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SOIL, GEOLOGY AND WASTEWATER STUDY

10675 Hardy Road
EPC Schedule No. 5114000007
El Paso County, Colorado

PREPARED FOR:

Andrea Rapson
10870 Elizabeth Way
Colorado Springs, CO 80908

JOB NO. 180667

January 8, 2021

Respectfully Submitted,
RMG – Rocky Mountain Group

Kelli Zigler
Project Geologist

Reviewed by,
RMG – Rocky Mountain Group

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PROFESSIONAL ENGINEER

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Sr. Geotechnical Project Engineer

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Subsurface Soil Investigation, 10675 Hardy Road, El Paso County, Colorado, prepared by RMG – Rocky Mountain Group, Job No. 177583, dated August 3, 2020.

APPENDIX C

Profile Pit Evaluation, 10695 Hardy Road, prepared by JDM Consulting, LLC, Project number 20-127, dated July 13, 2020.

1.0 GENERAL SITE AND PROJECT DESCRIPTION

1.1 Project Location

The project lies in the SE¼ of the SE¼ of Section 14, Township 11 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado. The site is located near the southeast corner of the intersection of Black Squirrel Road and Hardy 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 19.6 acres. The proposed site development is to consist of subdividing the 19.6-acre parcel into two lots. Lot 1 is to consist of 14.337 acres and Lot 2 is to consist of 5.007 acres. The 19.6-acre parcel is currently identified as:

- EPC Schedule No. 5114000007, currently addressed as 10675 Hardy Road and is zoned "RR-5" *Residential Rural.*

The site as referenced in this report refers to the entire 19.6-acre parcel. It is our understanding the proposed development is to consist of one single-family residence with a well and an on-site wastewater treatment system on Lot 2. The existing residence, well and onsite water treatment system is to remain on Lot 1 and be addressed as 10675 Hardy Road. Lot 2 currently has not received a new address. The subdivision is to be referred to as the Rapson subdivision. The Proposed Lot Layout, Figure 2, outlines the proposed subdivision and the general boundaries of our investigation.

This report presents the results of our geologic evaluation and wastewater study for an individual on-site wastewater treatment system.

2.0 QUALIFICATIONS OF PREPARERS

This Geology and Soils report was prepared by a professional geologist as defined by Colorado Revised Statures 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 Geoff Webster, 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.

Geoff Webster, P.E. is a licensed Professional Engineer with 35 years of experience in the structural and geotechnical engineering fields. Mr. Webster holds a Master's degree from the

University of Central Florida. Mr. Webster has supervised and performed numerous geological and geotechnical field investigation programs in Colorado and other states.

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.

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
- Profile pit logs by JDM Consulting, LLC
- 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 were available for our review and are listed below.

1. *Site Plan*, provided by client, hand drawn with not date.
2. *Profile Pit Evaluation, 10695 Hardy Road*, prepared by JDM Consulting, LLC, Project number 20-127, dated July 13, 2020.
3. *OWTS Design, 10695 Hardy Road*, prepared by JDM Consulting, LLC, Project number 20-127, dated August, 20, 2020.
4. *Subsurface Soil Investigation, 10675 Hardy Road, El Paso County, Colorado,* prepared by RMG – Rocky Mountain Group, Job No. 177583, dated August 3, 2020.
5. *Soils Report, 10675 Hardy Road, El Paso County, Colorado,* prepared by Geoquest, Job #19-1125, dated December 6, 2019.

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 contains one existing structure near the center of the property. Topographically the site is gently rolling terrain and contains slopes less than 10 percent across the property. The overall slope is downward from the west to the east, with an elevation difference of approximately 28 feet across the site.

West Kiowa Creek traverses the site near the center of the property. The proposed new home on Lot 2 is to be located near the northeastern portion of the site, north of the creek, in a clear area. The trees are denser near the southern portion of the site, south of the creek, near the existing structure on Lot 1. The entire site consists of low lying native grasses and weeds, where not covered with trees.

4.2 Aerial photographs and remote-sensing imagery

Personnel of RMG reviewed aerial photos available through Google Earth Pro dating back to 1999, and historical photos by historicaerials.com dating back to 1947. The site has remained generally undisturbed since 1947. The Kiowa

5.0 FIELD INVESTIGATION AND LABORATORY TESTING

It is our understanding the existing residence on Lot 1, is still under construction and a new residence is proposed for Lot 2.

5.1 Drilling

The subsurface conditions within the area of the proposed new single-family residence was explored by RMG by drilling a total of two (2) exploratory borings, extending to 20 feet below the existing ground surface on July 8, 2020. Two (2) test pits were also observed on the same day by JDM Consulting, LLC. The approximate locations of the RMG test borings locations and the JDM Consulting, LCC test pits are presented on the General Engineering and Geology Map, Figure 3.

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. The test boring logs are included in the Subsurface Soil Investigation, presented in Appendix B.

5.2 Profile Pit Excavations

The two profile pits were performed by JDM Consulting, LLC to explore the subsurface soils underlying the proposed Onsite Wastewater Treatment Systems. The number of test pits is in accordance with Regulations of the El Paso County Board of Health, Chapter 8, Onsite Wastewater Treatment Systems (OWTS) as required by 8.5.D.3.a.

According to the JDM Consulting, LLC, Profile Pit Evaluation, the Profile Pits were excavated to 7.0 and 7.5 feet below the existing ground surface. Additional information is provided in Section 9.0, On-site Disposal of Wastewater.

5.3 OWTS Visual and Tactile Evaluation

A visual and tactile evaluation performed by JDM Consulting, LLC, is to be used in conjunction with this investigation. The soils were evaluated to determine the soils types and structure. Bedrock and restrictive layers were not encountered in the profile pits. Evidence of seasonal high groundwater was observed in the Profile Pits. Groundwater was encountered in Profile Pit PP#1 at a depth of 5.0 feet and in PP#2 at a depth 5.5 feet at the time of JDM Consulting, LLC inspection. The soil descriptions of the profile pit evaluation are presented in Appendix C.

5.4 Groundwater

Groundwater was encountered in test boring TB-1 performed by RMG at a depth of 19.5 feet and in the profile pits borings during JDM Consulting, LLC field report. Groundwater levels are anticipated to have sufficient separation from the bottom of proposed crawlspace foundation components and groundwater conditions have been considered in the completed OWTS design, referenced above.

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. 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.

6.0 SOIL, GEOLOGY, AND ENGINEERING GEOLOGY

6.1 Geologic Conditions

The site physiographically lies in the western portion of the Great Plains Physiographic Province south of the Palmer Divide. Approximately 11 miles to the west is a major structural feature known as the Rampart Range Fault. The fault marks the boundary between the Great Plains Physiographic and Southern Rocky Mountain Province. The site exists within the southeastern edge of a large structural feature known as the Denver Basin. The bedrock underlying the site consists of the Dawson Arkose Formation. Overlying this formation are unconsolidated deposits of residual soils and alluvial soils of the Holocene and late Pleistocene Age. The residual soils are produced by the in-situ action of weathering of the bedrock onsite.

6.2 Subsurface Soil Conditions

The subsurface soils encountered in the test borings performed by RMG were classified using the Unified Soil Classification System (USCS). The laboratory testing performed revealed the on-site soils classified as clayey sand (SC) and silty sand (SM).

The subsurface soils encountered in the JDM Consulting, LLC profile pit excavations were classified using the United States Department of Agriculture (USDA). The profile pit summary, revealed the onsite soils classified as sandy clay and sandy loam.

Additional descriptions and the interpreted distribution (approximate depths) of the subsurface materials are presented in the Subsurface Soil Investigation completed by RMG, presented in Appendix B. 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

Bedrock (as defined by USDA Soil Structure and Grade) was not encountered in the profile pit excavations used for this investigation. In general, the bedrock (as defined by Colorado Geologic Survey) beneath the site is considered to be part of the Dawson Formation – facies unit five 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 sandstones are poorly sorted with high clay contents. The sandstone is generally permeable, well drained, and has good foundation characteristics. The Dawson sandstone is generally not considered a restrictive layer for OWTS.

6.4 U.S. Soil Conservation Service

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

- 1 – Alamosa loam, the Alamosa loam was mapped by the USDA to encompass a "Y-shaped" section of the property to include Kiowa Creek. The Alamosa loam encompasses approximately one-third of the property. Properties of the Alamosa loam include, poorly-drained soil, depth of the water table is anticipated to be 12 to 18 inches, runoff is anticipated to be very high, frequency of flooding is none to frequent and ponding is none. Landforms include floodplains and fans. The hydrologic soil group of the unit is D. The Alamos loam is anticipated in the area of the new residence and treatment area on the new lot.

- 25 – Elbeth sandy loam, 3 to 8 percent slopes. Elbeth sandy loam was mapped by the USDA to encompass the majority of the site, approximately 60 percent of the property. Properties of the Elbeth sandy loam include, well-drained soils, depth of the water table is anticipated to be greater than 80 inches, frequency of flooding and ponding is none, and landforms include hills. The hydrologic soil group of the unit is B.

The Elbeth sandy loam, with slopes ranging between 8 to 15 percent were mapped on the very northeastern corner. This map unit is not discussed in further detail due to the visual selection of the property boundaries for the area of interest displayed. The map unit is considered to be less than a percent of the total property and is not influential to the location of the proposed residence and/or OWTS.

The USDA Soil Survey Map is presented in Figure 9.

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 silty to clayey sand overlying the Dawson Formation. The silty sand is generally permeable, well drained, and has good foundation characteristics, as the clay content increases the permeability and foundation characteristics decline. The sandstone is considered less permeable, not as well drained and generally suitable for foundations. Three geologic units were mapped at the site as:

- *Qau – alluvium, undivided (Holocene and Pleistocene)* – as mapped on the Black Forest Quadrangle, the formation is generally well to moderately sorted, sand and minor silt deposited primarily by water. Unit may contain variable amounts of silt and clays and may contain unmapped patches of loess. Total thickness of the unit is estimated between 10 to 20 feet. The alluvium sediments are generally dry, of low density, high porosity; soils with such properties may be prone to settlement upon wetting. Alluvium sand was encountered in the test borings to depth of approximately 20 feet.

- *$Tkda_5$ – Dawson Formation, facies 5 (early to middle(?) Eocene)* – the facies 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. Bedrock was not encountered in the test borings performed by RMG.

- *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.

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

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 is fairly level, with a gentle slope from the west to the east. Groundwater was encountered in RMG's TB-1 at approximately 19.5 feet and at 5.0 to 5.5 feet in the profile pits observed JDM Consulting, LLC, below the existing ground surface. Both the test borings and profile pits were located within the same general area and near the same elevation. Groundwater water depths are anticipated to fluctuate throughout the year, and may affect basement foundation construction. Basement construction is not proposed at this time.

6.9 Engineering Geology

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

- 1A – Stable alluvium, colluvium and bedrock on gentle slopes (0 to 5%).

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. 08041C0310G 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 10.

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
- Expansive Soils and Bedrock
- 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 section presents the geologic conditions that have been identified on the property:

8.1 Loose and 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.

Add as platy note and summarize in LOI

Mitigation

As stated in the Subsurface Soil Investigation completed by RMG, if loose soils are encountered during the Open Excavation Observation, they may require additional compaction to achieve the allowable bearing pressure indicated in this report. Fluctuations in material density may occur. In some cases, removal and recompaction of up to 2 feet of soil may be required. The removal and recompaction shall extend a minimum of 2 feet beyond the building perimeter, and at least that same distance beyond the perimeter of counterfort and "T" wall footings. The use of track-mounted excavation equipment, or other low ground pressure equipment, is recommended on loose soils to reduce the likelihood of loss of stability during excavation.

The following section presents the geologic hazards that have been identified on the property:

8.2 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.

Add as platy note and summarize in LOI

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.

All construction should remain outside the West Kiowa Creek drainageway. It is recommended West Bijou Creek be identified as a "Preservation Area" unless additional studies are performed, in conjunction with the drainage engineer, prior to any new construction. This area is shown on Figure 3.

8.3 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 15 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 0.183g for a short period (S_s) and 0.056g 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 D, with average shear wave velocities ranging from 2,500 to 5,000 feet per second for the materials in the upper 100 feet.

8.4 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.*

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 ON-SITE DISPOSAL OF WASTEWATER

It is our understanding an On-site Wastewater Treatment Systems (OWTS) is proposed. An individual well and septic system is proposed for the new single family residence. The site was evaluated by JDM Consulting, LLC. Two profile pits were performed within or near the probable OWTS location to obtain a general understanding of the soil and bedrock conditions. The Profile Pit Logs are presented in Appendix C.

9.1 Subsurface Materials

The subsurface materials encountered in the profile pit excavations evaluated by JDM Consulting, LLC were classified using Table 10-1 Soil Treatment Area Long-term Acceptance Rates from the EPCDHE Chapter 8, OWTS Regulations and the USDA Soil Structure Shape and Grade. The materials were grouped into the following general categories:

- *Sandy Clay:*
  USDA Soil Texture: Sandy Clay
  USDA Soil Type: 4
  USDA Structure Type and Grade: Blocky, Strong
  Non-cemented

- *Sandy Clay:*
  USDA Soil Texture: Sandy Clay
  USDA Soil Type: 4A
  USDA Structure Type and Grade: Massive, Structureless
  Non-cemented

- *Sandy Loam:*
  USDA Soil Texture: Sandy Loam
  USDA Soil Type: 2
  USDA Structure Type and Grade: Massive, Granular

Non-cemented

The soils on the proposed new lot were identified as sandy clay and sandy loam as indicated by the JDM Consulting, LLC. According to JDM Consulting, LLC, limiting layers were not encountered in the profile pits. The long term acceptance rates (LTAR) associated with the most restrictive soils observed in the profile pits was 0.15 gallons per day per square foot (gpd/sf) for the sandy loam (Soil Type 4A). Groundwater and indications of seasonally shallow groundwater were observed in the profile pit excavations by JDM Consulting, LLC at the time of their field observation.

9.2 Bedrock Conditions

Bedrock (as defined by USDA Soil Structure and Grade) was not encountered in the profile pit excavations by JDM Consulting, LLC. In general, the bedrock (as defined by Colorado Geologic Survey) beneath the site is considered to be part of the Dawson. The Dawson sandstone is generally considered a restrictive layer for OWTS.

9.3 Treatment Areas

Treatment areas at a minimum must achieve the following:

- The treatment areas must be 4 feet above groundwater or bedrock as defined by the Definitions 8.3.4 of the Regulations of the El Paso County Board of Health, Chapter 8 OWTS Regulations, most recently amended amended May 23, 2018;
- Prior to construction of an OWTS, an OWTS design prepared per *the Regulations of the El Paso County Board of Health, Chapter 8 OWTS Regulations* will need to be completed. A scaled site plan and engineered design will also be required prior to obtaining a building permit.
- Comply with any physical setback requirements of Table 7-1 of the El Paso County Department of Health and Environment (EPCHDE);
- Treatment areas are to be located a minimum 100 feet from any well (existing or proposed), including those located on adjacent properties per Table 7-2 per the EPCHDE;
- Treatment areas must also be located a minimum 50 feet from any drainages, floodplains, or ponded areas, and 25 feet from dry gulches.
- The new parcel, shall be laid out to insure that a minimum of 2 sites are appropriate for an OWTS and do not fall within any restricted areas, (e.g. utility easements, right of ways). Based on the profile pit observations performed by JDM Consulting, LLC, the parcel has a minimum of two locations for the OWTS as presented on the Septic Suitability Map, Figure 6.

Contamination of surface and subsurface water resources should not occur provided the OWTS is installed according to the El Paso County Guidelines and property maintained. The areas where OWTS sites are not recommended are also indicated on Figure 6.

In summary, it is our opinion the site is suitable for individual on-site wastewater treatment systems within the cited limitations; however, groundwater (perched water) conditions may restrict the type of system that can be installed. It should be noted that the LTAR values stated above are for the

Add mitigation and no-build restrictions for septic system in areas of shallow groundwater to plat. Summarize in LoI.

profile pit locations performed for JDM Consulting, LLC report only. JDM Consulting, LLC has recommended a design base on an LTAR of 0.15 GPD/SF and an above grade uniformly pressure dosed soil treatment is required for Lot 2.

This does not constitute an OWTS design. The individual OWTS design for Lot 2 has been designed by JDM Consulting LLC.

10.0 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: potentially compressible soils 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.

11.0 ADDITIONAL STUDIES

The findings, conclusions and recommendations presented in this report were provided to evaluate the suitability of the site for future development. Unless indicated otherwise, the test borings, laboratory test results, conclusions and recommendations presented in this report are intended for use for design and construction.

A site-specific Subsurface Soil Investigation has been performed by RMG and the Profile Pit Evaluation and OWTS Design have been prepared by JDM Consulting, LLC., all recommendations are to be followed for the proposed single family residence and the onsite wastewater system.

Add as plat note

12.0 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 unusual 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.

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,

Add as plat note

appropriate surface drainage should be established during construction and maintained by the homeowner.

All construction should remain outside the West Kiowa Creek drainageway. It is recommended West Bijou Creek be identified as a "Preservation Area" unless additional studies are performed, in conjunction with the drainage engineer, prior to any new construction. This area is shown on Figure 3.

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.

13.0 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 **Andrea Rapson** 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

NOT TO SCALE

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SITE VICINITY MAP

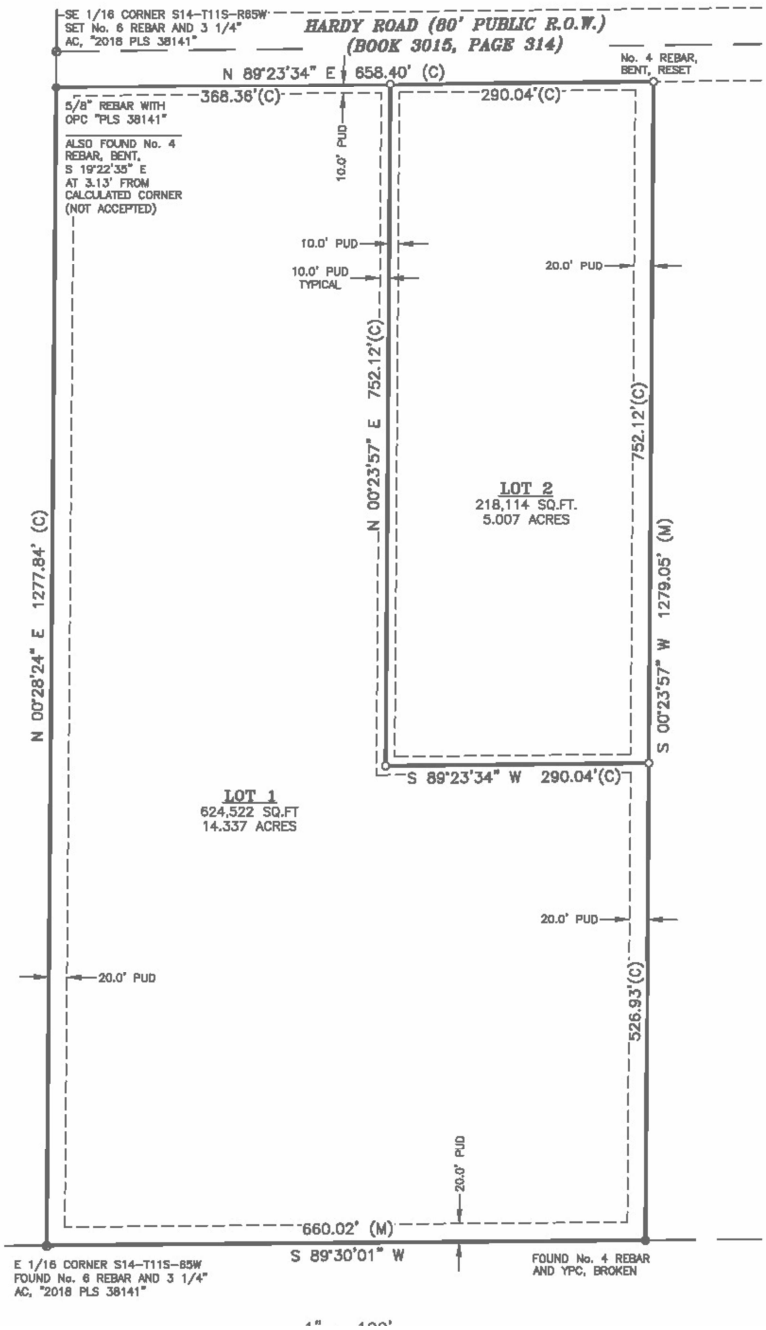
10675 HARDY ROAD
EPC SCHEDULE NO. 5114000007
EL PASO COUNTY, COLORADO
ANDREA RAPSON

JOB No. 180667

FIG No. 1

DATE 1-7-2021

AS PLATTED DETAILS



NOT TO SCALE
Base map provided by Barron Land

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PROPOSED LOT LAYOUT

10675 HARDY ROAD
EPC SCHEDULE NO. 5114000007
EL PASO COUNTY, COLORADO
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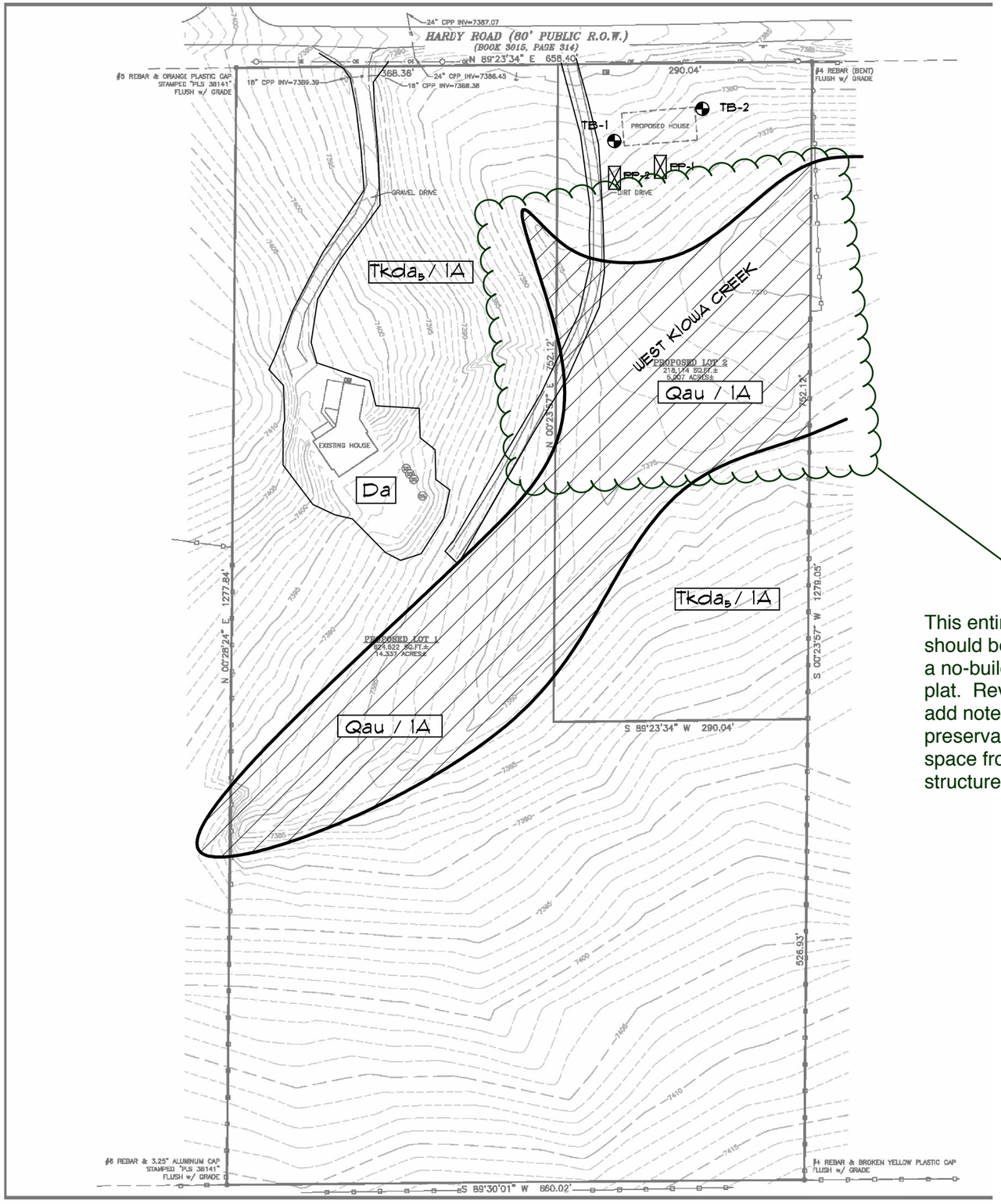
FIG No. 2

DATE 1-7-2021



This entire area should be shown as a no-build area on plat. Revise plat and add note regarding preservation of this space from structures.

Geologic

- *Qau - alluvium, undivided (Holocene and Pleistocene)* Total thickness of the unit is estimated between 10 to 20 feet. Alluvium sand was encountered in the test borings to depth of approximately 20 feet.
- *$Tkda_5$ - Dawson Formation, facies 5 (early to middle(?) Eocene)* - Total thickness of the formation is 2,000 feet. Bedrock was not encountered in the test borings perfromed by RMG.
- *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 and existing OWTS

Engineering

1A - stable alluvium, colluvium and bedrock on gentle slopes (0 to 5%)

Recommended preservation area unless addtional studies are perfromed prior to any new construction.

DENOTES APPROXIMATE LOCATION OF TEST BORING PERFORMED FOR THE SUBSURFACE SOIL INVESTIGATION PREPARED BY RMG, JOB NO. 177583, DATED AUGUST 3, 2020

DENOTES APPROXIMATE LOCATION OF TEST PITS PERFORMED FOR THE OWTS EVALUATION PREPARED BY JDM CONSULTING, LLC, DATED JULY 13, 2020

NOT TO SCALE

BASE MAP PROVIDED BY: Barron Land

JOB No. 180667

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Woodland Park Office:
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Monument Office:
(719) 488-2145
Pueblo / Canon City:
(719) 544-7750

10675 HARDY ROAD
EPC SCHEDULE NO. 5114000007
EL PASO COUNTY, CO
ANDREA RAPSON

ENGINEER:	GGW
DRAWN BY:	KZ
CHECKED BY:	GGW
ISSUED:	1-7-2021
REVISION:	DATE:
	JOB #:

ENGINEERING AND GEOLOGY MAP

SHEET No.
FIG-3

- 1 - Alamosa loam
- 25 -Elbeth sandy loam, 3 to 8 percent slopes

NOT TO SCALE
BASE MAP PROVIDED BY: USDA

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USDA SOILS SURVEY MAP

10675 HARDY ROAD
EPC SCHEDULE NO. 5114000007
EL PASO COUNTY, COLORADO
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FIG No. 4

DATE 1-7-2021

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BASE MAP PROVIDED BY: FEMA

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FEMA MAP

10675 HARDY ROAD
EPC SCHEDULE NO. 5114000007
EL PASO COUNTY, COLORADO
ANDREA RAPSON

JOB No. 180667

FIG No. 5

DATE 1-7-2021

APPENDIX A
Additional Reference Documents

1. *Topographical Map,* prepared by Barron Land, Project No. 18-017, dated December 15, 2020.
2. *Rapson Subdivision*, prepared by Barron Land, Project No. 18-017, dated December 16, 2020.
3. *Flood Insurance Rate Map, El Paso County, Colorado and Unincorporated Areas, Community Panel No. 081041C0310G,* Federal Emergency Management Agency (FEMA), effective December 7, 2018.
4. *Geologic Map of the Black Forest Quadrangle, El Paso County, Colorado*, Thorson, J.P., 2003, Colorado Geological Survey Open-File Report OF03-06.
5. *Black Forest, Quadrangle, Environmental and Engineering Geologic Map for Land Use*, compiled by Dale M. Cochran, Charles S. Robinson & Associates, Inc., Golden, Colorado, 1977.
6. *Black Forest, Quadrangle, Map of Potential Geologic Hazards and Surficial Deposits*, compiled by Dale M. Cochran, Charles S. Robinson & Associates, Inc., Golden, Colorado, 1977.
7. Schedule No.: 5114000007 https://property.spatialest.com/co/elpaso/#/property/5114000007
8. *Historical Aerials:* https://www.historicaerials.com/viewer, Images dated 1952, 1955, 1969, 1999, 2005, 2009, 2011, 2013, 2015 and 2017.
9. *USGS Historical Topographic Map Explorer:* http://historicalmaps.arcgis.com/usgs/ Colorado Springs Quadrangles dated 1893, 1909, 1948, 1950, 1951, 1954, 1961, 1966, 1969, 1975, 1981, and 1989.
10. *Google Earth Pro*, Imagery dated 1999, 2004, 2005, 2006, 2010, 2011, 2015, 2017, 2019, and 2020.

APPENDIX B

Subsurface Soil Investigation, 10675 Hardy Road, El Paso County, Colorado, prepared by RMG – Rocky Mountain Group, Job No. 177583, dated August 3, 2020.

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Civil/Planning

ROCKY MOUNTAIN GROUP
EMPLOYEE OWNED

SUBSURFACE SOIL INVESTIGATION

10675 Hardy Rd
El Paso County, Colorado

PREPARED FOR:

Poulson Construction
4995 W. Kiowa Creek Road
Elbert, CO 80103

JOB NO. 177583

August 3, 2020

Respectfully Submitted,
RMG – Rocky Mountain Group

Reviewed by,
RMG – Rocky Mountain Group

COLORADO REGISTERED
ANTHONY P. MUNGER
8/3/20
39818
PROFESSIONAL ENGINEER

Kelli Zigler
Project Geologist

Tony Munger, P.E.
Geotechnical Project Manager

Scope of Investigation

RMG – Rocky Mountain Group drilled two test borings for the proposed residence (a "modular" structure atop a basement foundation) at the above-referenced address on July 8, 2020. A Site Vicinity Map and Test Boring Location Plan are presented in Figures 1 and 2, respectively. Our findings, conclusions and recommendations are provided in this report.

This report presents geotechnical engineering recommendations for design and construction of residential foundations. This report does not include any recommendations for compliance with the HUD (Housing and Urban Development) definition of a “permanent” foundation or for design of elements to provide resistance to horizontal or uplift loading. The following is also excluded from the scope of this report including but not limited to geologic, natural and environmental hazards such as landslides, unstable slopes, seismicity, snow avalanches, water flooding, corrosive soils, erosion, radon, wild fire protection, hazardous waste and natural resources.

Subsurface Materials

The subsurface materials encountered in the test borings generally consisted of silty to clayey sand extending to approximately 18 feet below the existing surface in test boring TB-1 and to approximately 13 feet in test boring TB-2. Underlying the silty to clayey sand, silty to clayey sandstone extends to the 20-foot termination depth of the test borings. Additional descriptions and the interpreted distribution (approximate depths) of the subsurface materials are presented in the Test Boring Logs.

Groundwater was not encountered in TB-1 and groundwater was encountered at 19.5 feet in TB-2 at the time of drilling. 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.

An Explanation of the Test Boring Logs, the Test Boring Logs, and a Summary of Laboratory Test Results are presented in Figures 3 through 5. Soil Classification Data is presented in Figure 6. Swell/Consolidation Test Results are presented in Figure 7.

Overexcavation and Replacement

If loose soils are encountered during the Open Excavation Observation, they may require additional compaction to achieve the allowable bearing pressure indicated in this report. Fluctuations in material density may occur. In some cases, removal and recompaction of up to 2 feet of soil may be required. The removal and recompaction shall extend a minimum of 2 feet beyond the building perimeter, and at least that same distance beyond the perimeter of counterfort and "T" wall footings. The use of track-mounted excavation equipment, or other low ground pressure equipment, is recommended on loose soils to reduce the likelihood of loss of stability during excavation.

Foundation Recommendations

A spread footing foundation supported on the on-site native sand soils or on newly placed and compacted structural fill is suitable for the proposed residential structures. A maximum allowable bearing pressure of 1,500 psf may be used for design. We have anticipated the deepest excavation cuts for basement level construction will be approximately 6 to 8 feet below the existing ground surface.

The foundation design should be prepared by a qualified Colorado Registered Professional Engineer using the recommendations presented in this report. This foundation system should be designed to span a minimum of 10 feet under the design loads. The bottoms of exterior foundations should be at least 30 inches below finished grade for frost protection.

Open Excavation Observation

During construction, foundation excavations should be observed by RMG prior to placing structural fill, forms, or concrete to verify the foundation bearing conditions for each structure. Based on the conditions observed in the foundation excavation, the recommendations made at the time of construction may vary from those contained herein. In the case of differences, the Open Excavation Observation report shall be considered to be the governing document. The recommendations presented herein are intended only as preliminary guidelines to be used for interpreting the subsurface soil conditions exposed in the excavation and determining the final recommendations for foundation construction.

Soil Test Borings

The soil/rock classifications shown on the logs are based upon the engineer's classification of samples. Lines shown on the logs represent the approximate boundary between subsurface materials, and the actual transition may be gradual and vary across the site.

Interior Floor Slabs

Vertical slab movement on the order of one to three inches is considered possible for soils/bedrock of low expansion potential and for structural fill after recommended removal (overexcavation) of expansive soils/bedrock. In some cases, vertical movement may exceed this range. If movement and associated damage to floors and finishes cannot be tolerated, a structural floor system should be used.

Floor slabs should be separated from structural components to allow for vertical movement. Control and construction joints should be placed in accordance with the latest guidelines and standards published by the American Concrete Institute (ACI) and applicable local Building Code requirements.

Recommendations for exterior concrete slabs, such as patios, driveways, and sidewalks, are not included in this report.

Interior Partitions

Interior non-bearing partitions and attached furnishings (e.g., cabinets, shower stalls, etc.) on concrete slabs should be constructed with a void so that they do not transmit floor slab movement to the roof or overlying floor. A void of at least 1-1/2 inches is recommended beneath non-bearing partitions. The void may require reconstruction over the life of the structure to re-establish the void due to vertical slab movement.

Lateral Earth Pressure Parameters

Foundation walls should be designed to resist lateral earth pressures. For granular, non-expansive backfill materials, we recommend an equivalent fluid pressure of 40 pcf be used for design. Expansive soils or bedrock should not be used as backfill against foundation walls.

The above lateral earth pressure applies to level, drained backfill conditions. Equivalent Fluid Pressures for sloping/undrained conditions should be determined on an individual basis.

Surface Grading and Drainage

The ground surface should be sloped from the building with a minimum gradient of 10 percent for the first 10 feet. This is equivalent to 12 inches of fall across this 10-foot zone. If a 10-foot zone is not possible on the upslope side of the structure, then a well-defined swale should be created a minimum 5 feet from the foundation and sloped parallel with the wall with a minimum slope of 2 percent to intercept the surface water and transport it around and away from the structure. Roof drains should extend across backfill zones and landscaped areas to a region that is graded to direct flow away from the structure. Owners should maintain the surface grading and drainage recommended in this report to help prevent water from being directed toward and/or ponding near the foundations.

Landscaping should be selected to reduce irrigation requirements. Plants used close to foundation walls should be limited to those with low moisture requirements; and irrigated grass should not be located within 5 feet of the foundation. To help control weed growth, geotextiles should be used below landscaped areas adjacent to foundations. Impervious plastic membranes are not recommended.

Irrigation devices should not be placed within 5 feet of the foundation. Irrigation should be limited to the amount sufficient to maintain vegetation. Application of more water will increase the likelihood of slab and foundation movements.

The recommendations listed in this report are intended to address normal surface drainage conditions, assuming the presence of groundcover (established vegetation, paved surfaces, and/or structures) throughout the regions upslope from this structure. However, groundcover may not be present due to a variety of factors (ongoing construction/development, wildfires, etc.). During periods when groundcover is not present in the "upslope" regions, higher than normal surface drainage conditions may occur, resulting in perched water tables, excess runoff, flash floods, etc. In these cases, the surface drainage recommendations presented herein (even if properly maintained) may not mitigate all groundwater problems or moisture intrusion into the structure. We recommend that the site plan be prepared with consideration of increased runoff during periods when groundcover is not present on the upslope areas.

Perimeter Drain

A subsurface perimeter drain is recommended around portions of the structure which will have habitable or storage space located below the finished ground surface. This includes crawlspace areas but not the walkout trench, if applicable. A typical drain detail is presented in Figure 8.

A subsurface perimeter drain is designed to intercept some types of subsurface moisture and not others. Therefore, the drain could operate properly and not mitigate all moisture problems relating to foundation performance or moisture intrusion into the basement area.

Concrete

Type I/II cement is recommended for concrete in contact with the subsurface materials. Calcium chloride should be used with caution for soils with high sulfate contents. The concrete should not be placed on frozen ground. If placed during periods of cold temperatures, the concrete should be kept from

freezing. This may require covering the concrete with insulated blankets and heating. Concrete work should be completed in accordance with the latest applicable guidelines and standards published by ACI.

Exterior Backfill

Backfill should be placed in loose lifts not exceeding 8 to 12 inches, moisture conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content) and compacted to 85 percent of the maximum dry density as determined by the Modified Proctor test, ASTM D-1557 on exterior sides of walls in landscaped areas. In areas where backfill supports pavement and concrete flatwork, the materials should be compacted to 92 percent of the maximum dry density.

Fill placed on slopes should be benched into the slope. Maximum bench heights should not exceed 4 feet, and bench widths should be wide enough to accommodate compaction equipment.

The appropriate government/utility specifications should be used for fill placed in utility trenches. If material is imported for backfill, the material should be approved by the Geotechnical Engineer prior to hauling it to the site.

The backfill should not be placed on frozen subgrade or allowed to freeze during moisture conditioning and placement. Backfill should be compacted by mechanical means, and foundation walls should be braced during backfilling and compaction.

Structural Fill

Areas to receive structural fill should have topsoil, organic material, or debris removed. The upper 6 inches of the exposed surface soils should be scarified and moisture conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content) and compacted to a minimum of 95 percent of the maximum dry density as determined by the Standard Proctor test (ASTM D-698) or to a minimum of 92 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D-1557) prior to placing structural fill.

Structural fill placed on slopes should be benched into the slope. Maximum bench heights should not exceed 4 feet, and bench widths should be wide enough to accommodate compaction equipment.

Structural fill shall consist of granular, non-expansive material, and it should be placed in loose lifts not exceeding 8 to 12 inches, moisture conditioned to facilitate compaction (usually within 2 percent of the optimum moisture content) and compacted to a minimum of 92 percent of the maximum dry density as determined by the Modified Proctor test, ASTM D-1557. The materials should be compacted by mechanical means.

Materials used for structural fill should be approved by RMG prior to use. Structural fill should not be placed on frozen subgrade or allowed to freeze during moisture conditioning and placement.

To verify the condition of the compacted soils, density tests should be performed during placement. The first density tests should be conducted when 24 inches of fill have been placed.

Foundation Configuration Remarks

The configuration of the foundation system is critical to its performance. The position of foundation windows, jogs, steps and the relative elevation of adjacent and opposite walls can affect foundation performance. The nature of residential foundation construction does not allow for control of these conditions by the Foundation Design Engineer. Improper placement of the above can result in differential and lateral foundation movement not anticipated by the Geotechnical Engineer. The Foundation Design Engineer should be contacted regarding the foundation configuration.

General Remarks

The recommendations provided in this report are based upon the subsurface conditions encountered in the test borings, anticipated foundation loads, and accepted engineering procedures. The recommendations are intended to reduce differential movement. *It must be recognized that the foundation will undergo some movement on all soil types*. Concrete floor slabs will likely move vertically. The recommendations for isolating floor slabs from columns, walls, partitions or other structural components should be implemented to mitigate potential damage to the structure. Subsequent owners should be provided a copy of this report. The recommendations are based on accepted local engineering practice and are intended for individuals familiar with local construction practices and standards.

RMG does not assure the existence of and/or the compliance with the above recommendations. This is the responsibility of the client referenced on the first page. RMG provided recommendations only and does not supervise, direct or control the implementation of the recommendations.

Senate Bill 13

This report may be partial fulfillment of Colorado Senate Bill 13 (1984), C.R.S. 6-6.5-101, *The Soil and Hazard Analysis of Residential Construction*, if the purchaser receives this report at least fourteen days prior to closing.

The purpose of Senate Bill 13 is to inform the purchaser of the presence of expansive soil or hazards on the site. Geologic and environmental hazards are outside the scope of services of this report. Expansive soil and bedrock may result in movement of foundation components and floor slabs. The recommendations presented in this report are intended to reduce, not eliminate, these movements.

The owner and builder should review and become familiar with Special Publications 43 issued by the Colorado Geologic Survey.

This report and the recommendations contained therein are only valid if all parts of Senate Bill 13 are satisfied.

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

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SITE VICINITY MAP

10675 HARDY ROAD
EL PASO COUNTY, CO
POULSON CONSTRUCTION

JOB No. 177583

FIG No. 1

DATE 8-3-2020

GPS LOCATION OF TB-1:
N 39.0890568, W-104.6287368
ACCURACY +/- 20 FEET

DENOTES APPROXIMATE LOCATION OF TEST BORINGS

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TEST BORING LOCATION PLAN

10675 HARDY ROAD
EL PASO COUNTY, CO
POULSON CONSTRUCTION

JOB No. 177583

FIG No. 2

DATE 8-3-2020

SOILS DESCRIPTION

SANDSTONE

SILTY TO CLAYEY SAND

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. 177583

FIGURE No. 3

DATE Aug/03/2020

TEST BORING: **1** ELEVATION (FT): DATE DRILLED: 7/8/20 GROUNDWATER @ 19.5 ' 7/8/20	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SAND, SILTY TO CLAYEY, light brown, medium dense, moist	5			13	9.9
	10			18	4.0
	15			22	9.9
SANDSTONE, SILTY TO CLAYEY, light brown, medium hard, moist to wet	20			36	13.0

TEST BORING: **2** ELEVATION (FT): DATE DRILLED: 7/8/20 NO GROUNDWATER ON 7/8/20	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SAND, SILTY TO CLAYEY, light brown, medium dense, moist	5			27	5.2
	10			15	8.8
SANDSTONE, SILTY TO CLAYEY, light brown, medium hard to hard, moist	15			50	9.1
	20			50/10"	8.1

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TEST BORING LOG

JOB No. 177583

FIGURE No. 4

DATE Aug/03/2020

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	9.9		26	13	0.2	47.0			SC
1	9.0	4.0								
1	14.0	9.9								
1	19.0	13.0								
2	4.0	5.2								
2	9.0	8.8		NP	NP	0.0	35.9			SM
2	14.0	9.1	119.3	32	17	2.3	21.2		- 1.2	SC
2	19.0	8.1								

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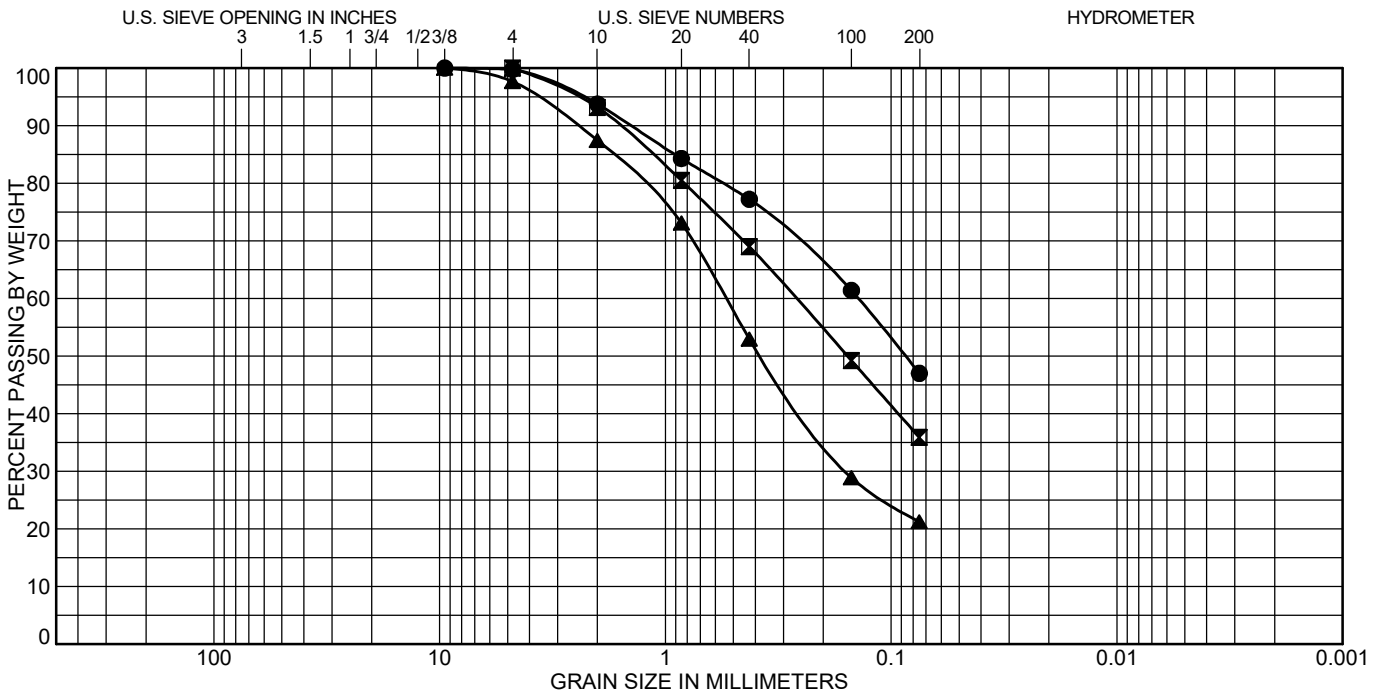
SUMMARY OF LABORATORY TEST RESULTS

JOB No. 177583
FIGURE No. 5
PAGE 1 OF 1
DATE Aug/03/2020



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	1	4.0	**CLAYEY SAND(SC)**	**26**	**13**	**13**
⊠	2	9.0	**SILTY SAND(SM)**	**NP**	**NP**	**NP**
▲	2	14.0	**CLAYEY SAND(SC)**	**32**	**15**	**17**

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	1	4.0	**0.2**	**52.8**	**47.0**	
⊠	2	9.0	**0.0**	**64.1**	**35.9**	
▲	2	14.0	**2.3**	**76.4**	**21.2**	

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SOIL CLASSIFICATION DATA

JOB No. 177583

FIGURE No. 6

DATE Aug/03/2020

PROJECT: **10675 Hardy Road, El Paso County, Colorado**
SAMPLE DESCRIPTION: **SANDSTONE, SILTY TO CLAYEY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **2 @ 14 FT**
NATURAL DRY UNIT WEIGHT: **119.3 PCF**
NATURAL MOISTURE CONTENT: **9.0%**
PERCENT SWELL/COMPRESSION: **- 1.2**

ROCKY MOUNTAIN GROUP

Architectural
Structural
Forensics

ARCHITECTS
RMG
ENGINEERS

Geotechnical
Materials Testing
Civil, Planning

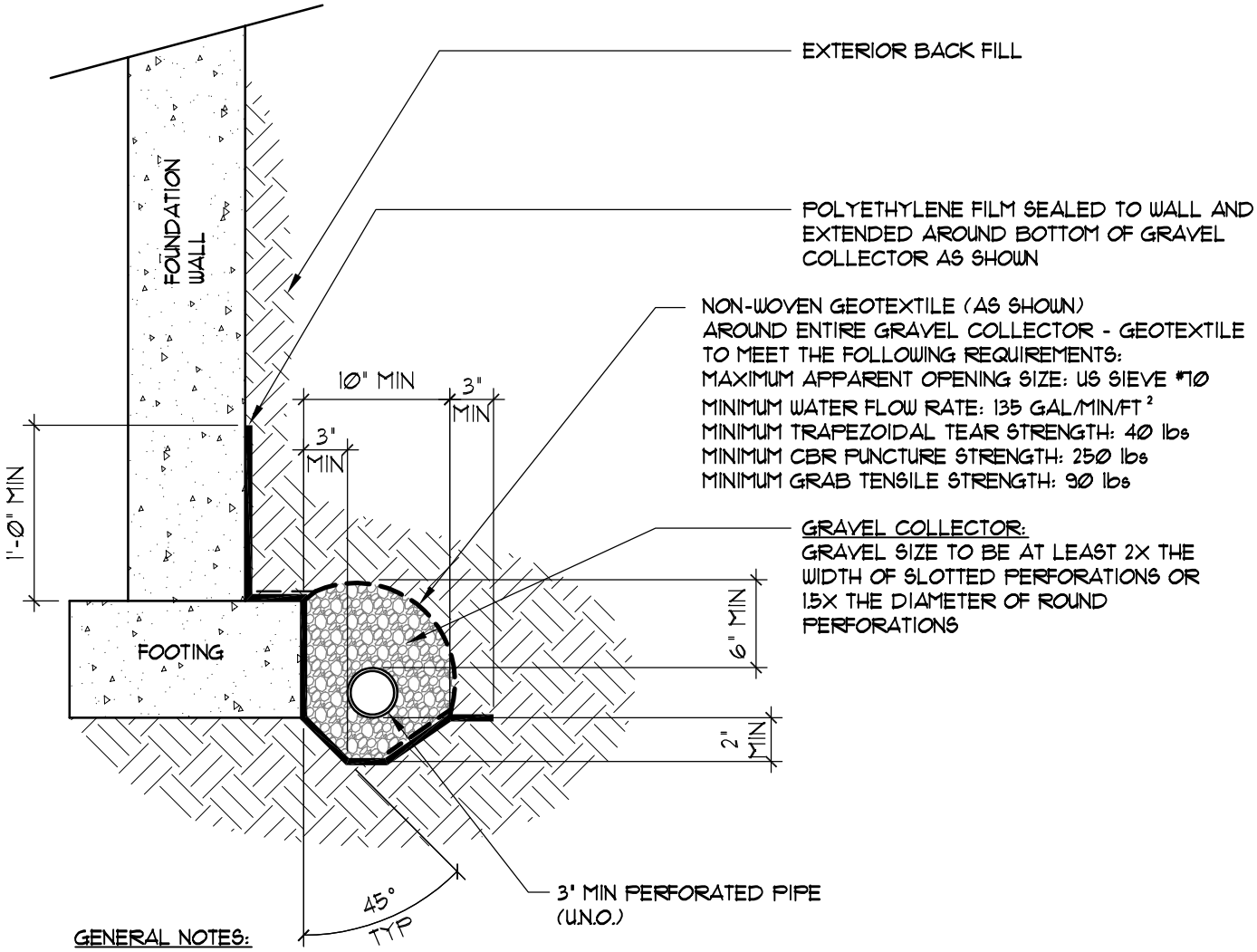
Colorado Springs: (Corporate Office)
2910 Austin Bluffs Parkway
Colorado Spings, CO 80918
(719) 548-0600
SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

SWELL/CONSOLIDATION TEST RESULTS

JOB No. 177583

FIGURE No. 7

DATE Aug/03/2020



GENERAL NOTES:

1. BOTTOM OF DRAIN PIPE SHALL BE AT OR BELOW BOTTOM OF FOOTING AT ALL LOCATIONS
2. ALL DRAIN PIPE SHALL BE PERFORATED PLASTIC, WITH THE EXCEPTION OF THE DISCHARGE PORTION WHICH SHALL BE SOLID, NON-PERFORATED PIPE.
3. DRAIN PIPE SHALL HAVE POSITIVE FALL THROUGHOUT.
4. DRAIN PIPE SHALL BE PROVIDED WITH A FREE GRAVITY OUTFALL, IF POSSIBLE. IF A GRAVITY OUTFALL CANNOT BE ACHIEVED, THEN A SUMP PIT AND PUMP SHALL BE USED. THE OUTFALL SHOULD EXTEND PAST BACKFILL ZONES AND DISCHARGE TO A LOCATION THAT IS GRADED TO DIRECT WATER OFF-SITE.
5. ALL DRAIN COMPONENTS SHALL BE RATED/APPROVED BY THE MANUFACTURER FOR THE INSTALLED DEPTH AND APPLICATION
6. DRAIN SYSTEM, INCLUDING THE OUTFALL OF THE DRAIN, SHALL BE OBSERVED BY QUALIFIED PERSONNEL PRIOR TO BACKFILLING TO VERIFY INSTALLATION.
7. A VERTICAL SEGMENT OF PERFORATED DRAIN PIPE, CAPPED AT THE TOP, SHALL EXTEND TO FINISH GRADE WITHIN ALL WINDOW WELLS.

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PERIMETER DRAIN

FIG No. 8

APPENDIX C

Profile Pit Evaluation, 10695 Hardy Road, prepared by JDM Consulting, LLC, Project number 20-127, dated July 13, 2020.

JDM CONSULTING, LLC

P.O. Box 26137, Colorado Springs, CO 80936
p. 719.251.5291 267.261.1825
e. daniel@jdmengineers.com jared@jdmengineers.com

Property Address:	10675 Hardy Road	Date:	July 13, 2020
	Colorado Springs, CO 80908	Job #:	20-127
Endorsement:	Daniel J. Mizicko, P.E.		

Purpose of Investigation: To determine the subsurface suitably for an Onsite Wastewater Treatment System (OWTS) as well as outline design criteria for a future Soil Treatment Area (STA) through both visual and tactile evaluations of the onsite subsurface soil. The onsite evaluation and associated soil testing were conducted in compliance with the El Paso County Board of Health OWTS Regulations

Profile Pit Summary	
Profile Pit #1	
Lat:	**39° 5'19.90"N**
Long:	**104°37'42.97"W**
0 - 0'-6"	**Topsoil**
0'-6" - 3'-0"	**Soil Type 4A**
3'-0" - 5'-0"	**Soil Type 2**
5'-0" - 7'-0"	**Soil Type 4**
-	**-**
Profile Pit #2	
Lat:	**39° 5'19.68"N**
Long:	**104°37'43.58"W**
0 - 0'-6"	**Topsoil**
0'-6" - 4'-6"	**Soil Type 4A**
4'-6" - 5'-6"	**Soil Type 2**
5'-6" - 7'-6"	**Soil Type 4**
-	**-**
Existing Well (If applicable)	
Lat:	**N/A**
Long:	**N/A**

Profile Pit #1		Profile Pit #2	
	Topsoil		Topsoil
1'-0"	Soil Type 4A	1'-0"	Soil Type 4A
2'-0"		2'-0"	
3'-0"		3'-0"	
	Soil Type 2		
4'-0"		4'-0"	
5'-0"		5'-0"	Soil Type 2
	Soil Type 4		
6'-0"		6'-0"	Soil Type 4
7'-0"		7'-0"	
8'-0"		8'-0"	
9'-0"		9'-0"	

Recommendations:

An Engineered On-Site Wastewater Treatment System (OWTS) will be required for this site due to: (a) Soil Type 4A & Soil Type 4 identified in the treatment zone of Profile Pit #1 & Profile Pit #2. (b) Redoximorphic features (seasonal groundwater and/or constantly saturated soils) identified in the treatment zone of Profile Pit #1 & Profile Pit #2. Soil Type 4A (LTAR = 0.15, Treatment Level 1) will be the most restrictive soil in the treatment zone of the soil treatment area.

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Site Map:

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Job Number:	20-127	Test Pit#	Pit #1
Date of Evaluation:	July 8, 2020	Total Depth:	7'-0"
Evaluator:	J.Dumke	STA Slope and Direction:	S @ ± 6%
Excavator:	Down to Earth Excavating	Latitude:	39° 5'19.90"N
Equipment:	Mini Excavator	Longitude:	104°37'42.97"W

10675 Hardy Road, 80908

Depth Below Grade	Sample Depth	USDA Soil texture	USDA Soil Structure - Type	USDA Soil Structure Grade	Soil Type	Redoximorphic Features Present (Y/N)
0 - 0'-6"	**Topsoil**					
0'-6" - 3'-0"	**2'-0"**	**Sandy Clay**	**Massive**	**Structureless**	**Soil Type 4A**	**No**
3'-0" - 5'-0"	**4'-0"**	**Sandy Loam**	**Granular**	**Moderate**	**Soil Type 2**	**No**
5'-0" - 7'-0"	**6'-0"**	**Sandy Clay**	**Blocky**	**Strong**	**Soil Type 4**	**Yes**
-	-	-	-	-	-	-

Total Depth =	**7'-0"**		
Groundwater Encountered?	**Yes**	If yes, what depth?	**5'-0"**
Bedrock Encountered?	**No**	If yes, what depth?	**-**
Is Dawson Arkose (DA) or Cemented Sands (CS) Present?			**No**
Is the material fractured and/or Jointed			**No**
If Yes, what is the cementation class?			
Is the Dawson Arkose or Cemented Sand a limiting layer?			**-**

Comments:

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Job Number:	20-127	Test Pit#	Pit #2
Date of Evaluation:	July 8, 2020	Total Depth:	7'-6"
Evaluator:	J.Dumke	STA Slope and Direction:	S @ ± 6%
Excavator:	Down to Earth Excavating	Latitude:	39° 5'19.68"N
Equipment:	Mini Excavator	Longitude:	104°37'43.58"W

10675 Hardy Road, 80908

Depth Below Grade	Sample Depth	USDA Soil texture	USDA Soil Structure - Type	USDA Soil Structure Grade	Soil Type	Redoximorphic Features Present (Y/N)
0 - 0'-6"	**Topsoil**					
0'-6" - 4'-6"	**-**	**Sandy Clay**	**Massive**	**Structureless**	**Soil Type 4A**	**No**
4'-6" - 5'-6"	**-**	**Sandy Loam**	**Granular**	**Moderate**	**Soil Type 2**	**No**
5'-6" - 7'-6"	**-**	**Sandy Clay**	**Blocky**	**Strong**	**Soil Type 4**	**Yes**
-	-	-	-	-	-	-

Total Depth =	**7'-6"**		
Groundwater Encountered?	**Yes**	If yes, what depth?	**5'-6"**
Bedrock Encountered?	**No**	If yes, what depth?	**-**
Is Dawson Arkose (DA) or Cemented Sands (CS) Present?			**No**
Is the material fractured and/or Jointed			**No**
If Yes, what is the cementation class?			
Is the Dawson Arkose or Cemented Sand a limiting layer?			**-**

Comments: