

Architectural
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Materials Testing
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SOIL, GEOLOGY, AND WASTEWATER STUDY

**6385 Vessey Road
El Paso County Schedule No. 5206000065
El Paso County, Colorado**

PREPARED FOR:

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6385 Vessey Road
Colorado Springs, CO 80920**

JOB NO. 185099

January 11, 2021

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

**Reviewed by,
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El Paso County Health Department – Sewage Disposal System Permit

1.0 GENERAL SITE AND PROJECT DESCRIPTION

1.1 Project Location

The project lies in SW 1/4 of the NE ¼ of section 6, Township 12 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado, and is generally located east of the intersection of Vessey Road and Black Forest Road. The approximate location of the site is shown on the Site Vicinity Map, Figure 1.

1.2 Existing Land Use

The site currently consists of one parcel (per the El Paso County Assessor's website). It is approximately 13.67 acres. The parcel included is:

- El Paso County Schedule No. 5206000065, current land use is classified as single-family residence with well and septic, and includes one barn structure, and two sheds.

The current zoning is "RR-5" – *Residential Rural*, The parcel is partially developed near the northern portion of the property.

1.3 Project Description

The site consists of approximately 13.67 acres and is partially developed. An existing single-story residence with one barn structure and two detached sheds are located in the northern portion of the lot. It is our understanding the existing 13.67 acres is to be subdivided into a total of three lots.

- Lot 1, closest to the road, will retain the existing single-family residence, well, and septic, and is to be approximately 5.42 acres.
- Lot 2 is to contain a new single-family residence, well, and septic, and is to be approximately 4.27 acres.
- Lot 3, is to contain a new single-family residence, well, and septic, and is to be approximately 3.98 acres. The Proposed Lot Layout is presented in Figure 2.

The new lots are to be serviced by on-site wastewater treatment systems (OWTS) and individual water supply wells. The lots are to be accessed from Vessey Road.

The existing well is to remain. Based on review of the City-County Health Department Premise Inspection, dated March 8, 1976, and discussion with the owner, the location of the leach field is unknown. For this reason, the septic system and leach field are not depicted in Figure 9, Septic Suitability Map.

2.0 QUALIFICATIONS OF PREPARERS

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

The principle investigators for this study are Kelli Zigler P.G., and Tony Munger, P.E. Ms. Zigler is a Professional Geologist as defined by State Statute (C.R.S 34-1-201) with over 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 on-site 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
- Test pit subsurface exploration
- Visual and tactile characterization of representative site soil and rock samples
- Geologic research and analysis
- Concept exhibit prepared by SMH Consultants

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 partially developed. The site is generally located east of the intersection of Vessey Road and Black Forest Road in El Paso County, Colorado and comprises approximately 13.67 acres. The site is zoned “RR-5” - *Rural Residential*. Adjacent properties to the north, south, and west are zoned “RR-5” - *Rural Residential*.

4.2 Topography

Based on our site reconnaissance on November 10, 2021 and review of the USGS 2019 topographic map of the Black Forest Quadrangle, the site generally slopes down from north to south with an elevation difference of approximately 49 feet across the site. An apparent drainage area was observed along the eastern boundary of the site feeding into a small pond area in the southeast corner of the property. The drainage area can be seen in Figure 6, Engineering and Geology Map. The water levels within the drainage area are anticipated to vary dependent upon local precipitation events.

4.3 Vegetation

Site vegetation primarily consists of native grasses and weeds. Deciduous trees exist near the eastern boundary of the property.

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 appeared to be vacant land in images captured prior to 1960. A dirt driveway and structure are visible in the 1960 imagery. The existing residence was reportedly constructed in 1995 and the barn and sheds were constructed in 2013.

5.0 FIELD INVESTIGATION AND LABORATORY TESTING

It is our understanding the existing 13.67 acres is to be subdivided into a total of three lots.

- Lot 1, closest to the road, will retain the existing single-family residence, outbuilding structures, well, and septic. Lot 1 is to be approximately 5.42 acres.
- Lot 2 will contain a new single-family residence, well, and septic, and is to be approximately 4.27 acres.
- Lot 3, will contain a new single-family residence, well, and septic, and is to be approximately 3.98 acres. The Proposed Lot Layout is presented in Figure 2.

5.1 Test Pit Excavations

Three test pits were observed by RMG to explore the subsurface soils in the vicinity of the proposed on-site wastewater treatment systems on lots 2 and 3. The number of test pits is in accordance with the 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 test pits were excavated to 8 feet below the existing ground surface. Additional information is provided in Section 9.0, On-site Disposal of Wastewater. The locations of the test pits are presented on the Site Vicinity Map, Figure 8.

5.2 OWTS Visual and Tactile Evaluation

A visual and tactile evaluation was performed by RMG for this investigation. The soils were evaluated to determine the soils types and structure. Bedrock and restrictive layers were not encountered in the test pits. The soil descriptions of the test pit evaluation are presented in Figure 4, Test Pit Logs.

5.3 Groundwater

Groundwater was not encountered in the test pits observed by RMG on November 11, 2021. No indications of redoximorphic conditions were observed.

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 central portion of the Great Plains Physiographic Province. A major structural feature known as the Rampart Range Fault is located approximately 12 miles west of the site. The Rampart Range Fault marks the boundary between the Great Plains Physiographic Province and the Southern Rocky Mountain Province. The site exists within the southwest portion of a large structural feature known as the Denver Basin. In general, the geology at the site consists of feldspathic loamy disintegration residuum consisting of sand, loamy sand, sandy loam, loam and sandy clay loam overlying Facies unit five of the upper part of the Dawson Formation consisting of very thick-bedded to massive, cross-bedded, light-colored arkose, pebbly arkose, and arkosic pebble conglomerate.

6.1 Subsurface Soil Conditions

The subsurface soils encountered in the RMG test pit excavations were classified using the United States Department of Agriculture (USDA). The on-site soils classified as sand, sandy loam, loamy sand, sandy clay loam, and loam.

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 not encountered in the test pit excavations performed for this investigation. In general, the bedrock (as defined by Colorado Geologic Survey) beneath the site is considered to be part of Facies unit five of the Upper Dawson Formation which consists of very thick-bedded to massive, cross-bedded, light-colored arkose, pebbly arkose, and arkosic 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.

6.3 U.S. Soil Conservation Service

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

- 26 – Elbeth sandy loamy, 8 to 15 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 and ponding is none, and landforms include hills.
- 40 – Kettle gravelly loamy sand, 3 to 8 percent slopes. Properties of the gravelly loamy sand include somewhat excessively drained soils, depth of the water table is anticipated to be greater than 80 inches, runoff is anticipated to be low, frequency of flooding and ponding is none, and landforms include hills.

The USDA Soil Survey map is presented in Figure 5.

6.4 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 conditions affecting the development are presented in the Engineering and Geology Map, Figure 6.

The site generally consists of feldspathic loamy disintegration residuum consisting of sand, loamy sand, sandy loam, loam and sandy clay loam overlying sandstone bedrock. Four geologic units were mapped at the site as:

- *xlu* – Feldspathic loamy disintegration residuum
- *TKda5* – *Facies Unit Five* (early to middle(?) Eocene) – Unit five is dominated by very thick-bedded to massive, cross-bedded, light-colored arkose, pebbly arkose, and arkosic pebble conglomerate. Facies unit five contains common beds of white to light-tan, fine- to medium-grained feldspathic, cross-bedded friable sandstone. These sandstones are poorly sorted, have high clay contents, and are usually thin or medium bedded; wavy bedding and ripple cross-laminations are also common. The unit also contains massive structure less beds interpreted to be the mudflows. Facies unit five is estimated to be about 500 ft thick in the Black Forest quadrangle; the top of the unit has been removed by erosion. Facies unit five is generally permeable, well-drained, and has good foundation characteristics.
- *psw* – *Potentially Seasonally Wet Area* – low-lying drainage area located near the eastern boundary feeding into a potentially seasonally wet depression area near the southeast boundary.
- *af* – *Artificial Fill Area* – Artificial fill placed between 1995 and 2013 with the construction of the existing structures on the property.

6.5 Engineering Geology

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

- *IA* – Stable alluvium, colluvium and bedrock on flat to gentle slopes (0-5%)
- *Qc* – Colluvium
- *c Tkd* – Colluvium, Dawson Formation (Upper Part)

6.6 Structural Features

Structural features such as schistosity, 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 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 from the north to the south-southeast. It is anticipated the direction of surface water and groundwater generally flow in the same direction. Groundwater was not encountered in the test pits performed for this study, and is not anticipated to affect shallow foundations. A low-lying drainage area extends along the eastern boundary of the property and discharges into a depression or pond-like area near the southeastern boundary, and is anticipated to be potentially seasonally wet.

6.10 Flooding and Surface Drainage

Based on our review of the Federal Emergency Management Agency (FEMA) Community Panel No. 08041C0315G and the online ArcGIS El Paso County Risk Map, the entire site lies outside of identified regulatory floodway and 100 or 500-year floodplains. The site lies in Zone X. 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. The FEMA Map is presented in Figure 7.

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 not identified on the aggregate resource evaluation map for any of the given classifications.

According to the *Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands*, the site is mapped within the southern part of the Denver Basin and is underlain primarily by the Dawson Arkose, a sedimentary formation of Tertiary age related to uplift and erosion of the Front Range. The bedrock geology of the area consists of arkosic sandstone and claystone facies of Dawson Arkose (Eocene and Paleocene) – yellowish-gray to light-gray, commonly iron-stained, coarse- to fine-grained, locally conglomeratic, massive to cross-bedded argillaceous arkose and feldspathic sandstone containing numerous gray to greenish-gray clay lenses. Locally contains thin carbonaceous shale lenses. Generally loosely cemented but contains numerous hard ironstone lenses in upper portion. Thickness up to 3,000 feet in subsurface.

No oil and gas wells are drilled in the area. The sedimentary rocks in this area appear to contain all of the essential elements; however, existing geological control is insufficient to determine the presence of a trap or reservoir. The general area in which the property lies is within the Denver coal region. The nearest historic coal mine sites are located about nine miles southwest of the tract in the Colorado Springs coal field (Carroll and Bauer, 2002). In this part of the Denver coal region, coal resources are locally present within the lower part of the Laramie Formation of Upper Cretaceous age. In the vicinity of this tract, the coal-bearing beds of the Laramie Formation lie at a depth of about 2,200 feet (Kirkham and Ladwig, 1979). The coal seams in the Laramie Formation tend to be lenticular and discontinuous in comparison to areas currently being mined in western Colorado. This tract is not prospective for metallic mineral resources. The Dawson Arkose is generally void of valuable industrial mineral resources.

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. They are not are not anticipated to pose a significant risk to the proposed development:

- Avalanches
- Debris Flow and Debris Fans
- Expansive Soils and Expansive Rock
- Flood Prone Areas
- Collapsible Soils
- Landslide areas or potential landslide areas
- Rockfall
- Steeply Dipping Bedrock
- Unstable or Potentially Unstable Slopes
- Scour, Erosion, accelerated erosion along creek banks and drainage ways
- Corrosive Minerals
- Subsidence and Abandoned Mining Activity
- Shallow Ground Water Tables
- Groundwater Springs or Seeps

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

8.1 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 is greater than 10 miles from the subject site.

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

Mitigation

The Pikes Peak Regional Building Code, 2017 Edition, indicates maximum considered earthquake spectral response accelerations of 0.198g for a short period (S_s) and 0.057g 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.

8.2 Radon

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

Northern El Paso County and the 80908 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.

8.3 Ponding Water

A potentially seasonally wet area in the form of a low-lying pond-like depression was encountered during our investigation. In this area, we would anticipate the potential for periodically high subsurface moisture conditions and frost heave potential. This area lies within a low-lying area in the southeast portion of the property.

Fluctuations in groundwater and subsurface moisture conditions may occur due to variations in rainfall and other factors not readily apparent at this time. Furthermore, the development processes (reshaping of the ground surface, installation of buried utilities, installation of an underdrain below the roadways, etc.) can significantly alter the depth and flow paths of the subsurface water. The construction of surrounding lots can also alter the amount and depth of subsurface groundwater below a given lot. The potential exists for high groundwater levels during high moisture periods and should structures encroach on these areas the following mitigations should be followed.

Mitigation

Foundations must have a minimum 30-inch depth for frost protection. Perimeter drains are recommended around portions of the structures which will have habitable or storage space located below the finished ground surface. This includes crawlspace areas but not the walkout trench, if applicable. Perimeter drains help reduce the likelihood of intrusion of "nuisance" water into below-grade spaces. A typical perimeter drain detail is presented in Figure 10.

The proposed development may include both basements and crawlspaces. If groundwater is encountered at the time of the site-specific subsurface soil investigations within 4 to 6 feet of the proposed basement slab elevations, an underslab drain should be considered in conjunction with the perimeter drain. It must be understood that subsurface drains are designed to intercept some types of subsurface moisture and not others. Therefore, the drains could operate properly and not mitigate all moisture problems relating to foundation performance or moisture intrusion into the basement area. A typical underslab drain detail is presented in Figure 11.

9.0 ON-SITE WASTEWATER TREATMENT SYSTEMS

It is our understanding that On-site Wastewater Treatment Systems (OWTS) are proposed for the development. Individual wells are also proposed for the residential structures. The site was evaluated in general accordance with the El Paso Land Development Code, specifically sections 8.4.8. Three 8-foot deep test pits were performed across the site to obtain a general understanding of the soil and bedrock conditions. The Test Pits Logs are presented in Figure 4.

The United States Department of Agriculture (USDA) as discussed in section 6.3 consisted of sand, sandy loam, loamy sand, sandy clay loam, and loam. Limiting layers were not encountered in the test pits. The long term acceptance rates (LTAR) associated with the soils observed in the test pits ranged from 0.35 to 0.80 (soil type 1-3) gallons per day per square foot. Signs of seasonal groundwater were not observed in the test pits.

Contamination of surface and subsurface water resources should not occur provided the OWTS sites are evaluated and installed according to the El Paso County Board of Health Guidelines and property maintained.

Treatment areas at a minimum, must achieve the following:

- Treatment areas must be 4 feet above groundwater or bedrock as defined by the Definitions 8.3.4 of the Regulations of the El Paso County Board of Health, Chapter 8 OWTS Regulations, most recently amended May 23, 2018;
- Each lot (after purchase but prior to construction of an OWTS) will require an OWTS report prepared per *the Regulations of the El Paso County Board of Health, Chapter 8 OWTS Regulations*. During the site reconnaissance, a minimum of two 8-foot deep test pits will need to be excavated in the vicinity of the proposed treatment area;
- Comply with any physical setback requirements of Table 7-1 of the El Paso County Department of Health and Environment (EPCHDE);
- Treatment areas are to be located a minimum 100 feet from any well (existing or proposed), including those located on adjacent properties per Table 7-2 per the EPCHDE;
- Each lot shall be designed to insure that a minimum of 2 sites are appropriate for a OWTS and do not fall within the restricted areas identified on the Engineering and Geology Map, Figure 6, (e.g. existing ponds, existing septic fields that may remain);

It is our opinion that the EPCHDE physical setback requirements are met for each lot. It is recommended that the placement of individual On-Site Wastewater Treatment Systems be located outside of the potentially seasonally wet low-lying pond-like area in the southeastern portion of the property.

Soil and groundwater conditions at the site are suitable for individual treatment systems. It should be noted that the LTAR values stated above are for the test pit locations performed for this report only. The LTAR values may change throughout the site. If an LTAR value of less than 0.35 (or soil types 3 to 5) are encountered at the time of the site specific OWTS evaluation, an "engineered system" will be required.

10.0 BEARING OF GEOLOGIC CONDITIONS UPON PROPOSED DEVELOPMENT

Geologic hazards (as described in Section 8.0 of this report) found to be present at this site include faults/seismicity and radon. It is our opinion that the existing geologic and engineering conditions can be satisfactorily mitigated through proper engineering, design, and construction practices.

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 pits, laboratory test results, conclusions and recommendations presented in this report are not intended for use for design and construction.

A lot-specific subsurface soil investigation will be required for all proposed structures including (but not limited to) residences, retaining walls, etc.

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 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 10. Surface water should be efficiently removed from the building area to prevent ponding and infiltration into the subsurface soil.

We believe the sand and loamy sand will classify as Type C material, the sandy loam and loam will classify as type B material, and the sandy clay loam will classify as Type A material as defined by OSHA in 29 CFR Part 1926. OSHA requires that temporary excavations made in Type C materials be laid back at ratios no steeper than 1 ½:1 (34°) (horizontal to vertical), temporary excavations made in Type B materials be laid back no steeper than 1:1 (45°) (horizontal to vertical), and temporary excavations made in Type A materials be laid back no steeper than ¾:1 (53°) (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.

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 **Pawel Posorski** 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. *Concept Exhibit, 6385 Vessey Road, Colorado Springs, Colorado*, prepared by SMH Consultants
2. *Flood Insurance Rate Map, El Paso County, Colorado and Unincorporated Areas, Community Panel No. 08041C0315G*, Federal Emergency Management Agency (FEMA), effective December 7, 2018.
3. *Generalized Surficial Geologic Map of the Denver 1 degree X 2 degree Quadrangle, Colorado*, compiled by Moore, Straub, Berry, Baker, and Brandt, 2003, U.S. Geological Survey, Miscellaneous Field Studies Map MF-2347.
4. *Geologic Map of the Black Forest Quadrangle, El Paso County, Colorado*, compiled by Thorson, J.P., Open File Report OF03-06, 2003.
5. *Cherry Valley and Black Forest Quadrangle, Environmental and Engineering Geologic Map for Land Use*, compiled by Dale M. Cochran, Charles S. Robinson & Associates, Inc., Golden, Colorado, 1977.
6. *Cherry Valley and Black Forest Quadrangle, Map of Potential Geologic Hazards and Surficial Deposits*, compiled by Dale M. Cochran, Charles S. Robinson & Associates, Inc., Golden, Colorado, 1977.
7. *Pikes Peak Regional Building Department*: <https://www.pprbd.org/>.
8. El Paso County Assessor Website
<https://property.spatalest.com/co/elpaso/#/property/5206000065>
Schedule No. 5206000065
9. *Colorado Geological Survey, USGS Geologic Map Viewer*:
<http://coloradogeologicalsurvey.org/geologic-mapping/6347-2/>.
10. *Historical Aerials*: <https://www.historicaerials.com/viewer>, Images dated 1947, 1952, 1955, 1960, 1969, 1983, 1999, 2005, 2009, 2011, 2013, 2015, and 2017.
11. *USGS Historical Topographic Map Explorer*: <http://historicalmaps.arcgis.com/usgs/>
Colorado Springs, Black Forest quadrangle dated 1954, 2010, 2013, 2016, and 2019.
12. *Google Earth Pro*, Imagery dated 1999, 2004, 2005, 2006, 2011, 2013, 2015, 2017, 2019 and 2020.
13. *Colorado Springs and Vicinity Natural Hazards Explorer ARC GIS Web Viewer*
<https://www.arcgis.com/apps/MapSeries/index.html?appid=dce03f88b282442d8ec751fd439e357e>
14. *USDA Web Soil Survey*
<https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx>

APPENDIX B
El Paso County Health Department – Sewage Disposal System
Permit

cc 3/19/76

paid yet

Receipt acc. # mar. '76 to [unclear]
3408 18 yr. old House
Nothing on file

CITY-COUNTY HEALTH DEPARTMENT
501 NORTH FOOTE AVENUE
COLORADO SPRINGS, COLORADO 80909
471-3700

#52060-00-065

ON PREMISE INSPECTION

DATE: 3/8 1976

ADDRESS OF PROPERTY 6385 Crosey Road Black Forest

NAME OF OWNER Melores Wagner (Seller) PHONE 495-9356

LETTER FOR: V.A. FHA OTHER Low WATER SUPPLY: PVT PUB.

LETTER REQUESTED BY: SELLER BUYER REALTY CO. OTHER

NAME OF PERSON OR COMPANY REQUESTING LETTER Ellen Toft 475-9401

ADDRESS Widman Co 13515 S. Chestnut PHONE 475-9400

LETTER TO BE: PICKED UP MAILED OTHER Sam Oriansbens
11am

INSPECTION

DISTANCE FROM LEACHING FIELD unknown. 3 bdrm.
WELL: GENERAL DESCRIPTION well casing to be raised out of pit
one foot above ground surface.

PLUMBING AND VENTING appears to be properly trapped & vented.

LAVATORY FACILITIES: appear to be in good working order.

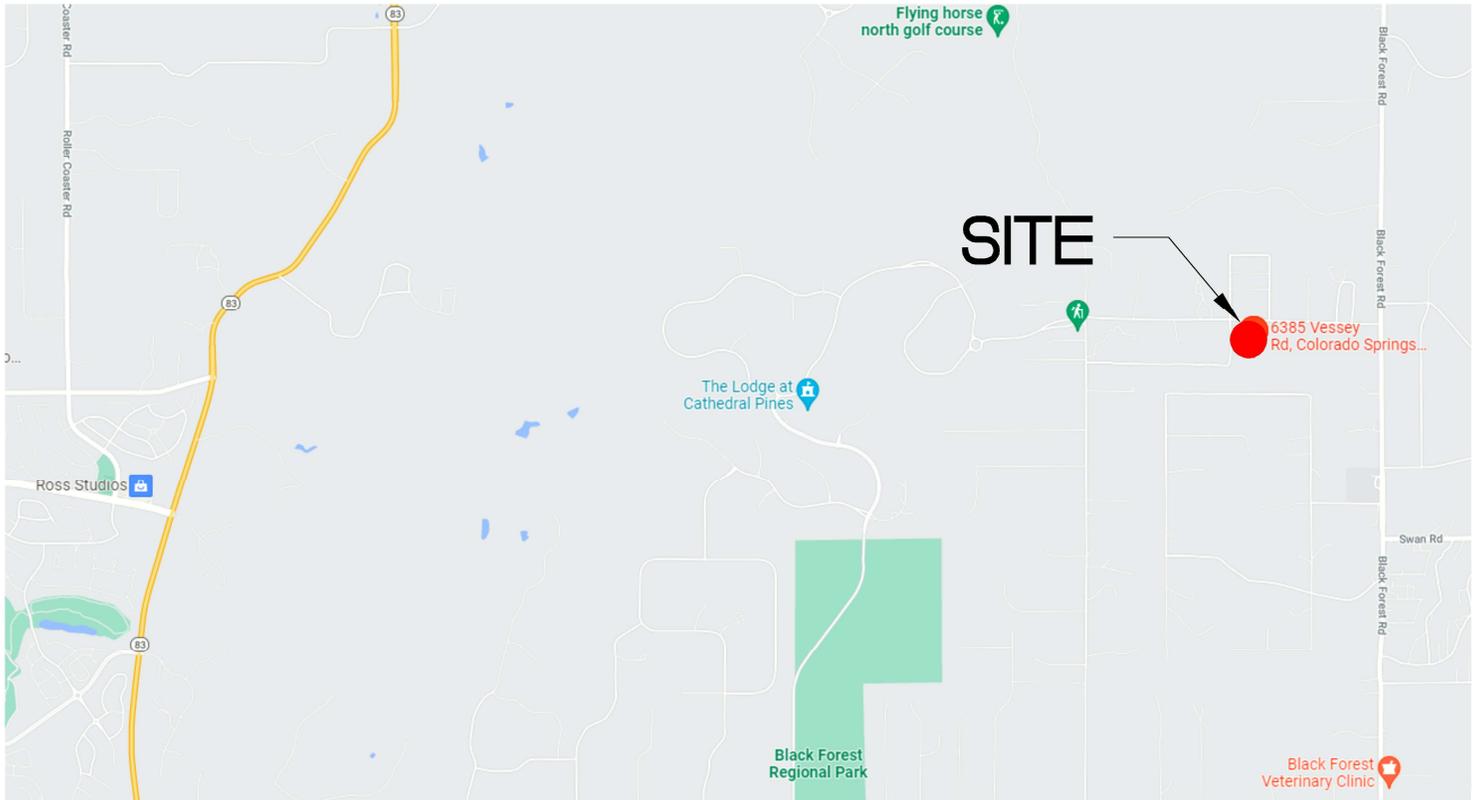
OTHER INFORMATION: No evidence of sewage from toilets
on ground surface however, washing
machine waste must be rerouted to drain
into S.T. This completed as re-inspected 2 Apr. '76
b.d.

Water OK.
taken 3/10/76

New well
wells SHOWN
4/14/76

water sample taken 10 mar. '76

INSPECTION MADE BY: D. Harris DATE OF INSPECTION 20 Mar. 1976



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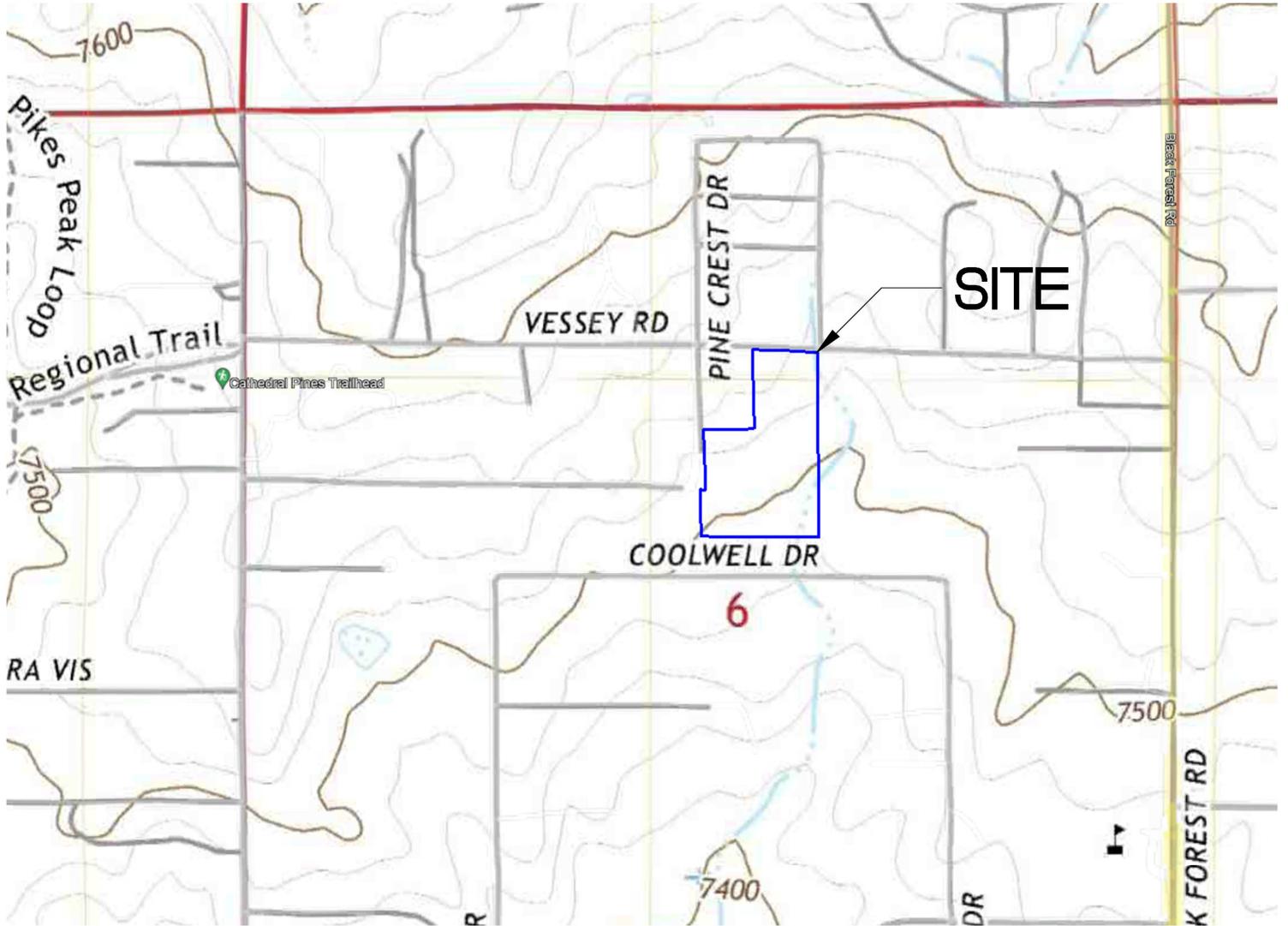
SITE VICINITY MAP

6385 VESSEY ROAD
 EL PASO COUNTY SCHEDULE NO. 5206000065
 EL PASO COUNTY, COLORADO
 PAWEL POSORSKI

JOB No. 185099

FIG No. 1

DATE 1-11-2022



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USGS TOPO MAP

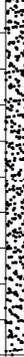
6385 VESSEY ROAD
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FIG No. 3

DATE 1-11-2022

TEST PIT TP-1			
DATE OBSERVED: 11/11/21			
SOIL DESCRIPTION	DEPTH (FT)	SYMBOL	SOIL TYPE
0 - 2.0 FT LOAMY SAND (STRUCTURELESS)	0 - 2ft		1
2.0 - 8.0 FT SANDY CLAY LOAM (MODERATE)	2ft - 8ft		3

TEST PIT TP-2			
DATE OBSERVED: 11/11/21			
SOIL DESCRIPTION	DEPTH (FT)	SYMBOL	SOIL TYPE
0 - 3.0 FT SANDY LOAM (MODERATE)	0 - 2ft		2
3.0 - 8.0 FT SAND (STRUCTURELESS)	2ft - 8ft		1

SOIL DESCRIPTIONS



LOAMY SAND



SANDY LOAM



SANDY CLAY LOAM



SAND



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TEST PIT LOGS

6385 VESSEY ROAD
EL PASO COUNTY SCHEDULE NO. 5206000065
EL PASO COUNTY, COLORADO
PAWEL POSORSKI

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FIGURE No. 4

PAGE 1 OF 2

DATE 1-11-2022

TEST PIT TP-3			
DATE OBSERVED: 11/11/21			
SOIL DESCRIPTION	DEPTH (FT)	SYMBOL	SOIL TYPE
0 - 2.5 FT LOAM (STRONG, BLOCKY)	2ft		2
2.5 - 8.0 FT SANDY LOAM (MODERATE)	4ft 6ft 8ft		2

SOIL DESCRIPTIONS



LOAM



SANDY LOAM



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TEST PIT LOGS

6385 VESSEY ROAD
EL PASO COUNTY SCHEDULE NO. 5206000065
EL PASO COUNTY, COLORADO
PAWEL POSORSKI

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FIGURE No. 4

PAGE 2 OF 2

DATE 1-11-2022



40 - Kettle gravelly loamy sand, 3 to 8 percent slopes

26 - Elbeth sandy loam, 8 to 15 percent slopes



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USDA SOIL SURVEY

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FIG No. 5

DATE 1-11-2022



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(970) 330-1071

Woodland Park Office:
(719) 687-6077

Monument Office:
(719) 488-2145

Pueblo / Canon City:
(719) 544-7750

6385 VESSEY ROAD
EL PASO COUNTY
SCHEDULE NO. 5206000065

EL PASO COUNTY, COLORADO
PAWEL POSORSKI

ENGINEER:	ITEM
DRAWN BY:	KGR
CHECKED BY:	TEH
ISSUED:	1-11-2022

ENGINEERING
AND GEOLOGY
MAP

SHEET No.
FIG-6

GEOLOGIC

- xlu - Feldspathic loamy disintegration residuum
 - TKda5 - Dawson Formation Facies Unit Five
 - psw - Potentially Seasonally Wet Area
 - af - Artificial Fill Area
- ENGINEERING**
- 1A - Stable alluvium, colluvium and bedrock on flat to gentle slopes (0-5%)
 - Oc - Colluvium
 - c Tkd - Colluvium, Dawson Formation (Upper Part)



REFERENCE
NOT TO SCALE

National Flood Hazard Layer FIRMette



104°42'50"W 39°2'28"N



0 250 500 1,000 1,500 2,000 Feet 1:6,000
 Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

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, AE2
 - 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**
 - Cross Sections with 1% Annual Chance Water Surface Elevation: 20.2, 17.5
 - 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

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 12/13/2021 at 11:11 AM 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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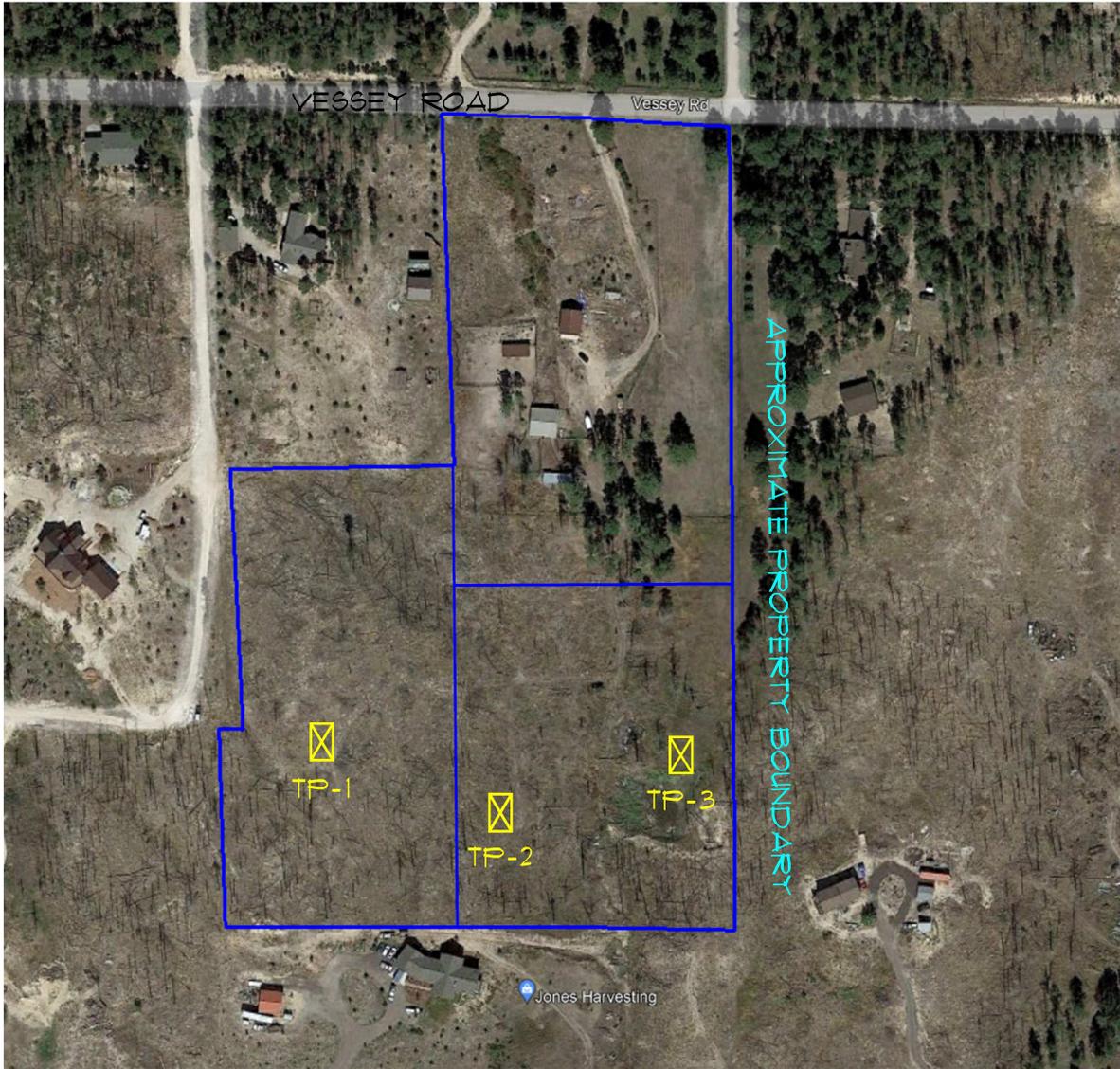
FEMA MAP

6385 VESSEY ROAD
 EL PASO COUNTY SCHEDULE NO. 5206000065
 EL PASO COUNTY, COLORADO
 PAWEL POSORSKI

JOB No. 185099

FIG No. 7

DATE 1-11-2022



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DENOTES APPROXIMATE LOCATION OF TEST PITS



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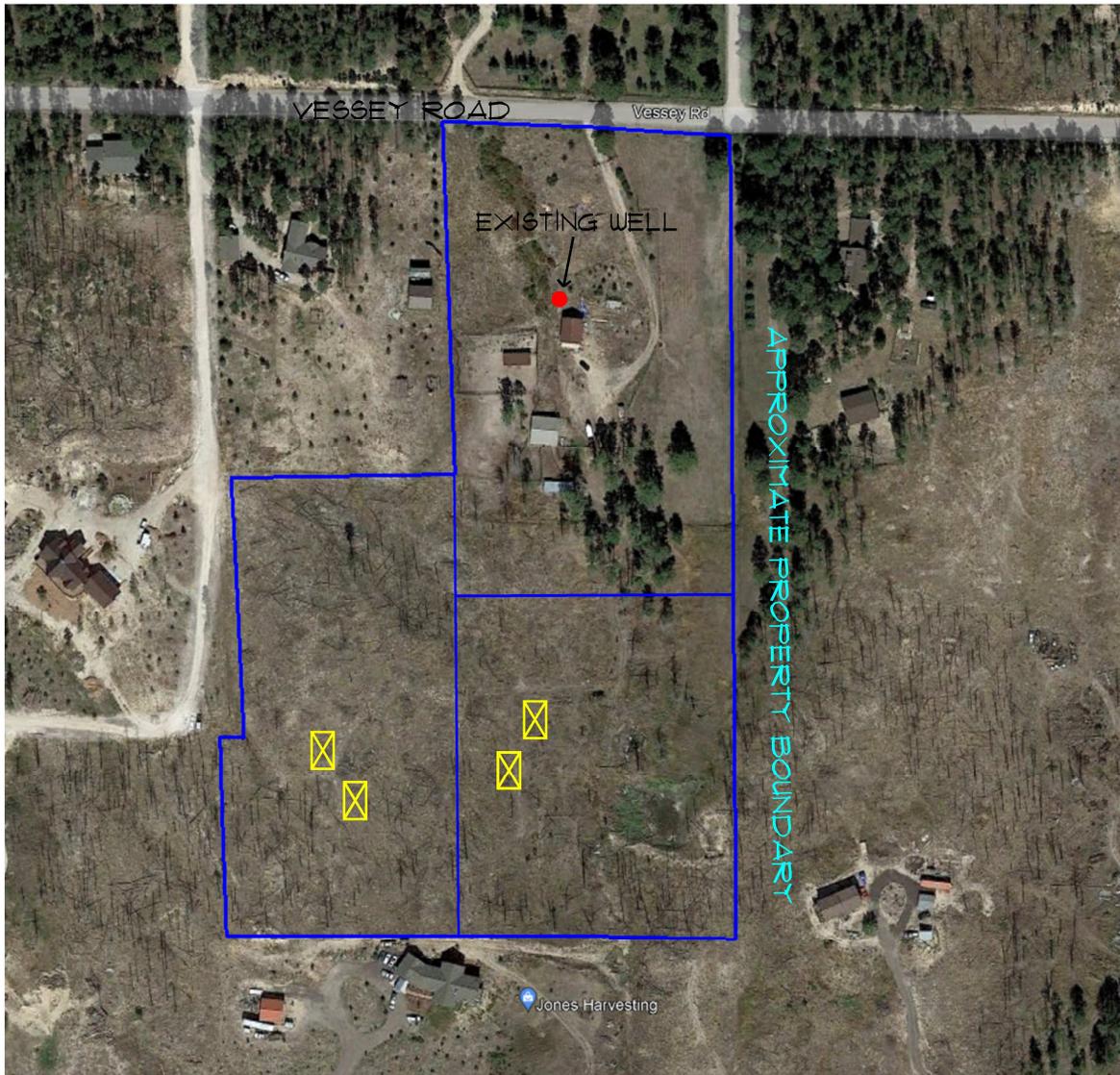
TEST PIT LOCATION MAP

6385 VESSEY ROAD
 EL PASO COUNTY SCHEDULE NO. 5206000065
 EL PASO COUNTY, COLORADO
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JOB No. 185099

FIG No. 8

DATE 1-11-2022



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DENOTES PRIMARY AND ALTERNATE SEPTIC LOCATIONS



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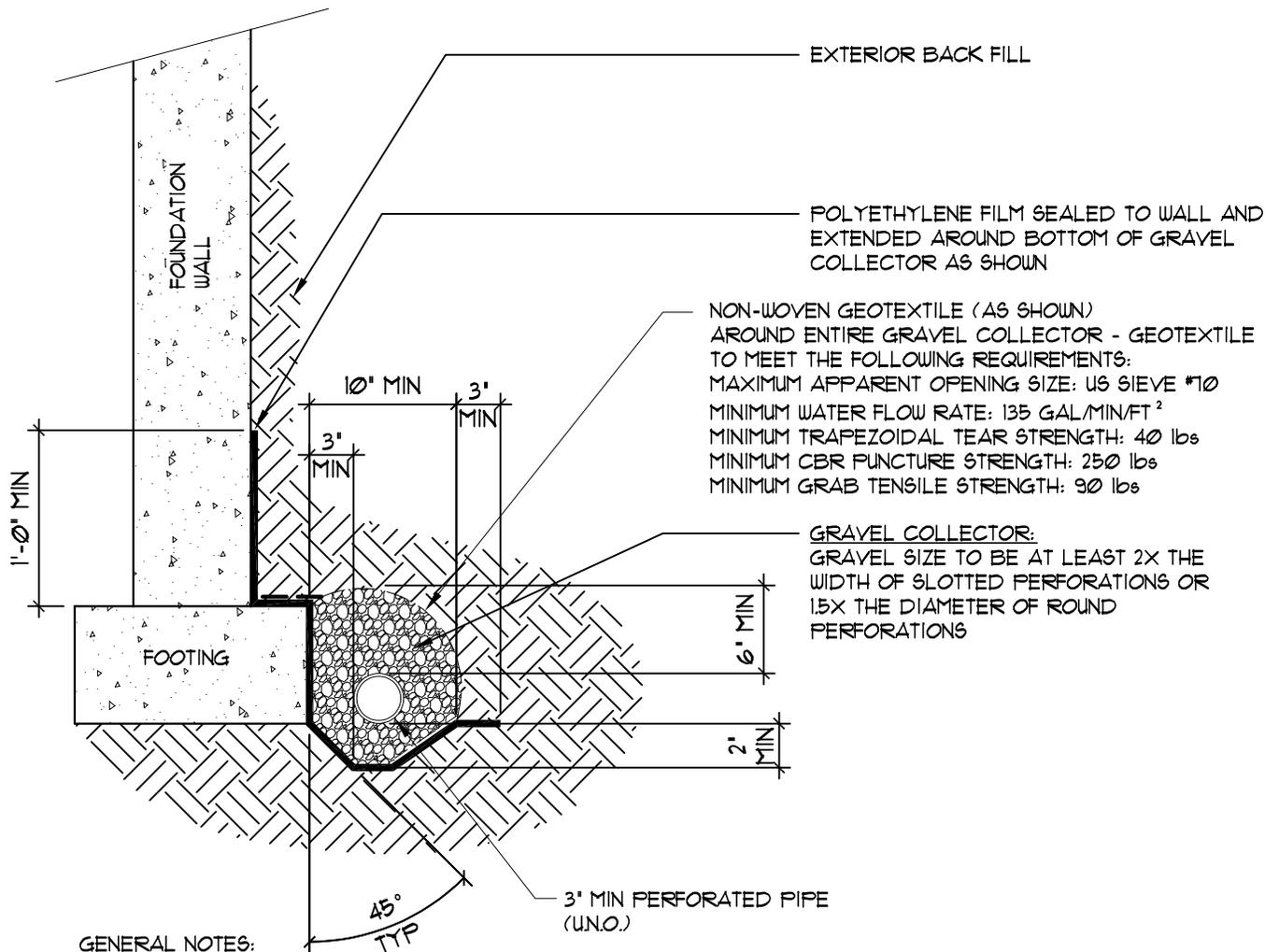
SEPTIC SUITABILITY MAP

6385 VESSEY ROAD
 EL PASO COUNTY SCHEDULE NO. 5206000065
 EL PASO COUNTY, COLORADO
 PAWEL POSORSKI

JOB No. 185099

FIG No. 9

DATE 1-11-2022



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.

Architecture
Structural
Geotechnical



Engineers / Architects

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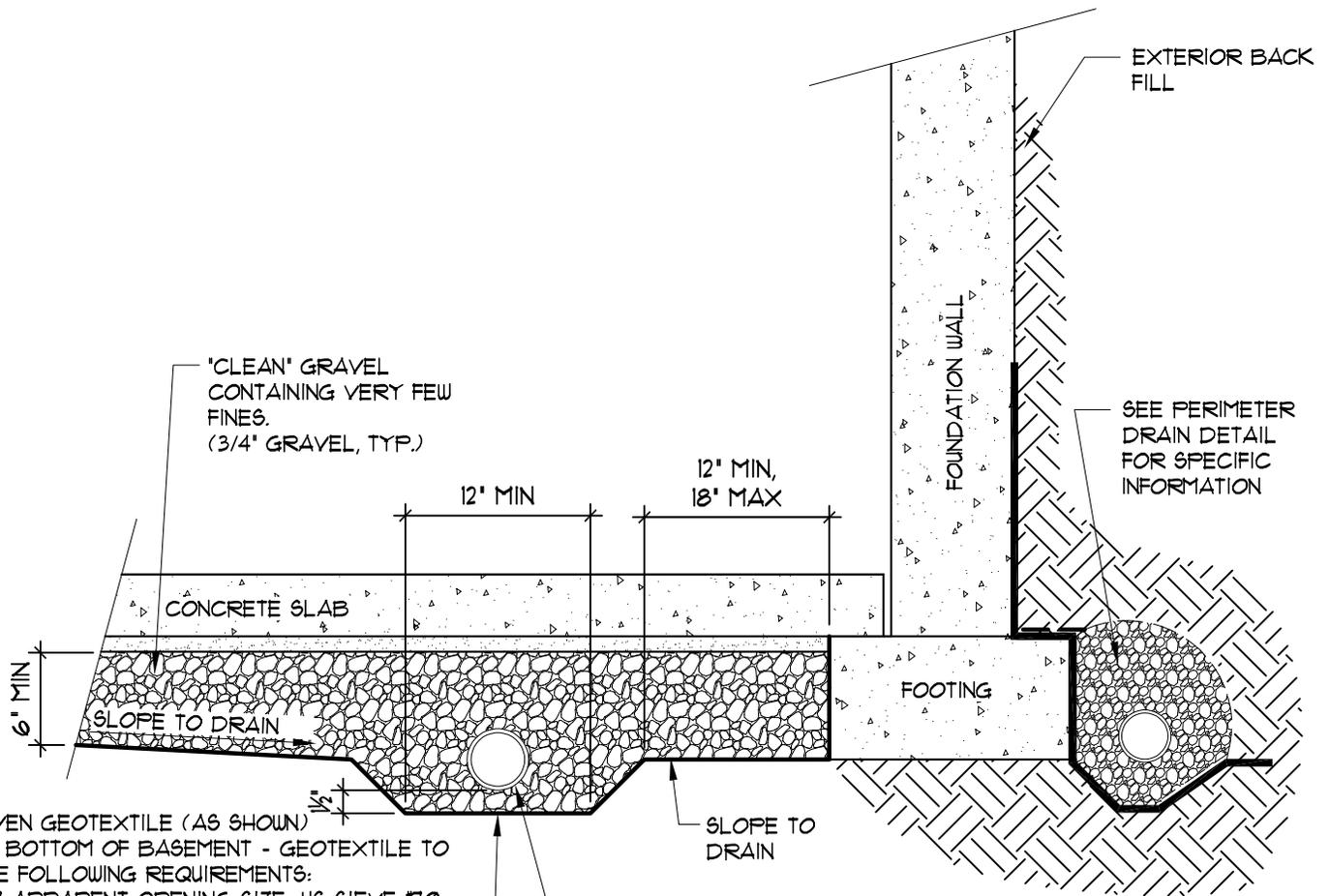
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SOUTHERN COLORADO, DENVER METRO, NORTHERN COLORADO

Materials Testing
Forensics
Civil / Planning

PERIMETER DRAIN

FIG No. 10



NON-WOVEN GEOTEXTILE (AS SHOWN) ACROSS BOTTOM OF BASEMENT - GEOTEXTILE TO MEET THE FOLLOWING REQUIREMENTS:
 MAXIMUM APPARENT OPENING SIZE: US SIEVE #10
 MINIMUM WATER FLOW RATE: 135 GAL/MIN/FT²
 MINIMUM TRAPEZOIDAL TEAR STRENGTH: 40 lbs
 MINIMUM CBR PUNCTURE STRENGTH: 250 lbs
 MINIMUM GRAB TENSILE STRENGTH: 90 lbs

3' DIAMETER RIGID PERFORATED PIPE CONNECTED TO A SUITABLE GRAVITY OUTFALL SUCH AS AN UNDERDRAIN LOCATED IN THE UTILITY TRENCH IN THE STREET WITH A MIN. GRADE OF PIPE = 1.5%. IF A FREE GRAVITY OUTFALL CANNOT BE ACHIEVED, A SUMP PIT AND PUMP SHOULD BE PROVIDED.

GENERAL NOTES:

1. ALL DRAIN PIPE SHALL BE PERFORATED PLASTIC, WITH THE EXCEPTION OF THE DISCHARGE PORTION WHICH SHALL BE SOLID, NON-PERFORATED PIPE.
2. DRAIN PIPE SHALL HAVE POSITIVE FALL THROUGHOUT.
3. 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.
4. ALL DRAIN COMPONENTS SHALL BE RATED/APPROVED BY THE MANUFACTURER FOR THE INSTALLED DEPTH AND APPLICATION
5. DRAIN SYSTEM, INCLUDING THE OUTFALL OF THE DRAIN, SHALL BE OBSERVED BY QUALIFIED PERSONNEL PRIOR TO BACKFILLING TO VERIFY INSTALLATION.

Architecture
 Structural
 Geotechnical



Engineers / Architects

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Materials Testing
 Forensics
 Civil / Planning

UNDERSLAB DRAIN

FIG No. 11

West Elevation

☀ 95°E (T) ● 39°2'10"N, 104°42'33"W ±16ft ▲ 7510ft



Overview
Kyle Reamer-Staff
Geologist-RMG

185099 - 6385 Vessey Road
10 Nov 2021, 1:53:29 PM

South West Elevation

☀ 28°NE (T) ● 39°2'10"N, 104°42'33"W ±16ft ▲ 7511ft



Overview
Kyle Reamer-Staff
Geologist-RMG

185099 - 6385 Vessey Road
10 Nov 2021, 1:53:36 PM



☀ 347°N (T) ● 39°2'8"N, 104°42'31"W ±16ft ▲ 7503ft

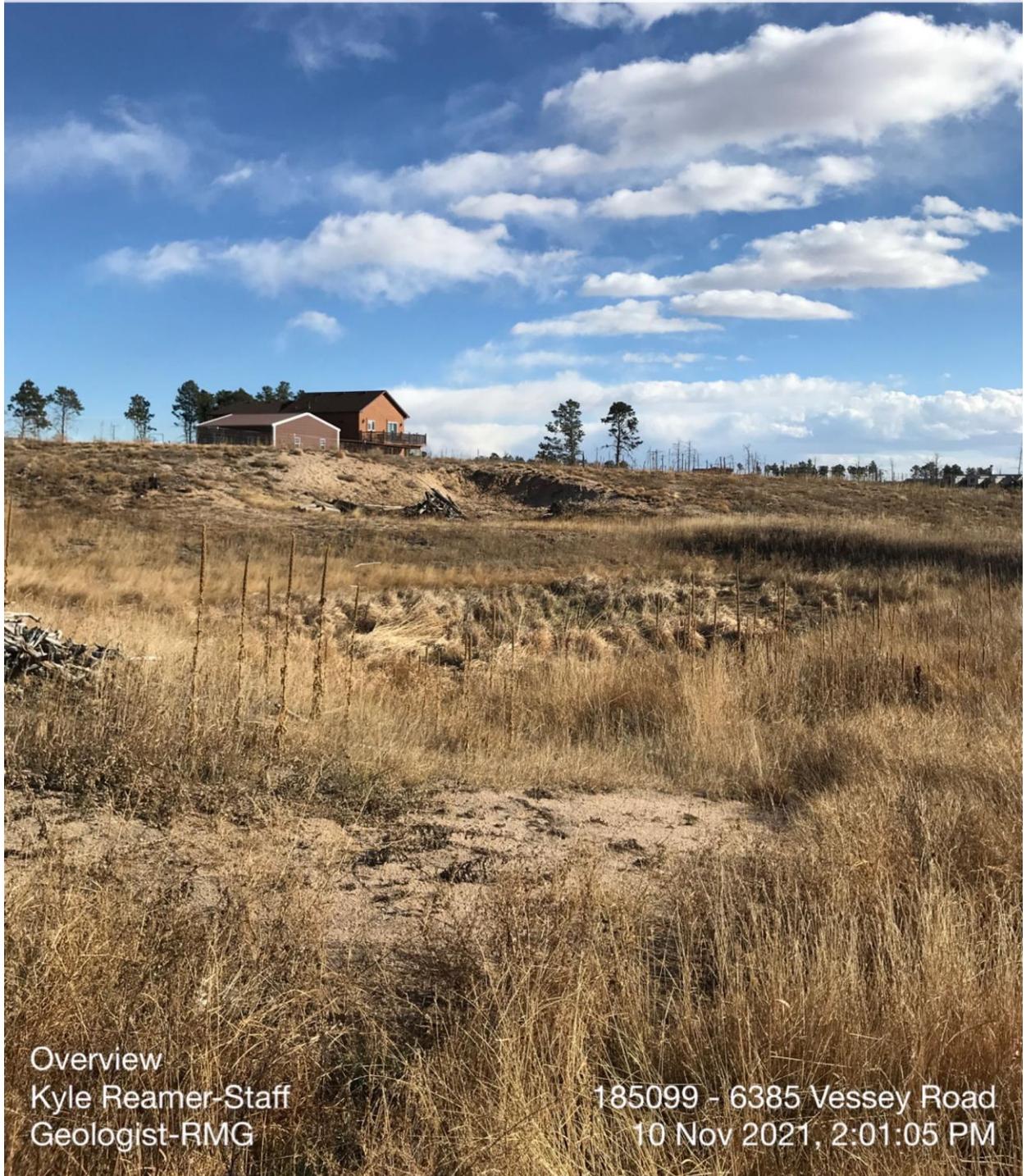


Overview
Kyle Reamer-Staff
Geologist-RMG

185099 - 6385 Vessey Road
10 Nov 2021, 1:59:28 PM



☀ 119°SE (T) ● 39°2'8"N, 104°42'29"W ±16ft ▲ 7496ft



Overview
Kyle Reamer-Staff
Geologist-RMG

185099 - 6385 Vessey Road
10 Nov 2021, 2:01:05 PM



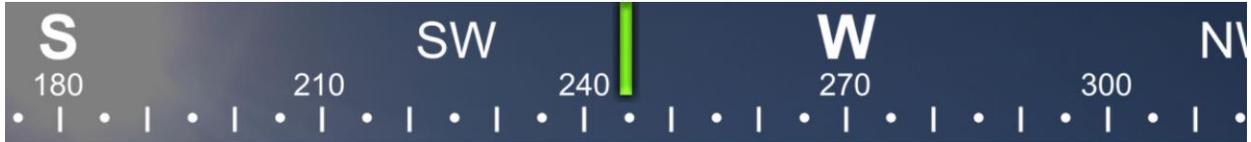
☉ 309°NW (T) ● 39°2'9"N, 104°42'28"W ±16ft ▲ 7494ft



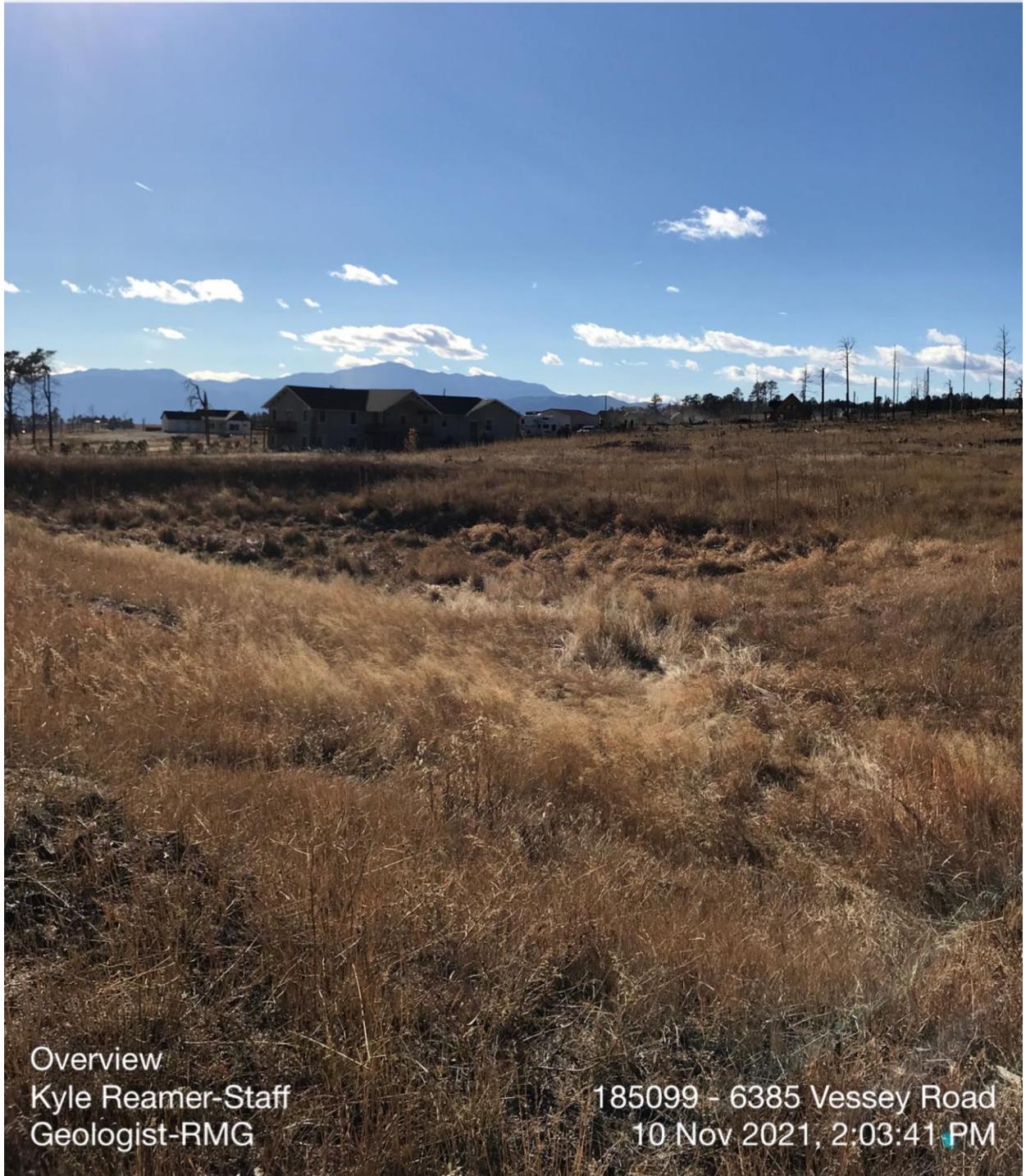
Overview
Kyle Reamer-Staff
Geologist-RMG

185099 - 6385 Vessey Road
10 Nov 2021, 2:03:03 PM





☀ 245°SW (T) ● 39°2'8"N, 104°42'27"W ±16ft ▲ 7491ft



Overview
Kyle Reamer-Staff
Geologist-RMG

185099 - 6385 Vessey Road
10 Nov 2021, 2:03:41 PM



☀ 350°N (T) ● 39°2'8"N, 104°42'27"W ±16ft ▲ 7493ft





☀ 236°SW (T) ● 39°2'8"N, 104°42'27"W ±16ft ▲ 7498ft



Overview
Kyle Reamer-Staff
Geologist-RMG

185099 - 6385 Vessey Road
10 Nov 2021, 2:04:15 PM



☀ 310°NW (T) ● 39°2'8"N, 104°42'27"W ±16ft ▲ 7504ft



Overview
Kyle Reamer-Staff
Geologist-RMG

185099 - 6385 Vessey Road
10 Nov 2021, 2:04:24 PM



☀ 331°NW (T) ● 39°2'6"N, 104°42'27"W ±16ft ▲ 7495ft



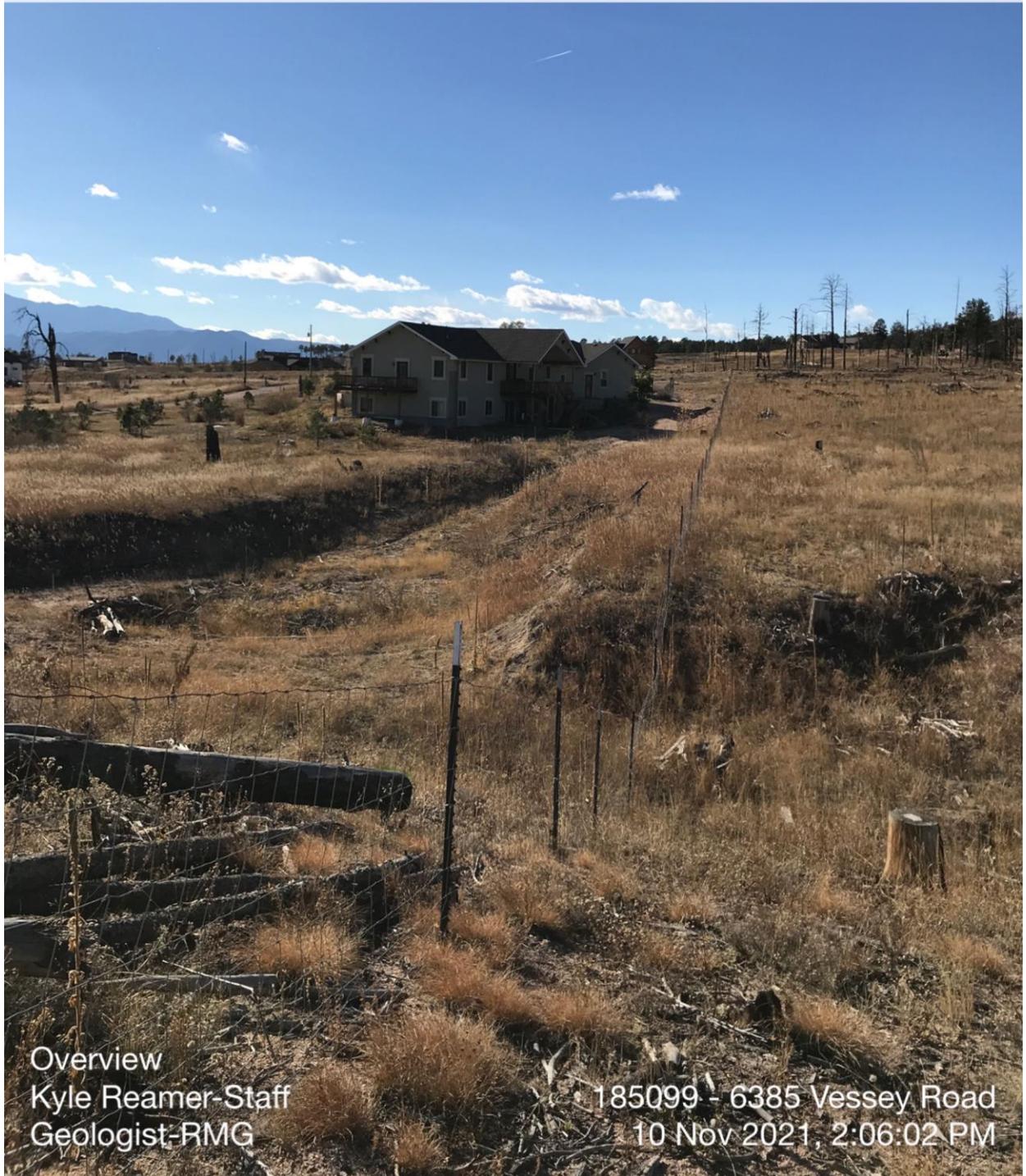
Overview

• Kyle Reamer-Staff
Geologist-RMG

185099 - 6385 Vessey Road
10 Nov 2021, 2:05:19 PM



☀ 265°W (T) ● 39°2'6"N, 104°42'28"W ±16ft ▲ 7491ft



Overview
Kyle Reamer-Staff
Geologist-RMG

185099 - 6385 Vessey Road
10 Nov 2021, 2:06:02 PM

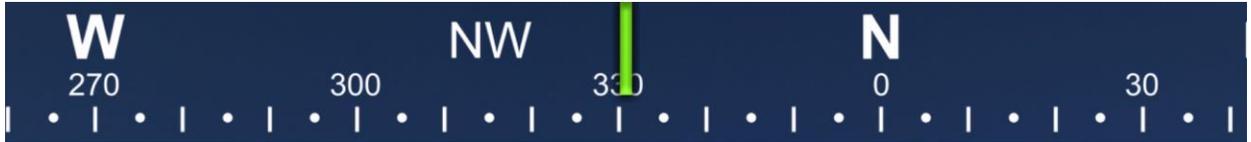


☀ 345°N (T) ● 39°2'6"N, 104°42'29"W ±16ft ▲ 7482ft



Overview
Kyle Reamer-Staff
Geologist-RMG

185099 - 6385 Vessey Road
10 Nov 2021, 2:06:25 PM



☀ 331°NW (T) ● 39°2'7"N, 104°42'34"W ±16ft ▲ 7497ft



Overview
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Geologist-RMG

185099 - 6385 Vessey Road
10 Nov 2021, 2:08:37 PM





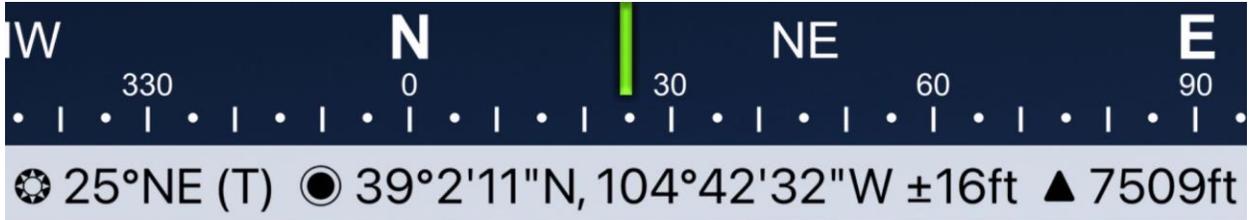


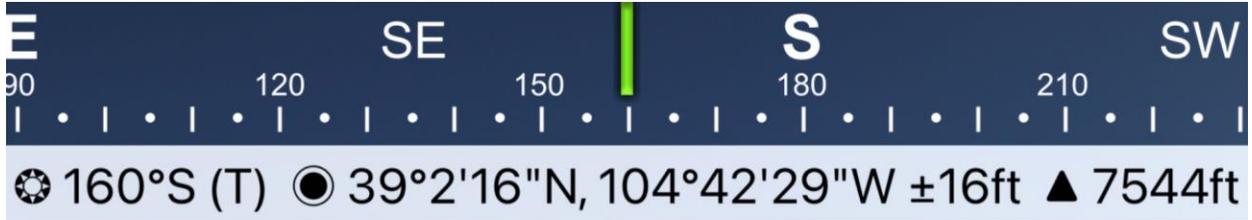
☀ 322°NW (T) ● 39°2'11"N, 104°42'32"W ±16ft ▲ 7508ft



Overview
Kyle Reamer-Staff
Geologist-RMG

185099 - 6385 Vessey Road
10 Nov 2021, 2:13:24 PM





Overview
Kyle Reamer-Staff
Geologist-RMG

185099 - 6385 Vessey Road
10 Nov 2021, 2:19:34 PM