COLORADO SPRINGS
OLYMPIC CITY USA

6/1/2023

GEOLOGIC HAZARD STUDY APPLICATION

Applicant: Goodwin Knight, LLC

Telephone: 719-598-5190

Address: 8605 Explorer Drive, Ste 250

Email: dmorrison@goodwinknight.com

City/State/Zip: Colorado Springs, Colorado 80920

Site Location: The Ridge at Spring Creek, Filing No. 1 (6428400027)

The following documents have been included and considered as part of this study (checked off by individual(s) preparing the geologic study):

____ Rezoning

__X__ Development Plan

____ Land Use

____ Public Improvement construction drawings

____ Final Plat

ENGINEER'S STATEMENT

I hereby attest that I am qualified to prepare a Geologic Hazard Study in accordance with the provisions of the City of Colorado Springs Unified Development Code Section, 7.4.5 Geological Hazards. I am qualified as:

X________ Professional Geologist as defined by C.R.S. § 23-41-208: or,

_________ A professional Geotechnical Engineer licensed by the Colorado State Board of Licensure for Architects, Professional Engineers and Professional Land Surveyors.

Kelli Zigler

Submitted by: Kelli Zigler Date: October 14, 2024

This Geologic Hazard Study Is filed in accordance with the City of Colorado Springs Unified Development Code Section 7.4.5 Geological Hazards.

City Engineering: ______________________________ **Date:** ______________

Structural
Geotechnical

Materials Testing
Forensic

GEOLOGIC HAZARD STUDY

The Ridge at Spring Creek, Filing No. 1
Colorado Springs, Colorado

PREPARED FOR:

Goodwin Knight LLC
8605 Explorer Drive Ste 250
Colorado Springs, CO 80920

JOB NO. 197354

October 14, 2024

Respectfully Submitted,
RMG – Rocky Mountain Group

Kelli Zigler

Kelli Zigler
Project Geologist

Reviewed by,
RMG – Rocky Mountain Group

COLORADO REGISTERED
ANTHONY P. MUNGER
10/14/24
39818
PROFESSIONAL ENGINEER

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

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1.0 INTRODUCTION

RMG – Rocky Mountain Group was retained to perform a Geologic Hazard Study of the site referenced above. The purpose of this study is to identify/characterize geologic conditions present on the site, and present our opinions of the potential effect of these conditions on the currently proposed development of the site.

1.1 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. Our services exclude the evaluation of the environmental and/or human, health-related work products or recommendations previously prepared, by others, for this project.

The objectives of our study are to:

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

This report presents the findings of the study performed by RMG relating to the geologic conditions of the above-referenced site. Revisions and modifications to this report may be issued subsequently by RMG, based upon:

- Additional observations made during grading and construction which may indicate conditions that require re-evaluation of some of the criteria presented in this report,
- Review of pertinent documents (development plans, plat maps, drainage reports/plans, etc.) not available at the time of this study,
- Comments received from the governing jurisdiction and/or their consultants subsequent to submission of this document.

1.2 Previous Studies and Field Investigations

Reports of previous geotechnical engineering/geologic investigations specifically addressed to this site or the surrounding development were reviewed and are referenced below:

- *Geologic Hazard Study (unapproved), The Ridge at Spring Creek, Filing No. El Paso County, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 182625, dated April 20, 2022.
- *Preliminary Subsurface Soils Investigation, Lots 1-90, The Ridge at Spring Creek, Filing No. 1, Colorado Springs, Colorado*, prepared by RMG – Rocky Mountain Group, Job No. 182625, last dated April 9, 2021.

- *Geologic Hazards Evaluation and Preliminary Geotechnical Investigation (unapproved), The Ridge at Spring Creek, Union Boulevard and Circle Drive, Colorado Springs, Colorado*, prepared by CTL Thompson Inc., Job No. CS15537-115, last dated October 12, 2005.

Colorado Springs Engineering Development Review and the CGS – Colorado Geological Survey reviewed our previous Geologic Hazard Study (2021), the comments were not addressed at that time and this new study takes into consideration the previous review comments from both agencies.

1.3 Additional Documents

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

2.0 QUALIFICATIONS OF PREPARERS

This Geologic Hazard 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 with over 23 years of experience in the geological and geotechnical engineering field. Ms. Zigler holds a Bachelor of Science in Geology from the University of Tulsa. Ms. Zigler has supervised and performed numerous geological and geotechnical field investigations in Colorado. Tony Munger is a licensed professional engineer with over 23 years of experience in the construction engineering (residential) field. Mr. Munger and holds a Bachelor of Science in Architectural Engineering from the University of Wyoming.

3.0 GENERAL SITE AND PROJECT DESCRIPTION

3.1 Site Location

The project lies in the NW¼ of the SE¼ of Section 28, Township 14 South, Range 66 West of the 6th Principal Meridian, El Paso County, Colorado. The proposed residential site is generally located near the northeast corner of the southbound off-ramp from South Circle Drive to South Union Boulevard. The location of the site is shown on the Site Vicinity Map, Figure 1.

3.2 Existing Land Use and Zoning

As recorded on the El Paso County Assessor's website, the parcel included in this study is as follows:

- **Schedule No. 6428400027**: currently labeled as South Union Boulevard, consists of approximately 16.75 acres of undeveloped land, and is zoned "PUD - *Planned Unit Development"*. A proposed site development plan is presented in Figure 2.

Currently the site is undeveloped. However, two homeless encampments have established themselves on the site. The inhabitants have created a "fort" surrounded with piles of trash. The property is also being used as a dump site for household and construction debris. A very large soil stockpile is located near the southwestern corner of the trash pile. Multiple smaller "end dump" piles of soil and trash are located east of the large stockpile. In addition to removal of the homeless camps and the "fort", it is our understanding the smaller soil "end dump" piles are to be removed from the site and properly disposed of. The larger stockpile may be used as fill soil on the site.

Water and sewer lines have been installed below a rough graded road near the toe of the slope. The rough graded road is to remain and may be transitioned into a hiking trail and/or access path for the proposed amenities. The site plan presented within this study shows two areas for the proposed amenities. The amenities locations are not finalized, and have only been included to consider their feasibility. The site contains scattered deciduous trees and tall prairie grasses throughout.

Additionally, the site is located within the mapped landslide susceptible area. A steep slope traverses the northern portion of the site. This slope is highly susceptible to lateral earth movement (landslide) and a slope stability analysis was completed to evaluate the slope with respect to the sensitivity of the soil strength parameters, accounting for variations in surface moisture, runoff, and groundwater conditions. The site is not located within the mapped steeply dipping bedrock zone.

3.3 Proposed Construction

It is our understanding that the site is to be developed with internal streets and up to 194 units. The units are to consist of cottage units with either a studio, one, or two bedrooms. The structures are anticipated to be two-stories in height with a combination of off-street parking and limited garages. The homes are to be constructed without basements. Amenities being considered include a pickle ball court, dog park, and a community center with a park. Access to the development is to be from S. Circle Drive from the east and the south. The site is to be serviced by Colorado Springs Utilities.

Preliminary grading plans prepared by Catamount Engineering include three retaining walls on the northern slope north of the pickle ball court, two retaining walls north of the dog park, and 1 to 3 tiers of retaining walls along the northeastern portion of the site, north of the proposed roadway. The retaining walls surrounding the pickle ball court may be 3-tiered walls, with each tier to be approximately 6 to 8 feet in height and spaced appropriately horizontally. The retaining walls surrounding the dog park are to vary in height from 4 to 8 feet and extend the entire length of the park. Additionally, the proposed one to three retaining walls, north of the structures (near the northeast corner of the property) are to range in height from 0.5 to 11.5 feet. Generally, the majority of residences on the southern portion of the site are to share a 3 to 4-foot landscaping wall between the back-side of the structures. The retaining walls are to be separated from the residences. This report does not include recommendations for foundation designs or retaining walls.

3.4 Aerial Photographs and Remote-Sensing Imagery

Personnel of RMG reviewed aerial photos available through Google Earth Pro dating back to 1999, and historical photos by historicaerials.com dating back to 1947. Structures in the surrounding area were constructed after 1983 but prior to 1999. Although the site has remained an undeveloped parcel, it appears the ground surface in some portions of the site has been modified from its native condition. Modifications include the addition of soil stockpiles and creation of several dirt paths. The soil stockpiles started to accumulate in this area prior to 2018, and the stockpile heights range from 5 to 40 feet. Landscaping debris to include mulch, rocks, bricks, along with household debris to include plastic containers, furniture, and biodegradable trash were observed near the southwestern and southern portion of the property, both atop the fill stockpiles and on the original ground surface. As these piles accumulated over several years, it's also possible that similar trash and/or debris has been buried within the soil stockpiles.

4.0 SITE GEOLOGY AND DESCRIPTIONS

4.1 General Physiographic and Geologic Setting

Based upon review of the *Geologic Map of the Colorado Springs quadrangle* and our site reconnaissance (September 6, 2024), the mesa north of the site is capped with pediment gravel comprised of silty sand and clay with sporadic gravels and cobbles. The lower portion of the mesa consists of the Pierre Shale formation. The Pierre Shale formation is prone to instability when inundated with water and/or when excavation cuts are made on the slope or near the base (toe) of the slope. Based on the test borings performed previously by CTL (2005) and RMG (2021) alluvial deposits are estimated to be less than 6 feet across the slope face. The underlying claystone/shale bedrock are present at the surface across the lower portion of the site. The site lies east of what is known as the Ute Pass Fault, which lies approximately 4.75 miles west of the site and is a major structural feature within the Rampart Range Fault which marks the boundary between the Great Plains and the southern Rocky Mountain provinces. The site is not mapped within the steeply dipping bedrock zone. However, as indicated on the Colorado Springs quadrangle, does dip down to the east at approximately 8 to 12 degrees, north of the site along the same ridgeline.

4.2 Geologic Mapping

The geologic units and engineering units mapped on the site are discussed in detail below. The Engineering and Geology Map is presented in Figure 10.

GEOLOGIC UNITS

- *Qg2 – Pediment gravel two (middle Pleistocene)* – The pediment gravel is texturally and lithologically similar to pediment deposit one (Qg1) but is clast-supported with cobbles and boulders in a sandy matrix at the base. Although not encountered in our borings, the pediment gravel was visible on the surface of the northern slope.
- *Kp – Pierre Shale (Upper Cretaceous)* – Gray shale. Includes numerous bentonite beds that are typically 1-3 in. thick and occasionally up to 8 in. thick. The shale typically weathers to brown and olive-green clay, with curvilinear fractures filled with sulfate salts. Formation is mostly covered by Quaternary deposits and is particularly susceptible to slope instability in steep

areas, such as the slope on-site. The claystone and shale bedrock were encountered below the artificial fill and native clay residuum at depths ranging from the ground surface to depths of 35 feet.

- *da* – Disturbed Areas – areas that are no longer in their native state such as the two tracks that transverse the property.
- *Af – Artificial fill* – Based on review of the previous reports and aerial photos dating back to 1937, the large stockpile near the southwestern portion of the site began accumulating soil around 1984. Since 1984, the site has been used as a "stockpile yard". Stockpiles began to grown and surficial dumping of soil, trash, and debris has continued until the present.
- *ss* – s*teep slopes* – The northern part of the site has slopes up to 2:1 (horizontal:vertical). The slopes "flatten" to the south and west with an approximate slope percentage over 30%.

ENGINEERING UNITS

The descriptions below are from Robinson & Associates, 1977 and give an indication of the slope percentages across the site.

- *1A* – Stable alluvium, colluvium and bedrock on flat to gentle slopes (0-5%).
- *4A* – Potentially unstable colluvium and bedrock on moderate to steep slopes (12%-24%)
- *3B* – Expansive and potentially expansive soil and bedrock on flat to moderate slopes (0-12%)

4.3 Surficial Deposits

The test borings performed for this study and the previous studies by CTL (2005) and RMG (2021), referenced above indicate the soils can be grouped into the general categories of silty to clayey sand, sandy clay, sandy claystone/shale, and sandstone. In general, the surficial soils vary in depth across the site. Deeper deposits of sandy clay were encountered near the western end of the site. Claystone bedrock was encountered near or at the ground surface in borings performed through the middle of the site. Silty sand overlays deeper claystone in the borings performed near the southern portion of the site.

4.4 Bedrock Units

The bedrock beneath the site is considered to be part of the Pierre Shale Formation (Upper Cretaceous). Based on the quadrangle mapping, the thickness of the Pierre Shale is about 4,500 ft. The Pierre Shale is generally easily excavated, but foundation stability is poor. The formation has a high potential for shrink-swell and heaving bedrock problems due to the presence of smectitic claystone and bentonite beds. The formation is also prone to slope instability, as landslides have occurred on slopes as shallow as 5 degrees. Fill material derived from Pierre Shale is not acceptable for use as structural foundation material without special soil treatments.

4.5 Landforms

The ground surface varies across the site. The northern area consists of slopes with ratios up to 2:1 that flatten to the south and west with large rocks and a variety of native shrubs, grasses, and weeds. The lower and more southern portion of the slope consists of uneven topography. The western portion of the site consists of an approximately 40-foot high stockpile of off-site material that slopes down to the east towards individual smaller piles. Dirt access roads extend throughout the property. The overall topography generally slopes moderately to steeply to the south. The landforms within and surrounding the site can generally be described as gently sloping terrain with the upper portion of the slopes consisting of colluvial deposits. The site lies within an area that has mapped ancient landslides and/or slope failures. The majority of the surficial material at the site is relatively stiff to hard, normally consolidated soil consisting of materials that have been transported downslope by a variable combination of processes that include landslide, rainwash, sheetwash, and relatively slow downslope creep.

4.6 Structural Features

Structural features such as joints, faults, shear zones, folds, schistocity, and foliation were not observed on the site or in the soil samples collected by RMG for laboratory testing of previous investigations. However, review of the *Geologic Map of the Colorado Springs quadrangle* and *Map of Areas Susceptible to Differential Heave in Expansive, Steeply Dipping Bedrock, City of Colorado Springs, Colorado* indicates there are several geologic faults near the site. These faults are associated with the Ute Pass and Rampart Range Fault complexes. The Ute Pass Fault lies approximately 4.75 miles west of the site and the Rampart Range Fault lies approximately 5.75 miles northwest of the site. No faults are mapped on the site itself. According to the CGS, these faults are not considered to be recently active, though the last known activities of the fault complexes are unknown. However, they have been active during geologic times, and the site (and surrounding areas) could be affected if one or more of these faults did rupture.

4.7 General Hydrogeology/Groundwater

Groundwater was reportedly encountered in 6 of the 9 borings at depths of 12 to 36.5 feet below the existing ground surface by CTL (2005), referenced above. Groundwater was shallowest in the southern part of the site. Groundwater was not encountered in any of the test borings performed by RMG (2021), referenced above.

Additionally, three new test borings were performed by RMG for this ostudy on September 13, 2024. The borings extended to 20 to 35 feet in depth, and groundwater was not encountered at the time of drilling or when checked n October 7, 2024, 24 days subsequent to drilling. We do understand the borings offer only a snapshot of the subsurface water. We believe the underground water beneath the site is a combination of surface runoff and/or localized areas of "perched" water within the layers of soil that are more permeable, such as the sandy soil atop the underlying sandstone/claystone bedrock. Water may also be trapped within the fractured claystone and sandstone.

Seasonal fluctuations in groundwater and subsurface moisture conditions will likely occur. A rise in groundwater (4 to 6 feet) should also be expected when construction is complete due to landscape irrigation. The presence of shallow bedrock and clay across the site may also result in the formation of perched groundwater after development. Development of the property and adjacent properties may also affect groundwater levels.

4.8 Floodplain

Based on a review of the Colorado Springs quadrangle 7.5-minute series topographic map dated 2019 and our site reconnaissance, the presence of springs or potential springs were not observed at or adjacent to the site. According to the Federal Emergency Management Agency (FEMA) Community Panel No. 08041C0741G, effective December 7, 2018 and the online ArcGIS El Paso County Risk Map, the site does not lie within a 100 or 500-year floodplain.

4.9 Surface Drainage and Irrigation

Due to the steep slope along the northern portion of the site, surface water sheet washing down the slope from the development above is expected. An erosional feature, anticipated to contain surface water during heavy precipitation storms, is located on the western portion of the south-facing slope. This erosional feature originates upslope, and over time water from upslope has “cut-in” a path down along the surface of the slope. Currently, this drainage path extends to the proposed new roadway. If heavy precipitation events occur during development, this erosional feature is anticipated to affect construction of the proposed roadway and structures, if not properly mitigated prior to development. Care should be taken (both during construction and in the final grading of the site) in redirecting this drainage path (and any resulting debris) around the roadway and structures. The new drainage flow path should maintain a minimum 10-foot separation from all structures. Care should also be taken to discharge the diverted drainage water and debris to a location which will not significantly alter the overall drainage of the development or result in the need for additional drainage mitigation measures at the time of construction on nearby lots. The final drainage study is to address the drainage onsite.

All proposed retaining walls will need to take into consideration the possibility of additional surface water migrating down the slope. Proper drainage around all retaining walls is imperative to the long-term performance of the walls. In discussion with HR Green and Catamount, it is our understanding a concrete channel may be utilized on the high side of some or all of the proposed retaining walls. The concrete channel would direct the water away from the walls and down to the street. The final drainage study is to address the potential for surface water across the steep northern slope.

4.10 Geophysical Investigations

Neither geophysical investigations nor monitoring programs were considered necessary for this investigation. However, CGS previously reviewed our 2021 study and recommended a groundwater monitoring program due to the groundwater levels encountered in the 2005 CTL report, referenced above. CTL noted groundwater in 6 of their 9 borings, 5 borings (TH-1 through TH-5) are located on the lower southern portion of the site and 4 of their borings (TH-6, and TH-101 through TH-103), were located on the lower portion (mid-slope) of the northern slope. Based on CTL’s *Depth to Groundwater* figure, within their 2005 report, the figure indicated groundwater levels were encountered at depths of 12 feet to over 40 feet below existing grade. RMG performed three additional borings (September 2024) on the southern portion of the site to supplement the groundwater depths from our previous borings (March 2021). Our findings between the groundwater depths in the last three years are similar. It should be noted that the spring of 2000 received four times the amount of rainfall that occurred in the spring of 2024. The referenced CTL report is last dated 2005, but the majority of the borings performed within the study were drilled in October 2000. Limited supplemental borings were drilled for the amended 2005 report. Based on historic precipitation data, Aug 28, 2000 made the top 10 record for a one-day precipitation event.

5.0 SUBSURFACE SOIL INVESTIGATIONS

5.1 Field and Laboratory Testing

The subsurface conditions below the subject site were previously investigated by RMG, drilling 12 exploratory test borings on March 8, 2021. Three additional test borings were performed by RMG for this new study on September 13, 2024. Additional investigations were also previously performed by CTL (referenced above), reportedly drilling a total of 6 borings in October of 2000 and 3 additional borings on August 18 and 25, 2005.

The RMG test borings were advanced with a power-driven, continuous-flight auger to depths of approximately 20 to 40 feet below the existing ground surface. Samples were obtained in general accordance with ASTM D-1586 utilizing a 2-inch OD split-barrel sampler or in general accordance with ASTM D-3550 utilizing a 2½-inch OD modified California sampler. The Explanation of Test Boring Logs and Test Boring Logs are presented in Figures 3 through 5.

The recovered samples obtained by RMG were tested in the laboratory. Moisture content, Grain-size analysis, Atterberg Limits tests, and Swell/Consolidation tests were performed on selected samples for purposes of classification and to develop pertinent engineering properties. The Summary of Laboratory Test Results, Soil Classification Data, and Swell/Consolidation Test Results are presented in Figures 6 through 8.

The results of the previous RMG Test Borings and laboratory data are presented and included as Appendix B.

6.0 POTENTIAL GEOLOGIC HAZARDS AND THEIR BEARING ON INTENDED LAND USE

This section involves the effects of the geologic features upon the proposed grading, construction, and land use, as well as the future effects (if any) of the proposed modifications upon the geological processes in the area. Some geologic conditions that will impact construction have been identified, such as a steep slope, expansive bedrock, and seasonally fluctuating groundwater. We believe these conditions will not preclude the development, as currently proposed. The conditions identified herein can be mitigated with typical construction practices common to the Colorado Springs and Fountain area.

A review of local geologic hazards mapping indicates that the following geologic hazards are not present at the site:

- Avalanches

- Debris Flows-Fans/Mudslides
- Compressible Soils
- Ground Subsidence and Abandoned Mining Activity
- Rockfall
- Springs or Seeps
- Ponding water
- Flood Prone Areas
- Steeply Dipping Bedrock
- Scour, Erosion, Accelerated Erosion Along Creek Banks and Drainageways
- Soil Slumps or Undercutting
- Corrosive Minerals

Potential geologic conditions for the site are identified and discussed below.

6.1 Mapped Landslide Susceptibility

The site is located within the Colorado Springs Landslide Susceptibility zone as mapped by CGS. The landslide map can be found here: https://cologeosurvey.maps.arcgis.com/apps/webappviewer/index.html?id=5e7484a637c4432e84f4f16d0af306d3. The map is intended to show areas that have the potential for landslide susceptibility. This designation does not imply that landslides will occur during the life of the structures, only that the risk is higher compared to areas not mapped within the Landslide Susceptibility zone.

Additionally, as noted on the website, *"No levels of risk assessment such as high, medium, or low were made within the susceptible zone. This map should not be used by itself to determine site specific hazard or risk assessments. These data were constructed qualitatively. Quantitative approaches, such as deterministic analyses and statistical and probabilistic risk modeling, were beyond the scope of this project.* ***For locations that lie within the susceptible area, this designation does not imply that landslides will occur during the life of a residential structure, only that a higher risk exists compared to areas not mapped as susceptible.*** *It should be noted that extreme natural or human activity (e.g., earthquakes or poorly designed excavations) may trigger slope instability and landslides in areas that are not included in the susceptible area".*

Mitigation

Based on the mapping, the landslide susceptible zone extends below the existing maintenance road, along the northern steep slope on-site. This area is denoted on the Engineering and Geology Map, Figure 10.

It is our opinion that no mitigation measures exist which can feasibly (and cost-effectively) be implemented on a lot-specific basis that would address the large-scale global stability of the surrounding area, other than avoidance. **It should be reiterated that *lots that lie within (below) the mapped landslide areas are associated with moderate to high risk and the potential damage caused by these natural phenomena.*** The risk of reactivation of this landslide complex (either partially or as a whole) or destabilization of localized slopes above the homes is a permanent risk, and one that may be adversely affected by factors outside the control of the current owner or future residents of the subject site.

This report represents a review of the geologic hazards specific only to the referenced site. Excluded from this report is a review or analysis of the "global" stability of the surrounding areas or an evaluation of the stability of landslides that have previously occurred (or may occur in the future) in the vicinity of this site.

We completed a slope stability analysis in conjunction with this study. The results of our analysis are presented below in Section **8.0 Slope Analysis**. The analysis took into consideration the sensitivity of the selected strength parameters and the influence of groundwater and surface water. The overall viability of the project relied on the analysis for guidance in the location of the amenities, roadway, and foundation selection.

6.2 Expansive Soils and Bedrock

The soils encountered in the test borings performed for the reports referenced above consisted of expansive clay soil and claystone/shale bedrock. Some of the claystone samples obtained contained thin layers of interbedded sandstone. The clay and claystone exhibited low swell potential in laboratory testing performed by RMG. The sandy clay and claystone exhibited low to high swell potential upon wetting in laboratory testing performed by CTL. Overall, the area is known to have moderate to highly expansive soils and bedrock and some form of mitigation will be required. Subexcavation, deep-excavation, overexcavation and replacement with moisture-conditioned structural fill or imported non-expansive granular fill is a commonly utilized method of mitigating expansive soils. If movement of slabs cannot be tolerated, drilled concrete piers are also an option.

<u>Mitigation</u>

Expansive clay and claystone are present at depths likely to influence the majority of the foundation designs. If subexcavation and replacement during land development operations is considered for mitigation of expansive soils and bedrock, our recommendations are presented in Section **7.0 Subexcavation and Replacement** of this report. We anticipate the depth of subexcavation required will be on the order of **8 feet** where shallow **claystone bedrock** is encountered. Where claystone bedrock is not encountered within 8 feet of the bottom of the proposed foundations, we anticipate an overexcavation depth of **4 feet** will be required.

Note, the subexcavation and replacement process does not guarantee that the swell potential will be reduced to acceptable levels. It is possible that the expansive material will retain swell potential in excess of the allowable value presented herein, even after processing and moisture-conditioning. If (at the time of lot-specific subsurface soil investigation and/or the open excavation observation) the soil is found to possess swell potential in excess of acceptable levels for the foundation system and design parameters proposed for construction at that time, overexcavation and replacement of some or all of the previously placed fill material may be required. Further site-specific investigations will be necessary to develop specific foundation recommendations and design criteria once the site grading is complete.

A site-specific subsurface soil investigation will be required once the overlot grading and installation of utilities is complete. The site-specific report will include foundation recommendations pertinent to the foundation design. Provided that appropriate mitigations and/or foundation design adjustments are implemented, the presence of expansive soils or bedrock is not considered to pose a risk to the proposed structures.

6.3 Shallow Groundwater

As previously mentioned, the presence of groundwater was observed in 6 of the 9 test borings at depths of 12 to 36.5 feet below the existing ground surface in CTL's (2005) referenced report. Of the 6 borings, 3 borings had water within 12 to 16 feet of the existing surface. Groundwater was not observed at the site at the time of drilling by RMG in March 2021 or in September 2024.

Based on the currently proposed construction (either stiffened slabs-on-grade or crawlspaces), shallow groundwater is not expected to adversely impact the proposed structures. Groundwater beneath the subject site predominates in the fractured weathered consolidated sedimentary bedrock located at depth. Perimeter drains should be anticipated around crawlspace foundations. Furthermore, we generally recommend a minimum of 4 to 6 feet of separation between the bottom for foundation and the groundwater surface to avoid the use of extensive subdrain systems. Perched water may develop in areas of the site after development is complete. Surface water is prone to penetrate relatively permeable loose backfill soils located adjacent to the structures and collect on the less permeable soils and/or bedrock located beneath the bottom of foundation excavations.

<u>Mitigation</u>

Perimeter drains are recommended for structures with habitable or storage spaces (including garages, stiffened slabs, and crawlspaces) below grade to prevent the infiltration of water and to help control wetting of potentially expansive and compressible soils in the immediate vicinity of foundation elements. Additionally, if groundwater was encountered within 4 to 6 feet of the proposed foundation slab elevation, an underslab drain should be anticipated, in conjunction with the perimeter drain. It must be understood that the 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 crawlspace area. Typical drain details are presented in Figures 11 and 12.

Groundwater at or near the top of the bedrock after development of the site may be due to the difference in the permeability between the bedrock and the overlying soils. It is our understanding, the proposed structures are to be stiffened slabs or crawlspaces, with excavation depths of 1 to 2 feet, once final grading is complete.

However, construction consideration will need to be taken if the amenities are to be placed on the steep northern slope. Cutting into the northern slope for the retaining walls may release trapped subsurface water. The builder/contractor should be prepared to stabilize the temporary excavations along the slope. Shotcrete or similar top down construction (soil nails) may be needed in these areas to prevent surficial slumping of the excavations. OSHA standards will be need to be followed.

6.4 Unstable or Potentially Unstable Slopes

The majority of the site lies within the Colorado Springs Landslide Susceptibility Zone, as mapped in the electronic (online) version, prepared by the CGS. Evidence of unstable slopes (tension cracks) was not observed around or on the property. The northern part of the site has slopes up to 2:1 (horizontal:vertical) that flatten to the south and west. RMG performed several slope stability analyses as part of our investigation and obtained Factors of Safety (FOS) ranging from 1.65 to 1.93 where obtained for the slope sections selected. The slope stability analyses included two slope sections (A and B) utilizing a variety of parameters and moisture conditions (sensitivity analysis). The results of the slope analysis are presented in Section 7.0. The slope sections are presented on the Engineering and Geology Map, Figure 10.

<u>Mitigation</u>
Based on the results of our slope stability analyses, RMG concluded the currently-proposed site development is feasible. If the Client were to proceed with the amenities as currently proposed, the required FOS 1.3 for non-critical structures were met. With the exception of potential temporary shoring during construction of the proposed site retaining walls, additional mitigations for unstable slopes are not required at this time. If the configuration of the proposed amenities, with respect to the wall type/size/location of the retaining walls, varies from the assumptions presented herein, additional slope stability analyses may be required.

6.5 Downhill/Downslope Creep

Relatively slow and gradual downhill movement of soil is commonly referred to as soil creep. No signs of ongoing slope creep were observed on the slope along the eastern property boundary. Visual evidence that slope creep had previously occurred (or is presently occurring) was not evident in the historical aerials reviewed or at the time of the site reconnaissance.

Areas with slope creep are generally acceptable for building. However, in these areas we would anticipate accelerated lateral and vertical movement of the near surface soils in the downslope direction.

<u>Mitigation</u>
Slope creep will increase the pressures against the retaining walls that may be utilized around the amenities. The design of the retaining walls should account for this additional pressure. The final design pressures for the retaining walls shall be included and determined at the time of the lot-specific subsurface soil investigations.

6.6 Undocumented Fill Placement

Limited fill soils were encountered in the test borings performed for the reports referenced above. Deep soil stockpiles are also present on the site. It is our understanding the Client is considering the use of the deep stockpile for fill on the site, but will likely remove the shallower soil "end dump" piles. The "end dump" piles have accumulated a lot of all trash and debris over the years, and it will likely be difficult to separate the soil from the debris. All fill soils currently on the site are considered "uncontrolled fill" in their current state.

Mitigation

It is anticipated the majority of the existing fill soils will be removed from the site during the land development process. Fill soils placed on the site will require proper compaction. The properties of the fill will affect the performance of foundations and pavements. Even properly compacted fill soils are likely to consolidate after placement. It is recommended that fill soils placed on the site be processed, placed, and compacted as presented in **Section 7.0**. Fill soils greater than 15 feet in depth are not anticipated unless a deep subexcavation plan is considered. Placement and compaction of fill should be observed and tested during construction to verify the contractor has achieved the adequate moisture and density.

6.7 Seismicity

Based on review of the Earthquake and Late Cenozoic Fault and Fold Map Server provided by CGS dating back to November 1, 1900, Colorado Springs has not been the epicenter of a recorded earthquake. The nearest recorded earthquake dates back to December 1995 in Manitou Springs, which experienced magnitudes ranging between 2.8 to 3.5. Additional earthquakes occurred between 1926 to 2001 in Woodland Park, which experienced magnitudes ranging from 2.7 to 3.3. Both of these locations are in the vicinity of the Ute Pass Fault, but 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 are more likely to affect structures at this site (and the surrounding area) will likely only affect slope stability to a minimal degree.

Mitigation

The Pikes Peak Regional Building Code, 2017 Edition, indicates maximum considered earthquake spectral response accelerations of 0.2g for a short period (S_s) and 0.058g 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.

6.8 Radon

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

"Radon Act 51 *passed by Congress set the natural outdoor level of radon gas (0.4 pCi/L) as the target radon level for indoor radon levels. The US EPA has set an action level of 4 pCi/L. At or* *above this level of radon, the EPA recommends you take corrective measures to reduce your exposure to radon gas".*

Most of Colorado is generally considered to have the potential for high indoor levels of radon gas, based on the geology, soils, construction type and aerial radiation measurements that have been gathered from indoor testing by the Colorado Department of Public Health and Environment (CDPHE), Radon Outreach Program and Colorado Environmental Public Health Tracking the information provided at:
https://www.elpasocountyhealth.org/sites/default/files/CDPHERadonMap.pdf

There is not believed to be unusually hazardous levels of radioactivity from naturally occurring sources at this site. However, the granular materials found in the area are often associated with the production of radon gas and concentrations may exceed those currently accepted by the EPA.

Mitigation
Radon is not believed to be an unusual hazard from the naturally occurring source of radioactivity on the property. However, the type of colluvial material found on the property is generally associated with the production of radon gas and concentrations that exceed the accepted EPA standards.

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 structure be tested after it is enclosed, and that commonly utilized mitigation measures be put in place to minimize the risk.

6.9 History of Landfill Activity

The site is not mapped as a landfill and historically has not been a landfill. However, the site has accumulated a lot of household trash, construction debris, and possibly human waste due to the homeless encampment. The smaller soil piles along the southern portion of the site also contain a variety of trash.

Mitigation
Goodwin Knight is aware of the trash onsite. It is our understanding Goodwin Knight is planning and preparing to haul away all the end dump soil stockpiles and trash onsite prior to site development activities. The trash should be disposed of in accordance with applicable regulatory requirements. During the removal process, if it appears the contamination extends beneath the surface or large quantities of unknown liquids are discovered buried beneath the surface, it would be prudent to call RMG to verify if additional environmental concerns are present.

6.10 General Compatibility of Natural Features with Proposed Land Use

Natural features impacting the proposed structures and their associated mitigation recommendations are presented in the relevant sections above.

Provided that the recommendations within this report and the referenced reports are adhered to, the proposed construction is not anticipated to adversely impact the natural features on surrounding properties.

Mitigation
It is our opinion that no additional mitigation measures (aside from those already described elsewhere in this report) are required.

7.0 SUBEXCAVATION AND REPLACEMENT

The majority of the proposed lots contain expansive clay and/or claystone bedrock at depths that are anticipated to effect the performance of foundations and floor slabs. The proposed subexcavation of the expansive soils and bedrock and replacement with moisture-conditioned structural fill is considered an acceptable alternative to lot-by-lot overexcavations.

7.1 Subexcavation

Where subexcavation is to be performed, vegetation, organic and deleterious material shall be cleared and disposed of in accordance with applicable requirements prior to performing excavation and/or filling operations. Based on our Preliminary Subsurface Soil Investigation, the subexcavation should extend to minimum depths of **8 feet** below the bottom of **spread footing** foundation components or **4 feet** below the bottom of **crawlspace** or **stiffened slab** foundation components, and at least those same distances (laterally) beyond the proposed "buildable" area on each lot. Before the placement of moisture-conditioned fill, the underlying subgrade shall be scarified, moisture conditioned to within 2% of the optimum moisture content and compacted to a minimum of 98 percent of the maximum dry density as determined by the Standard Proctor test (ASTM D-698) or to a minimum of 95 percent of the maximum dry density as determined by Modified Proctor test (ASTM D-1557) prior to placing structural fill.

7.2 Moisture-Conditioned Structural Fill

Moisture-conditioned 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.

Moisture conditioned structural fill shall consist of a moisture-conditioned, on-site cohesive fill material. The fill material shall be moisture conditioned and replaced as follows:

- Fill shall be free of deleterious material and shall not contain rocks or cobbles greater than 6 inches in diameter.

- Claystone fill shall be thoroughly "pulverized" and shall not contain claystone chunks greater than 3 inches in diameter.

- Fill materials shall be moisture-conditioned to a minimum of 1 percent to 4 percent above optimum moisture content (as determined by the Standard Proctor test, ASTM D-698), with an average of not less than 1 1/2 percent above optimum moisture content.

- The moisture-conditioned materials should be placed in maximum 6" compacted lifts. These materials should be compacted to a minimum of 98 percent of the maximum dry density as determined by the Standard Proctor test (ASTM D-698). Material not meeting the above requirements shall be reprocessed.

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

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

Frequent moisture content and density tests shall be performed in the field to verify conformance with the above specifications. Furthermore, representative samples of the moisture-conditioned fill should be obtained for follow-up swell testing to demonstrate that the swell potential has been reduced to not more than 1.5 percent swell when saturated under a 1,000 psf surcharge pressure. Areas where the follow-up swell tests indicate swells higher than that value shall have the fill material removed, reprocessed, recompacted, and retested.

The existing soils will require the addition of water to achieve the required moisture content. The fill soils should be thoroughly mixed or disked to provide uniform moisture content through the fill. It should be noted, that the clay soils compacted at the above moisture contents are likely to result in wet, slick conditions. We recommend that the excavation contractor retained to perform this work have significant experience processing subexcavation and moisture-conditioned soils.

RMG should be contacted a minimum of 3 days prior to initiation of sub-excavation and moisture conditioning processes in order to schedule appropriate field services. Fill shall not be placed on frozen subgrade or allowed to freeze during processing. The time of the year when night temperatures are above freezing are the most optimal period for a subexcavation operation.

Following completion of the subexcavation and moisture conditioning process, it is imperative that the "as-compacted" moisture content be maintained prior to construction and establishment of landscape irrigation. This may require reprocessing of materials and addition of supplemental water to prevent remobilization of swell potential within the fill.

7.3 Granular 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.

Granular 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 98 percent of the maximum dry density as determined by the Standard Proctor test (ASTM D-698) or to a minimum of 95 percent of the maximum dry density as determined by Modified Proctor test (ASTM D-1557).

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

To verify the condition of the compacted soils, density tests should be performed during placement. The first density tests should be conducted when 24 inches of fill have been placed. Frequent moisture content and density tests shall be performed in the field to verify conformance with the above specifications.

8.0 SLOPE STABILITY ANALYSIS

Slope stability analyses were performed utilizing the 2-D computer program SLIDE (Version 7.020) distributed by Rocscience, Inc. The slope stability was evaluated utilizing both the Simplified Bishop and the Corrected Janbu methods to determine the calculated Factor of Safety (FOS) along randomly generated failure surfaces within the slope. The Factor of Safety (FOS) can generally be described as the ratio of resisting forces to forces during failure.

For our analyses, five basic scenarios were evaluated for the retaining walls that may be utilized around the proposed amenities and structures located along the northeastern corner of the property.

1. The slope was evaluated in the "existing" condition (i.e. existing topography) with groundwater conditions.
2. The slope was evaluated in the “construction” phase (i.e. excavation completed) with and without groundwater conditions.
3. The slope was evaluated in the "post construction" phase with and without groundwater conditions.

For purposes of the slope evaluation, the following soil strength parameters were utilized for the soil materials:

Description	**γ_t, pcf**	**ϕ, degrees**	**Cohesion, psf**
Clayey Sand	125	27	50
Claystone, Sandy	130	15	500
Shale, Sandy	130	18	1,000

Output of our Slope Stability Analyses is presented in Appendix A, the slope stability cross-section is presented on Figure 10. The results of our analyses are presented in the following table:

SLOPE STABILITY RESULTS					
		Bishop Simplified Method		Corrected Janbu Method	
Scenario	**Ground Water**	**Minimum FOS[1]**	**Calculated FOS**	**Minimum FOS**	**Calculated FOS**
Existing A-A’	No	1.3	1.930	1.3	1.897
Construction Phase A-A’	No	1.3	1.814	1.3	1.850
Post-Construction Phase A-A’	Yes	1.3	1.629	1.3	1.591
Existing B-B’	No	1.3	2.503	1.3	2.518
Construction Phase B-B’	No	1.3	2.551	1.3	2.587
Post-Construction Phase B-B’	Yes	1.3	2.320	1.3	2.351

[1]FOS – Factor of Safety

> [3]Per the Engineering Criteria Manual, Section 3.8.7 – *"Development and adjacent properties in potentially unstable slope areas shall meet the following criteria: A safety factor of 1.3 or higher is required for non-critical structures, such as retaining walls, parking areas and roads; a safety factor of 1.5 or higher is required for critical structures such as buildings".*

The analyses indicate that the slopes have suitable FOS in their current state for the proposed retaining wall construction. Further analyses were performed on the Post-Construction conditions with respect to a water sensitivity. These further analyses indicate that the slopes have suitable FOS for a slope modeled with elevated water conditions, and with the claystone cohesion reduced to 350 psf and the shale cohesion reduced to 750 psf.

Based on the results of our Slope Stability Analyses, the slopes are suitable for the support of the proposed amenity retaining walls, as currently shown. Should the configuration of the proposed amenities, with respect to the wall type/size/location of the retaining walls, vary from the assumptions presented herein, additional slope stability analyses may be required.

Due to the deep excavation cuts that may occur for the proposed retaining walls along the steep northern slope, the contractor may need to utilize an appropriately designed and constructed shoring system for the proposed retaining wall excavation(s). This shoring system shall be in compliance with Occupational Safety and Health Administration (OSHA, 2005) guidelines. This shoring system should be designed both to prevent localized failures of the soil along the edges of the excavation, and to maintain the required factors of safety.

Due to the complexities involved in construction and the wide range of shoring systems available, the contractor is invited to propose alternatives to achieve the desired results. Upon selection of a system, RMG can provide (for an additional fee) design parameters appropriate to the type of system selected, conceptual review of the proposed system to verify its suitability to achieve the desired improvement in the overall factor of safety, or both (as desired by the client or as required by the City and/or their reviewing consultants).

9.0 CONCLUSIONS AND RECOMMENDATIONS

Geologic hazards that are anticipated to have significant bearing on the proposed construction on this site are the mapped landslide susceptibility, expansive soils and bedrock, seasonally fluctuating groundwater, unstable or potentially unstable slopes, downhill/downslope creep, undocumented fill placement, seismicity, and radon. It is our opinion that these conditions, can be mitigated with typical construction practices common to the Colorado Springs area, as described herein.

Grading operations and fill placement around the proposed structures shall not result in long-term fill slopes greater than 3:1 (horizontal to vertical). It is recommended that cut slopes be no steeper than 3:1 (horizontal to vertical) for long-term cuts and 3/4:1 (horizontal to vertical) for temporary cuts. It is recommended that fill slopes be no steeper than 3:1 (horizontal to vertical).

Recommendations for design and construction of the proposed engineered retaining walls should be provided in a site-specific soil investigation once the retaining wall types, locations, and configurations are finalized.

Significant care should be taken (both during construction and in the final grading of the lot) to divert surface drainage and downspout discharge water around the structure to a location that will not significantly alter the overall drainage of the development.

Roof drains should extend across backfill zones and landscaped areas to a region that is graded to direct flow away from the structure and the slope to the north. Owners should maintain the surface grading and drainage recommended in a site-specific subsurface soil investigation to help prevent water from being directed toward and/or ponding near the foundations.

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

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

The recommendations in this and the referenced reports are intended to address normal surface drainage conditions, assuming the presence of groundcover (established vegetation, paved surfaces, and/or structures) throughout the regions upslope from this structure. However, groundcover may not be present due to a variety of factors (ongoing construction/development, wildfires, etc.). During periods when groundcover is not present in the "upslope" regions, higher than normal surface drainage conditions may occur, resulting in perched water tables, excess runoff, flash floods, etc. In these cases, the surface drainage recommendations presented herein (even if properly maintained) may not mitigate all groundwater problems or moisture intrusion into the structure. Visual monitoring of the slope and drainage conditions by the homeowners is recommended through the life of the structure.

It is imperative the potential owner(s) of the property and future residents read and understand this report (as well as the previous reports referenced above) carefully to familiarize themselves with the landslide susceptibility associated with residential construction in this subdivision. This report only addresses the geologic constraints contained within the boundaries of the lot referenced above.

9.1 Geologic Hazard Disclosure Statement

It is required by the City of Colorado Springs Engineering Criteria Manual (Chapter 3 Section 3.7) that the following disclosure statement be placed on each Subdivision Plat and Development plan:

This property is subject to the findings, summary, and conclusions of a *Geologic Hazard Study* prepared by RMG, last dated October 14, 2024, which identified the following specific geologic hazards on the property are the mapped landslide susceptibility, expansive soils and bedrock, seasonally fluctuating groundwater, unstable or potentially unstable slopes, downhill/downslope creep, undocumented fill placement, seismicity, and radon. A copy of said report has been placed within the subdivision file of the City of Colorado Springs Planning and Development Team. Contact the Planning and Development Team, 30 South Nevada Avenue, Suite 105, Colorado Springs, CO, if you would like to review said report.

10.0 CLOSING

This report has been prepared for the exclusive purpose of providing geotechnical engineering information and recommendations for proposed storage expansion described in this report. RMG should be retained to review the final construction documents prior to construction to verify our findings, conclusions and recommendations have been appropriately implemented.

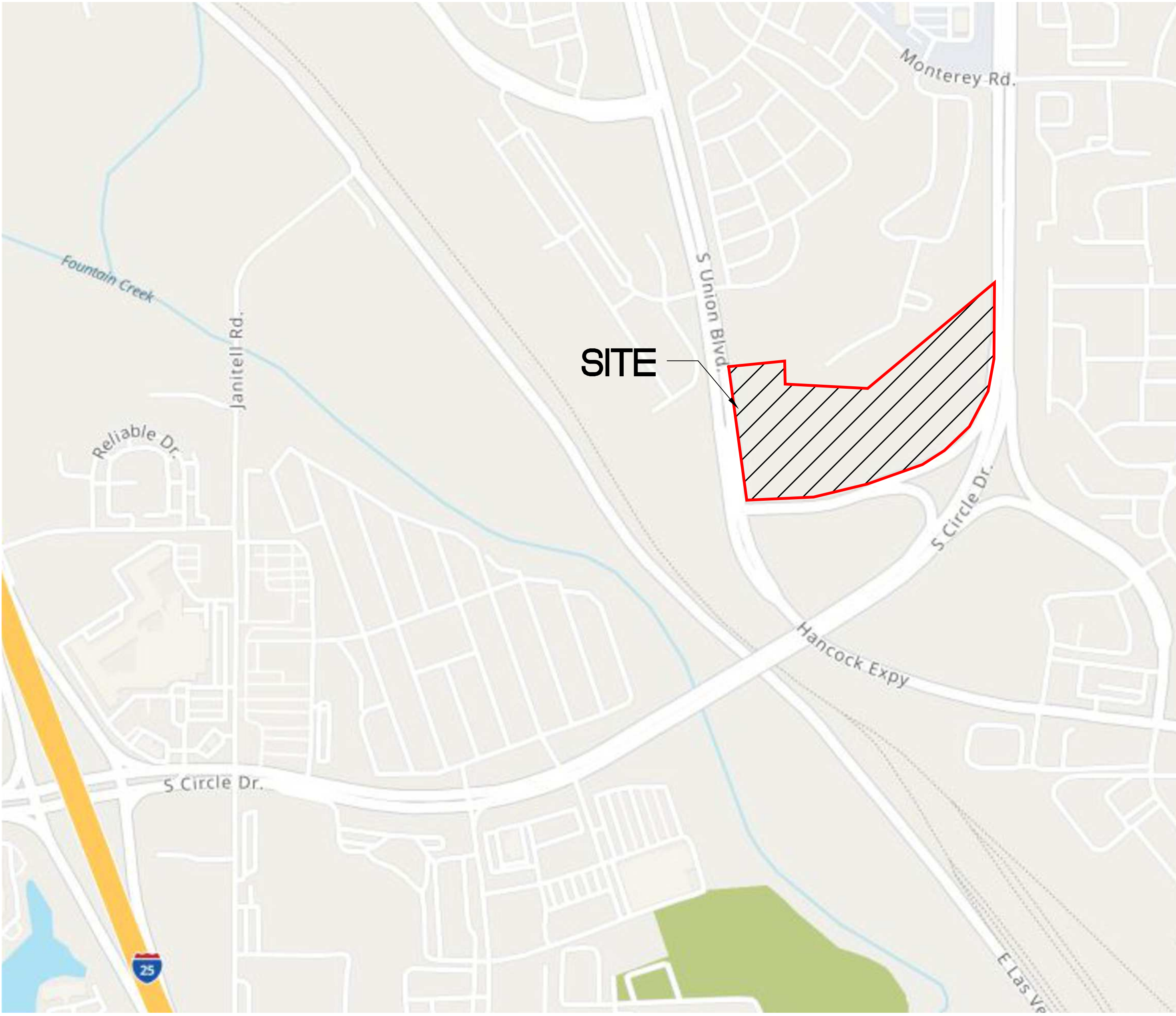
This report has been prepared for the exclusive use by **Goodwin Knight, LLC** for application as an aid in the design and construction of the proposed development in accordance with generally accepted geotechnical engineering practices. The analyses and recommendations in this report are based in part upon data obtained from test borings, site observations and the information presented in referenced reports. The nature and extent of variations may not become evident until construction. If variations then become evident, RMG should be retained to review the recommendations presented in this report considering the varied condition, and either verify or modify them in writing.

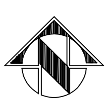
Our professional services were performed using that degree of care and skill ordinarily exercised, under similar circumstances, by geotechnical engineers practicing in this or similar localities. RMG does not warrant the work of regulatory agencies or other third parties supplying information which may 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.

The scope of services for this project does not include, either specifically or by implication, 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 Client desires investigation into the potential for such contamination or conditions, other studies should be undertaken.

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

FIGURES





ARCHITECTS RMG ENGINEERS
ROCKY MOUNTAIN GROUP

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

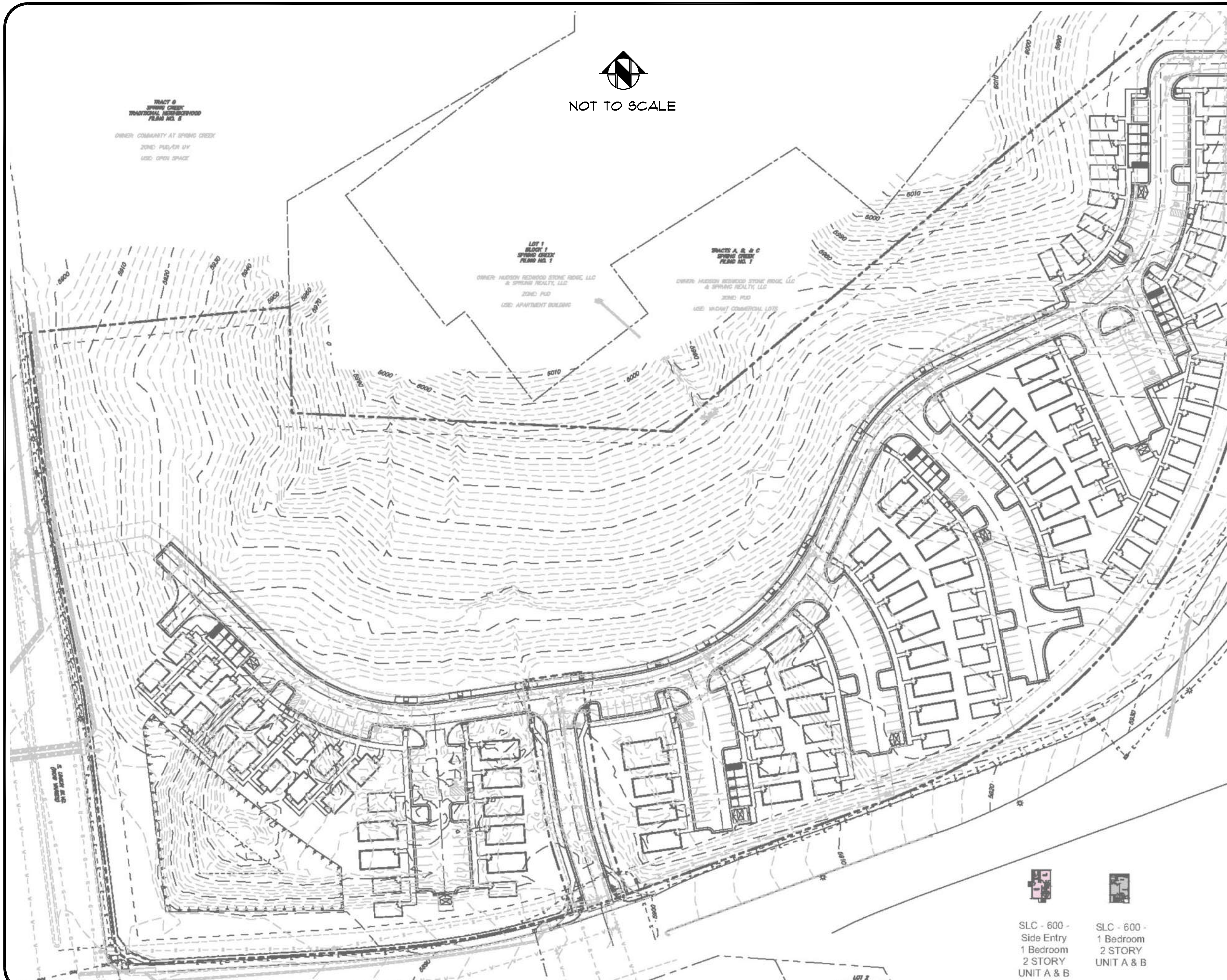
SITE VICINITY MAP

THE RIDGE AT SPRING CREEK
FILING NO. 1
COLORADO SPRINGS, COLORADO
GOODWIN KNIGHT, LLC

JOB No. 197354

FIG No. 1

DATE 10-14-2024



SITE DATA:

TOTAL ACRES:
CURRENT ZONE:

DENSITY 194 UNITS /16.71= 11

BUILDING SETBACK:
FRONT: 20'
SIDE: 5'
REAR: 15'

LANDSCAPE SETBACKS
NORTH 25'
SOUTH 25'
EAST 25'
WEST 25'

COTTAGE UNITS
SLC 480 -STUDIOS
SLC 600 - 1 BEDROOM (FE)
SLC 600 - 1 BEDROOM (SE)
SLC 840 - 2 BEDROOMS
TOTAL =

BEDROOM COUNT
SLC 480 - STUDIO
SLC 600 - 1 BEDROOM
SLC 840 - 2 BEDROOM
TOTAL

PARKING REQUIREMENTS:

UNIT	UNIT COUNT
SLC 480 - STUDIO	

JOB No. 197351

ARCHITECTS RMG ENGINEERS
ROCKY MOUNTAIN GROUP

Southern Office
Colorado Springs, CO 80918
(719) 548-0600
Central Office:
Englewood, CO 80112
(303) 688-9475
Northern Office:
Greeley / Evans, CO 80620
(970) 330-1071
Woodland Park Office:
(719) 687-6077
Monument Office:
(719) 488-2145
Pueblo / Canon City:
(719) 544-7750

THE RIDGE AT SPRING CREEK, FILING NO. 1

COLORADO SPRINGS, CO
GOODWIN KNIGHT, LLC

ENGINEER:	TM	
DRAWN BY:	KZ	
CHECKED BY:	TM	
ISSUED:	10-14-2024	
REVISION:		DATE: JOB #:

PROPSOED SITE DEVELOPMENT PLAN

SHEET No. FIG-2

SOILS DESCRIPTION

CLAYEY SAND

CLAYSTONE

SANDSTONE

SHALE

UNLESS NOTED OTHERWISE, ALL LABORATORY
TESTS PRESENTED HEREIN WERE PERFORMED BY:
RMG - ROCKY MOUNTAIN GROUP
2910 AUSTIN BLUFFS PARKWAY
COLORADO SPRINGS, COLORADO

SYMBOLS AND NOTES

XX — STANDARD PENETRATION TEST - MADE BY DRIVING A SPLIT-BARREL SAMPLER INTO THE SOIL BY DROPPING A 140 LB. HAMMER 30", IN GENERAL ACCORDANCE WITH ASTM D-1586. NUMBER INDICATES NUMBER OF HAMMER BLOWS PER FOOT (UNLESS OTHERWISE INDICATED).

XX — UNDISTURBED CALIFORNIA SAMPLE - MADE BY DRIVING A RING-LINED SAMPLER INTO THE SOIL BY DROPPING A 140 LB. HAMMER 30", IN GENERAL ACCORDANCE WITH ASTM D-3550. NUMBER INDICATES NUMBER OF HAMMER BLOWS PER FOOT (UNLESS OTHERWISE INDICATED).

FREE WATER TABLE

DEPTH AT WHICH BORING CAVED

BULK — DISTURBED BULK SAMPLE

AUG — AUGER "CUTTINGS"

4.5 — WATER CONTENT (%)

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Structural
Forensics

RMG Engineers / Architects

Geotechnical
Materials Testing
Civil, Planning

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

EXPLANATION OF TEST BORING LOGS

JOB No. 197354

FIGURE No. 3

DATE Oct/14/2024

TEST BORING: **101**

DATE DRILLED: 9/13/24

NO GROUNDWATER ON 9/13/24

Description	Depth (ft)	Blows per ft.	Water content %
SANDSTONE, CLAYEY with interbedded claystone, dark brown, medium hard to hard, moist	0–15		
	~4–5 (sample)	50/11"	15.6
	~9–9.7 (sample)	50/8"	14.4
	~14–14.5 (sample)	50/6"	11.1
SHALE, gray, very hard, moist	15–19.2		
	~19–19.2 (sample)	50/2"	9.4

TEST BORING: **102**

DATE DRILLED: 9/13/24

NO GROUNDWATER ON 9/13/24

Description	Depth (ft)	Blows per ft.	Water content %
SAND, CLAYEY, brown, loose to medium dense, moist	0–14		
	~2–3 (sample)	12	4.9
	~7–8 (sample)	20	5.0
CLAYSTONE, SANDY, brown, medium hard, moist	14–19.7		
	~14–14.8 (sample)	50/10"	8.3
	~19–19.7 (sample)	50/8"	9.8

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Materials Testing
Civil, Planning

Colorado Springs: (Corporate Office)
2910 Austin Bluffs Parkway
Colorado Spings, CO 80918
(719) 548-0600
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TEST BORING LOG

JOB No. 197354

FIGURE No. 4

DATE Oct/14/2024

TEST BORING: **104**

DATE DRILLED:
9/13/24
NO GROUNDWATER ON
9/13/24

Description	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAYSTONE, SANDY with interbedded sandstone, brown, hard to very hard, moist					
				50/6"	14.2
	5				
				50/5"	13.8
	10				
				50/4"	15.0
	15				
				50/4"	13.0
	20				

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Architectural
Structural
Forensics

RMG
Engineers / Architects

Geotechnical
Materials Testing
Civil, Planning

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

TEST BORING LOG

JOB No. 197354

FIGURE No. 5

DATE Oct/04/2024

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	Load at Saturation (psf)	% Swell/ Collapse	USCS Classification
101	4.0	15.6	110.3	37	19	0.0	85.1		1.2	CL
101	9.0	14.4								
101	14.0	11.1								
101	19.0	9.4								
102	2.0	4.9								
102	7.0	5.0								
102	14.0	8.3	96.7	31	13	1.7	76.1		- 1.5	CL
102	19.0	9.8								
104	4.0	14.2								
104	9.0	13.8								
104	14.0	15.0								
104	19.0	13.0	102.5	31	13	0.0	78.4		- 0.2	CL

ROCKY MOUNTAIN GROUP

Architectural
Structural
Forensics

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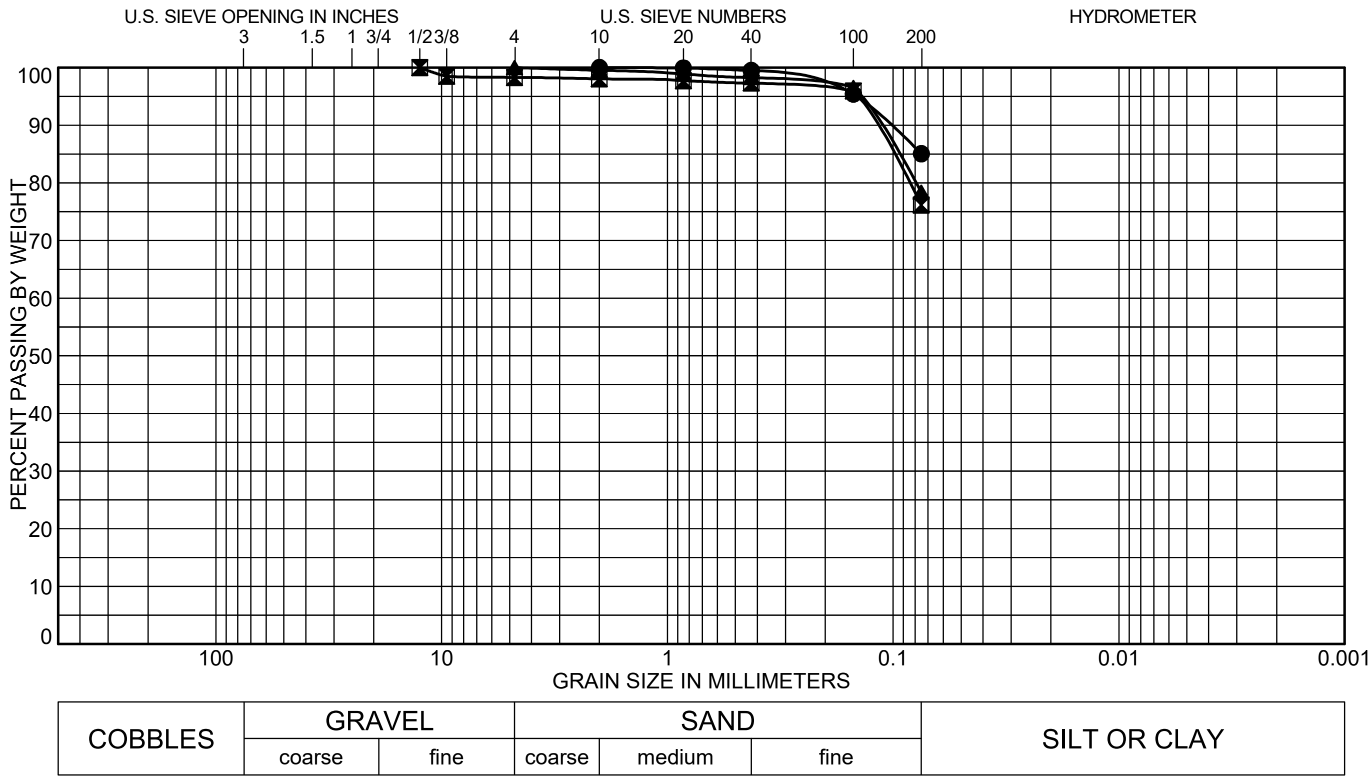
Civil, Planning

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

SUMMARY OF LABORATORY TEST RESULTS

JOB No. 197354
FIGURE No. 6
PAGE 1 OF 1
DATE Oct/14/2024



Test Boring	Depth (ft)	Classification	LL	PL	PI
● **101**	**4.0**	**LEAN CLAY(CL)**	**37**	**18**	**19**
⧗ **102**	**14.0**	**LEAN CLAY with SAND(CL)**	**31**	**18**	**13**
▲ **104**	**19.0**	**LEAN CLAY with SAND(CL)**	**31**	**18**	**13**

Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
● **101**	**4.0**	**0.0**	**14.9**	**85.1**	
⧗ **102**	**14.0**	**1.7**	**22.2**	**76.1**	
▲ **104**	**19.0**	**0.0**	**21.6**	**78.4**	

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Engineers / Architects

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Materials Testing
Civil, Planning

Colorado Springs: (Corporate Office)
2910 Austin Bluffs Parkway
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(719) 548-0600
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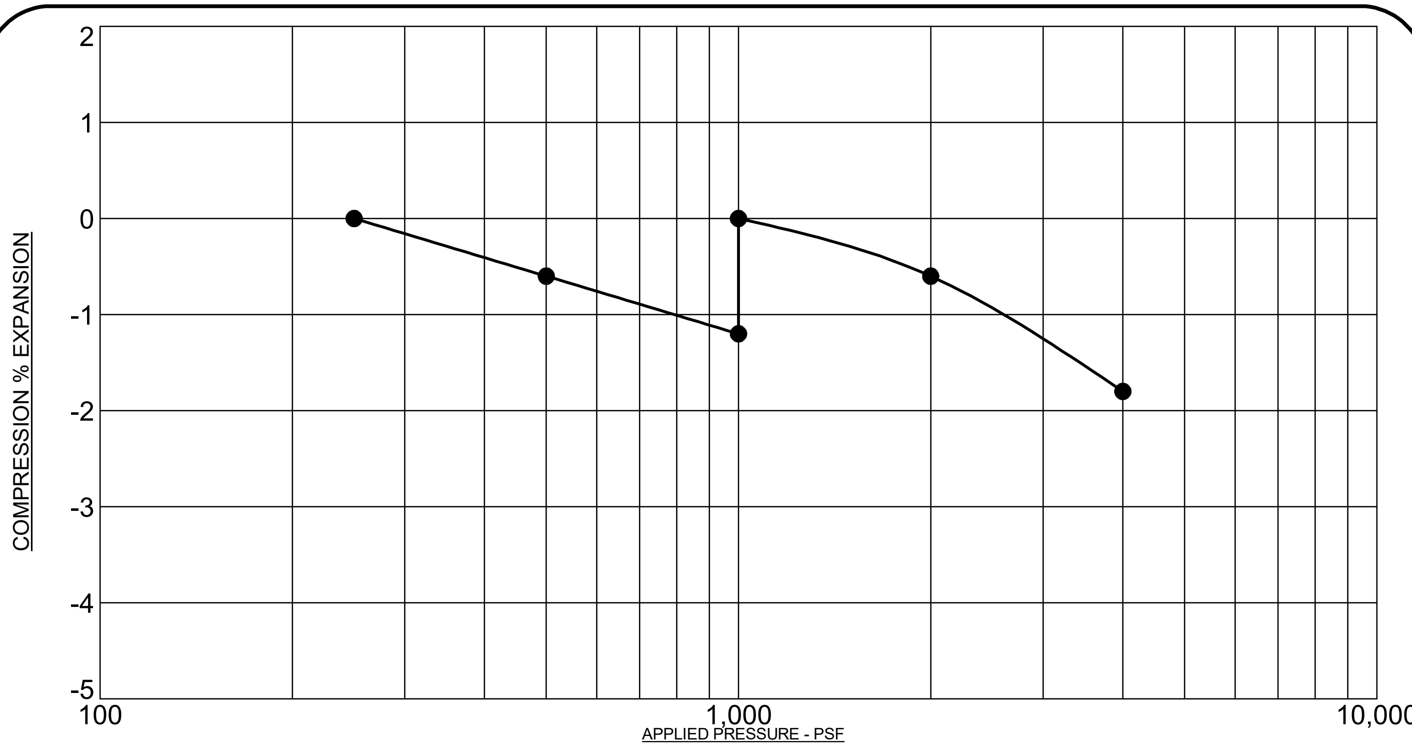
SOIL CLASSIFICATION DATA

JOB No. 197354

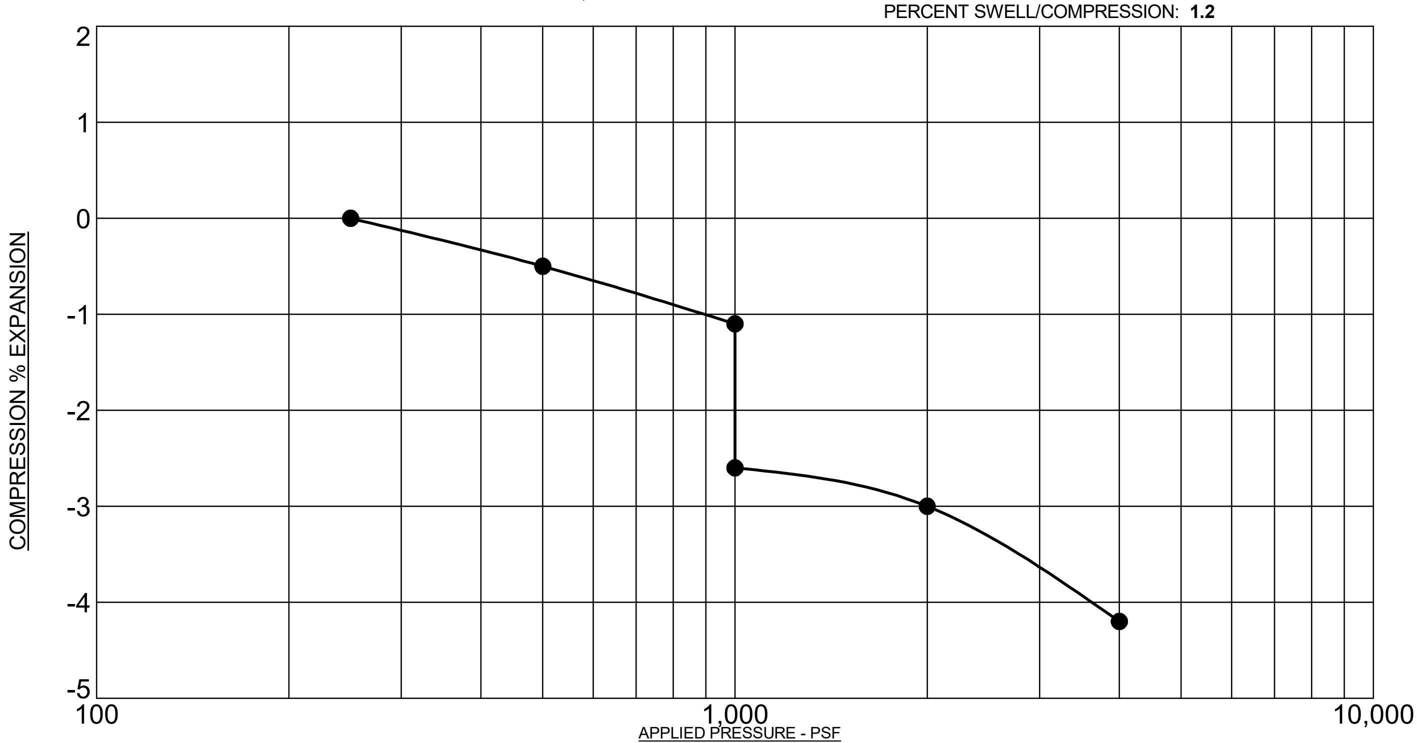
FIGURE No. 7

DATE Oct/14/2024



PROJECT: **Lots 1-90, Ridge at Spring Creek, Filing No. 1 Colorado Springs, Colorado**
SAMPLE DESCRIPTION: **SANDSTONE, CLAYEY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **101 @ 4 FT**
NATURAL DRY UNIT WEIGHT: **110.3 PCF**
NATURAL MOISTURE CONTENT: **15.6%**
PERCENT SWELL/COMPRESSION: **1.2**



PROJECT: **Lots 1-90, Ridge at Spring Creek, Filing No. 1 Colorado Springs, Colorado**
SAMPLE DESCRIPTION: **CLAYSTONE, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **102 @ 14 FT**
NATURAL DRY UNIT WEIGHT: **96.7 PCF**
NATURAL MOISTURE CONTENT: **8.3%**
PERCENT SWELL/COMPRESSION: **- 1.5**

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Colorado Springs: (Corporate Office)
2910 Austin Bluffs Parkway
Colorado Spings, CO 80918
(719) 548-0600
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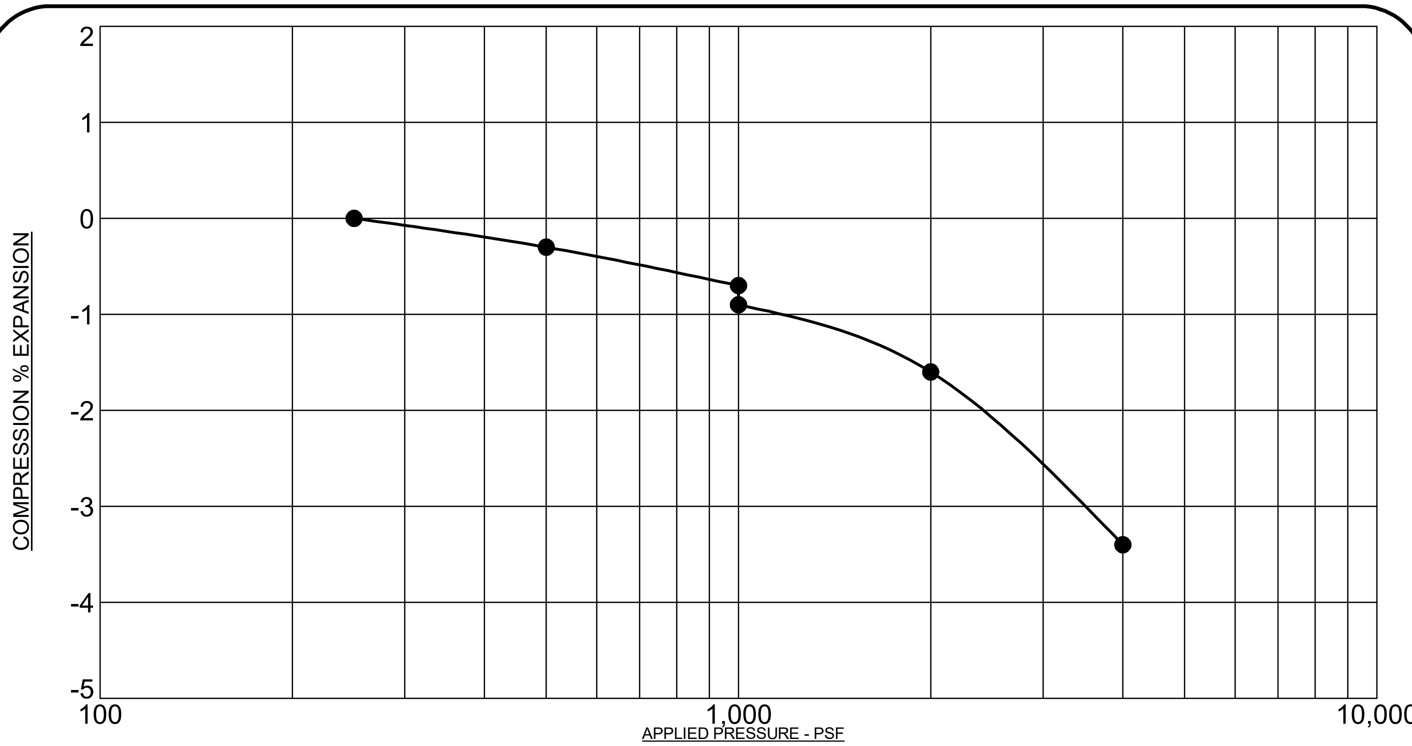
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 197354

FIGURE No. 8

DATE Oct/14/2024



PROJECT: **Lots 1-90, Ridge at Spring Creek, Filing No. 1 Colorado Springs, Colorado**
SAMPLE DESCRIPTION: **CLAYSTONE, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **104 @ 19 FT**
NATURAL DRY UNIT WEIGHT: **102.5 PCF**
NATURAL MOISTURE CONTENT: **13.0%**
PERCENT SWELL/COMPRESSION: **- 0.2**

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2910 Austin Bluffs Parkway
Colorado Spings, CO 80918
(719) 548-0600
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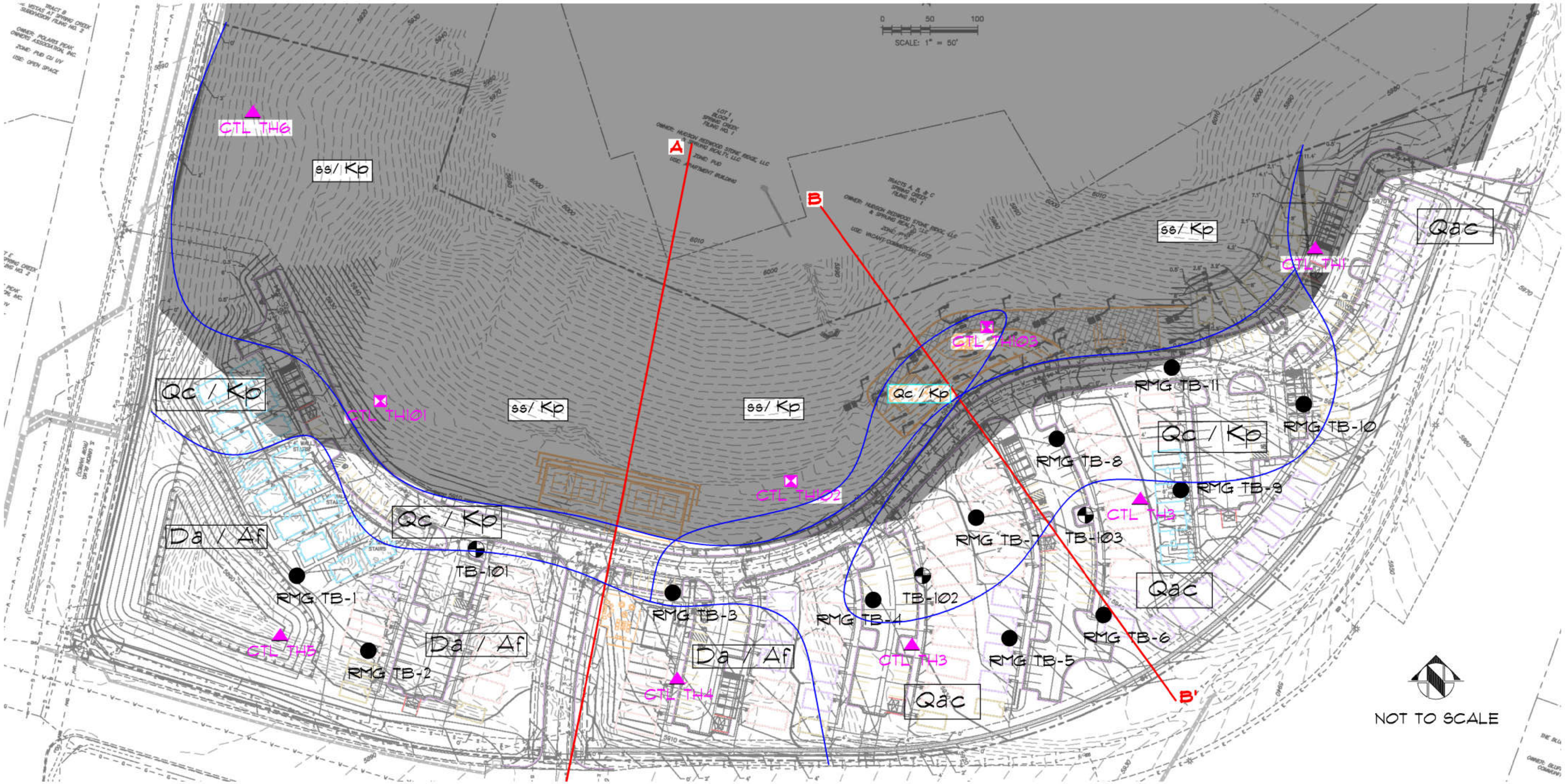
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 197354

FIGURE No. 9

DATE Oct/14/2024



DENOTES APPROXIMATE LOCATION OF RMG TEST BORINGS PERFORMED FOR THIS INVESTIGATION

DENOTES APPROXIMATE LOCATION OF PREVIOUS RMG TEST BORINGS PERFORMED FOR JOB NO. 182625, APRIL 9, 2021

DENOTES APPROXIMATE LOCATION OF CTL TEST HOLES PERFORMED FOR JOB NO. CS15537-115, OCTOBER 12, 2005

DENOTES APPROXIMATE LOCATION OF PREVIOUS CTL TEST HOLES PERFORMED FOR JOB NO. CS-11,349, OCTOBER 2000

BASE MAP PROVIDED BY CATAMOUNT ENGINEERING

Qg2 - Pediment gravel two (middle Pleistocene) - cobbles and boulders in a sandy matrix at the base. Although not encountered in our borings, the pediment gravel was visible on the surface of the northern slope.

Kp - Pierre Shale (Upper Cretaceous) - Gray shale. Formation is mostly covered by Quaternary deposits and is particularly susceptible to slope instability in steep areas, such as the slope on-site.

da - Disturbed Areas - areas that are no longer in their native state such as the two tracks that transverse the property.

Af - Artificial fill - Stockpiles of surficial dumping of soil, trash, and debris all along the southern portion of the site.

ss - steep slopes - The northern part of the site has slopes up to 2:1 (horizontal:vertical). The slopes "flatten" to the south and west with an approximate slope percentage over 30%.

DENOTES APPROXIMATE LOCATION SLOPE SECTIONS

AREAS MAPPED AS LANDSLIDE SUSCEPTIBLE

JOB No. 197351

ARCHITECTS RMG ENGINEERS

ROCKY MOUNTAIN GROUP

Southern Office
Colorado Springs, CO 80918
(719) 548-0600
Central Office:
Englewood, CO 80112
(303) 688-9475
Northern Office:
Greeley / Evans, CO 80620
(970) 330-1071
Woodland Park Office:
(719) 687-6077
Monument Office:
(719) 488-2145
Pueblo / Canon City:
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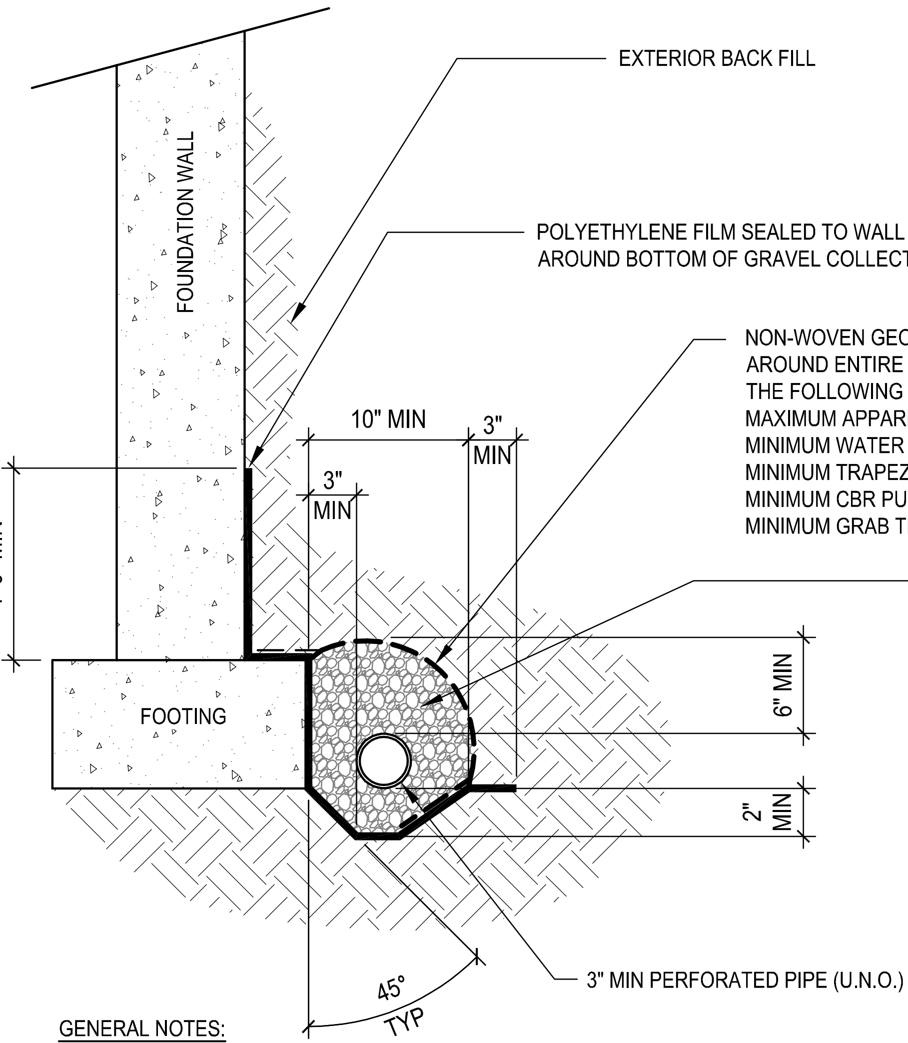
THE RIDGE AT SPRING CREEK, FILING NO. 1

COLORADO SPRINGS, CO
GOODWIN KNIGHT, LLC

ENGINEER:	TM
DRAWN BY:	KZ
CHECKED BY:	TM
ISSUED:	10-14-2024
REVISION:	DATE: JOB #:

ENGINEERING AND GEOLOGY MAP

SHEET No. FIG-10



GENERAL NOTES:

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

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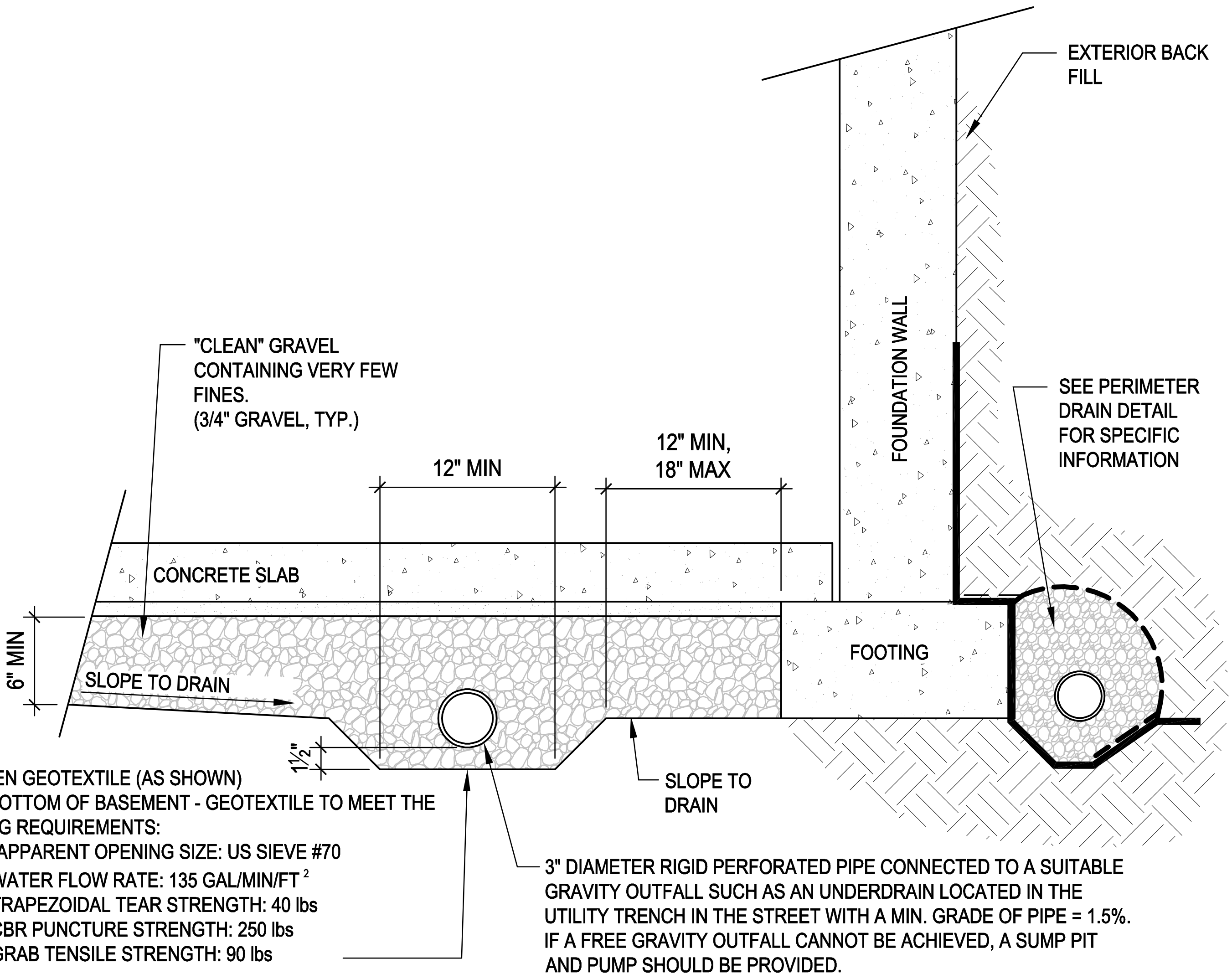
Engineers / Architects

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

PERIMETER DRAIN

FIG No. 11



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.

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

UNDERSLAB DRAIN

FIG No. 12

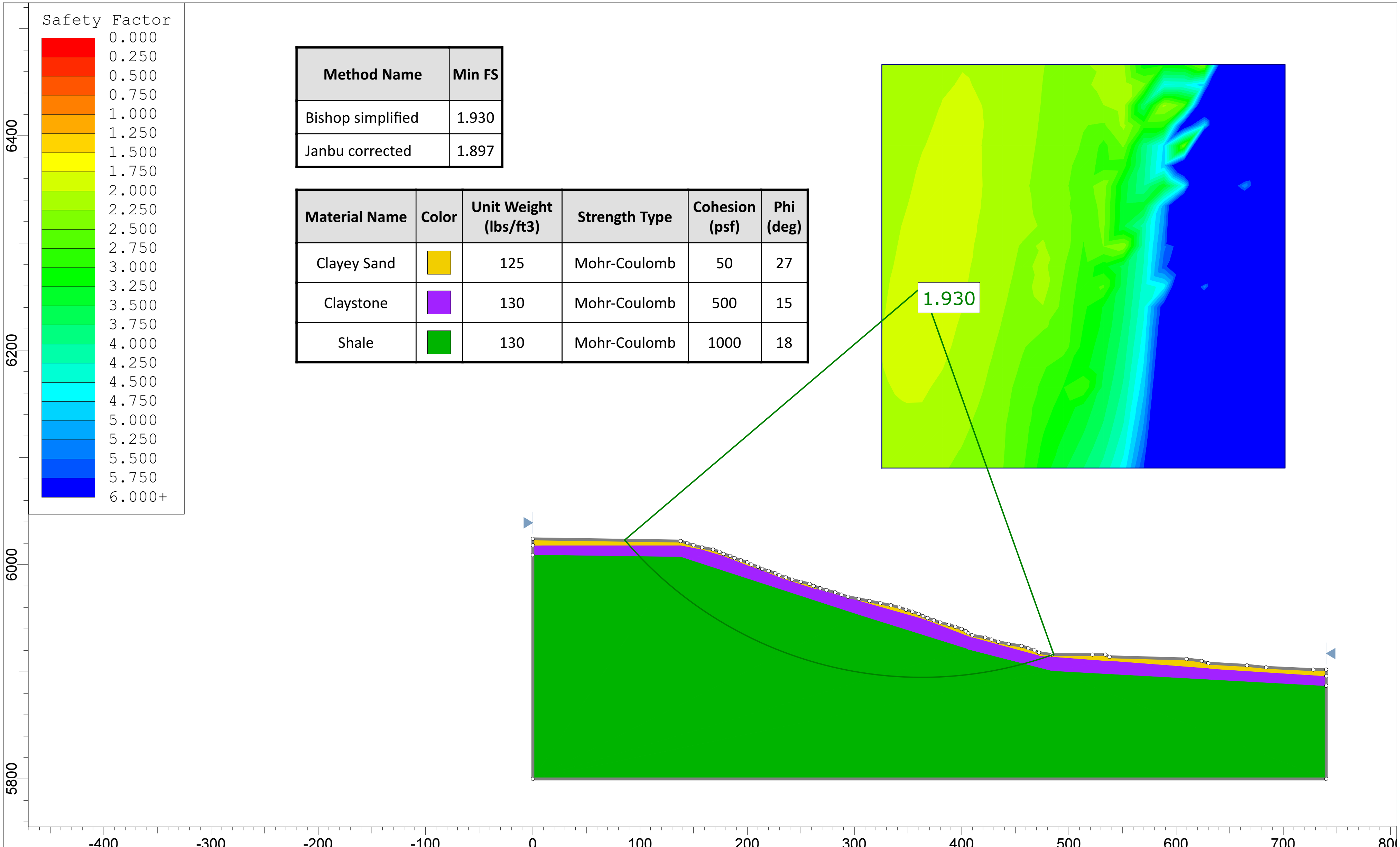
APPENDIX A
Additional Reference Documents

1. *(Preliminary) Wall Grading Exhibit, The Ridge at Spring Creek, Colorado Springs, Colorado,* prepared by Catamount Engineering, Job No. 24-415, dated September 5, 2024.
2. *(Preliminary) Cottage Concept, The Ridge at Spring Creek, Colorado Springs, Colorado,* prepared by Goodwin Knights, not dated.
3. *Flood Insurance Rate Map, El Paso County, Colorado and Unincorporated Areas, Community Panel No. 081041C0739G,* Federal Emergency Management Agency (FEMA), effective December 7, 2018.
4. *Map of Areas Susceptible to Differential Heave in Expansive, Steeply Dipping Bedrock, City of Colorado Springs, Colorado*, by John W. Himmelreich, Jr. and David C. Noe, Colorado Geologic Survey, Map Series 32, Plate 1 of 1, 1999.
5. *Master Plan for Mineral Extraction*, El Paso County, February 8, 1996.
6. *Colorado Springs Subsidence Investigation, State of Colorado Mined Land Reclamation*, Dames and Moore, 1985.
7. *Geologic Map of the Colorado Springs Quadrangle, El Paso County, Colorado*, Carroll, C.J. and Crawford, T.A. Colorado Geological Survey Open-File Report OF-00-3.
8. *Colorado Springs, Quadrangle, Environmental and Engineering Geologic Map for Land Use*, compiled by Dale M. Cochran, Charles S. Robinson & Associates, Inc., Golden, Colorado, 1977.
9. *Colorado Springs, Quadrangle, Map of Potential Geologic Hazards and Surficial Deposits*, compiled by Dale M. Cochran, Charles S. Robinson & Associates, Inc., Golden, Colorado, 1977.
10. *El Paso County Assessor, El Paso County, Colorado:* https://property.spatialest.com/co/elpaso/#/property/7513404023. 7513404023
11. *Google Earth, 1999, 2003, 2004, 2005, 2006, 2011, 2015, 2017, 2018, 2019, 2020, 202, 2023, and 20242*.
12. *El Paso County, Master Plan for Mineral Extraction,* dated February 8, 1996.
13. *Colorado Springs Landslide Susceptibility, Colorado Geological Survey:* https://cologeosurvey.maps.arcgis.com/apps/webappviewer/index.html?id=5e7484a637c4432e84f4f16d0af306d3
14. *Colorado Landslide Inventory, Colorado Geological Survey:* https://cologeosurvey.maps.arcgis.com/apps/webappviewer/index.html?id=9dd73db7fbc34139abe51599396e2648.
15. *Pikes Peak Regional Building Department:* https://www.pprbd.org/.
16. *City of Colorado Springs, Subdivision Document Viewer:* http://www.springsgov.com/SubDivView/default.asp?cmdGoBack=New+Search....
17. *El Paso County Assessor, El Paso County, Colorado:* https://property.spatialest.com/co/elpaso/#/property/7501203014

18. *Colorado Geological Survey, USGS Geologic Map Viewer*: http://coloradogeologicalsurvey.org/geologic-mapping/6347-2/.
19. *Historical Aerials:* https://www.historicaerials.com/viewer, Images dated 1947, 1955, 1960, 1969, 1983, 1999, 2005, 2009, 2011, 2013, 2015, 2017, and 2019.
20. *USGS Historical Topographic Map Explorer:* http://historicalmaps.arcgis.com/usgs/ Images dated 1950, 1951, 1956, 1657, 1963, 1966, 1970, 1974, 1977, 1994, 2001, 2013, and 2019.
21. *Google Earth Pro*, Imagery dated 1999, 2003, 2004, 2005, 2006, 2011, 2015, 2017, 2018, 2019, and 2020-2024.

APPENDIX B

Slide Figures



Method Name	Min FS
Bishop simplified	1.930
Janbu corrected	1.897

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Clayey Sand		125	Mohr-Coulomb	50	27
Claystone		130	Mohr-Coulomb	500	15
Shale		130	Mohr-Coulomb	1000	18

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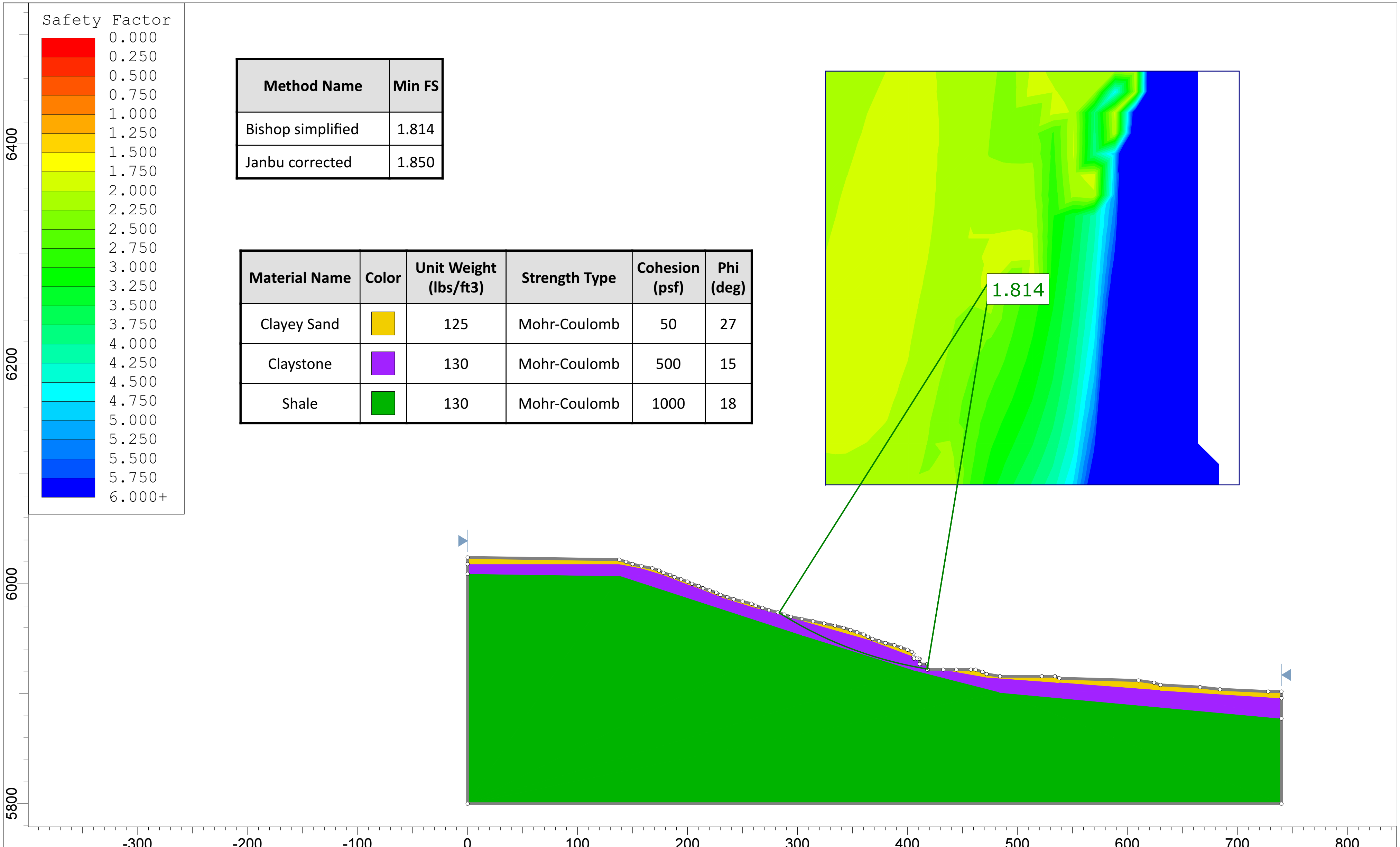
SLIDEINTERPRET 7.038

Project	The Ridge at Spring Creek Filing No. 1		
Analysis Description	A-A Existing		
Drawn By	Jared	*Scale* 1:1486	*Company* RMG
Date	10/14/2024		*File Name* SlideA-A2_Existing.slim



Method Name	Min FS
Bishop simplified	1.814
Janbu corrected	1.850

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Clayey Sand		125	Mohr-Coulomb	50	27
Claystone		130	Mohr-Coulomb	500	15
Shale		130	Mohr-Coulomb	1000	18

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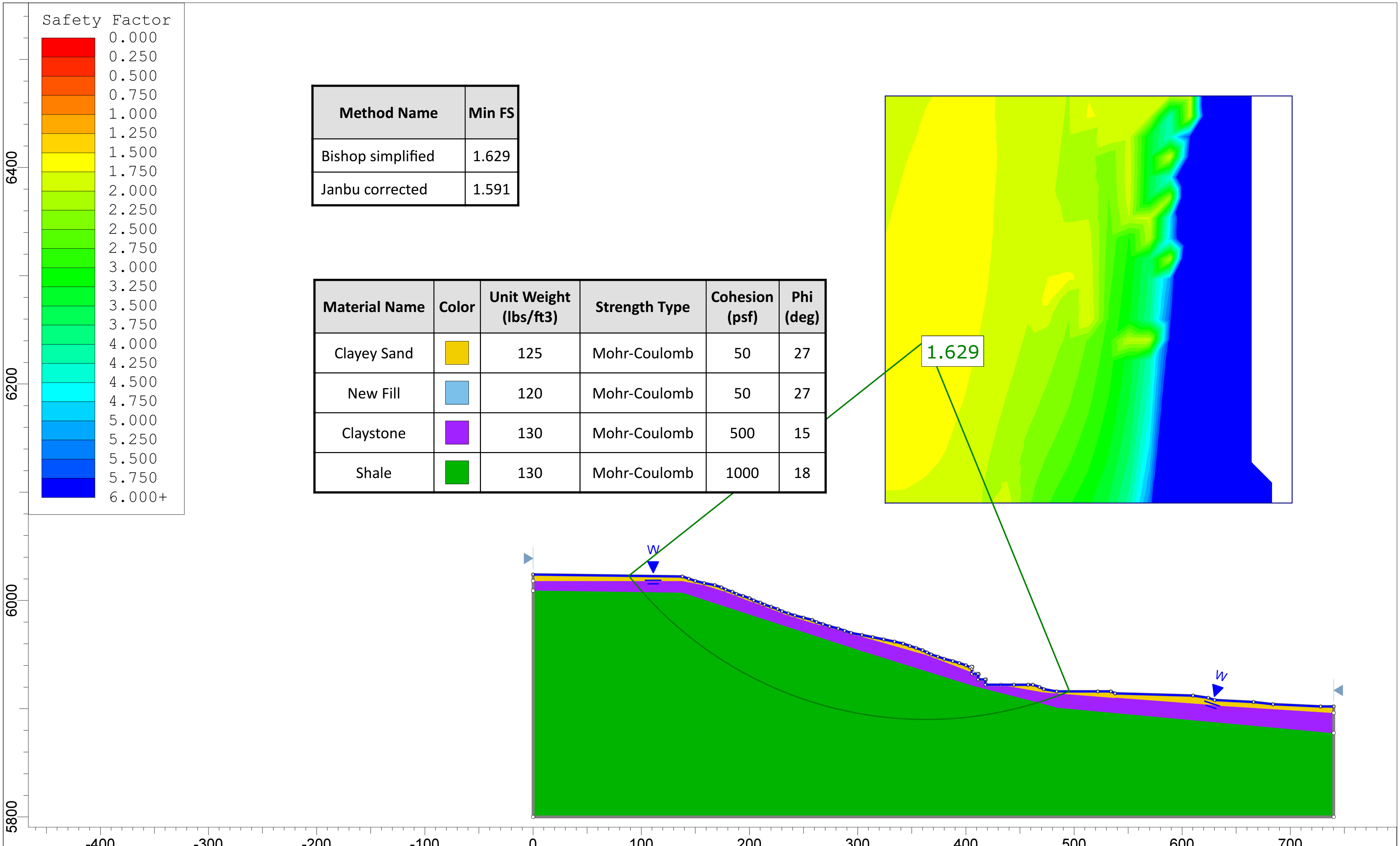
SLIDEINTERPRET 7.038

Project	The Ridge at Spring Creek Filing No. 1		
Analysis Description	A-A Construction		
Drawn By	Jared	*Scale* 1:1449	*Company* RMG
Date	10/14/2024	*File Name*	SlideA-A2_Precon.slim



Method Name	Min FS
Bishop simplified	1.629
Janbu corrected	1.591

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Clayey Sand		125	Mohr-Coulomb	50	27
New Fill		120	Mohr-Coulomb	50	27
Claystone		130	Mohr-Coulomb	500	15
Shale		130	Mohr-Coulomb	1000	18

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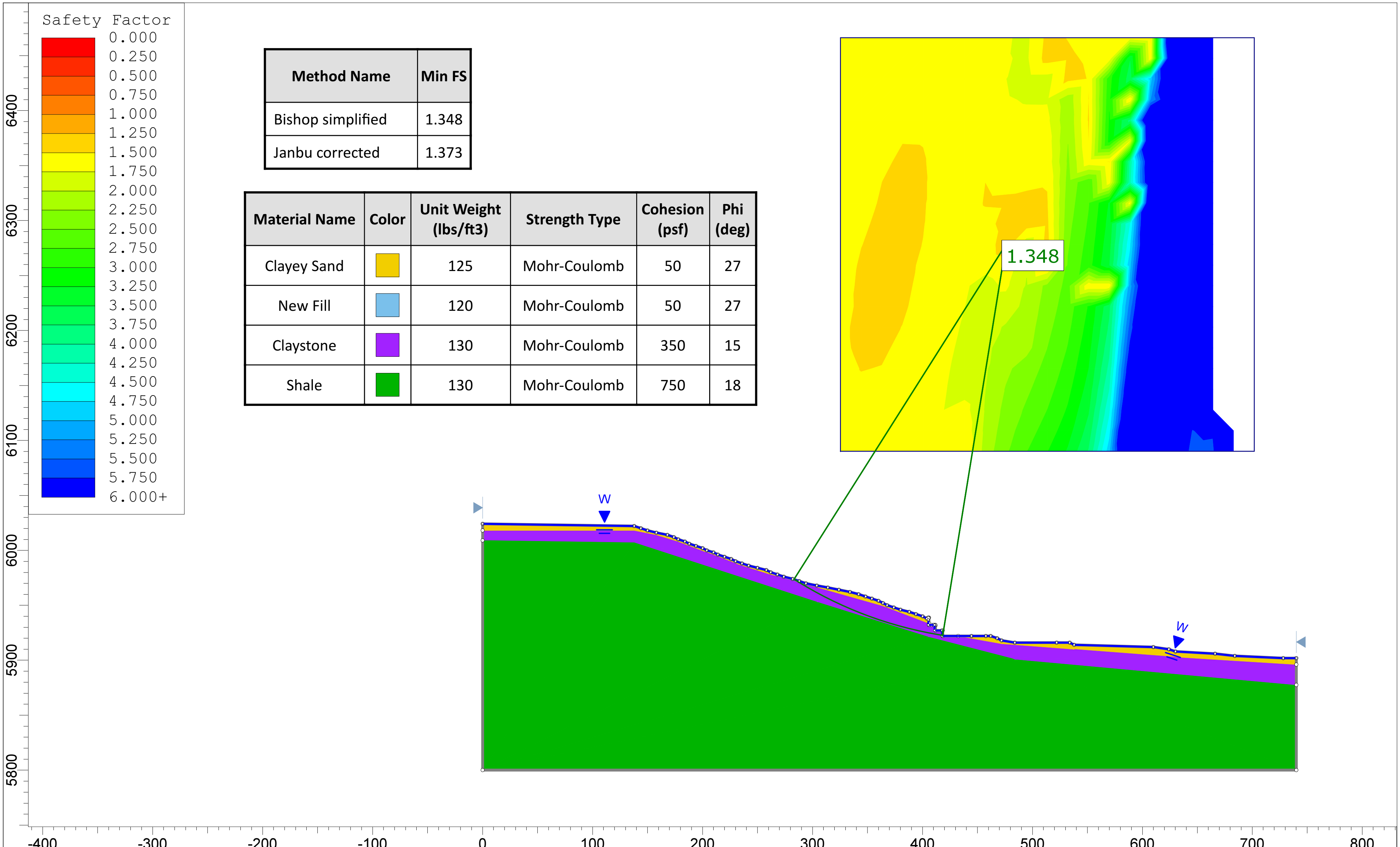
SLIDEINTERPRET 7.038

Project	The Ridge at Spring Creek Filing No. 1		
Analysis Description	A-A Post-Construction with water		
Drawn By Jared	*Scale* 1:1473	*Company*	RMG
Date	10/14/2024	*File Name*	SlideA-A2_Con with water.slim



Method Name	Min FS
Bishop simplified	1.348
Janbu corrected	1.373

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Clayey Sand		125	Mohr-Coulomb	50	27
New Fill		120	Mohr-Coulomb	50	27
Claystone		130	Mohr-Coulomb	350	15
Shale		130	Mohr-Coulomb	750	18

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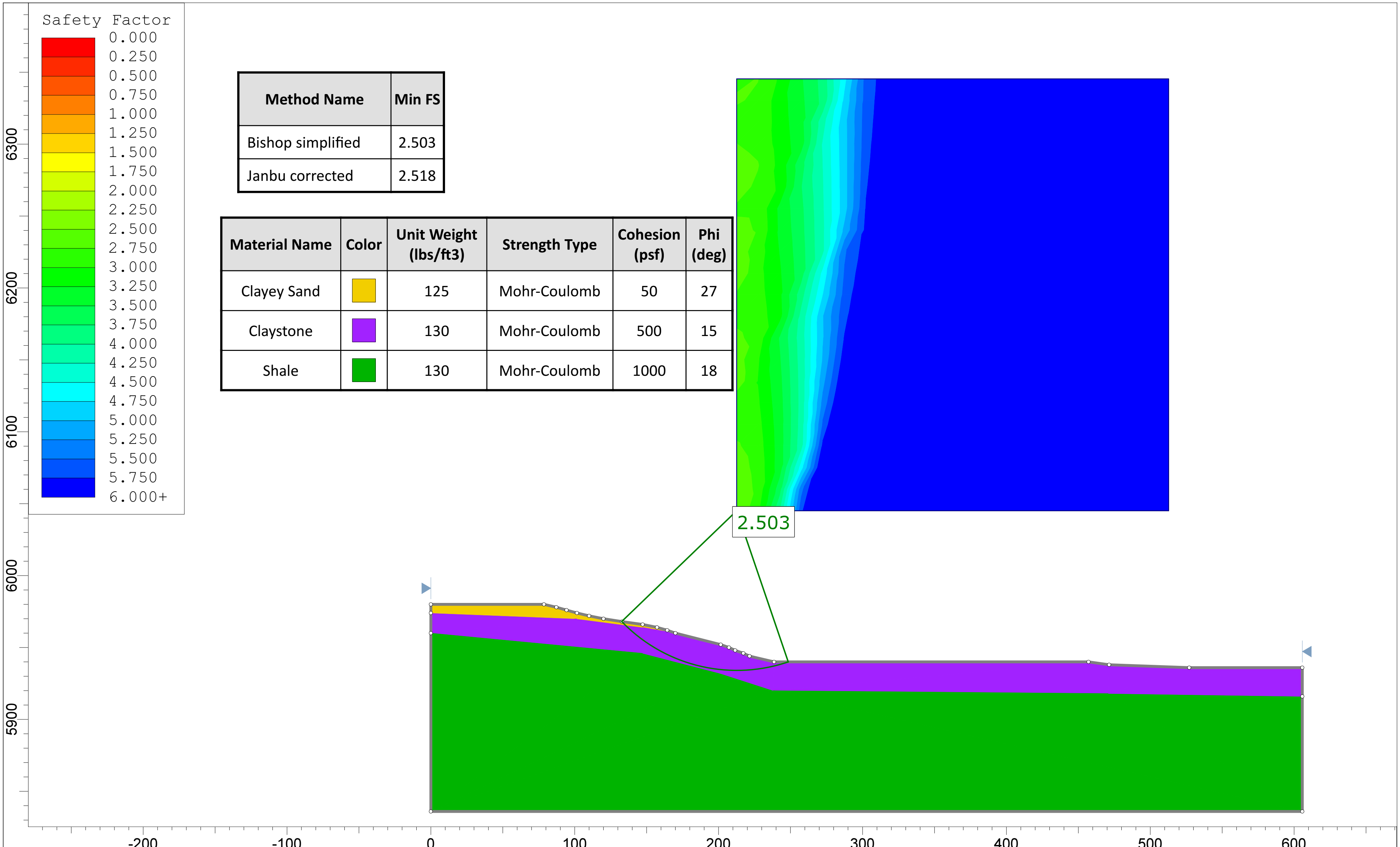
SLIDEINTERPRET 7.038

Project	The Ridge at Spring Creek Filing No. 1		
Analysis Description	A-A Post-Construction with water sensitivity		
Drawn By	Jared	*Scale* 1:1449	*Company* RMG
Date	10/14/2024	*File Name*	SlideA-A2_Con with water sensitivity.slim



Method Name	Min FS
Bishop simplified	2.503
Janbu corrected	2.518

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Clayey Sand		125	Mohr-Coulomb	50	27
Claystone		130	Mohr-Coulomb	500	15
Shale		130	Mohr-Coulomb	1000	18

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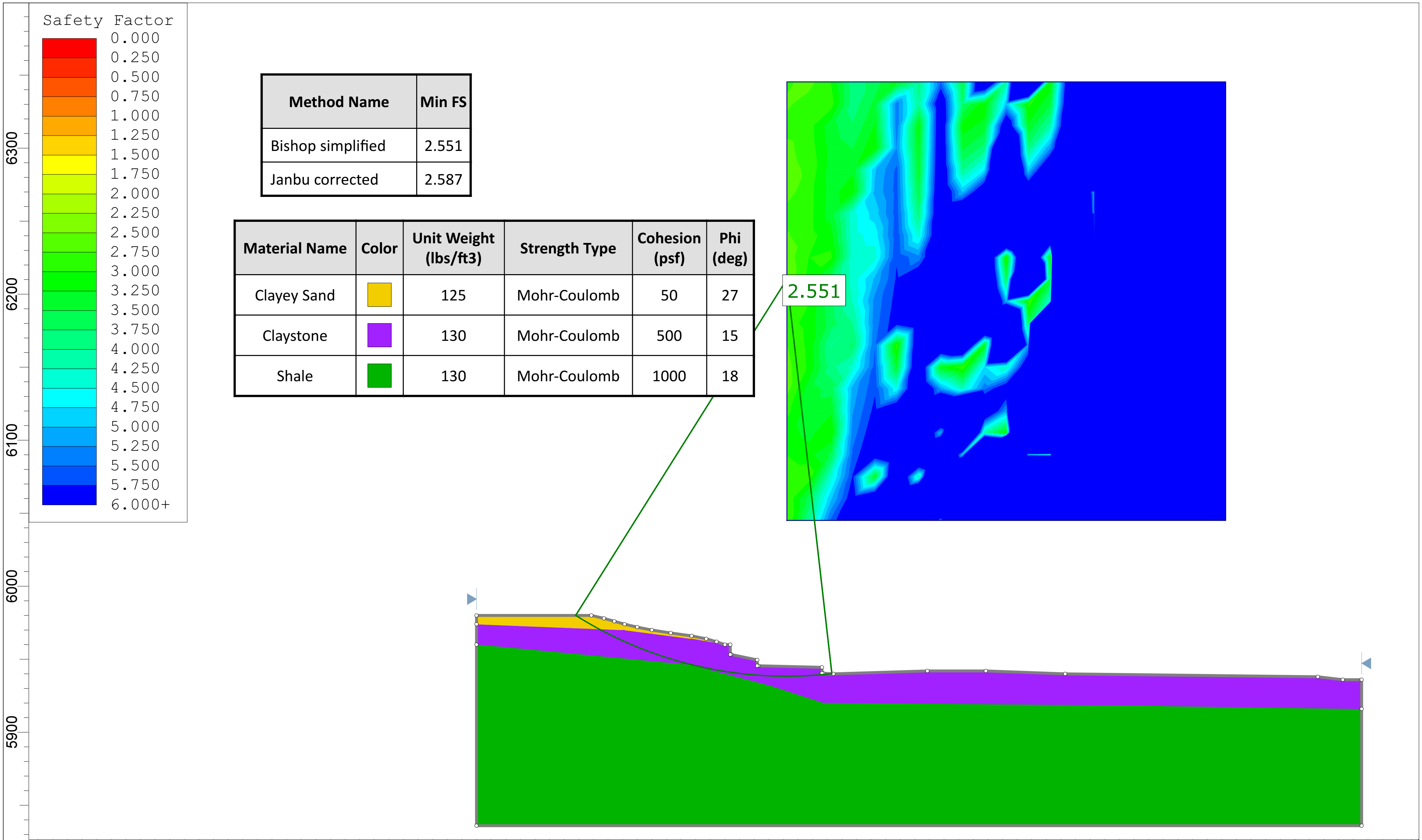
SLIDEINTERPRET 7.038

Project	The Ridge at Spring Creek B-B
Analysis Description	B-B existing
Drawn By	Jared
Scale	1:1108
Company	RMG
Date	10/14/2024
File Name	SlideB-B_Existing.slim



Method Name	Min FS
Bishop simplified	2.551
Janbu corrected	2.587

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Clayey Sand		125	Mohr-Coulomb	50	27
Claystone		130	Mohr-Coulomb	500	15
Shale		130	Mohr-Coulomb	1000	18

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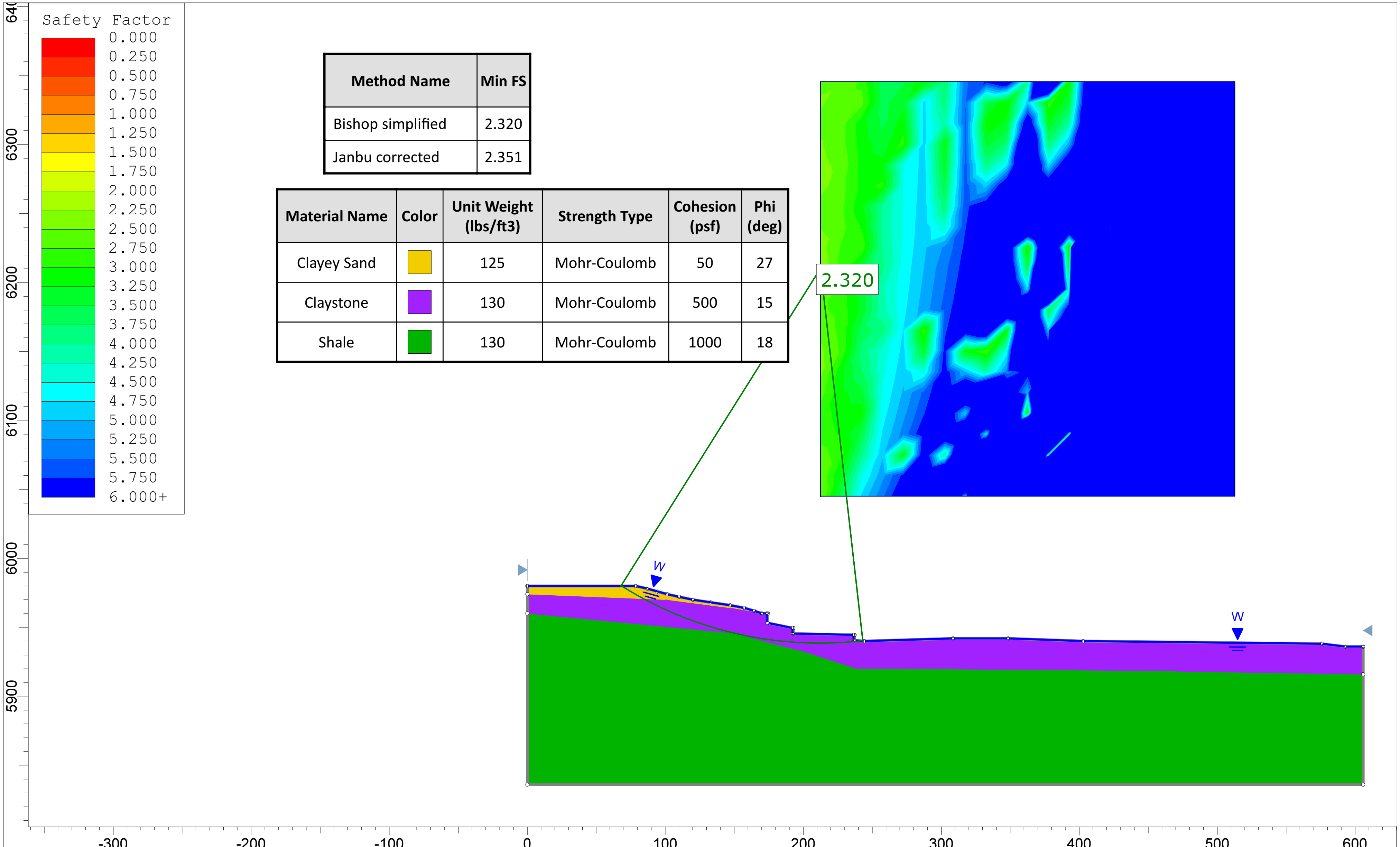
SLIDEINTERPRET 7.038

Project	The Ridge at Spring Creek B-B
Analysis Description	B-B Construction
Drawn By	Jared
Scale	1:1108
Company	RMG
Date	10/14/2024
File Name	SlideB-B_Precon.slim



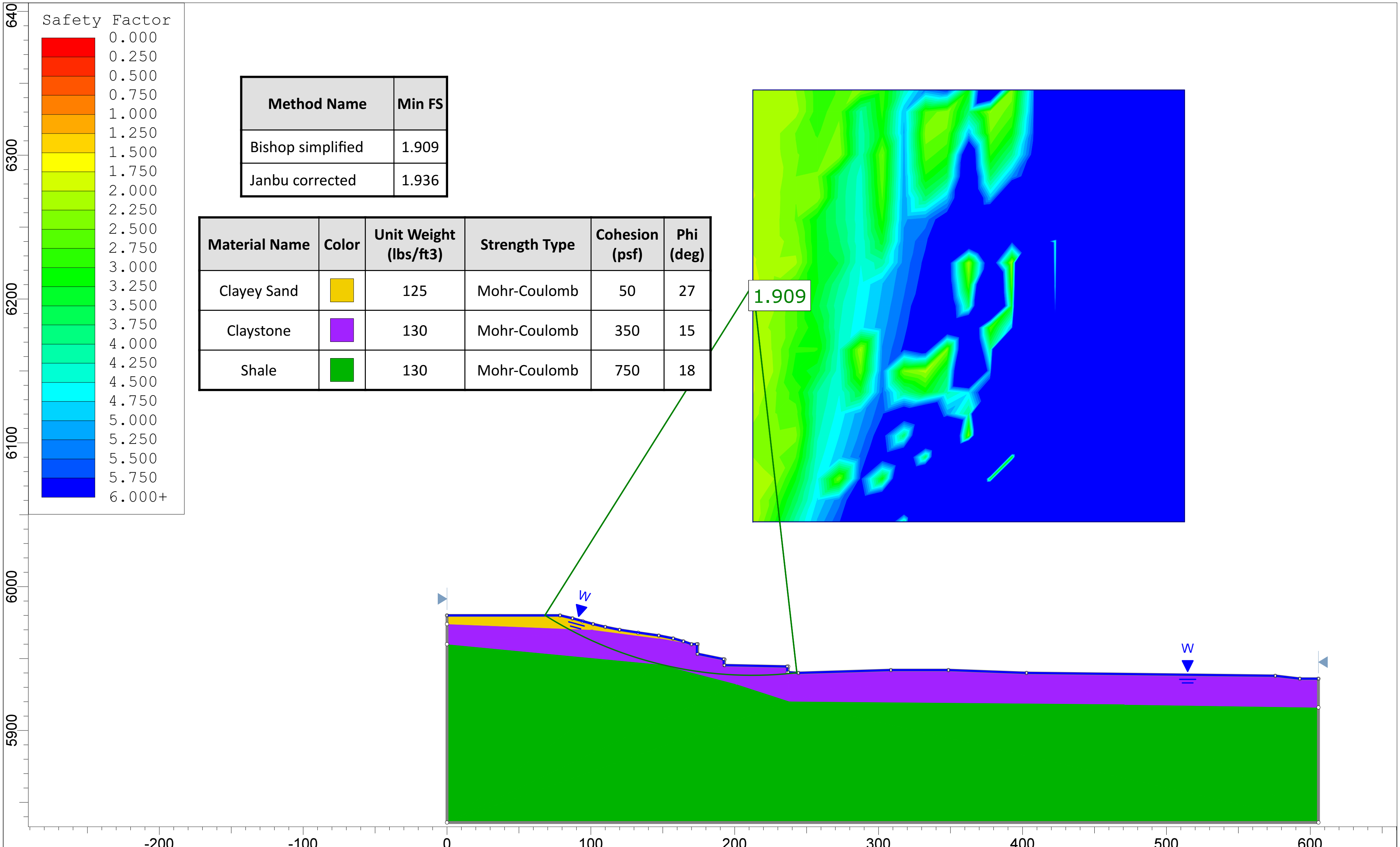
Method Name	Min FS
Bishop simplified	2.320
Janbu corrected	2.351

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Clayey Sand		125	Mohr-Coulomb	50	27
Claystone		130	Mohr-Coulomb	500	15
Shale		130	Mohr-Coulomb	1000	18

rocscience

SLIDEINTERPRET 7.038

Project	The Ridge at Spring Creek B-B
Analysis Description	B-B Post-Construction with Water
Drawn By	Jared
Scale	1:1155
Company	RMG
Date	10/14/2024
File Name	SlideB-B_ConWater.slim



Method Name	Min FS
Bishop simplified	1.909
Janbu corrected	1.936

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Clayey Sand		125	Mohr-Coulomb	50	27
Claystone		130	Mohr-Coulomb	350	15
Shale		130	Mohr-Coulomb	750	18

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SLIDEINTERPRET 7.038

Project	The Ridge at Spring Creek B-B
Analysis Description	B-B Post-Construction with water sensitivity
Drawn By	Jared
Scale	1:1108
Company	RMG
Date	10/14/2024
File Name	SlideB-B_ConWater sensitivity.slim

APPENDIX C

Test Boring Logs and Laboratory Results
RMG – Rocky Mountain Group (Job No. 182625, 2021)

TEST BORING: 1

DATE DRILLED: 3/8/21

NO GROUNDWATER ON 3/8/21

Description	Depth (ft)	Blows per ft.	Water content %
CLAY, SANDY, brown to gray, stiff to very stiff, moist	5	16	9.6
	10	16	15.6
	15	32	11.5
	20	22	13.3
	25	19	13.2
	30	18	12.7
CLAYSTONE, SANDY, brown, hard, moist	35	50/8"	14.0
	40	50/6"	13.0

TEST BORING: 2

DATE DRILLED: 3/8/21

NO GROUNDWATER ON 3/8/21

Description	Depth (ft)	Blows per ft.	Water content %
CLAY, SANDY, brown to gray, stiff to very stiff, moist	5	19	12.6
	10	20	9.6
	15	9	13.1
	20	21	13.9
SANDSTONE, CLAYEY, brown, hard, moist	25	50/10"	8.9

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Architectural
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ARCHITECTS RMG ENGINEERS

Geotechnical
Materials Testing
Civil, Planning

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

TEST BORING LOG

JOB No. 182625

FIGURE No. 4

DATE Apr/09/2021

TEST BORING: **3**

DATE DRILLED: 3/8/21
NO GROUNDWATER ON 3/8/21

Description	Depth (FT)	Samples	Blows per ft.	Water content %
FILL: SAND, CLAYEY, brown, moist	0–1			
SAND, CLAYEY, light brown, very dense, moist	1–5	4–5	50/10"	10.3
CLAYSTONE, SANDY, brown with rust staining, hard to very hard, moist	5–15	9–10	50/7"	11.3
		14–15	50/6"	42.7

TEST BORING: **4**

DATE DRILLED: 3/8/21
NO GROUNDWATER ON 3/8/21

Description	Depth (FT)	Samples	Blows per ft.	Water content %
CLAYSTONE, SANDY, brown, hard , moist	0–11	4–5	50/8"	10.9
		9–10	50/6"	12.1
SHALE, SANDY, grey, hard, moist	11–15	14–15	50/5"	8.3

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ARCHITECTS RMG ENGINEERS

Geotechnical
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Colorado Springs: (Corporate Office)
2910 Austin Bluffs Parkway
Colorado Spings, CO 80918
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TEST BORING LOG

JOB No. 182625

FIGURE No. 5

DATE Apr/09/2021

TEST BORING: 5

DATE DRILLED: 3/8/21

NO GROUNDWATER ON 3/8/21

Description	Depth (ft)	Sample	Blows per ft.	Water content %
SAND, CLAYEY, brown, medium dense, moist	5	■	24	4.3
	10	■	24	7.2
	15	■	21	9.4
CLAY, SANDY, light brown, very stiff, moist	20	■	20	10.6

TEST BORING: 6

DATE DRILLED: 3/8/21

NO GROUNDWATER ON 3/8/21

Description	Depth (ft)	Sample	Blows per ft.	Water content %
FILL: CLAY, SANDY, brown, very stiff, moist	5	■	20	11.1
SAND, SILTY, brown, loose, brown	10	■	6	5.5
	15	■	9	5.3
CLAYSTONE, SANDY, light brown, firm, moist	20	■	25	11.8

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Colorado Springs: (Corporate Office)
2910 Austin Bluffs Parkway
Colorado Spings, CO 80918
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TEST BORING LOG

JOB No. 182625

FIGURE No. 6

DATE Apr/09/2021

TEST BORING: **7** DATE DRILLED: 3/8/21 NO GROUNDWATER ON 3/8/21	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SAND, SILTY, light brown, moist					
CLAYSTONE, SANDY, light brown, hard, moist	5			50/6"	10.3
	10			50/6"	11.8
	15			50/6"	12.1

TEST BORING: **8** DATE DRILLED: 3/8/21 NO GROUNDWATER ON 3/8/21	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAYSTONE, SANDY, light brown, medium hard to hard, moist	5			30	8.0
	10			50/7"	12.3
	15			50/6"	7.3

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

TEST BORING LOG

JOB No. 182625

FIGURE No. 7

DATE Apr/09/2021

TEST BORING: **9** DATE DRILLED: 3/8/21 NO GROUNDWATER ON 3/8/21	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
WEATHERED CLAYSTONE, SANDY, light brown, weathered to hard, moist	5			12	12.4
	10			50/9"	16.0
	15			50/9"	12.9

TEST BORING: **10** DATE DRILLED: 3/8/21 NO GROUNDWATER ON 3/8/21	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
FILL: SAND, SILTY, light brown, loose to medium dense, moist	5			20	4.2
SAND, SILTY, light brown to tan, loose to medium dense, moist	10			7	5.5
	15			10	8.0
	20			9	6.6

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TEST BORING LOG

JOB No. 182625

FIGURE No. 8

DATE Apr/09/2021

TEST BORING: **11** DATE DRILLED: 3/8/21 NO GROUNDWATER ON 3/8/21	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
CLAYSTONE, SANDY, light brown, medium hard to hard, moist					
	5		■	41	15.7
	10		■	50/6"	12.7
SHALE, SANDY, blue to gray, hard, moist					
	15		■	50/4"	11.3

TEST BORING: **12** DATE DRILLED: 3/8/21 NO GROUNDWATER ON 3/8/21	DEPTH (FT)	SYMBOL	SAMPLES	BLOWS PER FT.	WATER CONTENT %
SAND, SILTY, brown, loose to medium dense, moist					
	5		■	9	30.9
	10		■	19	3.2
CLAYSTONE, SANDY, light brown, firm to hard, moist	15		■	21	9.9
	20		■	50/8"	11.7

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TEST BORING LOG

JOB No. 182625

FIGURE No. 9

DATE Apr/09/2021

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	FHA Expansion Pressure (psf)	% Swell/ Collapse	USCS Classification
1	4.0	9.6								
1	9.0	15.6								
1	14.0	11.5	100.8	31	13	0.0	58.8	1000	- 2.7	CL
1	19.0	13.3								
1	24.0	13.2								
1	29.0	12.7								
1	34.0	14.0		38	23	0.0	87.7			CL
1	39.0	13.0								
2	4.0	12.6	102.2	33	20	2.5	44.6	1000	- 1.3	SC
2	9.0	9.6								
2	14.0	13.1								
2	19.0	13.9								
2	24.0	8.9								
3	4.0	10.3								
3	9.0	11.3		35	20	0.0	75.1			CL
3	14.0	42.7								
4	4.0	10.9								
4	9.0	12.1								
4	14.0	8.3	91.2	36	22	0.0	82.3	1000	- 5.6	CL
5	4.0	4.3		30	15	33.6	18.0			SC
5	9.0	7.2								
5	14.0	9.4								
5	19.0	10.6								
6	4.0	11.1		37	22		79.4			CL
6	9.0	5.5								
6	14.0	5.3								
6	19.0	11.8								
7	4.0	10.3								
7	9.0	11.8	119.2	32	8		40.1	1000	0.6	SM
7	14.0	12.1								
8	4.0	8.0					47.9			
8	9.0	12.3								
8	14.0	7.3								
9	4.0	12.4	116.9					1000	- 0.1	

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SUMMARY OF LABORATORY TEST RESULTS

JOB No. 182625
FIGURE No. 10
PAGE 1 OF 2
DATE Apr/09/2021

Test Boring No.	Depth	Water Content (%)	Dry Density (pcf)	Liquid Limit	Plasticity Index	% Retained No.4 Sieve	% Passing No. 200 Sieve	FHA Expansion Pressure (psf)	% Swell/ Collapse	USCS Classification
9	9.0	16.0					68.9			
9	14.0	12.9								
10	4.0	4.2				27.1	11.3			
10	9.0	5.5								
10	14.0	8.0								
10	19.0	6.6								
11	4.0	15.7								
11	9.0	12.7								
11	14.0	11.3		36	21		63.2			CL
12	4.0	30.9								
12	9.0	3.2				0.0	9.7			
12	14.0	9.9								
12	19.0	11.7								

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SUMMARY OF LABORATORY TEST RESULTS

JOB No. 182625
FIGURE No. 10
PAGE 2 OF 2
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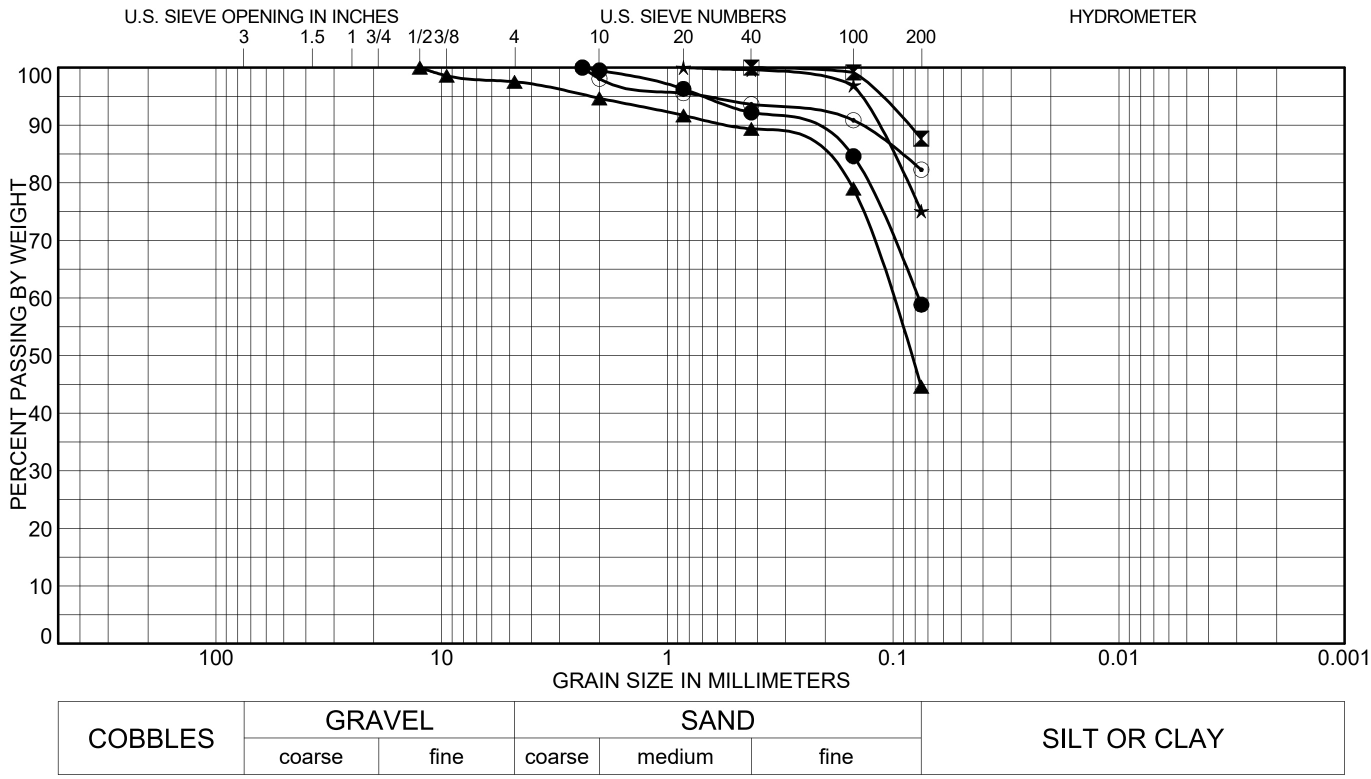

	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	**1**	**14.0**	**SANDY LEAN CLAY(CL)**	**31**	**18**	**13**
⧗	**1**	**34.0**	**LEAN CLAY(CL)**	**38**	**15**	**23**
▲	**2**	**4.0**	**CLAYEY SAND(SC)**	**33**	**13**	**20**
★	**3**	**9.0**	**LEAN CLAY with SAND(CL)**	**35**	**15**	**20**
☉	**4**	**14.0**	**LEAN CLAY with SAND(CL)**	**36**	**14**	**22**

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	**1**	**14.0**	**0.0**	**41.2**	**58.8**	
⧗	**1**	**34.0**	**0.0**	**12.3**	**87.7**	
▲	**2**	**4.0**	**2.5**	**52.9**	**44.6**	
★	**3**	**9.0**	**0.0**	**24.9**	**75.1**	
☉	**4**	**14.0**	**0.0**	**17.7**	**82.3**	

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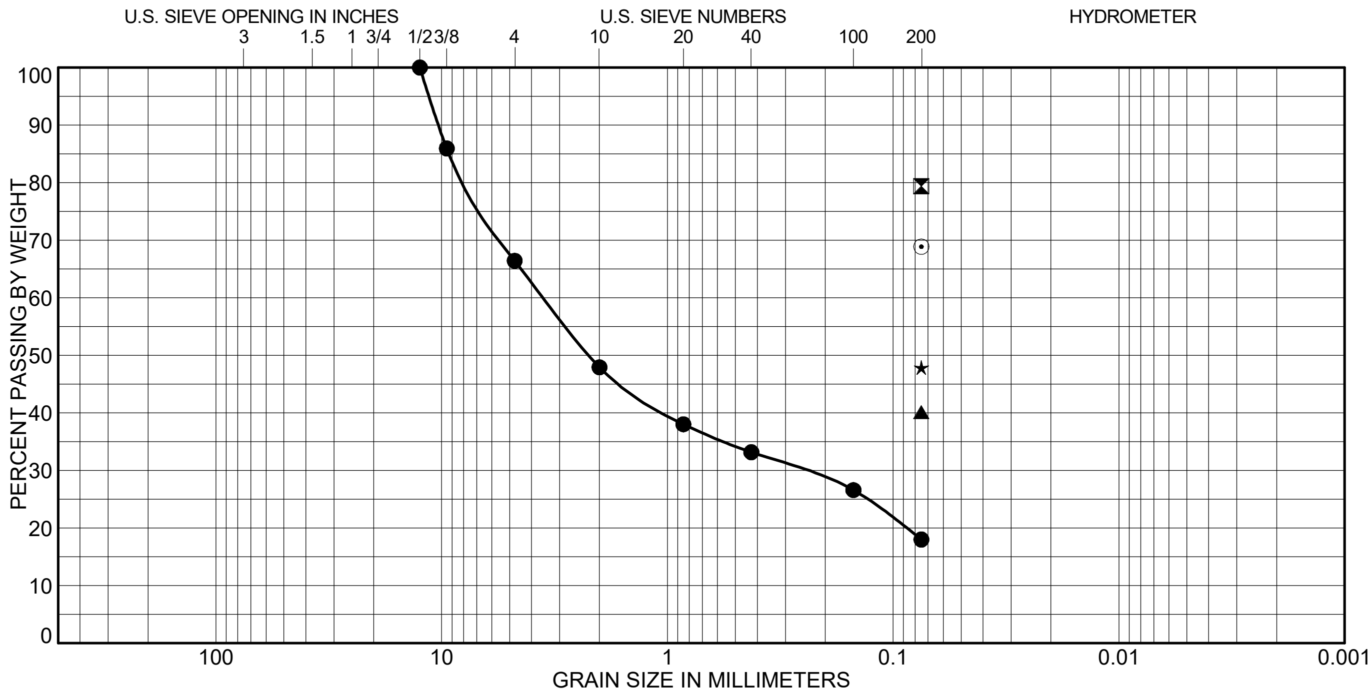
SOIL CLASSIFICATION DATA

JOB No. 182625

FIGURE No. 11

DATE Apr/09/2021



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	**5**	**4.0**	**CLAYEY SAND with GRAVEL(SC)**	**30**	**15**	**15**
⧗	**6**	**4.0**	**LEAN CLAY with SAND(CL)**	**37**	**15**	**22**
▲	**7**	**9.0**	**SILTY SAND(SM)**	**32**	**24**	**8**
★	**8**	**4.0**				
⊙	**9**	**9.0**				

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	**5**	**4.0**	**33.6**	**48.4**	**18.0**	
⧗	**6**	**4.0**			**79.4**	
▲	**7**	**9.0**			**40.1**	
★	**8**	**4.0**			**47.9**	
⊙	**9**	**9.0**			**68.9**	

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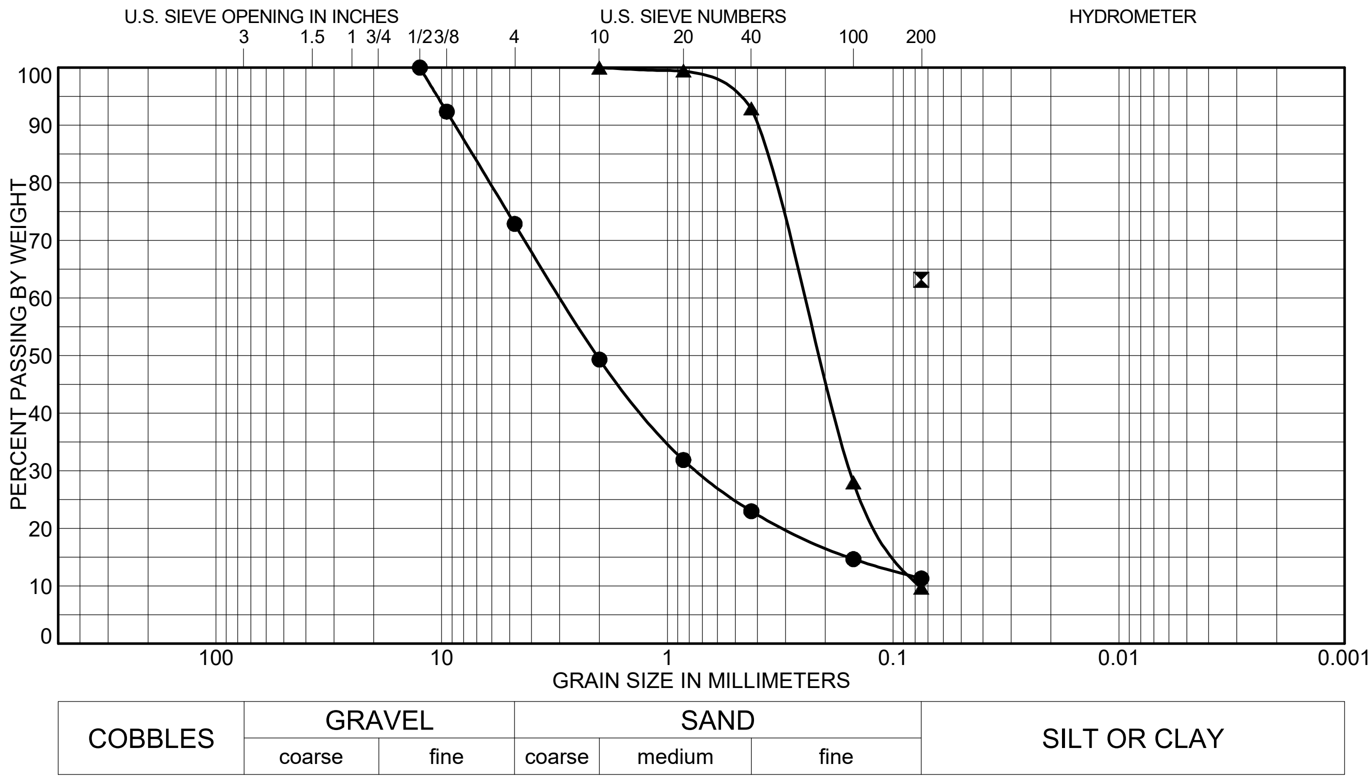
SOIL CLASSIFICATION DATA

JOB No. 182625

FIGURE No. 12

DATE Apr/09/2021



	Test Boring	Depth (ft)	Classification	LL	PL	PI
●	**10**	**4.0**				
⧗	**11**	**14.0**	**SANDY LEAN CLAY(CL)**	**36**	**15**	**21**
▲	**12**	**9.0**				

	Test Boring	Depth (ft)	%Gravel	%Sand	%Silt	%Clay
●	**10**	**4.0**	**27.1**	**61.6**	**11.3**	
⧗	**11**	**14.0**			**63.2**	
▲	**12**	**9.0**	**0.0**	**90.3**	**9.7**	

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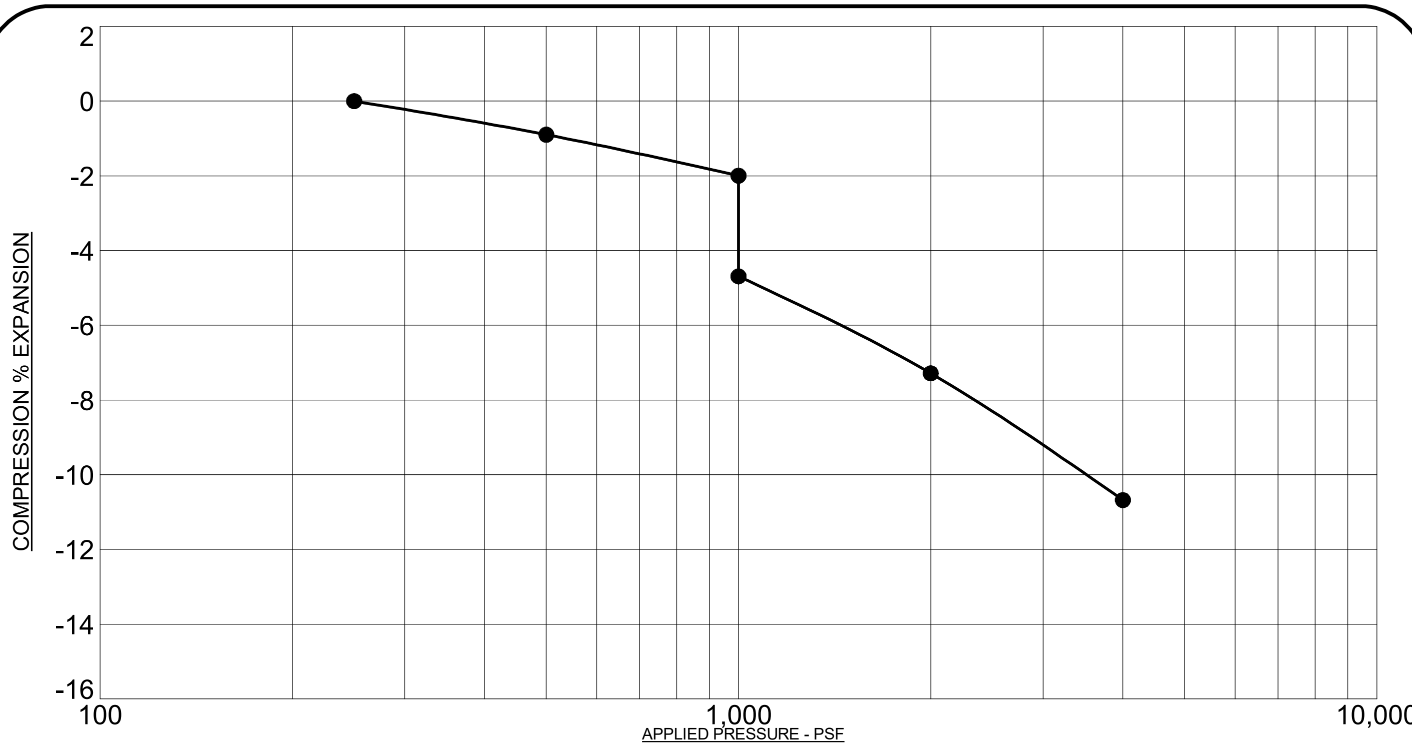
SOIL CLASSIFICATION DATA

JOB No. 182625

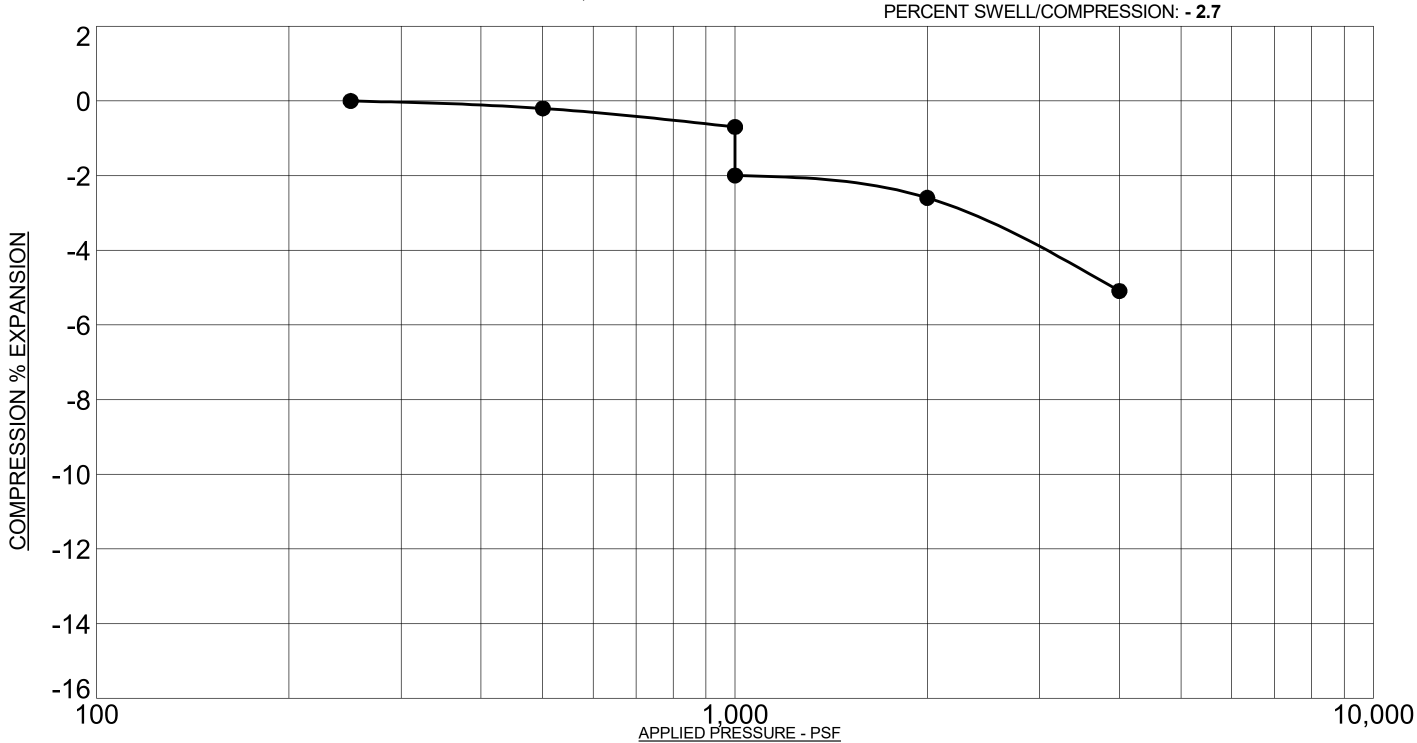
FIGURE No. 13

DATE Apr/09/2021



PROJECT: **The Ridge at Spring Creek, Filing No. 1, Colorado Springs, Colorado**
SAMPLE DESCRIPTION: **CLAY, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **1 @ 14 FT**
NATURAL DRY UNIT WEIGHT: **100.8 PCF**
NATURAL MOISTURE CONTENT: **9.6%**
PERCENT SWELL/COMPRESSION: **- 2.7**



PROJECT: **The Ridge at Spring Creek, Filing No. 1, Colorado Springs, Colorado**
SAMPLE DESCRIPTION: **FILL: SAND, CLAYEY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **2 @ 4 FT**
NATURAL DRY UNIT WEIGHT: **102.2 PCF**
NATURAL MOISTURE CONTENT: **12.6%**
PERCENT SWELL/COMPRESSION: **- 1.3**

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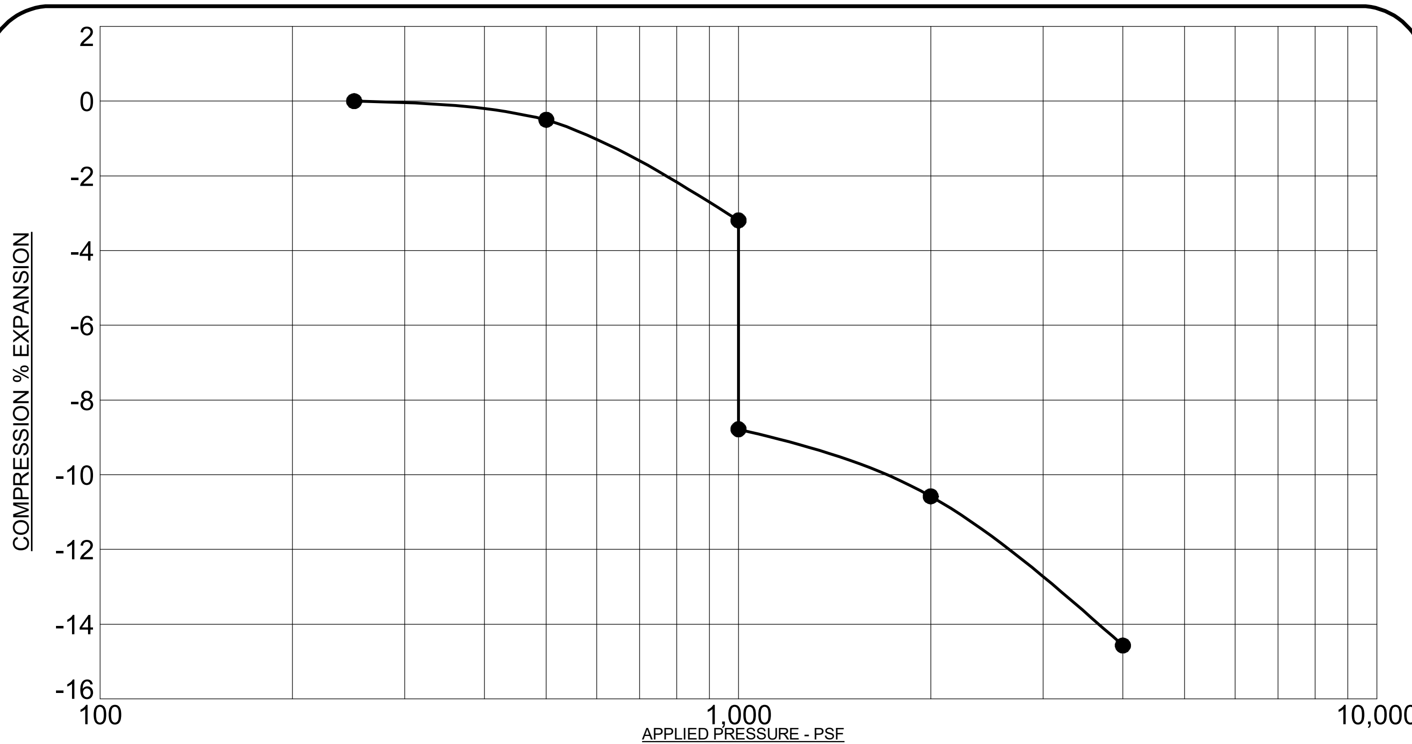
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 182625

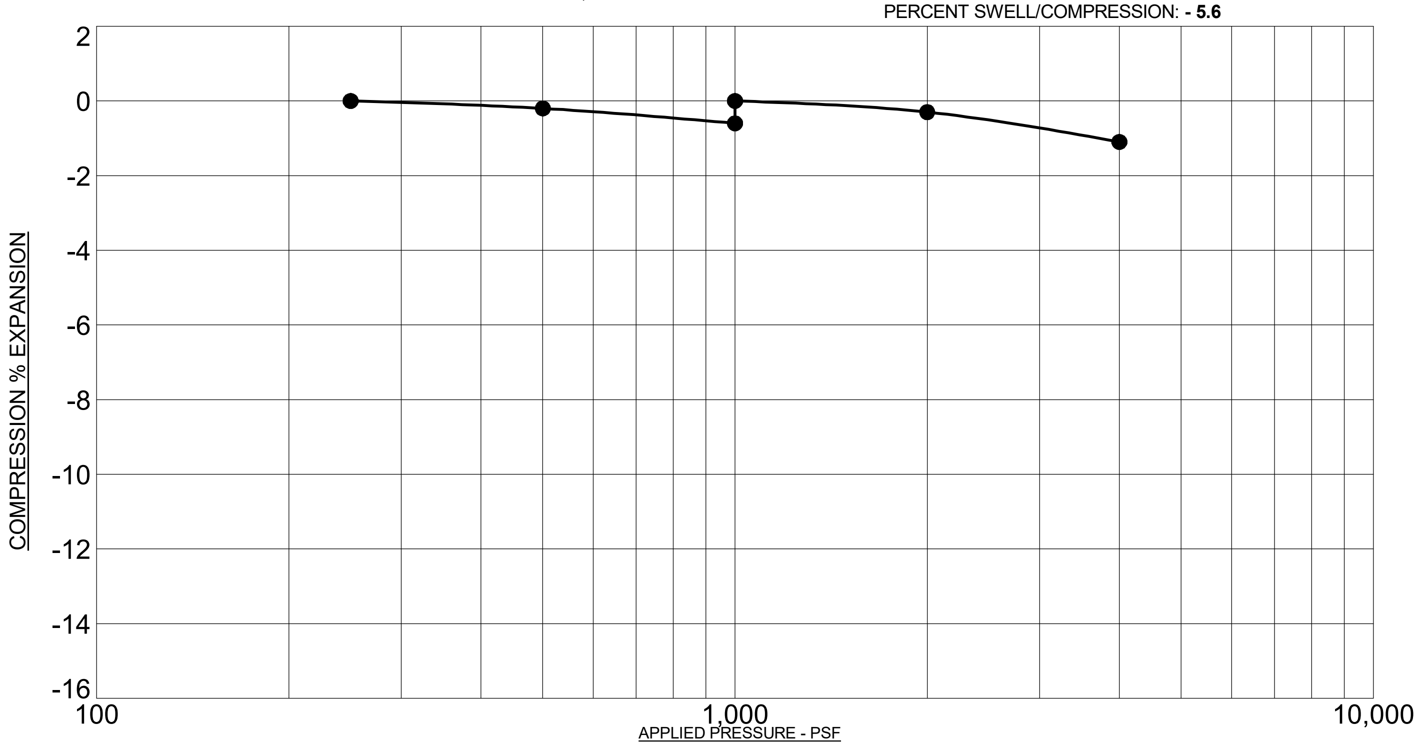
FIGURE No. 14

DATE Apr/09/2021



PROJECT: **The Ridge at Spring Creek, Filing No. 1, Colorado Springs, Colorado**
SAMPLE DESCRIPTION: **SHALE, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **4 @ 14 FT**
NATURAL DRY UNIT WEIGHT: **91.2 PCF**
NATURAL MOISTURE CONTENT: **8.3%**
PERCENT SWELL/COMPRESSION: **- 5.6**



PROJECT: **The Ridge at Spring Creek, Filing No. 1, Colorado Springs, Colorado**
SAMPLE DESCRIPTION: **CLAYSTONE, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **7 @ 9 FT**
NATURAL DRY UNIT WEIGHT: **119.2 PCF**
NATURAL MOISTURE CONTENT: **11.8%**
PERCENT SWELL/COMPRESSION: **0.6**

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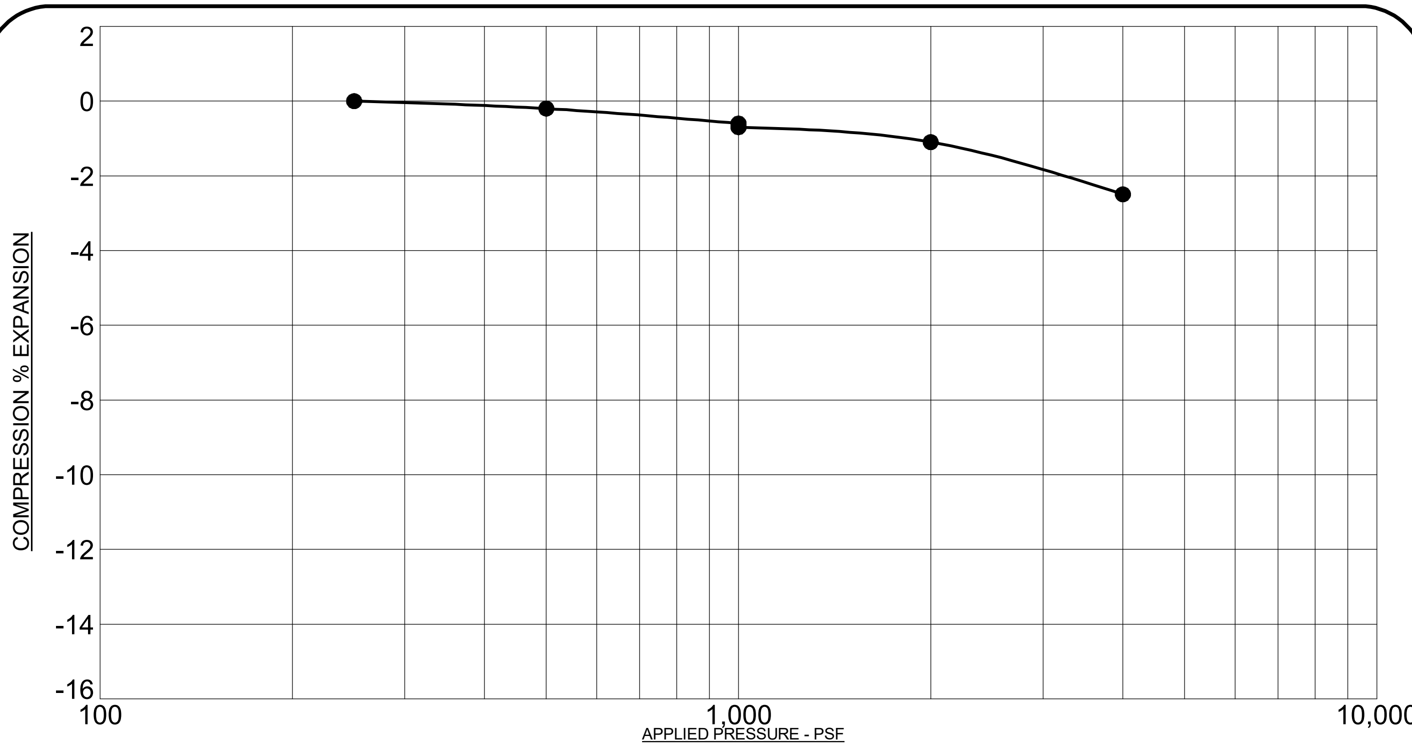
SWELL/CONSOLIDATION TEST RESULTS

JOB No. 182625

FIGURE No. 15

DATE Apr/09/2021



PROJECT: **The Ridge at Spring Creek, Filing No. 1, Colorado Springs, Colorado**
SAMPLE DESCRIPTION: **CLAYSTONE, SANDY**
NOTE: SAMPLE WAS INUNDATED WITH WATER AT 1,000 PSF

SAMPLE LOCATION: **9 @ 4 FT**
NATURAL DRY UNIT WEIGHT: **116.9 PCF**
NATURAL MOISTURE CONTENT: **12.4%**
PERCENT SWELL/COMPRESSION: **- 0.1**

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SWELL/CONSOLIDATION TEST RESULTS

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FIGURE No. 16

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