Architectural
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Materials Testing
Forensic
Civil/Planning

# SOIL AND GEOLOGY STUDY

## Mountain Road
## Guntzelman Porcelain Pines Subdivision
## El Paso County, Colorado

## PREPARED FOR:

**Kristian Guntzelman**
**5381 Sugar Camp Rd.**
**Milford, OH 45150**

## JOB NO. 188050

## March 18, 2022


**Respectfully Submitted,**

**RMG – Rocky Mountain Group**

**Kelli Zigler**
**Project Geologist**

**Reviewed by,**

**RMG – Rocky Mountain Group**

**Tony Munger, P.E.**
**Geotechnical Project Manager**

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# 1.0 GENERAL SITE AND PROJECT DESCRIPTION

### 1.1 Project Location

The project lies in Section 22, Township 13 South, Range 68 West of the 6th Principal Meridian in El Paso County, Colorado, and is generally located southeast of Chipita Park, Colorado near the intersection of Mountain Road and Kulsa Road. The approximate location of the site is shown on the Site Vicinity Map, Figure 1.

### 1.2 Existing and Proposed Land Use

The site currently consists of one parcel (per the El Paso County Assessor's website) of approximately 35.16 acres:

- Schedule No. 8322200018, current land use is classified as vacant land

The current zoning is *"R-T" – Residential Topographic.* The future zoning designation is to remain "*R-T" - Residential Topographic.*

### 1.3 Project Description

The site is currently undeveloped. It is our understanding the existing 35.16 acres is to be subdivided into a total of six lots. Lots one through four are to be approximately 6.16 acres each and lots five and six are to be approximately 5 acres. Each of the six new lots is to contain a single-family residence with an on-site wastewater treatment system. Each new lot is reportedly to have water serviced by Colorado Springs Utilities provided by an extension of a main line adjacent to the site. Individual water wells are not currently proposed. The Proposed Lot Layout is presented in Figure 2.

# 2.0 QUALIFICATIONS OF PREPARERS

This Soil and Geology Study 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 21 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, P.E. is a licensed professional engineer with over 21 years of experience in the construction engineering (residential) field. Mr. Munger holds a B.S. in Architectural Engineering from the University of Wyoming

# 3.0 STUDY OVERVIEW

The purpose of this investigation is to characterize the general geotechnical, geologic site conditions, and onsite wastewater treatment system (OWTS) feasibility and present our opinions of the potential effect of these conditions on the proposed development within El Paso County, Colorado. As such, our services exclude evaluation of the environmental and/or human, health related work products or recommendations previously prepared, by others, for this project.

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

## 3.1 Scope and Objective

The scope of this study is to include 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.

The objectives of our study are to:

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

This report presents the findings of the study performed by RMG-Rocky Mountain Group 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 several sources, including:

- Field reconnaissance
- Geologic and topographic maps
- Review of selected publicly available, pertinent engineering reports
- Available aerial photographs
- Subsurface exploration

- Visual and tactile characterization of representative site soil and rock samples
- Geologic research and analysis
- Site Concept Plan prepared by SMH Consultants
- *Preliminary Subsurface Soil Investigation and Geology Report*, prepared by RMG-Rocky Mountain Group, RMG Job No. 147611, last dated January 7, 2016.

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 Additional Documents

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

# 4.0 SITE CONDITIONS

### 4.1 Existing Site Conditions

The site is undeveloped. The site is generally located southeast of the intersection of Mountain Road and Kulsa Road in El Paso County, Colorado and comprises approximately 35.16 acres. The site is zoned R-T, residential topographic and is to remain residential topographic, in the future. Adjacent properties to the north, west, and south are zoned R-T, residential topographic. Adjacent properties to the east are zoned PUD, planned unit development and R-T, residential topographic.

### 4.2 Topography

Based on our site reconnaissance on February 22, 2022 and USGS 2019 topographic map of the Cascade Quadrangle, the site generally slopes down to the north and east with an overall elevation change of approximately 830 feet across the site.

### 4.3 Vegetation

The site vegetation primarily consists of tall native grasses, weeds, scrub oak, and dense pine and aspen forestation.

### 4.4 Aerial Photographs and Remote-Sensing Imagery

Personnel of RMG reviewed aerial photos available through Google Earth Pro dating back to 1999, CGS surficial geologic mapping, and historical photos by historicaerials.com dating back to 1947. Historically, the site has remained undeveloped, vacant land.

# 5.0 FIELD INVESTIGATION AND LABORATORY TESTING

### 5.1 Field and Laboratory Testing

The subsurface conditions below the subject site were investigated by RMG December 21, 2015 as part of the *Preliminary Subsurface Soil Investigation and Geology,* included in Appendix B.

### 5.2 Groundwater

Groundwater was not encountered in the test borings performed by RMG for the report referenced above.

Fluctuations in groundwater and subsurface moisture conditions may occur due to variations in rainfall and other factors not readily apparent at this time. Development of the property and adjacent properties may also affect groundwater levels.

# 6.0 SOIL, GEOLOGY, AND ENGINEERING GEOLOGY

The site is located within the western flank of the Colorado Piedmont section of the Great Plains physiographic province. The Colorado Piedmont, formed during the late tertiary and Early Quaternary time (approximately 2,000,000 years ago), is a broad, erosional trench which separates the Southern Rocky Mountains from the High Plains. During the Late Mesozoic and Early Cenozoic Periods (approximately 70,000,000 years ago), intense tectonic activity occurred, causing the uplifting of the Front Range and associated downwarping of the Denver Basin to the East. Relatively flat uplands and broad valleys characterize the present-day topography of the Colorado Piedmont in this region. A major structural feature known as the Ute Pass Fault traverses through the property from southeast to northwest.

### 6.1 Subsurface Soil Conditions

The subsurface materials encountered in the test borings for the previous report were described as silty to clayey sand with gravel, and granite bedrock.

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.

### 6.2 Bedrock Conditions

Bedrock (as defined by USDA Soil Structure and Grade) was encountered in the test borings performed for the previous investigation. In general, the bedrock beneath the site is considered to be part of the Pikes Peak Granite and Windy Point Granite formations.

### 6.3 U.S. Soil Conservation Service

The U.S. Soil Conservation Service along with the United States Department of Agriculture (USDA) identifies the site soils as:

- 26 – Legault-Rock outcrop complex, 15 to 65 percent slopes. Properties of the outcrop complex include well drained soils, depth of the water table is anticipated to be greater than 80 inches,

runoff is anticipated to be very high, frequency of flooding and ponding is none, and landforms include mountain slopes.

- 48 – Tecolote very gravelly sandy loam, 15 to 40 percent slopes. Properties of the sandy loam include well drained soils, depth of the water table is anticipated to be greater than 80 inches, runoff is anticipated to be medium, frequency of flooding is frequent to none and ponding is none, and landforms include mountain slopes.

The USDA Soil Survey Map is presented in Figure 4.

### 6.4 General Geologic Conditions

Based on our field observations and review of relevant geologic maps, we identified the geologic conditions (listed below) affecting the development, as shown on the Engineering and Geology Map, Figure 5.

The site generally consists of older fan deposits, alluvial and colluvial soils, and granite bedrock. Six geologic units were mapped at the site as:

- *Qf – Alluvial fan deposits (Holocene to late Pleistocene)* – Poorly sorted to moderately sorted, matrix-supported, gravelly, sandy silt to clast-supported, pebble and cobble gravel in a sandy silt or silty sand matrix. Clasts are mostly angular to subrounded and typically composed of granitic bedrock. Sediments are deposited primarily by streams; input from sheetwash, debris flows, and hyperconcentrated flows is minor. The maximum estimated thickness for fans along Fountain Creek locally exceeds 50 ft. These fans form on slope greater than 10 percent grade and lack fan-shaped morphology. Large precipitation events may trigger future deposition in areas underlain by alluvial fan deposits. Deposits may be prone to collapse, hydrocompaction, or slope failure when wetted or loaded. Deposit is a source of sand and gravel.
- *Ypp – Pikes Peak Granite (Middle Proterozoic)* - Resistant, red, pink, and locally pinkish-gray and greenish-gray, coarse-grained granite intrusions. Classified as granite according to the IUGS classification. On the basis of thin section petrography, the unit is characterized by generally equigranular but locally porphyritic textures made up mostly of microcline crystals, commonly about 1 in. long, subordinate quartz, moderate plagioclase, low hornblende, and low (about 3 percent) amounts of biotite. The rock is part of the Pikes Peak batholith, a huge anorogenic plutonic mass that is accompanied by several late-stage alkalic phases from several intrusive centers. The Pikes Peak Granite has sharp intrusive contacts, as opposed to older intrusive masses. The map unit includes uncommon aplite dikes, quartz veins, and pegmatite dikes and sills. The Pikes Peak Granite commonly weathers to grus, especially on north-facing slopes; deeper weathering, through processes described by Blair (1976), can result in a residuum cover as much as 150 ft thick. The age of the Pikes Peak Granite is about 1.08 to 1.02 Ga.
- *Ywp – Windy Point Granite (Middle Proterozoic)* - Resistant, red and pink, fine- to coarse-grained granitic and quartz monzonitic intrusions. These intrusions have the form of dikes, sills, and irregularly shaped plugs that intrude the Pikes Peak Granite in a north-trending belt that occupies the central to eastern part of the mapped area. Sills are mapped mostly along the eastern side of the mapped area. The unit is classified as granite according to the IUGS classification. On the basis of thin section petrography, the map unit is characterized by porphyritic textures in which red microcline phenocrysts as long as 1.2 in. make up as much as 40 percent of rock volume and rest in a red, fine- to medium-grained matrix of microcline, subordinate but abundant quartz, moderate to low plagioclase, low biotite, and 1 to 5 minerals, and significantly lower in quartz.
- *csk – Grus, crystalline-clast colluvium, alluvium, and rock outcrop*
- *SS – Steep Slopes* – Slopes exceeding 30%, designated as “no-build” zones

- *DW – Drainageway* – low lying areas that may collect seasonal surface run-off water

### 6.5 Engineering Geology

One engineering geology unit was mapped at the site as:

- *4C* – Old debris fan deposits along mountain front and along Fountain Creek above Manitou Springs

The map unit description for this unit is provided by Charles Robinson and Associates (1977).

### 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, in the surrounding area, or in the soil samples collected for laboratory testing.

### 6.7 Surficial (Unconsolidated) Deposits

Lake and pond sediments, 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.

### 6.8 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 study site or surrounding areas. Features indicating creep, slump, or slide masses in bedrock and surficial deposits were not observed on the property.

### 6.9 Drainage of Water and Groundwater

The overall topography of the site slopes down to the north and east. It is anticipated the direction of surface water and groundwater likely flow in the same direction. Groundwater was not encountered in the test borings performed for the previous investigation, and is not anticipated to affect shallow foundations.

### 6.10 Flooding and Surface Drainage

Based on our review of the Federal Emergency Management Agency (FEMA) Community Panel No. 08041C0486 and the online ArcGIS El Paso County Risk Map, the entire site lies outside of identified 100 or 500-year floodplains. The site lies in Zone X and Zone D. Zone X is defined by FEMA as an area of minimal flood hazard that is determined to be outside the Special Flood Hazard Area and higher than the elevation of the 0.2-percent-annual-chance (or 500-year) flood. Zone D is defined by FEMA as an Area of Undetermined Flood Hazard. The FEMA Map is presented in Figure 6.

# 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 granite and fine-grained granite. The granite is described as granite and granitic type rocks such as quartz, monzonite, and granodiorite underlying mountainous areas. The fine-grained granite is described as granite and granitic type rocks with small crystal structure generally dense and requiring blasting for excavation.

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, the tract identifier is 41-31. However, the area of the site has been mapped “little or no potential" for coal resources. In this part of the Denver coal region, the area lacks strata that may contain coal. According to an entry in the MRDS database from the U.S. Geological Survey, a small gold deposit is located about 0.7 miles south of the tract in an area underlain by Precambrian granite. The gold is said to possibly occur in a vein within the granite. There was never any significant gold production from this area. The tract has minimal potential for hosting metallic resources. No oil and gas wells are drilled in the area. This tract lacks all the essential elements of hydrocarbon accumulation. The tract is in an area consisting of Precambrian crystalline rocks. The Pikes Peak Granite, where weathered, can contain resources of grus (decomposed granite), which is used for basic construction purposes such as fill material. The Sawatch Quartzite, which overlies the Pikes Peak Granite in the far eastern part of this tract, has been used for dimension stone. The quartzite has been mined in the past from quarries in the area. In general, the tract is mostly underlain by granite of the Pikes Peak batholith. The Ute Pass Fault, a major reverse fault with thousands of feet of vertical displacement, transects the tract in a northwesterly direction. A small area of lower Paleozoic sedimentary rock is exposed in the southeastern corner of the tract.

# 8.0 IDENTIFICATION AND MITIGATION OF POTENTIAL GEOLOGIC CONDITIONS

The El Paso County Engineering Criteria Manual recognizes and delineates the difference between geologic 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 constraints were considered in the preparation of this report and are not anticipated to pose a significant risk to the proposed development:

- Avalanches
- Compressible Soils
- Expansive Soils
- Ground Subsidence
- Landslides
- Rockfall
- Ponding water
- Steeply Dipping Expansive Bedrock
- Scour, Erosion, accelerated erosion along creek banks and drainageways

- Corrosive Minerals

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

### 8.1 Debris Flows and Debris Fans

Debris flows consist of water with a high sediment load of sand, cobbles and boulders flowing down a stream, ravine, canyon, arroyo or gully, and are typically activated by heavy or long-term rains or snowmelts which cause rapid erosion and transport of surficial materials down slope of drainages. Debris fans are created when debris flows reach a valley with a much lower gradient. As the energy level drops, the sediment load is deposited creating the fan shape.

The presence of old debris fan deposits along the mountain front and along Fountain Creek above Manitou Springs was mapped in the area by Robinson and Associates. Alluvial fan deposits were also mapped in the area by Colorado Geological Survey.

Mitigation
Terrain features consistent with the formation of debris flows and debris fans were not present on the subject property site. However, debris fans were identified in the vicinity of the subject property site. The gradients and source materials on the subject property site are, in general, not conducive for generation of debris flows.

### 8.2 Potentially Unstable Slopes

No obvious signs of slope failures or unstable slopes were identified on the site during the course of this investigation or the previous investigation referenced above. Our review of publically available documents did not reveal any known landslides within or directly adjacent to this site. However, slopes greater than 30% currently exist on all of the proposed new lots. Slopes greater than 30% are considered potentially unstable and are generally designated as “no-build” zones.

Mitigation
Based on our review of the Site Concept Plan provided by SMH Consultants, it is not anticipated at this time that any structures are to be built within the designated “no-build” zones. The proposed structures should not encroach within 20 feet of the toe or 30 feet of the crest of potentially unstable slopes, unless a specific slope stability analysis has been performed to verify the long-term stability of the slope.

### 8.3 Faults and Seismicity

Based on review of the Earthquake and Late Cenozoic Fault and Fold Map Server provided by CGS located at http://dnrwebmapgdev.state.co.us/CGSOnline/ and the recorded information dating back to November of 1900, Colorado Springs has not experienced a recorded earthquake with a magnitude greater than 1.6 during that 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 located near the Ute Pass Fault, which traverses the subject site from southeast to northwest. The Rampart Range Fault is located approximately 5 miles to the east of 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 are more likely to affect structures at this site and will likely only affect slope stability to a minimal degree.

Mitigation

The Pikes Peak Regional Building Code, 2017 Edition, indicates maximum considered earthquake spectral response accelerations of 0.234g for a short period ($S_s$) and 0.062g for a 1-second period ($S_1$). Based on the results of our experience with similar subsurface conditions, we recommend the site be classified as Site Class B, with average shear wave velocities ranging from 2,500 to 5,000 feet per second for the materials in the upper 100 feet.

Structures spanning faults may experience differential movements and damage associated with relatively minor movements of the land masses on either side of the fault. Based upon information provided by CGS, relatively recent faults and folds have not been identified. However, the subject site is located near areas of a relic fault zone. If fault zones are identified during excavation, structures should be oriented such that they do not span the fault.

### 8.4 Radon

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

Western El Paso County and the 80809 zip code in which the site is located, has an EPA assigned Radon Zone of *1*. A radon Zone of *1* predicts an average indoor radon screening level greater than 0.4 pCi/L (picocuries per liter), which is above the recommended levels assigned by the EPA. *The EPA recommends corrective measures to reduce exposure to radon gas.*

All of the State of Colorado is considered EPA Zone 1 based on the information provided at https://county-radon.info/CO/El_Paso.html. Elevated hazardous levels of radon from naturally occurring sources are not anticipated 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. Passive radon mitigation systems are also available.

Passive and active mitigation procedures are commonly employed in this region to effectively reduce the buildup of radon gas. Measures that can be taken after the residence is enclosed during construction 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 they are enclosed and commonly utilized techniques are in place to minimize the risk.

# 9.0 BEARING OF GEOLOGIC CONDITIONS UPON PROPOSED DEVELOPMENT

Geologic hazards (as described in section 8 of this report) found to be present at this site include faults/seismicity and radon. Geologic constraints (as described in section 8 of this report) found to be present at this site include debris flows and debris fans and potentially unstable slopes. It is our opinion

that the existing geologic and engineering conditions can be satisfactorily mitigated through proper engineering, design, and construction practices.

# 10.0 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 not intended for use for design and construction. A site-specific subsurface soil investigation will be required for all proposed structures.

# 11.0 CONCLUSIONS

Based upon our evaluation of the geologic conditions, it is our opinion that the proposed development is feasible. The geologic conditions identified are considered typical 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 suitable construction practices.

In addition to the previously identified mitigation alternatives, surface and subsurface drainage systems should be considered. Exterior, perimeter foundation drains should be installed around below-grade habitable or storage spaces. A typical perimeter drain detail is presented in Figure 7. Surface water should be efficiently removed from the building area to prevent ponding and infiltration into the subsurface soil.

We believe the sand soils will classify as Type C materials as defined by OSHA in 29 CFR Part 1926. OSHA requires that temporary excavations made in C materials be laid back at ratios no steeper than ½:1 (horizontal to vertical), unless the excavation is shored and braced. Excavations deeper than 20 feet, or when water is present, should always be braced or the slope designed by a professional engineer.

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 the property to read and understand this report, and to carefully 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.

***The foundation systems for the proposed single-family residential structures and any retention/detention facilities should be designed and constructed based upon recommendations developed in a site-specific subsurface soil investigation.***

# 12.0 CLOSING

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

This report has been prepared for **Kristian Guntzelman** 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.

# FIGURES

# APPENDIX A

## Additional Reference Documents


1. *Site Concept Plan, Guntzelman Porcelain Pines Subdivision, Cascade, Colorado,* prepared by SMH Consultants, Project No. 2107-0307, dated September 8, 2021.
2. *Preliminary Subsurface Soil Investigation and Geology Report,* Jensen Subdivision, El Paso County, Colorado, prepared by RMG – Rocky Mountain Group, Job No. 147611, dated January 7, 2016
3. *Flood Insurance Rate Map, El Paso County, Colorado and Unincorporated Areas, Community Panel No. 08041C0486G,* Federal Emergency Management Agency (FEMA), effective December 7, 2018.
4. *Environmental and Engineering Geologic Map for Land Use*, compiled by Dale M. Cochran, Charles S. Robinson & Associates, Inc., Golden, Colorado, 1977.
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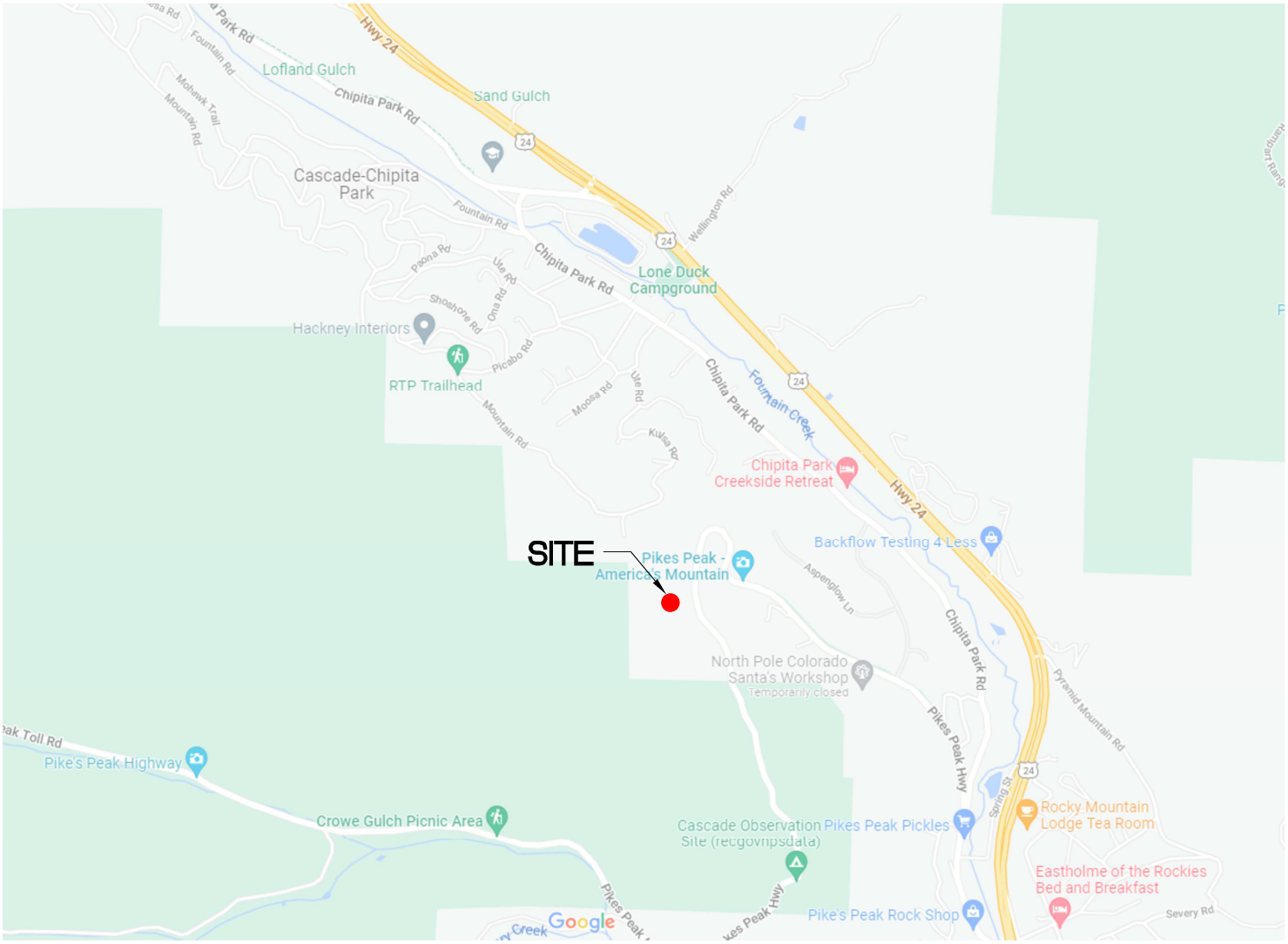
18. *Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands*
19. The *El Paso Aggregate Resource Evaluation Map, Master Plan for Mineral Extraction, Map 1*
20. Generalized surficial geologic map of the Pueblo 1 degree X 2 degree quadrangle, Colorado. Moore, D.W., Straub, A.W., Berry, M.E., Baker, M.L, and Brandt, T.R. , U.S. Geological Survey, Miscellaneous Field Studies Map MF-2388, 2002.

# APPENDIX B

*Preliminary Subsurface Soil Investigation and Geology Report*, Jensen Subdivision, El Paso County, Colorado, prepared by RMG – Rocky Mountain Group, Job No. 147611, dated January 7, 2016

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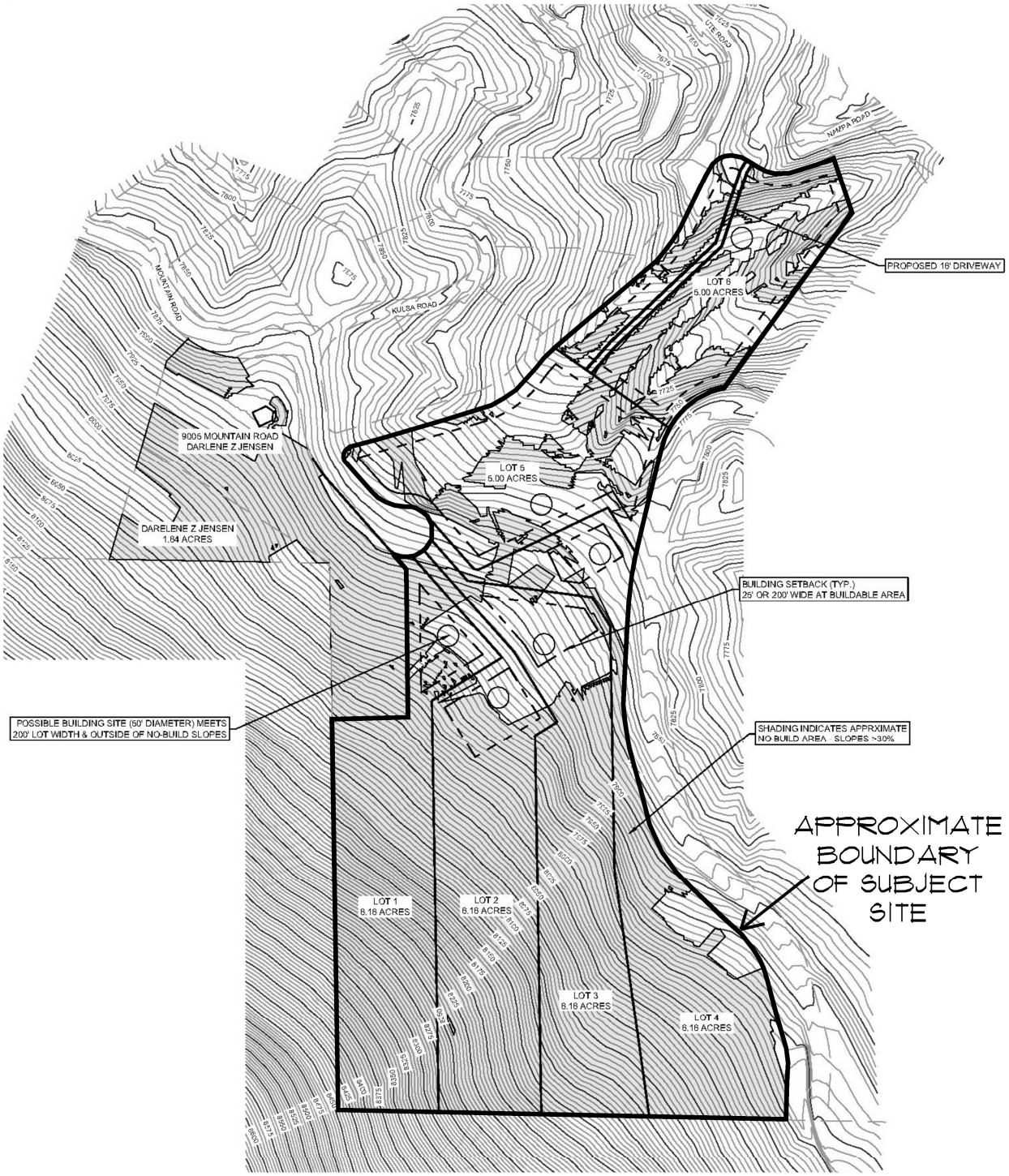
# SITE VICINITY MAP

MOUNTAIN ROAD
GUNTZELMAN PORCELAIN
PINES SUBDIVISION
EL PASO COUNTY, COLORADO
KRISTIAN GUNTZELMAN

JOB No. 188050

FIG No. 1

DATE 3-18-2022

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# PROPOSED LOT LAYOUT

MOUNTAIN ROAD
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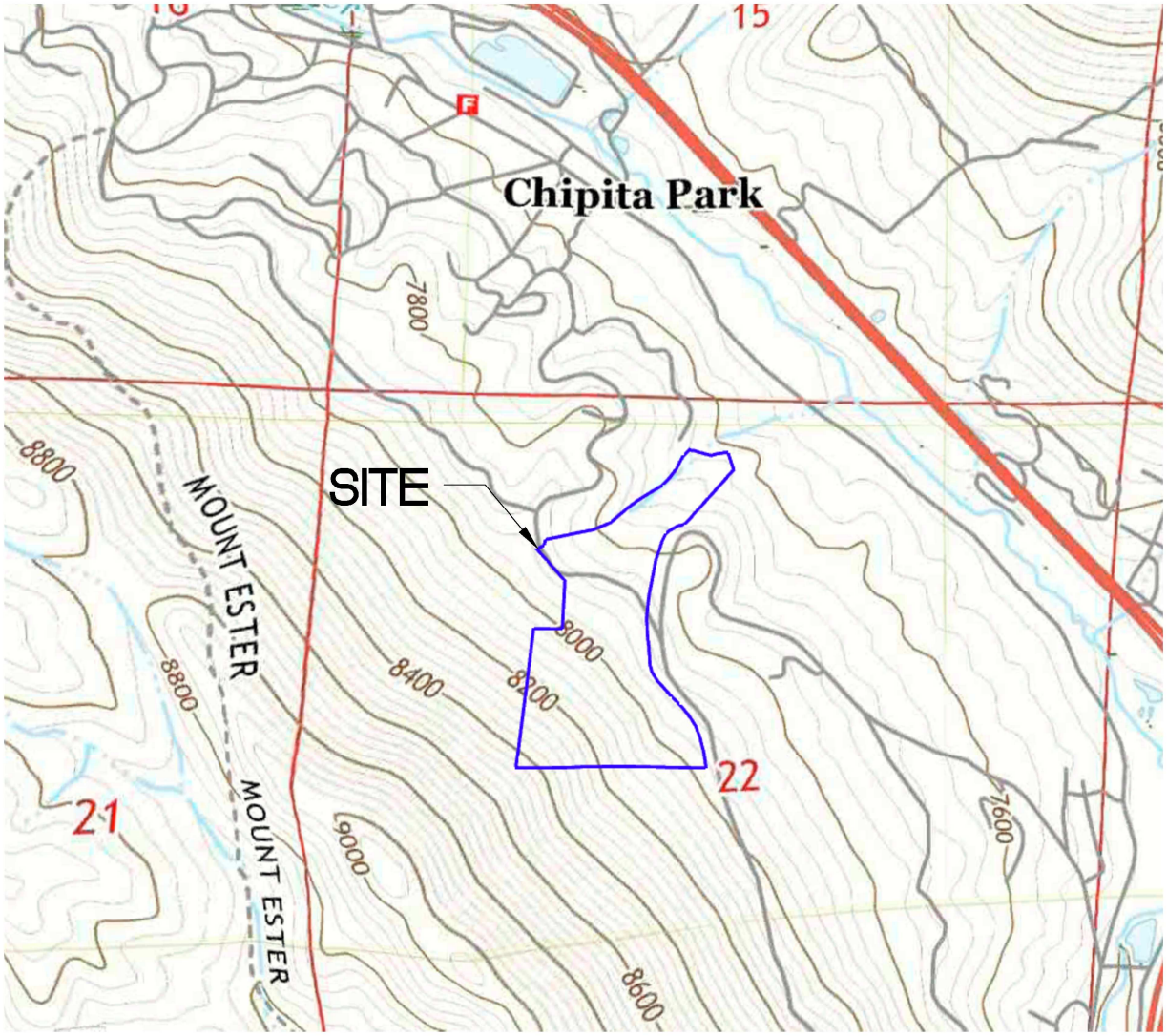
PINES SUBDIVISION
EL PASO COUNTY, COLORADO
KRISTIAN GUNTZELMAN

JOB No. 188050

FIG No. 2

DATE 3-18-2022

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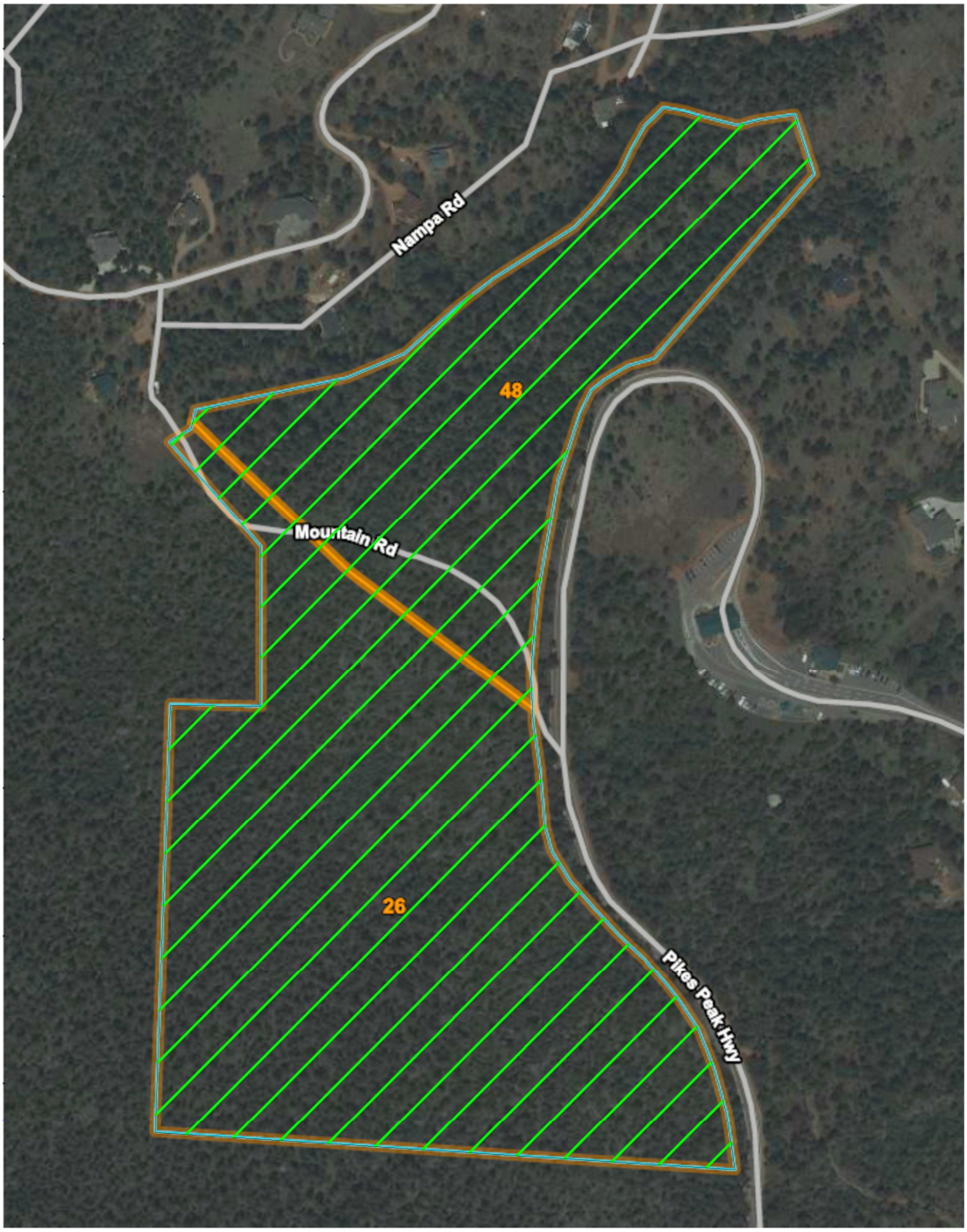
# USGS TOPO MAP

MOUNTAIN ROAD
GUNTZELMAN PORCELAIN
PINES SUBDIVISION
EL PASO COUNTY, COLORADO
KRISTIAN GUNTZELMAN

JOB No. 188050

FIG No. 3

DATE 3-18-2022




26 - Legault-Rock Outcrop Complex, 15 to 65 percent slopes

48 - Tecolote very gravelly sandy loam, 15 to 40 percent slopes, very stony

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# USDA SOIL SURVEY MAP

MOUNTAIN ROAD
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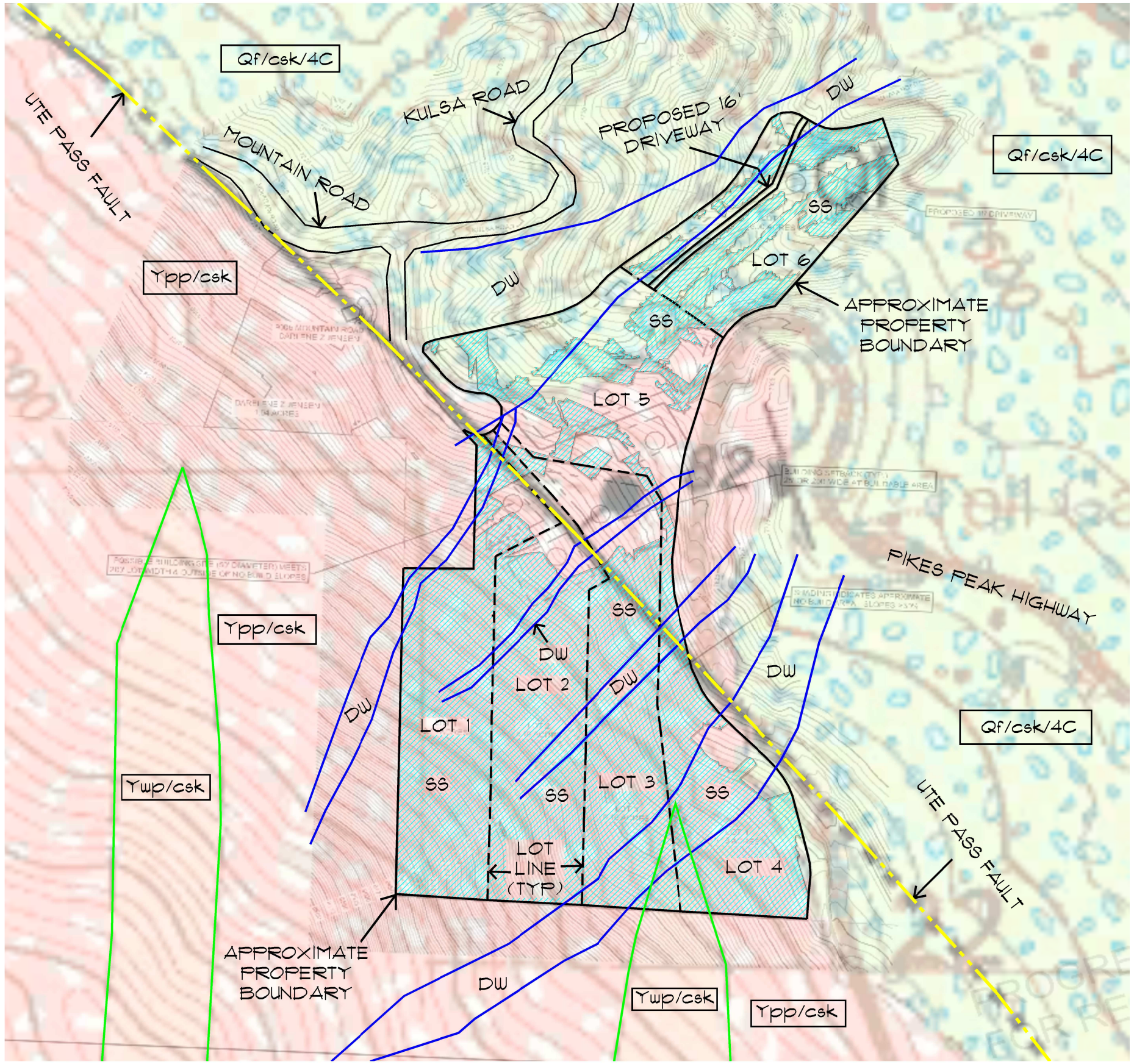
PINES SUBDIVISION
EL PASO COUNTY, COLORADO
KRISTIAN GUNTZELMAN

JOB No. 188050

FIG No. 4

DATE 3-18-2022




## Geologic Conditions

Qf - Alluvial fan deposits (Holocene to late Pleistocene)

Ypp - Pikes Peak Granite (Middle Proterozoic)

Ywp - Windy Point Granite (Middle Proterozoic)

csk - Grus, crystalline-clast colluvium, alluvium, and rock outcrop

SS - Steep Slopes, in excess of 30%, designated as "no-build" Zones

DW - Drainageway

## Engineering Conditions

4C - Old debris fan deposits along mountain front and along Fountain Creek above Manitou Springs

Denotes approximate area of steep slopes, "no-build" zones

Denotes approximate location of the Ute Pass Fault

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MOUNTAIN ROAD
GUNTZELMAN PORCELAIN
PINES SUBDIVISION

EL PASO COUNTY, COLORADO
KRISTIAN GUNTZELMAN

| | |
|---|---|
| ENGINEER: | TPM |
| DRAWN BY: | KCR |
| CHECKED BY: | TPM |
| ISSUED: | 3-18-2022 |

ENGINEERING AND GEOLOGY MAP

SHEET No.
FIG-5

# National Flood Hazard Layer FIRMette

FEMA


## Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

**SPECIAL FLOOD HAZARD AREAS**
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

**OTHER AREAS OF FLOOD HAZARD**
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

**OTHER AREAS**
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

**GENERAL STRUCTURES**
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

**OTHER FEATURES**
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

**MAP PANELS**
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 3/8/2022 at 4:55 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

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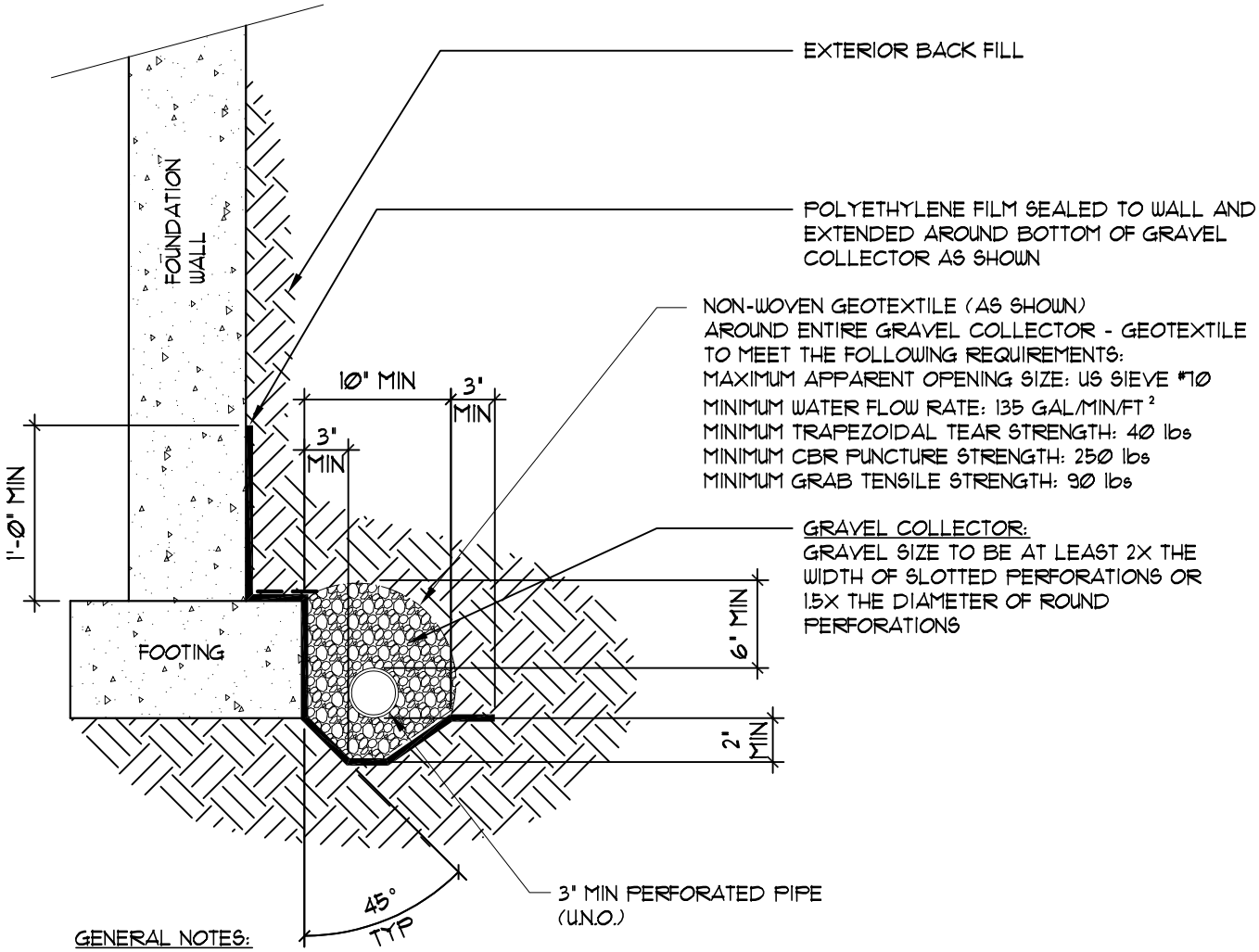
# FEMA MAP

MOUNTAIN ROAD
GUNTZELMAN PORCELAIN
PINES SUBDIVISION
EL PASO COUNTY, COLORADO
KRISTIAN GUNTZELMAN

JOB No. 188050

FIG No. 6

DATE 3-18-2022




GENERAL NOTES:

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

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# PERIMETER DRAIN

FIG No. 7

# APPENDIX A

## Additional Reference Documents


1. *Site Concept Plan*, *Guntzelman Porcelain Pines Subdivision, Cascade, Colorado,* prepared by SMH Consultants, Project No. 2107-0307, dated September 8, 2021.
2. *Preliminary Subsurface Soil Investigation and Geology Report*, Jensen Subdivision, El Paso County, Colorado, prepared by RMG – Rocky Mountain Group, Job No. 147611, dated January 7, 2016
3. *Flood Insurance Rate Map, El Paso County, Colorado and Unincorporated Areas, Community Panel No. 08041C0486G,* Federal Emergency Management Agency (FEMA), effective December 7, 2018.
4. *Environmental and Engineering Geologic Map for Land Use*, compiled by Dale M. Cochran, Charles S. Robinson & Associates, Inc., Golden, Colorado, 1977.
5. *Geologic Map of the Cascade Quadrangle, El Paso County, Colorado,* Morgan, M.L., Siddow, C.S., Rowley, P.D., Temple, J., Keller, J.W., Archuleta, B.H., and Himmelreich, J.W., Colorado Geological Survey, Open-File Report OF03-18, 2004.
6. *Pikes Peak Regional Building Department:* https://www.pprbd.org/.
7. El Paso County Assessor Website
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   Schedule No. 8322200018
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10. *USGS Historical Topographic Map Explorer:* http://historicalmaps.arcgis.com/usgs/ El Paso County, Cascade Quadrangle, 2019.
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15. Carroll, C.J., and Bauer, M.A., 2002, Historic coal mines of Colorado: Colorado Geological Survey Information Series 64, CD ROM.
16. Keller, J.W., Phillips, R.C., and Morgan, Karen, 2002, Digital inventory of industrial mineral mines and mine permit locations in Colorado: Colorado Geological Survey Information Series IS-62, CD ROM.
17. Mason, G. T., and Arndt, R. E., 1996, Mineral resource data system (MRDS): U.S. Geological Survey Digital Data Series DDS-20 (CD-ROM).
18. *Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands*
19. The *El Paso Aggregate Resource Evaluation Map, Master Plan for Mineral Extraction*, *Map 1*
20. Generalized surficial geologic map of the Pueblo 1 degree X 2 degree quadrangle, Colorado. Moore, D.W., Straub, A.W., Berry, M.E., Baker, M.L, and Brandt, T.R. , U.S. Geological Survey, Miscellaneous Field Studies Map MF-2388, 2002.

# APPENDIX B

*Preliminary Subsurface Soil Investigation and Geology Report*, Jensen Subdivision, El Paso County, Colorado, prepared by RMG – Rocky Mountain Group, Job No. 147611, dated January 7, 2016

ARCHITECTS RMG ENGINEERS

ROCKY MOUNTAIN GROUP

# PRELIMINARY SUBSURFACE SOIL INVESTIGATION AND GEOLOGY REPORT

## Jensen Subdivision
## El Paso County, Colorado

**PREPARED FOR:**

**Darlene Jensen**
**9005 Mountain Rd.**
**Cascade, CO 80809**

**JOB NO. 147611**

**January 7, 2016**

**Respectfully Submitted,**
**RMG – Rocky Mountain Group**

**Reviewed by**

COLORADO REGISTERED PROFESSIONAL ENGINEER
ANTHONY P. MUNGER
1/8/16
39818

Kelli Zigler

**Kelli Zigler, P.G.**
**Professional Geologist**

**Tony Munger, P.E.**
**Geotechnical Project Engineer**

# TABLE OF CONTENTS

# GENERAL SITE AND PROJECT DESCRIPTION

### Project Location

The project lies in Section 22, Township 13 South, Range 68 West of the 6th Principal Meridian in El Paso County, Colorado. The site is generally located southeast of Chipita Park, Colorado near the intersection of Mountain Road and Kulsa Road. The approximate location of the site is shown on the Site Vicinity Map, Figure 1 (Ref. 1).

### Project Description

Currently, a two story wood framed single family residence is located on the northwest portion of the site. The site consists of an approximately 41.71 acre parcel. There is an existing storage shed located east of the existing residence. The existing 41.71 acres is to be subdivided into lots approximately 5.00 to 7.86 acres each (with on-site waste water treatment systems) and one empty tract of approximately 0.77 acres. The existing residence will remain on a 5.03 acre lot to be known as Lot 1.

### Qualifications of Preparers

The principle investigators for this study are Kelli Zigler, P.G. and Tony Munger, P.E. Ms. Zigler is a professional Geologist with over 15 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 in Colorado.

Mr. Tony Munger, P.E. is a licensed professional engineer with over 15 years of experience in the construction engineering (residential) field. Mr. Munger holds a Bachelor of Science in Architectural Engineering from the University of Wyoming.

# STUDY OVERVIEW

The purpose of this investigation is to characterize the general and site-specific geologic site conditions and mineral resources, and present our opinions of the potential effect of these conditions on the proposed residential development within El Paso County, Colorado. As such, our services exclude evaluation of the environmental and/or human, health-related work products or recommendations previously prepared, by others, for this project.

Revisions to the conclusions presented in this report may be issued based upon submission of the development plan. This study has been prepared in general accordance with the requirements outlined in the El Paso County Land Development Code (LDC) and Engineering Criteria Manual (ECM), (References 2 and 3, respectively).

### Scope and Objective

The purpose of our report is to evaluate the occurrence of potential geologic hazards and our opinions of the observed conditions on the proposed development with the respect to the intended usage.

This report presents the findings of the study performed by RMG Engineers Group (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.

### 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 reports
- Review of available aerial photographs
- Exploratory borings
- 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 on this site and were not considered applicable for the scope of this report.

# SITE CONDITIONS

Land Use and Zoning

Based upon our review of the Public Record Real Estate Property Search provided by El Paso County Assessors web-site (Reference 1), the site is zoned "R-T – Residential Topographic." Adjacent properties to the east, west and south are zoned "PUD – Planned Unit Development". Adjacent properties to the north contain single-family residences.

Topography

The existing topography is presented in Figure 2, the Topographic Test Boring Location Plan (Ref. 4). In general, the site is considered to be moderately steep to steep. The site slopes generally to the north and east with approximately 800 feet of elevation difference from the southwest corner to the northeast corner of the site.

Vegetation

Most of the site consists of tall native grasses, weeds and deciduous trees and pine.

**Previous Studies and Field Investigation**

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

# FIELD INVESTIGATION AND LABORATORY TESTING

**Drilling**

The subsurface conditions on the site were investigated by drilling five exploratory test borings. Due to site access limitations at the time of our investigation, we were only able to perform test borings within a small portion of the site. The approximate location of the test borings are presented in the Topographic Test Boring Location Plan, Figure 2.

The test borings were advanced with a power-driven, continuous-flight auger drill rig to depths of about 20 to 25 feet below the existing ground surface. Samples were obtained in general accordance with the Standard Penetration Test ASTM D-1586, utilizing a 2-inch OD split-barrel sampler. An Explanation of Test Boring Logs is presented in Figure 3. The Test Boring Logs are presented in Figures 4 through 6.

**Laboratory Testing**

Soil laboratory testing was performed as part of this investigation. The laboratory tests included moisture content, grain-size analyses and Atterberg Limits. A Summary of Laboratory Test Results is presented in Figure 7. Soils Classification Data is presented in Figures 8 and 9.

# GEOLOGIC AND SUBSURFACE CONDITIONS

## General Physiographic Setting

The site is located within the western flank of the Colorado Piedmont section of the Great Plains physiographic province. The Colorado Piedmont, formed during Late Tertiary and Early Quaternary time (approximately 2,000,000 years ago), is a broad, erosional trench which separates the Southern Rocky Mountains from the High Plains. During the Late Mesozoic and Early Cenozoic Periods (approximately 70,000,000 years ago), intense tectonic activity occurred, causing the uplifting of the Front Range and associated downwarping of the Denver Basin to the east. Relatively flat uplands and broad valleys characterize the present-day topography of the Colorado Piedmont in this region.

## General Geology

In general, the geology at the site consists of older fan deposits and alluvium soils. A General Engineering Geology Map is presented in Figure 10. One geologic unit and one environmental engineering unit were mapped at the site as:

- Qf – Alluvial Fan Deposits (Upper Holocene) – sand with gravels, cobbles and boulders on steep slopes along the mountain front and Fountain Creek.

- 4C – Older debris fan deposits along the mountain front and Fountain Creek above Manitou Springs.

The Alluvial Fan deposits are underlain by the Pikes Peak Granite. The Pikes Peak Granite was encountered in four of the test borings drilled for this investigation.

The U.S. Soil Conservation Service (Reference 11) has identified the soils on the property as Tecolote, very gravelly sandy loam and Legault, rock outcrop complex. These soils are anticipated to drain well and have a high runoff rate with high infiltration rates. Depth to bedrock is anticipated to be greater than 5 feet and groundwater is anticipated to be greater than 7 feet.

## Subsurface Conditions

The subsurface materials encountered in the test borings were classified using the Unified Soils Classification System (USCS) and the materials were grouped into the general categories of silty to clayey sand with gravel and granite bedrock.

Additional descriptions and the interpreted distribution (approximate depths) of the subsurface materials are presented on the Test Boring Logs. The classifications shown on the logs are based upon the engineer's classification of the samples at the depths indicated. Stratification lines shown

on the logs represent the approximate boundaries between material types and the actual transitions may be gradual and vary with location.

### Groundwater

Groundwater was not observed in the test borings at the time of field exploration or when checked one day subsequent to 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.

### Recoverable 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 *Master Plan for Mineral Extraction* (Ref. 5), indicate the site is identified as granite and granitic type rocks. The test borings indicated alluvial fan deposits were encountered from the ground surface to approximately 12 to 25 feet. Extraction of the granite resources are not considered to be economical compared to materials available elsewhere within the county.

### Permeability

The permeability of a soil measures how well air and water can flow within the soil. Soil permeability varies according to the type of soil and other factors.

The infiltration rate of a soil refers to how much water a type of soil can absorb over a specific time period. Infiltration rates are determined by soil permeability and surface conditions, and usually are measured in inches per hour.

The soils encountered in the test borings were silty to clayey sand with gravel at the existing surface extending to depths of 12 feet of greater, overlying granite bedrock. The permeability of the sands is anticipated to be high.

## POTENTIAL GEOLOGIC HAZARDS

The following sections discuss potential geologic hazards that commonly exist within El Paso County, Colorado.

### Landslides

Landslides are a form of mass wasting slope failure that consists of relatively rapid downward sliding, falling, or flowing of a mass of soil, rock, or a mixture of the two. Landslides typically have one or more distinct failure surfaces. They typically occur on slope sides where the shear

strength of a material is exceeded by the driving mass or weight of the material and may be induced by the presence of groundwater, heavy precipitation, and seismic events.

The subject site is not located within a mapped area of landslide susceptibility according to the Colorado Geological Survey (Map of 2006).

**Unstable and Potentially Unstable Slopes**

In general, the site slopes moderately to steeply from the southwest to the northeast with approximately 800 feet of elevation difference from the northeast corner to the southwest corner of the property. No existing slope failures were observed on the site at the time of our investigation.

**Rockfall**

Rockfall is the falling of a newly detached mass of rock from a cliff or down a very steep slope, and is considered to be a type of landslide with a very rapid rate of down-slope movement. It usually occurs on mountainside or other steep slopes during periods of abundant moisture and frequent freeze-thaw cycles, and is caused by the loss of support from underneath or detachment from a larger rock mass. Ice wedging, root growth, or ground shaking, erosion or chemical weathering may start the fall. The rocks may freefall, bounce, tumble, roll, or slide down slope and can vary considerably in size.

The subject site does not have exposed cliffs or very steep slopes above it to generate rockfall. The subject property is not considered to be prone to rockfall.

**Debris Flows and Debris Fans**

Debris flows consist of water with a high sediment load of sand, cobbles and boulders flowing down a stream, ravine, canyon, arroyo or gully, and are typically activated by heavy or long-term rains or snowmelts which cause rapid erosion and transport of surficial materials down slope of drainages. Debris fans are created when debris flows reach a valley with a much lower gradient. As the energy level drops, the sediment load is deposited creating the fan shape.

Debris flows and fans have not been identified on the property. However, debris fans were identified in the immediate proximity to the subject property site. The gradients and source materials on the property are, in general, not conducive for generation of debris flows.

**Faults**

There are several geologic faults in the vicinity of the site associated with the Ute Pass Fault complex. However, according to the CGS these faults are not considered to be recently active.

### Seismicity

The Rampart Range Fault Zone is located less than ¼-mile west of the site. The fault generally extends northwest-southeast.

### Ground Subsidence

Review of the Colorado Springs Subsidence Investigation report (Dames and Moore, 1985) reveals that underground mining has not previously occurred beneath the site.

### Hydrocompactive and Potentially Expansive Soils

Potentially expansive (swelling or heaving) clays and shale were not encountered during the field investigation.

Hydrocompactive soils are prone to collapse (settlement) when exposed to increases in moisture content and/or loads from foundations. Based upon the general geology of the area, the soils are anticipated to generally exhibit low hydrocompactive characteristics and low expansion potential.

### Erosion and Corrosion

The sands encountered at the site are susceptible to erosion by wind and flowing water. The sands at this site typically have low resistivity values (less than 1,000 ohm-cm) and are not likely to be corrosive to buried, ferrous metal piping and other structures.

### Radioactivity/Radon Gas

There is not believed to be an unusual hazard from naturally occurring sources of radon activity (Ref. 7). However, most of Colorado is generally considered to have the potentially elevated levels of radon gas.

### Flooding and Surface Drainage

The site is located outside the 500-year floodplain of Fountain Creek (Zone X) as indicated on the Revised Federal Emergency Management Agency (FEMA) Community Panel No. 08041C0467F dated March 17, 1997, Figure 11 (Ref. 9).

# BEARING OF GEOLOGIC FACTORS UPON PROPOSED DEVELOPMENT

**Landslides**

The subject site has no known landslides that have been mapped on the Cascade Quadrangle according to the CGS. (Ref. 15)

**Unstable or Potentially Unstable Slopes**

No obvious signs of slope failures or unstable slopes were identified on the site during the course of this investigation. Our review of publically available documents did not reveal any known landslides within or directly adjacent to this site. However, areas of the site with a slope greater than 30% are considered potentially unstable. The proposed structures should not encroach within 20 feet of the toe or 30 feet of the crest of potentially unstable slopes, unless a specific slope stability analysis has been performed to verify the long-term stability of the slope.

**Rockfall**

The subject site does not have exposed cliffs or very steep slopes above it to generate rockfall. The subject property is not considered to be prone to rockfall.

**Debris Flows and Debris Fans**

Terrain features consistent with the formation of debris flows and debris fans are not present on the vicinity of the property.

**Faults**

Structures spanning faults may experience differential movements and damage associated with relatively minor movements of the land masses on either side of the fault. Based upon information provided by the CGS (Ref. 15), relatively recent faults and folds have not been identified. However, the subject site is located near areas of a relic fault zone. If fault zones are identified during excavation, structures should be oriented such that it does not span the fault.

**Seismicity**

The Rampart Range Fault Zone is located less than ¼-mile south of the site. The fault generally extends northwest-southeast.

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 (Kirkham and Rodgers, 1981). Ground motions resulting from small earthquakes are more likely to affect structures at this site and will likely only affect slopes stability to a minimal degree.

The Pikes Peak Building Code, 2011 Edition, indicates maximum considered earthquake spectral response accelerations of 0.185g for a short period ($S_S$) and 0.059g for a 1-second period ($S_1$). Based on the results of our experience with similar subsurface conditions, we recommend the site be classified as Site Class B, with an average a shear wave velocity ranging from 600 to 1,200 feet per second for the materials in the upper 100 feet.

**Ground Subsidence**

The subject site is located outside of known mined coal deposits. Subsurface conditions at the site are not consistent with soils and bedrock susceptible to ground subsidence.

**Hydrocompactive and Potentially Expansive Soils**

The potential for settlement and heave resulting from hydrocompaction and expansion, respectively, are typically addressed in a site-specific geotechnical engineering investigations and open excavation observations for each proposed structure. However, it is anticipated that the hydrocompactive and expansion potential will be low at this site.

Shallow foundations are anticipated for structures within this development. Foundation design and construction are typically adjusted for hydrocompactive and expansive soils. Subexcavation and replacement with moisture-conditioned excavated soils or overexcavation and replacement with imported structural fill are common construction practices and have been implemented successfully in nearby residential developments.

**Erosion and Corrosion**

Good surface drainage practices should be established to remove surface water efficiently without erosion. Surface water and snowmelt runoff should be controlled by appropriate drainage structures.

**Radioactivity/Radon Gas**

Based upon a Map of Radon Zones by the Colorado Department of Public Health and Environment (CDPHE) (Ref. 7), two zones of radon potential are indicated in Colorado, Zone 1 - High Radon Potential (probable indoor radon average >4 pCi/L) and Zone 2 -Moderate Radon Potential (probable indoor radon average 2-4 pCi/L). El Paso County is located within Zone 1.

Potential 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.

**Flooding and Surface Drainage**

In addition to help preventing erosion, good surface drainage practices should be established to remove surface water efficiently without damaging existing and proposed structures. Surface water and snowmelt runoff should be controlled by appropriate drainage structures.

**On-site Waste Water Treatment Systems**

Based on our investigation, we anticipate percolation rates ranging from 16 to 25 minutes per inch or a long term acceptance rate (LTAR) of 0.60 for the Engineering of a Treatment Level 1 OWTS. If on-site wastewater treatment systems are used, they shall comply with the El Paso County Department of Health and Environment (EPCDHE) regulations and the CDPHE guideline, as applicable.

Evaluation of the soils for the OWTS is typically addressed in a site-specific report for each lot. The site-specific evaluation should include a minimum of two 8-foot deep test pits excavated within the vicinity of each proposed system.

**Site Grading**

Grading plans were not provided at the time the report was issued. It is assumed based on the test borings for this investigation that the excavations will encounter silty to clayey sand with gravel, cobbles and occasional boulders overlying granite. The granite bedrock at this site is hard to very hard and may require the use of specialized heavy-duty equipment facilitate rock break-up and removal. It is assumed the on-site soils can be used as site grading fill.

New grading (cut or fill) on this site should not exceed a 3:1 slope, unless a specific slope stability analysis is performed. Fill slopes should be compacted and benched per the guidelines presented herein.

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

*Guideline Site Grading Specifications are included in Appendix A.*

## Buried Utilities

Based upon the conditions encountered in the exploratory test borings, we anticipate that the soils encountered in the utility trench excavations will consist of silty to clayey sand with gravel, cobbles and occasional boulders. It is anticipated that the sands will be encountered at loose to medium dense relative densities. Depending on the depth of excavation, high-powered excavation equipment may be required to advance excavations to the desired depths.

We believe the sand will classify as Type C materials as defined by OSHA in 29 CFR Part 1926. OSHA requires that temporary excavations be laid back at ratios no steeper than 1½:1 (horizontal to vertical, approximately 34 degrees) unless the excavation is shored and braced. Excavations deeper than 20 feet, or when water is present, should always be braced or the slope should be designed by a professional engineer.

Utility mains such as water and sanitary sewer lines are typically placed beneath paved roadways. The settlement of the utility trench backfill can have a detrimental effect on pavements and roadway surfaces. We recommend that utility trench backfill be placed in thin loose lifts, moisture conditioned as required and compacted to the recommendations outlined in the **Structural Fill** section of this report. The placement and compaction of utility trench backfill should be observed and tested by a representative of RMG Engineers during construction.

It is a common local practice for underdrains to be placed at the bottom of sanitary sewer trenched within drive lanes. Underdrains placed in the sanitary sewer trenches in areas where groundwater is anticipated will likely be the "active" type, which uses a perforated drain pipe. In areas where groundwater is not anticipated, "passive" type underdrains may be used. The outfall for the sanitary sewer trench underdrain was not known at the time of this investigation because the development plan and grading plan were not available for our review. Typical underdrain details are presented in Figures 12 and 13.

## Pavements

Preliminary plans by Westworks Engineering dated October 16, 2015 were provided prior to the report issue date. Roadways throughout the proposed development are anticipated to be classified as Minor Residential Collectors in accordance with Appendix D of the El Paso County Engineering Criteria Manual. The actual pavement section design for individual streets will be completed following overlot grading and rough cutting of the street subgrade.

For preliminary planning purposes, minimum asphalt pavement sections have been evaluated based on current design criteria. For purposes of this report, we anticipate the subgrade soils will primarily have American Association of State Highway and Transportation Officials (AASHTO) Soil Classifications of A-1-b, A-2-4, A-2-6 and A-6 with an estimated design subgrade "R-values" on the order of approximately 25 to 35.

| Estimated Pavement Section | |
|---|---|
| **Classification** | **Asphalt + Base Course, in.** |
| Minor Residential Collector | 3.0 or greater + 6 or greater [1] |

[1]Minimum section thicknesses per El Paso County Engineering Criteria Manual

The above value is for preliminary planning purposes and may vary upon final design, dependent upon the soil material used for subgrade construction.

**Anticipated Foundation Systems**

Based on the information presented previously, conventional shallow foundation systems consisting of standard spread footings/stemwalls are anticipated to be suitable for the proposed residential structures. It is assumed that the deepest excavation cuts will be approximately 6 to 8 feet below the final ground surface not including overexcavation, which is not anticipated.

If loose sands are encountered, they may require additional compaction to achieve the allowable bearing pressure indicated in this report. In some cases, removal and recompaction may be required for loose soils. Similarly, if shallow groundwater conditions were encountered and resulted in unstable soils, these soils may require stabilization prior to construction of foundation components.

The foundation system for each lot should be designed and constructed based upon recommendations developed in a detailed Subsurface Soils Investigation completed after site development activities are complete. The recommendations presented in the Subsurface Soils Investigation should be verified following the open excavation observation on each lot and evaluation of the building loads.

**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. 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.

### Design Parameters

The allowable bearing pressure of the on-site soils should be determined after recommended detailed Subsurface Soils Investigation is completed.

### Conclusions

Based upon the geologic and physiographic conditions observed and encountered, the site is considered to be suitable for the proposed development. The geologic hazards identified on this site are relatively common to this portion of El Paso County and can be mitigated by implementing appropriate planning, engineering, and local construction practices.

### Additional Investigations

The findings, conclusions and recommendations presented in this report were provided to evaluate the suitability of the site for mineral extraction and future development. Unless indicated otherwise, the test borings, laboratory test results, conclusions and recommendations presented in this report are not intended for use for design and construction. We recommend that specific Subsurface Soil Investigations be performed for the proposed structures.

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

# 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 **Darlene Jensen** 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 and/or geologic hazards point-of-view, please feel free to contact us.

## REFERENCES


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# APPENDIX A
# GUIDELINE SITE GRADING SPECIFICATIONS

# Guideline Site Grading Specifications

**Description:** Unless specified otherwise by local or state regulatory agencies, these guideline specifications are for the excavation, placement and compaction of material from locations indicated on the plans, or staked by the Engineer, as necessary to achieve the required elevations. These specifications shall also apply to compaction of materials that may be placed outside of the project.

**General:** The Geotechnical Engineer shall approve fill materials, method of placement, moisture contents and percent compactions, and shall give written approval of the compacted fill.

**Clearing Site:** The Contractor shall remove trees, brush, rubbish, vegetation, topsoil and existing structures before excavation or fill placement is commenced. The Contractor shall dispose of the cleared material to provide the Owner with a clean job site. Cleared material shall not be placed in areas to receive fill or where the material will support structures. Clearing shall also include removal of existing fills that do not meet the requirements of this specification and existing structures.

**Preparation of Slopes or Drainage Areas to Receive Fill:** Natural slopes or slopes of drainage gullies where grades are 20 percent (5:1, horizontal to vertical) or steeper shall be benched prior to fill placement. Benches shall be at least 10 feet wide. Benches may require additional width to accommodate excavation or compaction equipment. At least one bench shall be provided for each 5 feet or less of vertical elevation difference. The bench surface shall be essentially horizontal perpendicular to the slope or at a slight incline into the slope.

**Scarifying:** Topsoil and vegetation shall be removed from the ground surface in areas to receive fill. The surface shall be plowed or scarified a minimum of 12 inches until the surface is free from ruts, hummocks or other uneven features which would prevent uniform compaction by the equipment to be used.

**Compacting Area to Receive Fill:** After the area to receive fill has been cleared and scarified, it shall be disked or bladed until it is free from large clods, moisture conditioned to a proper moisture content and compacted to the maximum density as specified for the overlying fill. Areas to receive fill shall be worked, stabilized, or removed and replaced, if necessary, in accordance with the Geotechnical Engineer's recommendations in preparation for fill.

**Fill Materials:** Fill material shall be free from organic material or other deleterious substances, and shall not contain rocks or lumps having a diameter greater than six inches. Fill materials shall be obtained from cut areas shown on the plans or staked in the field by the Engineer or imported to the site and shall be approved by the Geotechnical Engineer prior to placement. It is recommended that the fill materials have nil to low expansion potential, i.e., consist of silty to slightly clayey sand.

**Moisture Content:** Fill materials shall be moisture conditioned to within limits of optimum moisture content specified. Sufficient laboratory compaction tests shall be made to determine the optimum moisture content for the various soils encountered in borrow areas or imported to the site.

The contractor may be required to add moisture to the excavation materials in the borrow area if, in the opinion of the Geotechnical Engineer, it is not possible to obtain uniform moisture content by adding water to the fill material during placement. The Contractor may be required to rake or disk the fill soils to provide uniform moisture content through the soils.

The application of water to embankment materials shall be made with watering equipment, approved by the Geotechnical Engineer, which will give the desired results. Water jets from the spreader shall not be directed at the embankment with such force that fill materials are eroded.

Should too much water be added to the fill, such that the material is too wet to permit the desired compaction to be obtained, compacting and work on that section of the fill shall be delayed until the material has been allowed to dry to the required moisture content. The Contractor will be permitted to rework the wet material in an approved manner to hasten its drying.

**Compaction of Fill Areas:** Selected fill material shall be placed and mixed in evenly spread layers. After each fill layer has been placed, it shall be uniformly compacted to not less than the specified percentage of maximum density. Fill materials shall be placed such that the thickness of loose material does not exceed 10 inches and the compacted lift thickness does not exceed 6 inches.

Compaction, as specified above, shall be obtained by the use of sheepsfoot rollers, multiple-wheel pneumatic-tired rollers, or other equipment approved by the Geotechnical Engineer. Granular fill shall be compacted using vibratory equipment or other equipment approved by the Geotechnical Engineer. Compaction shall be accomplished while the fill material is at the specified moisture content. Compaction of each layer shall be continuous over the entire area.

**Moisture Content and Density Criteria:**

Compaction for structural fills, supporting utilities, roadway, buildings and general grading fills shall conform to the specifications for El Paso County.

**Compaction of Slopes:** Fill slopes shall be compacted by means of sheepsfoot rollers or other suitable equipment. Compaction operations shall be continued until slopes are stable, but not too dense for planting, and such that there is no appreciable amount of loose soil on the slopes. Compaction of slopes may be done progressively in increments of three to five feet in height or after the fill is brought to its total height. Permanent fill slopes shall not exceed 3:1 (horizontal to vertical).

**Density Testing:** Field density testing shall be performed by the Geotechnical Engineer at locations and depths of his choosing. Where sheepsfoot rollers are used, the soil may be disturbed to a depth of several inches. Density tests shall be taken in compacted material below the disturbed surface. When density tests indicate the density or moisture content of any layer of fill or portion thereof is below that required, the particular layer or portion shall be reworked until the required density or moisture content has been achieved.

**Observation and Testing of Fill:** Observation by the Geotechnical Engineer shall be sufficient during the placement of fill and compaction operations so that he can declare the fill was placed in general conformance with Specifications. All observations necessary to test the placement of fill and observe compaction operations will be at the expense of the Owner.

**Seasonal Limits:** No fill material shall be placed, spread or rolled while it is frozen, thawing, or during unfavorable weather conditions. When work is interrupted by heavy precipitation, fill operations shall not be resumed until the Geotechnical Engineer indicates the moisture content and density of previously placed materials are as specified.

**Reporting of Field Density Tests:** Density tests made by the Geotechnical Engineer shall be submitted progressively to the Owner. Dry density, moisture content, percent compaction, and approximate location shall be reported for each test taken.

# FIGURES


NOT TO SCALE

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*Southern Office*
Colorado Springs,CO
80918
(719) 548-0600
*Central Office:*
Englewood, CO 80112
(303) 688-9475
*Northern Office:*
Greeley / Evans, CO 80620
(970) 330-1071

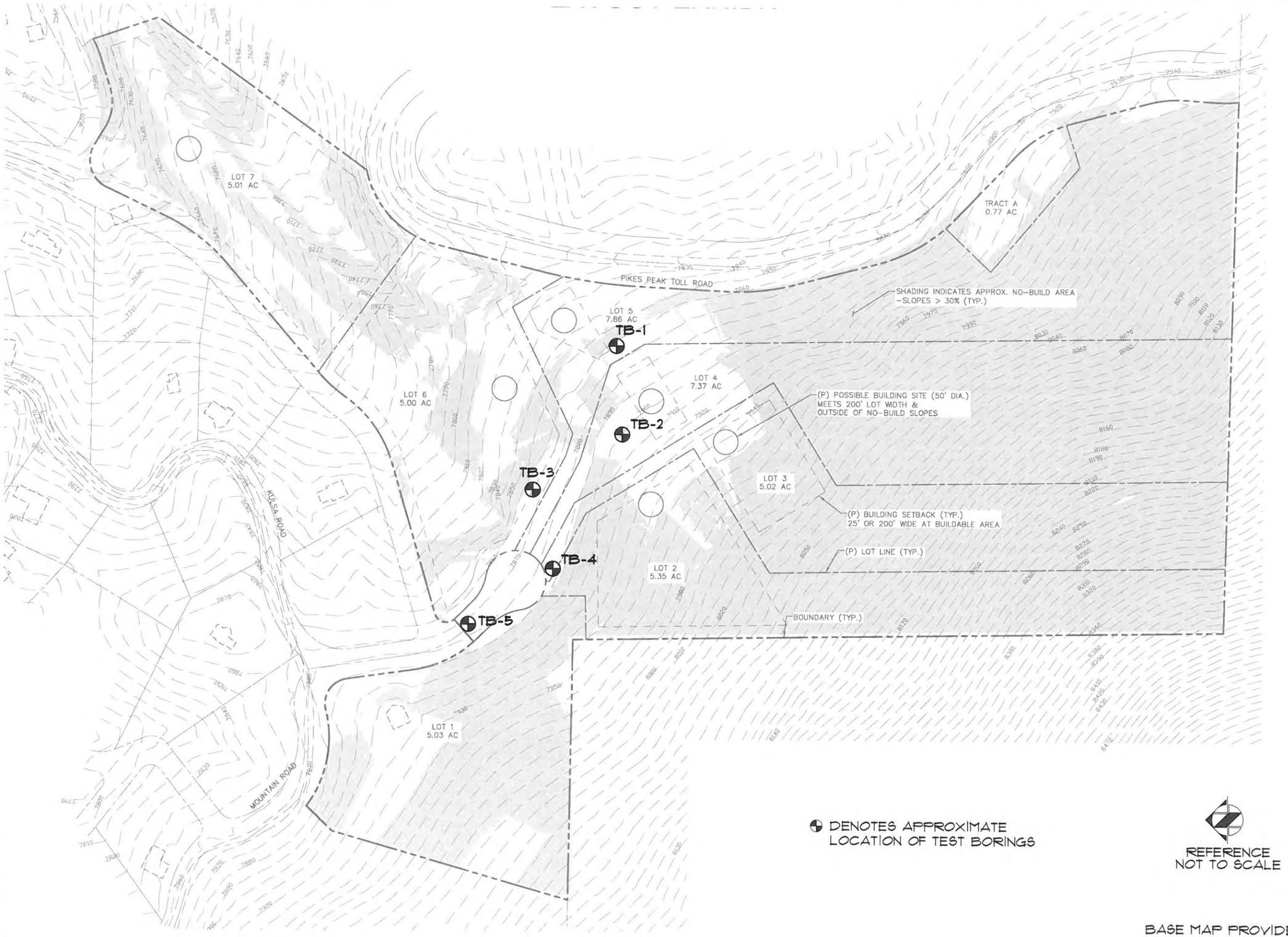
# SITE VICINITY MAP

JENSON SUBDIVISION
EL PASO COUNTY, CO
DARLENE JENSON

JOB No. 147611

FIG No. 1

DATE 1-6-2015




BASE MAP PROVIDED BY
WESTWORKS ENGINEERING

JOB No. 147611

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


# JENSEN SUBDIVISION

EL PASO COUNTY, CO
DARLENE JENSON

| | |
|---|---|
| ENGINEER: | TM |
| DRAWN BY: | KZ |
| CHECKED BY: | TM |
| ISSUED: | 1-06-2016 |
| REVISION: | DATE: |
| | JOB #: |

## TOPOGRAPHIC TEST BORING LOCATION PLAN

SHEET No.
FIG-2

## SOILS DESCRIPTION

GRANITE

SAND, SILTY TO CLAYEY, WITH GRAVEL

## 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

BULK — DISTURBED BULK SAMPLE

AUG — AUGER "CUTTINGS"

1 — RMG SOIL TYPE - SEE REPORT TEXT FOR DESCRIPTION

4.5 — WATER CONTENT (%)

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**EXPLANATION OF TEST BORING LOGS**

JOB No. 147611

FIGURE No. 3

DATE 1/6/16

TEST BORING: **1**
DATE DRILLED:
12/21/15
REMARKS:
NO GROUNDWATER ON
12/22/15

SAND, SILTY TO CLAYEY, with gravel, reddish brown, medium dense to very dense, moist

GRANITE, reddish brown, very hard, moist

| DEPTH (FT) | SYMBOL | SAMPLES | BLOWS PER FT. | WATER CONTENT % |
|---|---|---|---|---|
| 5 | | ■ | 50/6" | 4.8 |
| 10 | | ■ | 18 | 3.3 |
| 15 | | ■ | 50/6" | 3.3 |
| | | ■ | 50/0" | 2.7 |

TEST BORING: **2**
DATE DRILLED:
12/21/15
REMARKS:
NO GROUNDWATER ON
12/22/15

SAND, SILTY TO CLAYEY, with gravel, reddish brown, medium dense, moist

| DEPTH (FT) | SYMBOL | SAMPLES | BLOWS PER FT. | WATER CONTENT % |
|---|---|---|---|---|
| 5 | | ■ | 23 | 3.6 |
| 10 | | ■ | 22 | 3.9 |
| 15 | | ■ | 11 | 7.6 |
| 20 | | ■ | 16 | 5.8 |
| 25 | | ■ | 28 | 3.9 |

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# TEST BORING LOGS

JOB No. 147611

FIGURE No. 4

DATE 1/6/16

TEST BORING: **3**
DATE DRILLED:
12/21/15
REMARKS:
NO GROUNDWATER ON
12/22/15

| DEPTH (FT) | SYMBOL | SAMPLES | BLOWS PER FT. | WATER CONTENT % |
|---|---|---|---|---|
| | SAND, SILTY TO CLAYEY, with gravel, reddish brown, medium dense, moist | | | |
| 5 | | ■ | 23 | 6.5 |
| 10 | | ■ | 10 | 10.0 |
| | GRANITE, reddish brown, medium hard to very hard, moist | | | |
| 15 | | ■ | 49 | 10.4 |
| 20 | | ■ | 50/7" | 6.0 |

TEST BORING: **4**
DATE DRILLED:
12/21/15
REMARKS:
NO GROUNDWATER ON
12/22/15

| DEPTH (FT) | SYMBOL | SAMPLES | BLOWS PER FT. | WATER CONTENT % |
|---|---|---|---|---|
| | SAND, SILTY TO CLAYEY with gravel, reddish brown, loose to medium dense, moist | | | |
| 5 | | ■ | 24 | 3.9 |
| 10 | | ■ | 9 | 12.3 |
| 15 | | ■ | 11 | 8.7 |
| | GRANITE, reddish brown, hard to very hard, moist | | | |
| 20 | | ■ | 50 | 9.4 |
| 25 | | ■ | 50/7" | 9.8 |

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# TEST BORING LOGS

JOB No. 147611

FIGURE No. 5

DATE 1/6/16

TEST BORING: **5**
DATE DRILLED:
12/21/15
REMARKS:
NO GROUNDWATER ON
12/22/15

| DEPTH (FT) | SYMBOL | SAMPLES | BLOWS PER FT. | WATER CONTENT % |
|---|---|---|---|---|
| SAND, SILTY TO CLAYEY, with gravel, reddish brown, medium dense, moist | | | | |
| 5 | | | 14 | 7.4 |
| 10 | | | 23 | 9.0 |
| GRANITE, reddish brown, medium hard to very hard, moist | | | | |
| 15 | | | 42 | 6.0 |
| 20 | | | 50/5" | 4.5 |

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**TEST BORING LOGS**

JOB No. 147611

FIGURE No. 6

DATE 1/6/16

| Test Boring No. | Depth | Water Content (%) | Dry Density (pcf) | Liquid Limit | Plasticity Index | % Retained No.4 Sieve | % Passing No. 200 Sieve | % Swell/ Collapse | FHA Expansion Pressure (psf) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 4.0 | 4.8 | | | | | | | |
| 1 | 9.0 | 3.3 | | NP | NP | 27.8 | 16.3 | | |
| 1 | 14.0 | 3.3 | | | | | | | |
| 1 | 19.0 | 2.7 | | | | | | | |
| 2 | 4.0 | 3.6 | | | | | | | |
| 2 | 9.0 | 3.9 | | | | | | | |
| 2 | 14.0 | 7.6 | | NP | NP | 32.4 | 16.2 | | |
| 2 | 19.0 | 5.8 | | | | | | | |
| 2 | 24.0 | 3.9 | | NP | NP | 23.5 | 10.4 | | |
| 3 | 4.0 | 6.5 | | NP | NP | 18.5 | 30.7 | | |
| 3 | 9.0 | 10.0 | | 39 | 26 | 16.6 | 36.4 | | |
| 3 | 14.0 | 10.4 | | | | | | | |
| 3 | 19.0 | 6.0 | | | | | | | |
| 4 | 4.0 | 3.9 | | | | | | | |
| 4 | 9.0 | 12.3 | | 36 | 23 | 20.8 | 38.3 | | |
| 4 | 14.0 | 8.7 | | NP | NP | 8.3 | 24.4 | | |
| 4 | 19.0 | 9.4 | | | | | | | |
| 4 | 24.0 | 9.8 | | | | | | | |
| 5 | 4.0 | 7.4 | | 34 | 21 | 27.6 | 31.4 | | |
| 5 | 9.0 | 9.0 | | | | | | | |
| 5 | 14.0 | 6.0 | | | | | | | |
| 5 | 19.0 | 4.5 | | | | | | | |

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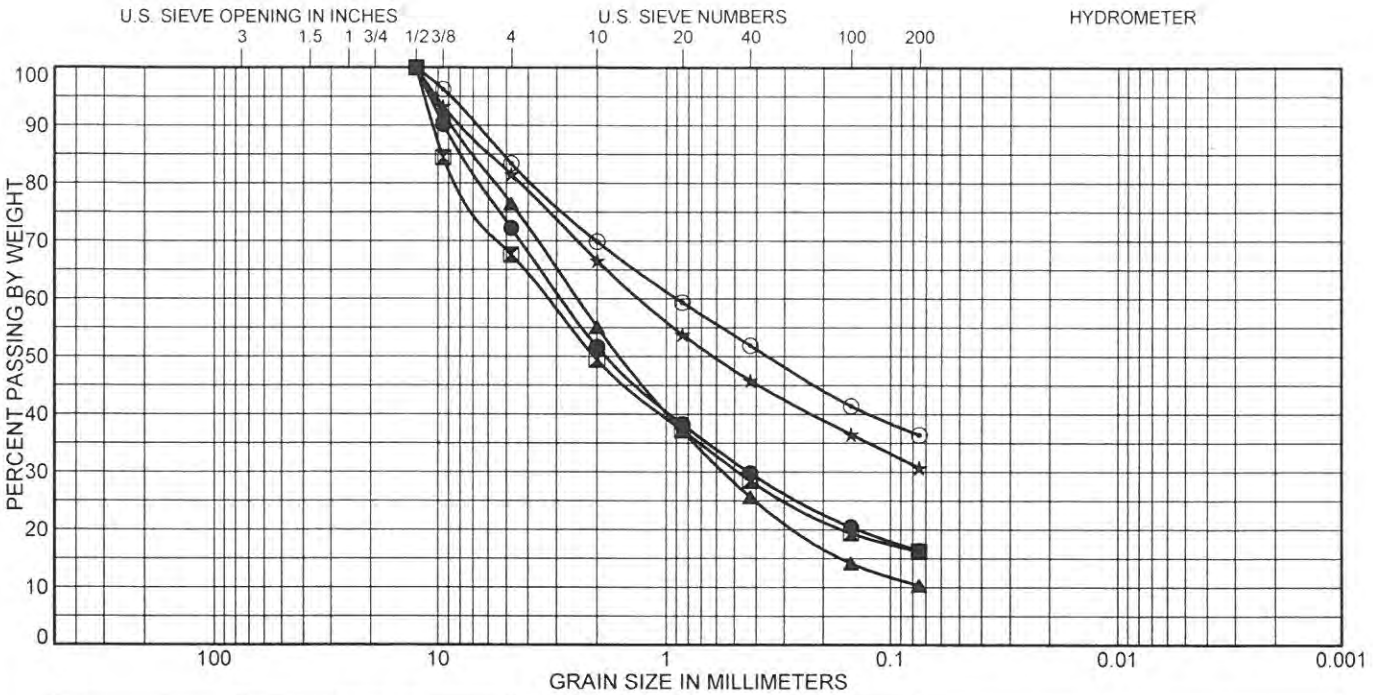
**SUMMARY OF LABORATORY TEST RESULTS**

JOB No. 147611
FIGURE No. 7
PAGE 1 OF 1
DATE 1/6/16




| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | coarse | fine | coarse | medium | fine | |

| | Test Boring | Depth (ft) | Classification | LL | PL | PI |
|---|---|---|---|---|---|---|
| ● | 1 | 9.0 | **SILTY SAND with GRAVEL(SM)** | **NP** | **NP** | **NP** |
| ⊠ | 2 | 14.0 | **SILTY SAND with GRAVEL(SM)** | **NP** | **NP** | **NP** |
| ▲ | 2 | 24.0 | **WELL-GRADED SAND with SILT and GRAVEL(SW-SM)** | **NP** | **NP** | **NP** |
| ★ | 3 | 4.0 | **SILTY SAND with GRAVEL(SM)** | **NP** | **NP** | **NP** |
| ⊙ | 3 | 9.0 | **CLAYEY SAND with GRAVEL(SC)** | **39** | **13** | **26** |

| | Test Boring | Depth (ft) | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|
| ● | 1 | 9.0 | **27.8** | **55.9** | **16.3** | |
| ⊠ | 2 | 14.0 | **32.4** | **51.4** | **16.2** | |
| ▲ | 2 | 24.0 | **23.5** | **66.1** | **10.4** | |
| ★ | 3 | 4.0 | **18.5** | **50.8** | **30.7** | |
| ⊙ | 3 | 9.0 | **16.6** | **47.0** | **36.4** | |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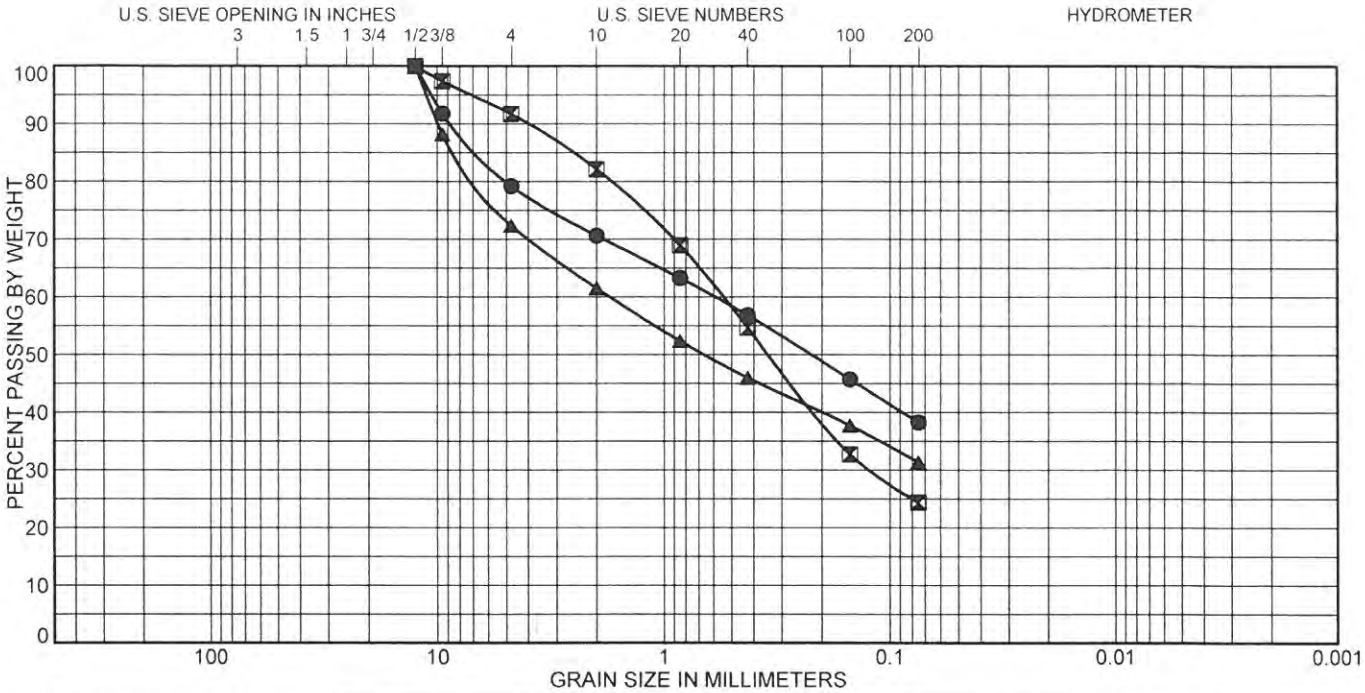
**SOIL CLASSIFICATION DATA**

JOB No. 147611

FIGURE No. 8

DATE 1/6/16




| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | coarse | fine | coarse | medium | fine | |

| | Test Boring | Depth (ft) | Classification | LL | PL | PI |
|---|---|---|---|---|---|---|
| ● | 4 | 9.0 | **CLAYEY SAND with GRAVEL(SC)** | **36** | **13** | **23** |
| ⊠ | 4 | 14.0 | **SILTY SAND(SM)** | **NP** | **NP** | **NP** |
| ▲ | 5 | 4.0 | **CLAYEY SAND with GRAVEL(SC)** | **34** | **13** | **21** |
| | | | | | | |
| | | | | | | |

| | Test Boring | Depth (ft) | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|
| ● | 4 | 9.0 | **20.8** | **41.0** | **38.3** | |
| ⊠ | 4 | 14.0 | **8.3** | **67.3** | **24.4** | |
| ▲ | 5 | 4.0 | **27.6** | **41.0** | **31.4** | |
| | | | | | | |
| | | | | | | |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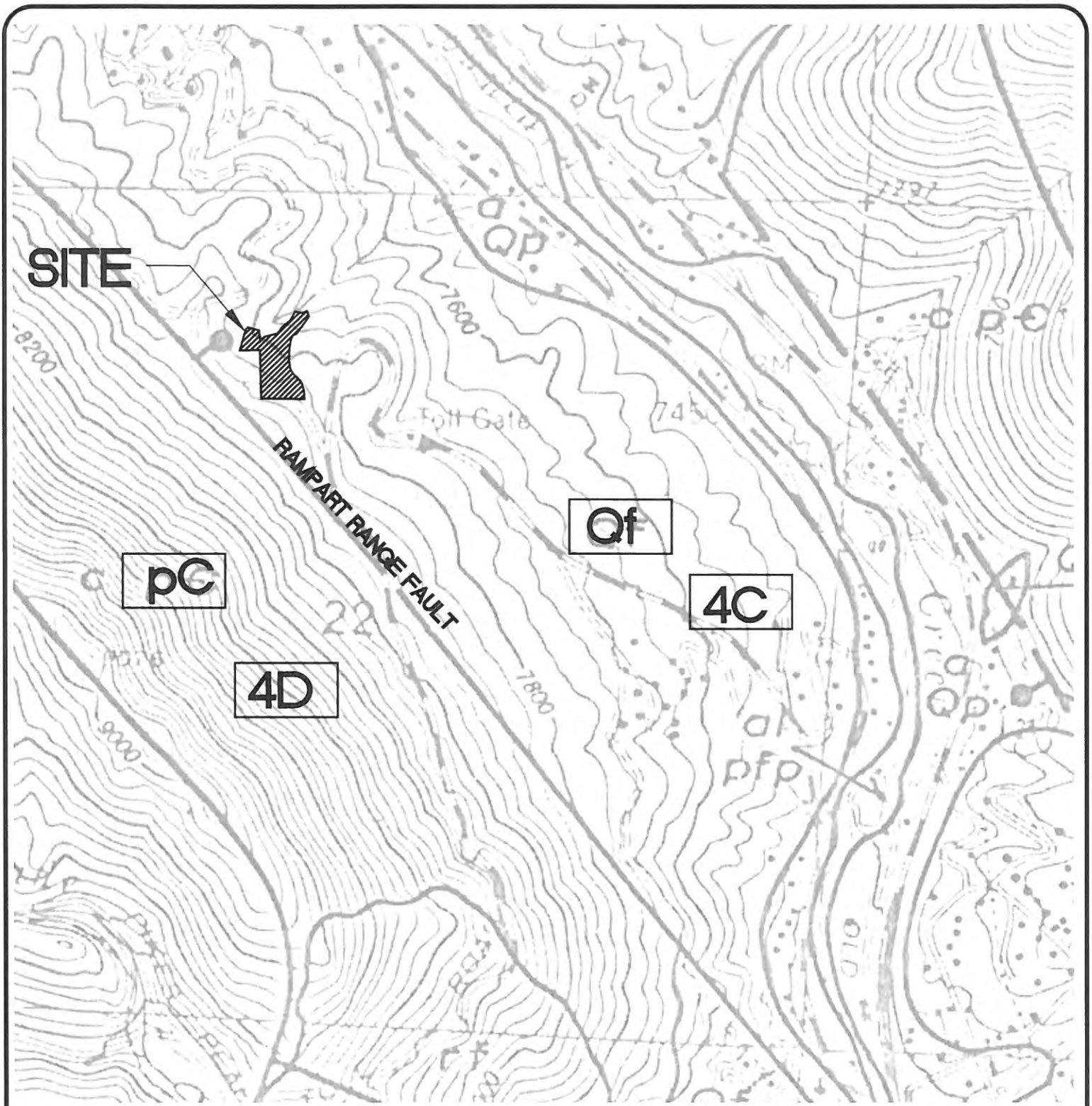
# SOIL CLASSIFICATION DATA

JOB No. 147611

FIGURE No. 9

DATE 1/6/16




NOT TO SCALE

BASE MAP PROVIDED BY:
USGS

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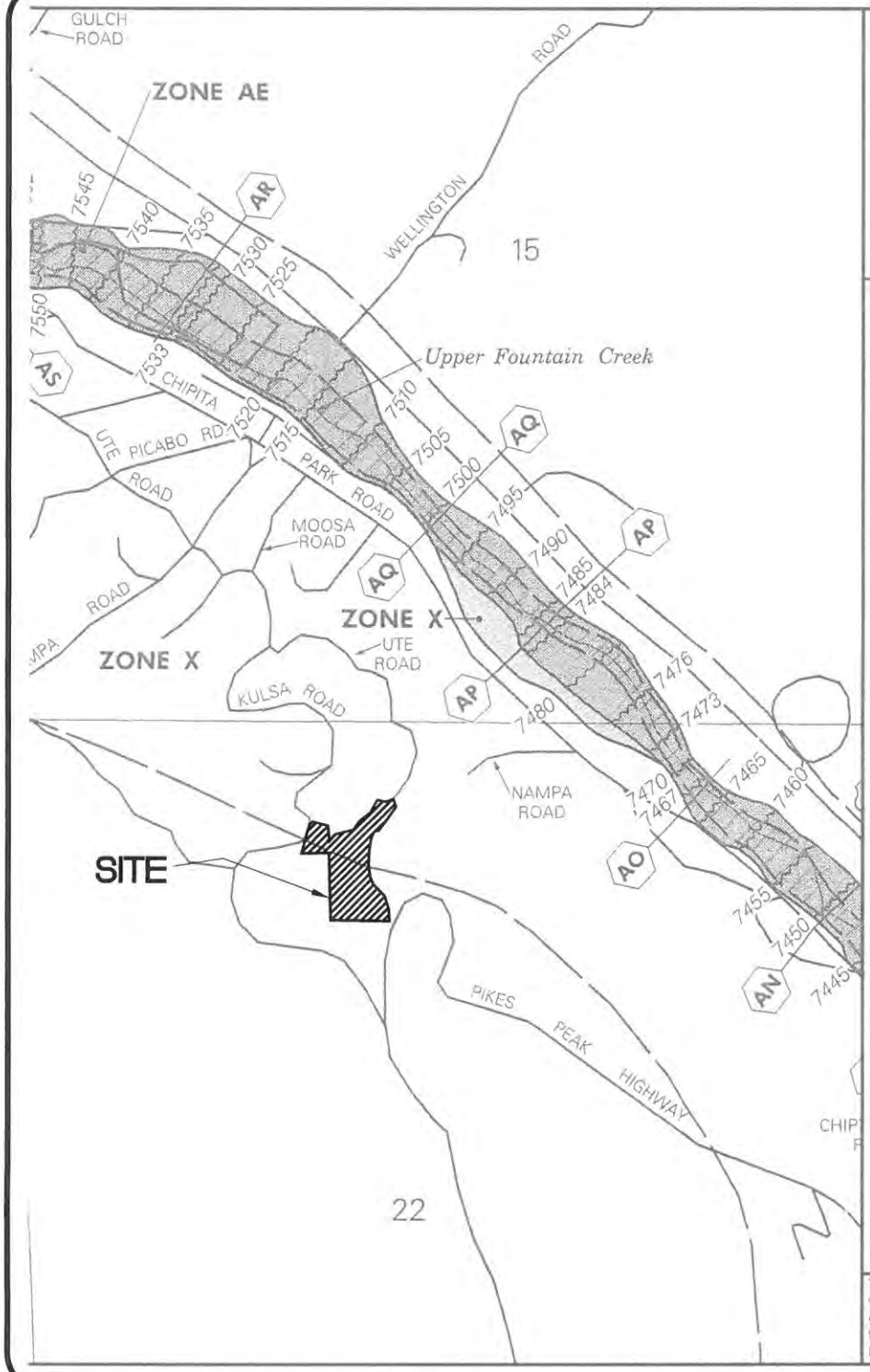
# ENGINEERING GEOLOGY MAP

JENSON SUBDIVISION
EL PASO COUNTY, CO
DARLENE JENSON

JOB No. 147611

FIG No. 10

DATE 1-6-2015




APPROXIMATE SCALE IN FEET

1000 0 1000

NATIONAL FLOOD INSURANCE PROGRAM

# FIRM

## FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

**PANEL 490 OF 1300**

(SEE MAP INDEX FOR PANELS NOT PRINTED)

| CONTAINS: COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| EL PASO COUNTY, UNINCORPORATED AREAS | 080059 | 0490 | F |

**MAP NUMBER 08041C0490 F**

**EFFECTIVE DATE: MARCH 17, 1997**

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood m
was extracted using F-MIT On-Line. This map does not reflect ch
or amendments which may have been made subsequent to the da
title block. For the latest product information about National Flooc
Program flood maps check the FEMA Flood Map Store at www.m

NOT TO SCALE

JOB No. 147611

FIG No. 11

DATE 1-6-2015

# FEMA MAP

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EL PASO COUNTY, CO
DARLENE JENSON


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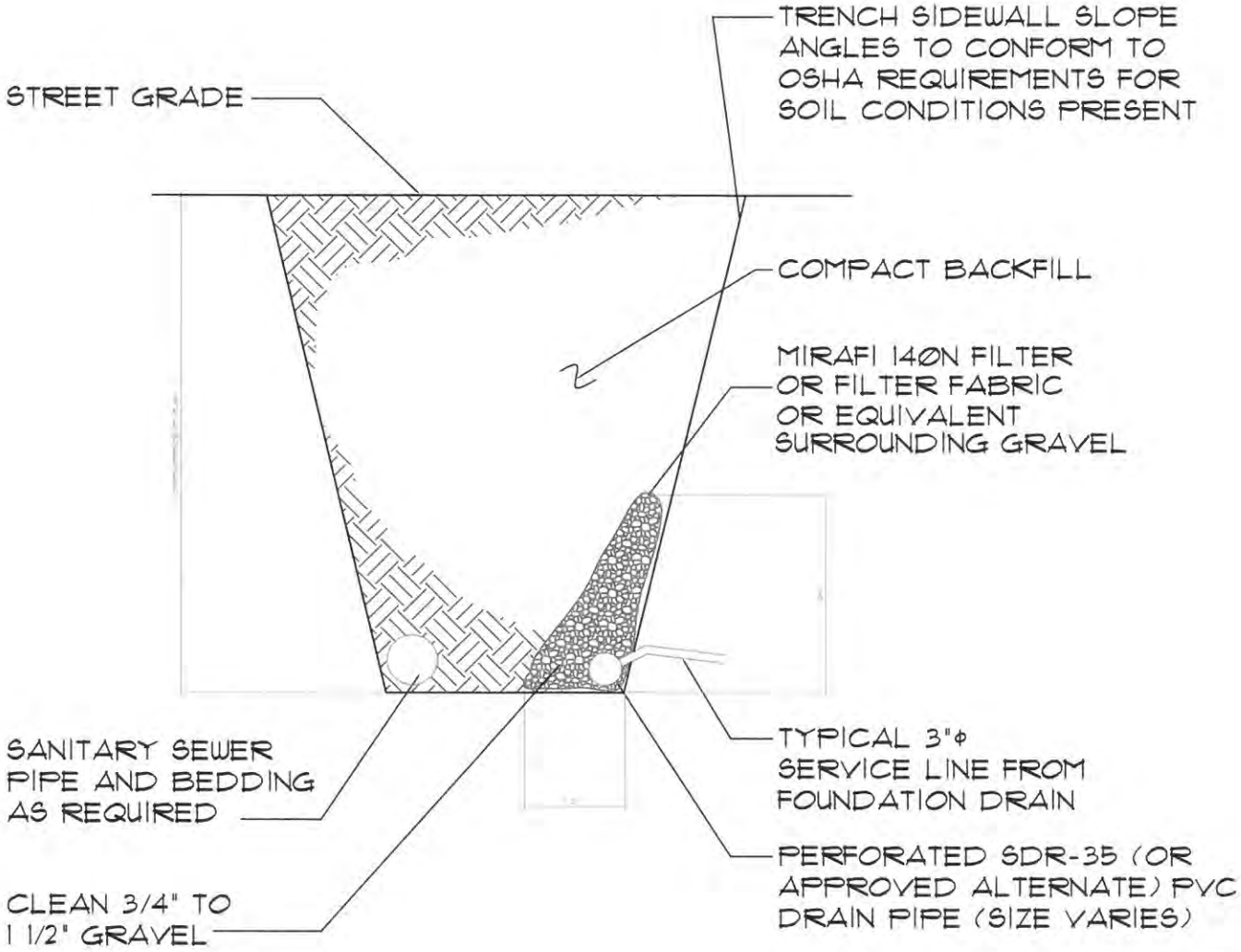
ROCKY MOUNTAIN GROUP

NOTE: TO BE USED IN CASES WHERE GROUNDWATER IS FOUND DURING TRENCHING OR WHERE SHALLOW GROUNDWATER IS KNOWN TO EXIST





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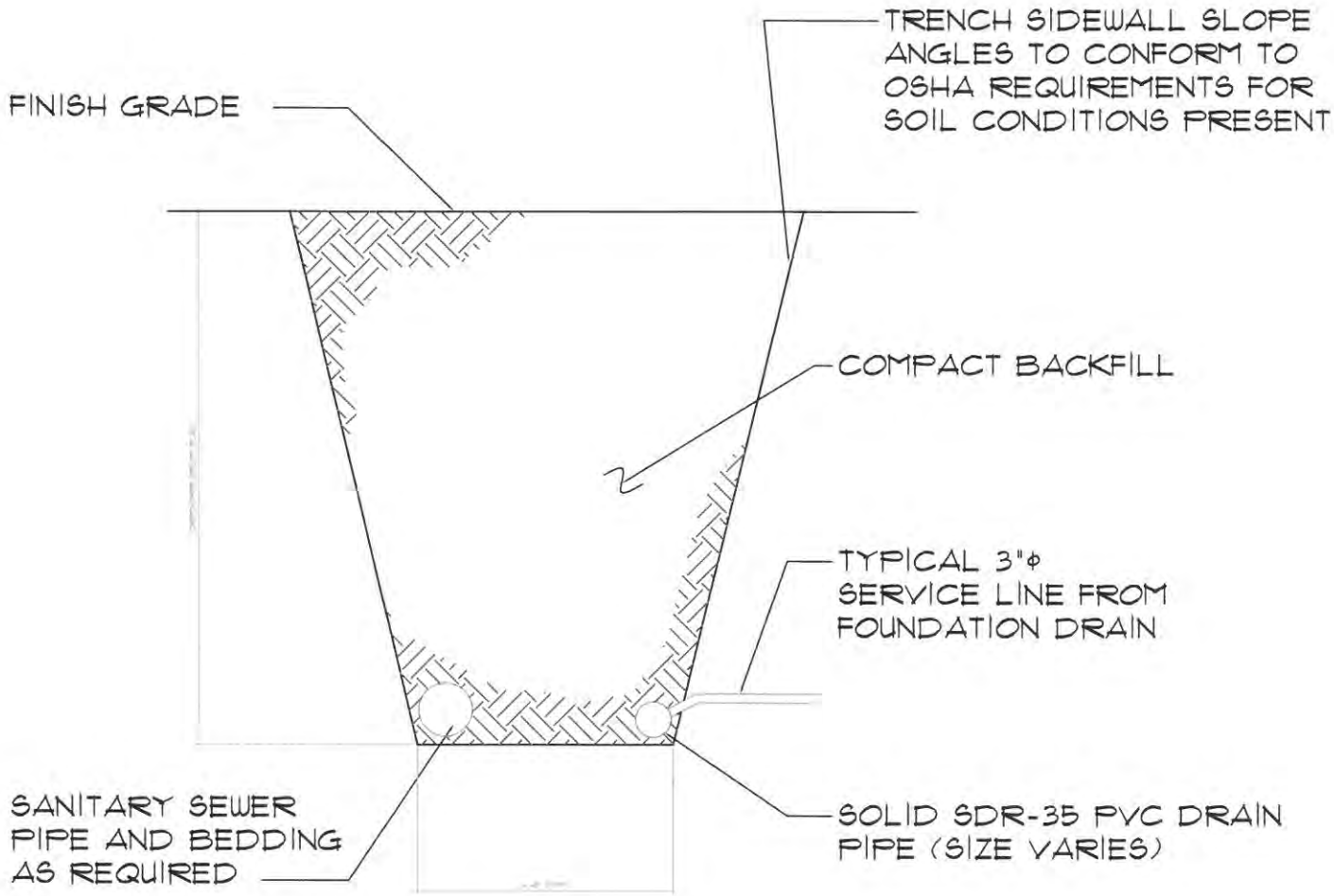
# ACTIVE DRAIN IN SEWER UTILITY TRENCH

FIG No. 12

NOTE: TO BE USED WHERE NO SHALLOW GROUNDWATER IS KNOWN TO EXIST

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PASSIVE DRAIN IN SANITARY SEWER TRENCH

FIG No. 13