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SOIL, GEOLOGY, GEOLOGIC HAZARD, AND WASTEWATER STUDY, FLYING HORSE NORTH FILING NO. 1 EL PASO COUNTY, COLORADO

Prepared for

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**SOIL, GEOLOGY, GEOLOGIC HAZARD,
AND WASTEWATER STUDY,
FLYING HORSE NORTH
FILING NO. 1
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1.0 SUMMARY

Project Location

The project consists of Section 36, and portions of the N ½ of Sections 34 and 35, Township 11 South, Range 66 West and portions of Sections 30 and 31, Township 11 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado. The site is located approximately 4 miles southeast of Monument, Colorado.

Project Description

Total acreage involved in Filing No. 1 the project is approximately 552 acres. The proposed site development consists of single-family rural residential lots with areas of open space, parks, a golf course and detention ponds. The development will utilize individual wells and on-site wastewater treatment systems.

Scope of Report

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

Land Use and Engineering Geology

This site was found to be suitable for the proposed development. Areas were encountered where the geologic conditions will impose some constraints on development and land use. These include areas of 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, and portions of the N ½ of Sections 34 and 35, Township 11 South, Range 66 West, and portions of Sections 30 and 31, Township 11 South, Range 65 West of the 6th 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 earthern dams. The site boundaries are indicated on the USGS Map, Figure 2. Previous land uses have included grazing and pasture land. The site contains primarily field grasses and weeds 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 Filing No. 1 of the proposed development is approximately 552 acres. Single-family rural residential lots are proposed with areas of open space, parks, a golf course and detention pads. The total number of lots in Filing No. 1 is 80. Lot sizes are 2.5 acres or larger. The area will be serviced by individual wells and on-site wastewater treatment systems. The proposed Development Plan is presented in Figure 3.

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 the following:

- A general geologic analysis utilizing published geologic data. Detailed site-specific mapping will be conducted to obtain general information in respect to major geographic and geologic features, geologic descriptions and their effects on the development of the property.
- The site will be evaluated for individual on-site wastewater treatment systems in accordance with El Paso Land Development Code.

4.0 FIELD INVESTIGATION

Our field investigation consisted of the preparation of a geologic map of any bedrock features and significant surficial deposits. The Natural Resource Conservation Service (NRCS), previously the Soil Conservation Service (SCS) survey 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. Site photographs are included in Appendix A.

Six (6) test borings were drilled as a part of a preliminary subsurface soil investigation to determine the soils classification and engineering characteristics. The borings were drilled to

depths of 15 to 20 feet using a truck-mounted, continuous flight auger drilling rig supplied and operated by Entech Engineering, Inc.

Eleven (11) tactile test pits were excavated and the soils evaluated to determine general suitability of the site for the use of on-site wastewater treatment system (OWTS). Additionally, fourteen (14) percolation tests were performed on the entire Flying Horse North property in previous studies. Four (4) of these percolation tests were conducted on Filing No. 1.

The locations of the Test Borings, Test Pits, and Test Pit Logs, and Percolation Tests are indicated on the Development Plan/Test Location Map, Figure 3. The Test Boring Logs, Test Pit Logs, and Profile Hole Logs are presented in Appendices B, C, and D, respectivily. 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 B, 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 six soil types on the site (Figure 4). In general, they vary from sandy loam to loam and sandy loam with subsoils of clay loam. The soils are described as follows:

Type	Description
14	Brussett loam, 1-3% slopes
26	Elbeth sandy loam, 8-15% slopes
41	Kettle gravelly loamy sand, 8-40% 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 and Monument Quadrangles Geology Maps showing the site is presented in Figure 5 (References 6 and 7). The Geology Map prepared for the site is presented in Figure 6. 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 and Monument Quadrangles* distributed by the Colorado Geological Survey in 2003 (References 6 and 7), 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 $1^0 \times 2^0$ Quadrangle*, distributed by the US Geological Survey in 1981 (Reference 9). The Test Borings from the profile holes were also used in evaluating the site and are included in Appendix B. The Geology Map prepared for the site is presented in Figure 6.

5.4 Soil Conditions

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

Soil Type 1 is a silty sand (SM), encountered in all of the test borings at the existing ground surface and extending to depths ranging from 9 feet to the termination of the borings (20 feet). This material is associated with highly weathered to weathered Dawson Sandstone. These

materials were encountered at medium dense to dense states and at moist conditions. Samples tested had 13 to 19 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 consists of silty to clayey sandstone (SM, SC). This material is associated with formational Dawson Sandstone. This material was encountered in five of the test borings at depths ranging from 9 to 17 feet bgs and extending to the termination of the borings (15 to 20 feet). The sandstone was encountered at very dense states and at moist conditions. The samples tested had 17 to 24 percent of the soil size particles passing the No. 200 sieve. Atterberg limits testing on a sample of clayey sandstone resulted in a liquid limit of 36 and a plastic index of 13. The silty sandstone typically exhibits low expansive potential. Expansive clayey sandstone and claystone 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 C and summarized in Table 3.

5.5 Groundwater

Groundwater was not encountered in any of the test borings which were drilled to 15 to 20 feet. Areas of seasonal and 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 6). This map shows the location of various geologic conditions of which the developers should be cognizant during the planning, design and construction stages of the project. These hazards and the recommended mitigation techniques are as follows:

Artificial Fill

These are 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

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

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

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. 08041CO295F, 08041CO315F, and 08041CO325F dated March 17, 1997 (Figure 8, Reference 11). A minor area in the extreme northern portion of the Flying Horse North PUD is mapped on a floodplain. This area is not located in Fling No. 1 and will be addressed in future filings. 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

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

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

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 rural residential. 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. The site does not lie within any floodplain zones according to FEMA Map Nos. 08041CO295F, 08041CO315F and 08041CO325F, dated March 17, 1997 (Figure 8, Reference 11). A floodplain is mapped in the extreme northern portion of the Flying Horse North PUD. This area does not lie within Filing No. 1 of the subdivision and will be addressed in future filings. 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 gullying 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 ON-SITE WASTEWATER TREATMENT

The site was evaluated for individual on-site wastewater treatment systems in accordance with El Paso Land Development Code. Eleven tactile test pits were excavated in Filing No.1. Fourteen (14) percolation tests were previously conducted within the entire Flying Horse North Subdivision (References 1 and 2). Four of these percolation tests were performed on Filing No. 1. The test pits may not be located in the exact areas of proposed systems. The approximate locations of the test pits and percolation tests are indicated on Figure 3 and the Septic Suitability Maps Figures 10, 10A, 10B, and 10C. A table showing the results of the Tactile Test Pit results is presented in Table 4. A table showing the results of the percolation tests is presented in Table 5 (References 1 and 2).

The Natural Resource Conservation Service (Reference 4), previously the Soil Conservation Service (Reference 5) has been mapped with 5 soil descriptions. The Soil Survey Map (Reference 4) is presented in Figure 4, and the Soil Survey Descriptions are presented in Appendix E. The soils are described as having moderate to rapid percolation rates.

Soils and bedrock encountered in the tactile test pits consisted of loamy sandy, sandy loam to gravelly sandy loam, sandy clay loam, sandy clay with underlying weathered to formational silty to clayey sandstone. The limiting layers encountered in the test pits are the sandy clay loam, sandy clay, and silty to clayey sandstone, which corresponds to LTAR values of 0.30 to 0.15 gallons per day per square foot. The conditions encountered in the eleven test pits would require engineered system. The weathered to formational bedrock was encountered at depths ranging from 3 to 7 feet bgs. The majority of the soils and bedrock encountered are associated with highly weathered to weathered Dawson Sandstone. Conventional septic systems do not perform adequately in the highly weathered and weathered Dawson Sandstone. Groundwater was not observed in the test pits, however; signs of seasonally high moisture conditions were observed at depths ranging from 3 to 6 feet bgs in four of the eleven test pits.

The individual percolation test results from the previous Soil, Geology, Geologic Hazard and Wastewater Study performed on the entire Flying Horse North Subdivision (References 1 and 2) ranged from 34 minutes per inch to 240 minutes per inch. Most of the percolation rates were slower than 60 minutes per inch or had shallow bedrock which would require designed systems.

Absorption fields must be maintained a minimum of 4 feet above groundwater. Groundwater was not encountered in any of the test borings, or profile holes which were excavated to 8 feet or drilled to depths of 15 to 20 feet. Signs of seasonally occurring high moisture conditions were observed in four test pits at depths ranging from 3 to 6 feet bgs. Should any be encountered within 6 feet of the surface, designed systems will be required.

Conditions encountered in the tactile test pits would require designed systems. El Paso County guidelines require designed systems for percolation rates that exceed Soil Type 3. Bedrock was encountered in eight of the test pits at depths that would affect conventional systems. Other areas of the site may also contain shallow bedrock. Where bedrock is encountered shallower than 6 feet, designed systems will be required. Septic Suitability Maps are presented in Figures 10, 10A, 10B, and 10C. A possible house location, two potential on-site wastewater treatment systems (OWTS) and a possible well location for each lot are indicated on Figures 10, 10A, 10B, and 10C. On-site wastewater systems are not recommended in drainage areas where the potential exits for shallow groundwater. In areas where suitable soil conditions cannot be found,

shallow groundwater exists or shallow bedrock exists, designed systems will be required. It is anticipated designed systems will be required on a majority of the lots.

In summary, it is our opinion the site is suitable for individual tactile on-site wastewater treatment systems (OWTS) and that contamination of surface and subsurface water resources should not occur provided the OWTS sites are evaluated and installed according to El Paso County and State Guidelines and properly maintained. Individual tactile test pits (two (2) minimum) will be required on each lot prior to construction. Systems must be located a minimum of 100 feet from any well, including those on adjacent properties. Absorption fields also be located a minimum of 50 feet from any active flowing drainages, floodplains or ponded areas and 25 feet from dry gulches.

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 Pulpit Rock Investments No. 2, LLC for application to the proposed project in accordance with generally accepted geologic soil and engineering practices. No other warranty expressed or implied is made.

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

BIBLIOGRAPHY

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TABLES

TABLE 1

SUMMARY OF LABORATORY TEST RESULTS FROM TEST BORINGS

CLIENT PULPIT ROCK, LLC
PROJECT FLYING HORSE NORTH
JOB NO. 171606

SOIL TYPE*	TEST BORING NO.	DEPTH (FT)	WATER (%)	DRY DENSITY (PCF)	PASSING NO. 200 SIEVE (%)	LIQUID LIMIT (%)	PLASTIC INDEX (%)	SULFATE (WT %)	FHA SWELL (PSF)	SWELL/ CONSOL (%)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION
1	1	2-3			12.9	NV	NP				SM	SAND, SILTY
1	2	10			18.7			<0.01			SM	SAND, SILTY
1	6	5			16.9				300		SM	SAND, SILTY
2	3	10			19.3	36	13				SC	SANDSTONE, CLAYEY
2	4	15			16.7			0.0			SM	SANDSTONE, SILTY
2	5	15			24.3						SM	SANDSTONE, SILTY

* - Soil type numbers based on Unified Soil Classification System (USCS)

TABLE 2

SUMMARY OF LABORATORY TEST RESULTS FROM OWTS TEST PITS

CLIENT PULPIT ROCK, LLC
PROJECT FLYING HORSE NORTH
JOB NO. 171606

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
1	1	3			5.9						SM-SW	LOAMY SAND
1	6	4			16.7						SM	LOAMY SAND
3A	8	4			47.2	26	12				SC	SANDY CLAY LOAM
4	10	3-4			86.7						CL	SANDY CLAY
4	11	2			64.3	26	12				CL	SANDY CLAY
4A	2	7			21.7	34	19				SC	SANDSTONE, CLAYEY
4A	7	8			15.3	NV	NP				SM	SANDSTONE, SILTY
4A	9	6			16.8						SM	SANDSTONE, SILTY

* - Soil type numbers based on USDA Classification system

TABLE 3

SUMMARY OF LABORATORY TEST RESULTS FROM PROFILE HOLES, ENTECH JOB NO. 160118

CLIENT PULPIT ROCK INVESTMENTS, LLC
PROJECT SHAMROCK RANCH
JOB NO. 160118

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,S ILTY
3	7	10			26.3						SM	SANDSTONE, SILTY

Table 4: Summary of Tactile Test Pit Results

Test Pit No.	USDA Soil Type Limiting Layer	LTAR Value	Depth to Bedrock (ft.)	Depth to Seasonally Occurring Groundwater (ft.)
1	3A*	0.30	7	N/A
2	4A*	0.15	6*	6*
3	4A*	0.15	3*	3*
4	4A*	0.15	5*	N/A
5	4A*	0.15	N/A	N/A
6	4A*	0.15	5*	N/A
7	4A*	0.15	7	N/A
8	3A*	0.30	N/A	N/A
9	4A*	0.15	4*	4*
10	4A*	0.15	N/A	N/A
11	4A*	0.15	3*	6*

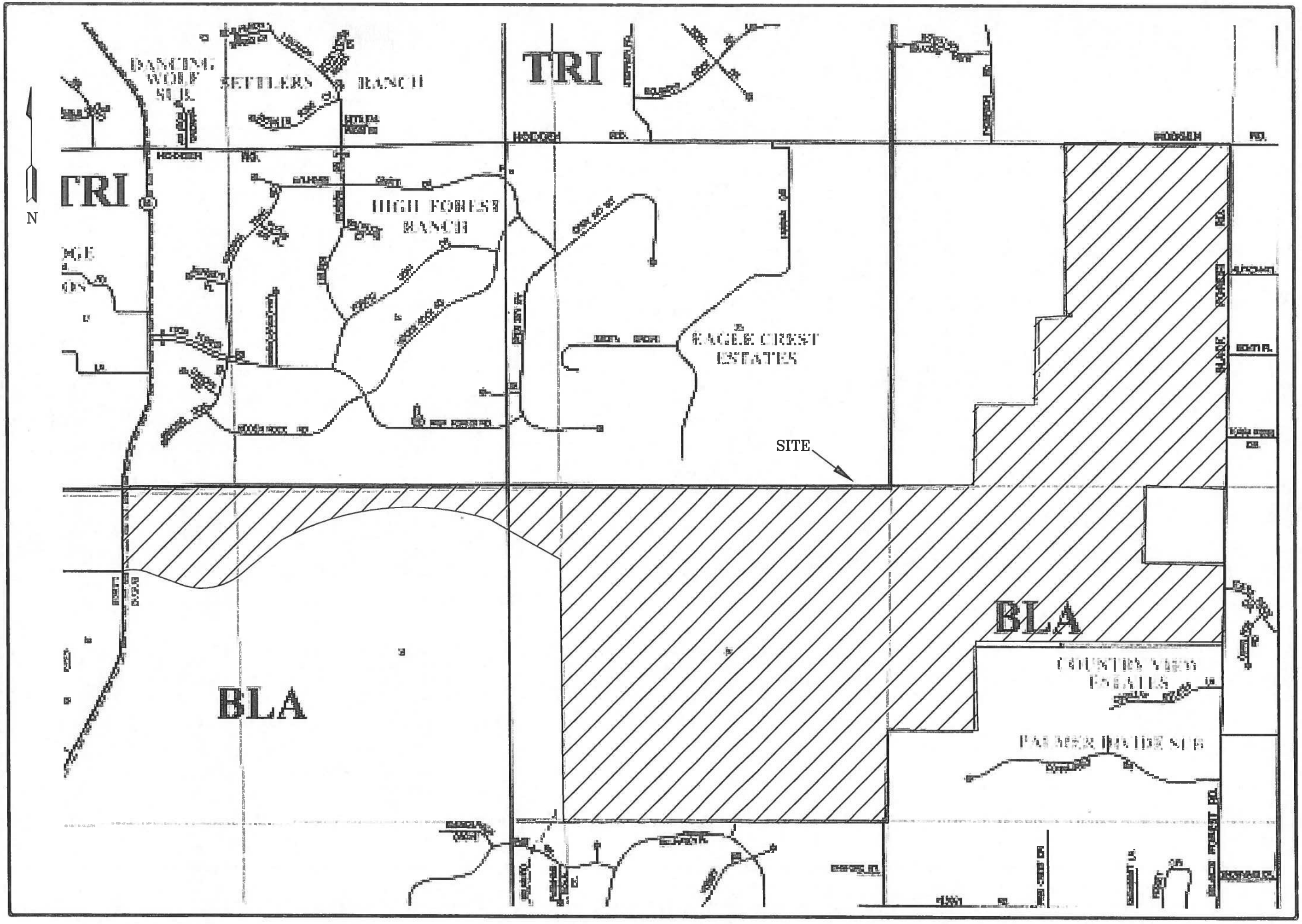
*- Conditions that will require an engineered OWTS

Table 5: Summary of Percolation Test Results from Entech Job No. 160118

Percolation Test No.	Percolation Rate (min/in)	Depth to Bedrock (ft.)	Depth to Groundwater (ft.)
1	6.3	9/11*	>15
2	240	>15	>15
3	67	9/>15*	>15
4	80	>15	>15
5	240	3/>15*	>15
6	187	8/10*	>15
7	240	11/>15*	>15
8	240	>15	>15
9	134	14	>15
10	111	>15	>15
11	40	9/11*	>15
12	67	11	>15
13	34	1	>15
14	76	11	>15

* Weathered bedrock/Formational bedrock

FIGURES



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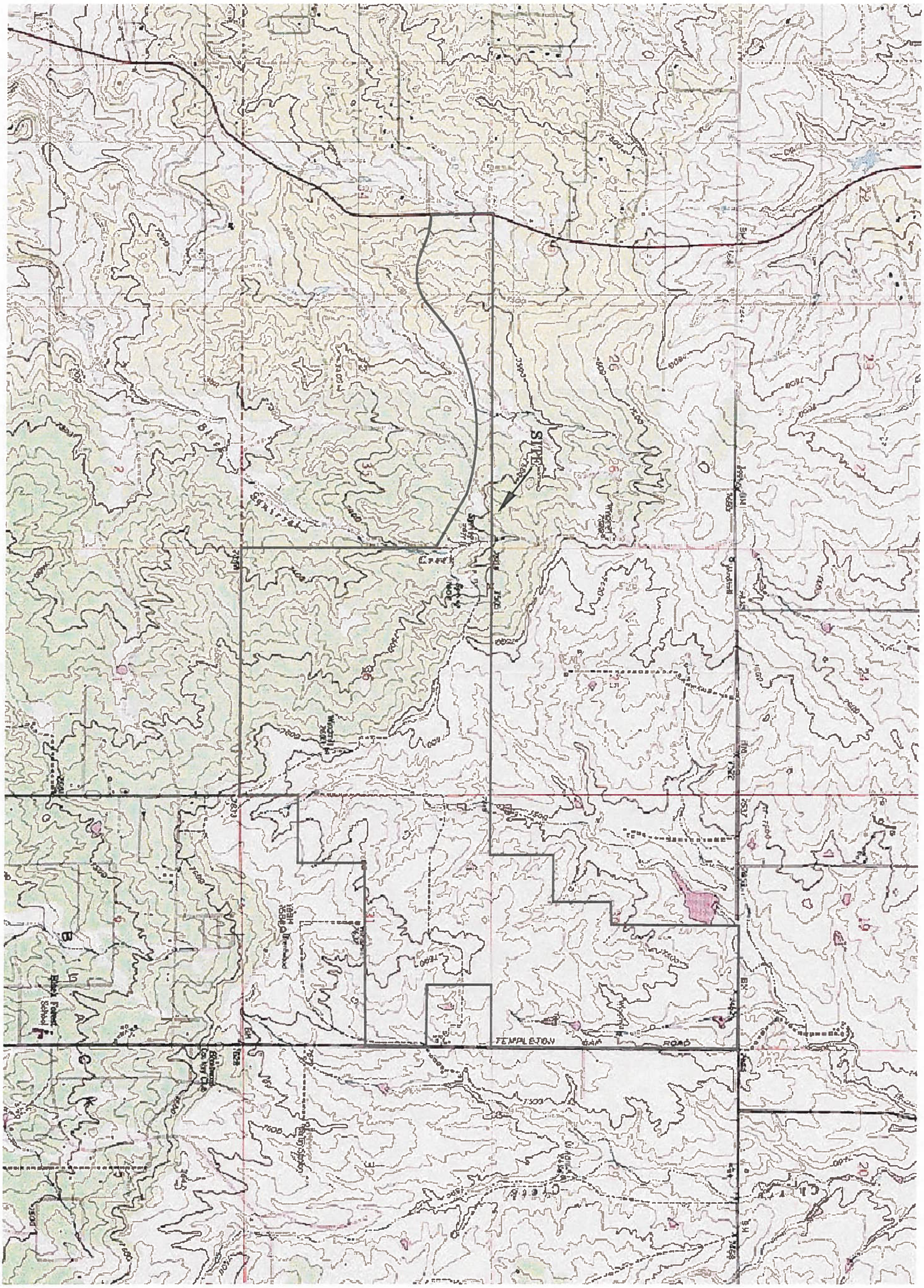
Vicinity Map
Flying Horse North
El Paso County, CO.

DRAWN	KAH
CHECKED	
DATE	2/12/16
SCALE	AS SHOWN
JOB NO.	171606
FIGURE No.	1



DRAWN	KAB
CHECKED	
DATE	2/12/16
SCALE	AS SHOWN
JOB NO.	171806
FIGURE No.	2

USGS Map
Flying Horse North
El Paso County, CO.

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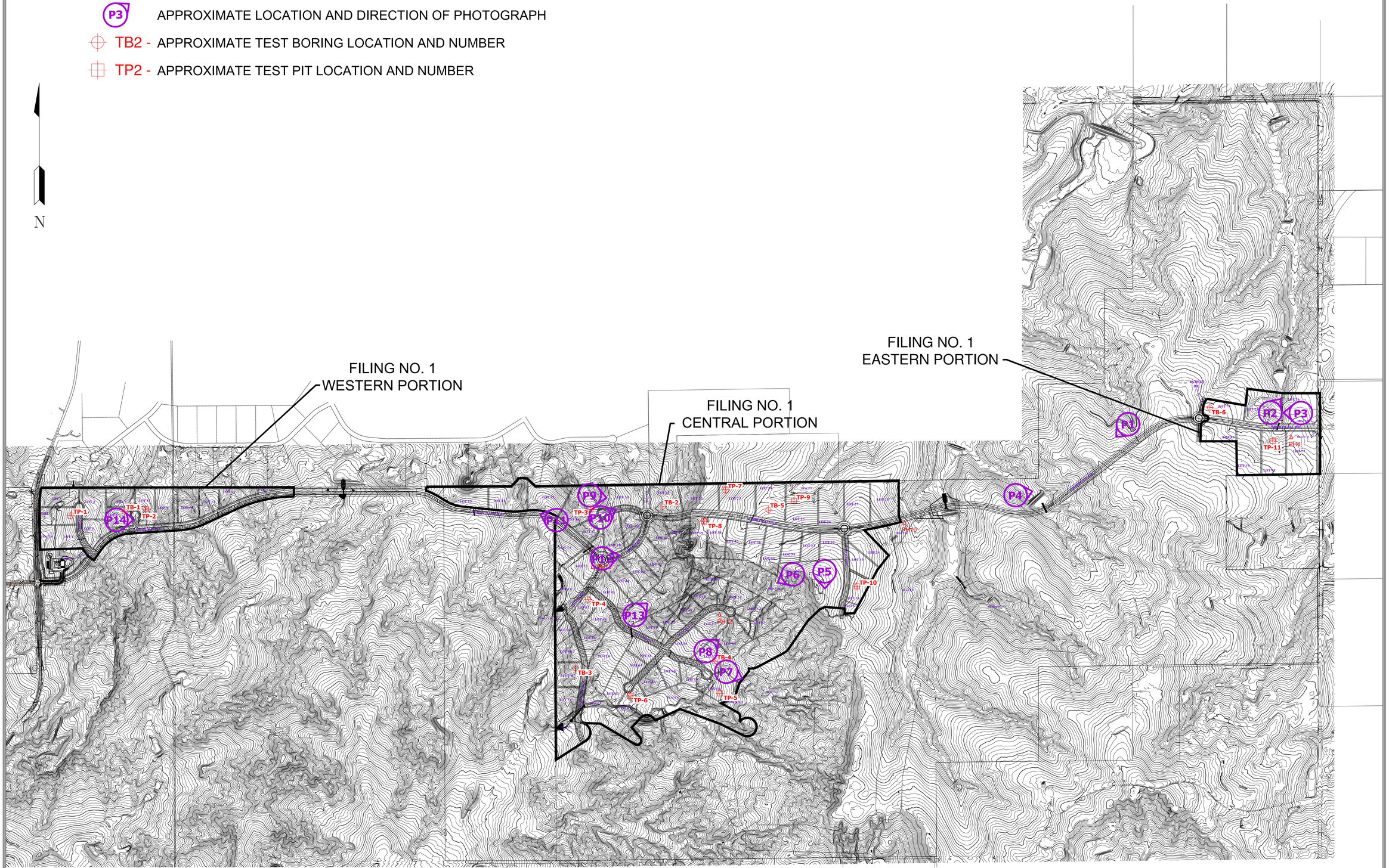
Δ PH14 - APPROXIMATE LOCATION OF PERCOLATION TEST

P3 APPROXIMATE LOCATION AND DIRECTION OF PHOTOGRAPH

TB2 - APPROXIMATE TEST BORING LOCATION AND NUMBER

TP2 - APPROXIMATE TEST PIT LOCATION AND NUMBER

N



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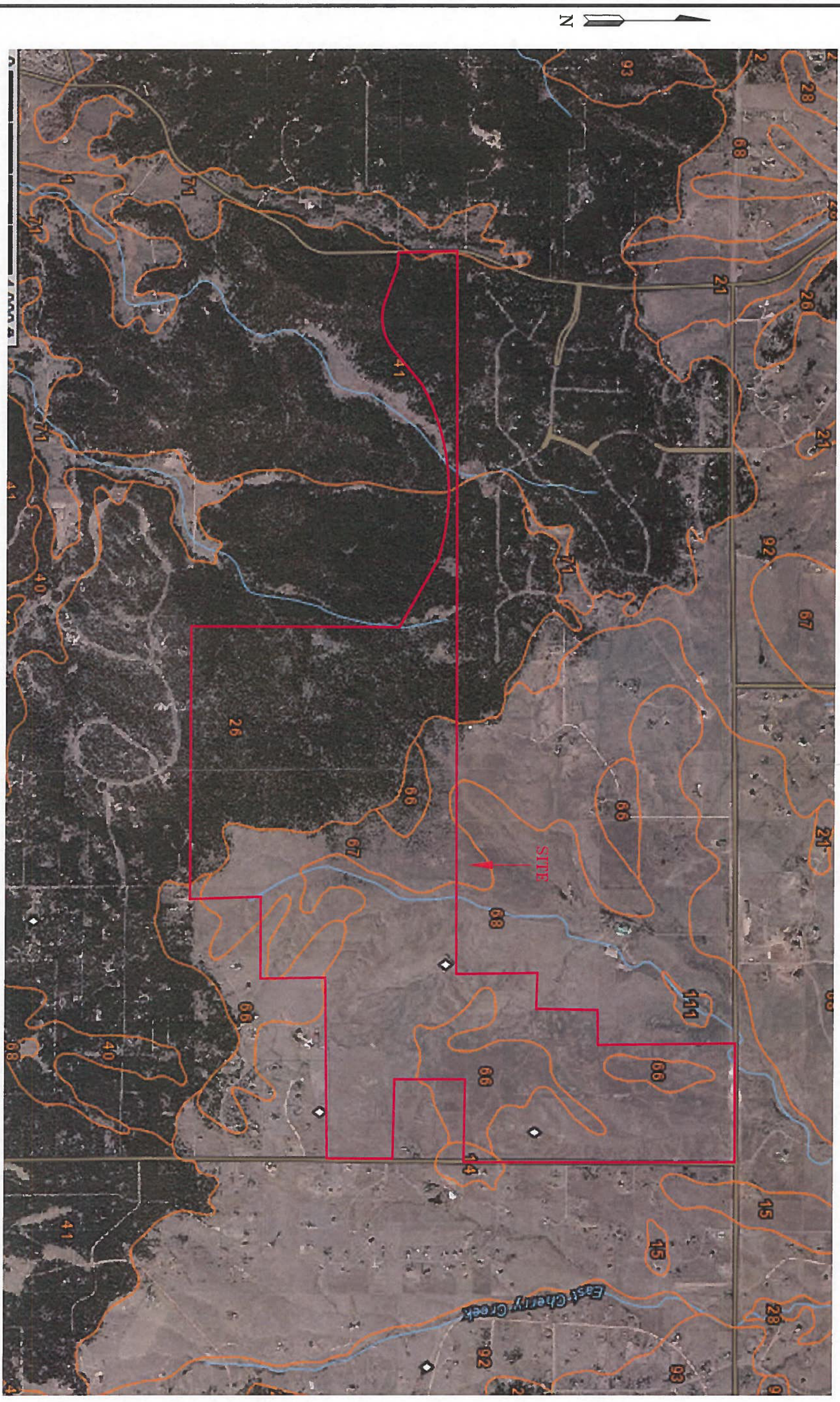
DEVELOPMENT PLAN/
TEST LOCATION MAP
FLYING HORSE NORTH
EL PASO COUNTY, CO
FOR: PULPIT ROCK, LLC

DRAWN	TLC
CHECKED	KAH
DATE	11/20/17
SCALE	1' = 600'
JOB NO.	171606
FIGURE No.	3



Soil Survey Map
Flying Horse North
El Paso County, CO.

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DRAWN KAH
CHECKED
DATE 2/12/10
SCALE AS SHOWN
JOB NO. 171606
FIGURE No. 4

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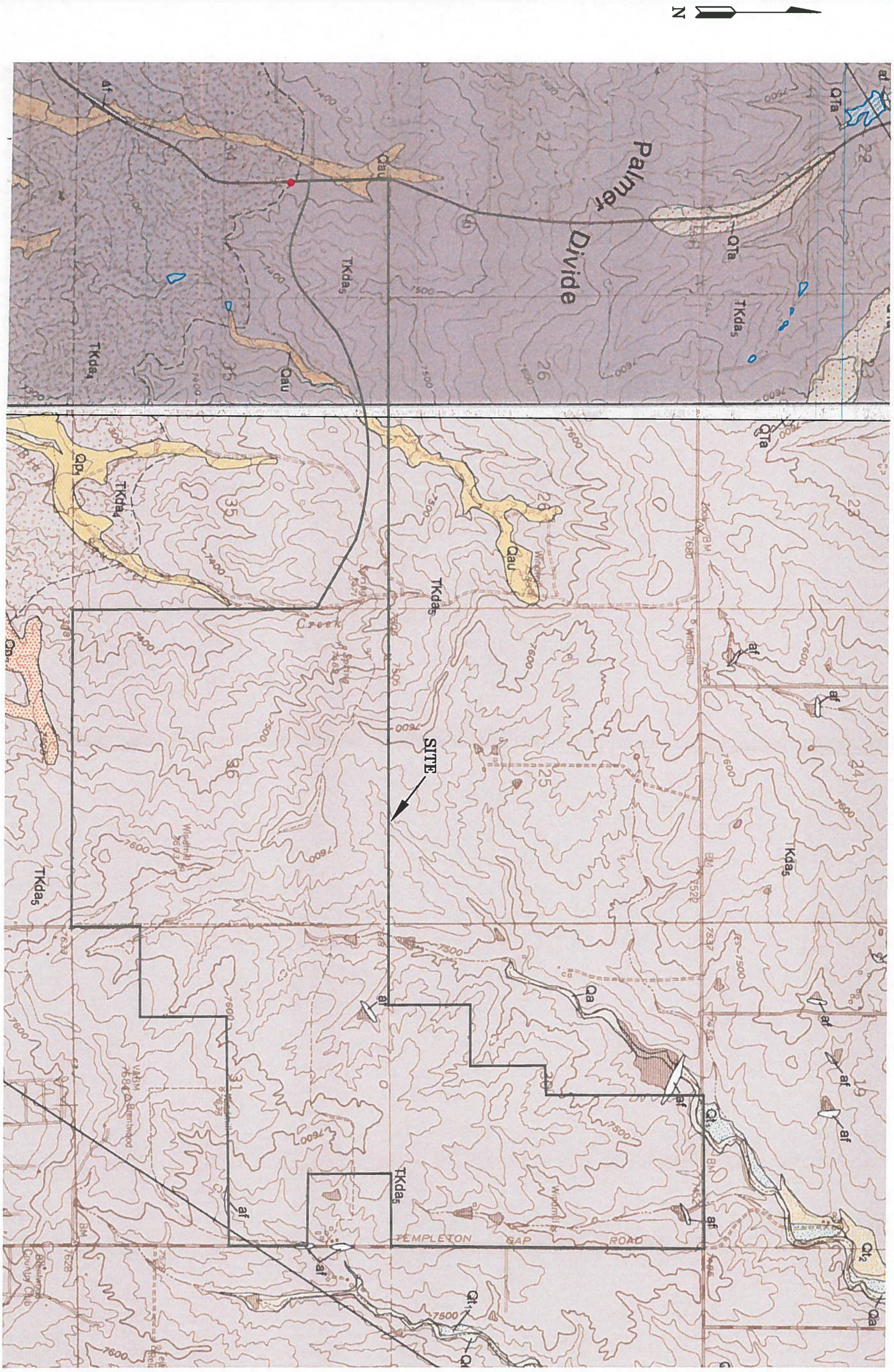

DRAWN	KAH
CHECKED	
DATE	2/12/16
SCALE	AS SHOWN
JOB NO.	171606
FIGURE No.	5

Mounment/Black Forest Quadrangle
Geology Map
Flying Horse North
El Paso County, CO.

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N

LEGEND

Qaf - Artificial Fill of Holocene Age:
Man-made fill deposits.

Qal - Recent Alluvium of Holocene Age:
Recent water deposited materials

Tkd - Dawson Formation of Tertiary and Cretaceous Age:
Arkosic sandstone with siltstone and claystone lenses

dsc - downslope creep

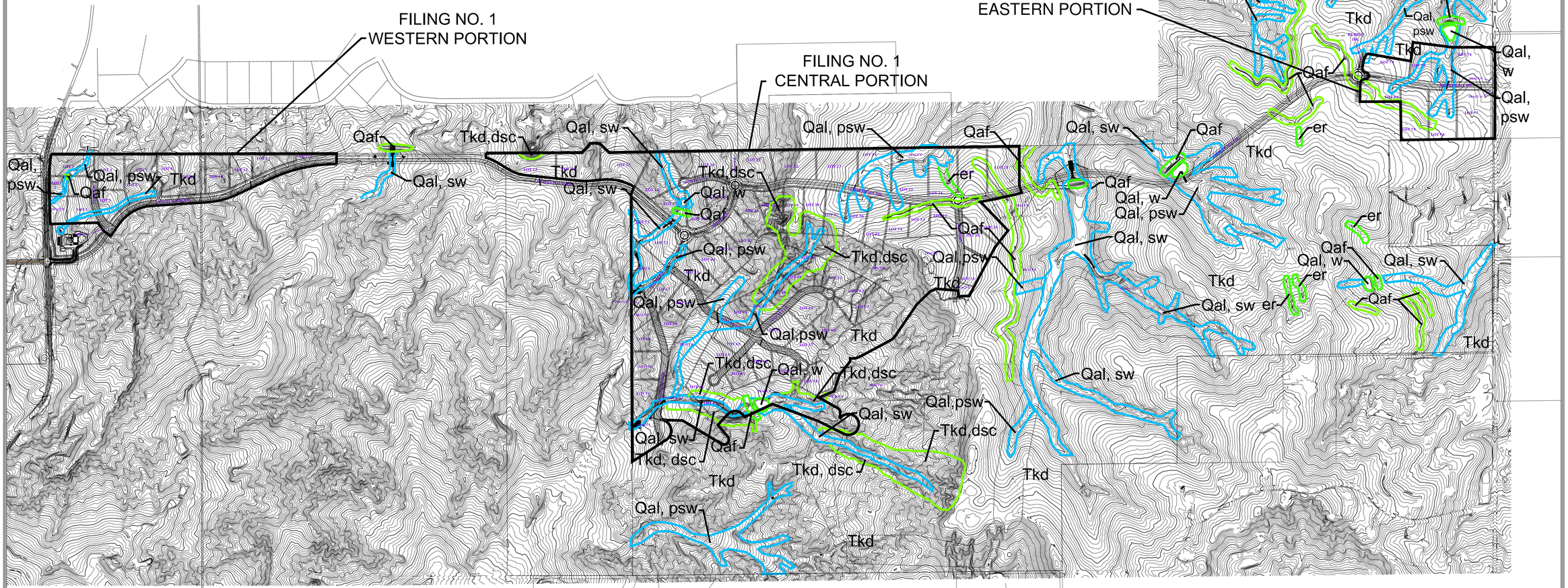
er - areas of erosion

fp - floodplain

psw - potentially seasonal shallow groundwater area

sw - seasonal shallow groundwater area

w - areas of ponded water



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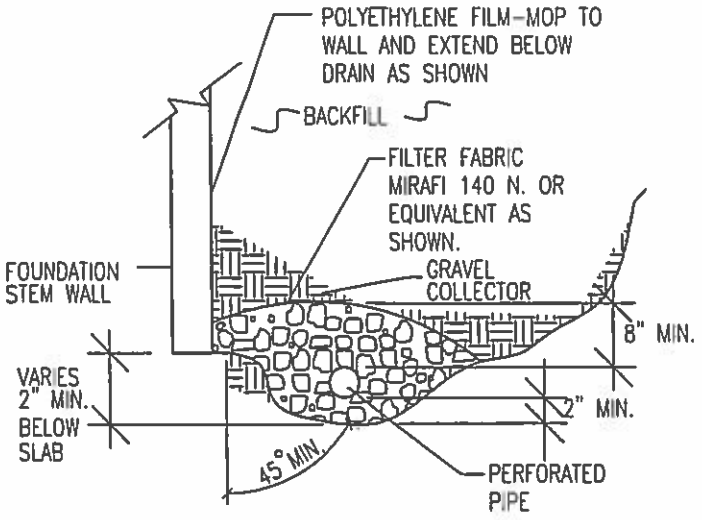
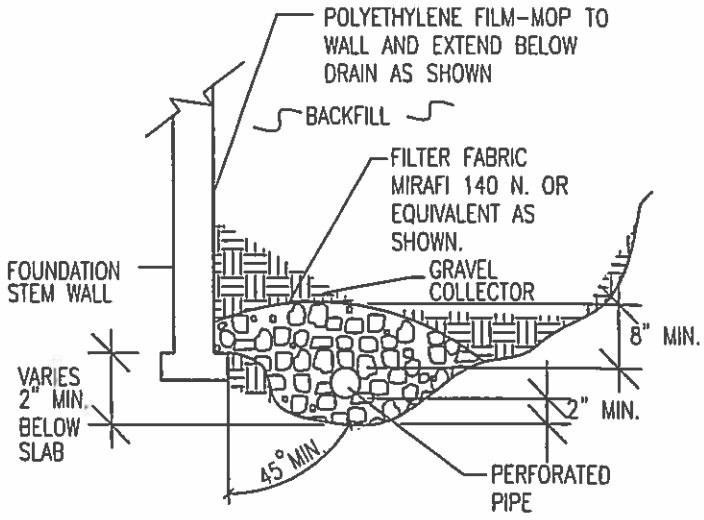
GEOLOGY/ENGINEERING GEOLOGY MAP
FLYING HORSE NORTH
EL PASO COUNTY, CO.
FOR: PULPIT ROCK, LLC

DRAWN	TLC
CHECKED	KAH
DATE	11/20/17
SCALE	1" = 600'
JOB NO.	171606
FIGURE No.	6





NOTES:

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

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

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

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

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

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

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PERIMETER DRAIN DETAIL

DRAWN:	DATE:	DESIGNED:	CHECKED:
	11/16/17	DS	

JOB NO.: 171606

FIG NO.: 7

LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100–YEAR FLOOD

ZONE A No base flood elevations determined.

ZONE AE Base flood elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE A99 To be protected from 100–year flood by Federal flood protection system under construction; no base elevations determined.

ZONE V Coastal flood with velocity hazard (wave action); no base flood elevations determined.

ZONE VE Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

ZONE X Areas of 500–year flood; areas of 100–year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100–year flood.

OTHER AREAS

ZONE X Areas determined to be outside 500–year floodplain.

ZONE D Areas in which flood hazards are undetermined.

UNDEVELOPED COASTAL BARRIERS

Identified 1983 | Identified 1990 | Otherwise Protected Areas

Coastal barrier areas are normally located within or adjacent to Special Flood Hazard Areas.

Flood Boundary

Floodway Boundary

Zone D Boundary

Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.

513 — Base Flood Elevation Line; Elevation in Feet. See Map Index for Elevation Datum.

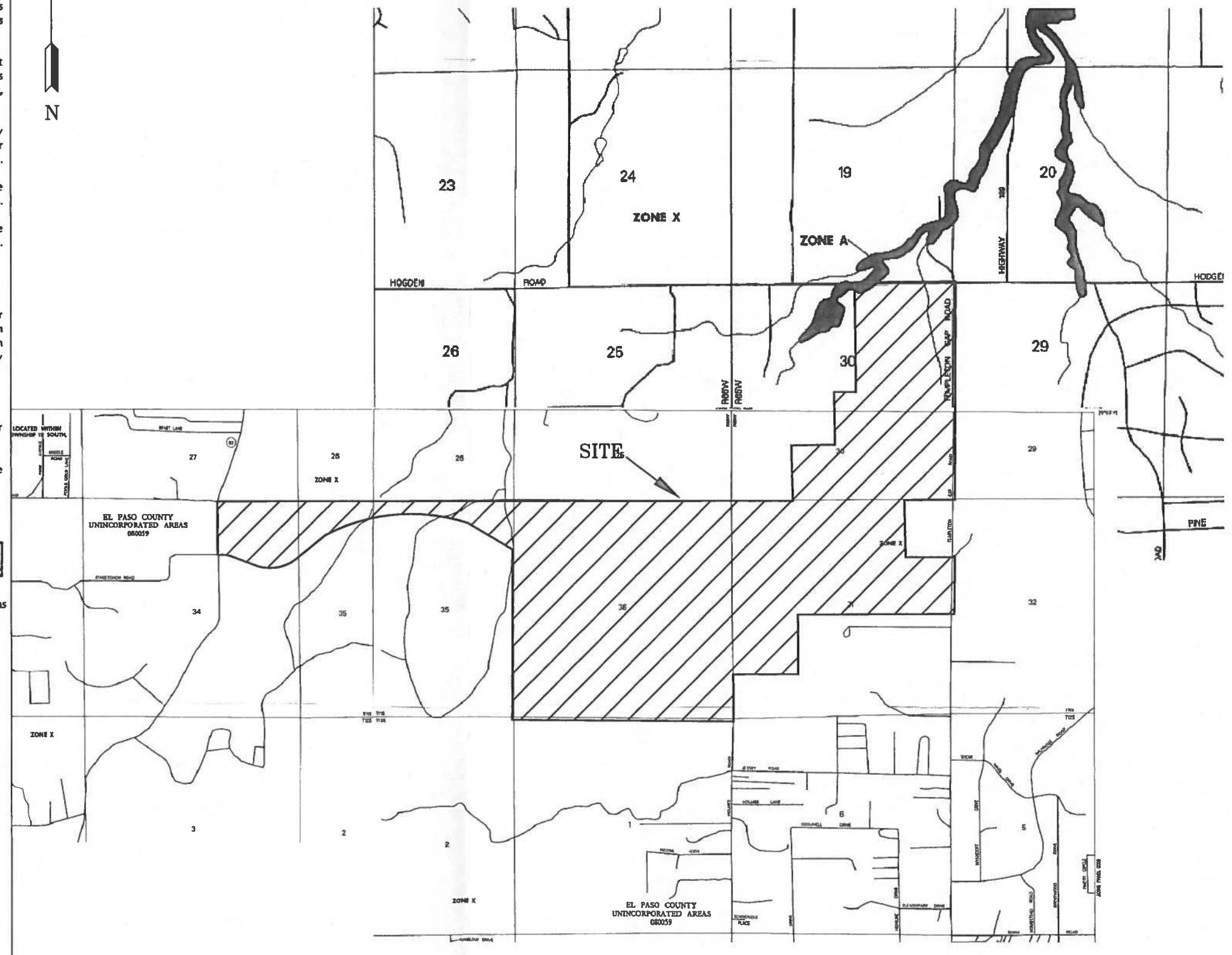
D — D — Cross Section Line

(EL 987) — Base Flood Elevation in Feet Where Uniform Within Zone. See Map Index for Elevation Datum.

RM7 × — Elevation Reference Mark

M2 — River Mile

97°07'30", 32°22'30" — Horizontal Coordinates Based on North American Datum of 1927 (NAD 27) Projection.



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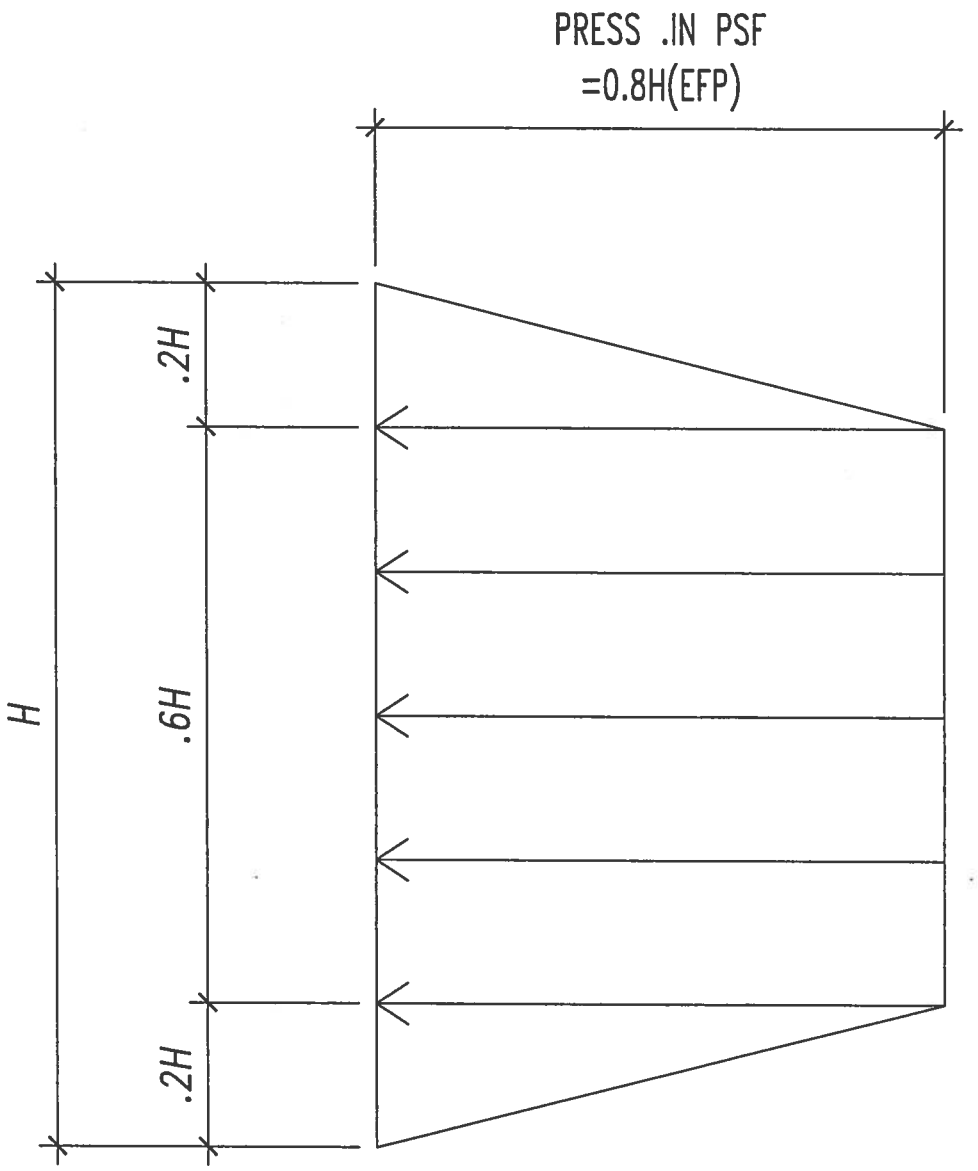
Floodplain Map
Flying Horse North
El Paso County, CO.

DRAWN	KAH
CHECKED	
DATE	2/12/16
SCALE	AS SHOWN
JOB NO.	171606
FIGURE No.	8



PRESSURE DISTRIBUTION

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LATERAL PRESSURE DISTRIBUTION
AREA WITH CREEP

DRAWN BY:	DATE DRAWN:		
R. MCBRIDE	03/13/13		11/16/17

JOB NO.: 171606

FIG. NO.: 9

N

TP2 - APPROXIMATE TEST PIT LOCATION AND NUMBER

Δ PH14 - APPROXIMATE LOCATION OF PERCOLATION TEST

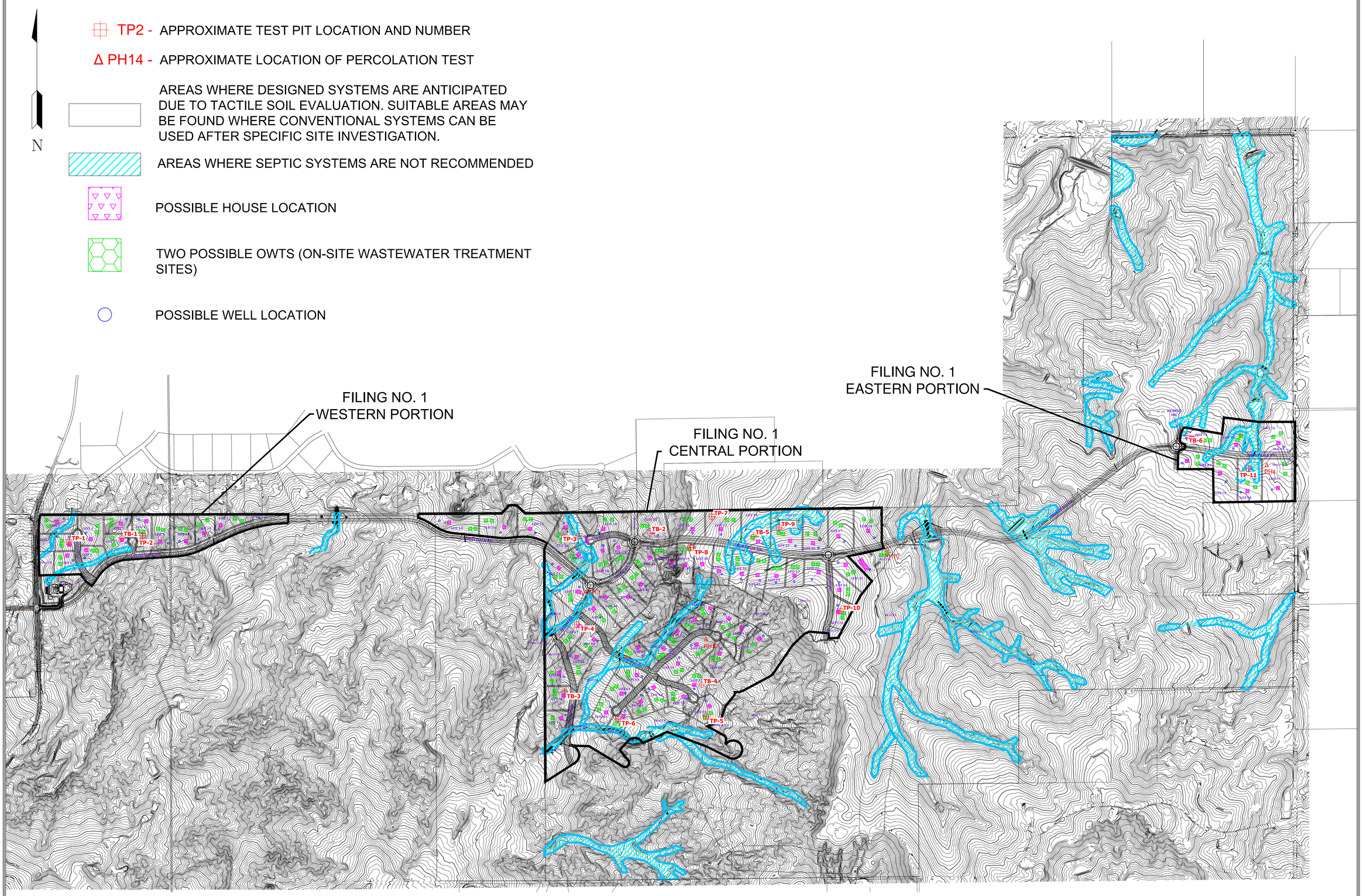
AREAS WHERE DESIGNED SYSTEMS ARE ANTICIPATED DUE TO TACTILE SOIL EVALUATION. SUITABLE AREAS MAY BE FOUND WHERE CONVENTIONAL SYSTEMS CAN BE USED AFTER SPECIFIC SITE INVESTIGATION.

AREAS WHERE SEPTIC SYSTEMS ARE NOT RECOMMENDED

POSSIBLE HOUSE LOCATION

TWO POSSIBLE OWTS (ON-SITE WASTEWATER TREATMENT SITES)

POSSIBLE WELL LOCATION



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SEPTIC SUITABILITY MAP
FLYING HORSE NORTH
EL PASO COUNTY, CO.
FOR: PULPIT ROCK, LLC

DRAWN	TLC
CHECKED	KAH
DATE	11/20/17
SCALE	1" = 600'
JOB NO.	171606
FIGURE No.	10

N

0 200 400 600

SCALE: 1" = 200'

TP2 - APPROXIMATE TEST PIT LOCATION AND NUMBER

Δ PH14 - APPROXIMATE LOCATION OF PERCOLATION TEST

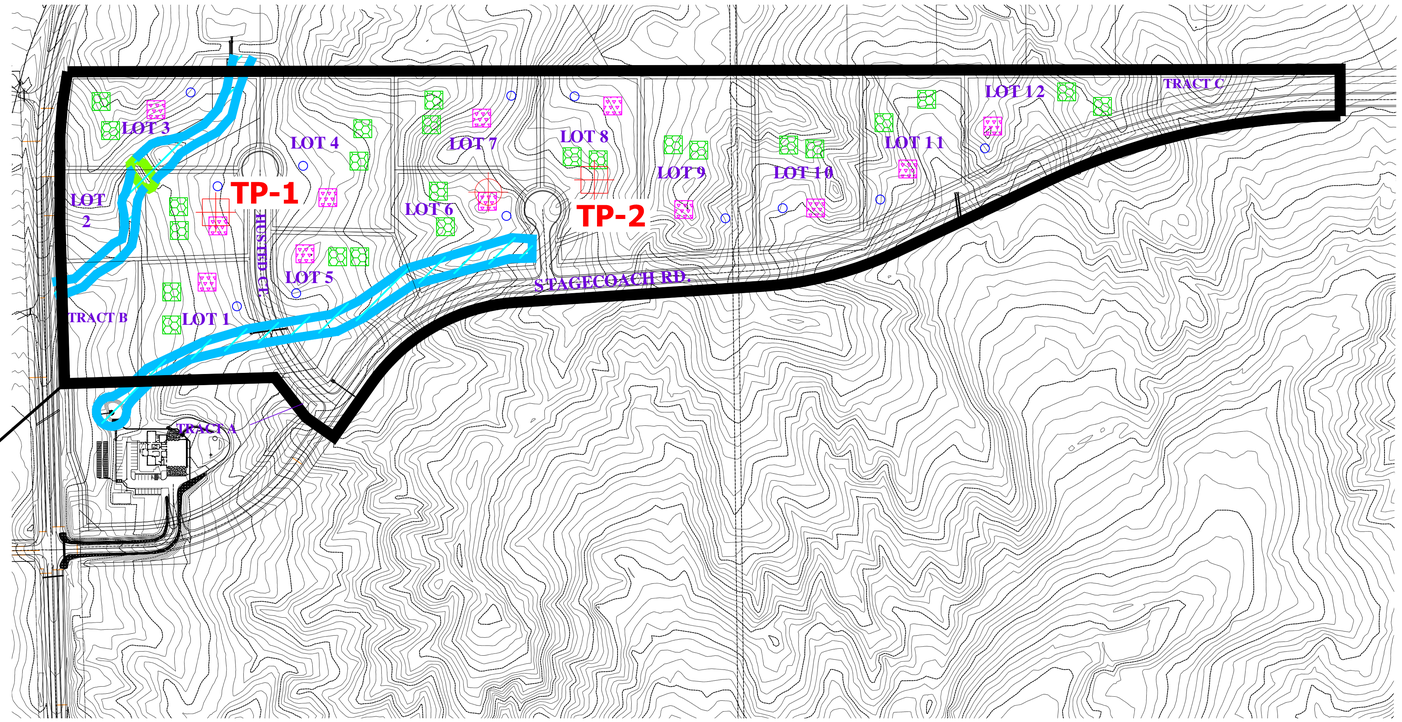
AREAS WHERE DESIGNED SYSTEMS ARE ANTICIPATED DUE TO TACTILE SOIL EVALUATION. SUITABLE AREAS MAY BE FOUND WHERE CONVENTIONAL SYSTEMS CAN BE USED AFTER SPECIFIC SITE INVESTIGATION.

AREAS WHERE SEPTIC SYSTEMS ARE NOT RECOMMENDED

POSSIBLE HOUSE LOCATION

TWO POSSIBLE OWTS (ON-SITE WASTEWATER TREATMENT SITES)

POSSIBLE WELL LOCATION



FILING NO. 1
WESTERN PORTION

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SEPTIC SUITABLILITY MAP - WEST
FLYING HORSE NORTH
EL PASO COUNTY, CO.
FOR: PULPIT ROCK, LLC

DRAWN	TLC
CHECKED	KAH
DATE	11/20/17
SCALE	AS SHOWN
JOB NO.	171606
FIGURE No.	10A

N

0 400 800 1200

SCALE: 1" = 400'

TP2 - APPROXIMATE TEST PIT LOCATION AND NUMBER

Δ PH14 - APPROXIMATE LOCATION OF PERCOLATION TEST

AREAS WHERE DESIGNED SYSTEMS ARE ANTICIPATED DUE TO TACTILE SOIL EVALUATION. SUITABLE AREAS MAY BE FOUND WHERE CONVENTIONAL SYSTEMS CAN BE USED AFTER SPECIFIC SITE INVESTIGATION.

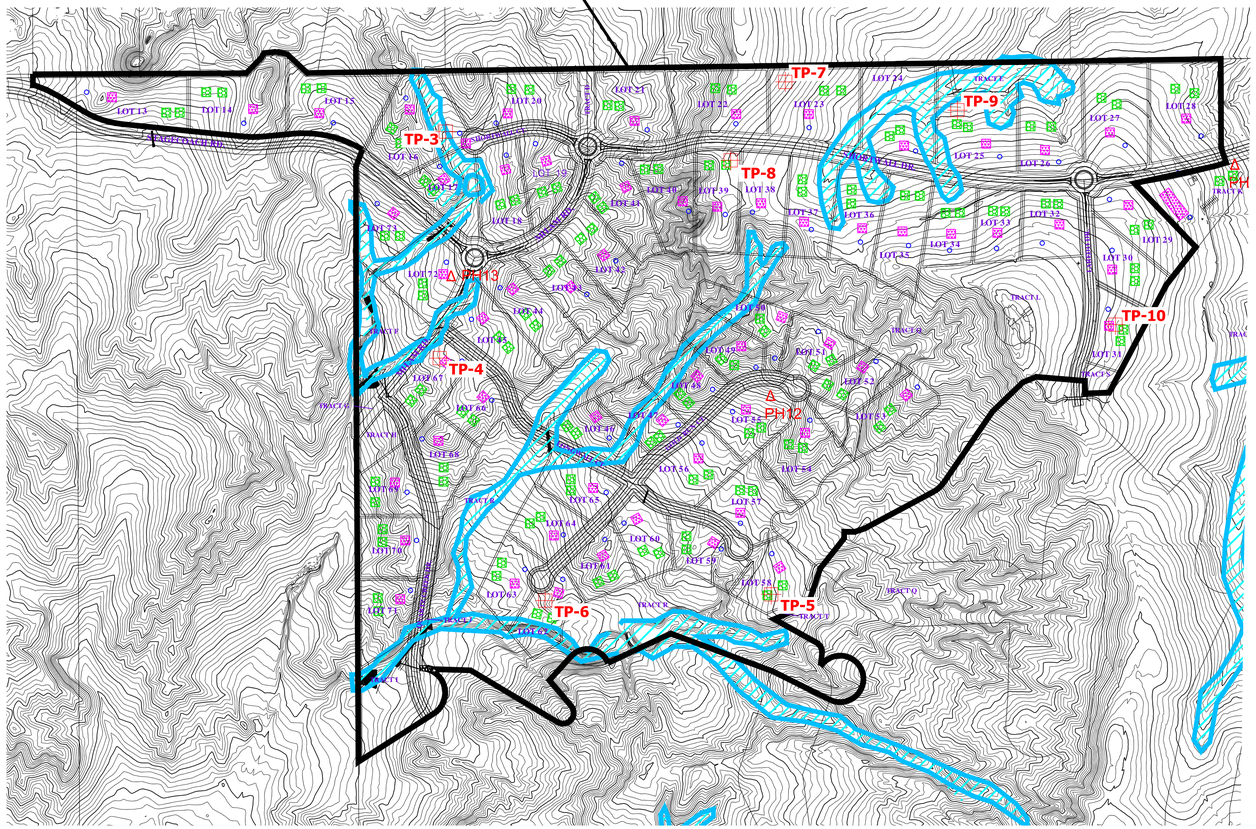
AREAS WHERE SEPTIC SYSTEMS ARE NOT RECOMMENDED

POSSIBLE HOUSE LOCATION

TWO POSSIBLE OWTS (ON-SITE WASTEWATER TREATMENT SITES)

POSSIBLE WELL LOCATION

FILING NO. 1
CENTRAL PORTION



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SEPTIC SUITABLILITY MAP – CENTRAL
FLYING HORSE NORTH
EL PASO COUNTY, CO.
FOR: PULPIT ROCK, LLC

DRAWN	TLC
CHECKED	KAH
DATE	11/20/17
SCALE	AS SHOWN
JOB NO.	171606
FIGURE No.	10B

N

0 200 400 600

SCALE: 1" = 200'

TP2 - APPROXIMATE TEST PIT LOCATION AND NUMBER

Δ PH14 - APPROXIMATE LOCATION OF PERCOLATION TEST

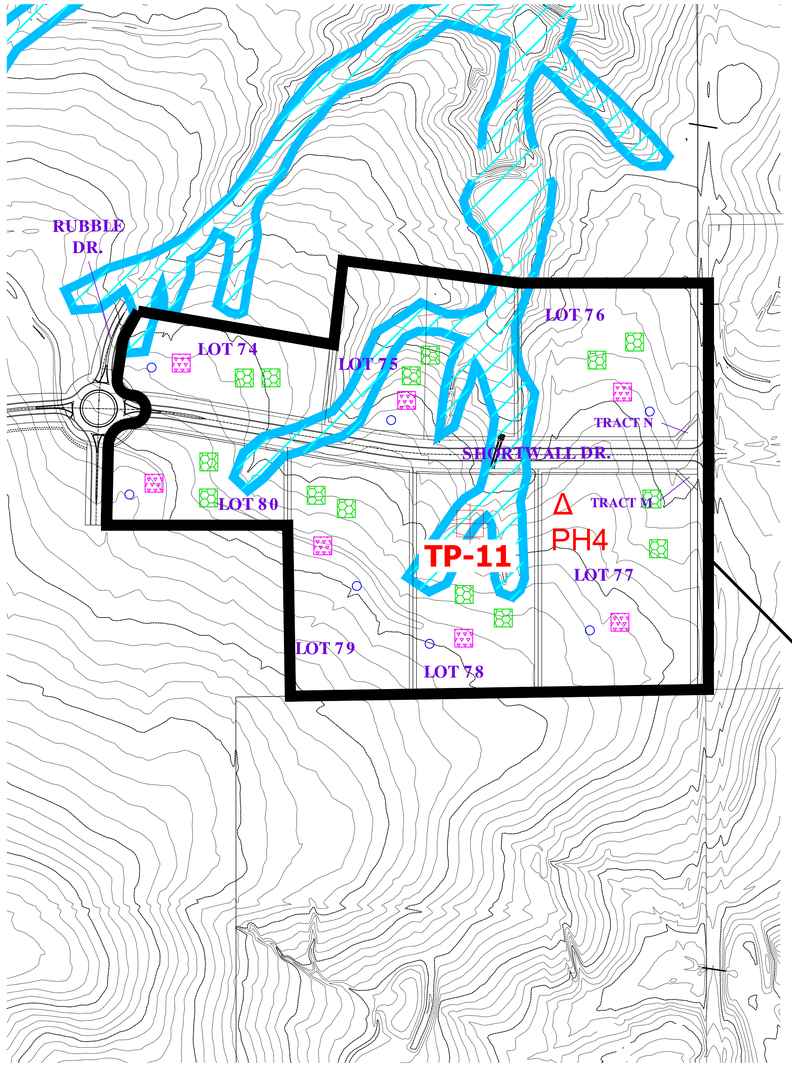
AREAS WHERE DESIGNED SYSTEMS ARE ANTICIPATED DUE TO TACTILE SOIL EVALUATION. SUITABLE AREAS MAY BE FOUND WHERE CONVENTIONAL SYSTEMS CAN BE USED AFTER SPECIFIC SITE INVESTIGATION.

AREAS WHERE SEPTIC SYSTEMS ARE NOT RECOMMENDED

POSSIBLE HOUSE LOCATION

TWO POSSIBLE OWTS (ON-SITE WASTEWATER TREATMENT SITES)

POSSIBLE WELL LOCATION



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SEPTIC SUITABLILITY MAP - EAST
FLYING HORSE NORTH
EL PASO COUNTY, CO.
FOR: PULPIT ROCK, LLC

DRAWN	TLC
CHECKED	KAH
DATE	11/20/17
SCALE	AS SHOWN
JOB NO.	171606
FIGURE No.	10C

APPENDIX A: Site Photographs

1

Looking west at roadway in northeast portion of the site.

October 31, 2017

2

Looking north at drainage gully in the east portion of the site.

October 31, 2017

Job No. 171606

3

Looking west from east portion of the site.

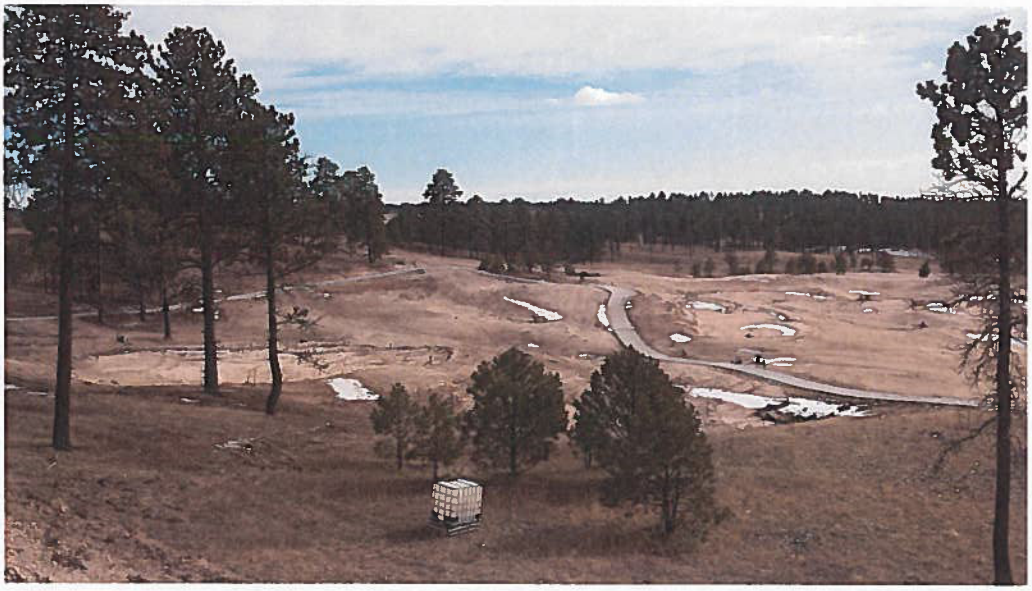
October 31, 2017

4

Looking east at dam and roadway in east-central portion of the site.

October 31, 2017

Job No. 171606



5

Looking south from north-central portion of the site.

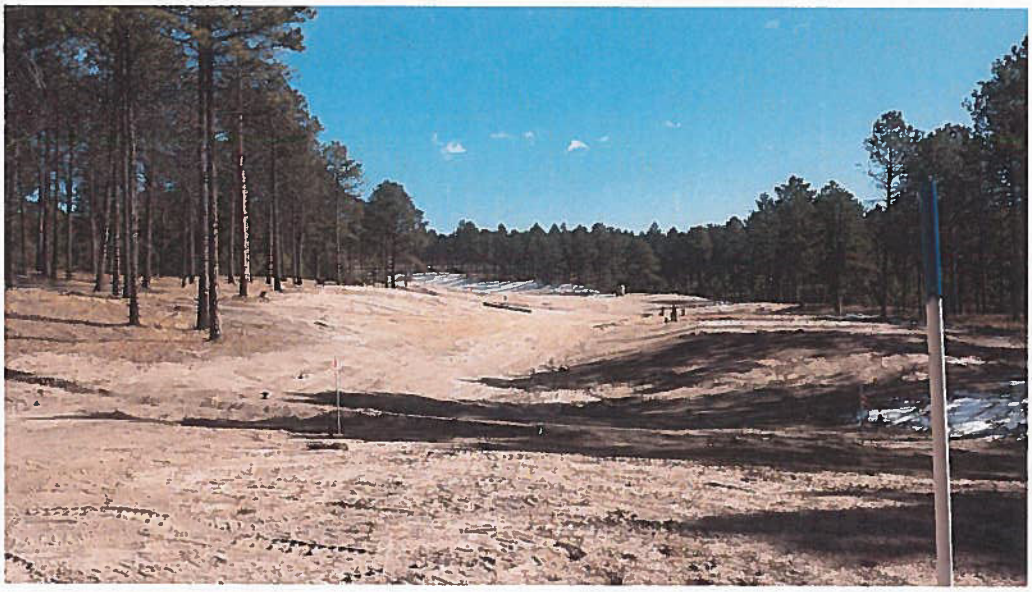
October 31, 2017

6

Looking west from north-central portion of the site.

October 31, 2017

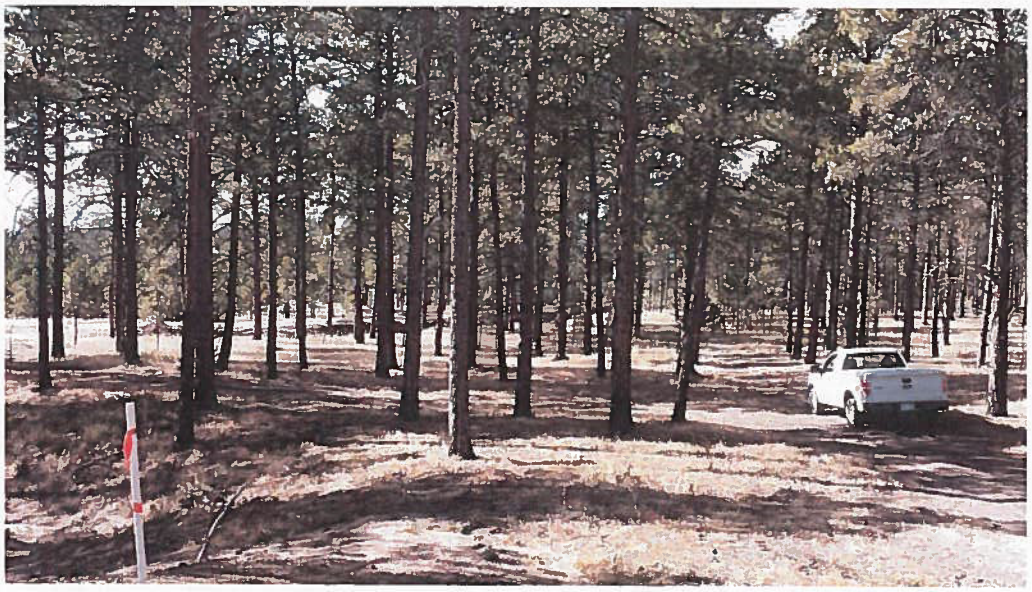
Job No. 171606



7

Looking southeast at golf course from south portion of the site.

October 31, 2017

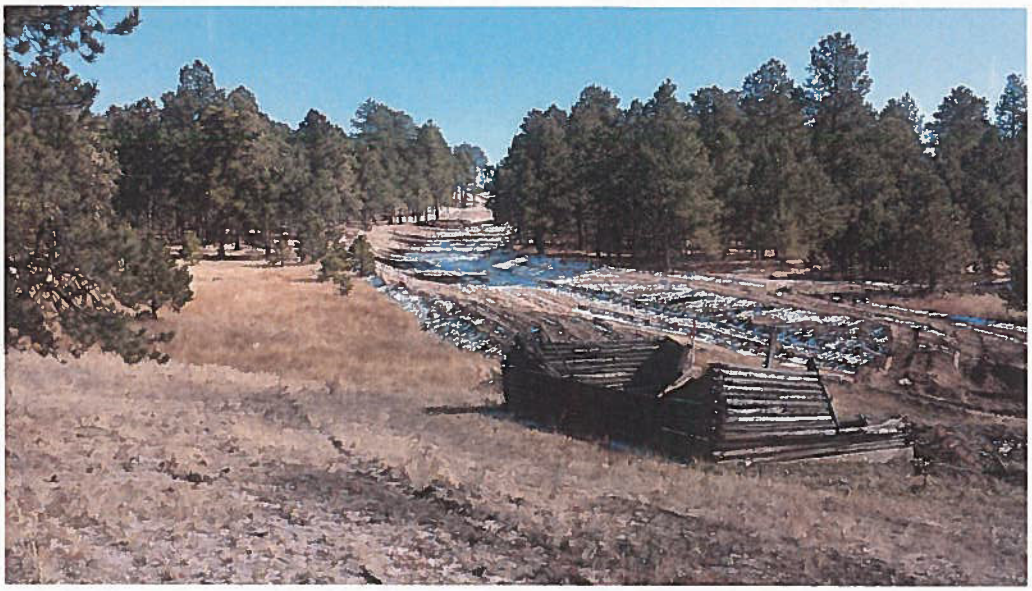


8

Looking northeast from south portion of the site.

October 31, 2017

Job No. 171606



9

Looking east from north-central portion of the site.

October 31, 2017

10

Looking west from north-central portion of the site.

October 31, 2017

Job No. 171606

11

Looking northwest at roadway from north-central portion of the site.

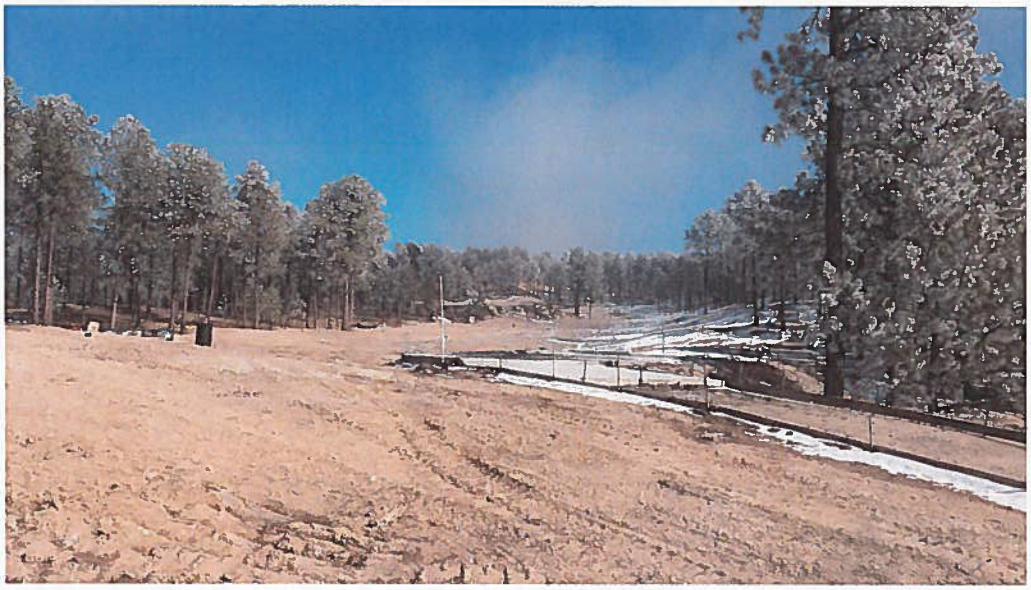
October 31, 2017

12

Looking east from north-central portion of the site.

October 31, 2017

Job No. 171606



13

Looking northeast from central portion of the site.

October 31, 2017

14

Looking east from northwestern portion of the site.

October 31, 2017

Job No. 171606

APPENDIX B: Test Boring Logs and Laboratory Test Results

TEST BORING NO. 1
DATE DRILLED 10/31/2017
Job # 171606

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
LOT 6 DRY TO 20', 10/31/17						
SAND, SILTY, HIGHLY WEATHERED TO WEATHERED DAWSON SANDSTONE, FINE TO COARSE GRAINED, BUFF, MEDIUM DENSE, MOIST				13	2.1	1
	5			22	2.0	1
	10			19	6.3	1
	15			19	7.8	1
	20			20	5.5	1

TEST BORING NO. 2
DATE DRILLED 10/31/2017
CLIENT PULPIT ROCK, LLC
LOCATION FLYING HORSE NORTH

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
LOT 21 DRY TO 20', 10/31/17						
SAND, SILTY, HIGHLY WEATHERED TO WEATHERED DAWSON SANDSTONE, FINE TO COARSE GRAINED, BUFF, MEDIUM DENSE TO DENSE, MOIST				16	5.8	1
	5			11	2.9	1
	10			14	2.9	1
	15			44	9.9	1
DAWSONE SANDSTONE, SILTY, FINE TO COARSE GRAINED, BUFF, MOIST	20			50/9"	11.3	2

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
			11/17/17

JOB NO.: 171606
FIG NO.: B-1

TEST BORING NO. 3
DATE DRILLED 10/31/2017
Job # 171606

REMARKS

LOT 70

DRY TO 15',
10/31/17

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			20	10.4	1
5			13	4.4	1
10			50/7"	10.1	2
15			50/4"	11.2	2
20					

SAND, SILTY, HIGHLY WEATHERED TO WEATHERED DAWSON SANDSTONE, FINE TO COARSE GRAINED, BUFF, MEDIUM DENSE, MOIST

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

TEST BORING NO. 4
DATE DRILLED 10/31/2017
CLIENT PULPIT ROCK, LLC
LOCATION FLYING HORSE NORTH

REMARKS

LOT 57

DRY TO 15',
10/31/17

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			13	3.3	1
5			19	8.8	1
10			50/8"	6.7	2
15			50/6"	6.1	2
20					

SAND, SILTY, HIGHLY WEATHERED TO WEATHERED DAWSON SANDSTONE, FINE TO COARSE GRAINED, BUFF, MEDIUM DENSE, MOIST

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

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE: 11/17/17

JOB NO.: 171606

FIG NO.: B-2

TEST BORING NO. 5
DATE DRILLED 10/31/2017
Job # 171606

REMARKS

LOT 25

DRY TO 20',
10/31/17

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			24	5.6	1
5			30	7.6	1
10			26	7.7	1
15			50/9"	7.1	2
20			50/10"	7.9	2

SAND, SILTY, HIGHLY WEATHERED TO WEATHERED DAWSON SANDSTONE, FINE TO COARSE GRAINED, BUFF, MEDIUM DENSE TO DENSE, MOIST

DAWSONE SANDSTONE, SILTY, FINE TO COARSE GRAINED, BUFF, VERY DENSE, MOIST

TEST BORING NO. 6
DATE DRILLED 10/31/2017
CLIENT PULPIT ROCK, LLC
LOCATION FLYING HORSE NORTH

REMARKS

LOT 74

DRY TO 20',
10/31/17

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			25	7.0	1
5			25	6.6	1
10			23	8.6	1
15			50/10"	9.3	2
20			50/6"	10.4	2

SAND, SILTY, HIGHLY WEATHERED TO WEATHERED DAWSON SANDSTONE, FINE TO COARSE GRAINED, BUFF, MEDIUM DENSE, MOIST

DAWSONE SANDSTONE, SILTY, FINE TO COARSE GRAINED, BUFF, VERY DENSE, MOIST

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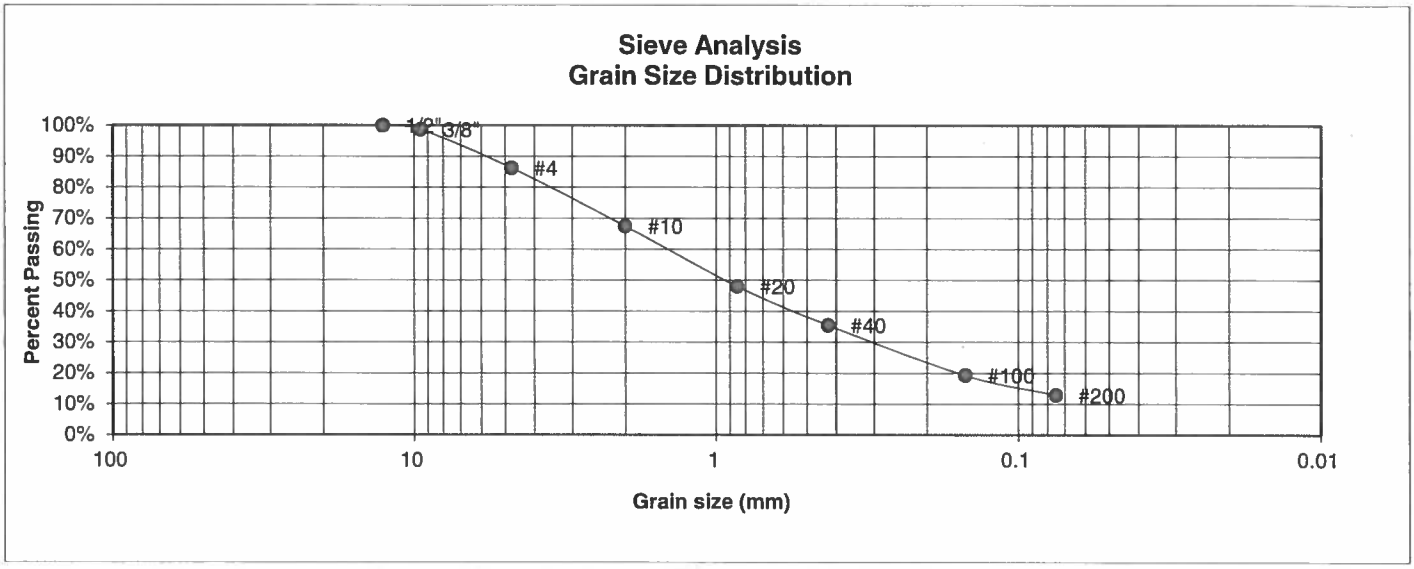
TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
			11/13/17

JOB NO.: 171606

FIG NO.: B-3

UNIFIED CLASSIFICATION	SM	CLIENT	PULPIT ROCK, LLC
SOIL TYPE #	1	PROJECT	FLYING HORSE NORTH
TEST BORING #	1	JOB NO.	171606
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	98.7%
4	86.2%
10	67.4%
20	48.0%
40	35.4%
100	19.3%
200	12.9%

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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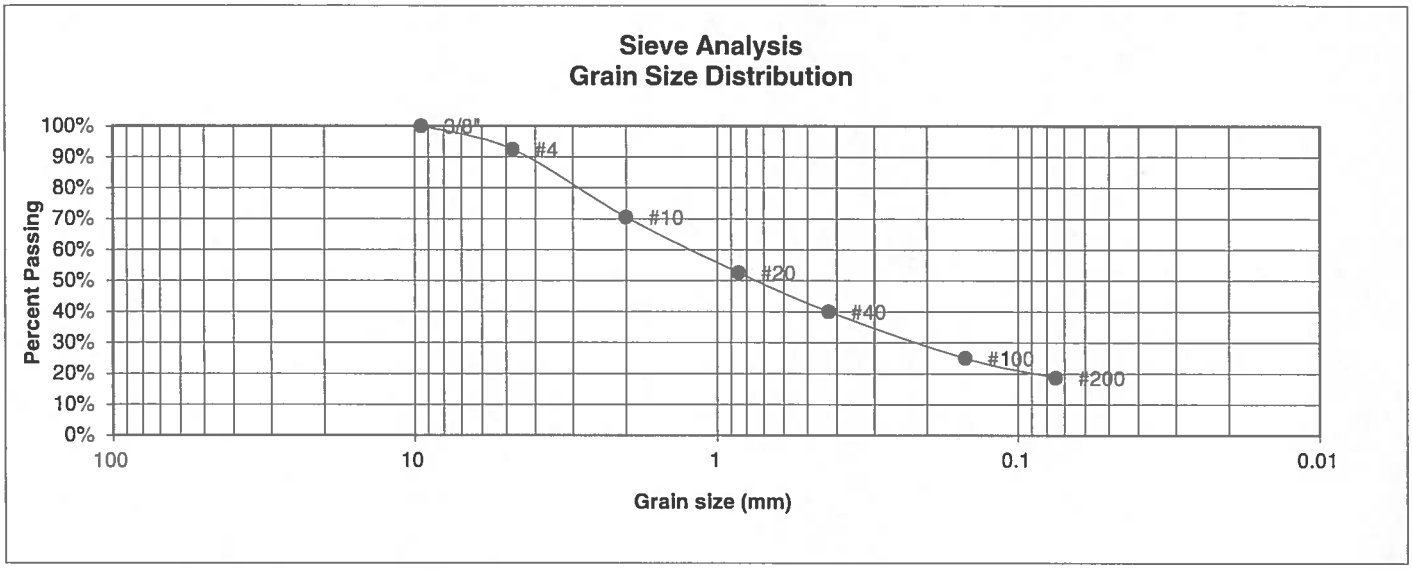
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			11/17/17

JOB NO.: 171606

FIG NO.: B-4

UNIFIED CLASSIFICATION	SM	CLIENT	PULPIT ROCK, LLC
SOIL TYPE #	1	PROJECT	FLYING HORSE NORTH
TEST BORING #	2	JOB NO.	171606
DEPTH (FT)	10	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	92.5%
10	70.5%
20	52.6%
40	40.1%
100	25.0%
200	18.7%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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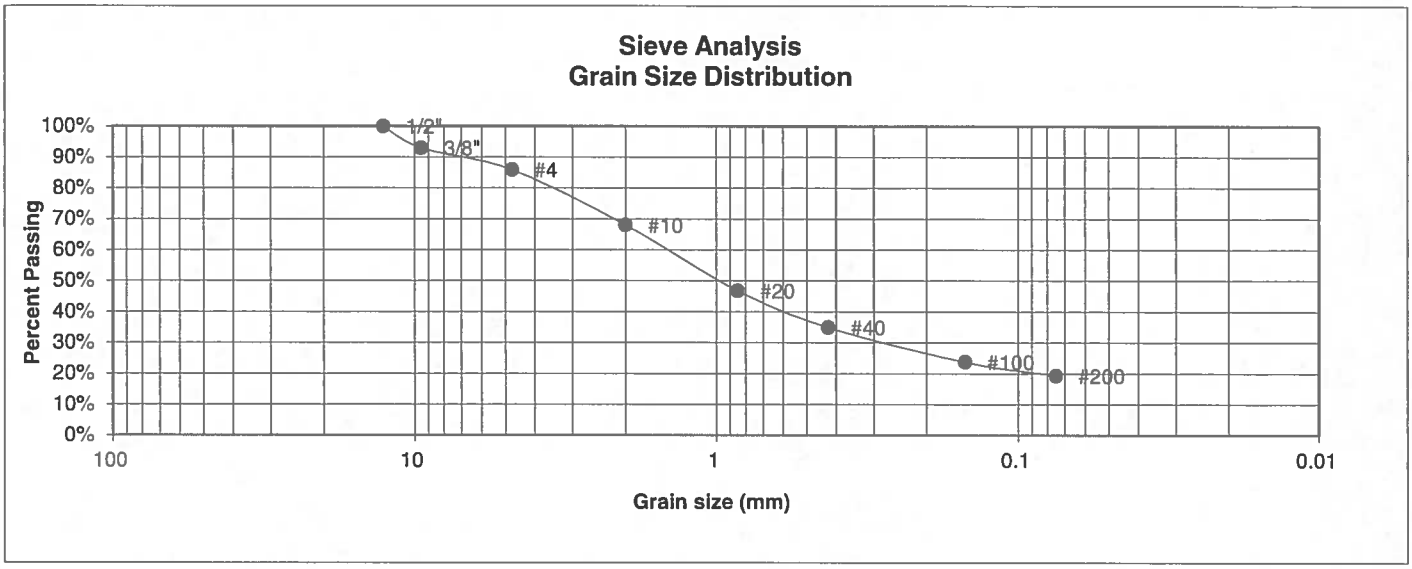
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
-			11/17/17

JOB NO.: 171606

FIG NO.: B-5

UNIFIED CLASSIFICATION	SC	CLIENT	PULPIT ROCK, LLC
SOIL TYPE #	2	PROJECT	FLYING HORSE NORTH
TEST BORING #	3	JOB NO.	171606
DEPTH (FT)	10	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	93.0%
4	85.9%
10	68.0%
20	46.8%
40	34.9%
100	23.7%
200	19.3%

Atterberg Limits	
Plastic Limit	23
Liquid Limit	36
Plastic Index	13

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

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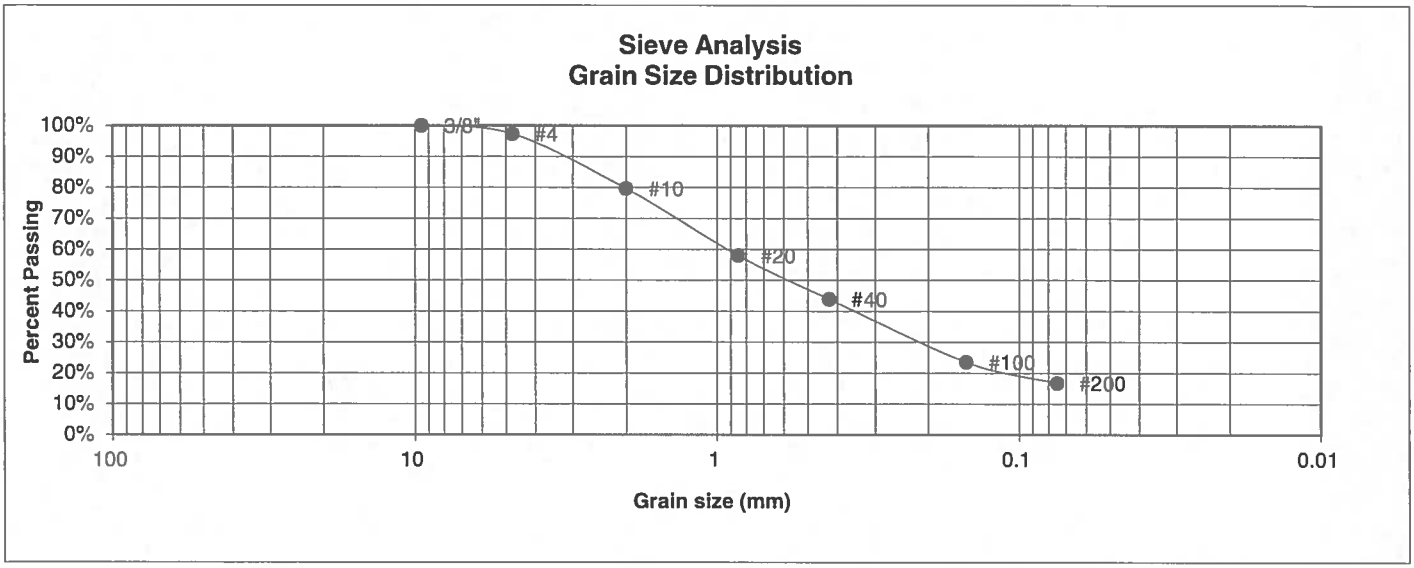
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			11/17/17

JOB NO.: 171606

FIG NO.: B-6

UNIFIED CLASSIFICATION	SM	CLIENT	PULPIT ROCK, LLC
SOIL TYPE #	2	PROJECT	FLYING HORSE NORTH
TEST BORING #	4	JOB NO.	171606
DEPTH (FT)	15	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	97.3%
10	79.7%
20	58.0%
40	43.9%
100	23.6%
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

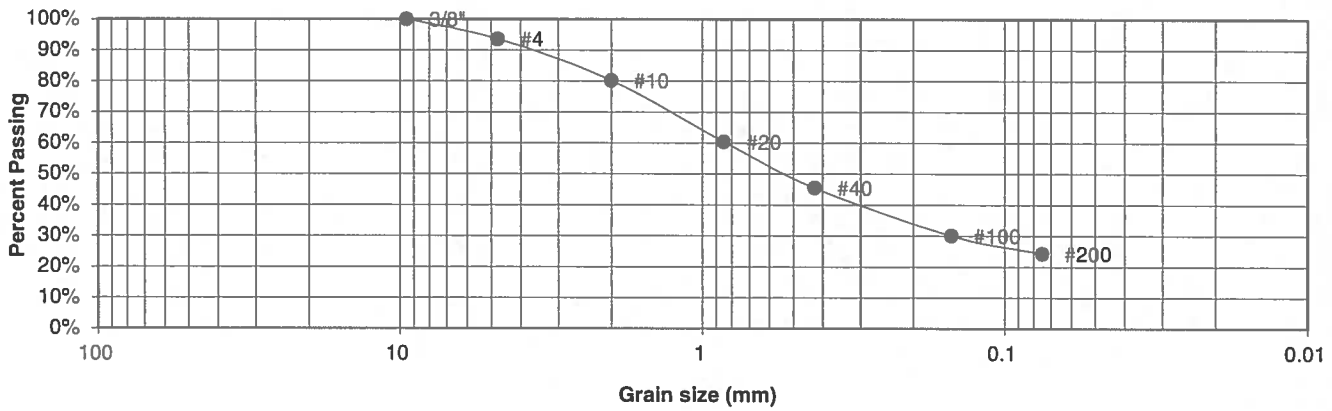
DRAWN:	DATE:	CHECKED:	DATE:
		~	11/17/17

JOB NO.: 171606

FIG NO.: B-7

UNIFIED CLASSIFICATION	SM	CLIENT	PULPIT ROCK, LLC
SOIL TYPE #	2	PROJECT	FLYING HORSE NORTH
TEST BORING #	5	JOB NO.	171606
DEPTH (FT)	15	TEST BY	BL

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	93.6%
10	80.2%
20	60.4%
40	45.5%
100	30.1%
200	24.3%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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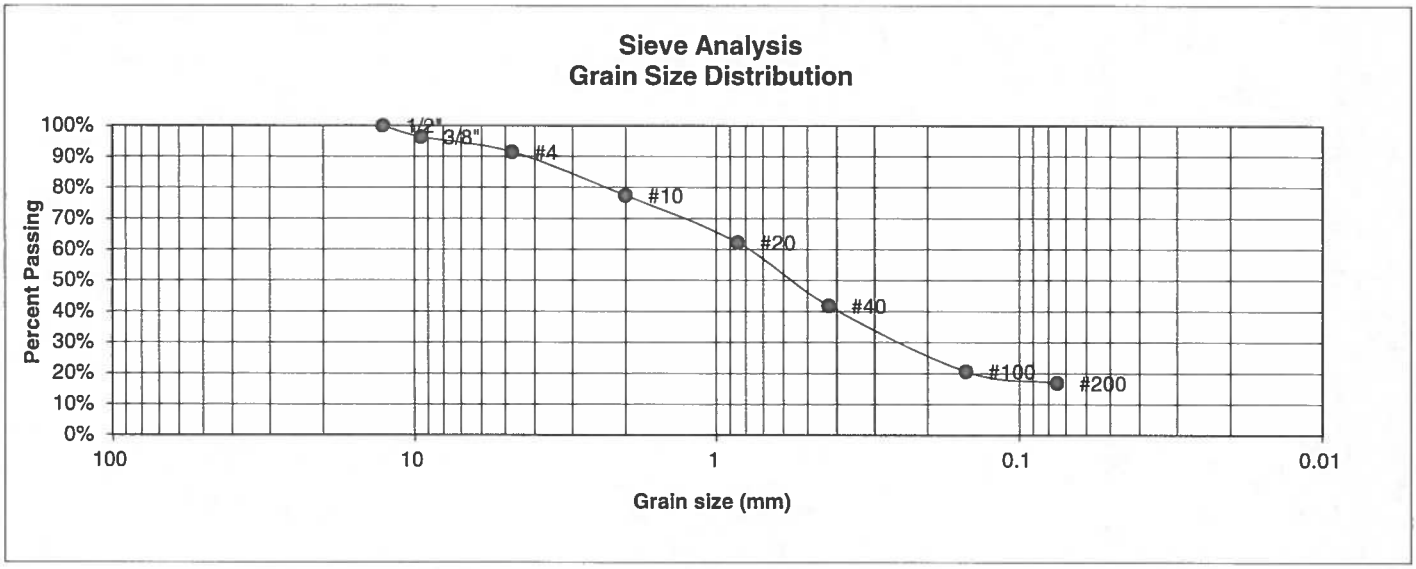
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			11/17/17

JOB NO.: 171606

FIG NO.: B-8

UNIFIED CLASSIFICATION	SM	CLIENT	PULPIT ROCK, LLC
SOIL TYPE #	1	PROJECT	FLYING HORSE NORTH
TEST BORING #	6	JOB NO.	171606
DEPTH (FT)	5	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	96.3%
4	91.4%
10	77.4%
20	62.2%
40	41.8%
100	20.6%
200	16.9%

Atterberg Limits

Plastic Limit	
Liquid Limit	
Plastic Index	

Swell

Moisture at start	8.9%
Moisture at finish	16.5%
Moisture increase	7.6%
Initial dry density (pcf)	105
Swell (psf)	300

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LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			11/17/17

JOB NO.: 171606

FIG NO.: B-9

CLIENT	PULPIT ROCK, LLC	JOB NO.	171606
PROJECT	FLYING HORSE NORTH	DATE	11/7/2017
LOCATION	FLYING HORSE NORTH	TEST BY	BL

BORING NUMBER	DEPTH, (ft)	SOIL TYPE NUMBER	UNIFIED CLASSIFICATION	WATER SOLUBLE SULFATE, (wt%)
TB-2	10	1	SM	<0.01
TB-5	15	2	SM	0.00

QC BLANK PASS

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LABORATORY TEST
SULFATE RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			11/17/17

JOB NO.: 171606

FIG NO.: B-10

APPENDIX C: Test Pit Logs and Laboratory Test Results

TEST PIT NO. 1
DATE EXCAVATED 11/1/2017
Job # 171606

REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type
Lot 2 GPS Location 39° 03'20.0" N 104° 45'44.4" W						
topsoil, sandy clay loam, brown	1					
sandy clay loam, fine to coarse grained, tan	2			gr	m	3
sand, fine to coarse grained , tan	3			sg		1
	4					
	5					
	6					
	7					
highly weathered sandstone, fine to coarse grained, tan	8			ma		3A
	9					
	10					

TEST PIT NO. 2
DATE EXCAVATED 11/1/2017
CLIENT PULPIT ROCK, LLC
LOCATION FLYING HORSE NORTH FILING NO. 1

REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type
Lot 8 GPS Location 39° 03'20.2" N 104° 45'29.9" W						
topsoil, sandy clay, brown	1					
sandy clay, tan	2			bl	m	4
	3					
	4					
	5					
loamy sand, fine to coarse grained, reddish tan	6			sg		1
clayey sandstone, fine to coarse grained, light gray	7			ma		4A
*signs of seasonally occurring groundwater at 6ft	8					
	9					
	10					

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

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

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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

TEST PIT LOG

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	11/10/17

JOB NO.: 171606
FIG NO.: C-1

TEST PIT NO. 3
DATE EXCAVATED 11/1/2017
Job # 171606

REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type
Lot 16 GPS Location 39° 03'20.5" N 104° 44'11.3" W						
topsoil, loamy sand, brown	1					
loamy sand, fine to coarse grained, tan to buff	2			gr	w	2A
	3					
weathered to formational clayey sandstone, reddish tan	4			ma		4A
*signs of seasonally occurring groundwater at 3ft	5					
	6					
	7					
	8					
	9					
	10					

TEST PIT NO. 4
DATE EXCAVATED 10/31/2017
CLIENT PULPIT ROCK, LLC
LOCATION FLYING HORSE NORTH FILING NO. 1

REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type
Lot 67 GPS Location 39° 03'06.9" N 104° 44'12.0" W						
topsoil, sandy loam, brown	1					
sandy loam, fine to coarse grained, tan	2			gr	w	2A
	3					
	4					
sandy clay, olive gray	5			ma		4A
formational silty sandstone, fine to coarse grained, buff	6			ma		4A
	7					
	8					
	9					
	10					

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

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

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TEST PIT LOG

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	11/10/17

JOB NO.: 171606
FIG NO.: C-2

TEST PIT NO. 5
DATE EXCAVATED 10/31/2017
Job # 171606

REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type
Lot 58 GPS Location 39° 02'54.9" N 104° 43'48.1" W						
topsoil, sandy loam, brown	1					
interbedded sand and clay, tan	2			gr	w	4A
	3					
sandy loam fine to coarse grained, reddish tan	4			gr	w	2A
	5					
	6					
	7					
	8					
	9					
	10					

TEST PIT NO. 6
DATE EXCAVATED 10/31/2017
CLIENT PULPIT ROCK, LLC
LOCATION FLYING HORSE NORTH FILING NO. 1

REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type
Lot 62 GPS Location 39° 03'53.7" N 104° 44'05.5" W						
topsoil, loamy sand, brown	1					
loamy sand, fine to coarse grained, tan	2			sg		1
	3					
	4					
	5					
formational silty sandstone, fine to coarse grained, buff	6			ma		4A
	7					
	8					
	9					
	10					

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

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

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TEST PIT LOG

DRAWN:	DATE:	CHECKED: LLL	DATE: 11/10/17

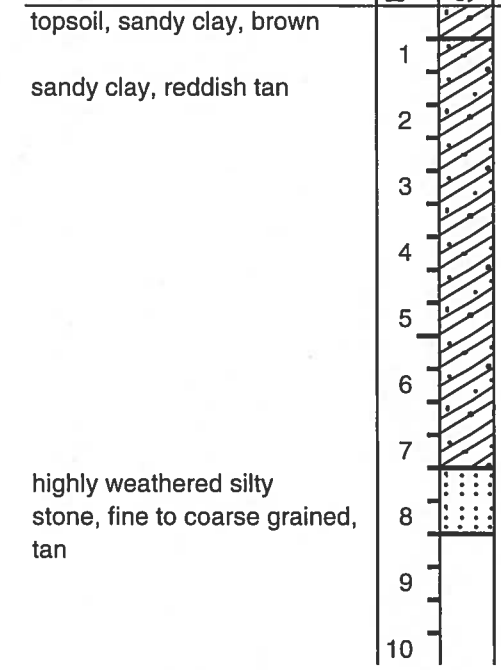
JOB NO.: 171606
FIG NO.: C-3

TEST PIT NO. 7
DATE EXCAVATED 10/31/2017
Job # 171606

REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type
Lot 24 GPS Location 39° 03'20.1" N 104° 43'38.5" W						
topsoil, sandy clay, brown	1					
sandy clay, reddish tan	2			bl	w	4A
	3					
	4					
	5					
	6					
	7					
highly weathered silty stone, fine to coarse grained, tan	8			ma		4A
	9					
	10					

TEST PIT NO. 8
DATE EXCAVATED 10/31/2017
CLIENT PULPIT ROCK, LLC
LOCATION FLYING HORSE NORTH FILING NO. 1

REMARKS	Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type
Lot 39 GPS Location 39° 03'16.9" N 104° 43'51.2" W						
topsoil, sandy clay, loam, brown	1					
sandy clay loam, tan	2			gr	w	3A
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					



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

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

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TEST PIT LOG

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	11/10/17

JOB NO.: 171606
FIG NO.: C-4

TEST PIT NO. 9
DATE EXCAVATED 10/31/2017
Job # 171606

REMARKS

Lot 28
GPS Location
39° 03'19.6" N
104° 43'20.1" W

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

TEST PIT NO. 10
DATE EXCAVATED 10/31/2017
CLIENT PULPIT ROCK, LLC
LOCATION FLYING HORSE NORTH FILING NO. 1

REMARKS

Lot 31
GPS Location
39° 03'08.5" N
104° 43'23.7" W

Depth (ft)	Symbol	Samples	Soil Structure Shape	Soil Structure Grade	USDA Soil Type
1	topsoil, sandy clay, brown				
2	sandy clay, tan		gr	m	4
3					
4					
5			ma		4A
6					
7					
8					
9					
10					

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

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

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TEST PIT LOG

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	11/10/17

JOB NO.: 171606
FIG NO.: C-5

TEST PIT NO. 11
DATE EXCAVATED 10/31/2017
Job # 171606

CLIENT PULPIT ROCK, LLC
LOCATION FLYING HORSE NORTH FILING NO. 1

REMARKS

Lot 79
GPS Location
39° 03'22.9" N
104° 44'13.1" W

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

REMARKS

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

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

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

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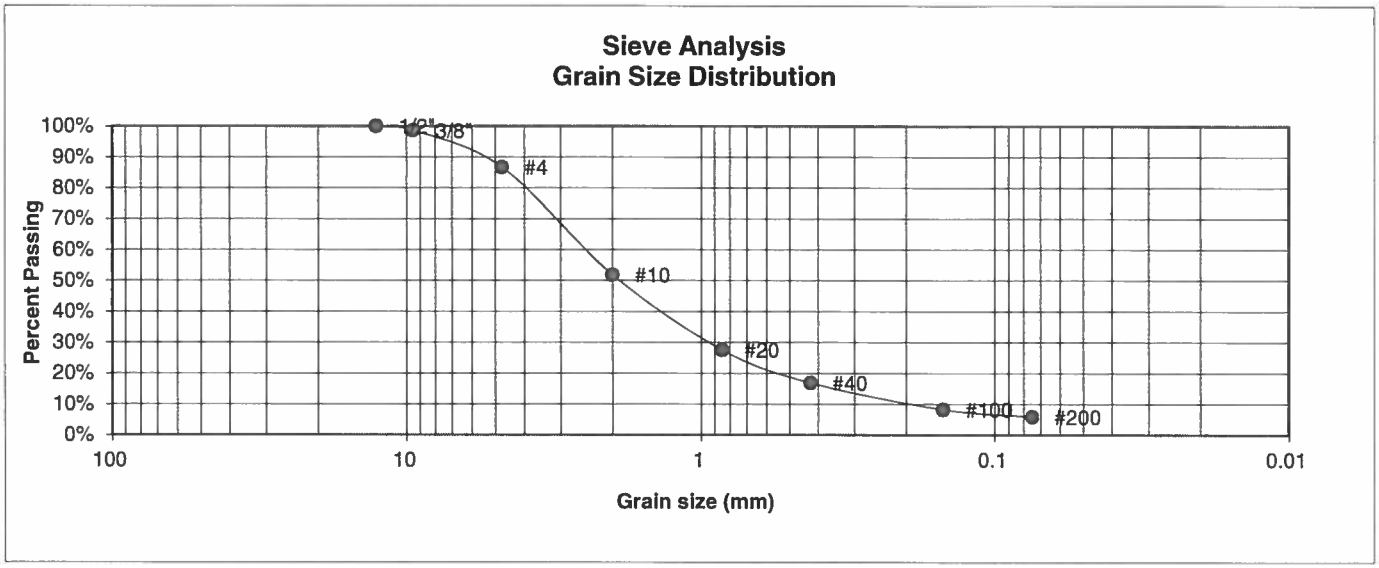
TEST PIT LOG

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	11/10/17

JOB NO.: 171606
FIG NO.: C-6

BORING NO.	TP-1	UNIFIED CLASSIFICATION	SM-SW	TEST BY	BL
DEPTH(ft)	3	AASHTO CLASSIFICATION		JOB NO.	171606
CLIENT	PULPIT ROCK, LLC				
PROJECT	FLYING HORSE NORTH				



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	98.6%
4	86.7%
10	51.8%
20	27.6%
40	16.9%
100	8.3%
200	5.9%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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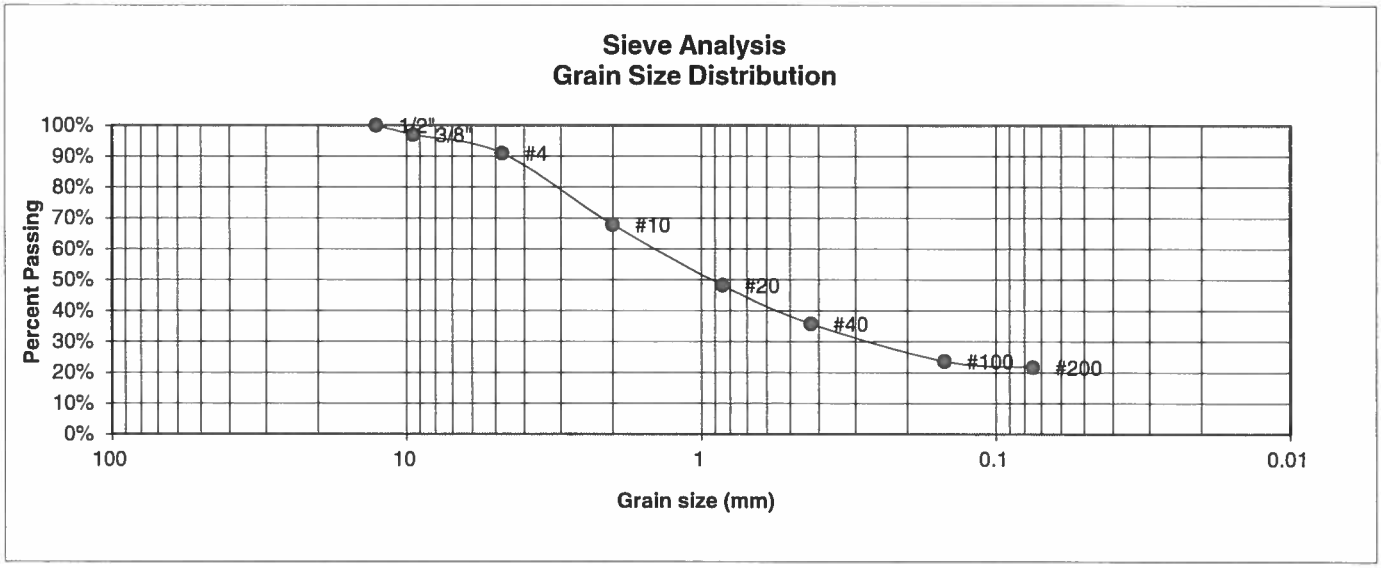
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	11/8/17

JOB NO.: 171606

FIG NO.: C-7

BORING NO.	TP-2	UNIFIED CLASSIFICATION	SC	TEST BY	BL
DEPTH(ft)	7	AASHTO CLASSIFICATION		JOB NO.	171606
CLIENT	PULPIT ROCK, LLC				
PROJECT	FLYING HORSE NORTH				



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	97.1%
4	91.0%
10	67.9%
20	48.2%
40	35.8%
100	23.7%
200	21.7%

Atterberg Limits	
Plastic Limit	15
Liquid Limit	34
Plastic Index	19

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

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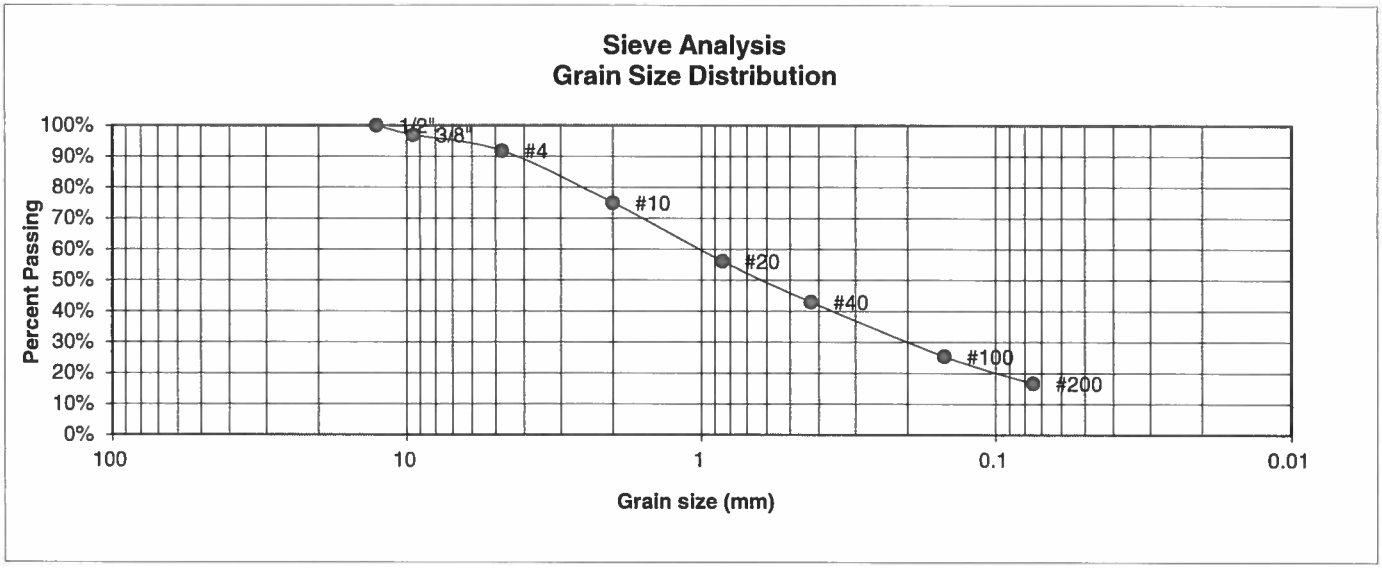
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	11/8/17

JOB NO.: 171606

FIG NO.: C-8

BORING NO.	TP-6	UNIFIED CLASSIFICATION	SM	TEST BY	BL
DEPTH(ft)	4	AASHTO CLASSIFICATION		JOB NO.	171606
CLIENT	PULPIT ROCK, LLC				
PROJECT	FLYING HORSE NORTH				



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	97.0%
4	91.8%
10	75.0%
20	56.2%
40	43.0%
100	25.5%
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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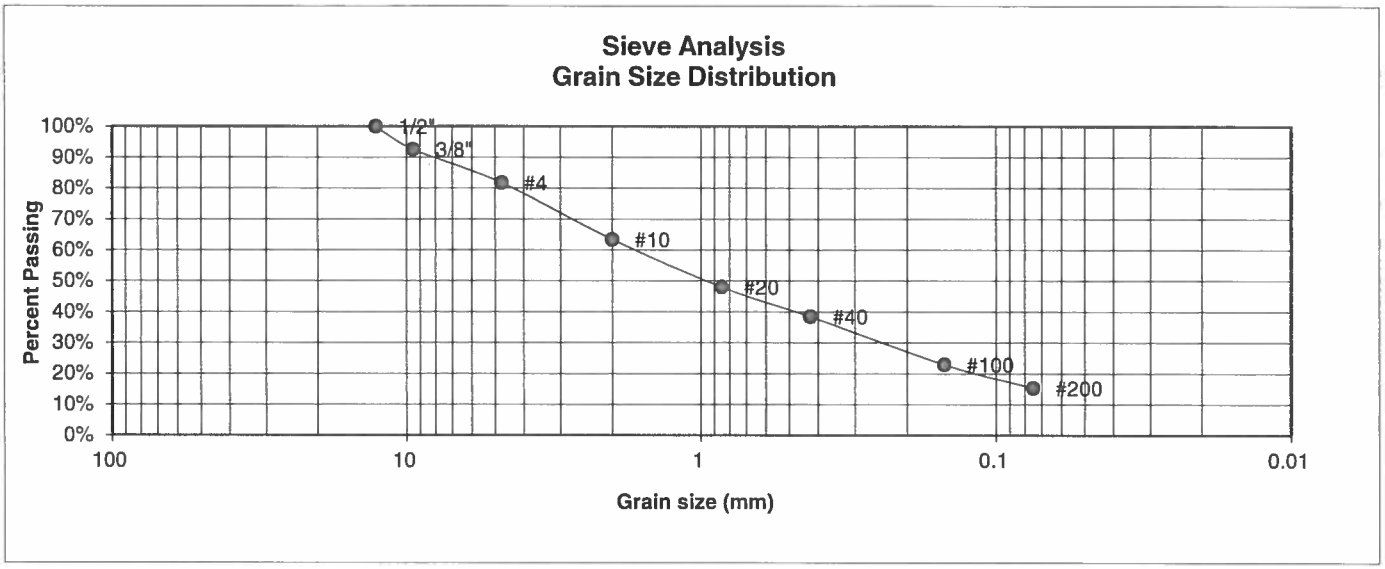
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	11/8/17

JOB NO.: 171606

FIG NO.: C-9

BORING NO.	TP-7	UNIFIED CLASSIFICATION	SM	TEST BY	BL
DEPTH(ft)	8	AASHTO CLASSIFICATION		JOB NO.	171606
CLIENT	PULPIT ROCK, LLC				
PROJECT	FLYING HORSE NORTH				



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	92.5%
4	81.7%
10	63.4%
20	48.0%
40	38.4%
100	22.9%
200	15.3%

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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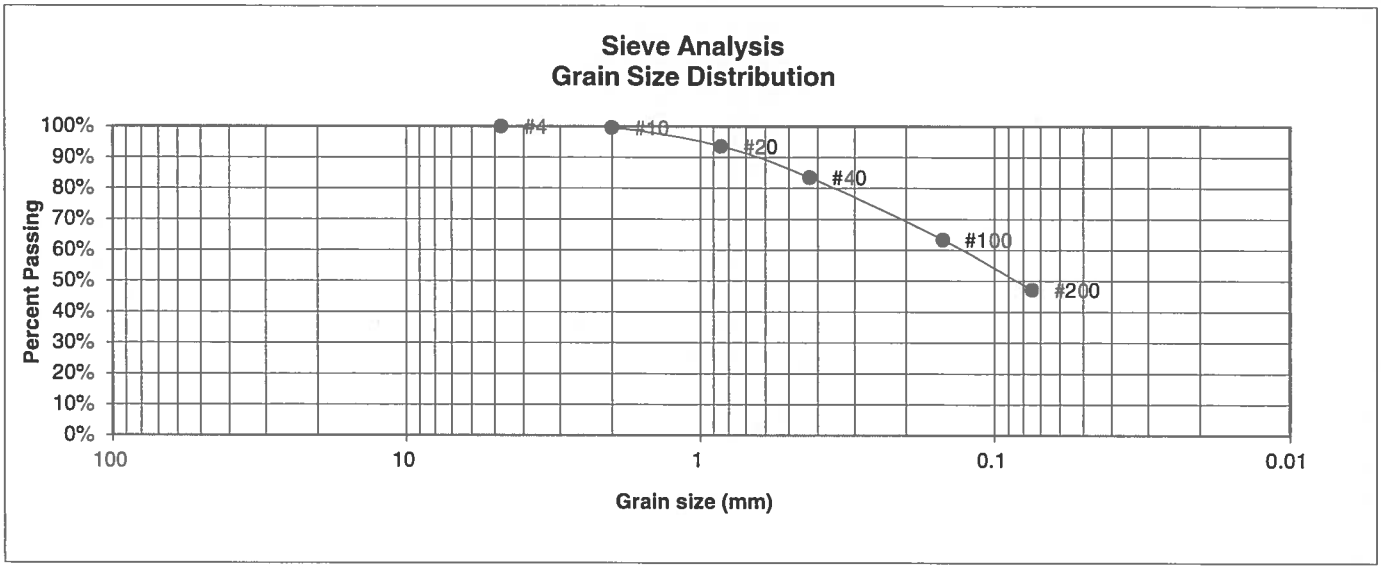
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	11/8/17

JOB NO.: 171606

FIG NO.: C-10

BORING NO.	TP-8	UNIFIED CLASSIFICATION	SC	TEST BY	BL
DEPTH(ft)	4	AASHTO CLASSIFICATION		JOB NO.	171606
CLIENT	PULPIT ROCK, LLC				
PROJECT	FLYING HORSE NORTH				



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.6%
20	93.6%
40	83.5%
100	63.4%
200	47.2%

Atterberg Limits	
Plastic Limit	14
Liquid Limit	26
Plastic Index	12

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

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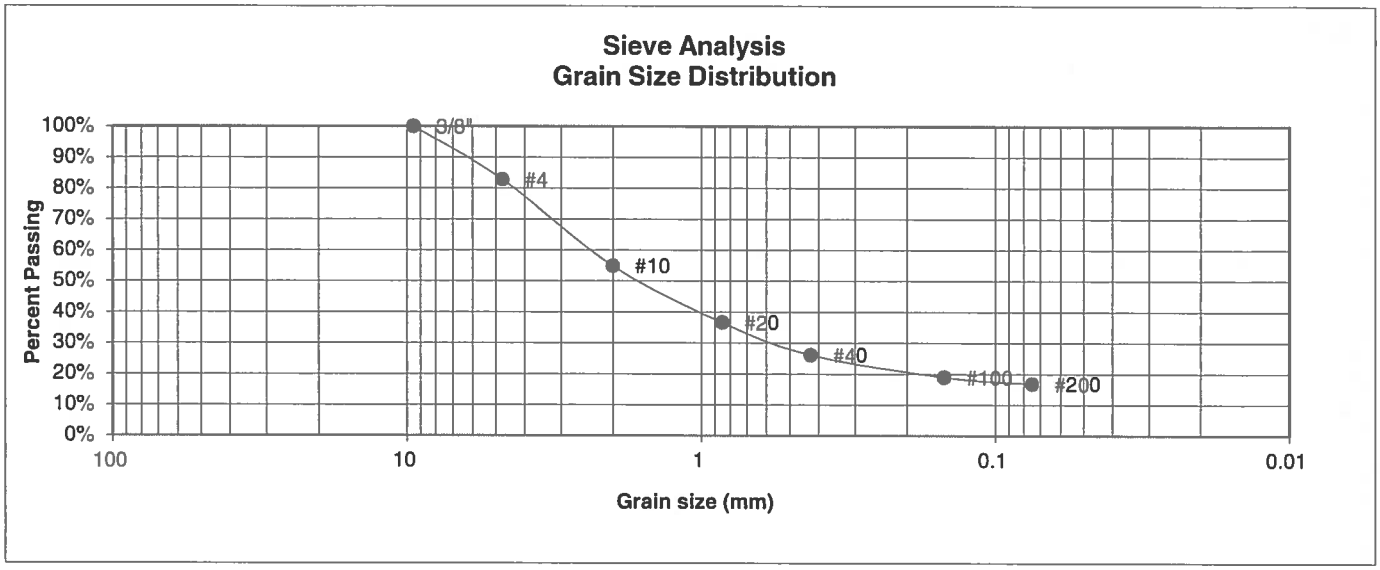
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	11/8/17

JOB NO.: 171606

FIG NO.: C-11

BORING NO.	TP-9	UNIFIED CLASSIFICATION	SM	TEST BY	BL
DEPTH(ft)	6	AASHTO CLASSIFICATION		JOB NO.	171606
CLIENT	PULPIT ROCK, LLC				
PROJECT	FLYING HORSE NORTH				



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	82.8%
10	54.8%
20	36.6%
40	26.2%
100	19.0%
200	16.8%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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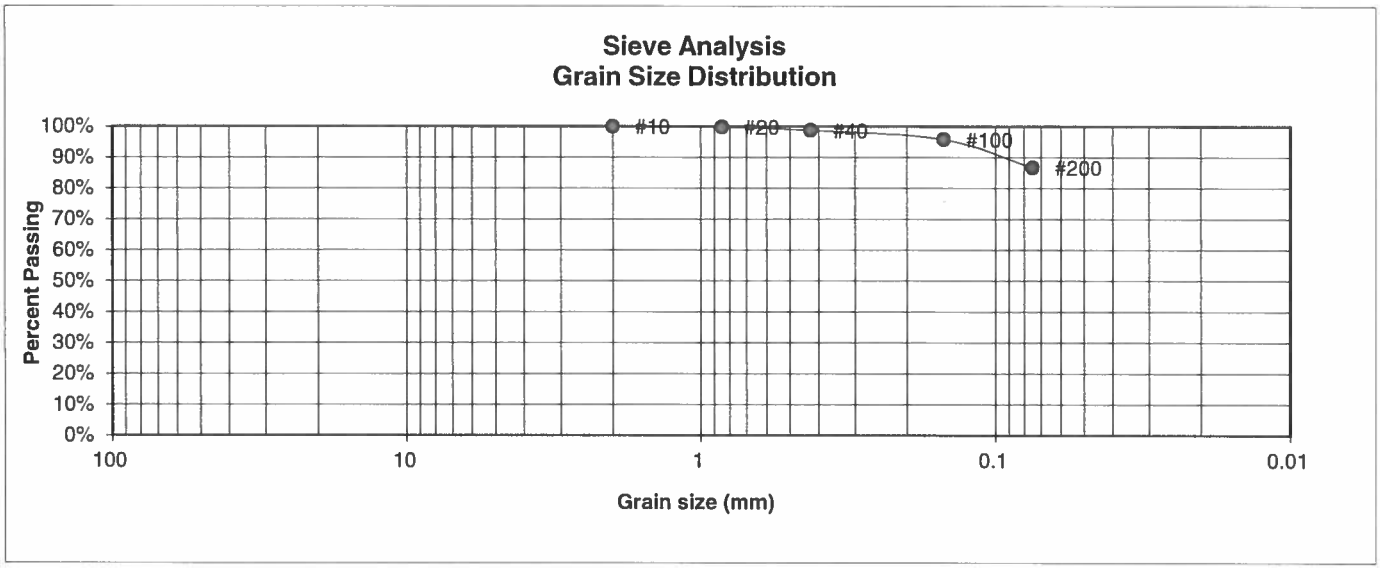
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	11/8/17

JOB NO.: 171606

FIG NO.: C-12

BORING NO.	TP-10	UNIFIED CLASSIFICATION	CL	TEST BY	BL
DEPTH(ft)	3-4	AASHTO CLASSIFICATION		JOB NO.	171606
CLIENT	PULPIT ROCK, LLC				
PROJECT	FLYING HORSE NORTH				



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	
10	100.0%
20	99.8%
40	98.7%
100	95.8%
200	86.7%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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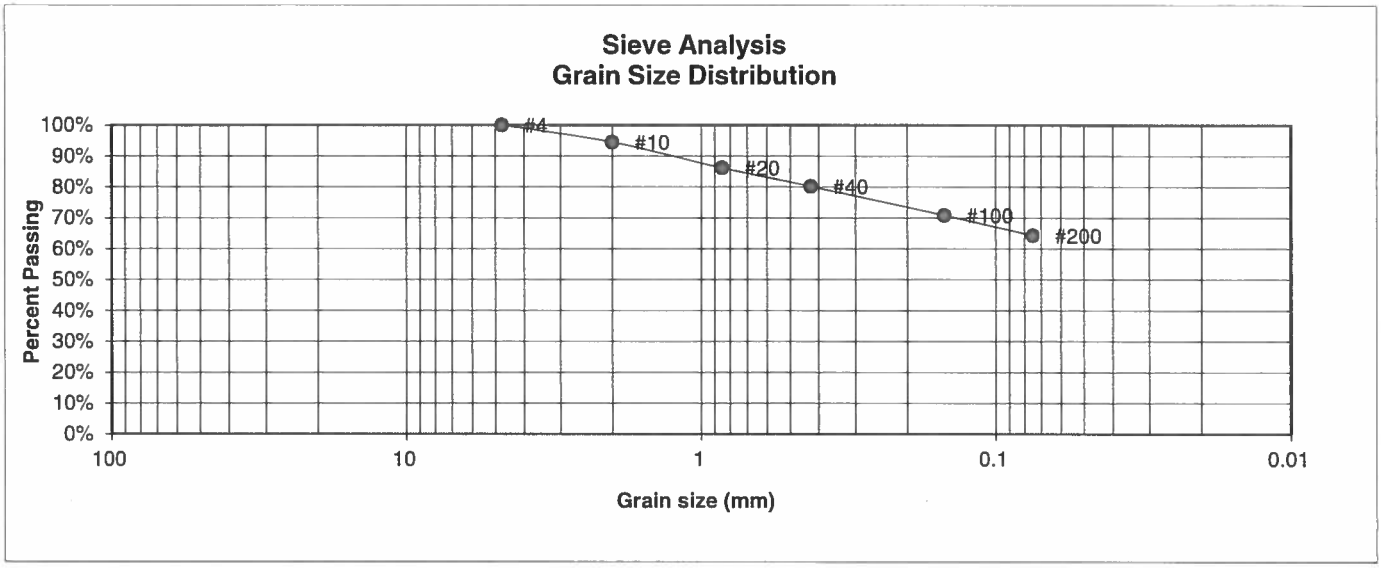
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	11/8/17

JOB NO.: 171606

FIG NO.: C-13

BORING NO.	TP-11	UNIFIED CLASSIFICATION	SC	TEST BY	BL
DEPTH(ft)	2	AASHTO CLASSIFICATION		JOB NO.	171606
CLIENT	PULPIT ROCK, LLC				
PROJECT	FLYING HORSE NORTH				



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	94.5%
20	86.2%
40	80.2%
100	70.8%
200	64.3%

Atterberg Limits	
Plastic Limit	14
Liquid Limit	26
Plastic Index	12

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

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LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	11/8/17

JOB NO.: 171606

FIG NO.: C-14

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

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

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 15', 1/24/15						
CLAY, SANDY, BROWN						2
SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST				19	6.1	1
	5			21	4.7	1
WEATHERED SANDSTONE, SILTY, FINE TO COARSE GRAINED, GRAY BROWN, DENSE, MOIST	10			35	11.1	3
SANDSTONE, SILTY, FINE TO COARSE GRAINED, GRAY, VERY DENSE, MOIST	15			50 10"	15.9	3
	20					

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

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 15', 1/24/15						
CLAY, SANDY TO VERY SANDY, BROWN TO TAN, STIFF TO FIRM, MOIST				25	7.2	2
	5			9	7.8	2
SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST	10			22	4.9	1
	15			29	5.8	1
	20					

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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

PROFILE BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		N	2/12/15

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

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

REMARKS

DRY TO 15', 1/24/15

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
CLAY, SANDY, BROWN, STIFF TO FIRM, MOIST			24	8.2	2
5			13	6.8	2
SAND, SILTY, TAN					1
WEATHERED SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, DENSE, MOIST			40	4.1	3
10					
15			42	8.3	3
20					

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

REMARKS

DRY TO 15', 1/24/15

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
CLAY, SANDY, TAN, STIFF, MOIST			16	8.6	2
5			15	9.1	2
SAND, CLAYEY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST			18	8.8	1
10					
15 CLAY, SANDY, BROWN, FIRM, MOIST			12	18.2	2
20					

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PROFILE BORING LOG

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

JOB NO.: 141588
FIG NO.: B-2

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

REMARKS

DRY TO 15', 2/3/15

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			16	2.7	1
5			42	11.5	3
10			42	14.3	3
15			45	4.4	3
20					

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

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

REMARKS

DRY TO 15', 1/27/15

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			21	22.4	2
5			16	8.9	2
10			42	8.7	3
15			50/11"	4.9	3
20					

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

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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

PROFILE BORING LOG

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

JOB NO.: 141588
FIG NO.: B-3

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

REMARKS

DRY TO 15', 1/27/15

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
CLAY, SANDY, TAN, FIRM, MOIST			12	6.6	2
SAND, CLAYEY, FINE TO COARSE GRAINED, BROWN, DENSE, MOIST	5		44	7.3	2
SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST	10		14	7.5	1
WEATHERED SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, DENSE, MOIST	15		46	8.8	3
	20				

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

REMARKS

DRY TO 15', 2/3/15

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
CLAY, SANDY TO VERY SANDY, TAN, STIFF, MOIST			15	9.0	2
	5		28	9.2	2
	10		24	5.7	2
	15		29	6.9	2
	20				

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COLORADO SPRINGS, COLORADO 80907

PROFILE BORING LOG

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

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

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

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 15', 2/4/15						
SAND, SILTY WITH CLAYEY LENSES, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE TO LOOSE, MOIST				24	5.6	1
	5			18	6.2	1
	10			6	8.9	1
SANDSTONE, SILTY, FINE TO COARSE GRAINED, GRAY, VERY DENSE, MOIST	15			50	11.2	3
	20					

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

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 15', 2/5/15						
SAND, SILTY, FINE TO COARSE GRAINED, TAN, DENSE, MOIST				32	3.8	1
CLAY, SANDY, TAN, VERY STIFF, MOIST	5			42	9.2	2
SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE TO LOOSE, MOIST	10			17	3.7	1
	15			6	3.3	1
	20					

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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

PROFILE BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		K	2/12/15

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

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

REMARKS

DRY TO 15', 12/2/14

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST			27	6.7	1
5			25	4.8	1
WEATHERED SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, DENSE, MOIST			32	7.8	3
10					
SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, VERY DENSE, MOIST			50/6"	10.0	3
15					
20					

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

REMARKS

DRY TO 15', 12/2/14

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
SAND, SILTY, FINE TO COARSE GRAINED, TAN, LOOSE TO MEDIUM DENSE, MOIST			7	10.5	1
5			22	5.6	1
			25	8.8	1
10					
SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, VERY DENSE, MOIST			50/7"	7.7	3
15					
20					

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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

PROFILE BORING LOG

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

JOB NO.: 141588
FIG NO.: B-6

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

REMARKS

DRY TO 15', 12/2/14

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

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

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

REMARKS

DRY TO 15', 12/2/14

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

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

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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

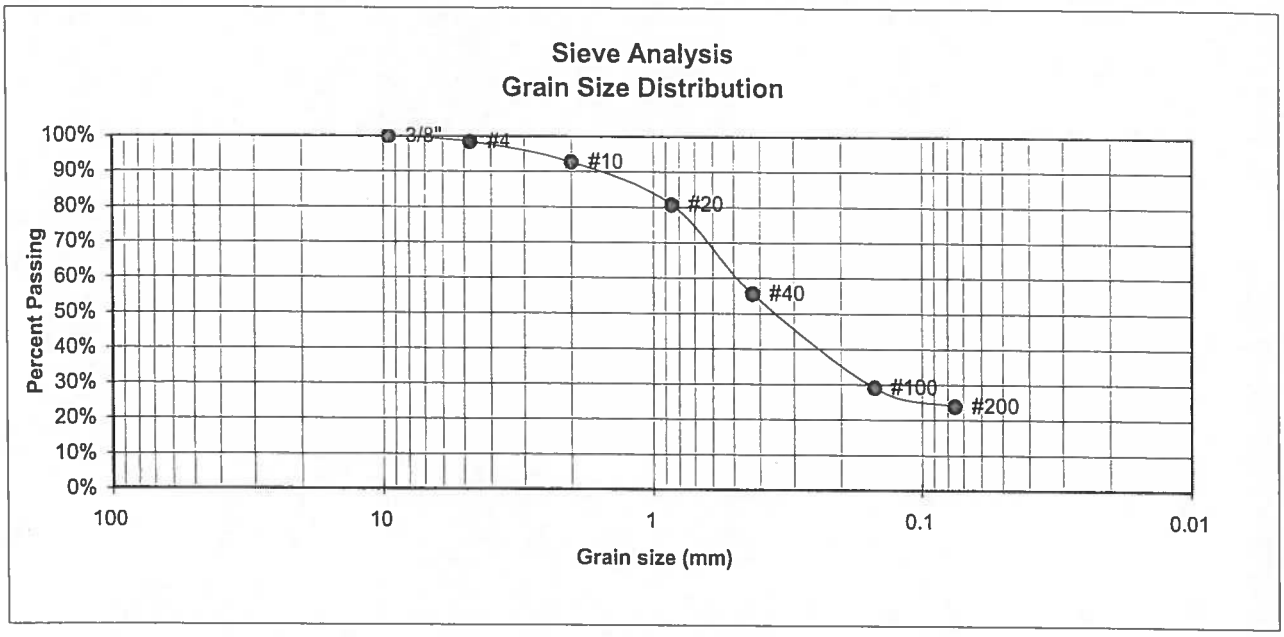
PROFILE BORING LOG

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

JOB NO.: 141588
FIG NO.: B-7

APPENDIX C: Laboratory Test Results

UNIFIED CLASSIFICATION	SM	CLIENT	NES, INC.
SOIL TYPE #	1	PROJECT	SHAMROCK RANCH
TEST BORING #	1	JOB NO.	141588
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	98.5%
10	92.7%
20	80.7%
40	55.5%
100	29.1%
200	23.9%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

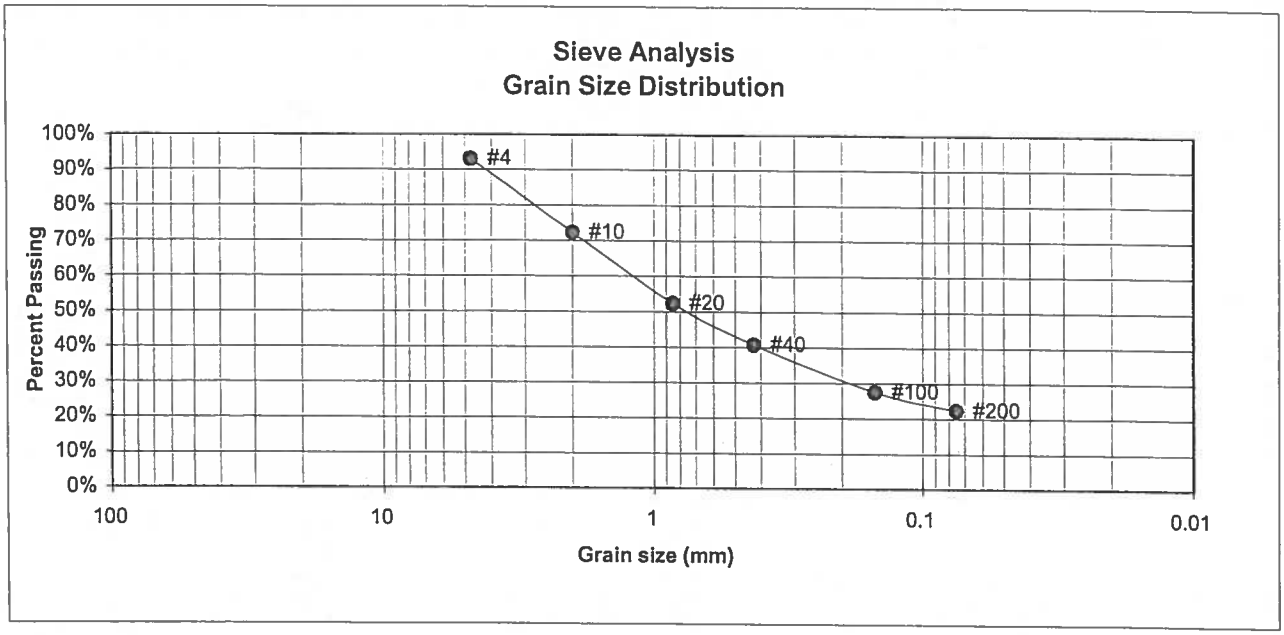
ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

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

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

UNIFIED CLASSIFICATION	SM	CLIENT	NES, INC.
SOIL TYPE #	1	PROJECT	SHAMROCK RANCH
TEST BORING #	5	JOB NO.	141588
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	93.1%
10	72.3%
20	52.4%
40	40.7%
100	27.6%
200	22.3%

Atterberg Limits	
Plastic Limit	18
Liquid Limit	22
Plastic Index	3

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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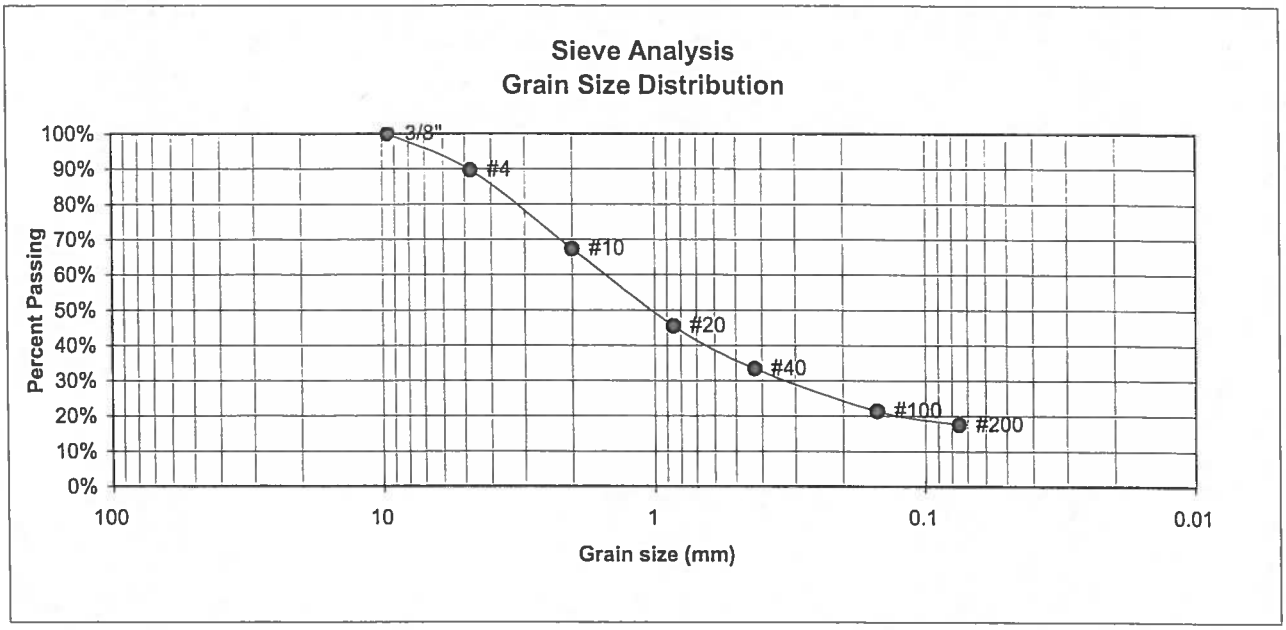
JOB NO.: 141588
FIG NO.: C-2

UNIFIED CLASSIFICATION	SM	CLIENT	NES, INC.
SOIL TYPE #	1	PROJECT	SHAMROCK RANCH
TEST BORING #	11	JOB NO.	141588
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	89.7%
10	67.3%
20	45.5%
40	33.4%
100	21.4%
200	17.6%

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

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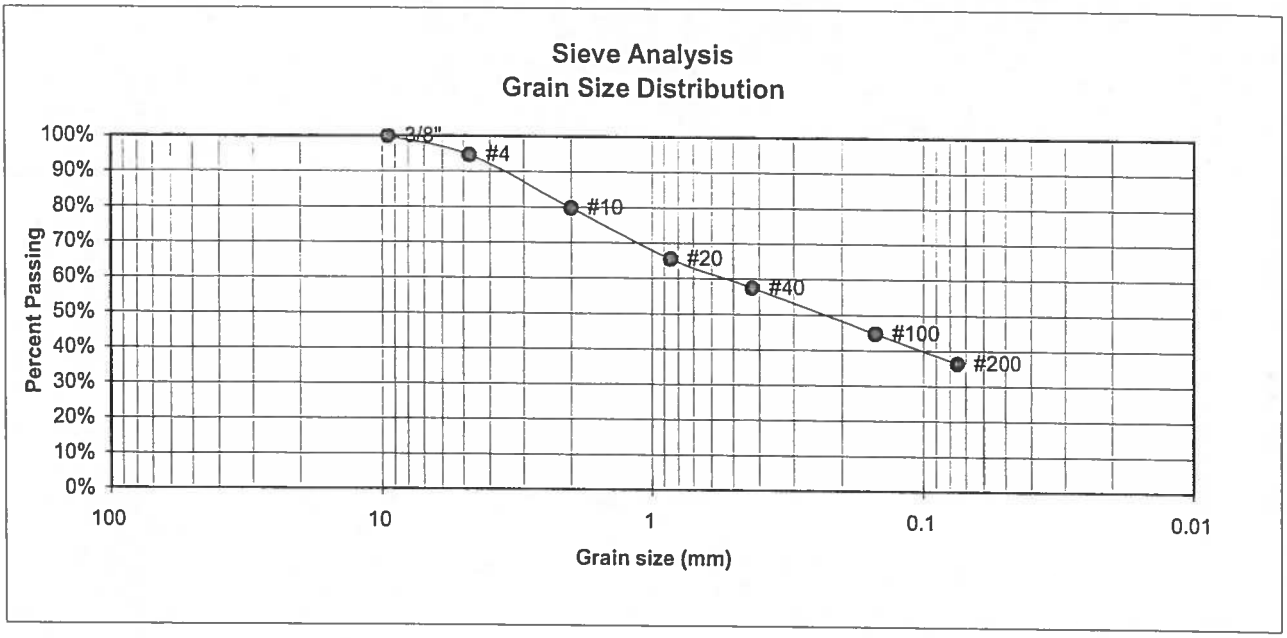
JOB NO.: 141588
FIG NO.: C-3

UNIFIED CLASSIFICATION	SM	CLIENT	NES, INC.
SOIL TYPE #	1	PROJECT	SHAMROCK RANCH
TEST BORING #	12	JOB NO.	141588
DEPTH (FT)	10	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	94.7%
10	79.8%
20	65.5%
40	57.4%
100	44.8%
200	36.5%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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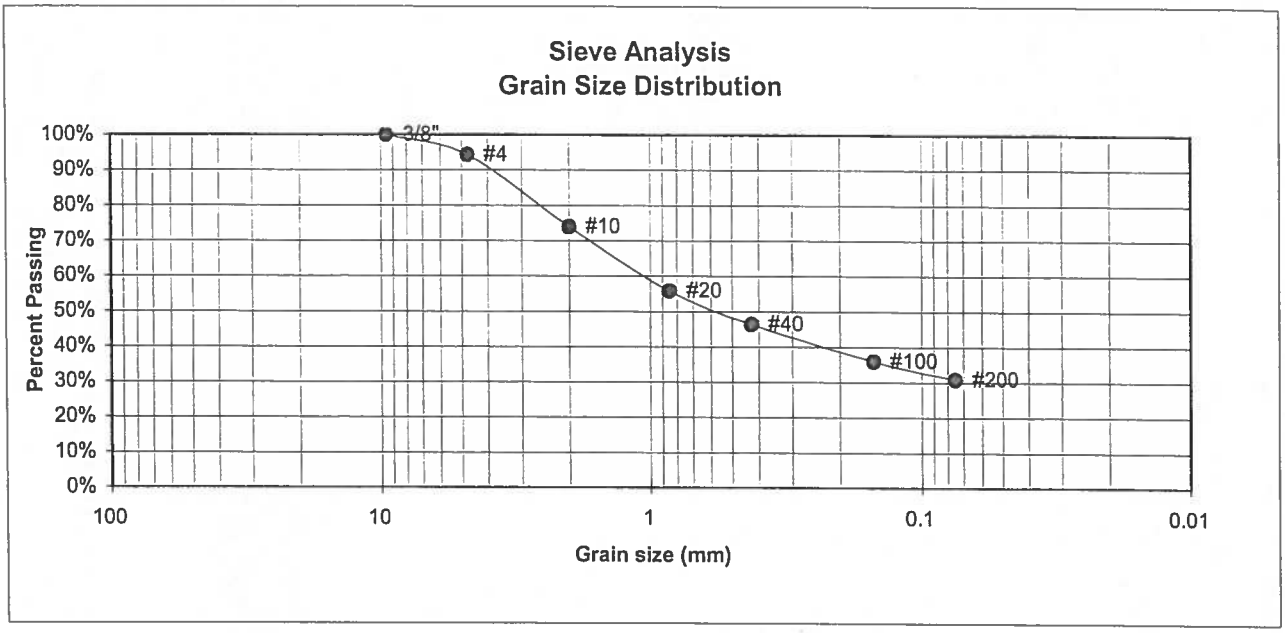
JOB NO.: 141588
FIG NO.: C-4

UNIFIED CLASSIFICATION	SM	CLIENT	NES, INC.
SOIL TYPE #	1	PROJECT	SHAMROCK RANCH
TEST BORING #	14	JOB NO.	141588
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	94.4%
10	73.9%
20	55.8%
40	46.4%
100	35.9%
200	30.8%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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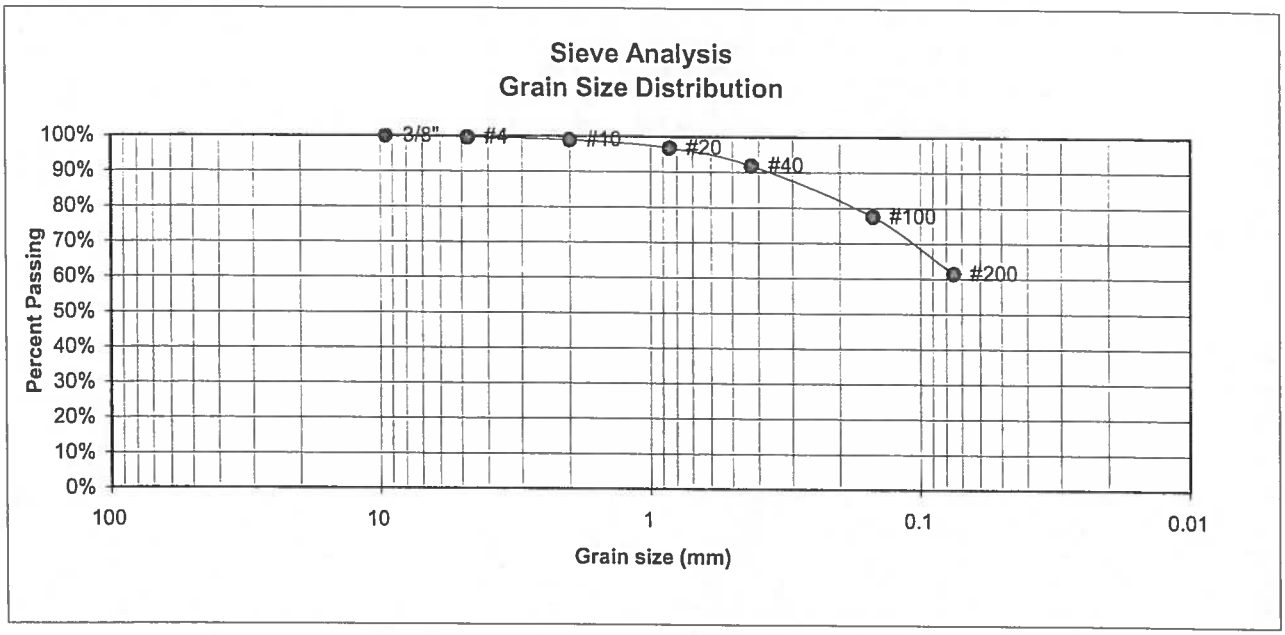
JOB NO.: 141588
FIG NO.: C-5

UNIFIED CLASSIFICATION	CL	CLIENT	NES, INC.
SOIL TYPE #	2	PROJECT	SHAMROCK RANCH
TEST BORING #	2	JOB NO.	141588
DEPTH (FT)	5	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.7%
10	99.0%
20	96.8%
40	91.9%
100	77.5%
200	61.4%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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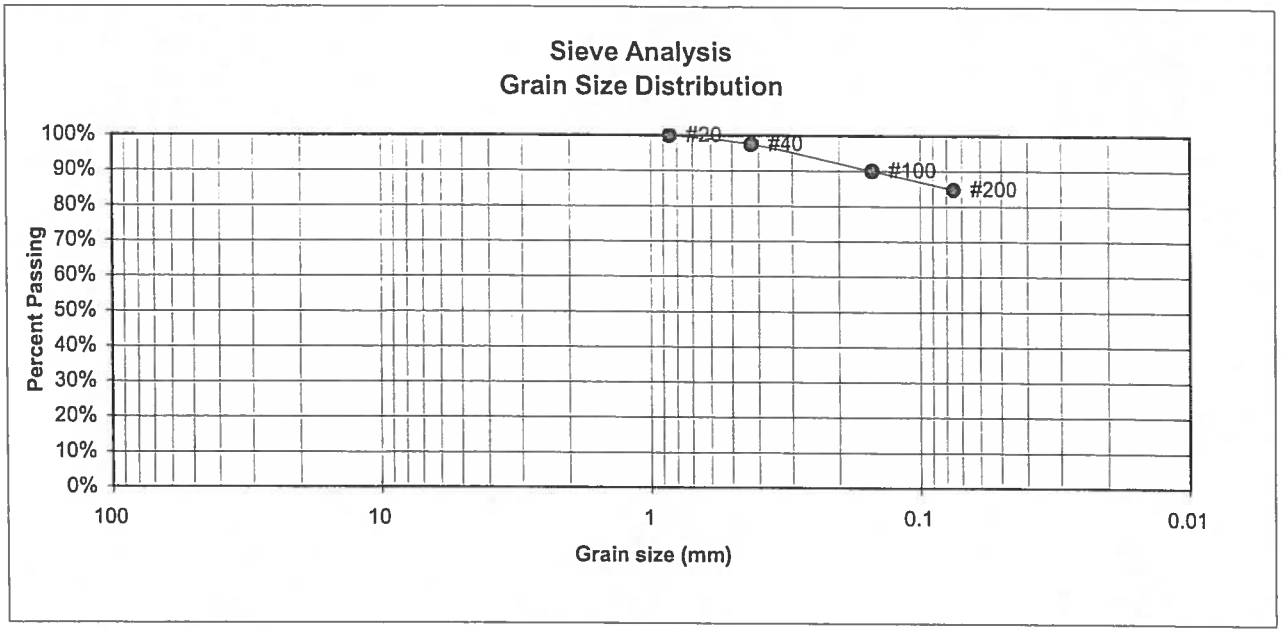
JOB NO.: 141588
FIG NO.: C-6

UNIFIED CLASSIFICATION	CL	CLIENT	NES, INC.
SOIL TYPE #	2	PROJECT	SHAMROCK RANCH
TEST BORING #	3	JOB NO.	141588
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	
10	
20	100.0%
40	97.5%
100	90.0%
200	84.8%

Atterberg Limits	
Plastic Limit	19
Liquid Limit	32
Plastic Index	13

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:
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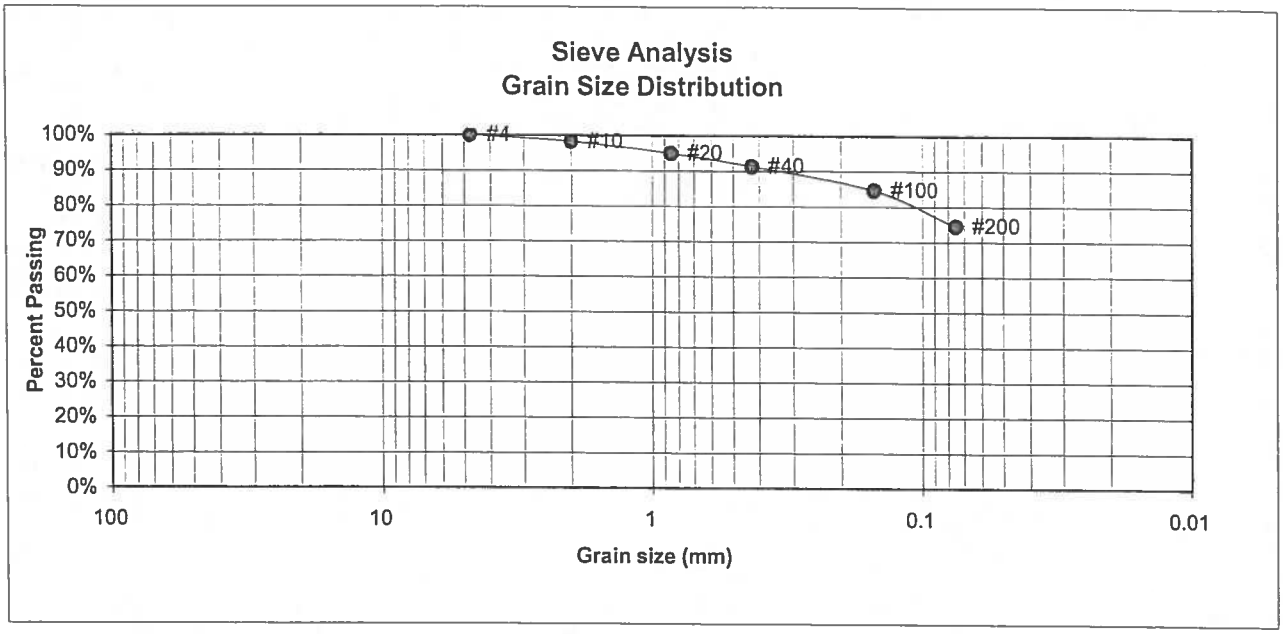
JOB NO.: 141588
FIG NO.: C-7

UNIFIED CLASSIFICATION	CL	CLIENT	NES, INC.
SOIL TYPE #	2	PROJECT	SHAMROCK RANCH
TEST BORING #	4	JOB NO.	141588
DEPTH (FT)	5	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	98.2%
20	95.0%
40	91.3%
100	84.6%
200	74.5%

Atterberg Limits

Plastic Limit

Liquid Limit

Plastic Index

Swell

Moisture at start	12.6%
Moisture at finish	19.9%
Moisture increase	7.3%
Initial dry density (pcf)	108
Swell (psf)	1485

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LABORATORY TEST RESULTS

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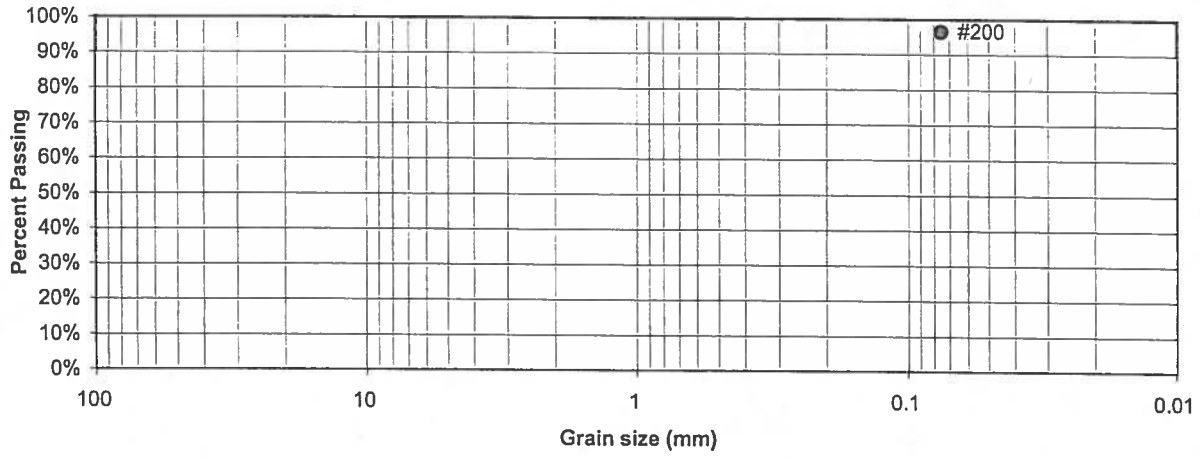
JOB NO.: 141588

FIG NO.: C-8

UNIFIED CLASSIFICATION	CL	CLIENT	NES, INC.
SOIL TYPE #	2	PROJECT	SHAMROCK RANCH
TEST BORING #	6	JOB NO.	141588
DEPTH (FT)	2-3	TEST BY	BL

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	
10	
20	
40	
100	
200	96.5%

Atterberg Limits	
Plastic Limit	23
Liquid Limit	39
Plastic Index	17

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

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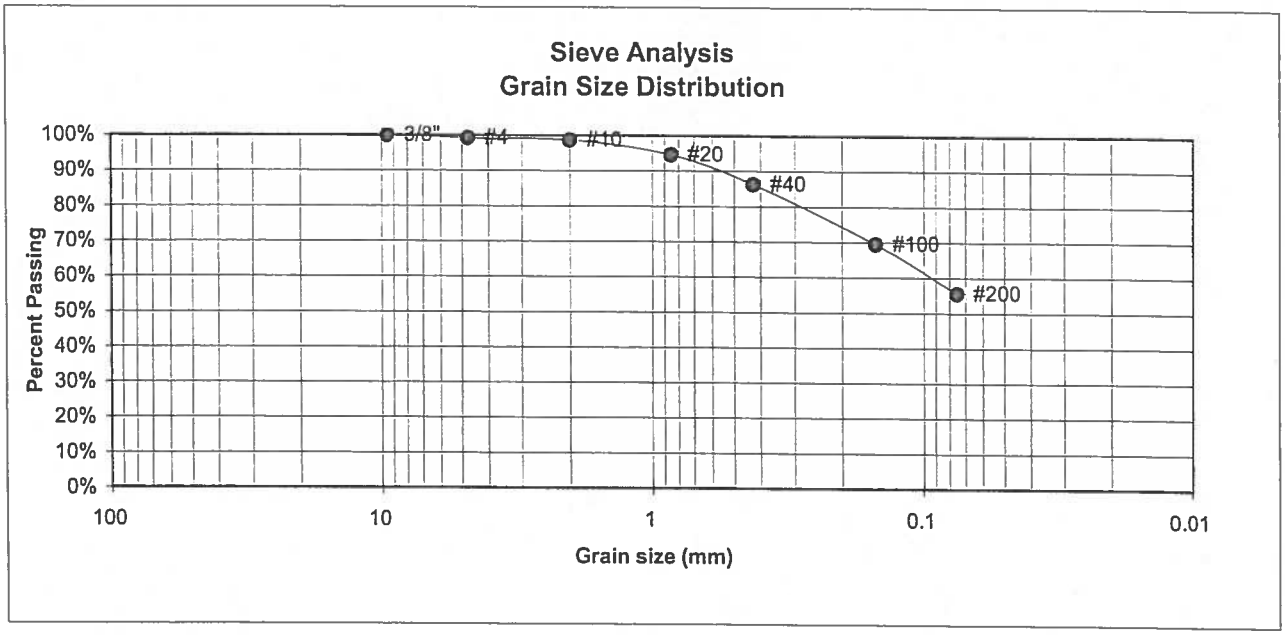
LABORATORY TEST RESULTS

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

JOB NO.: 141588
FIG NO.: C-9

UNIFIED CLASSIFICATION	CL	CLIENT	NES, INC.
SOIL TYPE #	2	PROJECT	SHAMROCK RANCH
TEST BORING #	8	JOB NO.	141588
DEPTH (FT)	10	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.3%
10	98.7%
20	94.6%
40	86.3%
100	69.5%
200	55.5%

Atterberg Limits	
Plastic Limit	24
Liquid Limit	36
Plastic Index	12

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

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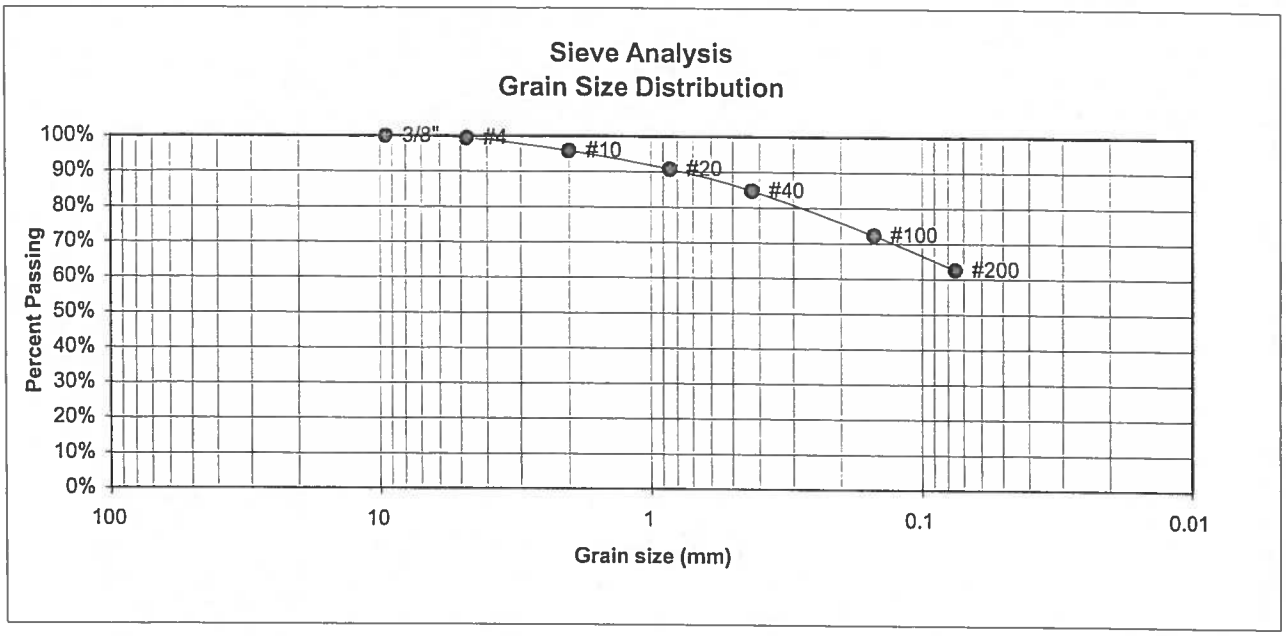
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			4/2/15

JOB NO.: 141588
FIG NO.: C-10

UNIFIED CLASSIFICATION	CL	CLIENT	NES, INC.
SOIL TYPE #	2	PROJECT	SHAMROCK RANCH
TEST BORING #	10	JOB NO.	141588
DEPTH (FT)	5	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.4%
10	95.9%
20	90.8%
40	84.8%
100	72.2%
200	62.5%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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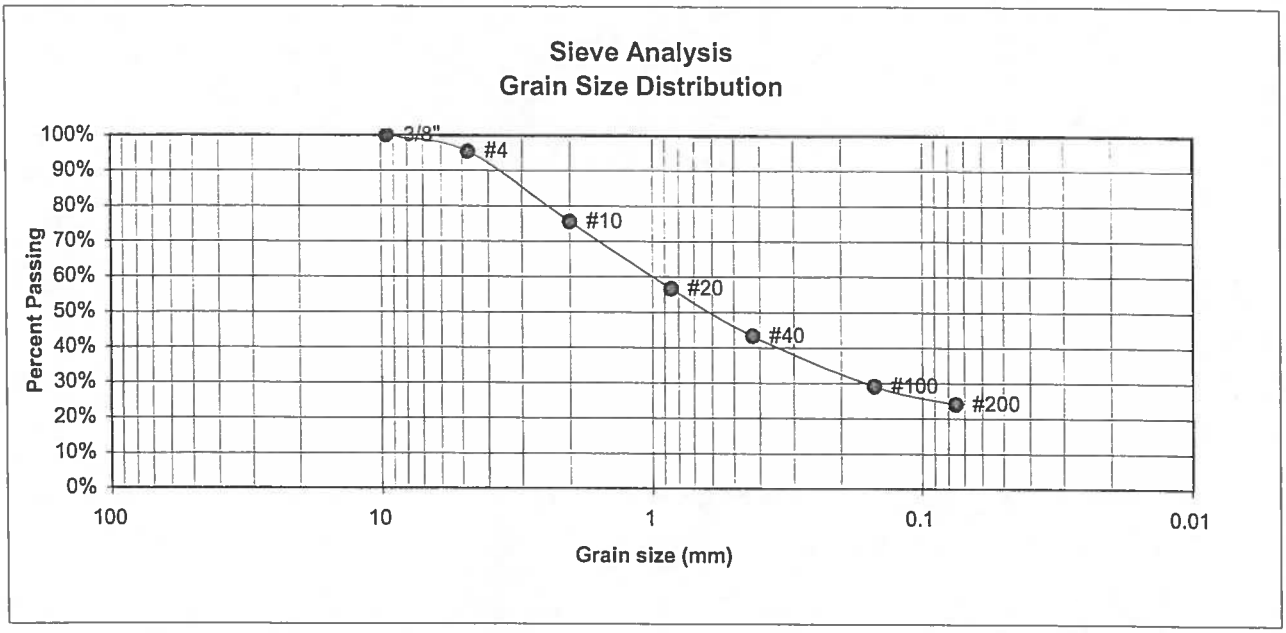
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
			12/12/15

JOB NO.: 141588
FIG NO.: C-11

UNIFIED CLASSIFICATION	SM	CLIENT	NES, INC.
SOIL TYPE #	3	PROJECT	SHAMROCK RANCH
TEST BORING #	1	JOB NO.	141588
DEPTH (FT)	15	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	95.5%
10	75.6%
20	56.6%
40	43.3%
100	29.1%
200	24.0%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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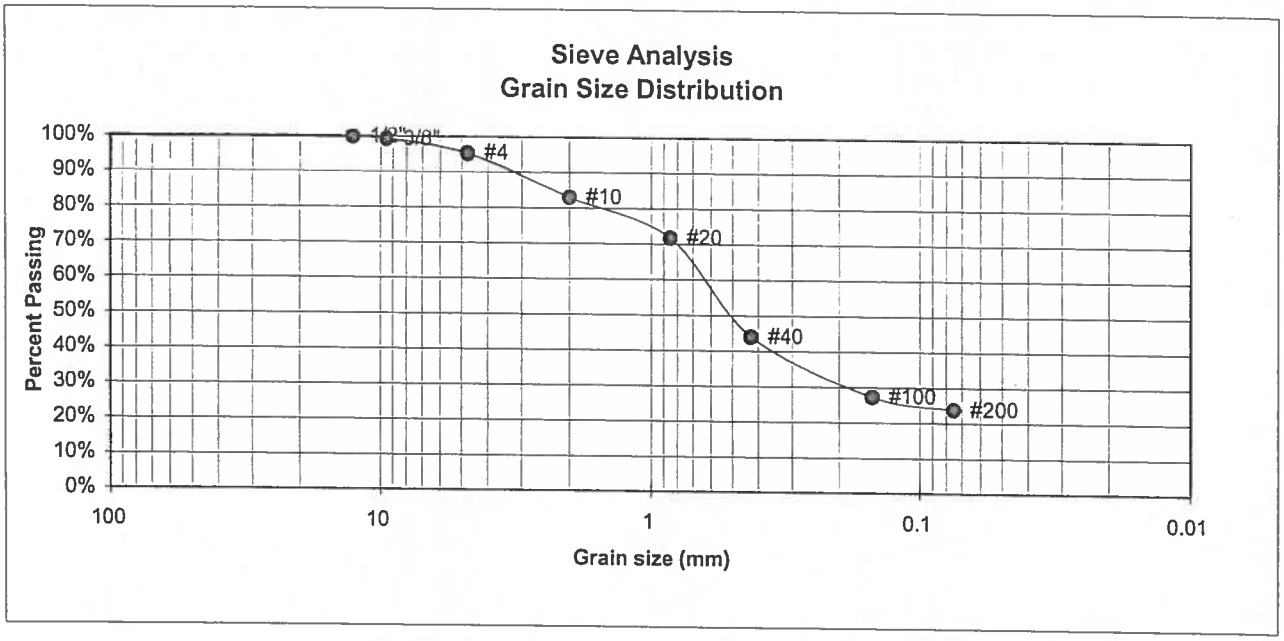
LABORATORY TEST RESULTS

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

JOB NO.: 141588
FIG NO.: C-12

UNIFIED CLASSIFICATION	SM	CLIENT	NES, INC.
SOIL TYPE #	3	PROJECT	SHAMROCK RANCH
TEST BORING #	3	JOB NO.	141588
DEPTH (FT)	10	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	99.3%
4	95.3%
10	83.0%
20	71.8%
40	44.0%
100	27.3%
200	23.8%

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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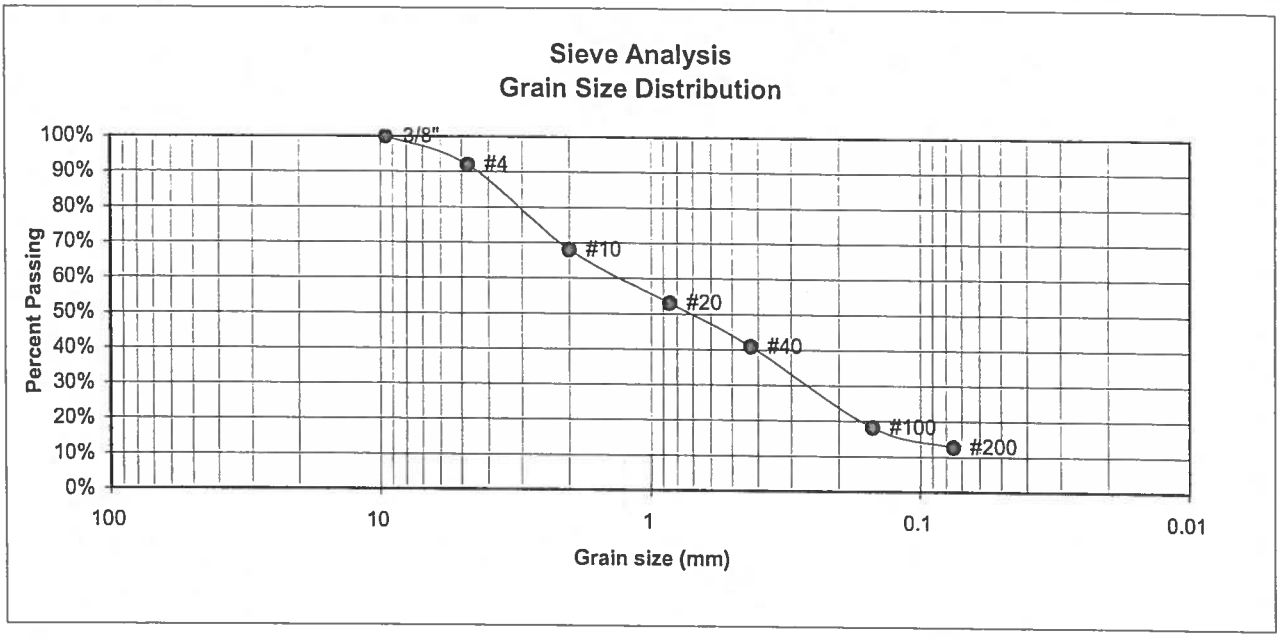
LABORATORY TEST RESULTS

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

JOB NO.: 141588

FIG NO.: C-13

UNIFIED CLASSIFICATION	SM	CLIENT	NES, INC.
SOIL TYPE #	3	PROJECT	SHAMROCK RANCH
TEST BORING #	6	JOB NO.	141588
DEPTH (FT)	15	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	91.9%
10	68.0%
20	53.1%
40	40.9%
100	18.2%
200	12.7%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
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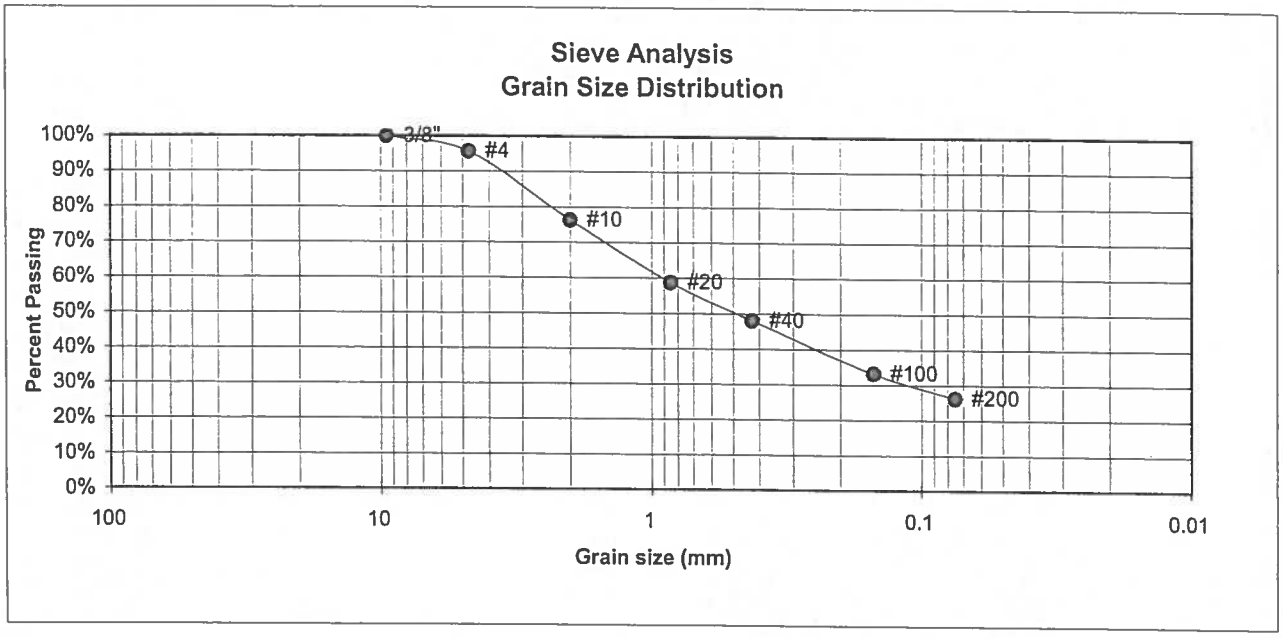
JOB NO.: 141588
FIG NO.: C-14

UNIFIED CLASSIFICATION	SM	CLIENT	NES, INC.
SOIL TYPE #	3	PROJECT	SHAMROCK RANCH
TEST BORING #	7	JOB NO.	141588
DEPTH (FT)	10	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	95.7%
10	76.3%
20	58.8%
40	48.0%
100	33.2%
200	26.3%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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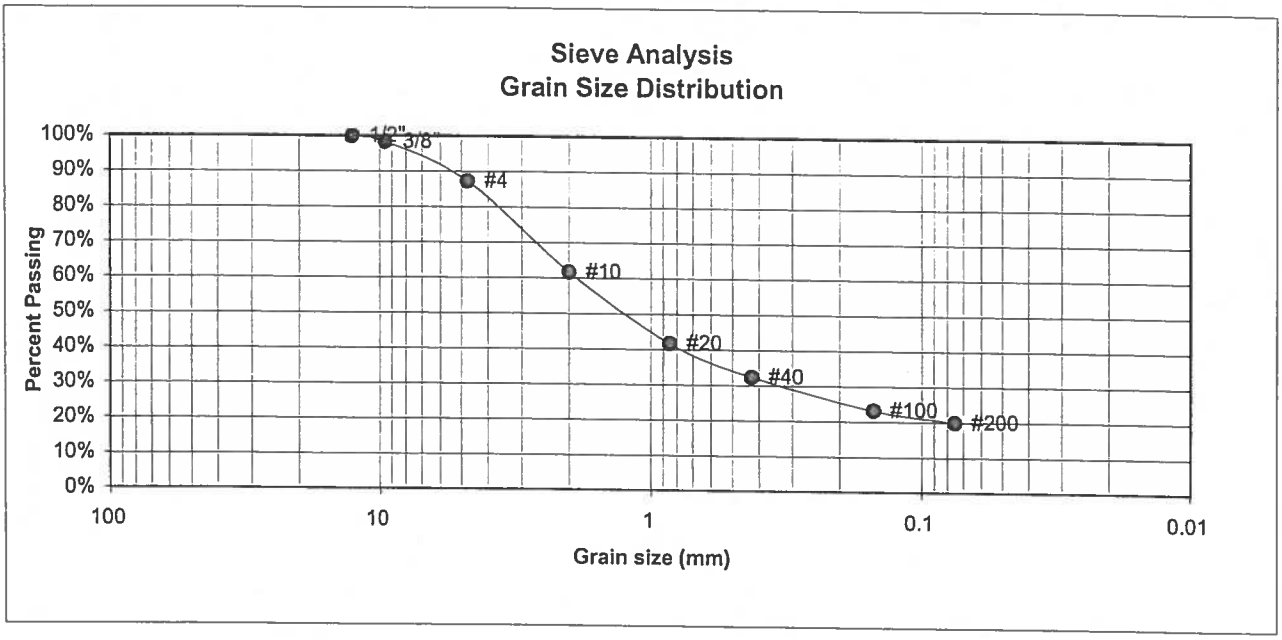
LABORATORY TEST RESULTS

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

JOB NO.: 141588
FIG NO.: C-15

UNIFIED CLASSIFICATION	SM	CLIENT	NES, INC.
SOIL TYPE #	3	PROJECT	SHAMROCK RANCH
TEST BORING #	13	JOB NO.	141588
DEPTH (FT)	5	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	98.4%
4	87.3%
10	61.7%
20	41.8%
40	32.4%
100	23.3%
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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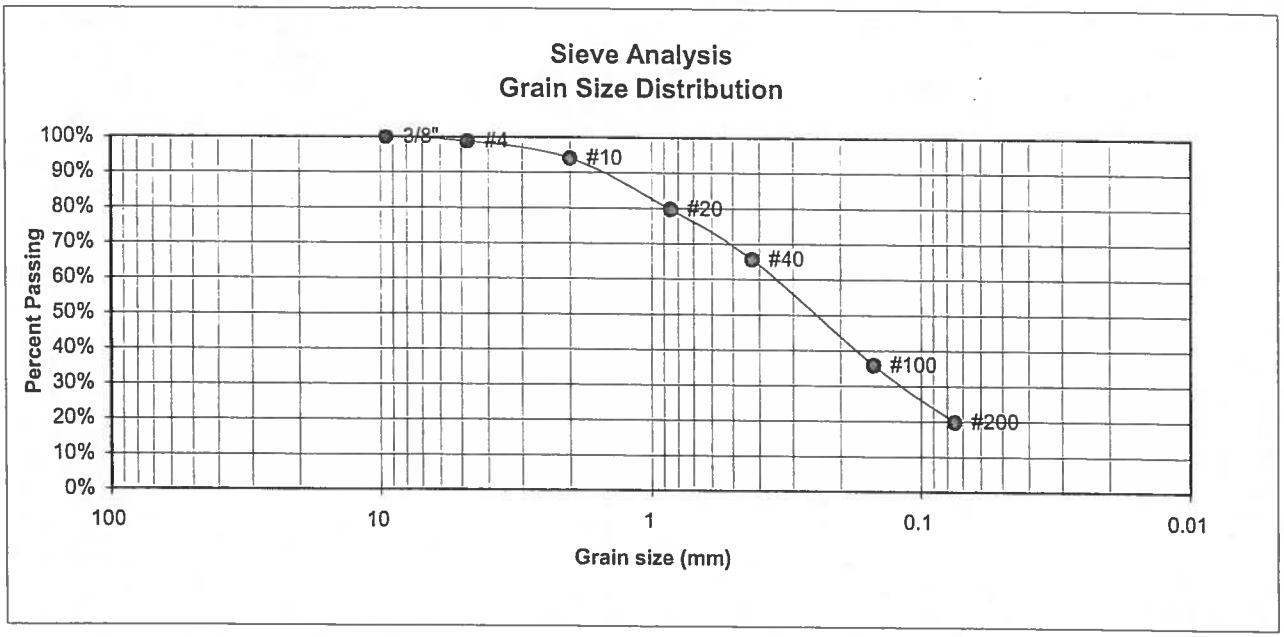
LABORATORY TEST RESULTS

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

JOB NO.: 141588
FIG NO.: C-16

UNIFIED CLASSIFICATION	SM	CLIENT	NES, INC.
SOIL TYPE #	1	PROJECT	SHAMROCK RANCH
TEST BORING #	9	JOB NO.	141588
DEPTH (FT)	10	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	98.8%
10	94.0%
20	79.7%
40	65.6%
100	35.9%
200	19.8%

Atterberg Limits

Plastic Limit

Liquid Limit

Plastic Index

Swell

Moisture at start	9.7%
Moisture at finish	20.0%
Moisture increase	10.3%
Initial dry density (pcf)	99
Swell (psf)	152

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LABORATORY TEST RESULTS

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

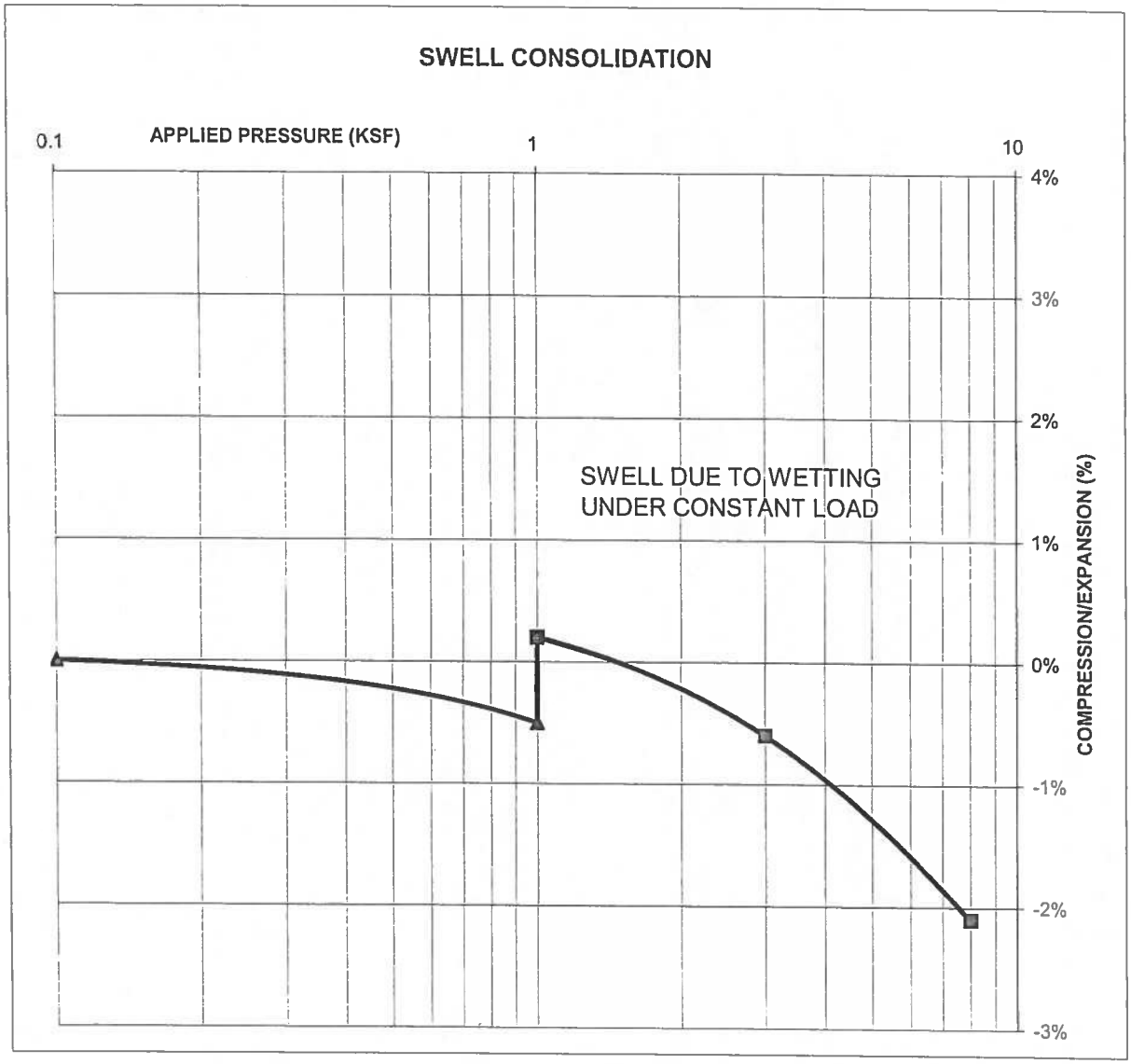
JOB NO.: 141588

FIG NO.: C-17

CONSOLIDATION TEST RESULTS

TEST BORING #	3	DEPTH(ft)	2-3
DESCRIPTION	CL	SOIL TYPE	2
NATURAL UNIT DRY WEIGHT (PCF)			116
NATURAL MOISTURE CONTENT			11.1%
SWELL/CONSOLIDATION (%)			0.7%

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



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SWELL CONSOLIDATION
TEST RESULTS

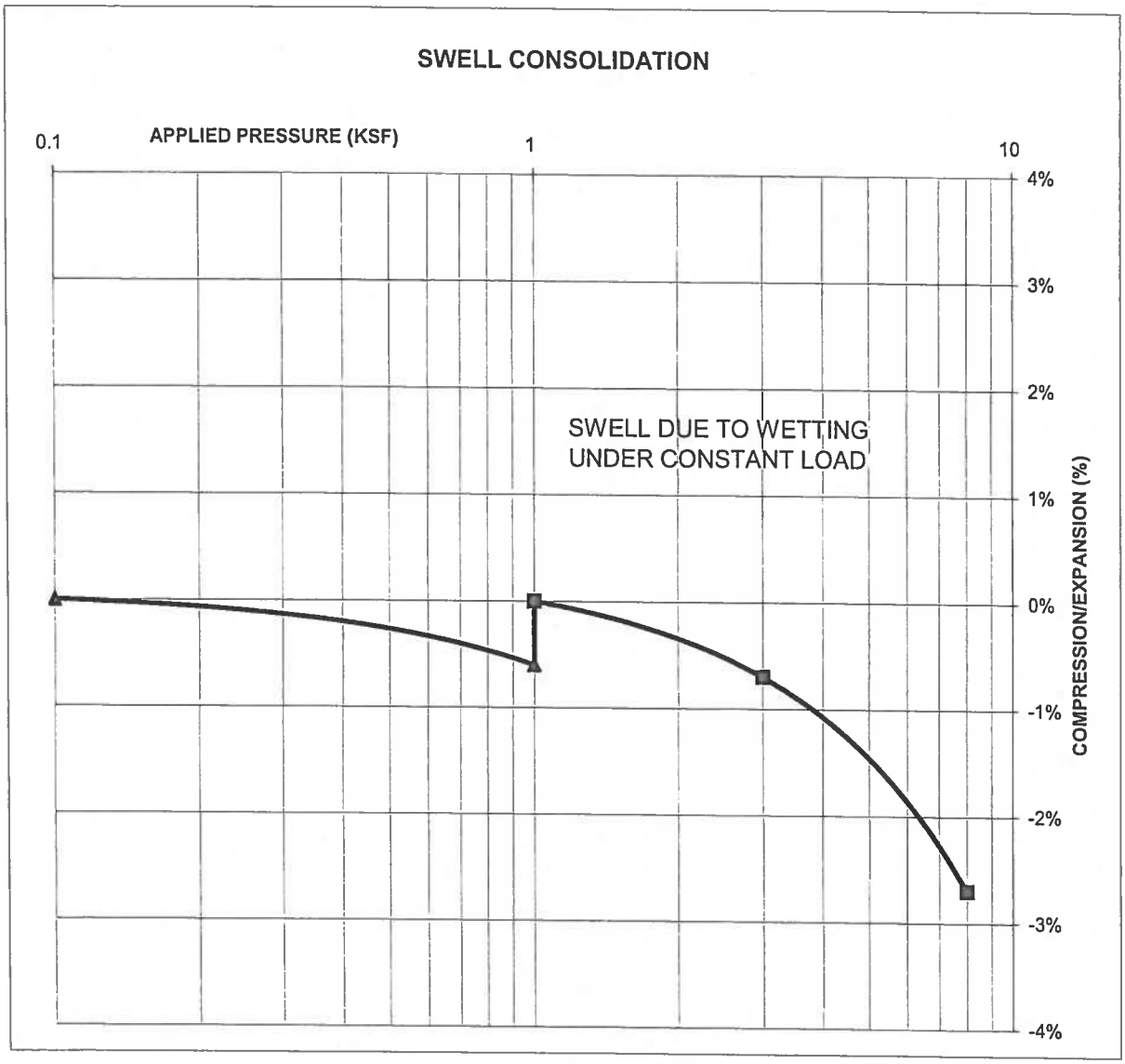
DRAWN:	DATE:	CHECKED:	DATE:
			12/12/15

JOB NO.: 141588
FIG NO.: C-18

CONSOLIDATION TEST RESULTS

TEST BORING #	6	DEPTH(ft)	2-3
DESCRIPTION	CL	SOIL TYPE	2
NATURAL UNIT DRY WEIGHT (PCF)			112
NATURAL MOISTURE CONTENT			10.7%
SWELL/CONSOLIDATION (%)			0.6%

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



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SWELL CONSOLIDATION
TEST RESULTS

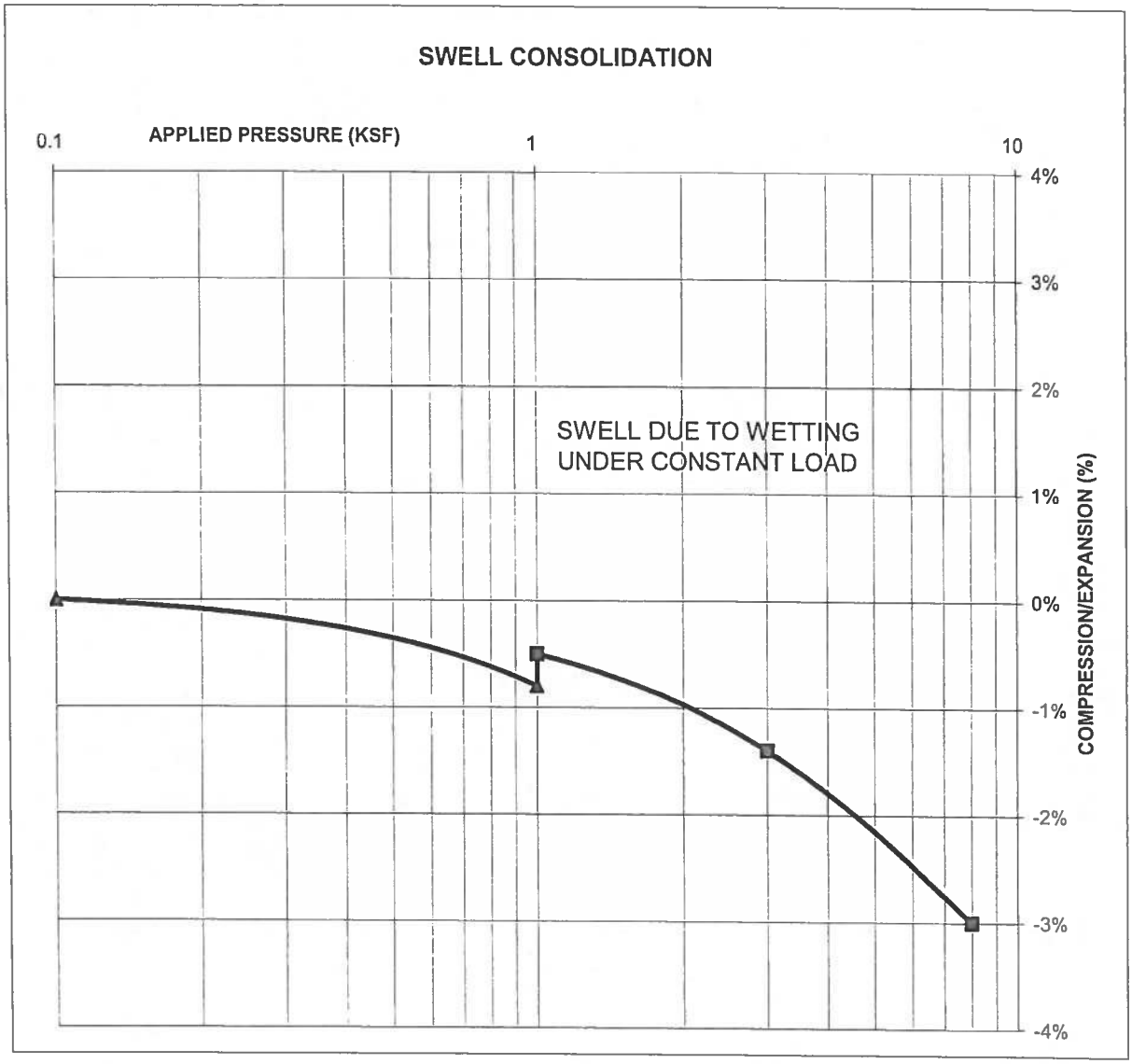
DRAWN:	DATE:	CHECKED:	DATE:
			2/12/15

JOB NO.: 141588
FIG NO.: C-19

CONSOLIDATION TEST RESULTS

TEST BORING #	8	DEPTH(ft)	10
DESCRIPTION	CL	SOIL TYPE	2
NATURAL UNIT DRY WEIGHT (PCF)			112
NATURAL MOISTURE CONTENT			10.8%
SWELL/CONSOLIDATION (%)			0.3%

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



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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

SWELL CONSOLIDATION
TEST RESULTS

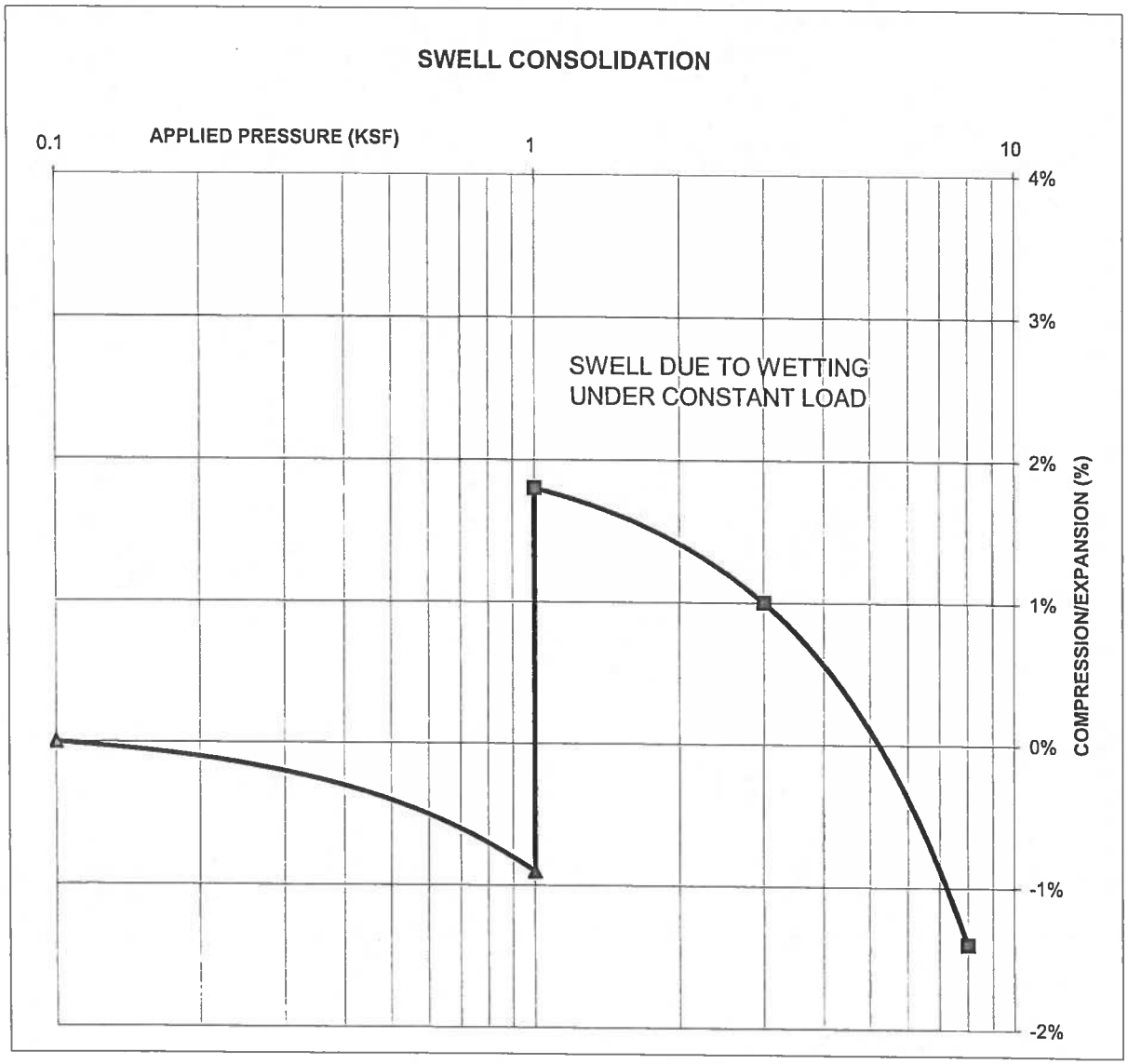
DRAWN:	DATE:	CHECKED:	DATE:
			7/12/15

JOB NO.: 141588
FIG NO.: E-20

CONSOLIDATION TEST RESULTS

TEST BORING #	10	DEPTH(ft)	5
DESCRIPTION	CL	SOIL TYPE	2
NATURAL UNIT DRY WEIGHT (PCF)			114
NATURAL MOISTURE CONTENT			14.3%
SWELL/CONSOLIDATION (%)			2.7%

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



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

SWELL CONSOLIDATION
TEST RESULTS

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

JOB NO.: 141588
FIG NO.: C-21

CLIENT	NES, INC.	JOB NO.	141588
PROJECT	SHAMROCK RANCH	DATE	2/10/2015
LOCATION	SHAMROCK RANCH	TEST BY	BL

BORING NUMBER	DEPTH, (ft)	SOIL TYPE NUMBER	UNIFIED CLASSIFICATION	WATER SOLUBLE SULFATE, (wt%)
TB-11	2-3	1	SM	<0.01
TB-12	10	3	SM	0.01

QC BLANK PASS

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

LABORATORY TEST
SULFATE RESULTS

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

JOB NO.: 141588
FIG NO.: C.22

APPENDIX E: Soil Survey Descriptions

14—Brussett loam, 1 to 3 percent slopes. This deep, well drained soil formed in eolian silt and sand on uplands. Elevation ranges from 7,200 to 7,500 feet. The average annual precipitation is about 18 inches, and the average annual air temperature is about 43 degrees F.

Typically, the surface layer is dark grayish brown loam about 8 inches thick. The subsoil is grayish brown and brown clay loam about 26 inches thick. The substratum is pale brown silt loam. Mycelia and soft masses of lime are common in the substratum.

Included with this soil in mapping are small areas of Peyton sandy loam, 1 to 5 percent slopes.

Permeability of this Brussett soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is slow, and the hazard of erosion is moderate.

Nearly all the acreage of this soil is used for nonirrigated winter wheat, spring oats, and improved pasture that is grazed by cattle and sheep. The chief pasture grasses are smooth brome, intermediate wheatgrass, and pubescent wheatgrass. Winter wheat is grown under a wheat-fallow system. Stubble mulching is the most important conservation practice. Application of fertilizer generally is not needed in the wheat-fallow system. Other crops respond to application of nitrogen. The growing season is too short for warm-season field crops. Management of the plant cover is needed to control erosion.

Rangeland vegetation consists of mountain muhly, little bluestem, needleandthread, Parry oatgrass, and junegrass.

Deferment of grazing in spring helps to maintain the vigor and reproduction of the cool-season bunchgrasses. Fencing and properly distributing livestock watering facilities may be needed to control grazing. Locating salt blocks in areas not generally grazed increases the amount of forage that is used on this soil.

Windbreaks and environmental plantings are generally well suited to this soil. Summer fallow a year prior to planting and continued cultivation for weed control are needed to insure the establishment and survival of plantings. Trees that are best suited and have good survival potential are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Shrubs that are best suited are skunkbush sumac, lilac, Siberian peashrub, and American plum.

This soil is suited to wildlife habitat. It is best suited to habitat for openland and rangeland wildlife. In cropland areas, habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed by establishing areas for nesting and escape cover. For pheasant, undisturbed nesting cover is vital and should be provided for in plans for habitat development. This is especially true in areas of intensive farming. Rangeland wildlife, such as pronghorn antelope, can be encouraged by developing livestock watering facilities, properly managing livestock grazing, and reseeding range where needed.

The main limitations for urban development are moderate shrink-swell potential and frost action potential. Dwellings and roads can be designed to overcome these limitations. Permeability adversely affects the performance of septic tank absorption fields. Capability subclass IIIc.

26—Elbeth sandy loam, 8 to 15 percent slopes. This deep, well drained soil formed in material transported from arkose deposits on uplands. Elevation ranges from 7,300 to 7,600 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 43 degrees F, and the average frost-free season is about 120 days.

Typically, the surface layer is very dark grayish brown sandy loam about 3 inches thick. The subsurface layer is light gray loamy sand about 20 inches thick. The subsoil is brown sandy clay loam about 45 inches thick. The substratum is light brown.

Included with this soil in mapping are small areas of Tomah-Crowfoot loamy sand, 8 to 15 percent slopes; Peyton-Pring complex, 8 to 15 percent slopes; Kettle gravelly loamy sand, 8 to 40 percent slopes; and Kettle-Rock outcrop complex.

Permeability of this Elbeth soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is slow to medium, and the hazard of erosion is moderate.

This soil is used for woodland, limited livestock grazing, recreation, wildlife habitat, and homesites.

This soil is suited to the production of ponderosa pine. It is capable of producing about 2,240 cubic feet, or 4,900 board feet (International rule), of merchantable timber per acre from a fully stocked, even-aged stand of 80-year-old trees. Conventional methods can be used for harvesting, but operations may be restricted during wet periods. Reforestation, after harvesting, must be carefully managed to reduce competition of undesirable understory plants.

Woodland wildlife, such as mule deer and wild turkey, is attracted to this soil because of its potential to produce ponderosa pine, Gambel oak, and various grasses and shrubs. Water developments, such as guzzlers, would enhance populations of wild turkey as well as other kinds of wildlife. Where wildlife and livestock share the same range, proper grazing management is needed to prevent overuse and to reduce competition. Livestock watering facilities would also benefit wildlife on this soil.

This soil has good potential for use as homesites. The main limitation is the moderate shrink-swell potential in the subsoil and frost action potential. Special road design is necessary on this soil to overcome these limitations. Slope is also a limitation. Special planning is needed on this soil to minimize site disturbance and tree and seedling damage. During seasons of low precipitation, fire may become a hazard to homesites on this soil. The hazard can be minimized by installing firebreaks and reducing the amount of potential fuel on the forest floor. Capability subclass VIe.

41—Kettle gravelly loamy sand, 8 to 40 percent slopes. This deep, well drained soil formed in sandy arkosic deposits on uplands. Elevation ranges from 7,000 to 7,700 feet. The average annual precipitation is about 18 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

Typically, the surface layer is gray gravelly loamy sand about 3 inches thick. The subsurface layer is light gray gravelly loamy sand about 13 inches thick. The subsoil is very pale brown gravelly sandy loam about 24 inches thick. It consists of a matrix of loamy coarse sand that has thin bands of coarse sandy loam or sandy clay loam. The substratum to a depth of 60 inches or more is light yellowish brown extremely gravelly loamy sand.

Included with this soil in mapping are small areas of Elbeth sandy loam, 8 to 15 percent slopes; Pring coarse sandy loam, 8 to 15 percent slopes; Tomah-Crowfoot loamy sands, 8 to 15 percent slopes; and a few rock outcrops.

Permeability of this Kettle soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is low to moderate. Surface runoff is medium, and the hazard of erosion is moderate. Some gullies have formed in drainageways.

The soil is used for woodland, livestock grazing, wildlife habitat, recreation, and homesites.

This soil is suited to the production of ponderosa pine. It is capable of producing 2,240 cubic feet, or 4,900 board feet (International rule), of merchantable timber per acre from a fully stocked, even-aged stand of 80-year-old trees. The main limitation for this use is the moderate hazard of erosion. Measures must be taken to reduce erosion when harvesting timber, especially on the steeper slopes. The low to moderate available water capacity also influences seedling survival, especially in areas where understory plants are plentiful.

This soil has good potential for mule deer, tree squirrel, cottontail, and wild turkey. These animals obtain their food and shelter from pine trees, shrubs, and ground cover, which provide browse, forbs, fruit, and seeds. The presence of ponderosa pine and Gambel oak should encourage wild turkey populations; however, where water is not naturally present, wildlife watering facilities must be provided to attract and maintain wild turkey and other wildlife species. Livestock grazing management is vital on this soil if wildlife populations are to be maintained.

The moderately sloping to steep slopes limit the suitability of this soil for homesites. Special practices must be provided to minimize surface runoff and thus keep erosion to a minimum. This soil requires special site or building designs because of the slope. Deep cuts, to provide essentially level building sites, may expose bedrock. Access roads must be designed to provide adequate cut-slope grade, and drains must be used to control surface runoff and keep soil losses to a minimum. During seasons of low precipitation, fire may become a hazard to homesites. This hazard can be minimized by installing firebreaks and reducing the amount of litter on the forest floor. Capability subclass VIe.

66—Peyton sandy loam, 1 to 5 percent slopes. This deep, noncalcareous, well drained soil formed in alluvium and residuum derived from weathered arkosic sedimentary rock on uplands. Elevation ranges from 6,800 to 7,600 feet. The average annual precipitation is about 17 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

Typically, the surface layer is grayish brown sandy loam about 12 inches thick. The subsoil, about 23 inches thick, is pale brown sandy clay loam in the upper 13 inches and pale brown sandy loam in the lower 10 inches. The substratum is pale brown sandy loam to a depth of 60 inches.

Included with this soil in mapping are small areas of Brussett loam, 1 to 3 percent slopes; Brussett loam, 3 to 5 percent slopes; Holderness loam, 1 to 5 percent slopes; and Pring coarse sandy loam, 3 to 8 percent slopes.

Permeability of this Peyton soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is slow, and the hazard of erosion is slight.

About half of the acreage of this soil is used for winter wheat grown in a wheat-fallow cropping system. The other half is used for range or pasture. This soil is also suited to oats. Choice of crops is limited by the short growing season. Crop residue management, such as stubble mulching, is needed to control water erosion.

This soil is well suited to the production of native vegetation suitable for grazing. The native vegetation is mainly mountain muhly, bluestem grasses, mountain brome, needleandthread, and blue grama. This soil is subject to invasion by Kentucky bluegrass and Gambel oak. Minor amounts of forbs such as hairy goldenrod, geranium, milkvetch, low larkspur, fringed sage, and buckwheat are in the stand.

Proper location of livestock watering facilities helps to control grazing. Timely deferment of grazing is needed to protect the plant cover.

Windbreaks and environmental plantings generally are suited to this soil. Soil blowing is the main limitation to the establishment of trees and shrubs. This limitation can be overcome by cultivating only in the tree rows and leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

This soil is suited to habitat for openland and rangeland wildlife. In cropland areas, habitat favorable for ringnecked pheasant, mourning dove, and many nongame species can be developed by establishing areas for nesting and escape cover. For pheasant, undisturbed nesting cover is vital and should be provided for in plans for habitat development. Rangeland wildlife, such as pronghorn antelope, can be encouraged by developing livestock watering facilities, properly managing livestock grazing, and reseeding range where needed.

This soil has a good potential for homesites and dwellings. The main limitations are its limited ability to support a load and potential frost action on roads and streets. Roads and buildings can be designed to overcome these limitations. Capability subclass IVe.

67—Peyton sandy loam, 5 to 9 percent slopes. This deep, noncalcareous, well drained soil formed in alluvium and residuum derived from weathered arkosic sedimentary rock on uplands. Elevation ranges from 6,800 to 7,600 feet.

Typically, the surface layer is grayish brown sandy loam about 12 inches thick. The subsoil, about 23 inches thick, is pale brown sandy clay loam in the upper 13 inches and pale brown sandy loam in the lower 10 inches. The substratum is pale brown sandy loam to a depth of 60 inches.

Included with this soil in mapping are small areas of Holderness loam, 5 to 8 percent slopes; Pring coarse sandy loam, 3 to 8 percent slopes; and Tomah-Crowfoot loamy sands, 3 to 8 percent slopes.

Permeability of this soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is medium, and the hazard of erosion is moderate. Gullies and rills are common.

Most of the acreage of this Peyton soil is used as rangeland. Some areas are used for wheat and oats. Stubble mulching or other crop residue management practices are needed to control water erosion. Wildlife habitat is also an important use.

This soil is well suited to the production of native vegetation suitable for grazing. The native vegetation is mainly mountain muhly, bluestem, mountain brome, needleandthread, and blue grama. This soil is subject to invasion by Kentucky bluegrass and Gambel oak. Minor amounts of forbs such as hairy goldenrod, geranium, milkvetch, low larkspur, fringed sage, and buckwheat are in the stand.

Proper location of livestock watering facilities helps to control grazing. Timely deferment of grazing is needed to protect the plant cover.

Windbreaks and environmental plantings generally are suited to this soil. Soil blowing is the main limitation to the establishment of trees and shrubs. This limitation can be overcome by cultivating only in the tree rows and leaving a strip of vegetation between the rows. Supplemental irrigation may be necessary when planting and during dry periods. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

This soil is suited to habitat for openland and rangeland wildlife. Rangeland wildife, such as pronghorn antelope, can be encouraged by developing livestock watering facilities, properly managing livestock grazing, and reseeding range where needed.

This soil has good potential for homesites. The main limitation is the limited ability to support a load and potential frost action. Buildings and roads can be designed to overcome these limitations. Capability subclass IVe.

68—**Peyton-Pring complex, 3 to 8 percent slopes.** These gently sloping to moderately sloping soils are on valley side slopes and on uplands. Elevation ranges from 6,800 to 7,600 feet. The average annual precipitation is about 17 inches, the average annual air temperature is about 43 degrees F, and the average frost-free period is about 120 days.

The Peyton soil makes up about 40 percent of the complex, the Pring soil about 30 percent, and other soils about 30 percent.

Included with these soils in mapping are areas of Holderness loam, 1 to 5 percent slopes; Holderness loam, 5 to 8 percent slopes; and Tomah-Crowfoot loamy sands, 3 to 8 percent slopes. In some places arkosic beds of sandstone and shale are at a depth of 0 to 40 inches.

The Peyton soil is commonly on the less sloping part of the landscape. It is deep, noncalcareous, and well drained. It formed in alluvium and residuum derived from weathered arkosic sedimentary rock. Typically, the surface layer is grayish brown sandy loam about 12 inches thick. The subsoil, about 23 inches thick, is pale brown sandy clay loam in the upper 13 inches and pale brown sandy loam in the lower 10 inches. The substratum is pale brown sandy loam to a depth of 60 inches or more.

Permeability of the Peyton soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is high. Surface runoff is medium, and the hazard of erosion is moderate.

The Pring soil is deep, noncalcareous, and well drained. It formed in sandy sediment derived from weathered arkosic sedimentary rock. Typically, the surface layer is dark grayish brown coarse sandy loam about 4 inches thick. The substratum is dark grayish brown coarse sandy loam about 10 inches thick over pale brown gravelly sandy loam that extends to a depth of 60 inches or more.

Permeability of the Pring soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is medium, and the hazard of erosion is moderate.

These soils are used as rangeland, for wildlife habitat, and for homesites.

These soils are well suited to the production of native vegetation suitable for grazing. The dominant native species are mountain muhly, bluestem, needleandthread, and blue grama. These soils are subject to invasion of Kentucky bluegrass and Gambel oak. Common forbs are hairy goldenrod, geranium, milkvetch, low larkspur, fringed sage, and buckwheat.

Properly locating livestock watering facilities helps to control grazing. Timely deferment of grazing is needed to protect the plant cover.

Windbreaks and environmental plantings generally are suited to these soils. Soil blowing is the main limitation to the establishment of trees and shrubs. This limitation can be overcome by cultivating only in the tree rows and leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

These soils are suited to habitat for openland and rangeland wildlife. Rangeland wildlife, such as pronghorn antelope, can be encouraged by developing livestock watering facilities, properly managing livestock grazing, and reseeding range where needed.

These soils have a good potential for homesites. The main limitations, especially on the Peyton soil, are low bearing strength and frost-action potential. Buildings and roads can be designed to overcome these limitations. Access roads should have adequate cut-slope grade and be provided with drains to control surface runoff and keep soil losses to a minimum. Capability subclass VIe.