AGEC
Applied GeoTech

GEOTECHNICAL INVESTIGATION

CEDAR IRON APEX
RAILROAD SPUR
CEDAR CITY, UTAH

PREPARED FOR:

BZI STEEL (BUILDING ZONE INDUSTRIES)
HC BOX 340
KANARAVILLE, UTAH 84742

ATTENTION: RYAN OBRAY

PROJECT NO. 2220054

JUNE 4, 2022

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SUMMARY

1. Applied Geotechnical Engineering Consultants, Inc. (AGEC) has conducted a geotechnical study for the proposed railroad spur at the Cedar Apex project in Iron County, west of Cedar City, Utah at the location shown on Figure 1. The field study for the project included the drilling of 2 borings at the approximate locations shown on Figure 2.

2. The subsurface profile observed within the explorations generally consists of interlayered silty sand, sandy, silty clay and lean clay to a depth of approximately 20 feet The upper approximately 2 feet of silty sand or sandy, silty clay is generally low to non plastic with fines contents varying from 35 to 50 percent. The subsurface soils within Boring B-1 were found to gradually increase with depth in fines content and plasticity. The soils gradually changed with depth from silty clay to lean with varied amounts of sand. The upper soils consisted of silty clay, lean and fat clay and is underlain by silty sand at a depth of approximately 9 feet in Boring B-2. Laboratory testing indicated the upper approximately 3 to 5 feet is collapsible or moisture sensitive.

3. No groundwater was encountered within the borings to the depths investigated.

4. We anticipate that the section will require up to several feet of fill to match the existing railroad (see photos 1 and 2 included within the appendix of the report). Due to the near surface soft/loose soils, prior to placing additional fill or the proposed roadbed section for the railroad spur, we recommend removing, processing and replacing at least 2 feet of the existing soils with proper compaction. Subgrade preparation, material and compaction recommendations are provided within the report.

5. The on-site soils may be re-used as fill or subgrade soils to support the rail tracks. The on-site soils were found to be dry and will require moisture conditioning prior to use as fill. The on site soils were classified as Zone 2 soils based on Union Pacific, Standard (STD) Drawing (DWG) 0013A. This classification will result in the need for a thickness of 12 inches of subballast.

6. There are no geologic hazards related to earthquakes that were observed on the site or within the available geologic literature.

SCOPE/REFERENCES

This report presents the results of a geotechnical investigation for the proposed railroad spur to be constructed at th approximate location shown on Figure 1. A field study was conducted that consisted of drilling 2 exploratory borings at the approximate locations shown on Figure 2.

This report presents the subsurface conditions encountered, laboratory test results, and recommendations for the project. This report was prepared in general accordance with the Proposal for Professional Geotechnical Services dated March 4, 2022.

This report has been prepared to summarize the data obtained during the study and to present our conclusions and recommendations based on the proposed construction and the subsurface conditions encountered. Design parameters and a discussion of geotechnical engineering considerations related to construction are included within this report.

AGEC has referenced the following documents as a part of the study:

1. “Union Pacific Railroad Industrial Track Specifications”, dated February 26, 2020.
2. “Union Pacific Public Projects, Geotechnical Requirements, dated March 19, 2020.
3. “Open File Report 627” , Utah Geological Survey, Interim Geologic Map of the Cedar City NW Quadrangle, Iron County, Utah, Knudsen and Biek, 2014.
4. “Utah Geologic Survey, Hazards Map Portal, https://geology.utah.gov/apps/hazards/
5. “Geotechnical Study”, American Packaging Corporation Facility, (located to the SE of the project site), by AGEC, Project No. 2211462, dated October 5, 2021.
6. AGEC also provided Quality Control for the SunEdison Solar Project to the NE of the project. AGEC has also reviewed the geotechnical study for the project prepared by Ninyo & Moore, dated April 23, 2015, Project No. 303839001.

SITE CONDITIONS

The site is located along the southwest side of the Union Pacific Railroad at Milepost 24.62 within the Cedar City Subdivision west of Cedar City in Iron County, Utah. The existing railroad alignment is oriented in a northwest to southeast direction along the east side of the Cedar Apex Development property. The railroad is generally several feet above the adjacent grade. There is an existing access/frontage roadway along the west side of the existing railroad along the portion of the spur to be constructed. The property is bounded with barbed wire fences along the perimeter of the property. Existing vegetation varies across the site with areas of moderate amounts of grasses/weeds and small brush. The general slope of the site is downward to the south and southeast. Photos that depict the area along the spur location are included within the appendix of this report.

FIELD STUDY

On March 9, 2022 an engineer from AGEC observed the drilling of 2 borings at the locations shown on Figure 2. The locations and elevations of the borings were determined by a hand held GPS device and the accuracy of the device for the location and elevation should be considered. The borings were drilled along the access road adjacent the proposed alignment of the railroad as shown on Figure 2 and within the attached photos.

SUBSURFACE SOIL CONDITIONS

The subsurface profile observed within the explorations generally consists of interlayered silty sand, sandy, silty clay and lean clay to a depth of approximately 20 feet The upper approximately 2 feet of silty sand or sandy, silty clay is generally low to non plastic with fines contents varying from 35 to 50 percent. The subsurface soils within Boring B-1 were found to gradually increase with depth in fines content and plasticity. The soils gradually changed with depth from silty clay to lean with varied amounts of sand. The upper soils consisted of silty clay, lean and fat clay and is underlain

by silty sand at a depth of approximately 9 feet in Boring B-2. Laboratory testing showed the upper approximately 3 to 5 feet were moderately collapsible or moisture sensitive.

A general description along with laboratory test results for the various soil types are described below:

Lean Clay (CL): The lean clay was encountered generally at depths of 2 to 7 feet below the surface. The lean clay contained varied amounts of sand is generally stiff to very stiff. The lean clay was slightly moist to moist and light brown in color. The plasticity of the clay is generally low to medium. A layer of fat clay or higher plasticity was encountered within Boring B-2 at a depth of 4 feet.

Laboratory tests conducted on samples of the lean clay indicate in place moisture contents varying from 8 to 25 percent with in-place, dry density values ranging from 92 to 107 pounds per cubic foot (pcf). Gradation tests indicate the lean clay has a fines content (percent passing the No. 200 sieve) ranging from 50 to 100 percent. Atterberg Limit tests indicate a liquid limit varying from 25 to 59 percent and plasticity indexes of 11 to 32 percent. One dimensional consolidation tests conducted on the clay indicate the near surface clay is moderately moisture sensitive/collapsible and the deeper clay soils are non to slightly moisture sensitive.

Silty Clay (CL-ML): The silty clay was encountered from a depth of 2 to 7 feet below the surface within Boring B-1 and in the upper 2 feet of Boring B-2. The silty clay contained varied amounts of sand was generally medium stiff to stiff. The silty clay was slightly moist to moist and light brown in color.

Laboratory tests conducted on samples of the silty-clay indicate in place moisture contents varying from 4 to 7 percent with in-place, dry density values ranging from 92 to 98 (pcf). Gradation tests indicate the silty-clay has a fines content ranging from 50 to 96 percent. Atterberg Limit tests indicate a liquid limit of 21 percent and plasticity indexes of 5 to 7 percent. A one dimensional consolidation tests conducted on the silty-clay indicates the upper 3 to 5 feet of these soils are moderately to highly moisture sensitive. A moisture

density relationship test (proctor) indicates a maximum dry density of 125.0 pcf and an optimum moisture content of 10.0 percent.

Silty Sand (SM): The silty sand is encountered at the surface of Boring B-1 and at a depth of approximately 9 feet in Boring B-2. The silty sand contained varied amounts of silt was generally medium dense to very dense. The silty sand is slightly moist to moist and light brown in color.

Laboratory tests conducted on samples of the silty sand indicate in place moisture contents varying from 4 to 10 percent, with in-place, dry density values ranging from 99 to 108 pcf. Gradation tests indicate the sand has a fines content ranging from 10 to 47 percent. A moisture density relationship test (proctor) indicates a maximum dry density of 130.0 pcf and an optimum moisture content of 8.0 percent.

The Logs of the Exploratory Borings are shown on Figure 3. The laboratory test results are also shown on Figure 3 and in the Summary of Laboratory Test Results, Table 1. The consolidation tests are shown on Figures 4 through 6 and the moisture density relationship tests (proctors) are shown on Figures 7 and 8.

SUBSURFACE WATER

Subsurface water was not encountered within the borings to the maximum depth investigated, approximately 20 feet. Fluctuations in the groundwater level may occur over time. An evaluation of such fluctuations is beyond the scope of this report.

PROPOSED CONSTRUCTION

We understand it is proposed to construct a railroad spur along the west to southwest side of the existing Union Pacific Railroad within the Cedar Apex Property as shown on Figures 1 and 2. We

anticipate that the spur will be constructed by raising the grade several feet to match the approximate grade of the existing railroad. The railroad spur will be constructed following the standard design using Union Pacific standard specifications (Reference No. 1).

RECOMMENDATIONS

Based on our experience in the area, the subsurface conditions encountered, laboratory test results, and the proposed construction, the following recommendations are given:

1. Grubbing

   Prior to placing fill, the site should be grubbed to remove vegetation and soil containing roots and organics. The amount of soil removal will vary up to approximately 12 inches.

2. Subgrade Overexcavation

   Due to the soft/loose, moisture sensitive soils near surface, we recommend that 2 feet of the near surface soils be overexcavated, moisture conditioned and properly recompacted. The overexcavation should extend at least 2 feet beyond the embankment area. Subsequent to overexcavation, the subgrade should be be prepared by scarifying, moisture conditioning and recompacting the exposed subgrade to at least 90 percent of the maximum dry density as per ASTM D-1557.

3. Excavation

   The excavation will be in the silt, clay, and sand type soils. We anticipate that the excavation may be conducted with standard excavation equipment. If wet moisture periods exist during grading, it may be necessary to limit the amount of heavy rubber tire equipment to avoid “pumping” of the subgrade.

4. Embankment Slopes

   Embankment slopes may be constructed at slopes of up to 2:1 (horizontal to vertical).

5. Materials

   The on-site soils free of organics may be used as site grading fill to raise the embankment. AGEC is currently conducting additional studies for the use of various materials within the overall property. Based on Union Pacific, Standard Drawing 0013A, the subgrade materials are mostly in zone 2. Based on the correlation, the proposed railroad will require 12 inches of subballast.

   Materials used for the ballast and Subballast portions of the roadbed section should meet the Union Pacific requirements as per standard drawing 0010E .

6. Subballast and Ballast Materials

   We anticipate that the subballast materials may be produced from sources on the site as noted above in AGEC's additional investigation. Materials used for the ballast and Subballast portions of the roadbed section should meet the Union Pacific requirements as per standard drawing 0010E .

7. Compaction

   Compaction of materials placed at the site should equal or exceed at least 95 percent of the maximum dry density as determined by ASTM D-1557. Based on Union Pacific guidelines, the compaction may be reduced to at least 90 percent for the zone below 3 feet from the top of the subgrade.

   To facilitate the compaction process, the fill should be moisture conditioned to within 3 percentage points of the optimum moisture content as determined by ASTM D-1557 prior to placement.

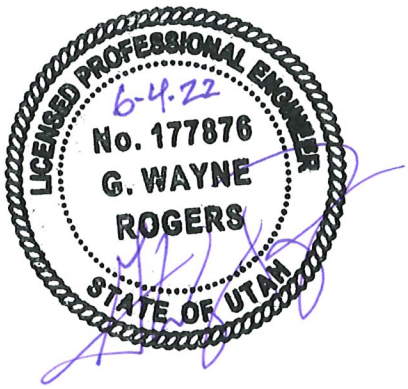
   Fill should be placed in loose lift thicknesses which do not exceed the capacity of the equipment being utilized. Generally, 8 to 12-inch, loose lifts are appropriate prior to compacting the material.

LIMITATIONS

This report has been prepared in accordance with generally accepted soil and foundation engineering practices in the area for the use of the client for design purposes. The conclusions and recommendations included within the report are based on the information obtained from the borings drilled, laboratory test results and from our experience in the area. Variations in the subsurface conditions may not become evident until excavation is conducted. If the subsurface conditions or groundwater level are found to be significantly different from those described above, we should be notified to reevaluate our recommendations.

If you have any questions or if we can be of further service please call.

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC.



G. Wayne Rogers, P.E.

Reviewed by: J.E., P.E.

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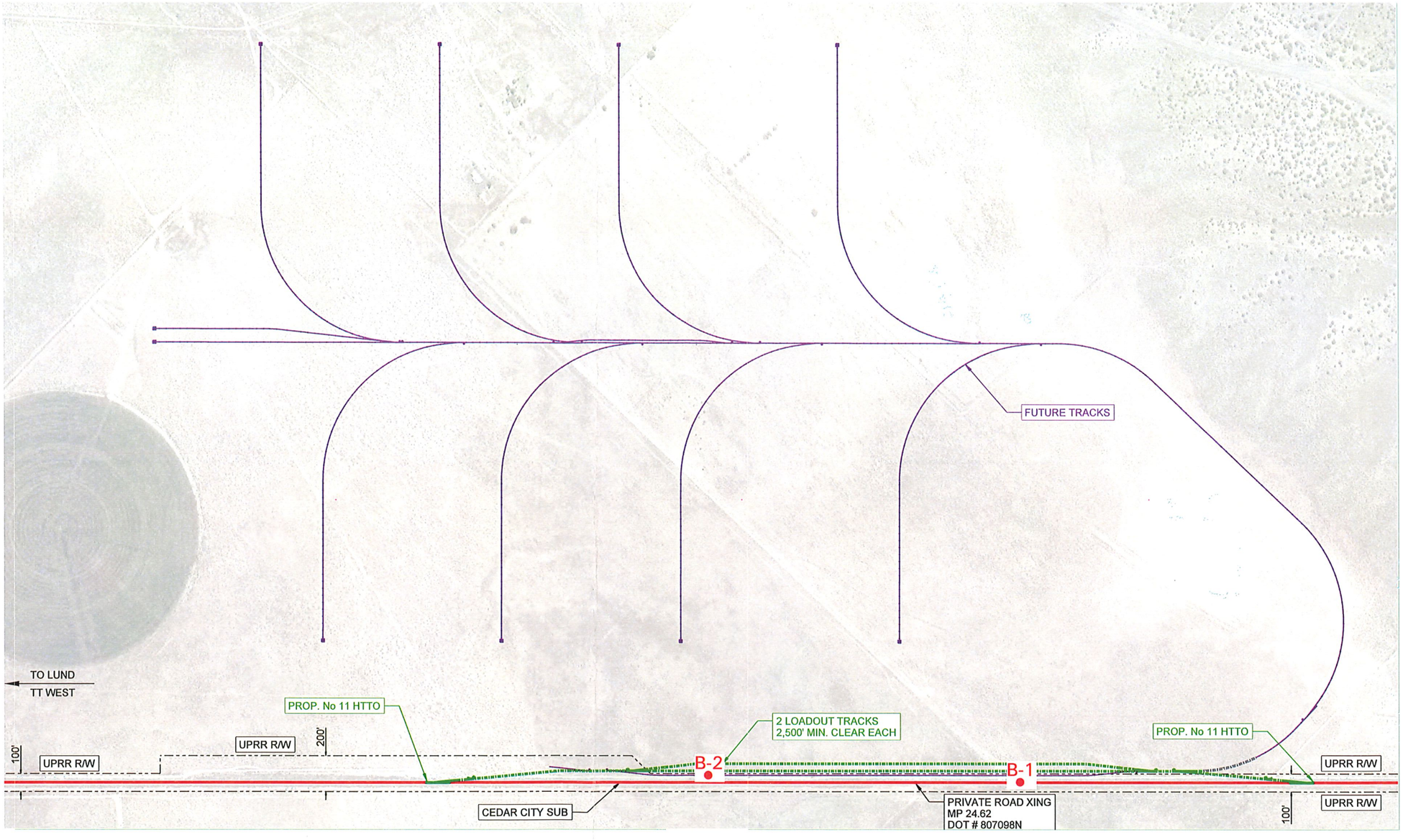
CEDAR IRON APEX
RAILROAD SPUR
CEDAR CITY, UTAH

N

Not to Scale

2220054	AGEC	Vicinity Map	Figure 1

CEDAR IRON APEX
RAILROAD SPUR
CEDAR CITY, UTAH

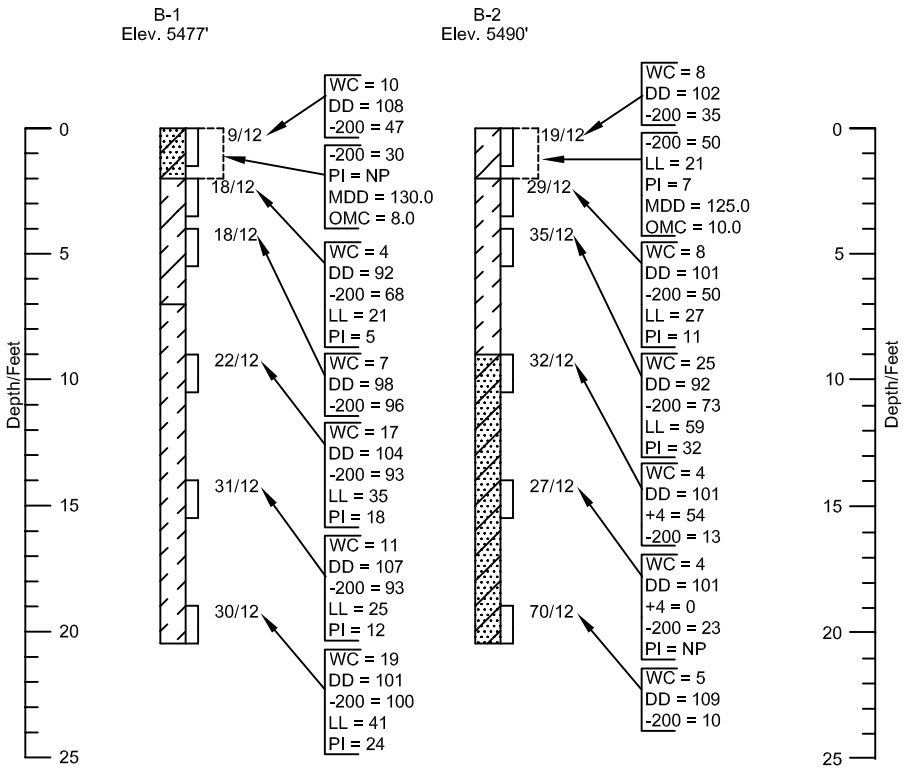


N

0 600 1200 feet

● Approximate boring location

2220054	AGEC	Site Plan	Figure 2



LEGEND:

Lean Clay (CL); varied amounts of sand, stiff to very stiff, slightly moist, varies from low to medium plastic, light brown.

Silty -Clay (CL-ML); varied amounts of sand, medium stiff to stiff, slightly moist, light brown.

Silty Sand (SM); medium dense to very dense, interlayered with thin layers of silt and clay and occasional small gravel, slightly moist, generally fine grained, brown.

10/12 California drive sample taken. The symbol 10/12 indicates that 10 blows from a 140 pound hammer falling 30 inches were required to drive the sampler 12 inches.

Indicates disturbed sample taken.

NOTES:

1. The borings were drilled on March 9, 2022 with a truck mounted drill rig equipped with 4-inch solid-stem augers.
2. The locations and elevations of the borings were located by a hand held GPS.
3. The boring locations and elevations should be considered accurate only to the degree implied by the method used.
4. The lines between the materials shown on the logs represent the approximate boundaries between material types and the transitions may be gradual.
5. Free water was not encountered in the borings at the time of drilling.
6. WC = water content (%);
   DD = dry density (pcf);
   +4 = percent retained on the No. 4 sieve;
   -200 = percent passing No. 200 sieve;
   LL = liquid limit (%);
   PI = plasticity index (%);
   NP = non-plastic;
   MDD = maximum dry density (pcf);
   OMC = optimum moisture content (%);

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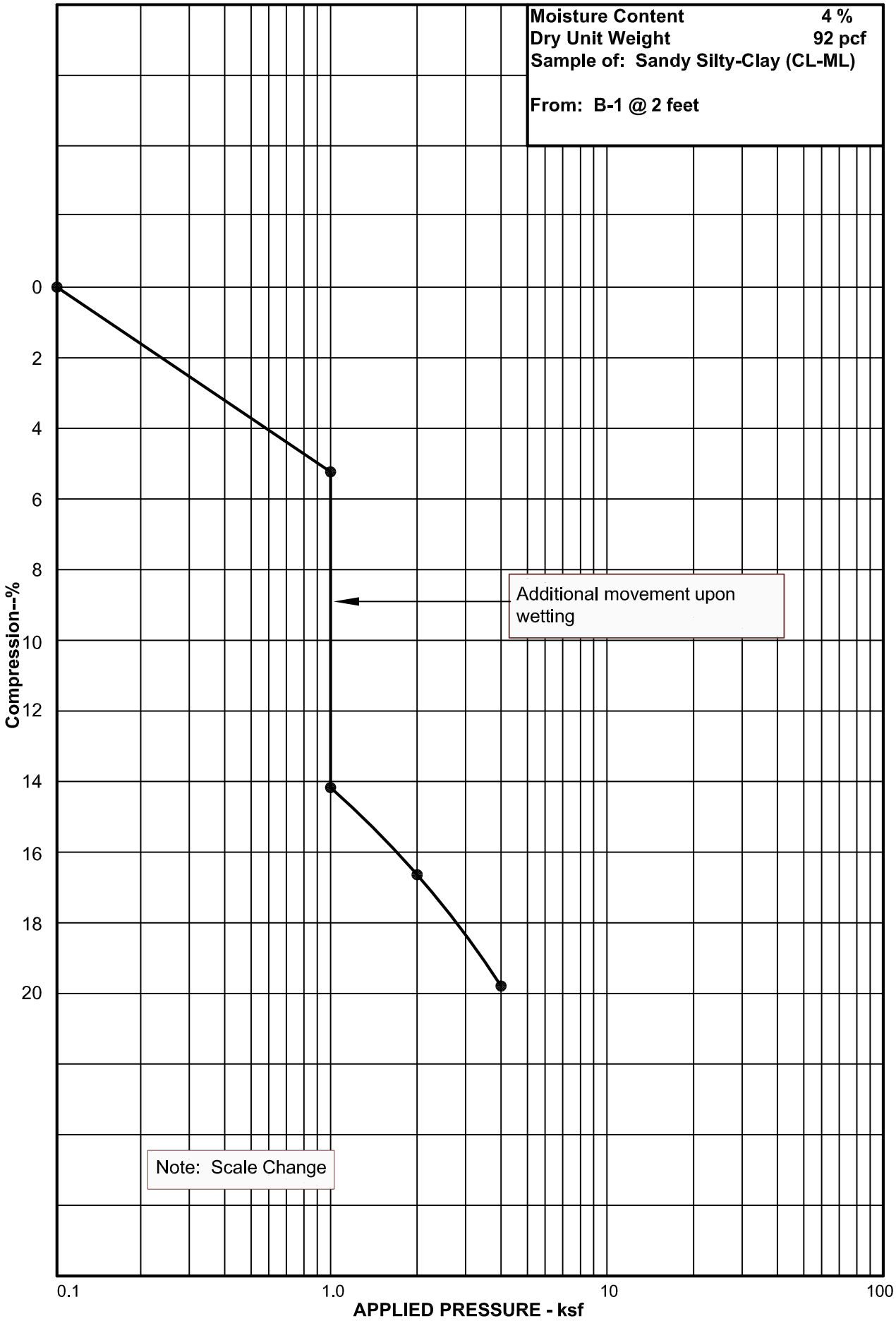
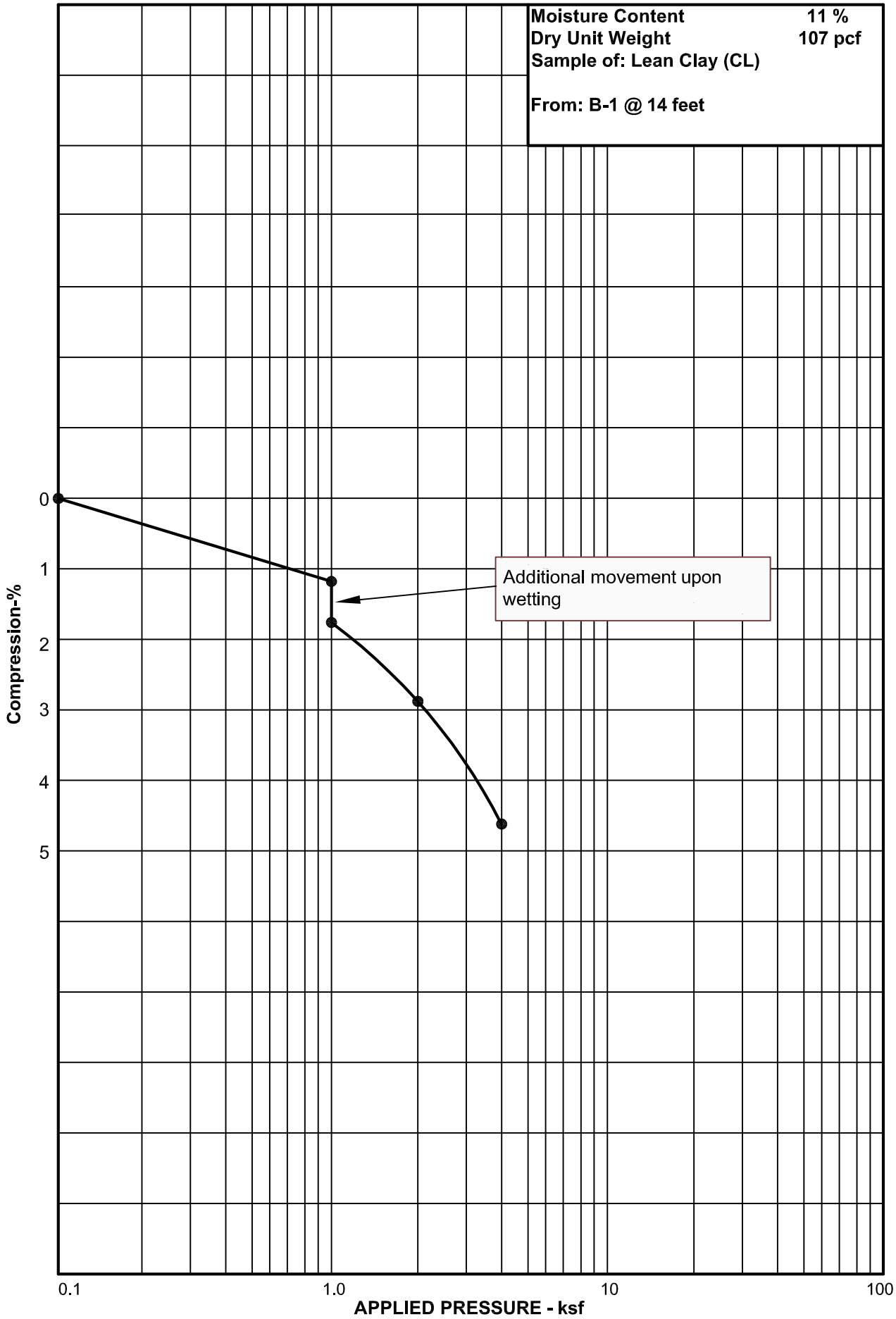


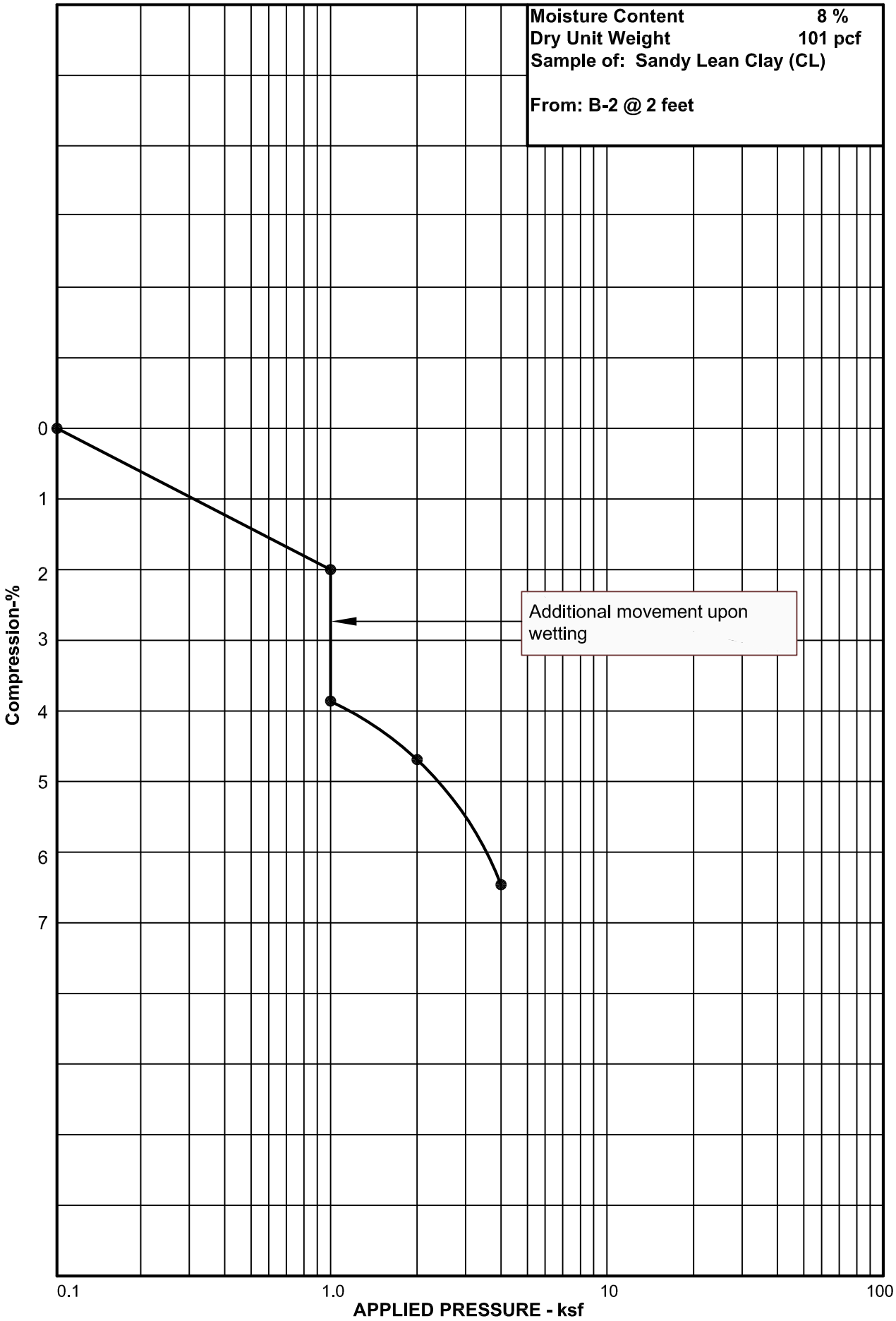
Project No. 2220054 **CONSOLIDATION TEST RESULTS** **Figure 4**

Applied Geotechnical Engineering Consultants, Inc.



Project No. 2220054 **CONSOLIDATION TEST RESULTS** Figure 5

Applied Geotechnical Engineering Consultants, Inc.



Project No. 2220054 **CONSOLIDATION TEST RESULTS** **Figure 6**

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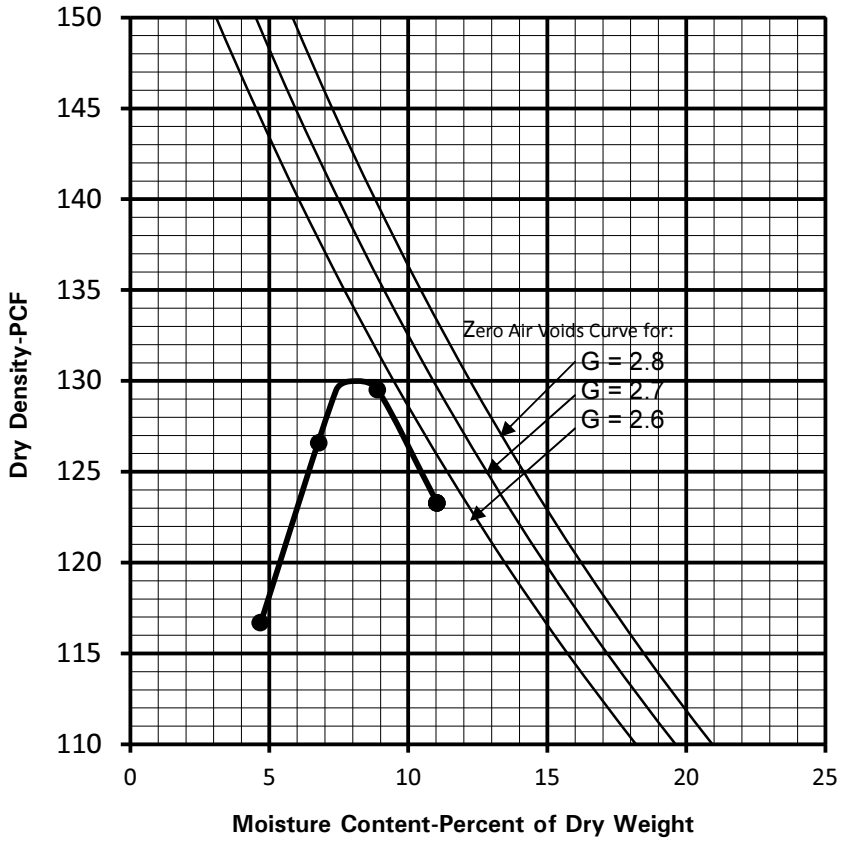
Project: Cedar Apex Rail Spur



Sample Date:	2/26/22
Sample No.	220328A
Maximum Dry Density:	130.0
Optimum Moisture:	8.0

Atterberg Limits

Liquid Limit:	
Plasticity Index:	Non-Plastic

Gradation

Gravel:	0%
Sand:	70%
Silt & Clay:	30%

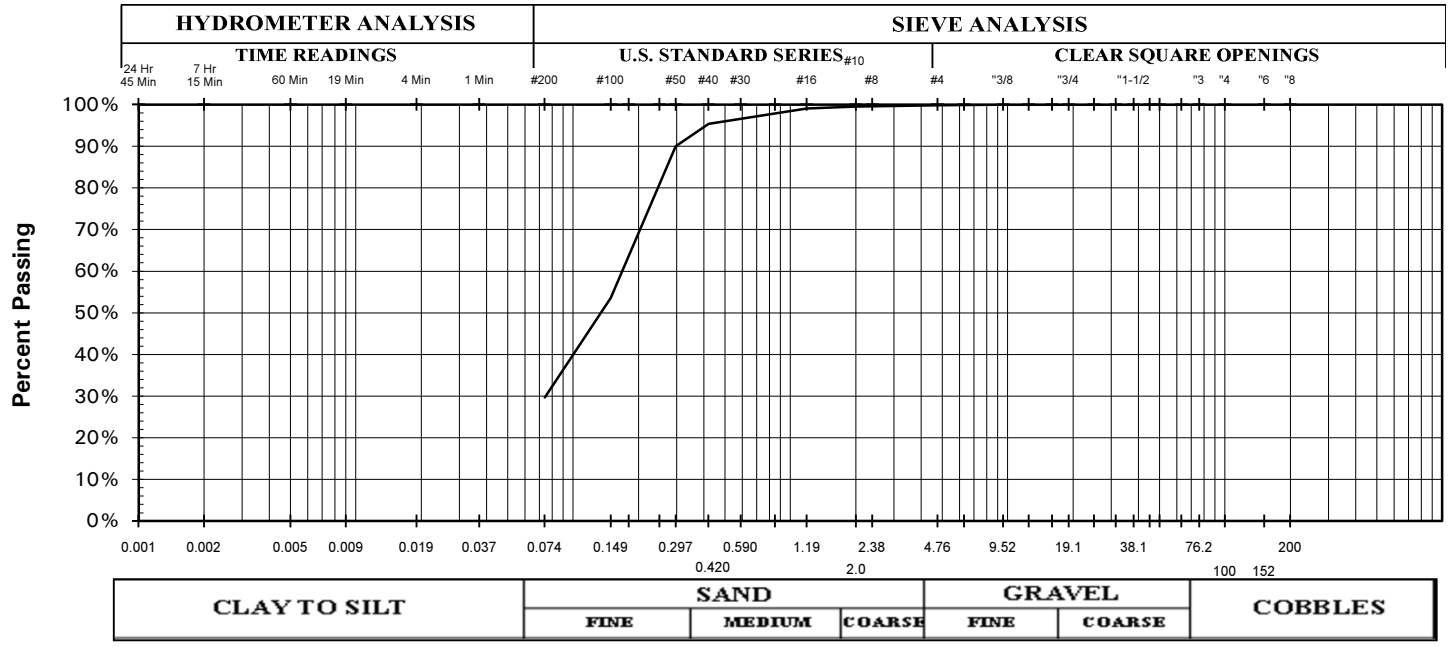
Moisture - Density Relationship Test Procedure: ASTM D-1557 B

Reviewed By: TT

USCS Classification: silty sand (SM)

AASHTO Classification: A-2-4

Sample Location: B-1 @ 0-2'



GRADATION AND MOISTURE-DENSITY RELATIONSHIP RESULTS

Project No.: 2220054

Figure: 7

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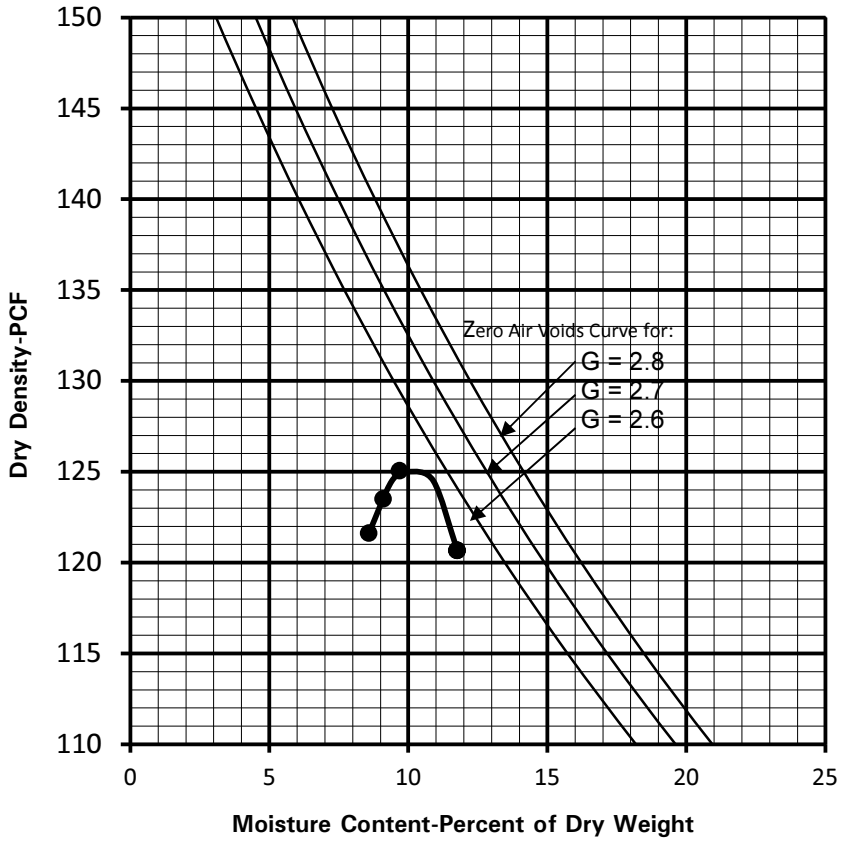
Project: Cedar Apex Rail Spur



Sample Date:	2/26/22
Sample No.	220328B
Maximum Dry Density:	125.0
Optimum Moisture:	10.0

Atterberg Limits

Liquid Limit:	21%
Plasticity Index:	7%

Gradation

Gravel:	0%
Sand:	50%
Silt & Clay:	50%

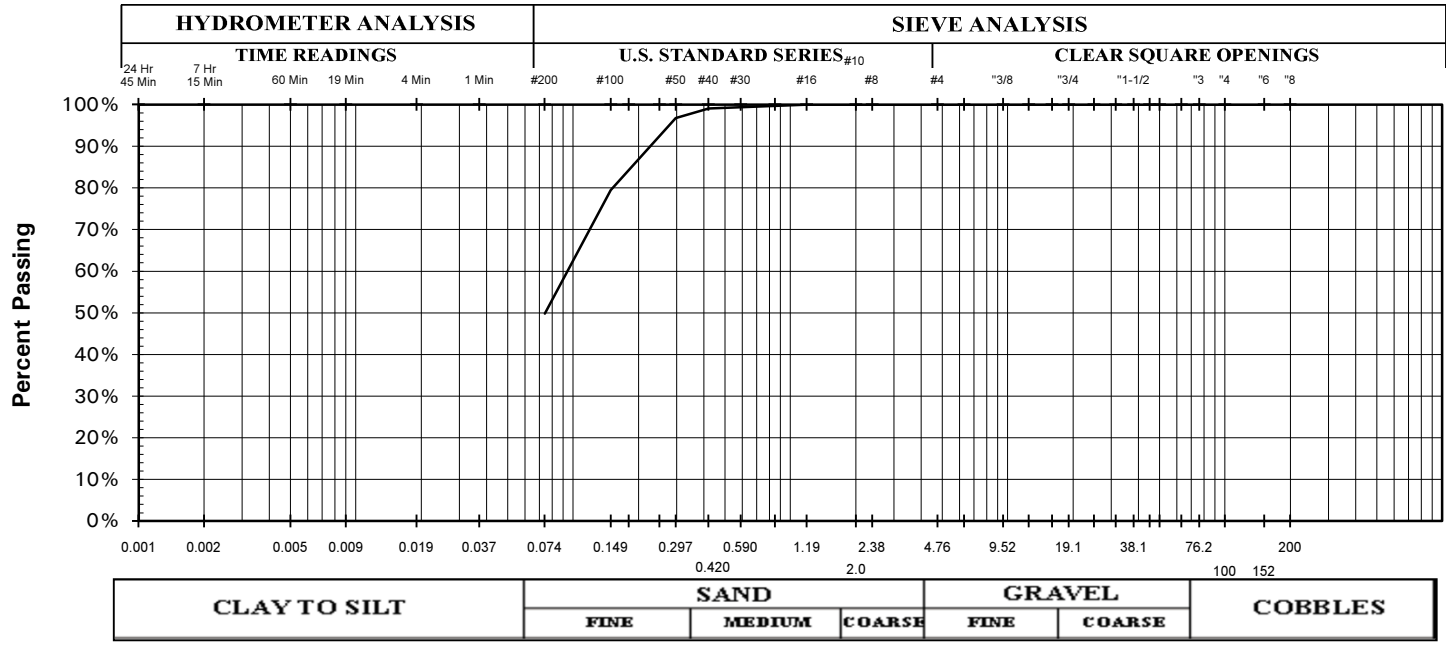
Moisture - Density Relationship Test Procedure: ASTM D-1557 B

Reviewed By: TT

USCS Classification: Sandy Silty-Clay (CL-ML)

AASHTO Classification: A-4

Sample Location: B-2 @ 0-2'



GRADATION AND MOISTURE-DENSITY RELATIONSHIP RESULTS

Project No.: 2220054

Figure: 8

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC.

TABLE I
SUMMARY OF LABORATORY TEST RESULTS

Cedar Apex Railroad Spur

Project Number 2220054

Sample Location		Natural Moisture Content (%)	Natural Dry Density (pcf)	Gradation			Atterberg Limits		Moisture Density Relationship		Sample Classification
Boring No.	Depth (feet)			Gravel (%)	Sand (%)	Silt/ clay (%)	Liquid Limit (%)	Plasticity Index (%)	Optimum Moisture Content (%)	Maximum Dry Density (pcf)	
B-1	0	10	108			47					Silty Sand (SM)
B-1	0-2			0	70	30		NP	130.0	8.0	Silty Sand (SM)
B-1	2	4	92			68	21	5			Sandy Silty Clay (CL-ML)
B-1	4	7	98			96					Silty Clay (CL-ML)
B-1	9	17	104			93	35	18			Lean Clay (CL)
B-1	14	11	107			93	25	12			Lean Clay (CL)
B-1	19	19	101			100	41	24			Lean Clay (CL)
B-2	0	8	102			35					Silty Sand (SM)
B-2	0-2			0	50	50	21	7	125.0	10.0	Sandy Silty Clay (CL-ML)
B-2	2	8	101			50	27	11			Sandy Lean Clay (CL)
B-2	4	25	92			72	59	32			Sandy Fat Clay (CH)
B-2	9	4	101	54	33	13					Silty Sand (SM)
B-2	14	5	99	0	77	23		NP			Poorly Graded Sand with Silt (SP-SM)
B-2	19	5	109			10					Silty Sand (SM)

NP = Non Plastic

APPENDIX

SITE PHOTOS

Photo No. 1, View of location for Boring B-1

Photo No. 2, View of location for Boring B-2