GEOTECHNICAL ENGINEERING REPORT

MEAD GRADER SHED
WELD COUNTY ROADS 34 AND 13
MEAD, COLORADO

NORTHERN COLORADO GEOTECH
PROJECT NO. 002-19
FEBRUARY 28, 2019

Prepared for:

Weld County Buildings and Grounds
1105 H Street
Greeley, Colorado 80631
Attn: Sterling Geesaman
February 28, 2019

Weld County Buildings and Grounds
1105 H Street
Greeley, Colorado 80631

Attn: Sterling Geesaman

Re: Geotechnical Engineering Report
Mead Grader Shed
Northern Colorado Geotech Project No. 002-19

Northern Colorado Geotech has completed a geotechnical engineering exploration for the proposed Mead Grader Shed to be located near the southwest corner of County Roads 34 and 13. This study was performed in general accordance with our proposal number P19001g dated January 3, 2019.

The subsurface soils at the site consisted of sandy lean clay and silty sand to depths of 11 to 15 feet. Siltstone/claystone bedrock was encountered at a depth of approximately 11 feet in Test Borings 1 and 2. Sandstone bedrock was encountered at a depth of 12½ in Test Boring 5. The results of our field exploration and laboratory testing indicate that the soils have low expansive potential and low load bearing capabilities.

Based on the anticipated construction and the results of our engineering exploration, it is our opinion that the proposed structures may be supported on spread footing foundations. Slab on grade may be utilized for the interior floor system provided that care is taken in the placement and compaction of the subgrade soil.

If you have any questions concerning this report or any of our consulting services, please do not hesitate to contact us.

Sincerely,
NORTHERN COLORADO GOTECH

Prepared by:
Doug Leafgren, P.G.
President

Reviewed by:
Gary G. Weeks, P.E.
Vice President

Copies to: Addresssee (3)
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<td></td>
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<tr>
<td>Laboratory Test Results</td>
<td></td>
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</tbody>
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GEOTECHNICAL ENGINEERING REPORT

MEAD GRADER SHED
WELD COUNTY ROADS 34 AND 13
MEAD, COLORADO

NORTHERN COLORADO GEOTECH
PROJECT NO. 002-19
FEBRUARY 28, 2019

SCOPE

This report contains the results of our geotechnical engineering exploration for the proposed Mead Grader shed to be located near the intersection of Weld County Roads 34 and 13. The site is located in the northeast quarter of Section 13, Township 3 North, Range 66 West of the 6th Principal Meridian.

This report includes descriptions of, and geotechnical engineering recommendations relative to:

- subsurface soil and bedrock conditions
- groundwater conditions
- foundation design and construction
- drainage
- floor slab design and construction
- earthwork

The recommendations contained in this report are based upon the results of field and laboratory testing, engineering analyses, and experience with similar soil conditions, structures and our understanding of the proposed project.

SITE CONDITIONS

The site is currently pasture ground that is sparsely vegetated with grasses and weeds. Overall surface drainage is fair to the southeast. The property is bordered to the north by Weld County Road 34. An existing residence on a acreage parcel borders the site to the west. Pasture ground was observed to the south. An approximate ¾-mile open space and Weld County Road 13 were observed to the east.

PROPOSED CONSTRUCTION

As we understand it, the project will consist of building three separate structures on the site. These will include a grader storage shed, a salt storage shed and a shed to house plow trucks. All the structures are anticipated to use spread footing foundations and slab on grade construction.
SITE EXPLORATION

A total of five test borings were drilled on January 17, 2019. The borings were drilled to approximate depths of 15 feet at the locations shown on the Site Plan, Figure 1. All borings were advanced with a truck-mounted drilling rig, utilizing 4-inch diameter solid stem augers.

The borings were located in the field by pacing from property lines and/or existing site features. Relative surface elevations at the boring locations were obtained by measurements with an engineer's level from a temporary bench mark (TBM) shown on the Site Plan. The accuracy of boring locations and elevations should only be assumed to the level implied by the methods used to determine each.

Lithologic logs of each boring were recorded by a representative of Northern Colorado Geotech during the drilling operations. At selected intervals, samples of the subsurface materials were taken by driving split-spoon and/or ring samplers. Bulk samples of subsurface materials were obtained from borings in pavement areas. Standard penetration measurements were recorded while driving a split-spoon and/or ring sampler into the subsurface materials. The standard penetration test is a useful index in estimating the density of the materials encountered.

Groundwater conditions were evaluated in each boring at the time of subsurface exploration, and seven days after the drilling.

Laboratory Testing

The samples retrieved during the subsurface exploration were returned to our laboratory for observation by the project manager. The soils were classified in general accordance with the Unified Soil Classification System. At that time, the field descriptions were confirmed or modified and an applicable laboratory testing program was formulated. Boring logs were prepared and are attached with this report.

Laboratory tests were conducted on selected samples and are presented on the boring logs and attached laboratory test sheets. The test results were used for the geotechnical engineering analyses, and the development of foundation and earthwork recommendations.

Selected samples were tested for the following engineering properties:

- Water Content
- Dry Density
- Consolidation
- Compressive Strength
- Expansion
SUBSURFACE CONDITIONS

Due to the relatively flat nature of the site, geologic hazards at the site are anticipated to be low. Seismic activity in the area is anticipated to be low; and from a structural standpoint, the property should be relatively stable. With proper site grading around proposed structures, erosional problems at the site should be minimal.

Soil and Bedrock Conditions

Soils at the site generally consisted of sandy lean clay and silty sand to depths of approximately 11 to 15 feet. In three of the test borings, the materials underlying the surface soils and extending to the maximum depth of exploration consisted of varying layers of siltstone/claystone bedrock and sandstone bedrock. Summary boring logs are attached with this report.

Groundwater Conditions

Groundwater was not observed in any test boring at the time of field exploration, nor when checked seven days after the drilling. 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 conditions can be expected to fluctuate with varying seasonal and weather conditions, and other factors.

Field Test Results

Field test results indicate that the clay soils are stiff in consistency. The sand soils vary from loose to medium dense in relative density. The bedrock varies from soft to hard in hardness.

Laboratory Test Results

Laboratory test results indicate that the soils have low expansive potential and low load bearing capabilities.

DESIGN RECOMMENDATIONS

Foundation Design

Based on the results of our subsurface exploration and the results of the laboratory testing, it is our opinion that spread footing foundations may be used for support of the proposed structures. The footings should be placed on undisturbed soils and/or engineered fill material. Potentially expansive soils will require particular attention in the design and construction.
Weld County Buildings and Grounds
Mead Grader Shed
Northern Colorado Geotech Project No. 002-19

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

Footing Foundations

Based on the results of our subsurface exploration and laboratory testing, it is our opinion that spread footing foundations bearing upon undisturbed soil and/or engineered fill may be used for support of the proposed structure. The footings may be designed for a maximum bearing pressure of 2,000 psf. In addition, the footings should be sized to maintain a minimum dead-load pressure of 500 psf. The design bearing pressure applies to dead loads plus design live load conditions. The design bearing pressure may be increased by one-third when considering total loads that include wind or seismic conditions.

Exterior footings should be placed a minimum of 30 inches below finished grade for frost protection and to provide confinement for the bearing soils. Finished grade is the lowest adjacent grade for perimeter footings.

Footings should be proportioned to reduce differential foundation movement. Proportioning on the basis of equal total movement is recommended; however, proportioning to relative constant dead-load pressure will also reduce differential movement between adjacent footings. Total movement resulting from the assumed structural loads is estimated to be on the order of 3/4 inch or less. Differential movement should be on the order of 1/2 to 3/4 of the estimated total movement. Additional foundation movements could occur if water from any source infiltrates the foundation soils; therefore, proper drainage should be provided in the final design and during construction.

Foundations and masonry walls should be reinforced as necessary to reduce the potential for distress caused by differential foundation movement. The use of joints at openings or other discontinuities in masonry walls is recommended.

Foundation excavations should be observed by Northern Colorado Geotech. If the soil conditions encountered differ significantly from those presented in this report, supplemental recommendations may be required.

Surface Drainage

Positive drainage should be provided during construction and maintained throughout the life of the proposed project. Infiltration of water into utility or foundation excavations must be prevented during construction. Planters and other surface features which could retain water in areas adjacent to the building or pavements should be sealed or eliminated. In areas where sidewalks or paving do not immediately adjoin the structure, we recommend that protective slopes be provided with a minimum
grade of approximately 10 percent for at least 10 feet from perimeter walls. Backfill against footings, exterior walls, and in utility and sprinkler line trenches should be well compacted and free of all construction debris to reduce the possibility of moisture infiltration.

Downspouts, roof drains or scuppers should discharge into splash blocks or extensions when the ground surface beneath such features is not protected by exterior slabs or paving. Sprinkler systems should not be installed within 5 feet of foundation walls. Landscaped irrigation adjacent to the foundation system should be minimized or eliminated.

Floor Slab Design and Construction

Some differential movement of slab-on-grade floor systems is possible should the subgrade soils become elevated in moisture content. To reduce potential slab movements, the subgrade soils should be prepared as outlined in the earthwork section of this report.

For structural design of concrete slabs-on-grade, a modulus of subgrade reaction of 100 pounds per cubic inch (pci) may be used for floors supported on existing or engineered fill consisting of on-site soils. A modulus of 200 pci may be used for floors supported on a minimum of two feet of structural fill meeting the specifications outlined below.

Additional floor slab design and construction recommendations are as follows:

- Positive separations and/or isolation joints should be provided between slabs and all foundations, columns or utility lines to allow independent movement.

- Control joints should be provided in slabs to control the location and extent of cracking.

- A minimum 2-inch void space should be constructed above, or below non-bearing partition walls placed on the floor slab. Special framing details should be provided at door jambs and frames within partition walls to avoid potential distortion. Partition walls should be isolated from suspended ceilings.

- Interior trench backfill placed beneath slabs should be compacted in accordance with recommended specifications outlined below.

- In areas subjected to normal loading, a minimum 4-inch layer of sand, clean-graded gravel or aggregate base course should be placed beneath interior slabs.
Weld County Buildings and Grounds  
Mead Grader Shed  
Northern Colorado Geotech Project No. 002-19

- Floor slabs should not be constructed on frozen subgrade.
- Other design and construction considerations, as outlined in the ACI Design Manual, Section 302.1R are recommended.

Exterior slabs-on-grade, exterior architectural features, and utilities founded on, or in backfill may experience some movement due to the volume change of the backfill. Potential movement could be reduced by:

- minimizing moisture increases in the backfill
- controlling moisture-density during placement of backfill
- using designs which allow vertical movement between the exterior features and adjoining structural elements
- placing effective control joints on relatively close centers

General Earthwork

All earthwork on the project should be observed and evaluated by Northern Colorado Geotech. The evaluation of earthwork should include observation and testing of engineered fill, subgrade preparation, foundation bearing soils, and other geotechnical conditions exposed during the construction of the project.

Site Preparation

Strip and remove existing vegetation, debris, and other deleterious materials from proposed building and pavement areas. All exposed surfaces should be free of mounds and depressions which could prevent uniform compaction.

Stripped materials consisting of vegetation and organic materials should be wasted from the site, or used to revegetate landscaped areas or exposed slopes after completion of grading operations.

If unexpected fills or underground facilities are encountered, such features should be removed and the excavation thoroughly cleaned prior to backfill placement and/or construction.

It is anticipated that excavations for the proposed construction can be accomplished with conventional earthmoving equipment.

The individual contractor(s) is responsible for designing and constructing stable, temporary excavations as required to maintain stability of both the excavation sides and bottom. All
excavations should be sloped or shored in the interest of safety following local, and federal regulations, including current OSHA excavation and trench safety standards.

**Fill Materials and Placement**

All exposed areas which will receive fill should be scarified to a minimum depth of eight inches, conditioned to near optimum moisture content, and compacted.

The placement of soils on the site should be observed by Northern Colorado Geotech. The fill should be assessed for suitability of use in the proposed fill and tested for placement including compaction percentage and moisture content.

Engineered fill should be placed and compacted in horizontal lifts, using equipment and procedures that will produce recommended moisture contents and densities throughout the lift. Recommended compaction criteria for engineered fill materials are as follows:

Clean on-site soils or approved imported materials may be used as fill material.

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

<table>
<thead>
<tr>
<th>Gradation</th>
<th>Percent fines by weight (ASTM C136)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6&quot;</td>
<td>100</td>
</tr>
<tr>
<td>3&quot;</td>
<td>70-100</td>
</tr>
<tr>
<td>No. 4 Sieve</td>
<td>50-100</td>
</tr>
<tr>
<td>No. 200 Sieve</td>
<td>60 (max)</td>
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</tbody>
</table>

- Liquid Limit ........................................ 30 (max)
- Plasticity Index .................................... 15 (max)

<table>
<thead>
<tr>
<th>Material</th>
<th>Minimum Percent (ASTM D698)</th>
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<tbody>
<tr>
<td>Scarified subgrade soils</td>
<td>95</td>
</tr>
</tbody>
</table>

On-site and imported fill soils:
- Beneath foundations .................. 95
- Beneath slabs ......................... 95
- Aggregate base ....................... 95
On-site or imported clay soils should be compacted within a moisture content range of 2 percent below, to 2 percent above optimum. Granular soils should be compacted within a moisture range of 3 percent below to 3 percent above optimum unless modified by the project geotechnical engineer.

GENERAL COMMENTS

The analysis and recommendations presented in this report are based upon data obtained from borings performed to obtain representative subsurface conditions at the site. Variations in the soil between borings will occur. Northern Colorado Geotech should be present during construction to observe the excavation and construction procedures and confirm or modify our recommendations.

The scope of services for this project does not include either specifically or by implication any environmental assessment of the site.

This report is intended exclusively for the use by the client. Any use or reuse of the findings and/or recommendations of this report by parties other than the client without the written consent of Northern Colorado Geotech is undertaken at said parties' sole risk.

This report has been prepared in accordance with generally accepted geotechnical engineering practices in this area at this time. No warranties, either express or implied, are intended or made.
WE ARE UNAWARE OF ANY EASEMENTS OR ROWS THAT WILL IMPACT THE PLACEMENT OF THE SEPTIC SYSTEM ON THE SITE.

BORING LOCATION PLAN
PROPOSED BUILDINGS AND SEPTIC SYSTEM
SW CORNER OF WELD COUNTY ROADS 34 AND 13
MEAD, COLORADO
FOR WELD COUNTY BUILDINGS AND GROUNDS

Other than the distances to setback objects indicated on the design documents, no other objects requiring setbacks from the proposed CWTS, as indicated in Table 30-7-1 of Chapter 30 of the Weld County Code, have been located or observed during our preliminary investigation, reconnaissance or detailed soil investigation.
LOG OF BORING No. 1

Weld County Buildings & Grounds

SW Corner of WCR 34 and 13
Mead, Colorado

Approx. Surface Elev.: 96.7 ft.

0.5
6" TOPSOIL

SANDY LEAN CLAY
Tan to brown, moist, stiff

11.0
WEATHERED SILTSTONE/CLAYSTONE
Tan, moist, soft

13.0
SILTSTONE/CLAYSTONE
Tan, moist, hard

15.0
BOTTOM OF BORING

STARTED 1/17/19  FINISHED 1/17/19
NCG PROJECT NO. 002-19

WATER LEVEL OBSERVATIONS

WL  None  W.D.
WL  None  A.B.

When Checked 7 Days A.B.

Northern
Colorado
Geotech

2956 29th Street, Unit 21
Greeley, Colorado 80631
Phone: 970-506-9244
Fax: 970-506-9242

DRILL CO.  Drilling Eng  DRILL RIG  CME-55
LOGGED BY  TK  APPROVED  DML
LOG OF BORING No. 2

CLIENT
Weld County Buildings & Grounds

SITE
SW Corner of WCR 34 and 13
Mead, Colorado

ARCHITECT/ENGINEER

PROJECT
Mead Grader Shed

SAMPLES

<table>
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<tr>
<th>DEPTH (FT)</th>
<th>BLOWS/12&quot; N-VALUE</th>
<th>NUMBER</th>
<th>TYPE</th>
<th>IN DRIVEN IN RECOVERED</th>
<th>MOISTURE, %</th>
<th>DRY DENSITY,pcf</th>
<th>HANC PENTROMETER psf</th>
<th>LIQUID LIMIT,PLASTIC INDEX</th>
<th>PERCENT FINES</th>
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<tr>
<td>13</td>
<td>1</td>
<td>SS</td>
<td>18</td>
<td>11</td>
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<td>101</td>
<td>8,000</td>
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<tr>
<td>9</td>
<td>3</td>
<td>SS</td>
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<tr>
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SANDY LEAN CLAY
Tan to brown, moist, stiff

WEATHERED SILTSTONE/CLAYSTONE
Tan, moist, soft

SILTSTONE/CLAYSTONE
Tan, moist, hard

BOTTOM OF BORING

WATER LEVEL OBSERVATIONS

<table>
<thead>
<tr>
<th>WL</th>
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<th>W.D.</th>
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<tbody>
<tr>
<td>WL</td>
<td>None</td>
<td>A.B.</td>
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When Checked 7 Days A.B.

Northern Colorado Geotech

2956 29th Street, Unit 21
Greeley, Colorado 80631
Phone: 970-506-5244
Fax: 970-506-5242

STARTED 1/17/19 FINISHED 1/17/19

DRILL CO. Drilling Eng DRILL RIG CME-55
LOGGED BY TK APPROVED DML

NCG PROJECT NO. 002-19
Approx. Surface Elev.: 94.4 ft.

<table>
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<tr>
<th>Depth (ft)</th>
<th>Description</th>
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<tbody>
<tr>
<td>0.5</td>
<td>6&quot; TOPSOIL</td>
</tr>
<tr>
<td>9.0</td>
<td>SILTY SAND</td>
</tr>
<tr>
<td>15.0</td>
<td>BOTTOM OF BORING</td>
</tr>
</tbody>
</table>

**Samples**

- **Blows/12" N-Value**: 18
- **In Driven in Recovered**: 17
- **Moisture, %**: 12
- **Dense PCF**: 97
- **Hand Penetrometer psf**: 9,000
- **Liquid Limit Index Percent Fines**: 1.4% Swell

**Water Level Observations**

<table>
<thead>
<tr>
<th>WL</th>
<th>None</th>
<th>W.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>WL</td>
<td>None</td>
<td>A.B.</td>
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When checked 7 days A.B.

**Started**: 1/17/19  **Finished**: 1/17/19

**Drill Co. Drilling Eng**: TK

**Drill Rig**: CME-55

**Logged By**: TK  **Approved**: DML

**NCG Project No.**: 002-19
### LOG OF BORING No. 4

**CLIENT**  
Weld County Buildings & Grounds

**SITE**  
SW Corner of WCR 34 and 13  
Mead, Colorado

**PROJECT**  
Mead Grader Shed

<table>
<thead>
<tr>
<th>DEPTH (FT)</th>
<th>SAMPLES</th>
<th>TESTS</th>
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<tbody>
<tr>
<td></td>
<td>BLOWS/12&quot;</td>
<td>NUMBER</td>
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<tr>
<td>0.5</td>
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<td>1</td>
</tr>
<tr>
<td>9.0</td>
<td>16</td>
<td>2</td>
</tr>
<tr>
<td>15.0</td>
<td>9</td>
<td>3</td>
</tr>
</tbody>
</table>

**Approx. Surface Elev.: 92.2 ft.**

- **6" TOPSOIL**
  - SANDY LEAN CLAY  
    - Tan to brown, moist, stiff

- **SILTY SAND**
  - Tan, moist, loose

**BOTTOM OF BORING**  
77.2 ft

---

**WATER LEVEL OBSERVATIONS**

<table>
<thead>
<tr>
<th>WL</th>
<th>None</th>
<th>W.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>None</td>
<td>A.B.</td>
</tr>
</tbody>
</table>

When Checked 7 Days A.B.

---

**Northern Colorado Geotech**

2956 29th Street, Unit 21  
Greeley, Colorado 80631  
Phone: 970-506-9244  
Fax: 970-506-9242

**STARTED** 1/17/19  **FINISHED** 1/17/19

**DRILL CO.** Drilling Eng.  **DRILL RIG** CME-55

**LOGGED BY** TK  **APPROVED** DML

**NCG PROJECT NO.** 002-19
LOG OF BORING No. 5

CLIENT
Weld County Buildings & Grounds

SITE
SW Corner of WCR 34 and 13
Mead, Colorado

ARCHITECT/ENGINEER

PROJECT
Mead Grader Shed

SAMPLES

TESTS

DEPTH (FT.)
17 1 SS 18 18

BLOWS/12" N-VALUE

IN. DRIVEN

RECOVERED

MOISTURE. %

DRY DENSITY

HAND PENETROMETER p.s

LIQUID LIMIT

PLASTIC INDEX

PERCENT FINES

GRIP

Approx. Surface Elev.: 90.6 ft.

0.5 6" TOPSOIL

SANDY LEAN CLAY
Tan to brown, moist, stiff

12.5

WEATHERED SANDSTONE
Tan, moist, soft

14.5

SANDSTONE
Tan, moist, hard

15.0

BOTTOM OF BORING

WATER LEVEL OBSERVATIONS

WL None W.D.

WL None A.B.

When Checked 7 Days A.B.

STARTED 1/17/19 FINISHED 1/17/19

DRILL CO. Drilling Eng DRILL RIG CME-55

LOGGED BY TK APPROVED DML

NCG PROJECT NO. 002-19
<table>
<thead>
<tr>
<th>Specimen Identification</th>
<th>Classification</th>
<th>$\gamma_d$</th>
<th>MC%</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Sandy Lean Clay</td>
<td>98</td>
<td>8</td>
</tr>
</tbody>
</table>

### CONSOLIDATION TEST

Client: Weld County Buildings & Grounds  Number: 002-19

Project: Mead Grader Shed

Location: SW Corner of WCR 34 and 13
<table>
<thead>
<tr>
<th>Specimen Identification</th>
<th>Classification</th>
<th>$\gamma_d$</th>
<th>MC%</th>
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<tbody>
<tr>
<td>2</td>
<td>Sandy Lean Clay</td>
<td>100</td>
<td>7</td>
</tr>
</tbody>
</table>

CONSOLIDATION TEST

Client: Weld County Buildings & Grounds  Number: 002-19
Project: Mead Grader Shed
Location: SW Corner of WCR 34 and 13
<table>
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<tr>
<th>Specimen Identification</th>
<th>Classification</th>
<th>$\gamma_d$</th>
<th>MC%</th>
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<tbody>
<tr>
<td>4</td>
<td>Sandy Lean Clay</td>
<td>94</td>
<td>10</td>
</tr>
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**CONSOLIDATION TEST**

Client: Weld County Buildings & Grounds  Number: 002-89
Project: Mead Grader Shed
Location: SW Corner of WCR 34 and 13
<table>
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<th>Classification</th>
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<th>MC%</th>
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<tr>
<td>5</td>
<td>Sandy Lean Clay</td>
<td>96</td>
<td>11</td>
</tr>
</tbody>
</table>

**CONSOLIDATION TEST**

Client: Weld County Buildings & Grounds   Number: 002-9
Project: Mead Grader Shed
Location: SW Corner of WCR 34 and 13