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SOIL, GEOLOGY, AND GEOLOGIC HAZARD STUDY
STERLING RANCH FILING NO. 4
PARCEL 10
EL PASO COUNTY, COLORADO

Prepared for

Classic SRJ
2138 Flying Horse Club Drive
Colorado Springs, Colorado 80921

Attn: Loren Moreland

May 25, 2022
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Respectfully Submitted,

ENTECH ENGINEERING, INC.

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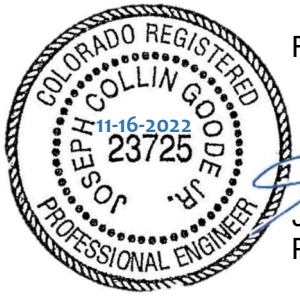
Geologist



Reviewed by:

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LLL

Encl.

Entech Job No. 220921
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1.0 SUMMARY

Project Location:

The project lies in portions of the SW ¼ Section 33, Township 12 South, and NW ¼ Section 4, Township 13 South, Range 65 West of the 6th Principal Meridian. The site is located east of Vollmer Road and north of Woodmen Road, along proposed Sterling Ranch Road, south of Dines Road in El Paso County, Colorado.

Project Description:

Total acreage involved in the project is approximately 57 acres. The proposed development is to consist of one-hundred and forty-eight single-family residential lots with associated site improvements. The development will be serviced by Sterling Ranch Metropolitan District.

Scope of Report:

The report presents the results of our geologic investigation and treatment of engineering geologic hazard study. This report presents the results of our geologic reconnaissance, a review of available maps, aerial photographs and our conclusions with respect to the impacts of the geologic conditions on development.

Land Use and Engineering Geology:

The site was found to be suitable for development. Geologic conditions will impose some constraints on development. These include areas of artificial fill, potentially expansive soils, hydrocompaction, and areas of seasonal and potentially seasonal shallow groundwater. Artificial fill is associated with recent grading and fill stockpiles. Hydrocompaction is associated with wind-blown sand deposits. Areas of seasonal and potentially seasonal shallow groundwater occur in a drainage in the western portion of the site and in southern areas of the site. Shallow bedrock will also be encountered on portions of the site. Site conditions will be discussed in greater detail in this report. All recommendations are subject to the limitations discussed in the report.

2.0 GENERAL SITE CONDITIONS AND PROJECT DESCRIPTION

The project lies in portions of SW ¼ Section 33, Township 12 South, and NW ¼ Section 4, Township 13 South, Range 65 West of the 6th Principal Meridian. The site is located east of Vollmer Road and north of Woodmen Road, along proposed Sterling Ranch Road, south of Dines Road in El Paso County, Colorado. The location of the site is shown on the Vicinity Map, Figure 1.

The topography of the site is generally gently sloping to the south with moderate slopes along the drainage in the western portion of the site, which flows in a southerly direction. An existing detention pond exists in the southern portion of the site. The area of the site is indicated on the USGS Map, Figure 2. Previous site uses have included aggregate extraction as a part of the Pioneer Sand Quarry. Existing sand and gravel quarries lie to the southeast of the site. The vegetation on site consists of low field grasses, weeds with areas where vegetation has been removed.

Total acreage involved in the proposed development is approximately 57 acres. The proposed development is to consist of one-hundred and forty-eight single-family residential lots with associated site improvements. The development is to be serviced by Sterling Ranch Metropolitan District. The overall site plan for the entire Sterling Ranch Development, including the subject site, is presented in Figure 3. The development plan for Sterling Ranch Filing No. 4 is presented in Figure 4. Site photographs, taken on April 20, 2022, are included in Appendix A. The approximate locations and directions of the photographs are indicated on Figure 4. The proposed grading is indicated on Figure 4.

3.0 SCOPE OF THE REPORT

The scope of this report will include the following:

- A geologic analysis of the site utilizing published geologic data, and subsurface soils information.
- Detailed site-specific mapping of major geographic and geologic features.
- Identification of geologic hazards and impacts on the proposed development.
- Recommended mitigation of geologic hazards where they affect development.

4.0 FIELD INVESTIGATION

Our field investigation consisted of the preparation of a geologic map of bedrock features and significant surficial deposits. The Natural Resources Conservation Service (Reference 1), previously the Soil Conservation Service (Reference 2) survey was reviewed to evaluate the site.

The positions of mappable units within the subject property are shown on the Geologic Map. Our mapping procedures involved field reconnaissance, measurements and interpretation. The same mapping procedures have also been utilized to produce the Engineering Geology Map which identifies pertinent geologic conditions affecting development.

Four (4) test borings were drilled by Entech Engineering, Inc. as a part of this investigation. The borings were drilled with a power-driven continuous flight auger drill rig to 20 feet. Samples were obtained during drilling using the Standard Penetration Test, ASTM D-1586, utilizing a 2-inch O.D. Split Barrel Sampler and a California Sampler. Results of the penetration tests are shown on the drilling logs to the right of the sampling point. The location of the test borings is shown on the Test Boring Location Plan, Figure 4. The drilling logs are included in Appendix B.

Laboratory testing was performed to classify and determine the soils engineering characteristic. Laboratory tests included moisture content, ASTM D-2216, grain size analysis, ASTM D-422, and Atterberg Limits, ASTM D-4318. Swell tests included FHA Swell Testing and Swell/Consolidation

Testing, ASTM D-4546. Results of the laboratory testing are included in Appendix C. A Summary of Laboratory Test Results is presented in Table 1.

Geologic Hazard Studies were previously performed by Entech Engineering, Inc. for the entire Sterling Ranch development, October 31, 2006 (Reference 3) and January 20, 2009 (Reference 4). The filing was also included in a previous investigation for Sterling Ranch Phase 2, and Sterling Ranch Filing No. 3 revised date May 4, 2021 (Reference 5). Four of the test borings from the previous investigations were located on the subject site (Test Boring Nos. 2 and 41 (EEI Job No. 82556, and Test Boring Nos. 3 and 4 (EEI Job No. 191089)). The locations of the test borings are indicated on Figure 4. Summary of depth of bedrock and groundwater for all of the test borings is presented in Table 2. The Test Boring Logs and Laboratory Test Results are included in Appendix D. Information from these reports was used in evaluating the site.

5.0 SOIL, GEOLOGY AND ENGINEERING GEOLOGY

5.1 General Geology

Physiographically, the site lies in the western portion of the Great Plains Physiographic Province. Approximately 10 miles to the west is a major structural feature known as Rampart Range Fault. This fault marks the boundary between the Great Plains Physiographic Province and the Southern Rocky Mountain Province. The site exists within the southern edge of a large structural feature known as the Denver Basin. Bedrock in the area tends to be gently dipping in a northeasterly direction (Reference 6). The rocks in the area of the site are sedimentary in nature, and typically Tertiary to Cretaceous in age. The bedrock underlying the site itself is the Dawson Formation. Overlying the Dawson Formation are unconsolidated deposits of artificial fill, residual, and alluvial soils. The site's stratigraphy will be discussed in more detail in Section 5.3.

5.2 Soil Survey

The Natural Resources Conservation Service (Reference 1), previously the Soil Conservation Service (Reference 2) has mapped four soil types on the site (Figure 5). In general, the soils consist of loamy sand. Soils are described as follows:

Type	Description
8	Blakeland Loamy Sand, 1 to 9% slopes
9	Blakeland Fluvaquentic Haplaquolls
19	Columbine Gravelly Sandy Loam, 0 to 3% slopes
71	Pring Coarse Sandy Loam, 3 to 8% slopes

Complete descriptions of the soils are presented in Appendix E (Reference 2). The soils have generally been described to have rapid to very rapid permeabilities. Limitations to development are varied on the different soil types and include frost action potential. Possible hazards with soil erosion are present on the site. The erosion potential can be controlled with vegetation. The soils have been described to have moderate erosion hazards.

5.3 Site Stratigraphy

The Falcon NW Quadrangle Geologic Map showing the site is presented in Figure 6 (Reference 7). The Geology Map prepared for the site is presented in Figure 7. Five mappable units were identified on this site, which are described as follows:

Qaf **Artificial Fill of Quaternary Age:** These are man-made fill deposits associated with a fill pile in the southwestern portion of the site and earthen dams for the ponds located along Sand Creek in the western portions of the site. Other areas of fill may be encountered that are not indicated on the map.

Qal **Recent Alluvium of Quaternary Age:** These are recent stream deposits that have been deposited in the drainage along the western boundary of the site. These materials consist of silty to clayey sands and sandy clays. Some of these alluviums may contain highly organic soils.

Qam **Middle Alluvium of Pleistocene Age:** These materials consist of stream terrace deposits. The Middle Alluvium typically consists of silty to clayey gravelly sands. This deposit is usually highly stratified and may contain lenses of silt, clay or cobbles. This unit correlates to the Broadway Alluvium in the Denver area.

Qes **Eolian Sand of Quaternary Age:** These deposits are fine to medium grained soil deposited on the site by the action of the prevailing winds from the west and northeast. They typically occur as large dune deposits or narrow ridges. These soil types are typically tan to brown in color and tend to have very uniform or well-sorted gradation. These materials tend to have a relatively high permeability and low density.

Tkd **Dawson Formation of Tertiary to Cretaceous Age:** The Dawson formation typically consists of arkosic sandstone with interbedded fine-grained sandstone, siltstone and claystone. Overlying this formation is a variable layer of residual and/or colluvial soils. The residual soils were derived from the in-situ weathering of the bedrock materials on-site. The colluvial soils have been transported by the action of sheetwash and gravity. These soils consisted of silty to clayey sands and sandy clays.

The soils listed above were mapped from site-specific mapping of the site, the *Geologic Map of the Falcon NW Quadrangle* by Madole, 2003 (Reference 7), the *Reconnaissance Geologic Map of Colorado Springs and Vicinity, Colorado* by Scott and Wobus in 1973 (Reference 8), and *the Geologic Map of the Colorado Springs-Castle Rock Area Front Range Urban Corridor, Colorado*, by Trimble and Machette, 1979 (Reference 9). The test borings from the subsurface investigation by Entech Engineering, Inc. were also used in evaluating the site.

5.4 Soil Conditions

Four soil and rock types were encountered in the test borings drilled on the site: Type 1: slightly silty to silty sand (SM-SW, SM), Type 2: sandy clay (CL), Type 3: silty to clayey sandstone bedrock (SM, SC), and Type 4: sandy claystone bedrock (CL). Each material type was classified using the results of the laboratory testing and the Unified Soil Classification System (USCS). The bedrock encountered in the borings was classified as soil in that the upper bedrock zone could be penetrated using conventional soil drilling and sampling techniques.

Soil Type 1 was classified as a slightly silty to silty sand (SM-SW, SM). The sand was encountered in all of the test borings at the existing ground surface and extending to depths ranging from 3 to 14 feet bgs. Standard Penetration Testing on the sand resulted in N-Values of 10 to 29 bpf, indicating medium dense states. Water content and grain size testing resulted in a water contents of 2 to 13 percent with approximately 6 to 35 percent of the soil size particles passing the No 200 severe. Atterberg limits testing resulted in non-plastic results.

Soil Type 2 was classified as a sandy clay (CL). The clay was encountered in Test Boring No.4 at a depth of 3 feet and extending to 8 feet below ground surface (bgs). Standard Penetration Testing on the clay resulted in a N-value of 47 blows per foot (bpf), indicating very stiff consistencies. Water content and grain size testing resulted in a water content of 11 percent with approximately 76 percent of the soil size particles passing the No. 200 sieve. Swell/Consolidation Testing resulted in a volume change of 2.0 percent, indicating moderate expansion potential.

Soil Type 3 was classified as silty to clayey sandstone bedrock (SM, SC). The sandstone was encountered in three of the test borings drilled as a part of this investigation at depths of approximately 4 to 8 feet bgs and extending to depths of 18 feet the termination of the borings (20 feet). Standard Penetration Testing on the sandstone resulted in N-values of 34 to greater than 50 bpf indicating dense to very dense states. Water content and grain size testing resulted in water contents of 7 to 16 percent with approximately 25 percent of the soil size particles passing the No. 200 sieve. Atterberg limits testing on the sandstone indicated non-plastic results.

Soil Type 4 was classified as a sandy claystone bedrock (CL). The claystone was encountered in two of the test borings drilled as a part of this investigation at 14 to 18 feet and extending to the termination of the borings (20 feet). Standard Penetration Testing on the claystone resulted in N-values of 41 to greater than 50 bpf, indicating very stiff to hard consistencies. Water content and grain size testing resulted in water contents of 10 to 13 percent with approximately 68 percent of the soil size particles passing the No. 200 Sieve. Atterberg limits testing resulted in a liquid limit of 32 and a plastic index of 12. Swell/Consolidation Testing of the claystone resulted in a consolidation of 0.4 percent, indicating low consolidation potential. Moderately to highly expansive claystone has been encountered in the area.

Test Boring logs are included in Appendix B. A Summary of the Laboratory Test Results for each of the soil and rock types is summarized in Table 1 and included in Appendix C. The Test Boring Log and Laboratory Test Results from previous investigations (Reference 3) is included in Appendix D.

5.5 Groundwater

Groundwater was encountered at depths of 7.5 and 11.5 feet in five of eight the test borings drilled across the filing. Groundwater was not encountered in the other three borings which were drilled to 20 feet. Bedrock and groundwater depths are summarized in Table 2. Areas of seasonal and potentially seasonal shallow groundwater have been mapped on the site and are discussed later in this report. It should be noted that these water levels are from previous investigations. Fluctuations in the groundwater conditions may occur due to conditions such as variations in rainfall, precipitation infiltration and development of nearby areas. Areas of seasonal and potentially seasonal shallow groundwater have been identified on the site. These areas will be discussed in the following sections.

6.0 ENGINEERING GEOLOGY - IDENTIFICATION AND MITIGATION OF GEOLOGIC HAZARDS

As mentioned previously, detailed mapping has been performed on this site to produce an Engineering Geology Map (Figure 7). This map shows the location of various geologic conditions of which the developers and planners should be cognizant during the planning, design and construction stages of the project. The hazards identified on this site include artificial fill, potentially expansive soils, hydrocompaction, and potentially seasonal shallow and shallow groundwater areas. The following hazards have been addressed:

Artificial Fill – Constraint

Areas of artificial fill were observed in areas of the site. The majority of these areas are associated with recent grading and fill stockpiling associated with the Colorado Concrete Crushers site.

Mitigation: It is anticipated the fill piles will be removed prior to construction. In the areas of site grading, fill records should be obtained to determine if the fill was placed in a controlled manner. Where uncontrolled fill is encountered beneath foundations, mitigation will be necessary. Mitigation typically involves removal and recompaction at a minimum of 95 percent of its maximum

Modified Proctor Dry Density, ASTM D-1557. Any new fill added to the site should be placed on native or controlled fill soils, compacted as recommended above.

Expansive Soils – Constraint

Expansive soils were encountered in some of the test borings drilled on-site and as a part of the previous investigation (References 3 through 5). The site is classified in areas of low to moderate swell potential according to the *Map of Potentially Swelling Soil and Rock in the Front Range Urban Corridor, Colorado* by Hart, 1974 (Reference 10); however, highly expansive clays and claystone are typically encountered in the area. These areas are sporadic; therefore, none have been indicated on the map. Expansive clays and claystone, if encountered, can cause differential movement in the structure foundation.

Mitigation: Mitigation of expansive soils will require special foundation design. Overexcavation and replacement with non-expansive soils at a minimum 95 percent of its maximum Modified Proctor Dry Density, ASTM D-1557 is a suitable mitigation which is common in the area. Drilled piers are another option that is used in areas where highly expansive soils are encountered. Typical minimum pier depths are on the order of 25 feet or more and require penetration into the bedrock material a minimum of 4 to 6 feet, depending upon building loads. Floor slabs on expansive soils should be expected to experience movement. Overexcavation and replacement has been successful in minimizing slab movements. The use of structural floors can be considered for basement construction on highly expansive clays. Final recommendations should be determined after additional investigation of each building site.

Subsidence Area – Hazard

Based on a review of a Subsidence Investigation Report for the Colorado Springs area by Dames and Moore, 1985 (Reference 11) and the mining report for the Colorado Springs coalfield (Reference 12), the site is not undermined. The closest underground mines in the area are 6 miles to the southwest and the site is not mapped within any potential subsidence zones.

Slope Stability and Landslide Hazard

The majority of the slopes on-site are gently sloping and do not exhibit any past or potential unstable slopes or landslides. Some moderate to steep slopes are located along the drainage in the western portion of the site. Based on the proposed development plan it appears the slopes and drainage will be regraded.

Debris Fans – Hazard

Based on-site observations, debris fans were not observed in this area.

Groundwater and Floodplain Areas – Constraint

Areas within the drainage swale along the western and northern portions of the site have been identified as seasonal and potentially seasonal shallow groundwater areas. According to the development plan, Figure 7, surface waters in this drainage are to be collected and piped along the western boundary to a detention pond south of the site. The Sand Creek drainage lies east of the site and has been mapped as a floodplain zone according to the FEMA Map No. 08041CO533G, Figure 8 (Reference 13). The site does not lie within the floodplain zone as indicated in Figure 8. Finished floor levels must be a minimum of one foot above the floodplain level. Exact floodplain locations by drainage studies are beyond the scope of this report. Much of the western portions of the site have been mapped as seasonal and potentially seasonal shallow groundwater due to the drainage swale, although, shallow groundwater could be encountered adjacent to these areas during periods of high moisture. These areas are discussed as follows:

Seasonal Shallow Groundwater: In these areas, we would anticipate the potential for periodically high subsurface moisture conditions and possible frost heave potential, depending on the soil conditions. These areas are located within the drainage swale along the western portions of the site. According to the grading plan, these areas are to be regraded and surface drainage will be collected and piped along the western boundary of the site to a detention pond south of the site. Areas of shallow groundwater may exhibit unstable subgrade conditions in terms of bearing support of construction equipment during overlot grading. Lots immediately adjacent to drainage may also experience higher subsurface moisture conditions during periods of higher flows.

Mitigation: In these locations, foundations subject to severe frost heave potential should penetrate sufficient depth so as to discourage the formation of ice lenses beneath foundations. At this location and elevation, a foundation depth for frost protection of 30 inches is recommended. Foundations should be kept as high as possible. Areas may experience higher groundwater levels during period of higher precipitation where water can flow through permeable sands on top of less permeable bedrock materials. Subsurface perimeter drains may be necessary to prevent the intrusion of water into areas below grade. Typical drain

details are presented in Figure 9. Where shallow groundwater is encountered, underslab drains or interceptor drains may be necessary. Typical drain details are presented in Figure 10 and 11. Where basements are considered, interceptor and underslab drains may be necessary. Lots that may be impacted by seasonally shallow groundwater include Lot Nos 109, 111, 135, 145-147, 173, 174, 180, 181, 183-188, 195-197, 207 and 208 (see Figure 7). According to the grading plan, these drainage areas are to be filled, further raising foundations above the groundwater level. Structures should not block drainages. Swales should be created to intercept surface runoff and carry it safely around and away from structures. Additional investigation, after grading is completed, is recommended to provide final foundation and subsurface drain recommendations.

Potentially Seasonal Shallow Groundwater: Shallow groundwater was encountered and observed along the drainage in the western portion of the site, particularly west of the drainage following precipitation events. Groundwater depths encountered in the test borings drilled on site are summarized in Table 2. Drainage from north of the site appears to back up west of the site during periods of high runoff. According to the proposed grading plan, the drainage from the north of the site is to be collected and piped along the eastern boundary of the site to a detention pond southeast of the site. Additionally, much of the area is to be filled, further raising the area above groundwater levels. Foundations should be kept as high as possible. Areas may experience higher groundwater levels during period of higher precipitation where water can flow through permeable sands on top of less permeable bedrock materials. Subsurface perimeter drains may be necessary to prevent the intrusion of water into areas below grade. Additionally, where shallow groundwater is encountered, underslab drains or interceptor drains may be necessary. Typical drain details are presented in Figures 9 through 11. Lots that may be impacted by potentially seasonal shallow groundwater include Lot Nos. 110, 112, 132-134, 136, 137 and 175-179 (see Figure 7). According to the grading plan, these areas are to be filled, further raising foundations above the groundwater level. Specific recommendations should be made after additional investigation and site grading has been completed.

Hydrocompaction - Constraint

Areas of loose or collapsible soils may also be encountered in these areas. Should loose or collapsible soils be encountered beneath foundations, removal and recompaction of the upper 2

to 3 feet with thorough moisture conditioning at a minimum of 95 percent of its maximum Modified Proctor Dry Density, ASTM D-1557 will be necessary. Specific recommendations should be made after additional investigation of each building site.

Faults - Hazard

The closest fault is the Rampart Range Fault, located approximately 10 miles to the west. No faults are mapped on the site itself. Previously, Colorado was mapped entirely within Seismic Zone 1, a very low seismic risk. Additionally, the International Residential Code (IRC), 2003, currently places this area in Design Category B, also a low seismic risk. According to a report by the Colorado Geological Survey by Kirkman and Rogers, 1981, (Reference 14) this area should be designed for Zone 2 due to more recent data on the potential for movement in this area, and any resultant earthquakes.

Dipping Bedrock - Constraint

The bedrock underlying the site is the Dawson Formation of Tertiary to Cretaceous Age. The bedrock in this area is gently dipping a northeasterly direction according to the *Geologic Structure Map of the Pueblo 1x2 Quadrangle*, *South-Central Colorado* (1978) (Reference 6). The bedrock encountered in the test borings did not exhibit steeply dipping characteristics; therefore, mitigation is not necessary.

Radioactivity – Hazard

Radon levels for the Colorado Geologic Survey in the Open-File have reported the area, Report No. 91-4 (Reference 15). Radon levels ranging from 0 to 20 pci/l have been measured in the area. Only two readings have been taken in the area. One reading was between 4 and 10 pci/l and the other was less than 4 pci/l. The minimal information from this report is not sufficient to determine if radon levels are higher for this site. An occurrence of radioactive minerals has been identified 4 miles northwest of the site (Reference 16). This occurrence is associated with a limonite deposit in the Dawson Formation. The radioactivity hazard was researched by CTL/Thompson, Inc. for Wolf Ranch, west of the site (Reference 17). It was determined that the area lies within a zone that may have small deposits of low intensity radioactivity. No known occurrences exist on the site, however, radon gas originating in the bedrock underlying the site could migrate up into the upper soil profile.

Mitigation: The potential exists for radon gas to build up in areas of the site. Build-ups of radon gas can be mitigated by providing increased ventilation of basements and crawlspaces and sealing of joints. Specific requirements for mitigation should be based on-site specific testing after the site is constructed.

7.0 EROSION CONTROL

The soil types observed on the site are mildly to moderately susceptible to wind erosion, and moderately to highly susceptible to water erosion. A minor wind erosion and dust problem may be created for a short time during and immediately after construction. Should the problem be considered severe enough during this time, watering of the cut areas or the use of chemical palliative may be required to control dust. However, once construction has been completed, and vegetation reestablished, the potential for wind erosion should be considerably reduced.

With regard to water erosion, loosely compacted soils will be the most susceptible to water erosion, residually weathered soils and weathered bedrock materials become increasingly less susceptible to water erosion. For the typical soils observed on-site, allowable velocities or unvegetated and unlined earth channels would be on the order of 3 to 4 feet/second, depending upon the sediment load carried by the water. Permissible velocities may be increased through the use of vegetation to something on the order of 4 to 7 feet/second, depending upon the type of vegetation established. Should the anticipated velocities exceed these values, some form of channel lining material may be required to reduce erosion potential. These might consist of some of the synthetic channel lining materials on the market or conventional riprap.

In cases where ditch-lining materials are still insufficient to control erosion, small check dams or sediment traps may be required. The check dams will serve to reduce flow velocities, as well as provide small traps for containing sediment. The determination of the amount, location and placement of ditch linings, check dams and of the special erosion control features should be performed by or in conjunction with the drainage engineer who is more familiar with the flow quantities and velocities.

Cut and fill slope areas will be subjected primarily to sheetwash and rill erosion. Unchecked rill erosion can eventually lead to concentrated flows of water and gully erosion. The best means to

combat this type of erosion is, where possible, the adequate re-vegetation of cut and fill slopes. Cut and fill slopes having gradients more than three (3) horizontal to one (1) vertical become increasingly more difficult to re-vegetate successfully. Therefore, recommendations pertaining to the vegetation of the cut and fill slopes may require input from a qualified landscape architect and/or the Soil Conservation Service.

8.0 ECONOMIC MINERAL RESOURCES

Some of the sandy materials on-site could be considered a low-grade sand resource. According to the *El Paso County Aggregate Resource Evaluation Map* (Reference 18), portions of the site are mapped as upland and floodplain deposits. According to the *Atlas of Sand, Gravel and Quarry Aggregate Resources, Colorado Front Range Counties* distributed by the Colorado Geological Survey (Reference 19), portions of the site are mapped as U3 – Upland deposits: sand, and V3: valley fill deposits: sand. According to the *Evaluation of Mineral and Mineral Fuel Potential* (Reference 20), tracts in the area of the site have been mapped as "Good" for industrial minerals. Quarries exist on the site and in the area of the site for sand and gravel, particularly in the Eolian Sand and Alluvial deposits. Based on the depth of bedrock encountered in the test borings, it appears the majority of the thicker deposits have been excavated from the site.

According to *the Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands* (Reference 19), the tracts in the area of the site have been mapped as "Poor" for coal resources and "Little or no Potential" metallic mineral resources.

The site has been mapped as "Fair" for oil and gas resources (Reference 19). No oil or gas fields have been discovered in the area of the site. The sedimentary rocks in the area lack the essential elements for oil or gas.

9.0 ROADWAY AND EMBANKMENT CONSTRUCTION RECOMMENDATIONS

In general, the site soils are suitable for the proposed roadways and embankments. Groundwater should be expected to be encountered in deeper cuts and along drainages and low-lying areas. If excavations encroach on the groundwater level unstable soil conditions may be encountered.

Excavation of saturated soils will be difficult with rubber-tired equipment. Stabilization using shot rock or geogrids may be necessary.

Any areas to receive fill should have all topsoil, organic material or debris removed. Prior to fill placement Entech should observe the subgrade. Fill must be properly benched and compacted to minimize potentially unstable conditions in slope areas. Fill slopes should be 3:1. The subgrade should be scarified and moisture conditioned to within 2% of optimum moisture content and compacted to a minimum of 95% of its maximum Modified Proctor Dry Density, ASTM D-1557, prior to placing new fill. Areas receiving fill may require stabilization with rock or fabric if shallow groundwater conditions are encountered.

New fill should be placed in thin lifts not to exceed 6 inches after compaction while maintaining at least 95% of its maximum Modified Proctor Dry Density, ASTM D-1557. These materials should be placed at a moisture content conducive to compaction, usually 0 to ±2% of Proctor optimum moisture content. The placement and compaction of fill should be observed and tested by Entech during construction. Entech should approve any import materials prior to placing or hauling them to the site. Additional investigation will be required for pavement designs once roadway grading is completed and utilities are installed.

10.0 RELEVANCE OF GEOLOGIC AND SITE CONDITIONS TO LAND USE PLANNING

The existing geologic and geotechnical conditions at the site will likely impose some constraints on the proposed development and construction. Avoidance or regrading can mitigate many hazards such as areas of potentially unstable slopes, seasonal and potentially seasonal shallow groundwater. Other constraints identified on the site such as expansive soils, hydrocompaction and artificial fill, can be mitigated through proper engineering design and construction. The floodplain in Sand Creek east of the site will be avoided.

The majority of the soils at typical foundation depths consist of sands, sandstone and claystone. Areas of shallow bedrock will be encountered on the site. Shallow sandstone will have higher bearing capacities. Excavation of the harder sandstone or claystone bedrock may be more difficult in some areas. Difficult excavation is anticipated in areas of shallow bedrock, particularly

areas with sandstone. Overlot grading and excavation for utility trenches and foundations will be affected by shallow bedrock. The use of track-mounted equipment will likely be required.

Expansive soils may be encountered in areas of this site. The expansive soils encountered in the test borings drilled on-site are sporadic; therefore, none have been indicated on the maps. Expansive soils, if encountered, will require special foundation design and/or overexcavation and replacement with non-expansive soil compacted to a minimum of 95 percent of the maximum dry density as determined by the Modified Proctor Test (ASTM D-1557). Other options include drilled piers.

Areas of hydrocompaction have been identified on this site where there is the potential for settlement movements upon saturation of the surficial soils. Good surface and subsurface drainage is critical in these areas and the ground surface should be positively sloped away from structures at all points. Roof drains should be made to discharge well away from structures and planting and watering in the immediate vicinity of structures should be minimized.

Areas of seasonal and potentially seasonal shallow groundwater have been mapped in the drainage area along the western and northern boundary of the site. This area will be regraded and drainage piped to the south, however, structures immediately adjacent to the drainage area may experience higher water levels during periods of high moisture. Additionally, shallow groundwater was encountered west of the site after precipitation events due to runoff from the north that backed up in permeable sands overlying the bedrock. According to the grading plan the drainage area is to be filled and regraded and drainage from the north collected and piped to a detention pond south of the site.

All soft or organic soils should be removed prior to fill placement. Unstable soils may be encountered where excavations approach the groundwater level. Shallow groundwater areas may also affect utility installation. Geo-grids or shotrock may be necessary to stabilize excavations. Foundations should be kept as high as possible. Foundations in or adjacent to seasonal or potentially seasonal shallow groundwater areas may require drains to control seepage within the foundation zone. Typical drain details are presented in Figures 9 through 11. Where basements are considered, interceptor and underslab drains may be necessary.

Additional investigation is recommended after grading and the storm sewer is installed to evaluate groundwater conditions.

In summary, development of the site can be achieved if the items discussed above are mitigated. These items can be mitigated through proper design and construction or by avoidance. Specific recommendations should be made after additional investigation prior to construction.

11.0 CLOSURE

It is our opinion that the existing geologic engineering and geologic conditions will impose some constraints on development and construction of the site. The geologic hazards identified on the site can either be avoided by development or satisfactorily mitigated through proper engineering design and construction practices.

It should be pointed out that because of the nature of data obtained by random sampling of such variable and non-homogeneous materials as soil and rock, it is important that we be informed of any differences observed between surface and subsurface conditions encountered in construction and those assumed in the body of this report. Discrepancies should be reported to Entech Engineering, Inc. soon after they are discovered so that the evaluation and recommendations presented can be reviewed and revised if necessary. Planning and design personnel should be made familiar with the contents of this report. In addition to lot investigations, additional subsurface soil investigation is recommended after the storm sewer is installed to evaluate groundwater conditions.

This report has been prepared for Classic SRJ for application to the proposed project in accordance with generally accepted geologic soil and engineering practices. No other warranty expressed or implied is made.

We trust this report has provided you with all the information you required. Should you require additional information, please do not hesitate to contact Entech Engineering, Inc.

BIBLIOGRAPHY

1. Natural Resources Conservation Service. September 23, 2016. *Web Soil Survey.* United States Department of Agriculture. http:/websoilsurvey.sc.egov.usda.gov.

2. Soil Conservation Service. June 1981. *Soil Survey of El Paso County Area, Colorado.* United States Department of Agriculture

3. Entech Engineering, Inc. October 31, 2006. *Geologic Hazard/Land Use Study and Preliminary Subsurface Soil Investigation, Sterling Ranch. El Paso County, Colorado.* Entech Job No. 82556.

4. Entech Engineering, Inc. January 20, 2009. *Geologic Hazard Evaluation, Sterling Ranch Residential, El Paso County, Colorado.* Entech Job No. 30898.

5. Entech Engineering, Inc. revised date May 4, 2021. *Soil, Geology, and Geologic Hazard Study, Sterling Ranch Phase 2 and Sterling Ranch Filing No. 3, El Paso County, Colorado.* Entech Job No. 191089.

6. Scott, Glen R.; Taylor, Richard B.; Epis, Rudy C. and Wobus, Reinhard A. 1978. *Geologic Structure Map of the Pueblo 1˚x2˚, South-Central Colorado.* Sheet 2. U.S. Geologic Survey. Map I-1022.

7. Madole, Richard F. 2003. *Geologic Map of the Falcon NW Quadrangle, El Paso County, Colorado. Colorado Geological Survey.* Open-File Report 03-8.

8. Scott, Glen R. and Wobus, Reinhard A. 1973. *Reconnaissance Geologic Map of Colorado Springs and Vicinity, Colorado.* US Geological Survey. Map MP-482.

9. Trimble, Donald E. and Machette, Michael N. 1979. *Geologic Map of the Colorado Springs-Castle Rock area, Front Range Urban Corridor, Colorad*o. U.S. Geological Survey. Map 1-847-F.

10. Hart, Stephen S. 1974. *Potentially Swelling Soil and Rock in the Front Range Urban Corridor, Colorado*. Colorado Springs – Castle Rock map. Colorado Geological Survey. Environmental Geology 7.

11. Dames and Moore. 1985. *Colorado Springs Subsidence Investigation*. State of Colorado Division of Mined Land Reclamation.

12. City of Colorado Springs Planning Department, August 1967. *Mining Report, Colorado Springs Coal Field.*

13. Federal Emergency Management Agency. December 7, 2018. *Flood Insurance Rate Maps for the City of Colorado Springs, Colorado*. Map Number 08041CO533G.

14. Kirkman, Robert M. and Rogers, William P. 1981. *Earthquake Potential in Colorado*. Colorado Geological Survey. Bulletin 43.

15. Colorado Geological Survey. 1991. *Results of the 1987-88 EPA Supported Radon Study in Colorado*. Open-file Report 91-4.

16. Nelson-Moore, James L.; Collins, Donna Bishop; and Hernbaker, Al. 1978. *Radioactive Mineral Occurrences of Colorado and Bibliography*. Colorado Geological Survey. Bulletin 40.

17. CTL/Thompson. April 22, 1997. *Reconnaissance Geologic Hazards Study, Wolf Ranch Master Plan Area, Colorado Springs, Colorado.* Job. No. CS-7272.

18. El Paso County Planning Department. December 1995. *El Paso County Aggregate Resource Evaluation Maps.*

19. Schwochow, S.D.; Shroba, R.R. and Wicklein, P.C. 1974*. Atlas of Sand, Gravel, and Quarry Aggregate Resources, Colorado Front Range Counties*. Colorado Geological Survey. Special Publication 5-B.

20. Keller, John W.; TerBest, Harry and Garrison, Rachel E. 2003. *Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands Administered by the Colorado State Land Board*. Colorado Geological Survey. Open-File Report 03-07.

TABLES

TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

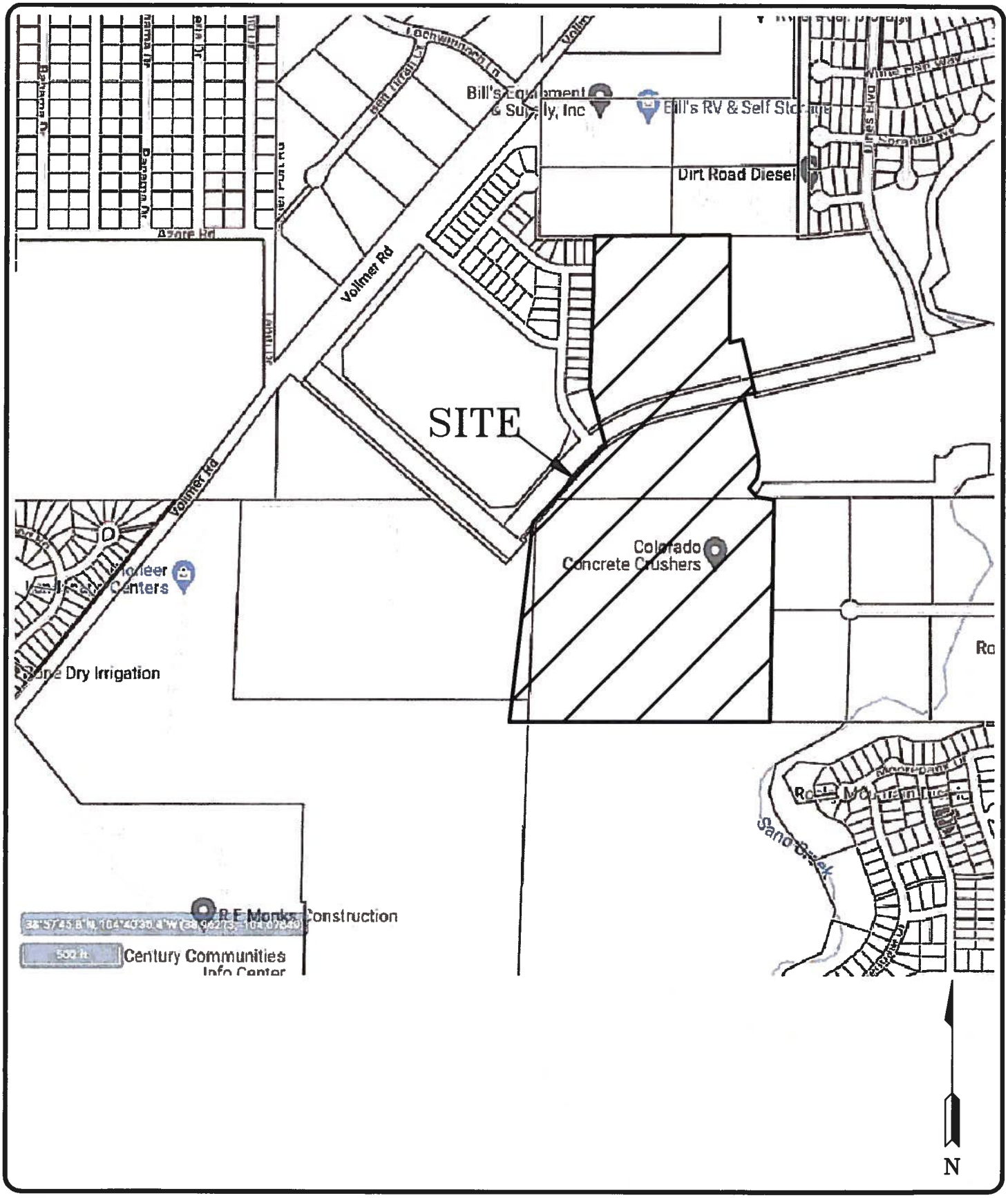
CLIENT CLASSIC SRJ
PROJECT STERLING RANCH, FIL 4
JOB NO. 220921

SOIL TYPE	TEST BORING NO.	DEPTH (FT)	WATER (%)	DRY DENSITY (PCF)	PASSING NO. 200 SIEVE (%)	LIQUID LIMIT (%)	PLASTIC INDEX (%)	SULFATE (WT %)	FHA SWELL (PSF)	SWELL/ CONSOL (%)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION
1	2	2-3	11.6	113.2	31.1	37	19	<0.01		0.7	SC	SAND, CLAYEY
1	3	5			7.8	NV	NP	<0.01			SM-SW	SAND, SLIGHTLY SILTY
1	4	2-3			11.4						SM-SW	SAND, SLIGHTLY SILTY
2	2	10			48.4	NV	NP	<0.01			SM	SANDSTONE, VERY SILTY
3	1	5	18.1	95.0	64.8	37	16	0.01		0.3	CL	CLAYSTONE, SANDY

TABLE 2: Summary of Depth of Bedrock and Groundwater

Test Boring No.	Depth of Bedrock (ft.)	Depth of Groundwater (ft.)
1	3	11.5
2	4	7.5
3	19	>20
4	9	>20
Previous Job No. 82556		
2	4	11
41	6	9
Previous Job No. 191089		
3	14	9.5
4	8	>19

FIGURES



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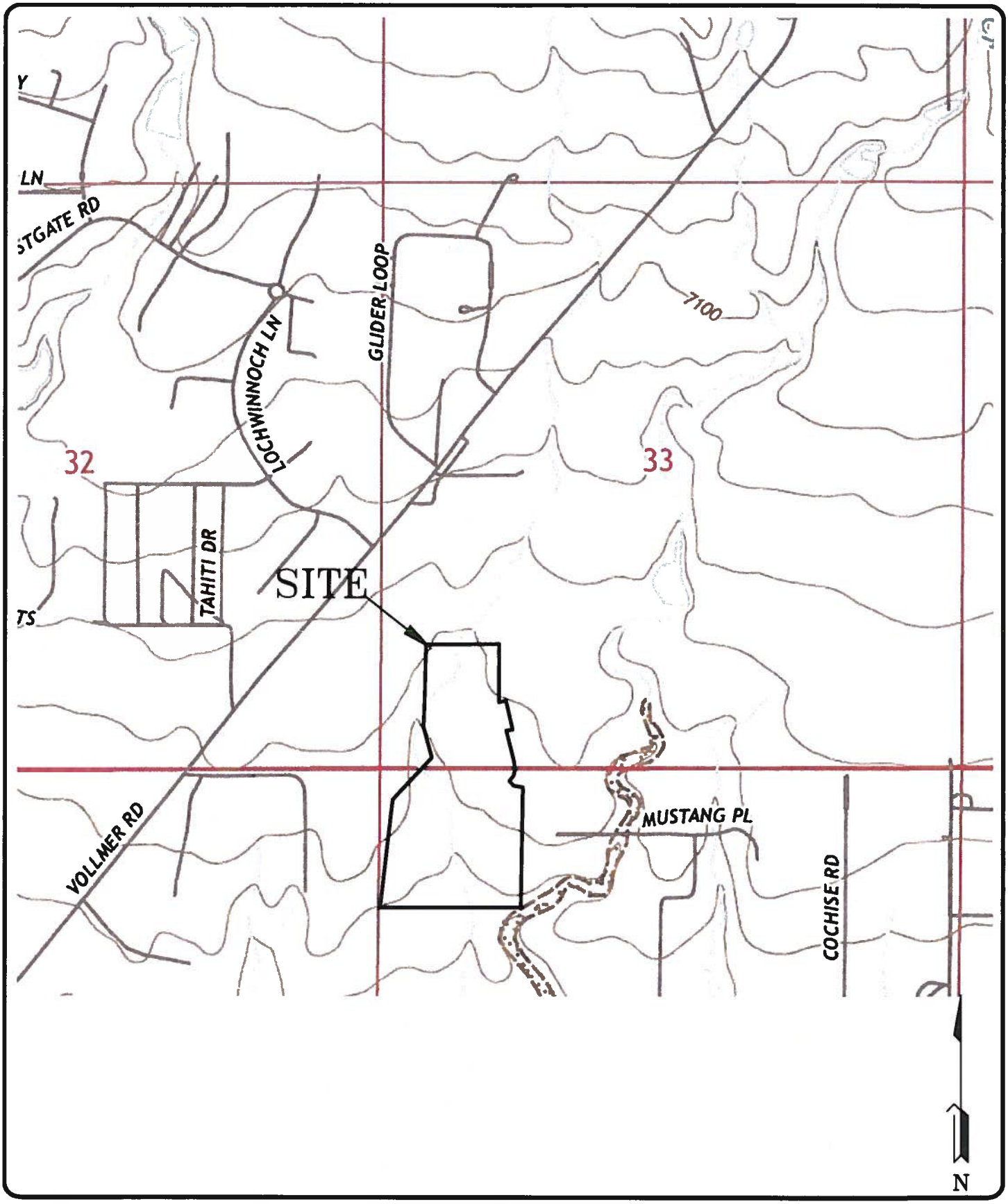
VICINITY MAP
STERLING RANCH FILING NO. 4
PARCEL 10
COLORADO SPRINGS, CO.
FOR: CLASSIC SRJ

DRAWN:	DATE:	CHECKED:	DATE:
LLL	5/20/22		

JOB NO.: 220921

FIG NO.: 1



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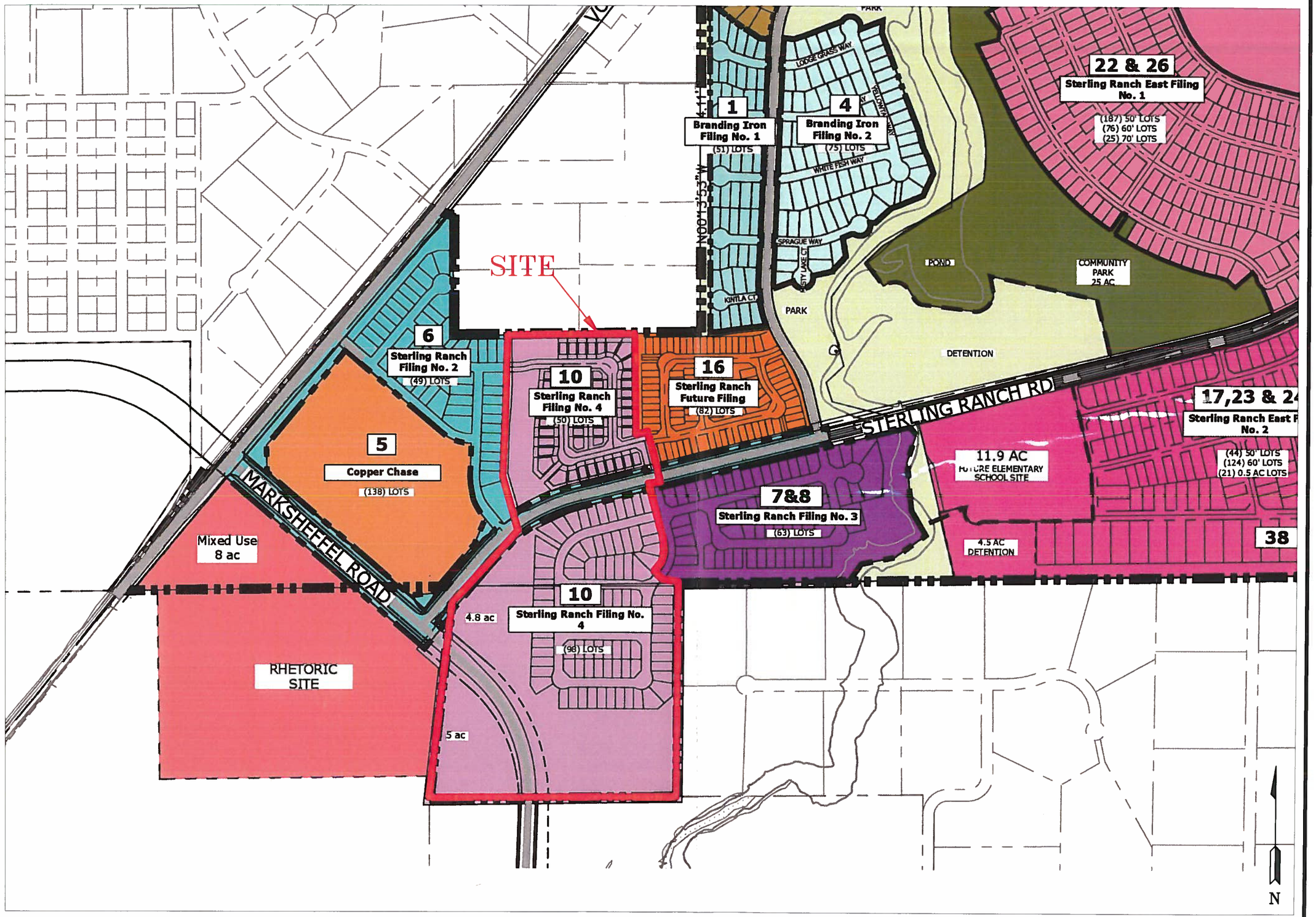
USGS MAP
STERLING RANCH FILING NO. 4
PARCEL 10
COLORADO SPRINGS, CO.
FOR: CLASSIC SRJ

DRAWN:	DATE:	CHECKED:	DATE:
LLL	5/20/22		

JOB NO.: 220921

FIG NO.: 2



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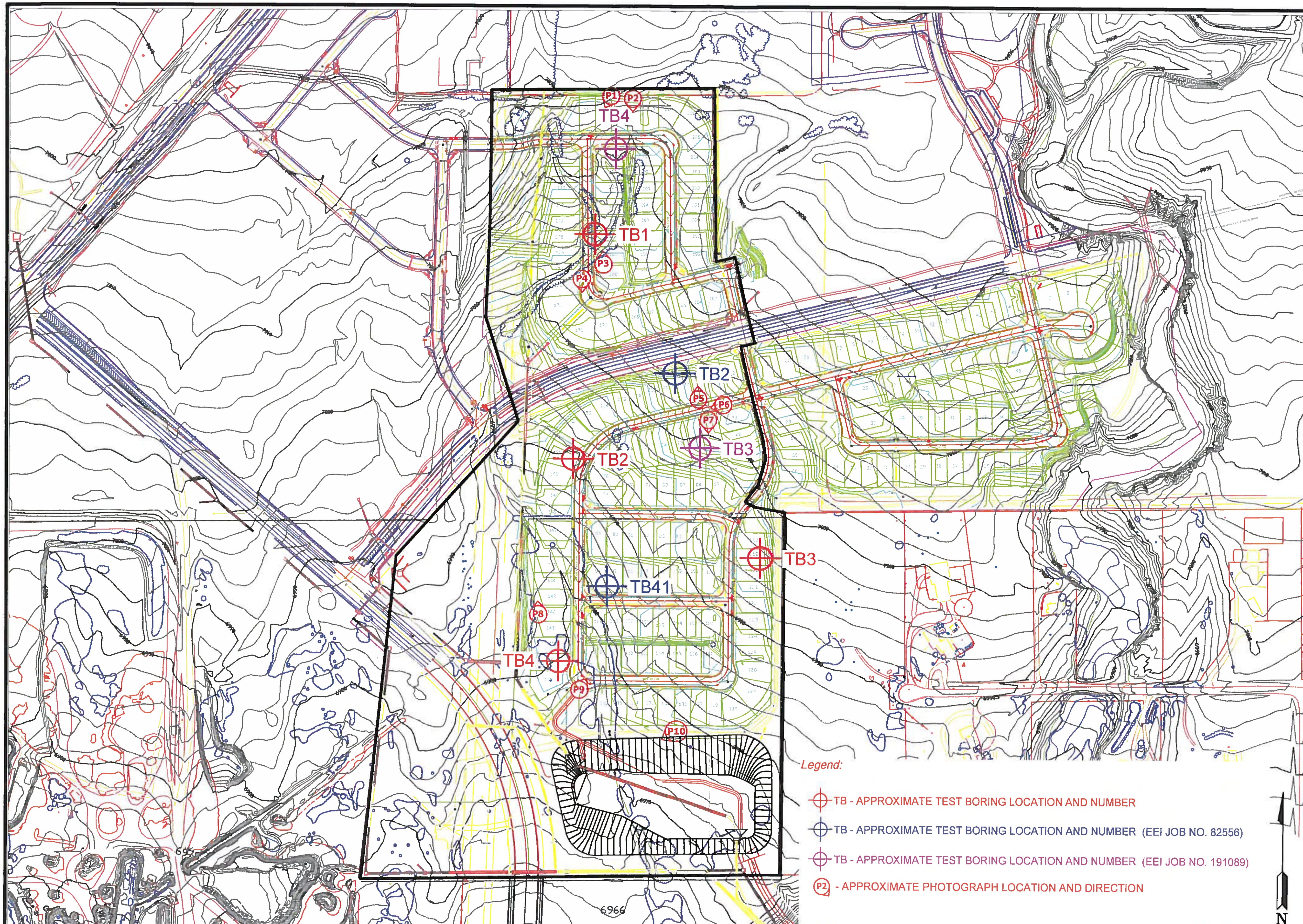
DEVELOPMENT PLAN
STERLING RANCH FILING NO. 4
PARCEL 10
COLORADO SPRINGS, CO.
FOR: CLASSIC SRJ

DRAWN	LLL
CHECKED	
DATE	5/20/22
SCALE	AS SHOWN
JOB NO.	220921
FIGURE No.	3



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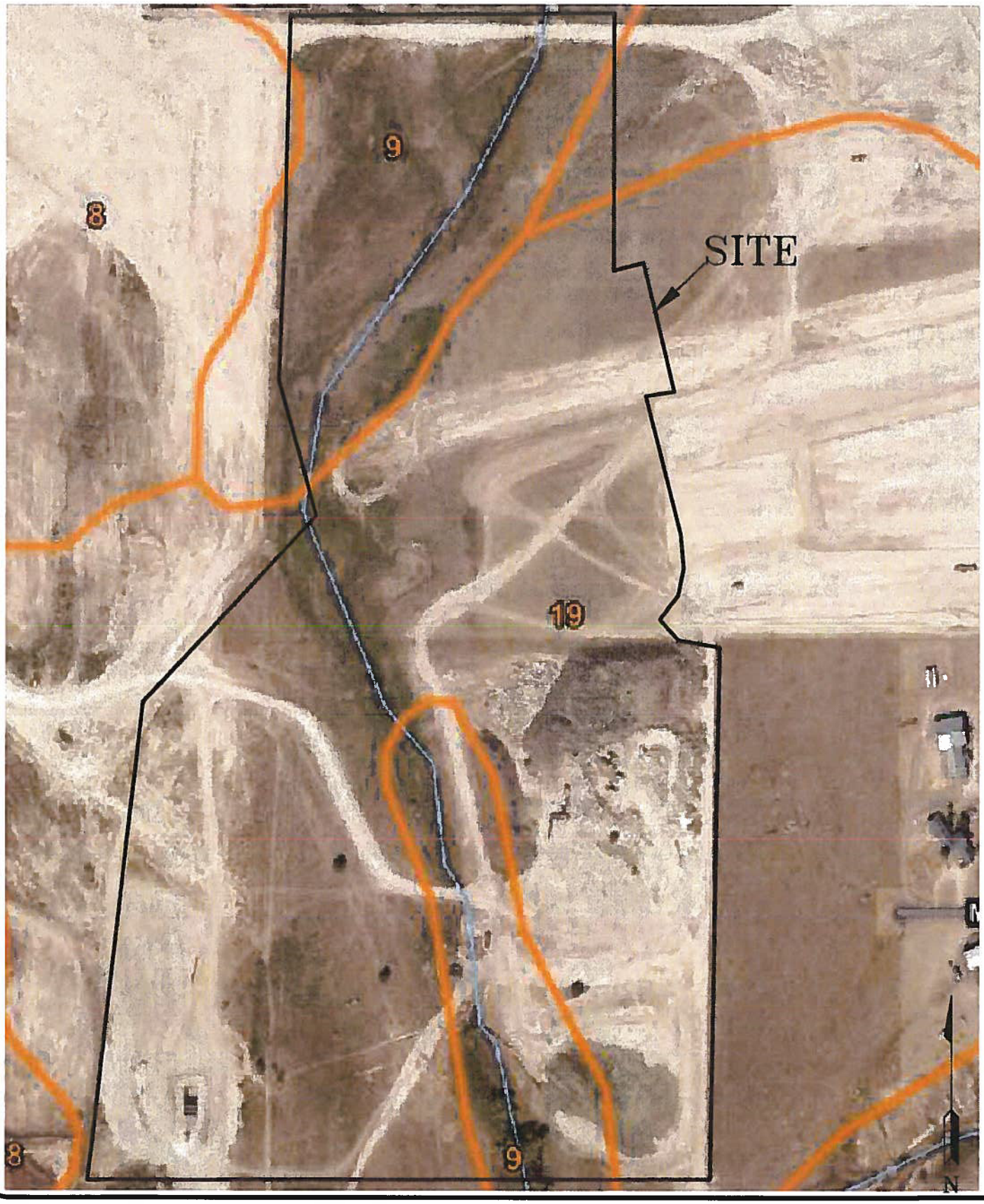
SITE PLAN/TEST BORING LOCATION MAP
STERLING RANCH FILING NO. 4
PARCEL 10
COLORADO SPRINGS, CO.
FOR: CLASSIC SRJ

DRAWN: LLL
CHECKED:
DATE: 5/25/22
SCALE: AS SHOWN
JOB NO. 220921
FIGURE No. 4



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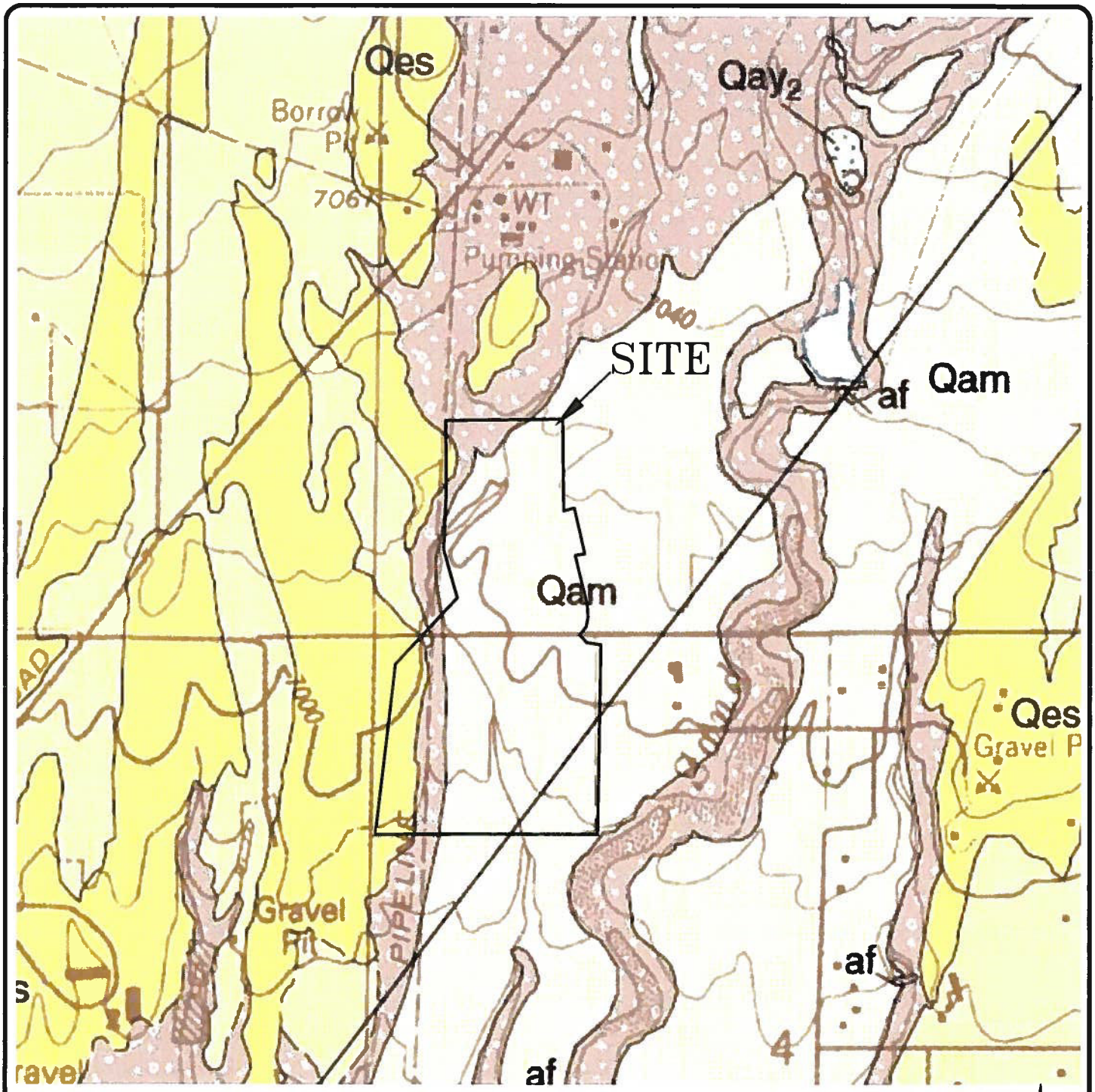
SOIL SURVEY MAP
STERLING RANCH FILING NO. 4
PARCEL 10
COLORADO SPRINGS, CO.
FOR: CLASSIC SRJ

DRAWN:	DATE:	CHECKED:	DATE:
LLL	4/15/22		

JOB NO.: 220921

FIG NO.: 5



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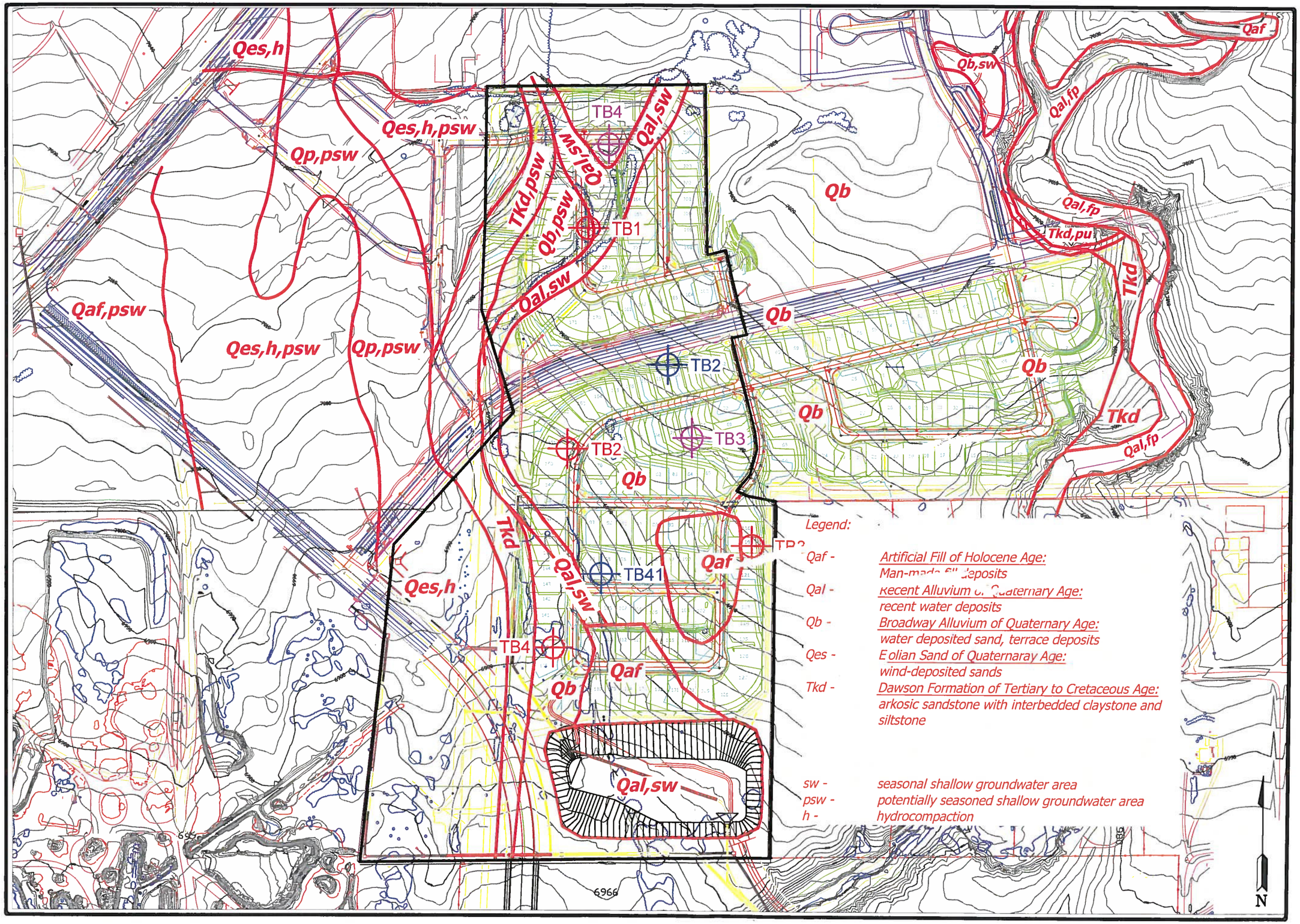
FALCON NW QUADRANGLE GEOLOGIC MAP
STERLING RANCH FILING NO. 4
PARCEL 10
COLORADO SPRINGS, CO.
FOR: CLASSIC SRJ

DRAWN:	DATE:	CHECKED:	DATE:
LLL	5/25/22		

JOB NO.: 220921

FIG NO.: 6



Legend:

Qaf -	Artificial Fill of Holocene Age: Man-made fill deposits
Qal -	Recent Alluvium of Quaternary Age: recent water deposits
Qb -	Broadway Alluvium of Quaternary Age: water deposited sand, terrace deposits
Qes -	Eolian Sand of Quaternaray Age: wind-deposited sands
Tkd -	Dawson Formation of Tertiary to Cretaceous Age: arkosic sandstone with interbedded claystone and siltstone
sw -	seasonal shallow groundwater area
psw -	potentially seasoned shallow groundwater area
h -	hydrocompaction

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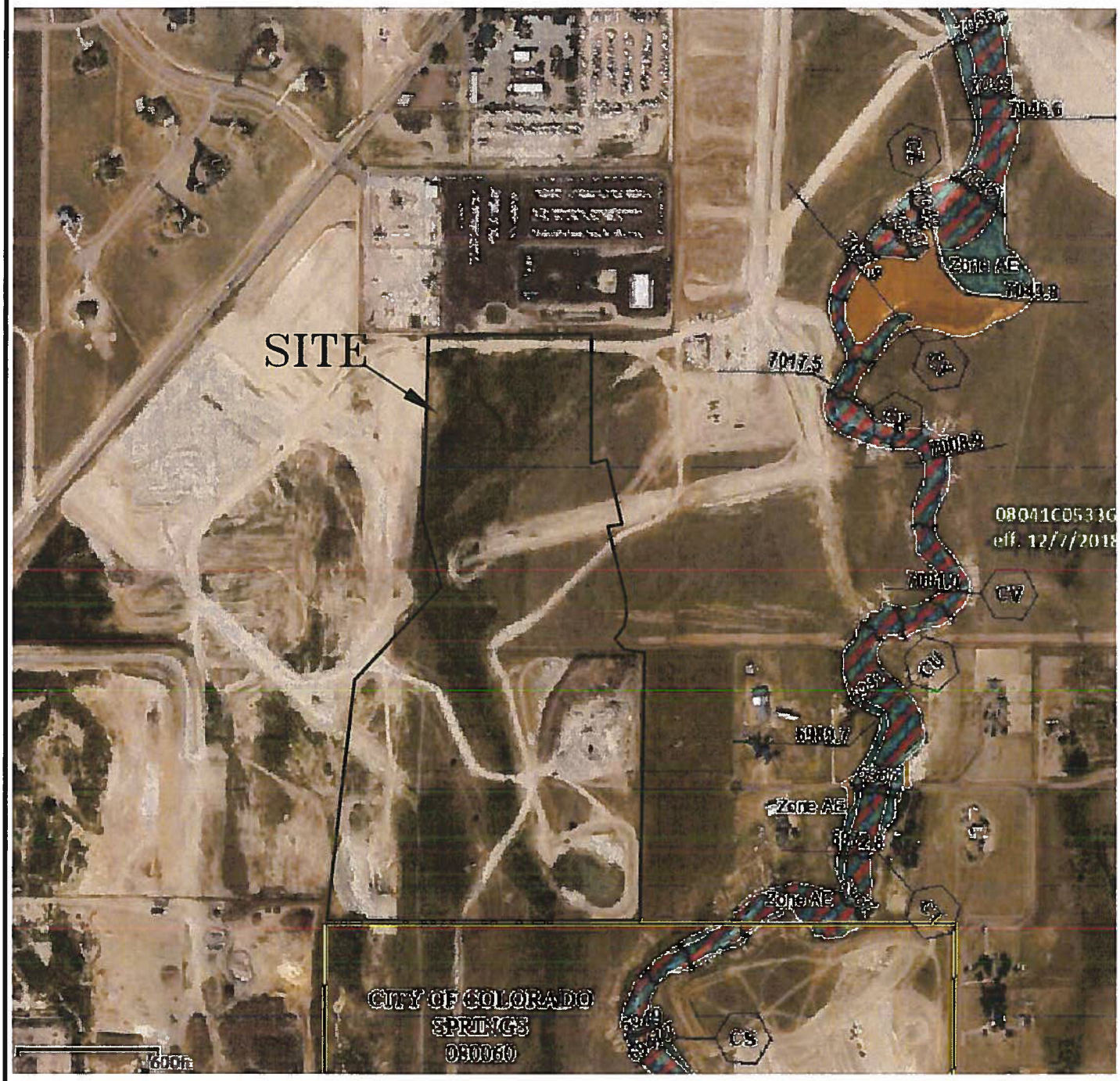
GEOLOGY/ENGINEERING GEOLOGY MAP
STERLING RANCH FILING NO. 4
PARCEL 10
COLORADO SPRINGS, CO.
FOR: CLASSIC SRJ

DRAWN	LLL
CHECKED	
DATE	4/19/22
SCALE	AS SHOWN
JOB NO.	220571
FIGURE No.	7



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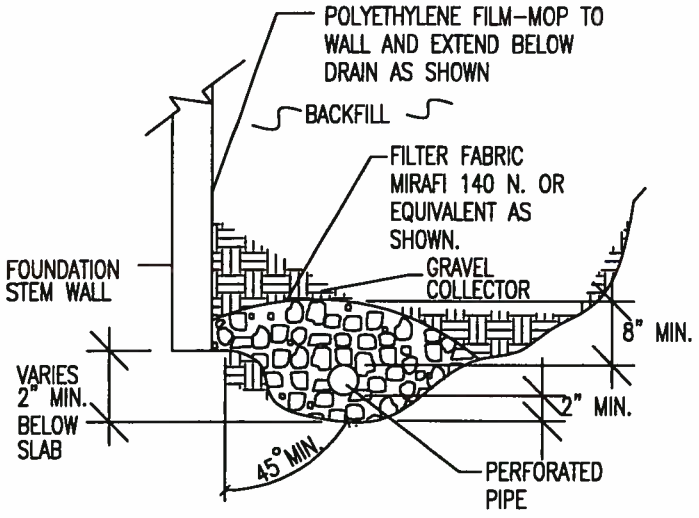
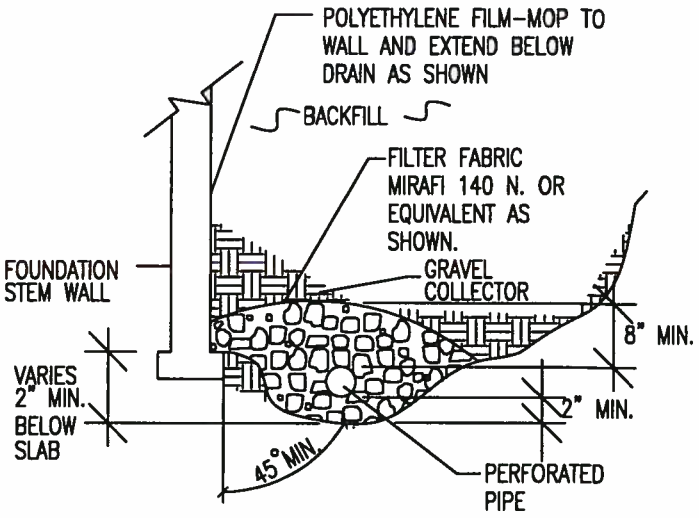
FLOODPLAIN MAP
STERLING RANCH FILING NO. 4
PARCEL 10
COLORADO SPRINGS, CO.
FOR: CLASSIC SRJ

DRAWN:	DATE:	CHECKED:	DATE:
LLL	5/20/22		

JOB NO.: 220921

FIG NO.: 8





NOTES:

–GRAVEL SIZE IS RELATED TO DIAMETER OF PIPE PERFORATIONS–85% GRAVEL GREATER THAN 2x PERFORATION DIAMETER.

–PIPE DIAMETER DEPENDS UPON EXPECTED SEEPAGE. 4–INCH DIAMETER IS MOST OFTEN USED.

–ALL PIPE SHALL BE PERFORATED PLASTIC. THE DISCHARGE PORTION OF THE PIPE SHOULD BE NON–PERFORATED PIPE.

–FLEXIBLE PIPE MAY BE USED UP TO 8 FEET IN DEPTH, IF SUCH PIPE IS DESIGNED TO WITHSTAND THE PRESSURES. RIGID PLASTIC PIPE WOULD OTHERWISE BE REQUIRED.

–MINIMUM GRADE FOR DRAIN PIPE TO BE 1% OR 3 INCHES OF FALL IN 25 FEET.

–DRAIN TO BE PROVIDED WITH A FREE GRAVITY OUTFALL, IF POSSIBLE. A SUMP AND PUMP MAY BE USED IF GRAVITY OUT FALL IS NOT AVAILABLE.

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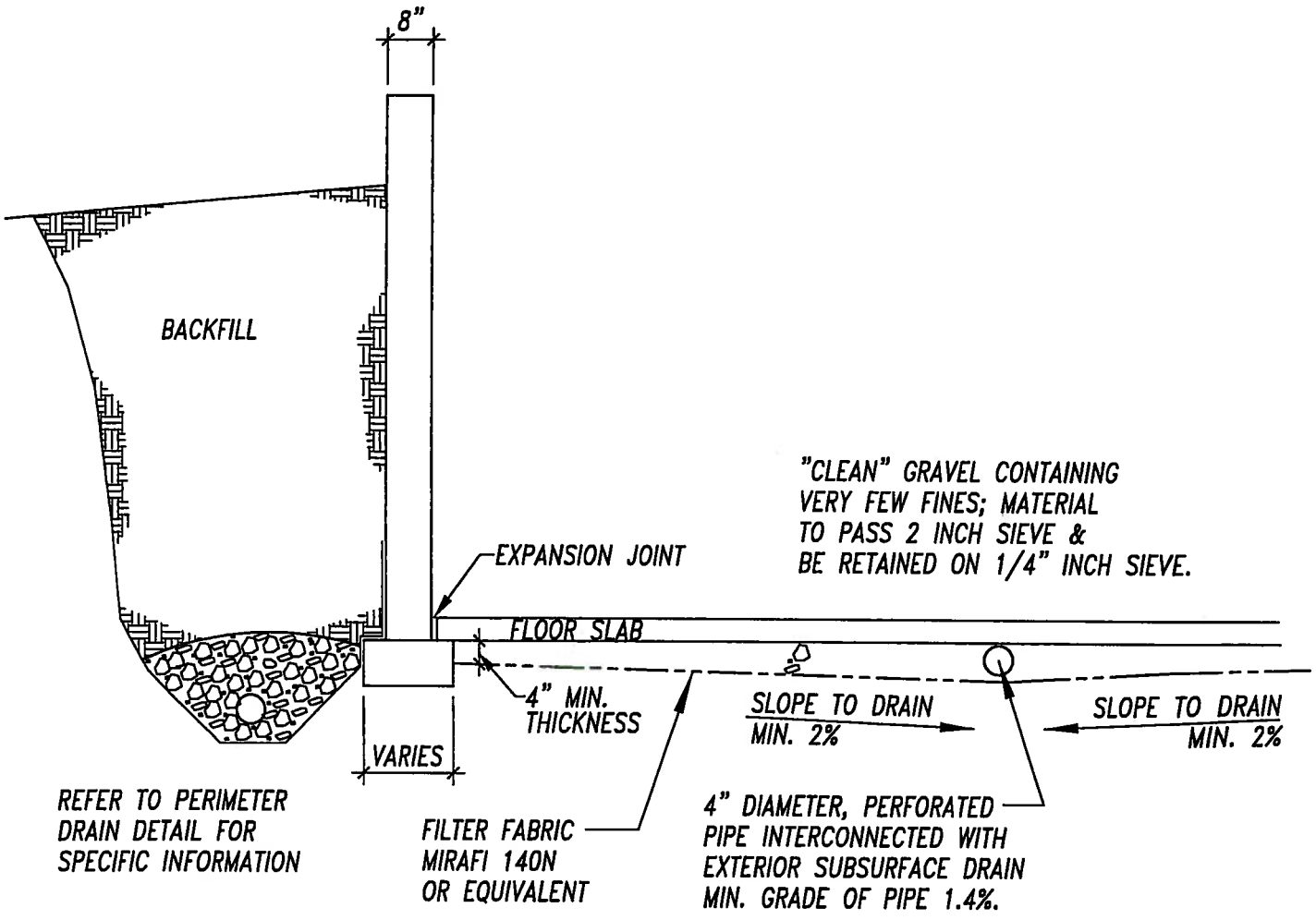
PERIMETER DRAIN DETAIL

DRAWN:	DATE:	DESIGNED:	CHECKED:

JOB NO.: 220921

FIG NO.: 9



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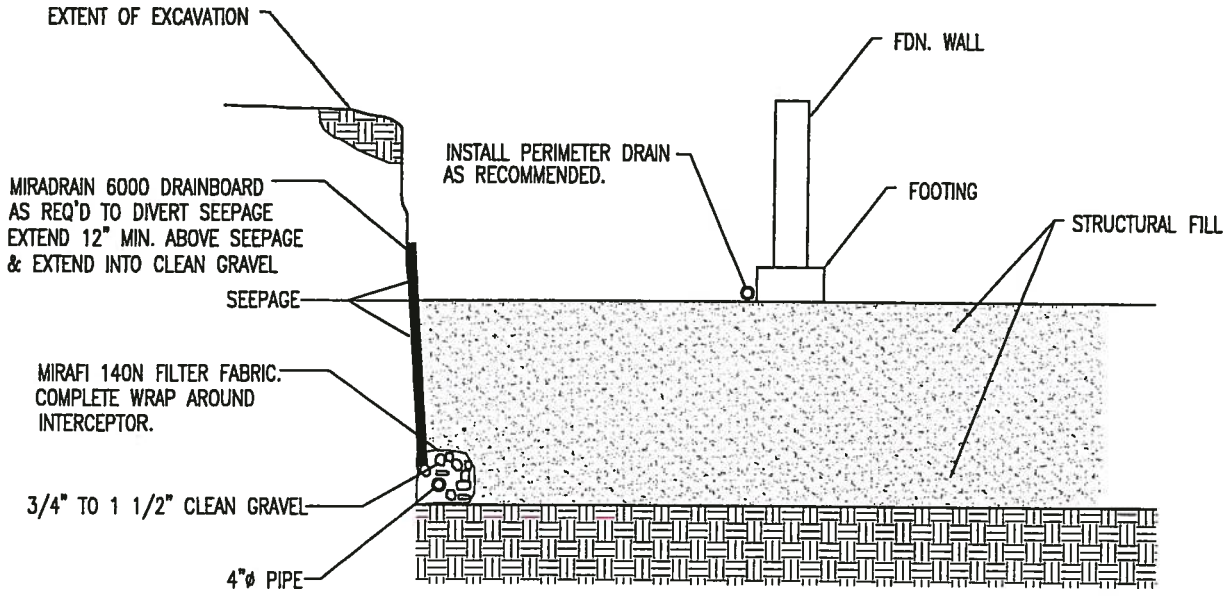
TYP. UNDERSLAB DRAINAGE
LAYER (CAPILLARY BREAK)

DRAWN:	DATE:	DESIGNED:	CHECKED:

JOB NO.: 220921

FIG NO.: 10



NOTE:
EXTEND INTERCEPTOR DRAIN TO DAYLIGHT

INTERCEPTOR DRAIN DETAIL

N.T.S.

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INTERCEPTOR DRAIN DETAIL			
DRAWN BY:	DATE DRAWN:		CHECKED:

JOB NO.: 220921

FIG. NO.: 11

APPENDIX A: Site Photographs

1

Looking southwest from the northern portion of the filing.

April 20, 2022

2

Looking south from the northern portion of the filing.

April 20, 2022

Job No. 220921

3

Looking north along drainage in the northwestern portion of the filing.

April 20, 2022

4

Looking south from the northwestern portion of the filing.

April 20, 2022

Job No. 220921

5

Looking north from the central portion of the filing south of Sterling Ranch Road.

April 20, 2022

6

Looking west from the east-central portion of the filing.

April 20, 2022

Job No. 220921

7

Looking south from the eastern-central portion of the filing.

April 20, 2022

8

Looking north from the southwestern portion of the filing.

April 20, 2022

Job No. 220921

9

Looking northeast towards fill stockpiles from the southwestern portion of the filing.

April 20, 2022

10

Looking southwest towards existing detention basin in the southern portion of the filing.

April 20, 2022

Job No. 220921

APPENDIX B: Test Boring Logs

TEST BORING NO. 1
DATE DRILLED 4/20/2022
Job # 220921

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
WATER @ 11.5', 4/25/22						
SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST				17	3.4	1
WEAHTERED CLAYSTONE, SANDY, GRAY BROWN, VERY STIFF, MOIST	5			46	15.5	3
SANDSTONE, CLAYEY, FINE TO COARSE GRAINED, GRAY BROWN, VERY DENSE, MOIST	10			50/7"	13.3	2
	15			50/7"	13.6	2
CLAYSTONE, SANDY, GRAY BROWN, HARD, MOIST	20			50/6"	12.6	3

TEST BORING NO. 2
DATE DRILLED 4/20/2022
CLIENT CLASSIC SRJ
LOCATION STERLING RANCH, FIL 4

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
WATER @ 7.5', 4/25/22						
SAND, CLAYEY, FINE GRAINED, DARK BROWN, MEDIUM DENSE, MOIST				20	12.9	1
SANDSTONE, SILTY, FINE TO COARSE GRAINED, GRAY BROWN, VERY DENSE, MOIST	5			50/10"	10.6	2
	10			50/7"	12.5	2
	15			50/5"	14.8	2
	20			50/7"	10.5	2

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	5/20/22

JOB NO.: 220921
FIG NO.: B- 1

TEST BORING NO. 3
DATE DRILLED 4/20/2022
Job # 220921

REMARKS

DRY TO 20', 4/20/22

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
						SAND, SLIGHTLY SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST
5			24	6.1	1	
10			18	6.9	1	
15			40	15.4	1	SAND, CLAYEY, FINE GRAINED, BROWN, DENSE, MOIST
20			50/10"	15.6	3	CLAYSTONE, SANDY, GRAY BROWN, HARD, MOIST

TEST BORING NO. 4
DATE DRILLED 4/20/2022
CLIENT CLASSIC SRJ
LOCATION STERLING RANCH, FIL 4

REMARKS

DRY TO 20', 4/25/22

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
			25	9.8	1	SAND, SLIGHTLY SILTY FINE TO COARSE GRAINED, TAN, MEDIUM DENSE TO DENSE, MOIST
5			42	9.6	1	
10			50/11"	11.7	2	SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, VERY DENSE, MOIST
15			50/9"	9.9	2	
20			50/10"	12.1	2	

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COLORADO SPRINGS, COLORADO 80907

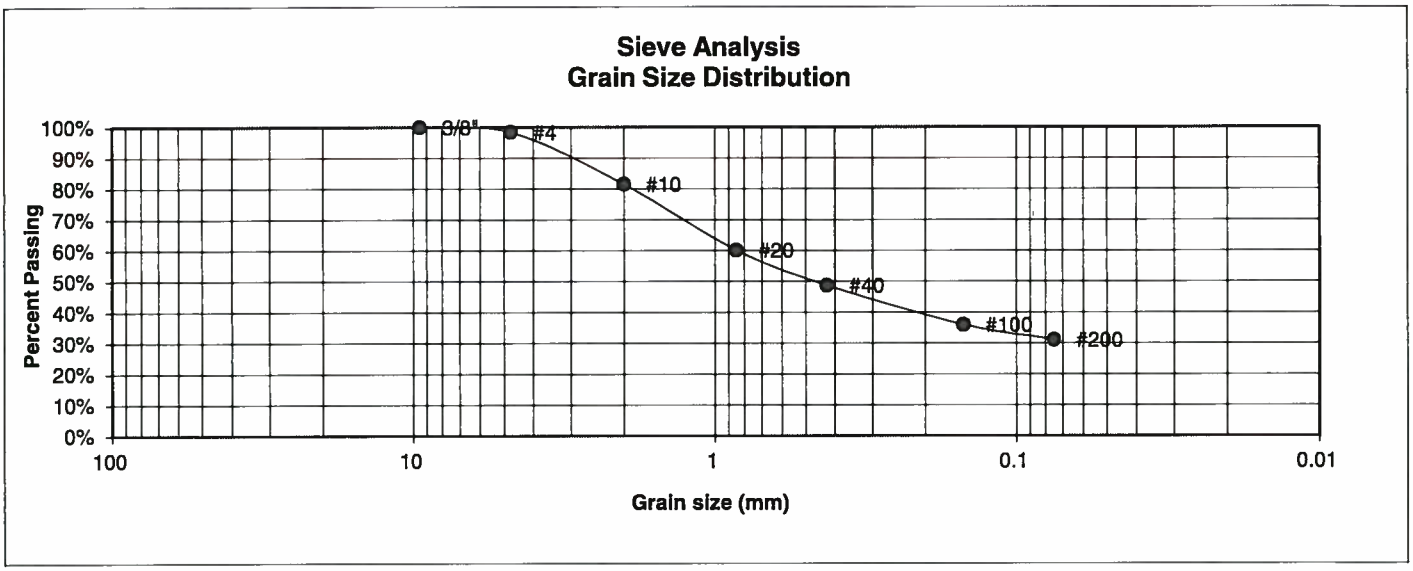
TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	5/20/22

JOB NO.: 220921
FIG NO.: B- 2

APPENDIX C: Laboratory Test Results

UNIFIED CLASSIFICATION	SC	CLIENT	CLASSIC SRJ
SOIL TYPE #	1	PROJECT	STERLING RANCH, FIL 4
TEST BORING #	2	JOB NO.	220921
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	98.4%
10	81.5%
20	60.2%
40	48.7%
100	36.0%
200	31.1%

Atterberg Limits	
Plastic Limit	18
Liquid Limit	37
Plastic Index	19

Swell	
Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	

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505 ELKTON DRIVE
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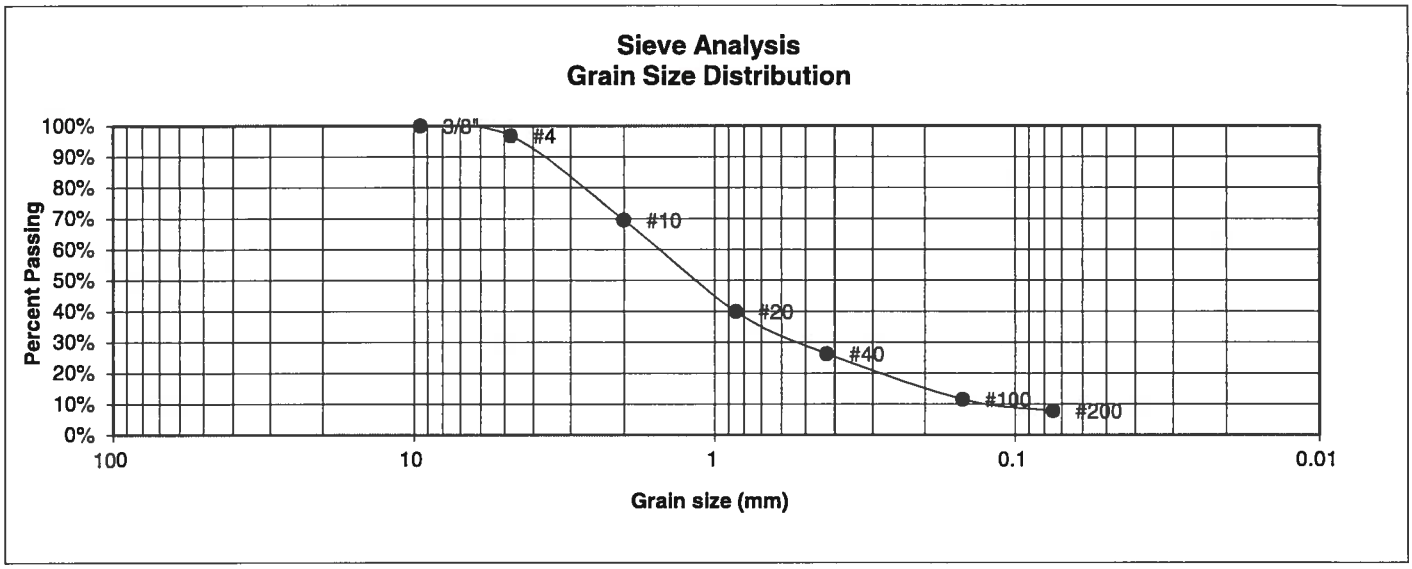
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	5/20/22

JOB NO.: 220921

FIG NO.: C-1

UNIFIED CLASSIFICATION	SM-SW	CLIENT	CLASSIC SRJ
SOIL TYPE #	1	PROJECT	STERLING RANCH, FIL 4
TEST BORING #	3	JOB NO.	220921
DEPTH (FT)	5	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	96.8%
10	69.6%
20	39.9%
40	26.3%
100	11.5%
200	7.8%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

Moisture at start

Moisture at finish

Moisture increase

Initial dry density (pcf)

Swell (psf)

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COLORADO SPRINGS, COLORADO 80907

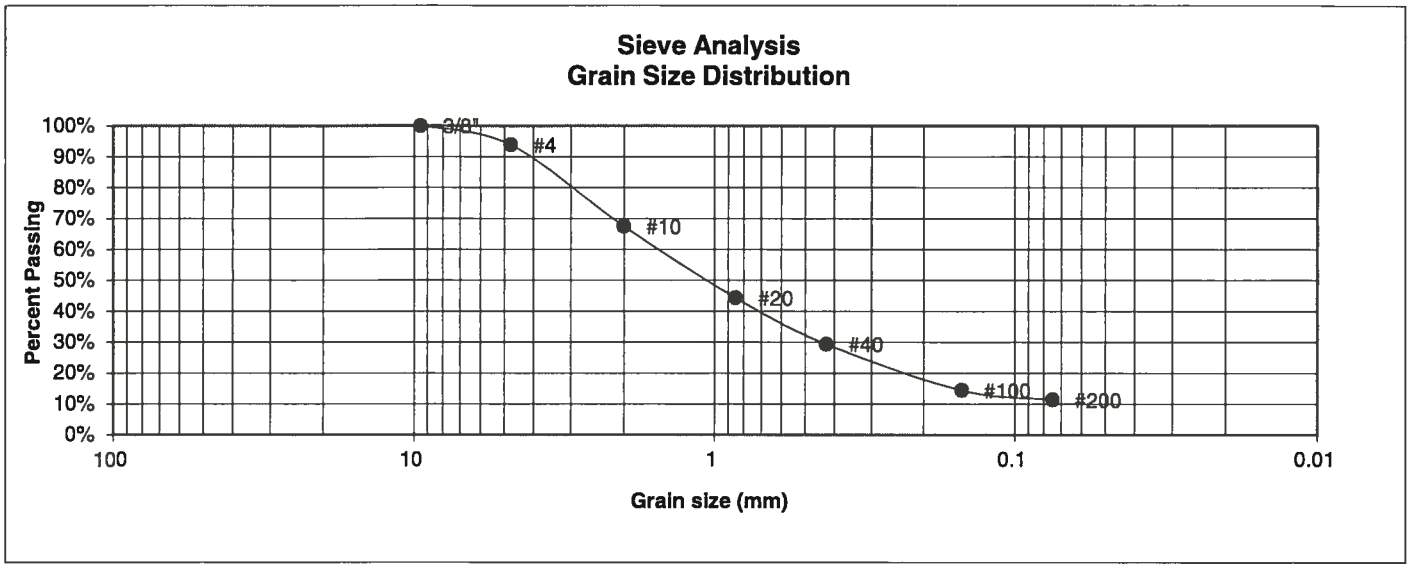
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	5/20/22

JOB NO.: 220921

FIG NO.: C-2

UNIFIED CLASSIFICATION	SM-SW	CLIENT	CLASSIC SRJ
SOIL TYPE #	1	PROJECT	STERLING RANCH, FIL 4
TEST BORING #	4	JOB NO.	220921
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	93.8%
10	67.5%
20	44.3%
40	29.3%
100	14.5%
200	11.4%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

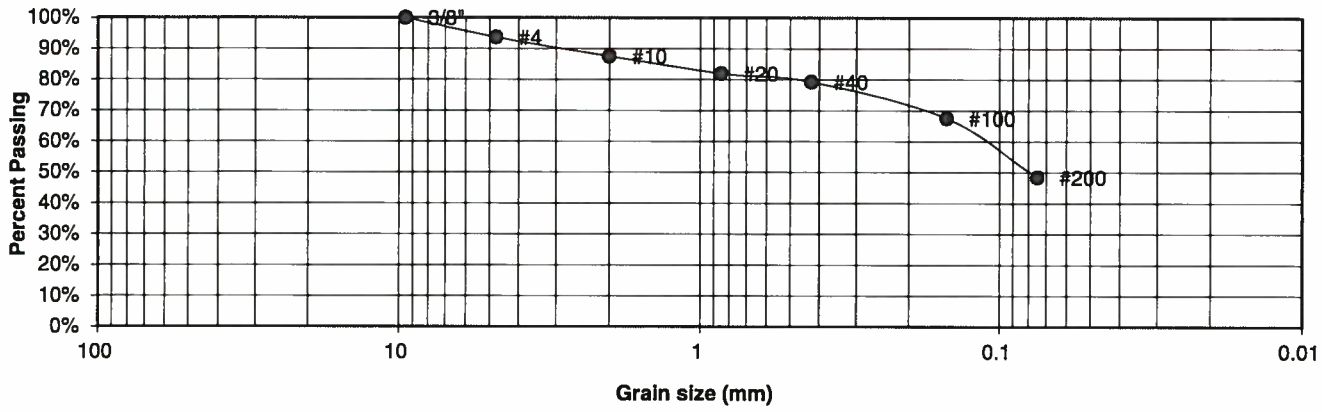
DRAWN:	DATE:	CHECKED:	DATE:
		LLL	5/20/22

JOB NO.: 220921

FIG NO.: C-3

UNIFIED CLASSIFICATION	SM	CLIENT	CLASSIC SRJ
SOIL TYPE #	2	PROJECT	STERLING RANCH, FIL 4
TEST BORING #	2	JOB NO.	220921
DEPTH (FT)	10	TEST BY	BL

Sieve Analysis
Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	93.7%
10	87.5%
20	82.0%
40	79.3%
100	67.5%
200	48.4%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

Moisture at start

Moisture at finish

Moisture increase

Initial dry density (pcf)

Swell (psf)

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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

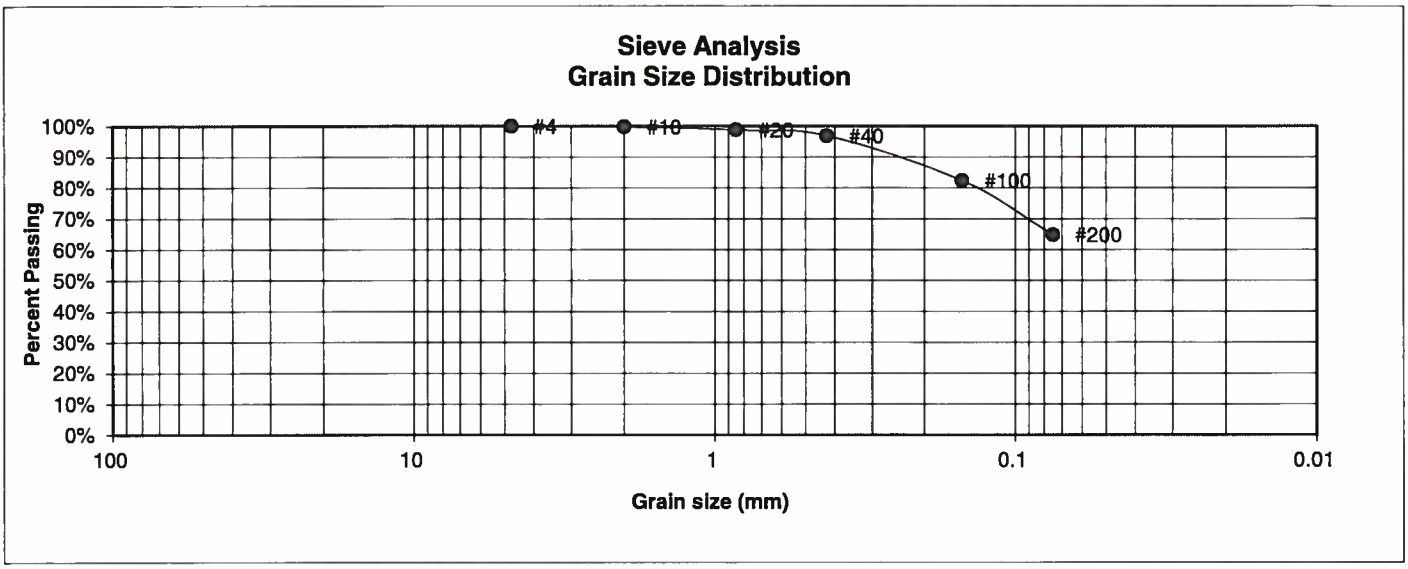
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	5/20/22

JOB NO.: 220921

FIG NO.: C-4

UNIFIED CLASSIFICATION	CL	CLIENT	CLASSIC SRJ
SOIL TYPE #	3	PROJECT	STERLING RANCH, FIL 4
TEST BORING #	1	JOB NO.	220921
DEPTH (FT)	5	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.8%
20	98.8%
40	96.9%
100	82.4%
200	64.8%

Atterberg Limits	
Plastic Limit	21
Liquid Limit	37
Plastic Index	16

Swell	
Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	

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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	5/20/22

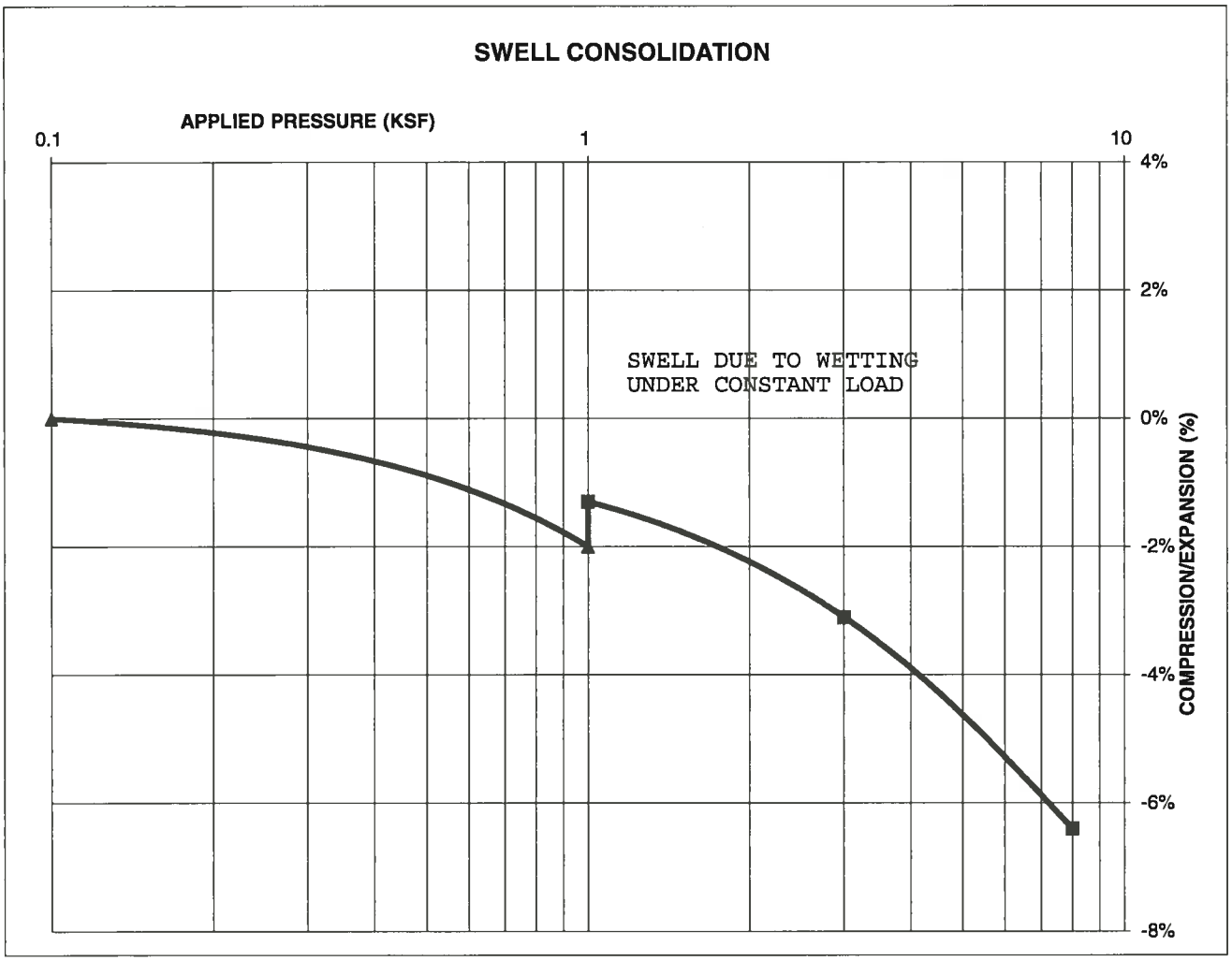
JOB NO.: 220921

FIG NO.: L-5

CONSOLIDATION TEST RESULTS

TEST BORING #	2	DEPTH(ft)	2-3
DESCRIPTION	SC	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			113
NATURAL MOISTURE CONTENT			11.6%
SWELL/CONSOLIDATION (%)			0.7%

JOB NO. 220921
CLIENT CLASSIC SRJ
PROJECT STERLING RANCH, FIL 4



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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

SWELL CONSOLIDATION
TEST RESULTS

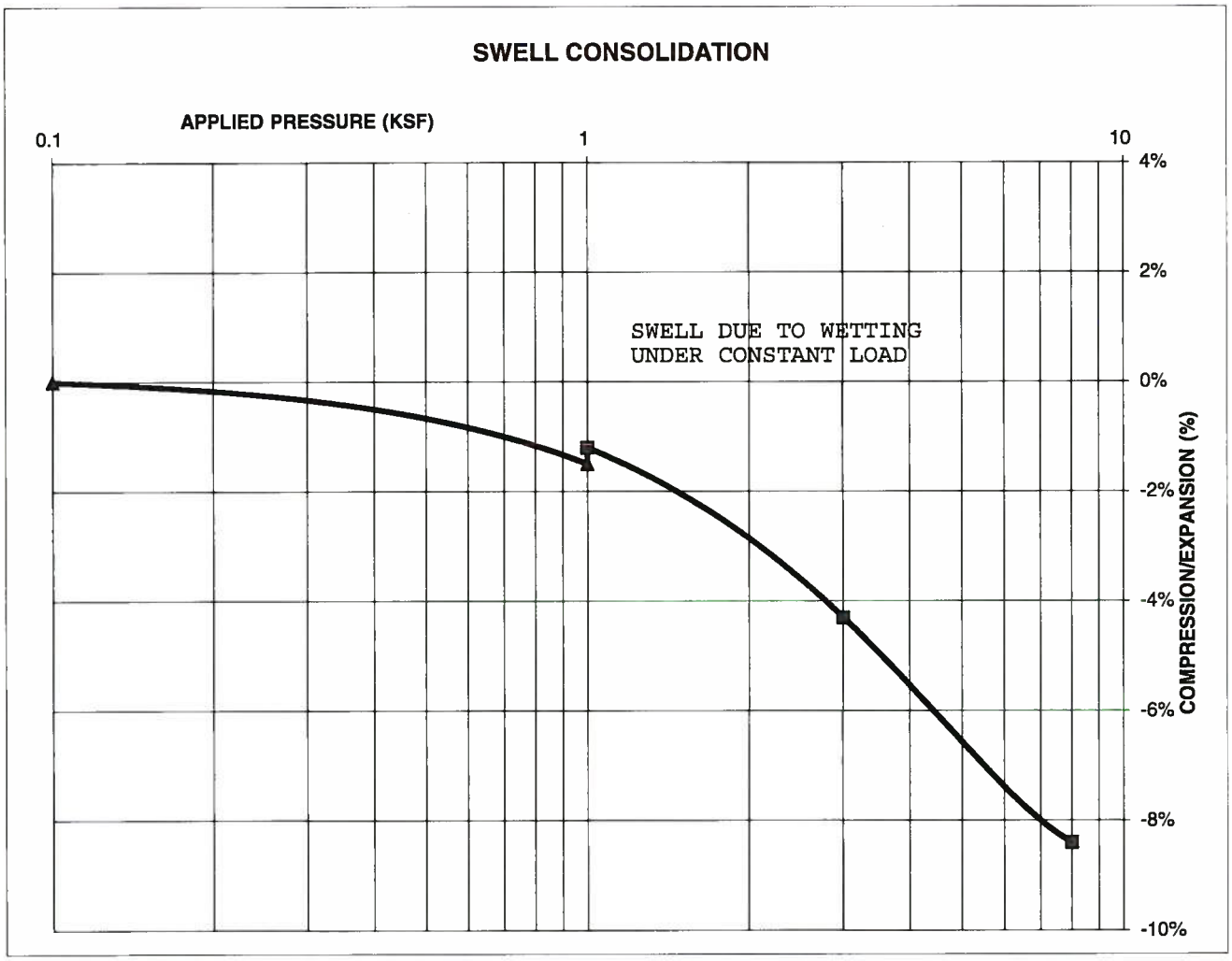
DRAWN:	DATE:	CHECKED:	DATE:
		LLL	5/20/22

JOB NO.: 220921
FIG NO.: C-6

CONSOLIDATION TEST RESULTS

TEST BORING #	1	DEPTH(ft)	5
DESCRIPTION	CL	SOIL TYPE	3
NATURAL UNIT DRY WEIGHT (PCF)			95
NATURAL MOISTURE CONTENT			18.1%
SWELL/CONSOLIDATION (%)			0.3%

JOB NO. 220921
CLIENT CLASSIC SRJ
PROJECT STERLING RANCH, FIL 4



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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

SWELL CONSOLIDATION
TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	5/20/22

JOB NO.: 220921
FIG NO.: C-7

CLIENT	CLASSIC SRJ	JOB NO.	220921
PROJECT	STERLING RANCH, FIL 4	DATE	4/26/2022
LOCATION	STERLING RANCH, FIL 4	TEST BY	BL

BORING NUMBER	DEPTH, (ft)	SOIL TYPE NUMBER	UNIFIED CLASSIFICATION	WATER SOLUBLE SULFATE, (wt%)
TB-1	5	3	CL	0.01
TB-2	10	2	SM	<0.01
TB-3	5	1	SM-SW	<0.01
TB-2	2-3	1	SC	<0.01

QC BLANK PASS

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COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST
SULFATE RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		LLL	5/20/22

JOB NO.: 220921

FIG NO.: C-8

APPENDIX D: Laboratory Testing Summary and Test Boring Logs from Entech Job No. 82556

TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

CLIENT MORLEY BENTLEY
PROJECT STERLING RANCH
JOB NO. 82556

SOIL TYPE	TEST BORING NO.	DEPTH (FT)	WATER (%)	DRY DENSITY (PCF)	PASSING NO. 200 SIEVE (%)	LIQUID LIMIT (%)	PLASTIC INDEX (%)	SULFATE (WT %)	FHA SWELL (PSF)	SWELL/ CONSOL (%)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION
1	4	2-5			10.0	NV	NP	<0.01			SM-SW	SAND, SLIGHTLY SILTY
1	9	5			22.4						SM	SAND, SILTY
1	12	5			8.6						SM-SW	SAND, SLIGHTLY SILTY
1	17	2-3			11.7						SM-SP	SAND, SLIGHTLY SILTY
1	19	5			15.9						SM	SAND, SILTY
1	20	10			10.7						SM-SW	SAND, SLIGHTLY SILTY
1	25	2-5			8.4						SM-SW	SAND, SLIGHTLY SILTY
1	26	5			17.3						SM	SAND, SILTY
1	41	5			44.1	23	7		574		SC-SM	SAND, VERY CLAYEY-SILTY
1	42	2-3			7.4						SM-SW	SAND, SLIGHTLY SILTY
1	44	5-10			5.7						SM-SW	SAND, SLIGHTLY SILTY
2	7	5	5.6	98.0		29	13			-2.3	CL	CLAY, SANDY
2	13	2-3			54.6				455		CL	CLAY, VERY SANDY
2	21	7						0.10	4179		CL	CLAY, SANDY
2	23	7							1085		CL	CLAY, SANDY
2	27	9							2300		CL	CLAY, SANDY
2	31	5	27.9	95.4	64.2	40	25			1.8	CL	CLAY, SANDY
2	34	2-5			51.6	27	13				CL	CLAY, VERY SANDY
3	5	15	10.4	116.6		24	11			-0.1	SC	SANDSTONE, CLAYEY
3	6	15-20			14.8			0.01			SM	SANDSTONE, SILTY
3	11	10			17.1						SM	SANDSTONE, SILTY
3	13	10			36.0						SM	SANDSTONE, SILTY
3	14	5			20.4						SM	SANDSTONE, SILTY
3	18	15							456		SM	SANDSTONE, SILTY
3	22	5	23.3	100.7	21.1	NV	NP			0.0	SM	SANDSTONE, SILTY
3	28	5-10			17.8						SM	SANDSTONE, SILTY
3	29	7							485		SC	SANDSTONE, CLAYEY
3	30	10			9.1						SM-SW	SANDSTONE, SLIGHTLY SILTY
3	33	5			14.4						SM	SANDSTONE, SILTY
3	35	15			11.1						SM-SW	SANDSTONE, SLIGHTLY SILTY
3	36	2-5			18.7				1014		SC	SANDSTONE, CLAYEY

TEST BORING NO. 1
DATE DRILLED 8/23/2006
Job # 82556

REMARKS

WATER @ 6', 8/25/06

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
					1
			50	12.1	4
5			50 6"	11.2	4
10			50 7"	13.1	4
15			50 5"	9.8	4
20					

SAND, SILTY, TAN

CLAYSTONE, SANDY, GRAY BROWN, HARD, MOIST

TEST BORING NO. 2
DATE DRILLED 8/23/2006
CLIENT MORLEY BENTLEY
LOCATION STERLING RANCH

REMARKS

WATER @ 11', 8/25/06

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			12	2.0	1
5			30	13.3	4
10			50 6"	11.1	3
15			50 5"	18.9	3
20					

SAND, SILTY, FINE TO COARSE GRAINED, DARK BROWN TO BROWN, MEDIUM DENSE, MOIST

WEATHERED CLAYSTONE, SANDY, GRAY, VERY STIFF, MOIST

SANDSTONE, CLAYEY, FINE TO COARSE GRAINED, LIGHT BROWN, VERY DENSE, MOIST TO VERY MOIST

ENTECH ENGINEERING, INC.
395 CLAYTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		KAH	9/5/06

JOB NO.: 82556
FIG NO.: D-1

TEST BORING NO. 41
DATE DRILLED 8/23/2006
Job # 82556

REMARKS

WATER @ 9', 8/25/06

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			25	10.4	1
			29	10.9	1
5			*	12.4	4
			50 7"	11.3	3
10					
			50 7"	11.7	3
15					
20					

SAND, SLIGHTLY SILTY, FINE TO COARSE GRAINED, BROWN, MEDIUM DENSE, MOIST

SAND, VERY CLAYEY, VERY SILTY, FINE TO COARSE GRAINED, GRAY, MEDIUM DENSE, MOIST

CLAYSTONE, SANDY, LIGHT GRAY

SANDSTONE, SILTY, FINE TO COARSE GRAINED, LIGHT GRAY, VERY DENSE, VERY MOIST

* - BULK SAMPLE TAKEN

TEST BORING NO. 42
DATE DRILLED 8/23/2006
CLIENT MORLEY BENTLEY
LOCATION STERLING RANCH

REMARKS

WATER @ 12', 8/28/06

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			18	4.6	1
5			25	2.9	1
			50 5"	11.4	4
10					
			50 5"	5.0	4
15					
20					

SAND, SLIGHTLY SILTY, FINE TO COARSE GRAINED, BROWN TO TAN, MEDIUM DENSE, MOIST

SANDSTONE, SILTY, FINE TO COARSE GRAINED, LIGHT GRAY, VERY DENSE, MOIST

ENTECH ENGINEERING, INC.
565 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
			9/5/06

JOB NO.: 82556
FIG NO.: D-2

APPENDIX E: Laboratory Testing Summary and Test Boring Logs from Entech Job No. 191089

TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

CLIENT MORLEY-BENTLEY INVEST.
PROJECT STERLING RANCH, P2, F3
JOB NO. 191089

SOIL TYPE	TEST BORING NO.	DEPTH (FT)	WATER (%)	DRY DENSITY (PCF)	PASSING NO. 200 SIEVE (%)	LIQUID LIMIT (%)	PLASTIC INDEX (%)	SULFATE (WT %)	FHA SWELL (PSF)	SWELL/ CONSOL (%)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION
1	1	2-3			6.4	NV	NP	<0.01			SM-SW	SAND, SLIGHTLY SILTY
1	2	5			8.7						SM-SW	SAND, SLIGHTLY SILTY
1	3	10			35.3	NV	NP	<0.01			SM	SAND, SILTY
1	4	2-3			17.8						SM	SAND, SILTY
2	4	5	12.5	113.2	75.9					2.0	CL	CLAY, SANDY
3	2	10			25.1	NV	NP	<0.01			SM	SANDSTONE, SILTY
4	3	20	6.4	120.6	62.7	32	12	<0.01		-0.4	CL	CLAYSTONE, SANDY

TEST BORING NO. 3
DATE DRILLED 7/12/2019
Job # 191089

REMARKS

WATER @ 9.5', 8/7/19

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
			19	3.8	1	SAND, SILTY, FINE TO COARSE GRAINED, TAN, MEDIUM DENSE, MOIST
5			17	7.1	1	
10			29	13.4	1	
15			41	10.0	4	WEATHERED TO FORMATIONAL CLAYSTONE, SANDY, GRAY BROWN, VERY STIFF TO HARD, MOIST
20			50/8"	11.3	4	

TEST BORING NO. 4
DATE DRILLED 7/12/2019
CLIENT MORLEY-BENTLEY INVEST.
LOCATION STERLING RANCH, P2, F3

REMARKS

DRY TO 19', 8/7/19

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
			10	1.6	1	SAND, SILTY, FINE TO COARSE GRAINED, BROWN, MEDIUM DENSE, DRY
5			47	11.1	2	CLAY, SANDY, GRAY BROWN, VERY STIFF, MOIST
10			50/6"	10.9	3	SANDSTONE, SILTY, FINE TO COARSE GRAINED, TAN, VERY DENSE, MOIST
15			50/7"	12.3	3	
20			50/5"	11.8	4	CLAYSTONE, SANDY, GRAY BROWN, HARD, MOIST

ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN	DATE	CHECKED:	DATE
			8/9/19

JOB NO. 191089
FIG NO B-2

APPENDIX F: Soil Survey Descriptions

El Paso County Area, Colorado

8—Blakeland loamy sand, 1 to 9 percent slopes

Map Unit Setting

National map unit symbol: 369v
Elevation: 4,600 to 5,800 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Blakeland and similar soils: 98 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blakeland

Setting

Landform: Hills, flats
Landform position (three-dimensional): Side slope, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from sedimentary rock and/or eolian deposits derived from sedimentary rock

Typical profile

A - 0 to 11 inches: loamy sand
AC - 11 to 27 inches: loamy sand
C - 27 to 60 inches: sand

Properties and qualities

Slope: 1 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Other soils

Percent of map unit: 1 percent
Hydric soil rating: No

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 19, Aug 31, 2021

El Paso County Area, Colorado

9—Blakeland-Fluvaquentic Haplaquolls

Map Unit Setting

National map unit symbol: 36b6
Elevation: 3,500 to 5,800 feet
Mean annual precipitation: 13 to 17 inches
Mean annual air temperature: 46 to 55 degrees F
Frost-free period: 110 to 165 days
Farmland classification: Not prime farmland

Map Unit Composition

Blakeland and similar soils: 60 percent
Fluvaquentic haplaquolls and similar soils: 38 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blakeland

Setting

Landform: Hills, flats
Landform position (three-dimensional): Side slope, talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium derived from arkose and/or eolian deposits derived from arkose

Typical profile

A - 0 to 11 inches: loamy sand
AC - 11 to 27 inches: loamy sand
C - 27 to 60 inches: sand

Properties and qualities

Slope: 1 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Somewhat excessively drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Available water supply, 0 to 60 inches: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XB210CO - Sandy Foothill

Hydric soil rating: No

Description of Fluvaquentic Haplaquolls

Setting

Landform: Swales
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

H1 - 0 to 12 inches: variable
H2 - 12 to 60 inches: stratified very gravelly sand to loam

Properties and qualities

Slope: 1 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 6.00 in/hr)
Depth to water table: About 0 to 24 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Maximum salinity: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 6.2 inches)

Interpretive groups

Land capability classification (irrigated): 6w
Land capability classification (nonirrigated): 6w
Hydrologic Soil Group: D
Ecological site: R048AY241CO - Mountain Meadow
Hydric soil rating: Yes

Minor Components

Pleasant

Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

Other soils

Percent of map unit: 1 percent
Hydric soil rating: No

Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 19, Aug 31, 2021

El Paso County Area, Colorado

19—Columbine gravelly sandy loam, 0 to 3 percent slopes

Map Unit Setting

National map unit symbol: 367p
Elevation: 6,500 to 7,300 feet
Mean annual precipitation: 14 to 16 inches
Mean annual air temperature: 46 to 50 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Columbine and similar soils: 97 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Columbine

Setting

Landform: Flood plains, fan terraces, fans
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium

Typical profile

A - 0 to 14 inches: gravelly sandy loam
C - 14 to 60 inches: very gravelly loamy sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 2.5 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Ecological site: R049XY214CO - Gravelly Foothill
Hydric soil rating: No

Minor Components

Fluvaquentic haplaquolls

Percent of map unit: 1 percent

Landform: Swales
Hydric soil rating: Yes

Other soils
Percent of map unit: 1 percent
Hydric soil rating: No

Pleasant
Percent of map unit: 1 percent
Landform: Depressions
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: El Paso County Area, Colorado
Survey Area Data: Version 19, Aug 31, 2021

El Paso County Area, Colorado

71—Pring coarse sandy loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 369k
Elevation: 6,800 to 7,600 feet
Farmland classification: Not prime farmland

Map Unit Composition

Pring and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Pring

Setting

Landform: Hills
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Arkosic alluvium derived from sedimentary rock

Typical profile

A - 0 to 14 inches: coarse sandy loam
C - 14 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): High (2.00 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 6.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Ecological site: R048AY222CO - Loamy Park
Hydric soil rating: No

Minor Components

Pleasant

Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes