Architectural
Structural
Geotechnical

RMG
Engineers / Architects

Materials Testing
Forensic
Civil/Planning

SOILS AND GEOLOGY STUDY

18885 Brown Road
Lots 1-3, Owl Ridge Subdivision
El Paso County, Color

Test pits described on Pg 6 need additional information per Engineering Criteria Manual Appendix C for Geologic Report guidelines Section C.2.2.6

See CGS review comments to be addressed on seasonal wet areas on Fig 4 and expected seasonal groundwater fluctuations etc. The drainage report depicts a proposed building site potentially directly in the area shown as season wet area.

PREPARED FOR:

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JOB NO. 185466

November 15, 2021
Revised: February 21,

Respectfully Submitted,
RMG – Rocky Mountain Group

Kelli Zigler

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Reviewed by,
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1.0 GENERAL SITE AND PROJECT DESCRIPTION

1.1 Project Location

The project lies in part of the north ½ of lot 2 of the SW ¼ of Section 7, Township 11 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado, and is generally located northwest of the intersection of Walker Road and Brown 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 61.55 acres. The parcel included is:

- Schedule No. 5100000447, current land use is classified as meadow hay land

The current zoning is *"RR-5" – Residential Rural.* The parcel is currently partially developed in the southern portion of the site where the existing residence is located.

1.3 Project Description

The site consists of approximately 61.55 acres and is partially developed. An existing two story agricultural residence is located on the southwest corner of the property. Two one-story barns are east of the residence. It is our understanding the existing 61.55 acres is to be subdivided into a total of three lots. Parcel A is to be subdivided into two lots of approximately 21.6 acres and 35 acres, respectively. Parcel B, is to retain the existing residence, well and septic, which is to encompass 5 acres. Each of the two new lots is to contain a single-family residence with well and septic. The Proposed Lot Layout is presented in Figure 2.

Each new lot will be served by an onsite wastewater treatment system (OWTS) and an individual water supply well. The site will be accessed from Brown Road.

2.0 QUALIFICATIONS OF PREPARERS

This Soil, Geology, and Wastewater 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 development concept plans 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 northwest of the intersection of Walker Road and Brown Road in El Paso County, Colorado and comprises approximately 61.55 acres. The site is zoned RR-5, rural residential. Adjacent properties to the north, west and east are zoned RR-5, rural residential.

4.2 Topography

Based on our site reconnaissance on September 8, 2021 and USGS 2019 topographic map of the Black Forest Quadrangle, the site generally slopes down from west to east with an elevation difference of approximately 70 feet across the site. There appears to be multiple irrigation ditch features that traverse the site from west to east, these can be seen in Figure 6, Engineering and Geology Map. The water levels in the irrigation ditch areas are anticipated to vary dependent upon local precipitation events.

4.3 Vegetation

Site vegetation primarily consists of native grasses and other prairie-type vegetation. Deciduous trees are scattered sparsely across the site.

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 partially developed land where the existing residence and barns are located since 1979. The parcel has remained vacant agricultural land north of the residence.

5.0 FIELD INVESTIGATION AND LABORATORY TESTING

It is our understanding the existing 61.55 acres is to be subdivided into a total of three lots. Parcel A is to be subdivided into two lots of approximately 21.6 acres and 35 acres, respectively. Parcel B (which is to encompass approximately 5 acres) is to retain the existing residence, well, and septic. Each of the two new lots is to contain a single-family residence with well and septic.

Test Pits and Trenches. The test pit and trench information shall: • Describe the location and dimensions of all pits and trenches and date of investigation; • Indicate the location of all excavations on the topographic/geologic map and profiles; • Provide a large scale descriptive log with sufficient detail; and, • Show sample location if supplemental laboratory tests were conducted.

5.1 Groundwater

Groundwater was not encountered in the test pits performed by RMG on September 22, 2021. No indications of redoximorhpic 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 12.5 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 southern portion of a large structural feature known as the Denver Basin. In general, the geology at the site consists of alluvium of Palmer Divide overlying the bedrock of the Upper part of the Dawson Formation. The alluvium generally consist of sandy to clayey loam, and sandy to silty clay. The upper part of the Dawson Formation is generally comprised of the arkosic sandstone, claystone, mudstone, and conglomerate and localized coal beds.

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 silty clay, sandy clay, sandy loam, and clay 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 the Upper Dawson Formation – facies unit five which consists of very thick-bedded to massive, cross-bedded, light-colored arkose, pebbly arkose, and arkosic pebble conglomerate. Facies unit five also contains common beds of white to light-tan, fine- to medium-grained feldspathic, cross-bedded friable sandstone. The Dawson formation is thick-bedded to massive, generally light colored arkose, and pebbly. 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:

- 15 – Brussett loam, 3 to 5 percent slopes. Properties of the loam include well 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.

- 67 – Peyton sandy loam, 5 to 9 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.

- 69 – Peyton-Pring complex, 8 to 15 percent slopes. Properties of the complex include well drained soils, depth of the water table is anticipated to be greater than 80 inches, runoff is anticipated to be medium, frequency of flooding and ponding is none, and landforms include hills.

The USDA Soils 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 alluvium deposits overlying sandstone bedrock. Four geologic units were mapped at the site as:

- *TKda5 – Dawson formation, facies unit five (early to middle(?) Eocene)* – The unit 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. The unit is estimated to be about 500 feet thick in the quadrangle; the top of the unit has been removed by erosion.

- *QTa – Alluvium of Palmer Divide (early? Pleistocene or Pliocene?)* – The deposits included in this oldest alluvial category include predominately sand deposits in the northwestern part of the quadrangle. The alluvium of Palmer Divide is up to 30 feet thick in the Black Forest quadrangle. The sandy deposits are composed generally of very pale-brown and pinkish-brown, fine to coarse sand interbedded with pinkish-gray to light brownish-gray pebble gravel. The sand is poorly sorted, medium to thin bedded, thinly laminated, and composed largely of quartz grains. The sandy pebble and cobble gravel is composed largely of subangular to subrounded fragments of white or light-gray quartz, light-pink to light-red and reddish-brown feldspar, a few fragments of pink to light-red to reddish-brown granite, and rare fragments of brownish-gray Wall Mountain Tuff.

- *psw* – Potentially Seasonally Wet Area.

- *af* – Artificial fill Area – Apparent artificial fill placed between 1955 and 1960 for the creation of multiple irrigation ditches throughout the site.

6.5 Engineering Geology

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

- *1A* – Stable alluvium, colluvium and bedrock on flat to gentle slopes (0-5%).
- *3B* – Expansive and potentially expansive soil and bedrock on flat to moderate slopes (0-12%)

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 from the west to east. 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 current study and is not anticipated to affect shallow foundations. Multiple irrigation ditch features (apparently man-made) traverse the site from west to east.

6.10 Flooding and Surface Drainage

Based on our review of the Federal Emergency Management Agency (FEMA) Community Panel No. 08041C0305G 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. 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 identified as Stream Terrace Deposits. The older stream deposits contain sand, gravel, silt and clay preserved on benches or broad flat to sloping areas adjacent to streams. Extraction of the sand, gravel, silt or clay more than likely would not be considered to be economical compared to materials available elsewhere within the county.

According to the *Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands*, the site is mapped within the southern part of the Denver Basin Coal Region. However, the area of the site has been mapped “Poor" for coal resources. The tract contains strata that may contain coal but no coal occurrences are within five miles. No metallic mineral resources have been mapped on the site. No oil and gas wells are drilled on this tract, or within two miles of it. The nearest historic coal mine sites

are located around nine miles southwest of the tract in the Colorado Springs coal field. 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.

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-Fans/Mudslides
- Floodplains
- Ground Subsidence
- Landslides
- Rockfall
- Ponding water
- Steeply Dipping Bedrock
- Unstable or Potentially Unstable Slopes
- Scour, Erosion, accelerated erosion along creek banks and drainage ways
- Corrosive Minerals

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

8.1 Expansive Soils

Based on the test pits performed by RMG for this investigation and our experience with similar materials in this area, the silty to sandy clay generally possess low to moderate swell potential. The Dawson formation is known to have moderate to high swell potential in some locations. It is anticipated that expansive soil/bedrock may be encountered at depths anticipated to affect residential foundations. If these materials are encountered in the excavations for the proposed residences, they can readily be mitigated with typical construction practices common to this region of El Paso County, Colorado.

Mitigation

Foundation design and construction are typically adjusted for expansive soils. Mitigation of expansive soils may include overexcavation and replacement with non-expansive structural fill. Drilled piers are not anticipated. Floor slabs bearing directly on expansive soils are expected to experience movement. Overexcavation and replacement with compacted non-expansive soils can be successful in reducing slab movement.

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

8.2 Compressible Soils

Based on the test pits performed by RMG for this investigation and our experience with similar materials in this area, the silty to sandy clay generally possess low compressibility potential. If compressible materials are encountered in the excavations for the proposed residences, they can readily be mitigated with typical construction practices common to this region of El Paso County, Colorado.

It is unknown at this time whether the proposed single-family residences will have crawlspaces, basements or a combination of both. Foundation design and construction are typically adjusted for compressible soils.

Mitigation

Mitigation of compressible soils and bedrock are typically accomplished by overexcavation and replacement with structural fill, subexcavation and replacement with on-site moisture-conditioned soils, and/or the installation of deep foundation systems. If soft or loose soils are encountered, mitigation of compressible soils can be accomplished by overexcavation and replacement with structural fill, subexcavation and replacement with on-site moisture-conditioned soils, and/or the use of a geogrid reinforced fill.

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

8.3 Undocumented Fill

Multiple irrigation ditches appear to be traversing the property and it is assumed that man-placed artificial fill was used to create the ditches between 1955 and 1960. The locations of the irrigation ditches are presented in the Engineering and Geology Map, Figure 6.

Mitigation

If undocumented fill is located below the proposed residences, it will require removal and replacement with structural fill that has been selected, placed, and compacted in accordance with the recommendations presented in section **10.0 Structural Fill – General** of this report.

Lot-specific subsurface soil investigations performed prior to construction should consider fill depths at that time. If fill placed subsequent to this report is encountered in the lot-specific soil investigations, documentation of the fill placement and compaction should be evaluated to determine the suitability of that fill to support the proposed foundation. If no such documentation is available, that fill should also be removed and replaced.

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

8.4 Faults and Seismicity

Based on review of the Earthquake and Late Cenozoic Fault and Fold Map Server provided by CGS located at http://dnrwebmapgdev.state.co.us/CGSOnline/ and the recorded information dating back to

November of 1900, Colorado Springs has not experienced a recorded earthquake with a magnitude greater than 1.6 during that 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 0.185g for a short period (S_s) and 0.059g for a 1-second period (S_1). Based on the results of our experience with similar subsurface conditions, we recommend the site be classified as Site Class B, with average shear wave velocities ranging from 2,500 to 5,000 feet per second for the materials in the upper 100 feet.

8.5 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 80908/80831 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 8.0 of this report) found to be present at this site include faults/seismicity and radioactivity/radon. Geologic constraints (as described in section 8.0 of this report) found to be present at this site include compressible soils, expansive soils, and undocumented fill. It is our opinion that the existing geologic and engineering conditions can be satisfactorily mitigated through proper engineering, design, and construction practices.

10.0 STRUCTURAL FILL - GENERAL

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.

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 and pumphouses, commercial buildings, 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 sandy clay and silty clay will classify as Type A materials and the sandy loam and clay loam will classify as Type B materials as defined by OSHA in 29 CFR Part 1926. OSHA requires that temporary excavations made in Type A and B materials be laid back at ratios no steeper than 3/4:1 (horizontal to vertical) and 1:1 (horizontal to vertical), respectively, 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 **SMH Consultants** in accordance with generally accepted geotechnical engineering and engineering geology practices. The conclusions and recommendations in this report are

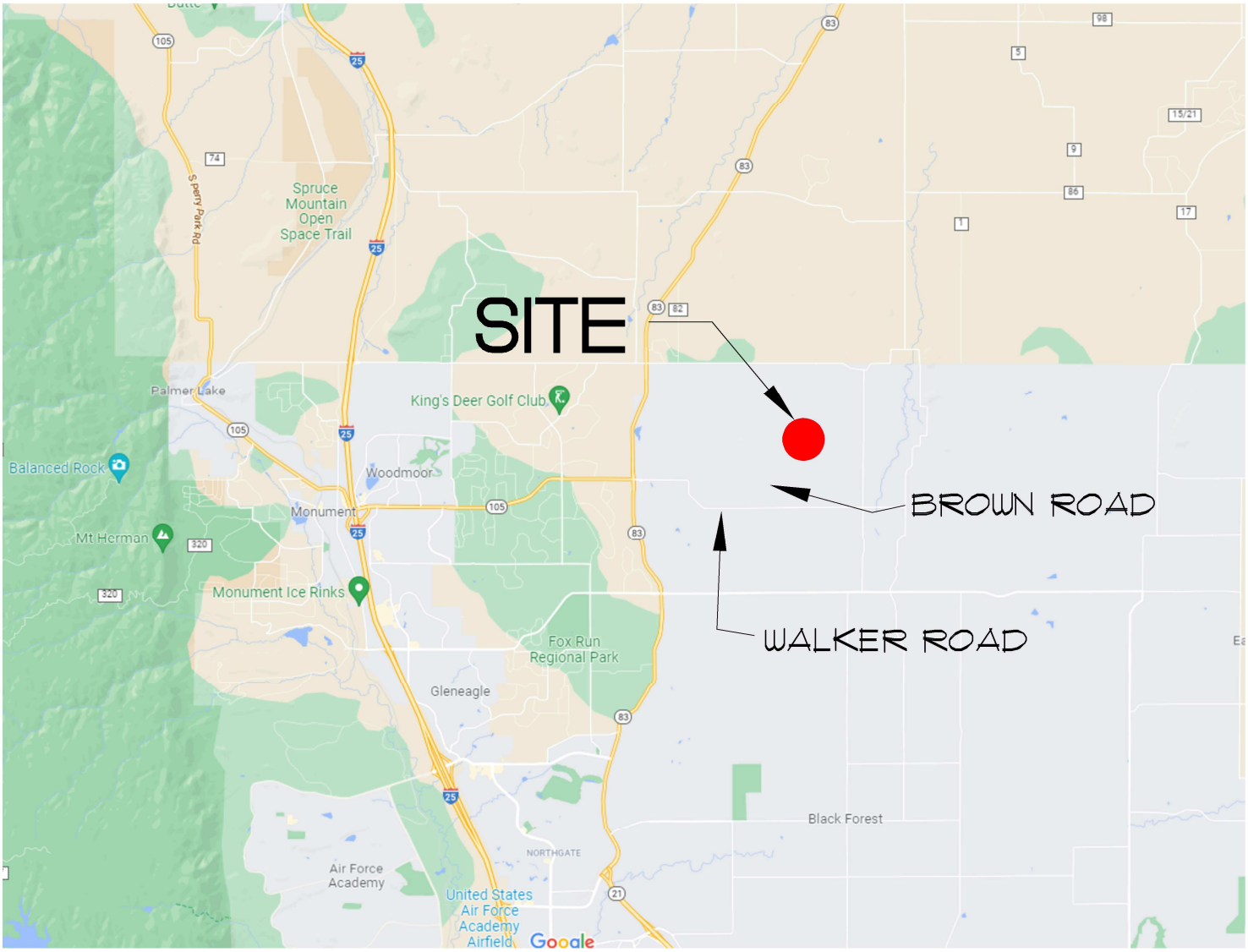
based in part upon data obtained from review of available topographic and geologic maps, review of available reports of previous studies conducted in the site vicinity, a site reconnaissance, and research of available published information, soil test borings, soil laboratory testing, and engineering 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.

APPENDIX A
Additional Reference Documents

1. *Land Survey Plat Map, 18885 Brown Road, Lots 1-3, Owl Ridge Subdivision, El Paso County, Colorado*, prepared by SMH Consultants, Job No. 2010CS4031, dated November 19, 2020.
2. *Flood Insurance Rate Map, El Paso County, Colorado and Unincorporated Areas, Community Panel No. 08041C0305G,* Federal Emergency Management Agency (FEMA), effective December 7, 2018.
3. *Geologic Map of the Black Forest Quadrangle, El Paso County, Colorado*, Madole, R.F., 2003, Colorado Geological Survey Open-File Report OF03-06.
4. *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.
5. *Black Forest Quadrangle, Map of Potential Geologic Hazards and Surficial Deposits*, compiled by Dale M. Cochran, Charles S. Robinson & Associates, Inc., Golden, Colorado, 1977.
6. *Pikes Peak Regional Building Department:* https://www.pprbd.org/.
7. El Paso County Assessor Website
   https://property.spatialest.com/co/elpaso/#/property/5100000447
   Schedule No. 5100000447
8. *Colorado Geological Survey, USGS Geologic Map Viewer*:
   http://coloradogeologicalsurvey.org/geologic-mapping/6347-2/.
9. *Historical Aerials:* https://www.historicaerials.com/viewer, Images dated 1947, 1952, 1955, 1960, 1969, 1983, 1999, 2005, 2009, 2011, 2013, 2015, and 2017.
10. *USGS Historical Topographic Map Explorer:* http://historicalmaps.arcgis.com/usgs/ Colorado Springs, Black Forest Quadrangle dated 1898, 1909, 1948, 1969, 1981 and 1989.
11. *Google Earth Pro*, Imagery dated 1999, 2004, 2005, 2006, 2011, 2013, 2015, 2017, 2019 and 2020.

FIGURES



NOT TO SCALE

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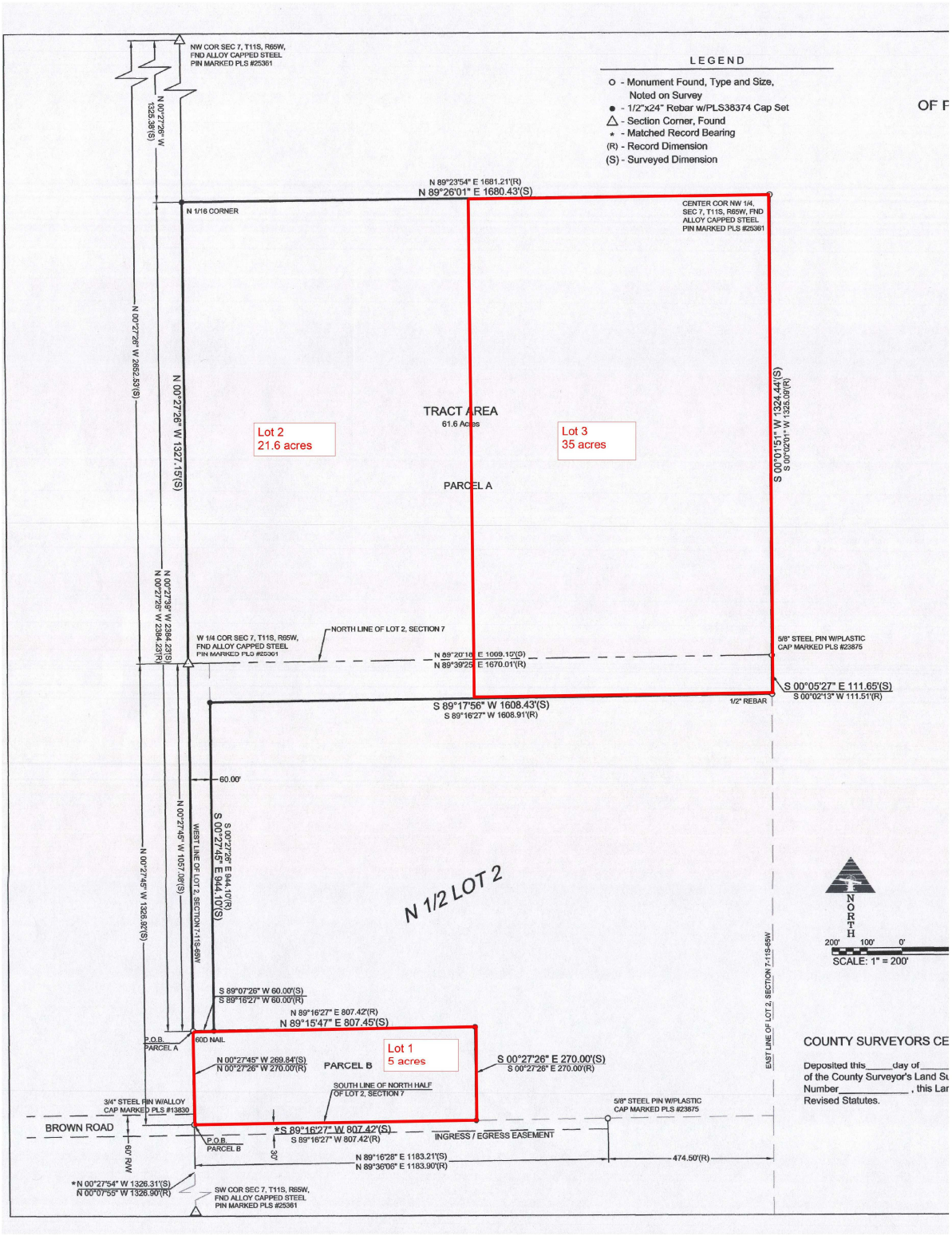
SITE VICINITY MAP

18885 BROWN ROAD
LOTS 1-3, OWL RIDGE SUBDIVISION
EL PASO COUNTY, COLORADO
SMH CONSULTANTS

JOB No. 185466

FIG No. 1

DATE 2-21-2022



NOT TO SCALE

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PROPOSED LOT LAYOUT

18885 BROWN ROAD
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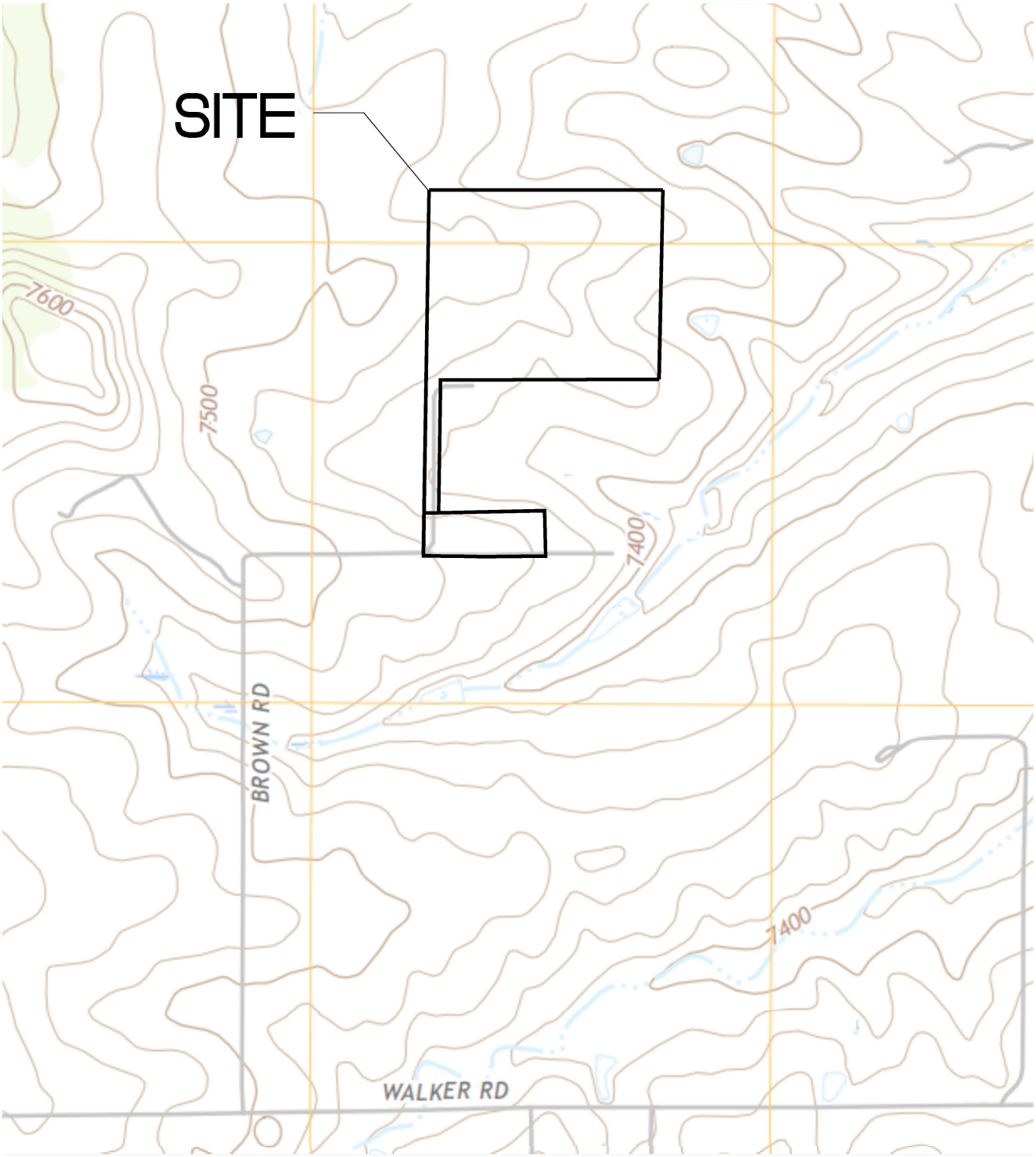
FIG No. 2

DATE 2-21-2022



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USGS TOPO MAP

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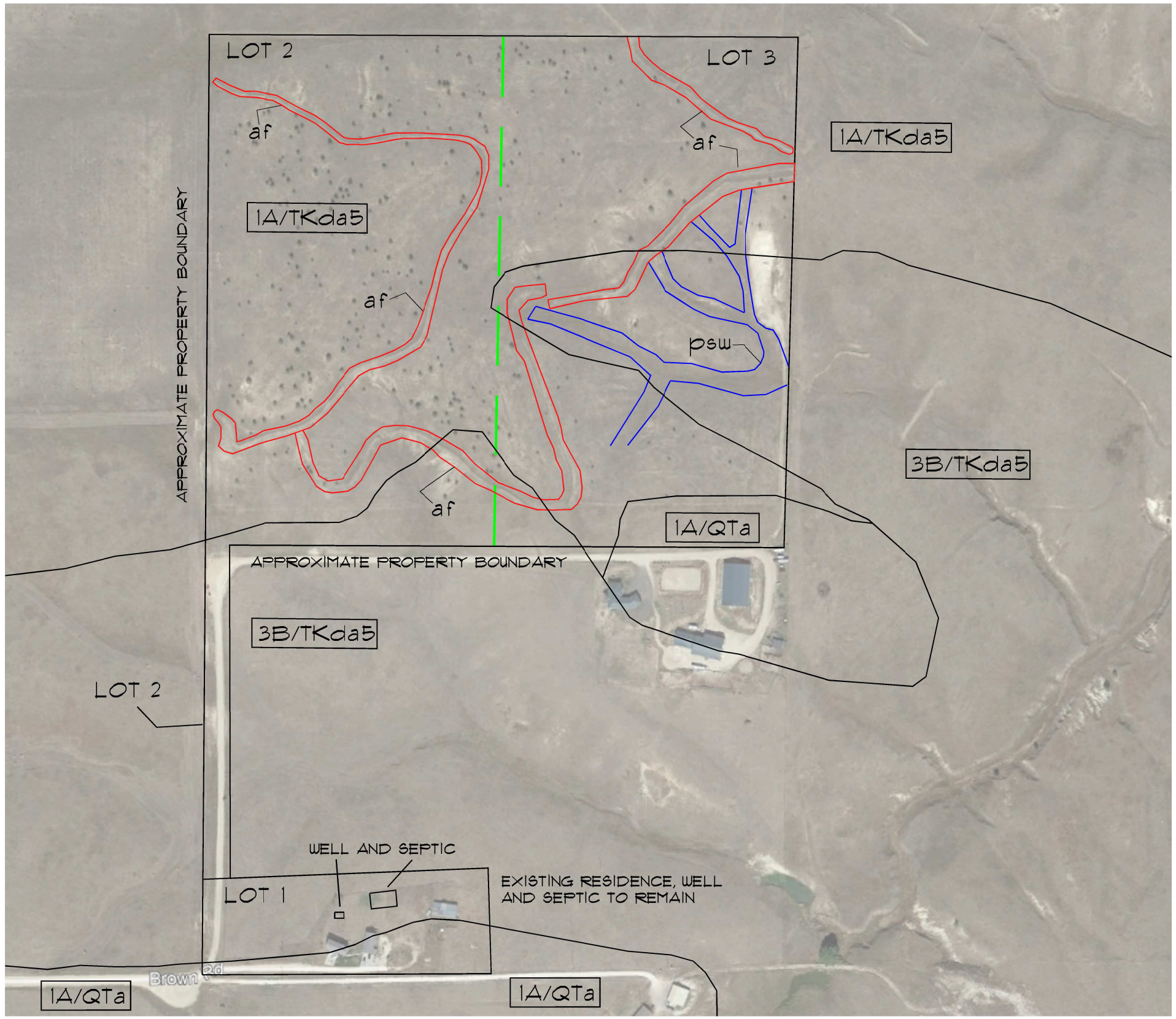
FIG No. 3

DATE 2-21-2022



NOT TO SCALE

Geologic

- TKda5 - Dawson Formation, facies unit three (early to middle Eocene) - Unit is estimated to be about 500 feet thick
- QTa - Alluvium of Palmer Divide (early Pleistocene or Pliocene) - Unit is up to 30 feet thick
- af - Artificial Fill Area - Artificial fill placed between 1955 and 1960 for the creation of irrigation ditchesthroughout the property
- psw - Potentially Seasonally Wet Area

Engineering

- 1A - stable alluvium, colluvium and bedrock on flat to gentle slopes (0-5%)
- 3B - expansive and potentially expansive soil and bedrock on flat to moderate slopes (0-12%)

DENOTES BOUNDARY BETWEEN LOTS 2 AND 3

DENOTES ARTIFICIAL FILL AREA

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

18885 BROWN ROAD
LOTS 1-3, OWL RIDGE SUBDIVISION
EL PASO COUNTY, COLORADO
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ENGINEER:	TPM
DRAWN BY:	KGR
CHECKED BY:	TPM
ISSUED:	2-21-2022

ENGINEERING AND GEOLOGY MAP

SHEET No.
FIG-4

PIN
Approximate location based on user input and does not represent an authoritative property location

MAP PANELS
Selected FloodMap Boundary
Digital Data Available
No Digital Data Available
Unmapped

OTHER AREAS
NO SCREEN Area of Minimal Flood Hazard Zone X
Effective LOMRs
Area of Undetermined Flood Hazard Zone D
Otherwise Protected Area
Coastal Barrier Resource System Area

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

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 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

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

NOT TO SCALE

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FEMA MAP

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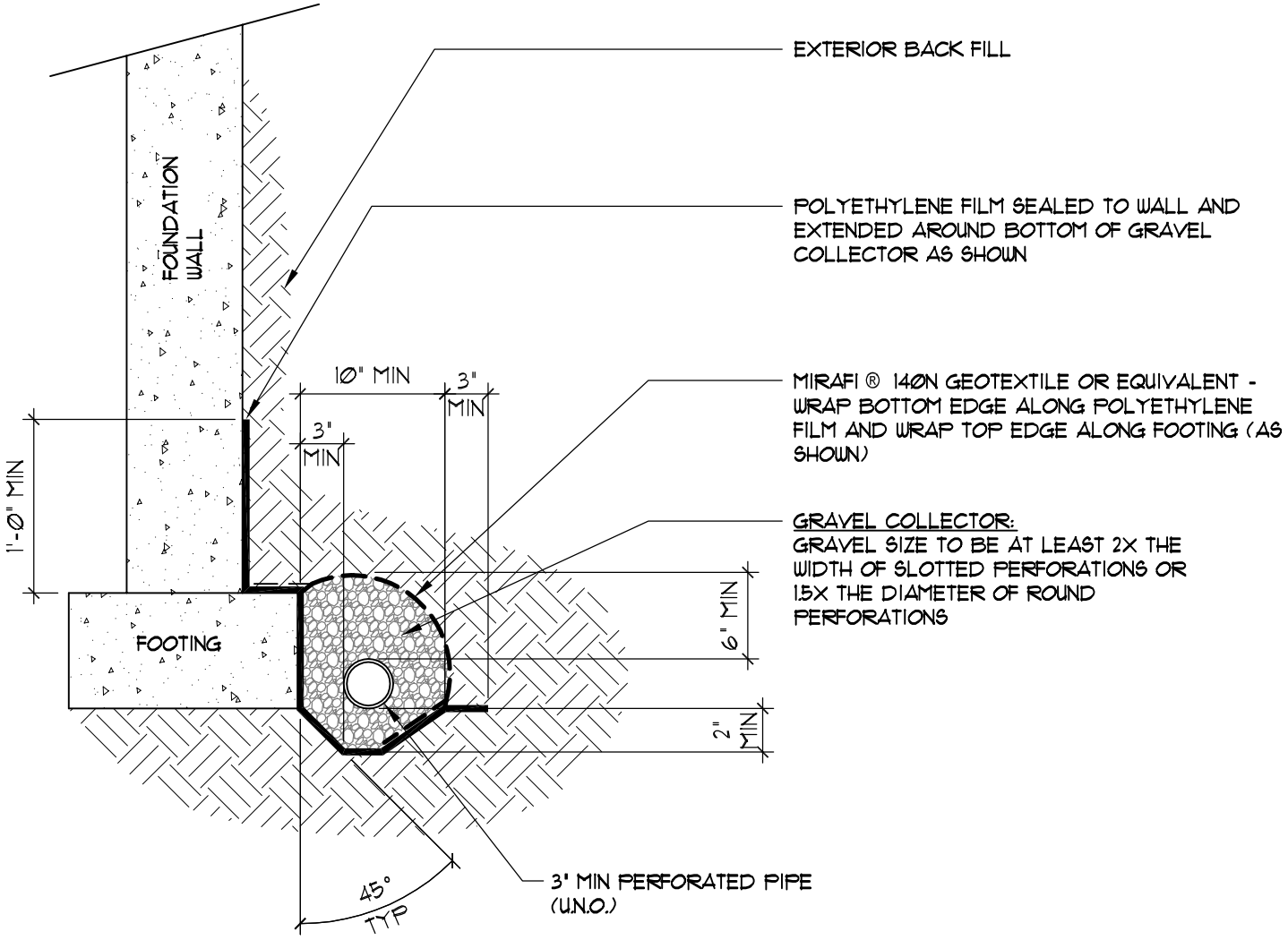
FIG No. 5

DATE 2-21-2022



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.
5. ALL DRAIN COMPONENTS SHALL BE RATED/APPROVED BY THE MANUFACTURER FOR THE INSTALLED DEPTH AND APPLICATION
6. DRAIN SYSTEM, INCLUDING THE OUTFALL OF THE DRAIN, SHALL BE OBSERVED BY QUALIFIED PERSONNEL PRIOR TO BACKFILLING TO VERIFY INSTALLATION.

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PERIMETER DRAIN

FIG No. 6