directions of the photographs are indicated in Figure 3.

Total acreage involved in Flying Horse North Sketch Plan is 912.5 acres. Single-family residential estate lots, low to high density lots, commercial golf club, hotel, fitness center, potential fire station, detention ponds, open space, parks and trail system. The area will be serviced by Cherokee Water and Sanitation. The proposed Sketch Plan prepared by HRGreen is presented in Figure 4.

The site was previously investigated as a part of a Soil, Geology, Geologic Hazard and Wastewater Study by Entech Engineering, Inc., February 26, 2015 (Reference 1), and a Soil, Geology, Geologic Hazard and Wastewater Study by Entech Engineering, Inc., February 22, 2016 (Reference 2). Information from these reports were also used in evaluating the site.

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

The scope of the report will include 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 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 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 Engineering Geology Map which identified pertinent geologic conditions affecting development. The field mapping was initially performed by personnel of Entech Engineering, Inc. on November 21 and December 2, 2014. Field mapping was updated by Entech Engineering, Inc., on October 31 and November 3, 2017. The site was revisited on February 24, 2022. Site photographs are included in Appendix A.

Six (6) test borings were drilled and eighteen (18) test pits excavated across the site to determine the soils classification and engineering characteristics. The borings were drilled to depths of 20 feet using a truck-mounted, continuous flight auger drilling rig supplied and operated by Entech Engineering, Inc., and the test pits were excavated to depths ranging from 3 to 8 feet.

The original field investigation consisted of fourteen (14) profile holes to determine general suitability of the site for construction. The location of the profile holes indicated on the Site Map/Testing Location Map, Figure 3. Additionally, fourteen (14) profile holes were performed on the entire Flying Horse North property in previous studies.

The locations of the Test Borings, Test Pits, and Test Pit Logs, and Profile Borings are indicated on the Development Plan/Test Location Map, Figure 3. The Test Boring Logs, Test Pit Logs, Laboratory Test Results, and Profile Hole Logs are presented in Appendices B, C, and D, respectively. Results of the testing will be discussed later in this report.

Laboratory testing was performed on the soils to classify and determine the soils engineering characteristics. Laboratory tests included moisture content testing, ASTM D-2216, grain-size analysis, ASTM D-422, and Atterberg Limits, ASTM D-4318. Swell testing included both FHA Swell Tests and Swell/Consolidation Tests. Results of the laboratory testing are included in Appendices C, and D. Summaries of Laboratory Test Results are presented in Tables 1, 2, and 3.

## **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 10 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 northerly direction (Reference 3). The rocks in the area of the site are sedimentary in nature, and typically Tertiary to Cretaceous in age. The bedrock underlying the site consists of the Dawson Arkose Formation. Overlying this formation are unconsolidated deposits of residual, colluvial, 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. Some colluvial soils exist which are deposited by gravity and sheetwash. The alluvial soils were deposited by water in the drainages

on site. Man-made soils exist as earthen dams and erosion berms. The site's stratigraphy will be discussed in more detail in Section 5.3.

## 5.2 Soil Conservation Survey

The Natural Resource Conservation Service (Reference 4), previously the Soil Conservation Service (Reference 5) has mapped five soil types on the site (Figure 5). In general, they vary from sandy loam to loam and sandy loam with subsoils of clay loam. The soils are described as follows:

<u>Type</u>	<u>Description</u>
14	Brussett loam, 1-3% slopes
26	Elbeth sandy loam, 8-15% slopes
66	Peyton sandy loam, 1-5% slopes
67	Peyton sandy loam, 5-9% slopes
68	Peyton-Pring complex, 3-8% slopes

Complete descriptions of each soil type are presented in Appendix E. The soils have generally been described to have moderate to rapid permeabilities. Limitations on development include, limited ability to support a load, shrink swell potential, slopes and frost action 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 Black Forest Quadrangle Geology Map showing the site is presented in Figure 6 (Reference 6). The Geology Map prepared for the site is presented in Figure 7. Three mappable units were identified on this site which are described as follows:

**Qaf Artificial Fill of Quaternary Age:** These are man-made fill deposits associated with erosion berms and earthen dams on-site. Additionally, temporary stockpiles were observed on the site. Other areas of fill may exist on the site other than those mapped due to on-going construction.

**Qal Recent Alluvium of Quaternary Age:** These are recent stream deposits associated with the drainages on-site. These materials generally consist of silty to clayey sands and may contain clay lenses. Highly organic soils may be encountered in some of these areas.

**Tkd Dawson Formation of Tertiary to Cretaceous Age:** The Dawson formation typically consists of arkosic sandstone with interbedded fine-grained sandstone, siltstone and claystone. Overlying this formation is a variable layer of residual soil. The residual soils were derived from the in-situ weathering of the bedrock materials on-site. These soils consisted of silty to clayey sands and sandy clays. Areas of colluvial soils may exist on some of the slopes on site. These materials are derived from the bedrock materials and have been re-deposited by the action of sheetwash and gravity.

The soils listed above were mapped from site-specific mapping, the *Geologic Map of the Black Forest Quadrangle* distributed by the Colorado Geological Survey in 2003 (References 6), the *Geologic Map of the Colorado Springs-Castle Rock Area*, distributed by the US Geological Survey in 1979 (Reference 8), 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 9). The Test Borings and Test Pit Logs used in evaluating the site and are included in Appendix B. The Geology Map prepared for the site is presented in Figure 7.

#### **5.4 Soil Conditions**

The soils encountered in the six test borings drilled on the site can be grouped into three general soil and rock types. The soils were classified using the Unified Soil Classification System (USCS).

Soil Type 1 is a silty to slightly silty sand and very clayey sand (SM, SM-SW, SC), encountered in all of the test borings at depths ranging from the existing ground surface to 8 feet bgs and extending to depths ranging from 1 foot to the termination of the borings (20 feet). This material is associated with colluvial soils and residual soils of the Dawson Sandstone. These materials were encountered at medium dense to dense states and at moist conditions. Samples tested had 12 to 47 percent of the soil size particles passing the No. 200 Sieve. Atterberg limits testing resulted in non-plastic results. A swell pressure of 150 psf was measured in the FHA Swell Test, indicating low expansion potential.

Soil Type 2 is a sandy to very sandy clay (CL), encountered in two of the test borings at depths ranging from the existing ground surface to 3 feet bgs and extending to depths ranging from 4 to 8 feet. These materials were encountered at stiff to very stiff consistencies and at moist conditions. Samples tested had 52 to 83 percent of the soil size particles passing the No. 200 Sieve. Atterberg limits testing resulted in a liquid limit of 38 and a plastic index of 21. FHA Swell Testing resulted in expansion pressures of 270 and 930 psf, indicating a low expansion potential. Expansive clays are common in the area.

Soil Type 3 consists of silty to clayey sandstone (SM, SC). This material is associated with formational Dawson Sandstone. This material was encountered in four of the test borings at depths ranging from 1 to 18 feet bgs and extending to the termination of the borings (20 feet). The sandstone was encountered at very dense states and at moist conditions. The samples tested had 9 to 20 percent of the soil size particles passing the No. 200 sieve. Atterberg limits testing resulted in non-plastic results. The silty sandstone typically exhibits low expansive potential, however, expansive claystone and siltstone are common in the area.

The soils encountered in the profile holes of the percolation tests performed as a part of the original Soil, Geology, Geologic Hazard and Wastewater Study for the entire Flying Horse North Subdivision by Entech Engineering, Inc. (References 1 and 2) consisted of silty sands and sandy to very sandy clays overlying silty sandstone. The silty sands and sandstone exhibited low expansion potential. The clays were encountered in nine of the fourteen profile holes at depths ranging from the existing ground surface to 14 feet and extending to depths ranging from one foot to the termination of the borings (15 feet). A FHA Swell pressure of 1485 psf was measured on the clays. Swell/Consolidation Tests resulted in volume changes ranging from 0.3 to 2.7 percent. These results indicate the clays exhibit low to high expansion potential.

The Test Boring Logs and Laboratory Test results as a part of this investigation are included in Appendix B and summarized in Table 1. The Profile Holes and Laboratory Test Results from References 1 and 2 are included in Appendix D.

## **5.5 Groundwater**

Groundwater was not encountered in any of the test borings which were drilled to 15 to 20 feet. Areas of seasonal, potentially seasonal shallow groundwater, and ponded water have been mapped in the drainages on-site. These areas are discussed in the following section. Fluctuation

in groundwater conditions may occur due to variations in rainfall and other factors not readily apparent at this time.

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

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

As mentioned previously, detailed mapping has been performed on this site to produce an Engineering Geology Map (Figure 7). 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 areas of man-made fill associated with earthen dams and erosion berms on-site. Additionally, temporary stockpiles were observed on the site.

**Mitigation:** The earthen dams lie within defined drainages and should be avoided as building sites. Some dams are to be removed or reconstructed as a part of detention ponds. The erosion berms can either be avoided or penetrated by foundations. It is anticipated the temporary stockpiles would be removed prior to construction. The fill on this site is considered uncontrolled for construction purposes. Any uncontrolled fill encountered beneath foundations will require removal and recompaction at a minimum of 95% of its maximum Modified Procter Dry Density, ASTM D-1557.

Areas of Erosion – Constraint

These are areas that are undergoing erosion by water and sheetwash producing gullies and rill erosion.

Mitigation: Due to the nature of the soils on this site, virtually all the soils are subject to erosion by wind and water. Other minor areas of erosion were observed on site other than those mapped, particularly where some rill erosion has occurred. Areas of erosion can occur across the entire site, particularly if the soils are disturbed during construction. Vegetation reduces the potential for erosion. The areas identified where erosion is actually taking place may require check dams, regrading and revegetation using channel lining mats to anchor vegetation. Further recommendations for erosion control are discussed under Section 9.0 "Erosion Control" of this report. Recommendations pertaining to revegetation may require input from a qualified landscape architect and/or the Natural Resource Conservation Service (previously Soil Conservation Service).

Expansive Soils – Constraint

The site is classified in an area of low to moderate swell potential according to *the Map of Potentially Swelling Soil and Rock in the Front Range Urban Corridor, Colorado* by Hart, 1974 (Reference 10). Expansive soils were encountered in some of the profile holes drilled on the site as a part of the entire Flying Horse North Subdivision (References 1 and 2). These occurrences are typically sporadic; therefore, none have been indicated on the maps. These clays, if encountered beneath foundations, can cause differential movement in the structure foundation. These occurrences should be identified and dealt with 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.

**Seasonal Shallow Groundwater Area – Constraint**

In these areas, we would anticipate periodic high subsurface moisture conditions and frost heave potential on a seasonal basis. Additional, highly organic soils could be encountered in these areas. These areas lie within defined drainages and it is anticipated they will be avoided by development. Any structures in or adjacent to these areas should follow the mitigation discussed below.

**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 7. Any grading in these areas should be done to direct surface flow around construction to avoid areas of ponded water. Structures should not block drainages. All organic material should be completely removed prior to any fill placement. Septic fields should not be located in areas where there is the potential for shallow groundwater. The area of the site located in Filing No. 1 does not lie within any floodplain zones according to the FEMA Map Nos. 08041CO305G, and 08041CO315G, dated December 7, 2018 (Figure 9, Reference 11). A floodplain is mapped in the extreme northwestern portion of the site. A detention pond is proposed in this area which will be located in an open space. Exact locations of floodplain and specific drainage studies are beyond the scope of this report. Finished floor levels must be located a minimum of one foot above floodplain levels.

**Potentially Seasonal Shallow Groundwater Area – Constraint**

In these areas, we would anticipate the potential for periodically high subsurface moisture conditions, frost heave potential and highly organic soils. The majority of these areas lie within defined drainages which can likely be avoided by the proposed development. The same mitigation recommendations for the seasonal shallow groundwater areas apply to the potentially seasonal shallow groundwater areas.

Areas of Ponded Water – Constraint

These are areas of standing water behind earth dams on site. We would not expect development in these areas. Either the dams can be avoided by construction or the areas may be completely regraded. Should complete regrading of the site be considered, all organic matter and soft, wet soils should be completely removed before filling. Any drainage into these areas should be rerouted in a non-erosive manner off of the site where it does not create areas of ponded water around proposed structures.

Downslope Creep Areas – Constraint

These areas are acceptable as building sites, however, in areas identified with this hazard classification, we would anticipate accelerated lateral and vertical movement of the near surface soils in the downslope direction.

Mitigation: The design of foundations in these areas should account for the additional pressure on the uphill side of the structure due to the creep potential. The lateral pressure distribution for sloping conditions in downslope creep area is presented in Figure 9. Tie-beams, buttresses and counterforts may be necessary in some areas. Where possible, in areas of downslope creep, structures should be designed to be as compact and rigid as possible. This will help them better tolerate the vertical and lateral movements to which the foundation system may be subjected with minimal damage. Long, rambling, irregular structures should be avoided, as they are associated with much greater potential for damaging differential movement. Additionally, structures should be designed to step up the slope. Deep cuts in these areas should be avoided. Any retaining walls proposed in these areas should also be properly designed for by a qualified professional engineer for the global slope stability. Proper control of drainage at both the surface and subsurface is important. Saturation of materials should be avoided that may create unstable conditions.

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

As mentioned earlier in this report, we understand that the development will be primarily residential with some commercial parcels. 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. Other hazards on site may be satisfactorily mitigated through proper engineering design and construction practices.

The upper residual soils are typically at medium to very dense states. The granular soils encountered in the upper soil profiles of the test borings should provide good support for foundations. Expansive soils were encountered on portions of the site that will require mitigation. Foundations anticipated for the site are standard spread footings possibly in conjunction with overexcavation in areas of expansive soils. Areas containing arkosic sandstone will have high allowable bearing conditions. Difficult excavation should be anticipated in areas of shallow bedrock. Expansive layers may also be encountered in the soil and bedrock on this site. Areas of expansive soils encountered on site are sporadic; therefore, none have been indicated on the maps. Expansive soils, if encountered, will require special foundation design and/or overexcavation. These soils will not prohibit development.

Areas of seasonal and potentially seasonal high groundwater areas and ponded water were encountered on site. Due to the size of the lots and the proposed development, these areas can be avoided by construction. Absorption fields are not recommended in these areas. Structures should not block drainages. Drains may be necessary for structures adjacent to these areas to help prevent the intrusion of water into areas below grade. Typical drain details are presented in Figure 7. Portions of the site do lie within floodplain zones according to FEMA Map Nos. 08041CO305G, and 08041CO315G, dated December 7, 2018 (Figure 9, Reference 11). A floodplain is mapped in the extreme northwestern portion of the site. A detention pond is proposed in this area which will be located in an open space. Exact locations of floodplain and specific drainage studies are beyond the scope of this report.

Areas of fill were observed on site associated with dams and erosion control berms. It is anticipated the dams could be avoided by development. The erosion berms can be avoided or penetrated by foundations. Any uncontrolled fill encountered beneath foundations should be removed and recompacted at a minimum of 95% of its maximum Modified Proctor Dry Density, ASTM D-1557.

Areas of erosion and gulying may require the construction of check dams and revegetation if construction encroaches on these areas. General recommendations for erosion control are discussed under Section 9.0 "Erosion Control".

Areas of downslope creep areas have been identified on this site. In areas of downslope creep, structures should be designed to be as compact and rigid as possible. Foundations may require tie-beams or additional reinforcement in these areas. Foundations should be designed to step up the slopes to avoid deep cuts. Deep cuts should be avoided on all steeper sloping areas of the site. Any retaining walls proposed should be designed for the global slope stability by a qualified professional engineer. This includes cuts made for terracing in backyards. Proper control of drainage at both the surface and subsurface is important. Saturation of materials should be avoided that may create unstable conditions.

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 also 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 12), portions of the area are mapped as stream terrace and floodplain deposits. According to the *Atlas of Sand, Gravel and Quarry Aggregate Resources, Colorado Front Range Counties* distributed by the Colorado Geological Survey (Reference 13), areas of the site are not mapped with any resources. According to the *Evaluation of Mineral and Mineral Fuel Potential* (Reference 14), the area of the site has been mapped as “Little or No Potential” for industrial minerals. It is possible sand materials on site could be an aggregate resource. However, considering the silty to clayey nature of much of these materials and abundance of similar materials through the region and the close proximity to developed land, they would be considered to have little significance as an economic resource.

According to the *Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands* (Reference 14), 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 14).

The site has been mapped as “Fair” for oil and gas resources (Reference 14). 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 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 on-site wastewater treatment 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 Flying Horse Development, 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.

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## **TABLES**

**TABLE 1**  
**SUMMARY OF LABORATORY TEST RESULTS**

CLIENT FLYING HORSE DEV.  
 PROJECT FLYING HORSE NORTH, F-2  
 JOB NO. 220404

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			20.0	NV	NP	0.01			SM	SAND, SILTY
1	5	2-3			11.6						SM-SW	SAND, SLIGHTLY SILTY
1	6	15			47.3						SC	SAND, VERY CLAYEY
2	3	5			82.8	38	21	<0.01	930		CL	CLAY, SANDY
2	6	2-3			52.1				270		CL	CLAY, VERY SANDY
3	5	20			16.7						SM	SANDSTONE, SILTY
3	6	20			9.1						SM-SW	SANDSTONE, SLIGHTLY SILTY
3	2	5			18.8	NV	NP	<0.01			SM	SANDSTONE, SILTY
3	4	10			20.0						SM	SANDSTONE, SILTY

**TABLE 2**  
**SUMMARY OF LABORATORY TEST RESULTS FROM TEST PITS**

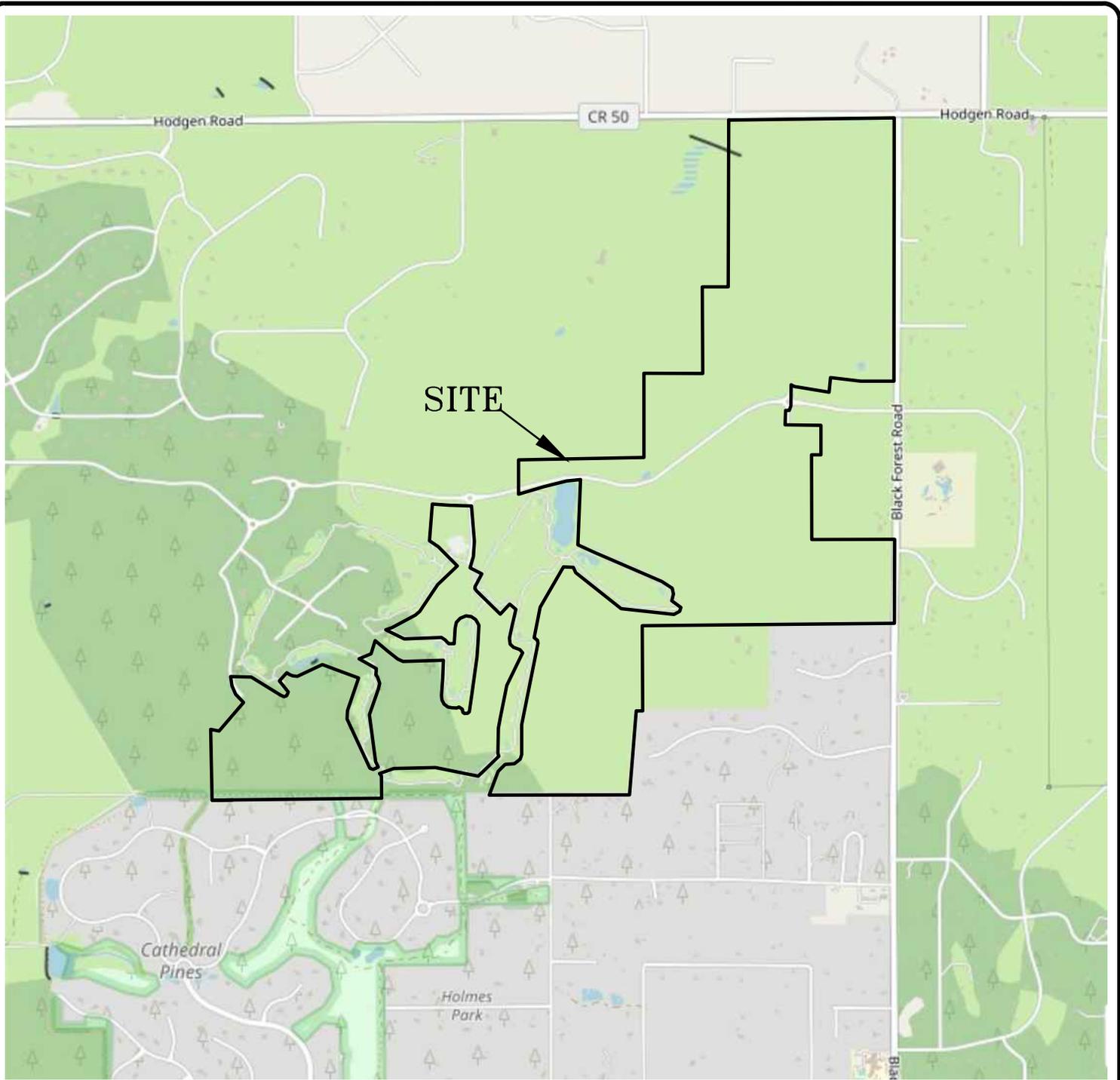
CLIENT FLYING HORSE DEVELOPMENT, LLC  
 PROJECT FLYING HORSE NORTH, FIL 2  
 JOB NO. 220404

USDA 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
2	TP-1	2			41.6						SM	SANDY LOAM
2	TP-4	1			17.0						SM	SANDY LOAM
3	TP-4	5			28.1						SM	SANDY CLAY LOAM
3	TP-6	4			14.2						SM	SANDY CLAY LOAM
4	TP-2	3			68.3						CL	SANDY SILTY CLAY
4	TP-12	4			50.6						SC-CL	SANDY SILTY CLAY
4	TP-14	3			67.7						CL	SANDY SILTY CLAY
4	TP-16	2			52.5						CL	SANDY SILTY CLAY
4	TP-8	4			39.0						SC	SANDY CLAY
4	TP-10	4			44.1						SC	SANDY CLAY
4A	TP-5	3			31.8						SM	SANDSTONE, SILTY TO CLAYEY
4A	TP-7	4			16.1						SM	WEATHERED SANDSTONE, SILTY
4A	TP-7	6			15.8						SM	SANDSTONE, SILTY
4A	TP-9	6			22.6						SM	SANDSTONE, SILTY
4A	TP-18	3			50.8						SC-CL	SANDSTONE, CLAYEY

**Table 3: Summary of Test Boring Results**

<b>Test Boring No.</b>	<b>Depth to Bedrock (ft.)</b>	<b>Depth to Groundwater (ft.)</b>
1	>20	>20
2	1	>20
3	>20	>20
4	3	>20
5	18	>20
6	17	13

## FIGURES



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

VICINITY MAP  
 FLYING HORSE NORTH SKETCH PLAN  
 EL PASO COUNTY, CO.  
 FOR: FLYING HORSE DEVELOPMENT, LLC

DRAWN:  
 LLL

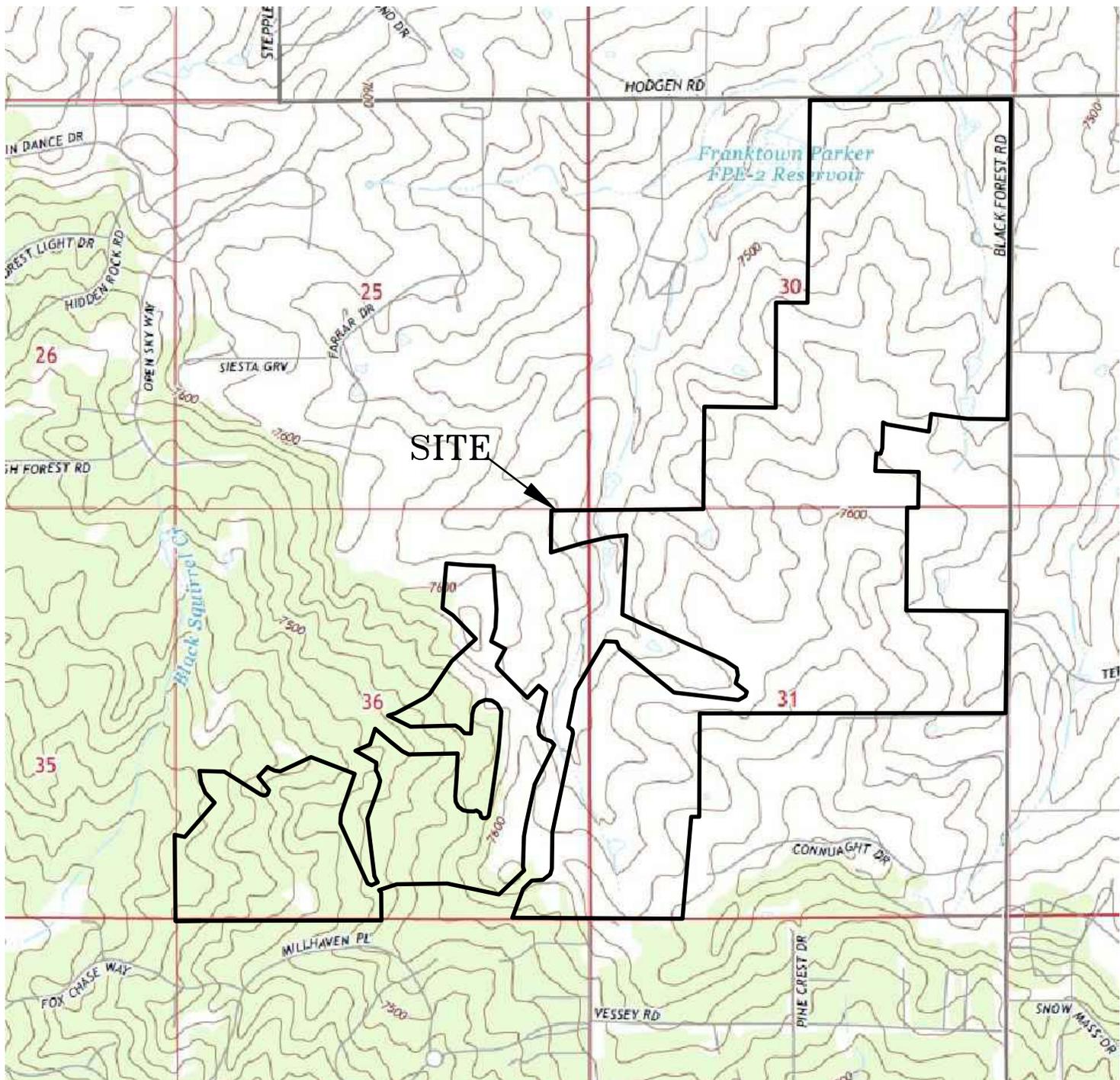
DATE:  
 3/7/22

CHECKED:

DATE:

JOB NO.:  
 220404

FIG NO.:  
 1



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

USGS TOPOGRAPHY MAP  
 FLYING HORSE NORTH SKETCH PLAN  
 EL PASO COUNTY, CO.  
 FOR: FLYING HORSE DEVELOPMENT, LLC

DRAWN:  
 LLL

DATE:  
 3/7/22

CHECKED:

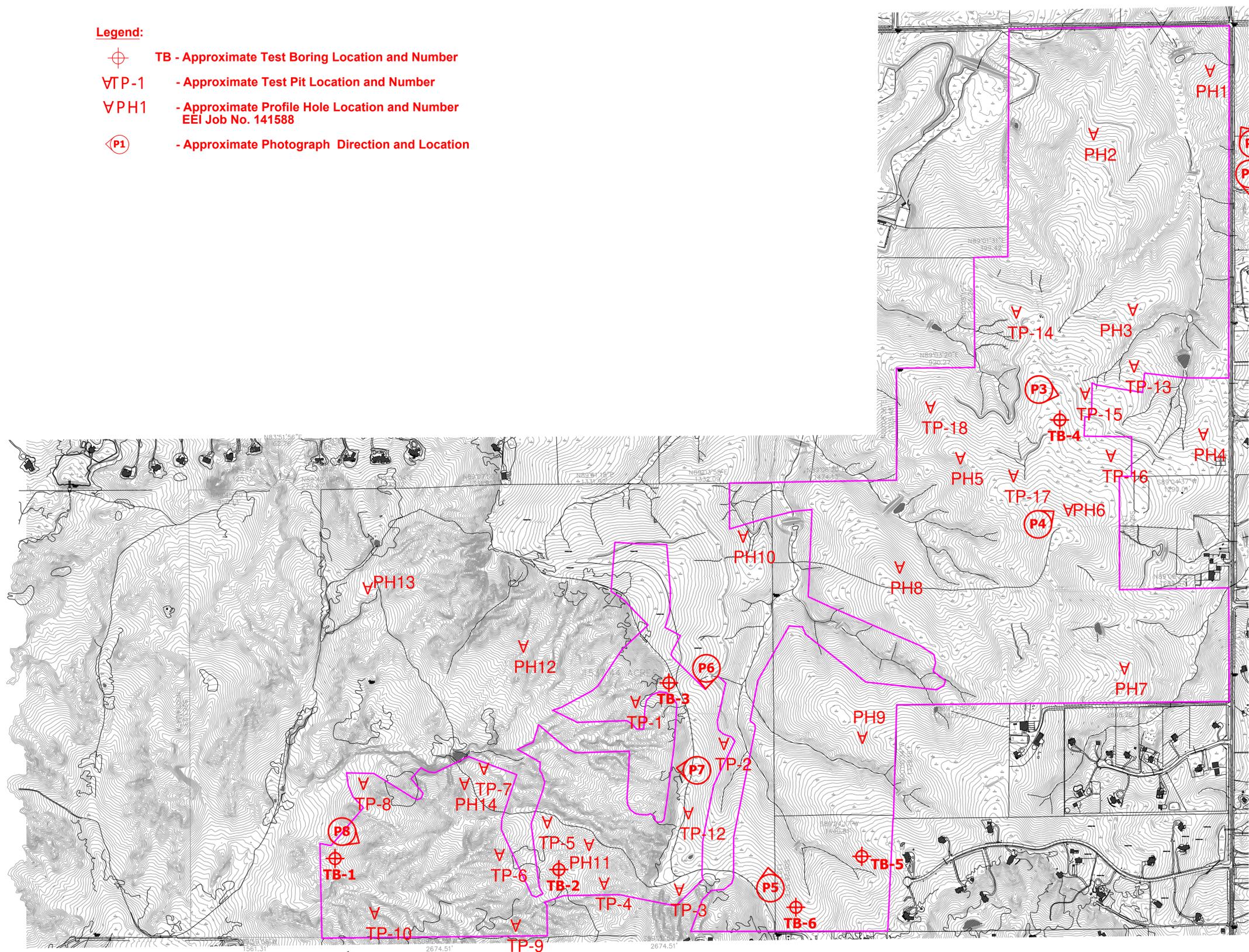
DATE:

JOB NO.:  
 220404

FIG NO.:  
 2

**Legend:**

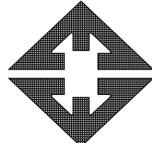
-  **TB - Approximate Test Boring Location and Number**
-  **TP-1 - Approximate Test Pit Location and Number**
-  **PH1 - Approximate Profile Hole Location and Number**  
EEI Job No. 141588
-  **- Approximate Photograph Direction and Location**



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



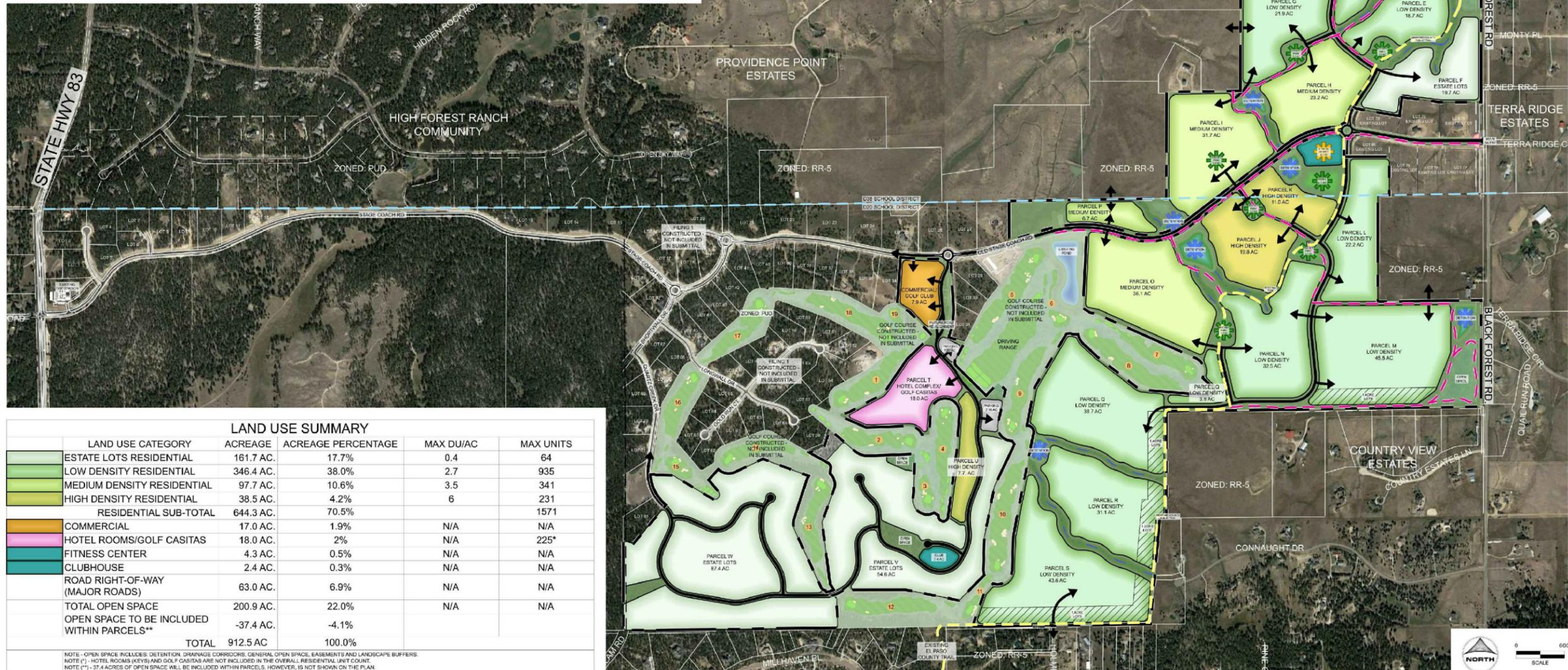
SITE MAP/TESTING LOCATION MAP  
FLYING HORSE NORTH SKETCH PLAN  
EL PASO COUNTY, CO.  
FOR: FLYING HORSE DEVELOPMENT, LLC

DRAWN LLL CHECKED
DATE 3/7/22
SCALE AS SHOWN
JOB NO. 220404
FIGURE No. <b>3</b>

# FLYING HORSE NORTH SKETCH PLAN

## LEGEND

- ESTATE LOTS
- LOW DENSITY
- 1 ACRE LOTS
- MEDIUM DENSITY
- HIGH DENSITY
- COMMERCIAL/GOLF CLUB
- HOTEL COMPLEX
- CLUB
- HOTEL PARKING
- ROADWAY
- DETENTION
- SITE BOUNDARY
- SCHOOL DISTRICT LINE
- FHN TRAIL
- PUBLIC COUNTY TRAIL
- DRAINAGE WAY
- PARK/POCKET PARK
- FITNESS CENTER
- POTENTIAL FIRE STATION
- PROPOSED DETENTION



### LAND USE SUMMARY

LAND USE CATEGORY	ACREAGE	ACREAGE PERCENTAGE	MAX DU/AC	MAX UNITS
ESTATE LOTS RESIDENTIAL	161.7 AC.	17.7%	0.4	64
LOW DENSITY RESIDENTIAL	346.4 AC.	38.0%	2.7	935
MEDIUM DENSITY RESIDENTIAL	97.7 AC.	10.6%	3.5	341
HIGH DENSITY RESIDENTIAL	38.5 AC.	4.2%	6	231
RESIDENTIAL SUB-TOTAL	644.3 AC.	70.5%		1571
COMMERCIAL	17.0 AC.	1.9%	N/A	N/A
HOTEL ROOMS/GOLF CASITAS	18.0 AC.	2%	N/A	225*
FITNESS CENTER	4.3 AC.	0.5%	N/A	N/A
CLUBHOUSE	2.4 AC.	0.3%	N/A	N/A
ROAD RIGHT-OF-WAY (MAJOR ROADS)	63.0 AC.	6.9%	N/A	N/A
TOTAL OPEN SPACE	200.9 AC.	22.0%	N/A	N/A
OPEN SPACE TO BE INCLUDED WITHIN PARCELS**	-37.4 AC.	-4.1%		
<b>TOTAL</b>	<b>912.5 AC</b>	<b>100.0%</b>		

NOTE - OPEN SPACE INCLUDES: DETENTION, DRAINAGE CORRIDORS, GENERAL OPEN SPACE, EASEMENTS AND LANDSCAPE BUFFERS.  
NOTE (\*) - HOTEL ROOMS (KEYS) AND GOLF CASITAS ARE NOT INCLUDED IN THE OVERALL RESIDENTIAL UNIT COUNT.  
NOTE (\*\*) - 37.4 ACRES OF OPEN SPACE WILL BE INCLUDED WITHIN PARCELS, HOWEVER IS NOT SHOWN ON THE PLAN.

DRAWN BY: JAG      JOB DATE: 2/25/2022      BAR IS ONE INCH ON OFFICIAL DRAWINGS.  
 APPROVED: PLS      JOB NUMBER: 211030      0" = 100' IF NOT ONE INCH, ADJUST SCALE ACCORDINGLY.  
 CAD DATE: 2/25/2022  
 CAD FILE: J:\2021\211030\CAD\Draws\C\Sketch-Plan\BUBBLE-PLAN

NO.	DATE	BY	REVISION DESCRIPTION



FLYING HORSE NORTH DEVELOPMENT, LLC.  
 EL PASO COUNTY, COLORADO

FLYING HORSE NORTH SKETCH PLAN  
 SKETCH PLAN DRAWING

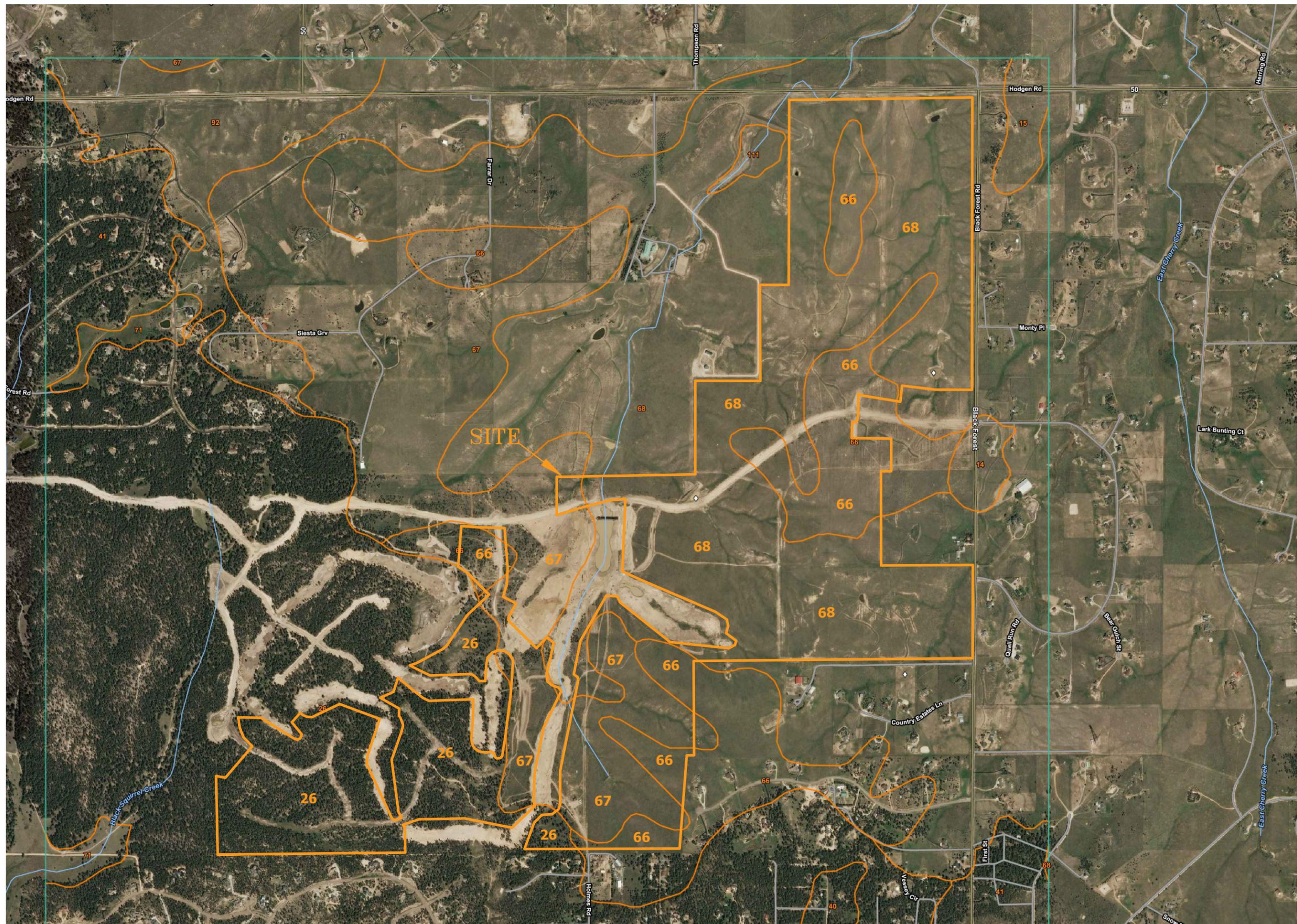
SHEET SP.2 2

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SKETCH PLAN  
 FLYING HORSE NORTH SKETCH PLAN  
 EL PASO COUNTY, CO.  
 FOR: FLYING HORSE DEVELOPMENT, LLC

DRAWN LLL  
 CHECKED  
 DATE 3/7/22  
 SCALE AS SHOWN  
 JOB NO. 220404  
 FIGURE No. 4

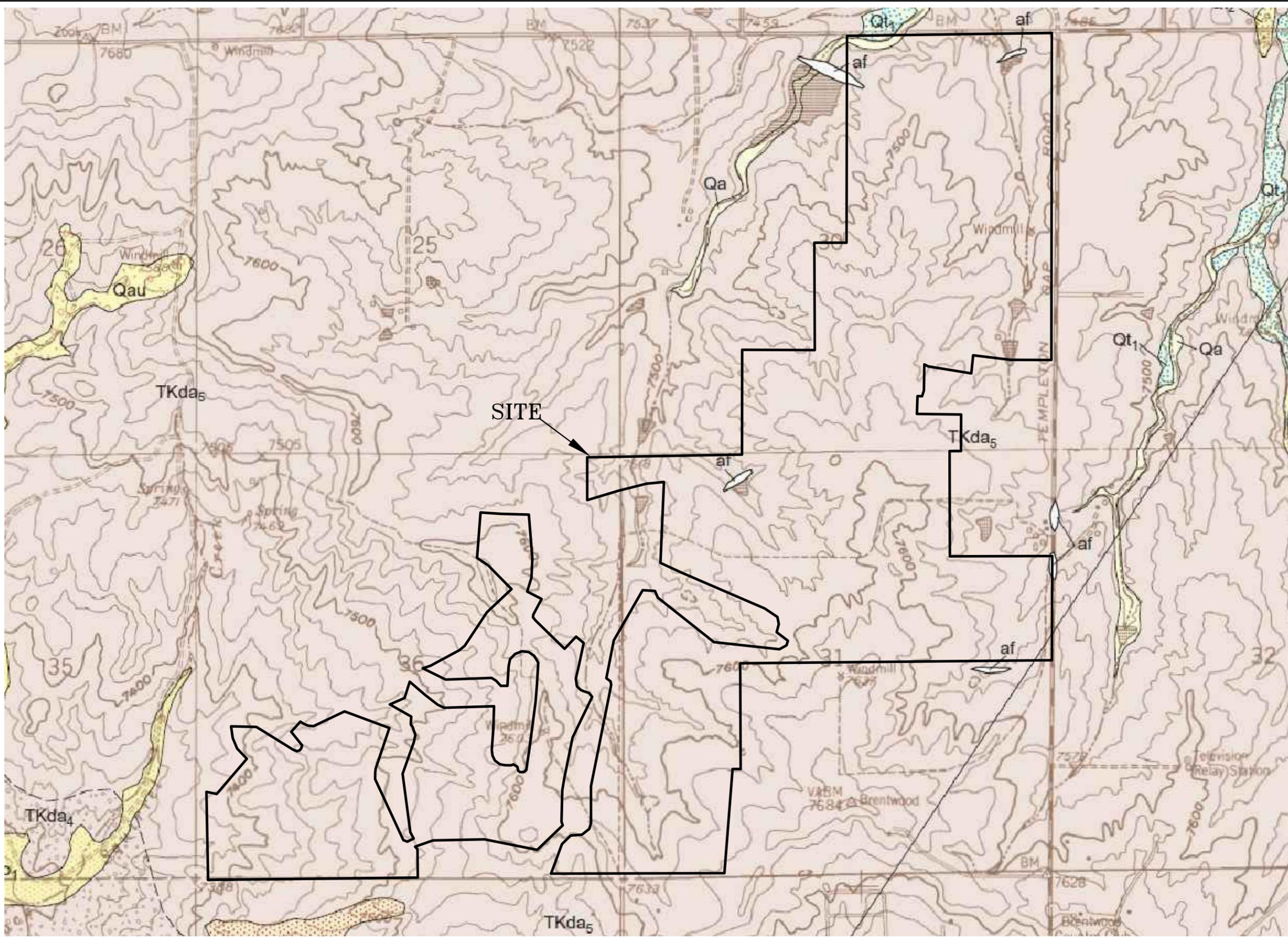


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 (719) 531-5599

SOIL SURVEY MAP  
 FLYING HORSE NORTH SKETCH PLAN  
 EL PASO COUNTY, CO.  
 FOR: FLYING HORSE DEVELOPMENT, LLC

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CHECKED
DATE 3/7/22
SCALE AS SHOWN
JOB NO. 220404
FIGURE No. 5



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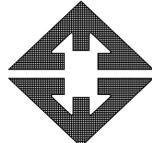
BLACK FOREST QUADRANGLE  
FLYING HORSE NORTH SKETCH PLAN  
EL PASO COUNTY, CO.  
FOR: FLYING HORSE DEVELOPMENT, LLC

DRAWN L.L.
CHECKED
DATE 3/7/22
SCALE AS SHOWN
JOB NO. 220404
FIGURE No. 6

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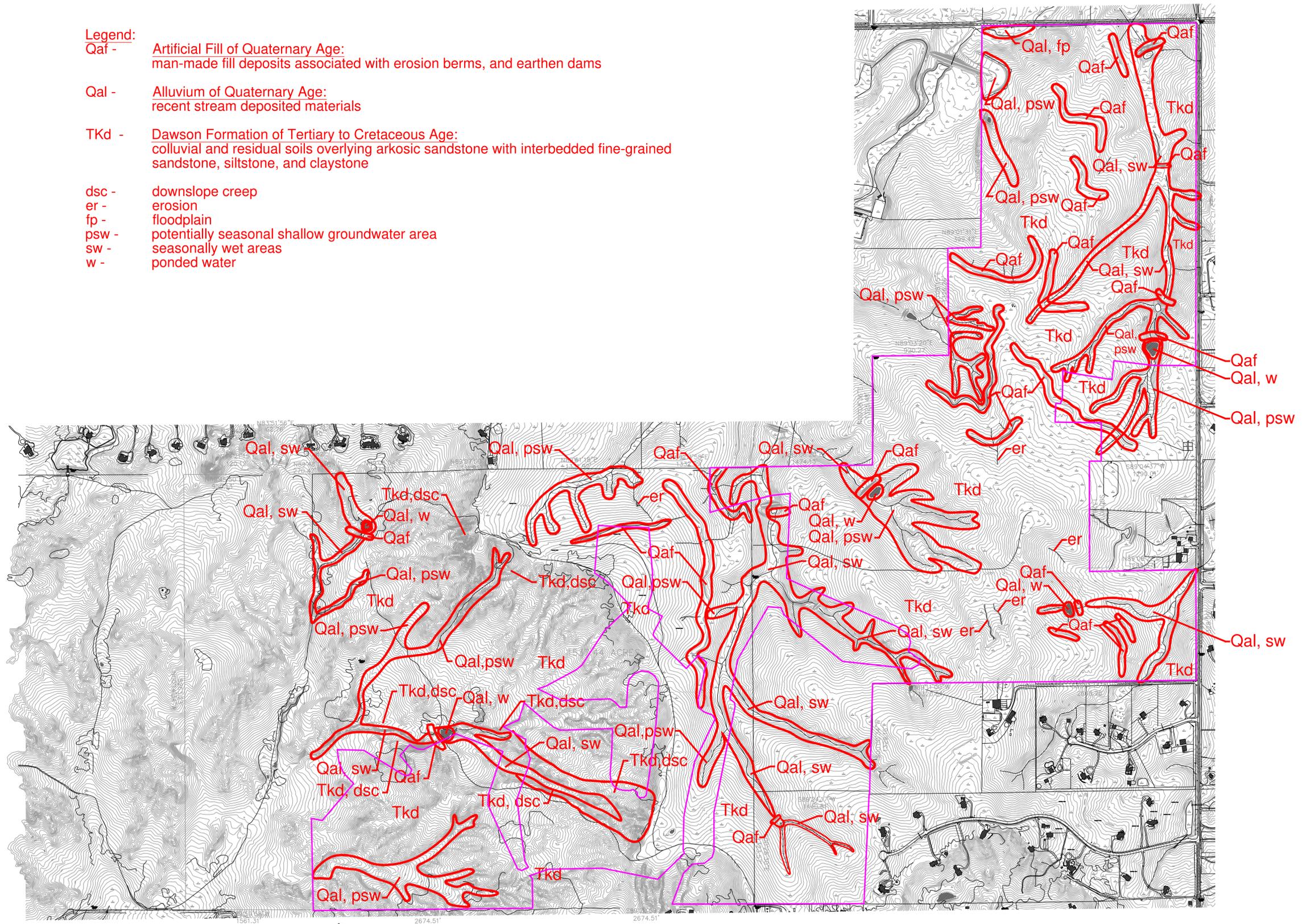
505 ELKTON DRIVE (719) 531-5599  
COLORADO SPRINGS, CO. 80907



GEOLOGY/ENGINEERING GEOLOGY MAP  
FLYING HORSE NORTH SKETCH PLAN  
EL PASO COUNTY, CO.  
FOR: FLYING HORSE DEVELOPMENT, LLC

DRAWN	LLL
CHECKED	
DATE	3/7/22
SCALE	AS SHOWN
JOB NO.	220404
FIGURE No.	7

- Legend:**
- Qaf -** Artificial Fill of Quaternary Age: man-made fill deposits associated with erosion berms, and earthen dams
  - Qal -** Alluvium of Quaternary Age: recent stream deposited materials
  - TKd -** Dawson Formation of Tertiary to Cretaceous Age: colluvial and residual soils overlying arkosic sandstone with interbedded fine-grained sandstone, siltstone, and claystone
  - dsc - downslope creep
  - er - erosion
  - fp - floodplain
  - psw - potentially seasonal shallow groundwater area
  - sw - seasonally wet areas
  - w - ponded water





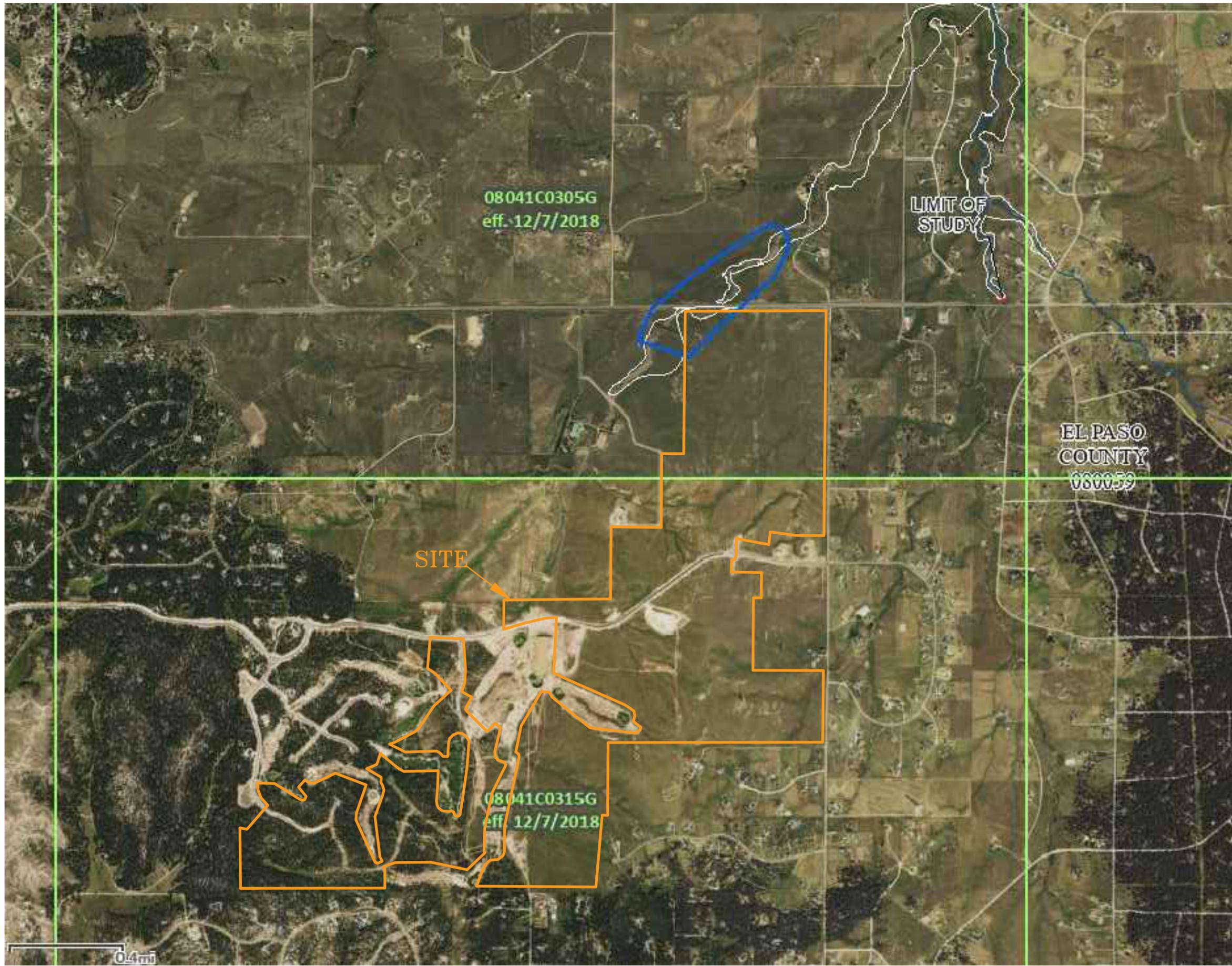
REVISION	BY

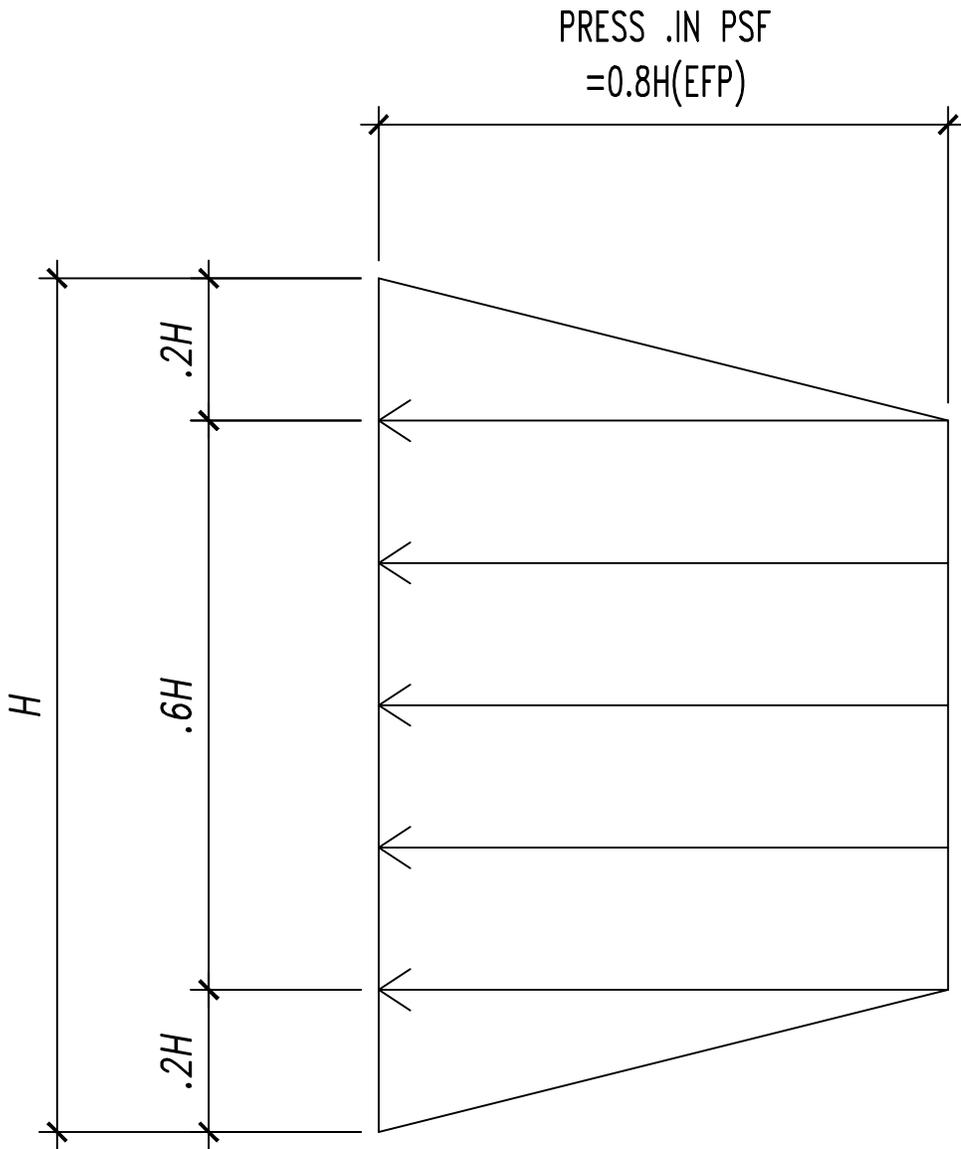
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FLOODPLAIN MAP  
 FLYING HORSE NORTH SKETCH PLAN  
 EL PASO COUNTY, CO.  
 FOR: FLYING HORSE DEVELOPMENT, LLC

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CHECKED
DATE 3/7/22
SCALE AS SHOWN
JOB NO. 220404
FIGURE No. 9





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

*LATERAL PRESSURE DISTRIBUTION  
AREA WITH CREEP*

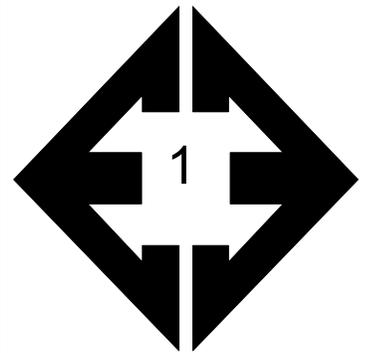
*DRAWN BY:*  
R. MCBRIDE

*DATE DRAWN:*  
03/13/13

*JOB NO.:*  
220404

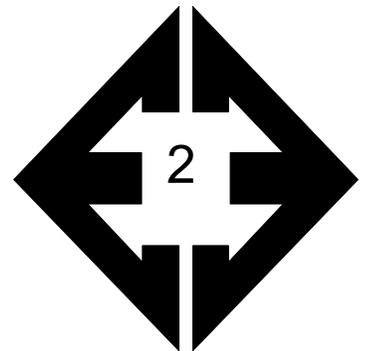
*FIG. NO.:*  
10

## **APPENDIX A: Site Photographs**



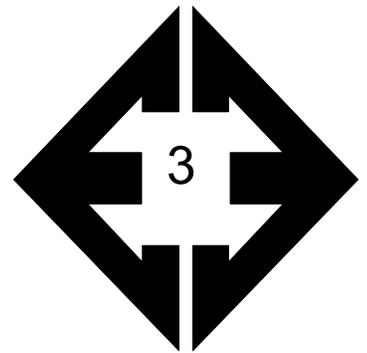
**Looking northwest  
from the northeastern  
side of the site along  
Black Forest Road.**

February 24, 2022



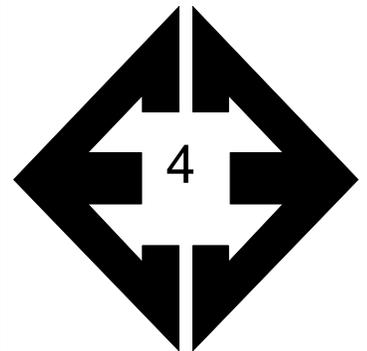
**Looking south from  
the northeastern side  
of the site along Black  
Forest Road.**

February 24, 2022



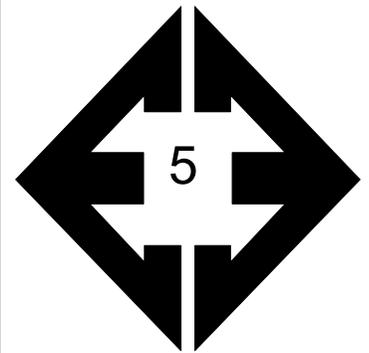
**Looking southeast  
from the north-central  
portion of the site.**

February 24, 2022



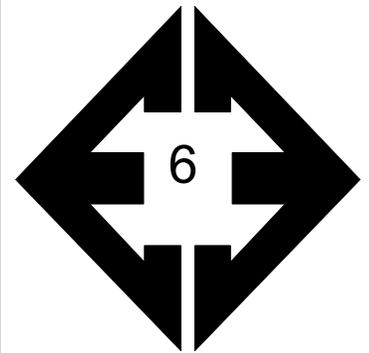
**Looking northeast  
from the central  
portion of the site.**

February 24, 2022



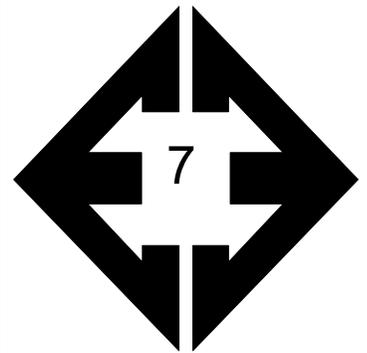
**Looking north from the southern portion of the site.**

February 24, 2022



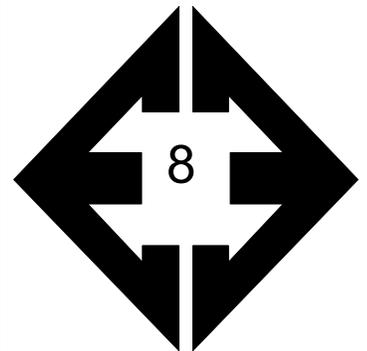
**Looking south from the central portion of the site.**

February 24, 2022



**Looking west from the west-central portion of the site.**

February 24, 2022



**Looking east from the southwestern side of the site.**

February 24, 2022

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

TEST BORING NO. 1  
 DATE DRILLED 2/14/2018  
 Job # 220404

TEST BORING NO. 2  
 DATE DRILLED 2/14/2018  
 CLIENT FLYING HORSE DEV.  
 LOCATION FLYING HORSE NORTH, F-2

REMARKS

DRY TO 20', 2/14/18

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

THIN CLAYEY LENSES

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			10	4.1	1
			12	6.8	1
10			13	14.1	1
15			10	3.6	1
20			14	10.6	1

REMARKS

DRY TO 20', 2/14/18

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

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			50	7.0	3
			10"		
			50	7.0	3
10			50	12.1	3
			6"		
15			50	10.7	3
			7"		
20			50	9.8	3
			6"		



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

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE:

LLL

3/8/22

JOB NO.:  
 220404

FIG NO.:

B-1

TEST BORING NO. 3  
 DATE DRILLED 2/14/2018  
 Job # 220404

TEST BORING NO. 4  
 DATE DRILLED 2/14/2018  
 CLIENT FLYING HORSE DEV.  
 LOCATION FLYING HORSE NORTH, F-2

REMARKS

DRY TO 20', 2/14/18

SAND, SILTY, FINE TO COARSE  
 GRAINED, TAN, MEDIUM  
 DENSE, MOIST  
 CLAY, SANDY, TAN, FIRM,  
 MOIST

SAND, SILTY WITH CLAYEY  
 LENSES, FINE TO COARSE  
 GRAINED, TAN, MEDIUM DENSE,  
 MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			21	6.6	1
5			13	11.4	2
10			17	8.2	1
15			21	8.8	1
20			13	5.5	1

REMARKS

DRY TO 20', 2/14/18

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

SANDSTONE, SILTY, FINE  
 GRAINED, GREEN TAN, VERY  
 DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			17	5.2	1
5			50	5.4	3
10			50 9"	8.2	3
15			50 8"	14.9	3
20			50 9"	16.7	3



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505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:

DATE:

CHECKED:  
*LLL*

DATE:  
 3/8/22

JOB NO.:  
 220404

FIG NO.:  
 B-2

TEST BORING NO. 5  
 DATE DRILLED 3/4/2022  
 Job # 220404

TEST BORING NO. 6  
 DATE DRILLED 3/4/2022  
 CLIENT FLYING HORSE DEV.  
 LOCATION FLYING HORSE NORTH, F-2

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 20', 3/4/22							DRY TO 20', 3/4/22						
SAND, SLIGHTLY SILTY, FINE TO COARSE GRAINED, TAN, DENSE,							CLAY, VERY SANDY, TAN, STIFF TO VERY STIFF, MOIST						
	5			42	5.1	1		5			16	8.3	2
				36	7.6	1					30	8.4	2
	10			36	6.4	1	SAND, SILTY, FINE TO COARSE GRAINED, RED BROWN, MEDIUM DENSE, MOIST	10			21	8.4	1
	15			40	10.4	1	SAND, VERY CLAYEY, FINE TO COARSE GRAINED, TAN, DENSE, MOIST	15			41	12.6	1
SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, VERY DENSE, MOIST	20			50	10.4	3	SANDSTONE, SLIGHTLY SILTY, FINE TO COARSE GRAINED, BROWN, VERY DENSE, MOIST	20			50	6.2	3
				10"							6"		



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**ENGINEERING, INC.**

505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

**TEST BORING LOG**

DRAWN:

DATE:

CHECKED:  
 LLL

DATE:  
 3/8/22

JOB NO.:  
 220404

FIG. NO.:

B-3

TEST PIT NO. 1  
 DATE EXCAVATED 1/31/2018  
 Job # 220404

TEST PIT NO. 2  
 DATE EXCAVATED 1/31/2018  
 CLIENT FLYING HORSE DEVELOPMENT, LLC  
 LOCATION FLYING HORSE NORTH FIL 2

REMARKS

Lot ?  
 GPS Location  
 39° 02' 57.3" N  
 104° 43' 30.1" W  
 sandy loam, tan

weathered to formational  
 silty sandstone, redish tan  
 to tan

\*formational sandstone at  
 4.5 feet

Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type
1	[Symbol]		gr	m	2
2	[Symbol]		gr	ma	4A
3	[Symbol]				
4	[Symbol]				
5	[Symbol]				
6	[Symbol]				
7	[Symbol]				
8	[Symbol]				
9	[Symbol]				
10	[Symbol]				

REMARKS

Lot ?  
 GPS Location  
 39° 02' 53.5" N  
 104° 43' 19.5" W

topsoil, sandy clay loam,  
 brown  
 sandy silty clay, fine grained,  
 tan

Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type
1	[Symbol]		bl	m	3
2	[Symbol]		bl	m	4
3	[Symbol]				
4	[Symbol]				
5	[Symbol]				
6	[Symbol]				
7	[Symbol]				
8	[Symbol]				
9	[Symbol]				
10	[Symbol]				

Soil Structure Shape

granular - gr  
 platy - pl  
 blocky - bl  
 prismatic - pr

Soil Structure Grade

weak - w  
 moderate - m  
 strong - s  
 single grain - sg  
 massive - ma



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505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

TEST PIT LOG

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DATE:

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*LL*

DATE:  
 3/8/22

JOB NO.:

220404

FIG NO.:

B-4

TEST PIT NO. 3  
 DATE EXCAVATED 1/31/2018  
 Job # 220404

TEST PIT NO. 4  
 DATE EXCAVATED 1/31/2018  
 CLIENT FLYING HORSE DEVELOPMENT, LLC  
 LOCATION FLYING HORSE NORTH FIL 2

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
Lot ? GPS Location 39° 02' 36.2" N 104° 43' 23.8" W							Lot ? GPS Location 39° 02' 37.3" N 104° 43' 38.8" W						
topsoil, sandy clay loam, brown	1			bl	m	3	sandy loam, fine to coarse grained, tan	1			gr	m	2
sandy silty clay, fine grained, tan	2			bl	m	4	sandy silty clay, tan	2			bl	m	4
	3						sandy clay loam, fine to coarse grained, tan	3			gr	m	3
	4							4					
	5							5					
	6							6					
	7							7					
	8							8					
	9							9					
	10							10					

Soil Structure Shape  
 granular - gr  
 platy - pl  
 blocky - bl  
 prismatic - pr

Soil Structure Grade  
 weak - w  
 moderate - m  
 strong - s  
 single grain - sg  
 massive - ma



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 3/8/22

JOB NO.:

220404

FIG NO.:

B-5

TEST PIT NO. 5  
 DATE EXCAVATED 1/31/2018  
 Job # 220404

TEST PIT NO. 6  
 DATE EXCAVATED 1/31/2018  
 CLIENT FLYING HORSE DEVELOPMENT, LLC  
 LOCATION FLYING HORSE NORTH FIL 2

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
Lot ? GPS Location 39° 02' 47.9" N 104° 43' 42.7" W							Lot ? GPS Location 39° 02' 41.3" N 104° 43' 51.0" W						
sandy loam, tan	1	[Symbol]		gr	m	2	sandy loam, fine to coarse grained, tan	1	[Symbol]		gr	m	2
weathered to formational silty to clayey sandstone, fine to coarse grained, olive tan	2	[Symbol]		gr	ma	4A	alternating layers of loamy sand and sandy clay loam, fine to coarse grained, tan	2	[Symbol]		gr	m	3
	3	[Symbol]						3	[Symbol]				
	4	[Symbol]						4	[Symbol]				
*formational sandstone at 2.5 feet	5	[Symbol]						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

Soil Structure Grade  
 weak - w  
 moderate - m  
 strong - s  
 single grain - sg  
 massive - ma



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JOB NO.:

220404

FIG NO.:

B-6

TEST PIT NO. 7  
 DATE EXCAVATED 1/31/2018  
 Job # 220404

TEST PIT NO. 8  
 DATE EXCAVATED 1/31/2018  
 CLIENT FLYING HORSE DEVELOPMENT, LLC  
 LOCATION FLYING HORSE NORTH FIL 2

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
Lot ? GPS Location 39° 02' 50.3" N 104° 43' 56.1" W							Lot ? GPS Location 39° 02' 49.3" N 104° 44' 11.5" W						
sandy loam, fine to coarse grained, tan	1	[Symbol]		gr	m	2	sandy loam, fine to coarse grained, tan	1	[Symbol]		gr	m	2
weathered to formational silty to clayey sandstone, fine to coarse grained, reddish tan to tan.	2	[Symbol]		gr	ma	4A	sandy clay, fine to coarse grained, brown	2	[Symbol]		gr	m	4
	3	[Symbol]						3	[Symbol]				
	4	[Symbol]						4	[Symbol]				
	5	[Symbol]						5	[Symbol]				
*formational sandstone at 5 feet	6	[Symbol]						6	[Symbol]				
	7	[Symbol]						7	[Symbol]				
	8	[Symbol]					highly weathered clayey sandstone, fine to coarse grained, olive tan	8	[Symbol]		gr	ma	4A
	9	[Symbol]						9	[Symbol]				
	10	[Symbol]						10	[Symbol]				

Soil Structure Shape  
 granular - gr  
 platy - pl  
 blocky - bl  
 prismatic - pr

Soil Structure Grade  
 weak - w  
 moderate - m  
 strong - s  
 single grain - sg  
 massive - ma



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**TEST PIT LOG**

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DATE:  
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JOB NO.:  
 220404

FIG NO.:  
 B-7

TEST PIT NO. 9  
 DATE EXCAVATED 2/1/2018  
 Job # 220404

TEST PIT NO. 10  
 DATE EXCAVATED 2/1/2018  
 CLIENT FLYING HORSE DEVELOPMENT, LLC  
 LOCATION FLYING HORSE NORTH FIL 2

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
Lot ? GPS Location 39° 02' 33.7" N 104° 43' 51.3" W							Lot ? GPS Location 39° 02' 33.1" N 104° 44' 07.6" W						
topsoil, sandy clay loam, brown	1						sandy loam fine to coarse grained, tan	1			gr	m	2
sandy clay loam, fine to coarse grained light brown	2			bl	m	3	sandy clay, fine to coarse grained, tan	2			gr	m	4
	3							3					
	4							4					
weathered silty sandstone fine to coarse grained, reddish tan	5			gr	ma	4A		5					
	6							6					
	7							7					
	8							8					
	9							9					
	10							10					

Soil Structure Shape  
 granular - gr  
 platy - pl  
 blocky - bl  
 prismatic - pr

Soil Structure Grade  
 weak - w  
 moderate - m  
 strong - s  
 single grain - sg  
 massive - ma



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JOB NO.:

*220404*

FIG NO.:

*B-8*

TEST PIT NO. 11  
 DATE EXCAVATED 2/1/2018  
 Job # 220404

TEST PIT NO. 12  
 DATE EXCAVATED 2/1/2018  
 CLIENT FLYING HORSE DEVELOPMENT, LLC  
 LOCATION FLYING HORSE NORTH FIL 2

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
Lot ? GPS Location 39° 02' 40.0" N 104° 44' 01.5" W							Lot ? GPS Location 39° 02' 45.8" N 104° 43' 24.6" W						
sandy loam, fine to coarse grained, tan	1			gr	m	2	topsoil, sandy clay loam, brown	1			bl	m	3
sandy silty clay, fine grained, tan	2			bl	m	4	sandy silty clay, fine grained, tan	2			bl	m	4
	3							3					
	4							4					
	5							5					
	6							6					
weathered silty sandstone, fine to coarse grained, tan	7			gr	ma	4A		7					
	8							8					
	9							9					
	10							10					

Soil Structure Shape  
 granular - gr  
 platy - pl  
 blocky - bl  
 prismatic - pr

Soil Structure Grade  
 weak - w  
 moderate - m  
 strong - s  
 single grain - sg  
 massive - ma



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JOB NO.:

*220404*

FIG NO.:

*B-9*

TEST PIT NO. 13  
 DATE EXCAVATED 2/1/2018  
 Job # 220404

TEST PIT NO. 14  
 DATE EXCAVATED 2/1/2018  
 CLIENT FLYING HORSE DEVELOPMENT, LLC  
 LOCATION FLYING HORSE NORTH FIL 2

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
Lot ? GPS Location 39° 03' 35.3" N 104° 42' 17.8" W							Lot ? GPS Location 39° 03' 41.7" N 104° 42' 36.9" W						
topsoil, sandy clay loam, brown	1			bl	m	3	topsoil, sandy clay loam, brown	1			bl	m	3
weathered very clayey sandstone, fine to coarse grained, reddish brown	2			gr	ma	4A	sandy silty clay, fine grained, tan	2			bl	m	4
interbedded claystone layer	3							3					
	4							4					
	5							5					
	6							6					
	7							7					
	8							8					
	9							9					
	10							10					

Soil Structure Shape  
 granular - gr  
 platy - pl  
 blocky - bl  
 prismatic - pr

Soil Structure Grade  
 weak - w  
 moderate - m  
 strong - s  
 single grain - sg  
 massive - ma



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TEST PIT LOG

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 3/3/22

JOB NO.:

220404

FIG NO.:

B-10

TEST PIT NO. 15  
 DATE EXCAVATED 2/1/2018  
 Job # 220404

TEST PIT NO. 16  
 DATE EXCAVATED 2/1/2018  
 CLIENT FLYING HORSE DEVELOPMENT, LLC  
 LOCATION FLYING HORSE NORTH FIL 2

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
Lot ? GPS Location 39° 03' 36.9" N 104° 42' 31.4" W							Lot ? GPS Location 39° 03' 25.7" N 104° 42' 24.0" W						
topsoil, sandy clay loam, brown	1			bl	m	3	topsoil, sandy clay loam, brown	1			bl	m	3
sandy silty clay, fine grained, tan	2			bl	m	4	sandy silty clay, fine grained, tan	2			bl	m	4
	3							3					
	4							4					
	5							5					
	6							6					
	7							7					
weathered very clayey sandstone, fine to coarse grained, reddish brown	8			gr	ma	4A	weathered very clayey sandstone, fine to coarse grained, reddish brown	8			gr	ma	4A
	9							9					
	10							10					

Soil Structure Shape  
 granular - gr  
 platy - pl  
 blocky - bl  
 prismatic - pr

Soil Structure Grade  
 weak - w  
 moderate - m  
 strong - s  
 single grain - sg  
 massive - ma



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TEST PIT LOG

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DATE:  
 3/8/22

JOB NO.:

220404

FIG NO.:

B-11

TEST PIT NO. 17  
 DATE EXCAVATED 2/1/2018  
 Job # 220404

TEST PIT NO. 18  
 DATE EXCAVATED 2/1/2018  
 CLIENT FLYING HORSE DEVELOPMENT, LLC  
 LOCATION FLYING HORSE NORTH FIL 2

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
Lot ? GPS Location 39° 03' 23.1" N 104° 42' 36.0" W							Lot ? GPS Location 39° 03' 25.7" N 104° 42' 24.0" W						
topsoil, sandy clay loam, brown	1			bl	m	3	topsoil, sandy clay loam, brown	1			bl	m	3
weathered to formational silty to clayey sandstone, fine to coarse grained, brown to tan	2			gr	ma	4A	sandy silty clay, fine grained, tan	2			bl	m	4
	3						weathered to formational silty to clayey sandstone, fine to coarse grained, brown to tan	3			gr	ma	4A
	4							4					
	5							5					
*formational sandstone at 5.5 feet	6						*formational sandstone at 5 feet	6					
	7							7					
	8							8					
	9							9					
	10							10					

Soil Structure Shape  
 granular - gr  
 platy - pl  
 blocky - bl  
 prismatic - pr

Soil Structure Grade  
 weak - w  
 moderate - m  
 strong - s  
 single grain - sg  
 massive - ma



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TEST PIT LOG

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DATE:  
*3/8/22*

JOB NO.:

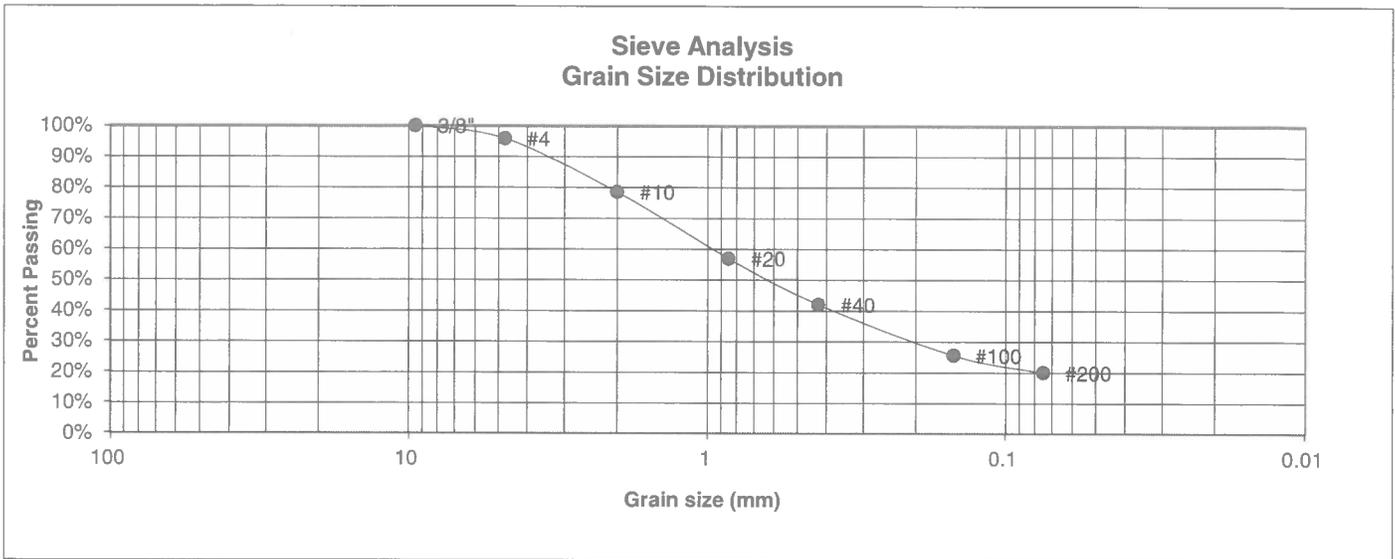
*220404*

FIG NO.:

*B-12*

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

UNIFIED CLASSIFICATION	SM	CLIENT	FLYING HORSE DEV.
SOIL TYPE #	1	PROJECT	FLYING HORSE NORTH, F-2
TEST BORING #	1	JOB NO.	220404
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	95.9%
10	78.5%
20	57.0%
40	42.0%
100	25.6%
200	20.0%

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)	



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**LABORATORY TEST  
RESULTS**

DRAWN:	DATE:	CHECKED:	DATE:
		LL	3/8/22

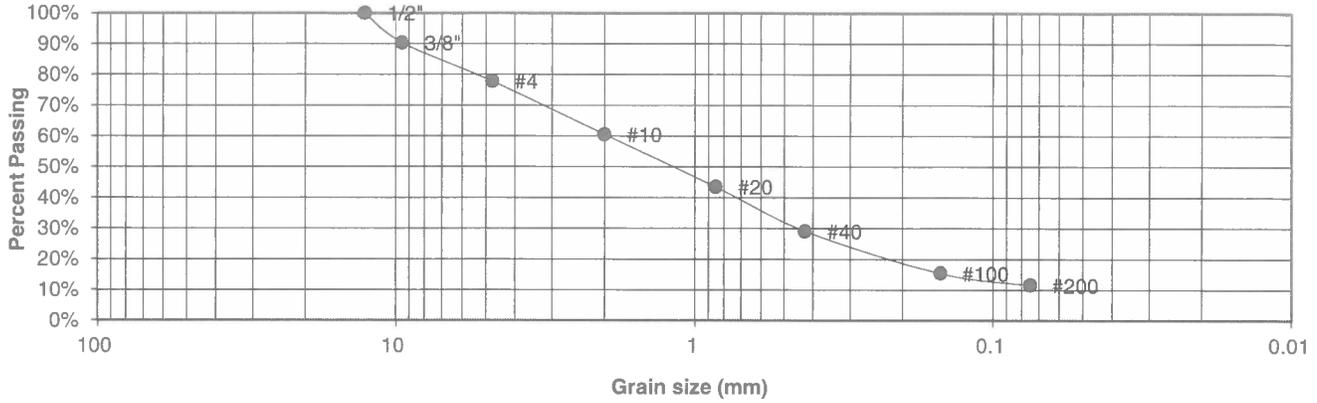
JOB NO.:  
220404

FIG NO.:

C-1

<u>UNIFIED CLASSIFICATION</u>	SM-SW	<u>CLIENT</u>	FLYING HORSE DEV.
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	FLYING HORSE NORTH, F-2
<u>TEST BORING #</u>	5	<u>JOB NO.</u>	220404
<u>DEPTH (FT)</u>	2-3	<u>TEST BY</u>	BL

**Sieve Analysis  
Grain Size Distribution**



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	90.3%
4	77.8%
10	60.5%
20	43.5%
40	29.1%
100	15.4%
200	11.6%

Atterberg Limits  
 Plastic Limit  
 Liquid Limit  
 Plastic Index

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



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**LABORATORY TEST  
RESULTS**

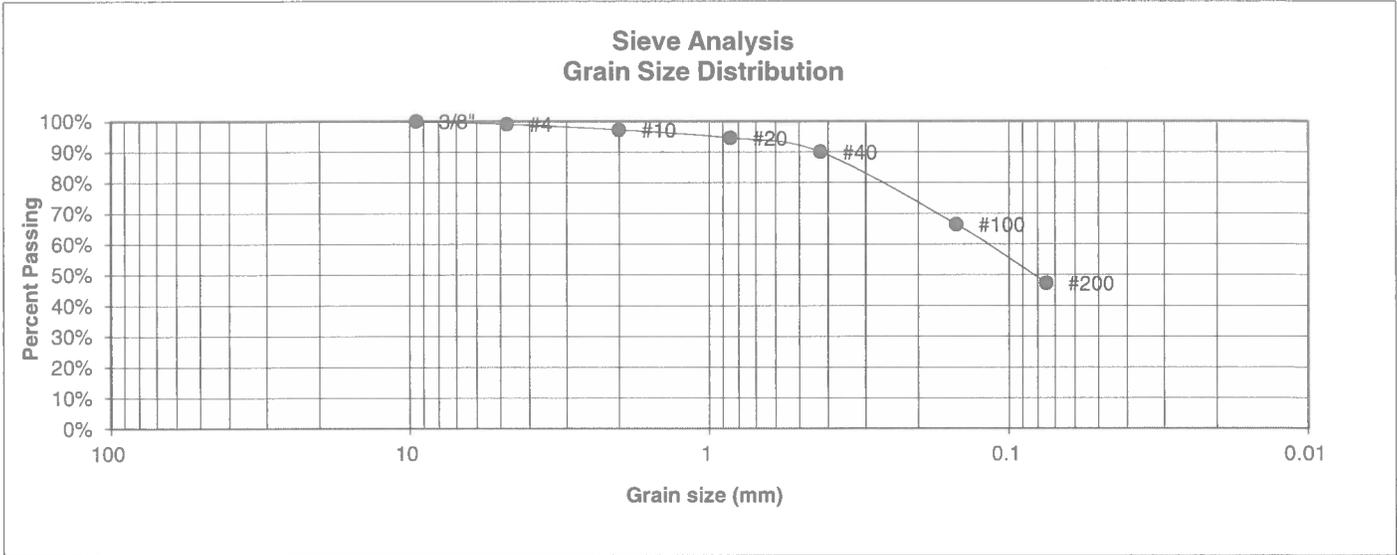
DRAWN:	DATE:	CHECKED: <i>LLL</i>	DATE: <i>3/8/22</i>
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JOB NO.:  
220404

FIG NO.:

*C-2*

UNIFIED CLASSIFICATION	SC	CLIENT	FLYING HORSE DEV.
SOIL TYPE #	1	PROJECT	FLYING HORSE NORTH, F-2
TEST BORING #	6	JOB NO.	220404
DEPTH (FT)	15	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.0%
10	97.2%
20	94.6%
40	90.0%
100	66.4%
200	47.3%

- Atterberg Limits
- Plastic Limit
- Liquid Limit
- Plastic Index
  
- Swell
- Moisture at start
- Moisture at finish
- Moisture increase
- Initial dry density (pcf)
- Swell (psf)



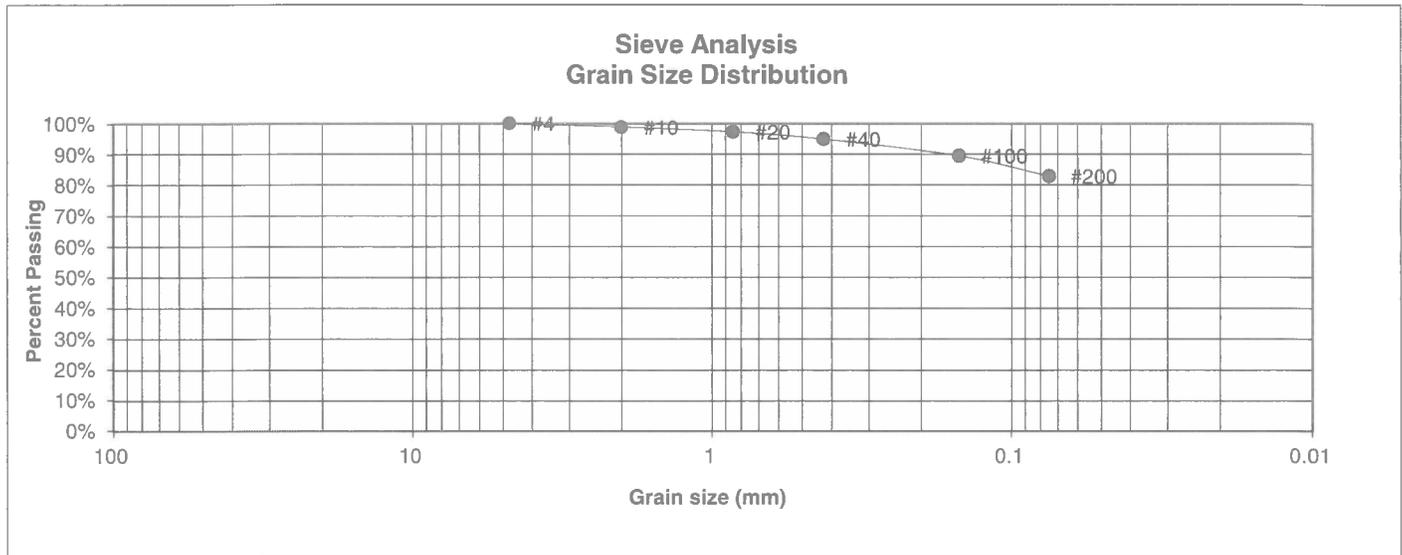
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**LABORATORY TEST RESULTS**

DRAWN:	DATE:	CHECKED: <i>LLL</i>	DATE: <i>3/8/22</i>
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JOB NO.: 220404  
FIG NO.: *C-3*

<u>UNIFIED CLASSIFICATION</u>	CL	<u>CLIENT</u>	FLYING HORSE DEV.
<u>SOIL TYPE #</u>	2	<u>PROJECT</u>	FLYING HORSE NORTH, F-2
<u>TEST BORING #</u>	3	<u>JOB NO.</u>	220404
<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"	
4	100.0%
10	98.8%
20	97.2%
40	94.9%
100	89.5%
200	82.8%

<u>Atterberg Limits</u>	
Plastic Limit	17
Liquid Limit	38
Plastic Index	21

<u>Swell</u>	
Moisture at start	7.5%
Moisture at finish	18.5%
Moisture increase	11.1%
Initial dry density (pcf)	105
Swell (psf)	930



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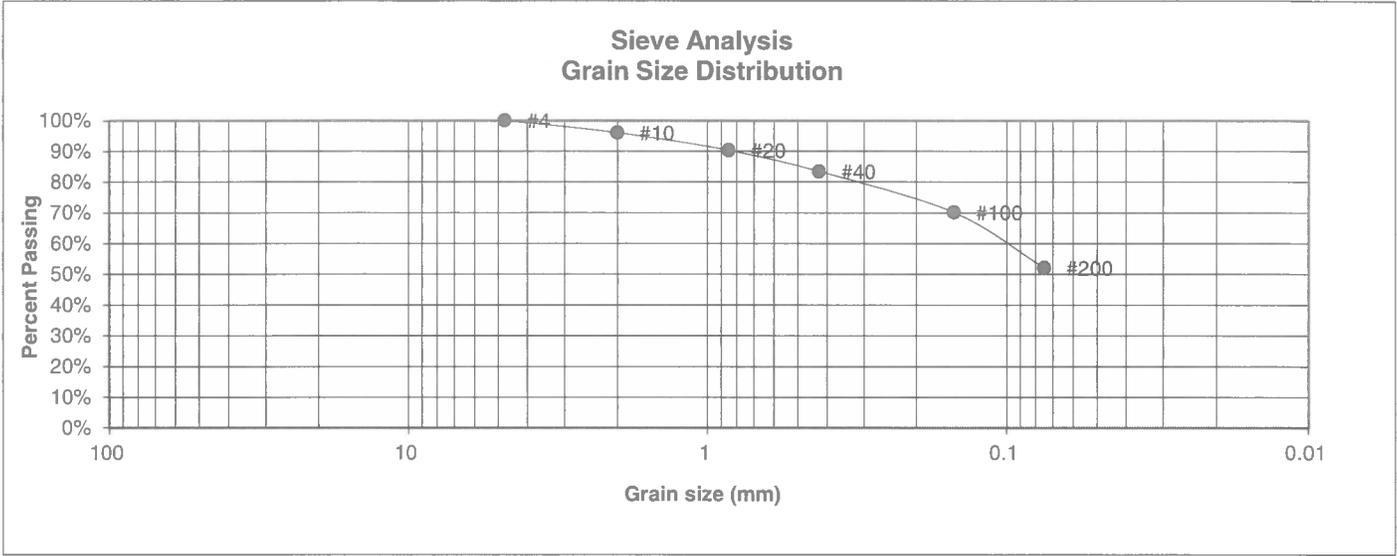
**LABORATORY TEST  
RESULTS**

DRAWN:	DATE:	CHECKED: LLL	DATE: 3/8/22
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JOB NO.:  
220404

FIG NO.:  
C-4

<u>UNIFIED CLASSIFICATION</u>	CL	<u>CLIENT</u>	FLYING HORSE DEV.
<u>SOIL TYPE #</u>	2	<u>PROJECT</u>	FLYING HORSE NORTH, F-2
<u>TEST BORING #</u>	6	<u>JOB NO.</u>	220404
<u>DEPTH (FT)</u>	2-3	<u>TEST BY</u>	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	96.0%
20	90.3%
40	83.4%
100	70.2%
200	52.1%

Atterberg Limits  
 Plastic Limit  
 Liquid Limit  
 Plastic Index

Swell

Moisture at start	11.5%
Moisture at finish	21.3%
Moisture increase	9.8%
Initial dry density (pcf)	101
Swell (psf)	270



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 COLORADO SPRINGS, COLORADO 80907

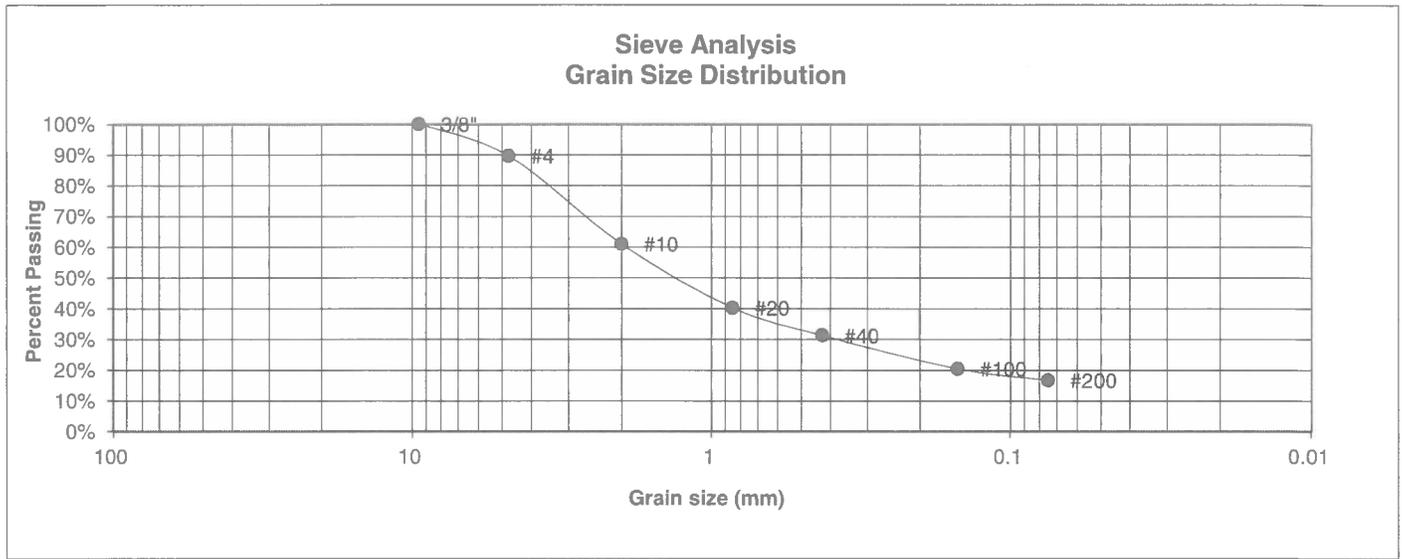
**LABORATORY TEST RESULTS**

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	3/8/22

JOB NO.:  
220404

FIG NO.:  
C-5

<u>UNIFIED CLASSIFICATION</u>	SM	<u>CLIENT</u>	FLYING HORSE DEV.
<u>SOIL TYPE #</u>	3	<u>PROJECT</u>	FLYING HORSE NORTH, F-2
<u>TEST BORING #</u>	5	<u>JOB NO.</u>	220404
<u>DEPTH (FT)</u>	20	<u>TEST BY</u>	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	89.7%
10	61.0%
20	40.3%
40	31.3%
100	20.5%
200	16.7%

Atterberg  
Limits  
Plastic Limit  
Liquid Limit  
Plastic Index

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



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**LABORATORY TEST  
RESULTS**

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DATE:

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*LLL*

DATE:  
*3/8/22*

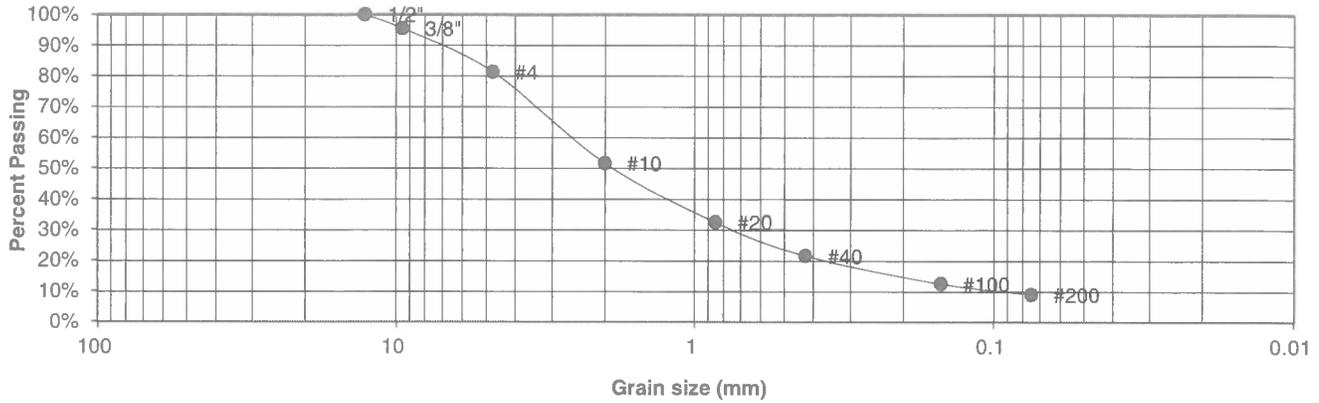
JOB NO.:  
220404

FIG NO.:

*C-6*

<u>UNIFIED CLASSIFICATION</u>	SM-SW	<u>CLIENT</u>	FLYING HORSE DEV.
<u>SOIL TYPE #</u>	3	<u>PROJECT</u>	FLYING HORSE NORTH, F-2
<u>TEST BORING #</u>	6	<u>JOB NO.</u>	220404
<u>DEPTH (FT)</u>	20	<u>TEST BY</u>	BL

**Sieve Analysis  
Grain Size Distribution**



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	95.5%
4	81.4%
10	51.6%
20	32.5%
40	21.6%
100	12.6%
200	9.1%

Atterberg Limits  
 Plastic Limit  
 Liquid Limit  
 Plastic Index

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



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505 ELKTON DRIVE  
COLORADO SPRINGS, COLORADO 80907

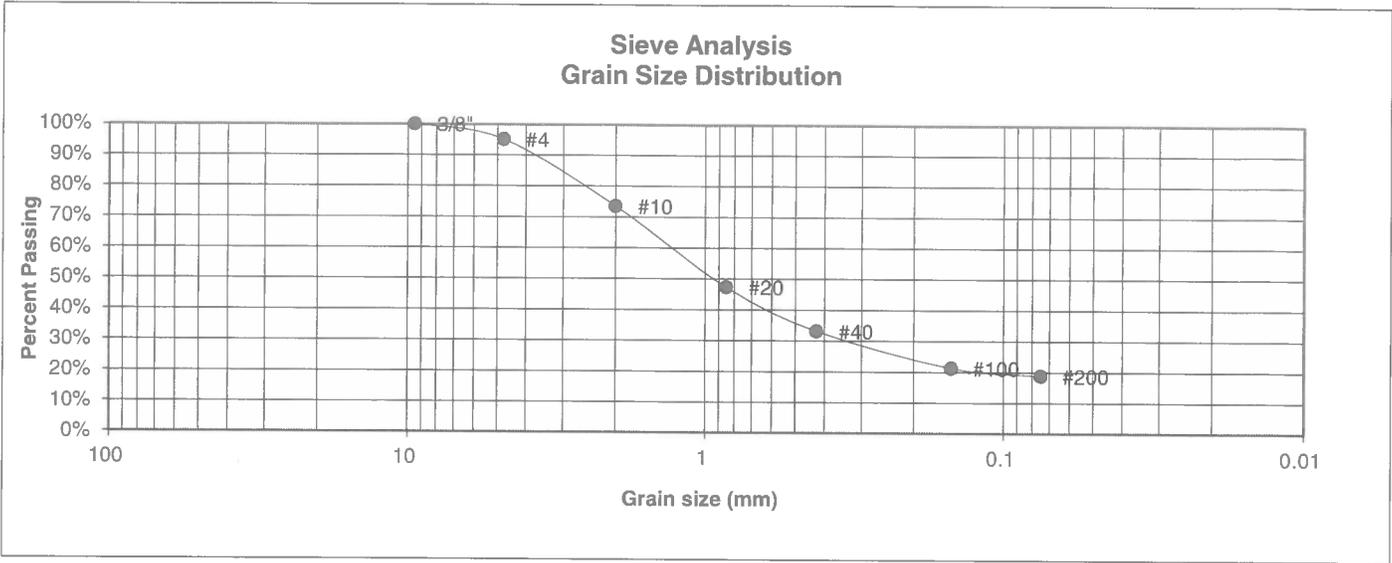
**LABORATORY TEST  
RESULTS**

<u>DRAWN:</u>	<u>DATE:</u>	<u>CHECKED:</u> LLL	<u>DATE:</u> 3/8/22
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JOB NO.:  
220404

FIG NO.:  
L-7

<u>UNIFIED CLASSIFICATION</u>	SM	<u>CLIENT</u>	FLYING HORSE DEV.
<u>SOIL TYPE #</u>	3	<u>PROJECT</u>	FLYING HORSE NORTH, F-2
<u>TEST BORING #</u>	2	<u>JOB NO.</u>	220404
<u>DEPTH (FT)</u>	5	<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	95.1%
10	73.4%
20	47.3%
40	33.1%
100	21.3%
200	18.8%

<u>Atterberg Limits</u>	
Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

<u>Swell</u>	
Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	



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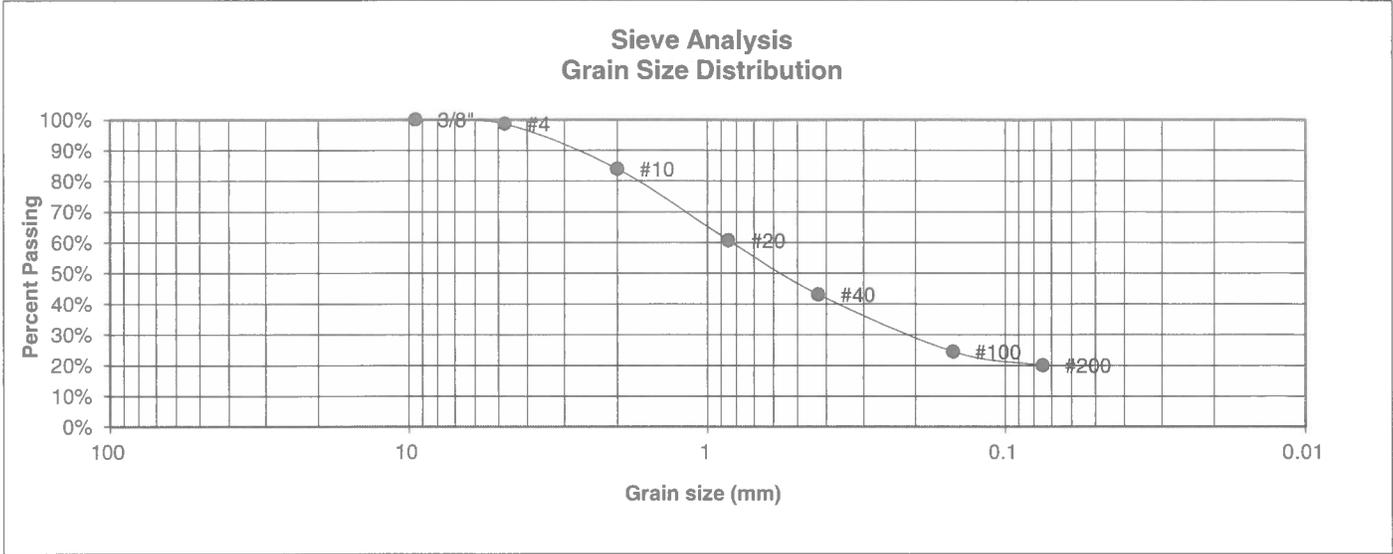
**LABORATORY TEST  
RESULTS**

<u>DRAWN:</u>	<u>DATE:</u>	<u>CHECKED:</u> LLL	<u>DATE:</u> 3/8/22
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JOB NO.:  
220404

FIG NO.:  
C-8

<u>UNIFIED CLASSIFICATION</u>	SM	<u>CLIENT</u>	FLYING HORSE DEV.
<u>SOIL TYPE #</u>	3	<u>PROJECT</u>	FLYING HORSE NORTH, F-2
<u>TEST BORING #</u>	4	<u>JOB NO.</u>	220404
<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"	100.0%
4	98.6%
10	84.0%
20	60.7%
40	43.0%
100	24.5%
200	20.0%

- Atterberg Limits
- Plastic Limit
- Liquid Limit
- Plastic Index
  
- Swell
- Moisture at start
- Moisture at finish
- Moisture increase
- Initial dry density (pcf)
- Swell (psf)



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COLORADO SPRINGS, COLORADO 80907

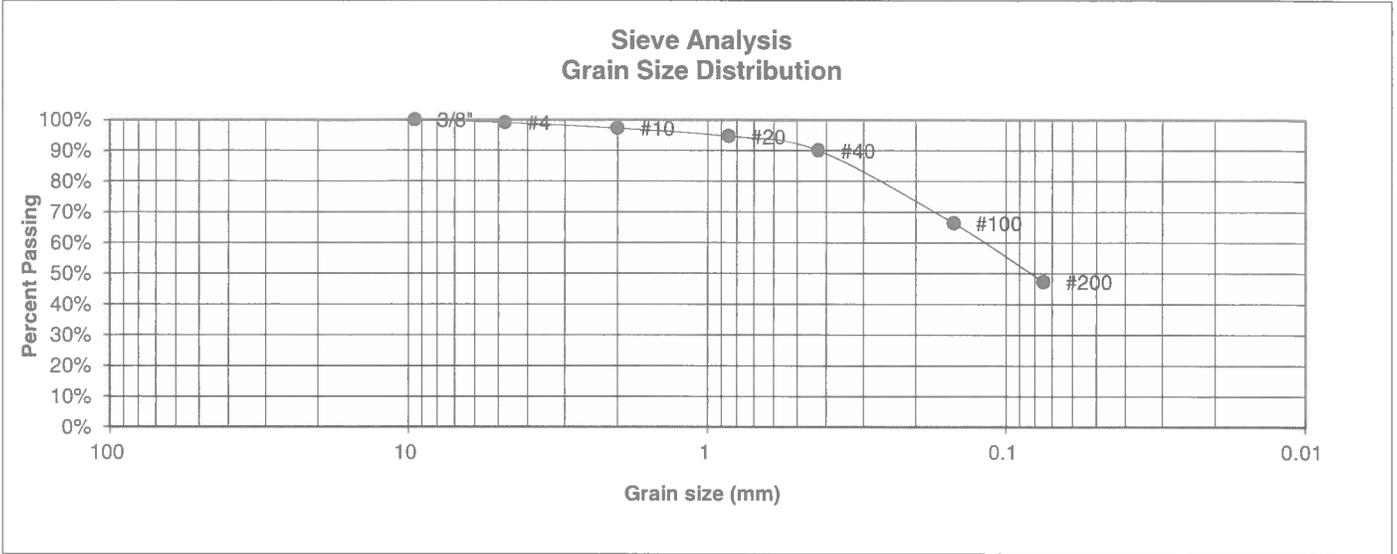
**LABORATORY TEST RESULTS**

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	3/8/22

JOB NO.:  
220404

FIG NO.:  
L-9

<u>UNIFIED CLASSIFICATION</u>	SC	<u>CLIENT</u>	FLYING HORSE DEV.
<u>SOIL TYPE #</u>	2	<u>PROJECT</u>	FLYING HORSE NORTH, F-2
<u>TEST BORING #</u>	6	<u>JOB NO.</u>	220404
<u>DEPTH (FT)</u>	15	<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	99.0%
10	97.2%
20	94.6%
40	90.0%
100	66.4%
200	47.3%

Atterberg Limits  
 Plastic Limit  
 Liquid Limit  
 Plastic Index

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



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**LABORATORY TEST  
RESULTS**

<u>DRAWN:</u>	<u>DATE:</u>	<u>CHECKED:</u> LLL	<u>DATE:</u> 3/8/22
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JOB NO.:  
220404

FIG NO.:  
C-10



**APPENDIX D: Profile Hole Logs and Laboratory Test Results  
Entech Job No. 160118/141588**

**TABLE 1**  
**SUMMARY OF LABORATORY TEST RESULTS**

CLIENT NES, INC.  
PROJECT SHAMROCK RANCH  
JOB NO. 141588

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			23.9						SM	SAND, SILTY
1	11	2-3			17.6	NV	NP	<0.01			SM	SAND, SILTY
1	14	2-3			30.8						SM	SAND, SILTY
1	5	2-3			22.3	22	3				SM	SAND, SILTY
1	9	10			19.8				152		SM	SAND, SILTY
1	12	10			36.5			0.01			SM	SAND, SILTY
2	8	10	10.8	111.7	55.5	36	12			0.3	CL	CLAY, VERY SANDY
2	2	5			61.4						CL	CLAY, VERY SANDY
2	3	2-3	11.1	116.2	84.8	32	13			0.7	CL	CLAY, SANDY
2	4	5			74.5				1485		CL	CLAY, SANDY
2	6	2-3	10.7	112.3	96.5	39	17			0.6	CL	CLAY, SANDY
2	10	5	14.3	113.6	62.5					2.7	CL	CLAY, SANDY
3	13	5			20.0						SM	SANDSTONE, SILTY
3	1	15			24.0						SM	SANDSTONE, SILTY
3	3	10			23.8	NV	NP				SM	SANDSTONE, SILTY
3	6	15			12.7						SM	SANDSTONE, SILTY
3	7	10			26.3						SM	SANDSTONE, SILTY

**Table 2: Summary of Profile Boring Test Results**

Percolation Test No.	Depth to Bedrock (ft.)	Depth to Groundwater (ft.)
1	9/11*	>15
2	>15	>15
3	9/>15*	>15
4	>15	>15
5	3/>15*	>15
6	8/10*	>15
7	11/>15*	>15
8	>15	>15
9	14	>15
10	>15	>15
11	9/11*	>15
12	11	>15
13	1	>15
14	11	>15

\* Weathered bedrock/Formational bedrock

PROFILE HOLE NO. 1  
 DATE DRILLED 1/23/2015  
 Job # 141588

PROFILE HOLE NO. 2  
 DATE DRILLED 1/23/2015  
 CLIENT NES, INC.  
 LOCATION SHAMROCK RANCH

REMARKS

REMARKS

DRY TO 15', 1/24/15

CLAY, SANDY, BROWN  
 SAND, SILTY, FINE TO COARSE  
 GRAINED, TAN, MEDIUM  
 DENSE, MOIST

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

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
0 - 5	[Symbol]		19	6.1	2
5 - 10	[Symbol]		21	4.7	1
10 - 15	[Symbol]		35	11.1	3
15 - 20	[Symbol]		50 10"	15.9	3

DRY TO 15', 1/24/15

CLAY, SANDY TO VERY SANDY,  
 BROWN TO TAN, STIFF TO FIRM,  
 MOIST

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

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
0 - 5	[Symbol]		25	7.2	2
5 - 10	[Symbol]		9	7.8	2
10 - 15	[Symbol]		22	4.9	1
15 - 20	[Symbol]		29	5.8	1



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PROFILE BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		<i>[Signature]</i>	2/2/15

JOB NO.:  
 141588  
 FIG NO.:  
 B-1

PROFILE HOLE NO. 3  
 DATE DRILLED 1/23/2015  
 Job # 141588

PROFILE HOLE NO. 4  
 DATE DRILLED 1/23/2015  
 CLIENT NES, INC.  
 LOCATION SHAMROCK RANCH

REMARKS

REMARKS

DRY TO 15', 1/24/15

CLAY, SANDY, BROWN, STIFF TO FIRM, MOIST

SAND, SILTY, TAN

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

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
0-5	[Diagonal Hatching]		24	8.2	2
5-7	[Diagonal Hatching]		13	6.8	2
7-10	[Dotted]				1
10-15	[Dotted]		40	4.1	3
15-20	[Dotted]		42	8.3	3

DRY TO 15', 1/24/15

CLAY, SANDY, TAN, STIFF, MOIST

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

CLAY, SANDY, BROWN, FIRM, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
0-5	[Diagonal Hatching]		16	8.6	2
5-7	[Diagonal Hatching]		15	9.1	2
7-10	[Dotted]				1
10-15	[Dotted]		18	8.8	1
15-20	[Diagonal Hatching]		12	18.2	2



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505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

PROFILE BORING LOG

DRAWN:	DATE:	CHECKED: <i>N</i>	DATE: 2/12/15
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JOB NO.: 141588  
 FIG NO.: B-2

PROFILE HOLE NO. 5  
 DATE DRILLED 2/2/2015  
 Job # 141588

PROFILE HOLE NO. 6  
 DATE DRILLED 1/26/2015  
 CLIENT NES, INC.  
 LOCATION SHAMROCK RANCH

REMARKS

REMARKS

DRY TO 15', 2/3/15

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

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
0-15	(Dotted pattern)				
16	(Solid black)		16	2.7	1
42	(Dotted pattern)		42	11.5	3
42	(Dotted pattern)		42	14.3	3
45	(Solid black)		45	4.4	3

DRY TO 15', 1/27/15

CLAY, SANDY, TAN, STIFF,  
 MOIST

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

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
0-15	(Diagonal lines)				
21	(Solid black)		21	22.4	2
16	(Solid black)		16	8.9	2
42	(Dotted pattern)		42	8.7	3
50 11"	(Solid black)		50 11"	4.9	3



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PROFILE BORING LOG

DRAWN: DATE: CHECKED: *W* DATE: 2/12/15

JOB NO.:

141588

FIG NO.:

B-3

PROFILE HOLE NO. 7  
 DATE DRILLED 1/26/2015  
 Job # 141588

PROFILE HOLE NO. 8  
 DATE DRILLED 2/2/2015  
 CLIENT NES, INC.  
 LOCATION SHAMROCK RANCH

REMARKS

DRY TO 15', 1/27/15  
 CLAY, SANDY, TAN, FIRM, MOIST

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

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

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

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
0-5	[Diagonal Hatching]		12	6.6	2
5-10	[Dotted]		44	7.3	2
10-15	[Dotted]		14	7.5	1
15-20	[Dotted]		46	8.8	3

REMARKS

DRY TO 15', 2/3/15  
 CLAY, SANDY TO VERY SANDY,  
 TAN, STIFF, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
0-5	[Diagonal Hatching]		15	9.0	2
5-10	[Diagonal Hatching]		28	9.2	2
10-15	[Diagonal Hatching]		24	5.7	2
15-20	[Diagonal Hatching]		29	6.9	2



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PROFILE BORING LOG

DRAWN: DATE: CHECKED: *u* DATE: 2/12/15

JOB NO.:  
 141588  
 FIG NO.:  
 B-4

PROFILE HOLE NO. 9  
 DATE DRILLED 2/3/2015  
 Job # 141588

PROFILE HOLE NO. 10  
 DATE DRILLED 2/2/2015  
 CLIENT NES, INC.  
 LOCATION SHAMROCK RANCH

REMARKS

REMARKS

DRY TO 15', 2/4/15

SAND, SILTY WITH CLAYEY LENSES,  
 FINE TO COARSE GRAINED, TAN,  
 MEDIUM DENSE TO LOOSE, MOIST

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

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
0-5	[Symbol]		24	5.6	1
5-10	[Symbol]		18	6.2	1
10-15	[Symbol]		6	8.9	1
15-20	[Symbol]		50	11.2	3

DRY TO 15', 2/5/15

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

CLAY, SANDY, TAN, VERY STIFF,  
 MOIST

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

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
0-5	[Symbol]		32	3.8	1
5-10	[Symbol]		42	9.2	2
10-15	[Symbol]		17	3.7	1
15-20	[Symbol]		6	3.3	1



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 505 ELKTON DRIVE  
 COLORADO SPRINGS, COLORADO 80907

PROFILE BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		<i>[Signature]</i>	2/12/15

JOB NO.:  
 141588  
 FIG NO.:  
 B-5

PROFILE HOLE NO. 11  
 DATE DRILLED 12/1/2014  
 Job # 141588

PROFILE HOLE NO. 12  
 DATE DRILLED 12/1/2014  
 CLIENT NES, INC.  
 LOCATION SHAMROCK RANCH

REMARKS

REMARKS

DRY TO 15', 12/2/14

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

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

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			27	6.7	1
			25	4.8	1
10			32	7.8	3
15			50 6"	10.0	3

DRY TO 15', 12/2/14

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

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

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			7	10.5	1
			22	5.6	1
10			25	8.8	1
15			50 7"	7.7	3



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 COLORADO SPRINGS, COLORADO 80907

PROFILE BORING LOG

DRAWN: DATE: CHECKED: *h* DATE: *2/12/15*

JOB NO.:

141588

FIG NO.:

B-6

PROFILE HOLE NO. 13  
 DATE DRILLED 12/1/2014  
 Job # 141588

PROFILE HOLE NO. 14  
 DATE DRILLED 1/26/2015  
 CLIENT NES, INC.  
 LOCATION SHAMROCK RANCH

REMARKS

DRY TO 15', 12/2/14

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

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
1					1
3			50	8.0	3
5			10"		
5			50	8.3	3
10			10"		
10			50	9.9	3
15			6"		
15			50	8.2	3
			4"		
20					

REMARKS

DRY TO 15', 12/2/14

SAND, SILTY TO CLAYEY, FINE TO  
 COARSE GRAINED, TAN, LOOSE,  
 MOIST

CLAY, SANDY, TAN, FIRM, MOIST  
 SAND, SILTY, FINE TO COARSE  
 GRAINED, TAN, MEDIUM DENSE,  
 MOIST

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

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
1					
4			4	12.2	1
5			9	15.2	2
10			12	14.4	1
15			50	8.8	3
			6"		
20					



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PROFILE BORING LOG

DRAWN:	DATE:	CHECKED: <i>aw</i>	DATE: 2/12/15
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JOB NO.: 141588  
 FIG NO.: B-7

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

## El Paso County Area, Colorado

### 14—Brussett loam, 1 to 3 percent slopes

#### Map Unit Setting

*National map unit symbol:* 367j  
*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:* Flats  
*Landform position (three-dimensional):* Talf  
*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:* 1 to 3 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 supply, 0 to 60 inches:* High (about 9.1 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified  
*Land capability classification (nonirrigated):* 3c  
*Hydrologic Soil Group:* B  
*Ecological site:* R048AY222CO - Loamy Park  
*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 19, Aug 31, 2021

## El Paso County Area, Colorado

### 26—Elbeth sandy loam, 8 to 15 percent slopes

#### Map Unit Setting

*National map unit symbol:* 367y

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

*Farmland 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:* 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 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 supply, 0 to 60 inches:* Moderate (about 7.1 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 4e

*Hydrologic Soil Group:* B

*Ecological site:* F048AY908CO - Mixed Conifer

*Hydric soil rating:* No

#### Minor Components

##### Pleasant

*Percent of map unit:*

*Landform:* Depressions  
*Hydric soil rating:* Yes

**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 19, Aug 31, 2021

## El Paso County Area, Colorado

### 66—Peyton sandy loam, 1 to 5 percent slopes

#### Map Unit Setting

*National map unit symbol:* 369c

*Elevation:* 6,800 to 7,600 feet

*Farmland classification:* Prime farmland if irrigated and the product of  
I (soil erodibility) x C (climate factor) does not exceed 60

#### Map Unit Composition

*Peyton and similar soils:* 85 percent

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

#### Description of Peyton

##### Setting

*Landform:* Hills, flats

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

*Down-slope shape:* Linear

*Across-slope shape:* Linear

*Parent material:* Arkosic alluvium derived from sedimentary rock  
and/or arkosic residuum weathered from sedimentary rock

##### Typical profile

*A - 0 to 12 inches:* sandy loam

*Bt - 12 to 25 inches:* sandy clay loam

*BC - 25 to 35 inches:* sandy loam

*C - 35 to 60 inches:* sandy loam

##### Properties and qualities

*Slope:* 1 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

*Available water supply, 0 to 60 inches:* Moderate (about 7.3  
inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 4c

*Hydrologic Soil Group:* B

*Ecological site:* R049XY216CO - Sandy Divide

*Hydric soil rating:* No

### **Minor Components**

#### **Pleasant**

*Percent of map unit:*

*Landform:* Depressions

*Hydric soil rating:* Yes

#### **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 19, Aug 31, 2021

## El Paso County Area, Colorado

### 67—Peyton sandy loam, 5 to 9 percent slopes

#### Map Unit Setting

*National map unit symbol:* 369d

*Elevation:* 6,800 to 7,600 feet

*Mean annual air temperature:* 43 to 45 degrees F

*Frost-free period:* 115 to 125 days

*Farmland classification:* Not prime farmland

#### Map Unit Composition

*Peyton and similar soils:* 85 percent

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

#### Description of Peyton

##### Setting

*Landform:* Hills

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

*Down-slope shape:* Linear

*Across-slope shape:* Linear

*Parent material:* Arkosic alluvium derived from sedimentary rock and/or arkosic residuum weathered from sedimentary rock

##### Typical profile

*A - 0 to 12 inches:* sandy loam

*Bt - 12 to 25 inches:* sandy clay loam

*BC - 25 to 35 inches:* sandy loam

*C - 35 to 60 inches:* sandy loam

##### Properties and qualities

*Slope:* 5 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 (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 supply, 0 to 60 inches:* Moderate (about 7.3 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 4e

*Hydrologic Soil Group:* B

*Ecological site:* R049XY216CO - Sandy Divide

*Hydric soil rating:* No

### **Minor Components**

#### **Pleasant**

*Percent of map unit:*

*Landform:* Depressions

*Hydric soil rating:* Yes

#### **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 19, Aug 31, 2021

## El Paso County Area, Colorado

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

#### Map Unit Setting

*National map unit symbol:* 369f

*Elevation:* 6,800 to 7,600 feet

*Farmland classification:* Not prime farmland

#### Map Unit Composition

*Peyton and similar soils:* 40 percent

*Pring and similar soils:* 30 percent

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

#### Description of Peyton

##### Setting

*Landform:* Hills

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

*Down-slope shape:* Linear

*Across-slope shape:* Linear

*Parent material:* Arkosic alluvium derived from sedimentary rock and/or arkosic residuum weathered from sedimentary rock

##### Typical profile

*A - 0 to 12 inches:* sandy loam

*Bt - 12 to 25 inches:* sandy clay loam

*BC - 25 to 35 inches:* sandy loam

*C - 35 to 60 inches:* sandy loam

##### Properties and qualities

*Slope:* 3 to 5 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Well drained

*Runoff class:* Low

*Capacity of the most limiting layer to transmit water*

*(Ksat):* Moderately high (0.20 to 0.60 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water supply, 0 to 60 inches:* Moderate (about 7.3 inches)

##### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 4c

*Hydrologic Soil Group:* B

*Ecological site:* R049XY216CO - Sandy Divide

*Hydric soil rating:* No

## Description of Pring

### Setting

*Landform:* Hills

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

*Down-slope shape:* Linear

*Across-slope shape:* Linear

*Parent material:* Arkosic alluvium derived from sedimentary rock

### Typical profile

*A - 0 to 14 inches:* coarse sandy loam

*C - 14 to 60 inches:* gravelly sandy loam

### Properties and qualities

*Slope:* 3 to 8 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Well drained

*Runoff class:* Low

*Capacity of the most limiting layer to transmit water (Ksat):* High  
(2.00 to 6.00 in/hr)

*Depth to water table:* More than 80 inches

*Frequency of flooding:* None

*Frequency of ponding:* None

*Available water supply, 0 to 60 inches:* Low (about 6.0 inches)

### Interpretive groups

*Land capability classification (irrigated):* None specified

*Land capability classification (nonirrigated):* 3e

*Hydrologic Soil Group:* B

*Ecological site:* R048AY222CO - Loamy Park

*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 19, Aug 31, 2021