Architectural
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Materials Testing
Forensic
Civil/Planning

SOILS, GEOLOGY AND WASTEWATER STUDY

Southeast corner of Old Ranch Rd and Otero Ave
Lots 1 and 2, Spring Crest Sub Amended
El Paso County, Colorado

PREPARED FOR:

Jay Stoner
5655 Bridlespur Ridge Place
Colorado Springs, CO 80918

JOB NO. 184689

November 8, 2021
Amended April 18, 2024

Respectfully Submitted,
RMG – Rocky Mountain Group

Kelli Zigler

Kelli Zigler
Project Geologist

Reviewed by,
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APPENDIX C – *Subsurface Soil Investigation, currently addressed as: 10245 Otero Avenue, Lot 8, Spring Crest AMD Filing, El Paso County, Colorado,* prepared by RMG – Rocky Mountain Group, Job No. 184689, dated Novemer 8, 2021.

1.0 GENERAL SITE AND PROJECT DESCRIPTION

1.1 Project Location

The project lies in the NW¼ of the NW¼ of Section 28, Township 12 South, Range 66 West of the 6th Principal Meridian in El Paso County, Colorado. The site is located near the southeast corner of the intersection of Old Ranch Road and Otero Avenue. 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 included parcel, as recorded on the El Paso County (EPC) Assessors website, is currently 5.13 acres. The proposed site development is to consist of subdividing the parcel into two lots. Lot 1 is to be located on the northern portion of the parcel and consist of 2.63 acres. Lot 2 is to be located on the southern portion of the parcel and consist of 2.50 acres. The included parcel is:

- EPC Schedule No. 6228005048, contains 5.13 acres, currently addressed as 10245 Otero Road, Lot 1, Kettle Creek Estates, and the zoning is currently not shown.

The site as referenced in this report refers to the entire 5.13-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 each new Lot 1 and 2. Each lot is to be given a new address. Lot 1 may be accessed from Otero Avenue or Old Ranch Road. Lot 2 is to be accessed from Otero Avenue. New roadways are not proposed. The Proposed Lot Layout, Figure 2, outlines the proposed subdivision and the general boundaries of our investigation.

An existing 40’ sewer easement runs parallel to the west side of Kettle Creek and crosses Kettle Creek near the center of Lot 1. The easement is to remain. The future residence and OWTS – Onsite Wastewater Treatment Systems will need to be located outside of the easement.

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

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 Tony Munger, P.E. Ms. Zigler is a Professional Geologist as defined by State Statute (C.R.S 34-1-201) with over 23 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 23 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. Mr. Munger has supervised and performed numerous geological and geotechnical field investigation programs in Colorado.

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 to include single-family within the referenced proposed development. 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 have been amended since the submission of the Preliminary Sketch 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 and profile pits by RMG
- Laboratory testing of representative site soil and rock samples
- 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 the immediate vicinity were available for our review and are listed below.

1. *Subsurface Soil Investigation, 10245 Otero Avenue, Lot 8, Spring Crest, AMD Filing, El Paso County, Colorado,* prepared by RMG – Rocky Mountain Group, Job No. 184689, dated November 5, 2021.
2. *Subsurface Soil Investigation, 2295 Old Ranch Road, Lot 7 Spring Crest, AMD, Filing, El Paso County, Colorado,* prepared by RMG – Rocky Mountain Group, Job No. 185103, dated November 5, 2021.
3. *Geologic Hazard Study, currently addressed as: 2210 Old Ranch Rd, EPC Schedule No. 6228001007, El Paso County, Colorado,* prepared by RMG – Rocky Mountain Group, Job No. 182596, dated July 8, 2021.
4. *Geology and Soils Report, with Wastewater Study, Lot 10, Lot K and Lot L, Spring Crest Subdivision, El Paso County, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 162650, last dated January 7, 2019.
5. *Subsurface Soil Investigation, 9965 Otero Avenue, Colorado Springs, Colorado*, prepared

by RMG - Rocky Mountain Group, Job No. 148483, dated July 24, 2015.

6. *Subsurface Soil Investigation, 1915 Alamosa Drive, Lot A, Blk F Spring Crest, Filing No. 2, El Paso County, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 147796, dated June 3, 2015.

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 southeast corner of the property. Topographically, the site is lower near the center with elevation gradually increasing to the east and west with gentle to moderately rolling terrain. Isolated steep slopes (greater than 25 percent) are located along the banks of Kettle Creek. The overall slope is downward from the northwest to southeast, with an elevation difference of approximately 90 feet across the entire site.

Kettle Creek traverses the site from the north to the southwest near the center of the property. The proposed new residences and onsite wastewater treatment systems on each lot are to be located outside the mapped Regulatory Floodway of Kettle Creek. The entire site consists of low lying native grasses and weeds, where not covered with trees. The trees are denser near the creek.

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.

5.0 FIELD INVESTIGATION AND LABORATORY TESTING

It is our understanding Lots 1 and 2 are each to contain one single-family residence, well, and septic once the subdivision is approved.

5.1 Drilling

The subsurface conditions within the area of the each proposed new single-family residence was explored by RMG by drilling two (2) exploratory borings for each residence, extending to 20 feet below the existing ground surface on July 26, 2021. Two (2) profile pits, one each on Lot 1 and 2 were observed on October 19, 2021. The approximate locations of the test borings and profile pit locations are presented on the 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 two Subsurface Soil Investigation reports, presented in Appendices B and C.

5.2 Profile Pit Excavations

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

The profile pits were excavated to approximately 8 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 in conjunction with this investigation. The soils were evaluated to determine the soils types and structure. Neither bedrock nor restrictive layers were encountered in the profile pits. Evidence of seasonal high groundwater was not observed in the profile pits. The profile pit logs and soil descriptions are presented in Figure 7.

5.4 Groundwater

Groundwater was not encountered in the four test borings performed by RMG. However, we would anticipate the potential for periodically high subsurface moisture conditions due to the proximity to Kettle Creek. Review of the reports in the immediate area, referenced above, indicates that groundwater conditions were encountered at depths ranging between 9 and 28 feet.

It should be noted that in granular soils and bedrock, some perched water conditions might be encountered due to the variability of the soil profile. Isolated sand and gravel layers within the soil, even those of limited thickness and width, can carry water in the subsurface. Groundwater may also flow atop the underlying bedrock. Builders and planners should be cognizant of the potential for the occurrence of subsurface water conditions during on-site construction, in order to evaluate and mitigate each individual problem as necessary.

Fluctuations in groundwater and subsurface moisture conditions may occur due to variations in rainfall, irrigation, changes in surface drainage patterns, and other factors not readily apparent at this time. Development of the property and adjacent properties may also affect groundwater levels. In the absence of irrigation, we anticipate a 4 to 6-foot fluctuation in groundwater levels, perched or within the fractured bedrock, should be expected.

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 6 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 upper Cretaceous and Paleocene Age. The residual soils are produced by the in-situ action of weathering of the bedrock.

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). Visual classification of the soil at the time of drilling and in the laboratory indicated clay, claystone/shale and sandstone are present on the site, generally the clay and claystone classify as (CL) lean clay and the sandstone would classify as SM to SC.

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

Additional descriptions and the interpreted distribution (approximate depths) of the subsurface materials are presented in the Subsurface Soil Investigation reports 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 two 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:

- 19 – Columbine gravelly sandy loam, 0 to 3 percent slopes. The Columbine gravelly sandy loam was mapped by the USDA to encompass a very small section near the northwest corner of the property. Properties of the sandy loam include, well-drained soils, depth of the water table is anticipated to be greater than 6.5 feet, runoff is anticipated to be low, frequency of flooding and/or ponding is none, and landforms include fans, floodplain and fan terraces.

- 85 – Stapleton-Bernal sandy loams, 3 to 20 percent slopes. The Stapleton-Bernal sandy loams were mapped by the USDA to encompass the majority of the proposed new Lots 1 and 2. Properties of the sandy loams include well drained soils, depth of the water table is anticipated to be greater than 6.5 feet, runoff is anticipated to be low, frequency of flooding and/or ponding is none, and landforms include hills.

- 93 – Tomah-Crowfoot complex, 8 to 15 percent slopes. The Tomah-Crowfoot complex was mapped by the USDA to encompass the majority of the southeastern portion of the property. Properties of the Tomah-Crowfoot complex include, well-drained soils, depth of the water table is anticipated to be greater than 6.5 feet, runoff is anticipated to be low, frequency of flooding and ponding is none, and landforms include hills.

The USDA Soil Survey Map is presented in Figure 3.

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 4.

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:

- *Qt_1 – Terrace alluvium one (Holocene and late Pleistocene)* – Unconsolidated stream alluvium that underlies low terraces up to 12 feet above Monument Creek; distinct from stream-channel and floodplain deposits. Poorly to moderately sorted, clast-supported, cobble gravel in a sandy, silty, or clayey matrix. Terrace alluvium sand was encountered in the four test borings ranging in depth from 7 to 20 feet below the surface

- *$Tkda_2$ – Dawson Formation, facies 2 (Upper Cretaceous and Paleocene)* – the facies is generally light-gray to greenish-gray arkosic sandstone interbedded with dark-gray to

grayish-green fine micaceous sandstone and sandy claystone, about 400 to 500 feet thick. Sandstone and Shale bedrock were encountered in three of the four test borings at depths ranging between 7 to 8 feet below the surface.

- *fw – Regulatory floodway* as designated by FEMA, this area is not to be disturbed during construction of the future residences and/or OWTS. This area is to be designated a "No Build Zone" until further investigations are completed.

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 Groundwater

The site contains one existing structure near the southeast corner of the property. Topographically, the site is lowest at the creek with elevations gradually increasing to the east and west with gentle to moderately rolling terrain.

Groundwater is not anticipated to preclude basement construction on Lots 1 and 2.

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%).
- 7A - Physiographic flood plain where erosion and deposition presently occurs and is generally subject to recurrent flooding. Includes the 100-year flood plain along major streams where flood plain studies have been conducted.

The engineering geology is presented in the Engineering and Geology Map, Figure 4.

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. 08041C0506G the online ArcGIS Pikes Peak Regional Floodplain Map, Kettle Creek lies in an area designated Regulatory Floodway. Base Flood Elevations (BFE) have been determined. The remainder of the site lies outside the 100-year or 500-year floodplains. The FEMA Map is presented in Figure 5.

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
- Loose and Compressible Soils
- Rockfall

- Steeply Dipping Bedrock
- Unstable or Potentially Unstable Slopes
- Springs and High Groundwater

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

8.1 Compressible Soils - *constraint*

Loose soils were not encountered in the test borings; however, the alluvial deposits may have localized areas of lower density. Any loose or compressible soils encountered beneath foundations or floor slabs will require mitigation.

Mitigation
As stated in the Subsurface Soil Investigation reports 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.

8.2 Expansive Soils and Bedrock - *constraint*

Based on the laboratory testing performed on the site by RMG and on the results presented in the previous investigations referenced above for the area, the sandy clay and claystone bedrock generally possess low to high swell potential. Expansive clay soils and bedrock were encountered on this site.

Mitigation
As stated in the Subsurface Soil Investigation reports completed by RMG, if expansive soils or bedrock are encountered during the Open Excavation Observation, they will require removal and recompaction to a depth of 3 feet below foundation components and floor slabs. The removal and recompaction shall extend a minimum of 3 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.
Provided the appropriate mitigations and/or foundation design adjustments are implemented as recommended in a lot-specific soil report, the presence of expansive soils or bedrock is not considered to pose a risk to the proposed structures.

8.3 Regulatory Floodway - *hazard*

Based on our review of the FEMA map and the online ArcGIS El Paso County Risk Map, the majority site lies outside the 100-year floodplain of Kettle Creek. However, portions of the site do lie within a Regulatory Floodway. Per the latest approved edition of the Pikes Peak Regional Building Code, the lowest finished floor elevation (including basement together with attendant utility and sanitary facilities) shall be elevated one-foot or more above the BFE.

Mitigation

The proposed residences are to be located near the western portion of Kettle Creek, outside the designated Regulatory Floodway as presented on Figure 2, Engineering and Geology Map. Currently no construction is proposed within the floodway. If new development and/or construction are proposed between the currently proposed structures and Kettle Creek in the future, additional investigations should be performed to determine the feasibility of construction within the streamside outer buffer zone and, if necessary, develop mitigation recommendations.

Per the latest approved edition of the Pikes Peak Regional Building Code, the lowest finished floor elevation (including basement together with attendant utility and sanitary facilities) shall be elevated one-foot or more above the BFE.

Builders should be advised that mitigation may be required for the potential floodwater and any resulting debris. Designs may be required to include (but are not limited to) openings to automatically equalize hydrostatic pressure, anchorage to resist buoyancy, "breakaway" panels, etc.

At the time of permit submittal, the building department may require the preparation of either a Zero Rise Certification or a Less Than One Foot Rise Certification to demonstrate that the proposed structures will cause zero or less than one foot of rise (respectively) in the established BFE. If this certification cannot be obtained, more extensive submittals to FEMA may be required.

The location of the proposed structures within the floodway is consistent with cabins that are already present on the site. The presence of the floodplain is not believed to pose a higher risk to the new structures than to several currently existing structures. Provided that the recommendations presented herein, as well as any requirements stipulated by the governing regulatory agencies, are followed, the presence of the revised floodplain/floodway is not anticipated to preclude the proposed construction.

8.4 Surface Drainage - *constraint*

Since portions of the property lie within a designated Regulated Floodway of Kettle Creek, its drainageway should be taken into consideration when considering the placement of the residences and OWTS treatment areas on each individual lot.

Mitigation
Kettle Creek should and can be avoided by construction. Structures should not block the creek. 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 Kettle Creek drainageway. It is recommended Kettle Creek be identified as a "No-Build Area" unless additional studies are performed, in conjunction with the drainage engineer, prior to any new construction. This area is shown on Figure 4.

8.5 Scour, Erosion, and Accelerated Erosion Along Creek Banks – *constraint*

Scour generally refers to a localized loss of soil, often around a foundation element(s). Erosion generally refers to lowering the ground surface over a wide area.

Visible evidence of ongoing accelerated erosion along the banks of Kettle Creek was not observed. Signs of significant and ongoing surface erosion were not observed along the creek.

Mitigation
A drainage plan was not reviewed in conjunction with this study. However, any proposed drainage improvements should mitigate any potential localized surficial sloughing and erosion along Kettle Creek. The proposed buildings should be located sufficiently away from the top of the creek banks such that slope stability should not be impacted by its construction.

It is recommended that silt fencing be installed along the top of the creek banks to reduce the potential for erosion (during construction). It is also recommended that vegetative cover be maintained during and after construction.

Significant care should be taken (both during construction and in the final grading of the lots) to divert surface drainage and downspout discharge water around the structures to locations that will not significantly alter the overall drainage of the development. At no point shall the overall drainage be diverted into Kettle Creek.

Any landscaping in the immediate vicinity of the proposed structure should utilize xeriscape techniques in order to minimize needed irrigation to maintain landscaping. Further, stormwater and snowmelt runoff from parking (driveway) areas should be directed towards drainage channels, both during construction activities and upon completion of site development.

It should be the responsibility of the future Owner(s) to periodically observe the slopes along Kettle Creek to identify signs of new or localized erosion. Areas undergoing active erosion should be promptly corrected and restored to ensure the continuing stability of the creek banks.

8.6 Faults and Seismicity - *hazard*

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.

8.7 Radon - *constraint*

Radon is a gas that can move feely within the soil and air but can become trapped in structures constructed on the soil. Radon is a byproduct of the natural decay of uranium and radium. Trace amounts of radioactive nuclides are common in the soils and bedrock that underlie this region and site.

***"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 that On-site Wastewater Treatment Systems (OWTS) are proposed on Lots 1 and 2. The site was evaluated by observing two profile pits, one each on Lot 1 and Lot 2, within or near the probable OWTS locations to obtain a general understanding of the soil and bedrock conditions. The Profile Pit Logs are presented in Figure 7.

9.1 Subsurface Materials

The subsurface materials encountered in the profile pit excavations 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:

- *Silty Clay Loam:*
  USDA Soil Texture: Silty Clay Loam
  USDA Soil Type: 3
  USDA Structure Type and Grade: Moderate
  Non-cemented

- *Silty Clay:*
  USDA Soil Texture: Silty Clay
  USDA Soil Type: 4
  USDA Structure Type and Grade: Strong
  Non-cemented

- *Sandy Clay*
  USDA Soil Texture: Sandy Clay
  USDA Soil Type: 4
  USDA Structure Type and Grade: Moderate
  Non-cemented

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

The soils on proposed Lots 1 and 2 were identified as silty clay loam, silty clay, sandy clay, and clay. Limiting layers were not encountered in the profile pits. The long term acceptance rate (LTAR) associated with the most restrictive soils observed in the profile pits was 0.20 gallons per day per square foot (gpd/sf) for the silty clay, sandy clay and clay (Soil Type 4). Neither groundwater nor indications of seasonally shallow groundwater were observed in the profile pit excavations 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 RMG. 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*, effective July 7, 2018, 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 (EPCDHE);
- 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 EPCDHE;
- Treatment areas must also be located a minimum 50 feet from any spring, lake, water course, irrigation ditch, stream or wetland, and 25 feet from dry gulches;
- Other setbacks include the treatment area to be located a minimum 10 feet from property lines, cut banks and fill areas (from the crest);
- The new lots shall be laid out to ensure that the proposed OWTS does not fall within any restricted areas, (e.g. utility easements, right of ways, No Build Zones). Based on the test pit observations, the parcel has a minimum of two locations for the OWTS.

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 recommended are indicated on Figure 6.

In summary, it is our opinion the sites are 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 profile pit locations performed only, for the purpose of demonstrating suitability of the proposed systems. The final OWTS systems shall be designed based on an LTAR determined at the time of the OWTS Site Evaluation.

This does not constitute an OWTS design. The individual OWTS design for Lots 1 and 2 should be completed prior to construction of the new residence.

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) include potentially compressible soils, expansive soils/bedrock, and a floodway. 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.

Site-specific Subsurface Soil Investigations have been performed for Lots 1 and 2 by RMG. A site-specific OWTS Site Evaluation and OWTS Design will need to be prepared for the proposed on-site wastewater systems for each lot prior to construction.

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

All construction should remain outside the Kettle Creek drainageway. It is recommended Kettle 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 4.

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

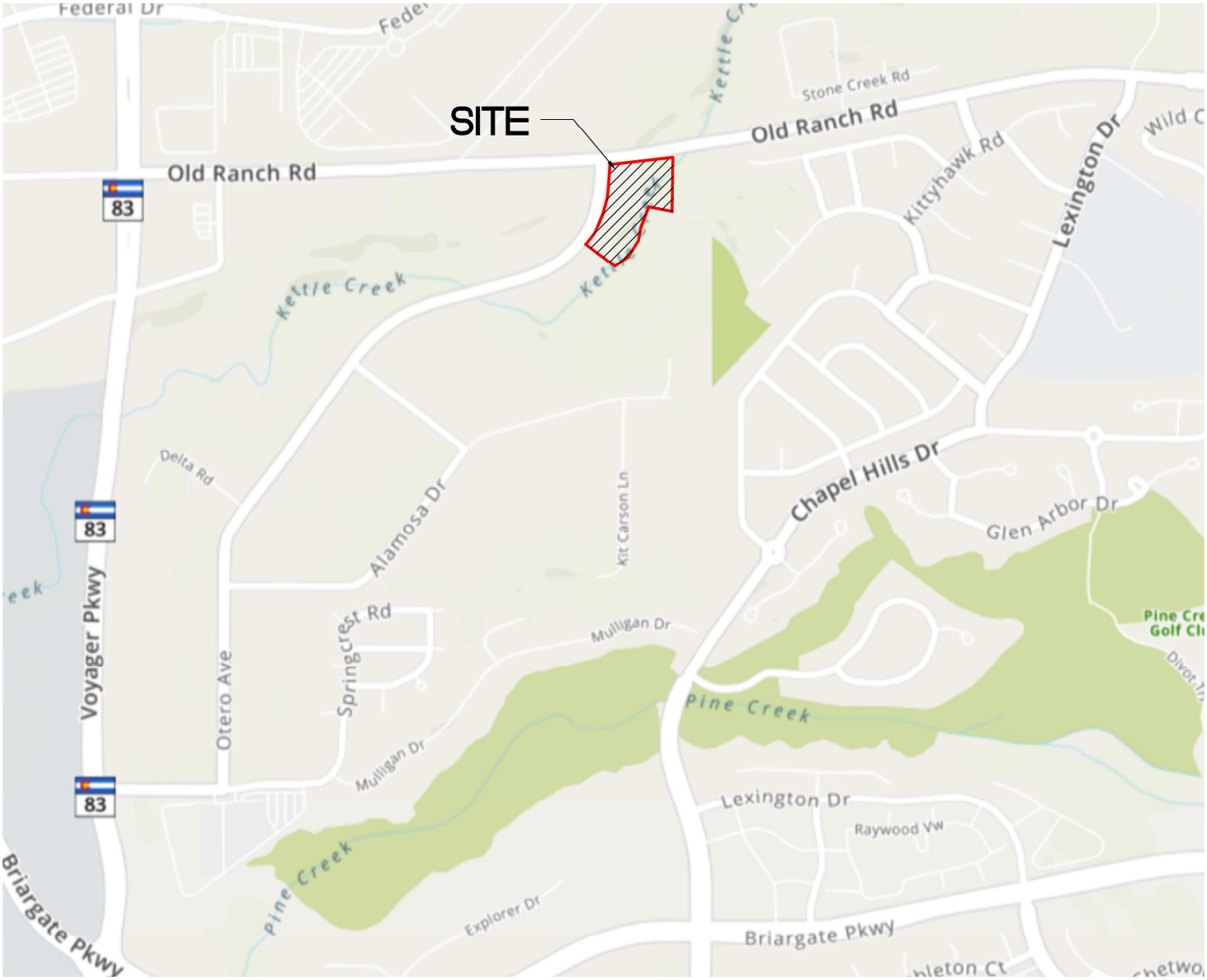
This report is for the exclusive purpose of providing geologic hazards information and preliminary geotechnical engineering recommendations. The scope of services did not include, either specifically or by implication, evaluation of wild fire hazards, environmental assessment of the site, or identification 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 **Jay Stoner** 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
BASE MAP PROVIDED BY MAPQUEST

ARCHITECTS RMG ENGINEERS
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Northern Office:
Greeley / Evans, CO 80620
(970) 330-1071

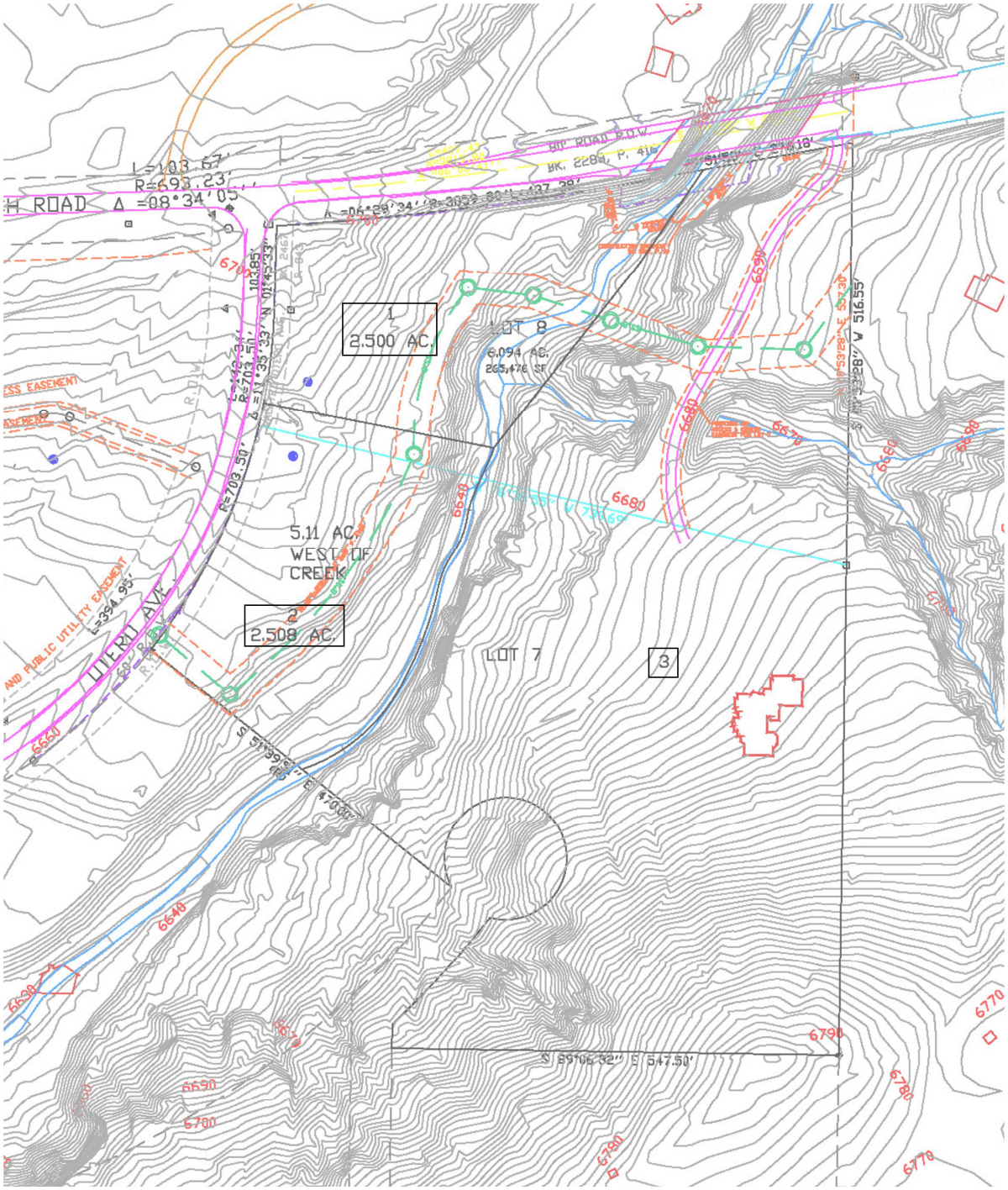
SITE VICINITY MAP

LOTS 1 AND 2, SPRING CREST SUB. AMENDED
EL PASO COUNTY, CO
JAY STONER

JOB No. 184689

FIG No. 1

DATE 11-8-2021
REV 4-18-2024



NOT TO SCALE

SITE PLAN PROVIDED BY OLIVER E. WATTS

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PROPOSED LOT LAYOUT

LOTS 1 AND 2, SPRING CREST SUB.
AMENDED
EL PASO COUNTY, CO
JAY STONER

JOB No. 184689

FIG No. 2

DATE 11-8-2021
REV 4-18-2024

19 - Columbine gravelly loamy sand, 0 to 3 percent slopes

85 - Stapleton-Bernal sandy loams, 3 to 20 percent slopes

93 - Tomah-Crowfoot complex, 8 to 15 percent slopes

NOT TO SCALE

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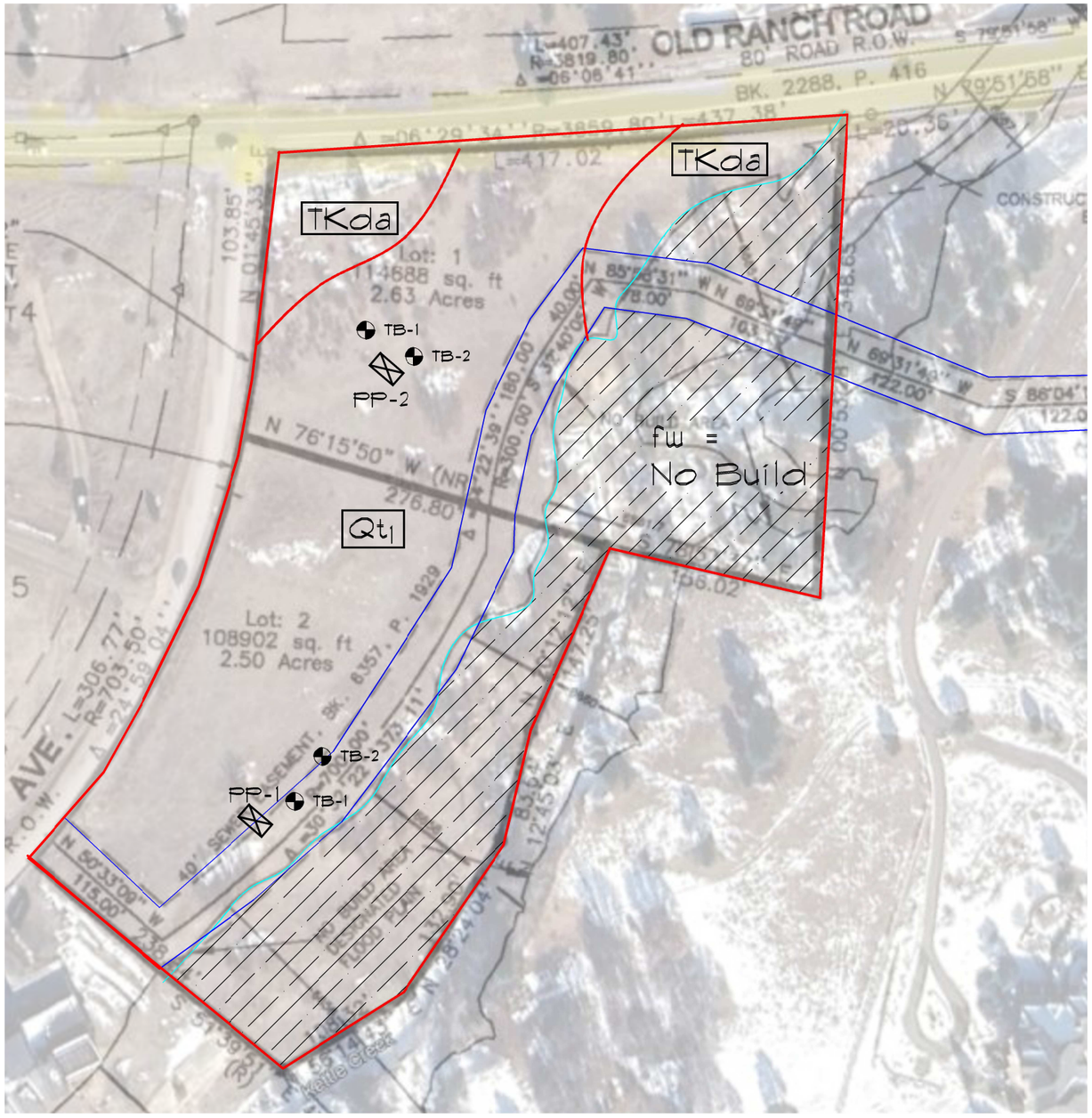
USDA Soils Survey Map

LOTS 1 AND 2, SPRING CREST SUB. AMENDED
EL PASO COUNTY, CO
JAY STONER

JOB No. 184689

FIG No. 3

DATE 11-8-2021
REV 4-18-2024



REFERENCE
NOT TO SCALE

General Geologic Conditions

- *Qt_1 - Terrace alluvium one (Holocene and late Pleistocene)* - Unconsolidated stream alluvium that underlies low terraces up to 12 feet above Monument Creek; distinct from stream-channel and floodplain deposits. Poorly to moderately sorted, clast-supported, cobble gravel in a sandy, silty, or clayey matrix. Terrace alluvium sand was encountered in the four test borings ranging in depth from 7 to 20 feet below the surface
- *$Tkda_2$ - Dawson Formation, facies 2 (Upper Cretaceous and Paleocene)* - the facies is generally light-gray to greenish-gray arkosic sandstone interbedded with dark-gray to grayish-green fine micaceous sandstone and sandy claystone, about 400 to 500 feet thick. Sandstone and Shale bedrock were encountered in three of the four test borings at depths ranging between 7 to 8 feet below the surface.
- *fw* - Regulatory floodway as designated by FEMA, this area is not to be disturbed during construction of the future residences and/or OWTS. This area is to be designated a "No Build Zone" until further investigations are completed.

Engineering Geology

- 1A - Stable alluvium, colluvium and bedrock on gentle slopes (0 to 5%).
- 7A - Physiographic flood plain where erosion and deposition presently occurs and is generally subject to recurrent flooding. Includes the 100-year flood plain along major streams where flood plain studies have been conducted.

DENOTES APPROXIMATE LOCATION OF TEST BORINGS

DENOTES APPROXIMATE LOCATION OF PROFILE PITS

APPROXIMATE BOUNDARY OF KETTLE CREEK FLOODWAY - TO BE DESIGNATED A NO-BUILD ZONE

JOB No. 184689

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Northern Office:
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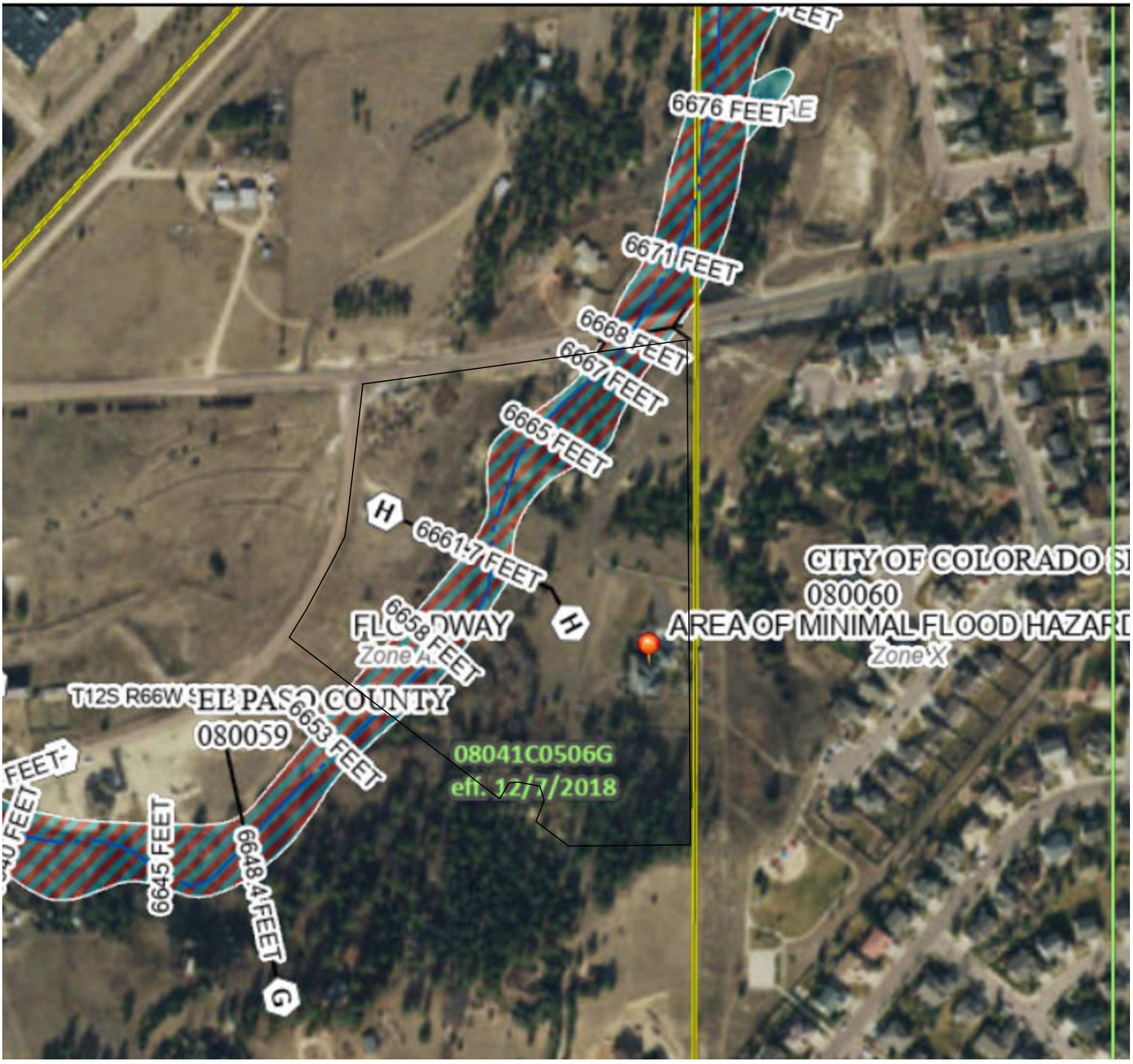
(970) 330-1071
Woodland Park Office:
(719) 687-6077
Monument Office:
(719) 488-2145
Pueblo / Canon City:
(719) 544-7750

LOTS 1 AND 2, SPRING CREST SUB. AMENDED
EL PASO COUNTY, COLORADO
JAY STONER

ENGINEER:	TPM
DRAWN BY:	KMZ
CHECKED BY:	TPM
ISSUED:	11-8-2021
REVISED:	4-18-2024

ENGINEERING AND GEOLOGY MAP

SHEET No.
FIG-4



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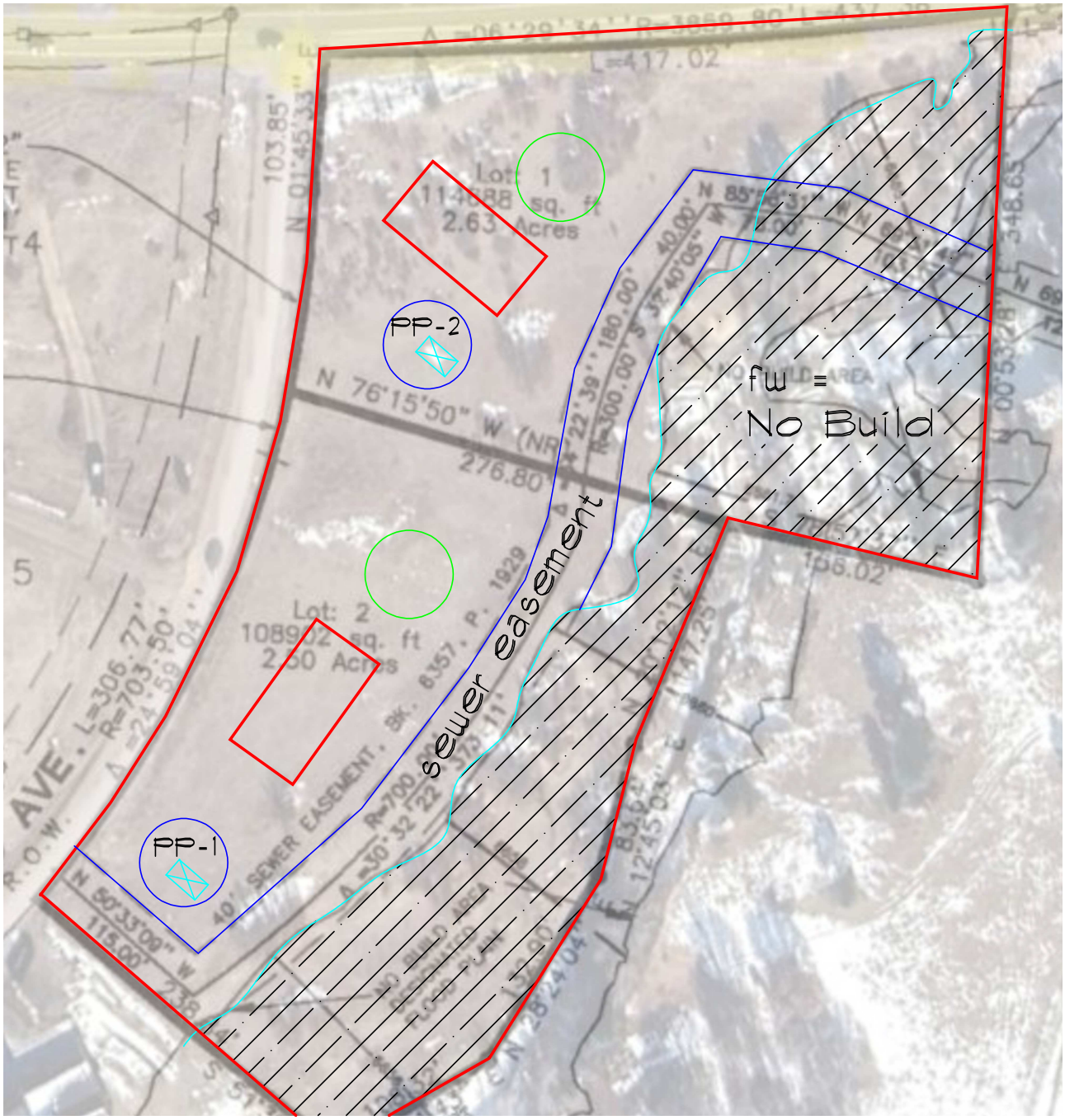
FEMA MAP

LOTS 7 AND 8, SPRING CREST SUB.
AMENDED
EL PASO COUNTY, CO
JAY STONER

JOB No. 184689

FIG No. 5

DATE 11-8-2021



FLOODPLAIN = NO BUILD ZONE

PROPOSED LOCATION OF NEW RESIDENCES

PROPOSED LOCATION OF OWTS

ALTERNATE LOCATION FOR OWTS

NOT TO SCALE

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SEPTIC SUITABILITY MAP

LOTS 1 AND 2, SPRING CREST SUB.
AMENDED
EL PASO COUNTY, CO
JAY STONER

JOB No. 184689

FIG No. 6

DATE 11-8-2021
REV 4-18-2024

PROFILE PIT PP-1

DATE OBSERVED: 10/19/2021

SOIL DESCRIPTION	DEPTH (FT)	SYMBOL	SOIL TYPE
0 - 3.5 FT SILTY CLAY LOAM (MODERATE)	2ft		3
3.5 FT - 5.0 FT SANDY CLAY (MODERATE)	4ft		4
5.0 FT - 8.0 FT CLAY (STRONG)	6ft		4
	8ft		

PROFILE PIT PP-2

DATE OBSERVED: 10/19/2021

SOIL DESCRIPTION	DEPTH (FT)	SYMBOL	SOIL TYPE
0 - 3.5 FT SILTY CLAY (STRONG)	2ft		4
3.5 FT - 8.0 FT SILTY CLAY LOAM (MODERATE)	4ft		3
	6ft		
	8ft		

SOIL DESCRIPTIONS

- SILTY CLAY LOAM
- SANDY CLAY
- SILTY CLAY
- CLAY

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ROCKY MOUNTAIN GROUP

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PROFILE PIT LOGS

LOTS 7 AND 8, SPRING CREST SUB. AMENDED
EL PASO COUNTY, COLORADO
JAY STONER

JOB No. 184689

FIG No. 7

DATE 11-8-2021

APPENDIX A

1. *Site Plan*, 2295 Old Ranch Road, Lots 7 & 8 Springcrest Amended Filing, El Paso County, prepared by Oliver E. Watts, Dwg No. 21-5669-02, dated July 29, 2021.
2. *Flood Insurance Rate Map, El Paso County, Colorado and Unincorporated Areas, Community Panel No. 081041C0506G,* Federal Emergency Management Agency (FEMA), effective December 7, 2018. *FEMA Flood Map Service Center:* https://msc.fema.gov/portal/search?AddressQuery=2295%20old%20ranch%20road%2C%20colorado%20springs%2C%20colorado#searchresultsanchor
3. *Geologic Map of the Pikeview 7.5 Minute Quadrangle, El Paso Couny, Colorado*, By Jon P. Thorson, Christopher J. Carroll, and Matthew L. Morgan, Geological Survey Open-File Map 01-3.
4. *Pike View Quadrangle, Environmental and Engineering Geologic Map for Land Use*, compiled by Dale M. Cochran, Charles S. Robinson & Associates, Inc., Golden, Colorado, 1977.
5. *Pike View Quadrangle, Map of Potential Geologic Hazards and Surficial Deposits*, compiled by Dale M. Cochran, Charles S. Robinson & Associates, Inc., Golden, Colorado, 1977.
6. *Reconnaissance Geologic Map of Colorado Springs and Vicinity, Colorado,* Department of the Interior United State Geologic Survey, prepared by Glenn R. Scott and Reinhord A. Wobus, Miscellaneous Field Studies, Map MF-482, Sheets 1 and 2, 1973.
7. *Colorado Springs Landslide Susceptibility, Colorado Geological Survey:* https://cologeosurvey.maps.arcgis.com/apps/webappviewer/index.html?id=5e7484a637c4432e84f4f16d0af306d3
8. *Colorado Landslide Inventory, Colorado Geological Survey:* https://cologeosurvey.maps.arcgis.com/apps/webappviewer/index.html?id=9dd73db7fbc34139abe51599396e2648.
9. *Pikes Peak Regional Building Department:* https://www.pprbd.org/.
10. *City of Colorado Springs, Subdivision Document Viewer:* http://www.springsgov.com/SubDivView/default.asp?cmdGoBack=New+Search....
11. *El Paso County Assessor, El Paso County, Colorado:* https://property.spatialest.com/co/elpaso/#/property/6228005030 and https://property.spatialest.com/co/elpaso/#/property/6228005033 Schedule No.s. 6228005033 and 6228005030
12. *Colorado Geological Survey, USGS Geologic Map Viewer*: http://coloradogeologicalsurvey.org/geologic-mapping/6347-2/.
13. *Historical Aerials:* https://www.historicaerials.com/viewer, Images dated 1947, 1960, 1969, 1999, 2005, 2009, 2011, 2013, and 2015.
14. *USGS Historical Topographic Map Explorer:* http://historicalmaps.arcgis.com/usgs/ Images dated 1950, 1951, 1956, 1657, 1963, 1966, 1970, 1974, 1977, 1994, 2001, 2013 and 2013.
15. *Google Earth Pro*, Imagery dated 1999, 2003, 2004, 2005, 2006, 2011, 2015, 2017, and 2018.

APPENDIX A

Subsurface Soil Investigation, 2295 Old Ranch Road, *Lot 7, Vac E. 20.0 Ft of Otero Ave, Adj Blk E, Spring Crest AMD Filing, El Paso County, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 185103, dated November 8, 2021.

Architecture
Structural
Geotechnical

Materials Testing
Forensic
Civil/Planning

ROCKY MOUNTAIN GROUP
EMPLOYEE OWNED

SUBSURFACE SOIL INVESTIGATION

Currently addressed as: 2295 Old Ranch Rd
Lot 7, Spring Crest AMD Filing
El Paso County, Colorado

PREPARED FOR:

Jay Stoner
5655 Bridlespur Ridge Place
Colorado Springs, CO 80918

JOB NO. 185103

November 8, 2021

Respectfully Submitted,
RMG – Rocky Mountain Group

Kelli Zigler
Project Geologist

Reviewed by,
RMG – Rocky Mountain Group

COLORADO REGISTERED
ANTHONY P. MUNGER
11/8/21
39818
PROFESSIONAL ENGINEER

Tony Munger, P.E.
Geotechnical Project Manager

Scope of Investigation

RMG – Rocky Mountain Group drilled two test borings for the proposed new single family residence (with basement) and greenhouse/shop at the above-referenced address on July 26, 2021. Currently the property is addressed as 2295 Old Ranch Road, Lot 7. However it is our understanding that once the minor subdivision approval is finalized through El Paso County Planning and Community Development Department, a new address is to be assigned to the new lot and a single-family residence is to be constructed. The new lot will be Lot 1 of the Spring Crest subdivision.

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. The following is 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.

Previous Studies and Field Investigation

Reports of previous geotechnical engineering/geologic investigations for this site and area were available for our review and are listed below:

1. *Soils and Geology Study, 10245 Otero Avenue, Lots 7 and 8, Spring Crest, AMD Filing, El Paso County, Colorado,* prepared by RMG – Rocky Mountain Group, Job No. 184689, dated November 8, 2021.
2. *Subsurface Soils Investigation, 10245 Otero Avenue, Lot 8 Spring Crest, AMD, Filing, El Paso County, Colorado,* prepared by RMG – Rocky Mountain Group, Job No. 185103, dated November 8, 2021.
3. *Geologic Hazard Study, currently addressed as: 2210 Old Ranch Rd, EPC Schedule No. 6228001007, El Paso County, Colorado,* prepared by RMG – Rocky Mountain Group, Job No. 182596, dated July 8, 2021.
4. *Subsurface Soil Investigation, 9965 Otero Avenue, Colorado Springs, Colorado*, prepared by RMG - Rocky Mountain Group, Job No. 148483, dated July 24, 2015.

The findings, conclusions and recommendations contained in this reports were considered during the preparation of this report.

Subsurface Materials

The subsurface materials encountered in test boring TB-1 generally consisted of sandy clay extending to approximately 8 feet below the existing surface. Underlying the surface materials in TB-1, sandy claystone extends to 18 feet and is underlain by sandy shale that extends to the 20-foot termination depth of the test boring. The subsurface materials encountered in test boring TB-2 generally consisted of sandy clay extending to approximately 8 feet below the existing surface.

Underlying the surface materials in TB-2, sandy claystone extends to the 20-foot termination depth of the test boring. Additional descriptions and the interpreted distribution (approximate depths) of the subsurface materials are presented in the Test Boring Logs.

Groundwater was not encountered in the test borings 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

The sandy clay, claystone, and shale are considered to possess moderate to high swell potential and are not suitable for support of shallow foundations. It is anticipated the sandy shale is to have sufficient separation from the bottom of foundation components and floor slabs. However, the sandy clay and claystone are anticipated to be determined at or near the bottom of foundation components and floor slabs, it will require removal (overexcavation) and replacement with non-expansive, granular structural fill to a depth which results in at least 3 feet of compacted structural fill below foundation components and floor slabs. The zone of overexcavation and replacement should extend a minimum of 3 feet beyond the building perimeter, including beyond the perimeter of counterforts and "T" wall footings. The structural fill should be observed and tested during placement as indicated under the **Structural Fill** section of this report, to ensure proper compaction.

Foundation Recommendations

A spread footing foundation supported on newly placed and compacted structural fill is suitable for the proposed structure. A maximum allowable bearing pressure of 2,000 psf with no minimum dead load requirement may be used for design. 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, including around 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.

Overexcavation Drain

If an overexcavation is performed and granular, non-expansive backfill is used for the replacement soils, a subsurface drain may also be recommended around the perimeter of the excavation. This drain is to be placed at the bottom of the overexcavated portion of the excavation (in this case 3 feet below footing grade) prior to backfilling. A typical drain detail is presented in Figure 9.

It must be understood that 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

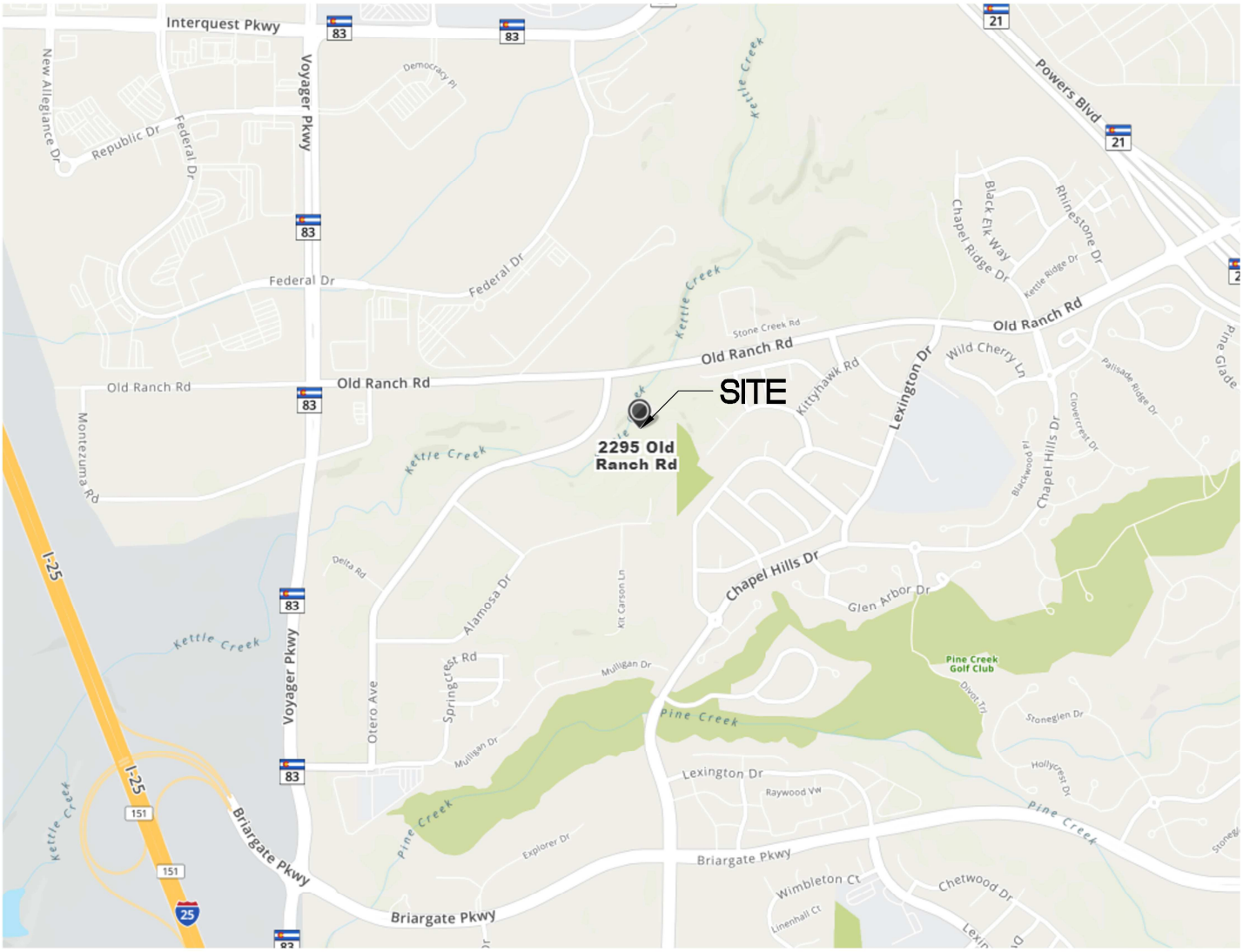
This report may be partial fulfillment of Colorado Senate Bill 13 (1984), C.R.S. 6-6.5-101, *The Soil and Hazard Analysis of Residential Construction*, if the purchaser receives this report at least fourteen days prior to closing.

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.



NOT TO SCALE

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Central Office:
Englewood, CO 80112
(303) 688-9475
Northern Office:
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(970) 330-1071

SITE VICINITY MAP

2295 OLD RANCH ROAD
LOT 7, SPRING CREST AMD FILING
EL PASO COUNTY, CO
JAY STONER

JOB No. 185103

FIG No. 1

DATE 11-8-2021

GPS COORDINATES:
TB-1: 38.980146, -104.786592
TB-2: 38.980218, -104.786710
ACCURACY +/- 20 FEET

DENOTES APPROXIMATE LOCATION OF TEST BORINGS

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TEST BORING LOCATION PLAN

2295 OLD RANCH ROAD
LOT 7, SPRING CREST AMD FILING
EL PASO COUNTY, CO
JAY STONER

JOB No. 185103

FIG No. 2

DATE 11-8-2021

SOILS DESCRIPTION

CLAYSTONE

SANDY CLAY

SHALE

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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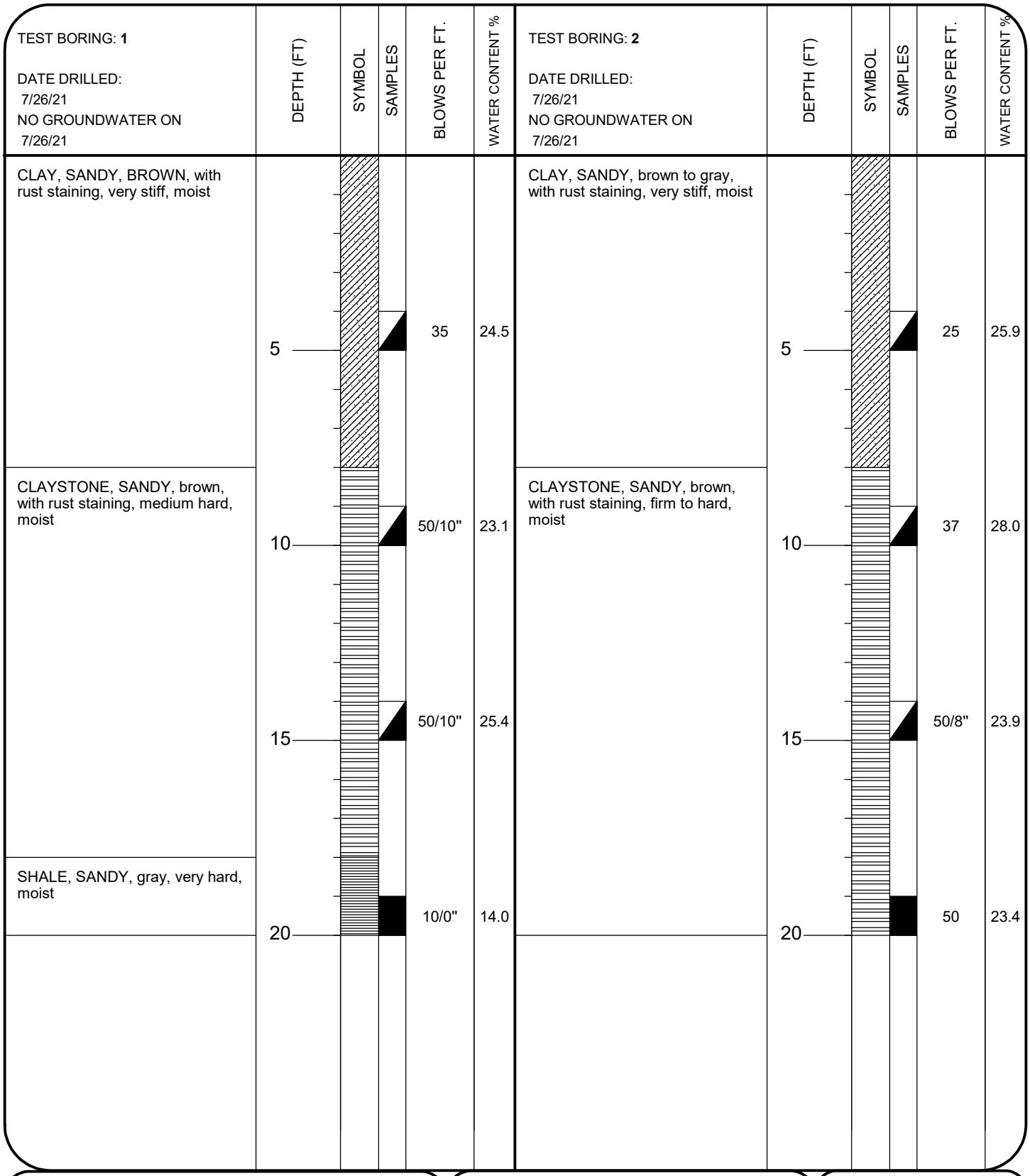
SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

EXPLANATION OF TEST BORING LOGS

JOB No. 185103

FIGURE No. 3

DATE Nov/08/2021



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TEST BORING LOG

JOB No. 185103

FIGURE No. 4

DATE Nov/08/2021

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	Load at Saturation (psf)	% Swell/ Collapse	USCS Classification
1	4.0	24.5		53	31		48.8			SC
1	9.0	23.1								
1	14.0	25.4								
1	19.0	14.0								
2	4.0	25.9								
2	9.0	28.0	90.6	60	29				2.6	
2	14.0	23.9								
2	19.0	23.4								

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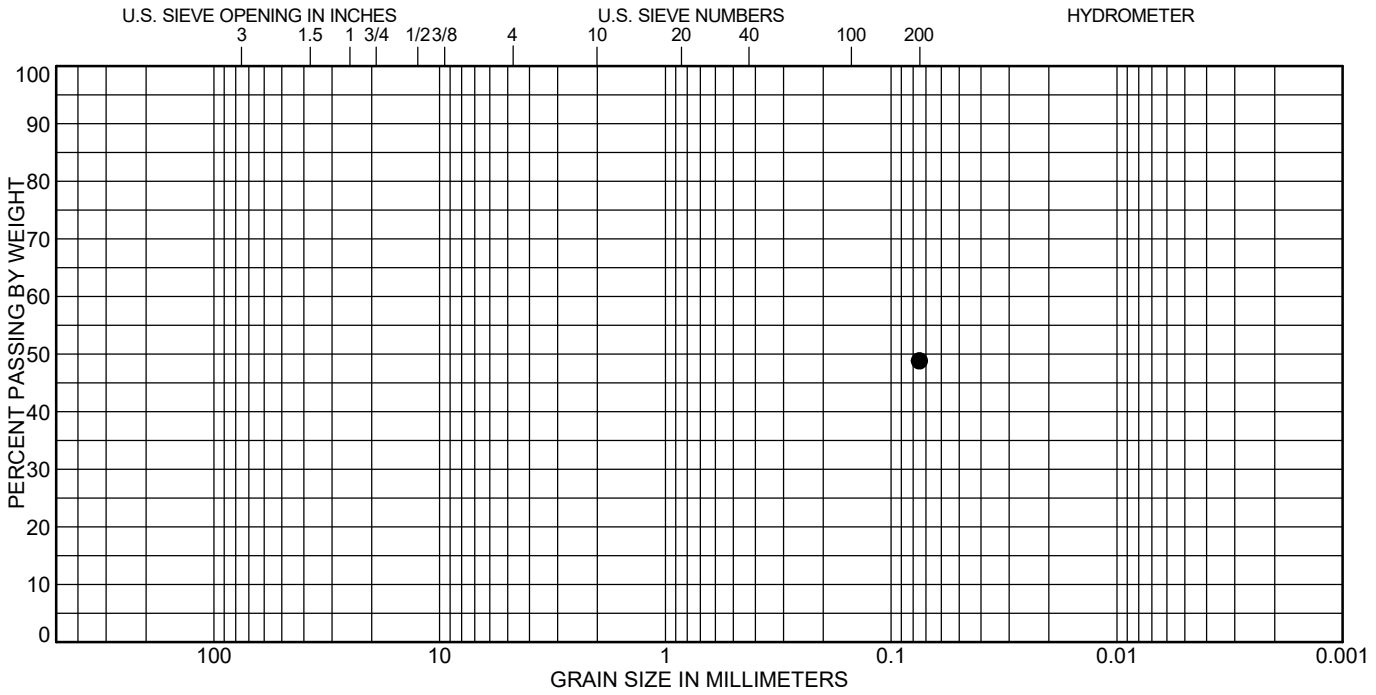
SUMMARY OF LABORATORY TEST RESULTS

JOB No. 185103
FIGURE No. 5
PAGE 1 OF 1
DATE Nov/08/2021



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)**	**53**	**22**	**31**

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	**1**	**4.0**			**48.8**	

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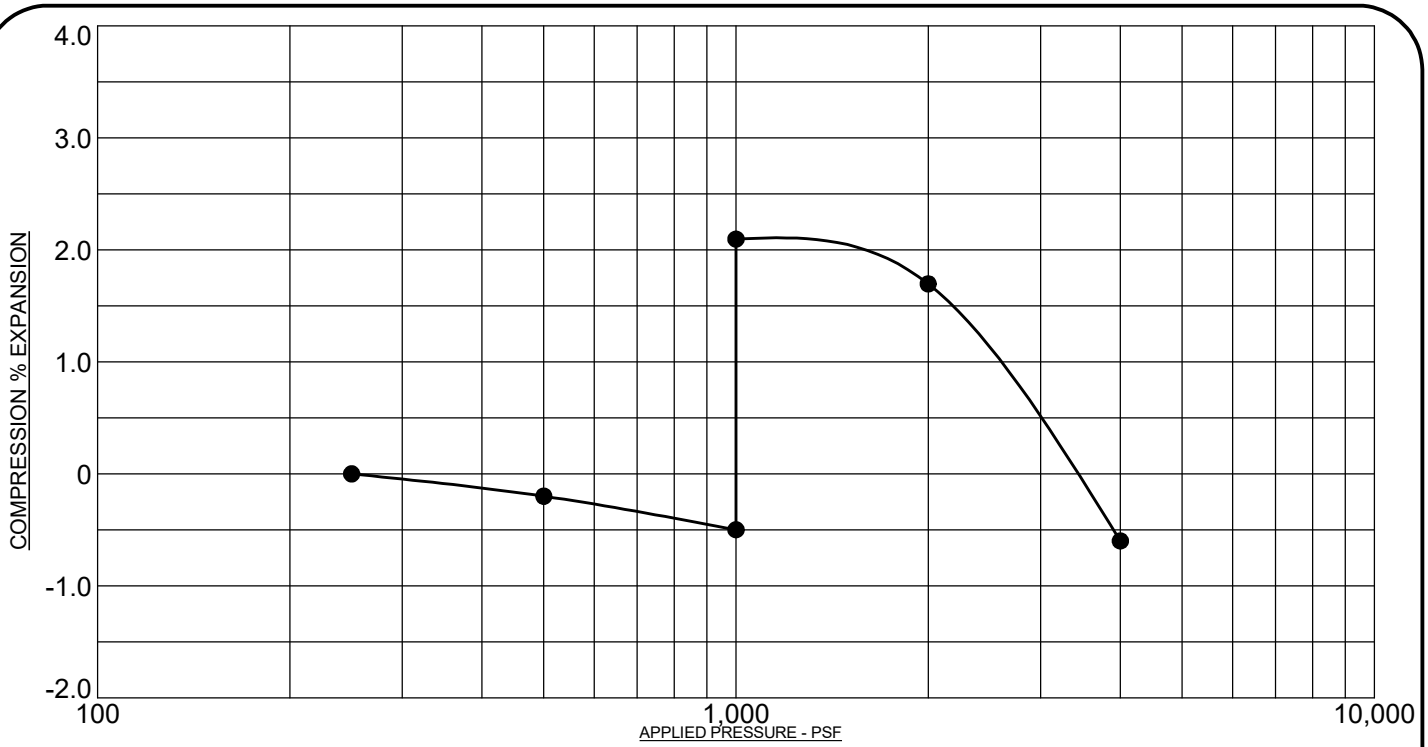
SOIL CLASSIFICATION DATA

JOB No. 185103

FIGURE No. 6

DATE Nov/08/2021



PROJECT: **2295 Old Ranch Road, El Paso County, Colorado**
SAMPLE DESCRIPTION: **CLAYSTONE, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **2 @ 9 FT**
NATURAL DRY UNIT WEIGHT: **90.6 PCF**
NATURAL MOISTURE CONTENT: **28.0%**
PERCENT SWELL/COMPRESSION: **2.6**

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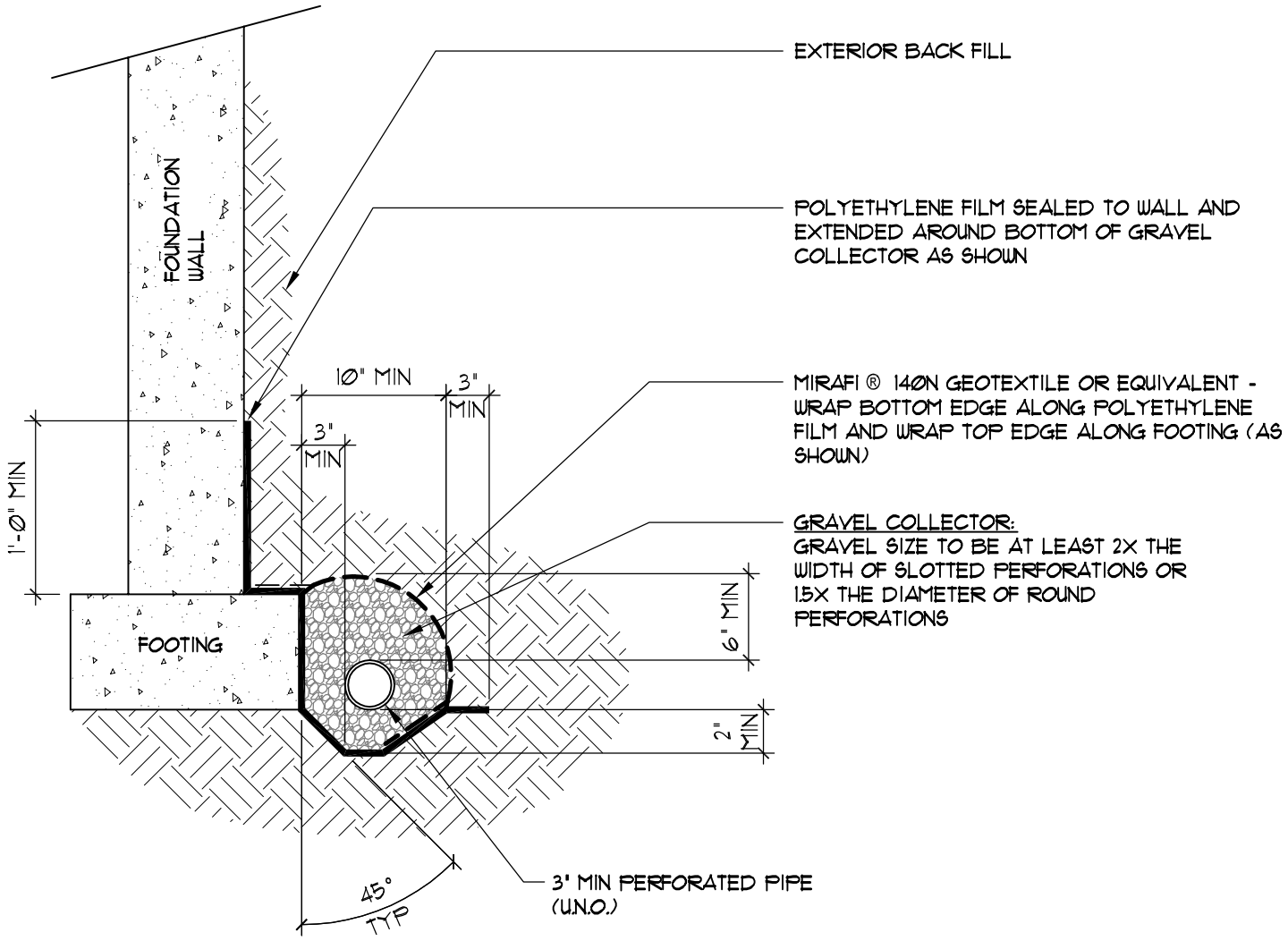
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 185103

FIGURE No. 7

DATE Nov/08/2021



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.
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.

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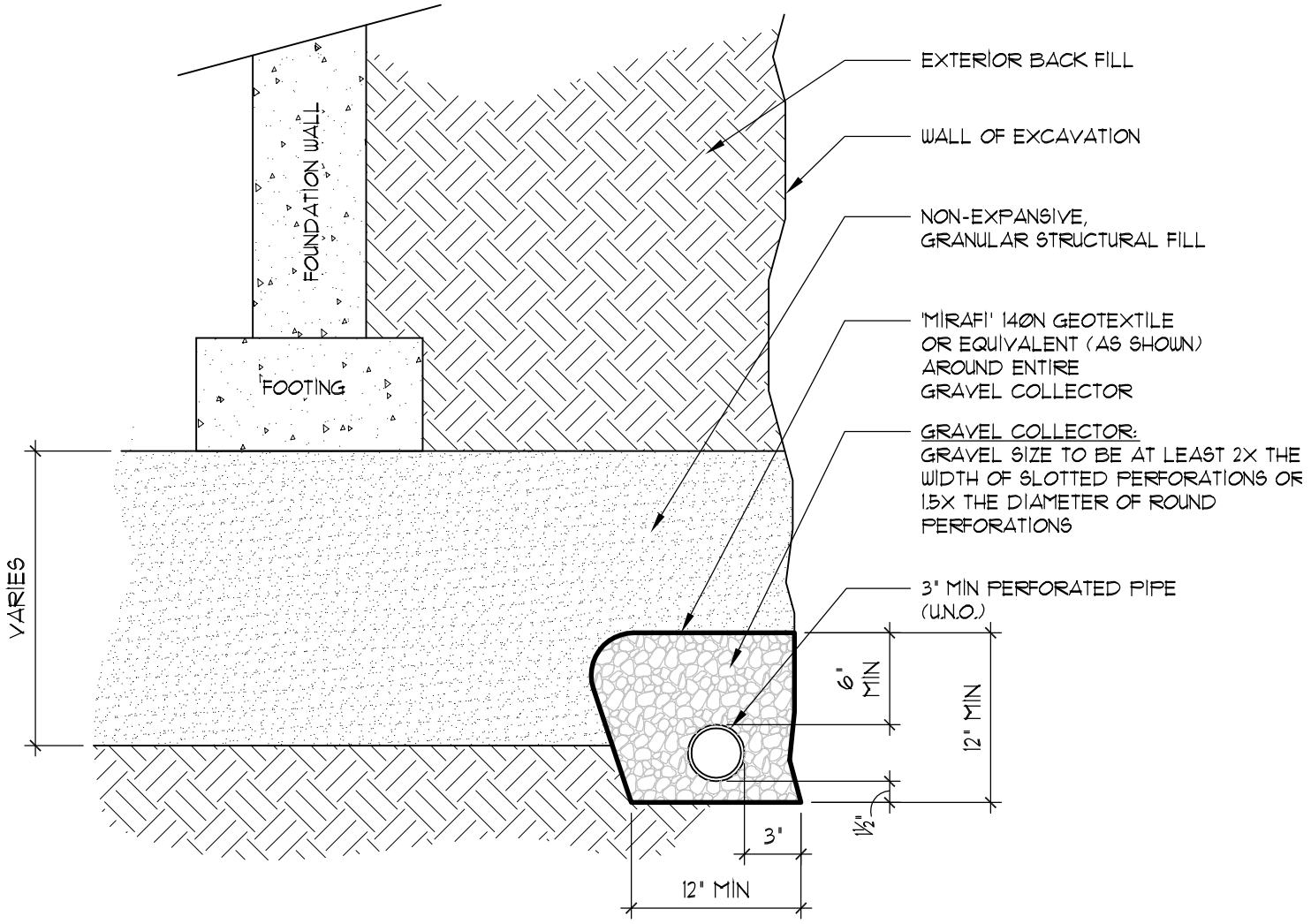
PERIMETER DRAIN

FIG No. 8



GENERAL NOTES:

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OVEREXCAVATION DRAIN

FIG No. 9

APPENDIX B

Subsurface Soil Investigation currently addressed as: 10245 Otero Avenue, Lot 8, Spring Crest AMD Filing, El Paso County, Colorado, prepared by RMG – Rocky Mountain Group, Job No. 184689, dated November 8, 2021.

Architecture
Structural
Geotechnical

Materials Testing
Forensic
Civil/Planning

ROCKY MOUNTAIN GROUP
EMPLOYEE OWNED

SUBSURFACE SOIL INVESTIGATION

10245 Otero Av
Lot 8, Spring Crest AMD Filing
El Paso County, Colorado

PREPARED FOR:

Jay Stoner
5655 Bridlespur Ridge Place
Colorado Springs, CO 80918

JOB NO. 184689

November 8, 2021

Respectfully Submitted,
RMG – Rocky Mountain Group

Kelli Zigler
Project Geologist

Reviewed by,
RMG – Rocky Mountain Group

COLORADO REGISTERED
ANTHONY P. MUNGER
11/8/21
39818
PROFESSIONAL ENGINEER

Tony Munger, P.E.
Geotechnical Project Manager

Scope of Investigation

RMG – Rocky Mountain Group drilled two test borings for the proposed Single Family Residence and barn at the above-referenced address on July 26, 2021. Currently the property is addressed as 2295 Old Ranch Road, Lot 7. However it is our understanding that once the minor subdivision approval is finalized through El Paso County Planning and Community Development Department, a new address is to be assigned to the new lot and a single-family residence is to be constructed. The new lot will be Lot 2 of the Spring Crest subdivision.

This report presents geotechnical engineering recommendations for design and construction of residential foundations. The following is 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.

Previous Studies and Field Investigation

Reports of previous geotechnical engineering/geologic investigations for this site and area were available for our review and are listed below:

1. *Soils and Geology Study, 10245 Otero Avenue, Lots 7 and 8, Spring Crest, AMD Filing, El Paso County, Colorado,* prepared by RMG – Rocky Mountain Group, Job No. 184689, dated November 8, 2021.
2. *Subsurface Soils Investigation, 2295 Old Ranch Road, Lot 7 Spring Crest, AMD, Filing, El Paso County, Colorado,* prepared by RMG – Rocky Mountain Group, Job No. 185103, dated November 8, 2021.
3. *Geologic Hazard Study, currently addressed as: 2210 Old Ranch Rd, EPC Schedule No. 6228001007, El Paso County, Colorado,* prepared by RMG – Rocky Mountain Group, Job No. 182596, dated July 8, 2021.
4. *Subsurface Soil Investigation, 9965 Otero Avenue, Colorado Springs, Colorado*, prepared by RMG - Rocky Mountain Group, Job No. 148483, dated July 24, 2015.

The findings, conclusions and recommendations contained in this reports were considered during the preparation of this report.

Subsurface Materials

The subsurface materials encountered in test boring TB-1 generally consisted of clayey sand with gravel extending to approximately 7 feet below the existing surface. Underlying the surface materials in TB-1, clayey sandstone extends to 15 feet and is underlain by sandy shale that extends to the 20-foot termination depth of the test boring. The subsurface materials encountered in test boring TB-2 generally consisted of clayey sand with gravel that extends to the 20-foot termination depth of the test boring. Additional descriptions and the interpreted distribution (approximate depths) of the subsurface materials are presented in the Test Boring Logs.

Groundwater was not encountered in the test borings 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.

Overexcavation and Replacement

The sandy shale is considered to possess low to moderate swell potential and is not suitable for support of shallow foundations. It is anticipated the shale will have sufficient separation from the bottom of foundation components and floor slabs. However, if the sandy shale is determined to be within 3 feet of the bottom of foundation components or floor slabs, it will require removal (overexcavation) and replacement with non-expansive, granular structural fill to a depth which results in at least 3 feet of compacted structural fill below foundation components and floor slabs. The zone of overexcavation and replacement should extend a minimum of 3 feet beyond the building perimeter, including beyond the perimeter of counterforts and "T" wall footings. The structural fill should be observed and tested during placement as indicated under the **Structural Fill** section of this report, to ensure proper compaction.

Foundation Recommendations

A spread footing foundation supported on the on-site sand soils, sandstone, or on newly placed and compacted structural fill is suitable for the proposed residential structures. We have anticipated the deepest excavation cuts for basement construction will be approximately 6 to 8 feet below the existing ground surface.

If the bottom of the excavation consists entirely of sandstone, a maximum allowable bearing pressure of 3,000 psf with no minimum dead load requirement may be used for design. However, the structure shall not be supported atop soils/bedrock of significantly different bearing capacities. If any portion of the structure is to be supported atop the on-site sand soils or on structural fill, the remaining portions of the excavation shall have the top 12 inches of exposed sandstone bedrock removed and replaced with structural fill.

For a structure supported atop sand soils and/or structural fill, a maximum allowable bearing pressure of 2,000 psf with no minimum dead load requirement may be used for design. 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, including around crawlspace areas but not the walkout trench, if applicable. A typical drain detail is presented in Figure 7.

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.

Overexcavation Drain

If an overexcavation is performed and granular, non-expansive backfill is used for the replacement soils, a subsurface drain may also be recommended around the perimeter of the excavation. This drain is to be placed at the bottom of the overexcavated portion of the excavation (in this case 3 feet below footing grade) prior to backfilling. A typical drain detail is presented in Figure 8.

It must be understood that 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.

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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.

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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

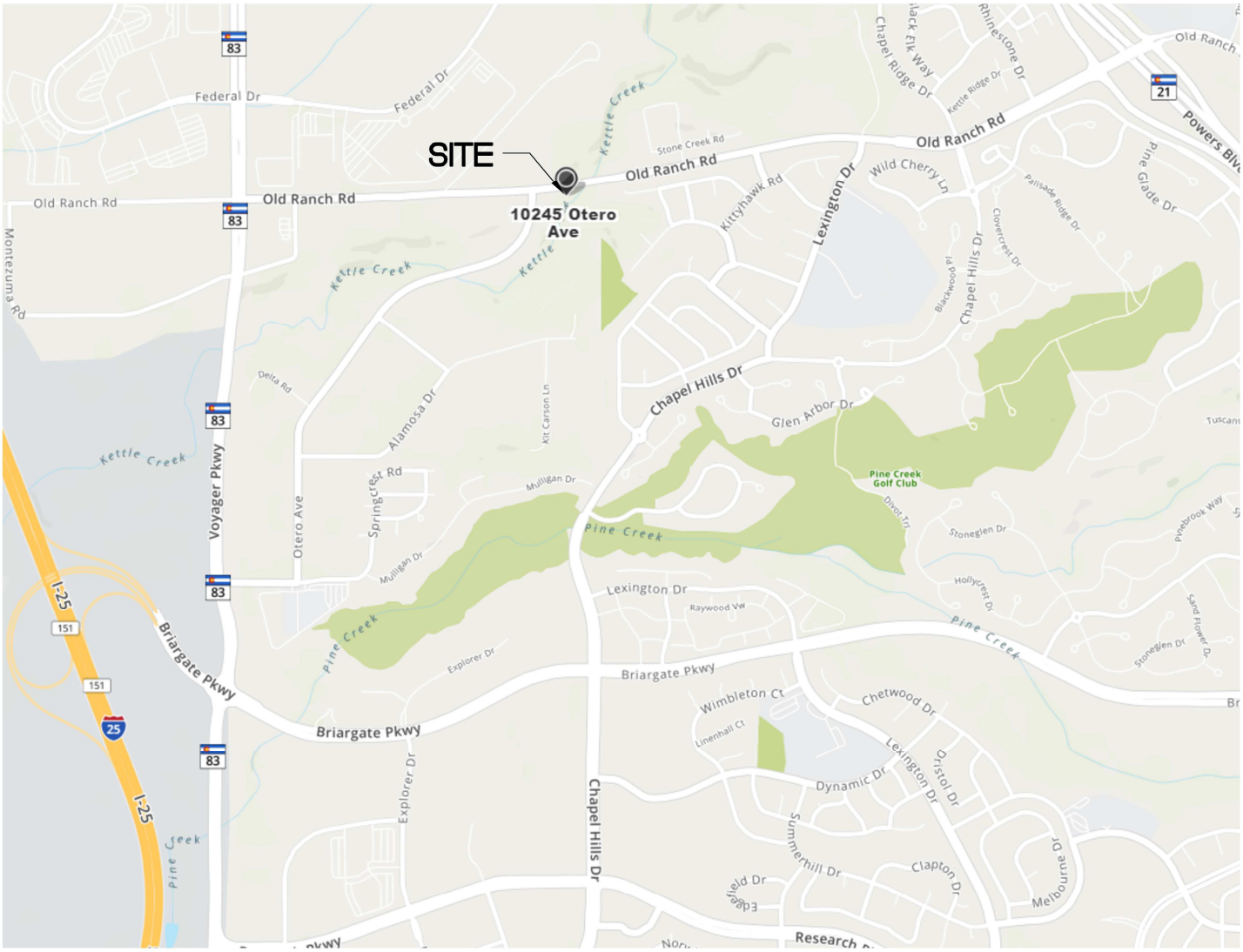
This report may be partial fulfillment of Colorado Senate Bill 13 (1984), C.R.S. 6-6.5-101, *The Soil and Hazard Analysis of Residential Construction*, if the purchaser receives this report at least fourteen days prior to closing.

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.



NOT TO SCALE

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SITE VICINITY MAP

10245 OTERO AVENUE
LOT 8, SPRING CREST AMD FILING
EL PASO COUNTY, CO
JAY STONER

JOB No. 184689

FIG No. 1

DATE 11-8-2021

GPS COORIDNATES:
TB-1:38.979325, -104.786569
TB-2: 38.979495, -104.786515
ACCURACY +/- 20 FEET

DENOTES APPROXIMATE LOCATION OF TEST BORINGS

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TEST BORING LOCATION PLAN

10245 OTERO AVENUE
LOT 8, SPRING CREST AMD FILING
EL PASO COUNTY, CO
JAY STONER

JOB No. 184689

FIG No. 2

DATE 11-8-2021

SOILS DESCRIPTION

 CLAYEY SAND

 SANDSTONE

 SHALE

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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Materials Testing
Civil, Planning

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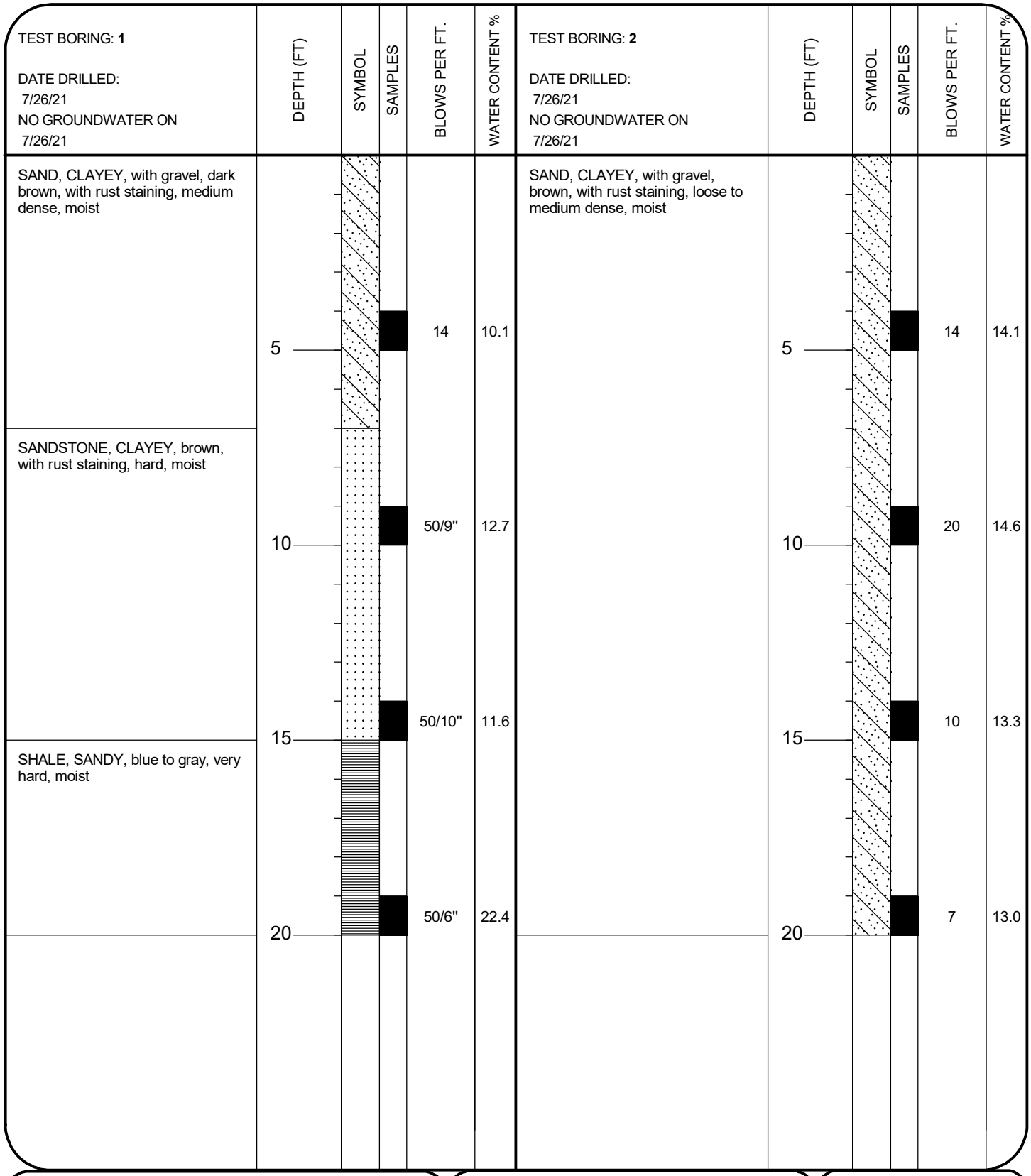
SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

EXPLANATION OF TEST BORING LOGS

JOB No. 184689

FIGURE No. 3

DATE Nov/08/2021



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TEST BORING LOG

JOB No. 184689

FIGURE No. 4

DATE Nov/08/2021

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	Load at Saturation (psf)	% Swell/ Collapse	USCS Classification
1	4.0	10.1								
1	9.0	12.7		NP	NP	0.0	9.5			SW-SM
1	14.0	11.6								
1	19.0	22.4								
2	4.0	14.1				4.5	21.8			SM
2	9.0	14.6								
2	14.0	13.3								
2	19.0	13.0								

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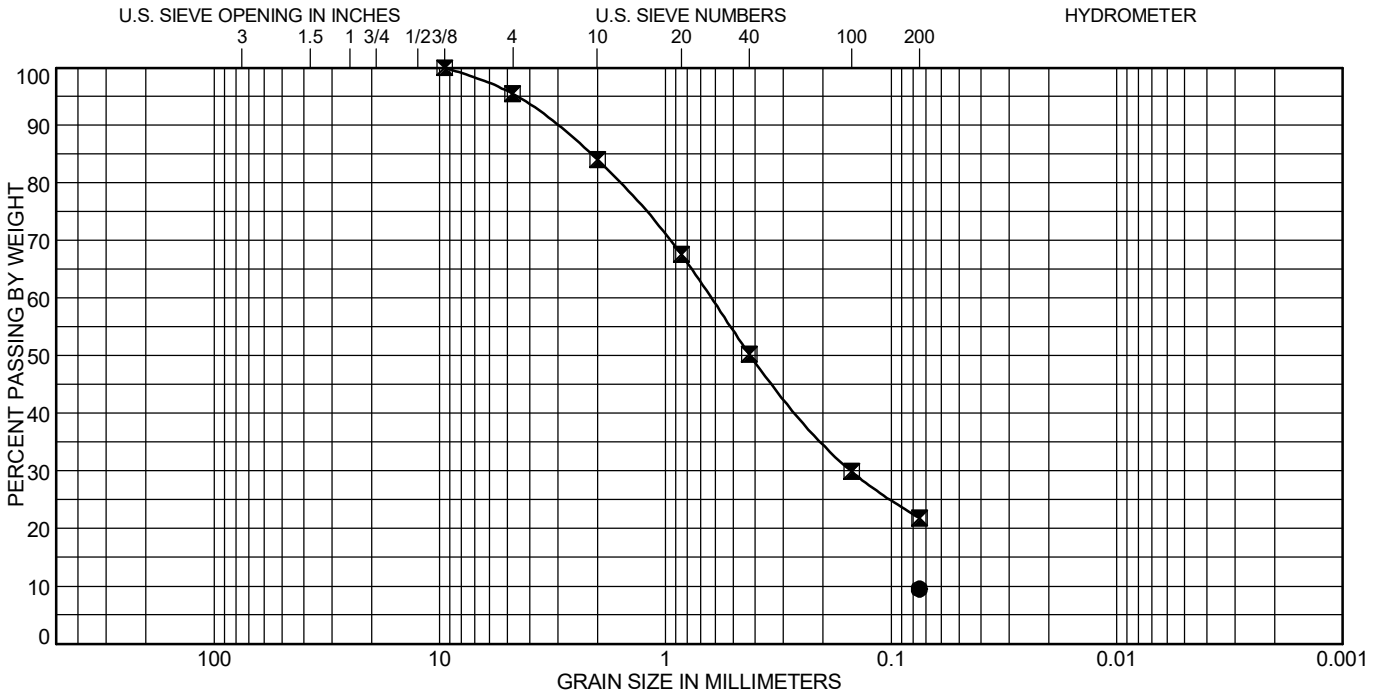
SUMMARY OF LABORATORY TEST RESULTS

JOB No. 184689
FIGURE No. 5
PAGE 1 OF 1
DATE Nov/08/2021



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	1	9.0		NP	NP	NP
⧓	2	4.0				

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	1	9.0			9.5	
⧓	2	4.0	4.5	73.7	21.8	

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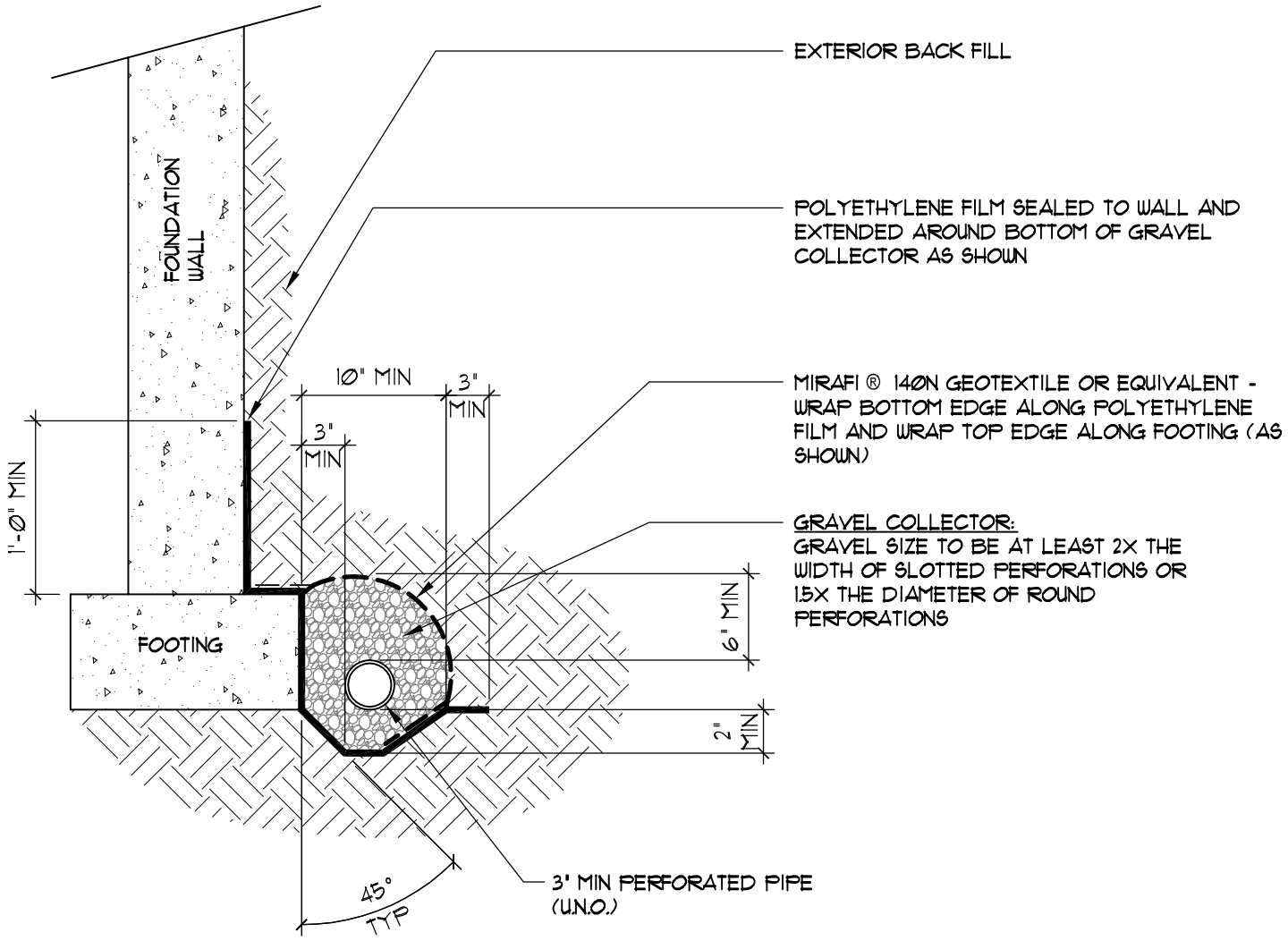
SOIL CLASSIFICATION DATA

JOB No. 184689

FIGURE No. 6

DATE Nov/08/2021



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.
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.

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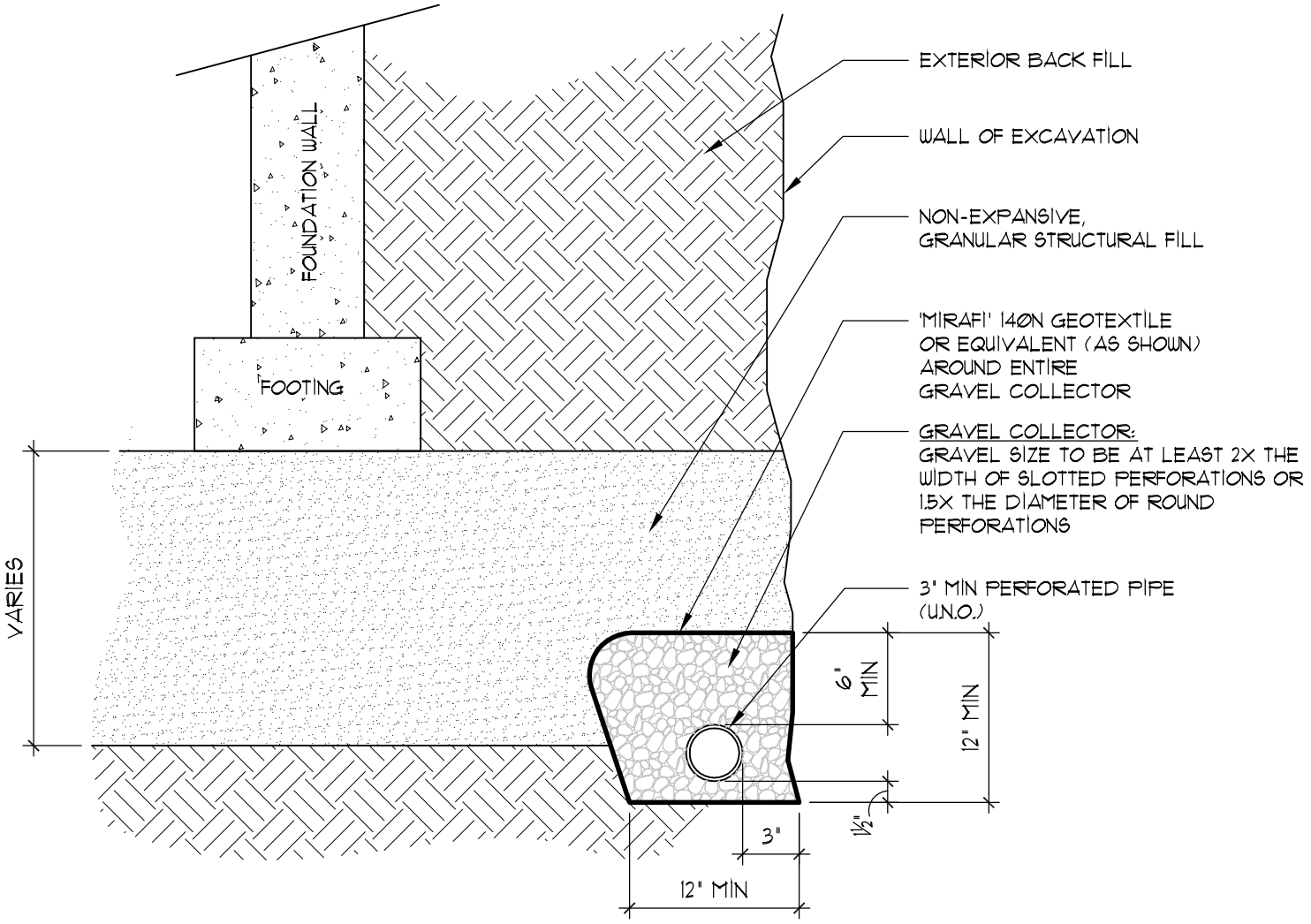
PERIMETER DRAIN

FIG No. 7



GENERAL NOTES:

1. ALL DRAIN PIPE SHALL BE PERFORATED PLASTIC, WITH THE EXCEPTION OF THE DISCHARGE PORTION WHICH SHALL BE SOLID, NON-PERFORATED PIPE.
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OVEREXCAVATION DRAIN

FIG No. 8