Architecture
Structural
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Materials Testing
Forensic
Civil/Planning

ROCKY MOUNTAIN GROUP
EMPLOYEE OWNED

SOILS AND GEOLOGY STUDY

Cleese Court
EPC Schedule No. 4100000075
El Paso County, Colorado

PREPARED FOR:

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Colorado Springs, CO 80917

JOB NO. 175674

October 1, 2020

Respectfully Submitted,
RMG – Rocky Mountain Group

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Reviewed by,
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1.0 GENERAL SITE AND PROJECT DESCRIPTION

1.1 Project Location

The project lies in the NW¼ of the NE¼ of Section 24, Township 11 South, Range 64 West of the 6th Principal Meridian in El Paso County, Colorado. The site is located in the northwest corner of the intersection of Cleese Court and Bradshaw Road. The approximate location of the site is shown on the Site Vicinity Map, Figure 1.

1.2 Proposed Land Use and Project Description

The total calculated area of the site, as recorded on the El Paso County (EPC) Assessors website, is 40 acres. The proposed site development is to consist of subdividing the 40-acre parcel into seven lots of approximately 5.00 to 5.59 acres each. The parcel included in this study is currently identified as:

- EPC Schedule No. 4100000075, currently addressed as 17720 Cleese Court and zoned *A-35, Agricultural*.

It is our understanding the proposed site development is to consist of one single family residence with a well and an on-site wastewater treatment system on each proposed lot. Each proposed new lot is anticipated to be zoned RR-5-*Residental Rural.* The Preliminary Lot Layout (Figure 2) presents the general boundaries of our investigation.

2.0 QUALIFICATIONS OF PREPARERS

This Soils and Geology Study was prepared by a professional geologist as defined by Colorado Revised Statutes section 34-1-201(3) and by a qualified geotechnical engineer as defined by policy statement 15, "Engineering in Designated Natural Hazards Areas" of the Colorado State Board of Registration for Professional Engineers and Professional Land Surveyors. (Ord. 96-74; Ord. 01-42)

The principle investigators for this study are Kelli Zigler P.G., and Tony Munger, P.E. Ms. Zigler is a Professional Geologist as defined by State Statute (C.R.S 34-1-201) with over 20 years of experience in the geological and geotechnical engineering field. Ms. Kelli Zigler holds a B.S. in Geology from the University of Tulsa. Ms. Zigler has supervised and performed numerous geological and geotechnical field investigations throughout Colorado.

Tony Munger is a licensed professional engineer with over 20 years of experience in the construction engineering (residential) field. Mr. Munger and holds a Bachelor of Science in Architectural Engineering from the University of Wyoming.

3.0 STUDY OVERVIEW

The purpose of this investigation is to characterize the general geotechnical and geologic site conditions, and present our opinions of the potential effect of these conditions on the proposed development of single-family residences within the referenced site. As such, our services exclude evaluation of the environmental and/or human, health-related work products or recommendations previously prepared, by others, for this project.

Revisions to the conclusions presented in this report may be issued based upon submission of the Development Plan. This study has been prepared in accordance with the requirements outlined in the El Paso County Land Development Code (LDC) specifically Chapter 8 last updated August 27, 2019 applicable sections include 8.4.8 and 8.4.9. and the Engineering Criteria Manual (ECM), specifically Appendix C last updated July 9, 2019.

This report presents the findings of the study performed by RMG relating to the geotechnical and geologic conditions of the above-referenced site. Revisions and modifications to the conclusions and recommendations presented in this report may be issued subsequently by RMG based upon additional observations made during grading and construction which may indicate conditions that require re-evaluation of some of the criteria presented in this report.

3.1 Scope and Objective

The scope of this study included a physical reconnaissance of the site and a review of pertinent, publically available documents including (but not limited to) previous geologic and geotechnical reports, overhead and remote sensing imagery, published geology and/or hazard maps, design documents, etc. Our services exclude the evaluation of the environmental and/or human, health-related work products or recommendations previously prepared, by others, for this project.

The objectives of our study are to:

- Identify geologic conditions that are present on this site,
- Analyze the potential negative impacts of these conditions on the proposed site development,
- Analyze the potential negative impacts to the surrounding properties and/or public services resulting from the proposed site development as it relates to existing geologic hazards,
- Provide our opinion of suitable techniques that may be utilized to mitigate the potential negative impacts identified herein.

This report presents the findings of the study performed by RMG relating to the geologic conditions of the above-referenced site. Revisions and modifications to this report may be issued subsequently by RMG, based upon:

- Additional observations made during grading and construction which may indicate conditions that require re-evaluation of some of the criteria presented in this report,
- Review of pertinent documents (development plans, plat maps, drainage reports/plans, etc.) not available at the time of this study,
- Comments received from the governing jurisdiction and/or their consultants subsequent to submission of this document.

3.2 Site Evaluation Techniques

The information included in this report has been compiled from:

- Field reconnaissance
- Geologic and topographic maps
- Review of selected publicly available, pertinent engineering reports
- Available aerial photographs
- Exploratory soil test borings by RMG

- Laboratory testing of representative site soil and rock samples by RMG
- Geologic research and analysis
- Site development plans prepared by others

Geophysical investigations were not considered necessary for characterization of the site geology. Monitoring programs, which typically include instrumentation and/or observations for changes in groundwater, surface water flows, slope stability, subsidence, and similar conditions, are not known to exist and were not considered applicable for the scope of this report.

3.3 Previous Studies and Field Investigation

Reports of previous geotechnical engineering/geologic investigations for this site and nearby sites were not available for our review.

3.4 Additional Documents

Additional documents reviewed during the performance of this study are included in Appendix A.

4.0 SITE CONDITIONS

4.1 Existing Site Conditions

The site is mostly undeveloped, other than several outbuildings located in the south-central portion of the site. A mobile home was once present on the property, but has been removed prior to this investigation. Based on a survey provided by Catamount Engineering, completed by Barron Land, referenced in Appendix A, a well is located on the new proposed Lot 6 just south of West Bijou Creek. It is our understanding an existing septic system is not present on the property, as the mobile home was not used as a permanent residence. West Bijou Creek traverses generally west to east across the site. The creek is currently in its native state throughout the property. An apparent man-made holding pond exists on the western property boundary. Apparent man-made berms exist along the southern edge of West Bijou Creek (across Lots 4 through 7) and along the front of proposed Lots 1 and 7.

4.2 Topography

Based on our site observation on August 21, 2020, the site topography is generally rolling hills and contains slopes less than 10 percent across the property. The site generally slopes downward from southwest to northeast, with an elevation difference of approximately 32 feet across the site.

4.3 Vegetation

The majority of the site consists of low lying native grasses and weeds. No deciduous trees are present on the site. The northern portion opens up to rolling hills and open fields with fewer scattered deciduous trees.

4.4 Aerial photographs and remote-sensing imagery

Personnel of RMG reviewed aerial photos available through Google Earth Pro dating back to 1999, CGS surficial geologic mapping, and historical photos by historicaerials.com dating back to 1952. The site

has remained generally undisturbed prior to 2004. A mobile home previously resided on the property, near the south-central portion of the site. The mobile home was removed prior to this investigation. According to the EPC Assessors website, a commercial shed was constructed in 2000 and remains on site, along with three additional outbuildings. RMG did not observe obvious signs of significant improvements to Bijou West Creek, other than the construction of a berm along the southern boundary of the waterway and the holding pond near the central portion of the western property line.

5.0 FIELD INVESTIGATION AND LABORATORY TESTING

5.1 Drilling

The subsurface conditions within the property were explored by drilling a total of five (5) exploratory borings on August 21, 2020, extending to depths of approximately 20 feet below the existing ground surface. The approximate locations of the RMG test borings locations are presented on the General Engineering and Geology Map, Figure 3.

The test borings were drilled with a power-driven, continuous-flight auger drill rig. Samples were obtained during drilling of the test boring in general accordance with ASTM D-1586 and D-3550, utilizing a 2-inch O.D. Split Barrel Sampler and a 2½-inch O.D. California sampler, respectively. An Explanation of Test Boring Logs and the Test Boring Logs are presented in Figures 4 through 7.

5.2 Laboratory Testing

Soil laboratory testing was performed as part of this investigation. The laboratory tests included moisture content, dry density, grain-size analyses, Atterberg Limits and Swell/Consolidation tests. A Summary of Laboratory Test Results is presented in Figure 8. Soil Classification Data is presented in Figure 9. Swell/Consolidation Test Results are presented in Figure 10.

5.3 Test Pit Excavations

Three test pits were performed by RMG to explore the subsurface soils underlying the proposed On-site Wastewater Treatment Systems. The number of test pits is in accordance with the *El Paso County Board of Health, Chapter 8, On-site Wastewater Treatment Systems (OWTS) Regulations* as required by 8.5.D.3.a.

The three test pits were located and observed by RMG. The test pits were excavated to approximately 8 feet below grade. Restrictive or limiting layers were not encountered in the test pits, though restrictive layers may be present in some locations across the site. The approximate locations of the test pits are presented in the Engineering and Geology Map, Figure 3.

5.4 OWTS Visual and Tactile Evaluation

The soils were evaluated to determine the soil types and structure. Bedrock was not encountered in the test pits. Restrictive layers were not encountered in the test pits, though restrictive layers may be present in locations across the site. Evidence of seasonal high groundwater was not observed in test pits. The soil descriptions of the test pit evaluation are presented in the Wastewater Study report referenced in Appendix A.

5.5 Groundwater

Groundwater, redoximorphic features indicating the fluctuation of groundwater or higher groundwater levels, or elevated water content were not encountered in the test borings or the tests pits performed by RMG. Fluctuations in groundwater and subsurface moisture conditions may occur due to variations in rainfall and other factors not readily apparent at this time. Development of the property and adjacent properties may also affect groundwater levels.

The presence of creeks, streams, holding ponds, or other waterways (particularly those that only intermittently contain water) are not necessarily indicative of a shallow groundwater condition. Such waterways can be fed solely from "upstream" precipitation, irrigation, and other surface sources. Shallow groundwater was not encountered in our test borings for this development. Furthermore, conditions consistent with a wide-spread shallow groundwater table were not encountered nor observed within the lots of the proposed development.

Based on our knowledge of the area and engineering design and construction techniques employed in the El Paso County area at this time, it is our opinion that there is insufficient reason to preclude full-depth basements on any of the lots in this subdivision at this time. If shallow groundwater conditions are found to exist at the time of the site specific Subsurface Soil Investigations, the feasibility of basement construction and/or any recommended mitigation measures are to be addressed at that time.

6.0 SOIL, GEOLOGY, AND ENGINEERING GEOLOGY

6.1 Geologic Conditions

Physiographically, the site lies near the center of the Denver Basin, an asymmetrical, oval-shaped, geological structural depression. This structural basin lies directly east of the Front Range and covers a large part of eastern Colorado. The formation of the Denver Basin began during the Ancestral Rockies uplift, approximately 300 million years ago. The Rampart Range fault is about 25 miles west of the site.

6.2 Subsurface Soil Conditions

The subsurface soils encountered in the test borings and test pit excavations were classified using the Unified Soil Classification System (USCS). The laboratory testing performed revealed the on-site soils classified as sandy lean clay (CL), silty sand (SM), well graded sand with silt (SW-SM) and poorly graded sand with silt (SP-SM)

Additional descriptions and the interpreted distribution (approximate depths) of the subsurface materials are presented on the Test Boring Logs. The classifications shown on the logs are based upon the engineer’s classification of the samples at the depths indicated. Stratification lines shown on the logs represent the approximate boundaries between material types and the actual transitions may be gradual and vary with location.

6.3 Bedrock Conditions

In general, the bedrock beneath the site (as mapped by the Colorado Geological Survey - CGS) is considered to be part of the Denver Basin Group D2 Sequence (Eocene), also known as the Dawson Arkose of Dawson Formation, which consists of silty sandstone with interbedded layers of claystone. The Dawson formation is thick-bedded to massive, generally light colored arkose, pebbly, and pebble conglomerate. The sandstone is generally poorly sorted with high clay content. The sandstone is generally permeable, well drained, and has good foundation characteristics. The claystone is generally well sorted with high sand content. The claystone generally is less permeable than the sandstone and is generally not suitable for direct bearing of shallow foundations.

6.4 U.S. Soil Conservation Service

The U.S. Soil Conservation Service along with USDA has identified the soils on the property as:

- 15 – Brussett loam, 3 to 5 percent slopes. The Brussett loam was mapped by the USDA to be located along and parallels the northern portion of West Bijou Creek. Brussett loam encompasses approximately 18 percent of the property. Properties of the Brussett loam include, well-drained soil, depth of the water table is anticipated to be greater than 80 inches, runoff is anticipated to be low, frequency of flooding and ponding is none, and landforms are hills. The Brussett loam is anticipated in the areas of the new residences and treatment areas on Lots 1,2 and 3.

- 66 – Peyton sandy loam, 1 to 5 percent slopes. The Peyton sandy loam was mapped by the USDA to encompass less than 10 percent of the property. Properties of the Peyton sandy loam include, well-drained soils, depth of the water table is anticipated to be greater than 80 inches, runoff is anticipated to be medium, frequency of flooding and ponding is none, and landforms include hills and flats.

- 67 – Peyton sandy loam, 5 to 9 percent slopes. The Peyton sandy loam was mapped by the USDA to encompass the south-west, western portion of the property. Properties of the Peyton sandy loam include, well-drained soils, depth of the water table is anticipated to be greater than 80 inches, runoff is anticipated to be medium, frequency of flooding and ponding is none, and landforms include hills.

The USDA Soil Survey Map is presented in Figure 11.

6.5 General Geologic Conditions

Based on our field observations and review of relevant geologic maps, a geologic map was prepared which identifies the geologic conditions affecting the development. The geologic units present on the site are presented in the Engineering and Geology Map, Figure 3.

The site generally consists of fine- to coarse-grained sand and sandy clay overlying the Dawson Formation. The sandstone is generally permeable, well drained, and has good foundation characteristics. The clay is generally considered less permeable, not as well drained and not suitable for foundations. Three geologic units were mapped at the site as:

- *Tkda – Dawson Basin Group D2 aka Formation (Eocene)* – as mapped on the Denver Basin Quadrangle, the formation is generally thick-bedded to massive and consists of poorly sorted friable sandstone with high clay content. Contains thin- to very thin interbedded claystone. Total thickness of the formation is 2,000 feet. The Dawson formation is generally resistant to erosion and foundation stability of the sandstone is good. The interbedded claystone is generally not suitable for direct bearing of shallow foundations.

- *Da – disturbed areas* – areas that are no longer in their native state, soils have been removed and/or replaced for the berms along West Bijou Creek, the man-made holding pond near the central western boundary, and miscellaneous outbuildings.

- *sw – seasonally wet* area where near-surface moisture conditions may sometimes occur.

6.6 Structural Features

Structural features such as schistocity, folds, zones of contortion or crushing, joints, shear zones or faults were not observed on the site, or in the surrounding area.

6.7 Surficial (Unconsolidated) Deposits

Minor accumulations of sediment exist at the bottom of the man-made holding pond. Swamp accumulations, sand dunes, marine terrace deposits, talus accumulations, creep, or slope wash were not observed on the site. Slump and slide debris were also not observed on the site. The alluvial deposits are non-marine terrace deposits that have been reworked from conglomerates in the Dawson Formation up-valley along nearby creeks.

6.8 Drainage of Water and Groundwater

The overall topography of the site slopes downward from the northern and southern property lines towards Bijou West Creek. Groundwater was not encountered in the test borings at the time of drilling.

West Bijou Creek is currently a defined drainage way that transverses the site from west to east across the site. It is not anticipated that the drainage of West Bijou Creek will adversely impact construction on the property.

6.9 Engineering Geology

Charles Robinson and Associates (1977) have mapped two environmental engineering units at the site as:

- 2E – Low terraces and valleys of minor tributary streams
- 7A – Physiographic floodplain where erosions and deposition presently occur and is generally subject to recurrent flooding. Include 100-year floodplain along major streams where floodplain studies have been conducted.

The engineering geology is presented in the Engineering and Geology Map, Figure 3.

6.10 Features of Special Significance

Features of special significance such as accelerated erosion, (advancing gully head, badlands, or cliff reentrants) were not observed on the property. Features indicating settlement or subsidence such as fissures, scarplets, and offset reference features were not observed on the property or surrounding areas.

Features indicating creep, slump, or slide masses in bedrock and surficial deposits were not observed on the property.

6.11 Flooding and Surface Drainage

Based on our review of the Federal Emergency Management Agency (FEMA) Community Panel No. 08041C0350G and 08041C0375G and the online ArcGIS Pikes Peak Regional Floodplain Map, the entire site lies outside of areas mapped as either 100-year or 500-year floodplains. The FEMA Map is presented in Figure 12.

7.0 ECONOMIC MINERAL RESOURCES

Under the provision of House Bill 1529, it was made a policy by the State of Colorado to preserve for extraction commercial mineral resources located in a populous county. Review of the *El Paso Aggregate Resource Evaluation Map, Master Plan for Mineral Extraction*, *Map 1* indicates the site is identified as upland deposits comprised of sand, gravel, silt and clay remnants of older stream deposits on topographic highs or beach like features. Extraction of the sand and gravel resources are not considered to be economical compared to materials available elsewhere within the county.

According to the *Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands*, the site is mapped within the Denver Basin Coal Region. However, the area of the site has been mapped "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.

8.0 IDENTIFICATION AND MITIGATION OF POTENTIAL GEOLOGIC CONDITIONS

The El Paso County Engineering Criteria Manual recognizes and delineates the difference between hazards and constraints. A geologic hazard is one of several types of adverse geologic conditions capable of causing significant damage or loss of property and life. Geologic hazards are defined in Section C.2.2 Sub-section E.1 of the ECM. A geologic constraint is one of several types of adverse geologic conditions capable of limiting or restricting construction on a particular site. Geologic constraints are defined in Section C.2.2 Sub-section E.2 of the ECM (1.15 Definitions of Specific Terms and Phrases). The following geologic conditions were considered in the preparation of this report, and are not are not anticipated to pose a significant risk to the proposed development:

- Avalanches
- Debris Flow-Fans/Mudslides
- Floodplains
- Ground Subsidence
- Landslides

- Rockfall
- Steeply Dipping Bedrock
- Unstable or Potentially Unstable Slopes
- Scour, Erosion, accelerated erosion along creek banks and drainageways
- Springs and High Groundwater

The following sections present geologic conditions that have been identified on the property:

8.1 Expansive Soils and Bedrock

The Dawson Formation is known to contain expansive soil/bedrock seams. Based on the test boring logs, test pit logs, and laboratory testing performed on the site, the sand and sandstone generally possess low swell potential and the clay and claystone (if encountered during construction) generally possess low to moderate swell potential.

Mitigation
Foundation design and construction are typically adjusted for expansive soils. If expansive soils or bedrock are encountered during construction, mitigation of these expansive materials should follow the recommendations presented in a lot-specific subsurface soil investigation performed for the proposed structure.

Typical mitigation can be accomplished by overexcavation and replacement with structural fill or by subexcavation and replacement with on-site moisture-conditioned soils.

8.2 Compressible Soils

Loose soils were not encountered in the test borings, however, the alluvial deposits are known to have low density. Any loose or compressible soils encountered beneath foundations or floor slabs will require mitigation.

Mitigation
It is anticipated the majority of the foundations will be outside the alluvial deposits along West Bijou Creek. However, if loose or compressible soils are encountered the foundation design and construction are typically adjusted for loose soils. If loose or collapsible soils are encountered during construction, mitigation of these expansive materials should follow the recommendations presented in a lot-specific subsurface soil investigation performed for the proposed structure.

Typical mitigation can be accomplished by overexcavation and replacement with structural fill or by subexcavation and replacement with on-site moisture-conditioned soils.

8.3 Surface Drainage

Although the property does not lay within a designated floodway of West Bijou Creek, its drainageway should be taken into consideration when considering the placement of the residences and OWTS treatment areas on each individual lot.

Mitigation

Due to the size of the lots within the proposed development, the drainage areas should and can be avoided by construction. Minor drainage swales and berms can be regraded. Structures should not block the drainageways. Any site grading should be done in a manner to avoid ponding of water around the structures and treatment areas. Treatment areas are not to be located in the drainageways due to the potential for seasonally wet conditions.

West Bijou Creek may need to be channelized and re-routed and/or contained. This might consist of check dams to reduce flow velocities, as well as small traps for containing sediment. The determination of the amount, location and placement of check dams and/or special erosion control features should be performed by or in conjunction with the drainage engineer who is familiar with the flow quantities and velocities of West Bijou Creek.

The man-made holding pond does intermittently retain water. Currently, RMG has not been provided with information regarding the eventual modifications to and/or usage of this existing pond. However, based on its positioning within the "Preservation Area", the pond is not anticipated to impact construction of the proposed structures. As such, the presence of the pond on the site is not anticipated to pose a risk to the proposed development.

8.4 Faults and Seismicity

Based on review of the Earthquake and Late Cenozoic Fault and Fold Map Server provided by CGS located at http://dnrwebmapgdev.state.co.us/CGSOnline/ and the recorded information dating back to November of 1900, Colorado Springs has not experienced a recorded earthquake with a magnitude greater than 1.6 during that time period. The nearest recorded earthquakes over 1.6 occurred in December of 1995 in Manitou Springs, which experienced magnitudes ranging between 2.8 to 3.5. Additional earthquakes over 1.6 occurred between 1926 and 2001 in Woodland Park, which experienced magnitudes ranging from 2.7 to 3.3. Both of these locations are in the vicinity of the Ute Pass Fault, which is greater than 10 miles from the subject site.

Earthquakes felt at this site will most likely result from minor shifting of the granite mass within the Pikes Peak Batholith, which includes pull from minor movements along faults found in the Denver basin. It is our opinion that ground motions resulting from minor earthquakes may affect structures (and the surrounding area) at this site if minor shifting were to occur.

Mitigation

The Pikes Peak Regional Building Code, 2017 Edition, indicates maximum considered earthquake spectral response accelerations of 0.185g for a short period (S_s) and 0.059g for a 1-second period (S_1). Based on the results of our experience with similar subsurface conditions, we recommend the site be classified as Site Class B, with average shear wave velocities ranging from 2,500 to 5,000 feet per second for the materials in the upper 100 feet.

8.5 Corrosive Minerals

The upper sands encountered at the site may contain corrosive minerals. The Dawson sandstone and claystone at this site typically have low resistivity values (less than 2,000 ohm-cm) and are likely to be potentially corrosive to buried concrete, ferrous metal piping and utilities.

Mitigation
To help mitigate potential corrosion, ferrous metal piping, conduit, and similar construction materials should be coated, wrapped or otherwise protected to avoid or reduce contact with the on-site soils. For environments corrosive to concrete, sulfate-resistant cement and additives should be used.

8.6 Erosion

The upper soils encountered at the site are susceptible to erosion by wind and flowing water.

Mitigation
During construction, disturbance of the site is anticipated around the building sites. Areas of the site may require regrading and revegetation. Minor wind erosion and dust problems may arise during and immediately after construction. If the problem becomes severe during this time, watering of the cut areas may be required to control dust. Installation of erosion protection or vegetation after completion of the structures is anticipated to mitigate the majority of the erosion and dust problems.

8.7 Fill Soils

Fill soils were not encountered in the test borings or test pits. A mobile home was placed on the proposed Lot 6 prior to 2004 and remained until sometime prior to this investigation. The EPC Assessors does not show record of a septic system being installed to-date. Some fill is anticipated to be present in the areas where the berms/swales exist. Additionally, limited fill soils may be encountered across the site, even where none are indicated on the test boring logs. If fill soils are encountered, they will be considered unsuitable unless appropriate documentation can be provided which indicates that the fill soils were selected, placed, and compacted as engineered structural fill.

Mitigation
If fill soils are encountered during construction, they should be removed (overexcavated) and replaced with new compacted structural fill. The on-site soils are generally suitable for re-use as structural fill. Provided that this recommendation is implemented, the presence of fill is not considered to pose a risk to proposed structures.

If an existing septic system is encountered, it will require removal. The tank, components, and any contaminated soil shall be removed from the site and disposed of properly in an approved location. The new treatment areas should not be located within the existing septic field areas unless the existing system has been properly mitigated.

8.8 Proposed Grading, Erosion Control, Cuts and Masses of Fill

A preliminary grading plan has not been prepared for the proposed new lots. However, significant depths of overlot grading and/or masses of fill are not anticipated. Based on the test borings performed for this investigation, the excavations will encounter the fine to coarse grained sand, sandy clay, and sandstone with low to moderate clay content.

The on-site soils are mildly susceptible to wind and water erosion. Minor wind erosion and dust may be an issue for a short time during and immediately after construction. Should the problem be considered severe during construction, watering of the cut areas may be required. Once construction is complete, vegetation should be re-established.

Prior to placement of any overlot grading fill or removal and recompaction of the existing materials, topsoil, low-density native soil, fill and organic matter should be removed from the fill area. The subgrade should be scarified, moisture conditioned (generally to within 2% of the optimum moisture content), and recompacted to the same degree as the overlying fill to be placed. The placement and compaction of fill should be periodically observed and tested by a representative of RMG during construction.

Mitigation

We anticipate that the deepest excavation cuts for basement level construction will be approximately 6 to 8 feet below the existing ground surface. We believe the surficial soils will classify as Type C materials as defined by OSHA in 29CFR Part 1926, dated January 2, 1990. OSHA requires temporary slopes made in Type C materials be laid back at ratios no steeper than 1.5:1 (horizontal to vertical) unless the excavation is shored or braced. Long term cut slopes in the upper soil should be limited to no steeper than 3:1 (horizontal to vertical). Flatter slopes will likely be necessary should groundwater conditions occur. It is recommended that fill slopes be no steeper than 3:1 (horizontal to vertical).

The following section presents geologic hazard that has been identified on the property:

8.9 Radon

***"Radon Act 51** passed by Congress set the natural outdoor level of radon gas (0.4 pCi/L) as the target radon level for indoor radon levels.*

Northern El Paso, CO and the 80931 zip code located in El Paso County, has an EPA assigned Radon Zone of 1. A radon zone of 1 predicts an average indoor radon screening level greater than 4 pCi/L, which is above the recommended levels assigned by the EPA. Black Forest is located in a high risk area of the country. *The EPA recommends you take corrective measures to reduce your exposure to radon gas.*

Most of Colorado is generally considered to have the potential of high levels of radon gas, based on the information provided at: http://county-radon.info/CO/El_Paso.html. There is not believed to be unusually hazardous levels of radon from naturally occurring sources at this site.

Mitigation

Radon hazards are best mitigated at the building design and construction phases. Providing increased ventilation of basements, crawlspaces, creating slightly positive pressures within structures, and sealing of joints and cracks in the foundations and below-grade walls can help mitigate radon hazards.

Measures that can be taken after the residence is enclosed include installing a blower connected to the foundation drain and sealing the joints and cracks in concrete floors and foundation walls. If the occurrence of radon is a concern, it is recommended that the residence be tested after it is enclosed and commonly utilized techniques are in place to minimize the risk.

9.0 BEARING OF GEOLOGIC CONDITIONS UPON PROPOSED DEVELOPMENT

Geologic hazards (as described in Section 8.0 of this report) that were found to be present at this site include radon, and faults/seismicity. Geologic constraints (also as described in section 8.0 of this report) such as: expansive soils/bedrock, potentially compressible soils, surface drainage, and corrosive minerals were found on the site. It is our opinion that the existing geologic and engineering conditions can be satisfactorily mitigated through proper engineering and design contraction practices and avoidance when deemed necessary.

10.0 ADDITIONAL STUDIES

The findings, conclusions and recommendations presented in this report were provided to evaluate the suitability of the site development. Unless indicated otherwise, the test borings, laboratory test results, conclusions and recommendations presented in this report are only intended for the use of the minor subdivision and are *not intended* for use for design and construction of the proposed single family residences or for any future proposed structures. We recommend that a *lot-specific subsurface soil investigation* be performed for each proposed new structure. The extent of any fill soils encountered during the lot-specific investigation(s) should be evaluated for suitability to support the proposed structures prior to construction.

Future lot-specific subsurface soil investigations should consider the proposed structure type, anticipated foundation loading conditions, location within the property, and local construction methods. Recommendations resulting from the investigations should be used for design and confirmed by on-site observation and testing during development and construction.

11.0 CONCLUSIONS

Based upon our evaluation of the geologic conditions, it is our opinion that the proposed development is feasible. The geologic conditions identified herein are not considered usual for the Front Range region of Colorado. Mitigation of geologic conditions is most effectively accomplished by avoidance. However, where avoidance is not a practical or acceptable alternative, geologic conditions should be mitigated by implementing appropriate planning, engineering, and local construction practices.

In addition to the previously identified mitigation alternatives, surface and subsurface drainage systems should be implemented. Exterior, perimeter foundation drains should be installed around below-grade habitable or storage spaces. Surface water should be efficiently removed from the building area to prevent ponding and infiltration into the subsurface soil.

All future construction should remain outside the West Bijou Creek drainageway. It is recommended West Bijou Creek be identified as a "Preservation Area", as shown on Figure 3.

The foundation and floor slabs of the structure should be designed using the recommendations provided in the lot-specific subsurface soil investigation performed for each lot. In addition, appropriate surface drainage should be established during construction and maintained by the homeowner.

We believe the surficial sand soils will classify as Type C materials and the clay soils will classify as Type B as defined by OSHA in 29CFR Part 1926, date January 2, 1990. OSHA requires temporary slopes made in Type C materials be laid back at ratios no steeper than 1.5:1 (horizontal to vertical) and slopes made in Type B materials be laid back at ratios no steeper than 1:1 (horizontal to vertical) unless the excavation is shored or braced.

Long term cut slopes in the upper soil should be limited to no steeper than 3:1 (horizontal to vertical). Flatter slopes will likely be necessary should groundwater conditions occur. It is recommended that long term fill slopes be no steeper than 3:1 (horizontal to vertical).

Revisions and modifications to the conclusions and recommendations presented in this report may be issued subsequently by RMG based upon additional observations made during grading and construction which may indicate conditions that require re-evaluation of some of the criteria presented in this report.

It is important for the Owner(s) of these properties read and understand this report, as well as the previous reports referenced above, and to carefully to familiarize themselves with the geologic hazards associated with construction in this area. This report only addresses the geologic constraints contained within the boundaries of the site referenced above.

12.0 CLOSING

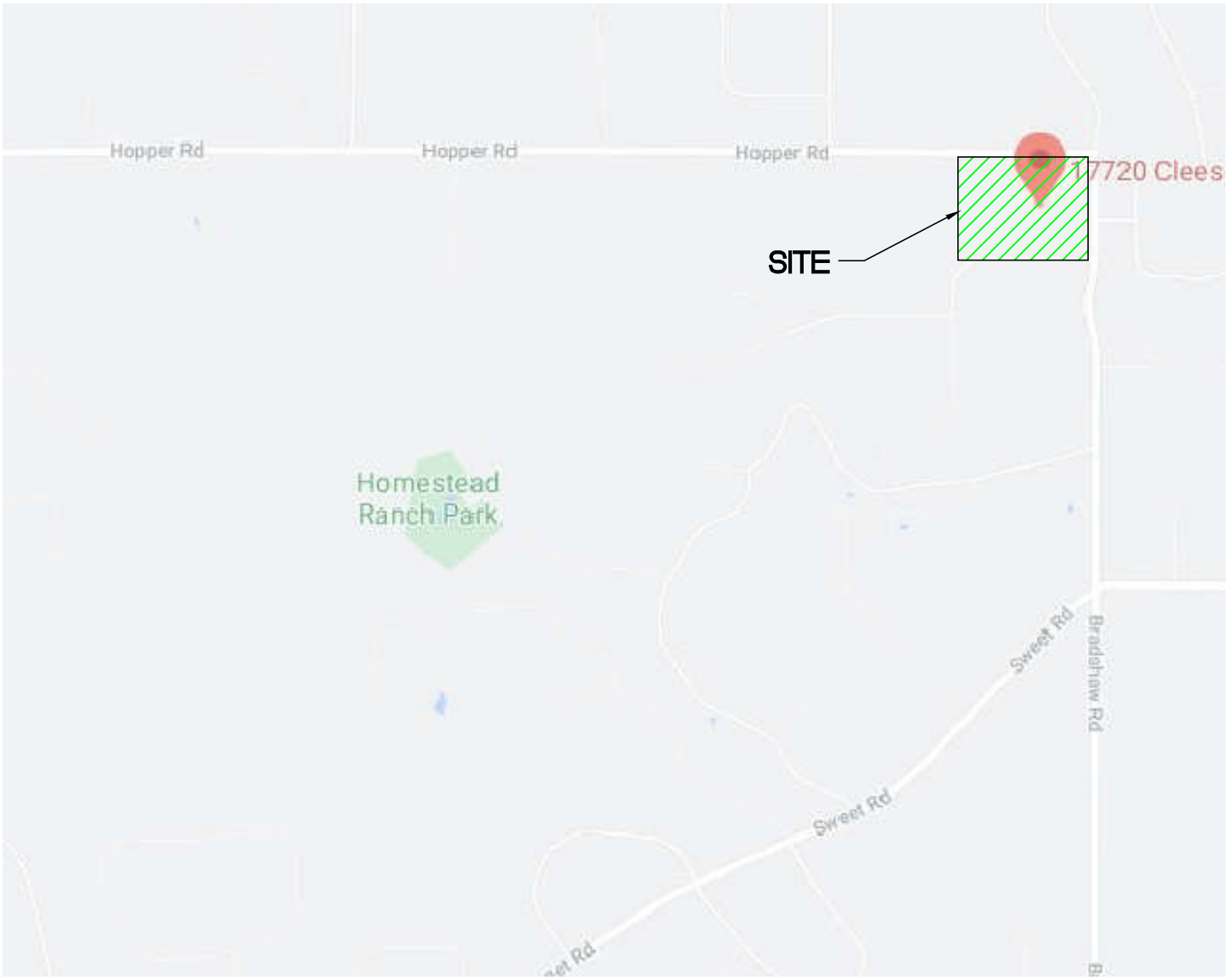
This report is for the exclusive purpose of providing geologic hazards information and preliminary geotechnical engineering recommendations. The scope of services did not include, either specifically or by implication, evaluation of wild fire hazards, environmental assessment of the site, or identification of contaminated or hazardous materials or conditions. Development of recommendations for the mitigation of environmentally related conditions, including but not limited to, biological or toxicological issues, are beyond the scope of this report. If the owner is concerned about the potential for such contamination or conditions, other studies should be undertaken.

This report has been prepared for **Adelaida Romens** in accordance with generally accepted geotechnical engineering and engineering geology practices. The conclusions and recommendations in this report are based in part upon data obtained from review of available topographic and geologic maps, review of available reports of previous studies conducted in the site vicinity, a site reconnaissance, and research of available published information, soil test borings, soil laboratory testing, and engineering analyses. The nature and extent of variations may not become evident until construction activities begin. If variations then become evident, RMG should be retained to re-evaluate the recommendations of this report, if necessary.

Our professional services were performed using that degree of care and skill ordinarily exercised, under similar circumstances, by geotechnical engineers and engineering geologists practicing in this or similar localities. RMG does not warrant the work of regulatory agencies or other third parties supplying information which may have been used during the preparation of this report. No warranty, express or implied, is made by the preparation of this report. Third parties reviewing this report should draw their own conclusions regarding site conditions and specific construction techniques to be used on this project.

If we can be of further assistance in discussing the contents of this report or analysis of the proposed development, from a geotechnical engineering point-of-view, please feel free to contact us.

FIGURES



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SITE VICINITY MAP

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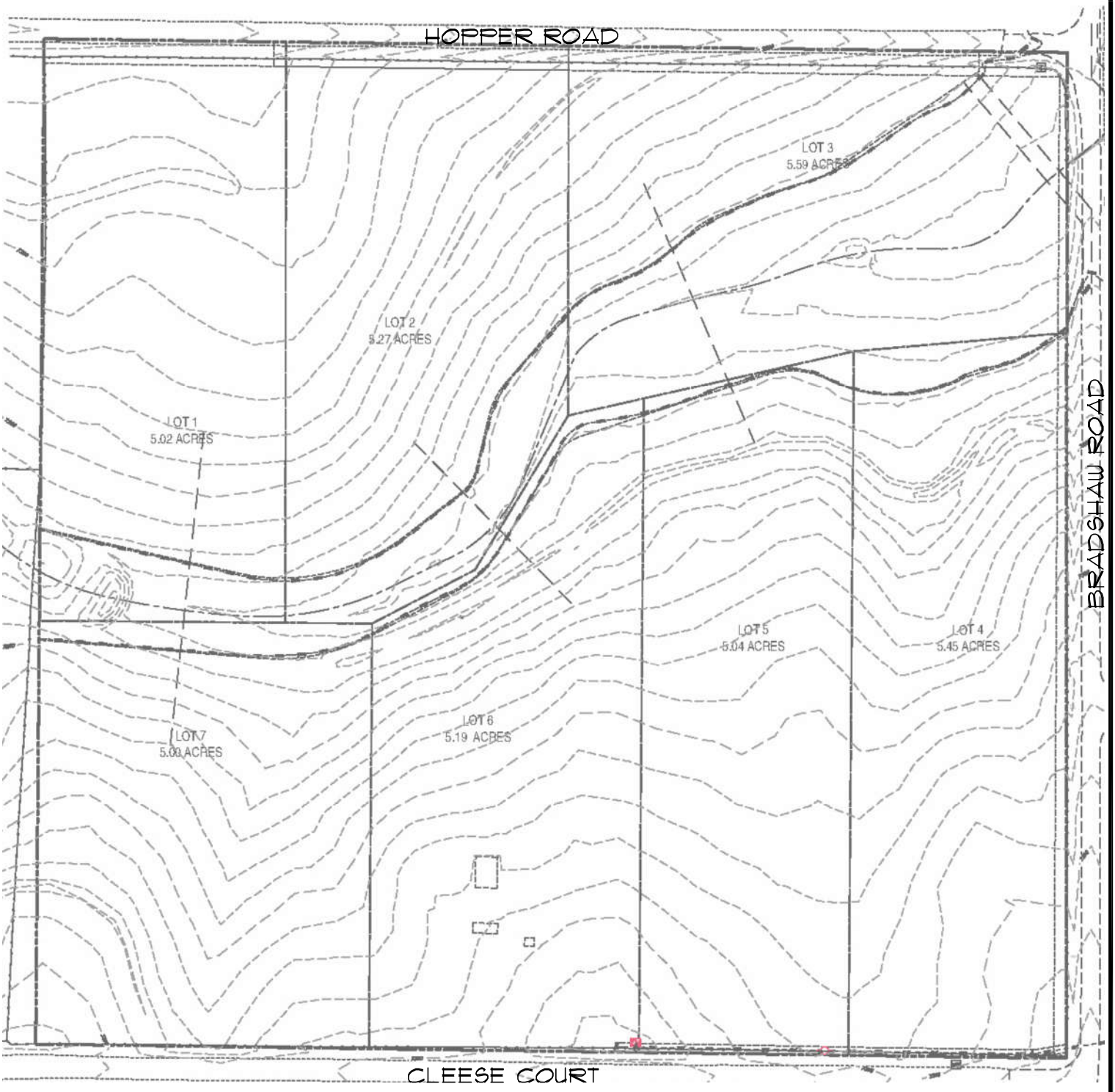
EL PASO COUNTY, COLORADO
ADELAIDA ROMENS

JOB No. 175674

FIG No. 1

DATE 10-1-2020



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Base map provided by Catamount Engineering

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PRELIMINARY LOT LAYOUT

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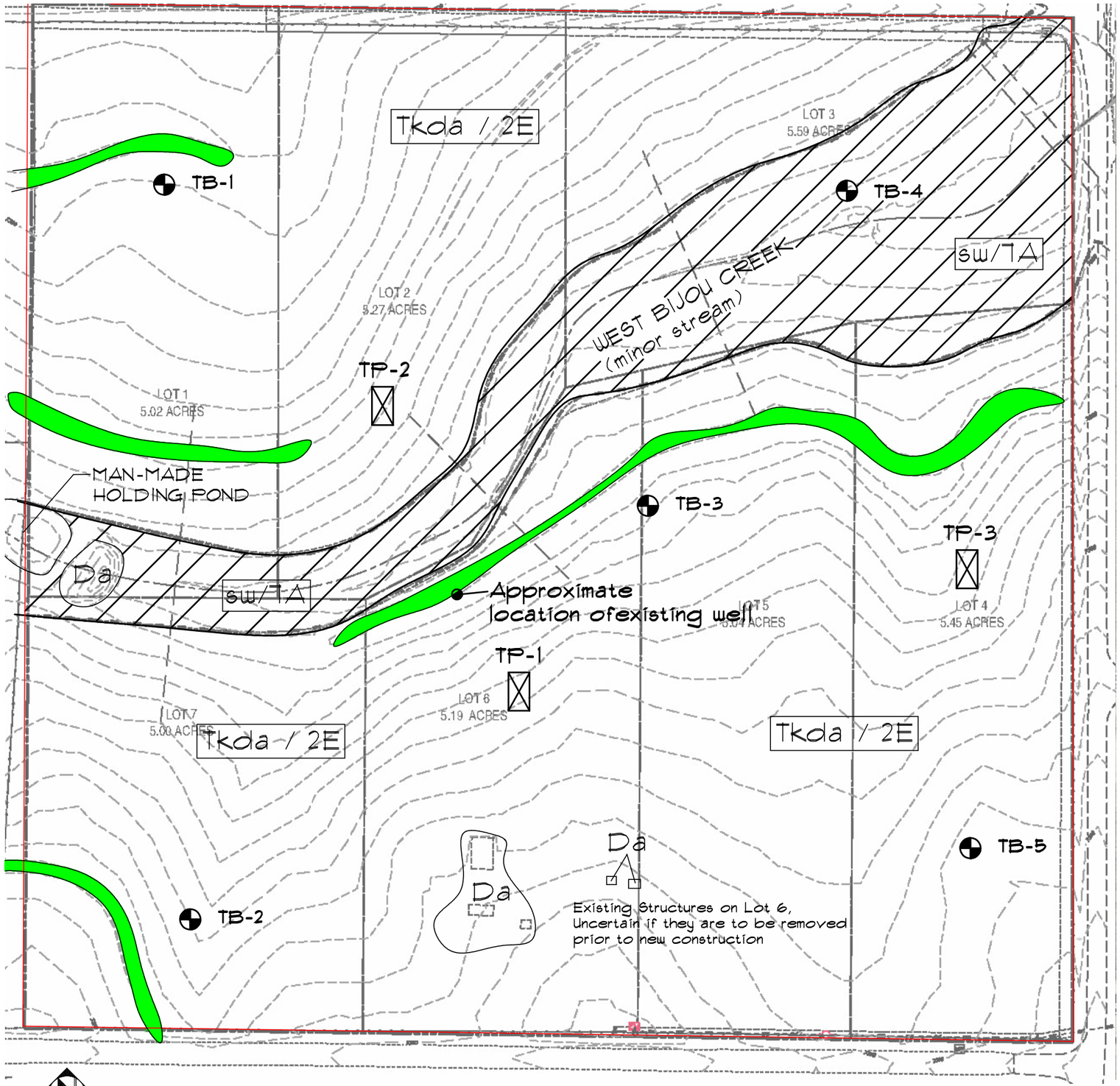
FIG No. 2

DATE 10-1-2020



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GRAPHICAL REPRESENTATION ONLY
(ALL LOCATIONS ARE APPROXIMATE)

General Geologic Units

- *Tkda - Dawson Formation (Eocene)* - the formation is generally thick-bedded to massive and consists of poorly sorted friable sandstone with high clay content. Contains thin- to very thin interbedded claystone. Total thickness of the formation is 2,000 feet. The Dawson formation is generally resistant to erosion and foundation stability of the sandstone is good. The interbedded claystone is generally not suitable for direct bearing of shallow foundations.
- *Da - disturbed areas* - areas that are no longer in their native state, soils have been removed and/or replaced for the existing driveway, existing residence, existing OWTS, and utility easements.
- *sw - seasonally wet* area where near-surface moisture conditions may sometimes occur.

Engineering Geology Units

- 2E - Low terraces and valleys of minor tributary streams
- 7A - Physiographic floodplain where erosions and deposition presently occur and is generally subject to recurrent flooding. Include 100-year floodplain along major streams where floodplain studies have been conducted

Areas not to be distruped unless other drainage improvements are proposed

Area recommended to be Preservation Area - new construction is not recommended in this area

DENOTES APPROXIMATE LOCATOIN OF TEST BORINGS PERFORMED FOR THIS INVESTIGAITON

DENOTES APPROXIMATE LOCATION OF TEST PITS OBSERVED BY RMG FOR THIS INVESTIGATION

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Woodland Park Office:
(719) 687-6077
Monument Office:
(719) 488-2145
Pueblo / Canon City:
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CLEESE COURT
EPC SCHEDULE NO. 4100000075
EL PASO COUNTY, CO
ADELAIDA ROMENS

ENGINEER:	TM
DRAWN BY:	KZ
CHECKED BY:	TM
ISSUED:	10-1-2020

ENGINEERING AND GEOLOGY MAP

SHEET No.
FIG-3

SOILS DESCRIPTION


CLAYEY SAND


SAND AND GRAVEL


SANDSTONE


SANDY CLAY


SILTY SAND


TOPSOIL

UNLESS NOTED OTHERWISE, ALL LABORATORY
TESTS PRESENTED HEREIN WERE PERFORMED BY:
RMG - ROCKY MOUNTAIN GROUP
2910 AUSTIN BLUFFS PARKWAY
COLORADO SPRINGS, COLORADO

SYMBOLS AND NOTES


XX — STANDARD PENETRATION TEST - MADE BY DRIVING A SPLIT-BARREL SAMPLER INTO THE SOIL BY DROPPING A 140 LB. HAMMER 30", IN GENERAL ACCORDANCE WITH ASTM D-1586. NUMBER INDICATES NUMBER OF HAMMER BLOWS PER FOOT (UNLESS OTHERWISE INDICATED).


XX — UNDISTURBED CALIFORNIA SAMPLE - MADE BY DRIVING A RING-LINED SAMPLER INTO THE SOIL BY DROPPING A 140 LB. HAMMER 30", IN GENERAL ACCORDANCE WITH ASTM D-3550. NUMBER INDICATES NUMBER OF HAMMER BLOWS PER FOOT (UNLESS OTHERWISE INDICATED).


FREE WATER TABLE


DEPTH AT WHICH BORING CAVED


BULK — DISTURBED BULK SAMPLE


AUG — AUGER "CUTTINGS"

4.5 — WATER CONTENT (%)

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EXPLANATION OF TEST BORING LOGS

JOB No. 175674

FIGURE No. 4

DATE Oct/01/2020

TEST BORING: **1** ELEVATION (FT): DATE DRILLED: 8/21/20 NO GROUNDWATER ON 8/21/20	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
TOPSOIL					
CLAY, SANDY, dark brown, very stiff, moist				42	11.6
	5				
SANDSTONE, SILTY, light brown with rust staining, medium hard to hard, moist				50/10"	2.6
	10				
				45	4.2
	15				
				50/11"	5.3
	20				

TEST BORING: **2** ELEVATION (FT): DATE DRILLED: 8/21/20 NO GROUNDWATER ON 8/21/20	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAY, SANDY, with gravel, light brown to dark brown, very stiff, moist				31	8.6
	5				
SAND, SILTY, light brown with rust staining, medium dense, moist				15	5.0
	10				
SANDSTONE, SILTY TO CLAYEY, light brown to gray, medium hard to hard, moist				43	7.5
	15				
				50	15.1
	20				

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TEST BORING LOG

JOB No. 175674

FIGURE No. 5

DATE Oct/01/2020

TEST BORING: **3** ELEVATION (FT): DATE DRILLED: 8/21/20 NO GROUNDWATER ON 8/21/20	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SAND AND GRAVEL, SILTY, with cobbles, brown, moist					
SANDSTONE, SILTY, TO CLAYEY, light brown with rust staining, firm to hard, moist	5			50	5.4
	10			23	7.6
	15			50/6"	13.7
	20			50/9"	12.4

TEST BORING: **4** ELEVATION (FT): DATE DRILLED: 8/21/20 NO GROUNDWATER ON 8/21/20	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
TOPSOIL					
SANDSTONE, SILTY TO CLAYEY, light brown with rust staining, medium hard to very hard, moist	5			50	9.8
	10			41	11.0
	15			50/10"	14.3
	20			50/6"	8.7

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TEST BORING LOG

JOB No. 175674

FIGURE No. 6

DATE Oct/01/2020

TEST BORING: **5**
ELEVATION (FT):
DATE DRILLED:
8/21/20
NO GROUNDWATER ON
8/21/20

DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
5			29	11.4
10			32	5.4
15			50/11"	6.4
20			50/8"	5.7

SAND, CLAYEY, with gravel, light brown to dark brown with rust staining, moist

SANDSTONE, SILTY, light brown with rust staining, firm, moist

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TEST BORING LOG

JOB No. 175674

FIGURE No. 7

DATE Oct/01/2020

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	FHA Expansion Pressure (psf)	% Swell/ Collapse	USCS Classification
1	4.0	11.6	115.4	43	28	1.8	72.1		3.7	CL
1	9.0	2.6								
1	14.0	4.2								
1	19.0	5.3								
2	4.0	8.6								
2	9.0	5.0		NP	NP	2.3	11.0			SW-SM
2	14.0	7.5								
2	19.0	15.1								
3	4.0	5.4		NP	NP	26.3	10.1			SP-SM
3	9.0	7.6								
3	14.0	13.7								
3	19.0	12.4								
4	4.0	9.8								
4	9.0	11.0								
4	14.0	14.3		NP	NP	3.9	14.0			SM
4	19.0	8.7								
5	4.0	11.4								
5	9.0	5.4		NP	NP	3.9	8.6			SW-SM
5	14.0	6.4								
5	19.0	5.7								

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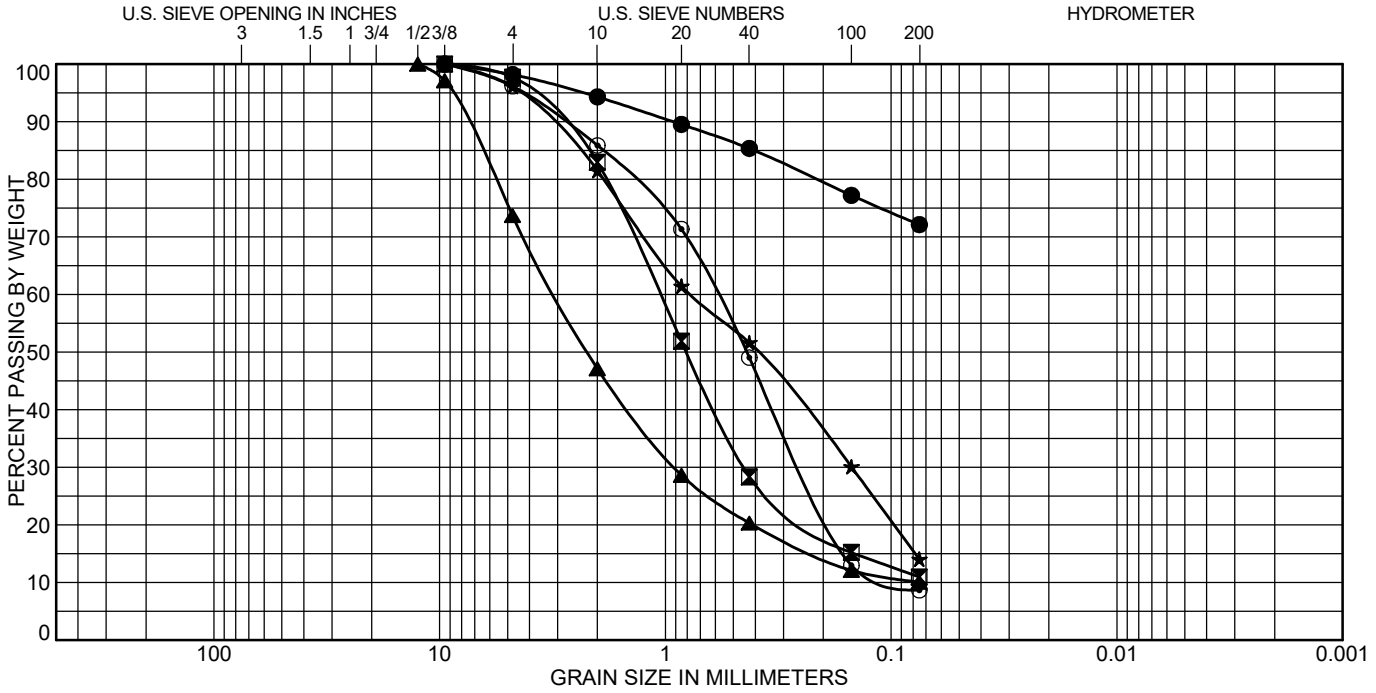
SUMMARY OF LABORATORY TEST RESULTS

JOB No. 175674
FIGURE No. 8
PAGE 1 OF 1
DATE Oct/01/2020



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	1	4.0	LEAN CLAY with SAND(CL)	43	15	28
⊠	2	9.0	WELL-GRADED SAND with SILT(SW-SM)	NP	NP	NP
▲	3	4.0	POORLY GRADED SAND with SILT and GRAVEL(SP-SM)	NP	NP	NP
★	4	14.0	SILTY SAND(SM)	NP	NP	NP
⊙	5	9.0	WELL-GRADED SAND with SILT(SW-SM)	NP	NP	NP

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	1	4.0	1.8	26.0	72.1	
⊠	2	9.0	2.3	86.8	11.0	
▲	3	4.0	26.3	63.6	10.1	
★	4	14.0	3.9	82.0	14.0	
⊙	5	9.0	3.9	87.5	8.6	

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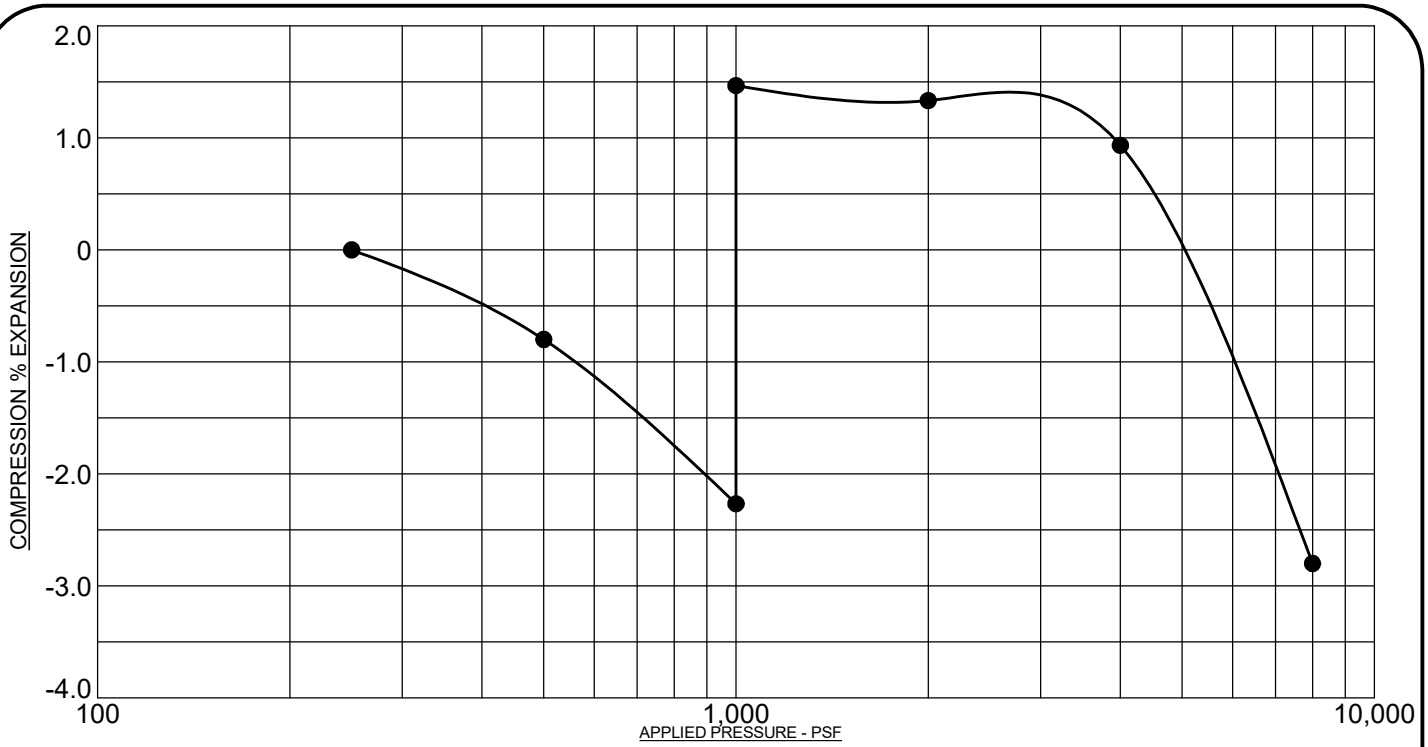
SOIL CLASSIFICATION DATA

JOB No. 175674

FIGURE No. 9

DATE Oct/01/2020



PROJECT: **Cleese Court, El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **1 @ 4 FT**
NATURAL DRY UNIT WEIGHT: **115.4 PCF**
NATURAL MOISTURE CONTENT: **11.6%**
PERCENT SWELL/COMPRESSION: **3.7**

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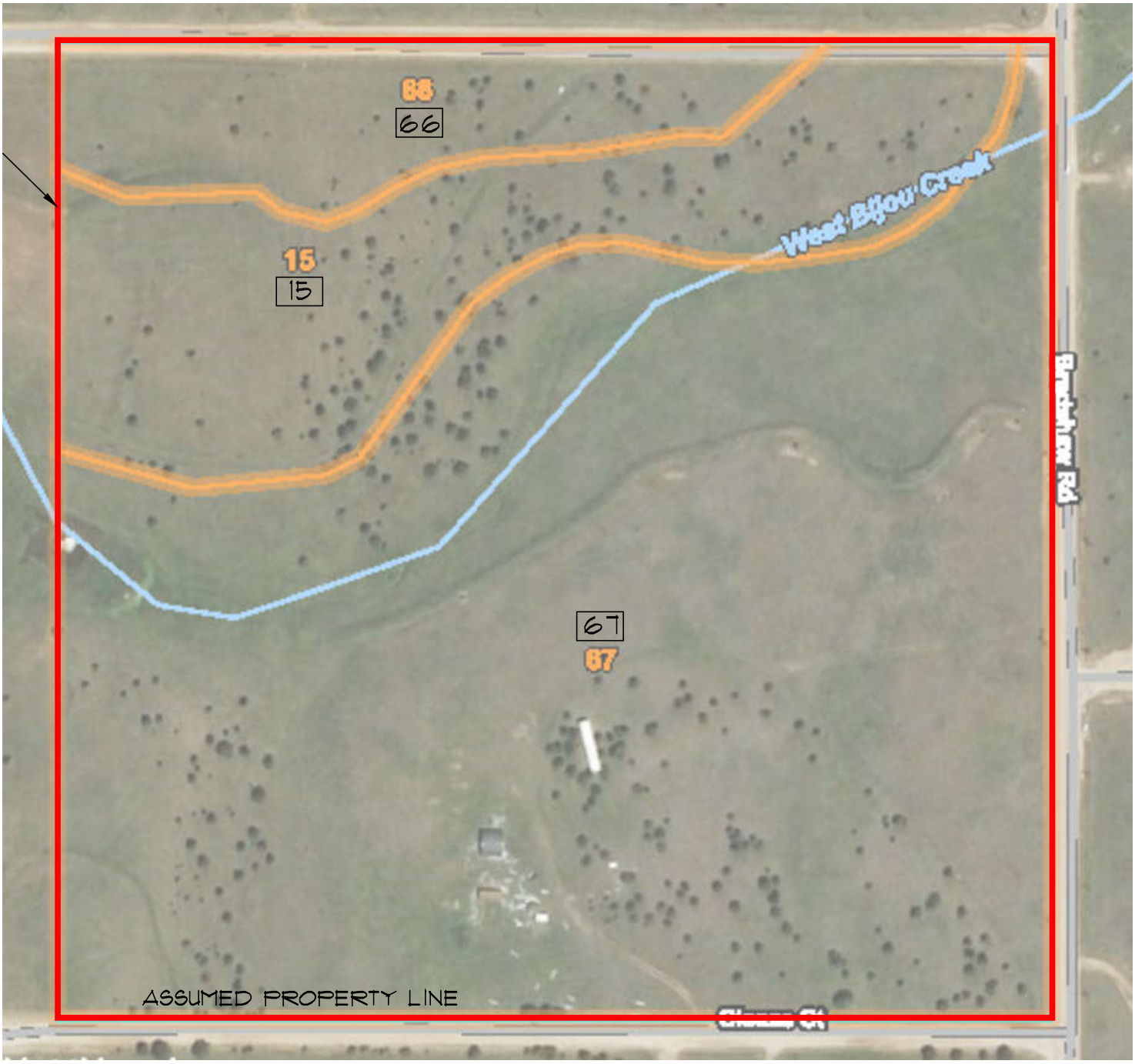
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 175674

FIGURE No. 10

DATE Oct/01/2020



Map Unit Symbol	Map Unit Name
15	Brussett loam, 3 to 5 percent slopes
66	Peyton sandy loam, 1 to 5 percent slopes
67	Peyton sandy loam, 5 to 9 percent slopes
Totals for Area of Interest	

NOT TO SCALE

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USDA SOIL SURVEY MAP

CLEESE COURT
EPC SCHEDULE NO. 4100000075
EL PASO COUNTY, COLORADO
ADELAIDA ROMENS

JOB No. 175674

FIG No. 11

DATE 10-1-2020

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FEMA MAP

CLEESE COURT
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FIG No. 12

DATE 10-1-2020

APPENDIX A
Additional Reference Documents

1. *Wastewater Study, Cleese Ct, ECP Schedule No. 4100000075, El Paso County, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 175674, last dated October 1, 2020.
2. *Improvement Survey Plan*, Barron Land, dated July 14, 2020.
3. *Preliminary Layout, Romens Subdivision,* prepared by Catamount Engineering, Job Number 20-248, not dated
4. *Flood Insurance Rate Map, El Paso County, Colorado and Unincorporated Areas, Community Panel No. 081041C0375G,* Federal Emergency Management Agency (FEMA), effective December 7, 2018.
5. *Notes on the Denver Basin geologic maps: Bedrock geology, structure, and isopath maps of the Upper Cretaceous to Paleogene strata between Greely and Colorado Springs, Colorado*, Colorado Geological Survey, Plate 1 of 13 Bedrock geologic map of the Denver Basin.
6. *Eastonville Quadrangle Geologic Map, El Paso County, Colorado,* Matthew L. Morgan and Peter E. Barkman, Colorado Geolgical Survey, Denver, CO. 2012.
7. *Elbert & Eastonville, Quadrangle, Environmental and Engineering Geologic Map for Land Use*, compiled by Dale M. Cochran, Charles S. Robinson & Associates, Inc., Golden, Colorado, 1977.
8. *Elbert & Eastonville, Quadrangle, Map of Potential Geologic Hazards and Surficial Deposits*, compiled by Dale M. Cochran, Charles S. Robinson & Associates, Inc., Golden, Colorado, 1977.
9. *Pikes Peak Regional Building Department:* https://www.pprbd.org/. https://property.spatialest.com/co/elpaso/#/property/4100000075 Schedule No.: 4100000075.
10. *Colorado Geological Survey, USGS Geologic Map Viewer*: http://coloradogeologicalsurvey.org/geologic-mapping/6347-2/.
11. *Historical Aerials:* https://www.historicaerials.com/viewer, Images dated 1952, 1955, 1968, 1999, 2005, 2009, 2011, 2013, 2015, 2017.
12. *USGS Historical Topographic Map Explorer:* http://historicalmaps.arcgis.com/usgs/ Colorado Springs Quadrangles dated 1953, 1957, 1958, 1960, 1969, 1970, 1975, and 1983.
13. *Google Earth Pro*, Imagery dated 1999, 2004, 2005, 2006, 2010, 2011, 2015, 2017, and 2019.