

Geotechnical Data Report Port of Newport Continuing Authority Program 107 Project

Newport, Oregon

October 25, 2024

Prepared for

DOWL

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1 INTRODUCTION

The Port of Newport (Port) seeks to change the design and layout of Port Dock 7 to update infrastructure for the Commercial Marina, which is over capacity. The U.S. Army Corps of Engineers (USACE) Continuing Authority Program (CAP) Section 107 project has been approved to improve the federal channel through the marina. The project will include increases in linear moorage at Port Dock 7 and complete dredging of access channels and berths to accommodate modern fishing vessels for the CAP 107 part of the project. The CAP 107 portion is also being completed under Corps Section 404/10 permit (NWP-2023-626) and Marine Protection, Research, and Sanctuaries Act Section 103 authority. The project location is shown on the Vicinity Map, Figure 1.

The Port is currently in the second phase of a three-phase CAP 107 navigational improvement project to provide 80-foot vessels access to the east end of the Commercial Marina. The current condition and design of Port Dock 7 do not reflect modern vessel design and do not adequately support the users of the Commercial Marina. The purpose of this project is to improve channel access and allow large, modern fishing vessels the maneuvering room to be able to access the future Port Dock 7.

The overall project goals include the following:

- Dredge access channels.
- Expand the marina moorage space.
- Change the available space to accommodate more vessels that are 60 feet to 80 feet long.
- Continue to provide adequate moorage for vessels under 60 feet in length, particularly those vessels that are 40 feet and under.
- Provide adequate draft for the full range of vessels in the berths and in the areas accessing the berths.
- Provide better amenities, services, and access to diverse moorage holders.

USACE maintenance of the main navigation channel and jetty features provides ongoing navigation access to the Port facilities.

2 PROJECT DESCRIPTION

The existing Federal Navigation Channel includes a 40-foot-deep, 400-foot-wide entrance channel; a 30-foot-deep, 300-foot-wide bay channel leading to a turning basin at Newport; and an 18-foot-deep, 200-foot-wide, 4.5-mile-long channel from Newport to Yaquina.

A breakwater for a small-boat basin on the north shore (a timber structure 2,650 feet long) was authorized in 1946 to protect commercial fishing boats.

USACE is working with the Port to construct and maintain a dedicated access channel to the Port's Commercial Marina, which is located on the north side of Yaquina Bay from river mile 1+12 to 1+45. The Commercial Marina Access Channel (CMAC) will be maintained at an elevation of approximately -20 feet Mean Lower Low Water (MLLW) but includes a 2-foot over-depth dredging allowance to an elevation of approximately -22 feet. The western dredge area outside the breakwater will be maintained at an elevation of -22 feet MLLW with a 2-foot over-depth dredging allowance to an elevation of -24 feet.

A separate design report will be prepared for the Port Dock 7 project.

3 PROJECT DIMENSIONS

The Yaquina CAP 107 project CMAC dredging area is west of the breakwater, as shown on the Site Plan, Figure 2. The dredging area is approximately 1,400 feet long and 180 feet wide, with a dredge depth elevation of -20 feet. Within the breakwater, the dredging area is about 2,250 feet long and varies from about 220 feet to 570 feet wide, with a dredge depth elevation of -22 feet.

4 SITE DESCRIPTION

4.1 Bathymetry

Based on review of bathymetry for the dredging area provided by the project team, mudline elevations range from elevations of about -6 feet to -28 feet for the dredging area west of the breakwater. Within the breakwater, mudline elevations range from elevations of about -20 feet to 12 feet, with the higher elevations along the breakwater near the south side of the navigation channel. All elevations in this report reference the MLLW datum unless stated otherwise.

4.2 Geology

Available geologic literature and our experience in the area indicate the channel is mantled with a variable thickness of marine sand or clay underlain by mudstone. Miocene-aged mudstone and sandstone of the Nye Formation underlie the bay at a relatively shallow depth (Snavely et al., 1976). Explorations at the site indicate the upper portion of the mudstone is typically moderately weathered to predominantly decomposed.

5 SUBSURFACE CONDITIONS

5.1 General

The subsurface exploration program for this geotechnical investigation phase of the CAP 107 dredging project was completed during two separate mobilizations. Drilling

during the first mobilization occurred between February 20 and 23, 2024, and included five roto sonic borings, designated 3-C, 4-A, 4-B, 5-B, and 5-C. Drilling during the second mobilization occurred on March 13, 2024, with one mud-rotary boring, designated 5-A, completed. The approximate locations of the borings are shown on the Site Plan, Figure 2. Logs of the borings are provided on Figures 1A through 6A. The field and laboratory testing programs completed for this project are described in Appendix A. The terms and symbols used to describe the soil and rock encountered in the borings are defined in Tables 1A and 2A, respectively, and the attached legend. Rotosonic core photographs are provided in Appendix B. The samples for testing were sent to Professional Service Industries of Portland, Oregon or Cooper Testing Laboratory of Palo Alto, California, and are summarized in Appendices C and D, respectively.

The subsurface borings were completed by overwater methods using a barge provided and operated by Bergerson Construction of Astoria, Oregon. The barge was held in place for drilling by two spuds.

A summary of the boring location, mudline elevation, elevation where rock was first encountered, and bottom-of-exploration elevation for the geotechnical borings completed for the CAP 107 portion of the overall project is provided in the table below.

Table 5-1: GEOTECHNICAL BORING LOCATIONS AND ELEVATIONS FOR CAP 107

Boring Type	Boring No.	Latitude	Longitude	Estimated Mudline Elevation, ^(a) feet MLLW	Estimated Top of Rock Elevation, ^(a) feet MLLW	Bottom of Boring Elevation, ^(a) feet MLLW
Geotechnical	3-C	44.6295	-124.0426	-11.2	-26.2	-31.2
Geotechnical	4-A	44.6313	-124.0456	-13.7	-13.7	-31.6
Geotechnical	4-B	44.6302	-124.0468	-10.2	-47.7	-49.2
Geotechnical	5-A	44.6298	-124.0514	-13.1	-23.6	-34.6
Geotechnical	5-B	44.6292	-124.0524	-11.8	-25.8	-33.3
Geotechnical	5-C	44.6279	-124.0540	-16.2	-22.7	-32.2

Abbreviation: MLLW = Mean Lower Low Water

Note:

^(a) All elevations are estimates. See Appendix A.1.2 for additional information.

In addition to the geotechnical borings discussed above, GRI completed sediment sampling for the overall CAP 107 project. A summary of the approximate boring location, mudline elevation, elevation where rock was first encountered, and bottom-of-exploration elevation for the borings for sediment sampling for the CAP 107 portion of the overall project is provided in Table 5-2.

Table 5-2: SEDIMENT SAMPLING BORING LOCATIONS AND ELEVATIONS FOR CAP 107

Boring Type	Boring No.	Latitude	Longitude	Estimated Mudline Elevation, ^(a) feet MLLW	Estimated Top of Rock Elevation, ^(a) feet MLLW	Bottom of Boring Elevation, ^(a) feet MLLW
Environmental	3-A	44.6302	-124.0453	-9.9	NA	-21.9
Environmental	3-B	44.6298	-124.0442	-8.7	NA	-21.7
Environmental	3-C	44.6295	-124.0426	-10.5	NA	-21.9
Environmental	4-A	44.6302	-124.0459	-9.8	NA	-21.5
Environmental	4-B	44.6302	-124.0468	-10.0	NA	-21.7
Environmental	4-C	44.6301	-124.0490	-9.0	NA	-21
Environmental	5-A	44.6298	-124.0514	-13.9	-22.8	-25.2
Environmental	5-B	44.6291	-124.0522	-9.2	-20.7	-24.3
Environmental	5-C	44.6279	-124.0539	-16	-21.4	-23.4

Abbreviations: MLLW = Mean Lower Low Water; NA = not applicable

Note:

^(a)All elevations are estimates. See Appendix A.1.2 for additional information.

In addition to the geotechnical borings completed for the CAP 107 dredging project and sediment sampling for the conceptual level design of the new Port Dock 7 configuration, a summary of the approximate boring location, mudline elevation, elevation where rock was first encountered, and bottom-of-exploration elevation for the geotechnical borings for the Port Dock 7 configuration project is provided in the table below. The Port Dock 7 borings will be provided in a separate upcoming report.

Table 5-3: GEOTECHNICAL BORING LOCATIONS AND ELEVATIONS FOR PORT DOCK 7

Boring Type	Boring No.	Latitude	Longitude	Estimated Mudline Elevation, ^(a) feet MLLW	Estimated Top of Rock Elevation, ^(a) feet MLLW	Bottom of Boring Elevation, ^(a) feet MLLW
Geotechnical	1-A	44.6305	-124.0423	-5.1	-6.6	-37.6
Geotechnical	2-A	44.6307	-124.0451	-17.9	-18.4	-52.8
Geotechnical	1-C	44.6307	-124.0430	-5.8	-6.8	-37.8

Abbreviation: MLLW = Mean Lower Low Water

Note:

^(a)All elevations are estimates. See Appendix A.1.2 for additional information.

5.2 Soil and Rock

For the purposes of this discussion, the materials disclosed by the geotechnical borings for the CAP 107 dredging (borings 3-C, 4-A, 4-B, 5-A, 5-B, and 5-C) have been grouped into the following units based on their physical characteristics and engineering properties and listed as they were encountered below the aforementioned pavement section:

- a. SAND
- b. MUDSTONE (Nye Mudstone)

The following paragraphs provide a description of the materials encountered and a discussion of the groundwater conditions at the site.

a. SAND

Sand was encountered at mudline in borings 3-C, 4-B, 5A, and 5-B and was likely encountered at mudline in boring 5-C; however, the initial 5 feet of drilling in boring 5-C had no recovery. The sand extended to depths ranging from 6.5 feet (elevation -22.7 feet) to 37.5 feet (elevation -47.7 feet). The sand is gray to dark gray, fine to medium grained, and contains variable percentages of silt ranging from a trace of silt to silty. The sand contains shell fragments, and an organic odor was encountered throughout most of the sand in borings 3-C and 4-B. Based on the Standard Penetration Resistance, the relative density of the sand is very loose to medium dense.

b. MUDSTONE (Nye Mudstone)

Mudstone was encountered at the mudline in boring 4-A and beneath the sand in borings 3-C, 4-B, 5-A, 5-B, and 5-C. It extended to depths ranging from 16 feet to 39 feet below mudline (elevations -31.2 feet to -49.2 feet), or to the maximum depths explored in all explorations. The mudstone is typically light brown or dark gray, moderately weathered to predominantly decomposed, and extremely weak (R0) to very weak (R1). Our experience in the area indicates that zones of R2 or harder mudstone can be encountered within the unit, although they were not specifically encountered at the exploration sampling locations within the depths explored.

6 DISCUSSION

In general, the recent explorations disclosed subsurface conditions consisting of marine sand over mudstone. Based on the recent explorations, the planned dredging to an elevation of -22 feet to the west of the breakwater and an elevation of -20 feet within the breakwater will likely encounter mudstone in portions of the dredged areas.

7 LIMITATIONS

This report has been prepared to aid USACE in the design and evaluation of this project. The scope is limited to the specific project and location described within this report. The

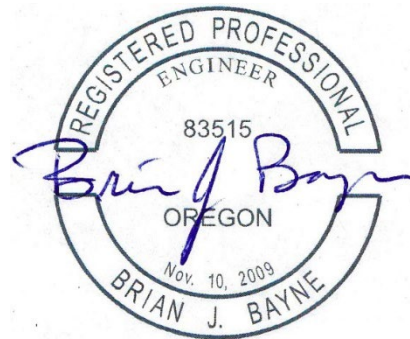
findings submitted in this report are based on the data obtained from the subsurface explorations made at the locations indicated on Figure 2 and other sources of information discussed in this report. In the performance of subsurface investigations, specific information is obtained at specific locations at specific times. However, it is acknowledged that variations in subsurface conditions may exist between exploration locations. This report does not reflect variations that may occur between these explorations.

We have included in Appendix E the Geoprofessional Business Association guidance document "Important Information about This Geotechnical-Engineering Report" to assist you and others in understanding the use and limitations of this report. We recommend you read this document.

Submitted for GRI,



RENEWS: 02/2025
George A. Freitag, CEG
Principal

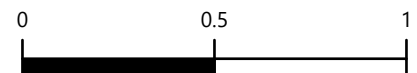


RENEWS: 12/2025
Brian J. Bayne, PE
Associate

This document has been submitted electronically.

8 REFERENCES

Snavely, P. D., MacLeod, N. S., Wagner, H. C., and Rau, W. W., 1976, Geologic map of the Yaquina and Toledo quadrangles, Lincoln County, Oregon: U.S. Geological Survey Miscellaneous Investigations Map I-867, scale 1:62,500.

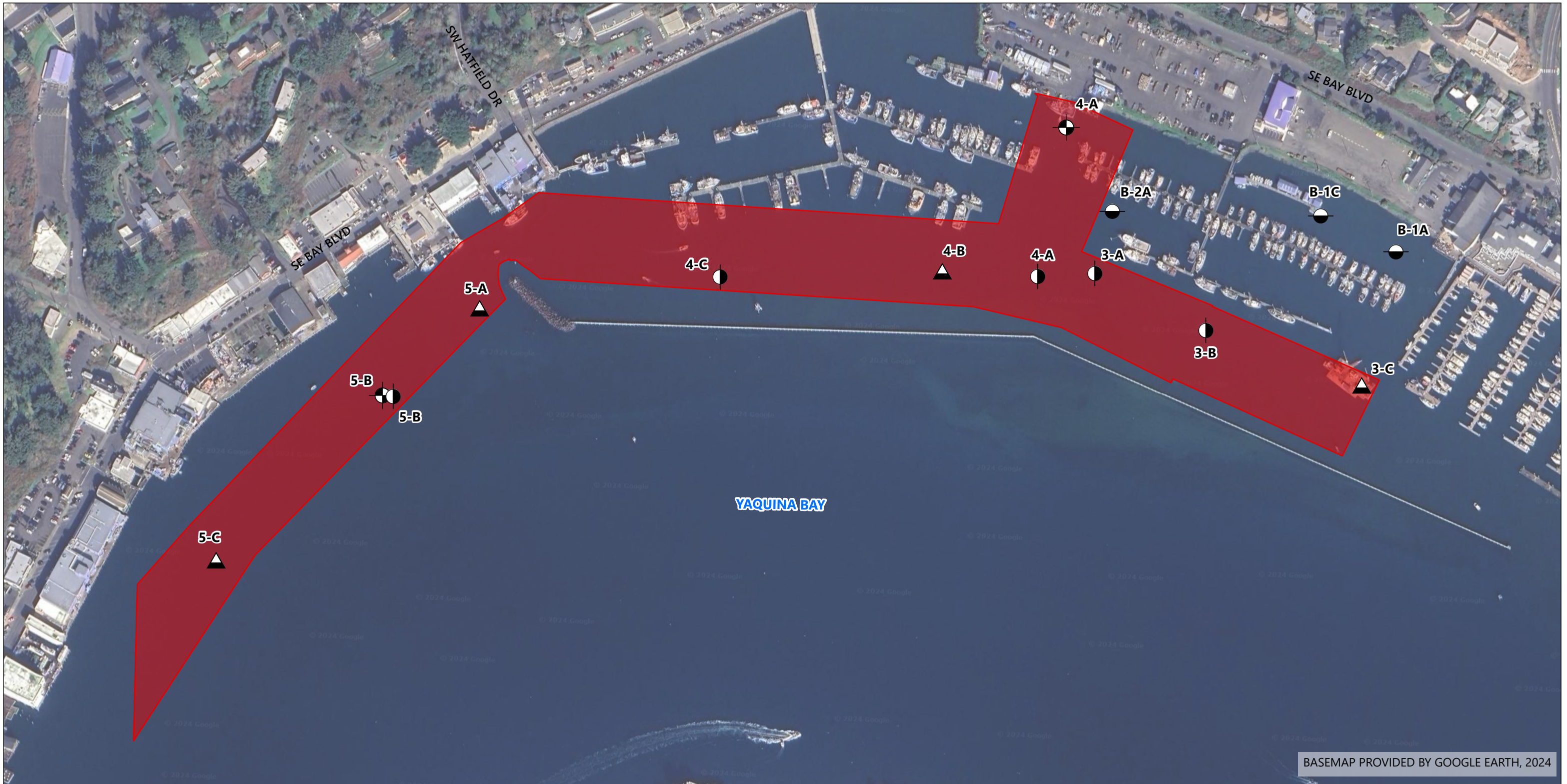


1 INCH = 0.5 MILES






DOWL, LLC
 PORT OF NEWPORT CAP 107
 NEWPORT, OREGON



VICINITY MAP




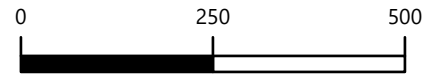
BASEMAP PROVIDED BY GOOGLE EARTH, 2024

LEGEND:


-  APPROXIMATE LOCATION OF GEOTECHNICAL BORING COMPLETED BY GRI FOR CAP 107 PROJECT (FEBRUARY 19 - MARCH 13, 2024)
-  APPROXIMATE LOCATION OF GEOTECHNICAL AND ENVIRONMENTAL BORINGS COMPLETED BY GRI FOR CAP 107 PROJECT
-  APPROXIMATE LOCATION OF ENVIRONMENTAL BORING COMPLETED BY GRI FOR CAP 107 PROJECT (FEBRUARY 19 - MARCH 13, 2024)

-  APPROXIMATE LOCATION OF GEOTECHNICAL BORING COMPLETED BY GRI FOR PORT DOCK 7 PROJECT (FEBRUARY 28 - MARCH 7, 2024)
-  PROPOSED DREDGING AREA





1 INCH = 250 FEET



DOWL, LLC
PORT OF NEWPORT CAP 107
NEWPORT, OREGON

SITE PLAN



APPENDIX A

Field Explorations and Laboratory Testing

APPENDIX A

FIELD EXPLORATIONS AND LABORATORY TESTING

A.1 FIELD EXPLORATIONS

A.1.1 General

The subsurface exploration program for this phase of the project was completed during two separate mobilizations. Drilling during the first mobilization occurred between February 20 and 23, 2024, and included five rotosonic borings designated 3-C, 4-A, 4-B, 5-B, and 5-C. Drilling during the second mobilization occurred on March 13, 2024, with one mud-rotary boring designated 5-A. The approximate locations of the borings are shown on the Site Plan, Figure 2.

The subsurface borings were completed by overwater methods using a barge provided and operated by Bergerson Construction of Astoria, Oregon. The barge was held in place for drilling by two spuds.

A.1.2 Comments on Mudline and Rock Elevations

The mudline elevations reported herein for the geotechnical borings should be considered approximate and were developed using the following methodology:

1. Tidal-water level elevations were estimated from available predictions.
2. A GRI field representative took several depth soundings from the barge deck to mudline at the location of the drilling equipment.
3. The distance from the barge deck to the water was subtracted from the depth taken in Step 2. This final depth was the depth from water level to mudline.
4. The depth noted in Step 3 was subtracted from the elevation noted in Step 1, which resulted in the approximate mudline elevation for the borings.
5. A barge spud was marked at the beginning of each boring. The spud markings were referenced during the recovery of each sample to correct for tidal changes during drilling.
6. Once back in the office, the predicted tide tables were compared to the verified tide tables from the National Oceanic and Atmospheric Administration Tide Predictions tables for the South Beach, Yaquina Bay, tidal station for the same time as the recordings were taken in the field. The mudline elevations were revised if needed.

The vertical uncertainty of elevations associated with the preceding procedure is estimated to be approximately +/- 1 foot.

A.1.3 Rotosonic Borings

Borings 3-C, 4-A, 4-B, 5-B, and 5-C were advanced to depths of 16 feet to 39 feet below mudline with rotosonic drilling techniques using a track-mounted Geoprobe 8150LS rotosonic track-mounted drill rig provided and operated by Western States Soil Conservation, Inc. (WSSC) of Hubbard, Oregon. Geotechnical or geology staff from GRI maintained a log of materials and conditions encountered in each boring. The borings were advanced using a 5-inch-diameter casing. Continuous 5-inch-diameter cores were obtained from some of the borings and stored in plastic bags. The plastic bags were opened in the field for visual classifications, and digital photographs were taken of each run. Representative soil samples were carefully examined in the field and saved in plastic sample bags for further examination in our laboratory. Photographs of the cores are provided in Appendix B.

Disturbed soil samples were typically obtained at intervals of up to 5 feet. Disturbed soil samples were obtained using a standard split-spoon sampler or grab sample. The standard penetration test (SPT) was conducted while obtaining the split-spoon samples. This test is performed by driving a 2-inch-outside-diameter, split-spoon sampler into the soil a distance of 18 inches using the force of a 140-pound hammer dropped 30 inches. The number of blows required to drive the sampler the last 12 inches is known as the Standard Penetration Resistance, or SPT N-value. The SPT N-values provide a measure of the relative density of granular soils and the relative consistency of cohesive soils. Samples obtained from the sampler or grab samples were placed in airtight bags and returned to our office for further classification and testing.

Logs of the rotosonic borings are provided on Figures 1A through 6A. Each log provides a descriptive summary of the various types of material encountered during drilling. To the left of the descriptive summary, a graphic log indicates the general soil type. To the right of the descriptive summary, the numbers and types of soil or rock samples taken during the drilling operation are indicated. Farther to the right, N-values are shown graphically, along with the natural moisture contents, percent material passing the No. 200 sieve, and Atterberg limits determinations. The terms used to describe the materials encountered in the borings are defined in Tables 1A and 2A.

A.1.4 Mud-Rotary Borings

Boring 5-A was advanced to a depth of 21.5 feet with mud-rotary drilling techniques using a CME 75 HT truck-mounted drill rig provided and operated by WSSC. Disturbed soil samples were obtained at 5-foot to 7.5-foot intervals of depth using a standard split-spoon sampler. The soil samples obtained in the split-spoon sampler were carefully

examined in the field, and representative portions were saved in airtight jars for further examination and physical testing in our laboratory. At the time of sampling, the SPT was being conducted. All samples were returned to our laboratory for further examination and physical testing.

A log of the mud-rotary boring is provided on Figure 4A. The log presents a descriptive summary of the various types of materials encountered in the boring and notes the depth at which the materials and/or characteristics of the materials change. To the right of the descriptive summary, the numbers and types of samples are indicated. Farther to the right, N-values are shown graphically, along with the natural moisture content and Atterberg limits determinations. The terms used to describe the materials encountered in the boring are defined in Tables 1A and 2A.

A.2 LABORATORY TESTING

A.2.1 General

The samples obtained from the borings were returned to our laboratory for further examination, and field classifications were modified where necessary. Samples were sent to Professional Service Industries (PSI), an external laboratory for testing including natural moisture content, percent passing the No. 200 sieve, and Atterberg limits testing. An additional sample of sand was sent to Cooper Testing Laboratory for consolidated undrained direct shear testing. A summary of the laboratory testing is provided on the logs, Figures 1A through 6A, and on the laboratory summary sheet provided in Appendices C and D.

A.2.2 Natural Moisture Contents

Natural moisture content determinations were made in conformance with ASTM International (ASTM) D2216 by PSI. The results are summarized on Figures 1A through 6A and tabulated in Appendix C.

A.2.3 Grain-Size Analysis

A.2.3.1 Washed-Sieve Method

To assist in classification of the soils, samples of known dry weight were washed over a No. 200 sieve by PSI. The material retained on the sieve is oven-dried and weighed. The percentage of material passing the No. 200 sieve is then calculated. The results are summarized on Figures 1A through 6A and tabulated in Appendix C.

A.2.4 Atterberg Limits

Atterberg limits determinations were performed on six representative samples in substantial conformance with ASTM D4318 by PSI. The test results are summarized on Figures 1A through 6A and tabulated in Appendix C.

A.2.5 Direct Shear

The effective friction angle of a grab sample of sand from a depth of 12 feet to 13 feet in boring B-5 was determined using a direct shear device under consolidated and undrained conditions. The grab sample was sent to Cooper Testing Laboratory, which completed the tests in substantial conformance with ASTM D3080M. Cooper Testing Laboratory used light compactive effort to remold the sample prior to testing. The test results are summarized in Appendix D. A fifth test was attempted at a normal load of 225 pounds per square foot; however, per discussions with Cooper Testing Laboratory, the normal load is below the calibration of their equipment and the data point was discarded.

Table 1A

GUIDELINES FOR DESCRIPTION OF SOIL¹

Description of Relative Density for Cohesionless (Coarse-Grained) Soils

Relative Density	Standard Penetration Resistance (N-values) blows/foot (ft)	3-inch Sampler, 140-lb hammer approx. N-Value (blows/ft) ²	3-inch Sampler, 300-lb hammer approx. N-Value (blows/ft) ¹
Very Loose	0 - 4	0 – 10	0 – 5
Loose	4 - 10	10 – 24	5 – 11
Medium Dense	10 - 30	24 – 73	11 – 34
Dense	30 - 50	73 – 122	34 – 57
Very Dense	over 50	over 122	over 57

Description of Relative Consistency for Cohesive (Fine-Grained) Soils

Relative Consistency	Standard Penetration Resistance (N-values) blows/ft	3-inch Sampler, 140 lb hammer approx. N-Value (blows/ft) ¹	3-inch Sampler, 300 lb hammer approx. N-Value (blows/ft) ²	Torvane or Undrained Shear Strength, tsf
Very Soft	0 - 2	0 – 3	0 – 1	less than 0.125
Soft	2 - 4	3 – 6	1 – 3	0.125 - 0.25
Medium Stiff	4 - 8	6 – 12	3 – 6	0.25 - 0.50
Stiff	8 - 15	12 – 23	6 – 11	0.50 - 1.0
Very Stiff	15 - 30	23 – 46	11 – 22	1.0 - 2.0
Hard	over 30	over 46	over 22	over 2.0

Grain-Size Classification	Modifier for Subclassification		
<i>Boulders:</i> > 12 inches		Primary Constituent SAND or GRAVEL	Primary Constituent SILT or CLAY
<i>Cobbles:</i> 3 inches - 12 inches	Adjective	Percentage of Other Material (By Weight)	
<i>Gravel:</i> ¼ inch - ¾ inch (fine) ¾ inch - 3 inches (coarse)	trace: some: sandy, gravelly:	5 - 15 (sand, gravel) 15 - 30 (sand, gravel) 30 - 50 (sand, gravel)	5 - 15 (sand, gravel) 15 - 30 (sand, gravel) 30 - 50 (sand, gravel)
<i>Sand:</i> No. 200 - No. 40 sieve (fine) No. 40 - No. 10 sieve (medium) No. 10 - No. 4 sieve (coarse)	trace: some: silty, clayey:	<5 (silt, clay) 5 - 12 (silt, clay) 12 - 50 (silt, clay)	<i>Relationship of clay and silt determined by plasticity index test</i>
<i>Silt/Clay:</i> Pass No. 200 sieve			

1. Soil descriptions are developed using visual-manual procedures (ASTM D2488) and generally follow ODOT Geotechnical Design Manual (Chapter 5) guidelines.
2. Oversized sampler (OD = 3 inches, ID = 2.4 inches) blow counts converted to SPT N-Value using equations provided by Burmister, D.M., 1948, The importance and practical use of relative density in soil mechanics: Proceedings of ASTM, v. 48:1249.

Table 2A

GUIDELINES FOR CLASSIFICATION OF ROCK

Relative Rock Weathering Scale

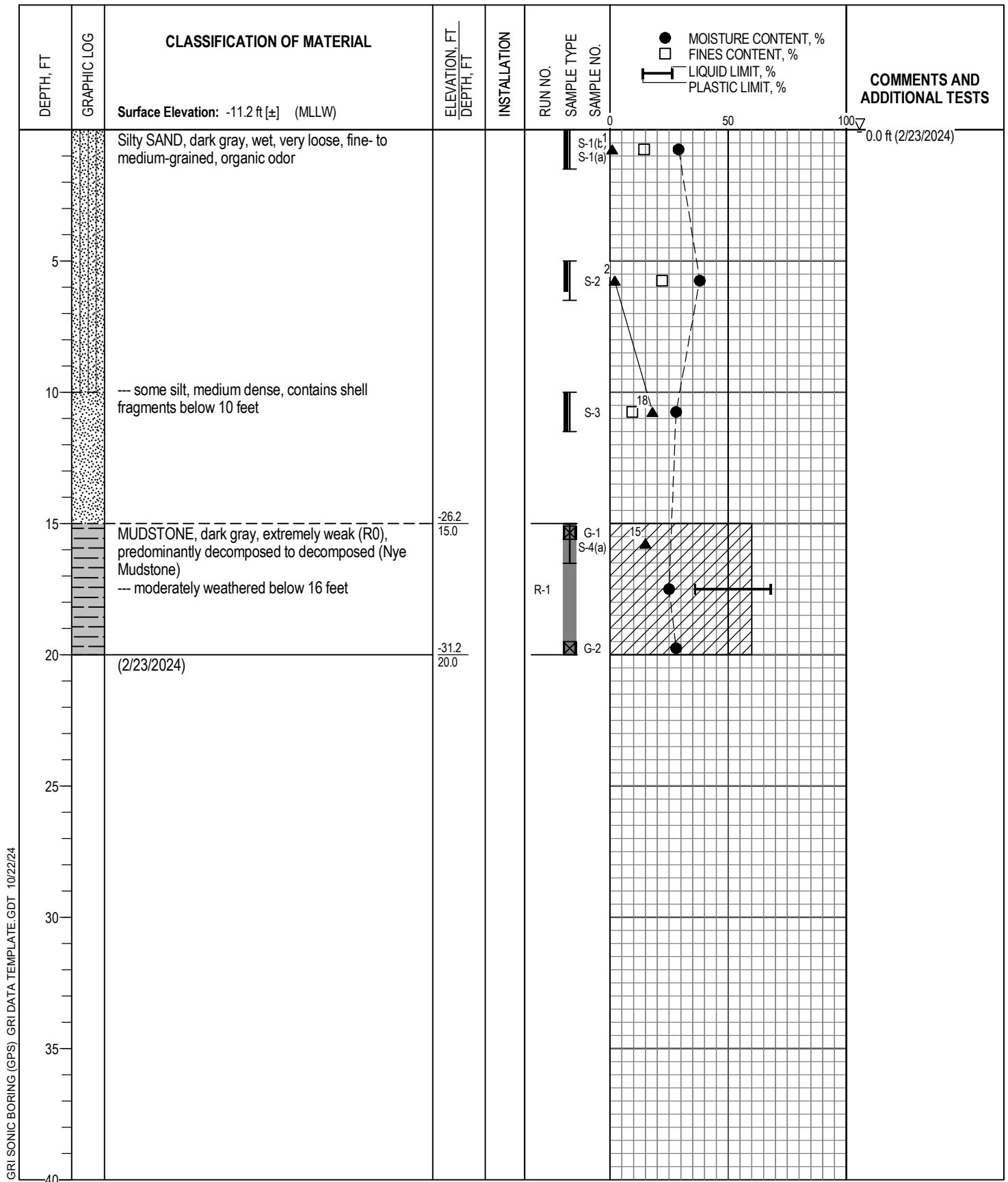
Term	Field Identification
Fresh	Crystals are bright. Discontinuities may show some minor surface staining. No discoloration in rock fabric.
Slightly Weathered	Rock mass is generally fresh. Discontinuities are stained and may contain clay. Some discoloration in rock fabric. Decomposition extends up to 1 in. into rock.
Moderately Weathered	Rock mass is decomposed 50% or less. Significant portions of rock show discoloration and weathering effects. Crystals are dull and show visible chemical alteration. Discontinuities are stained and may contain secondary mineral deposits.
Predominantly Decomposed	Rock mass is more than 50% decomposed. Rock can be excavated with geologist’s pick. All discontinuities exhibit secondary mineralization. Complete discoloration of rock fabric. Surface of core is friable and usually pitted due to washing out of highly altered minerals by drilling water.
Decomposed	Rock mass is completely decomposed. Original rock “fabric” may be evident. May be reduced to soil with hand pressure.

Relative Rock Strength Scale

Term	Hardness Designation	Field Identification	Approximate Unconfined Compressive Strength
Extremely Weak	R0	Can be indented with difficulty by thumbnail. May be moldable or friable with finger pressure.	35 - 150 psi
Very Weak	R1	Crumbles under firm blows with point of a geology pick. Can be peeled by a pocketknife and scratched with fingernail.	150 - 725 psi
Weak	R2	Can be peeled by a pocketknife with difficulty. Cannot be scratched with fingernail. Shallow indentation made by firm blow of geology pick.	725 – 3,500 psi
Medium Strong	R3	Can be scratched by knife or pick. Specimen can be fractured with a single firm blow of hammer/geology pick.	3,500 – 7,250 psi
Strong	R4	Can be scratched with knife or pick only with difficulty. Several hard hammer blows required to fracture specimen.	7,250 – 14,500 psi
Very Strong	R5	Cannot be scratched by knife or sharp pick. Specimen requires many blows of hammer to fracture or chip. Hammer rebounds after impact.	14,500 – 36,250 psi
Extremely Strong	R6	Can only be chipped with a rock hammer	>36,250 psi

RQD and Rock Quality

Relation of RQD and Rock Quality		Terminology for Planar Surface		
RQD (Rock Quality Designation), %	Description of Rock Quality	Bedding	Joints and Fractures	Spacing
0 - 25	Very Poor	Laminated	Very Close	< 2 in.
25 - 50	Poor	Thin	Close	2 in. – 12 in.
50 - 75	Fair	Medium	Moderately Close	12 in. – 36 in.
75 - 90	Good	Thick	Wide	36 in. – 10 ft
90 - 100	Excellent	Massive	Very Wide	> 10 ft

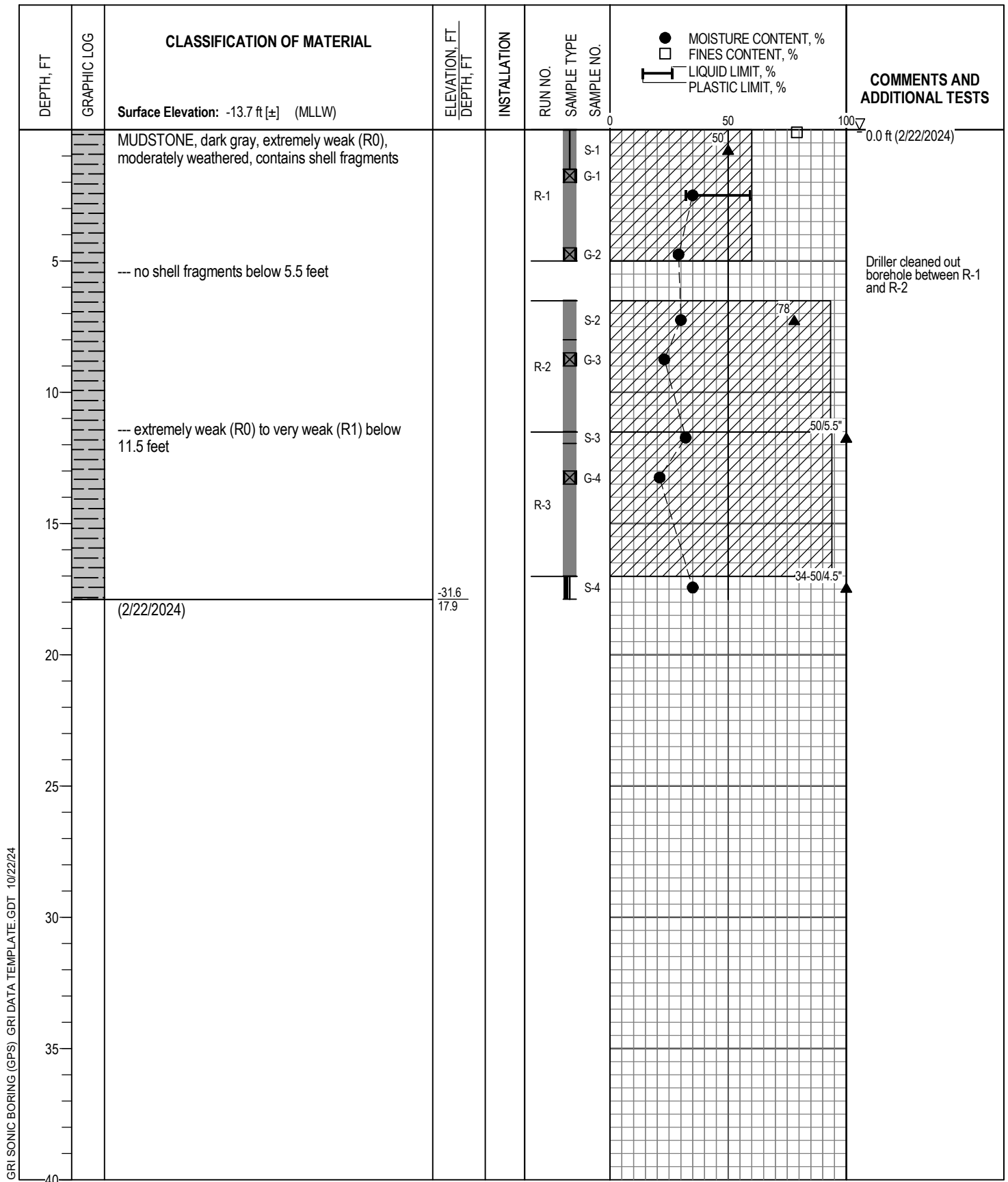


GRI SONIC BORING (GPS) GRI DATA TEMPLATE.GDT 10/22/24

Logged By: J. Strasilla		Drilled by: Western States Soil Conservation, Inc.	
Date Started: 2/23/24		GPS Coordinates: 44.6295123° N -124.0425591° W (WGS 84)	
Drilling Method: Roto Sonic		Hammer Type: Auto Hammer	
Equipment: Geoprobe Sonic 8150		Weight: 140 lb	
Hole Diameter: 5 in.		Drop: 30 in.	
Note: See Legend for Explanation of Symbols		Energy Ratio: 0.88	



BORING 3-C

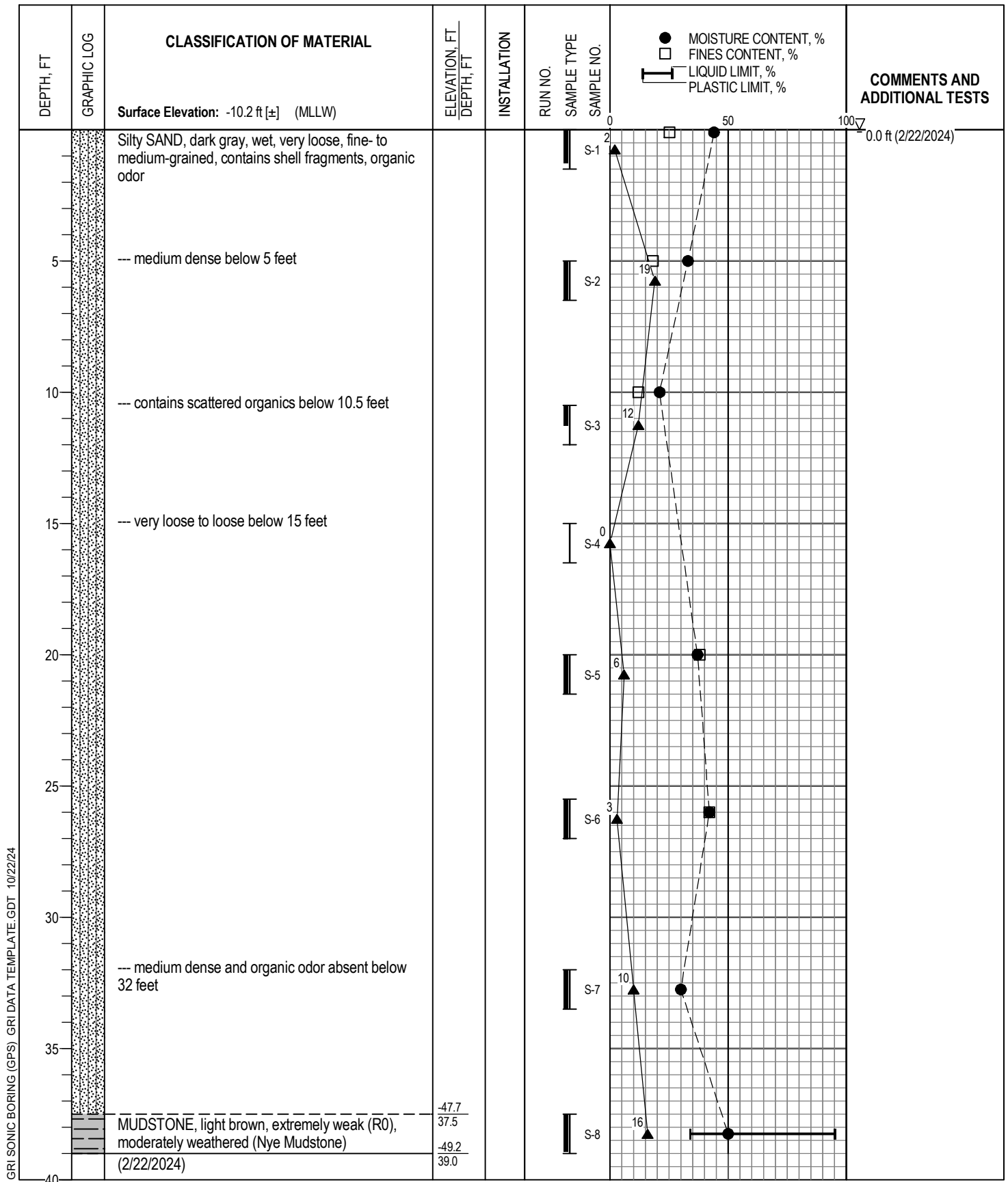


GRI SONIC BORING (GPS) GRI DATA TEMPLATE.GDT 10/22/24

Logged By: J. Strasilla		Drilled by: Western States Soil Conservation, Inc.	
Date Started: 2/22/24	GPS Coordinates: 44.6312626° N -124.0456427° W (WGS 84)		
Drilling Method: Roto Sonic	Equipment: Geoprobe Sonic 8150		Hammer Type: Auto Hammer
Hole Diameter: 5 in.			Weight: 140 lb
Note: See Legend for Explanation of Symbols		Drop: 30 in.	
		Energy Ratio: 0.88	



BORING 4-A

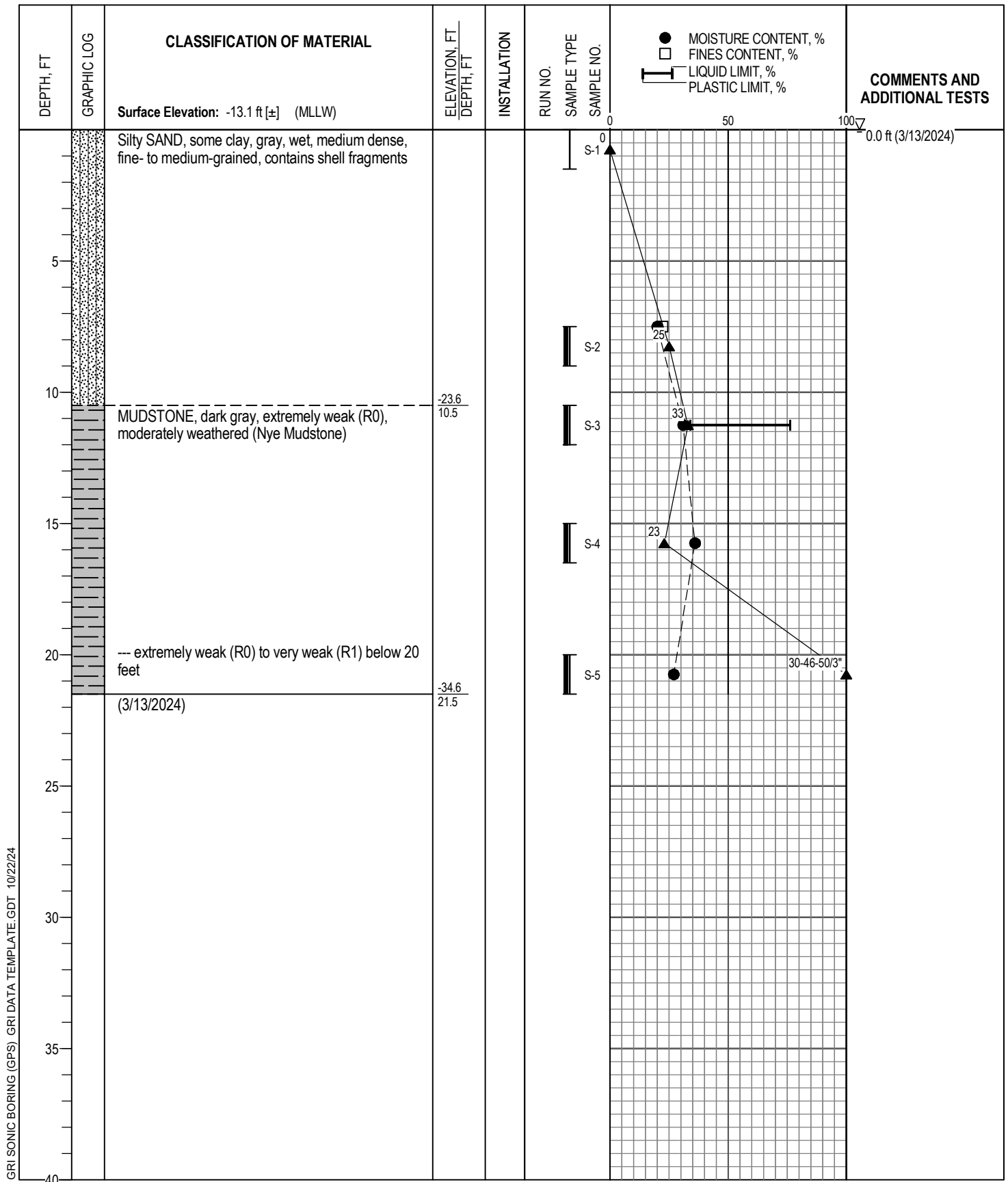


GRI SONIC BORING (GPS) GRI DATA TEMPLATE.GDT 10/22/24

Logged By: J. Strasilla	Drilled by: Western States Soil Conservation, Inc.
Date Started: 2/22/24	GPS Coordinates: 44.6301885° N -124.0468187° W (WGS 84)
Drilling Method: Roto Sonic	Hammer Type: Auto Hammer
Equipment: Geoprobe Sonic 8150	Weight: 140 lb
Hole Diameter: 5 in.	Drop: 30 in.
Note: See Legend for Explanation of Symbols	Energy Ratio: 0.88



BORING 4-B

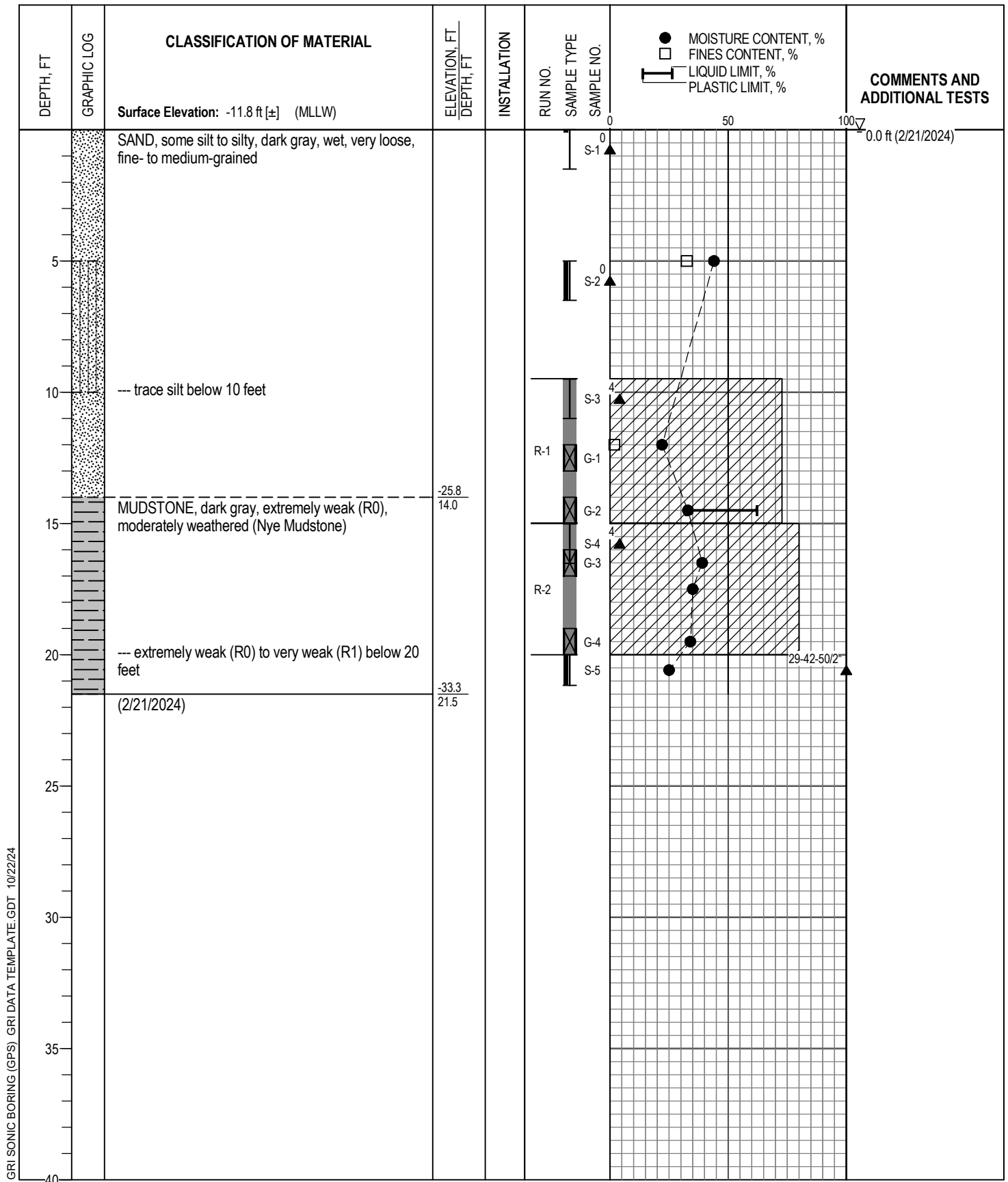


GRI SONIC BORING (GPS) GRI DATA TEMPLATE.GDT 10/22/24

Logged By: A. Horst		Drilled by: Western States Soil Conservation, Inc.	
Date Started: 3/13/24	GPS Coordinates: 44.6297565° N -124.0514345° W (WGS 84)		
Drilling Method: Mud Rotary	Equipment: Geoprobe Sonic 8150		Hammer Type: Auto Hammer
Hole Diameter: 5 in.			Weight: 140 lb
Note: See Legend for Explanation of Symbols			Drop: 30 in.
			Energy Ratio: 0.8



BORING 5-A

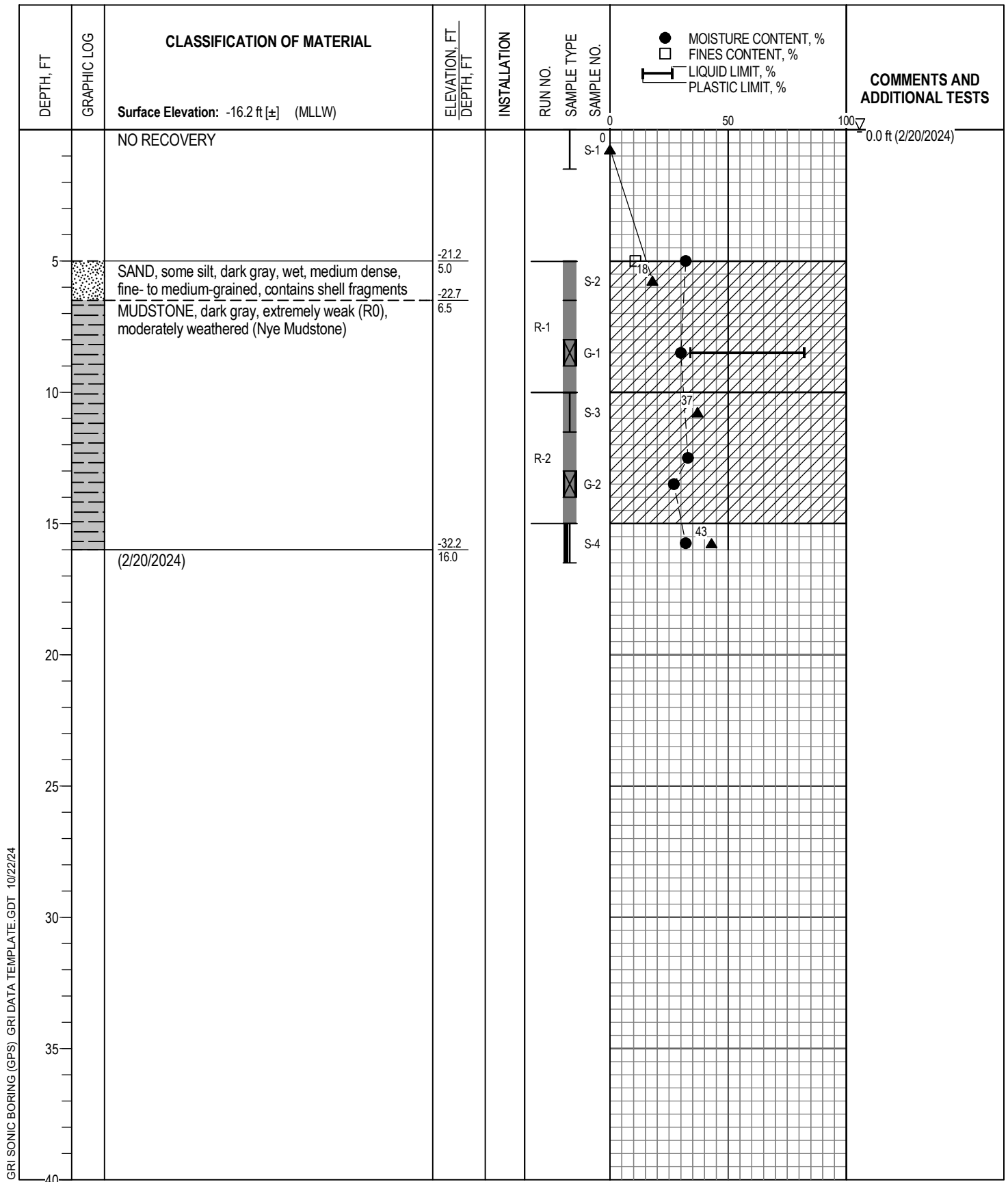


GRI SONIC BORING (GPS) GRI DATA TEMPLATE.GDT 10/22/24

Logged By: A. Horst		Drilled by: Western States Soil Conservation, Inc.	
Date Started: 2/21/24		GPS Coordinates: 44.629136° N -124.0523556° W (WGS 84)	
Drilling Method: Roto Sonic		Hammer Type: Auto Hammer	
Equipment: Geoprobe Sonic 8150		Weight: 140 lb	
Hole Diameter: 5 in.		Drop: 30 in.	
Note: See Legend for Explanation of Symbols		Energy Ratio: 0.88	



BORING 5-B



GRI SONIC BORING (GPS) GRI DATA TEMPLATE.GDT 10/22/24

Logged By: A. Horst		Drilled by: Western States Soil Conservation, Inc.	
Date Started: 2/20/24		GPS Coordinates: 44.6278672° N -124.0539529° W (WGS 84)	
Drilling Method: Roto Sonic		Hammer Type: Auto Hammer	
Equipment: Geoprobe Sonic 8150		Weight: 140 lb	
Hole Diameter: 5 in.		Drop: 30 in.	
Note: See Legend for Explanation of Symbols		Energy Ratio: 0.88	



BORING 5-C



APPENDIX B

Rotosonic Core Photographs



6801-B: BORING 3-C: CORE RUN 1 (ELEVATION -26.2 FEET TO -31.2 FEET)



CORE PHOTOGRAPHS



6801-B: BORING 4-A: CORE RUN1 (ELEVATION -14.8 FEET TO -19.8 FEET)



6801-B: BORING 4-A: CORE RUN 2 (ELEVATION -21.3 FEET TO -26.3 FEET)



6801-B: BORING 4-A: CORE RUN 3 (ELEVATION -26.3 FEET TO -31.8 FEET)



CORE PHOTOGRAPHS



6801-B: BORING 5-B: CORE RUN 1 (ELEVATION -22.6 FEET TO -27.6 FEET)



6801-B: BORING 5-B: CORE RUN 2 (ELEVATION -27.6 FEET TO -32.6 FEET)



CORE PHOTOGRAPHS



6801-B: BORING 5-C: CORE RUN 1 (ELEVATION -22 FEET TO -27 FEET)



6801-B: BORING 5-C: CORE RUN 2 (ELEVATION -27 FEET TO -32 FEET)



CORE PHOTOGRAPHS



APPENDIX C

Professional Service Industries Laboratory Results

Laboratory Summary Sheet

Sheet 1 of 1

Borehole	Approx. Depth	Liquid Limit	Plastic Limit	Plasticity Index	Qu (tsf)	%<#200 Sieve	Est. Specific Gravity	Water Content (%)	Dry Density (pcf)	Saturation (%)	Void Ratio
3-C	0					14.5%		29			
3-C	5					22.1%		38			
3-C	10					9.4%		28			
3-C	15	68	36	32				25			
3-C	18.5							28			
4-A	0	59	32	27		79.1%		35			
4-A	4.5							29			
4-A	6.5							30			
4-A	8.5							23			
4-A	11.5							32			
4-A	13							21			
4-A	17							35			
4-B	0					25.2%		44			
4-B	5					18.2%		33			
4-B	10					12.1%		21			
4-B	20					38.0%		37			
4-B	25.5					42.1%		42			
4-B	32							30			
4-B	37.5	95	34	61				50			
5-A	7.5					22.3%		20			
5-A	8.5							22			
5-A	10.5	76	34	42				31			
5-A	15							36			
5-A	20							27			
5-B	5					32.5%		44			
5-B	12					1.9%		22			
5-B	14	62	32	30				33			
5-B	15							35			
5-B	16							39			
5-B	19							34			
5-B	20							25			
5-C	5					10.8%		32			
5-C	8	82	34	48				30			
5-C	10							33			
5-C	13							27			
5-C	15							32			



Professional Service Industries
 6032 N. Cutter Circle, Suite 480
 Portland, OR 97219
 Telephone: (503) 289-1778
 Fax: (503) 289-1918

Summary of Laboratory Results

PSI Job No.: GRI-6801-B
 Project: GRI Project
 Location:



APPENDIX D

Cooper Testing Laboratory Direct Shear Test Results

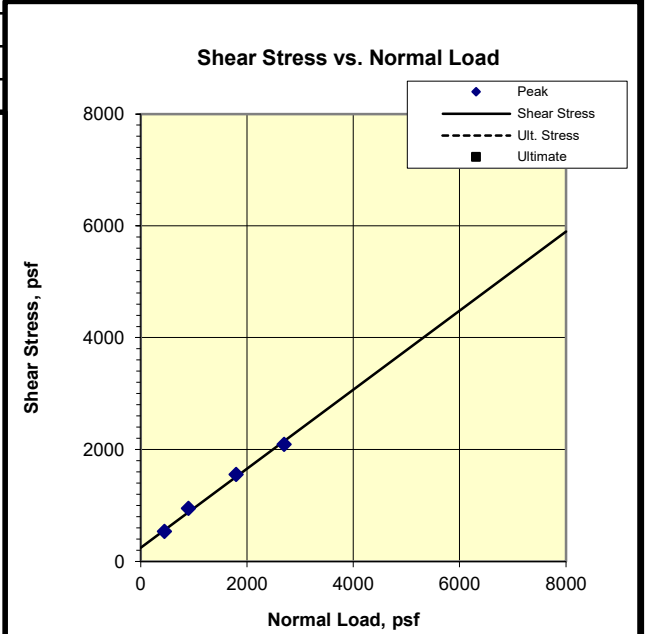
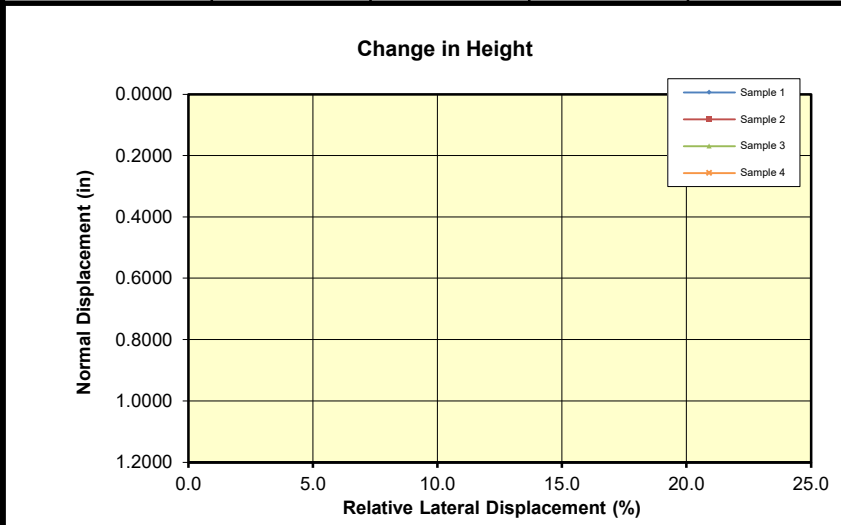
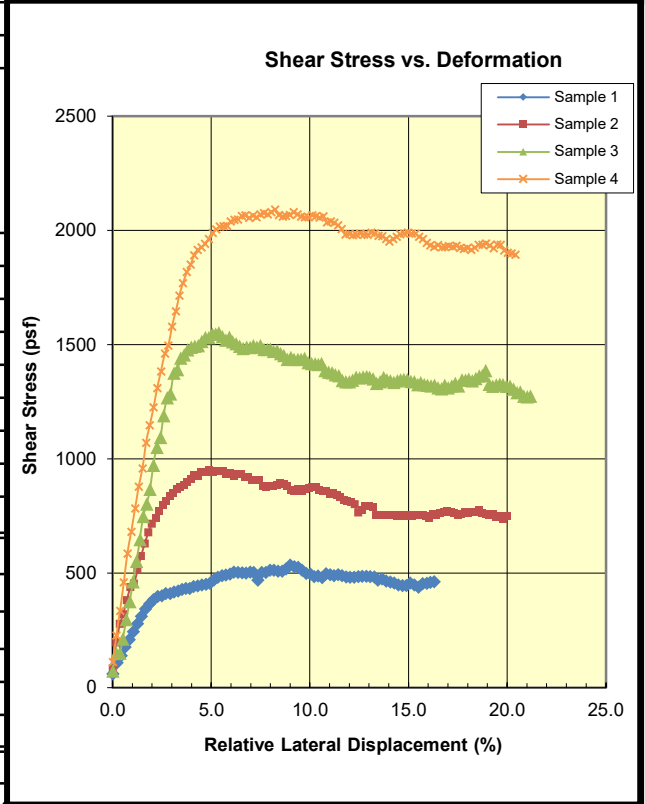


Consolidated Undrained Direct Shear (ASTM D3080M)

CTL Job #: 823-079 Project #: 6801-B By: MD
 Client: GRI Date: 10/22/2024 Checked: PJ
 Project Name: Newport Remolding Info: Samples remolded using light compactive effort.

Specimen Data				
	1	2	3	4
Boring:	5-B	5-B	5-B	5-B
Sample:	G-1	G-1	G-1	G-1
Depth (ft):	12-13	12-13	12-13	12-13
Visual Description:	Dark Greenish Gray SAND	Dark Greenish Gray SAND	Dark Greenish Gray SAND	Dark Greenish Gray SAND
Normal Load (psf)	450	900	1800	2700
Dry Mass of Specimen (g)	104.1	107.2	107.0	103.3
Initial Height (in)	1.00	1.00	1.00	1.00
Initial Diameter (in)	2.42	2.42	2.42	2.42
Initial Void Ratio	0.955	0.898	0.901	0.971
Initial Moisture (%)	22.1	22.2	23.0	22.6
Initial Wet Density (pcf)	105.2	108.5	109.1	104.9
Initial Dry Density (pcf)	86.2	88.8	88.7	85.5
Initial Saturation (%)	62.4	66.6	69.0	62.8
ΔHeight Consol (in)	0.0170	0.0160	0.0218	0.0305
At Test Void Ratio	0.922	0.868	0.860	0.911
At Test Moisture (%)	23.1	23.0	22.4	22.6
At Test Wet Density (pcf)	108.0	111.0	110.9	108.1
At Test Dry Density (pcf)	87.7	90.2	90.6	88.2
At Test Saturation (%)	67.7	71.6	70.3	67.0
Strain Rate (%/min)	1.2	1.1	1.0	1.1
Strengths Picked at	Peak	Peak	Peak	Peak
Shear Stress (psf)	535	949	1552	2091
ΔHeight (in) at Peak				
Ultimate Stress (psf)				

Phi (deg)	35.2	Ult. Phi (deg)	
Cohesion (psf)	250	Ult. Cohesion (psf)	



Remarks: *DS-CU* A fully undrained condition may not be attained in this test. ΔH is not measured during undrained direct shear tests.



APPENDIX E

Geoprofessional Business Association Guidance Document

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, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them 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 herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences 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.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

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

- for a different client;
- for a different project or purpose;
- 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, the reliability of a geotechnical-engineering report can be 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 you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site 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.

Most of the “Findings” Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site’s subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement 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 through project completion to obtain 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 judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed 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 continuing 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 available 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-phase observations.

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 information 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. 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. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. 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 provide 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 obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

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, the engineer’s services were not designed, conducted, or intended to prevent 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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