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SOIL, GEOLOGY, GEOLOGIC HAZARD STUDY
EAGLE RISING
PARCEL NOS. 52290-00-034 AND 52290-00-035
EL PASO COUNTY, COLORADO

Prepared for

Casas Limited Partnership #4
P.O. Box 2076
Colorado Springs, Colorado 80901

Attn: Steve Jacobs

Add PCD File # SF-22-025

June 29, 2022

Respectfully Submitted,

ENTECH ENGINEERING, INC.

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Entech Job No. 221458
AAprojects/2022/221458/sgghs

Update report throughout to coincide with current proposed plat and subdivision plan see comments and pg 25

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1.0 SUMMARY

Project Location

The project lies in a portion of the E ½ of Section 29, Township 12 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado. The site is located approximately ½ mile east of the city limits of Colorado Springs, Colorado.

This does not match plat and LOI

Project Description

Total acreage involved in the project is approximately 70 acres. The proposed site development consists of 17 single-family rural residential lots. The development will utilize central water and on-site wastewater treatment systems.

Scope of Report

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

Land Use and Engineering Geology

This site was found to be suitable for the proposed development. Areas were encountered where the geologic conditions will impose some constraints on development and land use. These include areas of seasonal and potentially seasonal shallow groundwater areas, drainage areas, floodplains, areas of ponded water, artificial fill, potentially expansive soils, areas of downslope creep, potentially unstable slopes, and shallow bedrock. 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 a portion of the E ½ of Section 29, Township 12 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado. The site is located approximately ½ mile east of the city limits of Colorado Springs, Colorado, at the south end of Kurie Road, east of Black Forest Road. The location of the site is as shown on the Vicinity Map, Figure 1.

The topography of the site varies from gently to moderately sloping generally to the south with some steeper slopes along the drainages on-site. The drainages on site flow in easterly and southerly directions through the property. Cottonwood Creek flows through the eastern portion of the property. Water was observed flowing in Cottonwood Creek at the time of the investigation. Two dams with ponded water are located on the property in the Cottonwood Creek drainage. The northern dam has a gentle upstream face with no observed erosion and a 3:1 downstream face. Ponderosa Pines with field grasses and weeds were observed on the dam with an area of willows at the eastern end. Soft soils were observed in the area of the willows. A small steeper area on the western end of the downstream face was observed. The southern dam has a gentle upstream face with no observed erosion and a 2:1 downstream face. Field grasses and weeds were observed on the dam with an area of willows in the eastern portion of the downstream face of the dam. Soft soils were noted across the entire downstream face of the southern dam. The spillways are not well-defined on either of the dams. Both dams have outlet works. Other minor drainages are located on the property. No water was observed flowing in the minor drainages at the time of this investigation.

The site boundaries are indicated on the USGS Map, Figure 2. Previous land uses have included grazing and pasture land. An existing residence which is to remain is located on the northern portion of the property. An existing barn and residence are located in the central portion of the site which are also to remain. The site contains primarily field grasses and weeds with ponderosa pine coverage in the northern portions of the site and deciduous trees and shrubs along Cottonwood Creek. Site photographs, taken June 21, 2022, are included in Appendix A.

Does not match Plat and LOI

Total acreage involved in the proposed development is approximately 70 acres. Seventeen single-family rural residential lots are proposed with areas of open space along Cottonwood Creek. Lot sizes range from 2.5 acres to 7.14 acres. The area will be serviced by central water and individual on-site wastewater treatment systems. The proposed Development Plan by Land Resource Associates 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.

4.0 FIELD INVESTIGATION

Our field investigation on this site 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 aerial photo reconnaissance and interpretation. The same mapping procedures have also been utilized to produce the Engineering Geology Map which identified pertinent geologic conditions affecting development. The field mapping was performed by personnel of Entech Engineering, Inc. on March 16, 2012, and the site was recently revisited on June 21, 2022 to verify that no significant changes have occurred. The roadway and several drainage improvements have been completed since the original investigation in 2012. A portion of northern dam was reconstructed, and the water main installed along the roadways in 2014. Entech Engineering, Inc. performed density testing on the reconstructed dam and the water main placed for the subdivision, these reports are included in Appendix D.

Six (6) percolation tests were performed on the site to determine general suitability of the site for the proposed development. The locations of the profile holes are indicated on the Percolation Test Location Plan/Development Plan, Figure 4. The Test Boring Logs from the Profile Holes 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 include grain-size analysis, ASTM D-422, and Atterberg Limits, ASTM D-4318. Swell testing included both FHA Swell Tests and Swell/Consolidation Tests. Results of the laboratory testing are included in 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. Approximately 11 miles to the west is a major structural feature known as the Rampart Range Fault. This fault marks the boundary between the Great Plains Physiographic Province and the Southern Rocky Mountain Province. The site exists within the southeastern edge of a large structural feature known as the Denver Basin. Bedrock in the area tends to be very gently dipping in a northerly direction (Reference 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, 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 drainages on site. Man-made soils exist as earthen dams, fill piles, and areas of fill associated with the existing buildings on site. 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 2 soil types and one water type associated with the ponds

on site (Figure 4). In general, the soils vary from gravelly loamy sand to sandy loam. The soils are described as follows:

Type	Description
8	Blakeland loamy sand, 1-9% slopes
40	Kettle gravelly loamy sand, 3-8% slopes
71	Pring coarse sandy loam, 3-8% slopes

Complete descriptions of each soil type are presented in Appendix E. The soils have generally been described to have rapid permeabilities. The soils have been described as good potential for use as homesites. Possible hazards with soil erosion are present on the site. The erosion potential can be controlled with vegetation. The majority of the soils have been described to have slight to moderate erosion hazards.

5.3 Site Stratigraphy

The Falcon NW Quadrangle Geology Map showing the site is presented in Figure 6 (Reference 4). The Geology Map prepared for the site is presented in Figure 7. Three mappable units were identified on this site which are described as follows:

Qaf **Artificial Fill of Holocene Age:** These are man-made fill deposits associated with earthen dams on-site, fill piles, and areas of fill associated with the existing structures on site.

Qal **Recent Alluvium of Holocene Age:** These are recent deposits that have been deposited in the drainages that exist on-site. These materials consist of silty to clayey sands and sandy clays. Some of these alluviums contain highly organic soils.

Tkd **Dawson Formation of Tertiary to Cretaceous Age:** The Dawson formation typically consists of arkosic sandstone with interbedded fine-grained sandstone, siltstone and claystone. Overlying this formation is a variable layer of residual soil. The residual soils were derived from the in-situ weathering of the bedrock materials on-site. These soils typically consisted of silty to clayey sands and sandy clays.

The soils listed above were mapped from site-specific mapping, the *Geologic Map of the Falcon NW Quadrangle* distributed by the Colorado Geological Survey in 2003 (Reference 4), the *Geologic Map of the Colorado Springs-Castle Rock Area*, distributed by the US Geological Survey in 1979 (Reference 5), the *Geologic Map of the Pueblo 1^0 x 2^0 Quadrangle*, distributed by the US Geological Survey in 1978 (Reference 6). The Test Borings from the profile holes were also used in evaluating the site and are included in Appendix B. The Geology Map prepared for the site is presented in Figure 6.

5.4 Soil Conditions

The soils encountered in the Profile Holes of the percolation tests can be grouped into 3 general soil and rock types: A slightly silty to silty sand (SM-SW, SM); Soil Type 1, a silty clay (CL); Soil Type 2, a slightly silty to silty sandstone (SM-SW, SM); Soil Type 3, a very sandy claystone and claystone-siltstone (CL, CL-ML); Soil Type 4. The soils were classified using the Unified Soil Classification System (USCS).

Soil Type 1 consists of slightly silty to silty sand (SM-SW, SM), encountered in the upper soil profile in all of the profile holes to depths ranging from 2 to 4 feet. These soils were encountered at very dense states and at moist conditions. Samples tested had 11% and 19% passing the 200 Sieve. The sands typically have low expansion potential.

Soil Type 2 consists of silty clay (CL). The silty clay was encountered in one of the profile holes at 3 feet extending to 8 feet. The clay was encountered at very stiff consistencies and moist conditions. The sample tested had 99 percent of the soil size particles passing the No. 200 sieve. An FHA Swell pressure of 510 psf was measured on the clay. This swell is in the low expansion range. A consolidation of 0.1 percent was measured on the clay in the Swell/Consolidation Test indicating low potential for consolidation.

Soil Type 3 consists of slightly silty to silty sandstone (SM-SW, SM). The sandstone was encountered in all of the profile holes at depths ranging from 2 to 12 feet and extending to depths ranging from 8 feet to the termination of the borings (15 feet). The sandstone was encountered at very dense states and moist conditions. Samples tested had 11% to 28% passing the 200 sieve. The sandstone typically has low expansion potential.

Soil Type 4 consists of very sandy claystone and claystone-siltstone (CL, CL-ML). This material was encountered in 3 of the profile holes at depths ranging from 4 to 14 feet and extending to depths ranging from 12 feet to the termination of the borings (15 feet). The claystone was encountered at hard consistencies and at moist conditions. The samples tested had 51% to 57% passing the 200 sieve. A swell of 1.0% was measured in the Swell/Consolidation Test. FHA Swell pressures of 60 psf and 410 psf were measured on the claystone. These swells are in the low expansion range. Moderately to highly expansive claystone is common in the area.

The Test Boring Logs from the Profile Holes 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 at 7 feet and 14.5 feet in Profile Hole Nos. 1 and 4, respectively. Groundwater was not encountered in the other profile holes which were drilled to 15 feet. Areas of seasonal and potentially seasonal shallow groundwater and ponded water have been mapped in the drainages on-site. These areas are discussed in the following section. Fluctuation in groundwater conditions may occur due to variations in rainfall and other factors not readily apparent at this time.

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

6.0 ENGINEERING GEOLOGY – IDENTIFICATION AND MITIGATION OF GEOLOGIC HAZARDS

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

Floodplain – constraint

Areas of the site are mapped within a floodplain zone according to the FEMA Map Nos. 08041CO527G and 08041CO535G, dated December 7, 2018 (Figure 7, Reference 7). These areas exist in the southern pond area and downstream from the dam. It has been designated as a preservation area on the development plant. Lots immediately adjacent to the floodplain may experience higher groundwater levels during peak flows. Subsurface Perimeter Drains are recommended for structures adjacent to the floodplain to help prevent the intrusion of water into areas below grade. Typical drain details are presented in Figure 8. Finished floor levels must be located a minimum of one foot above floodplain levels. Exact locations of floodplain and specific drainage studies are beyond the scope of this report.

Expansive Soils – constraint

Expansive soils were encountered in some of the test borings drilled on-site and as a part of the previous investigations (References 3 and 4). The site is classified in areas of low to moderate swell potential according to the *Map of Potentially Swelling Soil and Rock in the Front Range Urban Corridor, Colorado* by Hart, 1974 (Reference 9); however, highly expansive clays and claystone are typically encountered in the area. These areas are sporadic; therefore, none have been indicated on the map. Expansive clays and claystone, if encountered, can cause differential movement in the structure foundation.

Mitigation: Mitigation of expansive soils will require special foundation design. Overexcavation and replacement with non-expansive soils at a minimum 95% of its maximum Modified Proctor Dry Density, ASTM D-1557 is a suitable mitigation which is common in the area. Drilled piers are another option that is used in areas where highly expansive soils are encountered. 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 can be considered for basement construction on highly expansive clays. Final recommendations should be determined after additional investigation of each building site.

Seasonal Shallow Groundwater Area – constraint

In these areas, we would anticipate the potential for periodically high subsurface moisture conditions and frost heave potential on a seasonal basis. Additional, highly organic soils could be encountered in these areas. The majority of these areas are associated with the Cottonwood Creek drainage area and are designated as open space. Where structures encroach on these areas, the following precautions are recommended.

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. Due to lot size, it is anticipated these areas could be avoided by structures. Any grading in these areas should be done to direct surface flow around construction to avoid areas of ponded water near structures. All organic material would be completely removed prior to any fill placement.

Potentially Seasonal Shallow Groundwater Area – constraint

In these areas, we would anticipate the potential for periodically high subsurface moisture conditions, frost heave potential and highly organic soils. The majority of these areas lie within drainages which can be avoided by the proposed development. Construction in or adjacent to any portions of these areas, if required, should follow the precautions for seasonal shallow groundwater areas.

Areas of Ponded Water – constraint

These are areas where the ponds exist and areas within the drainages where standing water was observed. The two larger ponds in the eastern portion of the site are to be avoided by development. During periods of high runoff, water could also pond behind the small earthen dam in the north central portion of the site on Lot 3. According to the development plan, an access driveway is planned for this area, therefore, it is anticipated the pond will be drained and removed. Should construction be considered in these areas, regrading will be necessary in order to fill the area above the groundwater level. All soft or organic soils should be removed

prior to fill placement. The same mitigation techniques for seasonal shallow groundwater areas are recommended for structures that encroach on these areas as well.

Potentially Unstable Slopes – constraint

Some of the very steep slopes along the north pond area and a cut-slope in the central area on Lot 4 have been identified as potentially unstable. Considerable care must be exercised in these areas not to create a condition which would tend to activate instability.

Mitigation: The potentially unstable slope along the north pond areas is in an area designated as open space and will be avoided by development. The cut slope in the central portion of the site is cut in sandstone and appears to be stable in its present state. Structures should be located a minimum of 20 from any potentially unstable slope unless stabilized. Stabilization could involve regrading the slope to no steeper than 3:1 or the use of retaining walls. Proper control of drainage at both the surface and in the subsurface is extremely important. Areas of ponded water at the surface should be avoided above these slopes. Utility trenches, basement excavations and other subsurface features should not be permitted to become water traps which may promote saturation of the subsurface materials.

Downslope Creep Areas – constraint

These areas are acceptable as building sites, however, in areas identified with this hazard classification, we would anticipate accelerated lateral and vertical movement of the near surface soils in the downslope direction. These are minor areas located along the Cottonwood Creek drainage that is designated as open space. Structures encroaching on these areas may require the following mitigation.

Mitigation: The design of foundations in these areas should account for the additional pressure on the structure due to the creep potential. Tie-beams, buttresses and counterforts may be necessary in some areas. Deep cuts in these areas should be avoided. Proper control of drainage at both the surface and subsurface is important. Saturation of materials should be avoided that may create unstable conditions. It is anticipated, due to lot sizes, these areas could be avoided by development.

Artificial Fill – constraint

Fill associated with earthen dams, fill piles and fill associated with existing structures were observed on site. Additionally, other areas of artificial fill may be encountered in areas other than those mapped. These areas of fill are considered uncontrolled for construction purposes.

Mitigation: The earthen dams are in the area designated as open space and can be avoided by development. The fill piles are limited and it is anticipated they will be removed during site grading. Any uncontrolled fill encountered beneath foundation will require removal and recompaction at a minimum of 95% of its maximum Modified Proctor Dry Density, ASTM D-1557.

6.1 Relevance of Geologic Conditions to Land Use Planning

As mentioned earlier in this report, we understand that the development will be single-family rural residential. It is our opinion that the existing geologic and engineering geologic conditions will impose some constraints on the proposed development and construction. The most significant problems affecting development will be those associated with the drainages on site which can be avoided. Other hazards on site may be satisfactorily mitigated through proper engineering design and construction practices.

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

Areas of seasonal and potentially seasonal high groundwater areas, ponded water and floodplains were encountered on site. The areas of seasonal high groundwater, and ponded water and floodplain are located in areas designated as open space. Due to the size of the lots and the proposed development, the areas mapped as potentially seasonal high groundwater can be avoided by construction. Any grading done in these areas should direct surface water away from construction to avoid areas of ponded water near structures. Structures should not block drainages.

Areas of fill were observed on site associated with dams, fill piles and existing buildings and development. The majority of the dams are located in open space and it is anticipated the dams will be avoided by development. The willows on the northern dam have been removed and the soft soils recompacted. The small steeper portion of the downstream face of the northern dam at the western end has also been regraded to no steeper than 2.5:1. The repair work of the dam was observed by personnel of Entech Engineering, Inc., and density testing performed on the embankment fill. The southern dams downstream face is 2:1 and has loose soils and some willows. The willows have been removed and the downstream face recompacted and regraded to no steeper than 2.5:1. Wet, soft soils should be expected at the toe of the dam and stabilization may be necessary. Well-defined spillways should be maintained for both dams. It is anticipated other areas of fill will be removed during site grading or construction of individual structures. Any uncontrolled fill encountered beneath foundations should be removed and recompacted at a minimum of 95% of its maximum Modified Proctor Dry Density, ASTM D-1557.

Areas mapped as potentially unstable slopes and downslope creep areas have been mapped on this site. The majority of these areas exist along the pond area in the northeast portion of the site in areas designated as open space. Another area exists on Lot 4 in the western portion of the site where a cut slope exists. Sandstone bedrock was observed in the cut and appears to be stable in its present state. Structures should be located a minimum distance of 20 feet from any potentially unstable slope unless the slope is stabilized. Stabilization could involve regarding the slope to no steeper than 3:1. Structures encroaching on downslope creep areas or potentially unstable slopes may require additional foundation reinforcement or stiffeners. Due to the size of the lots, it is anticipated these areas can be avoided by construction.

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

7.0 ECONOMIC MINERAL RESOURCES

Some of the sandy materials on-site could be considered a low-grade sand resource. According to the *El Paso County Aggregate Resource Evaluation Map* (Reference 8), portions of the site have been mapped as upland and floodplain deposits. According to the *Atlas of Sand, Gravel and Quarry Aggregate Resources, Colorado Front Range Counties* distributed by the Colorado Geological Survey (Reference 9), the site is not mapped with any resources. According to the *Evaluation of Mineral and Mineral Fuel Potential* (Reference 10), the area of the site has been mapped as "Little or No Potential" for industrial minerals. Some of the sandy materials on site could be considered an aggregate resource. However, considering the silty to clayey nature of much of these materials and abundance of similar materials through the region and the close proximity to developed land, they would be considered to have little significance as an economic resource.

According to *the Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands* (Reference 10), 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 10).

The site has been mapped as "Fair" for oil and gas resources (Reference 10). No oil or gas fields have been discovered in the area of the site. The sedimentary rocks in the area may lack the geologic structure for trapping oil or gas; therefore, it may not be considered a significant resource. Hydraulic fracturing is a new method that is being used to extract oil and gas from rocks. It utilizes pressurized fluid to extract oil and gas from rocks that would not normally be productive. The area of the site has not been explored to determine if the rocks underlying the site would be commercially viable utilizing hydraulic fracturing. The practice of hydraulic fracturing has come under review due to concerns about environmental impacts, health and safety.

8.0 ROADWAY AND EMBANKMENT CONSTRUCTION RECOMMENDATIONS

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

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

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

9.0 EROSION CONTROL

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

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

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

10.0 CLOSURE

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

It should be pointed out that because of the nature of data obtained by random sampling of such variable and non-homogeneous materials as soil and rock, it is important that we be informed of any differences observed between surface and subsurface conditions encountered in construction and those assumed in the body of this report. Individual investigations for building sites and 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 Casas Limited Partnership #4 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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TABLE

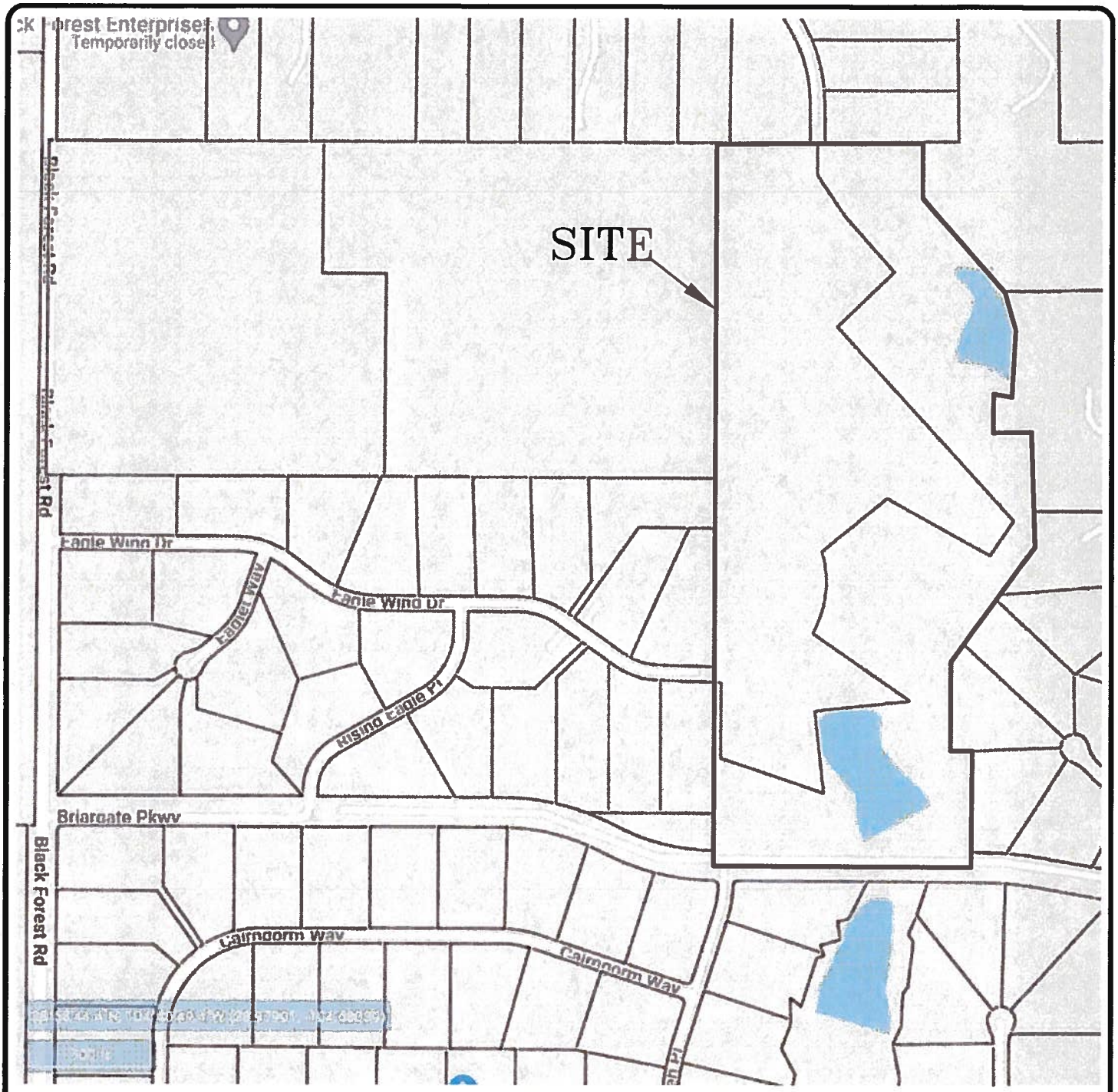
TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

CLIENT CASA'S LIMITED PARTNERSHIP
PROJECT EAGLE RISING SUBDIVISION
JOB NO. 221458

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	3	2-3			18.9						SM	SAND, SILTY
1	4	2-3			10.9	NV	NP				SM-SW	SAND, SLIGHTLY SILTY
1	6	2-3			48.3						SM	SAND, VERY SILTY
2	6	5	17.3	104.7	99.0				510	-0.1	CL	CLAY, SANDY
3	1	2-3			12.3						SM	SANDSTONE, SILTY
3	2	2-3			28.4	35	2				SM	SANDSTONE, SILTY
3	4	5			10.9						SM-SW	SANDSTONE, SLIGHTLY SILTY
3	5	5			37.2						SM	SANDSTONE, SILTY
4	1	10			51.4	37	18		410		CL	CLAYSTONE, VERY SANDY
4	1	15			53.1	28	7		60		CL-ML	CLAYSTONE-SILTSTONE, VERY SANDY
4	3	10	15.7	115.6	56.6	12	5			1.0	CL-ML	CLAYSTONE-SILTSTONE, VERY SANDY

FIGURES



N

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505 ELKTON DRIVE
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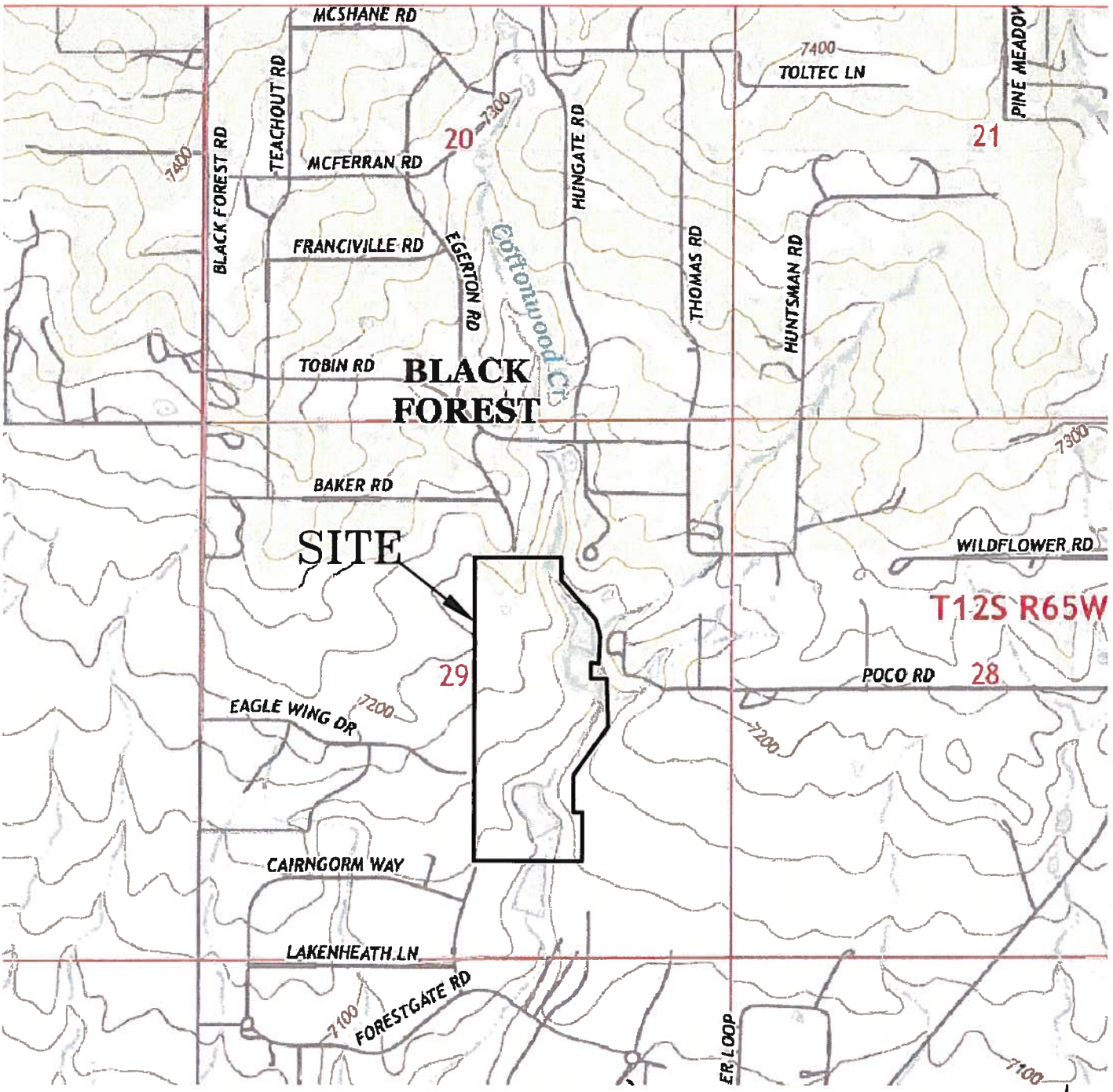
VICINITY MAP
EAGLE RISING
EL PASO COUNTY, COLORADO, CO.
FOR: CASAS LIMITED PARTNERSHIP #4

DRAWN:	DATE:	CHECKED:	DATE:
LLL	6/22/22		

JOB NO.: 221458

FIG NO.: 1



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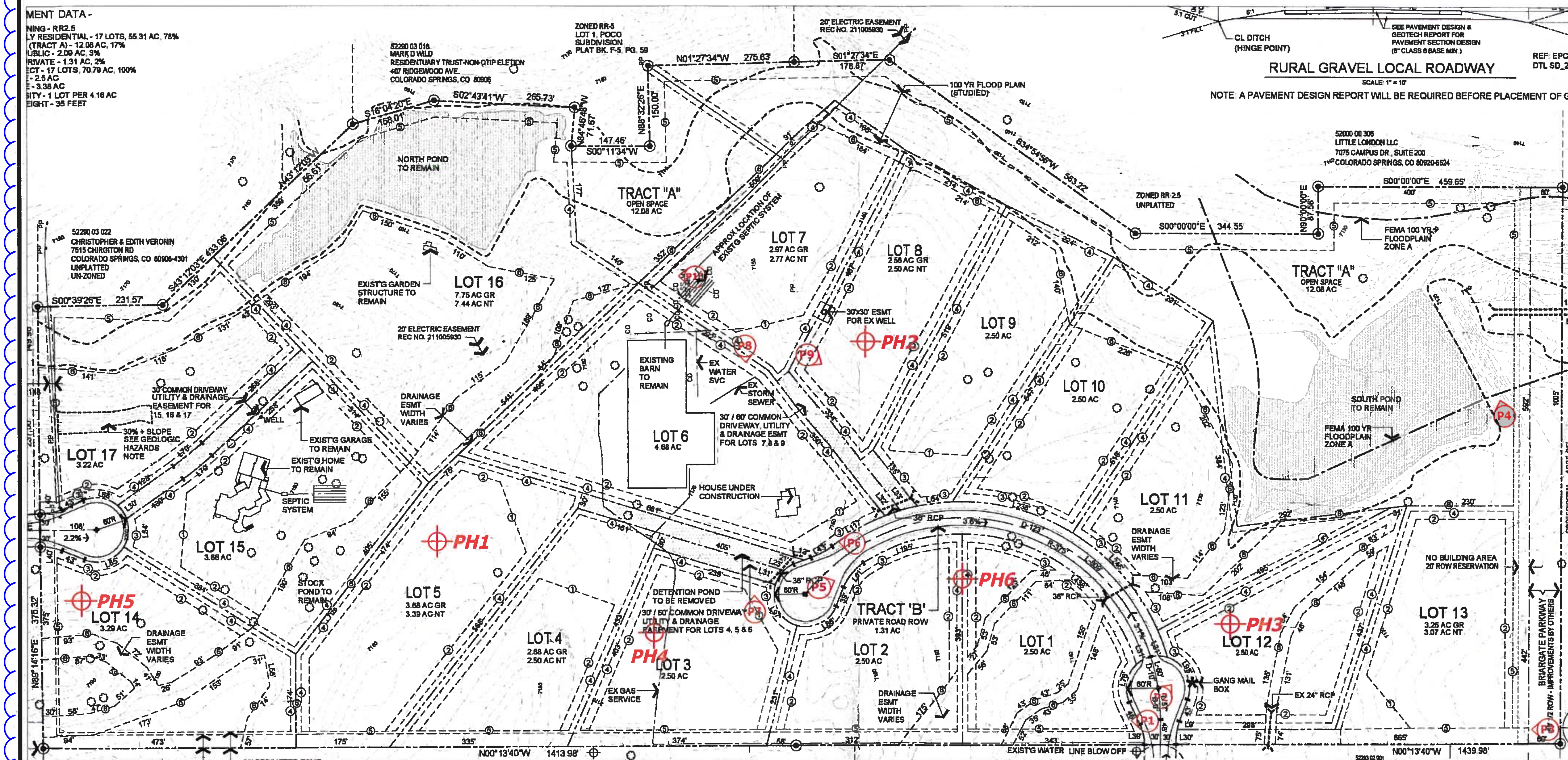
USGS MAP
EAGLE RISING
EL PASO COUNTY, COLORADO, CO.
FOR: CASAS LIMITED PARTNERSHIP #4

DRAWN:	DATE:	CHECKED:	DATE:
LLL	6/22/22		

JOB NO.: 221458

FIG NO.: 2



Legend:

⌖ TB - APPROXIMATE TEST BORING LOCATION AND NUMBER

(P2) - APPROXIMATE PHOTOGRAPH LOCATION AND DIRECTION

Replace with current proposed Plat and subdivision plan and align test points

REVISION	BY

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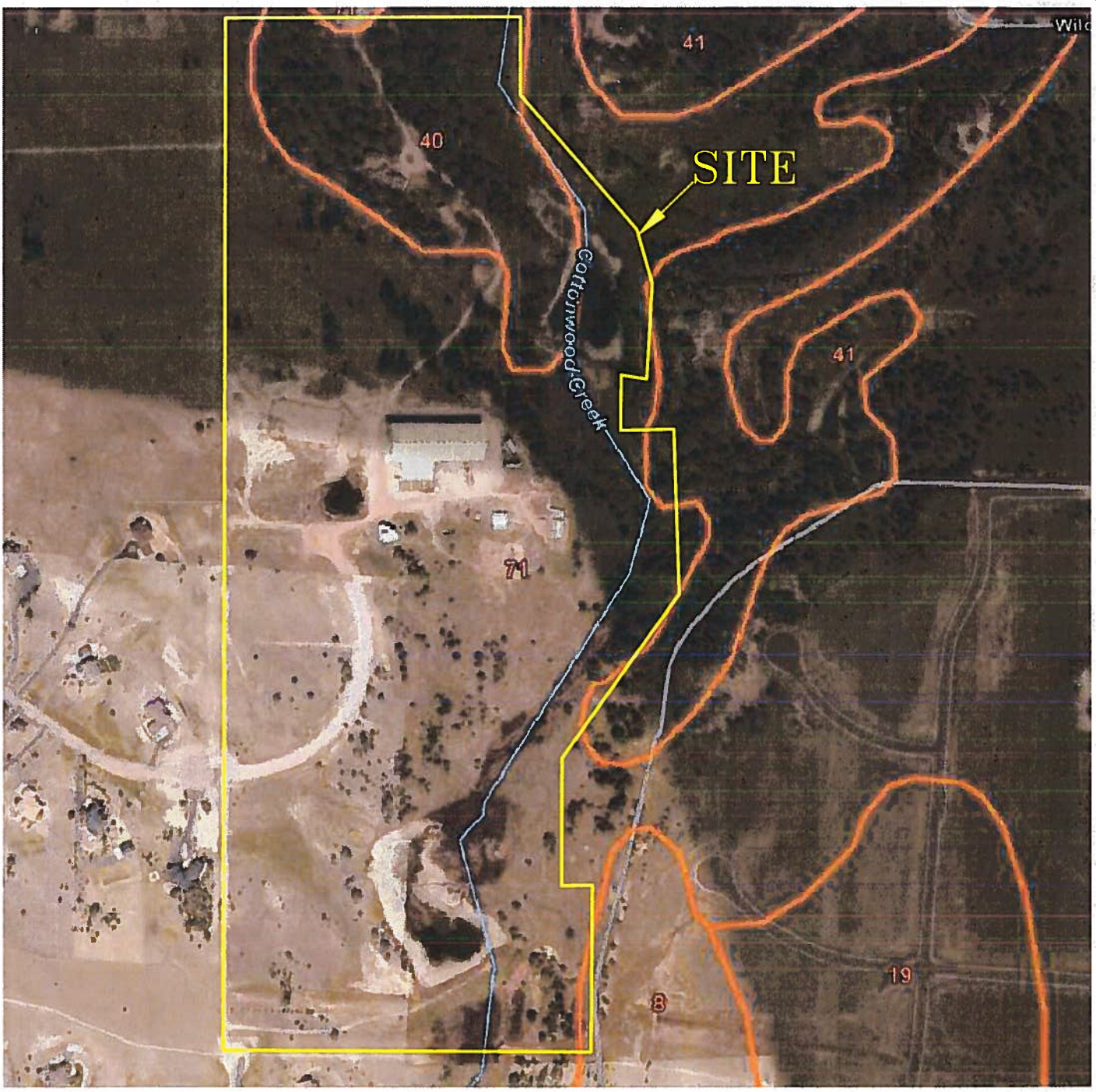
DEVELOPMENT PLAN/TEST BORING LOCATION MAP
SEAGLE RISING
EL PASO COUNTY, COLORADO, CO.
FOR: CASAS LIMITED PARTNERSHIP #4

DRAWN LLL
CHECKED
DATE 6/22/22
SCALE AS SHOWN
JOB NO. 221458
FIGURE No. 3



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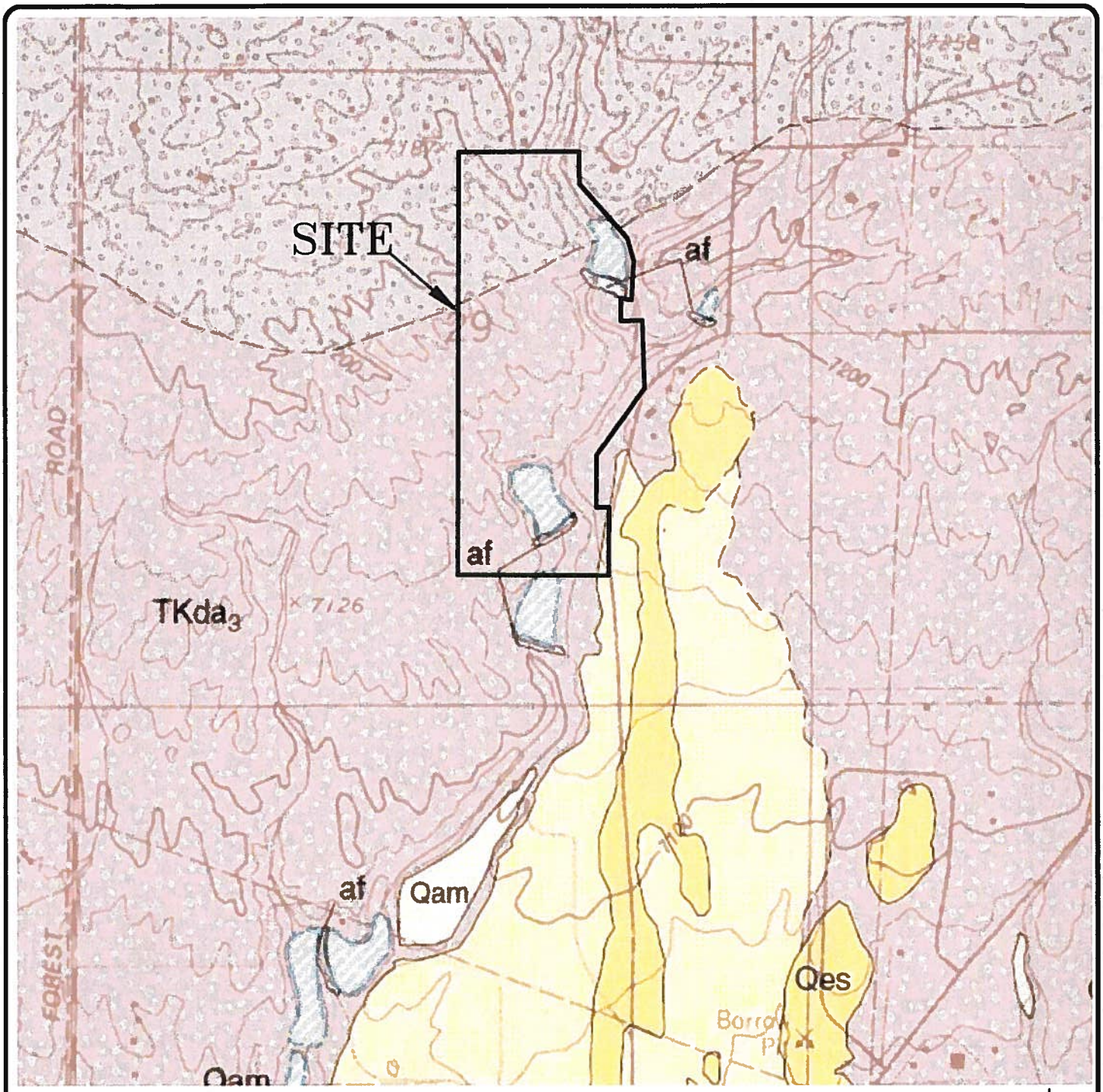
SOIL SURVEY MAP
EAGLE RISING
EL PASO COUNTY, COLORADO, CO.
FOR: CASAS LIMITED PARTNERSHIP #4

DRAWN:	DATE:	CHECKED:	DATE:
LLL	6/22/22		

JOB NO.: 221458

FIG NO.: 4



N

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FALCON NW QUADRANGLE GEOLOGIC MAP
EAGLE RISING
EL PASO COUNTY, COLORADO, CO.
FOR: CASAS LIMITED PARTNERSHIP #4

DRAWN:	DATE:	CHECKED:	DATE:
LLL	6/22/22		

JOB NO.: 221458

FIG NO.: 5

MENT DATA -
NING - RR2.5
LY RESIDENTIAL - 17 LOTS, 55.31 AC, 78%
(TRACT A) - 12.08 AC, 17%
UBLIC - 2.09 AC, 3%
RIVATE - 1.31 AC, 2%
ECT - 17 LOTS, 70.79 AC, 100%
E - 2.5 AC
E - 3.38 AC
SITY - 1 LOT PER 4.16 AC
EIGHT - 35 FEET

RURAL GRAVEL LOCAL ROADWAY
SCALE: 1" = 10'
NOTE: A PAVEMENT DESIGN REPORT WILL BE REQUIRED BEFORE PLACEMENT OF GR

LEGEND:

Qaf - **Artificial Fill of Quaternary Age:**
Man-made fill deposits

Qal - **Recent Alluvium of Quaternary Age:**
Water Deposited sands and clays

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

fp - floodplain

w - ponded water

sw - seasonal shallow groundwater

psw - potentially seasonal shallow groundwater

dsc - downslope creep

pu - potentially unstable slope

PH1 Approximate location of percolation test

N

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GEOLOGY/ENGINEERING GEOLOGY MAP
STERLING RANCH FILING NO. 4
PARCEL 10
COLORADO SPRINGS, CO.
FOR: CLASSIC SRJ

DRAWN	LLL
CHECKED	
DATE	6/22/22
SCALE	AS SHOWN
JOB NO.	220571
FIGURE No.	6

N

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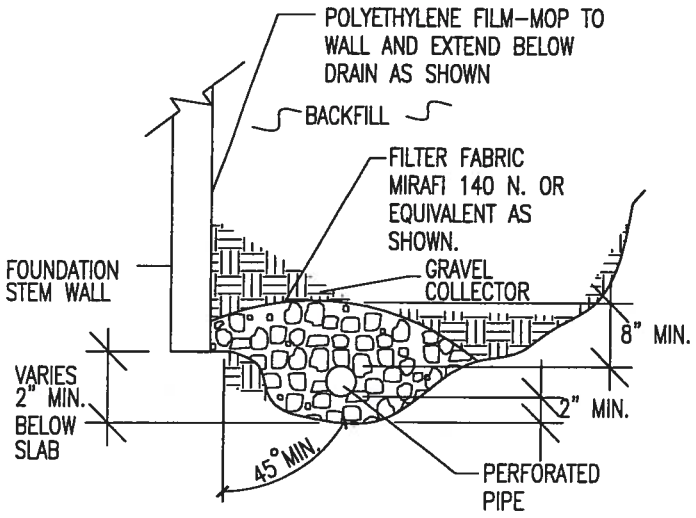
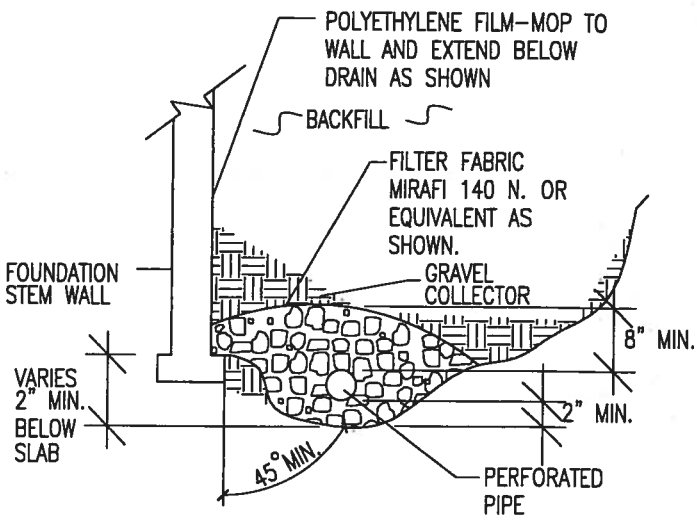
FLOODPLAIN MAP
EAGLE RISING
EL PASO COUNTY, COLORADO, CO.
FOR: CASAS LIMITED PARTNERSHIP #4

DRAWN:	DATE:	CHECKED:	DATE:
LLL	6/22/22		

JOB NO.: 221458

FIG NO.: 7





NOTES:

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

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

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

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

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

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

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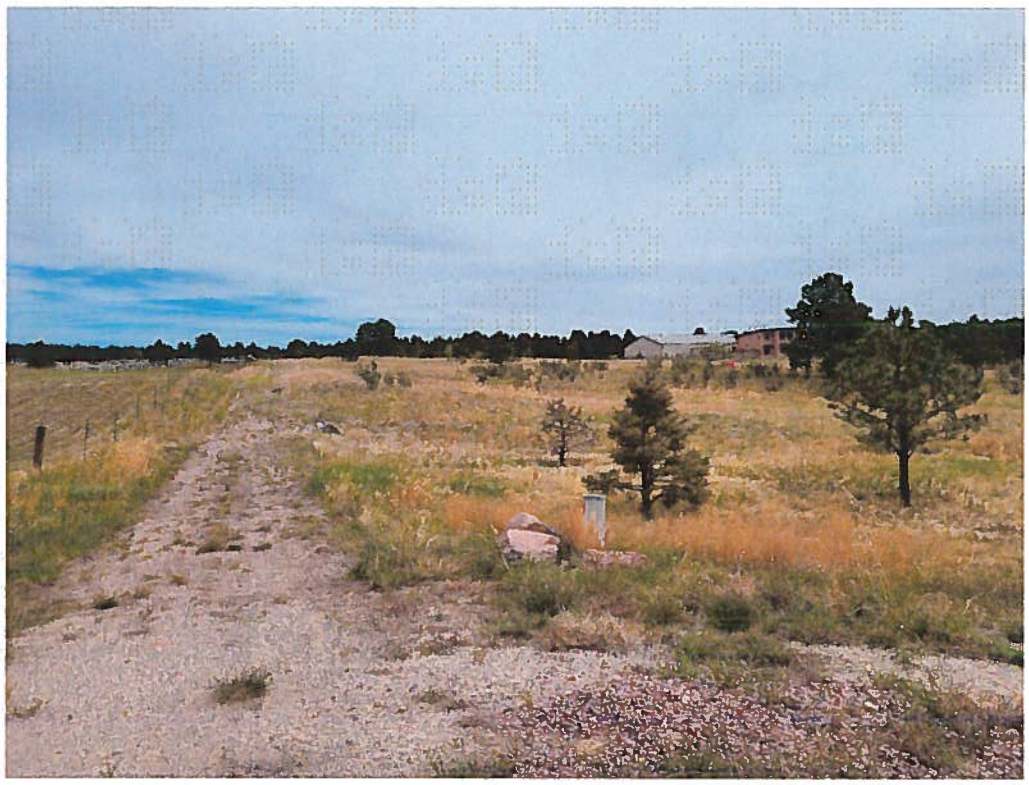
PERIMETER DRAIN DETAIL

DRAWN:	DATE:	DESIGNED:	CHECKED:

JOB NO.: 22145-8

FIC NO.: 8

APPENDIX A: Site Photographs



1

Looking north from the eastern side of the site from Eagle Wing Drive.

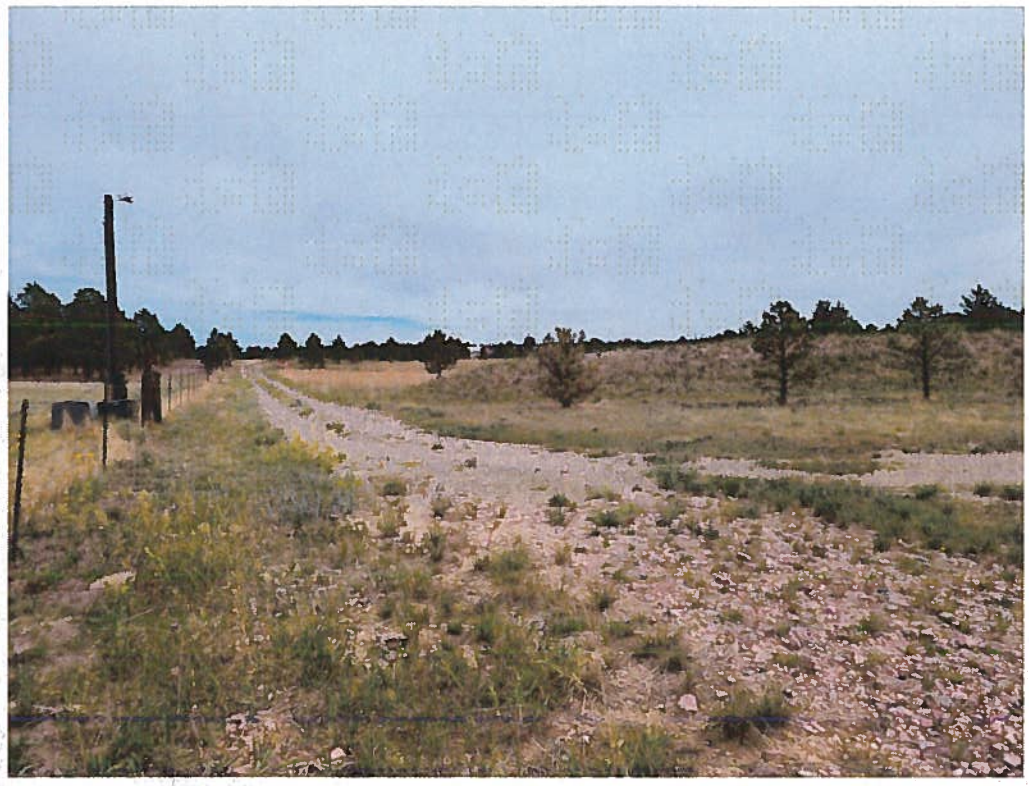
June 21, 2022

2

Looking southeast from the eastern side of the site.

June 21, 2022

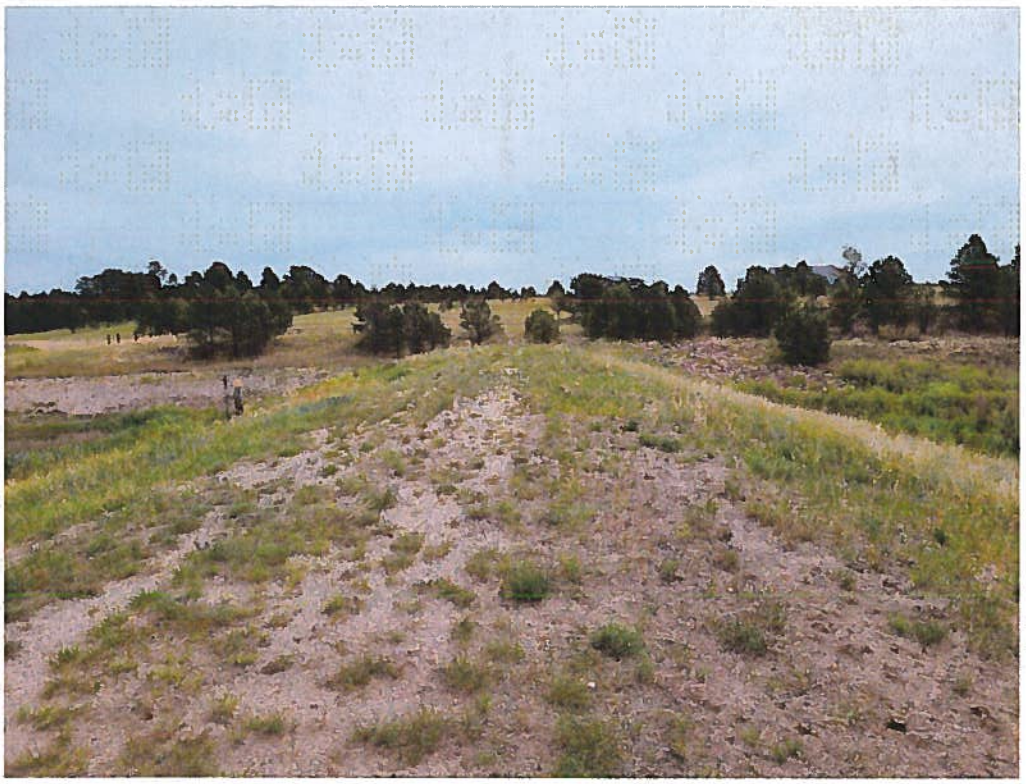
Job No. 221458



3

Looking north from the southwest corner of the site.

June 21, 2022



4

Looking east along earthen dam in the southern portion of the site.

June 21, 2022

Job No. 221458

5

Looking south from the central portion of the site.

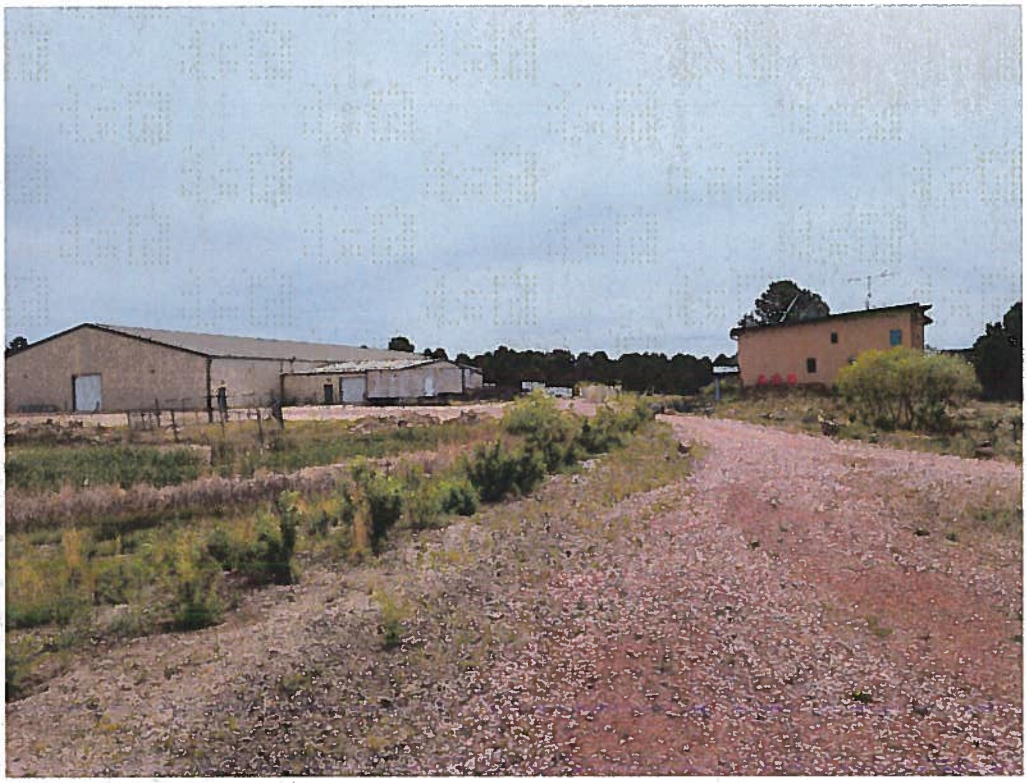
June 21, 2022

6

Looking north from the central portion of the site.

June 21, 2022

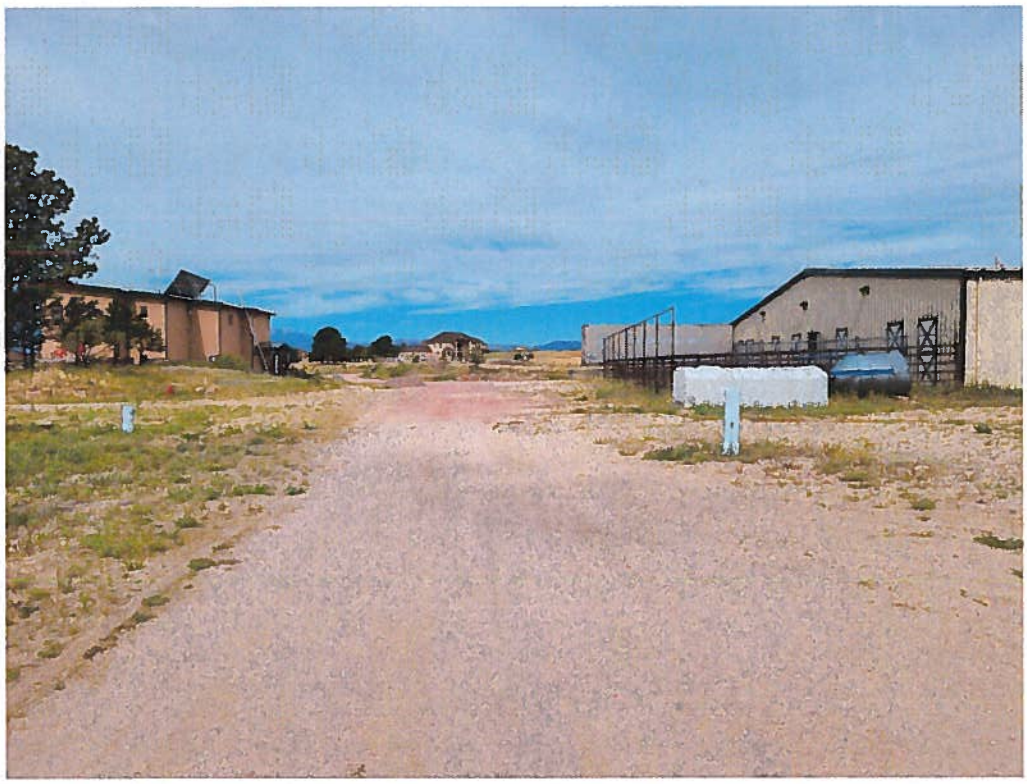
Job No. 221458



7

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

June 21, 2022

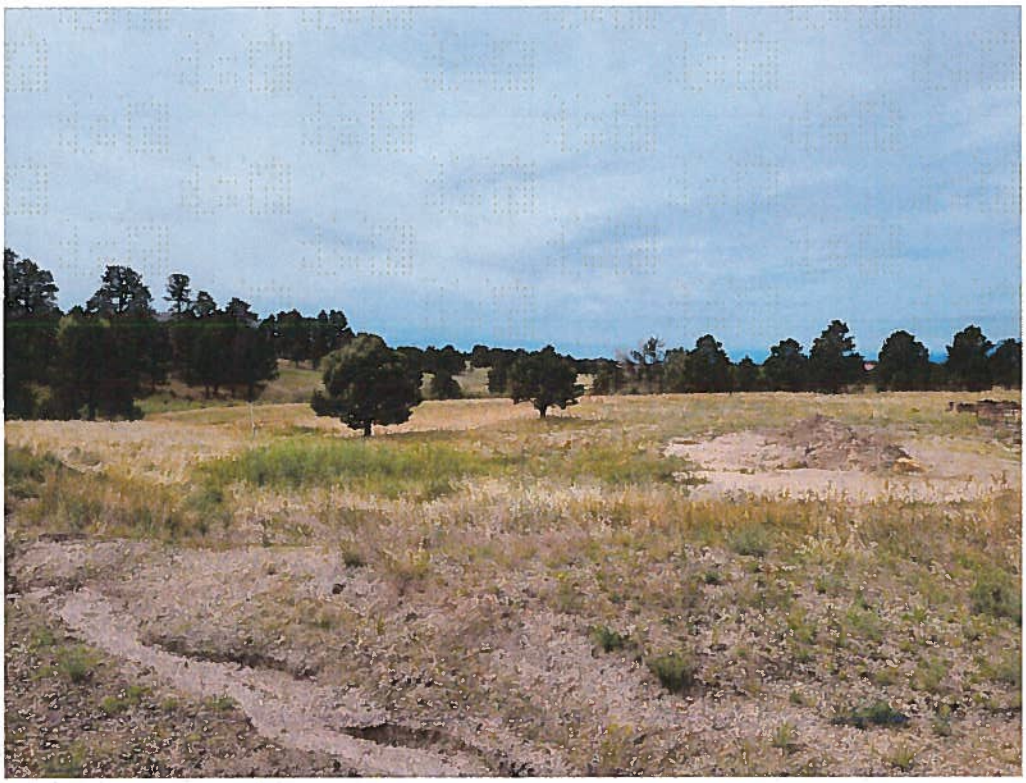


8

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

June 21, 2022

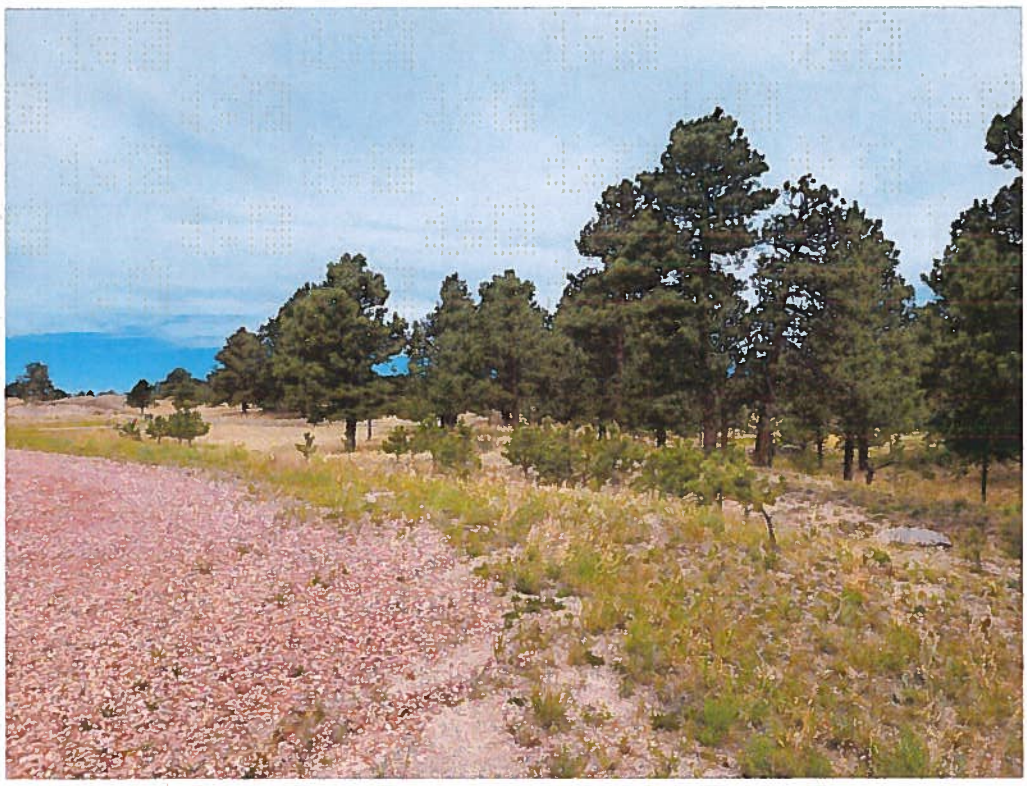
Job No. 221458



9

Looking south from the eastern portion of the site.

June 21, 2022



10

Looking northwest from the northeastern portion of the site.

June 21, 2022

Job No. 221458

APPENDIX B: Test Boring Logs from Profile Holes

TEST BORING NO. 1
DATE DRILLED 11/15/2011
Job # 221458

REMARKS

WATER @ 7', 11/16/11

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
					1
			50 / 9"	9.9	3
5			50 / 5"	10.4	3
10			50 / 6"	12.0	4
15			50 / 4"	10.1	4
20					

SAND, SILTY, TAN

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

CLAYSTONE, VERY SANDY, BROWN, HARD, MOIST

CLAYSTONE-SILTSTONE, VERY SANDY, GRAY BROWN, HARD, MOIST

TEST BORING NO. 2
DATE DRILLED 11/15/2011
CLIENT CASA'S LIMITED PARTNERSHIP
LOCATION EAGLE RISING SUBDIVISION

REMARKS

DRY TO 15', 11/16/11

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
					1
			50 / 7"	9.1	3
5			50 / 5"	4.2	3
10			50 / 4"	6.6	3
15			50 / 4"	10.0	3
20					

SAND, SILTY, TAN

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

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	6/22/22

JOB NO.: 221458
FIG NO.: B-1

TEST BORING NO. 3
DATE DRILLED 11/15/2011
Job # 221458

REMARKS

DRY TO 15', 11/16/11

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	Description
			50 / 6"	9.9	1	SAND, SILTY, FINE TO COARSE GRAINED, BROWN, VERY DENSE, MOIST
5			50 / 5"	11.8	4	CLAYSTONE-SILTSTONE, VERY SANDY, BROWN, HARD, MOIST
10			50 / 6"	15.6	4	
						SANDSTONE, SILTY, FINE TO COARSE GRAINED, BROWN, VERY DENSE, MOIST
15			50 / 4"	8.7	3	
20						

TEST BORING NO. 4
DATE DRILLED 11/15/2011
CLIENT CASA'S LIMITED PARTNERSHIP
LOCATION EAGLE RISING SUBDIVISION

REMARKS

WATER @ 14.5', 11/16/11

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	Description
			50	10.2	1	SAND, SLIGHTLY SILTY, FINE TO COARSE GRAINED, BROWN, VERY DENSE, MOIST
5			50 / 6"	11.1	3	SANDSTONE, SLIGHTLY SILTY, FINE TO COARSE GRAINED, VERY DENSE, MOIST
10			50 / 5"	14.7	3	
15			50 / 3"	16.6	4	CLAYSTONE, VERY SANDY, GRAY, HARD, VERY MOIST
20						

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	6/22/22

JOB NO.: 221458
FIG NO.: B-2

TEST BORING NO. 5
DATE DRILLED 4/9/2012
Job # 221458

REMARKS

DRY TO 14', 4/10/12

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			25	2.6	1
5			50/7"	8.2	3
10			50/6"	8.7	3
15			50/6"	10.8	3
20					

SAND, SILTY, FINE TO MEDIUM GRAINED, BROWN, MEDIUM DENSE, MOIST

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

TEST BORING NO. 6
DATE DRILLED 4/9/2012
CLIENT CASA'S LIMITED PARTNERSHIP
LOCATION EAGLE RISING SUBDIVISION

REMARKS

DRY TO 14', 4/10/12

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			16	4.3	1
5			43	16.0	2
10			50/6"	11.3	3
15			50/6"	11.3	3
20					

SAND, VERY SILTY, FINE TO MEDIUM GRAINED, BROWN, MEDIUM DENSE, MOIST

CLAY, SILTY, BROWN, VERY STIFF, MOIST

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

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COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

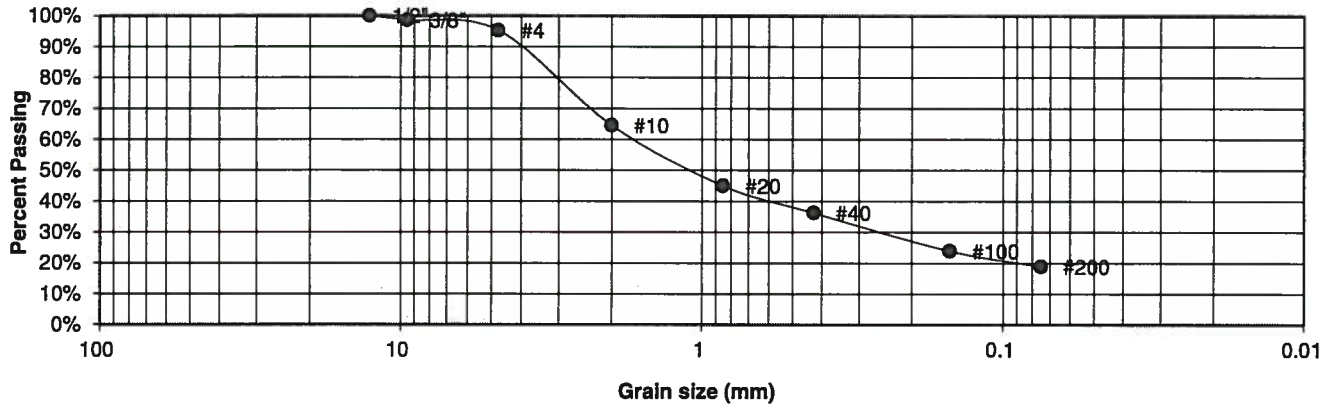
DRAWN:	DATE:	CHECKED:	DATE:
		LLL	6/22/22

JOB NO.: 221458
FIG NO.: B-3

APPENDIX C: Laboratory Test Results

UNIFIED CLASSIFICATION	SM	CLIENT	CASA'S LIMITED PARTNERSHIP
SOIL TYPE #	1	PROJECT	EAGLE RISING SUBDIVISION
TEST BORING #	3	JOB NO.	221458
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"	100.0%
3/8"	98.6%
4	95.2%
10	64.5%
20	45.0%
40	36.3%
100	23.9%
200	18.9%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

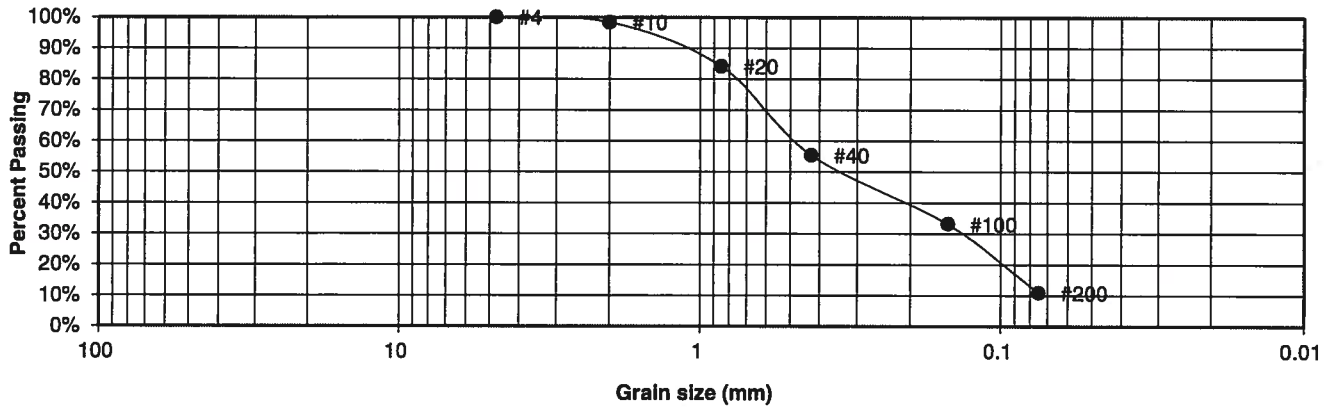
DRAWN:	DATE:	CHECKED:	DATE:
		LLL	6/22/22

JOB NO.: 221458

FIG NO.: C-1

UNIFIED CLASSIFICATION	SM-SW	CLIENT	CASA'S LIMITED PARTNERSHIP
SOIL TYPE #	1	PROJECT	EAGLE RISING SUBDIVISION
TEST BORING #	4	JOB NO.	221458
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	100.0%
10	98.4%
20	84.1%
40	55.4%
100	33.1%
200	10.9%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

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

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LABORATORY TEST RESULTS

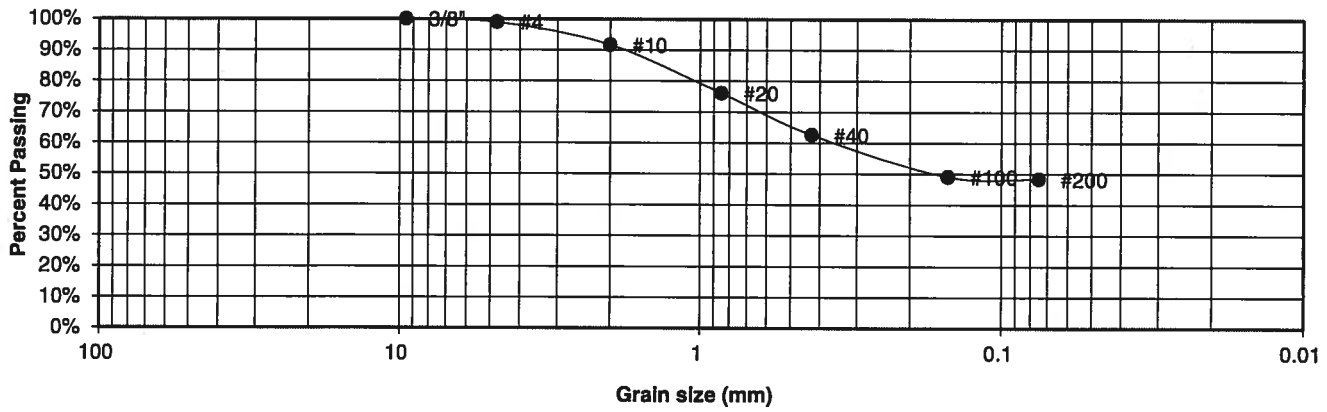
DRAWN:	DATE:	CHECKED:	DATE:
		LLL	6/22/22

JOB NO.: 221458

FIG NO.: C-2

UNIFIED CLASSIFICATION	SM	CLIENT	CASA'S LIMITED PARTNERSHIP
SOIL TYPE #	1	PROJECT	EAGLE RISING SUBDIVISION
TEST BORING #	6	JOB NO.	221458
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"	100.0%
4	99.0%
10	91.6%
20	76.1%
40	62.6%
100	49.1%
200	48.3%

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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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

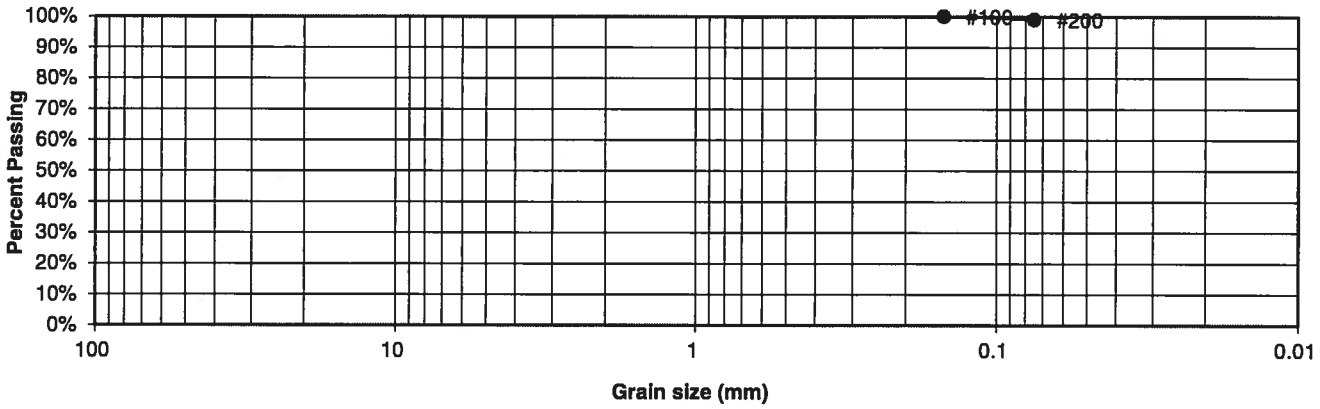
DRAWN:	DATE:	CHECKED:	DATE:
		LLL	6/22/22

JOB NO.: 221458

FIG NO.: C-3

UNIFIED CLASSIFICATION	CL	CLIENT	CASA'S LIMITED PARTNERSHIP
SOIL TYPE #	2	PROJECT	EAGLE RISING SUBDIVISION
TEST BORING #	6	JOB NO.	221458
DEPTH (FT)	5	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	100.0%
200	99.0%

Atterberg Limits	
Plastic Limit	
Liquid Limit	
Plastic Index	
Swell	
Moisture at start	15.0%
Moisture at finish	23.3%
Moisture increase	8.3%
Initial dry density (pcf)	99
Swell (psf)	510

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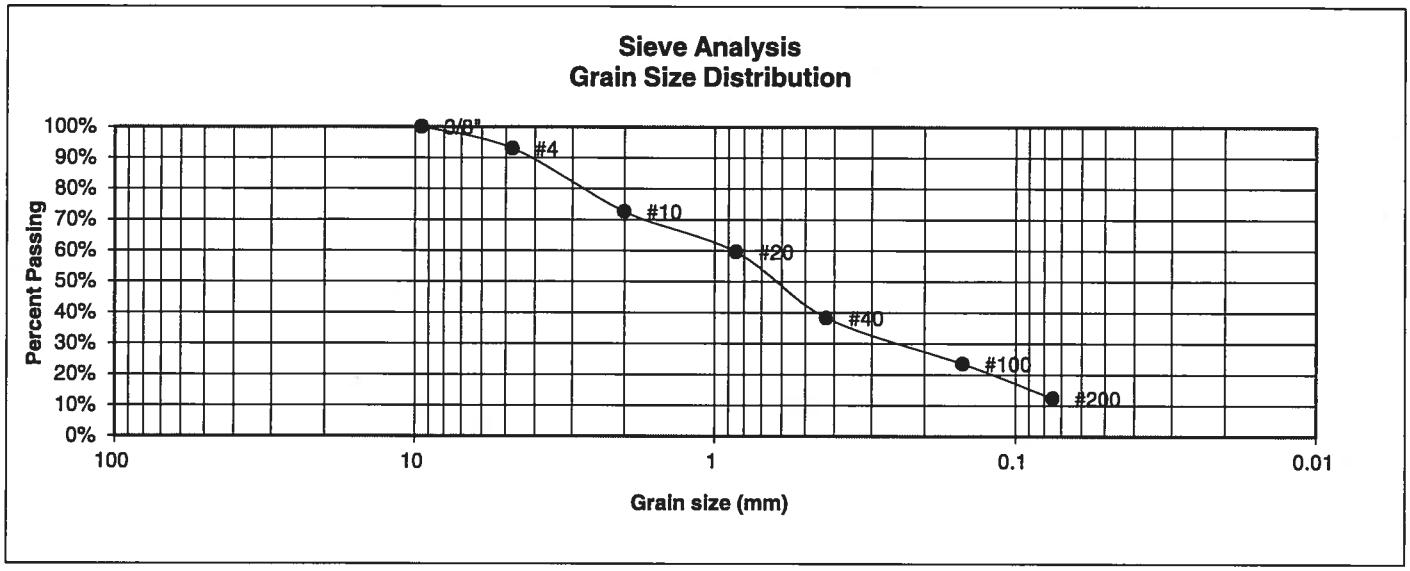
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	6/22/22

JOB NO.: 221458

FIG NO.: C-4

UNIFIED CLASSIFICATION	SM	CLIENT	CASA'S LIMITED PARTNERSHIP
SOIL TYPE #	3	PROJECT	EAGLE RISING SUBDIVISION
TEST BORING #	1	JOB NO.	221458
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	93.0%
10	72.6%
20	59.6%
40	38.3%
100	23.5%
200	12.3%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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

LABORATORY TEST RESULTS

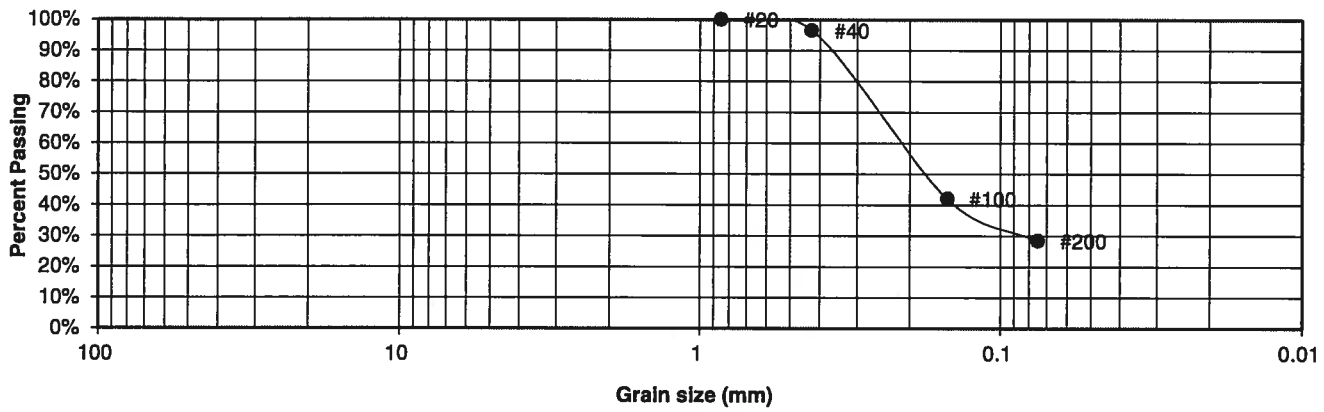
DRAWN:	DATE:	CHECKED:	DATE:
		LLL	6/22/22

JOB NO.: 221458

FIG NO.: C-5

UNIFIED CLASSIFICATION	SM	CLIENT	CASA'S LIMITED PARTNERSHIP
SOIL TYPE #	3	PROJECT	EAGLE RISING SUBDIVISION
TEST BORING #	2	JOB NO.	221458
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	100.0%
40	96.5%
100	42.0%
200	28.4%

Atterberg Limits	
Plastic Limit	33
Liquid Limit	35
Plastic Index	2

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

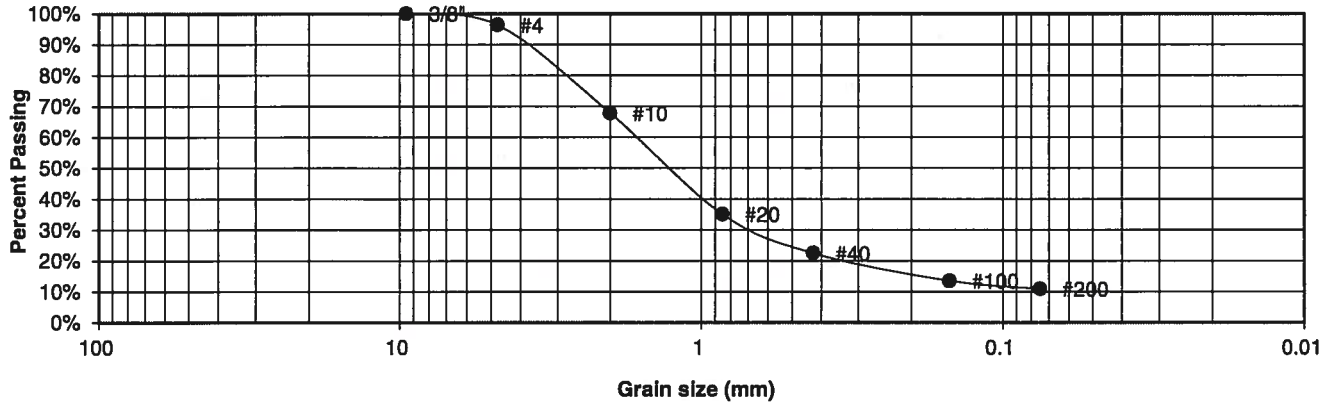
DRAWN:	DATE:	CHECKED:	DATE:
		LLL	6/22/22

JOB NO.: 221458

FIG NO.: C-6

UNIFIED CLASSIFICATION	SM-SW	CLIENT	CASA'S LIMITED PARTNERSHIP
SOIL TYPE #	3	PROJECT	EAGLE RISING SUBDIVISION
TEST BORING #	4	JOB NO.	221458
DEPTH (FT)	5	TEST BY	BL

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	96.3%
10	67.7%
20	35.0%
40	22.5%
100	13.5%
200	10.9%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

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

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COLORADO SPRINGS, COLORADO 80907

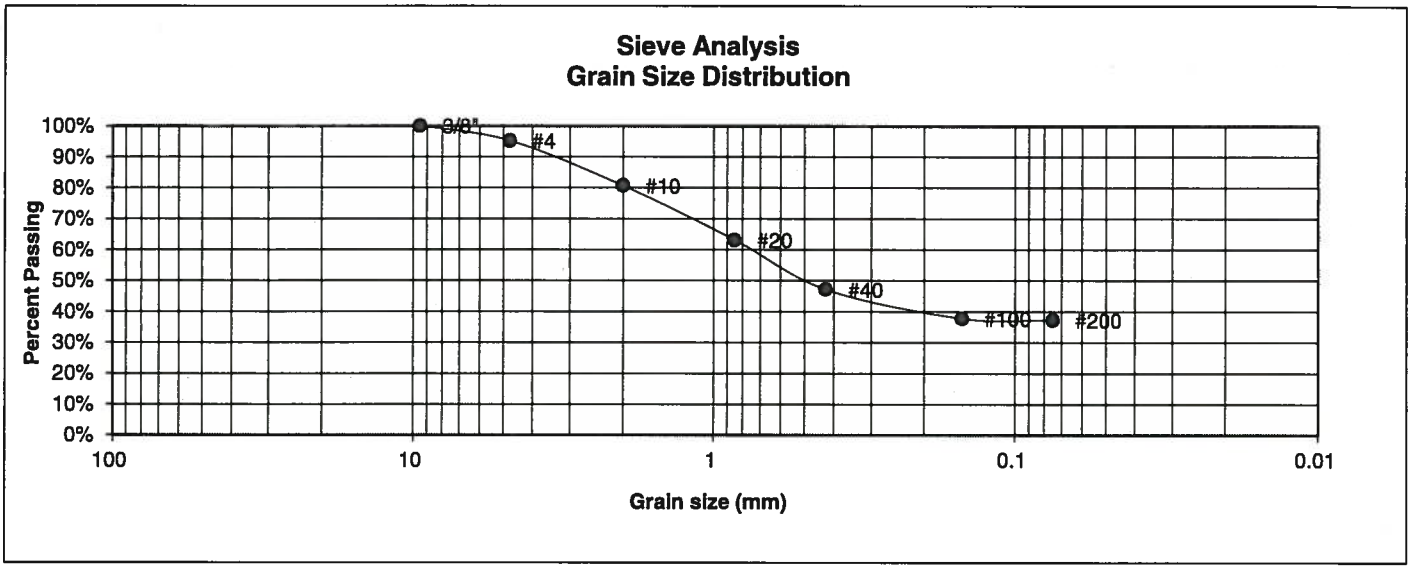
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	6/22/22

JOB NO.: 221458

FIG NO.: L-7

UNIFIED CLASSIFICATION	SM	CLIENT	CASA'S LIMITED PARTNERSHIP
SOIL TYPE #	3	PROJECT	EAGLE RISING SUBDIVISION
TEST BORING #	5	JOB NO.	221458
DEPTH (FT)	5	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	95.1%
10	80.7%
20	63.1%
40	47.1%
100	37.8%
200	37.2%

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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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

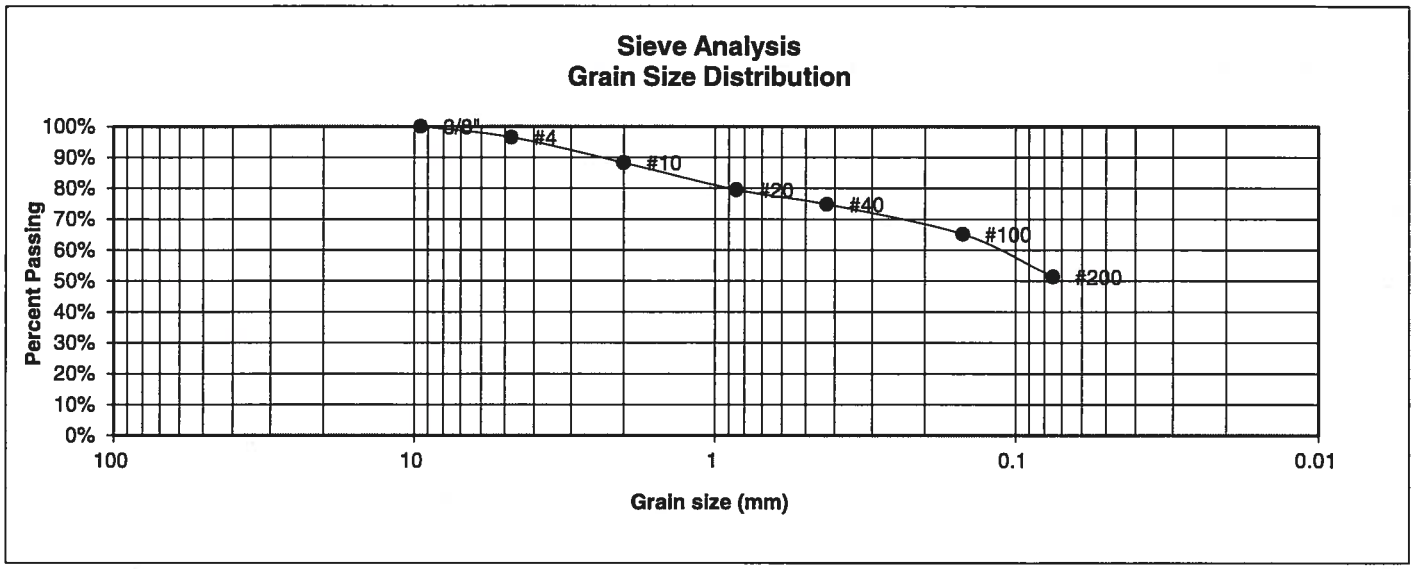
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	6/22/22

JOB NO.: 221458

FIG NO.: C-8

UNIFIED CLASSIFICATION	CL	CLIENT	CASA'S LIMITED PARTNERSHIP
SOIL TYPE #	4	PROJECT	EAGLE RISING SUBDIVISION
TEST BORING #	1	JOB NO.	221458
DEPTH (FT)	10	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	96.5%
10	88.3%
20	79.5%
40	74.8%
100	65.2%
200	51.4%

Atterberg Limits	
Plastic Limit	19
Liquid Limit	37
Plastic Index	18

Swell	
Moisture at start	9.3%
Moisture at finish	20.7%
Moisture increase	11.4%
Initial dry density (pcf)	100
Swell (psf)	410

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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

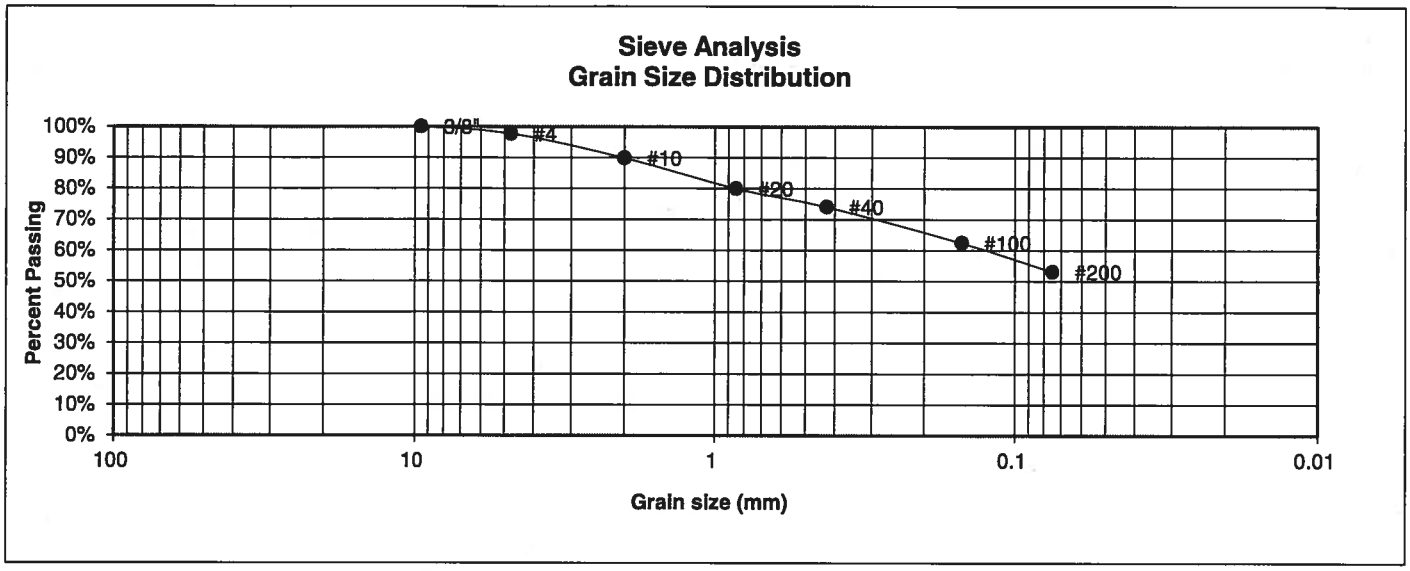
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	6/22/22

JOB NO.: 221458

FIG NO.: C-9

UNIFIED CLASSIFICATION	CL-ML	CLIENT	CASA'S LIMITED PARTNERSHIP
SOIL TYPE #	4	PROJECT	EAGLE RISING SUBDIVISION
TEST BORING #	1	JOB NO.	221458
DEPTH (FT)	15	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	97.8%
10	89.8%
20	79.9%
40	74.1%
100	62.4%
200	53.1%

Atterberg Limits	
Plastic Limit	21
Liquid Limit	28
Plastic Index	7

Swell	
Moisture at start	9.9%
Moisture at finish	17.5%
Moisture increase	7.6%
Initial dry density (pcf)	103
Swell (psf)	60

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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

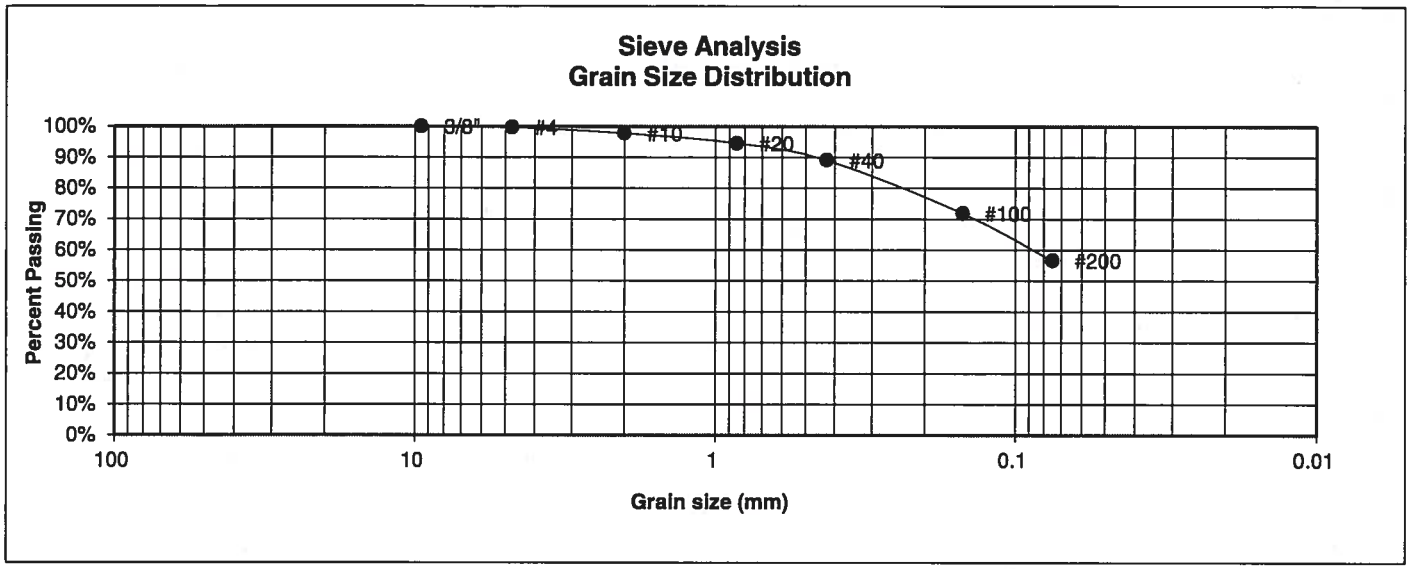
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	6/22/22

JOB NO.: 221458

FIG NO.: C-10

UNIFIED CLASSIFICATION	CL-ML	CLIENT	CASA'S LIMITED PARTNERSHIP
SOIL TYPE #	4	PROJECT	EAGLE RISING SUBDIVISION
TEST BORING #	3	JOB NO.	221458
DEPTH (FT)	10	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.7%
10	97.8%
20	94.6%
40	89.1%
100	71.9%
200	56.6%

Atterberg Limits	
Plastic Limit	7
Liquid Limit	12
Plastic Index	5

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

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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	6/22/22

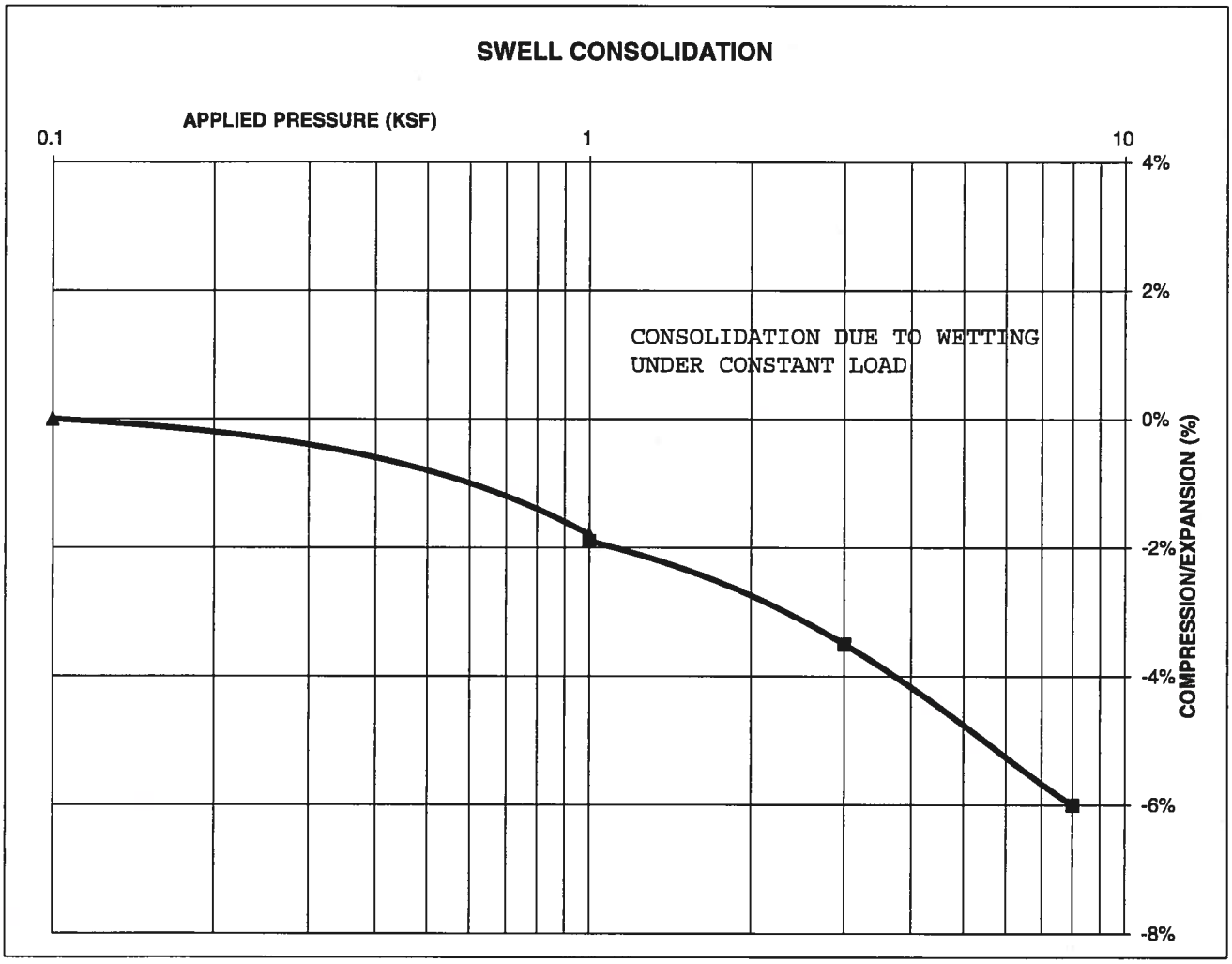
JOB NO.: 221458

FIG NO.: C-11

CONSOLIDATION TEST RESULTS

TEST BORING #	6	DEPTH(ft)	5
DESCRIPTION	CL	SOIL TYPE	2
NATURAL UNIT DRY WEIGHT (PCF)			105
NATURAL MOISTURE CONTENT			17.3%
SWELL/CONSOLIDATION (%)			-0.1%

JOB NO. 221458
CLIENT CASA'S LIMITED PARTNERSHIP
PROJECT EAGLE RISING SUBDIVISION



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

SWELL CONSOLIDATION
TEST RESULTS

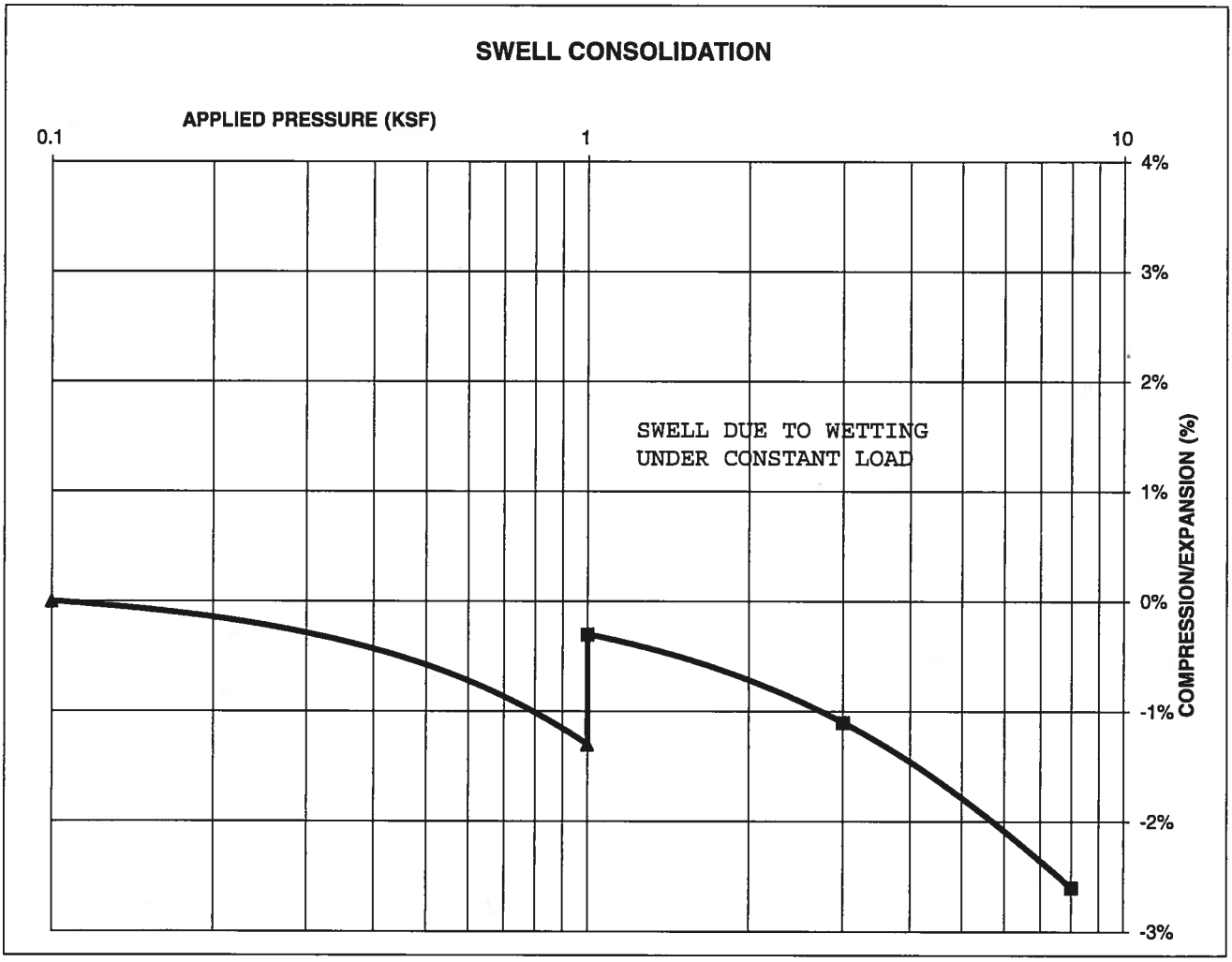
DRAWN:	DATE:	CHECKED:	DATE:
		LLL	6/22/22

JOB NO.: 221458
FIG NO.: C-12

CONSOLIDATION TEST RESULTS

TEST BORING #	3	DEPTH(ft)	10
DESCRIPTION	CL-MI	SOIL TYPE	4
NATURAL UNIT DRY WEIGHT (PCF)			116
NATURAL MOISTURE CONTENT			15.7%
SWELL/CONSOLIDATION (%)			1.0%

JOB NO. 221458
CLIENT CASA'S LIMITED PARTNERSHIP
PROJECT EAGLE RISING SUBDIVISION



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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

SWELL CONSOLIDATION
TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	6/22/22

JOB NO.: 221458
FIG NO.: C-13

APPENDIX D: Embankment Fill and Water Line Fill, Density Reports, Entech Job No. 131928

April 18, 2014

Casas Limited Partnership #4
P.O. Box 2076
Colorado Springs, CO 80901

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

Attn: Steve Jacobs

Re: Subsurface Soil Investigation
North Dam, Eagle Rising
El Paso County, Colorado

Dear Mr. Jacobs:

As requested, personnel have conducted a Subsurface Soil Investigation at the above referenced site. At the time of the investigation, the central area of the dam had been excavated approximately 8 to 10 feet. The Subsurface Soil Investigation consisted of drilling two test borings in the excavated area on April 2, 2014. The Test Boring Logs are included with this letter.

Eight feet of loose to medium dense silty sands were encountered overlying clayey sand and clayey sandstone. Groundwater was encountered at 7 and 8 feet in the test borings.

To minimize seepage in the dam, it is recommended the central area (core of the dam) be excavated down to clayey sand or sandstone and replaced with compacted clayey sand. The silty sand can be used on the dam faces. The compacted soil should be free of organics, debris and cobbles greater than 3-inches in diameter. The base of the excavation should be stabilized and compacted prior to fill placement. All fill placed within the area should be approved by Entech, and be compacted to a minimum of 92 percent of the soils maximum dry density as determined by the Modified Proctor Test (ASTM D-1557) for sands and a minimum of 95 percent of the soils maximum dry density as determined by the Standard Proctor Test (ASTM D-698) for clayey materials. Fill material should be placed in horizontal lifts such that each finished lift has a compacted thickness of six inches or less. Fill should be placed at water contents conducive to achieving adequate compaction, usually within ±2 percent of the optimum water content as determined by ASTM D-1557. Entech Engineering Inc. should observe and test fill placement to ensure proper compaction.

We trust that this has provided you with the information you required. If you have any questions or need additional information, please do not hesitate to contact us.

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Kristen A. Andrew-Hoeser, P.G.
Engineering Geologist

Reviewed by:

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

COLORADO LICENSED
JOSEPH COLLIN GOODE JR
23725
PROFESSIONAL ENGINEER

KAH/lpb

Entech Job No. 131928
2MSW/let/2013/131928ssi

TEST BORING NO. 1
DATE DRILLED 4/2/2014
Job # 221458

REMARKS

WATER @ 8', 4/2/14

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE TO LOOSE, MOIST			11	6.8	
5			9	5.1	
SAND, CLAYEY, FINE GRAINED, GRAY BROWN, LOOSE, VERY MOIST			6	27.0	
10					
SANDSTONE, CLAYEY, FINE TO COARSE GRAINED, GRAY, VERY DENSE, MOIST			50/10"	13.5	
15					
20					

TEST BORING NO. 2
DATE DRILLED 4/2/2014
CLIENT CASA'S LIMITED PARTNERSHIP
LOCATION EAGLE RISING SUBDIVISION

REMARKS

WATER @ 7', 4/2/14

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
SAND, SILTY, FINE TO COARSE GRAINED, BROWN, LOOSE TO MEDIUM DENSE, MOIST			6	6.7	
5			12	10.9	
SANDSTONE, CLAYEY, FINE TO COARSE GRAINED, GRAY, VERY DENSE, MOIST			50/11"	11.0	
10					
15					
20					

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

TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:

JOB NO.: 131928
FIG NO.: A-

ENTECH
ENGINEERING, INC.

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

May 13, 2014

Casas Limited Partnership #4
PO Box 2076
Colorado Spring, CO 80901

Attn: Steve Jacobs

Re: Density Testing – Embankment Fill
70 Acre Kurie Road Parcel
Black Forest, Colorado
Report No. 4, Tests 28 and 29

Dear Mr. Jacobs:

As requested, personnel of Entech Engineering, Inc. have performed density testing at the above referenced site.

Density testing on this site was performed on May 5, 2014. The density testing indicates that the materials have been adequately compacted at the depths and locations noted. Results of the density tests are attached with this letter.

We trust that this has provided you with the information you required. Should you have any questions or need further information, please do not hesitate to contact us.

Respectfully Submitted,

ENTECH ENGINEERING, INC.

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

COLORADO REGISTERED
JOSEPH COLLIN GOODE JR.
23725
5.13.14
PROFESSIONAL ENGINEER

JCG/pw

Encl.

Entech Job No. 131928
3MSW/DEN/2013/ 131928.1clc

Client: Casas Limited Partnership #4	**Entech Job #:** 131928.1	**Proctor Value Key:**	**M = modified, ASTM D-1557**
Project: 70 Acre Kurie Road Parcel	**Tested By:** J. Lynn		**S = standard, ASTM D-698**
Subject: Embankment Fill	**Report Date:** 05-15-2014		**T = AASHTO, T-180**

Test #	Test Location	Testing Date	Percent Compaction	Percent Required	Percent Moisture	Soil Type	Proctor Type/Value	Pass/Fail ☑ = Fail
28	Downstream slope on the south dam, center of the dam, at grade.	5/5/14	96	95	13.8	SC	M - 117.9 @ 12.9	☐
29	Downstream slope on the south dam, 30' west of the east end of the dam, at grade.	5/5/14	96	95	13.1	SC	M - 117.9 @ 12.9	☐

Comments:

Scope of Observation: PERIODIC; CONTRACTOR'S OR CLIENT'S REPRESENTATIVE ADVISED

All dimensions are approximate. Cl. = Centerline

ENTECH
ENGINEERING, INC.
505 Elkton Drive
Colorado Springs, CO 80907
(719) 531-5599 • (719) 531-5238 (fax)

FIELD DENSITY RESULTS

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

ENTECH
ENGINEERING, INC.

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

April 30, 2014

Casa's Limited Partnership #4
PO Box 2076
Colorado Spring, CO 80901

Attn: Steve Jacobs

Re: Density Testing – Water Line Trench Backfill
70 Acre Kurie Road Parcel
Black Forest, Colorado
Report No. 1, Test 1

Dear Mr. Jacobs:

As requested, personnel of Entech Engineering, Inc. have performed density testing at the above referenced site.

Density testing on this site was performed on April 25, 2014. The density testing indicates that the materials have been adequately compacted at the depth and location noted. Results of the density tests are attached with this letter.

We trust that this has provided you with the information you required. Should you have any questions or need further information, please do not hesitate to contact us.

Respectfully Submitted,

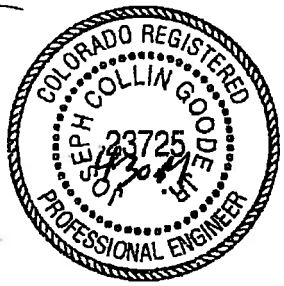
ENTECH ENGINEERING, INC.

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

JCG/pw

Encl.

Entech Job No. 131928
3MSW/DEN/2013/ 131928.3cl



Client: Casas Limited Partnership #4	**Entech Job #:** 131928.3	**Proctor Value Key:**	**M = modified, ASTM D-1557**
Project: 70 Acre Kurie Road Parcel	**Tested By:** J. Lynn		**S = standard, ASTM D-698**
Subject: Water Line Trench Backfill	**Report Date:** 04-29-2014		**T = AASHTO, T-180**

Test #	Test Location	Testing Date	Percent Compaction	Percent Required	Percent Moisture	Soil Type	Proctor Type/Value	Pass/Fail ☑ = *Fail*
1	Kurie Road, 50' north of the hydrant, 4' below grade.	4/25/14	95	95	10.3	SM	M - 125.9 @ 9.0	☐

Comments:

Scope of Observation: PERIODIC; CONTRACTOR'S OR CLIENT'S REPRESENTATIVE ADVISED

All dimensions are approximate. Cl. = Centerline

ENTECH
ENGINEERING, INC.
505 Elkton Drive
Colorado Springs, CO 80907
(719) 531-5599 • (719) 531-5238 (fax)

FIELD DENSITY RESULTS

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

ENTECH
ENGINEERING, INC.

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

May 7, 2014

Casa's Limited Partnership #4
PO Box 2076
Colorado Spring, CO 80901

Attn: Steve Jacobs

Re: Density Testing – Water Line Trench Backfill
70 Acre Kurie Road Parcel
Black Forest, Colorado
Report No. 2, Tests 2 and 3

Dear Mr. Jacobs:

As requested, personnel of Entech Engineering, Inc. have performed density testing at the above referenced site.

Density testing on this site was performed on April 28 through 30, 2014. The density testing indicates that the materials have been adequately compacted at the depths and locations noted. Results of the density tests are attached with this letter.

We trust that this has provided you with the information you required. Should you have any questions or need further information, please do not hesitate to contact us.

Respectfully Submitted,

ENTECH ENGINEERING, INC.

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

COLORADO REGISTERED
JOSEPH COLLIN GOODE JR.
23725
PROFESSIONAL ENGINEER

JCG/pw

Encl.

Entech Job No. 131928
3MSW/DEN/2013/ 131928.3cla

Client:	Casas Limited Partnership #4	**Entech Job #:**	131928.3	**Proctor Value Key:**	**M = modified, ASTM D-1557**
Project:	70 Acre Kurie Road Parcel	**Tested By:**	J. Lynn		**S = standard, ASTM D-698**
Subject:	Water Line Trench Backfill	**Report Date:**	05-06-2014		**T = AASHTO, T-180**

Test #	Test Location	Testing Date	Percent Compaction	Percent Required	Percent Moisture	Soil Type	Proctor Type/Value	Pass/Fail ☑ = Fail
2	45' south of the driveway to 10235 Kurie Road, 2' below grade.	4/28/14	96	95	9.4	SM	M - 125.9 @ 9.0	☐
3	In the driveway to 10195 Kurie Road, 75' south of the north end of the driveway entrance, at grade.	4/30/14	96	95	9.6	SM	M - 125.9 @ 9.0	☐

Comments:

Scope of Observation: PERIODIC; CONTRACTOR'S OR CLIENT'S REPRESENTATIVE ADVISED

All dimensions are approximate. Cl. = Centerline

ENTECH
ENGINEERING, INC.
505 Elkton Drive
Colorado Springs, CO 80907
(719) 531-5599 • (719) 531-5238 (fax)

FIELD DENSITY RESULTS

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

ENTECH
ENGINEERING, INC.

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

May 13, 2014

Casa's Limited Partnership #4
PO Box 2076
Colorado Spring, CO 80901

Attn: Steve Jacobs

Re: Density Testing – Water Line Trench Backfill
70 Acre Kurie Road Parcel
Black Forest, Colorado
Report No. 3, Tests 4 and 5

Dear Mr. Jacobs:

As requested, personnel of Entech Engineering, Inc. have performed density testing at the above referenced site.

Density testing on this site was performed on May 5, 2014. The density testing indicates that the materials have been adequately compacted at the depths and locations noted. Results of the density tests are attached with this letter.

We trust that this has provided you with the information you required. Should you have any questions or need further information, please do not hesitate to contact us.

Respectfully Submitted,

ENTECH ENGINEERING, INC.

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

COLORADO REGISTERED
JOSEPH COLLIN GOODE JR.
23725
5.13.14
PROFESSIONAL ENGINEER

JCG/pw

Encl.

Entech Job No. 131928
3MSW/DEN/2013/ 131928.3clb

Client:	Casas Limited Partnership #4	**Entech Job #:**	131928.3	**Proctor Value Key:**	**M = modified, ASTM D-1557**
Project:	70 Acre Kurie Road Parcel	**Tested By:**	J. Lynn		**S = standard, ASTM D-698**
Subject:	Water Line Trench Backfill	**Report Date:**	05-12-2014		**T = AASHTO, T-180**

Test #	Test Location	Testing Date	Percent Compaction	Percent Required	Percent Moisture	Soil Type	Proctor Type/Value	Pass/Fail ☑ = Fail
4	In the driveway to House #10195, 105' north of the gate by the house, 2' below grade.	5/5/14	95	95	9.1	SM	M - 125.9 @ 9.0	☐
5	In the driveway to House #10195, 200' north of the gate by the house, at grade.	5/5/14	96	95	8.7	SM	M - 125.9 @ 9.0	☐

Comments:

Scope of Observation: PERIODIC; CONTRACTOR'S OR CLIENT'S REPRESENTATIVE ADVISED

All dimensions are approximate. Cl. = Centerline

ENTECH
ENGINEERING, INC.
505 Elkton Drive
Colorado Springs, CO 80907
(719) 531-5599 • (719) 531-5238 (fax)

FIELD DENSITY RESULTS

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

APPENDIX E: Soil Survey Descriptions

El Paso County Area, Colorado

8—Blakeland loamy sand, 1 to 9 percent slopes

Map Unit Setting

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

Map Unit Composition

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

Description of Blakeland

Setting

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

Typical profile

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

Properties and qualities

Slope: 1 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: Low (about 4.5 inches)

Interpretive groups

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

Minor Components

Other soils

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

Pleasant

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

Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 19, Aug 31, 2021

El Paso County Area, Colorado

40—Kettle gravelly loamy sand, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 368g
Elevation: 7,000 to 7,700 feet
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Kettle

Setting

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

Typical profile

E - 0 to 16 inches: gravelly loamy sand
Bt - 16 to 40 inches: gravelly sandy loam
C - 40 to 60 inches: extremely gravelly loamy sand

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 3.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: F048AY908CO - Mixed Conifer
Hydric soil rating: No

Minor Components

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
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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
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 6.0 inches)

Interpretive groups

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

Minor Components

Pleasant

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

Other soils

Percent of map unit:
Hydric soil rating: No

Data Source Information

Soil Survey Area: El Paso County Area, Colorado
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