March 4, 2015

Colorado School for the Deaf and Blind
33 North Institute Street
Colorado Springs, Colorado 80903

Attn: Mr. Kevyn Brown

Re: Geotechnical Engineering Report
    Colorado School for the Deaf and Blind Parking Lot Pavement Thickness Design
    Northwest Corner of Hancock Avenue and Pikes Peak Avenue
    Colorado Springs, Colorado
    Terracon Project Number: 23155003

Terracon Consultants, Inc. (Terracon) has performed geotechnical engineering services for the above referenced project. This study was performed in general accordance with our proposal number D2315042 dated February 9, 2015. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of pavements for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,

Terracon Consultants, Inc.

Robert M. Hernandez, P.E.
Project Geotechnical Engineer

Ryan W. Feist, P.E.
Geotechnical Services Manager

Copies to: Addressee (1, *.pdf)
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EXECUTIVE SUMMARY

A geotechnical investigation has been performed for the proposed parking lot to be located at the northwest corner of Hancock Avenue and Pikes Peak Avenue in Colorado Springs, Colorado. Two test borings were advanced to depths of approximately 5 feet below the existing ground surface within the general vicinity of the proposed parking lot area. The following geotechnical considerations were identified:

- Pavements should be supported on a minimum of 12 inches of scarified, water conditioned, and re-compacted on-site soils. On-site sand soils are considered suitable for reuse as engineered fill beneath pavements. Recommended pavement thicknesses are included in subsequent sections of this report.

- Close monitoring of the construction operations discussed herein will be critical in achieving the design subgrade support. We therefore recommend that Terracon be retained to monitor this portion of the work.

This summary should be used in conjunction with the entire report for design purposes. It should be recognized that details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. The section titled GENERAL COMMENTS should be read for an understanding of the report limitations.
1.0 INTRODUCTION

A geotechnical investigation has been performed for the proposed parking lot to be located at the northwest corner of Hancock Avenue and Pikes Peak Avenue in Colorado Springs, Colorado. Two test borings were advanced to depths of approximately 5 feet below the existing ground surface within the general vicinity of the proposed parking lot area. Boring logs along with a Boring Location Plan are included in Appendix A of this report.

The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- subsurface soil conditions
- groundwater conditions
- pavement thickness design
- earthwork
- drainage

2.0 PROJECT INFORMATION

2.1 Project Description

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site layout</td>
<td>See Appendix A, Exploration Plan</td>
</tr>
<tr>
<td>Proposed Development</td>
<td>Construction will include a 75 parking stall addition to an existing parking lot.</td>
</tr>
<tr>
<td>Traffic Loading</td>
<td>Traffic loading for the parking lot was not known at the time this report was prepared. We understand the parking lot is anticipated to be utilized mainly for passenger car vehicles.</td>
</tr>
<tr>
<td>Grading</td>
<td>Unknown. We anticipated finished construction grades to be within 1-foot of existing site grades.</td>
</tr>
<tr>
<td>Cut and fill slopes</td>
<td>Assumed to be no steeper than 5H:1V (Horizontal to Vertical)</td>
</tr>
<tr>
<td>Proposed retaining walls</td>
<td>Not reported as part of site development</td>
</tr>
<tr>
<td>Below grade areas</td>
<td>Not reported as part of site development</td>
</tr>
</tbody>
</table>
2.2 Site Location and Description

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location</td>
<td>The project site is located at the northwest corner of Hancock Avenue and Pikes Peak Avenue in Colorado Springs, Colorado.</td>
</tr>
<tr>
<td>Existing improvements</td>
<td>The overall site is currently developed with the Colorado School for the Deaf and Blind campus. The subject site for the proposed parking lot expansion is currently undeveloped and bordered to the north by an existing parking lot, to the east by Pikes Peak Avenue, to the south by Hancock Avenue, and to the west by relatively undeveloped land similar to the subject site, followed by tennis courts.</td>
</tr>
<tr>
<td>Current ground cover</td>
<td>Ground cover consisted of a moderate growth of native grasses and weeds.</td>
</tr>
<tr>
<td>Existing topography</td>
<td>The site was relatively flat. Drainage appeared to be in the form of sheet surface flow directed toward the south and east.</td>
</tr>
</tbody>
</table>

3.0 SUBSURFACE CONDITIONS

3.1 Typical Profile

Subsurface conditions on the project site can be generalized as shown on the following page:

<table>
<thead>
<tr>
<th>Description</th>
<th>Approximate Depth to Bottom of Stratum</th>
<th>Material Encountered</th>
<th>Consistency/Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stratum 1</td>
<td>5 feet</td>
<td>Sand with varying amounts of silt</td>
<td>Loose to medium dense</td>
</tr>
</tbody>
</table>

Conditions encountered at each boring location are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil and bedrock types; in-situ, the transition between materials may be gradual. Details for each of the borings can be found on the boring logs in Appendix A of this report.

3.2 Groundwater

Groundwater was not observed in the borings at the time of field exploration. These observations represent groundwater conditions at the time of the field exploration, and may not be indicative of other times, or at other locations. Groundwater levels can be expected to fluctuate with varying seasonal and weather conditions. Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs.
The possibility of groundwater level fluctuations should be considered when developing the
design and construction plans for the project. Fluctuations in groundwater levels can best be
determined by implementation of a groundwater monitoring plan. Such a plan would include
installation of groundwater monitoring wells and periodic measurement of groundwater levels
over a sufficient period of time.

4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

4.1 Geotechnical Considerations

Based on the results of our field investigation, laboratory testing program and geotechnical
analyses, development of the site is considered feasible from a geotechnical viewpoint provided
that the conclusions and considerations provided herein are incorporated into the design and
construction of the project.

Pavements should be supported on a minimum of 12 inches of scarified, water conditioned, and re-
compacted on-site soils. On-site sand soils are considered suitable for reuse as engineered fill
beneath pavements. Recommended pavement thicknesses are included in subsequent sections
of this report.

Design and construction recommendations for pavements and other earth connected phases of
the project are outlined below.

4.2 Earthwork

4.2.1 Site Preparation

Prior to placing any fill, all vegetation and any otherwise unsuitable material should be removed
from the proposed pavement areas. Pavement subgrade should be proof-rolled to aid in
locating loose, soft, or otherwise undesirable areas. Proof-rolling can be performed with a fully
loaded tandem axle dump truck. Unacceptable soil should be removed or mitigated in place
prior to placing fill or pavement.

Although evidence of underground facilities such as septic tanks and cesspools, was not
observed during the site reconnaissance, such features could be encountered during
construction. If unexpected underground facilities are encountered, such features should be
removed and the excavation benched to expose firm, approved materials prior to backfill
placement and/or construction.
4.2.2 Material Types

Engineered fill should meet the following material property requirements:

<table>
<thead>
<tr>
<th>Fill Type</th>
<th>USCS Classification</th>
<th>Acceptable Location for Placement</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-Site Soils</td>
<td>SM</td>
<td>The on-site sand soils are considered acceptable for use as engineered fill beneath pavements after properly moisture conditioned.</td>
</tr>
<tr>
<td>Imported Soils</td>
<td>Varies</td>
<td>Imported soils meeting the gradation outlined herein can be considered acceptable for use as engineered fill beneath foundations and slabs.</td>
</tr>
</tbody>
</table>

1. Controlled, compacted fill should consist of approved materials that are free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the geotechnical engineer for evaluation.

Imported soils (if required) should conform to the following:

<table>
<thead>
<tr>
<th>Gradation</th>
<th>Percent finer by weight (ASTM C136)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3”</td>
<td>100</td>
</tr>
<tr>
<td>No. 4 Sieve</td>
<td>50-100</td>
</tr>
<tr>
<td>No. 200 Sieve</td>
<td>35 (max)</td>
</tr>
</tbody>
</table>

Liquid Limit………………………………………………………………………………..NP
Plastic Limit………………………………………………………………………………..NP

4.2.3 Compaction Requirements

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fill Lift Thickness</td>
<td>8-inches or less in loose thickness when heavy, self-propelled compaction equipment is used</td>
</tr>
<tr>
<td></td>
<td>4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack, plate compactor) is used</td>
</tr>
<tr>
<td>Compaction Requirements</td>
<td>95% of the materials maximum dry density (ASTM D698)</td>
</tr>
<tr>
<td></td>
<td>98% of the materials maximum dry density (ASTM D698) within 12 inches of pavement subgrade</td>
</tr>
<tr>
<td>Water Content 2</td>
<td>Non-plastic soils – Within three percent of optimum water content</td>
</tr>
</tbody>
</table>
1. We recommend that engineered fill be tested for water content and compaction during placement. Should the results of the in-place density tests indicate the specified water or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified water and compaction requirements are achieved.

2. Specifically, water levels should be maintained low enough to allow for satisfactory compaction to be achieved without the compacted fill material pumping when proofrolled.

### 4.2.4 Construction Considerations

Although the exposed subgrade is anticipated to be relatively stable upon initial exposure, unstable subgrade conditions could develop during general construction operations, particularly if the soils are wetted and/or subjected to repetitive construction traffic. Should unstable subgrade conditions develop, stabilization measures will need to be employed. Options for subgrade stabilization can include removal of unsuitable material and replacement with approved fill material. An alternative can include the use of geogrid overlain by CDOT Class 5 or 6 aggregate base course. The depth of aggregate base course will depend on the severity of unstable soils.

Upon completion of filling and grading, care should be taken to maintain the subgrade moisture content prior to construction of pavements. Construction traffic over the completed subgrade should be avoided to the extent practical. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. If the subgrade should become frozen, desiccated, saturated, or disturbed, the affected material should be removed or these materials should be scarified, moisture conditioned, and recompacted prior to pavement construction.

As a minimum, all temporary excavations should be sloped or braced as required by Occupational Health and Safety Administration (OSHA) regulations to provide stability and safe working conditions. Temporary excavations will probably be required during grading operations. The grading contractor, by his contract, is usually responsible for designing and constructing stable, temporary excavations and should shore, slope or bench the sides of the excavations as required, to maintain stability of both the excavation sides and bottom. All excavations should comply with applicable local, state and federal safety regulations, including the current OSHA Excavation and Trench Safety Standards.

### 4.3 Pavement Thickness Design and Construction

Design of pavements for the project has been based on the procedures outlined in the National Asphalt Pavement Association (NAPA) Information Series 109 (IS-109) and our experience with similar soil conditions. Traffic loading for the parking lot was not known at the time this report was prepared. We understand the parking lot is anticipated to be utilized mainly for passenger car vehicles.
We have based our pavement thickness design on the following NAPA design traffic class:

- **Traffic Class I** – Parking stalls, parking lots for autos and pickup trucks and 18-kip equivalent single axle loads (ESAL’s) up to 7,000.

- **Traffic Class II** – Traffic consisting of autos, home delivery trucks, trash pickup, occasional moving vans, and ESAL’s up to 27,000.

Traffic classifications and/or design ESAL’s should be reviewed and approved by the owner prior to commencement of pavement operations. The anticipated on-site soils classify as silty sands and have an estimated design class of “medium” according to Table B of NAPA IS-109. As a minimum, we suggest the following pavement sections be considered:

<table>
<thead>
<tr>
<th>Traffic Classification</th>
<th>Asphalt Concrete (in.)</th>
<th>Portland Cement Concrete (in.)</th>
<th>Minimum Prepared and Compacted Subgrade (in.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic Class I/II</td>
<td>4</td>
<td>---</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>---</td>
<td>5</td>
<td>12</td>
</tr>
</tbody>
</table>

### 4.3.1 Construction Considerations

Once properly cleared, all exposed pavement areas should be scarified to a minimum depth of 12 inches, water conditioned, and compacted as outlined in the “Earthwork” section of this report. Pavements should not be placed on frozen subgrade.

Asphalt concrete should be composed of a mixture of aggregate, filler and additives, if required, and approved bituminous material. The asphalt concrete should conform to approved mix designs stating the Hveem properties, optimum asphalt content, job mix formula and recommended mixing and placing temperatures and designed to a minimum 50 gyrations as determined by CDOT Superpave. Aggregate used in plant-mixed asphalt concrete should meet Colorado Department of Transportation Grading S or SX specifications. Mix designs should be submitted prior to construction to verify their adequacy. Asphalt material should be placed in maximum 3-inch lifts and should be compacted to a minimum of 92 to 96 percent of the maximum theoretical density as determined by CP 51. The performance of all pavements can be enhanced by reducing excess water, which can reach the subgrade soils. The following are recommended at minimum:

- Site grading at a minimum 2 percent grade away from the pavements;
- Compaction of any utility trenches for landscaped areas to the same criteria as the pavement subgrade;
- Install drainage surrounding areas anticipated for snow management and snow banks;
Snow management plans should be developed designating areas outside pavement and planter areas for stockpiling of snow;

Sealing or providing area drains and curb cuts in all landscaped areas in, or adjacent to pavements to reduce or prevent water migration to subgrade soils;

Installing edge drains around storm water quality ponds

Placing compacted backfill against the exterior side of curb and gutter; and,

Placing curb, gutter and/or sidewalk directly on subgrade soils without the use of base course materials.

Preventative maintenance should be planned and provided for through an on-going pavement management program in order to enhance future pavement performance. Preventative maintenance activities are intended to slow the rate of pavement deterioration, and to preserve the pavement investment.

Preventive maintenance consists of both localized maintenance (e.g. crack sealing and patching) and global maintenance (e.g. surface sealing). Preventative maintenance is usually the first priority when implementing a planned pavement maintenance program and provides the highest return on investment for pavements.

Recommended preventative maintenance policies for asphalt concrete pavements, based upon type and severity of distress, can be provided. Prior to implementing any maintenance additional engineering observation is recommended to determine the type and extent of preventative maintenance.

4.4 Corrosion Considerations

The table below lists the results of laboratory soluble sulfate, soluble chloride, electrical resistivity, and pH testing. These values may be used to estimate potential corrosive characteristics of the on-site soils with respect to contact with the various underground materials which will be used for project construction.

<table>
<thead>
<tr>
<th>Boring</th>
<th>Soluble Sulfate (Percent)</th>
<th>Soluble Chloride (Percent)</th>
<th>Electrical Resistivity (ohm.cm)</th>
<th>pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-1</td>
<td>&lt;0.001</td>
<td>0.003</td>
<td>7,042</td>
<td>4.4</td>
</tr>
</tbody>
</table>

Results of soluble sulfate testing indicate that samples of the on-site soils tested possess negligible sulfate concentrations when classified in accordance with Table 4.3.1 of the ACI Design Manual. Concrete should be designed in accordance with the provisions of the ACI Design Manual, Section 318, Chapter 4.
5.0 GENERAL COMMENTS

Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.
APPENDIX A

FIELD EXPLORATION
Field Exploration Description

Two test borings were advanced in the vicinity of the proposed pavement areas on February 13, 2015 to depths of approximately 5 feet below existing site grade at the approximate locations shown on the Exploration Plan, Exhibit A-2. The borings were advanced with a truck-mounted drilling rig, utilizing 4-inch diameter solid-stem auger.

The borings were located in the field by measurements from property lines and existing site features. The accuracy of the boring locations should only be assumed to the level implied by the methods used.

Lithologic logs of the borings were recorded by the Terracon field representative during drilling operations. At selected intervals, samples of the subsurface materials were taken by driving split-spoon and ring barrel samplers. Representative bulk samples of subsurface materials were also obtained.

Penetration resistance measurements were obtained by driving the split-spoon and ring barrel samplers into the subsurface materials with a 140-pound hammer falling 30 inches. The penetration resistance value is a useful index to the consistency, relative density or hardness of the materials encountered.

An automatic SPT hammer was used to advance the samplers in the borings. A greater efficiency is typically achieved with the automatic hammer compared to the conventional safety hammer operated with a cathead and rope. Published correlations between the barrel blow counts, SPT values, and soil properties are based on the lower efficiency cathead and rope method. This higher efficiency affects the standard penetration resistance blow count value by increasing the penetration per hammer blow over what would be obtained using the cathead and rope method. The effect of the automatic hammer’s efficiency has been considered in the interpretation and analysis of the subsurface information for this report.

Groundwater measurements were made in the borings at the time of site. Borings were backfilled with auger cuttings prior to leaving the site. Some settlement of the backfill should be anticipated.
**BORING LOG NO. B-1**

**PROJECT:** Parking Lot Addition  
**SITE:** Hancock Avenue and Pikes Peak Avenue  
**COLORADO SPRINGS, COLORADO**

**CLIENT:** Colorado School for Deaf and Blind  
**33 N INSTITUTE STREET, COLORADO SPRINGS**

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>DEPTH (FT)</th>
<th>WATER LEVEL OBSERVATIONS</th>
<th>FIELD TEST RESULTS</th>
<th>WATER CONTENT (%)</th>
<th>DRY UNIT WEIGHT (pcf)</th>
<th>ATTERBERG LIMITS</th>
<th>PERCENT FINES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WELL GRADED SAND WITH SILT (SW-SM)</strong>, dark brown, loose, fine to coarse grained, trace rootlets.</td>
<td>2.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NP</td>
<td>10</td>
</tr>
<tr>
<td><strong>Silty Sand (SM)</strong>, dark brown, loose, fine to medium grained.</td>
<td>5.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7</td>
<td>5-6</td>
</tr>
</tbody>
</table>

**Boring Terminated at 5 Feet**

Stratification lines are approximate. In-situ, the transition may be gradual.

- **Hammer Type:** Automatic

**Advancement Method:** 4" Flight Auger

**Abandonment Method:** Borings backfilled with soil cuttings upon completion.

**See Exhibit A-3 for description of field procedures.**

**See Appendix B for description of laboratory procedures and additional data (if any).**

**See Appendix C for explanation of symbols and abbreviations.**

---

**WATER LEVEL OBSERVATIONS**

- **No free water observed**

---

**GEO SMART LOG-NO WELL 23155003.GPJ  TERRACON 2012.GDT  3/4/15**

**4172 CENTER PARK DRIVE  
COLORADO SPRINGS, COLORADO**

**Boring Started:** 2/13/2015  
**Boring Completed:** 2/13/2015

**Drill Rig:** D-90  
**Driller:** GDI

**Project No.:** 23155003  
**Exhibit:** A-4
**BORING LOG NO. B-2**

**PROJECT:** Parking Lot Addition  
**SITE:** Hancock Avenue and Pikes Peak Avenue  
**COLORADO SPRINGS, COLORADO**

**CLIENT:** Colorado School for Deaf and Blind  
33 N Institute Street, Colorado Springs

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**LOCATION**  
See Exhibit A-2

**GRAPHIC LOG**

<table>
<thead>
<tr>
<th>DEPTH (FT)</th>
<th>WATER LEVEL OBSERVATIONS</th>
<th>RECOVERY (IN)</th>
<th>FIELD TEST RESULTS</th>
<th>WATER CONTENT (%)</th>
<th>DRY UNIT WEIGHT (pcf)</th>
<th>LL-PL-PI</th>
<th>ATTERBERG LIMITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.0</td>
<td><strong>SILTY SAND (SM)</strong> dark brown, loose, fine to medium grained</td>
<td>8</td>
<td>3-4</td>
<td>6</td>
<td>100</td>
<td>NP</td>
<td>13</td>
</tr>
</tbody>
</table>

trace clay, color change to brown below 3 feet

---

**Boring Terminated at 5 Feet**

---

**Notes:**

- Stratification lines are approximate. In-situ, the transition may be gradual.
- Hammer Type: Automatic

---

**Advancement Method:** 4" Flight Auger

**Abandonment Method:** Borings backfilled with soil cuttings upon completion.

---

**WATER LEVEL OBSERVATIONS**

No free water observed

---

**FIELD TEST RESULTS**

- LL: Low Limit
- PL: Plastic Limit
- PI: Plastic Index

---

**PROJECT NOTES:**

- **Driller:** GD
- **Boring Completed:** 2/13/2015
- **Exhibit:** A-5
- **Notes:**
  - See Exhibit A-3 for description of field procedures.
  - See Appendix B for description of laboratory procedures and additional data (if any).
  - See Appendix C for explanation of symbols and abbreviations.

---

**Drill Rig:** D-90  
**Exhibit:** A-5  
**Project No.:** 23155003
APPENDIX B
LABORATORY TESTING
Laboratory Testing

Samples retrieved during the field exploration were returned to the laboratory for observation by the project geotechnical engineer. An applicable laboratory testing program was formulated to determine engineering properties of the subsurface materials. The field descriptions were confirmed or modified as necessary, and were classified in general accordance with the Unified Soil Classification System described in Appendix C.

Laboratory test results are presented on the Logs of Borings and in Appendix B, and were used for the geotechnical engineering analyses, and the development of foundation and earthwork recommendations. Laboratory tests were performed in general accordance with the applicable Terracon test standards.

Selected soil samples were tested for the following engineering properties:

- Water content
- Dry density
- Plasticity index
- Grain size
### Boring Log

<table>
<thead>
<tr>
<th>Boring ID</th>
<th>Depth</th>
<th>LL</th>
<th>PL</th>
<th>PI</th>
<th>Fines</th>
<th>USCS</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-1</td>
<td>0 - 1</td>
<td>NP</td>
<td>NP</td>
<td>NP</td>
<td>10</td>
<td>SW-SM</td>
<td>WELL-GRADED SAND with SILT</td>
</tr>
<tr>
<td>B-2</td>
<td>0 - 1</td>
<td>NP</td>
<td>NP</td>
<td>NP</td>
<td>13</td>
<td>SM</td>
<td>SILTY SAND</td>
</tr>
</tbody>
</table>

---

** chloride or olivine
** CH or OH
** MH or OH
** CL-ML
** ML or OL

** Project: Parking Lot Addition
** Site: Hancock Avenue and Pikes Peak Avenue, Colorado Springs, Colorado

** Client: Colorado School for the Deaf and Blind
** Address: 33 N Institute Street, Colorado Springs, Colorado

** Project Number: 23155003
** Exhibit: B-2

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** ATTENTION: LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. **

** ATTERBERG LIMITS 23155003.GPJ TERRACON 2012.GDT 3/4/15 **
### Boring ID | Depth | USCS Classification | LL | PL | PI | Cc | Cu
---|---|---|---|---|---|---|---
B-1 | 0 - 1 | WELL-GRADED SAND with SILT(SW-SM) | NP | NP | NP | 1.12 | 6.54
B-2 | 0 - 1 | SILTY SAND(SM) | NP | NP | NP | |

### Boring ID | Depth | $D_{100}$ | $D_{50}$ | $D_{20}$ | $D_{10}$ | %Gravel | %Sand | %Silt | %Clay
---|---|---|---|---|---|---|---|---|---
B-1 | 0 - 1 | 9.5 | 0.501 | 0.207 | 0.077 | 0.1 | 90.2 | 9.7 | |
B-2 | 0 - 1 | 4.75 | 0.415 | 0.171 | 0.0 | 0.0 | 87.3 | 12.7 | |
## Analytical Results

**TASK NO:** 150219005

**Report To:** Ryan Feist  
**Company:** Terracon, Inc. - Colo Springs  
**Address:** 4172 Center Park Drive  
**City, State, Zip:** Colo. Springs CO 80916

**Bill To:** Accounts Payable  
**Company:** Terracon, Inc. - Lenexa  
**Address:** 13910 W. 96th Terrace  
**City, State, Zip:** Lenexa KS 66215

---

<table>
<thead>
<tr>
<th>Test</th>
<th>Result</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chloride - Water Soluble</td>
<td>0.0003%</td>
<td>AASHTO T291-91/ASTM D4327</td>
</tr>
<tr>
<td>pH</td>
<td>4.4 units</td>
<td>AASHTO T289-91</td>
</tr>
<tr>
<td>Resistivity</td>
<td>7042 ohm.cm</td>
<td>AASHTO T288-91</td>
</tr>
<tr>
<td>Sulfate - Water Soluble</td>
<td>&lt; 0.001%</td>
<td>AASHTO T290-91/ASTM D4327</td>
</tr>
</tbody>
</table>

---

**Customer Sample ID:** 23155003 Boring B-1 1-5 Ft.  
**Lab Number:** 150219005-01  
**Date Received:** 2/19/15  
**Date Reported:** 2/26/15  
**Matrix:** Soil - Geotech

---

**Abbreviations/References:**
- AASHTO - American Association of State Highway and Transportation Officials.
- ASA - American Society of Agronomy.

**DATA APPROVED FOR RELEASE BY**

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240 South Main Street  /  Brighton, CO  80601-0507  /  303-659-2313  
Mailing Address: P.O. Box 507  /  Brighton, CO  80601-0507  /  Fax: 303-659-2315  

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Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

**LOCATION AND ELEVATION NOTES**

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

**DESCRIPTIVE SOIL CLASSIFICATION**

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

**GENERAL NOTES**

<table>
<thead>
<tr>
<th>FIELD TESTS</th>
<th>(HP)</th>
<th>Hand Penetrometer</th>
</tr>
</thead>
<tbody>
<tr>
<td>(T)</td>
<td>Torvane</td>
<td></td>
</tr>
<tr>
<td>(bf)</td>
<td>Standard Penetration Test (blows per foot)</td>
<td></td>
</tr>
<tr>
<td>(PID)</td>
<td>Photo-Ionization Detector</td>
<td></td>
</tr>
<tr>
<td>(OVA)</td>
<td>Organic Vapor Analyzer</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RELATIVE DENSITY OF COARSE-GRAINED SOILS</th>
<th>DESCRIBITIVE TERMS (DENSITY)</th>
<th>STRENGTH TERMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>(More than 50% retained on No. 200 sieve.)</td>
<td>Density determined by Standard Penetration Resistance Includes gravels, sands and silts.</td>
<td>Ring Sampler Blows/Ft.</td>
</tr>
<tr>
<td>Water Initially Encountered</td>
<td>Water Level After a Specified Period of Time</td>
<td></td>
</tr>
<tr>
<td>Water Level After a Specified Period of Time</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water Level After a Specified Period of Time</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CONSISTENCY OF FINE-GRAINED SOILS**

(50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance

<table>
<thead>
<tr>
<th>RELATIVE DENSITY OF COARSE-GRAINED SOILS</th>
<th>CONSISTENCY OF FINE-GRAINED SOILS</th>
<th>BEDROCK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Descriptive Term (Consistency)</td>
<td>Unconfined Compressive Strength, Qu, psf</td>
<td>Descriptive Term (Consistency)</td>
</tr>
<tr>
<td>Descriptive Term (Consistency)</td>
<td>Unconfined Compressive Strength, Qu, psf</td>
<td>Standard Penetration or N-Value Blows/Ft.</td>
</tr>
</tbody>
</table>

**RELATIVE PROPORTIONS OF SAND AND GRAVEL**

<table>
<thead>
<tr>
<th>Descriptive Term(s) of other constituents</th>
<th>Percent of Dry Weight</th>
<th>Major Component of Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trace</td>
<td>&lt; 15</td>
<td>Boulders</td>
</tr>
<tr>
<td>With</td>
<td>15 - 29</td>
<td>Cobbles</td>
</tr>
<tr>
<td>Modifier</td>
<td>&gt; 30</td>
<td>Gravel</td>
</tr>
<tr>
<td></td>
<td></td>
<td>#4 to #200 sieve (4.75mm to 0.075mm)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sand</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Silt or Clay</td>
</tr>
</tbody>
</table>

**GRAIN SIZE TERMINOLOGY**

<table>
<thead>
<tr>
<th>Descriptive Term(s)</th>
<th>Percent of Dry Weight</th>
<th>Grain Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trace</td>
<td>&lt; 5</td>
<td>Over 12 in. (300 mm)</td>
</tr>
<tr>
<td>With</td>
<td>5 - 12</td>
<td>12 in. to 3 in. (300mm to 75mm)</td>
</tr>
<tr>
<td>Modifier</td>
<td>&gt; 12</td>
<td>3 in. to #4 sieve (75mm to 4.75 mm)</td>
</tr>
</tbody>
</table>

**RELATIVE PROPORTIONS OF FINES**

<table>
<thead>
<tr>
<th>Descriptive Term(s) of other constituents</th>
<th>Percent of Dry Weight</th>
<th>Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trace</td>
<td>&lt; 5</td>
<td>Non-plastic</td>
</tr>
<tr>
<td>With</td>
<td>5 - 12</td>
<td>Low</td>
</tr>
<tr>
<td>Modifier</td>
<td>&gt; 12</td>
<td>Medium</td>
</tr>
</tbody>
</table>

**PLASTICITY DESCRIPTION**

<table>
<thead>
<tr>
<th>Plasticity Index</th>
<th>Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Non-plastic</td>
</tr>
<tr>
<td>1 - 10</td>
<td>Low</td>
</tr>
<tr>
<td>11 - 30</td>
<td>Medium</td>
</tr>
<tr>
<td>&gt; 30</td>
<td>High</td>
</tr>
</tbody>
</table>

**LOCATION AND ELEVATION NOTES**

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

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</tr>
</tbody>
</table>
### UNIFIED SOIL CLASSIFICATION SYSTEM

#### Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests

<table>
<thead>
<tr>
<th>Soil Classification</th>
<th>Group Symbol</th>
<th>Group Name</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gravels:</strong> More than 50% retained on No. 200 sieve</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clean Gravels: Less than 5% fines</td>
<td>Cu ≥ 4 and/or 1 ≤ Cc ≤ 3</td>
<td>GW</td>
</tr>
<tr>
<td>Gravels with Fines: More than 12% fines</td>
<td>Cu &lt; 4 and/or 1 &gt; Cc &gt; 3</td>
<td>GP</td>
</tr>
<tr>
<td><strong>Sands:</strong> 50% or more of coarse fraction passes No. 4 sieve</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clean Sands: Less than 5% fines</td>
<td>Cu ≥ 6 and 1 ≤ Cc ≤ 3</td>
<td>SW</td>
</tr>
<tr>
<td>Sands with Fines: More than 12% fines</td>
<td>Cu &lt; 6 and/or 1 &gt; Cc &gt; 3</td>
<td>SP</td>
</tr>
<tr>
<td><strong>Sands and Clays:</strong> Liquid limit less than 50</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inorganic: PI &gt; 7 and plots on or above “A” line</td>
<td>CL</td>
<td>Lean clay</td>
</tr>
<tr>
<td>Organic: Liquid limit - oven dried</td>
<td>OL</td>
<td>Organic clay</td>
</tr>
<tr>
<td>Liquid limit - not dried</td>
<td>&lt; 0.75</td>
<td>Organic silt</td>
</tr>
<tr>
<td><strong>Sands and Clays:</strong> Liquid limit 50 or more</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inorganic: PI plots on or above “A” line</td>
<td>CH</td>
<td>Fat clay</td>
</tr>
<tr>
<td>Organic: Liquid limit - oven dried</td>
<td>MH</td>
<td>Elastic Silt</td>
</tr>
<tr>
<td>Liquid limit - not dried</td>
<td>&lt; 0.75</td>
<td>Organic silt</td>
</tr>
<tr>
<td>Highly organic soils: Primarily organic matter, dark in color, and organic odor</td>
<td>PT</td>
<td>Peat</td>
</tr>
</tbody>
</table>

A Based on the material passing the 3-in. (75-mm) sieve
B If field sample contained cobbles or boulders, or both, add “with cobbles or boulders, or both” to group name.
C Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.
D Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.
E $Cu = D_{60}/D_{10}$  
$Cc = (D_{30})^2 \cdot (D_{10} \times D_{60})$
F If soil contains ≥ 15% sand, add “with sand” to group name.
G If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

H If fines are organic, add “with organic fines” to group name.
I If soil contains ≥ 15% gravel, add “with gravel” to group name.
J If Atterberg limits plot in shaded area, soil is a CL-ML, silt clay.
K If soil contains 15 to 29% plus No. 200, add “with sand” or “with gravel,” whichever is predominant.
L If soil contains ≥ 30% plus No. 200 predominantly sand, add “sandy” to group name.
M If soil contains ≥ 30% plus No. 200, predominantly gravel, add “gravelly” to group name.
N PI ≥ 4 and plots on or above “A” line.
O PI < 4 or plots below “A” line.
P PI plots on or above “A” line.
Q PI plots below “A” line.