



ENTECH
ENGINEERING, INC.

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

**SOILS AND GEOLOGY STUDY
11745 OWL PLACE
PARCEL NO. 53010-01-015
EL PASO COUNTY, COLORADO**

Prepared for:
**Doubletree Ventures
106 South Kyrene Road, Suite 2
Chandler, Arizona 85226**

Attn: Brian Zurek

June 22, 2023

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Reviewed by:


Logan L. Langford, P.G.
Geologist

LLL





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

Table of Contents

1	SUMMARY.....	1
2	GENERAL SITE CONDITIONS AND PROJECT DESCRIPTION	2
3	SCOPE OF THE REPORT	2
4	FIELD INVESTIGATION	2
5	SOIL, GEOLOGY, AND ENGINEERING GEOLOGY.....	3
5.1	General Geology	3
5.2	Soil Conservation Survey	4
5.3	Site Stratigraphy.....	4
5.4	Soil Conditions	5
6	ENGINEERING GEOLOGY – IDENTIFICATION AND MITIGATION OF GEOLOGIC HAZARDS.....	6
6.1	Relevance of Geologic Conditions to Land Use Planning	9
7	ECONOMIC MINERAL RESOURCES.....	10
8	EROSION CONTROL	11
9	ROADWAY AND EMBANKMENT CONSTRUCTION RECOMMENDATIONS.....	12
10	CLOSURE.....	12
11	BIBLIOGRAPHY.....	14

FIGURES

Figure 1: Vicinity Map

Figure 2: USGS Map

Figure 3: Development Plan/Test Boring Location Map

Figure 4: Soil Survey Map

Figure 5: Falcon Quadrangle Geology Map

Figure 6: Geology Map/Engineering Geology

Figure 7: Floodplain Map

Figure 8: Typical Perimeter Drain Details

Figure 9: Underslab Drainage Layer (Capillary Break)

Figure 10: Interceptor Drain Detail

APPENDIX A: Site Photographs

APPENDIX B: Laboratory Testing Summary and Test Boring Logs from Entech Job No. 230586

APPENDIX C: Soil Survey Descriptions

APPENDIX D: El Paso County Health Department Septic Records

1 SUMMARY

Project Location

The project lies in portions of the SE¼ of Section 1, Township 13 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado. The site is located north and west of the intersection of East Woodmen Road and Meridian Road in Falcon, Colorado.

Project Description

Total acreage involved subdivision is approximately 4.61 acres, and four lots are proposed as part of the rezoning. The proposed development is to consist of commercial lots, with associated site improvements, and will be serviced by municipal water and sewer.

Scope of Report

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

Land Use and Engineering Geology

This site was found to be suitable for the proposed development. Areas were encountered where the geologic conditions will impose some constraints on development and land use. These include potentially expansive soils, shallow bedrock, seasonally shallow groundwater, and a mapped floodplain. 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 GENERAL SITE CONDITIONS AND PROJECT DESCRIPTION

The site is located in portions of the SE¼ of Section 1, Township 13 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado. The site is located north and west of the intersection of East Woodmen Road and Meridian Road in Falcon, Colorado. The location of the site is as shown on the Vicinity Map, Figure 1.

The topography of the site is generally gradually sloping to the south-southwest. An existing house and out buildings are currently located on the site, but will be removed. A drainage crosses the site from the northeast to the southwest. The drainage had water flowing, and standing water was observed within the mapped floodplain area at the time of our field mapping and site investigation. The site boundaries are indicated on the USGS Map, Figure 2. Previous land uses have included equipment storage, a fill borrow area, and grazing and pasture land. The site contains primarily field grasses, cacti, yucca, and weeds. Site photographs, taken June 13, 2023, are included in Appendix A.

4.61 acres, and four lots are proposed as part of the rezoning. The proposed development is to consist of commercial lots, with associated site improvements, and will be serviced by municipal water and sewer. A 10'x8' box culvert is proposed along the northern and western sides of the site in order to reroute the existing drainage. Final grading plans were not available at the time of this report. The Development Plan/Test Boring Location Map is presented in Figure 3.

3 SCOPE OF THE REPORT

The scope of the report will include a general geologic analysis utilizing published geologic data. Detailed site-specific mapping will be conducted to obtain general information in respect to major geographic and geologic features, geologic descriptions and their effects on the development of the property.

4 FIELD INVESTIGATION

Our field investigation consisted of the preparation of a geologic map of any bedrock features and significant surficial deposits. The Natural Resource Conservation Service (NRCS), previously the Soil Conservation Service (SCS) survey was also reviewed to evaluate the site. The position of mappable units within the subject property are shown on the Geologic Map. Our mapping procedures involved both field reconnaissance and measurements and air photo reconnaissance

and interpretation. The same mapping procedures have also been utilized to produce the Engineering Geology Map which identified pertinent geologic conditions affecting development. The field mapping was performed by personnel of Entech Engineering, Inc. on June 13, 2023.

Four Test Borings were drilled as part of a Preliminary Subsurface Soil Investigation completed by Entech dated May 1, 2023, (Reference 1). Information from this report was used in preparing the Soils and Geology Study. The locations of the test borings are indicated on the Development Plan/Test Boring Location Map, Figure 3. The Test Boring Logs are presented in Appendix B, and Summarized on Table 1B. 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, Atterberg Limits ASTM D-4318, volume change testing using Swell/Consolidation test. Sulfate testing was performed on select samples to evaluate potential for below grade concrete degradation due to sulfate attack. A summary of the laboratory testing results is included in Appendix B.

5 SOIL, GEOLOGY, AND ENGINEERING GEOLOGY

5.1 General Geology

Physiographically, the site lies in the western portion of the Great Plains Physiographic Province. Approximately 12¼ 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 northeasterly direction (Reference 2). The rocks in the area of the site are sedimentary in nature and typically Upper Cretaceous in age. The bedrock underlying the site consists of the Black Squirrel Formation. Overlying this formation are unconsolidated deposits of alluvial and residual soils of Quaternary Age. The alluvial soils were deposited by water on site and as stream terraces along drainage located on the 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 3), previously the Soil Conservation Service (Reference 4) has mapped one soil type on the site Figure 4. In general, the soils classify as gravelly sandy loam. The soils are described as follows:

<u>Type</u>	<u>Description</u>
19	Columbine Gravelly Sandy Loam, 0 to 3% slopes

Complete descriptions of each soil type are presented in Appendix C. The soils have generally been described to have moderate to moderately rapid permeabilities. 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 Falcon 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. Three mappable units were identified on this site which are described as follows:

Qa₁ Alluvium One of Holocene Age: These materials consist of stream-deposited alluvium, typically classified as a silty to well-graded sand, brown to dark brown in color and of moderate density occurring as terrace deposits. Old Alluvium One can sometimes be very highly stratified containing thin layers of very silty and clayey soil. This unit correlates to the Louviers Alluvium in the Denver area.

Tbs Black Squirrel Formation of Paleocene Age: These materials formations typically consist of sandstone with interbedded siltstone and claystone. The bedrock encountered in the test borings consisted of gray sandy claystone and some clayey sandstone. Overlying this formation is a variable layer of residual soil derived from the in-situ weathering of the bedrock on-site. The clays and claystone are typically expansive.

The bedrock underlying the site consists of the Dawson Formation of Tertiary to Cretaceous Age. The Black Squirrel Formation that typically consists of arkosic sandstone with interbedded fine-grained sandstone, siltstone and claystone. Overlying this formation are variable layers of alluvial

deposits, and residual soil. The residual soils were derived from the in-situ weathering of the bedrock materials on-site. These soils consisted of silty to clayey sands and sandy clays.

The soils listed above were mapped from site-specific mapping, the *Geologic Map of the Falcon Quadrangle* distributed by the Colorado Geological Survey in 2011 (Reference 5), the *Geologic Map of the Colorado Springs-Castle Rock Area*, distributed by the US Geological Survey in 1978 (Reference 5), and the *Geologic Map of the Pueblo 1^o x 2^o Quadrangle*, distributed by the US Geological Survey in 1981 (Reference 6). The Test Borings were also used in evaluating the site and are included in Appendix B. The Geology Map prepared for the site is presented in Figure 6.

5.4 Soil Conditions

The soils encountered in the Test Borings can be grouped into three general soil types. The soils were classified using the Unified Soil Classification System (USCS).

Soil Type 1 classified as silty to very silty sand (SM). The sand was encountered in all of the test borings from the ground surface and extending to depths ranging from 1 to 4 feet below ground surface (bgs). Standard Penetration Testing on the sand resulted in N-values of 31 to 45 bpf indicating dense states. Water content and grain size testing resulted in approximately 3 to 7 percent water content with 39 percent of the soil size particles passing the No. 200 sieve. Atterberg limits testing on a sample of silty sand resulted in a liquid limit of 26 percent and a plastic index of 8 percent. Sulfate Testing resulted in a sulfate content of 0.02 percent which indicates a negligible potential for below grade concrete degradation due to sulfate attack.

Soil Type 2 classified a slightly silty to silty sandstone bedrock (SM-SW). The sandstone was encountered in all of the test borings at depths ranging from 1 to 4 feet and extending to 8 feet or to the depths explored (20 feet) bgs. Standard Penetration Testing on the sandstone resulted in an N-values of 42 or greater than 50 bpf indicating dense to very dense states. Water content and grain size testing resulted in 2.5 to 21 percent water content and approximately 10 to 12 percent of the soil size particles passing the No. 200 sieve. Atterberg limits testing resulted in no values and sulfate testing yielded negligible results.

Soil Type 3 classified as sandy claystone bedrock (CL). The claystone was encountered in Test Boring No. 3 at 8 feet bgs and extended to termination of boring at 20 feet bgs. Standard

penetration testing resulted in N-values of 44 to greater than 50 indicating a hard consistency. Water contents and grain size testing resulted in 12 to 17 percent water content with 70 percent of the soil size particles passing the No. 200 sieve. Atterberg Limits testing resulted in a liquid limit of 37 percent and a plastic index of 16 percent. Swell/Consolidation testing resulted in a volume change of 0.4 percent indicating a low expansion potential. Sulfate testing resulted in a sulfate content of 0.01 percent indicating a negligible potential for concrete degradation.

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

5.5 Groundwater

Groundwater was encountered in the test borings at depths of 10 to 16.5 feet subsequent to drilling on April 26, 2023. The borings were checked again during our field mapping, Test Boring Nos. 1 and 4 remained open and groundwater was encountered at 2.5 and 6.25 feet respectively. It should be noted that these measurements were taken following significant rainfall. 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 ENGINEERING GEOLOGY – IDENTIFICATION AND MITIGATION OF GEOLOGIC HAZARDS

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

Artificial Fill – Constraint

Fill was not encountered in the borings, however, fill associated with the existing structure and septic fill should be expected.

Mitigation: The fill should be mitigated during site grading or at the time of construction on the individual lots. The fill on this site is considered uncontrolled for construction purposes. Any uncontrolled fill encountered beneath foundations will require removal and recompaction at a minimum of 95% of its maximum Modified Proctor Dry Density, ASTM D-1557. If the existing septic system is located within building areas removal will be required.

Expansive Soils – Constraint

Expansive soils were encountered in the test borings drilled on site. These occurrences are sporadic; therefore, none have been indicated on the maps. The clays and claystone, if encountered at foundation grade, can cause differential movement in structures. These occurrences should be identified and dealt with on an individual basis.

Mitigation Should expansive soils be encountered beneath foundations; mitigation will be necessary. Mitigation of expansive soils will require special foundation design. Overexcavation 3 to 5 feet 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. 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.

Shallow Bedrock – Constraint

Bedrock was encountered in all the test borings at depths ranging from 1 to 4 feet. Shallow bedrock will be encountered in a majority of areas of this site particularly in the area mapped as Tbs on Figure 6. Where claystone or sandstone are encountered, excavation/grading may be difficult requiring track-mounted excavators with ripper attachments. Bedrock will likely be encountered cuts for utility excavations.

Groundwater and Floodplain Areas – Constraint

A portion of the site is mapped within floodplain Zone A according to the FEMA Map No. 08041CO553G, (Figure 7, Reference 7). A drainage crosses the site from the northeast to the southwest, and flowing and standing water were observed within the mapped floodplain area at the time of our field mapping and site investigation. The proposed development plan indicates that a 10'x8' box culvert will be installed rerouting the drainage around the northern and western sides of the site. Groundwater encountered in the test borings at depths of 10 to 16.5 feet

subsequent to drilling on April 26, 2023. The borings were checked again during our field mapping, Test Boring Nos. 1 and 4 remained open and groundwater was encountered at 2.5 and 6.25 feet respectively. These areas are discussed as follows:

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. These areas are associated with the two stock ponds in the northern portion of the site. Grading plans were not available at the time of this investigation. A minimum separation of 3 feet between foundation components and groundwater levels 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. Foundations should be kept as high as possible. Areas may experience higher groundwater levels during period of higher precipitation where water can flow through permeable sands on top of less permeable bedrock materials. Subsurface perimeter drains may be necessary to prevent the intrusion of water into areas below grade. Typical drain details are presented in Figure 8. Where shallow groundwater is encountered, underslab drains or interceptor drains may be necessary. Typical drain details are presented in Figures 9 and 10. It is anticipated that the shallow water areas will be mitigated with site grading and the installation of the box culvert. Specific recommendations should be made after additional investigation and site grading has been completed.

Radon – Hazard

Radon levels for the area have been reported by the Colorado Geologic Survey in the open file, Report No. 91-4 (Reference 9). Average Radon levels for the 80831-zip code is 4.50 pCi/l. The following is a table of radon levels in this area:

<u>80831</u>	
0 < 4 pCi/l	0.00%
4 < 10 pCi/l	100.00%
10 < 20 pCi/l	0.00%
> 20 pCi/l	0.00%

Mitigation:

The potential for high radon levels is present for the site. Build-up of radon gas can usually be

mitigated by providing increased ventilation of basement and crawlspace and sealing joints. Specific requirements for mitigation should be based on site specific testing.

6.1 Relevance of Geologic Conditions to Land Use Planning

We understand that the development will be commercial lots. It is our opinion that the existing geologic and engineering geologic conditions will impose some constraints on the proposed development and construction. The most significant problems affecting development will be those associated with the potentially expansive soils, shallow bedrock, seasonally shallow groundwater, and a mapped floodplain on the site can be satisfactorily mitigated through proper engineering design and construction practices.

The upper materials are typically at medium to dense states. The granular soils encountered in the upper soil profiles of the test borings should provide good support for foundations. Loose soils if encountered at foundation depth will require mitigation. Foundations anticipated for the site are standard spread footings possibly in conjunction with overexcavation in areas of expansive soils or recompaction in areas of loose soils. Excavation is anticipated to be moderate with rubber-tired equipment for the site sand materials, and will require track mounted equipment for the dense sandstone. 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.

A portion of the site is mapped within floodplain Zone A according to the FEMA Map No. 08041CO553G, (Figure 7, Reference 7). A drainage crosses the site from the northeast to the southwest, and flowing and standing water were observed within the mapped floodplain area at the time of our field mapping and site investigation. The proposed development plan indicates that a 10'x8' box culvert will be installed rerouting the drainage around the northern and western sides of the site. It is anticipated that the shallow water areas will be mitigated with site grading and the installation of the box culvert, however, additional site investigation should be conducted following the installation of the box culvert and prior to construction on the new lots. Groundwater encountered in the test borings at depths of 10 to 16.5 feet subsequent to drilling on April 26, 2023. **Exact locations of floodplain and specific drainage studies are beyond the scope of this report.** Subsurface perimeter drains may be necessary to prevent the intrusion of water into areas below grade. Typical drain details are presented in Figure 8. Where shallow groundwater

is encountered, underslab drains or interceptor drains may be necessary. Typical drain details are presented in Figures 9 and 10.

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 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), the area is not mapped with any aggregate deposits. According to the *Atlas of Sand, Gravel and Quarry Aggregate Resources, Colorado Front Range Counties* distributed by the Colorado Geological Survey (Reference 9), areas of the site are 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 “Fair” for industrial minerals. However, considering the silty 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-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 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 become increasingly less susceptible to water erosion. For the typical soils observed on-site, allowable velocities on unvegetated and unlined earth channels would be on the order of 3 to 4 feet/second, depending upon the sediment load carried by the water. Permissible velocities may be increased through the use of vegetation to something on the order of 4 to 7 feet/second, depending upon the type of vegetation established. Should the anticipated velocities exceed these values, some form of channel lining material may be required to reduce erosion potential. These might consist of some of the synthetic channel lining materials on the market or conventional riprap. In cases where ditch-lining materials are still insufficient to control erosion, small check dams or sediment traps may be required. The check dams will serve to reduce flow velocities, as well as provide small traps for containing sediment. The determination of the amount, location and placement of ditch linings, check dams and of the special erosion control features should be performed by or in conjunction with the drainage engineer who is more familiar with the flow quantities and velocities.

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

9 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, if encountered, will be difficult with rubber-tired equipment. Stabilization using shot rock or geogrids may be necessary.

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

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

10 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 mitigated through proper engineering design and construction practices. The proposed development and use are 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 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.

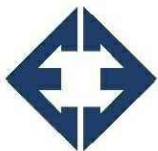
This report has been prepared for Doubletree Ventures for application to the proposed project in accordance with generally accepted geologic soil and engineering practices. No other warranty expressed or implied is made.

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.

11 BIBLIOGRAPHY

1. Entech Engineering, Inc. May 1, 2023. *Preliminary Subsurface Soil Investigation, 11745 Owl Place, Lots 1-4, Peyton, El Paso County, Colorado*. Entech Job No. 230568.
2. Scott, Glen R., Taylor, Richard B., Epis, Rudy C., and Wobus, Reinhard A. 1978. *Geologic Structure Map of the Pueblo 1° x 2° Quadrangle, North-Central Colorado*. Sheet 2. U.S. Geologic Survey. Map I-1022.
3. Natural Resource Conservation Service, September 22, 2015. *Web Soil Survey*. United States Department Agriculture, <http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>.
4. United States Department of Agriculture Soil Conservation Service. June 1981. *Soil Survey of El Paso County Area, Colorado*.
5. Morgan, Matthew L., and White, Jonathan L., 2012. *Falcon Quadrangle Geologic Map, El Paso County, Colorado*. Colorado Geological Survey. Open-File Report 12-05.
6. Trimble, Donald E. and Machette, Michael N. 1979. *Geologic Map of the Colorado Springs-Castle Rock Area, Front Range Urban Corridor, Colorado*. USGS, Map I-857-F.
7. Scott, Glen R., Taylor, Richard B., Epis, Rudy C., and Wobus, Reinhard A. 1978. *Geologic Map of the Denver 1° x 2° Quadrangle, North-Central Colorado*. U.S. Geologic Survey. Map 1-1022.
8. Federal Emergency Management Agency. December 7, 2018. *Flood Insurance Rate Maps for El Paso County, Colorado and Incorporated Areas*. Map Number 08041CO553G.
9. Kirkman, Robert M. and Rogers, William P. 1981. *Earthquake Potential in Colorado*. Colorado Geological Survey. Bulletin 43.
10. Colorado Geological Survey. 1991. *Results of the 1987-88 EPA Supported Radon Study in Colorado*. Open-file Report 91-4.
11. El Paso County Planning Development. December 1995. *El Paso County Aggregate Resource Evaluation Maps*.
12. Schwochow, S.D.; Shroba, R.R. and Wicklein, P.C. 1974. *Atlas of Sand, Gravel, and Quarry Aggregate Resources, Colorado Front Range Counties*. Colorado Geological Survey. Special Publication 5-B.
13. 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.

FIGURES

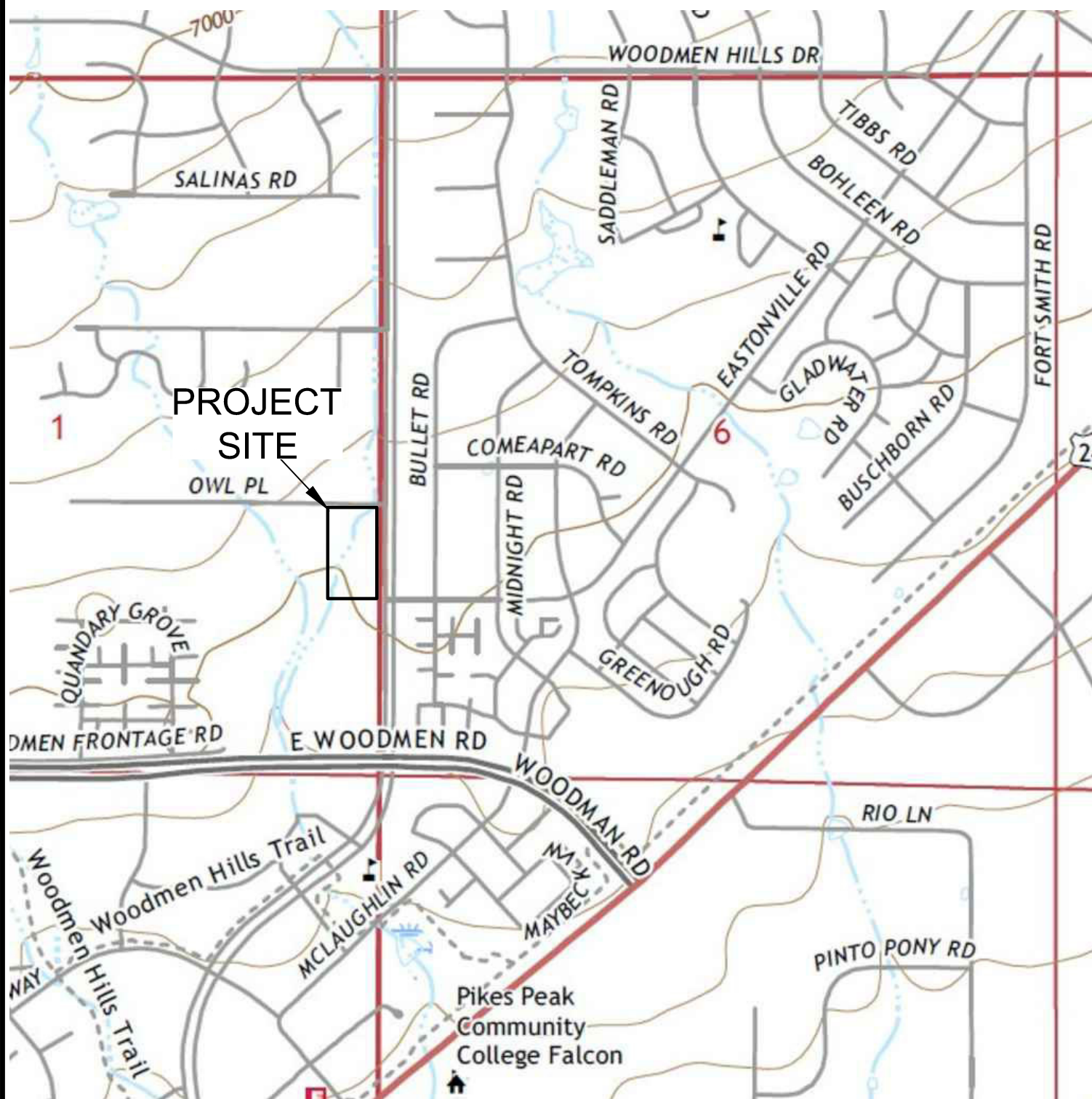


ENTECH
ENGINEERING, INC.

VICINITY MAP
11745 OWL PLACE
DOUBLETREE VENTURES

JOB NO.
230804

FIG. 1

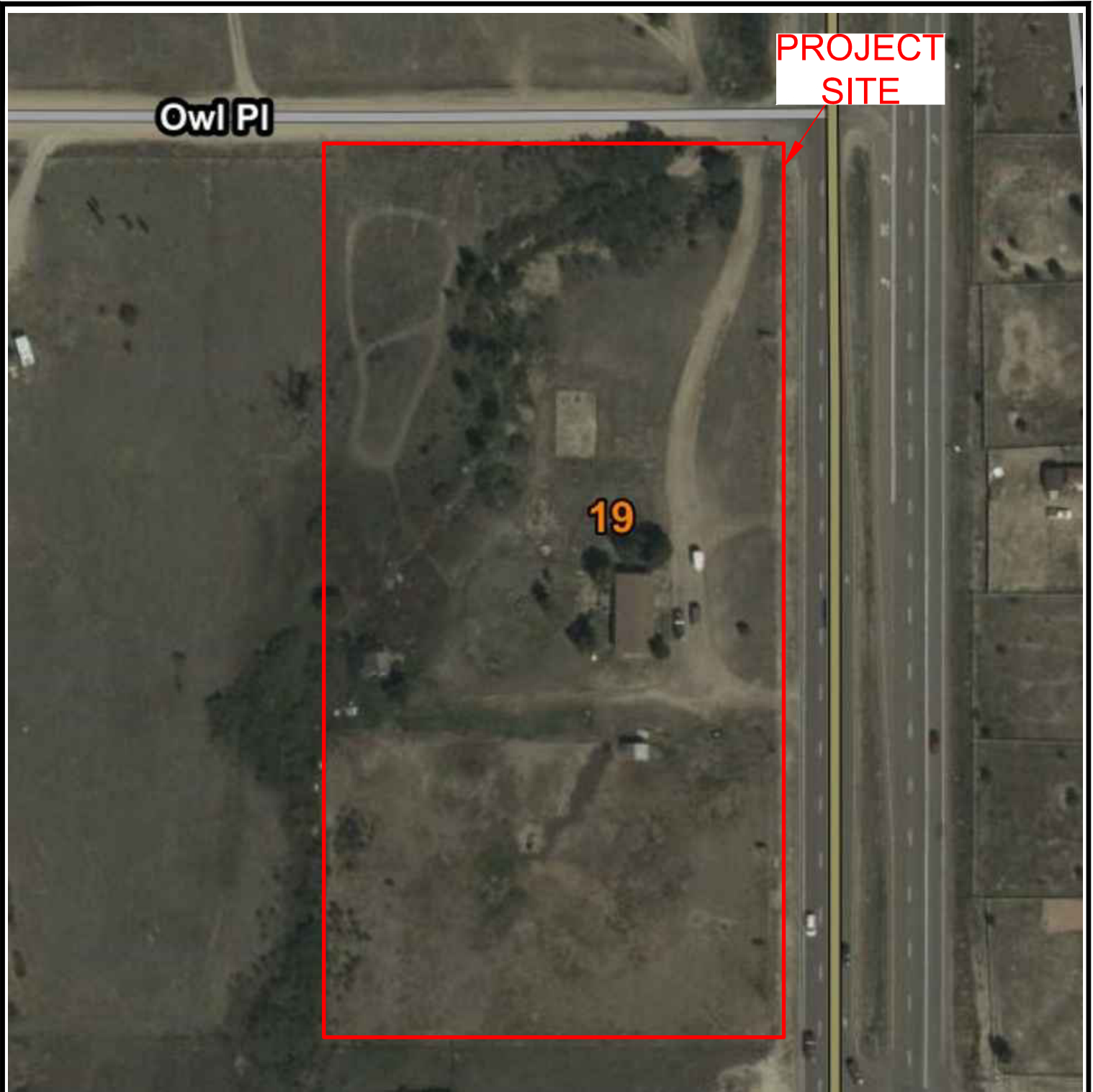


ENTECH
ENGINEERING, INC.

USGS TOPOGRAPHY MAP
11745 OWL PLACE
DOUBLETREE VENTURES

JOB NO.
230804

FIG. 2

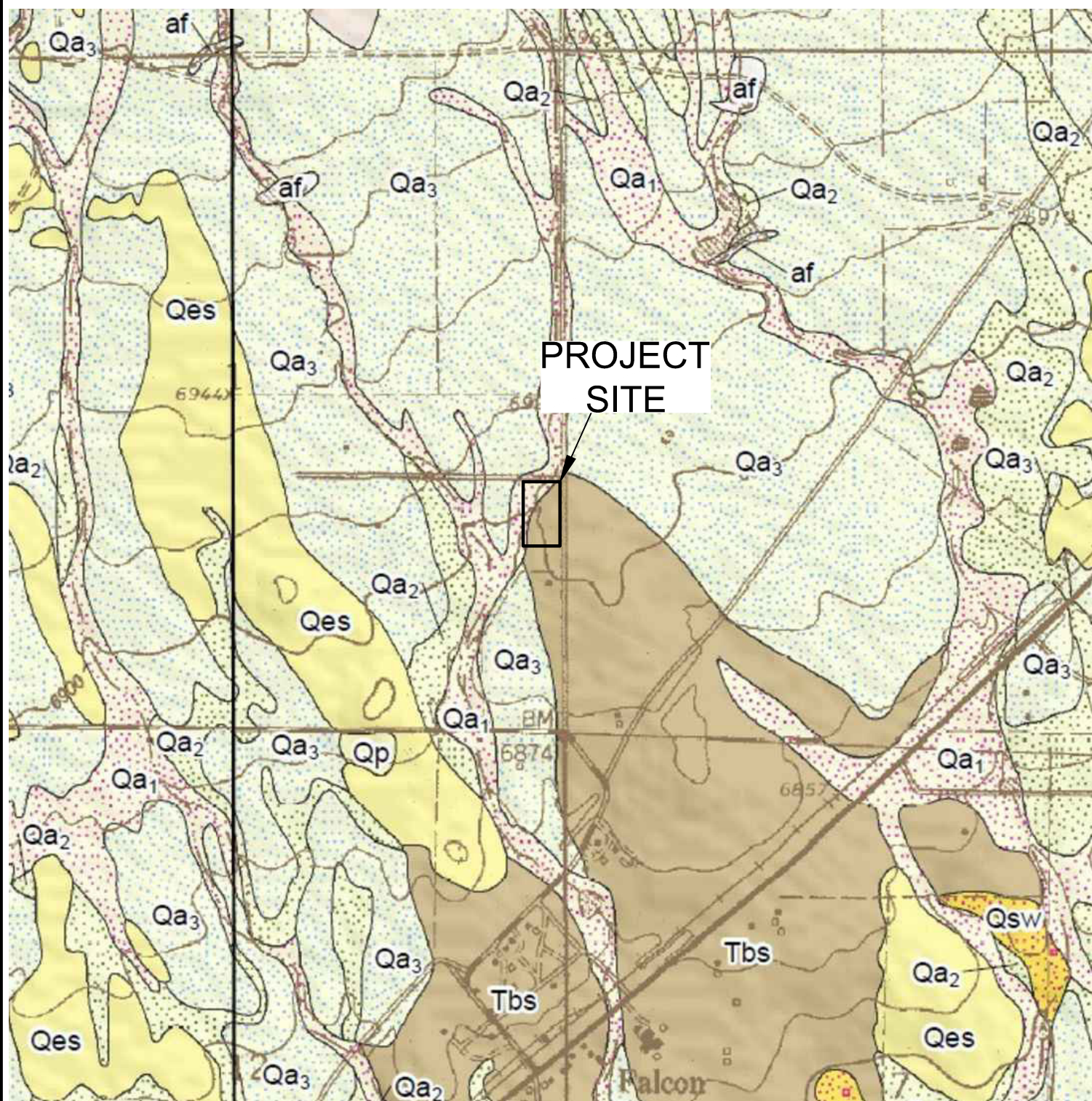


ENTECH
ENGINEERING, INC.

SOIL SURVEY MAP
11745 OWL PLACE
DOUBLETREE VENTURES

JOB NO.
230804

FIG. 4



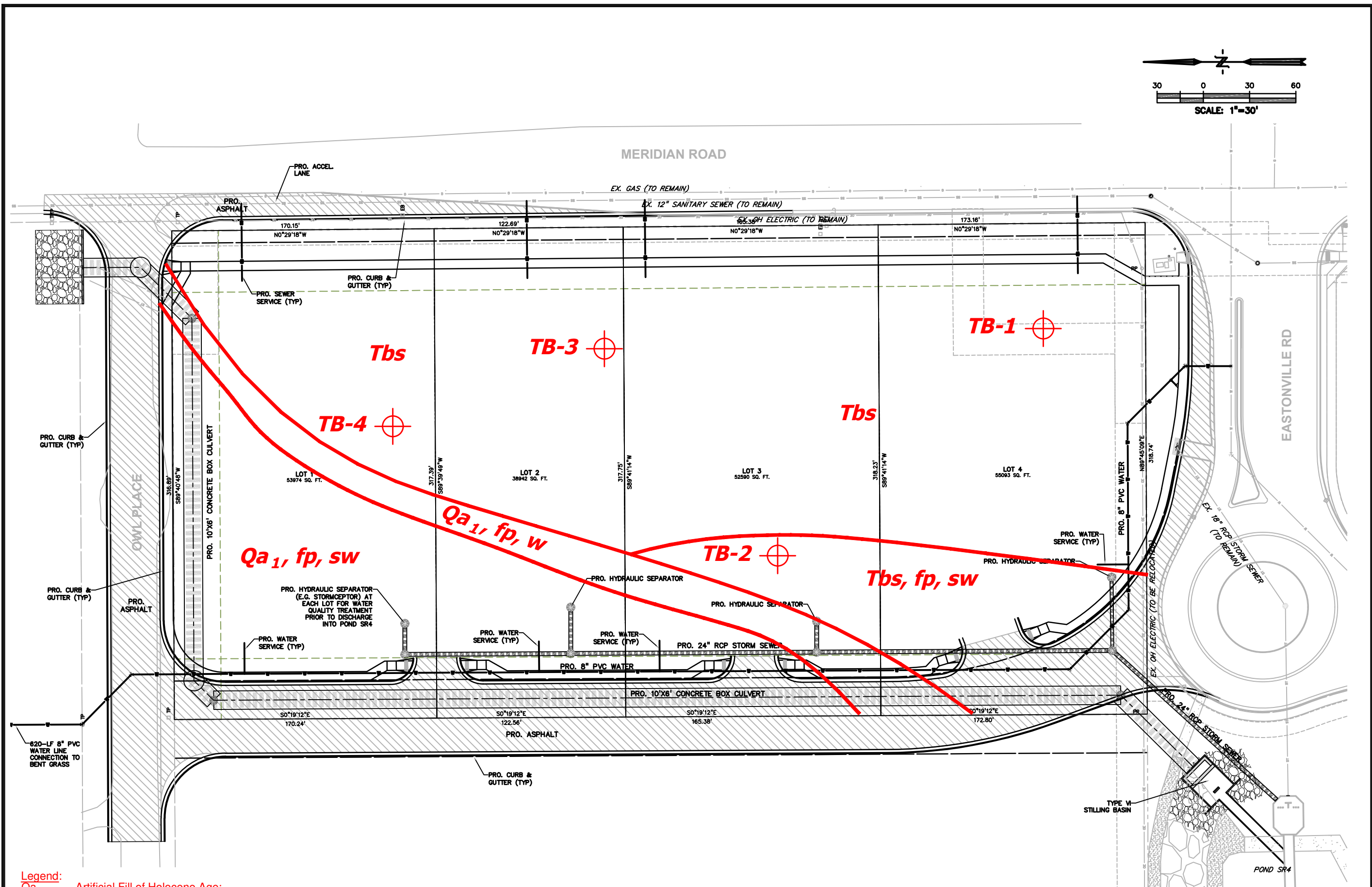
ENTECH
ENGINEERING, INC.

FALCON QUADRANGLE GEOLOGIC MAP

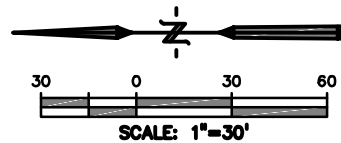
11745 OWL PLACE
DOUBLETREE VENTURES

JOB NO.
230804

FIG. 5



Legend:
Qa₁ - Artificial Fill of Holocene Age:
man-made fill deposits associated with existing erosion berms
Tbs - The Pierre Shale of Cretaceous Age:
marine deposited claystone and shale
ex - expansive soils

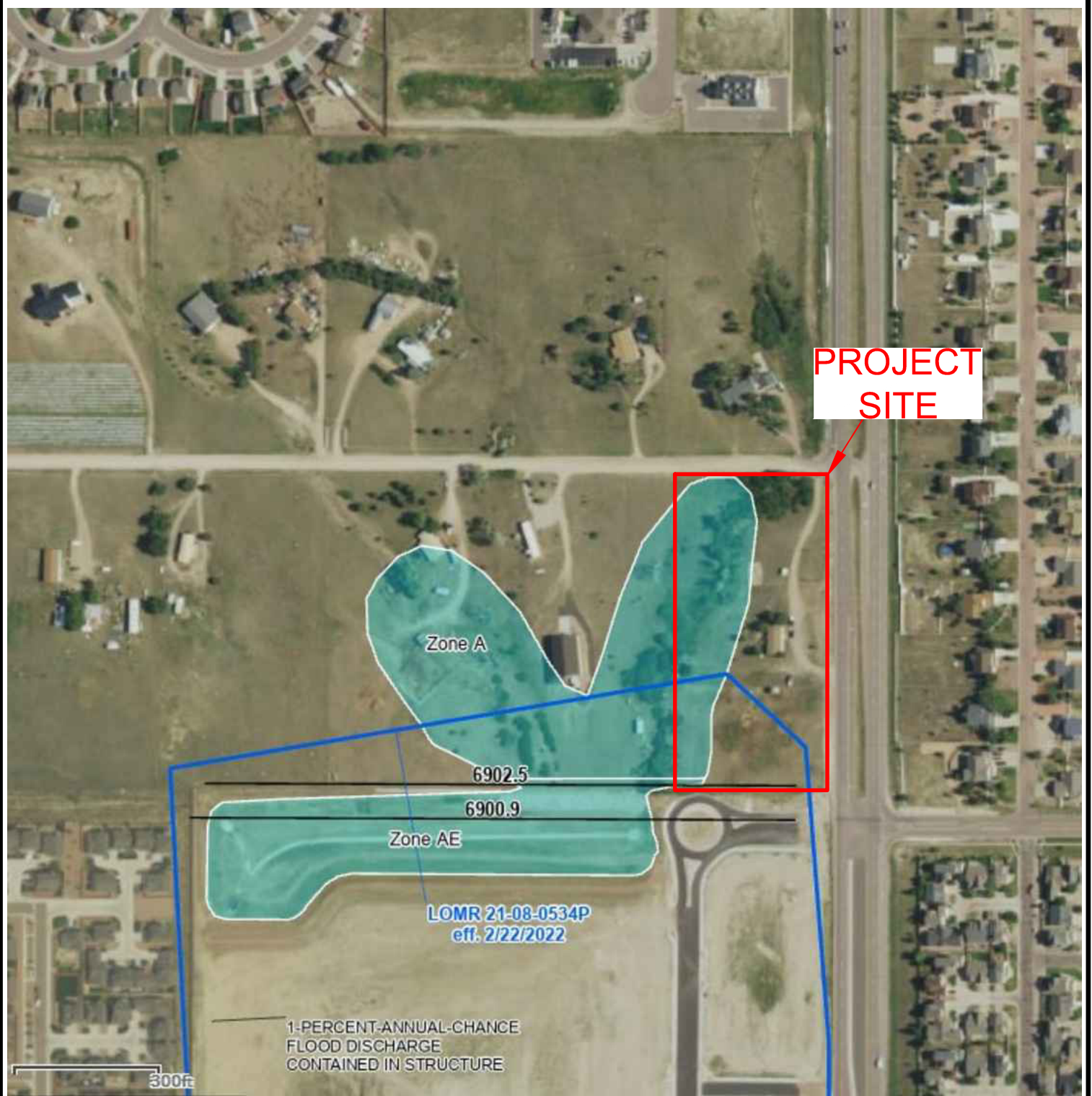


REVISION	BY



GEOLOGY/ENGINEERING MAP
VILLAS AT ASPEN TRAILS
RJ DEVELOPMENT

JOB NO.
230745
FIG. 6

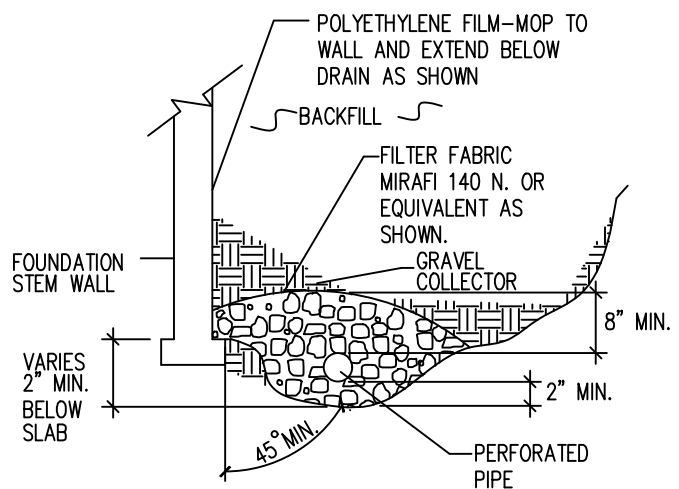
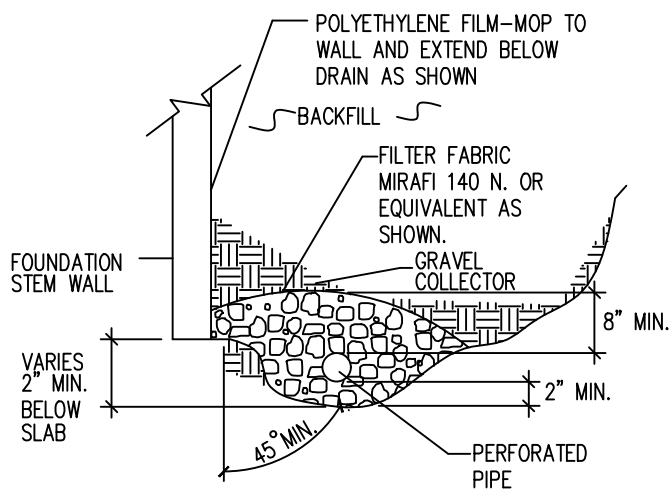


ENTECH
ENGINEERING, INC.

FEMA FLOODPLAIN MAP
11745 OWL PLACE
DOUBLETREE VENTURES

JOB NO.
230804

FIG. 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.

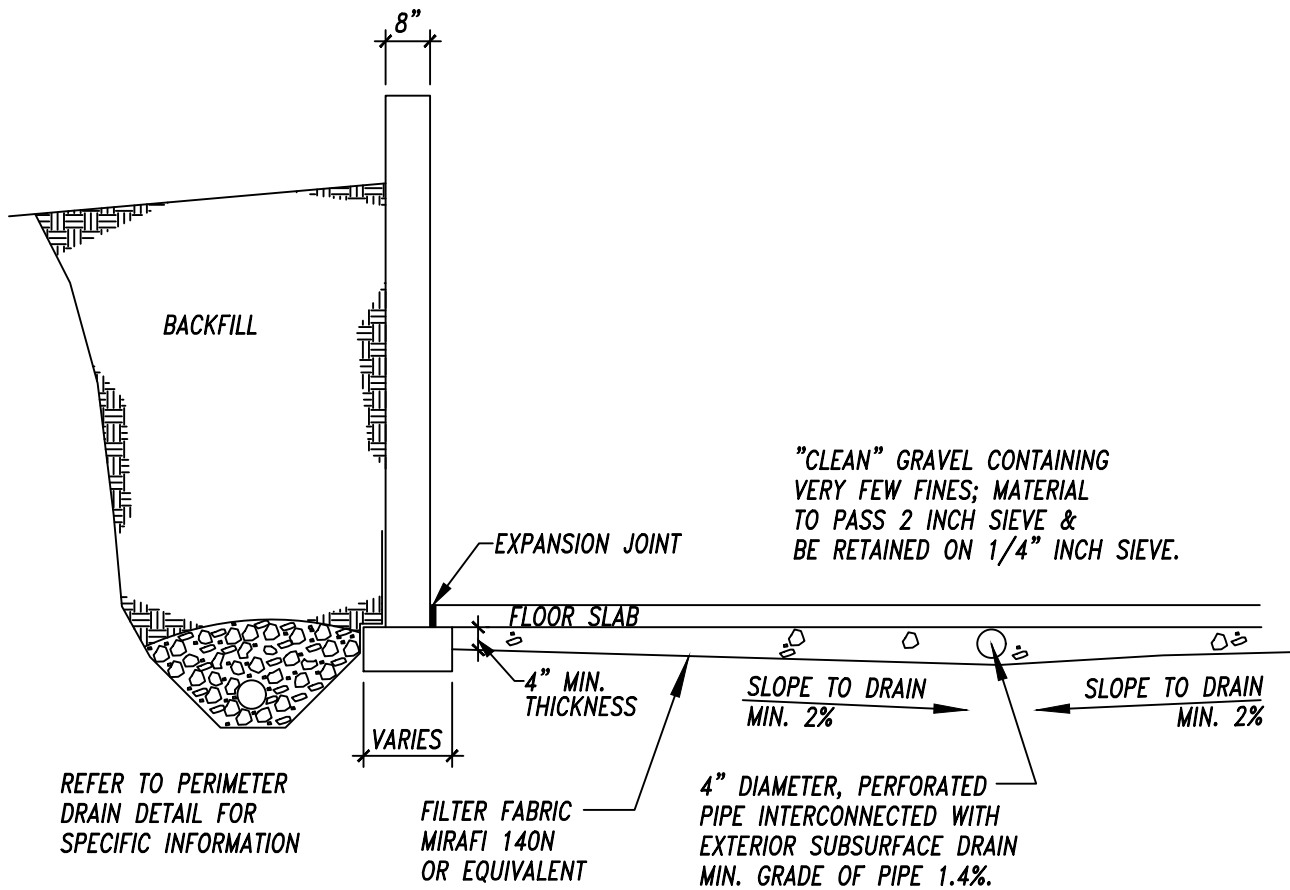


ENTECH
ENGINEERING, INC.

PERIMETER DRAIN DETAIL
11745 OWL PLACE
DOUBLETREE VENTURES

JOB NO.
230804

FIG. 8



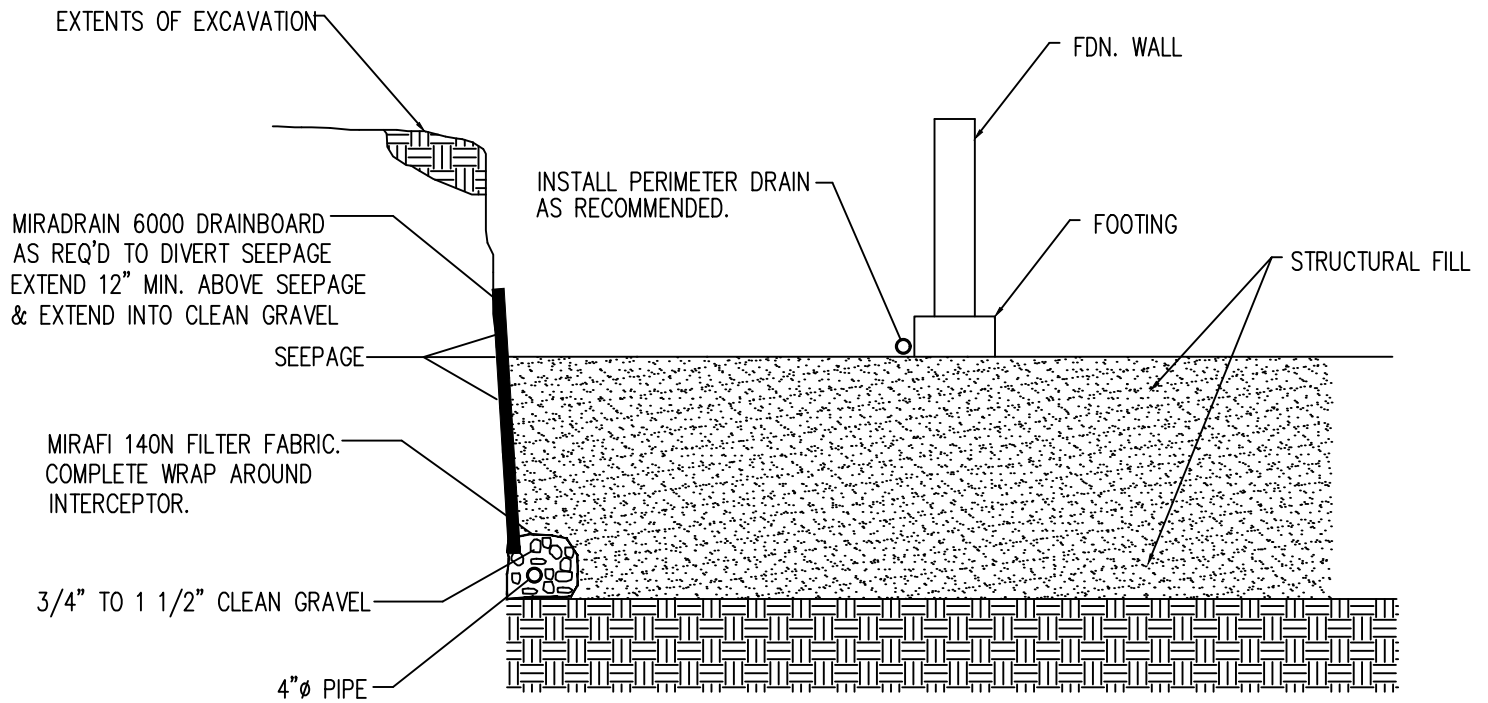
ENTECH
ENGINEERING, INC.

**TYP. UNDERSLAB DRAINAGE LAYER
(CAPILLARY BREAK)**

11745 OWL PLACE
DOUBLETREE VENTURES

JOB NO.
230804

FIG. 9



NOTE:
EXTEND INTERCEPTOR DRAIN TO UNDERDRAIN OR TO SUMP.
BENCH DRAIN INTO NATIVE SOILS 12 INCHES MINIMUM.

INTERCEPTOR DRAIN DETAIL

N.T.S.



ENTECH
ENGINEERING, INC.

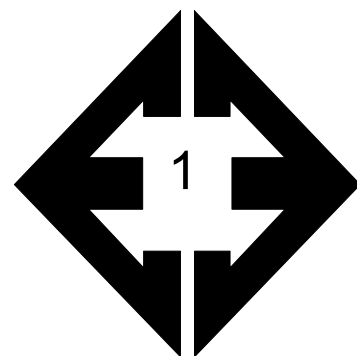
INTERCEPTOR DRAIN DETAIL

11745 OWL PLACE
DOUBLETREE VENTURES

JOB NO.
230804

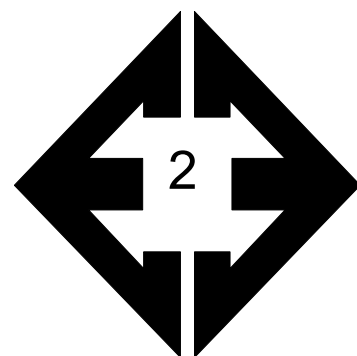
FIG. 10

APPENDIX A: Site Photographs



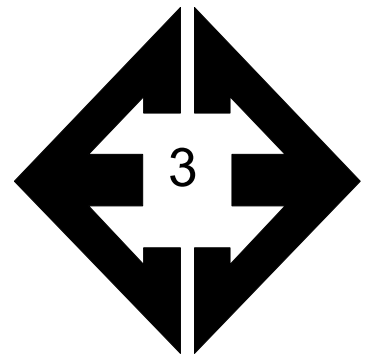
**Looking east from the
southwestern side of
the site.**

June 13, 2023



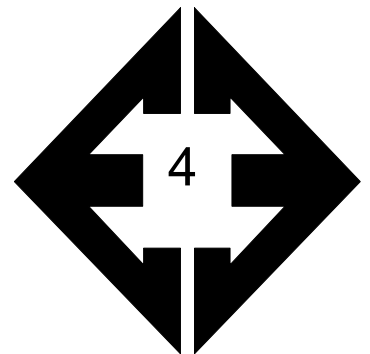
**Looking north from the
southwestern side of
the site.**

June 13, 2023



**Looking southwest
from the northeastern
side of the site.**

June 13, 2023



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

June 13, 2023

**APPENDIX B: Laboratory Testing Summary & Test Boring Logs,
Entech Job No. 230568**

TABLE 1
SUMMARY OF LABORATORY TEST RESULTS

CLIENT DOUBLETREE VENTURES
PROJECT 11745 OWL PLACE
JOB NO. 230568

SOIL TYPE	TEST BORING NO.	DEPTH (FT)	WATER (%)	DRY DENSITY (PCF)	PASSING NO. 200 SIEVE (%)	LIQUID LIMIT (%)	PLASTIC INDEX (%)	SULFATE (WT %)	FHA SWELL (PSF)	SWELL/ CONSOL (%)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION
1	1	2-3			38.6	26	8	0.02			SM	SAND, VERY SILTY
2	2	10			9.8	NV	NP	0.00			SM-SW	SANDSTONE, SLIGHTLY SILTY
2	4	15			11.7						SM-SW	SANDSTONE, SLIGHTLY SILTY
3	3	10	16.7	94.6	69.8	37	16	0.01		0.4	CL	CLAYSTONE, SANDY

TEST BORING NO. 1
DATE DRILLED 4/20/2023
REMARKS

WATER @ 16.5', 4/26/23

SAND, VERY SILTY, FINE GRAINED,
TAN, DENSE, MOIST

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

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			31	6.7	1
5			50 9"	6.0	2
10			50 7"	13.0	2
15			42	14.4	2
20			50 7"	12.9	2



TEST BORING NO. 2
DATE DRILLED 4/20/2023
REMARKS

WATER @ 15.5', 4/26/23

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

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			50	2.5	2
5			50 9"	20.7	2
10			50 7"	8.3	2
15			50 8"	12.7	2
20			50 8"	14.4	2



ENTECH
ENGINEERING, INC.

505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG
11745 OWL PLACE
DOUBLETREE VENTURES

JOB NO.
230568
FIG NO.
A- 1

TEST BORING NO. 3
DATE DRILLED 4/20/2023
REMARKS

WATER @ 10', 4/26/23

SAND, VERY SILTY, FINE GRAINED,
TAN, DENSE, MOIST

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

CLAYSTONE, SANDY, GRAY
BROWN, HARD, MOIST



Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			45	3.5	1
5			50 10"	7.2	2
10			44	17.3	3
15			50 8"	11.7	3
20			50 8"	12.3	3

TEST BORING NO. 4
DATE DRILLED 4/20/2023
REMARKS

WATER @ 10.5', 4/26/23

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



Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
					1
			50 9"	4.7	2
5			50 8"	6.4	2
10			50 8"	10.5	2
15			50 9"	13.8	2
20			50 9"	13.0	2



**ENTECH
ENGINEERING, INC.**

505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG
11745 OWL PLACE
DOUBLETREE VENTURES

JOB NO.
230568
FIG NO.
A- 2

APPENDIX C: Soil Survey Descriptions

El Paso County Area, Colorado

19—Columbine gravelly sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 367p

Elevation: 6,500 to 7,300 feet

Mean annual precipitation: 14 to 16 inches

Mean annual air temperature: 46 to 50 degrees F

Frost-free period: 125 to 145 days

Farmland classification: Not prime farmland

Map Unit Composition

Columbine and similar soils: 97 percent

Minor components: 3 percent

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

Description of Columbine

Setting

Landform: Fans, fan terraces, flood plains

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Alluvium

Typical profile

A - 0 to 14 inches: gravelly sandy loam

C - 14 to 60 inches: very gravelly loamy sand

Properties and qualities

Slope: 0 to 3 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Well drained

Runoff class: Very 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

Available water supply, 0 to 60 inches: Very low (about 2.5 inches)

Interpretive groups

Land capability classification (irrigated): 4e

Land capability classification (nonirrigated): 6e

Hydrologic Soil Group: A

Ecological site: R049XY214CO - Gravelly Foothill

Hydric soil rating: No

Minor Components

Fluvaquentic haplaquolls

Percent of map unit: 1 percent

Landform: Swales
Hydric soil rating: Yes

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 20, Sep 2, 2022

**APPENDIX D: El Paso County Health Department
Septic Records**

SEWAGE DISPOSAL INSPECTION FORM

4828

DATE 6-13-77
ENVIRONMENTALIST Dele Brockhaus

LEGAL DESCRIPTION Lat 15 Falcon Ranchette

TYPE OF CONSTRUCTION House NO. OF BEDROOMS 3

SYSTEM INSTALLED BY Same

COMMERCIAL MFG. Pre Cast SIZE 1000 gal

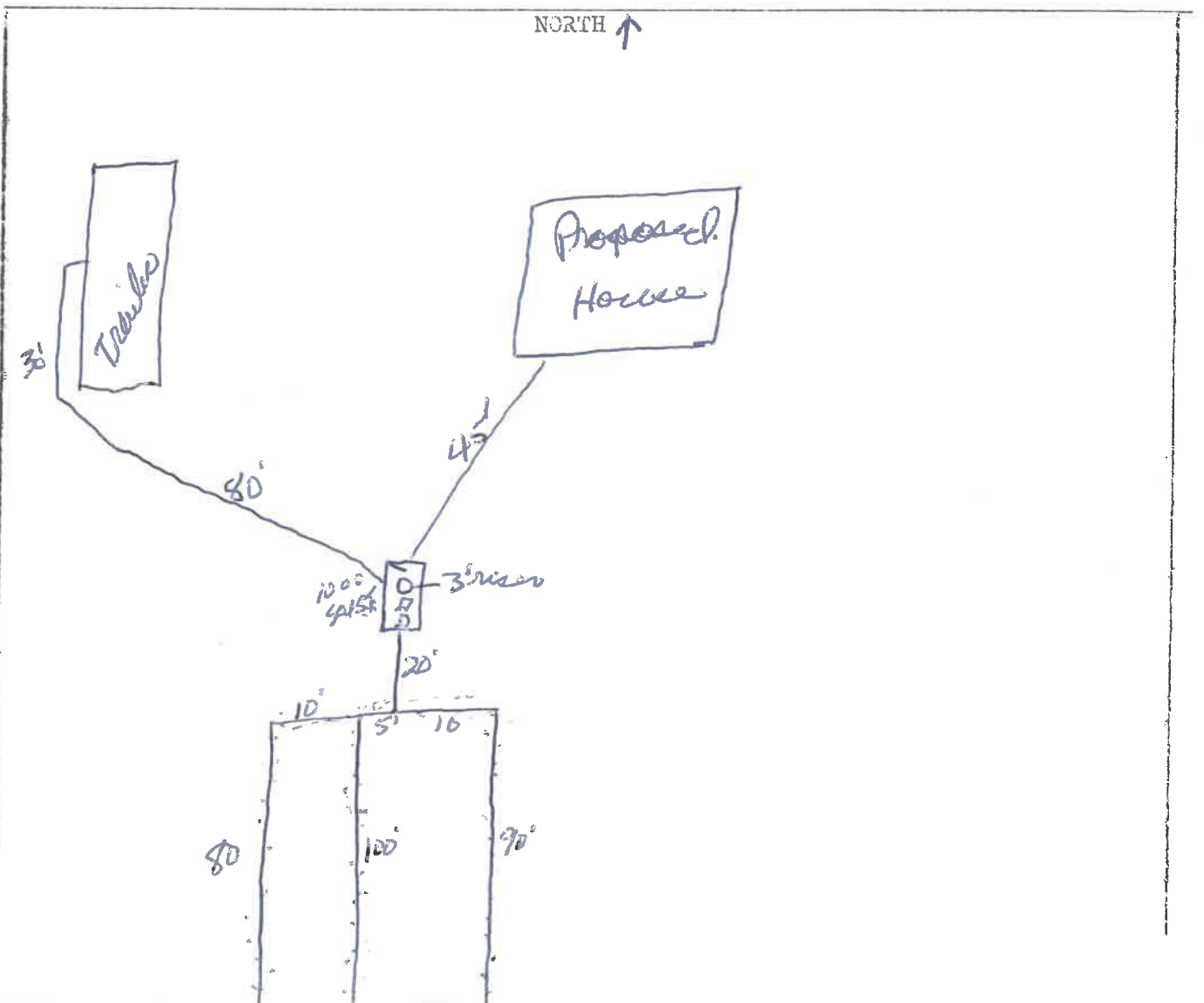
[illegible]

WIDTH 4 LENGTH _____ DEPTH (total) _____ LIQ. CAP. _____

DISPOSAL FIELD: BED OR TRENCH DEPTH 3' WIDTH 3' LENGTH 29.5' SQ. FT. 885²²

DISTANCE BETWEEN LINES 10' ROCK 3/4-2" pit DEPTH 12" UNDER 6" OVER 2"

LEACHING PITS(NO.) _____ LINING MATERIAL _____ CAPACITY SQ. FT. _____



EL PASO COUNTY CITY-COUNTY HEALTH DEPARTMENT
501 North Foote Avenue Colorado Springs, Colorado - 475-8240

Acres _____
Supply _____

Receipt No. _____

PERMIT

TO CONSTRUCT, ALTER, REPAIR OR MODIFY AN INDIVIDUAL SEWAGE DISPOSAL SYSTEM

2804

Issued To _____ Date _____

Address of Property _____
(Permit valid at this address only)

Builder - Contractor - Owner Address _____ Phone _____

Sewage-Disposal System work to be performed by _____ Phone _____

This Permit is issued in accordance with Regulation XII and Article 2 of Chapter 66, Colorado Revised Statutes 1963, as amended by the addition of a new Section 66-2-16. (H.B. 1205, 7-1-65). PERMIT EXPIRES upon completion-installation of sewage-disposal system or at the end of six (6) months from date of issue - whichever occurs first - (unless work is in progress).

- This Permit does not denote approval of zoning and acreage requirements. -

Permit Fee \$50.00 Director, City-County Health Department

Date of Expiration _____ Environmental list _____

NOTE: LEAVE ENTIRE SEWAGE-DISPOSAL SYSTEM UNCOVERED FOR FINAL INSPECTION.
24-HOUR ADVANCE NOTICE REQUIRED

Septic tank _____ gals. Field _____ Feet of trench _____ inches wide
OR. Field _____ Feet of trench _____ inches wide
Seepage bed _____ ft. long _____ sq. ft. _____ diam. _____ w/d

The Health Officer shall assume no responsibility in case of failure or inadequacy of a sewage-disposal system, beyond consulting in good faith with the property owner or representative. Free access to the property shall be authorized at reasonable times for the purpose of making such inspections as are necessary to determine compliance with requirements of this regulation.

EL PASO CITY-COUNTY HEALTH DEPARTMENT
501 NORTH FOOTE AVENUE
COLORADO SPRINGS, COLORADO
475-8240 EXT. 220

Application for permit to construct, Remodel, or Install a Sewage Disposal System

Name of Owner Ron Leary Phone 495-2840

Address of Property 7750 Meridian

Legal Description of Property Lot 15 Falcon Ranchito

Owner's Address (if different) _____ Phone _____

Systems Contractor Same Address _____

Type of Construction House Source and Type of Water Supply well

Size of Lot 5

The construction of the Sewage Disposal System will comply with all applicable Laws, Ordinances, Standards or Resolutions.

HEALTH DEPARTMENT USE ONLY

Permit Number _____ Receipt Number _____

Number of Bedrooms 3 Tank Capacity 1000 gallons Absorption area 525 Sq. Ft.

REMARKS 185' of 36"

APPLICATION IS ☒ APPROVED ☐ DENIED

ENVIRONMENTALIST John Brockman DATE 6-2 1977

PLOT PLAN WILL INCLUDE THE FOLLOWING

Plot plan may be drawn on the back of this sheet or on a seperate sheet.

1. Streams, Lakes, Ponds, Irrigation Ditches and other Water Courses
2. North Direction
3. Location of Property Line
4. Buildings
5. Wells
6. Location of Proposed Septic System
7. Location of percolation test
8. Geographical features
9. Other Information as required



chen and associates, inc.
CONSULTING ENGINEERS



SOIL & FOUNDATION
ENGINEERING

2803 NORTH EL PASO • COLORADO SPRINGS, COLORADO 80907 • 303/634-5169

May 26, 1977

Subject: Percolation Test for a Proposed
Residence on Lot 15, Falcon Ranchets
Falcon, Colorado.
Job # 14648

Mr. Ron Gary
7750 Meridian Road
Falcon Ranchets
Falcon, Colorado

Dear Sir:

As requested, we performed a percolation test at the subject site on May 24, 1977. Three percolation test holes and one profile hole were drilled. The location and typical logs are shown in the attached figures. The soils consisted of approximately 5 feet of clays overlying silty sands. No free water was encountered to a depth of 8 feet.

The tests were conducted in accordance with the standard procedures of the Department of Health, Education and Welfare. The results, as shown in the attached tables, indicate a percolation rate of 50 minutes per inch in the clay stratum and a percolation rate of 14 minutes per inch in the sand stratum.

If we can be of further service, please call.

Yours truly,

CHEN & ASSOCIATES, INC.

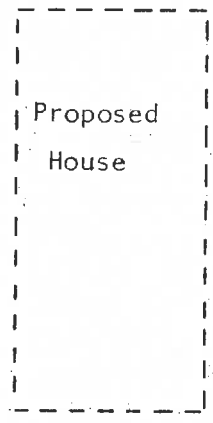
By Bill Koepf
Bill Koepf

Approved by Fu Hua Chen
Fu Hua Chen, P.E.

BK:jp

out place.

well



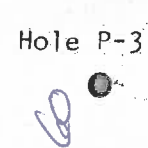
Proposed House



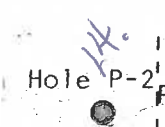
Hole P-1



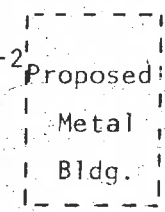
Profile Hole



Hole P-3



Hole P-2



Proposed Metal Bldg.

Meridian Road

S.W. Property Corner

S.E. Property Corner

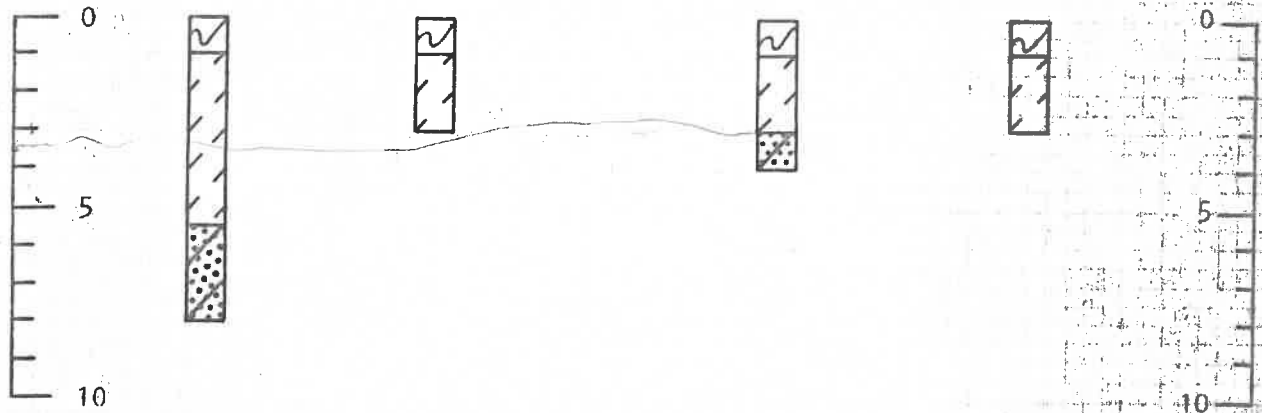
Scale 1" = 60'

Profile Hole

Hole P-1

Hole P-2

Hole P-3



Top Soil



Clay (CL) Sandy, Medium Stiff, Gray to Light Brown, Moist.



Sand (SP_SM) Slightly Silty, Medium Dense, Light Brown, Moist.

LOAN INSPECTION OF RESIDENTIAL UNIT

With's Dirks 495-2450

DATE REQUESTED 8/23/82 REQUESTED BY RONALD F. & JANE M. PHONE 495-4333

ADDRESS OF PROPERTY 7750 MERIDIAN PEGTON CO OWNER'S NAME RONALD F. GEAR

LEGAL DESCRIPTION LOT 15 FALCON RANCHETTES, PEGTON CO

INSPECTION FOR: V.A. _____ FHA X CONVENTIONAL _____

REPORT TO BE: PICKED UP X MAILED _____ FIELD DELIVERED _____

REPORT SENT TO _____

Water Supply: Public yes _____ No ✓ Private Yes ✓ No _____
Well 100 Feet from Sewage System Yes ✓ No _____
Well casing terminates in pit Yes _____ No ✓
Well casing 12 inches above ground surface Yes ✓ No _____
Water sample taken Yes ✓ No _____ Date of sample 8/24/82
Results Safe ✓ Unsafe _____ as of date of sampling.

Sewage Disposal System

Approved permitted system Yes ✓ No _____
System installed prior to permit requirements Yes _____ No ✓

Type of System (if known) circle one

- a.) Cesspool (Note: construction, alternation or repair of a Cesspool is prohibited by Statute.)
b.) Septic tank/leach lines
c.) Septic tank/absorption bed
d.) Septic tank/absorption pit (dry well)
e.) Other (describe) _____
f.) Unknown _____

Yes _____ No ✓ Sewage noted on the ground surface, at the time of inspection.

Copy of permit/Inspection report enclosed Yes ✓ No _____

COMMENTS _____

If lack of file information or other circumstances require a field visit, the charge for inspection will be \$25.00.

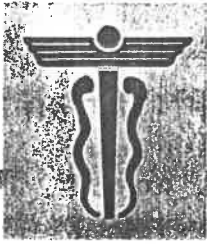
If a second visit is necessary an additional charge of \$12.50 will be assessed.

Both fees are payable BEFORE inspection will be made.

Paid: Yes ✓ No _____ Date 8/23/82 Receipt Number 7949

Second visit required Yes _____ No _____ PAID: Yes _____ No _____ Date _____
Receipt Number _____

Date 8/24/82 Time 12:00 Environmentalist Jff Kamis



3-5 days
EL PASO COUNTY HEALTH DEPARTMENT

501 NORTH FOOTE AVENUE • COLORADO SPRINGS, CO 80909-4598

AIR QUALITY CONTROL: 501 NORTH FOOTE, 80909-4598 • 578-3137

DRUG TREATMENT PROGRAM: 710 SOUTH TEJON, 80903 • 578-3150

VITAL STATISTICS: 27 EAST VERMILIO, 80903 • 520-7475

REPLY TO:

NAME John Schwarz DAY TIME PHONE 495-2365 DATE Aug. 15, '86

ADDRESS OF PROPERTY 7750 Meridian Road

LEGAL DESCRIPTION Lot 15 Falcon Ranchettes

Please supply the following on the back of this form;

1. Directions to the property.
2. Location of the well.

REPORT TO BE: Picked up X Mailed

MAILED TO:

Fees are payable before inspection will be made. If a second visit is necessary an additional charge of \$12.50 will be assessed.

Receipt Number 6468 Date 8/15/86

Receipt Number Date (2nd visit)

DO NOT WRITE BELOW THIS LINE

WATER SUPPLY

Public Private X
 X Yes No Well 100 feet from sewage system.
 Yes X No Well casing terminates in pit.
 X Yes No Well casing 12 inches above ground surface.
 X Yes No Water sample taken; Date of sample 8-19-86
Water Results: 0 Coliform 0 (growth) Other Bacteria

COMMENTS:

SEWAGE DISPOSAL SYSTEM

 X Yes No Approved permitted system.
 Yes X No System installed prior to permit requirements (3-1-66)
 Yes X No* Sewage noted on the ground surface, at the time of inspection
* This does not guarantee a properly functioning system.

Type of system

 Cesspool (construction, alteration or repair of cesspool is prohibited by Statute.)
 X Septic tank/leach lines.
 Septic tank/absorption bed.
 Septic tank/absorption pit (dry well)
 Other (describe)
 Unknown

COMMENTS: Recommendation: Weeds over leach field are several
feet tall. Weeds should be mowed down to allow sun
to shine over surface of field.

DATE: 8-19-86 TIME: 9:45 Environmentalist Julie P. Inbrassen