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**PRELIMINARY SOIL, GEOLOGY, GEOLOGIC HAZARD,
AND WASTEWATER STUDY,
MCCUNE RANCH SUBDIVISION
PARCEL NO. 51000-00-493
17480 MERIDIAN ROAD NORTH
EL PASO COUNTY, COLORADO**

Prepared for

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1.0 SUMMARY

Project Location

The project site lies in Section 24 and a portion of the S½ of Section 13, Township 11 South, Range 65 West of the 6th Principal Meridian, and a portion of the W½ of Section 19, Township 11 South, Range 64 West of the 6th Principal Meridian in El Paso County, Colorado. The site is located approximately 12 miles east of Monument, Colorado, northwest of Hodgen Road and Meridian Road North.

Project Description

Total acreage involved in the project is approximately 766 acres. The proposed site development consists of one-hundred and forty-three single-family rural residential lots and one commercial lot. 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 artificial fill, potentially expansive soils, potentially unstable slopes, downslope creep areas, floodplain, potentially seasonal shallow groundwater, and seasonal shallow groundwater areas. Based on the proposed development plan, it appears that these areas will have some impact on the development. These conditions will be discussed in greater detail in the report.

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

2.0 GENERAL SITE CONDITIONS AND PROJECT DESCRIPTION

The site is located in Section 24 and a portion of the S½ of Section 13, Township 11 South, Range 65 West of the 6th Principal Meridian, and a portion of the W½ of Section 19, Township 11 South, Range 64 West of the 6th Principal Meridian in El Paso County, Colorado. The site is located approximately 12 miles east of Monument, Colorado, northwest of Hodgen Road and Meridian Road North. The location of the site is as shown on the Vicinity Map, Figure 1.

The topography of the site consists of rolling hills that vary from gradually to moderately sloping generally to the southeast and northwest. West Kiowa Creek bisects the site. Steep slopes are located along some of the drainages on the site. The drainages on site flow in a northeasterly direction through the central portion of the site. Water was observed in West Kiowa Creek at the time of this investigation. The site boundaries are indicated on the USGS Map, Figure 2. Previous land uses have included grazing and pasture land. The site contains primarily field grasses and weeds. Site photographs, taken September 12 and 15, 2018, are included in Appendix A.

Total acreage involved in the proposed development is approximately 766 acres. One hundred and forty-three single-family rural residential lots and one commercial lot are proposed. The proposed residential lots are approximately 2.5 to 5 acres each, and the commercial lot is 6.8 acres. The area will be serviced by individual wells and on-site wastewater treatment systems. The proposed Site Plan/Testing Location Map is presented in Figure 3.

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 Geology/Engineering Geology Map which identified pertinent geologic conditions affecting development. The field mapping was performed by personnel of Entech Engineering, Inc. on September 12 and 15, 2018.

Five (5) test borings, and ten (10) tactile test pits were performed on the site to determine general suitability of the site for the use of on-site wastewater treatment systems. The locations of the test borings, and test pits are indicated on the Site Plan/Testing Location Map, Figure 3. The Test Boring and Test Pit Logs are presented in Appendix B. Results of this testing will be discussed later in this report.

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

5.0 SOIL, GEOLOGY AND ENGINEERING GEOLOGY

5.1 General Geology

Physiographically, the site lies in the western portion of the Great Plains Physiographic Province, north of the Palmer Divide. Approximately 16 miles to the west is a major structural feature known as the Rampart Range Fault. This fault marks the boundary between the Great Plains Physiographic Province and the Southern Rocky Mountain Province. The site exists within the southeastern edge of a large structural feature known as the Denver Basin. Bedrock in the area tends to be very gently dipping in a northwesterly direction (Reference 1). The rocks in the area

of the site are sedimentary in nature and typically Tertiary to Upper Cretaceous in age. The bedrock underlying the site consists of the Dawson Arkose Formation. Overlying this formation are unconsolidated deposits of residual soils, man-made, and alluvial soils of the Quaternary Age. The residual soils are produced by the in-situ action of weathering of the bedrock on site. The alluvial soils were deposited by water in the major drainage on the site and as stream terrace deposits. Man-made soils exist as erosion berms. The site's stratigraphy will be discussed in more detail in Section 5.3.

5.2 Soil Conservation Survey

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

<u>Type</u>	<u>Description</u>
1	Alamosa Loam, 1-3% slopes
15	Brussett Loam, 3 to 5% slopes
21	Cruckton Sandy Loam, 1 to 9% slopes
25	Elbeth Sandy Loam, 3 to 8% slopes
26	Elbeth Sandy Loam, 8 to 15% slopes
36	Holderness Loam, 8 to 15% slopes
67	Peyton Sandy Loam, 5-9% slopes
68	Peyton-Pring Complex, 3-8% slopes
71	Pring Coarse Sandy Loam, 3 to 8% slopes
92	Tomah-Crowfoot Loamy Sands, 3 to 8% slopes

Complete descriptions of each soil type are presented in Appendix D. The soils have generally been described to typically have slow to rapid permeabilities. The majority of the soils have moderate permeabilities. Limitations described for the soils include shrink-swell potential on Soil Type Nos. 15, 25, 26, and 36, slope on Soil Type Nos. 26 and 36, and the hazard of flooding on Soil Type No. 1. Soil Type No. 1 is mapped in the floodplain zone that is designated as open space. Roads may need to be designed to minimize frost-heave potential. Possible hazards with soil erosion are present on the site. The erosion potential can be controlled with vegetation. The majority of the soils have been described to have moderate erosion hazards.

5.3 Site Stratigraphy

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

- Qaf Recent Artificial Fill of Holocene Age:** These are man-made fill deposits associated with erosion berms on-site.
- Qal Recent Alluvium of Late Holocene Age:** These materials consist of water deposited sands located along some of the minor drainages across the site.
- Qp Piney Creek Alluvium (Alluvium One and Two) of Early Holocene Age:** These materials consist of low stream-terrace deposits above the current stream channel. The materials typically consist of silty to well graded sand.
- Qb Broadway Alluvium (Alluvium Three) of Late Pleistocene Age:** These materials consist of middle stream terrace deposits. The materials typically consist of silty to clayey gravelly sands.
- Qlo Louviers Alluvium (Alluvium Four) Late Middle Pleistocene Age:** These materials consist of upper stream terrace deposits. The materials typically consist of light brown silty sands which contain an abundance of gravels.
- Qsw Sheetwash Deposits of Holocene to Late Pleistocene Age:** These materials consist of silty to clayey sands with some cobbles and boulders. The material was deposited by the action of sheetwash and gravity.
- Qc/Tkd Colluvium of Quaternary Age overlying Dawson Formation of Tertiary to Cretaceous Age:** The Dawson Formation typically consists of arkosic sandstone with interbedded fine-grained sandstone, siltstone and claystone. Overlying this formation is a variable layer of residual soil. The residual soils were derived from the in-situ

weathering of the bedrock materials on-site. These soils consisted of silty to clayey sands, sandy clays and sandy silts.

The soils listed above were mapped from site-specific mapping, the *Geologic Map of the Eastonville Quadrangle* distributed by the Colorado Geological Survey in 2012 (Reference 4), and the *Geologic Map of the Denver 1° x 2° Quadrangle*, distributed by the US Geological Survey in 1981 (Reference 5). The Test Pits and Profile Holes were also used in evaluating the site and are included in Appendix B. The Geology Map prepared for the site is presented in Figure 6.

5.4 Soil Conditions

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

Soil Type 1 is a slightly silty to silty and clayey sand (SM-SW, SM, SC). This material was encountered in the test borings and in nine of the test pits. The sand was encountered at depths ranging from the existing surface to 12 to 15 feet bgs and extended to the termination of the Test Boring Nos. 2, 3 and 5 (20 feet). These soils were encountered at loose to medium dense states and at dry to moist conditions. Samples tested had 7 to 34 percent of the soil sized particles passing the No. 200 Sieve. Atterberg Limits Testing resulted in the sand being non-plastic. FHA Swell Testing on a sample of the sand resulted in an expansion of 30 psf, indicating a low expansion potential.

Soil Type 2 is a sandy clay (CL). This material was encountered in Test Pit No. 1 and Test Boring No. 2. The clays were encountered at depths of the existing surface grade in the test pit and at 19 feet in the test boring and extended to depths up to 8 feet bgs to the termination of the test boring (20 feet). The clays were encountered at firm consistencies and moist conditions. The sample tested had 75 percent of the soil sized particles passing the No. 200 sieve. Atterberg Limits Testing resulted in a liquid limit of 30 and a plastic index of 10.

Soil Type 3 is a silty to clayey sandstone and very clayey sandstone (SM, SC, SC-SM, CL-SC). This material was encountered Test Boring No. 4 and in Test Pit Nos. 2, 3, 6, 7 and 8. The

sandstone was encountered at depths ranging from 3 to 16 feet bgs and extended to the termination of the boring and pits (7 to 20 feet). The sandstone was encountered at very dense states and moist conditions. Samples tested had 14 to 54 percent of the soil sized particles passing the No. 200 sieve. Atterberg Limits Testing resulted in liquid limits of 21 to 31 and plastic indexes of 7 to 14. FHA Swell Testing resulted in an expansion pressure of 350 psf, indicating a low expansion potential. Highly expansive clayey sandstone and claystone are commonly interbedded in the sandstone in the area.

Soil Type 4 is a sandy claystone (CL). This material was encountered Test Boring No. 1 at 12 feet bgs and extended to the termination of the boring (20 feet). The claystone was encountered at hard consistencies and moist conditions. Samples tested had 73 percent of the soil sized particles passing the No. 200 sieve. Swell/Consolidation Testing resulted in a volume change of 2.5 percent, indicating a moderate to high expansion potential.

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

5.5 Groundwater

Groundwater was encountered in Test Boring No. 3 at 16.5 feet. Groundwater was not encountered in the remaining test borings which were drilled to 20 feet. Areas of seasonal and potentially seasonal shallow groundwater have been mapped in low-lying areas and 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. Builders and planners should be cognizant of the potential for the occurrence of such subsurface water features during construction on-site and deal with each individual problem as necessary at the time of construction.

6.0 ENGINEERING GEOLOGY – IDENTIFICATION AND MITIGATION OF GEOLOGIC HAZARDS

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

Artificial Fill

These are man-made fill deposits associated with erosion berms on-site.

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

Loose or Collapsible Soils

Loose soils were encountered in one of the test borings. Any loose or collapsible soils encountered beneath foundations or floor slabs will require mitigation.

Mitigation: Any loose or collapsible soils encountered beneath foundations or floor slabs should be overexcavated 2 to 3 feet, moisture-conditioned and recompact. The soils should be recompact to 95 percent of the soils maximum Modified Proctor Dry Density ASTM D-1557 at ± 2 percent of optimum moisture content. The reconditioned soils on this site should be observed and tested to verify adequate compaction. Areas requiring recompaction should be determined during the excavation observation.

Expansive Soils

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

Mitigation: Should expansive soils be encountered beneath the foundation, mitigation will be necessary. Mitigation of expansive soils will require special foundation design. Overexcavation and replacement with non-expansive soils at a minimum of 95% of its maximum Modified Proctor Dry Density, ASTM D-1557 is a suitable mitigation, which is common in the area. Another alternative in areas of highly expansive soils is the use of drilled pier foundation systems. Typical minimum pier depths are on the order of 25 feet or more and require penetration into the bedrock material a minimum of 4 to 6 feet, depending upon building loads. Floor slabs on expansive soils should be expected to experience movement. Overexcavation and replacement has been successful in minimizing slab movements. The use of structural floors should be considered for basement construction on highly expansive clays. Final recommendations should be determined after additional investigation of each building site.

Slope Stability and Landslide Hazard

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

- Potentially Unstable Slope Area

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

Mitigation: Building should be avoided in these areas. The lot most significantly affected by potentially unstable slopes is Lot 55. The structures on these lots should be set back a minimum of 30 feet from the crest of these slopes. It appears there is sufficient room on the lots to avoid this hazard. Proper control of drainage at both the surface above the slope and the subsurface is extremely important. Areas of ponded water at the surface should be avoided. Utility trenches, basement excavations and other subsurface features should not be permitted to become water traps which may promote saturation of the subsurface materials. Drainage should not be permitted over the potentially unstable slope but directed in a non-

erosive manner away from the slope. Irrigation above these slopes should be kept to a minimum to prevent saturation of the subsurface soils. The use of xeriscape landscaping utilizing native plantings is recommended to reduce the need for irrigation.

- Downslope Creep Area

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

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

Floodplain and Drainage Areas

Portions of the site associated with the West Kiowa Creek drainage are mapped within a floodplain zone according to the FEMA Map No. 08041CO350F, dated March 17, 1997 (Figure 7, Reference 6). Water was observed flowing in West Kiowa Creek. The floodplain areas have been designated as open space and/or can be avoided by construction. Additionally, areas of seasonal and potentially seasonal shallow groundwater were observed across the site. In these areas, we would anticipate the potential for periodically high subsurface moisture conditions and frost heave potential. These areas lie within low-lying areas along the drainage in the southeastern portion of the site and in the low-lying areas and minor drainages across the site. Water was not observed in any of the minor drainages at the time of our site investigation. These areas can likely be avoided or properly mitigated by development. The floodplain should be avoided by construction unless site-specific floodplain determination and drainage studies are performed. The potential exists for high groundwater levels during high moisture periods and should structures encroach on these areas the following precautions should be followed.

Mitigation: Foundations must have a minimum 30-inch depth for frost protection. In areas where high subsurface moisture conditions are anticipated periodically, subsurface perimeter drains are recommended to help prevent the intrusion of water into areas below grade. Typical drain details are presented in Figure 8. Some of the minor drainage swales can be avoided or regraded. The main drainage that bisects the site is designated as open space and will be avoided. Any grading in these areas should be done to direct surface flow around construction to avoid areas of ponded water. Finished floors must be located at least one foot above floodplain levels. Specific drainage studies and exact floodplain locations are beyond the scope of this report.

6.1 Relevance of Geologic Conditions to Land Use Planning

We understand that the development will be rural residential lots and a commercial lot. It is our opinion that the existing geologic and engineering geologic conditions will impose some constraints on the proposed development and construction. The most significant problems affecting development will be those associated with the drainages on site that can be avoided or properly mitigated during construction on each lot. Other hazards on site may be satisfactorily mitigated through proper engineering design and construction practices or avoidance.

The upper materials are typically at medium dense to dense states. Areas of loose soils were encountered that may require recompaction. The medium dense to dense granular soils encountered in the upper soil profiles of the test borings and test pits should provide good support for foundations. Loose soils, if encountered beneath foundations or slabs, will require removal of the upper 2 to 3 feet of material and recompaction. Expansive soils, although sporadic, were encountered. Expansive clayey sandstone and claystone are common in the Dawson Formation, and may require mitigation. Foundations anticipated for the site are standard spread footings possibly in conjunction with overexcavation in areas of expansive soils or loose soils. Areas of artificial fill, if encountered beneath foundations will require penetration or recompaction. Areas containing arkosic sandstone will have high allowable bearing conditions. Expansive layers may also be encountered in the soil and bedrock on this site. Expansive soils, if encountered, will require special foundation design and/or overexcavation. These soils will not prohibit development.

A potentially unstable slope exists along portions of the site where the drainages have eroded cut banks. A 30-foot building setback is recommended from the crest of the potentially unstable slope. Septic fields should not be located within the building setback as well. The slopes primarily affect Lot 55. It appears there is sufficient room on the lots to avoid the potentially unstable slopes. Additionally, minor areas of downslope creep have been mapped on the site. Many of these areas can be avoided by construction, however, Lot 44 may be affected. These areas are acceptable as building sites with mitigation for the sloping conditions taken into consideration. Additional reinforcement may be necessary in the foundation to account for additional pressures due to sloping conditions. Tie-beams and/or buttresses may be necessary, depending on site conditions and grading plans.

Areas of seasonal shallow groundwater and potentially seasonal shallow groundwater were encountered on site. Additionally, portions of the site have been mapped in a floodplain zone associated with West Kiowa Creek. The floodplain area is in the designated open space area and can be avoided by development. Water was observed in the West Kiowa Creek floodplain, however, water was not observed in the minor drainages on-site during our site investigation. Due to the size of the lots and the proposed development, the majority of these areas can be avoided by construction on the lots. The lot boundaries in the area of Lots 86 and 128 may require adjustments to accommodate the minor drainage that bisects the lots. Regrading can also mitigate some minor drainages on some of the lots. Structures should not block drainages. Any site grading should be done in such a manner as to not create areas of ponded water around structures or septic fields. Finished floor levels must be a minimum of one foot above the floodplain level. Septic fields should not be located in drainage areas due to the potential for periodic high groundwater conditions. Specific floodplain locations and drainage studies are beyond the scope of this report.

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

7.0 ON-SITE WASTEWATER TREATMENT

The site was evaluated for individual and commercial on-site wastewater treatment systems in accordance with El Paso Land Development Code. Ten (10) tactile test pits were performed on the property. The test pits were located in potential locations of future systems. The approximate locations of the percolation tests are indicated on Figure 3, on the Geology/Engineering Geology Map, Figure 6, and on the Septic Suitability Map, Figure 9. A table showing the results of the Tactile Test Pits is presented in Table 2. Test Pit Logs are included in Appendix B.

The Natural Resource Conservation Service (Reference 2), previously the Soil Conservation Service (Reference 3) has been mapped with ten soil descriptions. The Soil Survey Map (Reference 2) is presented in Figure 4, and the Soil Survey Descriptions are presented in Appendix D. The soils are described as having slow to rapid percolation rates. The majority of the soils have been described with moderate permeabilities.

Soils encountered in the tactile test pits consisted of loamy sand, sandy clay loam and sandy clay. Bedrock was not encountered in the test pits which were excavated to 7 to 8 feet. The limiting layers encountered in the test pits are the sandy loam (Soil Type 2), and sandy clay (Soil Type 4A) which corresponds to LTAR values of 0.80 to 0.15 gallons per day per square foot. The conditions encountered in the Test Pit Nos. 1 through 4 and 6 through 8 will require a designed system. Additional investigation may identify areas where suitable for conventional systems could be used.

In summary, it is our opinion the site is suitable for individual 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. Based on the testing performed as part of this investigation designed systems will likely be required for the majority of the lots. A Septic Suitability Map is presented in Figure 9. Areas where OWTS sites are not recommended are indicated on Figure 9. Individual soil testing is required on the lots prior to construction. Absorption fields must be located a minimum of 100 feet from any well, including those on adjacent properties. Absorption fields must also be located a minimum of 50 feet from any 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 7), the area is mapped with floodplain, valley fill and upland deposits. According to the *Atlas of Sand, Gravel and Quarry Aggregate Resources, Colorado Front Range Counties* distributed by the Colorado Geological Survey (Reference 8), areas of the site are mapped with upland and floodplain deposits: sand and probable aggregate resource (U3, U4 and F4). According to the *Evaluation of Mineral and Mineral Fuel Potential* (Reference 9), the area of the site has been mapped as "Good" for industrial minerals. However, considering the abundance of similar materials through the region and the close proximity to developed land, they would be considered to have little significance as an economic resource.

According to the *Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands* (Reference 9), the site is mapped within the Denver Basin Coal Region. However, the area of the site has been mapped as "Poor" for coal resources. No active or inactive mines have been mapped in the area of the site. No metallic mineral resources have been mapped on the site (Reference 9).

The site has been mapped as "Fair" for oil and gas resources (Reference 9). No oil or gas fields have been discovered in the area of the site. The sedimentary rocks in the area may lack the geologic structure for trapping oil or gas; therefore, it may not be considered a significant resource. Hydraulic fracturing is a new method that is being used to extract oil and gas from rocks. It utilizes pressurized fluid to extract oil and gas from rocks that would not normally be productive. The area of the site has not been explored to determine if the rocks underlying the site would be commercially viable utilizing hydraulic fracturing. The practice of hydraulic fracturing has come under review due to concerns about environmental impacts, health and safety.

9.0 EROSION CONTROL

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

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

Cut and fill slope areas will be subjected primarily to sheetwash and rill erosion. Unchecked rill erosion can eventually lead to concentrated flows of water and gully erosion. The best means to combat this type of erosion is, where possible, the adequate re-vegetation of cut and fill slopes. Cut and fill slopes having gradients more than three (3) horizontal to one (1) vertical become increasingly more difficult to revegetate successfully. Therefore, recommendations pertaining to the vegetation of the cut and fill slopes may require input from a qualified landscape architect and/or the Soil Conservation Service.

10.0 CLOSURE

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

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

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

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

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4. Morgan, Matthew L. and Barkmann, Peter E., 2012. *Geologic Map of the Eastonville Quadrangle, El Paso and Elbert Counties, Colorado*. Colorado Geological Survey. Open-File Report 12-03.
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6. Federal Emergency Management Agency. March 17, 1997. *Flood Insurance Rate Maps for the City of Colorado Springs, Colorado*. Map Number 08041CO350F
7. El Paso County Planning Development. December 1995. *El Paso County Aggregate Resource Evaluation Maps*.
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9. Keller, John W.; TerBest, Harry and Garrison, Rachel E. 2003. *Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands Administered by the Colorado State Land Board*. Colorado Geological Survey. Open-File Report 03-07.

TABLES

TABLE 1
SUMMARY OF LABORATORY TEST RESULTS

CLIENT PROTERRA PROPERTIES
PROJECT McCUNE RANCH
JOB NO. 181459

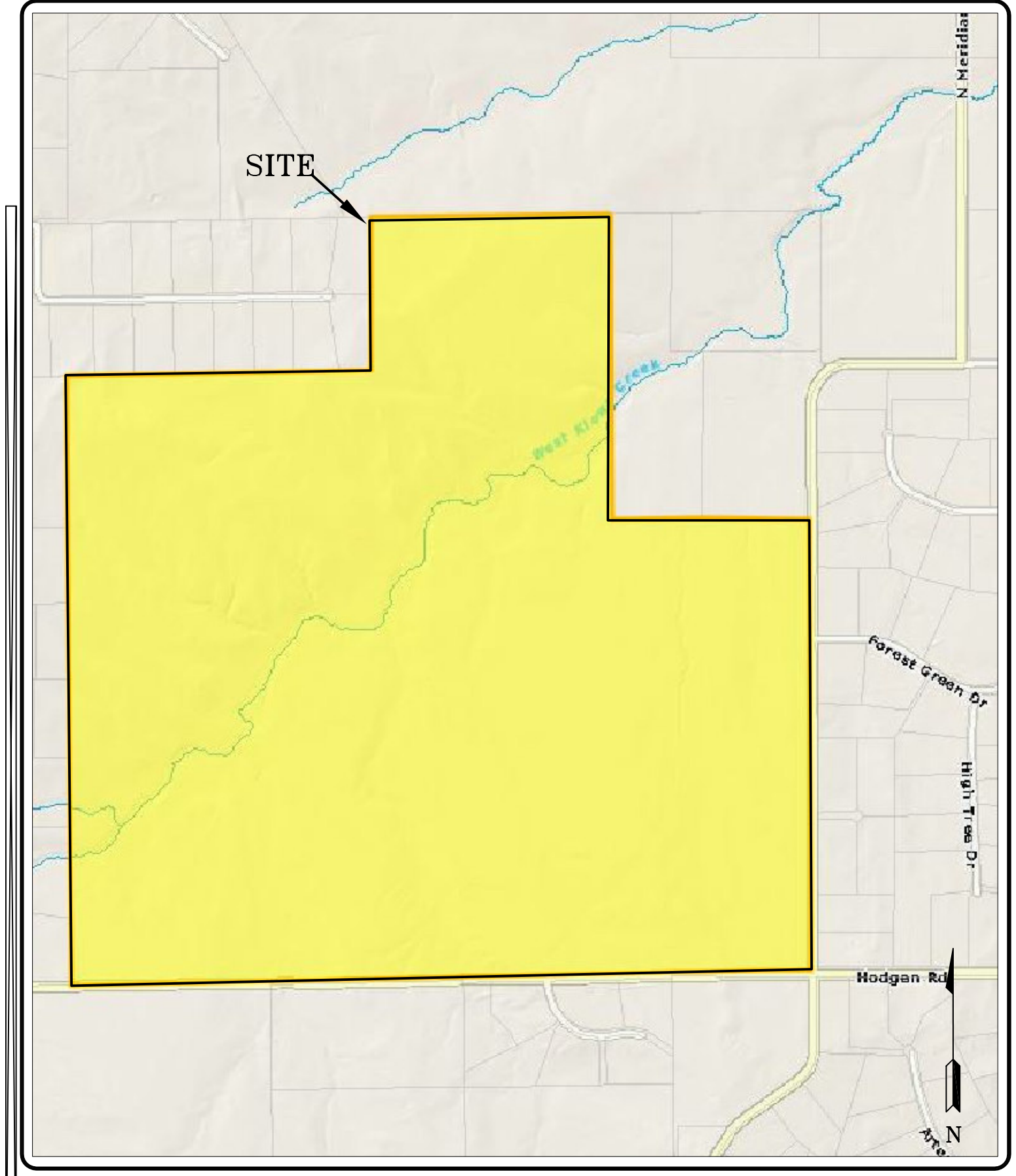
SOIL TYPE	TEST BORING NO.	DEPTH (FT)	WATER (%)	DRY DENSITY (PCF)	PASSING NO. 200 SIEVE (%)	LIQUID LIMIT (%)	PLASTIC INDEX (%)	SULFATE (WT %)	FHA SWELL (PSF)	SWELL/CONSOL (%)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION
1	2	2-3			12.1	NV	NP				SM	SAND, SILTY
1	3	10			6.5			<0.01			SM-SW	SAND, SLIGHTLY SILTY
1	5	5			17.3						SM	SAND, SILTY
1	TP-3	2-3			23.7						SM	SAND, SILTY
1	TP-4	5-6			15.3						SM	SAND, SILTY
1	TP-5	2-3			19.2						SM	SAND, SILTY
1	TP-7	2-3			33.5						SM	SAND, SILTY
1	TP-9	5-6			21.3				30		SM	SAND, SILTY
1	TP-10	2-3			32.0						SM	SAND, SILTY
2	TP-1	5-6			74.8	30	10				CL	CLAY, SANDY
3	TP-2	5-6			14.0	30	9				SM	SANDSTONE, SILTY
3	TP-8	5-6			21.1	33	14				SC	SANDSTONE, CLAYEY
3	TP-6	5-6			54.2				350		CL-SC	SANDSTONE, VERY CLAYEY
3	4	20			18.6	21	7	<0.01			SC-SM	SANDSTONE, SILTY, CLAYEY
4	1	15	13.4	120.4	73.2	35	13	<0.01		2.5	CL	CLAYSTONE, SANDY

Table 2: Summary Tactile Test Pit Results

Test Pit No.	USDA Soil Type	LTAR Value	Depth to Bedrock (ft.)	Depth to Seasonally Occurring Groundwater (ft.)
1	4A*	0.15*	N/A	N/A
2	3A*	0.30*	3*	N/A
3	3A*	0.30*	3*	N/A
4	4A*	0.15*	N/A	N/A
5	1	0.80	N/A	N/A
6	4A*	0.15*	3.5*	7'
7	4A*	0.15*	3.5*	7'
8	4A*	0.15*	3*	6'
9	3	0.35	N/A	N/A
10	3	0.35	N/A	N/A

*- Conditions that will require an engineered OWTS

FIGURES



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VICINITY MAP
MCCUNE RANCH SUBDIVISION
17480 MERIDIAN ROAD NORTH
EL PASO COUNTY, CO.
FOR: PROTERRA PROPERTIES, LLC

DRAWN:
LLL

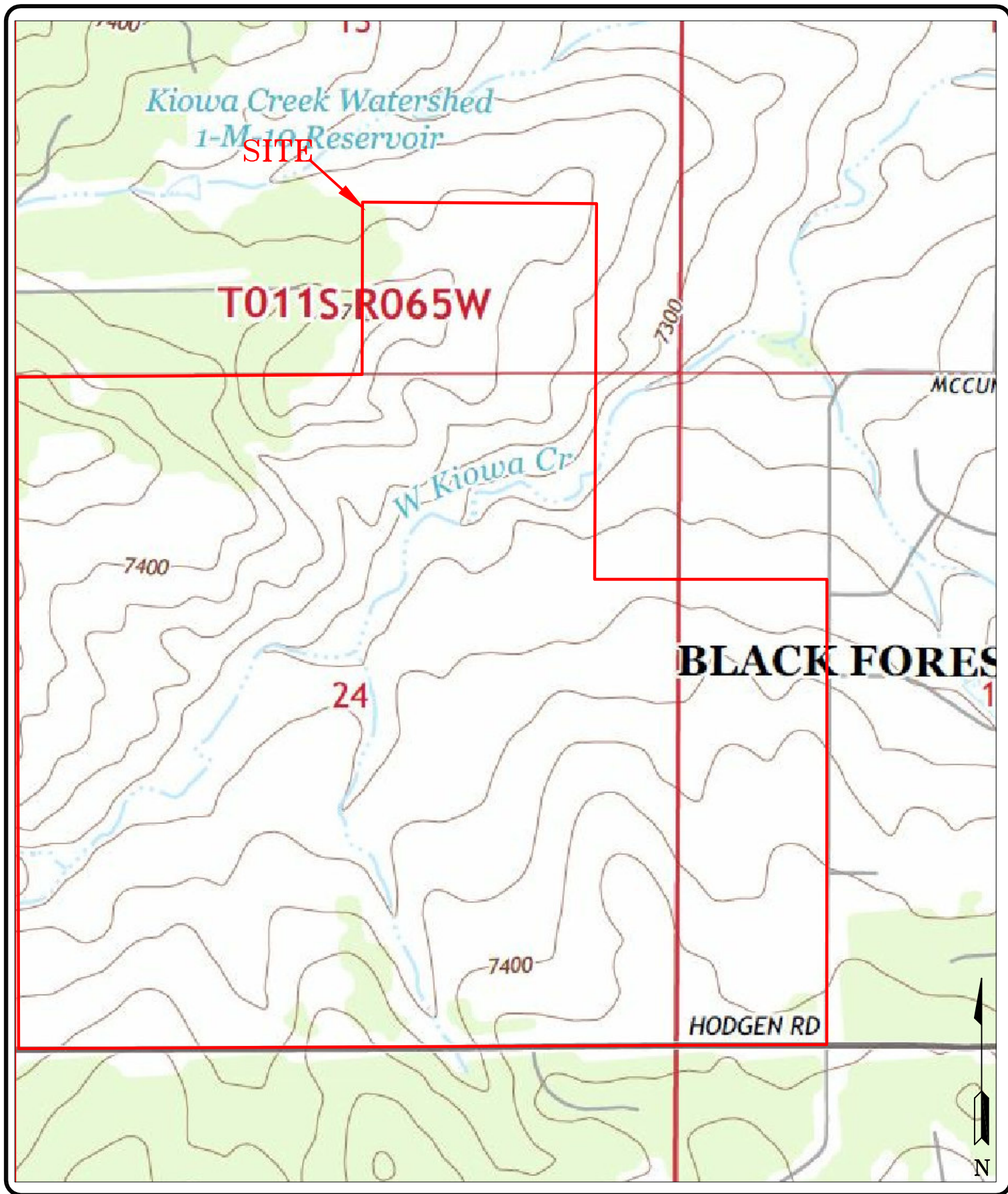
DATE:
9/21/18

CHECKED:

DATE:

JOB NO.:
181459

FIG NO.:
1



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USGS MAP
MCCUNE RANCH SUBDIVISION
17480 MERIDIAN ROAD NORTH
EL PASO COUNTY, CO.
FOR: PROTERRA PROPERTIES, LLC

DRAWN:
LLL

DATE:
9/21/18

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DATE:

JOB NO.:
181459

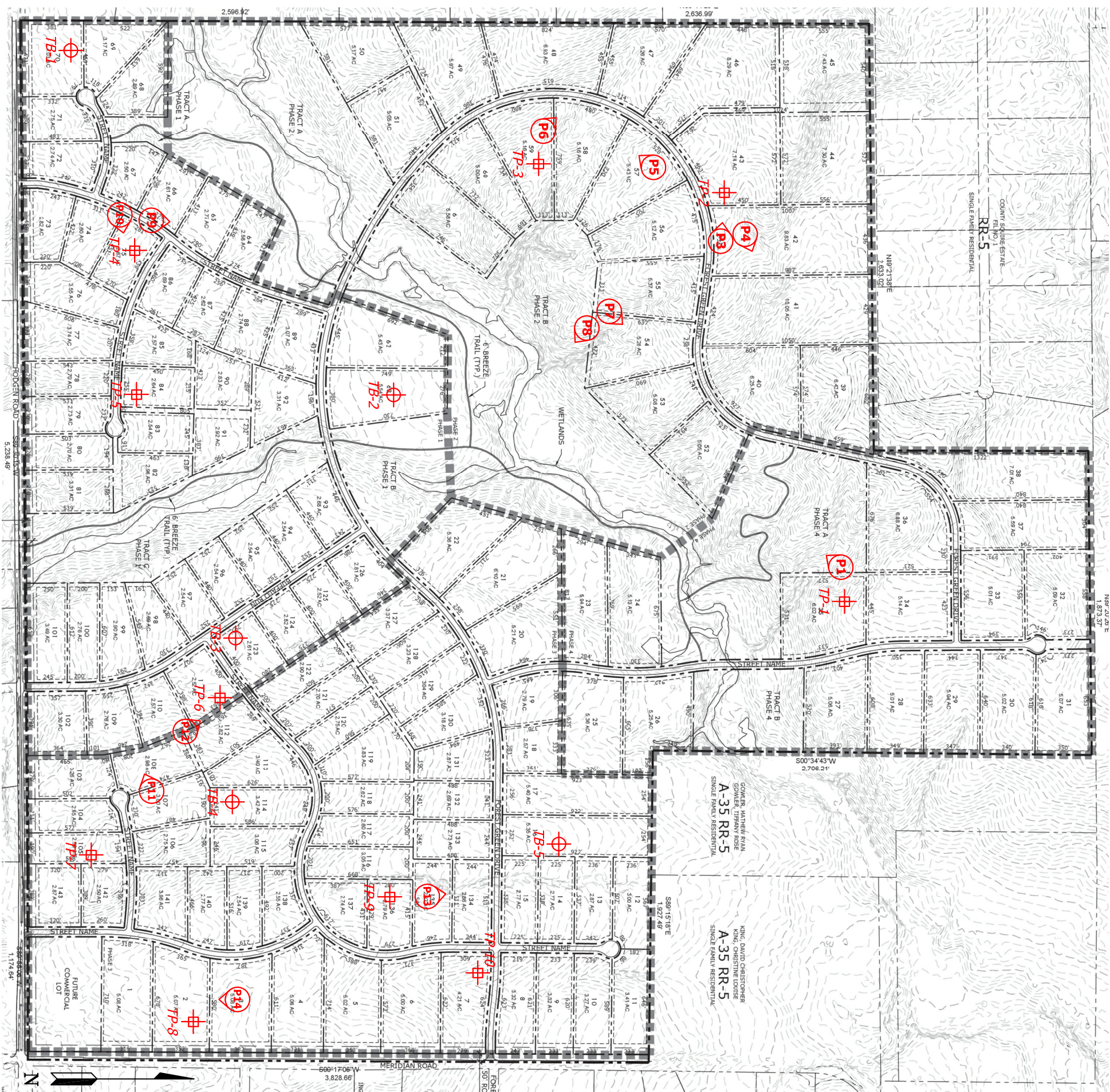
FIG NO.:
2

LEGEND:

 TB-APPROXIMATE TEST BORING LOCATION AND NUMBER

TP- APPROXIMATE TEST PIT LOCATION AND NUMBER	TP- APPROXIMATE TEST PIT LOCATION AND NUMBER
--	--

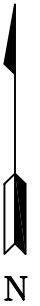
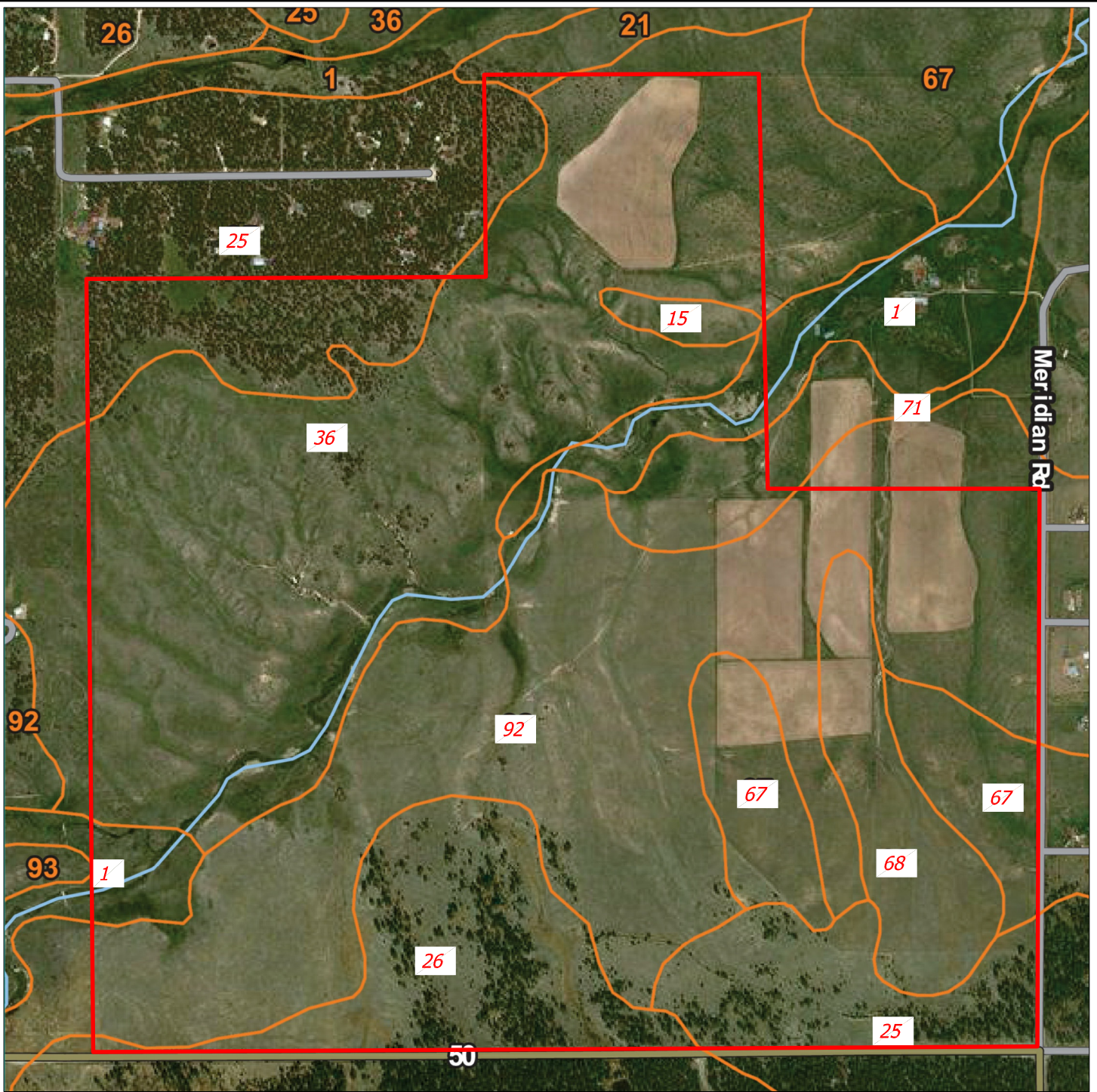
- APPROXIMATE TEST PIT LOCATION AND NUMBER

[illegible]

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

**SITE PLAN/TEST BORING LOCATION MAP
MCCUNE RANCH SUBDIVISION
17480 MERIDIAN ROAD NORTH
EL PASO COUNTY, CO.
FOR: PROTERRA PROPERTIES, LLC**

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CHECKED	SCALE
	AS SHOWN
	JOB NO.
	181459
	FIGURE No.
	3



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SOIL SURVEY MAP
MCCUNE RANCH SUBDIVISION
17480 MERIDIAN ROAD NORTH
EL PASO COUNTY, CO.
FOR: PROTERRA PROPERTIES, LLC

DRAWN:
LLL

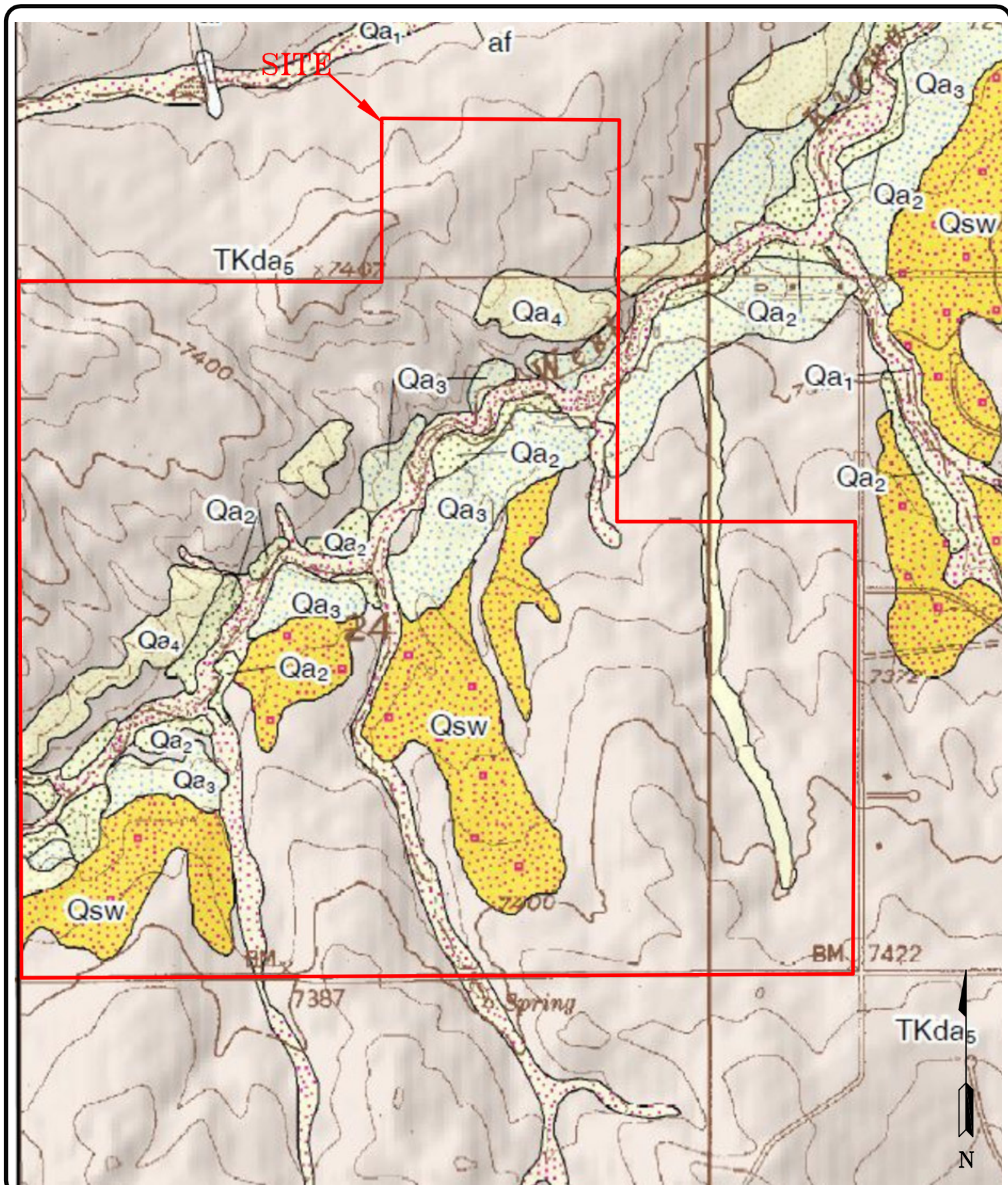
DATE:
9/21/18

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DATE:

JOB NO.:
181459

FIG NO.:
4



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EASTONVILLE QUADRANGLE GEOLOGIC MAP
MCCUNE RANCH SUBDIVISION
17480 MERIDIAN ROAD NORTH
EL PASO COUNTY, CO.
FOR: PROTERRA PROPERTIES, LLC

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DATE:
9/21/18

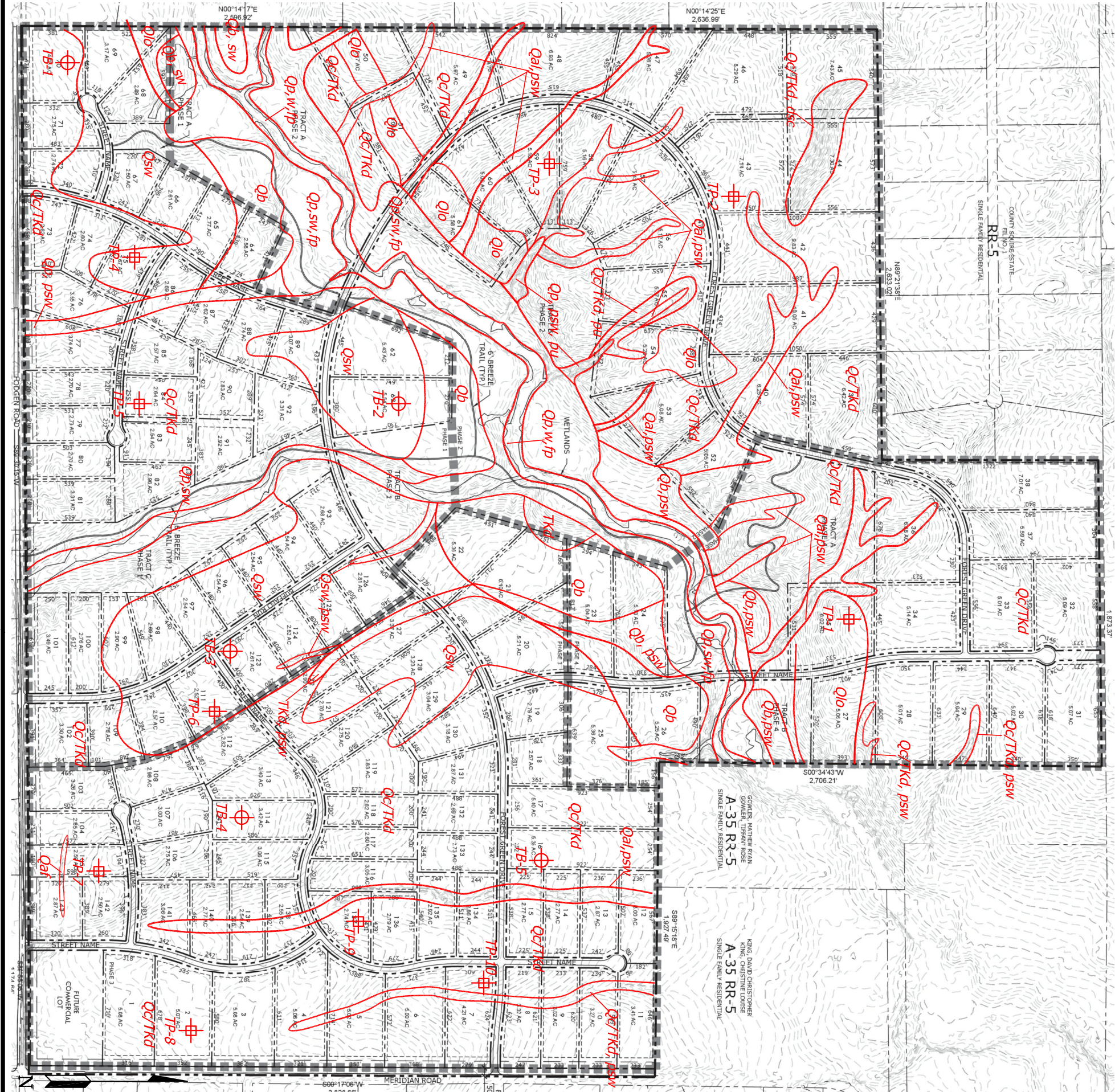
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DATE:

JOB NO.:
181459


FIG NO.:
5

- LEGEND:**
- Artificial Fill of Holocene Age:
artificial fill associated with erosion berms
 - Recent Alluvium of Holocene Age:
recent alluvium located in several of the minor drainages on-site
 - Piney Creek Alluvium Two of Early Holocene Age:
low stream terrace deposits above current stream channel
 - Broadway Alluvium of Late Pleistocene Age:
stream terrace deposited sands
 - Louvers Alluvium of Late Middle Pleistocene Age:
stream terrace deposited sands
 - Sheetwash of Holocene to Late Pleistocene Age:
silty to clayey sand sheetwash deposits
 - Colluvium of Quaternary Age overlying Dawson Formation of Tertiary to Cretaceous Age:
colluvium and residual soils overlying arkosic sandstone with interbedded fine-grained sandstone, siltstone and claystone
 - downslope creep area
 - floodplain
 - potentially unstable slope
 - potentially seasonal shallow groundwater area
 - seasonal shallow groundwater area
 - flowing water
 - approximate test boring location
 - approximate test pit location



DRAWN LIL	DATE 9/21/18
CHECKED	SCALE AS SHOWN
	JOB NO. 181459
	FIGURE NO. 6

GEOLOGY/ENGINEERING GEOLOGY MAP
MCCUNE RANCH SUBDIVISION
17480 MERIDIAN ROAD NORTH
EL PASO COUNTY, CO.
FOR: PROTERRA PROPERTIES, LLC



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REVISION	BY

LEGEND

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

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

ZONE A No Base Flood Elevations determined.

ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

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

ZONE AR Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decrefied. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

1% annual chance floodplain boundary

0.2% annual chance floodplain boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

Base Flood Elevation line and value; elevation in feet*

Base Flood Elevation value where uniform within zones; elevation in feet*

(L.L. 2017)

*Referenced to the National Geodetic Vertical Datum of 1929

Cross section line

Transect line

Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere

1000-meter Universal Transverse Mercator grid tick values, zone 4

5000-foot grid tick values: Hawaii State Plane coordinate system, zone 3 (FIPSZONE 5103), Transverse Mercator projection

Bench mark (see explanation in Notes to Users section of this FIRW panel)

Coastal Mile marker

MAP REPOSITORY

Refer to listing of Map Repositories on Map Index

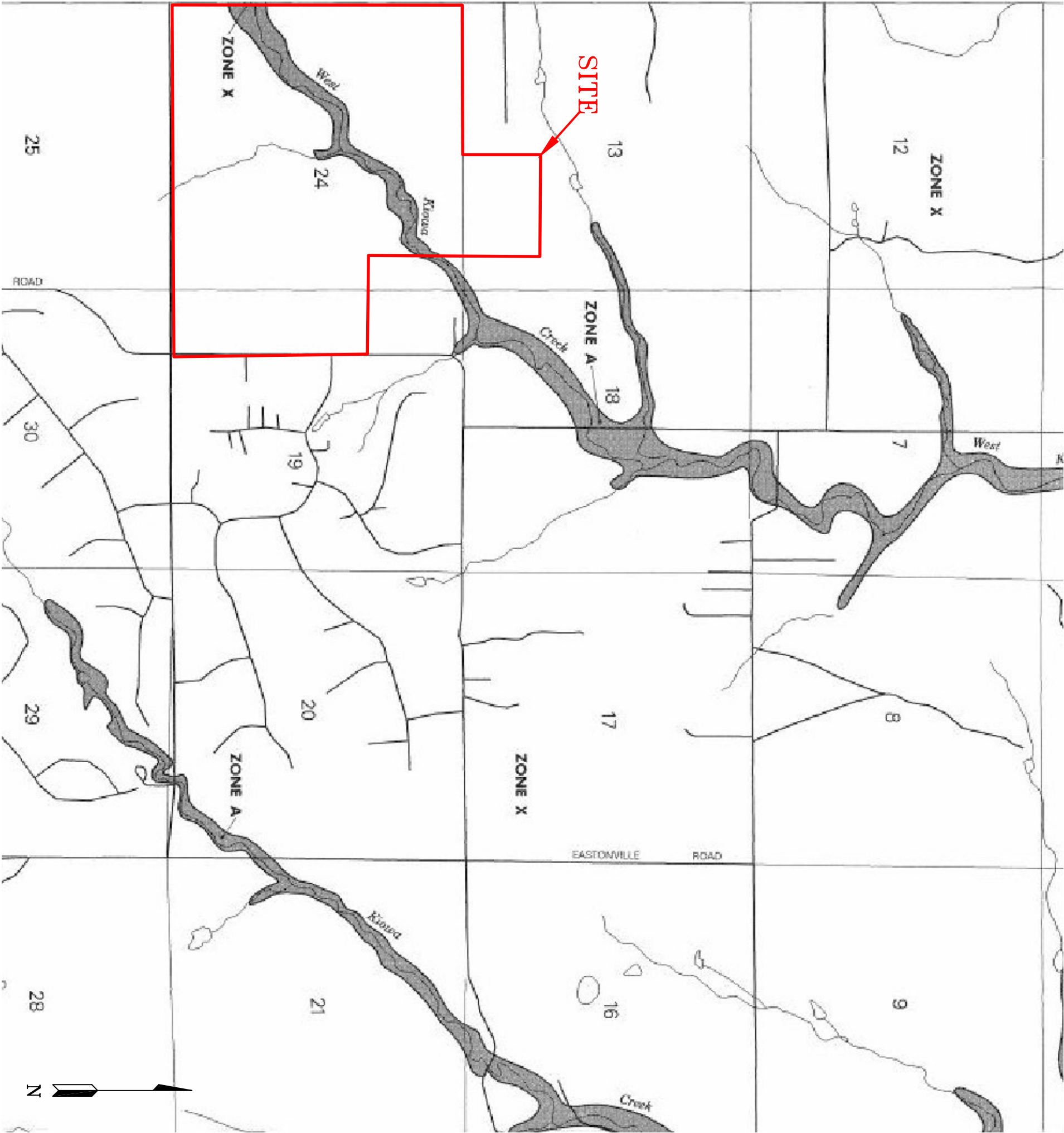
EFFECTIVE DATE OF COUNTYWIDE

FLOOD INSURANCE RATE MAP

November 20, 2000

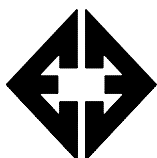
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

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



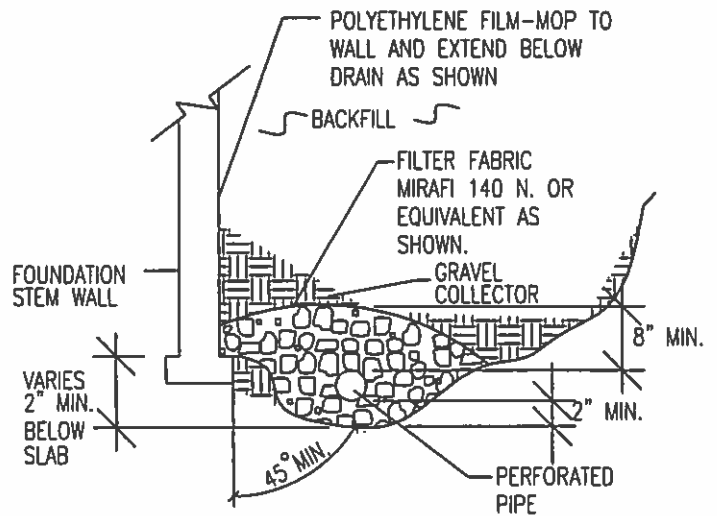
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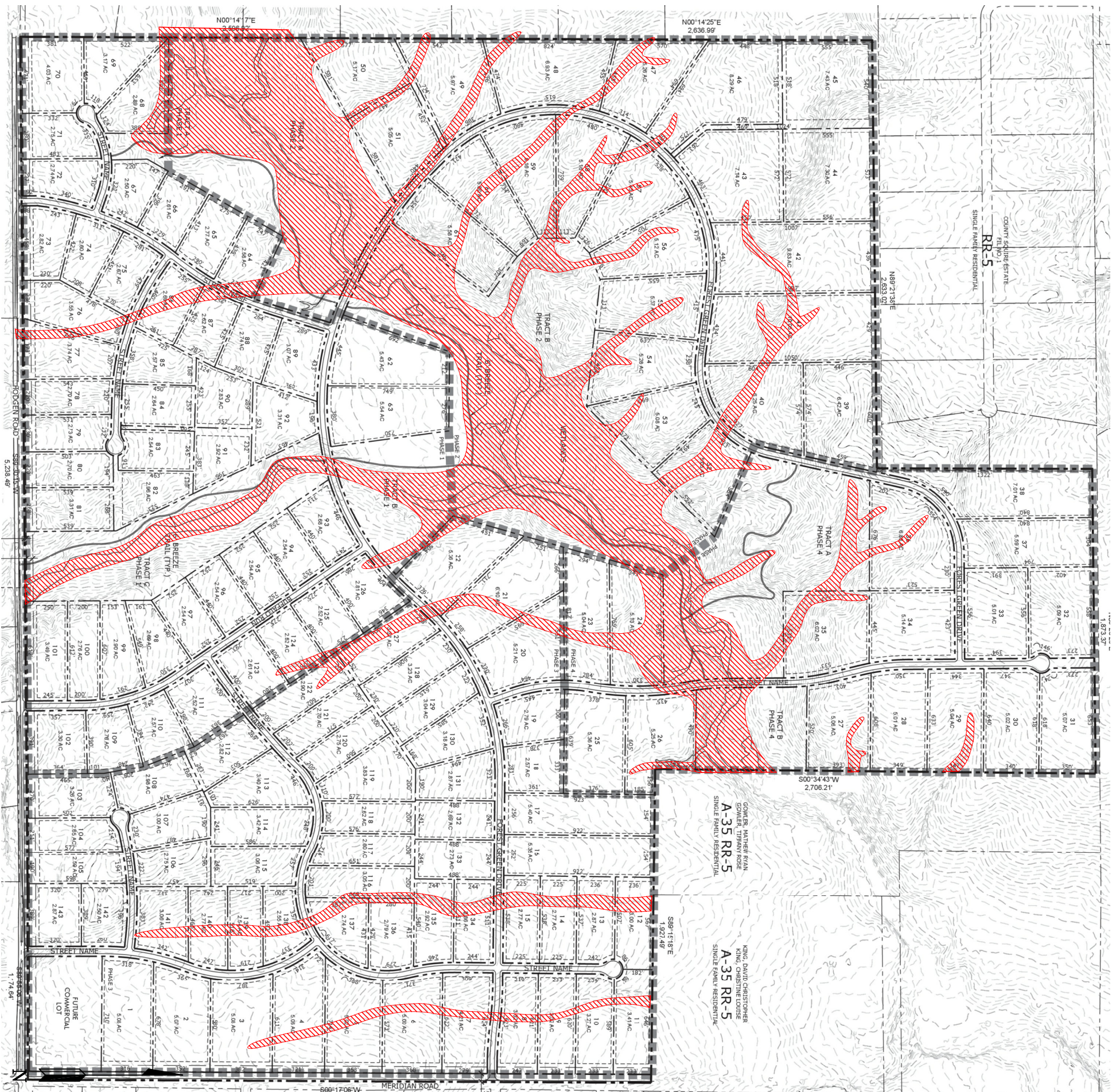
FLOODPLAIN MAP
MCCUNE RANCH SUBDIVISION
17480 MERIDIAN ROAD NORTH
EL PASO COUNTY, CO.
FOR: PROTERRA PROPERTIES, LLC

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AS SHOWN
JOB NO.
181459
FIGURE NO.
7



8

-AREAS THAT ARE NOT SUITABLE FOR ON-SITE WASTE WATER TREATMENT SYSTEMS

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SEPTIC SUITABILITY MAP
MCCUNE RANCH SUBDIVISION
17480 MERIDIAN ROAD NORTH
EL PASO COUNTY, CO.
FOR: PROTERRA PROPERTIES, LLC

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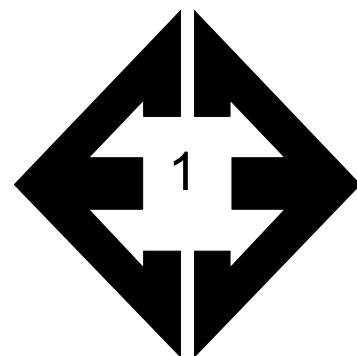
AS SHOWN

181459

FRONT NO.

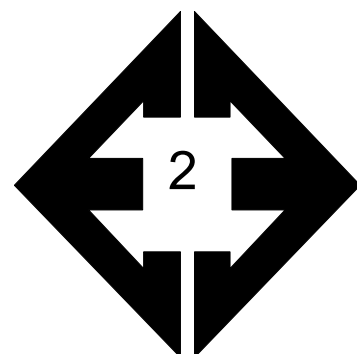
9

APPENDIX A: Site Photographs



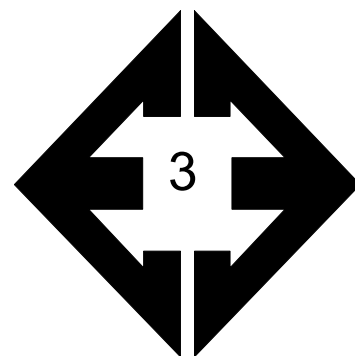
**Looking southwest
from the northern
portion of the site.**

September 12, 2018



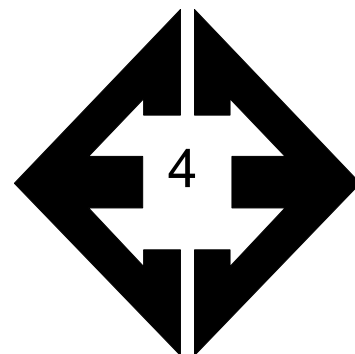
**Looking south from
the northern portion of
the site.**

September 12, 2018



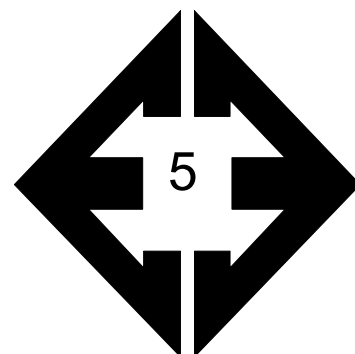
**Looking west from the
northern portion of the
site.**

September 12, 2018



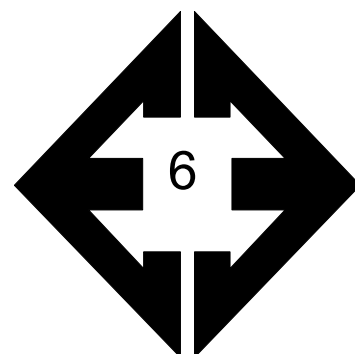
**Looking east along
drainage in the
northern portion of the
site.**

September 12, 2018



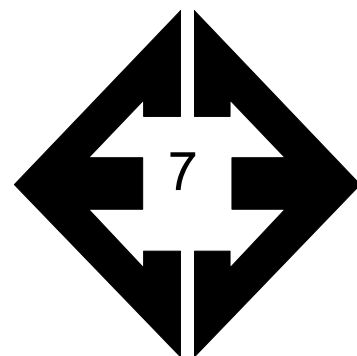
**Looking south from
the western portion of
the site.**

September 12, 2018



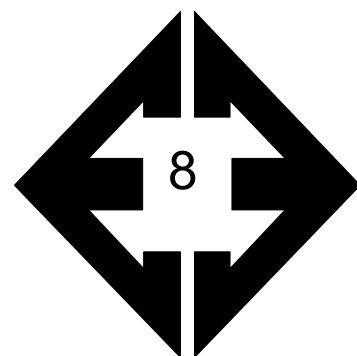
**Looking north along
small drainage in the
western portion of the
site.**

September 12, 2018



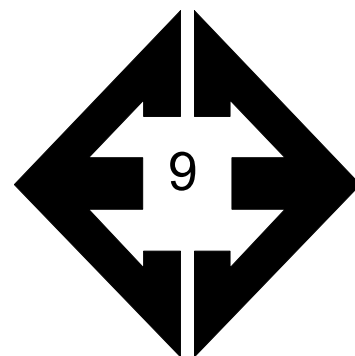
**Looking northeast
from the central
portion of the site.**

September 12, 2018



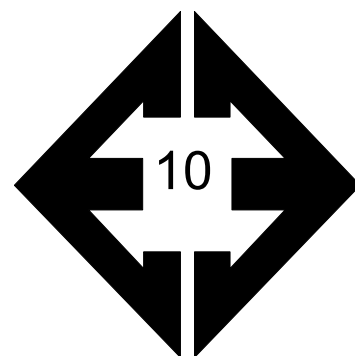
**Looking east towards
W. Kiowa Creek in the
central portion of the
site.**

September 12, 2018



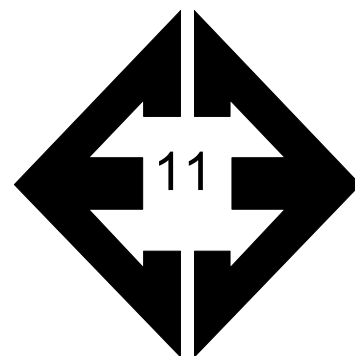
**Looking north from the
southwestern portion
of the site.**

September 12, 2018



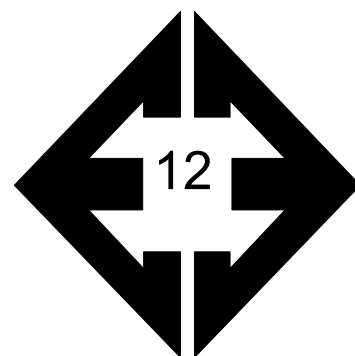
**Looking east from the
southwestern portion
of the site.**

September 12, 2018



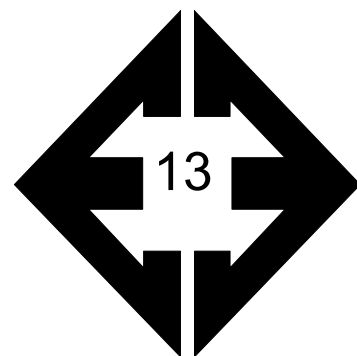
**Looking west from the
southeastern portion
of the site.**

September 12, 2018



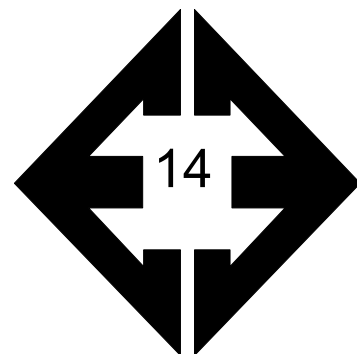
**Looking northwest
from the southeast
portion of the site.**

September 12, 2018



**Looking north along
drainage in the
northeastern portion of
the site.**

September 15, 2018



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

September 15, 2018

APPENDIX B: Test Boring Logs and Test Pit Logs

TEST BORING NO 1
 DATE DRILLED 9/18/2018
 Job # 181459

TEST BORING NO 2
 DATE DRILLED 9/18/2018
 CLIENT PROTERRA PROPERTIES
 LOCATION McCUNE RANCH

REMARKS

DRY TO 20', 9/19/18

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

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

CLAYSTONE, SANDY, TAN,
 HARD, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			29	3.7	1
5			17	4.7	1
10			15	11.1	1
15			50 11"	12.4	4
20			50 7"	12.8	4

REMARKS

DRY TO 17.5', 9/19/18

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

CLAY, SANDY, BROWN, FIRM,
 MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			12	1.5	1
5			16	2.4	1
10			24	3.3	1
15			25	3.1	1
20			13	13.2	2



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TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE:

JOB NO:
 181459

FIG NO:

B-1

TEST BORING NO 3
 DATE DRILLED 9/18/2018
 Job # 181459

TEST BORING NO 4
 DATE DRILLED 9/18/2018
 CLIENT PROTERRA PROPERTIES
 LOCATION McCUNE RANCH

REMARKS

WATER @ 16.5', 9/19/18

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

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			35	1.7	1
			16	3.0	1
10			28	3.9	1
15			24	3.6	1
20			17	10.7	1



REMARKS

DRY TO 20', 9/19/18

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

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

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			29	2.5	1
5			26	5.0	1
10			16	3.7	1
15			27	6.9	1
20			50	6.2	3
			10"		



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505 ELKTON DRIVE
 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE:

L

9/28/18

JOB NO.:
 181459

FIG NO.:

B-2

TEST BORING NO. 5
 DATE DRILLED 9/18/2018
 Job # 181459

TEST BORING NO.
 DATE DRILLED
 CLIENT PROTERRA PROPERTIES
 LOCATION McCUNE RANCH

REMARKS

DRY TO 20', 9/19/18

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

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			5	3.8	1
5			5	6.0	1
10			14	6.2	1
15			10	8.1	1
20			27	7.8	1

REMARKS

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5					
10					
15					
20					



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ENGINEERING, INC.

505 ELKTON DRIVE
 COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN:

DATE:

CHECKED:

DATE:

LLL

9/27/18

JOB NO.
 181459

FIG NO.:

6-3

TEST PIT NO. 1
 DATE EXCAVATED 9/12/2018
 Job # 181459

TEST PIT NO. 2
 DATE EXCAVATED 9/12/2018
 CLIENT PROTERRA PROPERTIES, LLC
 LOCATION MCCUNE RANCH SUBDIVISION

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

Soil Structure Shape

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

Soil Structure Grade

weak - w
 moderate - m
 strong - s
 loose - l



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ENGINEERING, INC.

505 ELKTON DRIVE
 COLORADO SPRINGS, COLORADO 80907

TEST PIT LOG

DRAWN:

DATE:

CHECKED:

DATE:
 9/21/18

JOB NO.:

181459

FIG NO.:

B-4

TEST PIT NO. 3
 DATE EXCAVATED 9/12/2018
 Job # 181459

TEST PIT NO. 4
 DATE EXCAVATED 9/12/2018
 CLIENT PROTERRA PROPERTIES, LLC
 LOCATION MCCUNE RANCH SUBDIVISION

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

Soil Structure Shape

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

Soil Structure Grade

weak - w
 moderate - m
 strong - s
 loose - l



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505 ELKTON DRIVE
 COLORADO SPRINGS, COLORADO 80907

TEST PIT LOG

DRAWN

DATE

CHECKED

DATE: 9/22/18

JOB NO.

181459

FIG NO.

B-5

TEST PIT NO. 5
DATE EXCAVATED 9/12/2018
Job # 181459

TEST PIT NO. 6
DATE EXCAVATED 9/12/2018
CLIENT PROTERRA PROPERTIES, LLC
LOCATION MCCUNE RANCH SUBDIVISION

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

Soil Structure Shape

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

Soil Structure Grade

weak - w
moderate - m
strong - s
loose - l



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TEST PIT LOG

DRAWN:

DATE:

CHECKED:

DATE:
9/21/18

JOB NO.:

181459

FIG NO.:

B-6

TEST PIT NO. 7
DATE EXCAVATED 9/12/2018
Job # 181459

TEST PIT NO. 8
DATE EXCAVATED 9/15/2018
CLIENT PROTERRA PROPERTIES, LLC
LOCATION MCCUNE RANCH SUBDIVISION

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

Soil Structure Shape

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

Soil Structure Grade

weak - w
moderate - m
strong - s
loose - l



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TEST PIT LOG

DRAWN

DATE

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L.L.L.

DATE
9/21/18

JOB NO.:

181459

FIG NO.:

B-7

TEST PIT NO. 9
DATE EXCAVATED 9/15/2018
Job # 181459

TEST PIT NO. 10
DATE EXCAVATED 9/15/2018
CLIENT PROTERRA PROPERTIES, LLC
LOCATION MCCUNE RANCH SUBDIVISION

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

Soil Structure Shape

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

Soil Structure Grade

weak - w
moderate - m
strong - s
loose - l



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TEST PIT LOG

DRAWN:

DATE

CHECKED:

DATE

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9/21/18

JOB NO.:

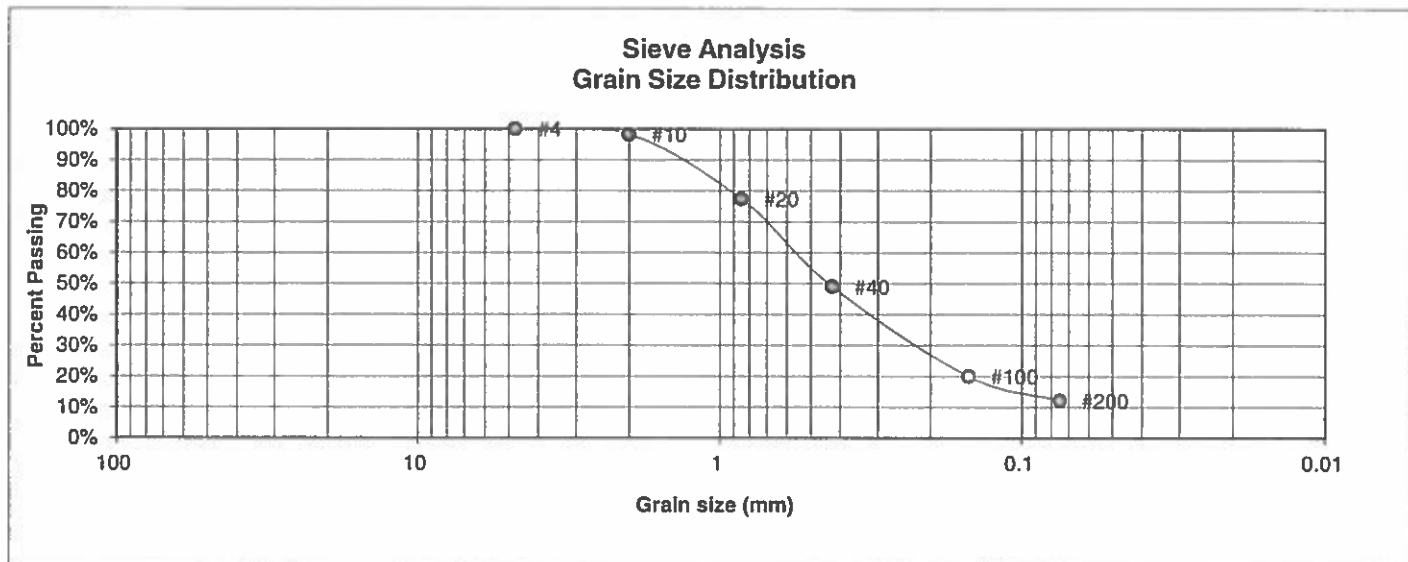
181459

FIG NO.:

B-8

APPENDIX C: Laboratory Test Results

<u>UNIFIED CLASSIFICATION</u>	SM	<u>CLIENT</u>	PROTERRA PROPERTIES
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	McCUNE RANCH
<u>TEST BORING #</u>	2	<u>JOB NO.</u>	181459
<u>DEPTH (FT)</u>	2-3	<u>TEST BY</u>	BL



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	98.3%
20	77.4%
40	49.0%
100	20.0%
200	12.1%

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

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



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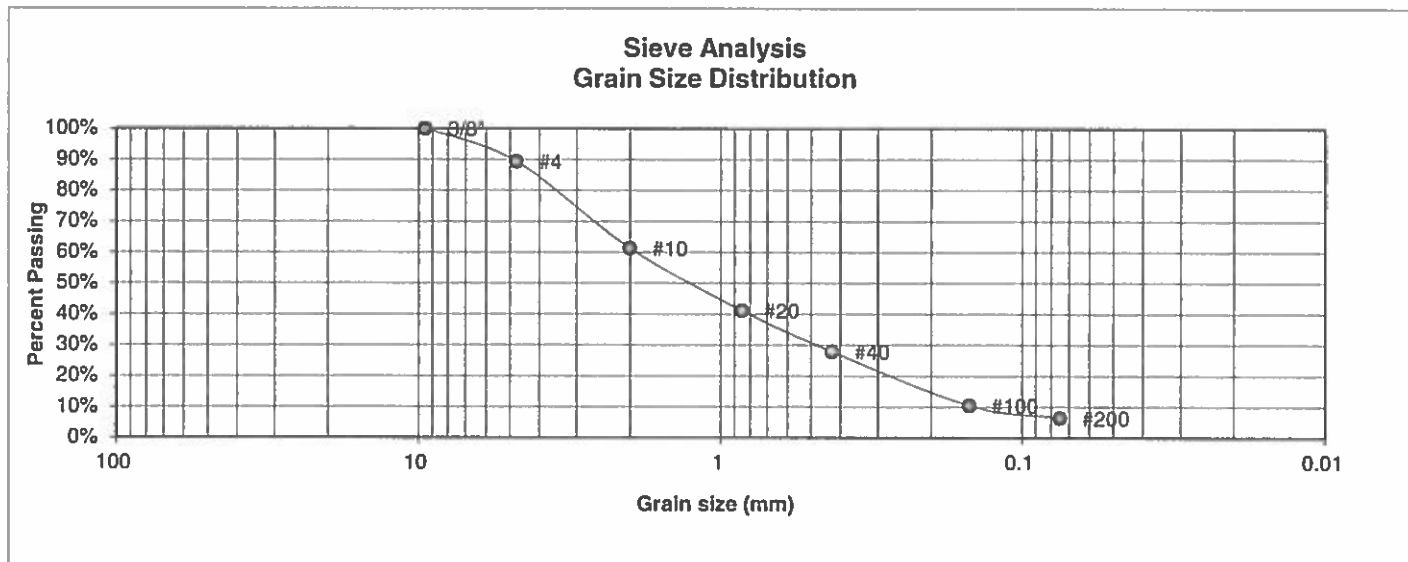
LABORATORY TEST RESULTS

<u>DRAWN:</u>	<u>DATE:</u>	<u>CHECKED:</u>	<u>DATE:</u>
		LLL	9/27/18

JOB NO.:
181459

FIG NO.:
C-1

UNIFIED CLASSIFICATION	SM-SW	CLIENT	PROTERRA PROPERTIES
SOIL TYPE #	1	PROJECT	McCUNE RANCH
TEST BORING #	3	JOB NO.	181459
DEPTH (FT)	10	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	89.3%
10	61.3%
20	41.2%
40	27.9%
100	10.5%
200	6.5%

Atterberg
Limits
Plastic Limit
Liquid Limit
Plastic Index

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



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LABORATORY TEST RESULTS

DRAWN:

DATE:

CHECKED:

DATE:

LLL

9/27/18

JOB NO.:
181459

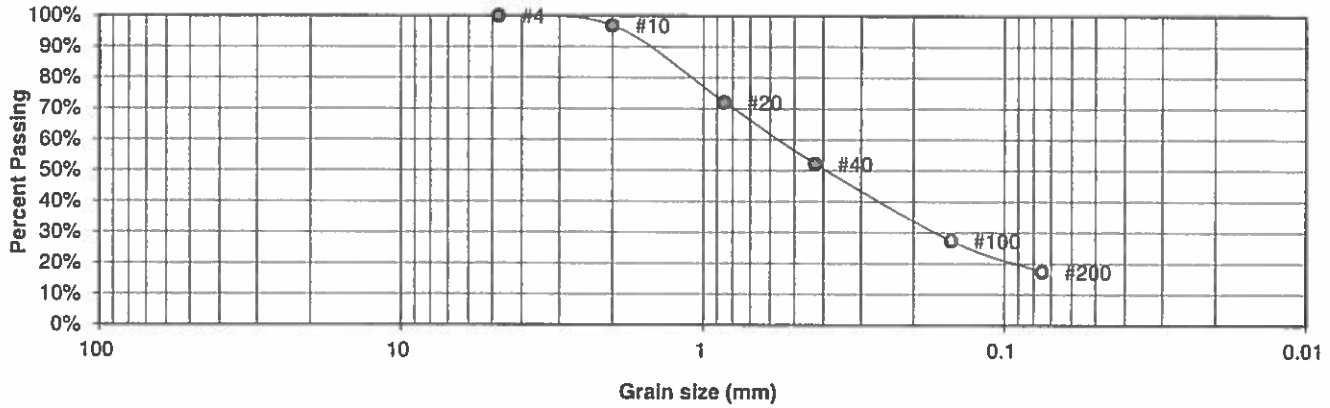
FIG NO.:

C-2

UNIFIED CLASSIFICATION	SM
SOIL TYPE #	1
TEST BORING #	5
DEPTH (FT)	5

CLIENT	PROTERRA PROPERTIES
PROJECT	McCUNE RANCH
JOB NO.	181459
TEST BY	BL

**Sieve Analysis
Grain Size Distribution**



**U.S.
Sieve #**

**Percent
Finer**

**Atterberg
Limits**

3"

Plastic Limit

1 1/2"

Liquid Limit

3/4"

Plastic Index

1/2"

3/8"

4

100.0%

Swell

10

96.9%

Moisture at start

20

72.1%

Moisture at finish

40

52.2%

Moisture increase

100

27.4%

Initial dry density (pcf)

200

17.3%

Swell (psf)



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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST
RESULTS**

DRAWN:

DATE:

CHECKED:

DATE:

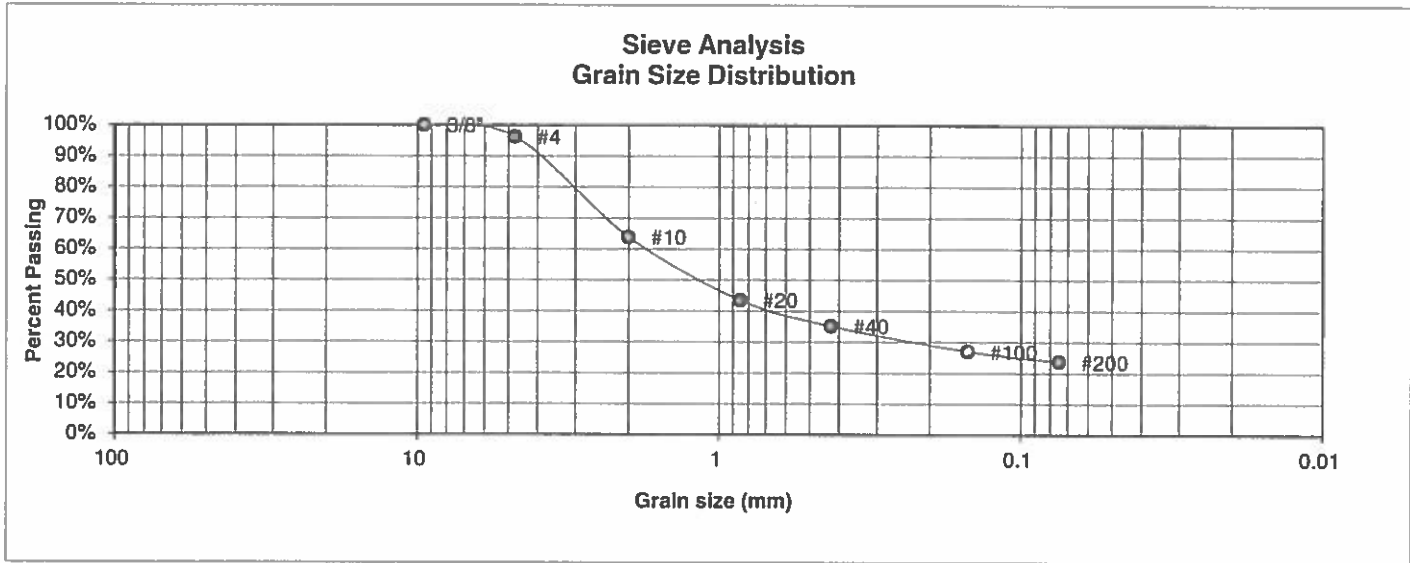
LLL

9/27/18

JOB NO.:
181459

FIG NO.:
C-3

<u>UNIFIED CLASSIFICATION</u>	SM	<u>CLIENT</u>	PROTERRA PROPERTIES
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	McCUNE RANCH
<u>TEST BORING #</u>	TP-3	<u>JOB NO.</u>	181459
<u>DEPTH (FT)</u>	2-3	<u>TEST BY</u>	BL



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	96.3%
10	63.9%
20	43.5%
40	35.2%
100	27.0%
200	23.7%

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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COLORADO SPRINGS, COLORADO 80907

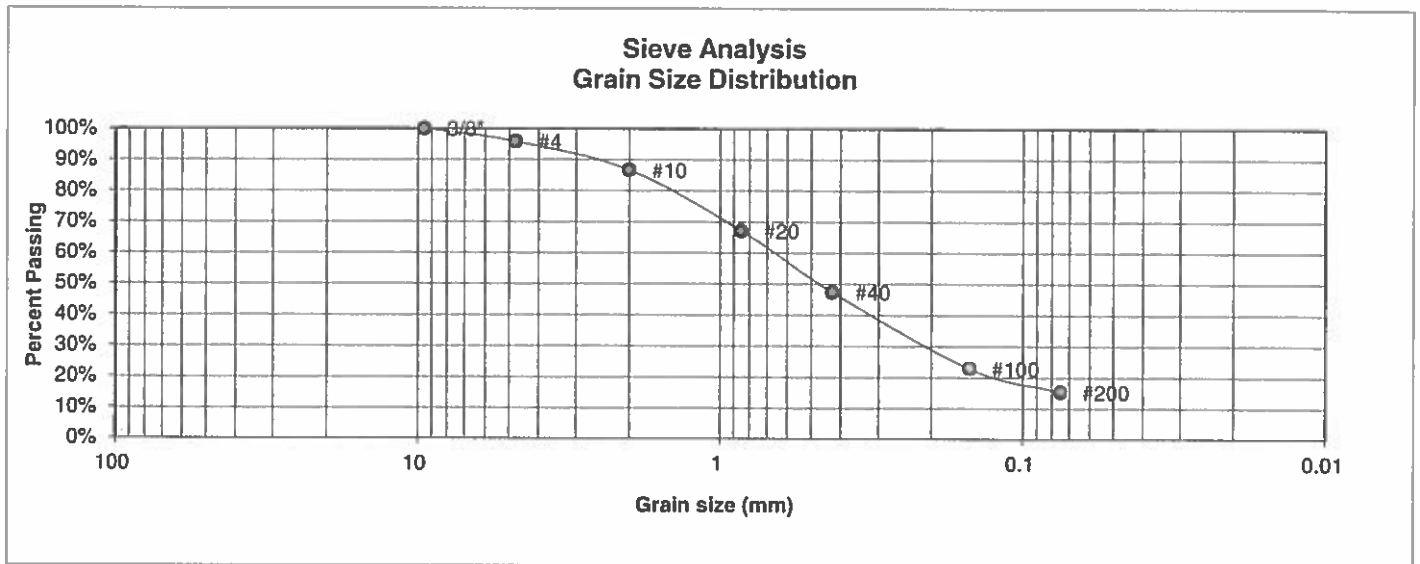
LABORATORY TEST RESULTS

<u>DRAWN</u>	<u>DATE</u>	<u>CHECKED</u> LLL	<u>DATE</u> 9/27/18
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JOB NO.:
181459

FIG NO.:
C-4

<u>UNIFIED CLASSIFICATION</u>	SM	<u>CLIENT</u>	PROTERRA PROPERTIES
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	McCUNE RANCH
<u>TEST BORING #</u>	TP-4	<u>JOB NO.</u>	181459
<u>DEPTH (FT)</u>	5-6	<u>TEST BY</u>	BL



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	95.8%
10	86.7%
20	67.2%
40	47.4%
100	22.9%
200	15.3%

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:

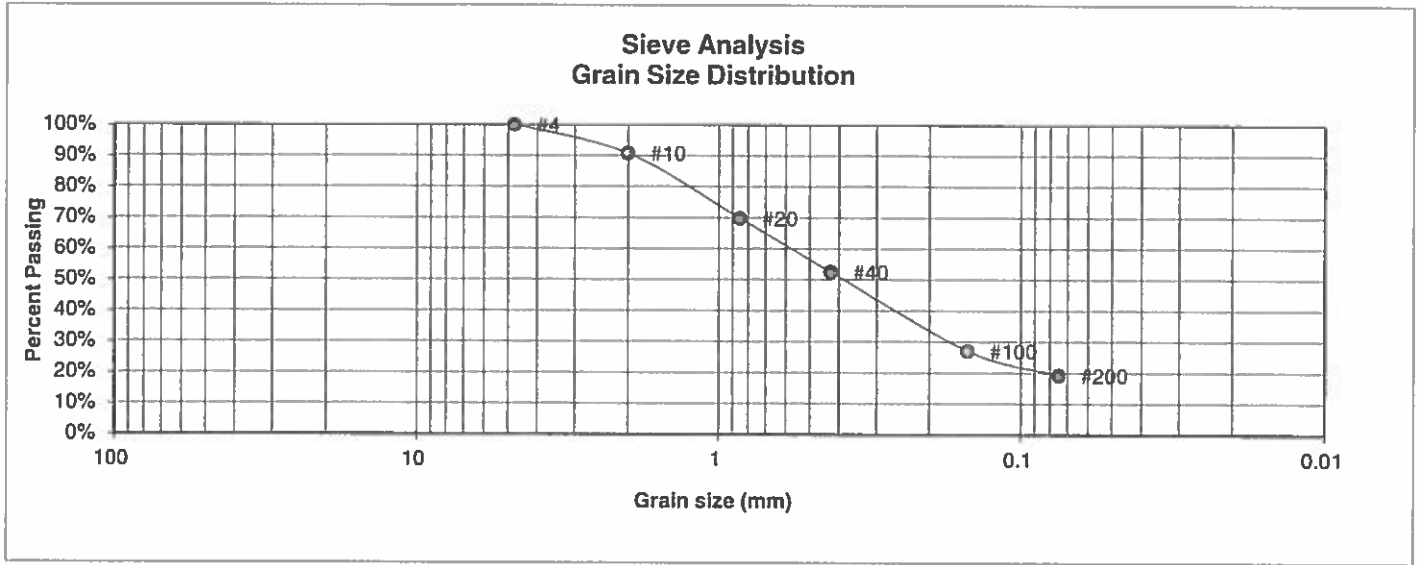
LLC

9/27/18

JOB NO.:
181459

FIG NO.:
C-5

UNIFIED CLASSIFICATION	SM	CLIENT	PROTERRA PROPERTIES
SOIL TYPE #	1	PROJECT	McCUNE RANCH
TEST BORING #	TP-5	JOB NO.	181459
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	90.8%
20	69.8%
40	52.5%
100	27.1%
200	19.2%

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

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



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LABORATORY TEST RESULTS

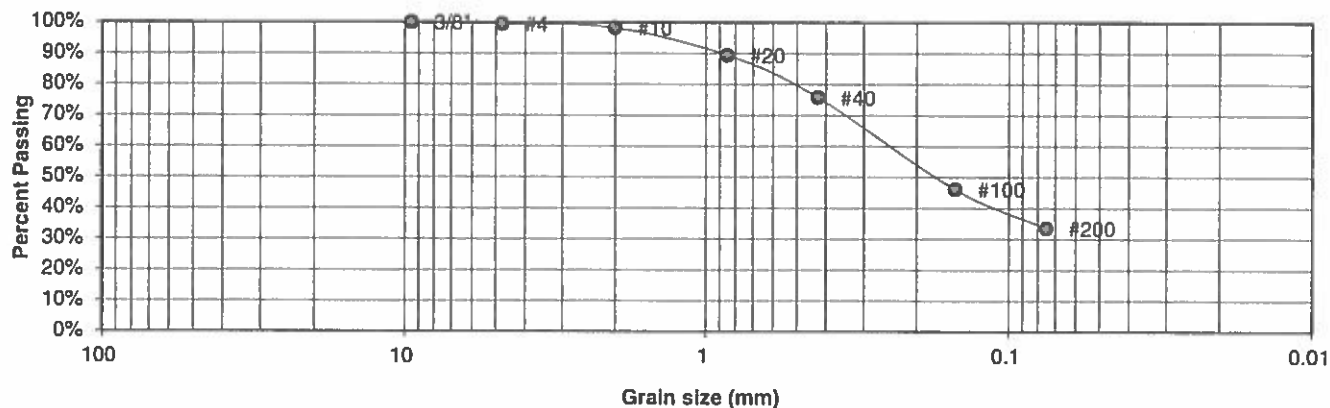
DRAWN:	DATE:	CHECKED:	DATE:
		LL	9/27/18

JOB NO:
181459

FIG NO:
C-6

UNIFIED CLASSIFICATION	SM	CLIENT	PROTERRA PROPERTIES
SOIL TYPE #	1	PROJECT	MCCUNE RANCH
TEST BORING #	TP-7	JOB NO.	181459
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

100.0%
99.5%
98.3%
89.5%
75.8%
46.1%
33.5%

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:

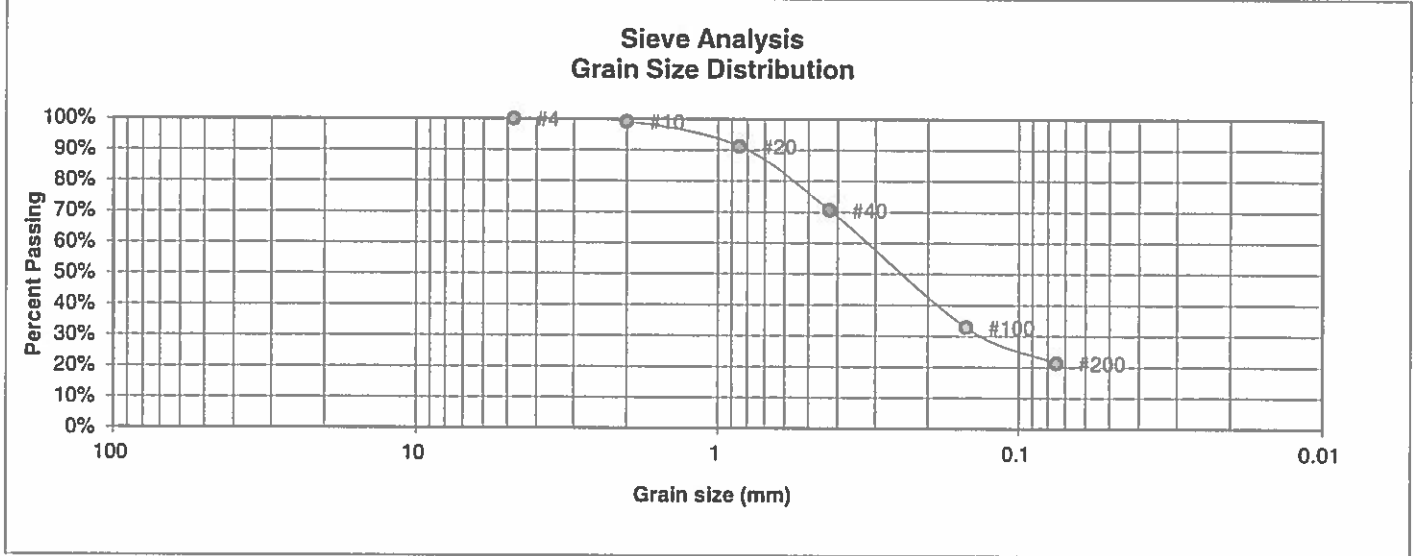
LLC

9/27/18

JOB NO:
181459

FIG NO:
L-7

UNIFIED CLASSIFICATION	SM	CLIENT	PROTERRA PROPERTIES
SOIL TYPE #	1	PROJECT	McCUNE RANCH
TEST BORING #	TP-9	JOB NO.	181459
DEPTH (FT)	5-6	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.2%
20	91.2%
40	70.6%
100	32.9%
200	21.3%

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

Swell	
Moisture at start	12.7%
Moisture at finish	22.9%
Moisture increase	10.1%
Initial dry density (pcf)	98
Swell (psf)	30



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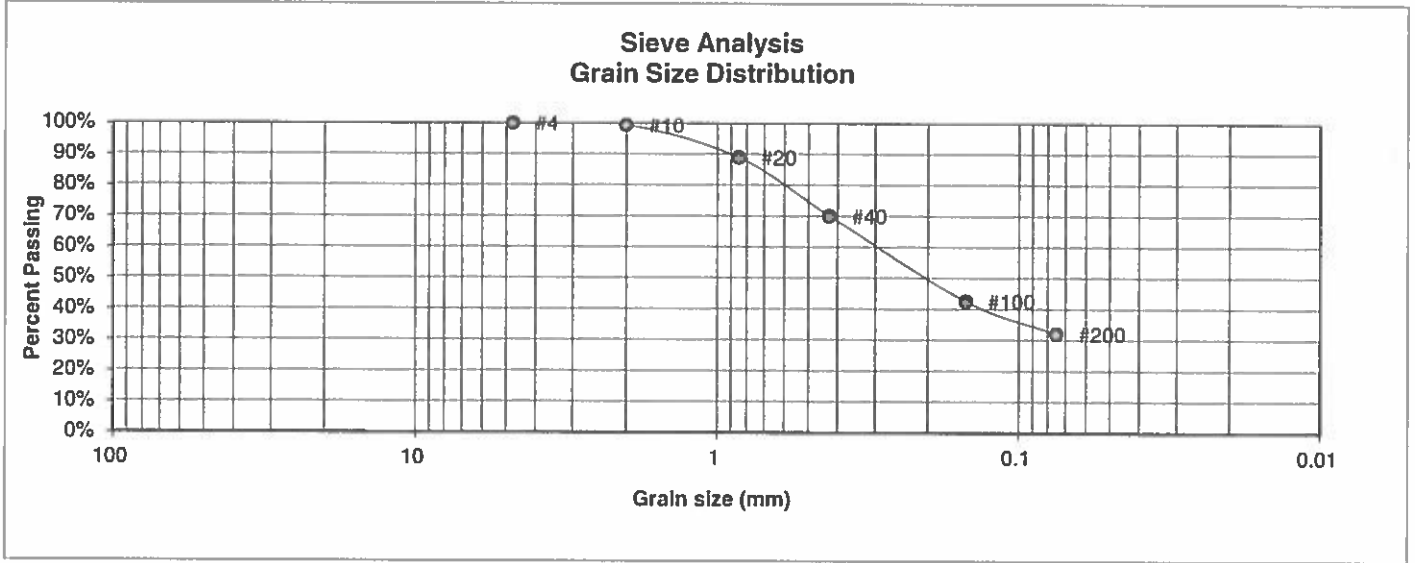
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LL	9/27/18

JOB NO.:
181459

FIG NO.:
C-8

<u>UNIFIED CLASSIFICATION</u>	SM	<u>CLIENT</u>	PROTERRA PROPERTIES
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	McCUNE RANCH
<u>TEST BORING #</u>	TP-10	<u>JOB NO.</u>	181459
<u>DEPTH (FT)</u>	2-3	<u>TEST BY</u>	BL



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.4%
20	88.9%
40	70.0%
100	42.6%
200	32.0%

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

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DATE:

CHECKED:

DATE:

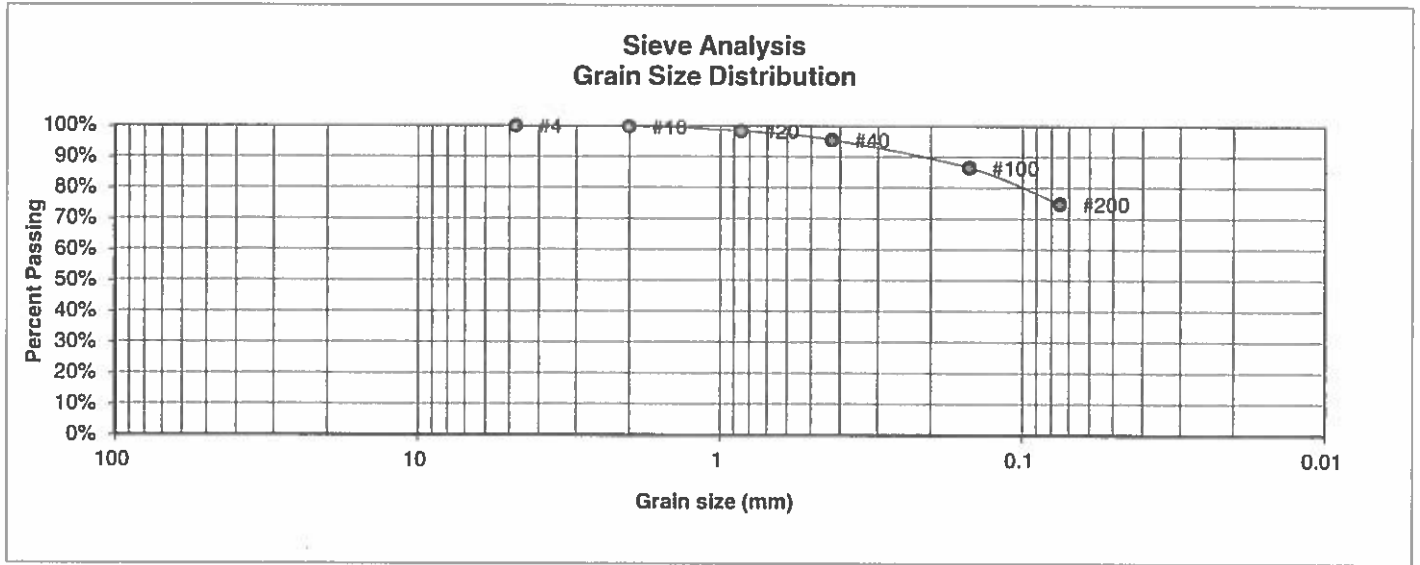
LLL

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JOB NO:
181459

FIG NO:
C-9

UNIFIED CLASSIFICATION	CL	CLIENT	PROTERRA PROPERTIES
SOIL TYPE #	2	PROJECT	McCUNE RANCH
TEST BORING #	TP-1	JOB NO.	181459
DEPTH (FT)	5-6	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.8%
20	98.4%
40	95.4%
100	86.5%
200	74.8%

Atterberg Limits	
Plastic Limit	20
Liquid Limit	30
Plastic Index	10

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



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LABORATORY TEST RESULTS

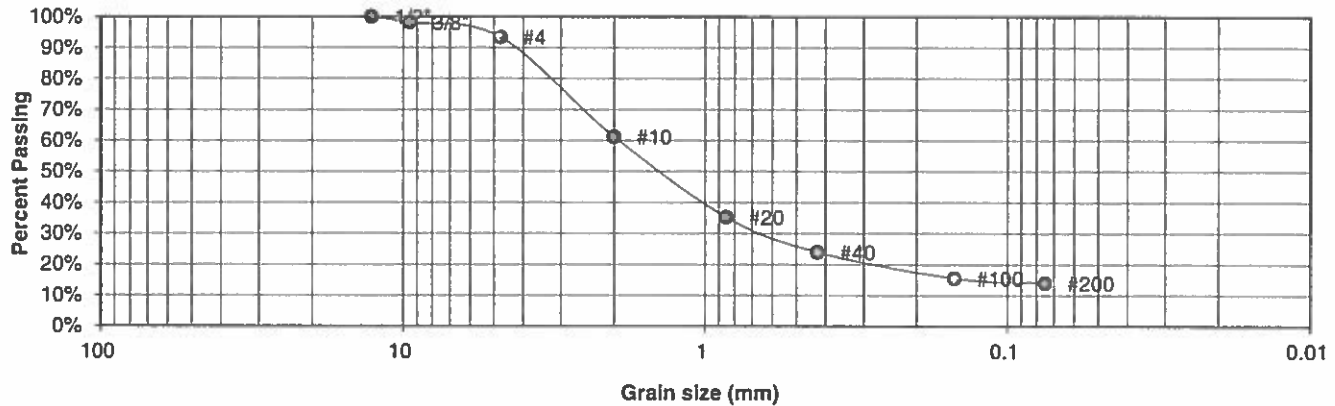
DRAWN:	DATE:	CHECKED:	DATE:
		LL	9/27/18

JOB NO:
181459

FIG NO:
C-10

<u>UNIFIED CLASSIFICATION</u>	SM	<u>CLIENT</u>	PROTERRA PROPERTIES
<u>SOIL TYPE #</u>	3	<u>PROJECT</u>	McCUNE RANCH
<u>TEST BORING #</u>	TP-2	<u>JOB NO.</u>	181459
<u>DEPTH (FT)</u>	5-6	<u>TEST BY</u>	BL

Sieve Analysis Grain Size Distribution



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	98.2%
4	93.4%
10	61.2%
20	35.3%
40	24.0%
100	15.6%
200	14.0%

<u>Atterberg Limits</u>	
Plastic Limit	21
Liquid Limit	30
Plastic Index	9

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



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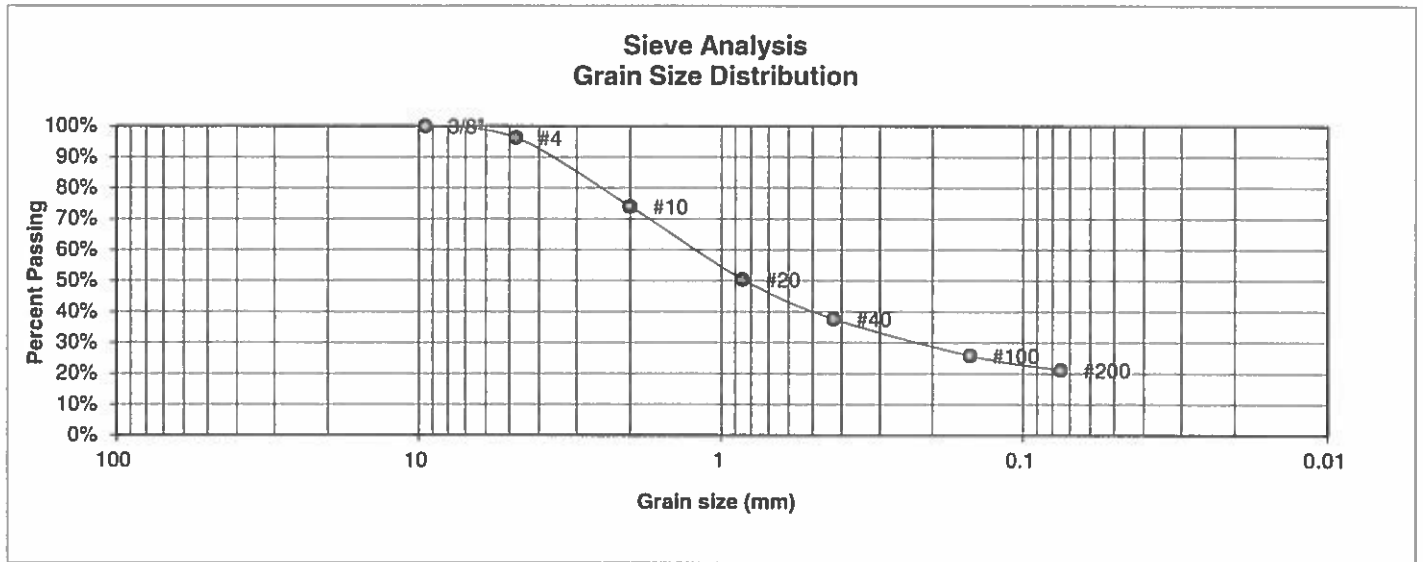
LABORATORY TEST RESULTS

<u>DRAWN:</u>	<u>DATE:</u>	<u>CHECKED:</u>	<u>DATE:</u>
		LLL	9/27/18

JOB NO:
181459

FIG NO:
C-11

UNIFIED CLASSIFICATION	SC	CLIENT	PROTERRA PROPERTIES
SOIL TYPE #	3	PROJECT	McCUNE RANCH
TEST BORING #	TP-8	JOB NO.	181459
DEPTH (FT)	5-6	TEST BY	BL



U.S. Sieve #	Percent Finer	Atterberg Limits	
3"		Plastic Limit	19
1 1/2"		Liquid Limit	33
3/4"		Plastic Index	14
1/2"			
3/8"	100.0%	<u>Swell</u>	
4	96.2%	Moisture at start	
10	74.0%	Moisture at finish	
20	50.4%	Moisture increase	
40	37.7%	Initial dry density (pcf)	
100	25.8%	Swell (psf)	
200	21.1%		



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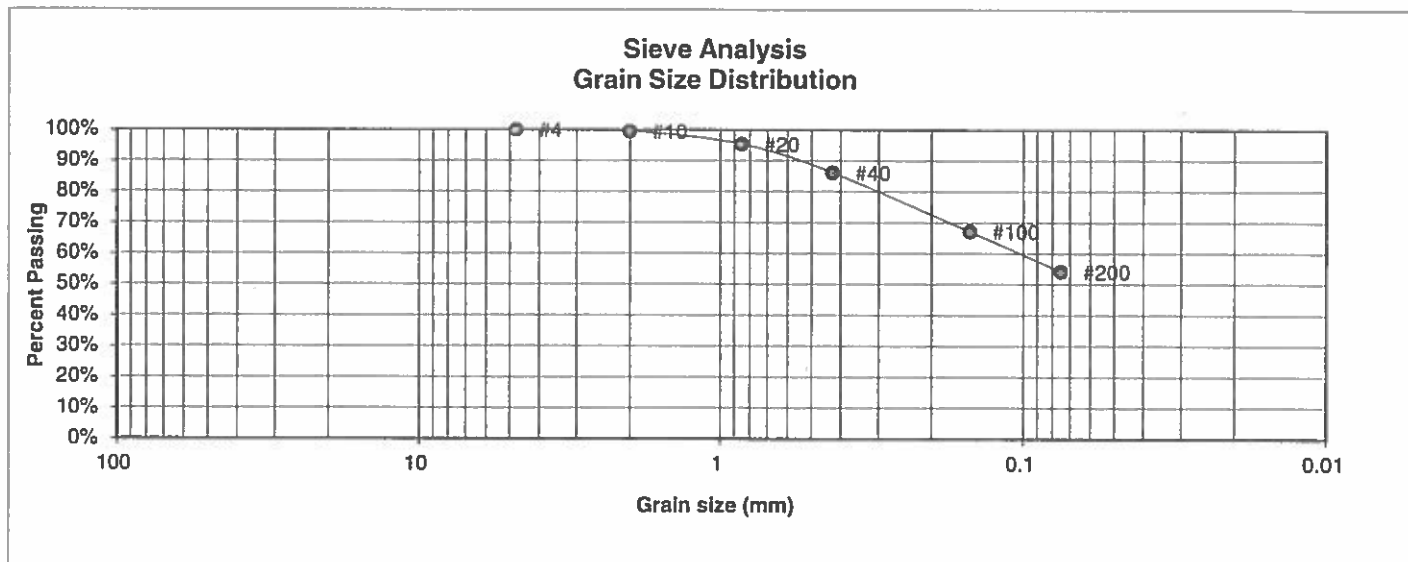
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED: LLL	DATE: 9/27/13
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JOB NO.:
181459

FIG NO.:
C-12

UNIFIED CLASSIFICATION	CL-SC	CLIENT	PROTERRA PROPERTIES
SOIL TYPE #	3	PROJECT	McCUNE RANCH
TEST BORING #	TP-6	JOB NO.	181459
DEPTH (FT)	5-6	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.5%
20	95.4%
40	86.1%
100	67.1%
200	54.2%

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

Swell	
Moisture at start	8.4%
Moisture at finish	20.4%
Moisture increase	12.0%
Initial dry density (pcf)	101
Swell (psf)	350



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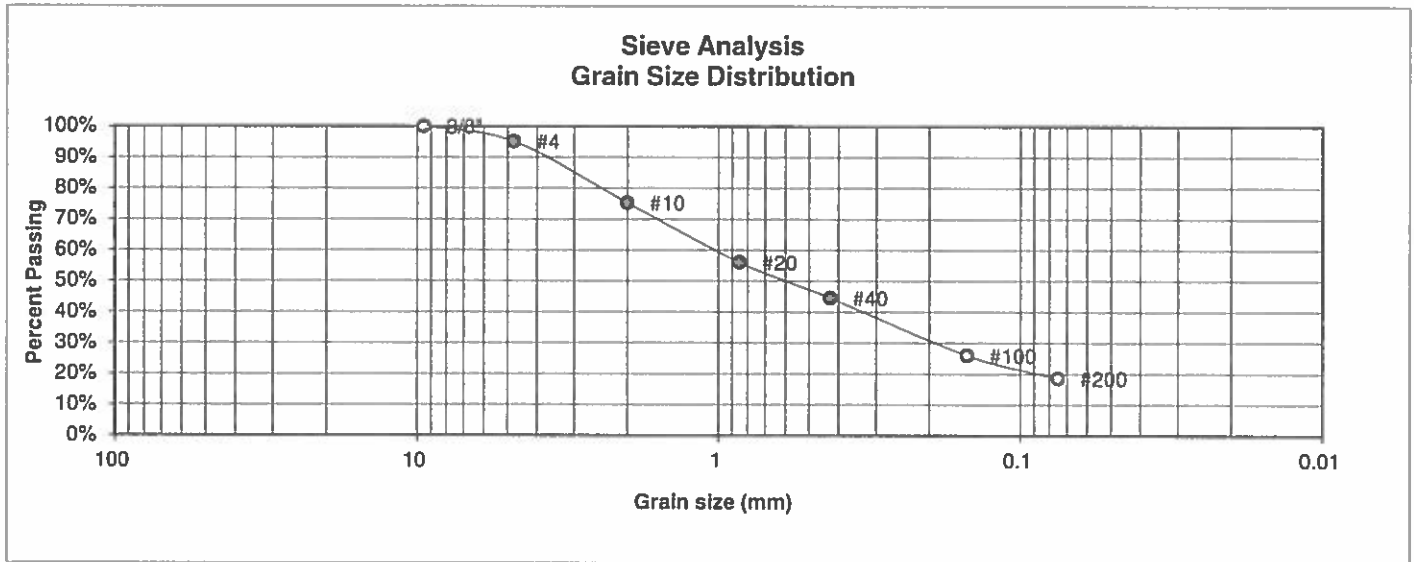
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	9/27/18

JOB NO.:
181459

FIG NO.:
C-13

UNIFIED CLASSIFICATION	SC-SM	CLIENT	PROTERRA PROPERTIES
SOIL TYPE #	3	PROJECT	McCUNE RANCH
TEST BORING #	4	JOB NO.	181459
DEPTH (FT)	20	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	95.1%
10	75.3%
20	56.1%
40	44.6%
100	26.0%
200	18.6%

Atterberg Limits	
Plastic Limit	14
Liquid Limit	21
Plastic Index	7

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



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LABORATORY TEST RESULTS

DRAWN:

DATE:

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DATE:

LL

9/27/18

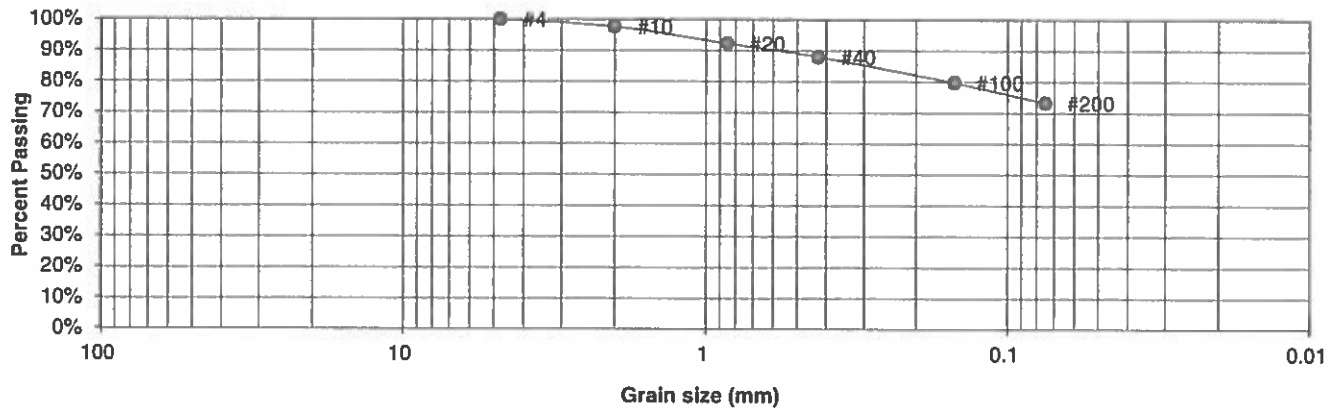
JOB NO:
181459

FIG NO:
C-14

UNIFIED CLASSIFICATION	CL
SOIL TYPE #	4
TEST BORING #	1
DEPTH (FT)	15

CLIENT	PROTERRA PROPERTIES
PROJECT	McCUNE RANCH
JOB NO.	181459
TEST BY	BL

Sieve Analysis Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	97.7%
20	92.3%
40	88.0%
100	79.8%
200	73.2%

Atterberg Limits	
Plastic Limit	22
Liquid Limit	35
Plastic Index	13

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



**ENTECH
ENGINEERING, INC.**

505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

DRAWN:

DATE:

CHECKED:

DATE:

LLL

9/27/18

JOB NO.:
181459

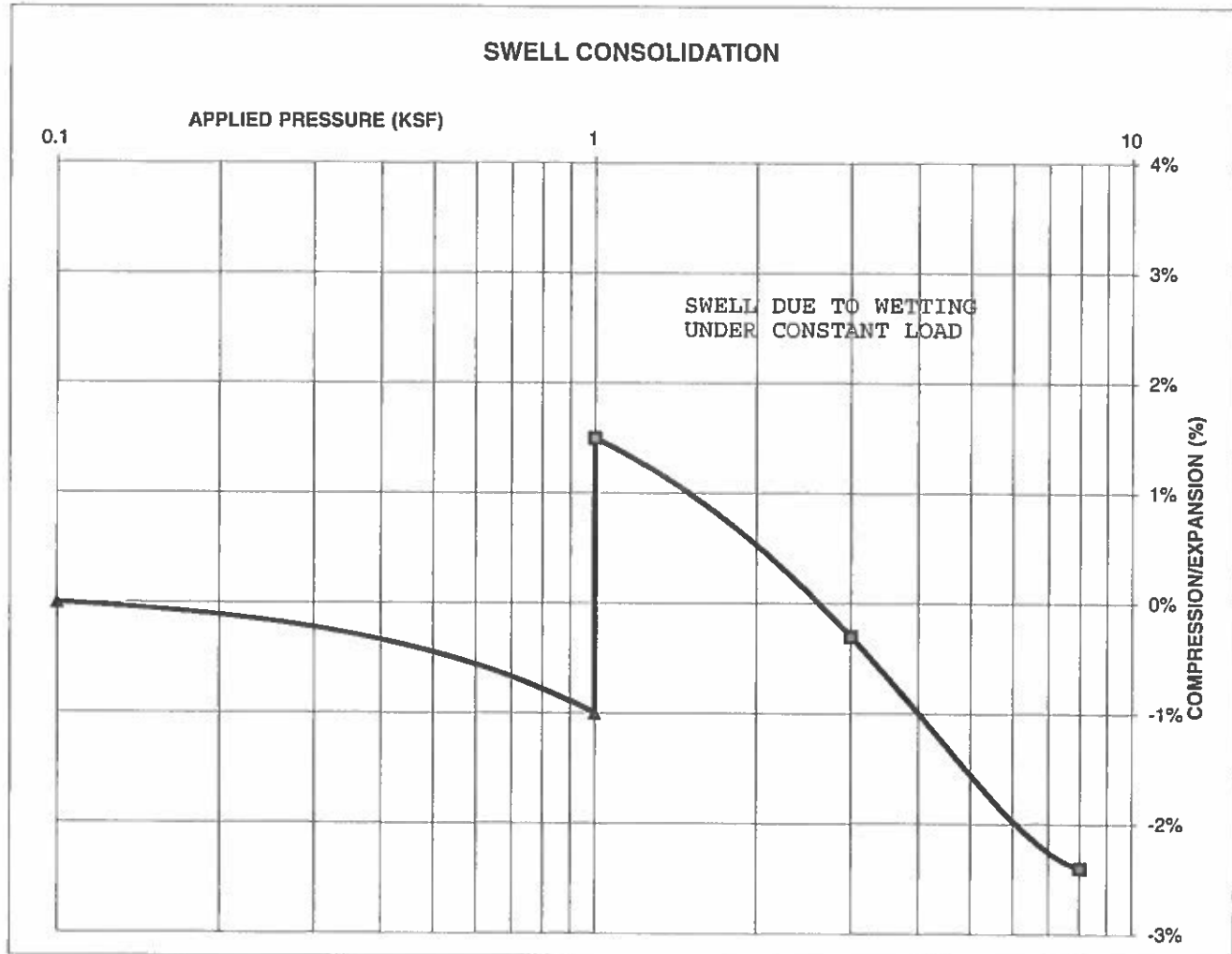
FIG NO.:

C-15

CONSOLIDATION TEST RESULTS

TEST BORING #	1	DEPTH(ft)	15
DESCRIPTION	CL	SOIL TYPE	4
NATURAL UNIT DRY WEIGHT (PCF)			120
NATURAL MOISTURE CONTENT			13.4%
SWELL/CONSOLIDATION (%)			2.5%

JOB NO. 181459
 CLIENT PROTERRA PROPERTIES
 PROJECT McCUNE RANCH



**ENTECH
ENGINEERING, INC.**

505 ELKTON DRIVE
 COLORADO SPRINGS, COLORADO 80907

SWELL CONSOLIDATION TEST RESULTS

DRAWN:

DATE:

CHECKED:

DATE:

LLL

9/27/18

JOB NO:
181459

FIG NO:
C-16

CLIENT	PROTERRA PROPERTIES	JOB NO.	181459
PROJECT	McCUNE RANCH	DATE	9/24/2018
LOCATION	McCUNE RANCH	TEST BY	BL

BORING NUMBER	DEPTH, (ft)	SOIL TYPE NUMBER	UNIFIED CLASSIFICATION	WATER SOLUBLE SULFATE, (wt%)
TB-1	15	4	CL	<0.01
TB-3	10	1	SM-SW	<0.01
TB-4	20	3	SC-SM	<0.01

QC BLANK PASS



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

**LABORATORY TEST
SULFATE RESULTS**

DRAWN:	DATE:	CHECKED:	DATE:
		<i>[Signature]</i>	9/28/18

JOB NO:	181459
FIG NO:	C-17

APPENDIX D: Soil Survey Descriptions

El Paso County Area, Colorado

1—Alamosa loam, 1 to 3 percent slopes

Map Unit Setting

National map unit symbol: 3670

Elevation: 7,200 to 7,700 feet

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

Map Unit Composition

Alamosa and similar soils: 85 percent

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

Description of Alamosa

Setting

Landform: Flood plains, fans

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Alluvium

Typical profile

A - 0 to 6 inches: loam

Bt - 6 to 14 inches: clay loam

Btk - 14 to 33 inches: clay loam

Cg1 - 33 to 53 inches: sandy clay loam

Cg2 - 53 to 60 inches: sandy loam

Properties and qualities

Slope: 1 to 3 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Poorly drained

Runoff class: Very high

Capacity of the most limiting layer to transmit water (Ksat):

Moderately high (0.20 to 0.60 in/hr)

Depth to water table: About 12 to 18 inches

Frequency of flooding: Frequent

Frequency of ponding: None

Calcium carbonate, maximum in profile: 5 percent

Salinity, maximum in profile: Very slightly saline to strongly saline
(2.0 to 16.0 mmhos/cm)

Available water storage in profile: High (about 10.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 5w

Hydrologic Soil Group: D

Ecological site: Mountain Meadow (R048AY241CO)

Hydric soil rating: Yes

Minor Components

Other soils

Percent of map unit:

Hydric soil rating: No

Data Source Information

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 15, Oct 10, 2017

El Paso County Area, Colorado

15—Brussett loam, 3 to 5 percent slopes

Map Unit Setting

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

Map Unit Composition

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

Description of Brussett

Setting

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

Typical profile

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

Properties and qualities

Slope: 3 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat):
Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 9.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: Loamy Park (R048AY222CO)
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:

Hydric soil rating: No

Data Source Information

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 15, Oct 10, 2017

El Paso County Area, Colorado

21—Cruckton sandy loam, 1 to 9 percent slopes

Map Unit Setting

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

Map Unit Composition

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

Description of Cruckton

Setting

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

Typical profile

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

Properties and qualities

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

Interpretive groups

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

Minor Components

Other soils

Percent of map unit:

Hydric soil rating: No

Data Source Information

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 15, Oct 10, 2017

El Paso County Area, Colorado

25—Elbeth sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 367x

Elevation: 7,300 to 7,600 feet

Farmland classification: Not prime farmland

Map Unit Composition

Elbeth and similar soils: 85 percent

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

Description of Elbeth

Setting

Landform: Hills

Landform position (three-dimensional): Side slope

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Alluvium derived from arkose

Typical profile

A - 0 to 3 inches: sandy loam

E - 3 to 23 inches: loamy sand

Bt - 23 to 68 inches: sandy clay loam

C - 68 to 74 inches: sandy clay loam

Properties and qualities

Slope: 3 to 8 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Well drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat):

Moderately high (0.20 to 0.60 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water storage in profile: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4e

Hydrologic Soil Group: B

Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:

Hydric soil rating: No

Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 15, Oct 10, 2017

El Paso County Area, Colorado

26—Elbeth sandy loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 367y

Elevation: 7,300 to 7,600 feet

Farmland classification: Not prime farmland

Map Unit Composition

Elbeth and similar soils: 85 percent

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

Description of Elbeth

Setting

Landform: Hills

Landform position (three-dimensional): Side slope

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Alluvium derived from arkose

Typical profile

A - 0 to 3 inches: sandy loam

E - 3 to 23 inches: loamy sand

Bt - 23 to 68 inches: sandy clay loam

C - 68 to 74 inches: sandy clay loam

Properties and qualities

Slope: 8 to 15 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Well drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat):

Moderately high (0.20 to 0.60 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water storage in profile: Moderate (about 7.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4e

Hydrologic Soil Group: B

Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:

Hydric soil rating: No

Pleasant

Percent of map unit:

Landform: Depressions

Hydric soil rating: Yes

Data Source Information

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 15, Oct 10, 2017

El Paso County Area, Colorado

36—Holderness loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 3689

Elevation: 7,200 to 7,400 feet

Farmland classification: Not prime farmland

Map Unit Composition

Holderness and similar soils: 85 percent

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

Description of Holderness

Setting

Landform: Hills

Landform position (three-dimensional): Side slope

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Loamy alluvium derived from arkose

Typical profile

A - 0 to 9 inches: loam

Bt - 9 to 43 inches: clay loam

C - 43 to 60 inches: gravelly sandy clay loam

Properties and qualities

Slope: 8 to 15 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Well drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat):

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

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum in profile: 5 percent

Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)

Available water storage in profile: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): 4e

Land capability classification (nonirrigated): 4e

Hydrologic Soil Group: C

Ecological site: Loamy Park (R048AY222CO)

Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:

Hydric soil rating: No

Data Source Information

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 15, Oct 10, 2017

El Paso County Area, Colorado

67—Peyton sandy loam, 5 to 9 percent slopes

Map Unit Setting

National map unit symbol: 369d
Elevation: 6,800 to 7,600 feet
Mean annual air temperature: 43 to 45 degrees F
Frost-free period: 115 to 125 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Peyton

Setting

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

Typical profile

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

Properties and qualities

Slope: 5 to 9 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat):
Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 7.3 inches)

Interpretive groups

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

Minor Components

Other soils

Percent of map unit:

Hydric soil rating: No

Pleasant

Percent of map unit:

Landform: Depressions

Hydric soil rating: Yes

Data Source Information

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 15, Oct 10, 2017

El Paso County Area, Colorado

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

Map Unit Setting

National map unit symbol: 369f

Elevation: 6,800 to 7,600 feet

Farmland classification: Not prime farmland

Map Unit Composition

Peyton and similar soils: 40 percent

Pring and similar soils: 30 percent

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

Description of Peyton

Setting

Landform: Hills

Landform position (three-dimensional): Side slope

Down-slope shape: Linear

Across-slope shape: Linear

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

Typical profile

A - 0 to 12 inches: sandy loam

Bt - 12 to 25 inches: sandy clay loam

BC - 25 to 35 inches: sandy loam

C - 35 to 60 inches: sandy loam

Properties and qualities

Slope: 3 to 5 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Well drained

Runoff class: Low

Capacity of the most limiting layer to transmit water (Ksat):

Moderately high (0.20 to 0.60 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water storage in profile: Moderate (about 7.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4c

Hydrologic Soil Group: B

Ecological site: Sandy Divide (R049BY216CO)

Hydric soil rating: No

Description of Pring

Setting

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

Typical profile

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

Properties and qualities

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

Interpretive groups

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

Minor Components

Other soils

Percent of map unit:
Hydric soil rating: No

Pleasant

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

Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 15, Oct 10, 2017

El Paso County Area, Colorado

71—Pring coarse sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 369k

Elevation: 6,800 to 7,600 feet

Farmland classification: Not prime farmland

Map Unit Composition

Pring and similar soils: 85 percent

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

Description of Pring

Setting

Landform: Hills

Landform position (three-dimensional): Side slope

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Arkosic alluvium derived from sedimentary rock

Typical profile

A - 0 to 14 inches: coarse sandy loam

C - 14 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 8 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Well drained

Runoff class: Low

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

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water storage in profile: Low (about 6.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 3e

Hydrologic Soil Group: B

Ecological site: Loamy Park (R048AY222CO)

Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:

Hydric soil rating: No

Pleasant

Percent of map unit:

Landform: Depressions

Hydric soil rating: Yes

Data Source Information

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 15, Oct 10, 2017

El Paso County Area, Colorado

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

Map Unit Setting

National map unit symbol: 36b9

Elevation: 7,300 to 7,600 feet

Farmland classification: Not prime farmland

Map Unit Composition

Tomah and similar soils: 50 percent

Crowfoot and similar soils: 30 percent

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

Description of Tomah

Setting

Landform: Alluvial fans, hills

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

Down-slope shape: Linear

Across-slope shape: Linear

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

Typical profile

A - 0 to 10 inches: loamy sand

E - 10 to 22 inches: coarse sand

C - 48 to 60 inches: coarse sand

Properties and qualities

Slope: 3 to 8 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Well drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat):

Moderately high to high (0.60 to 2.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water storage in profile: Very low (about 2.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4e

Hydrologic Soil Group: B

Ecological site: Sandy Divide (R049BY216CO)

Hydric soil rating: No

Description of Crowfoot

Setting

Landform: Alluvial fans, hills

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

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Alluvium

Typical profile

A - 0 to 12 inches: loamy sand

E - 12 to 23 inches: sand

Bt - 23 to 36 inches: sandy clay loam

C - 36 to 60 inches: coarse sand

Properties and qualities

Slope: 3 to 8 percent

Depth to restrictive feature: More than 80 inches

Natural drainage class: Well drained

Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat):

Moderately high to high (0.60 to 2.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water storage in profile: Low (about 4.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4e

Hydrologic Soil Group: B

Ecological site: Sandy Divide (R049BY216CO)

Hydric soil rating: No

Minor Components

Other soils

Percent of map unit:

Hydric soil rating: No

Pleasant

Percent of map unit:

Landform: Depressions

Hydric soil rating: Yes

Data Source Information

Soil Survey Area: El Paso County Area, Colorado

Survey Area Data: Version 15, Oct 10, 2017