GEOTECHNICAL • ENVIRONMENTAL • GEOLOGY • MATERIALS TESTING & INSPECTION • FORENSIC • LABORATORY

SALEM
engineering group, inc.

LAND ANALYSIS REPORT

FOR
COMMERCIAL DEVELOPMENT
SWC MESA RIDGE PARKWAY AND SYRACUSE STREET
FOUNTAIN, COLORADO

SALEM PROJECT NO. 7-219-0518
JANUARY 6, 2020

PREPARED FOR:

MR. MICHAEL JUSTICE
EVERGREEN DEVCO
2390 EAST CAMELBACK ROAD, SUITE 410
PHOENIX, AZ 85016

PREPARED BY:

SALEM ENGINEERING GROUP, INC.
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January 6, 2020

Project No. 7-219-0518

To: City of Fountain

SUBJECT: **COMMERCIAL DEVELOPMENT**
SWC MESA RIDGE PARKWAY AND SYRACUSE STREET

This letter presents a land analysis report on the above mentioned site. The entire site is approximately 33 acres which is divided into a northern section and southern section. The northern section will be developed for commercial/retail uses (approximaltey17.06 acres). The southern section – which is expected to be, at least in part, a retention pond. In addition, a sliver of land located between the rights of way of the Atchison, Topeka and the Santa Fe Railroad and the Denver & Rio Grande Western Railroad along the western portion of the site is included in this report. The sliver of land encompasses approximately 3.5 acres. The site area is depicted on the attached topographic map and aerial photograph.

The site is currently an undeveloped vacant land with miscellaneous seasonal grasses and a few trees. Railroad tracks run along the western portion of the site. There is a ditch in the northern part of the northern section that is approximately 6 feet lower than the rest of the area. The average elevation of the northern section of the site is approximately 5,654 feet above means sea level based on Google Earth imagery. The southern section has an average elevation of approximately 5,640 feet above mean sea level based on Google Earth imagery.

A Geotechnical Engineering Investigation Report prepared by Same Engineering Group, Inc. is included in the Appendix.

We appreciate the opportunity to assist you with this project. Should you have questions regarding this report or need additional information, please contact the undersigned at (303) 848-3945.

Respectfully Submitted,

SALEM ENGINEERING GROUP, INC.

Clarence Jiang
Senior Geotechnical Engineer

R. Sammy Salem, MS, PE
Principal Engineer
PE No. 45178 – Expires 04/30/2021

Section 16.21.080 – 16.21.080 36 1. A Land Analysis Report (LAR) containing both mapped and written information identifying the extent of and impact upon the property's natural features and environmental constraints, and that addresses proposed mitigating measures which may include avoidance, replacement, proposed plat notes, etc. The LAR may take the form of a single report or multiple reports at the discretion of the subdivider. The intent of the report should be to identify all potential issues associated with the development of the property and, where appropriate, identify how the proposal mitigates these issues or why an issue has been dismissed. At a minimum the report shall include:

SITE FEATURES

The site encompasses approximately 33 acres and is divided into a northern section and southern section. An approximately 17.06 acres of the northern section will be developed for commercial/retail uses. The southern section – which is expected to be, at least in part, a retention pond. It features a commercial/retail shopping center. In addition, a sliver of land located between the rights of way of the Atchison, Topeka and the Santa Fe Railroad and the Denver & Rio Grande Western Railroad along the western portion of the site is included in this report. The sliver of land encompasses approximately 3.5 acres. The site area is depicted on the attached topographic map and aerial photograph.

The site is irregular in shape and is located at the southwest corner of the intersection of Mesa Ridge Parkway and Syracuse Street in the City of Fountain, Colorado. The site is currently an undeveloped vacant land with miscellaneous seasonal grasses and a few trees. Railroad tracks run along the western portion of the site.

There is a ditch in the northern part of the northern section that is approximately 6 feet lower than the rest of the area. The average elevation of the northern section of the site is approximately 5,654 feet above means sea level based on Google Earth imagery. The southern section has an average elevation of approximately 5,640 feet above mean sea level based on Google Earth imagery. Based on historical data, the site was vacant/agricultural use from 1937 to 1972, and vacant land since then. A road formerly transected the site in a north to south direction and later moved to adjoin the site to the east.

There are currently no known man-made or natural features or constraints that require mitigation. This include wildlife, wetlands, soils, geologic hazards, wildfire hazards, and/or other issues.

Drainage on the site is primarily from north to south. Stormwater contained within Syracuse Street and Mesa Ridge Parkway is conveyed by ditches along the roadway.

a. A discussion of site features depicted on the plat that may affect the evaluation of the proposed development. All significant natural and man-made features shall be identified, including major views into and out of the subdivision in any proposed industrial and commercial subdivisions. A written analysis shall be provided that summarizes the existing site features and constraints and addresses how the development of the site will occur in a manner that considers both the opportunities and constraints. The written analysis must address the site's physical constraints and hazards, along with proposed impact mitigation measures. The report shall also address wildlife, wetlands, soils, geologic hazard, wildfire hazard, and other issues. Where a particular parameter does not apply, the report shall identify how a determination was made that the parameter does not apply.

SOILS REPORT – See attached Geotechnical Engineering Investigation Report in Appendix of this report.

b. Evidence establishing soil suitability in the form of a report prepared by a professional engineer or professional geologist and information on the geological characteristics of the site prepared by a qualified professional. Significant natural features (e.g., drainage channels, bodies of water, rock outcroppings, ravines, ridge lines, buttes and bluffs) and geologic hazards (e.g., down slope creep, debris flow, flood hazards, rockfall hazards, underground mines, known areas of soil problems such as subsidence or shrink/swell, soil contamination, soil corrosiveness) that may require unusual mitigation during design and construction of structures and infrastructure.

WATER SUPPLY

c. Unless the City of Fountain has provided a commitment to serve, evidence that an adequate water supply is provided.

There are currently no water facilities providing services within this site. Service will be provided by Fountain City Water Department.

WASTEWATER PROVISION

d. Evidence of the physical and legal capability to provide wastewater.

There are currently no wastewater facilities providing services within this site. Service will be provided by Fountain Sanitation District.

PROTECTION HISTORICAL RESOURCES

e. A discussion on the effect of the proposal on significant cultural, archaeological and historical resources and plans for the protection of such resources.

Based on the results of the files search and literature review, there are no known cultural, archaeological or historical resources present.

CULTURAL RESOURCES REPORT – See attached Cultural Resources Files Search Report in Appendix of this report.

Per Fountain website, this is part of Mesa Ridge Business Corridor:

ADDRESS and Location Description:

El Paso County Assessor's Parcel Numbers: 55300-00-066, 55300-00-074 and 66300-00-082

Description: Southwest Corner of Mesa Ridge Parkway and Syracuse Street

LOCATION: Fountain, Colorado in El Paso County

CONTACT: Evergreen Devco
2390 East Camelback Road, Suite 410
Phoenix, AZ 85016

UTILITIES:	**UTILITIES WILL BE PROVIDED BY**
ELECTRIC	Fountain Utilities Department
WATER	Fountain City Water Department
SEWER	Fountain Sanitation District
GAS	Black Hills Energy

ZONING: Regional Commercial District (City of Fountain Zoning Map)

ENTERPRISE ZONE: PROBABLE per City Retailer Welcome Letter:

SUITED FOR: A mix of commercial and retail uses.

NEIGHBORS:

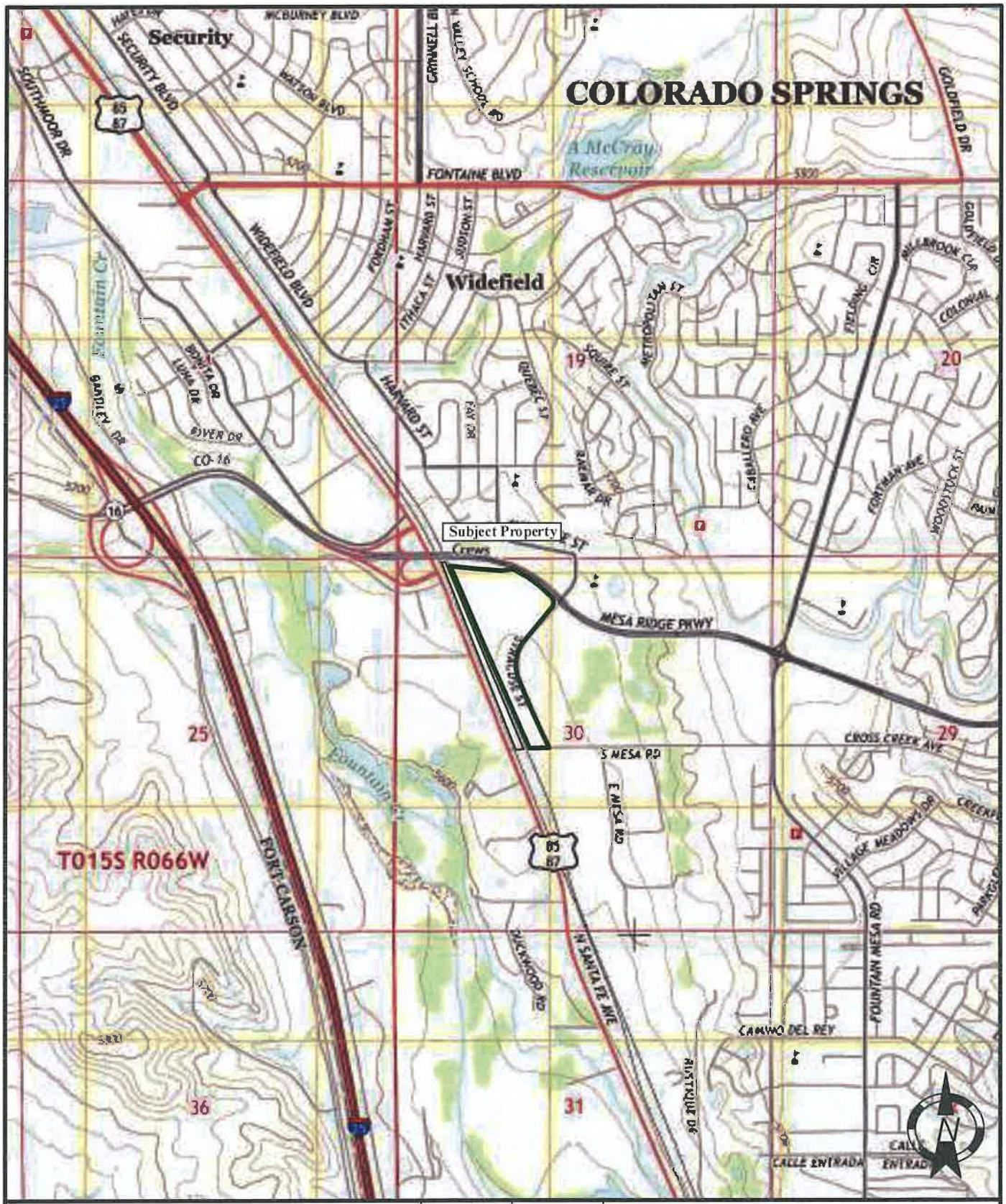
Adjacent Streets and Property Use

DIRECTION	ADJACENT STREET	ADJACENT PROPERTY USE
Northeast	Mesa Ridge Parkway	Vacant Land
Southeast	Syracuse Street	Vacant Land
South	Mesa Road	Vacant Land
Southwest	North Santa Fe Avenue	Vacant Land
West	North Santa Fe Avenue	Scotts Miracle Grow (3 Assembly Court)
Northwest	Mesa Ridge Parkway	Vacant Land
East	Syracuse Street & Mesa Ridge Parkway	Mesa Ridge High School (6070 Mesa Ridge Parkway); Residential

LAND ANALYSIS REPORT

APPENDIX

Geotechnical Engineering Investigation Report
&
Cultural Resources Files Search Report



TOPOGRAPHIC MAP (2013)	SCALE: NTS	DATE: Jan 2020
PROPOSED COMMERCIAL DEVELOPMENT WEST CORNER OF MESA RIDGE PARKWAY & SYRACUSE STREET FOUNTAIN, COLORADO	DRAWN BY: BR	APPROVED BY: RM
	PROJECT NO.: 7-419-0534	FIGURE NO.: 1

SALEM engineering group, inc.

AERIAL PHOTOGRAPH (2017)	SCALE: NTS	DATE: Jan 2020	SALEM engineering group, inc.
PROPOSED COMMERCIAL DEVELOPMENT WEST CORNER OF MESA RIDGE PARKWAY & SYRACUSE STREET FOUNTAIN, COLORADO	DRAWN BY: BR	APPROVED BY: RM	
	PROJECT NO.: 7-419-0534	FIGURE NO.: 2	

SITE MAP	SCALE: NTS	DATE: Jan 2020	SALEM engineering group, inc.
PROPOSED COMMERCIAL DEVELOPMENT WEST CORNER OF MESA RIDGE PARKWAY & SYRACUSE STREET FOUNTAIN, COLORADO	DRAWN BY: BR	APPROVED BY: RM	
	PROJECT NO.: 7-419-0534	FIGURE NO.: 3	

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GEOTECHNICAL ENGINEERING INVESTIGATION

PROPOSED COMMERCIAL DEVELOPMENT
SWC MESA RIDGE PARKWAY AND SYRACUSE STREET
FOUNTAIN, COLORADO

SALEM PROJECT NO. 7-219-0518
JULY 10, 2019

PREPARED FOR:

MR. MICHAEL JUSTICE
EVERGREEN DEVCO
2390 EAST CAMELBACK ROAD, SUITE 410
PHOENIX, AZ 85016

PREPARED BY:

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July 10, 2019

Project No. 7-219-0518

Mr. Michael Justice
Evergreen Devco
2390 East Camelback Road, Suite 410
Phoenix, AZ 85016

SUBJECT: **GEOTECHNICAL ENGINEERING INVESTIGATION**
PROPOSED COMMERCIAL DEVELOPMENT
SWC MESA RIDGE PARKWAY AND SYRACUSE STREET
FOUNTAIN, COLORADO

Dear Mr. Justice:

At your request and authorization, SALEM Engineering Group, Inc. (SALEM) has prepared this Geotechnical Engineering Investigation report for the Proposed Commercial Development to be located at the subject site.

The accompanying report presents our findings, conclusions, and recommendations regarding the geotechnical aspects of designing and constructing the project as presently proposed. In our opinion, the proposed project is feasible from a geotechnical viewpoint provided our recommendations are incorporated into the design and construction of the project.

We appreciate the opportunity to assist you with this project. Should you have questions regarding this report or need additional information, please contact the undersigned at (909) 980-6455.

Respectfully Submitted,

SALEM ENGINEERING GROUP, INC.

Clarence Jiang
Senior Geotechnical Engineer

R. Sammy Salem, MS, PE
Principal Engineer
PE No. 45178 – Expires 04/30/2021

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GEOTECHNICAL ENGINEERING INVESTIGATION
PROPOSED COMMERCIAL DEVELOPMENT
SWC MESA RIDGE PARKWAY AND SYRACUSE STREET
FOUNTAIN, COLORADO

1. PURPOSE AND SCOPE

This report presents the results of our Geotechnical Engineering Investigation for the Proposed Commercial Development to be located at the southwest corner of Mesa Ridge Parkway and Syracuse Street in Fountain, Colorado (see Figure 1, Vicinity Map).

The purpose of our geotechnical engineering investigation was to observe and sample the subsurface conditions encountered at the site, and provide conclusions and recommendations relative to the geotechnical aspects of constructing the project as presently proposed.

The scope of this investigation included a field exploration, laboratory testing, engineering analysis and the preparation of this report. Our field exploration was performed on June 25, 2019 and included the drilling of ten (10) small-diameter soil borings to a maximum depth of 31½ feet below existing grade at the site. Additionally, two (2) percolation tests were performed at a depth of approximately 10 feet below existing grade for the determination of the percolation rate. The locations of the soil borings and percolation tests are depicted on Figures 2a and 2b, Site Plan. A detailed discussion of our field investigation, exploratory boring logs are presented in Appendix A.

Laboratory tests were performed on selected soil samples obtained during the investigation to evaluate pertinent physical properties for engineering analyses. Appendix B presents the laboratory test results in tabular and graphic format.

The recommendations presented herein are based on analysis of the data obtained during the investigation and our experience with similar soil and geologic conditions. If project details vary significantly from those described herein, SALEM should be contacted to determine the necessity for review and possible revision of this report.

Earthwork and Pavement Specifications are presented in Appendix C. If text of the report conflict with the specifications in Appendix C, the recommendations in the text of the report have precedence.

2. PROJECT DESCRIPTION

Based on the site plan provided to us, development of the site will include construction of new commercial development with the vacant land located on near the intersection of southwest corner of ridge parkway and Syracuse Street in Fountain, Colorado. The new development will encompass approximately 17.06 acres and include 9 lots ranging from 0.50 to 5.68 acres. Lot 1 will be a Maverick Gas Station on a 1.61

acre land. Lots 2 through 8 will be retail/restaurant/commercial buildings. Lot 9 (5.68 acres) is undetermined. The vacant land south of the subject site is anticipated to be, at least in part, a retention pond area. On-site parking and landscaping are planned to be associated with the development. Maximum wall load is expected to be on the order of 3 kips per linear foot. Maximum column load is expected to be on the order of 50 kips. Floor slab soil bearing pressure is expected to be on the order of 150 psf.

A site grading plan was available at the time of preparation of this report. As the site area is essentially level, we anticipate that cuts and fills during earthwork will be minimal and limited to providing level positive site drainage. In the event that changes occur in the nature or design of the project, the conclusions and recommendations contained in this report will not be considered valid unless the changes are reviewed and the conclusions of our report are modified. The site configuration and locations of proposed improvements are shown on the Site Plan, Figures 2a and 2b.

3. SITE LOCATION AND DESCRIPTION

The site is irregular in shape and is located at the southwest corner of the intersection of Mesa Ridge Parkway and Syracuse Street in the City of Fountain, Colorado (see Vicinity Map, Figure 1). The site is currently an undeveloped vacant land with miscellaneous seasonal grasses and a few trees. Railroad tracks run along the western portion of the site.

The site is divided into a northern section and southern section. There is a ditch in the northern part of the northern section that is approximately 6 feet lower than the rest of the area. The average elevation of the northern section of the site is approximately 5,654 feet above means sea level based on Google Earth imagery. The southern section – which is expected to be, at least in part, a retention pond area – has an average elevation of approximately 5,640 feet above mean sea level based on Google Earth imagery.

Based on historical data, the site was vacant/agricultural use from 1937 to 1972, and vacant land since then. A road formerly transected the site in a north to south direction and later moved to adjoin the site to the east.

4. FIELD EXPLORATION

Our field exploration consisted of site surface reconnaissance and subsurface exploration. The exploratory test borings (B-1 through B-10) were drilled on June 25, 2019 in the areas shown on the Site Plan, Figures 2a and 2b. The test borings were advanced with a 4 inch diameter hollow stem auger rotated by a truck-mounted Simco 2800 drill rig. The test borings were extended to a maximum depth of 31½ feet below existing grade.

The materials encountered in the test borings were visually classified in the field, and logs were recorded by a field engineer and stratification lines were approximated on the basis of observations made at the time of drilling. Visual classification of the materials encountered in the test borings were generally made in accordance with the Unified Soil Classification System (ASTM D2487). A soil classification chart and key to sampling is presented on the Unified Soil Classification Chart, in Appendix "A."

The logs of the test borings are presented in Appendix "A." The Boring Logs include the soil type, color, moisture content, dry density, and the applicable Unified Soil Classification System symbol. The location

of the test borings were determined by measuring from features shown on the Site Plan, provided to us. Hence, accuracy can be implied only to the degree that this method warrants.

The actual boundaries between different soil types may be gradual and soil conditions may vary. For a more detailed description of the materials encountered, the Boring Logs in Appendix "A" should be consulted. Soil samples were obtained from the test borings at the depths shown on the logs of borings. The MCS samples were recovered and capped at both ends to preserve the samples at their natural moisture content; SPT samples were recovered and placed in a sealed bag to preserve their natural moisture content. The borings were backfilled with soil cuttings after completion of the drilling.

5. LABORATORY TESTING

Laboratory tests were performed on selected soil samples to evaluate their physical characteristics and engineering properties. The laboratory-testing program was formulated with emphasis on the evaluation of natural moisture, density, shear strength, expansion index, Atterberg limits, R-Value, maximum density and optimum moisture determination, and gradation of the materials encountered.

In addition, chemical tests were performed to evaluate the corrosivity of the soils to buried concrete and metal. Details of the laboratory test program and the results of laboratory test are summarized in Appendix "B." This information, along with the field observations, was used to prepare the final boring logs in Appendix "A."

6. GEOLOGIC SETTING

The site is located in the foothills of the southern Front Range in an area of variable geologic structures. The Rampart Range Fault is one of the major structural features of the region. During the mountain building episodes which formed the present day Rocky Mountains, the mountains to the west rose as the area to the east dropped along the Rampart Range Fault. The Rampart Fault trends north-south along the Front Range, north of Colorado Springs.

It appears that a maximum probable event along fault zones in the vicinity could produce a peak horizontal ground acceleration of approximately 0.136g (2% probability of being exceeded in 50 years). With respect to this hazard, the site is comparable to others in this general area within similar geologic settings. No evidence of surface faulting was observed on the property during our reconnaissance. Soils on site are classified as Site Class D in accordance with Chapter 16 of the International Building Code (IBC). The proposed structures are determined to be in Seismic Design Category B.

7. LIQUEFACTION

Soil liquefaction is a state of soil particles suspension caused by a complete loss of strength when the effective stress drops to zero. Liquefaction normally occurs under saturated conditions in soils such as sand in which the strength is purely frictional. Primary factors that trigger liquefaction are: moderate to strong ground shaking (seismic source), relatively clean, loose granular soils (primarily poorly graded sands and silty sands), and saturated soil conditions (shallow groundwater). Due to the increasing overburden pressure with depth, liquefaction of granular soils is generally limited to the upper 50 feet of a soil profile. However, liquefaction has occurred in soils other than clean sand.

The soils encountered within the depth of 31½ feet on the project site consisted predominately of stiff to hard sandy clay and medium dense to very dense silty sand. Free groundwater was encountered at a depth of approximately 18 feet below the existing grade. Low to very low cohesion strength is associated with the sandy soil. A seismic hazard, which could cause damage to the proposed development during seismic shaking, is the post-liquefaction settlement of the liquefied sands. The site was evaluated for liquefaction potential.

The liquefaction potential of the site is considered to be low due to the relative dense/stiff materials and low seismicity activities in the region. Therefore, no mitigation measures are warranted. Detailed geotechnical engineering recommendations are presented in the remaining portions of the text. The recommendations are based on the properties of the materials identified during our investigation.

8. SOIL AND GROUNDWATER CONDITIONS

8.1 Subsurface Conditions

The subsurface conditions encountered appear typical of those found in the geologic region of the site. In general, the soils within the depth of exploration consisted predominately of stiff to hard sandy clay and medium dense to very dense silty sand. Field and laboratory tests suggest that the deeper native soils are moderately strong and slightly compressible. These soils extended to the termination depth of our borings.

Fill soils are anticipated to be present onsite between our test boring locations since a road was transected the site. Verification of the presence of fill should be determined during site grading. Undocumented fill materials are not suitable to support any future structures and should be replaced with Engineered Fill. The extent and consistency of the fills should be verified during site construction. Prior to fill placement, Salem Engineering Group, Inc. should inspect the bottom of the excavation to verify the fill condition.

The soils were classified in the field during the drilling and sampling operations. The stratification lines were approximated by the field engineer on the basis of observations made at the time of drilling. The actual boundaries between different soil types may be gradual and soil conditions may vary. For a more detailed description of the materials encountered, the Boring Logs in Appendix "A" should be consulted.

The Boring Logs include the soil type, color, moisture content, dry density, and the applicable Unified Soil Classification System symbol. The locations of the test borings were determined by measuring from feature shown on the Site Plan, provided to us. Hence, accuracy can be implied only to the degree that this method warrants.

8.2 Groundwater

The test boring locations were checked for the presence of groundwater during and after the drilling operations. Free groundwater was encountered at a depth of approximately 18 feet below the exiting grade. It should be recognized that water table elevations may fluctuate with time, being dependent upon seasonal precipitation, irrigation, land use, localized pumping, and climatic conditions as well as other factors. Therefore, water level observations at the time of the field investigation may vary from those encountered during the construction phase of the project. The evaluation of such factors is beyond the scope of this report.

8.3 Soil Corrosion Screening

Excessive sulfate in either the soil or native water may result in an adverse reaction between the cement in concrete and the soil. The 2014 Edition of ACI 318 (ACI 318) has established criteria for evaluation of sulfate and chloride levels and how they relate to cement reactivity with soil and/or water. A soil sample was obtained from the project site and was tested for the evaluation of the potential for concrete deterioration or steel corrosion due to attack by soil-borne soluble salts and soluble chloride. The water-soluble sulfate concentration in the saturation extract from the soil sample was detected to be 323 mg/kg. ACI 318 Tables 19.3.1.1 and 19.3.2.1 outline exposure categories, classes, and concrete requirements by exposure class. ACI 318 requirements for site concrete based upon soluble sulfate are summarized in Table 8.3 below.

TABLE 8.3
WATER SOLUBLE SULFATE EXPOSURE REQUIREMENTS

Water Soluble Sulfate (SO_4) in Soil, Percentage by Weight	Exposure Severity	Exposure Class	Maximum w/cm Ratio	Minimum Concrete Compressive Strength	Cementations Materials Type
0.0323	Not Severe	S0	N/A	2,500 psi	No Restriction

The water-soluble chloride concentration detected in saturation extract from the soil samples was 45 mg/kg. This level of chloride concentration is not considered to be severely corrosive. It is recommended that a qualified corrosion engineer be consulted regarding protection of buried steel or ductile iron piping and conduit or, at a minimum, applicable manufacturer's recommendations for corrosion protection of buried metal pipe be closely followed.

8.4 Percolation Testing

Two percolation tests (P-1 and P-2) were performed on June 26, 2019 at the proposed storm pond area. Results of the falling head tests are presented in the attachments to this report. The approximate locations of the percolation tests are shown on the attached Site Plan, Figure 2b. The holes were pre-saturated before percolation testing commenced. Two (2) 4-inch diameter boreholes were advanced to a depth of approximately 10 feet below existing grade. Percolation rates were measured by filling the test holes with clean water and measuring the water drops at a certain time interval. The percolation rate data are presented in tabular format at the end of this Report. The difference in the percolation rates are reflected by the varied type of soil materials at the bottom of the test hole. The test results are shown on the table below:

Test No.	Depth (feet)	Measured Percolation Rate (min/inch)	Tested Infiltration Rate* (inch/hour)	Soil Type
P-1	10	1.6	2.99	Silty SAND w/Gravel (SM)
P-2	9.9	1.1	3.95	Silty SAND w/Gravel (SM)

*** Tested infiltration Rate = $(\Delta H\ 60\ r) / (\Delta t(r + 2H_{avg}))$**

The soil infiltration or percolation rates are based on tests conducted with clear water. The infiltration/percolation rates may vary with time as a result of soil clogging from water impurities. The infiltration/percolation rates will deteriorate over time due to the soil conditions. The soils may also become less permeable to impermeable if the soil is compacted. Thus, periodic maintenance consisting of clearing the bottom of the drainage system of clogged soils should be expected.

The infiltration/percolation rate may become slower if the surrounding soil is wet or saturated due to prolonged rainfalls. Additional percolation tests should be conducted at bottom of the drainage system during construction to verify the infiltration/percolation rate. Groundwater, if closer to the bottom of the drainage system, will also reduce the infiltration/percolation rate.

The scope of our services did not include a groundwater study and was limited to the performance of percolation testing and soil profile description, and the submitted data only. Our services did not include those associated with septic system design. Neither did services include an Environmental Site Assessment for the presence or absence of hazardous and/or toxic materials in the soil, groundwater, or atmosphere; or the presence of wetlands.

Any statements, or absence of statements, in this report or on any boring logs regarding odors, unusual or suspicious items, or conditions observed, are strictly for descriptive purposes and are not intended to convey engineering judgment regarding potential hazardous and/or toxic assessment. The geotechnical engineering information presented herein is based upon professional interpretation utilizing standard engineering practices. The work conducted through the course of this investigation, including the preparation of this report, has been performed in accordance with the generally accepted standards of geotechnical engineering practice, which existed in the geographic area at the time the report was written. No other warranty, express or implied, is made.

Please be advised that when performing percolation testing services in a relatively small diameter boring, that the testing may not fully model the actual full scale long term performance of a given site. This is particularly true where percolation test data is to be used in the design of large infiltration system such as may be proposed for the site.

The measured percolation rate includes dispersion of the water at the sidewalls of the boring as well as into the underlying soils. Subsurface conditions, including percolation rates, can change over time as fine-grained soils migrate. It is not warranted that such information and interpretation cannot be superseded by future geotechnical engineering developments. We emphasize that this report is valid for the project outlined above and should not be used for any other sites.

9. CONCLUSIONS AND RECOMMENDATIONS

9.1 General

9.1.1 Based upon the data collected during this investigation, and from a geotechnical engineering standpoint, it is our opinion that the site is suitable for the proposed construction of improvements at the site as planned, provided the recommendations contained in this report are incorporated into the project design and construction. Conclusions and recommendations provided in this report are based on our review of available literature, analysis of data obtained from our field

exploration and laboratory testing program, and our understanding of the proposed development at this time.

9.1.2 The primary geotechnical constraints identified in our investigation is the presence of moderate to high expansive soils at the site. Recommendations to mitigate the effects of these soils are provided in this report.

9.1.3 Fill materials are anticipated to be present on site between our boring locations. Undocumented and uncompacted fill materials are not suitable to support any future structures and should be replaced with Engineered Fill or excavated and recompacted. Prior to fill placement, Salem Engineering Group, Inc. should inspect the bottom of the excavation to verify the fill condition.

9.1.4 The scope of our services for the investigation does not include a slope stability evaluation of the site. For the proposed buildings adjacent to the descending slopes, a setback equals to one-third (1/3) of the slope height but needs not exceed 40 feet should be provided between the footing bottom and the slope face. If the slope is steeper than 1:1 (horizontal to vertical), the required setback should be measured from an imaginary plane 45 degrees to the horizontal, projected upward from the toe of the slope.

9.1.5 Fill and cut slopes should not be constructed steeper than at a gradient of 2:1 (horizontal to vertical).

9.1.6 Where fill slopes are to be constructed on original ground that slopes steeper than 6:1 (horizontal to vertical), the ground should be stepped or benched. The benches should be cut into the dense slope as the grading operations proceed. The first bench (base or key bench) should be at least 15 feet wide. Each bench should consist of a minimum 8 feet wide of level terrace, with the rise to the next bench held for 4 feet or less.

9.1.7 The horizontal distance between the outer edges of the footing bottom and the adjacent slope face should be at least 7 feet.

9.1.8 To reduce the erosion of graded slopes, it is recommended that all slopes be planted with ground cover vegetation and deep rooted vegetation as soon as practical. The proper maintenance of proper lot drainage and vegetation should be performed. Over-irrigation should be prevented. A rodent control program should be established and maintained.

9.1.9 Site demolition activities shall include removal of all surface obstructions not intended to be incorporated into final site design. In addition, underground buried structures and/or utility lines encountered during demolition and construction should be properly removed and the resulting excavations backfilled with Engineered Fill. After demolition activities, it is recommended that disturbed soils be removed and/or recompacted.

9.1.10 Surface vegetation should be removed by stripping to a sufficient depth to remove organic-rich topsoil. The upper 8 to 10 inches of the soils containing, vegetation, roots and other objectionable organic matter encountered at the time of grading should be stripped and removed from the surface. Deeper stripping may be required in localized areas. The stripped vegetation will not be suitable for use as Engineered Fill or within 5 feet of building pads or within pavement areas.

However, stripped topsoil may be stockpiled and reused in landscape or non-structural areas or exported from the site.

9.1.11 The upper soils within the project site are predominately sandy clay. The clayey soils exhibit a moderately high swell potential and are subject to volumetric changes if moisture contents vary. The clayey soil, in its present condition, possess hazards to construction in terms of possible post-construction movement of the foundations and floor systems if no mitigation measures are employed. The estimated swell pressures of the clayey material may cause movement affecting slabs and brittle exterior finishes. Accordingly, measures are considered necessary to reduce anticipated soil movement.

9.1.12 To minimize the potential soil movement due to expansive soil conditions, it is recommended that the upper 24 inches of soil beneath the required granular aggregate subbase within slab on grade and exterior flatwork areas be removed and replaced with Non-Expansive Engineered Fill meeting the requirements of section 9.4. Other than complete soil replacement, mitigation measures will not eliminate post-construction soil movement, but will reduce the soil movement. Success of the mitigation measures will depend on the thoroughness of the contractor and developer in dealing with the soil conditions. In any event, the developer should be aware that some soil movement is to be expected.

9.1.13 Based on the subsurface conditions at the site and the anticipated structural loading, we anticipate that the proposed buildings may be supported using conventional shallow foundations provided that the recommendations presented herein are incorporated in the design and construction of the project.

9.1.14 Provided the site is graded in accordance with the recommendations of this report and foundations constructed as described herein, we estimate that total settlement due to static loads utilizing conventional shallow foundations for the proposed buildings will be within 1½ inches and corresponding differential settlement will be less than ¾ inch over 30 feet.

9.1.15 SALEM shall review the project grading and foundation plans, and specifications prior to final design submittal to assess whether our recommendations have been properly implemented and evaluate if additional analysis and/or recommendations are required. If SALEM is not provided plans and specifications for review, we cannot assume any responsibility for the future performance of the project.

9.1.16 SALEM shall be present at the site during site demolition and preparation to observe site clearing/demolition, preparation of exposed surfaces after clearing, and placement, treatment and compaction of fill material.

9.1.17 SALEM's observations should be supplemented with periodic compaction tests to establish substantial conformance with these recommendations. Moisture content of footings and slab subgrade should be tested immediately prior to concrete placement. SALEM should observe foundation excavations prior to placement of reinforcing steel or concrete to assess whether the actual bearing conditions are compatible with the conditions anticipated during the preparation of this report.

9.2 Seismic Design Criteria

9.2.1 For seismic design of the structures, and in accordance with the seismic provisions of the 2015 IBC, our recommended parameters are shown below. These parameters are based on Probabilistic Ground Motion of 2% Probability of Exceedance in 50 years. The Site Class was determined based on the results of our field exploration.

TABLE 9.2.1
SEISMIC DESIGN PARAMETERS

Seismic Item	Symbol	Value
Site Coordinates (Datum = NAD 83)		38.7210 Lat -104.7138 Lon
Site Class	--	D
Soil Profile Name	--	Stiff Soil
Risk Category	--	II
Site Coefficient for PGA	F_{PGA}	1.6
Peak Ground Acceleration (adjusted for Site Class effects)	PGA_M	0.136 g
Seismic Design Category	SDC	B
Mapped Spectral Acceleration (Short period - 0.2 sec)	S_S	0.172
Mapped Spectral Acceleration (1.0 sec. period)	S_1	0.06 g
Site Class Modified Site Coefficient	F_a	1.6
Site Class Modified Site Coefficient	F_v	2.4
MCE Spectral Response Acceleration (Short period - 0.2 sec) $S_{MS} = F_a S_S$	S_{MS}	0.276 g
MCE Spectral Response Acceleration (1.0 sec. period) $S_{M1} = F_v S_1$	S_{M1}	0.144 g
Design Spectral Response Acceleration $S_{DS}=⅔S_{MS}$ (short period - 0.2 sec)	S_{DS}	0.184 g
Design Spectral Response Acceleration $S_{D1}=⅔S_{M1}$ (1.0 sec. period)	S_{D1}	0.096 g

9.2.2 Conformance to the criteria in the above table for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur if a large earthquake occurs. The primary goal of seismic design is to protect life, not to avoid all damage, since such design may be economically prohibitive.

9.3 Soil and Excavation Characteristics

9.3.1 Based on the soil conditions encountered in our soil borings, the upper onsite soils can be excavated with moderate effort using conventional heavy-duty earthmoving equipment.

9.3.2 It is the responsibility of the contractor to ensure that all excavations and trenches are properly shored and maintained in accordance with applicable Occupational Safety and Health Administration (OSHA) rules and regulations to maintain safety and maintain the stability of adjacent existing improvements.

9.3.3 The upper soils within the project site are identified primarily as lean/fat clay with sand. The clayey soils are moisture sensitive and moderately to highly expansive.

9.3.4 The near surface soils identified as part of our investigation are, generally, moist to very moist due to the absorption characteristics of the soil. Earthwork operations may encounter very moist unstable soils which may require removal to a stable bottom. Exposed native soils exposed as part of site grading operations shall not be allowed to dry out and should be kept continuously moist prior to placement of subsequent fill.

9.4 Materials for Fill

9.4.1 The upper soils are predominately sandy clay. The test results indicate that the soils have a moderate to high expansion potential. It is recommended that the upper 24 inches of soil within the building pad and exterior flatwork areas to be replaced with Non-Expansive Fill (EI<20).

9.4.2 The soils with an EI greater than 20 (EI>20) and less than 80 (EI<80) should be placed at a depth greater than 24 inches within the building pad and exterior flatwork areas or in the parking and non-structural areas.

9.4.3 Import soil shall be well-graded, slightly cohesive silty fine sand or sandy silt, with relatively impervious characteristics when compacted. A clean sand or very sandy soil is not acceptable for this purpose. This material should be approved by the Engineer prior to use and should typically possess the soil characteristics summarized below in Table 9.4.3.

TABLE 9.4.3
IMPORT FILL REQUIREMENTS

Minimum Percent Passing No. 200 Sieve	20
Maximum Percent Passing No. 200 Sieve	50
Minimum Percent Passing No. 4 Sieve	80
Maximum Particle Size	3"
Maximum Plasticity Index	12
Maximum Expansion Index	20

9.4.4 Environmental characteristics and corrosion potential of import soil materials should also be considered.

9.4.5 Proposed import materials should be sampled, tested, and approved by SALEM prior to its transportation to the site.

9.5 Grading

9.5.1 A SALEM representative should be present during all site clearing and grading operations to test and observe earthwork construction. This testing and observation is an integral part of our service as acceptance of earthwork construction is dependent upon compaction of the material and the stability of the material. The Geotechnical Engineer may reject any material that does not meet compaction and stability requirements. Further recommendations of this report are predicated upon the assumption that earthwork construction will conform to recommendations set forth in this section as well as other portions of this report.

9.5.2 A preconstruction conference should be held at the site prior to the beginning of grading operations with the owner, contractor, civil engineer and geotechnical engineer in attendance.

9.5.3 Site preparation should begin with removal of existing surface/subsurface structures, underground utilities (as required), any existing uncertified fill, and debris. Excavations or depressions resulting from site clearing operations, or other existing excavations or depressions, should be restored with Engineered Fill in accordance with the recommendations of this report.

9.5.4 Surface vegetation should be removed by stripping to a sufficient depth to remove organic-rich topsoil. The upper 8 to 10 inches of the soils containing, vegetation, roots and other objectionable organic matter encountered at the time of grading should be stripped and removed from the surface. Deeper stripping may be required in localized areas. The stripped vegetation will not be suitable for use as Engineered Fill or within 5 feet of building pads or within pavement areas. However, stripped topsoil may be stockpiled and reused in landscape or non-structural areas or exported from the site.

9.5.5 All fill materials encountered during grading should be removed and replaced with engineered fill. The actual depth of the overexcavation and recompaction should be determined by our field representative during construction.

9.5.6 Structural building pad areas should be considered as areas extending a minimum of 5 feet horizontally beyond the outside dimensions of buildings, including footings and non-cantilevered overhangs carrying structural loads.

9.5.7 To minimize post-construction soil movement and provide uniform support for the proposed structures, it is recommended that over-excavation and recompaction within the proposed building areas be performed to a minimum depth of **three (3) feet** below existing grade or **two (2) feet** below proposed footing bottom, whichever is deeper. The overexcavation and recompaction should also extend laterally to a minimum of 5 feet beyond the outer edges of the proposed footings.

9.5.8 Within pavement areas, it is recommended that over-excavation and recompaction be performed to a minimum depth of **two (2) feet** below existing grade or **two (2) feet** below proposed grade, whichever is deeper. The overexcavation and recompaction should also extend laterally to a minimum of 2 feet beyond the outer edges of the proposed pavement.

9.5.9 Prior to placement of fill soils, the native subgrade soils should be scarified to a depth of 12 inches, moisture-conditioned to no less than the optimum moisture content, and recompacted to a minimum of 90% (95% for granular soils) of the maximum dry density based on ASTM D1557 Test Method.

9.5.10 All Engineered Fill (including scarified ground surfaces and backfill) should be placed in thin lifts to allow for adequate bonding and compaction (typically 6 to 8 inches in loose thickness).

9.5.11 Engineered Fill soils should be placed, moisture conditioned to no less than the optimum moisture content and compacted to at least 90% (95% for granular soils) relative compaction based on ASTM D1557 Test Method.

9.5.12 Non-Expansive Engineered Fill and non-cohesive soils should be placed, moisture conditioned to near optimum moisture content, and compacted to at least 95% relative compaction.

9.5.13 An integral part of satisfactory fill placement is the stability of the placed lift of soil. If placed materials exhibit excessive instability as determined by a SALEM field representative, the lift will be considered unacceptable and shall be remedied prior to placement of additional fill material. Additional lifts should not be placed if the previous lift did not meet the required dry density or if soil conditions are not stable.

9.5.14 Final pavement subgrade should be finished to a smooth, unyielding surface. We further recommend proof-rolling the subgrade with a loaded water truck (or similar equipment with high contact pressure) to verify the stability of the subgrade prior to placing aggregate base.

9.5.15 The most effective site preparation alternatives will depend on site conditions prior to grading. We should evaluate site conditions and provide supplemental recommendations immediately prior to grading, if necessary.

9.5.16 We do not anticipate groundwater or seepage to adversely affect construction if conducted during the drier moths of the year (typically summer and fall). However, groundwater and soil moisture conditions could be significantly different during the wet season (typically winter and spring) as surface soil becomes wet; perched groundwater conditions may develop. Grading during this time period will likely encounter wet materials resulting in possible excavation and fill placement difficulties. Project site winterization consisting of placement of aggregate base and protecting exposed soils during construction should be performed. If the construction schedule requires grading operations during the wet season, we can provide additional recommendations as conditions warrant.

9.5.17 Wet soils may become non conducive to site grading as the upper soils yield under the weight of the construction equipment. Therefore, mitigation measures should be performed for stabilization. Typical remedial measures include: discing and aerating the soil during dry weather; mixing the soil with dryer materials; removing and replacing the soil with an approved fill material or placement of crushed rocks or aggregate base material; or mixing the soil with an approved lime or cement product.

The most common remedial measure of stabilizing the bottom of the excavation due to wet soil condition is to reduce the moisture of the soil to near the optimum moisture content by having the subgrade soils scarified and aerated or mixed with drier soils prior to compacting. However, the drying process may require an extended period of time and delay the construction operation.

To expedite the stabilizing process, crushed rock may be utilized for stabilization provided this method is approved by the owner for the cost purpose. If the use of crushed rock is considered, it is recommended that the upper soft and wet soils be replaced by 6 to 24 inches of ¾-inch to 1-inch crushed rocks. The thickness of the rock layer depends on the severity of the soil instability. The recommended 6 to 24 inches of crushed rock material will provide a stable platform. It is further recommended that lighter compaction equipment be utilized for compacting the crushed rock.

A layer of geofabric is recommended to be placed on top of the compacted crushed rock to minimize migration of soil particles into the voids of the crushed rock, resulting in soil movement. Although it is not required, the use of geogrid (e.g. Tensar TX7) below the crushed rock will enhance stability and reduce the required thickness of crushed rock necessary for stabilization. Our firm should be consulted prior to implementing remedial measures to provide appropriate recommendations.

9.6 Shallow Foundations

9.6.1 The site is suitable for use of conventional shallow foundations consisting of continuous footings and isolated pad footings bearing on properly compacted Engineered Fill.

9.6.2 For frost protection, exterior footings should be deepened to a minimum depth of 36 inches below finish grade or in according with the local jurisdiction's requirements. Interior footings should be embedded to a minimum depth of 12 inches below finish grade in heated areas.

9.6.3 It is recommended that continuous bearing wall footings to have a minimum width of 15 inches. Isolated column footings should have a minimum width of 24 inches.

9.6.4 Footing concrete should be placed into neat excavation. The footing bottoms shall be maintained free of loose and disturbed soil.

9.6.5 Footings proportioned as recommended above may be designed for the maximum allowable soil bearing pressures shown in the table below.

Loading Condition	Allowable Loading Footing Depth =36"	Allowable Loading Footing Depth=12"
Dead Load Only	2,000 psf	1,500 psf
Dead-Plus-Live Load	2,500 psf	2,000 psf
Total Load, with Wind or Seismic Loads	3,325 psf	2,660 psf

9.6.6 For design purposes, total settlement due to static loading on the order of 1 inch may be assumed for shallow footings. Differential settlement due to static loading, along a 20-foot exterior wall footing or between adjoining column footings, should be ½ inch, producing an angular distortion of 0.002. Most of the settlement is expected to occur during construction as the loads are applied. However, additional post-construction settlement may occur if the foundation soils are flooded or saturated. The footing excavations should not be allowed to dry out any time prior to pouring concrete.

9.6.7 Resistance to lateral footing displacement can be computed using an allowable coefficient of friction factor of 0.30 acting between the base of foundations and the supporting subgrade.

9.6.8 Lateral resistance for footings can alternatively be developed using an allowable equivalent fluid passive pressure of 300 pounds per cubic foot acting against the appropriate vertical native footing faces. The frictional and passive resistance of the soil may be combined provided that a 50% reduction of the frictional resistance factor is used in determining the total lateral resistance.

9.6.9 Minimum reinforcement for footings should consist of four No. 4 steel reinforcing bars; two placed near the top of the footing and two near the bottom or be designed by the project structural engineer.

9.6.10 Underground utilities running parallel to footings should not be constructed in the zone of influence of footings. The zone of influence may be taken to be the area beneath the footing and within a 1:1 plane extending out and down from the bottom edge of the footing.

9.6.11 The foundation subgrade should be sprinkled as necessary to maintain a moist condition without significant shrinkage cracks as would be expected in any concrete placement. Prior to placing rebar reinforcement, foundation excavations should be evaluated by a representative of SALEM for appropriate support characteristics and moisture content. Moisture conditioning may be required for the materials exposed at footing bottom, particularly if foundation excavations are left open for an extended period.

9.7 Caisson Foundations

9.7.1 The caissons for canopy foundations should have a minimum depth of 8 feet below the lowest adjacent grade.

9.7.2 The caissons may be designed using an allowable sidewall friction of 250 psf. This value is for dead-plus-live loads. An allowable end bearing capacity of 3,000 psf may be used provided that the bottom of the caisson is cleaned with the use of a clean-out bucket or equivalent and inspected by our representative prior to placement of reinforcement and concrete. An increase of one-third is permitted when using the alternate load combination in Section 1605.3.2 that includes wind or earthquake loads.

9.7.3 Uplift loads can be resisted by caissons using an allowable sidewall friction of 200 psf of the surface area and the weight of the caisson.

9.7.4 The total settlement of the caisson footing is not expected to exceed 1 inch. Differential settlement should be less than ½ inch. Most of the settlement is expected to occur during construction as the loads are applied.

9.7.5 Lateral loads for caissons may be designed utilizing the Isolated Pole Formula and Specifications shown on Table 1804.2, Sections 1804.3.1 and 1808.2.2 of the International Building Code. The drilled caissons may be designed for a lateral capacity of 300 pounds per square foot per foot of depth below the lowest adjacent grade to a maximum of 4,500 psf. The lowest adjacent grade should include all the ground surface within 5 feet of the caisson.

9.7.6 These values may be increased by one-third when using the alternative load combinations in Section 1605.3.2 of the IBC that include wind or earthquake loads. These values should not be doubled since the values given herein are higher than the tabular values shown on the Table 1804.2. The lateral loading criteria is based on the assumption that the load application is applied at the ground level and flexible cap connections applied.

9.7.7 The top one-foot of adjacent subgrade should be deleted from the passive pressure computation.

9.7.8 Casing of the drilled caisson will be required if groundwater/seepage is encountered or the drilled hole has to be left open for an extended period of time.

9.8 Concrete Slabs-on-Grade

9.8.1 Slab thickness and reinforcement should be determined by the structural engineer based on the anticipated loading. We recommend that non-structural slabs-on-grade be at least 4 inches thick and underlain by six (6) inches of compacted granular aggregate subbase material compacted to at least 95% relative compaction based on ASTM Test Method D1557.

9.8.2 Granular aggregate subbase material shall conform to ASTM D-2940, Latest Edition (Table 1, bases) with at least 95 percent passing a 1½-inch sieve and not more than 8% passing a No. 200 sieve or its approved equivalent to prevent capillary moisture rise.

9.8.3 The use of processed asphalt in the granular aggregate subbase material (i.e. recycled or miscellaneous base) will have to be approved by the owner. Asphalt is a petroleum hydrocarbon with numerous components, including naphthalene and other semi-volatile constituents. This material in the subsurface could become a potential vapor intrusion risk (naphthalene is a recent risk-driver that DTSC is actively pursuing).

9.8.4 We recommend reinforcing slabs, at a minimum, with No. 4 reinforcing bars placed 18 inches on center, each way.

9.8.5 Slabs subject to structural loading may be designed utilizing a modulus of subgrade reaction K of 100 pounds per square inch per inch. The K value was approximated based on inter-relationship of soil classification and bearing values (Portland Cement Association, Rocky Mountain Northwest).

9.8.6 The spacing of crack control joints should be designed by the project structural engineer. In order to regulate cracking of the slabs, we recommend that full depth construction joints or control joints be provided at a maximum spacing of 15 feet in each direction for 5-inch thick slabs and 12 feet for 4-inch thick slabs.

9.8.7 Crack control joints should extend a minimum depth of one-fourth the slab thickness and should be constructed using saw-cuts or other methods as soon as practical after concrete placement. The exterior floors should be poured separately in order to act independently of the walls and foundation system.

9.8.8 Moisture within the structure may be derived from water vapors, which were transformed from the moisture within the soils. This moisture vapor penetration can affect floor coverings and produce mold and mildew in the structure. To minimize moisture vapor intrusion, it is recommended that a vapor retarder be installed in accordance with manufacturer's recommendations and/or ASTM guidelines, whichever is more stringent. In addition, ventilation of the structure is recommended to reduce the accumulation of interior moisture.

9.8.9 In areas where it is desired to reduce floor dampness where moisture-sensitive coverings are anticipated, construction should have a suitable waterproof vapor retarder (a minimum of 15 mils thick polyethylene vapor retarder sheeting, Raven Industries "VaporBlock 15, Stego Industries 15 mil "StegoWrap" or W.R. Meadows Sealtight 15 mil "Perminator") incorporated into the floor slab design. The water vapor retarder should be decay resistant material complying with ASTM E96 not exceeding 0.04 perms, ASTM E154 and ASTM E1745 Class A. The vapor barrier should be placed between the concrete slab and the compacted granular aggregate subbase material. The water vapor retarder (vapor barrier) should be installed in accordance with ASTM Specification E 1643-94.

9.8.10 The concrete maybe placed directly on vapor retarder. The vapor retarder should be inspected prior to concrete placement. Cut or punctured retarder should be repaired using vapor retarder material lapped 6 inches beyond damaged areas and taped.

9.8.11 The recommendations of this report are intended to reduce the potential for cracking of slabs due to soil movement. However, even with the incorporation of the recommendations presented herein, foundations, stucco walls, and slabs-on-grade may exhibit some cracking due to soil movement. This is common for project areas that contain expansive soils since designing to eliminate potential soil movement is cost prohibitive.

9.8.12 The occurrence of concrete shrinkage cracks is independent of the supporting soil characteristics. Their occurrence may be reduced and/or controlled by limiting the slump of the concrete, proper concrete placement and curing, and by the placement of crack control joints at periodic intervals, in particular, where re-entrant slab corners occur.

9.8.13 Proper finishing and curing should be performed in accordance with the latest guidelines provided by the American Concrete Institute, Portland Cement Association, and ASTM.

9.9 Lateral Earth Pressures and Frictional Resistance

9.9.1 Active, at-rest and passive unit lateral earth pressures against footings and walls are summarized in the table below:

Lateral Pressures Level Backfill and Drained Conditions	Ultimate Equivalent Fluid Pressure, pcf
Active Pressure	46
At-Rest Pressure	66
Passive Pressure	300
Related Parameters	
Allowable Coefficient of Friction	0.30
In-Place Soil Density (lbs/ft^3)	120

9.9.2 Active pressure applies to walls, which are free to rotate. At-rest pressure applies to walls, which are restrained against rotation. The preceding lateral earth pressures assume sufficient drainage behind retaining walls to prevent the build-up of hydrostatic pressure.

9.9.3 The top one-foot of adjacent subgrade should be deleted from the passive pressure computation.

9.9.4 The foregoing values of lateral earth pressures represent allowable soil values and a safety factor consistent with the design conditions should be included in their usage.

9.9.5 For stability against lateral sliding, which is resisted solely by the passive pressure, we recommend a minimum safety factor of 1.5.

9.9.6 For stability against lateral sliding, which is resisted by the combined passive and frictional resistance, a minimum safety factor of 2.0 is recommended.

9.9.7 For lateral stability against seismic loading conditions, we recommend a minimum safety factor of 1.1.

9.9.8 For dynamic seismic lateral loading the following equation shall be used:

Dynamic Seismic Lateral Loading Equation
Dynamic Seismic Lateral Load = $\frac{3}{8}\gamma K_h H^2$
Where: γ = In-Place Soil Density
K_h = Horizontal Acceleration = $\frac{2}{3}PGA_M$
H = Wall Height

9.10 Retaining Walls

9.10.1 Retaining and/or below grade walls should be drained with either perforated pipe encased in free-draining gravel or a prefabricated drainage system. The gravel zone should have a minimum width of 12 inches wide and should extend upward to within 12 inches of the top of the wall. The upper 12 inches of backfill should consist of native soils, concrete, asphaltic-concrete or other suitable backfill to minimize surface drainage into the wall drain system. The gravel should conform to permeable materials graded in accordance with the current Standard Specifications.

9.10.2 Prefabricated drainage systems, such as Miradrain®, Enkadrain®, or an equivalent substitute, are acceptable alternatives in lieu of gravel provided they are installed in accordance with the manufacturer's recommendations. If a prefabricated drainage system is proposed, our firm should review the system for final acceptance prior to installation.

9.10.3 Drainage pipes should be placed with perforations down and should discharge in a non-erosive manner away from foundations and other improvements. The top of the perforated pipe should be placed at or below the bottom of the adjacent floor slab or pavements. The pipe should be placed in the center line of the drainage blanket and should have a minimum diameter of 4 inches. Slots should be no wider than 1/8-inch in diameter, while perforations should be no more than ¼-inch in diameter.

9.10.4 If retaining walls are less than 5 feet in height, the perforated pipe may be omitted in lieu of weep holes on 4 feet maximum spacing. The weep holes should consist of 2-inch minimum diameter holes (concrete walls) or unmortared head joints (masonry walls) and placed no higher than 18 inches above the lowest adjacent grade. Two 8-inch square overlapping patches of geotextile fabric (conforming to the Standard Specifications for "edge drains") should be affixed to the rear wall opening of each weep hole to retard soil piping.

9.10.5 During grading and backfilling operations adjacent to any walls, heavy equipment should not be allowed to operate within a lateral distance of 5 feet from the wall, or within a lateral distance equal to the wall height, whichever is greater, to avoid developing excessive lateral pressures. Within this zone, only hand operated equipment ("whackers," vibratory plates, or pneumatic compactors) should be used to compact the backfill soils.

9.11 Temporary Excavations

9.11.1 We anticipate that the majority of the sandy site soils will be classified as OSHA "Type C" soil when encountered in excavations during site development and construction. Excavation sloping, benching, the use of trench shields, and the placement of trench spoils should conform to the latest applicable OSHA standards. The contractor should have an OSHA-approved "competent person" onsite during excavation to evaluate trench conditions and make appropriate recommendations where necessary.

9.11.2 It is the contractor's responsibility to provide sufficient and safe excavation support as well as protecting nearby utilities, structures, and other improvements which may be damaged by earth movements. All onsite excavations must be conducted in such a manner that potential surcharges from existing structures, construction equipment, and vehicle loads are resisted. The surcharge

area may be defined by a 1:1 projection down and away from the bottom of an existing foundation or vehicle load.

9.11.3 Temporary excavations and slope faces should be protected from rainfall and erosion. Surface runoff should be directed away from excavations and slopes.

9.11.4 Open, unbraced excavations in undisturbed soils should be made according to the slopes presented in the following table:

RECOMMENDED EXCAVATION SLOPES

Depth of Excavation (ft)	Slope (Horizontal : Vertical)
0-5	1:1
5-10	2:1

9.11.5 If, due to space limitation, excavations near property lines or existing structures are performed in a vertical position, slot cuts, braced shorings or shields may be used for supporting vertical excavations. Therefore, in order to comply with the local and state safety regulations, a properly designed and installed shoring system would be required to accomplish planned excavations and installation. A Specialty Shoring Contractor should be responsible for the design and installation of such a shoring system during construction.

9.11.6 Braced shorings should be designed for a maximum pressure distribution of 30H, (where H is the depth of the excavation in feet). The foregoing does not include excess hydrostatic pressure or surcharge loading. Fifty percent of any surcharge load, such as construction equipment weight, should be added to the lateral load given herein. Equipment traffic should concurrently be limited to an area at least 3 feet from the shoring face or edge of the slope.

9.11.7 The excavation and shoring recommendations provided herein are based on soil characteristics derived from the borings within the area. Variations in soil conditions will likely be encountered during the excavations. SALEM Engineering Group, Inc. should be afforded the opportunity to provide field review to evaluate the actual conditions and account for field condition variations not otherwise anticipated in the preparation of this recommendation. Slope height, slope inclination, or excavation depth should in no case exceed those specified in local, state, or federal safety regulation, (e.g. OSHA) standards for excavations, 29 CFR part 1926, or Assessor's regulations.

9.12 Underground Utilities

9.12.1 Underground utility trenches should be backfilled with properly compacted material. The material excavated from the trenches should be adequate for use as backfill provided it does not contain deleterious matter, vegetation or rock larger than 3 inches in maximum dimension. Trench backfill should be placed in loose lifts not exceeding 8 inches and compacted to at least 90 percent (95 percent for granular, non-expansive soils) relative compaction at or above the optimum moisture content.

9.12.2 Bedding and pipe zone backfill typically extends from the bottom of the trench excavations to approximately 6 to 12 inches above the crown of the pipe. Pipe bedding and backfill material should conform to the requirements of the governing utility agency.

9.12.3 It is suggested that underground utilities crossing beneath new or existing structures be plugged at entry and exit locations to the building or structure to prevent water migration. Trench plugs can consist of on-site clay soils, if available, or sand cement slurry. The trench plugs should extend 2 feet beyond each side of individual perimeter foundations.

9.12.4 The contractor is responsible for removing all water-sensitive soils from the trench regardless of the backfill location and compaction requirements. The contractor should use appropriate equipment and methods to avoid damage to the utilities and/or structures during fill placement and compaction.

9.13 Surface Drainage

9.13.1 Proper surface drainage is critical to the future performance of the project. Uncontrolled infiltration of irrigation excess and storm runoff into the soils can adversely affect the performance of the planned improvements. Saturation of a soil can cause it to lose internal shear strength and increase its compressibility, resulting in a change to important engineering properties. Proper drainage should be maintained at all times.

9.13.2 Site drainage should be collected and transferred away from improvements in non-erosive drainage devices. Drainage should not be allowed to pond anywhere on the site, and especially not against any foundations or retaining walls. Drainage should not be allowed to flow uncontrolled over any descending slope. The proposed structures should be provided with roof gutters. Discharge from downspouts, roof drains and scuppers are not permitted onto unprotected soils within five feet of the buildings perimeters. Planters which are located adjacent to foundations should be sealed or properly drained to prevent moisture intrusion into the materials providing foundation support. Landscape irrigation within 5 feet of the building's perimeter footings should be kept to a minimum to just support vegetative life.

9.13.3 Roof drains should be installed with appropriate downspout extensions out-falling on splash blocks so as to direct water a minimum of 5 feet away from the structures or be connected to the storm drain system for the development.

9.14 Pavement Design

9.14.1 Based on site soil conditions and laboratory test results, an R-value of 10 was used for the preliminary pavement design. The R-value may be verified during grading of the pavement areas.

9.14.2 The asphaltic concrete should be placed in two lifts and compacted to between 92 and 96 percent of the Theoretical Maximum Density per ASTM D2041 (Rice Method). Materials and construction methods should conform to the Colorado Department of Transportation (CDOT) Standard Specifications for Road and Bridge Construction Section 403. Aggregate base materials should conform to CDOT requirements for Class 5 or 6 aggregate base course per Table 703-2.

9.14.3 The pavement design recommendations provided herein are based on the National Asphalt Pavement Association (NAPA) and the American Concrete Institute (ACI). The asphaltic concrete (flexible pavement) is based on a 20-year pavement life. The following table shows the recommended pavement sections for various traffic indices.

TABLE 9.14.3
ASPHALTIC CONCRETE PAVEMENT

Traffic Index	Asphaltic Concrete[3]	Aggregate Base[1]	Compacted Subgrade[2]
5.0 (Parking and Vehicle Drive Areas)	4.5"	5.5"	12.0"
6.0 (Heavy Truck Areas)	4.5"	9.5"	12.0"

[1]95% compaction based on ASTM D1557 Test Method
[2]90% (95% for non-expansive, granular soils) compaction based on ASTM D698Test Method
[3]Per City of Fountain Pavement Design Criteria Manual

9.14.4 The following recommendations are for light-duty and heavy-duty Portland Cement Concrete pavement sections.

TABLE 9.14.4
PORTLAND CEMENT CONCRETE PAVEMENT

Traffic Index	Portland Cement Concrete[1&4]	Class II Aggregate Base[2]	Compacted Subgrade[3]
5.0 (Light Duty)	5.0"	6.0"	12.0"
6.0 (Heavy Duty)	7.0"	8.0"	12.0"

[1]Minimum Compressive Strength of 4,000 psi
[2]95% compaction based on ASTM D1557 Test Method
[3]90% (95% for non-expansive, granular soils) compaction based on ASTM D1557 Test Method
[4]Per City of Fountain Pavement Design Criteria Manual

9.14.5 Materials and construction methods should conform to the Colorado Department of Transportation (CDOT) Standard Specifications for Road and Bridge Construction Section 403. Aggregate base materials should conform to CDOT requirements for Class 5 or 6 aggregate base course per Table 703-3.

9.14.6 Concrete reinforcing should be determined by the structural engineer. The construction joint and spacing, concrete patching, transportation, placement and finishing should conform to the recommendations of American Concrete Institute (ACI).

10. PLAN REVIEW, CONSTRUCTION OBSERVATION AND TESTING

10.1 Plan and Specification Review

10.1.1 SALEM should review the project plans and specifications prior to final design submittal to assess whether our recommendations have been properly implemented and evaluate if additional analysis and/or recommendations are required.

10.2 Construction Observation and Testing Services

10.2.1 The recommendations provided in this report are based on the assumption that we will continue as Geotechnical Engineer of Record throughout the construction phase. It is important to maintain continuity of geotechnical interpretation and confirm that field conditions encountered are similar to those anticipated during design. If we are not retained for these services, we cannot assume any responsibility for others interpretation of our recommendations, and therefore the future performance of the project.

10.2.2 SALEM should be present at the site during site preparation to observe site clearing, preparation of exposed surfaces after clearing, and placement, treatment and compaction of fill material.

10.2.3 SALEM's observations should be supplemented with periodic compaction tests to establish substantial conformance with these recommendations. Moisture content of footings and slab subgrade should be tested immediately prior to concrete placement. SALEM should observe foundation excavations prior to placement of reinforcing steel or concrete to assess whether the actual bearing conditions are compatible with the conditions anticipated during the preparation of this report.

11. LIMITATIONS AND CHANGED CONDITIONS

The analyses and recommendations submitted in this report are based upon the data obtained from the test borings drilled at the approximate locations shown on the Site Plan, Figures 2a and 2b. The report does not reflect variations which may occur between borings. The nature and extent of such variations may not become evident until construction is initiated. If variations then appear, a re-evaluation of the recommendations of this report will be necessary after performing on-site observations during the excavation period and noting the characteristics of such variations. The findings and recommendations presented in this report are valid as of the present and for the proposed construction.

If site conditions change due to natural processes or human intervention on the property or adjacent to the site, or changes occur in the nature or design of the project, or if there is a substantial time lapse between the submission of this report and the start of the work at the site, the conclusions and recommendations contained in our report will not be considered valid unless the changes are reviewed by SALEM and the conclusions of our report are modified or verified in writing.

The validity of the recommendations contained in this report is also dependent upon an adequate testing and observations program during the construction phase. Our firm assumes no responsibility for construction compliance with the design concepts or recommendations unless we have been retained to perform the on-

site testing and review during construction. SALEM has prepared this report for the exclusive use of the owner and project design consultants

SALEM does not practice in the field of corrosion engineering. It is recommended that a qualified corrosion engineer be consulted regarding protection of buried steel or ductile iron piping and conduit or, at a minimum, that manufacturer's recommendations for corrosion protection be closely followed. Further, a corrosion engineer may be needed to incorporate the necessary precautions to avoid premature corrosion of concrete slabs and foundations in direct contact with native soil. The importation of soil and or aggregate materials to the site should be screened to determine the potential for corrosion to concrete and buried metal piping.

The report has been prepared in accordance with generally accepted geotechnical engineering practices in the area. No other warranties, either express or implied, are made as to the professional advice provided under the terms of our agreement and included in this report.

If you have any questions, or if we may be of further assistance, please do not hesitate to contact our office at (909) 980-6455.

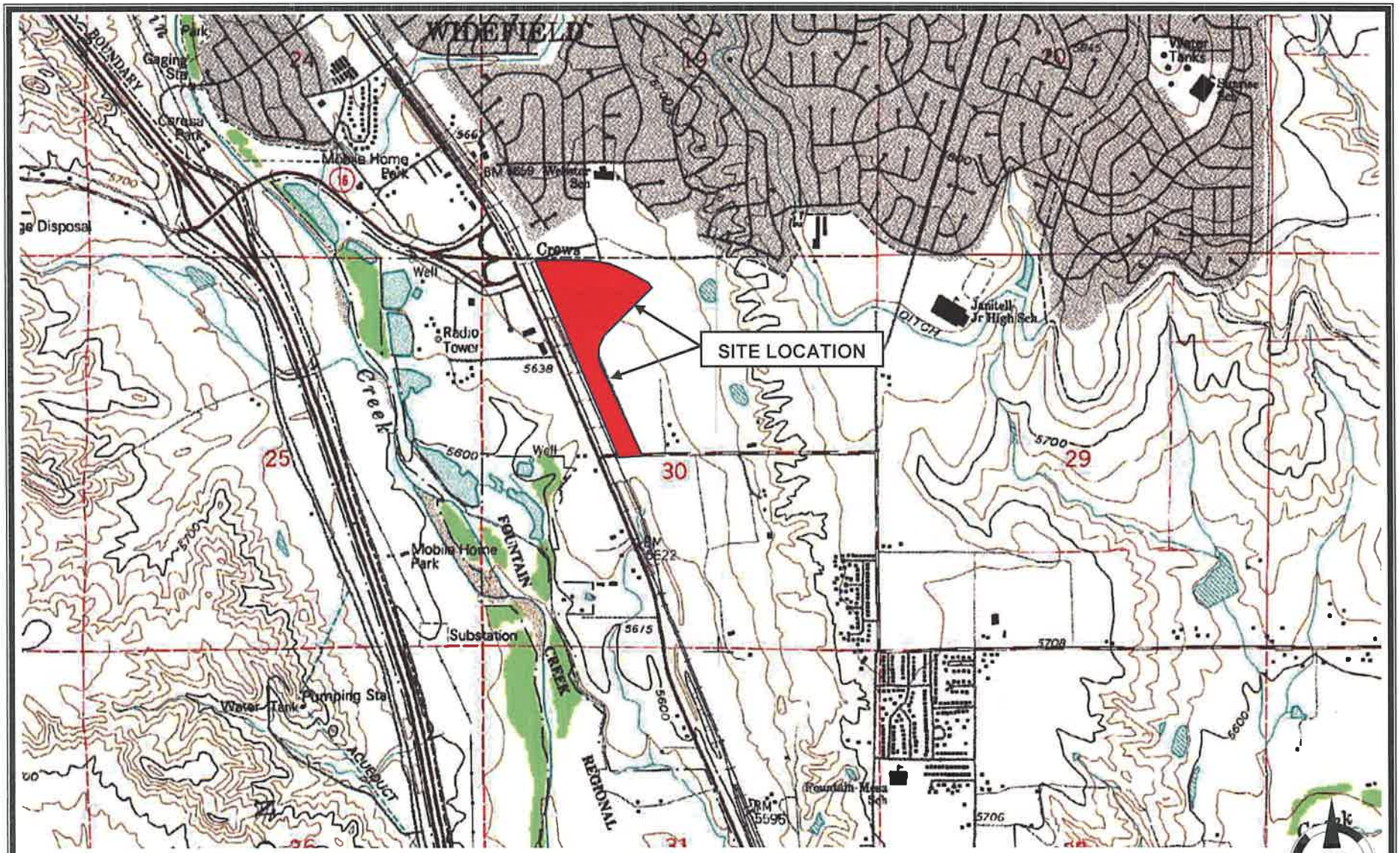
Respectfully Submitted,

SALEM ENGINEERING GROUP, INC.

Jared Christiansen
Geotechnical Staff Engineer

Clarence Jiang
Senior Geotechnical Engineer

R. Sammy Salem, MS, PE
Principal Engineer
PE No. 45178 – Expires 04/30/2021



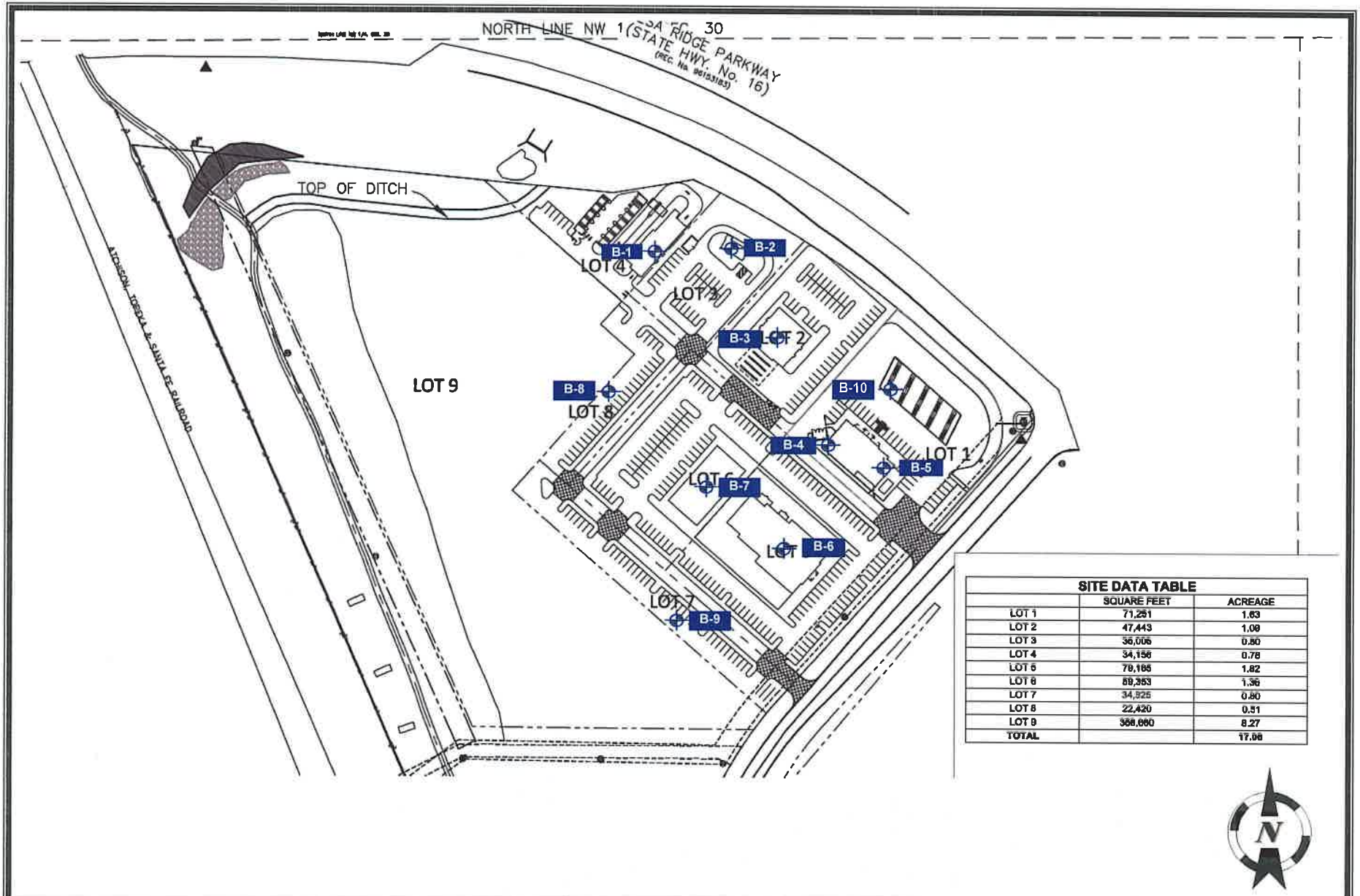
Source Image: U.S. Geological Survey Fountain, Colorado, 38104-F6-TF-024, 1961 (Photorevised 1994)

VICINITY MAP

GEOTECHNICAL ENGINEERING INVESTIGATION
Proposed Commercial Development
Mesa Ridge Parkway and Syracuse Street
Fountain, Colorado

SCALE:	DATE:
NOT TO SCALE	07/2019
DRAWN BY:	APPROVED BY:
JC	CJ
PROJECT NO.	FIGURE NO.
7-219-0518	1

SALEM engineering group, inc.



SITE DATA TABLE		
	SQUARE FEET	ACREAGE
LOT 1	71,251	1.63
LOT 2	47,443	1.09
LOT 3	36,006	0.80
LOT 4	34,156	0.78
LOT 5	79,185	1.82
LOT 6	59,353	1.36
LOT 7	34,925	0.80
LOT 8	22,420	0.51
LOT 9	360,660	8.27
TOTAL		17.06

SITE PLAN

GEOTECHNICAL ENGINEERING INVESTIGATION
Proposed Commercial Development
Mesa Ridge Parkway and Syracuse Street
Fountain, Colorado

SCALE:	DATE:
NOT TO SCALE	07/2019
DRAWN BY:	APPROVED BY:
JC	CJ
PROJECT NO.	FIGURE NO.
7-219-0518	2a

LEGEND:

B-1 Soil Boring Locations

All Locations Approximate

SALEM engineering group, inc.

SITE PLAN

GEOTECHNICAL ENGINEERING INVESTIGATION
Proposed Commercial Development
Mesa Ridge Parkway and Syracuse Street
Fountain, Colorado

SCALE:	DATE:
NOT TO SCALE	07/2019
DRAWN BY:	APPROVED BY:
JC	CJ
PROJECT NO.	FIGURE NO.
7-219-0518	2b

LEGEND:

P-1 Percolation Test Locations

All Locations Approximate

SALEM engineering group, inc.

APPENDIX

A

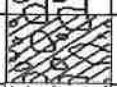
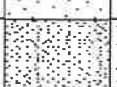
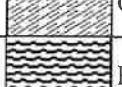
APPENDIX A
FIELD EXPLORATION

Fieldwork for our investigation (drilling) was conducted on June 25, 2019 and included a site visit, subsurface exploration, and soil sampling. Percolation testing was performed on June 26, 2019. The locations of the exploratory borings and percolation tests are shown on the Site Plan, Figures 2a and 2b. Boring logs for our exploration are presented in figures following the text in this appendix. Borings were located in the field using existing reference points. Therefore, actual boring locations may deviate slightly.

In general, our borings were performed using a truck-mounted Simco 2800 drill rig equipped with a 4-inch diameter hollow stem auger. Sampling in the borings was accomplished using a hydraulic 140-pound hammer with a 30-inch drop. Samples were obtained with a 2-inch outside-diameter (OD), split spoon sampler, and a 2-inch OD, Standard Penetration Test (SPT) sampler. The number of blows required to drive the sampler the last 12 inches (or fraction thereof) of the 18-inch sampling interval were recorded on the boring logs. The blow counts shown on the boring logs should not be interpreted as standard SPT "N" values; corrections have not been applied. Upon completion, the borings were backfilled with drill cuttings.

Subsurface conditions encountered in the exploratory borings were visually examined, classified and logged in general accordance with the American Society for Testing and Materials (ASTM) Practice for Description and Identification of Soils (Visual-Manual Procedure D2488). This system uses the Unified Soil Classification System (USCS) for soil designations. The logs depict soil and geologic conditions encountered and depths at which samples were obtained. The logs also include our interpretation of the conditions between sampling intervals. Therefore, the logs contain both observed and interpreted data. We determined the lines designating the interface between soil materials on the logs using visual observations, drill rig penetration rates, excavation characteristics and other factors. The transition between materials may be abrupt or gradual. Where applicable, the field logs were revised based on subsequent laboratory testing.

Unified Soil Classification System

Major Divisions			Letter	Symbol	Description
Coarse-grained Soils More than ½ retained on the No. 200 Sieve	**Gravels** More than ½ coarse fraction retained on the No. 4 sieve	Clean Gravels	GW		Well-graded gravels and gravel-sand mixtures, little or no fines.
			GP		Poorly-graded gravels and gravel-sand mixtures, little or no fines.
		Gravels With Fines	GM		Silty gravels, gravel-sand-silt mixtures.
			GC		Clayey gravels, gravel-sand-clay mixtures.
	Sands More than ½ passing through the No. 200 sieve	Clean Sands	SW		Well-graded sands and gravelly sands, little or no fines.
			SP		Poorly-graded sands and gravelly sands, little or no fines.
		Sands With Fines	SM		Silty sands, sand-silt mixtures
			SC		Clayey sands, sandy-clay mixtures.
Fine-grained Soils More than ½ passing through the No. 200 Sieve	**Silts and Clays** Liquid Limit less than 50%		ML		Inorganic silts, very fine sands, rock flour, silty or clayey fine sands.
			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL		Organic clays of medium to high plasticity.
	Silts and Clays Liquid Limit greater than 50%		MH		Inorganic silts, micaceous or diatomaceous fines sands or silts, elastic silts.
			CH		Inorganic clays of high plasticity, fat clays.
			OH		Organic clays of medium to high plasticity.
Highly Organic Soils			PT		Peat, muck, and other highly organic soils.

Consistency Classification

Granular Soils			*Cohesive Soils*		
Description - Blows Per Foot (Corrected)			Description - Blows Per Foot (Corrected)		
	MCS	SPT		MCS	SPT
Very loose	<5	<4	Very soft	<3	<2
Loose	5 - 15	4 - 10	Soft	3 - 5	2 - 4
Medium dense	16 - 40	11 - 30	Firm	6 - 10	5 - 8
Dense	41 - 65	31 - 50	Stiff	11 - 20	9 - 15
Very dense	>65	>50	Very Stiff	21 - 40	16 - 30
			Hard	>40	>30

MCS = Modified California Sampler

SPT = Standard Penetration Test Sampler

SALEM engineering group, inc.

Test Boring: B-1 **Page** 1 **Of:** 2

Project Number: 7-219-0518

Date: 06/25/2019

Client: Evergreen Devco

Project: Proposed Commercial Development

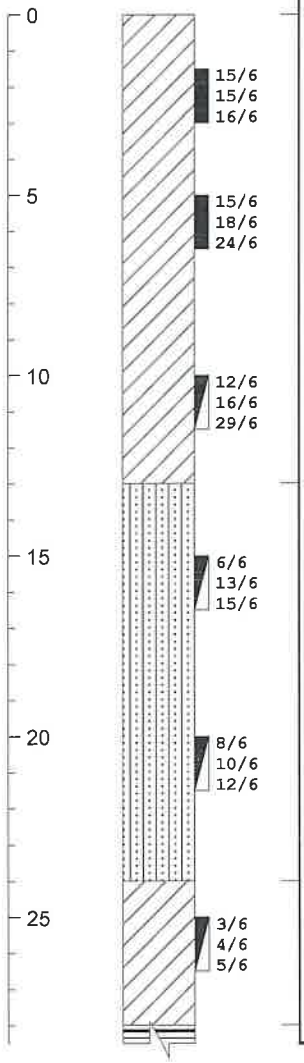
Location: SWC Mesa Ridge Parkway and Syracuse Street, Fountain, Colorado

Drilled By: RMG Engineering

Drill Type: Simco 2800 **Logged By:** JH

Auger Type: 4 inch Hollow Stem Auger **Elevation:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in **Depth to Groundwater:** Not Encountered



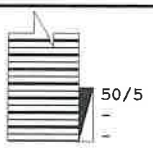
ELEVATION/ DEPTH (feet)	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
	CL	Sandy CLAY Very stiff; moist; brown; fine grain sand.	31	10.0	111.5	
		Grades as above; hard.	42	14.4	105.1	
		Grades as above; very moist.	45	17.7	-	
	SM	Silty SAND Medium dense; damp; reddish brown; fine to coarse grain sand; with fine to coarse gravel.	28	1.4	-	
		Grades as above; slightly moist.	22	3.7	-	
	CL	Sandy CLAY Stiff; wet; dark brown; with fine gravel.	9	30.4	-	

Notes:

Figure Number A-1

SALEM engineering group, inc.

Project Number: 7-219-0518
Date: 06/25/2019
Test Boring: B-1

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
30		CL	Sandy CLAY Hard; very moist; dark brown; shale/intensely weathered clay/ siltstone.	>50	16.3	-	
			End of boring at 31.5 feet BSG.				
35							
40							
45							
50							
55							
60							

Notes:

Figure Number A-1

SALEM engineering group, inc.

Test Boring: B-2 **Page** 1 **Of:** 1

Project Number: 7-219-0518

Date: 06/25/2019

Client: Evergreen Devco

Project: Proposed Commercial Development

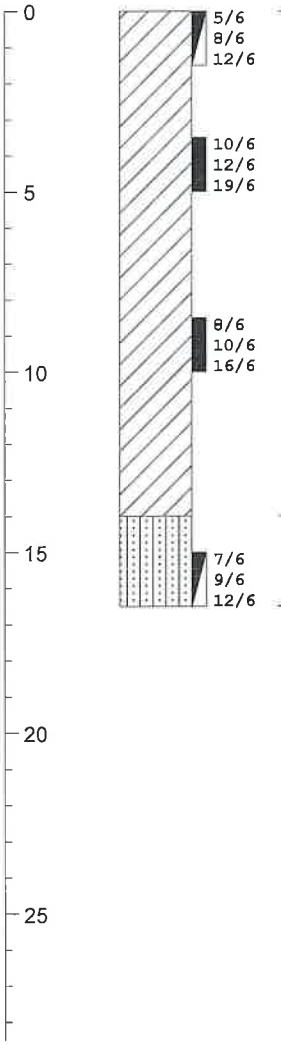
Location: SWC Mesa Ridge Parkway and Syracuse Street, Fountain, Colorado

Drilled By: RMG Engineering

Drill Type: Simco 2800 **Logged By:** JH

Auger Type: 4 inch Hollow Stem Auger **Elevation:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in **Depth to Groundwater:** Not Encountered



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
		CL	Sandy CLAY Very stiff; moist; brown; with fine gravel and abundant roots in upper 12".	20	9.2	-	
			Grades as above; very stiff; no gravel.	31	16.4	102.1	
			Grades as above; very moist.	26	24.0	64.2	
		SM	Silty SAND Medium dense; damp; reddish brown; fine to coarse grain sand; with fine to coarse gravel.	21	1.6	-	
			End of boring at 16.5 feet BSG.				

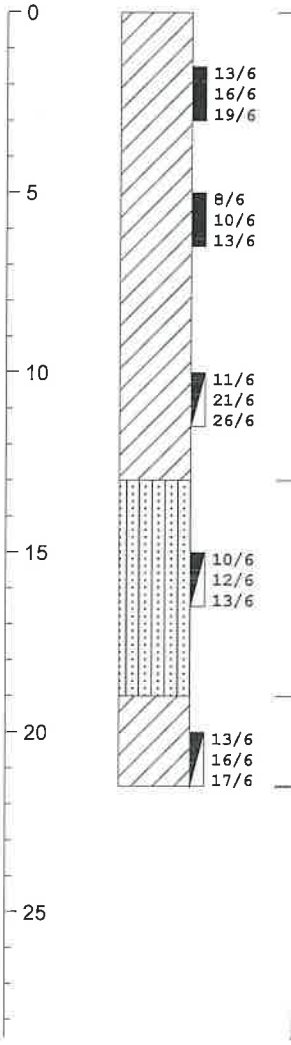
Notes:

Figure Number A-2

SALEM
engineering group, inc.

Test Boring: B-3 **Page** 1 **Of:** 1
Project Number: 7-219-0518
Date: 06/25/2019
Client: Evergreen Devco

Project: Proposed Commercial Development
Location: SWC Mesa Ridge Parkway and Syracuse Street, Fountain, Colorado
Drilled By: RMG Engineering
Drill Type: Simco 2800 **Logged By:** JH
Auger Type: 4 inch Hollow Stem Auger **Elevation:** N/A
Hammer Type: Automatic Trip - 140 lb/30 in **Depth to Groundwater:** Not Encountered



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
		CL	Sandy CLAY Very stiff; moist; brown. Grades as above.	35	8.4	111.6	
			Grades as above; very moist.	23	19.1	100.1	
			Grades as above; moist.	47	14.8	-	
		SM	Silty SAND Medium dense; damp; reddish brown; fine to coarse grain sand; with fine gravel.	25	1.6	-	
		CL	Sandy CLAY Hard; wet; reddish brown; with fine to coarse gravel.	33	25.5	-	
			End of boring at 21.5 feet BSG.				

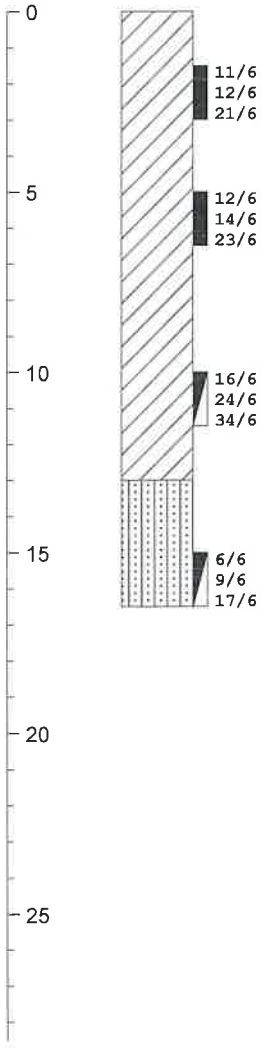
Notes:

Figure Number A-3

SALEM
engineering group, inc.

Test Boring: B-4 **Page** 1 **Of:** 1
Project Number: 7-219-0518
Date: 06/25/2019
Client: Evergreen Devco

Project: Proposed Commercial Development
Location: SWC Mesa Ridge Parkway and Syracuse Street, Fountain, Colorado
Drilled By: RMG Engineering
Drill Type: Simco 2800 **Logged By:** JH
Auger Type: 4 inch Hollow Stem Auger **Elevation:** N/A
Hammer Type: Automatic Trip - 140 lb/30 in **Depth to Groundwater:** Not Encountered



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
		CL	Sandy CLAY Very stiff; moist; brown.	33	8.9	108.5	
			Grades as above.	37	16.6	104.2	
			Grades as above; hard.	58	16.7	-	
		SM	Silty SAND Medium dense; damp; reddish brown; fine to coarse grain sand; with fine to coarse gravel.	26	1.6	-	
			End of boring at 16.5 feet BSG.				

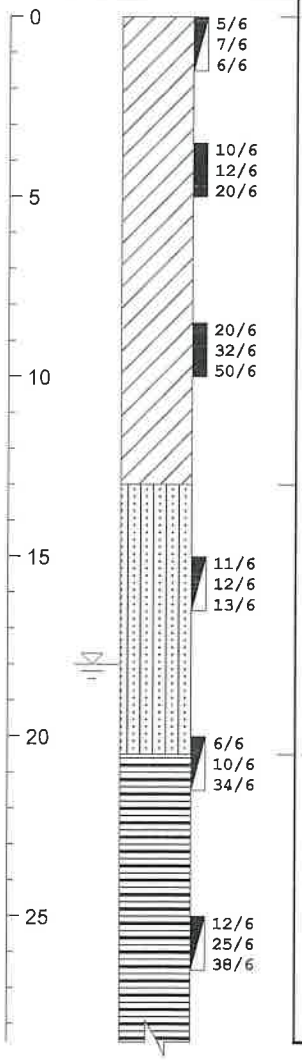
Notes:

Figure Number A-4

SALEM
engineering group, inc.

Test Boring: B-5 **Page** 1 **Of:** 2
Project Number: 7-219-0518
Date: 06/25/2019
Client: Evergreen Devco

Project: Proposed Commercial Development
Location: SWC Mesa Ridge Parkway and Syracuse Street, Fountain, Colorado
Drilled By: RMG Engineering
Drill Type: Simco 2800 **Logged By:** JH
Auger Type: 4 inch Hollow Stem Auger **Elevation:** N/A
Hammer Type: Automatic Trip - 140 lb/30 in **Depth to Groundwater:** 18 feet



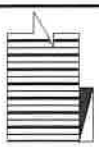
ELEVATION/ DEPTH (feet)	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
	CL	Sandy CLAY Stiff; moist; brown.	13	9.0	-	
		Grades as above; very stiff.	32	11.8	98.5	
		Grades as above; hard; very moist.	82	18.3	102.1	
	SM	Silty SAND Medium dense; slightly moist; yellowish brown; fine to coarse grain sand; with fine gravel.	25	2.3	-	
		Grades as above; dense; moist.	44	7.2	-	
	CL	Sandy CLAY Hard; wet; brown; fine to coarse grain sand; with fine to coarse gravel; shale/intensely weathered clay/siltstone				
		Grades as above.	63	15.3	-	

Notes:

Figure Number A-5

SALEM engineering group, inc.

Project Number: 7-219-0518
Date: 06/25/2019
Test Boring: B-5

ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
30	 15/6 30/6 42/6		Grades as above.	72	11.7	-	
			End of boring at 31.5 feet BSG.				
35							
40							
45							
50							
55							
60							

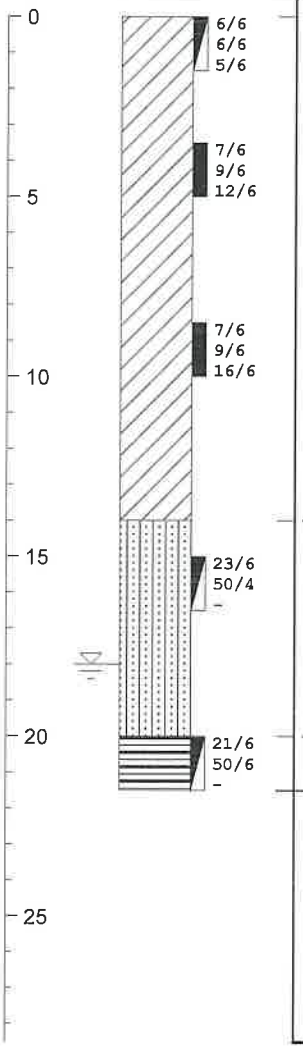
Notes:

Figure Number A-5

SALEM
engineering group, inc.

Test Boring: B-6 **Page** 1 **Of:** 1
Project Number: 7-219-0518
Date: 06/25/2019
Client: Evergreen Devco

Project: Proposed Commercial Development
Location: SWC Mesa Ridge Parkway and Syracuse Street, Fountain, Colorado
Drilled By: RMG Engineering
Drill Type: Simco 2800 **Logged By:** JH
Auger Type: 4 inch Hollow Stem Auger **Elevation:** N/A
Hammer Type: Automatic Trip - 140 lb/30 in **Depth to Groundwater:** 18 feet



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
		CL	Sandy CLAY Stiff; moist; brown.	11	10.0	-	
			Grades as above; very stiff; dark brown.	21	15.3	97.7	
			Grades as above.	25	13.1	108.4	
		SM	Silty SAND Very dense; damp; reddish brown; fine to coarse grain sand; with gravel and cobbles.	>50	1.5	-	
		CL	Sandy CLAY Hard; moist; reddish brown; with fine to coarse gravel; intensely weathered SHALE.	>50	16.6	-	
			End of boring at 21.5 feet BSG.				

Notes:

Figure Number A-6

SALEM engineering group, inc.

Test Boring: B-7 **Page** 1 **Of:** 1

Project Number: 7-219-0518

Date: 06/25/2019

Client: Evergreen Devco

Project: Proposed Commercial Development

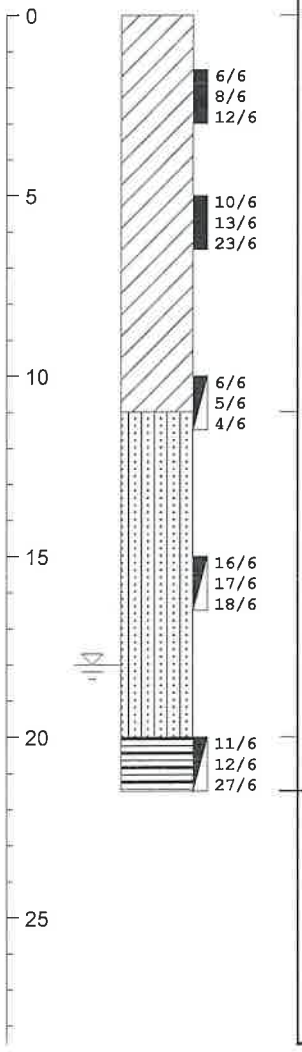
Location: SWC Mesa Ridge Parkway and Syracuse Street, Fountain, Colorado

Drilled By: RMG Engineering

Drill Type: Simco 2800 **Logged By:** JH

Auger Type: 4 inch Hollow Stem Auger **Elevation:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in **Depth to Groundwater:** 18 feet



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
		CL	Sandy CLAY Stiff; moist; brown.	20	10.0	111.8	
			Grades as above; very stiff.	36	16.5	93.8	
			Grades as above; stiff; slightly moist.	9	4.9	-	
		SM	Silty SAND Loose; moist; reddish brown; fine to coarse grain sand; trace clay.				
			Grades as above; dense; damp; with fine to coarse gravel; no clay.	35	2.0	-	
		CL	Sandy CLAY Hard; moist; dark grayish brown; shale/intensely weathered clay/ siltstone.	39	15.9	-	
			End of boring at 21.5 feet BSG.				

Notes:

Figure Number A-7

SALEM engineering group, inc.

Test Boring: B-8 **Page** 1 **Of:** 1

Project Number: 7-219-0518

Date: 06/25/2019

Client: Evergreen Devco

Project: Proposed Commercial Development

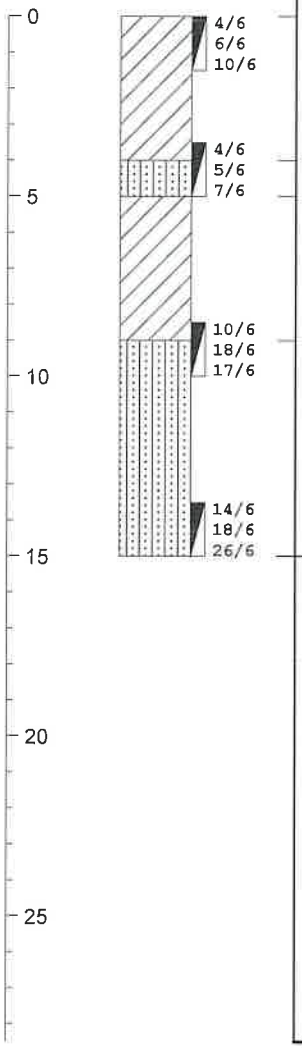
Location: SWC Mesa Ridge Parkway and Syracuse Street, Fountain, Colorado

Drilled By: RMG Engineering

Drill Type: Simco 2800 **Logged By:** JH

Auger Type: 4 inch Hollow Stem Auger **Elevation:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in **Depth to Groundwater:** Not Encountered



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
		CL	Sandy CLAY Very stiff; moist; dark brown; abundant roots.	16	14.2	-	
			Grades as above; stiff.	12	3.6	-	
		SM	Silty SAND				
		CL	Medium dense; slightly moist; brown; fine grain sand; trace clay.				
			Sandy CLAY Stiff; moist; brown.				
		SM	Grades as above; hard; slightly moist.	35	0.9	-	
			Silty SAND Dense; dry; reddish brown; fine to coarse grain sand; with fine gravel.				
			Grades as above; damp.	44	1.6	-	
			End of boring at 15 feet BSG.				

Notes:

Figure Number A-8

SALEM engineering group, inc.

Test Boring: B-9 **Page** 1 **Of:** 1

Project Number: 7-219-0518

Date: 06/25/2019

Client: Evergreen Devco

Project: Proposed Commercial Development

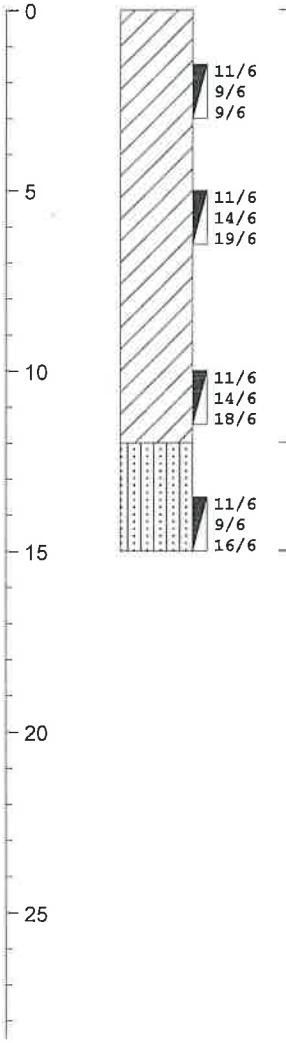
Location: SWC Mesa Ridge Parkway and Syracuse Street, Fountain, Colorado

Drilled By: RMG Engineering

Drill Type: Simco 2800 **Logged By:** JH

Auger Type: 4 inch Hollow Stem Auger **Elevation:** N/A

Hammer Type: Automatic Trip - 140 lb/30 in **Depth to Groundwater:** Not Encountered



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
		CL	Sandy CLAY Very stiff; moist; brown.	18	8.4	-	
			Grades as above; hard.	33	13.5	-	
			Grades as above; with fine gravel; slightly moist.	32	5.6	-	
		SM	Silty SAND Medium dense; damp; brown; with fine to coarse gravel.	25	1.3	-	
			End of boring at 15 feet BSG.				

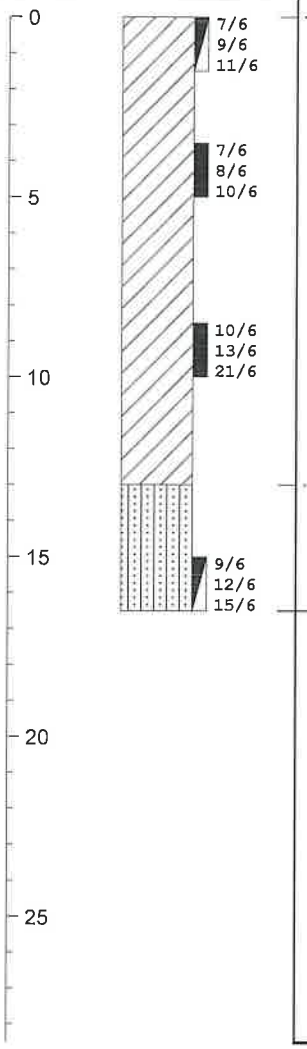
Notes:

Figure Number A-9

SALEM
engineering group, inc.

Test Boring: B-10 **Page** 1 **Of:** 1
Project Number: 7-219-0518
Date: 06/25/2019
Client: Evergreen Devco

Project: Proposed Commercial Development
Location: SWC Mesa Ridge Parkway and Syracuse Street, Fountain, Colorado
Drilled By: RMG Engineering
Drill Type: Simco 2800 **Logged By:** JH
Auger Type: 4 inch Hollow Stem Auger **Elevation:** N/A
Hammer Type: Automatic Trip - 140 lb/30 in **Depth to Groundwater:** Not Encountered



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Soil Description	N-Values blows/ft.	Moisture Content %	Dry Density, PCF	Remarks
		CL	Sandy CLAY Very stiff; moist; brown; abundant roots.	20	13.7	-	
			Grades as above; stiff.	18	16.6	102.2	
			Grades as above; very stiff; with fine gravel; very moist.	34	19.9	98.7	
		SM	Silty SAND Medium dense; damp; reddish brown; fine to coarse grain sand; fine to coarse gravel.	27	1.7	-	
			End of boring at 16.5 feet BSG.				

Notes:

Figure Number A-10

KEY TO SYMBOLS

Symbol Description

Strata symbols

 Lean Clay

 Silty sand

 Weathered

Misc. Symbols

 Boring continues

 Water table during drilling

Soil Samplers

 Two-inch ring sampler

 Standard penetration test

Notes:

Consistency Classification

Blows Per Foot (Uncorrected)

Granular Soils

	MCS	SPT
Very loose	<5	<4
Loose	5 -15	4 - 10
Medium dense	16 - 40	11 - 30
Dense	41 - 65	31 - 50
Very dense	65 - 50	>50

Cohesive Soils

	MCS	SPT
Very soft	<3	<2
Soft	3 - 5	2 - 4
Firm	6 - 10	5 - 8
Stiff	11 - 20	9 - 15
Very Stiff	21 - 40	16 - 30
Hard	>40	>30

SPT = Standard Penetration Test Sampler

Percolation Test Worksheet

Project: Proposed Commercial Development
Syracuse Street & Mesa Ridge Pkway
Fountain, Colorado

Job No.: 7-219-0518
Date Drilled: 6/25/2019
Soil Classification: Silty SAND w/gravel

Hole Radius: 3 in.
Pipe Dia.: 3 in.
Total Depth of Hole: 120 in.

Test Hole No.: P-1
Tested by: JH
Drilled Hole Depth: 10 ft.

Presoaking Date: 6/25/2019
Test Date: 6/26/2019

Pipe Stickup 0.4 ft

Time Start	Time Finish	Depth of Test Hole (ft)#	Refill-Yes or No	Elapsed Time (hrs:min)	Initial Water Level# (ft)	Final Water Level# (ft)	Δ Water Level (in.)	Δ Min.	Meas. Perc Rate (min/in)	Initial Height of Water (in)	Final Height of Water (in)	Average Height of Water (in)	Infiltration Rate, It (in/hr)
9:00	9:10	10.4	Y	0:10	8.50	9.15	7.80	10	1.3	22.8	15.0	18.9	3.44
9:11	9:21	10.4	Y	0:10	8.60	9.20	7.20	10	1.4	21.6	14.4	18.0	3.32
9:22	9:32	10.4	Y	0:10	8.50	9.12	7.44	10	1.3	22.8	15.4	19.1	3.25
9:33	9:43	10.4	Y	0:10	8.70	9.25	6.60	10	1.5	20.4	13.8	17.1	3.19
9:44	9:54	10.4	Y	0:10	8.60	9.17	6.84	10	1.5	21.6	14.8	18.2	3.13
9:55	10:05	10.4	Y	0:10	8.70	9.23	6.36	10	1.6	20.4	14.0	17.2	3.06
10:06	10:16	10.4	Y	0:10	8.65	9.19	6.48	10	1.5	21.0	14.5	17.8	3.03
10:17	10:27	10.4	Y	0:10	8.70	9.22	6.24	10	1.6	20.4	14.2	17.3	2.99
10:28	10:38	10.4	Y	0:10	8.60	9.15	6.60	10	1.5	21.6	15.0	18.3	3.00
10:39	10:49	10.4	Y	0:10	8.50	9.08	6.96	10	1.4	22.8	15.8	19.3	3.01
Recommended for Design:										**Infiltration Rate**			**2.99**

Measured from pipe top

SALEM engineering group, Inc.

Percolation Test Worksheet

Project: Proposed Commercial Development
Syracuse Street & Mesa Ridge Pkway
Fountain, Colorado

Job No.: 7-219-0518
Date Drilled: 6/25/2019
Soil Classification: Silty SAND w/gravel

Hole Radius: 3 in.
Pipe Dia.: 3 in.
Total Depth of Hole: 118.8 in.

Test Hole No.: P-2
Tested by: JH
Drilled Hole Depth: 9.9 ft.

Presoaking Date: 6/25/2019
Test Date: 6/26/2019

Pipe Stickup 0.7 ft

Time Start	Time Finish	Depth of Test Hole (ft)#	Refill-Yes or No	Elapsed Time (hrs:min)	Initial Water Level# (ft)	Final Water Level# (ft)	Δ Water Level (in.)	Δ Min.	Meas. Perc Rate (min/in)	Initial Height of Water (in)	Final Height of Water (in)	Average Height of Water (in)	Infiltration Rate, It (in/hr)
11:00	11:10	10.6	Y	0:10	8.50	9.41	10.92	10	0.9	25.2	14.3	19.7	4.63
11:11	11:21	10.6	Y	0:10	8.40	9.32	11.04	10	0.9	26.4	15.4	20.9	4.44
11:22	11:32	10.6	Y	0:10	8.50	9.36	10.32	10	1.0	25.2	14.9	20.0	4.31
11:33	11:43	10.6	Y	0:10	8.50	9.32	9.84	10	1.0	25.2	15.4	20.3	4.07
11:44	11:54	10.6	Y	0:10	8.50	9.30	9.60	10	1.0	25.2	15.6	20.4	3.95
11:55	12:05	10.6	Y	0:10	8.45	9.27	9.84	10	1.0	25.8	16.0	20.9	3.96
12:06	12:16	10.6	Y	0:10	8.50	9.30	9.60	10	1.0	25.2	15.6	20.4	3.95
12:17	12:27	10.6	Y	0:10	8.60	9.37	9.24	10	1.1	24.0	14.8	19.4	3.98
12:28	12:38	10.6	Y	0:10	8.55	9.34	9.48	10	1.1	24.6	15.1	19.9	3.99
Recommended for Design:										**Infiltration Rate**			**3.95**

Measured from pipe top

SALEM engineering group, Inc.

APPENDIX

B

APPENDIX B
LABORATORY TESTING

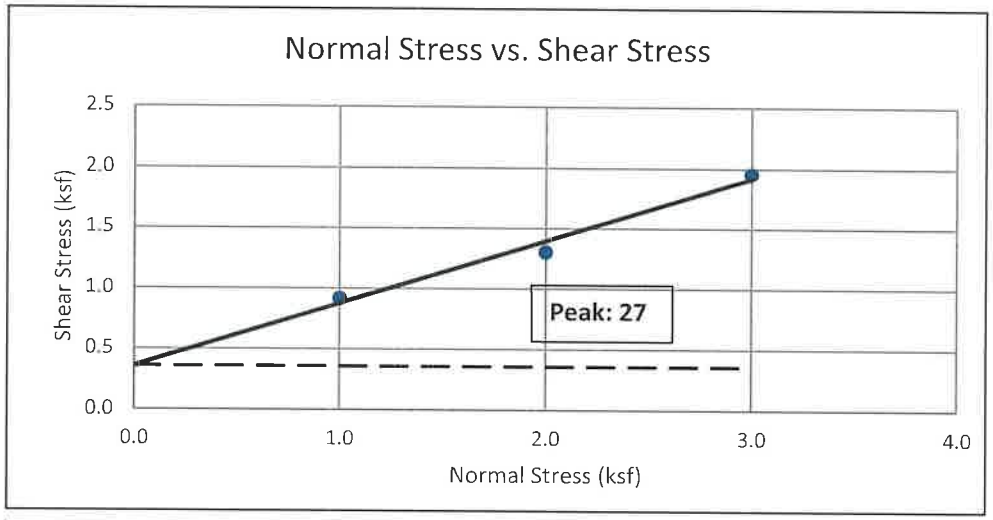
Laboratory tests were performed in accordance with generally accepted test methods of the American Society for Testing and Materials (ASTM), or other suggested procedures. Selected samples were tested for in-situ dry density and moisture content, corrosivity, shear strength, expansion index, Atterberg limits, R-Value, maximum density and optimum moisture content and grain size distribution. The results of the laboratory tests are summarized in the following figures.

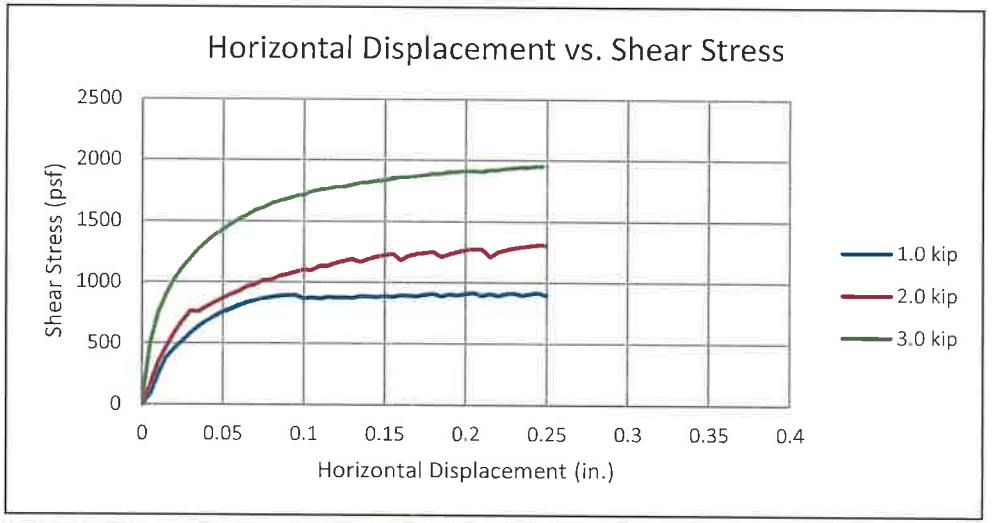
Direct Shear Test (ASTM D3080)

Project Name: Commercial Development - Fountain, Colorado
Project Number: 7-219-0518
Client:
Boring: B-1 @ 1.5'
Soil Type:
Sample Type: Remolded
Tested By: NL
Reviewed By:
Date of Test: 7/9/19
Test Equipment: GeoComp ShearTrac II

	Loading		
	1.0 kip	2.0 kip	3.0 kip
Normal Stress (ksf)	1.00	2.00	3.00
Shear Rate (in/min)	0.0025	0.0025	0.0025
Peak Shear Stress (ksf)	0.92	1.30	1.95
Residual Shear Stress (ksf)	0.00	0.00	0.00

Initial Height of Sample (in)	1.000	1.000	1.000
Post-Consol. Sample Height (in.)	0.913	0.834	0.828
Post-Shear Sample Height (in.)	0.892	0.807	0.809
Diameter of Sample (in)	2.416	2.416	2.416
Initial (pre-shear) Values			
Moisture Content (%)		10.3	
Dry Density (pcf)	111.7	108.6	110.9
Saturation %	54.6	50.4	53.5
Void Ratio	0.51	0.55	0.52
Consolidated Void Ratio	0.38	0.29	0.26
Final (post-shear) Values			
Final Moisture Content (%)	24.0	24.8	22.6
Dry Density (pcf)	49.4	48.5	59.9
Saturation %	187.3	266.8	266.7
Void Ratio	0.35	0.25	0.23



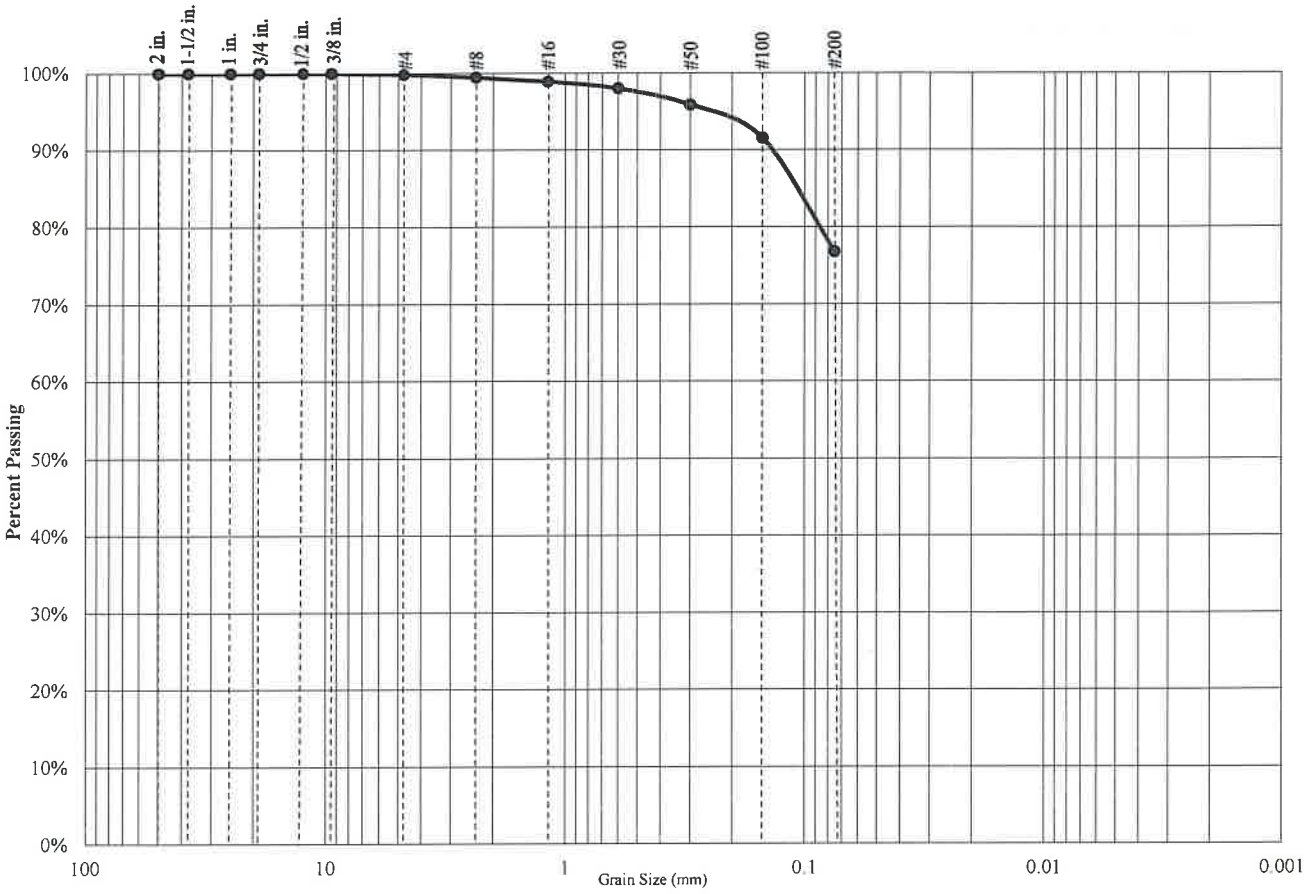


Peak Shear Strength Values		Residual Shear Strength Values	
Slope	0.52	Slope	0.00
Friction Angle	27	Friction Angle	0
Cohesion (psf)	354	Cohesion (psf)	0

SALEM engineering group, Inc.
4729 W. Jacquelyn Ave.
Fresno, CA 93722

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
0%	23%	77%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	100.0%
#4	99.8%
#8	99.4%
#16	98.9%
#30	98.0%
#50	95.9%
#100	91.5%
#200	76.8%

Atterberg Limits		
PL=	LL=	PI=

Coefficients				
D_{85}=		D_{60}=		D_{50}=
D_{30}=		D_{15}=		D_{10}=
C_u=	N/A	C_c=	N/A	

USCS CLASSIFICATION
0

Project Name: Commercial Development - Fountain, Colorado

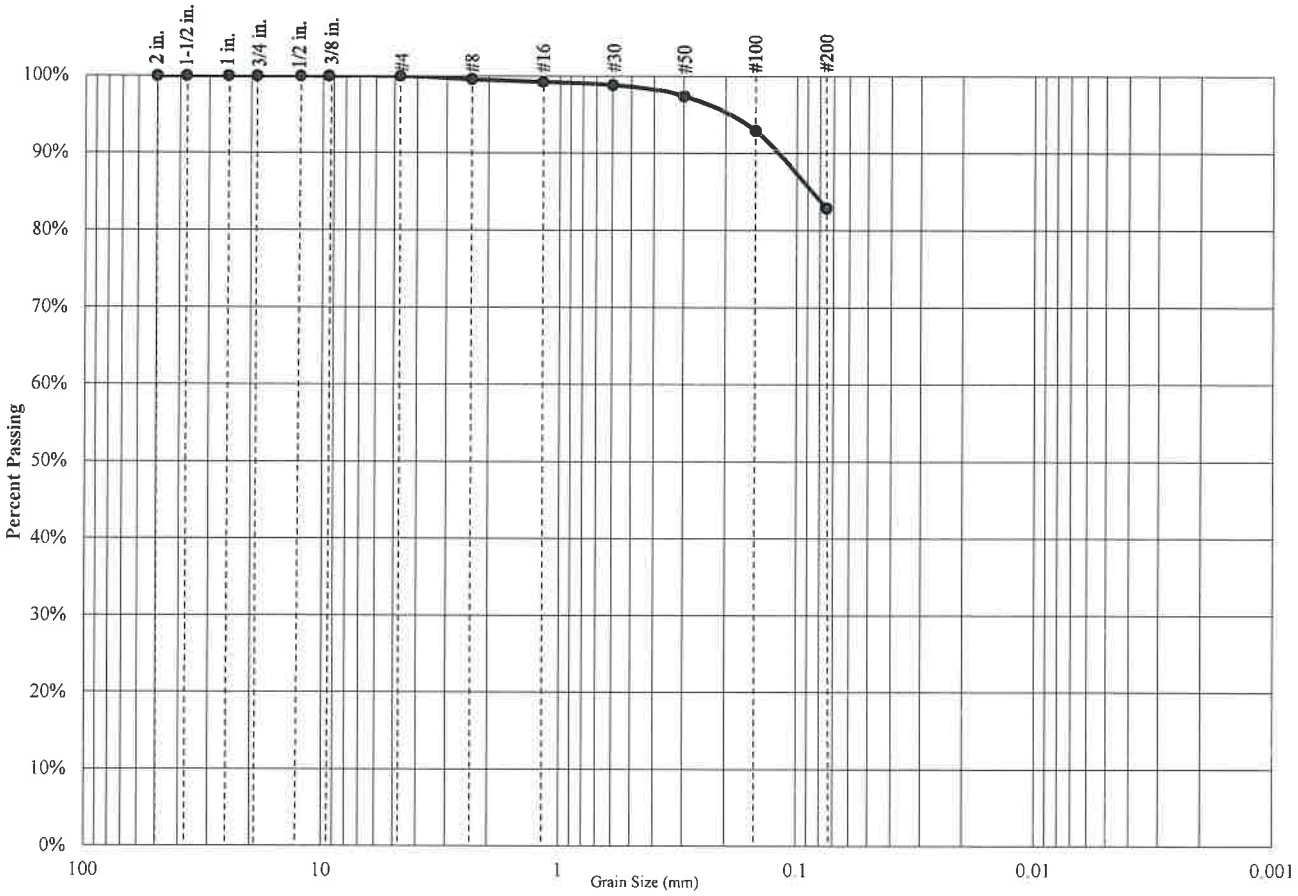
Project Number: 7-219-0518

Boring: B-1 @ 1.5'

SALEM engineering group, Inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
0%	17%	83%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	100.0%
#4	100.0%
#8	99.6%
#16	99.2%
#30	98.9%
#50	97.4%
#100	92.9%
#200	82.9%

Atterberg Limits					
PL=	27	LL=	67	PI=	40

Coefficients					
D_{85}=		D_{60}=		D_{50}=	
D_{30}=		D_{15}=		D_{10}=	
C_u=	N/A	C_c=	N/A		

USCS CLASSIFICATION
Fat CLAY with Sand (CH)

Project Name: Commercial Development - Fountain, Colorado

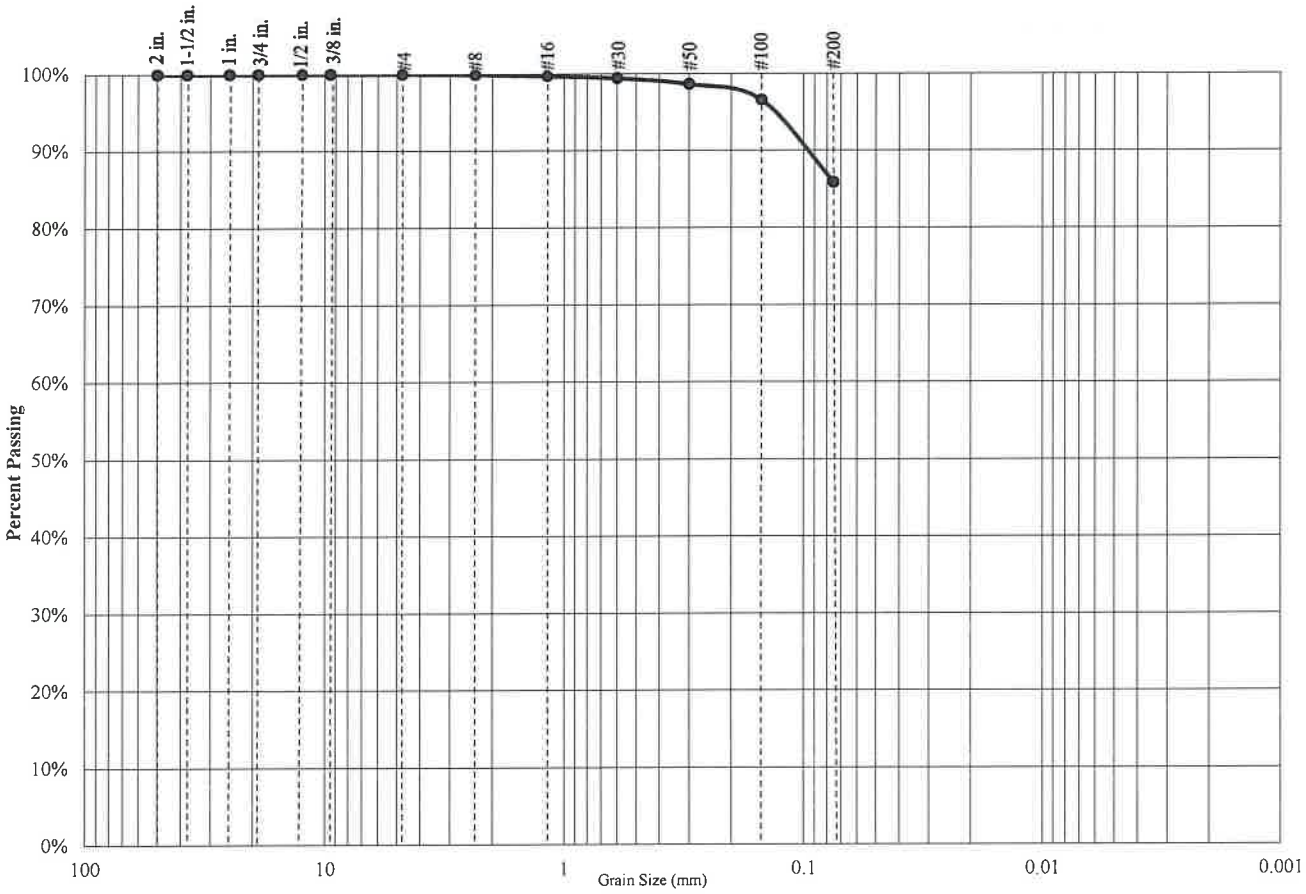
Project Number: 7-219-0518

Boring: B-1 @ 5'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
0%	14%	86%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	100.0%
#4	100.0%
#8	99.9%
#16	99.7%
#30	99.4%
#50	98.6%
#100	96.6%
#200	85.9%

Atterberg Limits					
PL=	19	LL=	42	PI=	23

Coefficients					
D_{85}=		D_{60}=		D_{50}=	
D_{30}=		D_{15}=		D_{10}=	
C_u=	N/A	C_c=	N/A		

USCS CLASSIFICATION
Lean CLAY (CL)

Project Name: Commercial Development - Fountain, Colorado

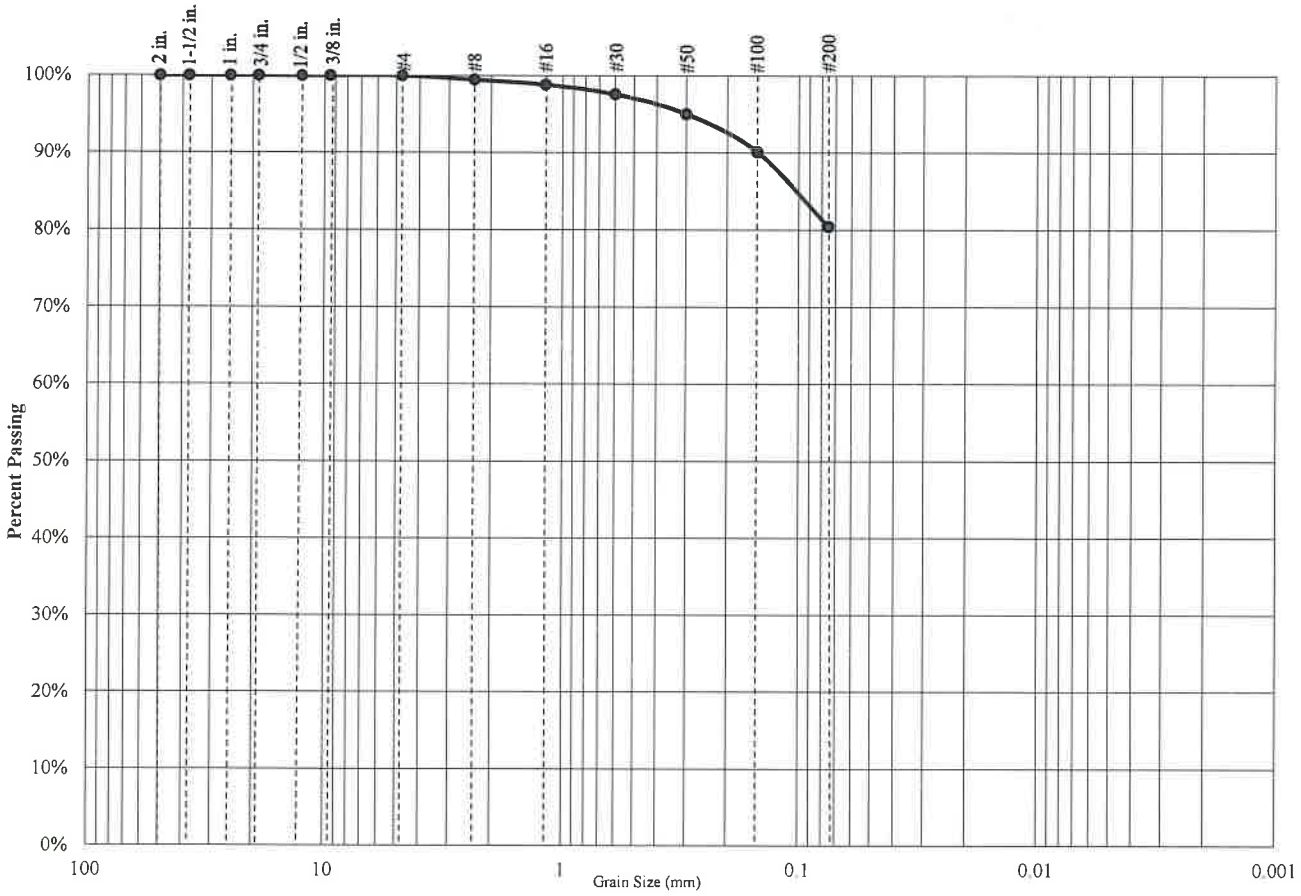
Project Number: 7-219-0518

Boring: B-3 @ 1.5'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
0%	20%	80%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	100.0%
#4	100.0%
#8	99.4%
#16	98.8%
#30	97.6%
#50	95.0%
#100	90.1%
#200	80.4%

Atterberg Limits					
PL=	22	LL=	58	PI=	36

Coefficients					
D_{85}=		D_{60}=		D_{50}=	
D_{30}=		D_{15}=		D_{10}=	
C_u=	N/A	C_c=	N/A		

USCS CLASSIFICATION
Fat CLAY with Sand (CH)

Project Name: Commercial Development - Fountain, Colorado

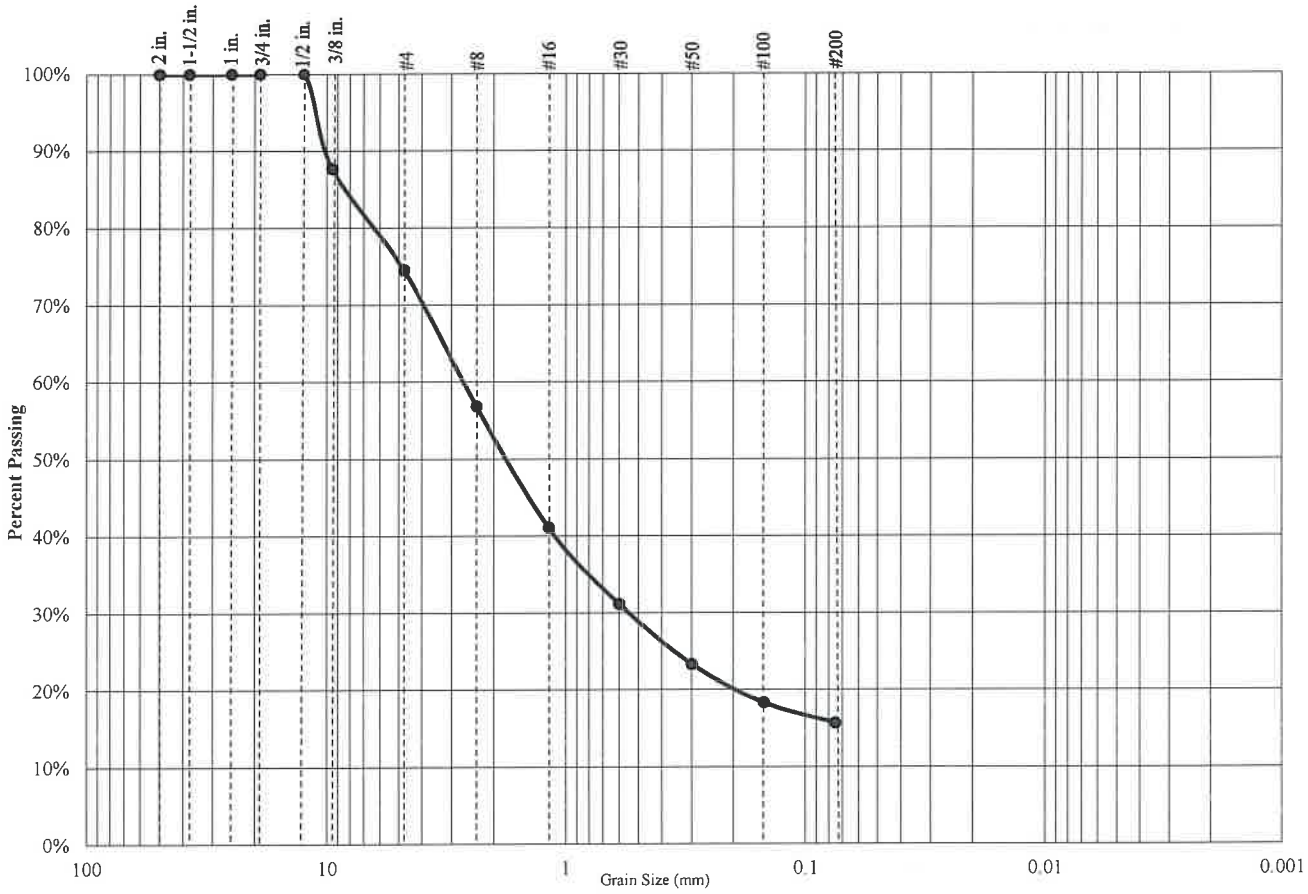
Project Number: 7-219-0518

Boring: B-6 @ 3.5'

SALEM engineering group, Inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
25%	59%	16%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	87.7%
#4	74.5%
#8	56.8%
#16	41.1%
#30	31.2%
#50	23.3%
#100	18.3%
#200	15.7%

Atterberg Limits		
PL=	LL=	PI=

Coefficients				
D_{85}=		D_{60}=		D_{50}=
D_{30}=		D_{15}=		D_{10}=
C_u=	N/A	C_c=	N/A	

USCS CLASSIFICATION
Silty SAND with Gravel (SM)

Project Name: Commercial Development - Fountain, Colorado

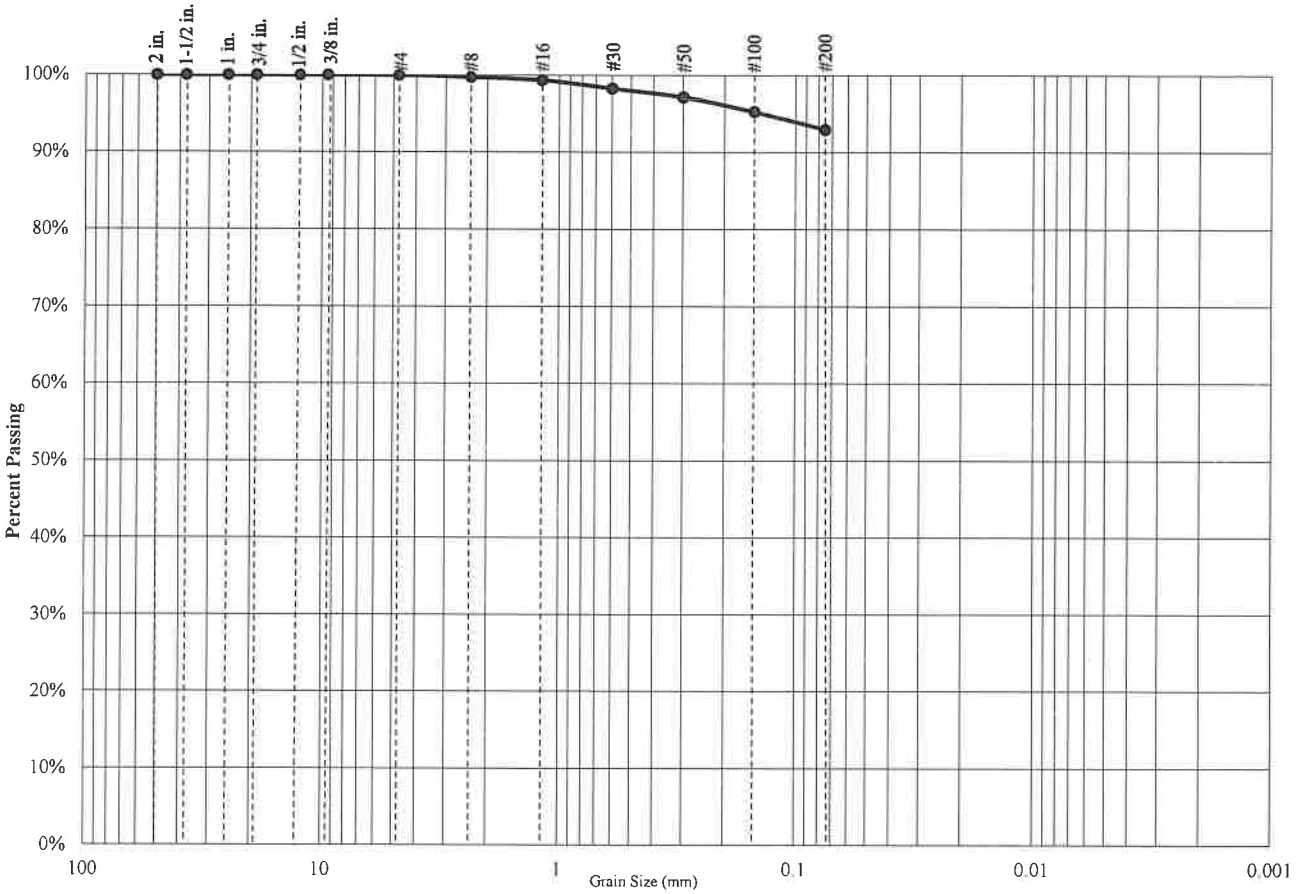
Project Number: 7-219-0518

Boring: B-7 @ 15'

SALEM engineering group, inc.

PARTICLE SIZE DISTRIBUTION DIAGRAM

GRADATION TEST - ASTM C136



Percent Gravel	Percent Sand	Percent Silt/Clay
0%	7%	93%

Sieve Size	Percent Passing
3/4 inch	100.0%
1/2 inch	100.0%
3/8 inch	100.0%
#4	100.0%
#8	99.7%
#16	99.3%
#30	98.3%
#50	97.1%
#100	95.3%
#200	93.0%

Atterberg Limits		
PL=	LL=	PI=

Coefficients			
D_{85}=		D_{60}=	D_{50}=
D_{30}=		D_{15}=	D_{10}=
C_u=	N/A	C_c=	N/A

USCS CLASSIFICATION
Lean CLAY (CL)

Project Name: Commercial Development - Fountain, Colorado

Project Number: 7-219-0518

Boring: B-10 @ 8.5'

SALEM engineering group, Inc.

EXPANSION INDEX TEST
ASTM D4829

Project Name: Commercial Development - Fountain, Colorado
Project Number: 7-219-0518
Date Sampled: 6/25/19 Date Tested: 7/3/19
Sampled By: SEG Tested By: DZ
Sample Location: B-10 @ 0 - 3'
Soil Description:

Trial #	1	2	3
Weight of Soil & Mold, g.	566.2		
Weight of Mold, g.	188.2		
Weight of Soil, g.	378.0		
Wet Density, pcf	114.0		
Weight of Moisture Sample (Wet), g.	810.0		
Weight of Moisture Sample (Dry), g.	720.7		
Moisture Content, %	12.4		
Dry Density, pcf	101.4		
Specific Gravity of Soil	2.7		
Degree of Saturation, %	50.6		

Time	Inital	30 min	1 hr	6 hrs	12 hrs	24 hrs
Dial Reading	0	0.0656	0.0702	0.0747	--	0.0772

Expansion Index $_{measured}$ = 77.2
Expansion Index $_{50}$ = 77.7

Expansion Index = **78**

Expansion Potential Table	
Exp. Index	Potential Exp.
0 - 20	Very Low
21 - 50	Low
51 - 90	Medium
91 - 130	High
>130	Very High

SALEM engineering group, inc.

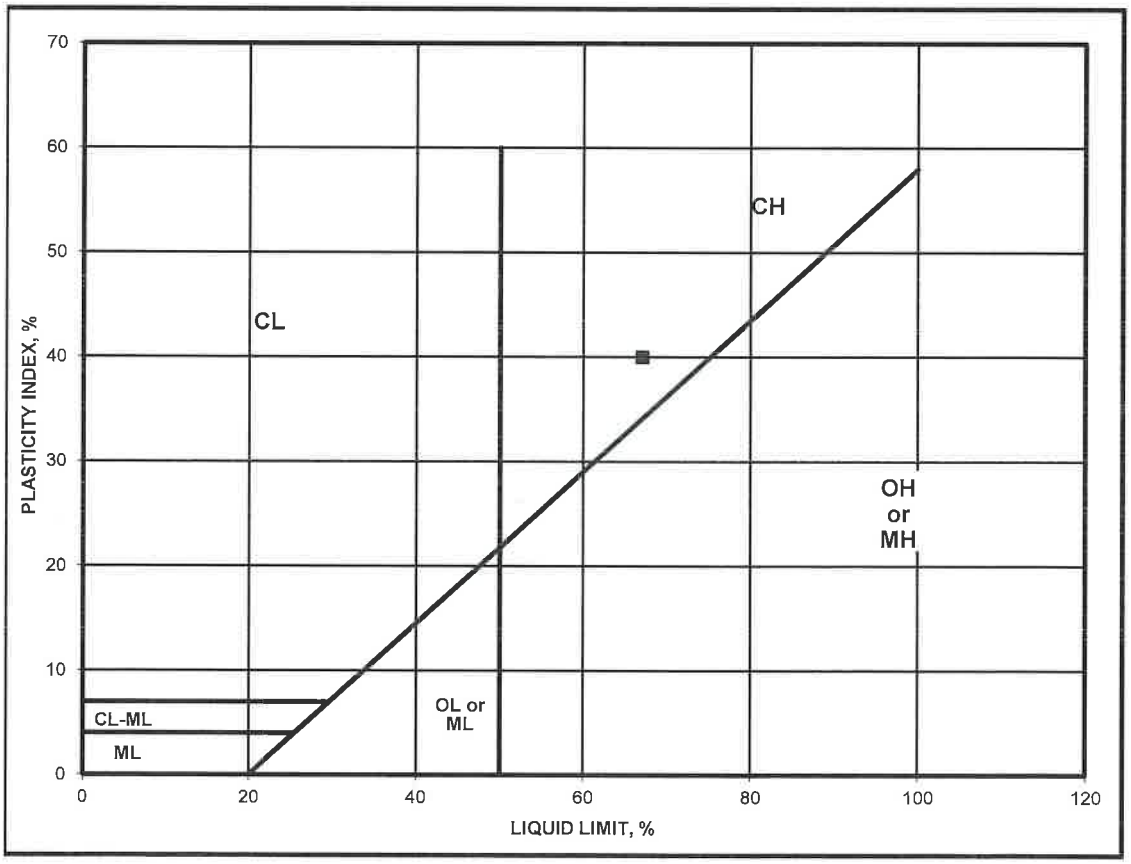
Atterberg Limits Determination
ASTM D4318

Project Name: Commercial Development - Fountain, Colorado
Project Number: 7-219-0518
Date Sampled: 6/25/19 Date Tested: 7/3/19
Sampled By: SEG Tested By: JH
Sample Location: B-1 @ 5'

Run Number	Plastic Limit			Liquid Limit		
	1	2	3	1	2	3
Weight of Wet Soil & Tare	29.84	27.42	27.58	30.27	31.64	29.87
Weight of Dry Soil & Tare	28.01	26.01	26.05	26.63	27.15	26.16
Weight of Water	1.83	1.41	1.53	3.64	4.49	3.71
Weight of Tare	20.52	20.82	20.67	20.92	20.61	20.92
Weight of Dry Soil	7.49	5.19	5.38	5.71	6.54	5.24
Water Content	24.4	27.2	28.4	63.7	68.7	70.8
Number of Blows				33	23	17

Plastic Limit : 27 **Liquid Limit : 67**

Plasticity Index : 40
Unified Soil Classification : CH



SALEM engineering group, inc.

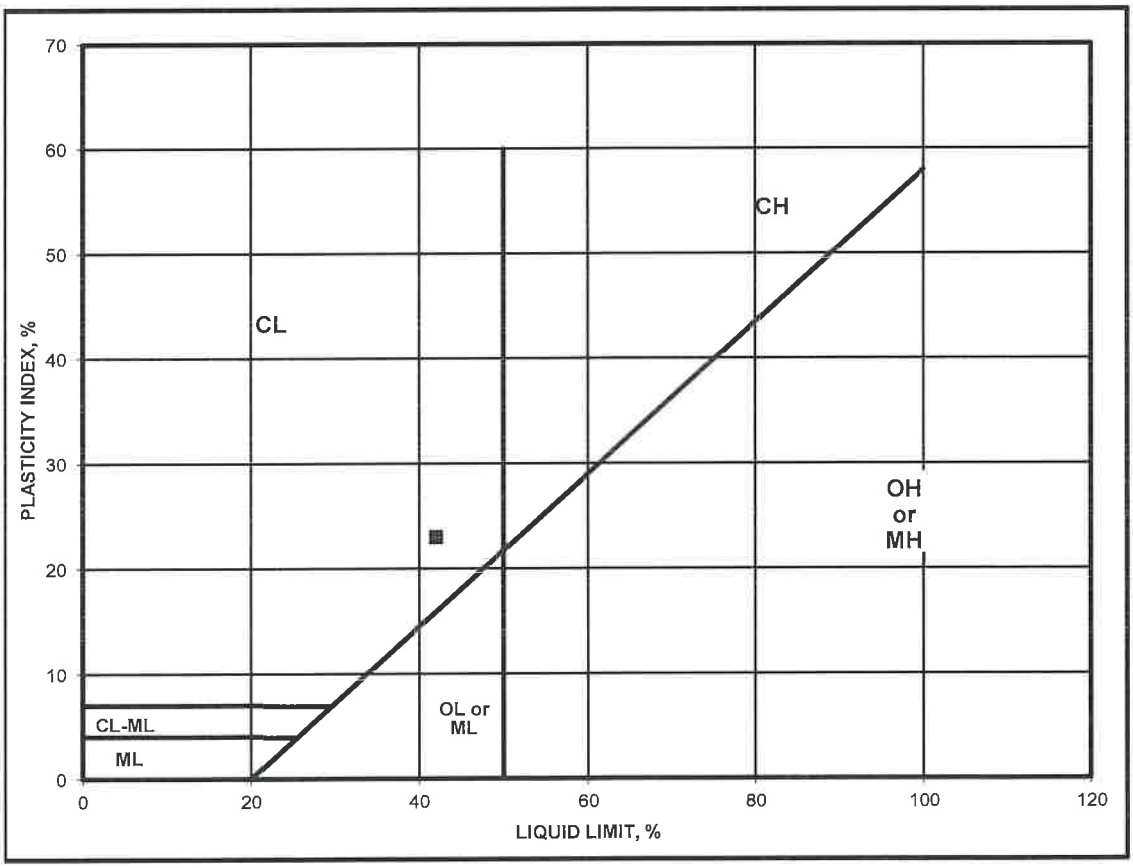
Atterberg Limits Determination
ASTM D4318

Project Name: Commercial Development - Fountain, Colorado
Project Number: 7-219-0518
Date Sampled: 6/25/19 Date Tested: 7/3/19
Sampled By: SEG Tested By: JH
Sample Location: B-3 @ 1.5'

Run Number	Plastic Limit			Liquid Limit		
	1	2	3	1	2	3
Weight of Wet Soil & Tare	26.60	27.71	27.60	30.03	31.48	34.78
Weight of Dry Soil & Tare	25.65	26.58	26.56	27.45	28.32	30.49
Weight of Water	0.95	1.13	1.04	2.58	3.16	4.29
Weight of Tare	20.85	20.97	20.88	20.87	20.52	20.72
Weight of Dry Soil	4.80	5.61	5.68	6.58	7.80	9.77
Water Content	19.8	20.1	18.3	39.2	40.5	43.9
Number of Blows				35	30	16

Plastic Limit : 19 **Liquid Limit : 42**

Plasticity Index : 23
Unified Soil Classification : CL



SALEM engineering group, inc.

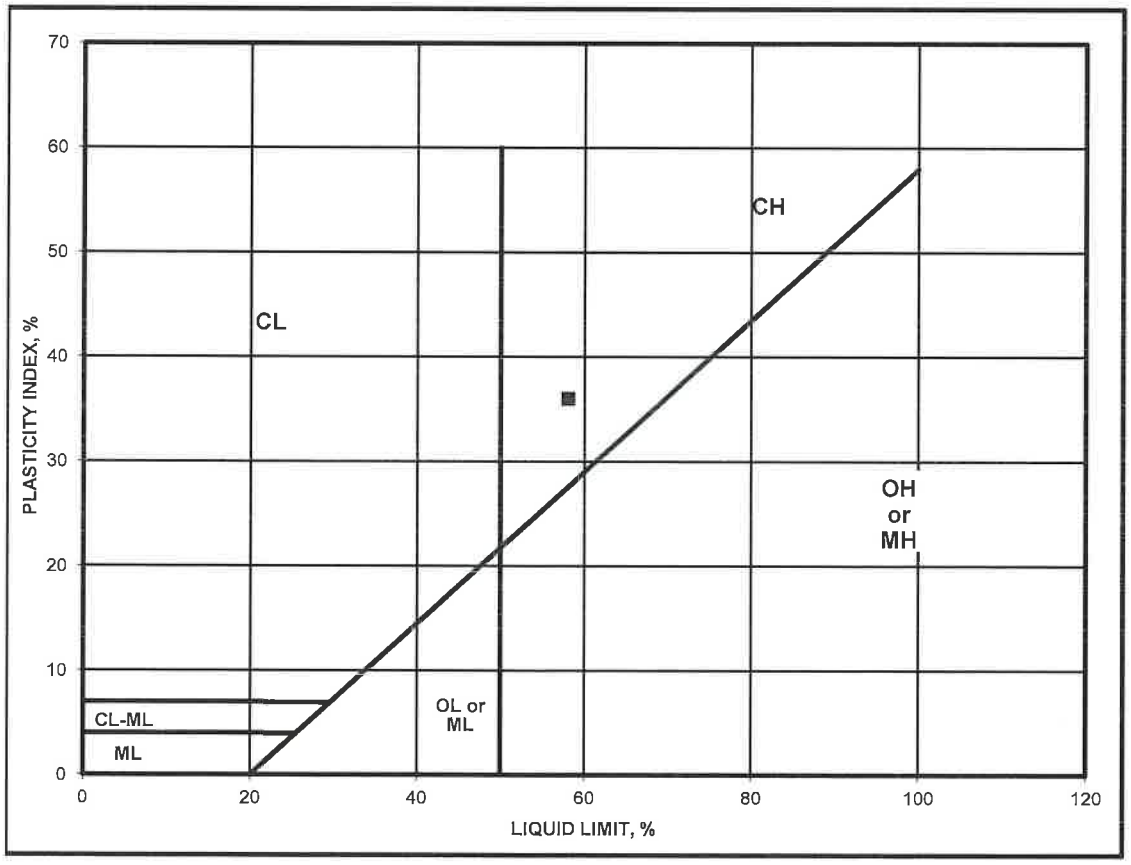
Atterberg Limits Determination
ASTM D4318

Project Name: Commercial Development - Fountain, Colorado
Project Number: 7-219-0518
Date Sampled: 6/25/19 Date Tested: 7/3/19
Sampled By: SEG Tested By: JH
Sample Location: B-6 @ 3.5'

Run Number	Plastic Limit			Liquid Limit		
	1	2	3	1	2	3
Weight of Wet Soil & Tare	27.69	27.66	28.62	32.62	31.67	31.28
Weight of Dry Soil & Tare	26.50	26.40	27.22	28.45	27.70	27.45
Weight of Water	1.19	1.26	1.40	4.17	3.97	3.83
Weight of Tare	20.99	21.01	20.92	21.07	21.12	21.11
Weight of Dry Soil	5.51	5.39	6.30	7.38	6.58	6.34
Water Content	21.6	23.4	22.2	56.5	60.3	60.4
Number of Blows				28	21	20

Plastic Limit : 22 **Liquid Limit : 58**

Plasticity Index : 36
Unified Soil Classification : CH



SALEM engineering group, inc.

CHEMICAL ANALYSIS

SO_4 - Modified CTM 417 & Cl - Modified CTM 417/422

Project Name: Commercial Development - Fountain, Colorado
Project Number: 7-219-0518
Date Sampled: 6/25/19 Date Tested: 7/9/19
Sampled By: SEG Tested By: DZ
Soil Description:

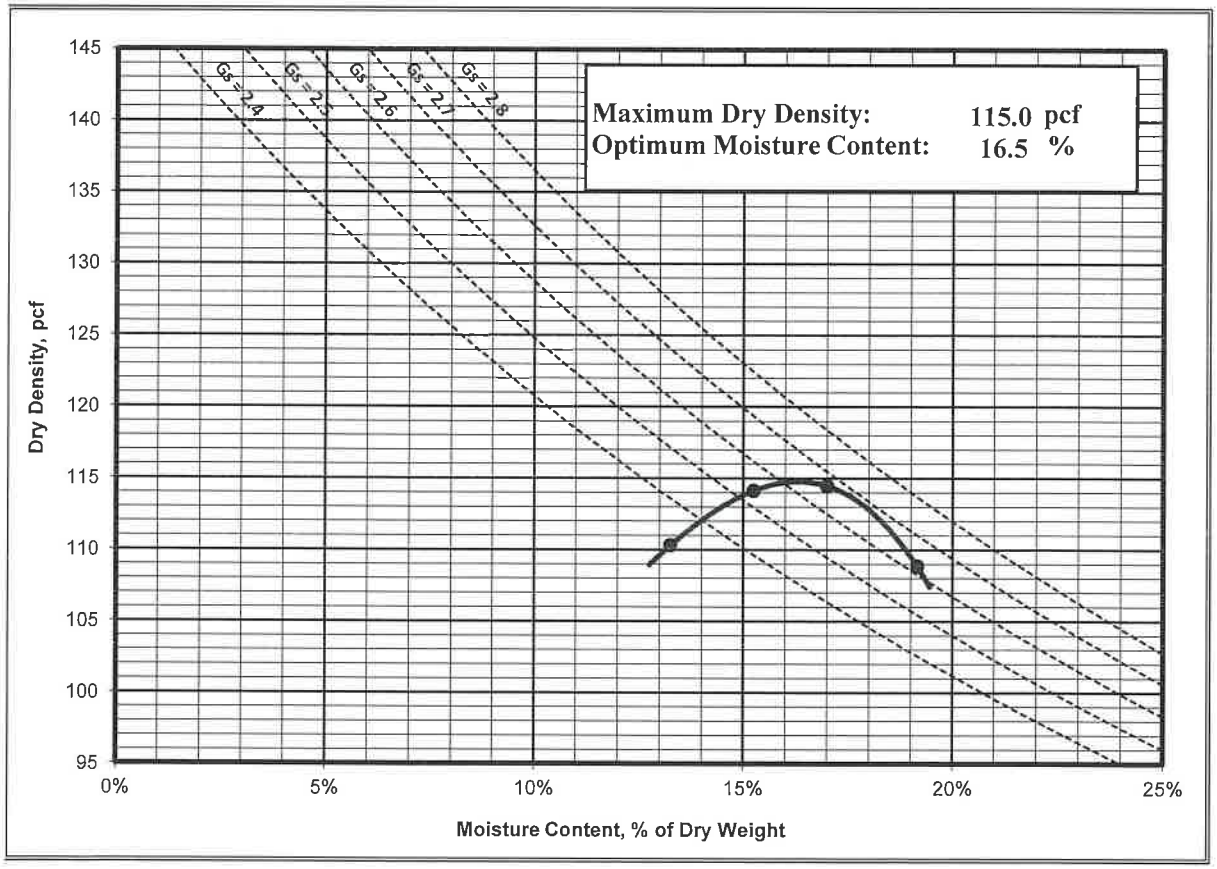
Sample Number	Sample Location	Soluble Sulfate SO_4-S	Soluble Chloride Cl	pH
1a.	B-10 @ 0 - 3'	330 mg/kg	46 mg/kg	8.0
1b.	B-10 @ 0 - 3'	320 mg/kg	45 mg/kg	8.0
1c.	B-10 @ 0 - 3'	320 mg/kg	45 mg/kg	8.0
Average:		**323 mg/kg**	**45 mg/kg**	**8.0**

SALEM
engineering group, inc.

Laboratory Compaction Curve
ASTM D1557

Project Name: Commercial Development - Fountain, Colorado
Project Number: 7-219-0518
Date Sampled: 6/25/19 Date Tested: 7/9/19
Sampled By: SEG Tested By: RM
Sample Location: B-10 @ 0 - 3'
Soil Description: Brown, Highly Cohesive, Silt
Test Method: Method A

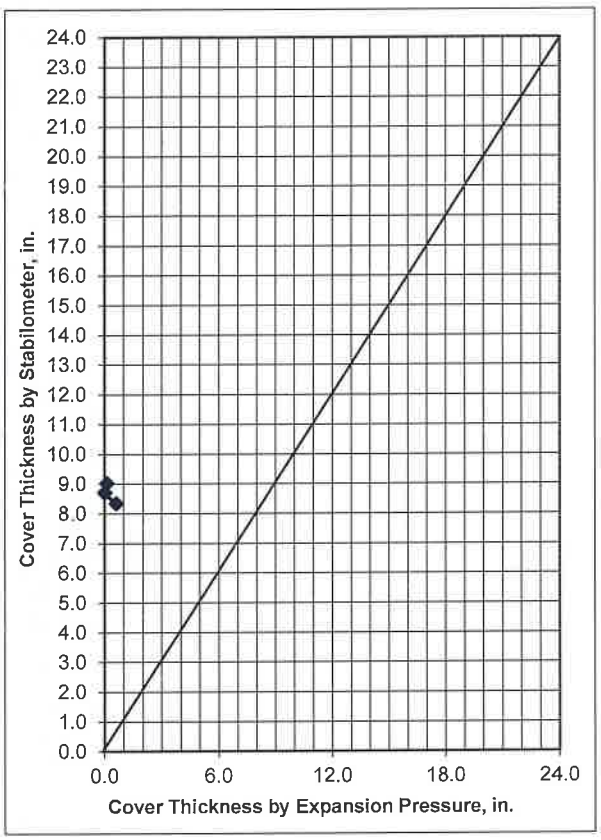
	1	2	3	4
Weight of Moist Specimen & Mold, (g)	3864.6	3964.4	4000.7	3937.2
Weight of Compaction Mold, (g)	1975.7	1975.7	1975.7	1975.7
Weight of Moist Specimen, (g)	1888.9	1988.7	2025.0	1961.5
Volume of Mold, (ft^3)	0.0333	0.0333	0.0333	0.0333
Wet Density, (pcf)	124.9	131.5	133.9	129.7
Weight of Wet (Moisture) Sample, (g)	336.5	336.5	336.5	336.5
Weight of Dry (Moisture) Sample, (g)	297.1	292.0	287.6	282.4
Moisture Content, (%)	13.3%	15.2%	17.0%	19.2%
Dry Density, (pcf)	110.3	114.1	114.5	108.9

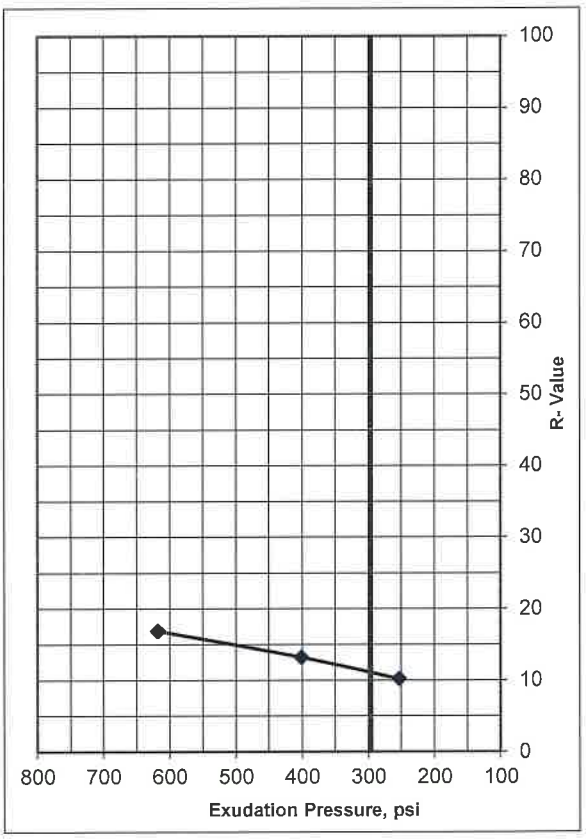


SALEM engineering group, inc.

Resistance R-Value
and Expansion Pressure of Compacted Soils
ASTM D2844

Project Name: Commercial Development - Fountain, Colorado
Project Number: 7-219-0518
Date Sampled: 6/25/19
Date Tested: 7/3/19
Sampled By: SEG
Tested By: RM
Sample Location: B-10 @ 0 - 3'
Soil Description:





Specimen	1	2	3
Exudation Pressure, psi	617.3	401.1	253.7
Moisture at Test, %	13.8	16.1	18.7
Dry Density, pcf	114.4	108.9	104.4
Expansion Pressure, psf	65	0	13
Thickness by Stabilometer, in.	8.3	8.7	9.0
Thickness by Expansion Pressure, in.	0.6	0.0	0.1
R-Value by Stabilometer	17	13	10
R-Value by Expansion Pressure	N/A		
R-Value at 300 psi Exudation Pressure	11		

Controlling R-Value	**11**

SALEM engineering group, inc.

APPENDIX

C

APPENDIX C
GENERAL EARTHWORK AND PAVEMENT SPECIFICATIONS

When the text of the report conflicts with the general specifications in this appendix, the recommendations in the report have precedence.

1.0 SCOPE OF WORK: These specifications and applicable plans pertain to and include all earthwork associated with the site rough grading, including, but not limited to, the furnishing of all labor, tools and equipment necessary for site clearing and grubbing, stripping, preparation of foundation materials for receiving fill, excavation, processing, placement and compaction of fill and backfill materials to the lines and grades shown on the project grading plans and disposal of excess materials.

2.0 PERFORMANCE: The Contractor shall be responsible for the satisfactory completion of all earthworks in accordance with the project plans and specifications. This work shall be inspected and tested by a representative of SALEM Engineering Group, Incorporated, hereinafter referred to as the Soils Engineer and/or Testing Agency. Attainment of design grades, when achieved, shall be certified by the project Civil Engineer. Both the Soils Engineer and the Civil Engineer are the Owner's representatives. If the Contractor should fail to meet the technical or design requirements embodied in this document and on the applicable plans, he shall make the necessary adjustments until all work is deemed satisfactory as determined by both the Soils Engineer and the Civil Engineer. No deviation from these specifications shall be made except upon written approval of the Soils Engineer, Civil Engineer, or project Architect.

No earthwork shall be performed without the physical presence or approval of the Soils Engineer. The Contractor shall notify the Soils Engineer at least 2 working days prior to the commencement of any aspect of the site earthwork.

The Contractor agrees that he shall assume sole and complete responsibility for job site conditions during the course of construction of this project, including safety of all persons and property; that this requirement shall apply continuously and not be limited to normal working hours; and that the Contractor shall defend, indemnify and hold the Owner and the Engineers harmless from any and all liability, real or alleged, in connection with the performance of work on this project, except for liability arising from the sole negligence of the Owner or the Engineers.

3.0 TECHNICAL REQUIREMENTS: All compacted materials shall be densified to no less that 98 percent (95 percent for cohesive fine-grained soils) of relative compaction based on methods specified in the technical portion of the Soil Engineer's report. The location and frequency of field density tests shall be as determined by the Soils Engineer. The results of these tests and compliance with these specifications shall be the basis upon which satisfactory completion of work will be judged by the Soils Engineer.

4.0 SOILS AND FOUNDATION CONDITIONS: The Contractor is presumed to have visited the site and to have familiarized himself with existing site conditions and the contents of the data presented in the Geotechnical Engineering Report.

The Contractor shall make his own interpretation of the data contained in the Geotechnical Engineering Report and the Contractor shall not be relieved of liability under the Contractor for any loss sustained as a result of any variance between conditions indicated by or deduced from said report and the actual conditions encountered during the progress of the work.

5.0 DUST CONTROL: The work includes dust control as required for the alleviation or prevention of any dust nuisance on or about the site or the borrow area, or off-site if caused by the Contractor's operation either during the performance of the earthwork or resulting from the conditions in which the Contractor leaves the site. The Contractor shall assume all liability, including court costs of codefendants, for all claims related to dust or wind-blown materials attributable to his work.

Site preparation shall consist of site clearing and grubbing and preparation of foundation materials for receiving fill.

6.0 CLEARING AND GRUBBING: The Contractor shall accept the site in this present condition and shall demolish and/or remove from the area of designated project earthwork all structures, both surface and subsurface, trees, brush, roots, debris, organic matter and all other matter determined by the Soils Engineer to be deleterious. Such materials shall become the property of the Contractor and shall be removed from the site.

Tree root systems in proposed building areas should be removed to a minimum depth of 3 feet and to such an extent which would permit removal of all roots greater than 1 inch in diameter. Tree roots removed in parking areas may be limited to the upper 1½ feet of the ground surface. Backfill or tree root excavation should not be permitted until all exposed surfaces have been inspected and the Soils Engineer is present for the proper control of backfill placement and compaction. Burning in areas which are to receive fill materials shall not be permitted.

7.0 SUBGRADE PREPARATION: Surfaces to receive Engineered Fill, building or slab loads, shall be prepared as outlined above, scarified to a minimum of 6 inches, moisture-conditioned as necessary, and recompacted to 98 percent (95 percent for cohesive fine-grained soils) relative compaction based on Standard Proctor Test ASTM Test Method D698.

Loose soil areas and/or areas of disturbed soil shall be moisture-conditioned as necessary and recompacted to 98 percent (95 percent for cohesive fine-grained soils) relative compaction based on Standard Proctor Test ASTM Test Method D698. All ruts, hummocks, or other uneven surface features shall be removed by surface grading prior to placement of any fill materials. All areas which are to receive fill materials shall be approved by the Soils Engineer prior to the placement of any of the fill material.

8.0 EXCAVATION: All excavation shall be accomplished to the tolerance normally defined by the Civil Engineer as shown on the project grading plans. All over-excavation below the grades specified shall be backfilled at the Contractor's expense and shall be compacted in accordance with the applicable technical requirements.

9.0 FILL AND BACKFILL MATERIAL: No material shall be moved or compacted without the presence of the Soils Engineer. Material from the required site excavation may be utilized for construction site fills, provided prior approval is given by the Soils Engineer. All materials utilized for constructing site fills shall be free from vegetation or other deleterious matter as determined by the Soils Engineer.

10.0 PLACEMENT, SPREADING AND COMPACTION: The placement and spreading of approved fill materials and the processing and compaction of approved fill and native materials shall be the responsibility of the Contractor. However, compaction of fill materials by flooding, ponding, or jetting shall not be permitted unless specifically approved by local code, as well as the Soils Engineer. Both cut and fill shall be surface-compacted to the satisfaction of the Soils Engineer prior to final acceptance.

11.0 SEASONAL LIMITS: No fill material shall be placed, spread, or rolled while it is frozen or thawing, or during unfavorable wet weather conditions. When the work is interrupted by heavy rains, fill operations shall not be resumed until the Soils Engineer indicates that the moisture content and density of previously placed fill is as specified.

12.0 DEFINITIONS - The term "pavement" shall include asphaltic concrete surfacing, untreated aggregate base, and aggregate subbase. The term "subgrade" is that portion of the area on which surfacing, base, or subbase is to be placed.

The term "relative compaction" refers to the field density expressed as a percentage of the maximum laboratory density as defined in the applicable tests outlined in the Materials Manual.

13.0 SCOPE OF WORK - This portion of the work shall include all labor, materials, tools, and equipment necessary for, and reasonably incidental to the completion of the pavement shown on the plans and as herein specified, except work specifically notes as "Work Not Included."

14.0 PREPARATION OF THE SUBGRADE - The Contractor shall prepare the surface of the various subgrades receiving subsequent pavement courses to the lines, grades, and dimensions given on the plans. The upper 12 inches of the soil subgrade beneath the pavement section shall be compacted to a minimum relative compaction of 98 percent (95 percent for cohesive fine-grained soils) based on Standard Proctor Test ASTM Test Method D698. The finished subgrades shall be tested and approved by the Soils Engineer prior to the placement of additional pavement courses.

15.0 UNTREATED AGGREGATE BASE - The aggregate base material shall be spread and compacted on the prepared subgrade in conformity with the lines, grades, and dimensions shown on the plans. The aggregate base material shall conform to the requirements of the Standard Specifications for Class 5 or 6 materials. The aggregate base material shall be compacted to a minimum relative compaction of 98 percent based on Standard Proctor Test ASTM Test Method D698. The aggregate base material shall be spread in layers not exceeding 6 inches and each layer of aggregate material course shall be tested and approved by the Soils Engineer prior to the placement of successive layers.

16.0 AGGREGATE SUBBASE - The aggregate subbase shall be spread and compacted on the prepared subgrade in conformity with the lines, grades, and dimensions shown on the plans. The aggregate subbase material shall conform to the requirements of the Standard Specifications for Class 5 or 6 materials. The aggregate subbase material shall be compacted to a minimum relative compaction of 98 percent based on Standard Proctor Test ASTM Test Method D698, and it shall be spread and compacted in accordance with the Standard Specifications. Each layer of aggregate subbase shall be tested and approved by the Soils Engineer prior to the placement of successive layers.

17.0 ASPHALTIC CONCRETE SURFACING - Asphaltic concrete surfacing shall consist of a mixture of mineral aggregate and paving grade asphalt, mixed at a central mixing plant and spread and compacted on a prepared base in conformity with the lines, grades, and dimensions shown on the plans. The viscosity grade of the asphalt shall be Grading S or SX. The drying, proportioning, and mixing of the materials shall conform to the Standard Specifications.

The prime coat, spreading and compacting equipment, and spreading and compacting the mixture shall conform to the applicable chapters of the Standard Specifications, with the exception that no surface course shall be placed when the atmospheric temperature is below 50 degrees F. The surfacing shall be rolled with a combination steel-wheel and pneumatic rollers, as described in the Standard Specifications. The surface course shall be placed with an approved self-propelled mechanical spreading and finishing machine.

18.0 FOG SEAL COAT - The fog seal (mixing type asphaltic emulsion) shall conform to and be applied in accordance with the requirements of the Standard Specifications.

Metcalf Archaeological Consultants, Inc.
Est. 1980

January 6, 2020

Maria Ruvalcaba
Salem Engineering Group, Inc.

transmittal via e-mail
Maria@salem.net

Re: Proposed Mesa Ridge Commercial Development in the City of Fountain, El Paso County, Colorado

Dear Maria,

Metcalf Archaeological Consultants, Inc. (Metcalf) was contacted to assist Salem Engineering Group, Inc. (Salem) with completing a cultural resources files search and literature review for a proposed commercial development located on the southwest corner of Mesa Ridge Parkway and Syracuse Street (Mesa Ridge Developments) within the City of Fountain, El Paso County, Colorado. This letter is written in support of the Land Analysis Report (LAR) for the City of Fountain specifically to address the section regarding the proposed development's potential impact to significant cultural resources and plans for the protection of such resources. The parcel subject to this study comprises roughly 33 acres of private land in two parcels separated by the existing railroad tracks (Map 1). The proposed commercial development would entail development of 15 acres of those 33 acres. The proposed commercial uses for the development include a restaurant, retail, fitness, medical office, storage, gas station, and childcare. Detention will be located in the southern portion of the property known as the "porkchop".

Construction activities for the proposed commercial development will involve surface and subsurface disturbance which could potentially impact significant cultural resources, if present. In order to assess this potential, Metcalf requested a formal files search with the Colorado Office of Archaeology and Historic Preservation (OAHP) on December 16, 2019 to obtain information for previous survey and known cultural resources. The files search covered the proposed project area and all sections within ¼ mile of the project area. This included Sections 24 and 25 of Township 15 South, Range 65 West and Sections 19 and 30 of Township 15 South, Range 66 West of the 6th prime meridian. The files search results included 18 previous inventories and 19 previously recorded resources in the searched sections (map included with agency copy only). These results are summarized in Table 1 and Table 2, respectively.

Limited previous survey overlaps the eastern edge (including the portion of the parcel in between the rail lines) and a small area on the north of the parcel proposed for development. Three inventories are noted and each study was limited to, or very near, the right of ways associated with Mesa Ridge Parkway and US Hwy 87/North Santa Fe Avenue. These projects include EP.CH.NR34 conducted in 1994 by the Colorado Department of Transportation (CDOT), EP.CH.NR53 conducted in 2002 by CDOT, and EP.CH.R55 conducted in 2005 by TEC Environmental Management (Map 2).

Table 1 Previous survey within the file-searched sections.

OAHP SURVEY ID	TITLE/DESCRIPTION	INVESTIGATOR*	YEAR
EP.CH.NR25	CULTURAL RESOURCE SURVEY OF I-25 BETWEEN SOUTH ACADEMY BOULEVARD AND SECURITY, EL PASO COUNTY, COLORADO (M2-90-1)	CDOH	1990
EP.CH.NR31	CULTURAL RESOURCES INVENTORY FOR TWO HIGHWAY MAINTENANCE PROJECTS IN EL PASO COUNTY, COLORADO (M2-93-6)	CDOT	1993
EP.CH.NR34	CULTURAL RESOURCE SURVEY OF THE PROPOSED POWERS BOULEVARD EXTENSION IN WIDEFIELD, EL PASO COUNTY, COLORADO (STU 2000(25))	CDOT	1994
EP.CH.NR53	AN INTENSIVE ARCHAEOLOGICAL RESOURCE INVENTORY OF THE PROPOSED POWERS BOULEVARD/STATE HIGHWAY 16 INTERCHANGES ON US HIGHWAY 85 AND INTERSTATE 25 IN WIDEFIELD, EL PASO COUNTY, COLORADO (STU R200-110)	CDOT	2002
EP.CH.R12	CULTURAL RESOURCES SURVEY OF INTERSTATE 25 BETWEEN STATE HIGHWAY 83 AND U.S. HIGHWAY 85 SOUTH OF COLORADO SPRINGS, EL PASO COUNTY, COLORADO (IM 0252-279)	CDOT	1995
EP.CH.R38	CULTURAL RESOURCE SURVEY OF PROJECT MU 0085(9), FOUNTAIN NORTH STATE HIGHWAY 85, EL PASO COUNTY, COLORADO	CDOH	1983
EP.CH.R39	THE ARCHAEOLOGICAL SURVEY OF THE PROPOSED POWERS BOULEVARD CORRIDOR COLORADO SPRINGS, EL PASO COUNTY, COLORADO (M-7780(1))	CDOH	1976
EP.CH.R40	CULTURAL RESOURCE SURVEY AND TEST EXCAVATION FOR THE I-25 CORRIDOR IMPROVEMENTS PROJECTS, MONUMENT TO SECURITY-WIDEFIELD, EL PASO COUNTY, COLORADO	Centennial	2002
EP.CH.R48	INTERSTATE 25 ENVIRONMENTAL ASSESSMENT PROJECT NUMBER 151077.13 HISTORIC RESOURCES SURVEY REPORT HISTORY AND SURVEY RESULTS	CDOT	2003
EP.CH.R49	A CLASS III CULTURAL RESOURCE INVENTORY OF THE POWERS BOULEVARD CORRIDOR EL 2005PASO COUNTY, COLORADO (ORIGINAL AND ADDENDUM)	WCRM	2003
EP.CH.R55	HISTORIC RESOURCES SURVEY OF THE POWERS ROAD/STATE HIGHWAY 16 CORRIDOR, EL PASO COUNTY, COLORADO (STU R200-110)	TEC	2005
EP.DA.NR40	MEMORANDUM FOR RECORD: CULTURAL RESOURCES SURVEY AND EVALUATION WITHIN THE MAIN POST, EL PASO COUNTY, COLORADO (CF2012-014)	DoD	2014
EP.DA.NR6	MEMORANDUM FOR RECORD: CULTURAL RESOURCES SURVEY WITHIN RANGE 29 FOR A PROPOSED FCMR ROD AND GUN CLUB (REC 2010-222)	DoD	2010
EP.DA.NR7	MEMORANDUM FOR RECORD: CULTURAL RESOURCES SURVEY AND EVALUATION, RANGE 29 SHOOT HOUSE AND TRENCH, EL PASO COUNTY, COLORADO (2000-082)	DoD	2000
EP.DA.NR8	MEMORANDUM FOR RECORD: CULTURAL RESOURCES SURVEY AND EVALUATION, UNIT 99-7, EL PASO COUNTY, COLORADO (1999-024)	DoD	1999

OAHP SURVEY ID	TITLE/DESCRIPTION	INVESTIGATOR*	YEAR
EP.DA.R39	MEMORANDUM FOR RECORD: CULTURAL RESOURCES SURVEY IN THE RANGE 30 AREA FOR A PROPOSED FCMR ROD AND GUN CLUB (REC 2010-222)	DoD	2010
MC.CH.R96	A CULTURAL RESOURCE SURVEY OF INTERSTATES 25, 70, 225, AND 270, U.S. HIGHWAYS 34 AND 160, AND STATE HIGHWAYS 13 AND 470, FOR THE PROPOSED ADESTA COMMUNICATIONS FIBER OPTIC SYSTEM, COLORADO (C SW00-102)	Centennial	1999
MC.DA.R6	ARCHAEOLOGICAL SURVEY OF HIGH PRIORITY PARCELS AND OTHER MISCELLANEOUS AREAS ON THE FORT CARSON MILITARY RESERVATION, EL PASO, PUEBLO AND FREMONT COUNTIES, COLORADO (REPORT AND APPENDICES A AND B) (1988-004)	Centennial	1990
*CDOH=Colorado Department of Highways; CDOT=Colorado Department of Transportation; Centennial=Centennial Archaeology, Inc.; DoD=Department of Defense, Fort Carson; TEC=TEC Environmental Management; WCRM=Western Cultural Resource Management, Inc.			

Table 2. List of cultural resources located in the file-searched sections.

SITE ID	SITE NAME/TYPE	RESOURCE AGE	NRHP STATUS
5EP.1003.10	BURLINGTON NORTHERN SANTA FE RAILROAD (SEGMENT) ~ SANTA FE RAILROAD RIGHT-OF-WAY - SEGMENT	Historic	Eligible, officially
5EP.2181.12	DENVER AND RIO GRANDE WESTERN RAILROAD - SEGMENT ~ UNION PACIFIC RAILROAD (SEGMENT) ~ DENVER AND RIO GRANDE RAILROAD	Historic	Eligible, officially
5EP.3614	BRIDGE J-18-B	Historic	Not Eligible, officially
5EP.3615	CLOVER DITCH BRIDGE ~ J-18-BA	Historic	Not Eligible, officially
5EP.3616	CLOVER DITCH BRIDGE ~ J-18-BD	Historic	Not Eligible, officially
5EP.4428	LEEPER HOUSE	Historic	Not Eligible, officially
5EP.4429	WOODY RESIDENCE	Historic	Not Eligible, officially
5EP.4430	FELIX RESIDENCE	Historic	Not Eligible, officially
5EP.4462	TRUJILLO RESIDENCE	Historic	Not Eligible, officially
5EP.4463	HARRIS HOUSE ~ SHADY GROVE APARTMENTS	Historic	Not Eligible, officially
5EP.4464	THOMPSON RESIDENCE	Historic	Not Eligible, officially
5EP.4465	DICK'S ROCK SHOP	Historic	Not Eligible, officially
5EP.4466	SAMOAN ASSEMBLY OF GOD	Historic	Not Eligible, officially
5EP.4467	NETTER RESIDENCE	Historic	Not Eligible, officially
5EP.4468	TRAILER PARK	Historic	Not Eligible, officially
5EP.4475.1	WIDEFIELD FEEDER DITCH	Historic	Not Eligible, officially
5EP.5037	ORTIZ RESIDENCE	Historic	Not Eligible, officially
5EP.5895	RANGE 29~T-9208~T-9211~PRG029-B~RG029B	Historic	Not Eligible, officially
5EP.6193	OPEN CAMP	Prehistoric	Not Eligible, officially

Of the 19 resources revealed by the files search, none are located within the footprints of the proposed parcel or development area. Historic linear segments 5EP1003.10 and 5EP2181.12 are located along the western edge of the proposed parcel, but are outside of the project area;

these two resources are the only resources within the files search data assemblage that are listed as eligible for the National Register of Historic Places (NRHP). A vast majority of the remaining resources are historic and most are structures associated with the early development of the area. Other historic site types include bridges, a ditch, and a military firing range. Only one prehistoric site (an open camp) has been previously recorded in the searched sections.

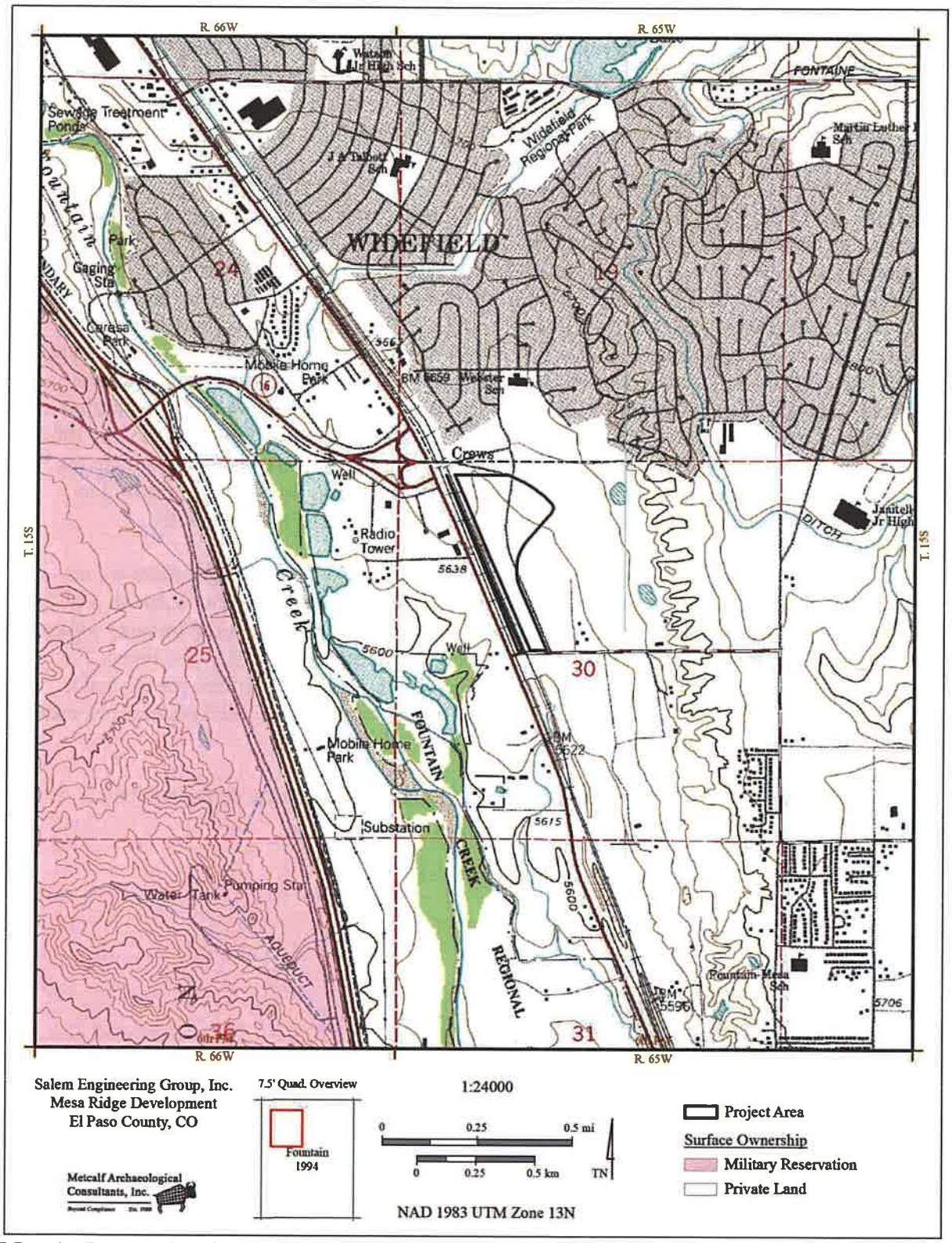
Historic maps and aerial imagery were also reviewed as part of this study. The 1866 General Land Office (GLO) plat for the area shows the Denver and Rio Grande Railroad plotted in its general location as depicted on later maps. A trail is also plotted trending southwest-northeast through the central portion of Section 30, although it appears to stay south and east of the project area. The 1893 Colorado Springs 1:250,000 scale topographic maps depicts the Denver and Rio Grande and Atchison Topeka and Santa Fe Railroad lines, and a road that is likely the predecessor of modern US Hwy 87/North Santa Fe Avenue traversing immediately west of the project area. These resources are maintained and remain in use today. Several additional historic maps of varying scales were also consulted, but show nothing in addition to the aforementioned railroads and road. Additionally, aerial imagery dating from 1937 to 1969 provided by Salem was reviewed; no obvious structures or features are visible other than the aforementioned railroads and road (Maps 3 through 5). It appears from aerial imagery the project area has been either agricultural or abandoned land since at least the 1930s.

In sum, the results of this files search and literature review indicate that there are no previously recorded cultural resources within the proposed parcel which is not surprising given that the parcel has never been formally surveyed for cultural resources. Aerial imagery indicates the land has likely served as agricultural land and largely undeveloped in historic times. No farmsteads or homesteads are plotted nearby. Based on the results of the files search, and a review of historic maps and aerials, a low potential exists for any unrecorded cultural resources to be located within the 33-acre parcel.

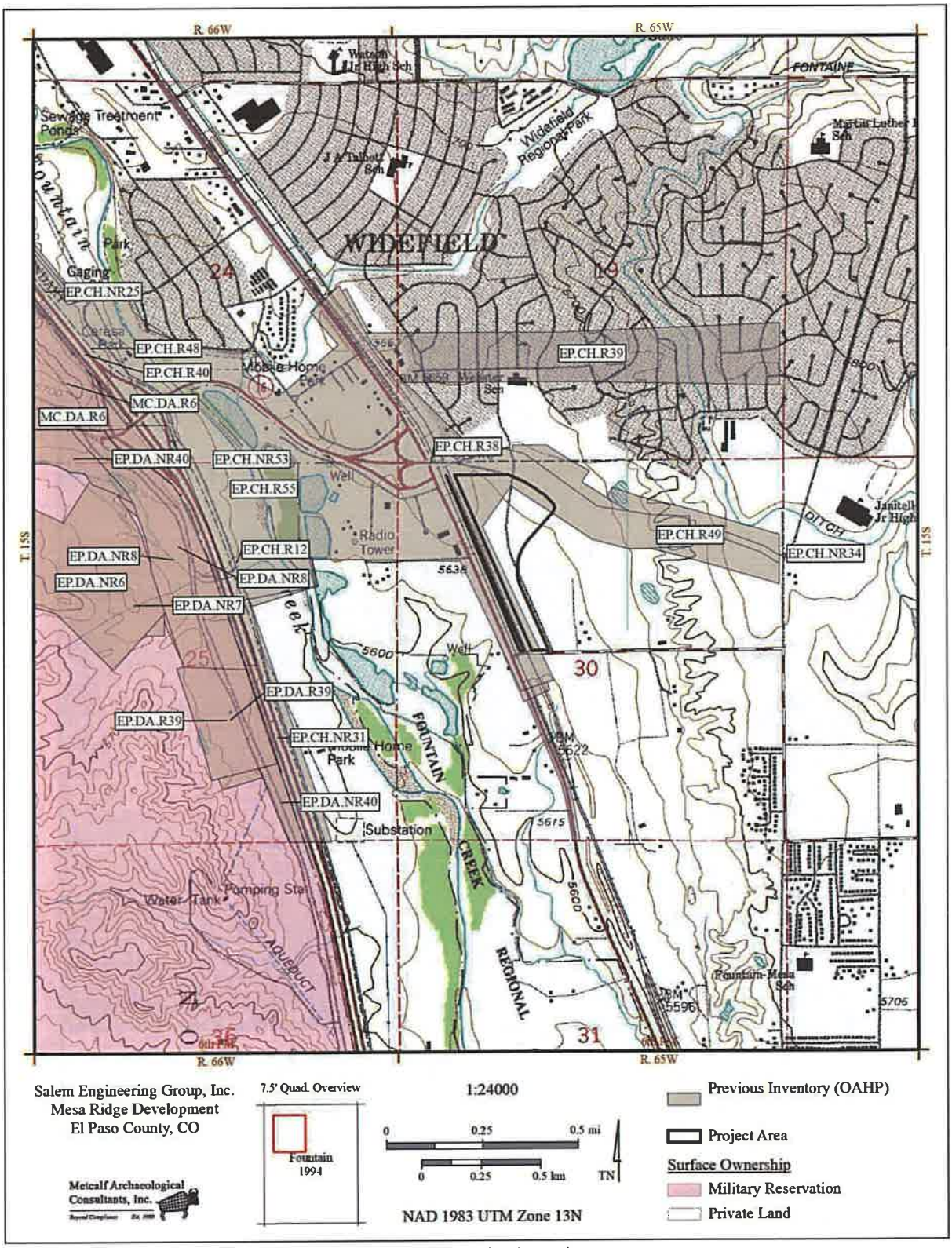
If you have any questions, or need additional information, please do not hesitate to contact me.

Sincerely,

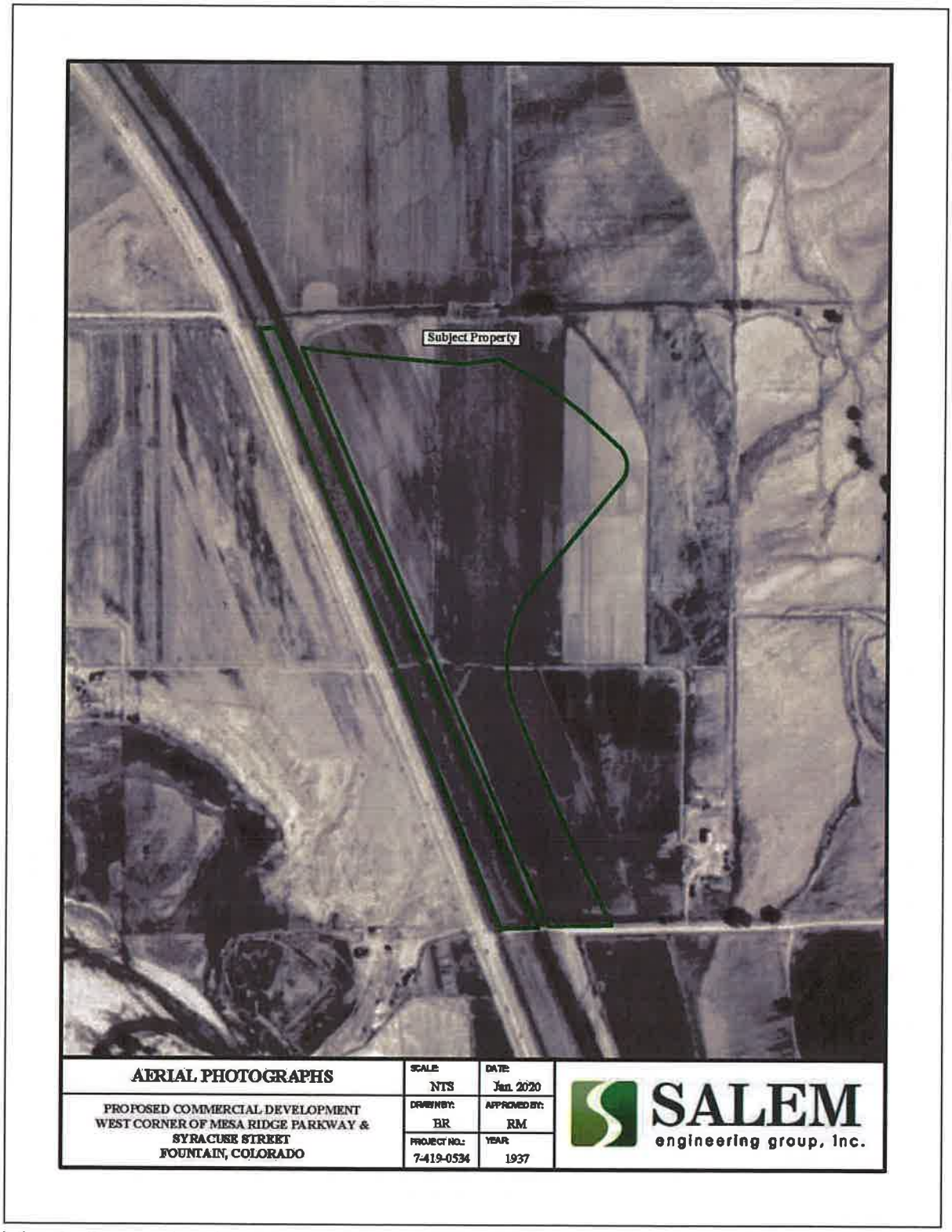
Kimberly Kintz, M.A., RPA
Principal Investigator
Metcalf Archaeological Consultants, Inc.



Map 1: Proposed project area



Map 2: Previous inventories within the files searched sections.



Map 3: Proposed project area overlaid on 1937 aerial imagery, from Salem Engineering Group, Inc. Not to original scale.

Map 4: Proposed project area overlaid on 1969 aerial imagery, from Salem Engineering Group, Inc. Not to original scale.

Map 5: Proposed project area overlaid on 1983 aerial imagery, from Salem Engineering Group, Inc. Not to original scale.

Resource Location Map
(agency copies only)

Project area showing previously recorded resources (Agency copy only; omitted from client copy).