# GEOTECHNICAL STUDY
# PROPOSED SIEVERS BUSINESS PARK
# 1945 DEER CREEK ROAD
# MONUMENT, COLORADO

**KLEINFELDER PROJECT #20172793.001A**

**DECEMBER 21, 2016**

A Report Prepared for:

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Kleinfelder Project No. 20172793.001A

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# 1 INTRODUCTION

## 1.1 GENERAL

This report presents the results of our geotechnical study performed for the proposed Sievers Business Center located at 1945 Deer Creek Road in Monument, Colorado. The general location of the project is shown in Figure 1, Exploration Location Plan and Vicinity Map.

This report includes our recommendations relating to the geotechnical aspects of project design and construction. The conclusions and recommendations stated in this report are based upon the subsurface conditions found at the locations of our exploratory borings at the time our explorations were performed. They also are subject to the provisions stated in the report sections titled **Additional Services** and **Limitations**. In addition, an article prepared by Geoprofessional Business Association (GBA), Important Information about This Geotechnical Engineering Report, has been included in Appendix C. We recommend that all individuals who read the report understand the report limitations along with the included GBA document.

Our findings, conclusions and recommendations should not be extrapolated to other areas or used for other projects without our prior review. Furthermore, they should not be used if the site has been altered, or if more than two years elapsed since the date of the report, without Kleinfelder's prior review to determine if they remain valid.

## 1.2 PROJECT DESCRIPTION

Design of the development is in the preliminary stages and detailed building and site grading plans are not available. Our understanding of the project is based on our discussion with you and the conceptual site plan dated July 5, 2016. The project includes the design and construction of a commercial site consisting of two single level structures for offices and a warehouse. Additional construction at the site will include an access road, parking areas, and a storm water detention pond. The approximate site boundaries and anticipated footprint of the structures are presented on Figure 1.

Both structures are anticipated to be of reinforced concrete and wood frame construction. Structural loads will be transmitted through bearing walls and columns to supporting shallow foundations. We anticipate that the maximum column and wall loads will be on the order of 150 kips and 3 kips per linear foot, respectively. Floor slab loads will be light.

Site grading is anticipated to be minor, with maximum anticipated cuts and fills of about three feet, outside the detention pond area. No basements or retaining structures are planned.

Flexible pavements will be constructed surrounding the structures for drive lanes and parking. Traffic volumes and distribution of vehicle class were not provided. We have assumed low traffic volumes, typical of a residential type roadway. Truck traffic is anticipated to be confined to trash and light delivery trucks. We estimate traffic volumes of 100,000 equivalent 18-kip single axle load application (ESAL) for areas subjected to truck traffic, and 50,000 for automobile only traffic areas for a 20-year design life.

If the type of construction, building loads, or proposed grading plans vary from those described above, Kleinfelder should be notified immediately in order to review and revise our recommendations, as necessary.

## 1.3 PURPOSE AND SCOPE

The purpose of our geotechnical study was to explore and evaluate the subsurface conditions at the project site and, based on the conditions, develop recommendations relating to the geotechnical aspects of project design and construction. Our conclusions and recommendations are based on analyses of the data from our field exploration, laboratory tests, and our experience with similar geologic conditions in the area. To meet the intended purpose, we completed the following scope.

- Review of selected geologic and geotechnical data specific to the project site; including review of Kleinfelder report for adjacent property, Kleinfelder project number 78476/CSP7R004 dated January 19, 2007.
- Preliminary site visit to locate the borings and establish safety plan.
- Notification of public utility locate service (CO 811).
- Subsurface exploration that consisted of advancing eight borings in the vicinity of the proposed structures in order to characterize the subsurface conditions and collect samples for geotechnical and analytical laboratory testing.

- Evaluation and engineering analysis of the field and laboratory data to develop our geotechnical conclusions and recommendations for foundations, earthwork, and pavement thickness.
- Report preparation

As requested, our scope does not include detention pond recommendations.

# 2 FIELD EXPLORATION AND LABORATORY TESTING

## 2.1 FIELD EXPLORATION

Our field exploration program was performed on November 15, 2016, and included advancing eight borings in the vicinity of the proposed structures, as shown in Figure 2. Borings were advanced to a maximum depth of 21 feet below the existing ground surface (bgs).

The exploratory borings were advanced using a truck-mounted CME-55 drill rig equipped with 4-inch outside-diameter, continuous-flight, solid-stem augers. Subsurface soil samples were obtained during exploration by using a California-type sampler (2.0-inch I.D./2.5-inch O.D.) and standard penetration-test type sampler (1.375-inch I.D./2.0-inch O.D.) driven into the strata, with blows from a 140-pound hammer falling 30 inches. The blows required to drive the sampler into the strata are recorded on the logs. These blow counts are an indication of the relative density or consistency of the strata.

Appendix A includes individual boring logs describing the subsurface conditions encountered, and legends to the boring logs. The lines defining boundaries between soil and bedrock types on the logs are based on drill rig behavior and interpolation between samples and laboratory test results, and are therefore approximate. Transitions between soil and bedrock types may be abrupt or may be gradual.

## 2.2 LABORATORY TESTING

### 2.2.1 Geotechnical Laboratory Testing

Geotechnical laboratory tests were performed on selected soil and bedrock samples to estimate their relative engineering properties and to aid in classification. The following tests were performed in general accordance with recognized standards:

- Gradation analysis;
- Liquid limit, plastic limit, and plasticity index;
- Natural density and moisture content; and
- Hveem stabilometer (R-value).

Results of the geotechnical laboratory tests are included in Appendix B, and selected test results are also shown on the boring logs contained in Appendix A.

### 2.2.2 Analytical Laboratory Testing

The following analytical laboratory testing was performed on a select on-site soil samples by an independent laboratory:

- Water soluble sulfates;
- pH;
- Soil resistivity;
- Soluble sulfates;
- Soluble chlorides;
- Redox; and
- Sulfides.

# 3 SITE CONDITIONS

## 3.1 SURFACE

The site is located east of Interstate-25 (I-25) within primarily residential and light commercial developments. The property is bounded to the north by Deer Creek Road, the west by Monument Hill Road, to the east by developed lots consisting of a self-storage facility, and to the south by a church.

At the time of our exploration, the site was comprised of a relatively level, flat, open field with sparse ground cover vegetation consisting of grass and weeds. The site was covered with about 3 inches of snow during our field exploration. Photograph 1 shows the site surface conditions at the time of our exploration. A review of available aerial photography[1] suggests that the site was previously undeveloped. No significant drainages or ponding were observed on the site.

**Photograph 1: Site Surface Conditions Looking North near Boring B-7**

## 3.2 GEOLOGY

Prior to mobilization, the geology of the site was evaluated by reviewing geologic maps, including the Geologic Map of The Monument Quadrangle, El Paso County, Colorado, (Thorson and Madole, 2003). The mapping indicates the surficial soil consists of alluvial material deposited

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[1] *Google earth Pro, 1999 to 2016*

during the middle Pleistocene (Pre-Bull Lake age). The alluvium is comprised of poorly graded to well graded, sandy soil. The alluvium overlies bedrock of the Lower Tertiary Dawson Formation and consists mainly of silty, clayey, sandstone.

## 3.3 SUBSURFACE

The subsurface conditions encountered at the boring locations are generally consistent with the mapped geology of the site, and comprise native sandy soils overlying sandstone bedrock. Based on the conditions encountered during our field exploration, we characterized the subsurface and developed the general profile described below.

> Overburden soils encountered at the surface consist of poorly-graded sand with clay to clayey sand extending from the surface to about 6 ½ to 8 feet bgs. Overburden sandy soils consist of fine- and medium-grained sand, and are brown, non-plastic to low plastic, moist, and very loose to medium dense. No surficial soils containing significant organics (topsoil) were encountered at the boring locations.
>
> Sandstone bedrock of the Dawson Formation was encountered below the overburden soils to the maximum depths explored of 21 feet bgs. The sandstone bedrock encountered is generally yellow-brown to white and gray, highly to moderately weathered, and extremely weak to weak.

The boring logs contained in Appendix A should be reviewed for more detailed descriptions of the subsurface conditions.

## 3.4 GROUNDWATER

Groundwater was not encountered during our exploration to the maximum depths explored of 21 feet bgs. Soil moisture levels and groundwater levels commonly vary over time and space depending upon seasonal precipitation, irrigation practices, land use and runoff conditions. It is considered possible that a shallow, perched groundwater condition may develop at this site at the contact between soil and bedrock during wetter periods or seasons. Accordingly, the soil moisture and groundwater data in this report pertain only to the locations and times at which exploration was performed. A hydrologic study to assess the seasonal groundwater conditions was outside our scope of services.

# 4 CONCLUSIONS AND RECOMMENDATIONS

## 4.1 GEOTECHNICAL FEASIBILITY OF PROPOSED CONSTRUCTION

Based on our results of our study and experience with similar projects, it is our opinion that the planned development is geotechnically feasible, provided the recommendations for design and construction presented herein are followed. Shallow foundations consisting of conventional spread or strip footing are appropriate for the site.

Our geotechnical design and construction recommendations for site preparation, foundations, floor systems, pavements, and other related construction topics are provided in the following sections.

## 4.2 CONSTRUCTION CONSIDERATIONS

### 4.2.1 Site and Subgrade Preparation

All site preparation and earthwork operations should be performed in accordance with applicable codes, safety regulations and other local, state or federal guidelines.

Initial site work should consist of stripping all vegetation and other deleterious materials within an area extending at least 5 feet laterally beyond all proposed structures. As previously described, no surficial soils containing significant organics (topsoil with >5% organics) was observed at the exploration locations. All of the vegetative and deleterious material should be removed for offsite disposal in accordance with local laws and regulations or, if appropriate, stockpiled in proposed landscaped areas for future use.

After stripping all vegetative and deleterious materials from the site, all areas beneath foundations and floor slabs should be excavated to the required depths. Care should be taken not to disturb exposed subgrade and excavators should be equipped with flat edge “cleaning” buckets. Exposed subgrades should be inspected by a qualified representative of a geotechnical engineer. Where possible, inspection of the subgrade should include the observation a proof roll to verify the subgrade is in a uniform and firm condition. Proof rolling should be completed with a fully loaded, pneumatic tired dump truck or similar weight equipment. Soft areas identified during the proof roll should be completely removed and replaced. If soft soil is encountered to a depth greater than two feet below the final subgrade elevation, we should be contacted to provide alternative options for subgrade stabilization.

Following approval of the exposed subgrade by a qualified representative of a geotechnical engineer, structural fill may be placed to achieve required bottom of foundations or slab grades. Structural fill should meet the classification, and compaction required presented below.

Subgrade beneath pavement areas should be scarified to a depth of 8 inches, adjusted to within 2 percent of optimum moisture content and compacted to at least 95 percent of the maximum standard Proctor density. Following scarification and compaction the entire pavement subgrade should be proofrolled with a heavily loaded pneumatic-tired vehicle. Areas that deform under heavy wheel loads are not stable and should be removed and replaced to achieve a stable subgrade prior to paving.

### 4.2.2 Excavation Characteristics

We anticipate that excavations on the order of three feet will be required to install foundations. We anticipate that overburden soils can be excavated using conventional heavy-duty excavation equipment.

All excavations must comply with the applicable local, state, and federal safety regulations, and particularly with the excavation standards of the Occupational Safety and Health Administration (OSHA). Construction site safety, including excavation safety, is the sole responsibility of the contractor as part of its overall responsibility for the means, methods and sequencing of construction operations. The determination of soil type and allowable sloping must be made in the field by an OSHA-qualified "competent person."

### 4.2.3 Structural Fill Specifications

Structural fill refers to material that is suitable for the support of foundations, floor slabs and pavements. The near-surface sandy soils are suitable for reuse as structural fill. If imported fill is required to meet proposed site grades, it should consist of non-expansive, mainly granular material that meets the requirements presented below.

**Table 1**

**Import Structural Fill Specifications**

| Liquid Limit | Plastic Limit | Percent passing the No. 200 Sieve | Maximum Particle Size (in) |
|---|---|---|---|
| 30 or less | Less than 10 | 10 to 30 | 2 |

A sample of any proposed imported structural fill should be submitted to our office for review and testing at least three days prior to stockpiling at the site. Structural fill should be placed on properly prepared subgrade in accordance with Section 4.2.1, and compacted according to the recommendations in Section 4.2.5.

### 4.2.4 Utility Trench Backfill

Backfill material should be essentially free of plant matter, organic soil, debris, trash, other deleterious matter and rock particles larger than 3 inches and may comprise the on-site soils. However, backfill material in the "pipe zone" (from the trench floor to 1 foot above the top of pipe) should not contain rock particles larger than 1 inch. Strictly observe any requirements specified by the utility agency for bedding and pipe-zone fill. In general, backfill above the pipe zone in utility trenches should be placed in lifts of 6 to 8 inches, and compacted using power equipment designed for trench work. Compact trench backfill as recommended in Section 4.2.5 of this report.

### 4.2.5 Compaction Requirements

Fill materials should be placed in loose lifts thicknesses that are appropriate for the compaction equipment being used; however, in no case should loose lift thickness exceed 8inches. Table 2 presents the minimum compaction criteria for fill materials.

**Table 2**

**Fill Compaction Specifications**

| Fill Location | Minimum Percent Compaction* (ASTM D 1557) | Moisture Content |
|---|---|---|
| Structural Fill (onsite/ import) | 95 | -2% to +2% of optimum |

## Table 2
## Fill Compaction Specifications

| Fill Location | Minimum Percent Compaction* (ASTM D 1557) | Moisture Content |
|---|---|---|
| Utility Trenches | 95 | -2% to +2% of optimum |
| Aggregate Base Course | 95 | -2% to +2% of optimum |

In non-structural or landscaped areas, the compaction specification may be reduced to 92 percent, ASTM D 1557.

### 4.2.6 Construction in Wet or Cold Weather

During construction, grade the site such that surface water can drain readily away from the structural areas. Promptly pump out or otherwise remove any water that may accumulate in excavations or on subgrade surfaces, and allow these areas to dry before resuming construction. The use of berms, ditches, and similar means may be used to prevent stormwater from entering the work area and to convey any water off site efficiently.

No grading fill, structural fill or other fill should be placed on frosted or frozen ground, nor should frozen material be placed as fill. Frozen ground should be allowed to thaw or be completely removed prior to placement of fill. A good practice is to cover the compacted fill with a “blanket” of loose fill to help prevent the compacted fill from freezing.

Foundations, concrete slabs-on-grade, or other concrete elements should not be constructed on frozen soil. Frozen soil should be completely removed from beneath the concrete elements, or thawed, scarified and re-compacted. The amount of time passing between excavation or subgrade preparation and placing concrete should be minimized during freezing conditions to prevent the prepared soils from freezing. Blankets, soil cover or heating as required may be utilized to prevent the subgrade from freezing.

### 4.2.7 Surface Drainage and Landscaping

Positive drainage away from the structure is essential to the performance of foundations and flatwork, and should be provided during the life of the structure. Surface drainage should be created such that water is diverted off the site and away from backfill areas of adjacent buildings.

Landscape areas within 10 feet of the structure should slope away at a minimum of 8 percent. Areas where pavements or slabs are constructed adjacent to the structure should slope away at a minimum grade of 2 percent. All downspouts from roof drains should spill onto pavement or be piped to the storm water drainage system. Landscaping improvements that require supplemental watering are not recommended adjacent to improved areas including foundations, pavements or slabs.

### 4.3 SHALLOW FOUNDATIONS

We recommend conventional spread or strip footing foundations constructed on properly prepared subgrade soils be designed and constructed in accordance with the following criteria.

- Footing excavations must be cleaned of all non-engineered fill, topsoil, soft or disturbed soils, construction debris, frozen soil, moisture sensitive soils, or ponded water. All loose or disturbed soils should be completely removed or recompacted to the requirements of structural fill.
- Footings constructed on subgrade soils prepared in accordance with this report may be designed for a maximum allowable bearing pressure of 3,000 pounds per square foot (psf).
- Calculated settlement of footings constructed as described above projected to be less than one inch.
- Footings may be designed to resist lateral movement with a nominal coefficient of sliding friction of 0.38, and a passive earth pressure of 300 psf. The structural engineer should select and apply appropriate factors of safety for lateral resistance parameters.
- Footing size should be determined by a structural engineer; however, as a minimum, we recommend isolated columns be supported on square pads of at least 18 inches wide. Continuous strip footings should be at least 12 inches in width.
- Exterior footings should be protected from frost action. We recommend the footings be protected with at least 30 inches of soil cover, or that which is required by local building codes, whichever is greater.

### 4.3.1 Floor Slabs

Floor slabs placed on subgrade soil prepared as described above, may be designed and constructed with the following recommendations. The floor slabs should be separated from other structural elements so that they can move independently. Control joints in slabs should be provided so that no floor area exceeding 400 square feet remains without a joint. Additional joints should be placed at columns and inside corners. For design purposes, a modulus of subgrade reaction of 150 pounds per cubic inch (pci) can be used for properly prepared native sandy soils or structural fill placed.

If moisture sensitive flooring will be utilized within the building, a capillary break or moisture barrier should be constructed below slabs to reduce migration of moisture vapor through the concrete. A capillary break should be at least 6 inches thick, consisting of sand, gravel, or crushed rock meeting the following criteria.

- The largest particle size should not exceed 1 inch
- No more than 20 percent by weight should pass the No. 4 sieve
- No more than 5 percent by weight, as placed, should pass the No. 200 sieve
- The material should be non-plastic

As an alternative, a moisture barrier may be utilized that consists of an impermeable, minimum 10-mil thick polyethylene membrane placed over the subgrade. The sheeting used for the barrier should be lapped and properly joined at all seams and sealed at all penetrations by walls, pipes, or other objects.

## 4.4 PAVEMENTS

A pavement section is a layered system designed to distribute concentrated traffic loads to the subgrade. Performance of the pavement structure is directly related to the physical properties of the subgrade soils and traffic loadings. Soils are represented for pavement design purposes by means of a soil support value for flexible pavements and a modulus of subgrade reaction for rigid pavements. Both values are empirically related to strength. Pavement design procedures are based on strength properties of the subgrade and pavement materials, along with the design traffic conditions. The following sections present our pavement design and construction recommendations.

### 4.4.1 Pavement Subgrade Soil

The pavement subgrade soils encountered in our borings consist predominantly of sandy soils. Based on laboratory test results we have assumed an R-value of 60 for the onsite native sandy soils. A resilient modulus ($M_R$) of 18,250 pounds per square inch (psi) was determined from the following equation per section 4.2 of the City of Colorado Springs Pavement Design Criteria Manual.

$$M_r = 10^{\frac{S+18.72}{6.24}}, \qquad S = \frac{R\ value - 5}{11.29} + 3$$

### 4.4.2 Design Sections

The design pavement sections were calculated in general accordance with sections 4.3 and 4.4 of the City of Colorado Springs Pavement Design Criteria Manual and following the 1993 AASHTO Guide for Design of Pavement Structures. Strength coefficients of 0.44 and 0.12 were used for Hot Mix Asphalt (HMA) pavement and aggregate base course (ABC). The minimum recommended composite asphaltic concrete pavement and Portland cement concrete (PCC) pavement sections are presented in Table 3.

**Table 3**
**Minimum HMA Pavement Section Thicknesses**

| Pavement Area | Pavement Section Thicknesses |
|---|---|
| Automobile Only Areas | 3 inches HMA<br>over 4 inches ABC |
| Areas Subject to Truck Traffic[1] | 5 inches PCC<br>over 6 inches ABC |

1. Typical areas subject to truck traffic include but not limited to: fire lanes, loading docks, and trash service areas.

ABC should consist of crushed gravel, natural gravel, or crushed stone conforming to the requirements of City of Colorado Springs City Engineering Standard Specifications. The base should be placed in a uniform layer without segregation of size and compacted in loose lifts not exceeding 6 inches. The material should be compacted as recommended in Section 4.2.5.

HMA pavement should consist of a bituminous plant mix composed of a mixture of aggregate and bituminous material that meets the requirements of a job-mix formula established by a qualified engineer. Asphalt/PCC mix design, all associated materials, construction standards, materials testing, and inspection shall conform to the City of Colorado Springs City Engineering Standard Specifications or equivalent alternative locally accepted specifications.

### 4.4.5 Maintenance

The collection and diversion of surface drainage away from paved areas is extremely important to the satisfactory performance of pavement. Drainage design should provide for the removal of water and snow from paved areas and prevent the wetting of the subgrade soils.

Periodic maintenance of paved areas will extend the pavement life. Crack sealing should be performed annually, and as new cracks appear. Chip seals, fog seals, or slurry seals applied at approximate intervals of 3 to 5 years will reduce oxidative embrittlement problems associated with asphalt. Joint seals in concrete should be replaced as they deteriorate. As conditions warrant, it may be necessary to perform full depth patching, milling and overlays at approximate 5 to 10 year intervals.

## 4.5 CORROSIVITY

Ferrous metal and concrete elements in contact with soil, whether part of a foundation or part of the supported structure, are subject to degradation due to corrosion or chemical attack. Therefore, buried ferrous metal and concrete elements should be designed to resist corrosion and degradation based on accepted practices. Kleinfelder has completed laboratory testing to provide data regarding corrosivity of onsite soils. Our scope of services does not include corrosion engineering and, therefore, a detailed analysis of the corrosion test results is not included in this report. A qualified corrosion engineer should be retained to review the test results and design protective systems that may be required.

Laboratory chloride concentration, sulfate concentration, sulfide concentration, pH, oxidation reduction potential, and electrical resistivity tests were performed for soil samples obtained from the borings. The results of the tests are attached and are summarized in Table 4. If fill materials will be imported to the project site, similar corrosion potential laboratory testing should be completed on the imported material.

## Table 4

## Analytical Laboratory Test Results

| Boring | Depth (ft) | Material | Resistivity (ohm-cm) | pH | Oxidation Reduction Potential (mV) | Water-Soluble Ion Concentration | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | Chloride (%) | Sulfide | Sulfate (%) |
| B-3 | 2.5 – 4.0 | Sand with Clay | 9,268 | 5.5 | 366 | 0.0002 | Negative | < 0.001 |

Based on the "10-point" method developed by the American Water Works Association (AWWA) in standard AWWA C105/A21.5, the soils at the site exhibit a low corrosion potential for buried ferrous metal piping, cast iron pipes, or other objects made of these materials. We recommend that a corrosion engineer be consulted to recommend appropriate protective measures.

The degradation of concrete or cement grout can be caused by chemical agents in the soil or groundwater that react with concrete to either dissolve the cement paste or precipitate larger compounds within the concrete, causing cracking and flaking. The concentration of water-soluble sulfates in the soils is a good indicator of the potential for chemical attack of concrete or cement grout. The American Concrete Institute (ACI) in their publication Guide to Durable Concrete (ACI 201.2R-08) provides guidelines for this assessment. The results of sulfate test indicate the potential for deterioration of concrete is mild; therefore, no special requirements should be necessary for the concrete mix. We recommend that a corrosion engineer be consulted to recommend appropriate protective measures.

Concrete and the reinforcing steel within it are at risk of corrosion when exposed to water-soluble chloride in the soil or groundwater. Chloride tests indicated that the sample had a measureable concentration. The project structural engineer should review this data to determine if remedial measures are necessary for the concrete reinforcing steel.

# 5 ADDITIONAL SERVICES

## 5.1 REQUIREMENTS FOR ADDITIONAL SERVICES

In most cases, other services beyond completion of a geotechnical report are necessary or desirable to complete a project satisfactorily. It also sometimes happens that, while performing our services, we discover conditions or circumstances that require the performance of additional work that was not anticipated when the geotechnical report was written. Kleinfelder offers a range of environmental, geological, geotechnical, and construction services to suit the varying needs of our clients. This section outlines some of those services that may pertain to this project. Kleinfelder will be happy to submit a proposal for performing any such services upon request.

## 5.2 REVIEW OF PLANS AND SPECIFICATIONS

We strongly recommend that Kleinfelder be given an opportunity to review the plans and specifications for this project before they are finalized. Such a review allows us to verify that our recommendations and concerns have been adequately incorporated in the design. It also gives us an opportunity to discuss those recommendations and concerns with other members of the design team so that we can clear up misunderstandings or ambiguities before the project reaches the construction stage.

## 5.3 PRE-CONSTRUCTION MEETINGS

We recommend that the Owner, the Contractor, and the other members of the design team hold a pre-construction meeting with Kleinfelder's project engineer. The purpose of this meeting is to go over geotechnical aspects of the project so that all parties have a clear understanding of the geotechnical issues that affect the Contractor's work and how they will be handled. The meeting also allows us to set up the communication and coordination needed for construction observation and testing, and to identify points of confusion or disagreement that need to be resolved.

## 5.4 CONSTRUCTION OBSERVATION AND TESTING

The recommendations in this report depend on the assumption that an adequate program of testing and observation will be made during construction to verify compliance with our recommendations. These tests and observations may include, but not necessarily be limited to, the following:

- Observations and density testing during site preparation and earthwork;
- Observation of foundation excavations and foundation installation;
- Observation and testing of construction materials; and
- Consultation as may be required during construction.

Adequate testing and observation is essential to successful and economical completion of a construction project. Testing and observation allow us to verify that our recommendations are being followed. They also make it possible to identify new or changed conditions that require us to modify those recommendations. Construction testing and observation should be scheduled in advance so that our personnel can plan to be available for the work. It is also desirable that we receive a set of project plans and specifications at the time our work is first scheduled.

# 6 LIMITATIONS

This work was performed in a manner consistent with that level of care and skill ordinarily exercised by other members of Kleinfelder's profession practicing in the same locality, under similar conditions and at the date the services are provided. Our conclusions, opinions, and recommendations are based on a limited number of observations and data. It is likely that subsurface conditions could vary between or beyond the data evaluated. Kleinfelder makes no other representation, guarantee, or warranty, express or implied, regarding the services, communication (oral or written), report, opinion, or instrument of service provided.

The scope of services was limited to eight exploratory boring and review of a previous report performed adjacent to the project site. It should be recognized that definition and evaluation of subsurface conditions are difficult. Judgments leading to conclusions and recommendations are generally made with incomplete knowledge of the subsurface conditions present due to the limitations of data from field studies.

Recommendations contained in this report are based on our field observations and subsurface explorations, limited laboratory tests, and our present knowledge of the proposed construction. If subsurface conditions are encountered during construction that differ from those described herein, or if significant revisions to the planned construction occur, the client is responsible for ensuring that Kleinfelder is notified immediately so that we may re-evaluate the recommendations of this report.

The scope of services for this subsurface exploration and geotechnical report did not include environmental assessments or evaluations regarding the presence or absence of wetlands or hazardous substances in the soil, surface water, or groundwater at this site. Kleinfelder offers various levels of investigative and engineering services to suit the varying needs of different clients. Although risk can never be eliminated, more detailed and extensive studies yield more information, which may help understand and manage the level of risk. The owner's tolerance of risk and expectations for future performance and maintenance should be considered in review of this report.

This report may be used only by the Client and the registered design professional in responsible charge and only for the purposes stated for this specific engagement within a reasonable time from its issuance, but in no event later than two (2) years from the date of the report.

# FIGURES

PLOTTED: 12/8/2016 1:09:23 PM BY: mpalmer

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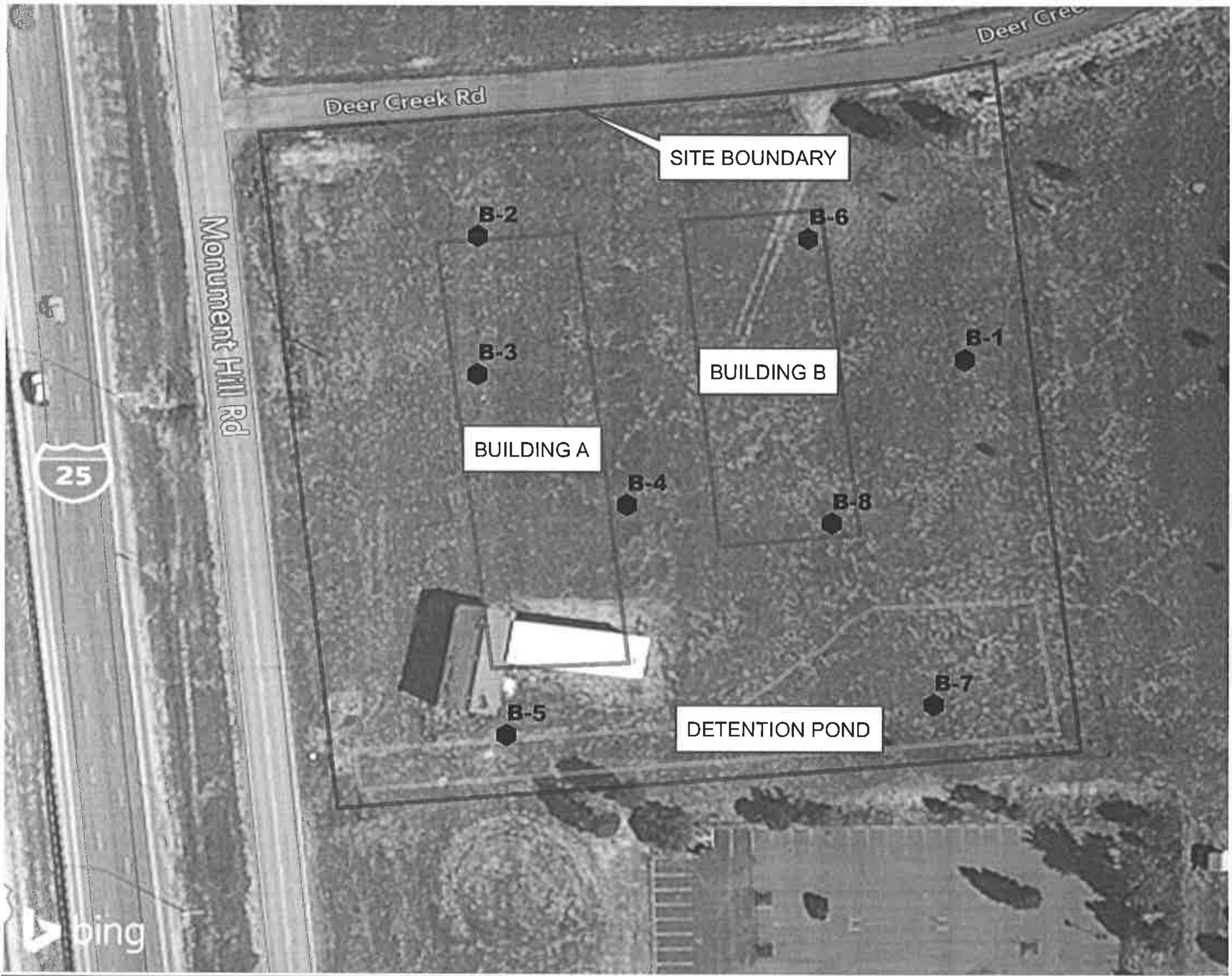
## LEGEND

⬢ SOIL BORING

NOTE:
BASE MAPPING AND VICINITY MAP CREATED FROM LAYERS
COMPILED BY ESRI PRODUCTS AND
2016 MICROSOFT CORPORATION.

VICINITY MAP NOT TO SCALE



0 100 200

1 " = 100 SCALE IN FEET

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*Bright People. Right Solutions.*

| | |
|---|---|
| PROJECT NO. | 20172793 |
| DRAWN BY: | MAP |
| CHECKED BY: | JTM |
| DATE: | 12-08-2016 |
| REVISED: | - |

EXPLORATION LOCATION PLAN
AND VICINITY MAP

Proposed Siever Business Park
1945 Deer Creek Road
Monument, Colorado

FIGURE
1

GIS FILE: E:\Projects\Client\Monument Hill Business Park, LLC\20172793 Proposed Siever Business Park\20172793 boring location map.mxd

# APPENDIX A

## Boring Logs

## SAMPLE/SAMPLER TYPE GRAPHICS

☒ BULK / GRAB / BAG SAMPLE

MODIFIED CALIFORNIA SAMPLER
(2 or 2-1/2 in. (50.8 or 63.5 mm.) outer diameter)

CALIFORNIA SAMPLER
(3 in. (76.2 mm.) outer diameter)

STANDARD PENETRATION SPLIT SPOON SAMPLER
(2 in. (50.8 mm.) outer diameter and 1-3/8 in. (34.9 mm.) inner diameter)

SHELBY TUBE SAMPLER

HOLLOW STEM AUGER

SOLID STEM AUGER

WASH BORING

NQ CORE SAMPLE
(1.874 in. (47.6 mm.) core diameter)

TEXAS CONE PENETRATION

## GROUND WATER GRAPHICS

∇ WATER LEVEL (level where first observed)

▼ WATER LEVEL (level after exploration completion)

▼ WATER LEVEL (additional levels after exploration)

≈ OBSERVED SEEPAGE

## NOTES

- The report and graphics key are an integral part of these logs. All data and interpretations in this log are subject to the explanations and limitations stated in the report.
- Lines separating strata on the logs represent approximate boundaries only. Actual transitions may be gradual or differ from those shown.
- No warranty is provided as to the continuity of soil or rock conditions between individual sample locations.
- Logs represent general soil or rock conditions observed at the point of exploration on the date indicated.
- In general, Unified Soil Classification System designations presented on the logs were based on visual classification in the field and were modified where appropriate based on gradation and index property testing.
- Fine grained soils that plot within the hatched area on the Plasticity Chart, and coarse grained soils with between 5% and 12% passing the No. 200 sieve require dual USCS symbols, ie., GW-GM, GP-GM, GW-GC, GP-GC, GC-GM, SW-SM, SP-SM, SW-SC, SP-SC, SC-SM.
- If sampler is not able to be driven at least 6 inches then 50/X indicates number of blows required to drive the identified sampler X inches with a 140 pound hammer falling 30 inches.

## UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487)

| | | | | | | |
|---|---|---|---|---|---|---|
| COARSE GRAINED SOILS (More than half of material is larger than the #200 sieve) | GRAVELS (More than half of coarse fraction is larger than the #4 sieve) | CLEAN GRAVEL WITH <5% FINES | $Cu \geq 4$ and $1 \leq Cc \leq 3$ | | GW | WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES |
| | | | $Cu < 4$ and/ or $1 > Cc > 3$ | | GP | POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES |
| | | GRAVELS WITH 5% TO 12% FINES | $Cu \geq 4$ and $1 \leq Cc \leq 3$ | | GW-GM | WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES |
| | | | | | GW-GC | WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES |
| | | | $Cu < 4$ and/ or $1 > Cc > 3$ | | GP-GM | POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES |
| | | | | | GP-GC | POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES |
| | | GRAVELS WITH > 12% FINES | | | GM | SILTY GRAVELS, GRAVEL-SILT-SAND MIXTURES |
| | | | | | GC | CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES |
| | | | | | GC-GM | CLAYEY GRAVELS, GRAVEL-SAND-CLAY-SILT MIXTURES |
| | SANDS (More than half of coarse fraction is smaller than the #4 sieve) | CLEAN SANDS WITH <5% FINES | $Cu \geq 6$ and $1 \leq Cc \leq 3$ | | SW | WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES |
| | | | $Cu < 6$ and/ or $1 > Cc > 3$ | | SP | POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES |
| | | SANDS WITH 5% TO 12% FINES | $Cu \geq 6$ and $1 \leq Cc \leq 3$ | | SW-SM | WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES |
| | | | | | SW-SC | WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES |
| | | | $Cu < 6$ and/ or $1 > Cc > 3$ | | SP-SM | POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES |
| | | | | | SP-SC | POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES |
| | | SANDS WITH > 12% FINES | | | SM | SILTY SANDS, SAND-GRAVEL-SILT MIXTURES |
| | | | | | SC | CLAYEY SANDS, SAND-GRAVEL-CLAY MIXTURES |
| | | | | | SC-SM | CLAYEY SANDS, SAND-SILT-CLAY MIXTURES |

| | | | | |
|---|---|---|---|---|
| FINE GRAINED SOILS (More than half of material is smaller than the #200 sieve) | SILTS AND CLAYS (Liquid Limit less than 50) | | ML | INORGANIC SILTS AND VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS, SILTS WITH SLIGHT PLASTICITY |
| | | | CL | INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS |
| | | | CL-ML | INORGANIC CLAYS-SILTS OF LOW PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS |
| | | | OL | ORGANIC SILTS & ORGANIC SILTY CLAYS OF LOW PLASTICITY |
| | SILTS AND CLAYS (Liquid Limit greater than 50) | | MH | INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILT |
| | | | CH | INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS |
| | | | OH | ORGANIC CLAYS & ORGANIC SILTS OF MEDIUM-TO-HIGH PLASTICITY |

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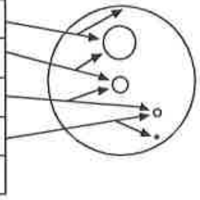
| | | | |
|---|---|---|---|
| PROJECT NO.: 20172793 | GRAPHICS KEY | FIGURE |
| DRAWN BY: MAP | | |
| CHECKED BY: JTM | Proposed Siever Business Park<br>1945 Deer Creek Road<br>Monument, Colorado | A-1 |
| DATE: 12/6/2016 | | |
| REVISED: - | | |

PLOTTED: 12/07/2016 07:50 PM BY: mpalmer

gINT FILE: Klf_gint_master_2016
gINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2016.GLB [GEO-LEG 1 (GRAPHICS KEY) WITH USCS - SQL]

## GRAIN SIZE

| DESCRIPTION | | SIEVE SIZE | GRAIN SIZE | APPROXIMATE SIZE |
|---|---|---|---|---|
| Boulders | | >12 in. (304.8 mm.) | >12 in. (304.8 mm.) | Larger than basketball-sized |
| Cobbles | | 3 - 12 in. (76.2 - 304.8 mm.) | 3 - 12 in. (76.2 - 304.8 mm.) | Fist-sized to basketball-sized |
| Gravel | coarse | 3/4 -3 in. (19 - 76.2 mm.) | 3/4 -3 in. (19 - 76.2 mm.) | Thumb-sized to fist-sized |
| | fine | #4 - 3/4 in. (#4 - 19 mm.) | 0.19 - 0.75 in. (4.8 - 19 mm.) | Pea-sized to thumb-sized |
| Sand | coarse | #10 - #4 | 0.079 - 0.19 in. (2 - 4.9 mm.) | Rock salt-sized to pea-sized |
| | medium | #40 - #10 | 0.017 - 0.079 in. (0.43 - 2 mm.) | Sugar-sized to rock salt-sized |
| | fine | #200 - #40 | 0.0029 - 0.017 in. (0.07 - 0.43 mm.) | Flour-sized to sugar-sized |
| Fines | | Passing #200 | <0.0029 in. (<0.07 mm.) | Flour-sized and smaller |



## SECONDARY CONSTITUENT

| Term of Use | AMOUNT | |
|---|---|---|
| | Secondary Constituent is Fine Grained | Secondary Constituent is Coarse Grained |
| Trace | <5% | <15% |
| With | ≥5 to <15% | ≥15 to <30% |
| Modifier | ≥15% | ≥30% |

## MUNSELL COLOR

| NAME | ABBR | NAME | ABBR |
|---|---|---|---|
| Red | R | Blue | B |
| Yellow Red | YR | Purple Blue | PB |
| Yellow | Y | Purple | P |
| Green Yellow | GY | Red Purple | RP |
| Green | G | Black | N |
| Blue Green | BG | | |

## MOISTURE CONTENT

| DESCRIPTION | FIELD TEST |
|---|---|
| Dry | Absence of moisture, dusty, dry to the touch |
| Moist | Damp but no visible water |
| Wet | Visible free water, usually soil is below water table |

## CEMENTATION

| DESCRIPTION | FIELD TEST |
|---|---|
| Weakly | Crumbles or breaks with handling or slight finger pressure. |
| Moderately | Crumbles or breaks with considerable finger pressure. |
| Strongly | Will not crumble or break with finger pressure. |

## CONSISTENCY - FINE-GRAINED SOIL

| CONSISTENCY | SPT - $N_{60}$ (# blows / ft) | UNCONFINED COMPRESSIVE STRENGTH ($Q_u$)(psf) | VISUAL / MANUAL CRITERIA |
|---|---|---|---|
| Very Soft | <2 | <500 | Thumb will penetrate more than 1 inch (25 mm). Extrudes between fingers when squeezed. |
| Soft | 2 - 4 | 500 - 1000 | Thumb will penetrate soil about 1 inch (25 mm). Remolded by light finger pressure. |
| Medium | 4 - 8 | 1000 - 2000 | Thumb will penetrate soil about 1/4 inch (6 mm). Remolded by strong finger pressure. |
| Stiff | 8 - 15 | 2000 - 4000 | Can be imprinted with considerable pressure from thumb. |
| Very Stiff | 15 - 30 | 4000 - 8000 | Thumb will not indent soil but readily indented with thumbnail. |
| Hard | >30 | >8000 | Thumbnail will not indent soil. |

FROM TERZAGHI AND PECK, 1948; LAMBE AND WHITMAN, 1969; FHWA, 2002; AND ASTM D2488

## REACTION WITH HYDROCHLORIC ACID

| DESCRIPTION | FIELD TEST |
|---|---|
| None | No visible reaction |
| Weak | Some reaction, with bubbles forming slowly |
| Strong | Violent reaction, with bubbles forming immediately |

## APPARENT / RELATIVE DENSITY - COARSE-GRAINED SOIL

| APPARENT DENSITY | SPT-$N_{60}$ (# blows/ft) | MODIFIED CA SAMPLER (# blows/ft) | CALIFORNIA SAMPLER (# blows/ft) | RELATIVE DENSITY (%) |
|---|---|---|---|---|
| Very Loose | <4 | <4 | <5 | 0 - 15 |
| Loose | 4 - 10 | 5 - 12 | 5 - 15 | 15 - 35 |
| Medium Dense | 10 - 30 | 12 - 35 | 15 - 40 | 35 - 65 |
| Dense | 30 - 50 | 35 - 60 | 40 - 70 | 65 - 85 |
| Very Dense | >50 | >60 | >70 | 85 - 100 |

FROM TERZAGHI AND PECK, 1948

## PLASTICITY

| DESCRIPTION | LL | FIELD TEST |
|---|---|---|
| Non-plastic | NP | A 1/8-in. (3 mm.) thread cannot be rolled at any water content. |
| Low (L) | < 30 | The thread can barely be rolled and the lump or thread cannot be formed when drier than the plastic limit. |
| Medium (M) | 30 - 50 | The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump or thread crumbles when drier than the plastic limit. |
| High (H) | > 50 | It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump or thread can be formed without crumbling when drier than the plastic limit. |

## STRUCTURE

| DESCRIPTION | CRITERIA |
|---|---|
| Stratified | Alternating layers of varying material or color with layers at least 1/4-in. thick, note thickness. |
| Laminated | Alternating layers of varying material or color with the layer less than 1/4-in. thick, note thickness. |
| Fissured | Breaks along definite planes of fracture with little resistance to fracturing. |
| Slickensided | Fracture planes appear polished or glossy, sometimes striated. |
| Blocky | Cohesive soil that can be broken down into small angular lumps which resist further breakdown. |
| Lensed | Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay; note thickness. |

## ANGULARITY

| DESCRIPTION | CRITERIA |
|---|---|
| Angular | Particles have sharp edges and relatively plane sides with unpolished surfaces. |
| Subangular | Particles are similar to angular description but have rounded edges. |
| Subrounded | Particles have nearly plane sides but have well-rounded corners and edges. |
| Rounded | Particles have smoothly curved sides and no edges. |

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PROJECT NO.: 20172793
DRAWN BY: MAP
CHECKED BY: JTM
DATE: 12/6/2016
REVISED: -

SOIL DESCRIPTION KEY

Proposed Siever Business Park
1945 Deer Creek Road
Monument, Colorado

FIGURE
A-2

PLOTTED: 12/07/2016 07:50 PM BY: mpalmer

gINT FILE: Klf_gint_master_2016
gINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2016.GLB [GEO-LEGEND 2 (SOIL DESC KEY) REV 072616]

PLOTTED: 12/07/2016 07:51 PM BY: mpalmer

## INFILLING TYPE

| NAME | ABBR | NAME | ABBR |
|---|---|---|---|
| Albite | Al | Muscovite | Mus |
| Apatite | Ap | None | No |
| Biotite | Bi | Pyrite | Py |
| Clay | Cl | Quartz | Qz |
| Calcite | Ca | Sand | Sd |
| Chlorite | Ch | Sericite | Ser |
| Epidote | Ep | Silt | Si |
| Iron Oxide | Fe | Talc | Ta |
| Manganese | Mn | Unknown | Uk |

## DENSITY/SPACING OF DISCONTINUITIES

| DESCRIPTION | SPACING CRITERIA |
|---|---|
| Unfractured | >6 ft. (>1.83 meters) |
| Slightly Fractured | 2 - 6 ft. (0.061 - 1.83 meters) |
| Moderately Fractured | 8 in - 2 ft. (203.20 - 609.60 mm) |
| Highly Fractured | 2 - 8 in (50.80 - 203.30 mm) |
| Intensely Fractured | <2 in (<50.80 mm) |

## ADDITIONAL TEXTURAL ADJECTIVES

| DESCRIPTION | RECOGNITION |
|---|---|
| Pit (Pitted) | Pinhole to 0.03 ft. (3/8 in.) (>1 to 10 mm.) openings |
| Vug (Vuggy) | Small openings (usually lined with crystals) ranging in diameter from 0.03 ft. (3/8 in.) to 0.33 ft. (4 in.) (10 to 100 mm.) |
| Cavity | An opening larger than 0.33 ft. (4 in.) (100 mm.), size descriptions are required, and adjectives such as small, large, etc., may be used |
| Honeycombed | If numerous enough that only thin walls separate individual pits or vugs, this term further describes the preceding nomenclature to indicate cell-like form. |
| Vesicle (Vesicular) | Small openings in volcanic rocks of variable shape and size formed by entrapped gas bubbles during solidification. |

## ADDITIONAL TEXTURAL ADJECTIVES

| DESCRIPTION | CRITERIA |
|---|---|
| Unweathered | No evidence of chemical / mechanical alternation; rings with hammer blow. |
| Slightly Weathered | Slight discoloration on surface; slight alteration along discontinuities; <10% rock volume altered. |
| Moderately Weathered | Discoloring evident; surface pitted and alteration penetration well below surface; Weathering "halos" evident; 10-50% rock altered. |
| Highly Weathered | Entire mass discolored; Alteration pervading most rock, some slight weathering pockets; some minerals may be leached out. |
| Decomposed | Rock reduced to soil with relic rock texture/structure; Generally molded and crumbled by hand. |

## RELATIVE HARDNESS / STRENGTH DESCRIPTIONS

| GRADE | | UCS (Mpa) | FIELD TEST |
|---|---|---|---|
| R0 | Extremely Weak | 0.25 - 1.0 | Indented by thumbnail |
| R1 | Very Weak | 1.0 - 5.0 | Crumbles under firm blows of geological hammer, can be peeled by a pocket knife. |
| R2 | Weak | 5.0 - 25 | Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer. |
| R3 | Medium Strong | 25 - 50 | Cannot be scraped or peeled with a pocket knife, specimen can be fractured with a single firm blow of a geological hammer. |
| R4 | Strong | 50 - 100 | Specimen requires more than one blow of geological hammer to fracture it. |
| R5 | Very Strong | 100 - 250 | Specimen requires many blows of geological hammer to fracture it. |
| R6 | Extremely Strong | > 250 | Specimen can only be chipped with a geological hammer. |

## ROCK QUALITY DESIGNATION (RQD)

| DESCRIPTION | RQD (%) |
|---|---|
| Very Poor | 0 - 25 |
| Poor | 25 - 50 |
| Fair | 50 - 75 |
| Good | 75 - 90 |
| Excellent | 90 - 100 |

## APERTURE

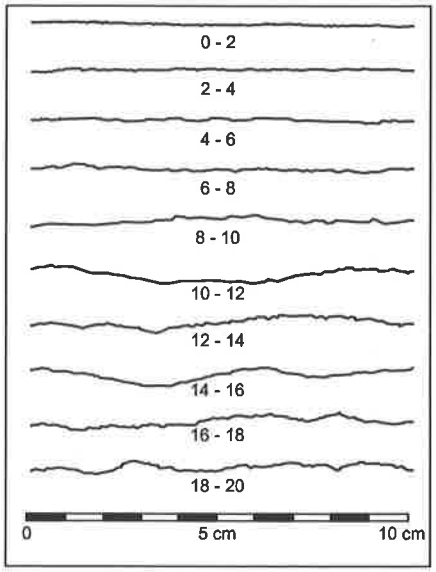
| DESCRIPTION | CRITERIA [in (mm)] |
|---|---|
| Tight | <0.04 (<1) |
| Open | 0.04 - 0.20 (1 - 5) |
| Wide | >0.20 (>5) |

## BEDDING CHARACTERISTICS

| DESCRIPTION | Thickness [in (mm)] |
|---|---|
| Very Thick Bedded | >36 (>915) |
| Thick Bedded | 12 - 36 (305 - 915) |
| Moderately Bedded | 4 - 12 (102 - 305) |
| Thin Bedded | 1 - 4 (25 - 102) |
| Very Thin Bedded | 0.4 - 1 (10 - 25) |
| Laminated | 0.1 - 0.4 (2.5 - 10) |
| Thinly Laminated | <0.1 (<2.5) |

| | |
|---|---|
| Bedding Planes | Planes dividing the individual layers, beds, or stratigraphy of rocks. |
| Joint | Fracture in rock, generally more or less vertical or traverse to bedding. |
| Seam | Applies to bedding plane with unspecified degree of weather. |

## JOINT ROUGHNESS COEFFICIENT (JRC)



From Barton and Choubey, 1977

| | |
|---|---|
| RQD | Rock-quality designation (RQD) Rough measure of the degree of jointing or fracture in a rock mass, measured as a percentage of the drill core in lengths of 10 cm. or more. |

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PROJECT NO.: 20172793
DRAWN BY: MAP
CHECKED BY: JTM
DATE: 12/6/2016
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ROCK DESCRIPTION KEY

Proposed Siever Business Park
1945 Deer Creek Road
Monument, Colorado

FIGURE
A-3

gINT FILE: Klf_gint_master_2016
gINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2016.GLB [GEO-LEGEND 3 (ROCK DESC KEY)] REV 072616]

PLOTTED: 12/08/2016 11:49 AM BY: mpalmer

**Date Begin - End:** 11/15/2016
**Logged By:** E. Faber
**Hor.-Vert. Datum:** Not Available
**Plunge:** -90 degrees
**Weather:** Sunny, 15° F

**Drilling Company:** Custom Auger
**Drill Crew:** Nick & Tim
**Drilling Equipment:** CME-55
**Drilling Method:** Solid Stem Auger
**Exploration Diameter:** 4 in. O.D.

**BORING LOG B-1**

**Hammer Type - Drop:** 140 lb. Cathead - 30 in.

FIELD EXPLORATION | LABORATORY RESULTS

Latitude: 39.10480° N
Longitude: -104.86295° E
Surface Condition: Grass under 3" of snow

| Depth (feet) | Graphical Log | Lithologic Description | Sample Type | Blow Counts(BC)= Uncorr. Blows/6 in. | Recovery (NR=No Recovery) | USCS Symbol | Water Content (%) | Dry Unit Wt. (pcf) | Passing #4 (%) | Passing #200 (%) | Liquid Limit | Plasticity Index (NP=NonPlastic) | Additional Tests/ Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ▨ | **Poorly graded SAND with Clay (SP-SC)**: fine to coarse-grained sand, low plasticity, brown, moist, loose, weakly cemented, roots up to 1/16" diameter present to 18" bgs | | | | | | | | | | | |
| | ▨ | - tan to brown at 1.5 feet | ◣ | BC=3<br>3<br>5 | 18" | SP-SC | 3.7 | | 96 | 8.5 | | | |
| 5 | ▨ | - medium dense, orange to brown | ◣ | BC=9<br>9<br>7 | 17" | | | | | | | | |
| | ░ | **Dawson Formation**<br>**SANDSTONE**: yellowish brown, very weak, moderately weathered, (Clayey SAND: fine to coarse-grained sand, medium plasticity) | ■ | BC=15<br>50/6" | 8" | | | | | | | | |
| 10 | ░ | | ■ | BC=24<br>50/6" | 8" | SC | 11.4 | 119.1 | | 29 | 30 | 10 | |
| 15 | ░ | **Dawson Formation**<br>**SANDSTONE**: white to gray, weak, moderately weathered | ■ | BC=36<br>50/5" | | | | | | | | | |
| 20 | ░ | | ■ | BC=50/4" | 4" | | | | | | | | |

The boring was terminated at approximately 20.5 ft. below ground surface. The boring was backfilled with auger cuttings on November 15, 2016.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not encountered during drilling or after completion.

GENERAL NOTES:
The exploration location is approximate and was estimated by Kleinfelder using a handheld GPS unit with an accuracy of +/- 10 feet.

25

30

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PROJECT NO.: 20172793
DRAWN BY: MAP
CHECKED BY: JTM
DATE: 12/6/2016
REVISED: -

BORING LOG B-1

Proposed Siever Business Park
1945 Deer Creek Road
Monument, Colorado

BORING
B-1

PAGE: 1 of 1

gINT FILE: Klf_gint_master_2016
gINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2016.GLB [KLF_BORING/TEST PIT SOIL LOG]

## BORING LOG B-2

**Date Begin - End:** 11/15/2016
**Logged By:** E. Faber
**Hor.-Vert. Datum:** Not Available
**Plunge:** -90 degrees
**Weather:** Sunny, 35° F
**Drilling Company:** Custom Auger
**Drill Crew:** Nick & Tim
**Drilling Equipment:** CME-55
**Drilling Method:** Solid Stem Auger
**Exploration Diameter:** 4 in. O.D.
**Hammer Type - Drop:** 140 lb. Cathead - 30 in.

FIELD EXPLORATION

Latitude: 39.10500° N
Longitude: -104.86376° E
Surface Condition: Grass under 3" of snow

LABORATORY RESULTS

| Depth (feet) | Graphical Log | Lithologic Description | Sample Type | Blow Counts(BC)= Uncorr. Blows/6 in. | Recovery (NR=No Recovery) | USCS Symbol | Water Content (%) | Dry Unit Wt. (pcf) | Passing #4 (%) | Passing #200 (%) | Liquid Limit | Plasticity Index (NP=NonPlastic) | Additional Tests/ Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | ▨ | **Poorly graded SAND with Clay (SP-SC)**: fine and medium-grained sand, low plasticity, brown, moist, medium dense, roots up to 1/16" diameter present to 18" bgs<br>- tan at 1.5 feet | ◣ | BC=7<br>7<br>6 | 18" |  |  |  |  |  |  |  |  |
| 5 | ▨ | - fine to coarse-grained sand, loose | ◣ | BC=1<br>1<br>2 | 18" | SP-SC | 6.0 |  |  | 12 |  |  |  |
|  |  | **Dawson Formation**<br>**SANDSTONE**: tan to orange brown, extremely weak, highly weathered, (Clayey SAND: fine to coarse-grained sand, medium plasticity) | ◣ | BC=8<br>15<br>27 | 18" |  |  |  |  |  |  |  |  |
| 10 |  |  | ◣ | BC=17<br>23<br>31 | 18" |  |  |  |  |  |  |  |  |
| 15 |  | **Dawson Formation**<br>**SANDSTONE**: tan to white, weak, moderately weathered | ■ | BC=50/6" | 6" |  |  |  |  |  |  |  |  |
| 20 |  |  | ◣ | BC=50/6" | 6" |  |  |  |  |  |  |  |  |
| 25 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  |  |  |  |  |  |  |  |

The boring was terminated at approximately 20.5 ft. below ground surface. The boring was backfilled with auger cuttings on November 15, 2016.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not encountered during drilling or after completion.

GENERAL NOTES:
The exploration location is approximate and was estimated by Kleinfelder using a handheld GPS unit with an accuracy of +/- 10 feet.

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PROJECT NO.: 20172793
DRAWN BY: MAP
CHECKED BY: JTM
DATE: 12/6/2016
REVISED: -

BORING LOG B-2

Proposed Siever Business Park
1945 Deer Creek Road
Monument, Colorado

BORING
B-2

PAGE: 1 of 1

PLOTTED: 12/08/2016 11:42 AM BY: mpalmer

gINT FILE: Klf_gint_master_2016
gINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2016.GLB [KLF_BORING/TEST PIT SOIL LOG]

PLOTTED: 12/08/2016 11:42 AM BY: mpalmer

**BORING LOG B-3**

**Date Begin - End:** 11/15/2016
**Logged By:** E. Faber
**Hor.-Vert. Datum:** Not Available
**Plunge:** -90 degrees
**Weather:** Sunny, 30° F
**Drilling Company:** Custom Auger
**Drill Crew:** Nick & Tim
**Drilling Equipment:** CME-55
**Drilling Method:** Solid Stem Auger
**Exploration Diameter:** 4 in. O.D.
**Hammer Type - Drop:** 140 lb. Cathead - 30 in.

FIELD EXPLORATION | LABORATORY RESULTS

Latitude: 39.10478° N
Longitude: -104.86376° E
Surface Condition: Grass under 3" of snow

| Depth (feet) | Graphical Log | Lithologic Description | Sample Type | Blow Counts(BC)= Uncorr. Blows/6 in. | Recovery (NR=No Recovery) | USCS Symbol | Water Content (%) | Dry Unit Wt. (pcf) | Passing #4 (%) | Passing #200 (%) | Liquid Limit | Plasticity Index (NP=NonPlastic) | Additional Tests/ Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Poorly graded SAND with Clay (SP-SC):** fine to coarse-grained sand, low plasticity, brown, moist, loose, roots up to 1/16" diameter present to 18" bgs<br>- medium dense, orange to tan below 1.5 feet | | | | | | | | | | | |
| | | | ◣ | BC=10<br>10<br>10 | 18" | | | | | | | | |
| 5 | | - 4" fine sand seam, dark brown to black | ◣ | BC=9<br>10<br>11 | 18" | | | | | | | | |
| | | **Dawson Formation**<br>**SANDSTONE:** tan to brown, extremely weak to very weak, highly weathered, (Clayey SAND: fine to coarse-grained sand, medium plasticity) | | | | | | | | | | | Harder drilling at 6.5 feet |
| | | | ◣ | BC=11<br>13<br>20 | 18" | SC | 9.1 | | 97 | 18 | 27 | 5 | |
| 10 | | | ■ | BC=13<br>30 | 8" | | | | | | | | |
| 15 | | **Dawson Formation**<br>**SANDSTONE:** orange to brown, weak, moderately weathered | ■ | BC=50/5" | 10" | | | | | | | | |

The boring was terminated at approximately 15.5 ft. below ground surface. The boring was backfilled with auger cuttings on November 15, 2016.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not encountered during drilling or after completion.
GENERAL NOTES:
The exploration location is approximate and was estimated by Kleinfelder using a handheld GPS unit with an accuracy of +/- 10 feet.

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PROJECT NO.: 20172793
DRAWN BY: MAP
CHECKED BY: JTM
DATE: 12/6/2016
REVISED: -

BORING LOG B-3

Proposed Siever Business Park
1945 Deer Creek Road
Monument, Colorado

BORING
B-3

PAGE: 1 of 1

gINT FILE: Klf_gint_master_2016
gINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2016.GLB [KLF_BORING/TEST PIT SOIL LOG]

## BORING LOG B-4

**Date Begin - End:** 11/15/2016
**Logged By:** E. Faber
**Hor.-Vert. Datum:** Not Available
**Plunge:** -90 degrees
**Weather:** Sunny, 30° F
**Drilling Company:** Custom Auger
**Drill Crew:** Nick & Tim
**Drilling Equipment:** CME-55
**Drilling Method:** Solid Stem Auger
**Exploration Diameter:** 4 in. O.D.
**Hammer Type - Drop:** 140 lb. Cathead - 30 in.

Latitude: 39.10456° N
Longitude: -104.86351° E
Surface Condition: Grass under 3" of snow

| | | FIELD EXPLORATION | | | | LABORATORY RESULTS | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (feet) | Graphical Log | Lithologic Description | Sample Type | Blow Counts(BC)= Uncorr. Blows/6 in. | Recovery (NR=No Recovery) | USCS Symbol | Water Content (%) | Dry Unit Wt. (pcf) | Passing #4 (%) | Passing #200 (%) | Liquid Limit | Plasticity Index (NP=NonPlastic) | Additional Tests/ Remarks |
| | ▨ | **Clayey SAND (SC)**: fine and medium-grained sand, low plasticity, brown, moist, loose, roots up to 1/16" diameter present to 18" bgs<br>- fine to coarse-grained sand below 1.5 feet | ◣ | BC=4<br>4<br>3 | 8" | SP-SC | | | | 18 | NP | NP | Organic Content= 1.2% |
| 5 | ▨ | - 4" fine sand seam, dark brown to black | ◣ | BC=5<br>4<br>5 | 18" | | | | | | | | |
| | | **Dawson Formation**<br>**SANDSTONE**: orange to brown, extremely weak to very weak, highly weathered, (Sandy Lean CLAY: fine to coarse-grained sand, medium plasticity) | ◣ | BC=9<br>17<br>22 | | CL | 15.8 | | | 65 | 40 | 18 | Harder drilling at 7.5 feet |
| 10 | | - gray below 10 feet | ◣ | BC=22<br>50/6" | | | | | | | | | |
| 15 | | | ◣ | BC=28<br>50/6" | | | | | | | | | |

20

25

30

The boring was terminated at approximately 16 ft. below ground surface. The boring was backfilled with auger cuttings on November 15, 2016.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not encountered during drilling or after completion.

GENERAL NOTES:
The exploration location is approximate and was estimated by Kleinfelder using a handheld GPS unit with an accuracy of +/- 10 feet.

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| | | | |
|---|---|---|---|
| PROJECT NO.: | 20172793 | BORING LOG B-4 | BORING |
| DRAWN BY: | MAP | | B-4 |
| CHECKED BY: | JTM | Proposed Siever Business Park<br>1945 Deer Creek Road<br>Monument, Colorado | |
| DATE: | 12/6/2016 | | |
| REVISED: | - | | PAGE: 1 of 1 |

PLOTTED: 12/08/2016 11:42 AM BY: mpalmer

| | | | | | |
|---|---|---|---|---|---|
| **Date Begin - End:** | 11/18/2016 | **Drilling Company:** | Custom Auger | | **BORING LOG B-5** |
| **Logged By:** | E. Faber | **Drill Crew:** | Nick & Tim | | |
| **Hor.-Vert. Datum:** | Not Available | **Drilling Equipment:** | CME-55 | **Hammer Type - Drop:** | 140 lb. Cathead - 30 in. |
| **Plunge:** | -90 degrees | **Drilling Method:** | Solid Stem Auger | | |
| **Weather:** | Sunny, 25° F | **Exploration Diameter:** | 4 in. O.D. | | |

| FIELD EXPLORATION | | | | | | LABORATORY RESULTS | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (feet) | Graphical Log | Latitude: 39.10418° N<br>Longitude: -104.86371° E<br>Surface Condition: Grass under 3" of snow<br>Lithologic Description | Sample Type | Blow Counts(BC)= Uncorr. Blows/6 in. | Recovery (NR=No Recovery) | USCS Symbol | Water Content (%) | Dry Unit Wt. (pcf) | Passing #4 (%) | Passing #200 (%) | Liquid Limit | Plasticity Index (NP=NonPlastic) | Additional Tests/ Remarks |
| | | **Poorly graded SAND with Clay (SP-SC):** fine and medium-grained sand, low plasticity, brown, moist, loose, roots up to 1/16" diameter present to 18" bgs<br>- fine to coarse-grained sand, medium dense below 2 feet | ◣ | BC=14<br>13<br>13 | 8" | | | | | | | | Harder drilling at 3 feet |
| 5 | | - 1" fine sand seam, dark brown to black | ◣ | BC=9<br>9<br>9 | 10" | | | | | | | | |
| | | **Dawson Formation**<br>**SANDSTONE:** tan to brown, extremely weak, highly weathered, (Clayey SAND: fine to coarse-grained sand, medium plasticity) | ◣ | BC=9<br>11<br>15 | 18" | SC | 12.7 | | | 29 | 24 | 6 | Harder drilling at 6.5 feet |
| 10 | | | ■ | BC=13<br>20 | | | | | | | | | |
| 15 | | **Dawson Formation**<br>**SANDSTONE:** orange to brown, weak, moderately weathered | ◣ | BC=32<br>50/5" | | SC | 8.9 | | | 45 | 32 | 15 | |
| 20 | | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | | |

The boring was terminated at approximately 16 ft. below ground surface. The boring was backfilled with auger cuttings on November 18, 2016.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not encountered during drilling or after completion.

GENERAL NOTES:
The exploration location is approximate and was estimated by Kleinfelder using a handheld GPS unit with an accuracy of +/- 10 feet.

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| | | | |
|---|---|---|---|
| PROJECT NO.: 20172793 | BORING LOG B-5 | | BORING |
| DRAWN BY: MAP | | | |
| CHECKED BY: JTM | Proposed Siever Business Park<br>1945 Deer Creek Road<br>Monument, Colorado | | B-5 |
| DATE: 12/6/2016 | | | |
| REVISED: - | | | PAGE: 1 of 1 |

gINT FILE: Klf_gint_master_2016
gINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2016.GLB [KLF_BORING/TEST PIT SOIL LOG]

PLOTTED: 12/08/2016 11:42 AM BY: mpalmer

**BORING LOG B-6**

**Date Begin - End:** 11/15/2016
**Logged By:** E. Faber
**Hor.-Vert. Datum:** Not Available
**Plunge:** -90 degrees
**Weather:** Sunny, 20° F
**Drilling Company:** Custom Auger
**Drill Crew:** Nick & Tim
**Drilling Equipment:** CME-55
**Drilling Method:** Solid Stem Auger
**Exploration Diameter:** 4 in. O.D.
**Hammer Type - Drop:** 140 lb. Cathead - 30 in.

FIELD EXPLORATION

Latitude: 39.10500° N
Longitude: -104.86321° E
Surface Condition: Grass under 3" of snow

LABORATORY RESULTS

| Depth (feet) | Lithologic Description | Sample Type | Blow Counts(BC)= Uncorr. Blows/6 in. | Recovery (NR=No Recovery) | USCS Symbol | Water Content (%) | Dry Unit Wt. (pcf) | Passing #4 (%) | Passing #200 (%) | Liquid Limit | Plasticity Index (NP=NonPlastic) | Additional Tests/ Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | **Poorly graded SAND with Clay (SP-SC)**: fine and medium-grained sand, low plasticity, brown, moist, loose, roots up to 1/16" diameter present to 18" bgs<br>- medium dense below 2 feet | | | | | | | | | | | |
| | | | BC=5<br>8<br>10 | 15" | | | | | | | | |
| 5 | | | BC=10<br>13<br>13 | 15" | | | | | | | | |
| | **Dawson Formation**<br>**SANDSTONE:** orange to brown, extremely weak, highly weathered, (Clayey SAND: fine to coarse-grained sand, medium plasticity) | | BC=7<br>19<br>26 | 18" | | | | | | | | |
| 10 | | | BC=25<br>47 | | | | | | | | | |
| 15 | **Dawson Formation**<br>**SANDSTONE:** orange to brown, weak, moderately weathered | | BC=34<br>50/4" | | | | | | | | | |
| 20 | | | BC=50/4" | | SC | 12.0 | 109.9 | | 34 | 34 | 13 | |

The boring was terminated at approximately 20.5 ft. below ground surface. The boring was backfilled with auger cuttings on November 15, 2016.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not encountered during drilling or after completion.

GENERAL NOTES:
The exploration location is approximate and was estimated by Kleinfelder using a handheld GPS unit with an accuracy of +/- 10 feet.

25

30

gINT FILE: Klf_gint_master_2016
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PROJECT NO.: 20172793
DRAWN BY: MAP
CHECKED BY: JTM
DATE: 12/6/2016
REVISED: -

BORING LOG B-6

Proposed Siever Business Park
1945 Deer Creek Road
Monument, Colorado

BORING
B-6

PLOTTED: 12/08/2016 11:43 AM BY: mpalmer

**BORING LOG B-7**

**Date Begin - End:** 11/15/2016
**Logged By:** E. Faber
**Hor.-Vert. Datum:** Not Available
**Plunge:** -90 degrees
**Weather:** Sunny, 25° F
**Drilling Company:** Custom Auger
**Drill Crew:** Nick & Tim
**Drilling Equipment:** CME-55
**Drilling Method:** Solid Stem Auger
**Exploration Diameter:** 4 in. O.D.
**Hammer Type - Drop:** 140 lb. Cathead - 30 in.

FIELD EXPLORATION

Latitude: 39.10423° N
Longitude: -104.86300° E
Surface Condition: Grass under 3" of snow

| Depth (feet) | Graphical Log | Lithologic Description | Sample Type | Blow Counts(BC)= Uncorr. Blows/6 in. | Recovery (NR=No Recovery) | USCS Symbol | Water Content (%) | Dry Unit Wt. (pcf) | Passing #4 (%) | Passing #200 (%) | Liquid Limit | Plasticity Index (NP=NonPlastic) | Additional Tests/ Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Poorly graded SAND with Clay (SP-SC)**: fine and medium-grained sand, low plasticity, brown, moist, loose, roots up to 1/16" diameter present to 18" bgs<br>- medium dense below 1.5 feet | | BC=14<br>14<br>14 | 11" | | | | | | | | |
| 5 | | | | BC=5<br>5<br>9 | 15" | | | | | | | | |
| | | **Dawson Formation**<br>**SANDSTONE**: orange to brown, extremely weak, highly weathered, (Clayey SAND: fine to coarse-grained sand, medium plasticity) | | BC=27<br>50/6" | | SC | 14.2 | | | 48 | 36 | 10 | |
| 10 | | **Dawson Formation**<br>**SANDSTONE**: orange to brown, weak, moderately weathered | | BC=50/6" | | | | | | | | | |
| 15 | | | | BC=50/6" | 11" | | | | | | | | |
| 20 | | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | | |

The boring was terminated at approximately 15.5 ft. below ground surface. The boring was backfilled with auger cuttings on November 15, 2016.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not encountered during drilling or after completion.

GENERAL NOTES:
The exploration location is approximate and was estimated by Kleinfelder using a handheld GPS unit with an accuracy of +/- 10 feet.

gINT FILE: Klf_gint_master_2016
gINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2016.GLB [KLF_BORING/TEST PIT SOIL LOG]

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PROJECT NO.: 20172793
DRAWN BY: MAP
CHECKED BY: JTM
DATE: 12/6/2016
REVISED: -

BORING LOG B-7

Proposed Siever Business Park
1945 Deer Creek Road
Monument, Colorado

BORING
B-7

PAGE: 1 of 1

PLOTTED: 12/08/2016 12:03 PM BY: mpalmer

**BORING LOG B-8**

**Date Begin - End:** 11/15/2016
**Logged By:** E. Faber
**Hor.-Vert. Datum:** Not Available
**Plunge:** -90 degrees
**Weather:** Sunny, 20° F
**Drilling Company:** Custom Auger
**Drill Crew:** Nick & Tim
**Drilling Equipment:** CME-55
**Drilling Method:** Solid Stem Auger
**Exploration Diameter:** 4 in. O.D.
**Hammer Type - Drop:** 140 lb. Cathead - 30 in.

| | | FIELD EXPLORATION | | | | LABORATORY RESULTS | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Depth (feet) | Graphical Log | Latitude: 39.10453° N<br>Longitude: -104.86317° E<br>Surface Condition: Grass under 3" of snow<br>Lithologic Description | Sample Type | Blow Counts(BC)= Uncorr. Blows/6 in. | Recovery (NR=No Recovery) | USCS Symbol | Water Content (%) | Dry Unit Wt. (pcf) | Passing #4 (%) | Passing #200 (%) | Liquid Limit | Plasticity Index (NP=NonPlastic) | Additional Tests/ Remarks |
| | | **Poorly graded SAND with Clay (SP-SC)**: fine and medium-grained sand, low plasticity, brown, moist, loose, roots up to 1/16" diameter present to 18" bgs<br>- medium dense below 1.5 feet | | BC=11<br>16<br>16 | 18" | | | | | | | | |
| 5 | | | | BC=7<br>9<br>13 | 18" | SP-SC | 4.0 | | 98 | 8.4 | NP | NP | |
| | | **Dawson Formation**<br>**SANDSTONE**: orange to brown, extremely weak to very weak, highly weathered, (Clayey SAND: fine to coarse-grained sand, medium plasticity) | | BC=17<br>18<br>25 | 18" | | | | | | | | |
| 10 | | | | BC=42<br>50/3" | | | | | | | | | |
| 15 | | | | BC=38<br>26 | | | | | | | | | |
| 20 | | | | BC=50/3" | | | | | | | | | |
| 25 | | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | | |

The boring was terminated at approximately 20.5 ft. below ground surface. The boring was backfilled with auger cuttings on November 15, 2016.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not encountered during drilling or after completion.

GENERAL NOTES:
The exploration location is approximate and was estimated by Kleinfelder using a handheld GPS unit with an accuracy of +/- 10 feet.

gINT FILE: Kif_gint_master_2016
gINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2016.GLB [KLF_BORING/TEST PIT SOIL LOG]

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CHECKED BY: JTM
DATE: 12/6/2016
REVISED: -

BORING LOG B-8

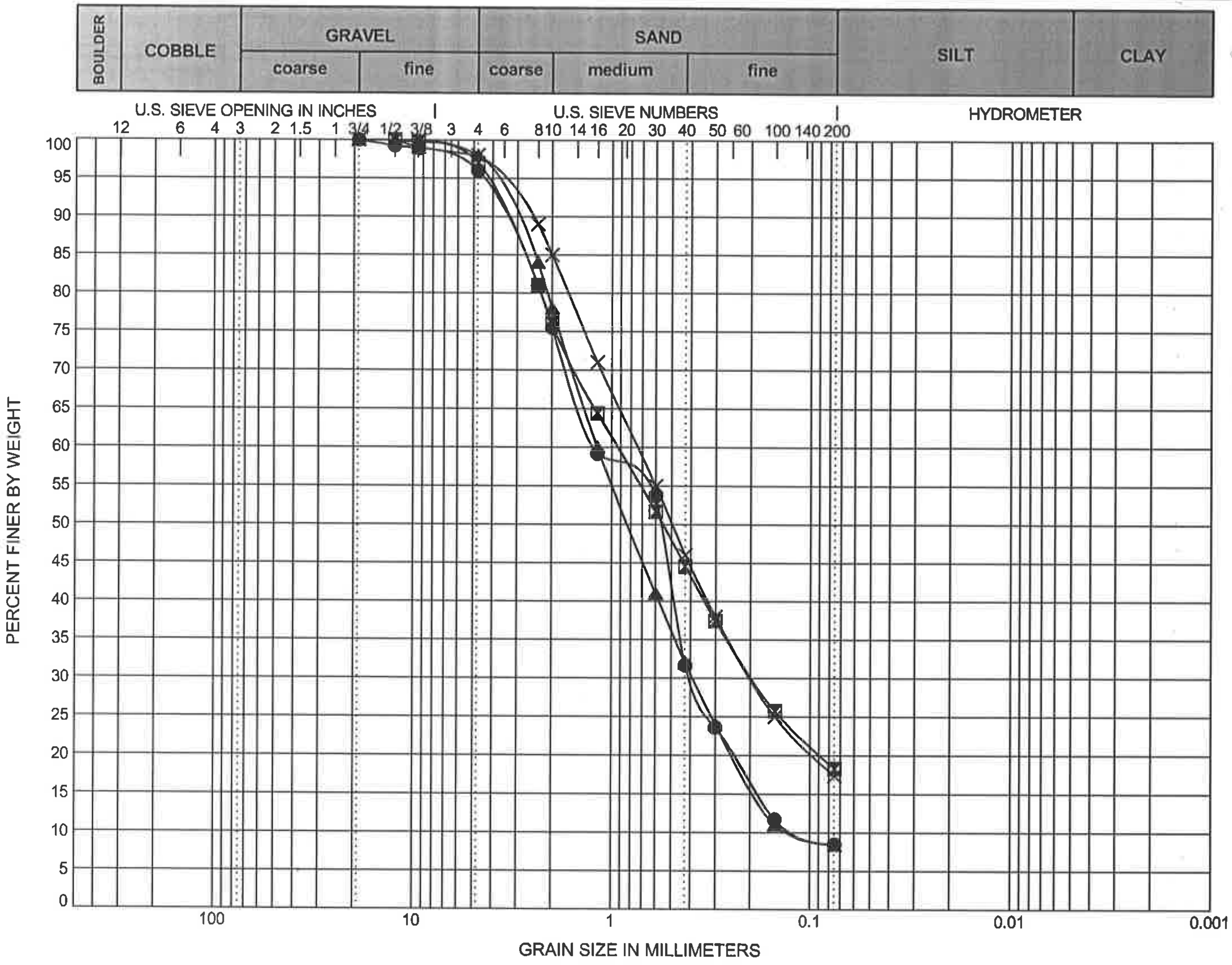
Proposed Siever Business Park
1945 Deer Creek Road
Monument, Colorado

BORING
B-8

# APPENDIX B

## Geotechnical Laboratory Test Results

PLOTTED: 12/08/2016 11:44 AM BY: mpalmer



| | Exploration ID | Depth (ft.) | Sample Description | LL | PL | PI |
|---|---|---|---|---|---|---|
| ● | B-1 | 2.5 | POORLY GRADED SAND WITH CLAY (SP-SC) | NM | NM | NM |
| ☒ | B-3 | 7.5 | CLAYEY SAND (SC) | 27 | 22 | 5 |
| ▲ | B-8 | 4 | POORLY GRADED SAND WITH CLAY (SP-SC) | NP | NP | NP |
| × | Comp. B-1 B-2 B-5 | 0 - 5 | CLAYEY SAND (SC) | 20 | 19 | 1 |
| | | | | | | |

| | Exploration ID | Depth (ft.) | $D_{100}$ | $D_{60}$ | $D_{30}$ | $D_{10}$ | Cc | Cu | Passing 3/4" | Passing #4 | Passing #200 | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | B-1 | 2.5 | 19 | 1.211 | 0.395 | 0.104 | 1.24 | 11.69 | 100 | 96 | 8.5 | NM | NM |
| ☒ | B-3 | 7.5 | 12.5 | 0.934 | 0.193 | NM | NM | NM | | 97 | 18 | NM | NM |
| ▲ | B-8 | 4 | 19 | 1.18 | 0.39 | 0.115 | 1.12 | 10.27 | 100 | 98 | 8.4 | NM | NM |
| × | Comp. B-1 B-2 B-5 | 0 - 5 | 19 | 0.741 | 0.196 | NM | NM | NM | 100 | 98 | 17 | NM | NM |
| | | | | | | | | | | | | | |

Coefficients of Uniformity - $C_u = D_{60} / D_{10}$
Coefficients of Curvature - $C_c = (D_{30})^2 / D_{60}\ D_{10}$
$D_{60}$ = Grain diameter at 60% passing
$D_{30}$ = Grain diameter at 30% passing
$D_{10}$ = Grain diameter at 10% passing

Sieve Analysis and Hydrometer Analysis testing performed in general accordance with ASTM D422.
NP = Nonplastic
NM = Not Measured

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PROJECT NO.: 20172793
DRAWN BY: MAP
CHECKED BY: JTM
DATE: 12/6/2016
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## SIEVE ANALYSIS

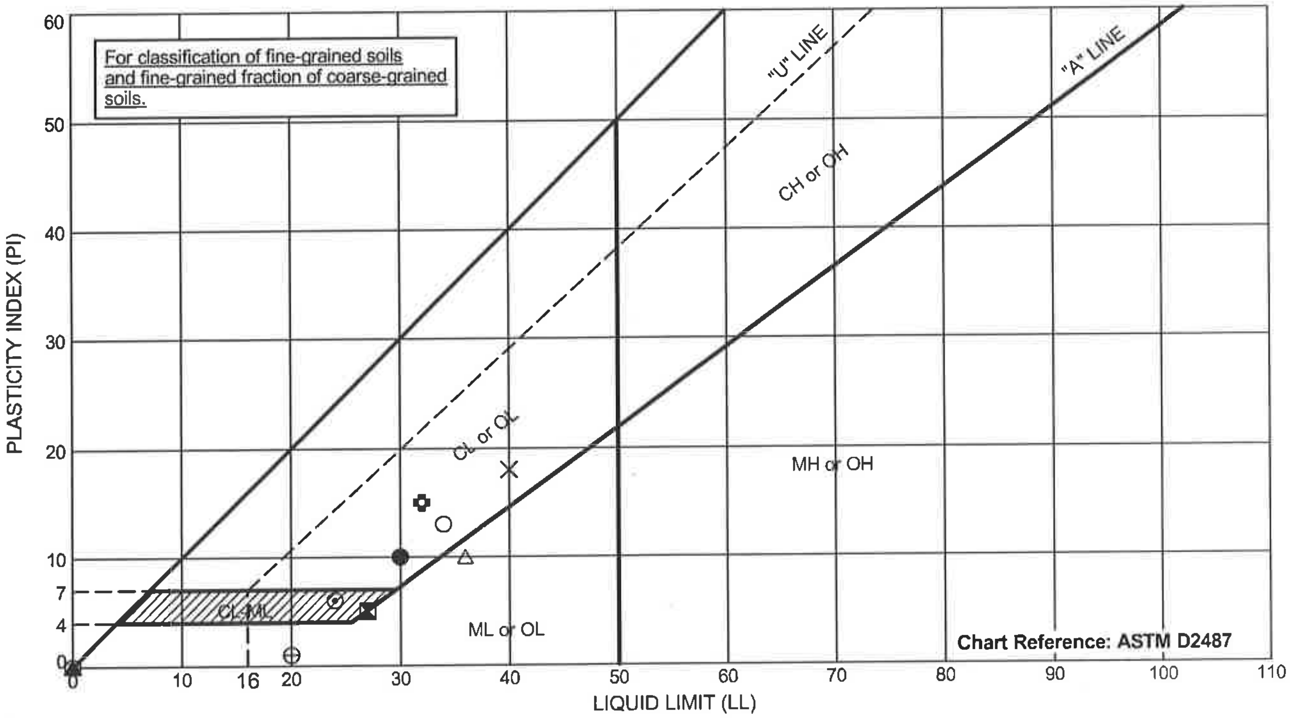
Proposed Siever Business Park
1945 Deer Creek Road
Monument, Colorado

FIGURE

B-1

gINT FILE: Klf_gint_master_2016
gINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2016.GLB [KLF_SIEVE_ANALYSIS]

PLOTTED: 12/08/2016 11:44 AM BY: mpalmer



| | Exploration ID | Depth (ft.) | Sample Description | Passing #200 | LL | PL | PI |
|---|---|---|---|---|---|---|---|
| ● | B-1 | 10 | CLAYEY SAND (SC) | 29 | 30 | 20 | 10 |
| ⊠ | B-3 | 7.5 | CLAYEY SAND (SC) | 18 | 27 | 22 | 5 |
| ▲ | B-4 | 1 | CLAYEY SAND (SC) | 18 | NP | NP | NP |
| ✕ | B-4 | 8 | SANDY LEAN CLAY (CL) | 65 | 40 | 22 | 18 |
| ⊙ | B-5 | 7.5 | CLAYEY SAND (SC) | 29 | 24 | 18 | 6 |
| ✿ | B-5 | 15 | CLAYEY SAND (SC) | 45 | 32 | 17 | 15 |
| ○ | B-6 | 20 | CLAYEY SAND (SC) | 34 | 34 | 21 | 13 |
| △ | B-7 | 8 | CLAYEY SAND (SC) | 48 | 36 | 26 | 10 |
| ⊗ | B-8 | 4 | POORLY GRADED SAND WITH CLAY (SP-SC) | 8.4 | NP | NP | NP |
| ⊕ | Comp. B-1 B-2 B-5 | 0 - 5 | CLAYEY SAND (SC) | 17 | 20 | 19 | 1 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

Testing perfomed in general accordance with ASTM D4318.
NP = Nonplastic
NM = Not Measured

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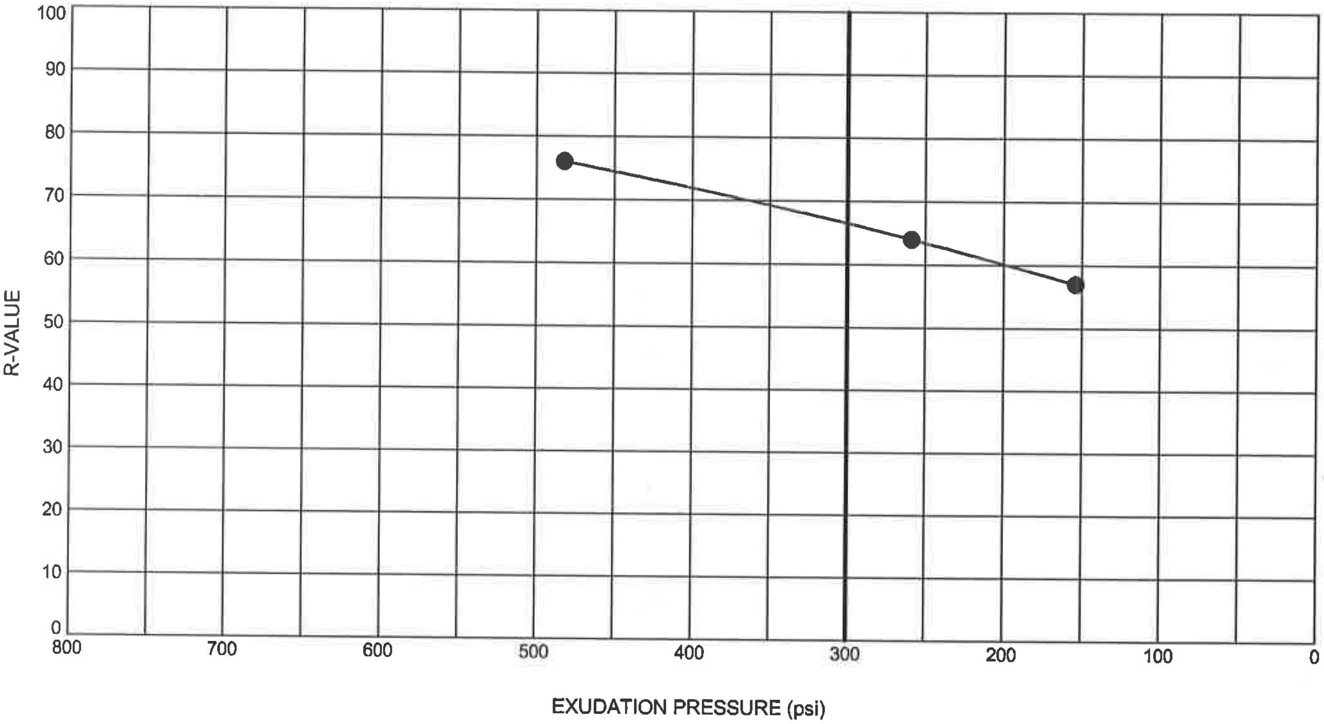
PROJECT NO.: 20172793
DRAWN BY: MAP
CHECKED BY: JTM
DATE: 12/6/2016
REVISED: -

## ATTERBERG LIMITS

Proposed Siever Business Park
1945 Deer Creek Road
Monument, Colorado

FIGURE
B-2

gINT FILE: Klf_gint_master_2016
gINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2016.GLB [KLF_ATTERBERG (ASTM)]



| Exploration ID | Depth (ft.) | Sample Description | R-Value @ 300 psi Exudation Pressure |
|---|---|---|---|
| Comp. B-1 B-2 B-5 | 0 - 5 | CLAYEY SAND (SC) | 66 |

| Specimen No. | Moisture at Time of Test (%) | Dry Unit Weight (pcf) | Expansion Pressure (psi) | Exudation Pressure (psi) | Corrected Resistance Value |
|---|---|---|---|---|---|
| 1 | 7.7 | 130.2 | 0 | 482 | 76 |
| 2 | 8.5 | 127.4 | 0 | 259 | 64 |
| 3 | 8.9 | 128.6 | 0 | 154 | 57 |

Testing perfomed in general accordance with ASTM D2844.

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| | |
|---|---|
| PROJECT NO.: | 20172793 |
| DRAWN BY: | MAP |
| CHECKED BY: | JTM |
| DATE: | 12/6/2016 |
| REVISED: | - |

R-VALUE

Proposed Siever Business Park
1945 Deer Creek Road
Monument, Colorado

FIGURE

B-3

# APPENDIX C
# Important Information About This Geotechnical Engineering Report

# Important Information about This

# Geotechnical-Engineering Report

**Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.**

**While you cannot eliminate all such risks, you can manage them. The following information is provided to help.**

**The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.**

### Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled.* No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

### Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

### You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

### This Report May Not Be Reliable

*Do not rely on this report* if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be,* and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

### Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

## This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final,* because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

## This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

## Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

## Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

## Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

## Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration.*** Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

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