

To: Jonathan Griffin, P.E., Structures Project Manager

From: Henry Bacon, Geotechnical Section Intern, via, August Arles, Geotechnical Engineer

Date: July 23rd, 2024

Subject: Chelsea ER P23-1(440) – Geotechnical Data Report

1.0 INTRODUCTION

As requested, we have completed our subsurface investigation for the Chelsea ER P23-1(440) project. The project consists of the replacement of Bridge 13 carrying VT 110 over the First Branch White River in the town of Chelsea, VT. The project is located approximately 3.7 miles north of the intersection of VT 110 with VT 113. Contained herein are the results of our field sampling and testing, laboratory analysis of soil samples, attached boring logs.

2.0 FIELD INVESTIGATION

The field investigation was conducted between May 15th and May 30th, 2024. Four standard borings were advanced to evaluate the subsurface profile for design and construction of the replacement structure. A summary of the final location of each boring can be found in Table 2.1. The values for Northings and Eastings are based on the Vermont State Plane Grid Coordinate System NAD83. The elevations for the borings are based on the North American Vertical Datum, NAVD 88. The borings were located in the field by members of the VTrans Geotechnical Engineering Section during drilling operations. The locations for the borings should be considered accurate only to the degree implied by the method used to determine them.

Table 2.1 Boring Locations

Boring No.	Northing (ft)	Easting (ft)	Approximate Ground Elevation (ft)	Approximate Bedrock Elevation (ft)
B-101	985.8	1647077.2	985.8	950.3
B-102	559962.7	1647100.2	981.7	951.7
B-103	560058.9	1647087.7	986.2	950.7
B-104	560035.5	1647119.6	978.5	953.2

The borings were performed in general accordance with AASHTO T206, *Standard Method of Test for Penetration Test and Split-Barrel Sampling of Soils*. During boring operations, split spoon samples and standard penetration tests (STP) were taken for each boring. For all borings, B-101 through B-104, samples were taken continuously to 15 feet (ft) below ground surface (bgs), then at 5 ft intervals until bedrock was encountered. For each boring, bedrock was confirmed with 10 ft of NX core. Bedrock was encountered at a depth of 35.0 ft, 30.0 ft, 35.5 ft, and 25.3 ft for B-101 through B-104, respectively.

Soil samples were visually identified in the field and SPT blow counts were recorded on the boring logs when applicable. Soil samples were preserved and returned to the VTrans Construction and Materials Bureau Central Laboratory for further evaluation. The attached boring logs in Appendix A display the types of soil strata encountered and include the laboratory test data, SPT data, and any pertinent observations made by the boring crew. Bedrock core times per foot were recorded on the boring logs when applicable. Cores were then placed in boxes and returned to the VTrans Construction and Materials Bureau Laboratory for further evaluation and testing.

3.0 FIELD AND LABORATORY TESTINGS

The standard penetration resistance of the in-situ soil is determined by the number of blows required to drive a 2-inch outside diameter (OD) split-barrel sampler into the soil with a 140-pound hammer dropped from a height of 30 inches, in accordance with procedures specified in AASHTO T206. The number of blows required to drive the sampler each 6-inch increment is recorded, and the Standard Penetration Resistance (N-Value) is calculated as the sum of the blows over the second and third 6-inch intervals. The SPT N-value is commonly used with established correlations to estimate several soil parameters, particularly the shear strength and density of cohesionless soils. The N-values provided on the boring logs are raw values and have not been corrected for energy, borehole diameter, rod length, or overburden pressure.

The VT Agency of Transportation has determined a hammer correction value, C_E , to account for the efficiency of the SPT hammers on its drill rigs. An Acker Renegade was used for all three borings. Due to this drill rig being new, an energy efficiency factor has not been calibrated for hammer correction, therefore a conservation value of 1.3 should be used in all soil parameter calculations. This value, included on the boring logs, should be used in calculations to estimate soil parameters.

A detailed description of the rock cores is presented on the boring logs including run length, drill times, recovery, and Rock Quality Designation (RQD). Recovery is defined as the length of core obtained expressed as a percentage of the total length cored. In accordance with ASTM D6032, Standard Test Method for Determining Rock Quality Designation (RQD) of Rock Core, RQD is the total length of core pieces, 4 inches or greater in length, expressed as a percentage of the total length cored. RQD provides an indication of the integrity of the rock mass and relative extent of seams, jointing and bending planes. The Rock Mass Rating (RMR) is also included on the logs. RMR is AASHTO's (LRFD Bridge Design Specification) recommended method of classifying rock and is based on five different parameters that all have relative ratings which combine to form the RMR. These parameters include rock strength, RQD, joint spacing, joint condition, and groundwater (AASHTO Section 10.4.6.4).

4.0 SOIL PROFILE

The following soil strata have been identified based on our review of the boring logs and laboratory testing. It should be noted that groundwater elevations are subject to change given the fact that boreholes were generally left open for a short period of time. Because groundwater elevations can fluctuate seasonally and are affected by temperature and precipitation, groundwater may be encountered during construction when not previously noted on the logs.

4.1 Boring B-101

The ground surface elevation at B-101 was approximately 985.8 ft. Groundwater was recorded before drilling on May 22nd, 2024, at a depth of 12.6 ft, corresponding to an approximate elevation of 973.2 ft. Groundwater was not observed after the hole collapsed at a depth of 7.0 ft bgs.

Table 4.1 Boring B-101 Soil Profile

Depth (Below Ground Surface Elevation)	Soil Profile
0 – 2.1 ft	Asphalt
2.1 – 6 ft	Loose, Fine SAND, some Silt, little Gravel
6 – 9.7 ft	Dense, SAND, some Silt, little Gravel
9.7 – 11.7 ft	Assumed Cobbles/Boulders
11.7 – 20 ft	Medium Dense, SAND and GRAVEL, some Silt
20 – 35 ft	Dense to Very Dense, Fine SAND and GRAVEL, little Silt
>35 ft	Bedrock – METALIMESTONE and QUARTZITE

4.2 Boring B-102

The ground surface elevation at B-102 was approximately 981.7 ft. Groundwater was measured during and after drilling on May 15th, 2024 at 7.8 ft and 8.7 ft, respectively, corresponding to an approximate elevation of 973.9 ft and 973.0 ft, respectively.

Table 4.2 Boring B-102 Soil Profile

Depth (Below Ground Surface Elevation)	Soil Profile
0 – 2 ft	Medium Dense, GRAVEL, some Sand, trace Silt
2 – 10 ft	Loose to Medium Dense, SAND, some Gravel, little Silt
10 – 25 ft	Dense, SAND some Silt, little Gravel
25 – 30 ft	Very Dense SAND, some Gravel, little Silt
>30 ft	Bedrock – PHYLLITE and QUARTZITE

4.3 Boring B-103

The ground surface elevation at B-103 was approximately 986.2 ft. Groundwater was measured after drilling on May 30th, 2024, at 11.4 ft corresponding to an approximate elevation of 974.8 ft.

Table 4.3 Boring B-103 Soil Profile

Depth (Below Ground Surface Elevation)	Soil Profile
0 – 0.8 ft	Asphalt
1 – 3 ft	Dense, SAND, some Gravel, little Silt
3 – 15 ft	Loose, SAND, some Silt, some Gravel
15 – 20 ft	Medium Dense, Coarse SAND, little Gravel
20 – 22 ft	Very Loose, Coarse SAND, little Silt
22 – 27 ft	Dense to Very Dense, SAND, some Silt, some Gravel
>35.5 ft	Bedrock – METALIMESTONE and QUARTZITE

4.4 Boring B-104

The ground surface elevation at B-104 was approximately 978.5 ft. Groundwater was measured after drilling on May 16th, 2024, at a depth of 5.3 ft below ground surface corresponding to an approximate elevation of 973.2 ft.

Table 4.4 Boring B-104 Soil Profile

Depth (Below Ground Surface Elevation)	Soil Profile
0 – 6 ft	Very Loose to Loose, SAND, some Silt, little Gravel
6 – 12 ft	Medium Dense, SAND, some Gravel, trace Silt
12 – 14.5 ft	Loose, SAND, some Gravel, little Silt
14.5 – 15.5 ft	Assumed Cobbles/Boulders
15.5 – 25.3 ft	Medium Dense, SAND, some Gravel, trace Silt
>25.3 ft	Bedrock - METALIMESTONE

4.5 Rock Parameters

A summary of the rock core findings are available in the attached boring logs. Information from the cores indicated medium hard to hard Metalimestone and Quartzite to be present at the boring locations. The bedrock had an average rock mass rating (RMR) of 71 indicating good rock.

5.0 CONCLUSION

If you have any questions or would like to discuss this report, please contact the Geotechnical Engineering Section via email. Computerized boring logs can be found in the project folder <M:\Projects\23b796\MaterialsResearch>.

Reviewed by: August Arles, Geotechnical Engineer *AA*

Enclosures: Appendix 1: Boring Layout Plan (1 Page)
Appendix 2: Boring Logs (8 Pages)

cc: Electronic Read File/MG
Project File/CEE
AJA

[Z:\Highways\CMB\GeotechEngineering\Projects\Chelsea ER P23-1\(440\) 23B796\REPORTS\Chelsea ER P23-1\(440\) Geotechnical Data Report.docx](Z:\Highways\CMB\GeotechEngineering\Projects\Chelsea ER P23-1(440) 23B796\REPORTS\Chelsea ER P23-1(440) Geotechnical Data Report.docx)

SOIL CLASSIFICATION

AASHTO

A1	Gravel and Sand
A3	Fine Sand
A2	Silty or Clayey Gravel and Sand
A4	Silty Soil - Low Compressibility
A5	Silty Soil - Highly Compressible
A6	Clayey Soil - Low Compressibility
A7	Clayey Soil - Highly Compressible

ROCK QUALITY DESIGNATION

R.O.D. (X)	ROCK DESCRIPTION
<25	Very Poor
25 to 50	Poor
51 to 75	Fair
76 to 90	Good
>90	Excellent

SHEAR STRENGTH

UNDRAINED SHEAR STRENGTH IN P.S.F.	CONSISTENCY
<250	Very Soft
250-500	Soft
500-1000	Med. Stiff
1000-2000	Stiff
2000-4000	Very Stiff
>4000	Hard

CORRELATION GUIDE OF "N" TO DENSITY/CONSISTENCY

DENSITY (GRANULAR SOILS)		CONSISTENCY (COHESIVE SOILS)	
N	DESCRIPTIVE TERM	N	DESCRIPTIVE TERM
<5	Very Loose	<2	Very Soft
5-10	Loose	2-4	Soft
11-24	Med. Dense	5-8	Med. Stiff
25-50	Dense	9-15	Stiff
>50	Very Dense	16-30	Very Stiff
		31-60	Hard
		>60	Very Hard

DEFINITIONS (AASHTO)

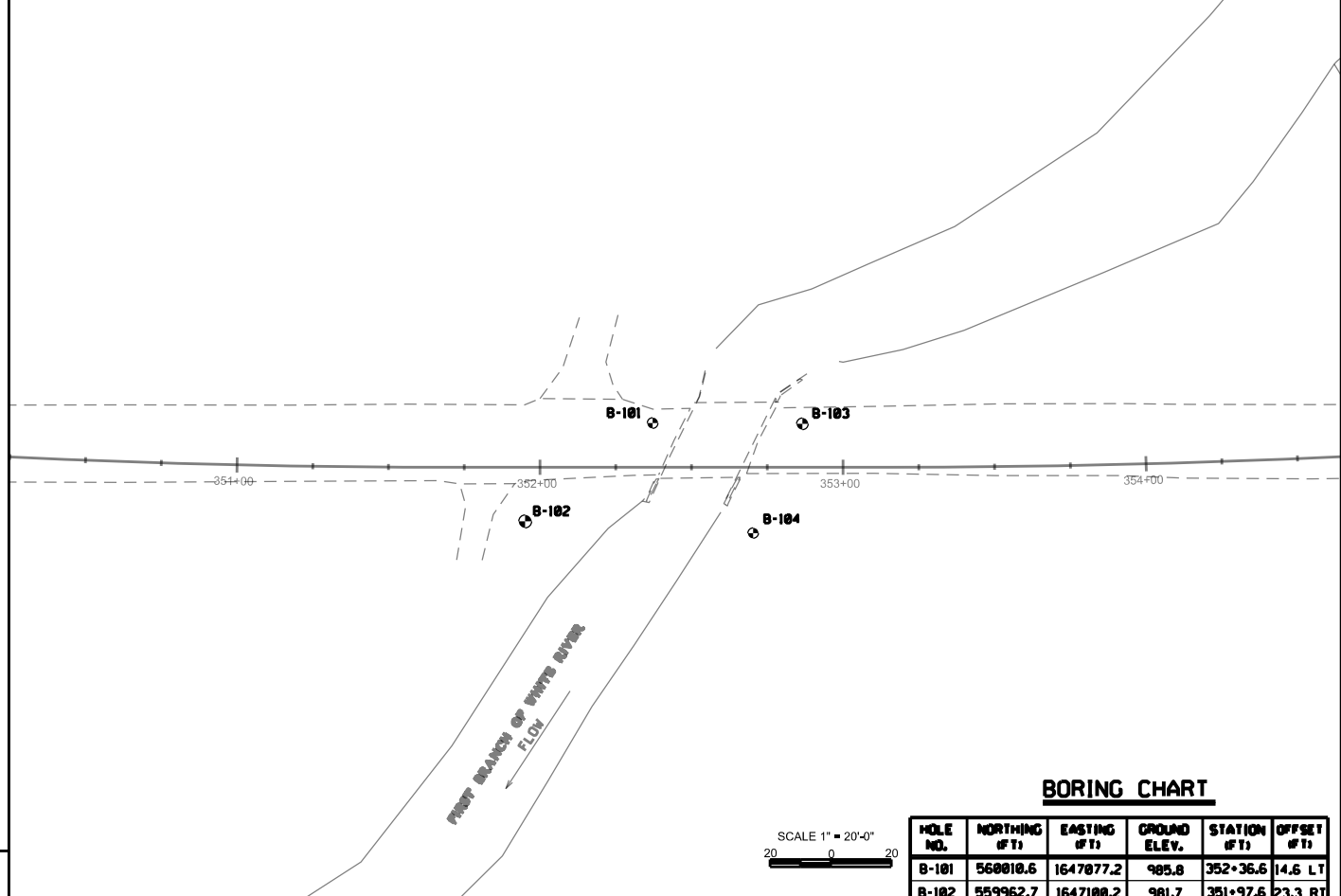
BEDROCK (LEDGE) - Rock in its native location of indefinite thickness.
BOULDER - A rock fragment with an average dimension > 12 inches.
COBBLE - Rock fragments with an average dimension between 3 and 12 inches.
GRAVEL - Rounded particles of rock < 3" and > 0.075" (#10 sieve).
SAND - Particles of rock < 0.075" (#10 sieve) and > 0.0025" (#200 sieve).
SLT - Soil < 0.0025" (#200 sieve), non or slightly plastic and exhibits no strength when air-dried.
CLAY - Fine grained soil, exhibits plasticity when moist and considerable strength when air-dried.

VARVED - Alternate layers of silt and clay.
HARDPAN - Extremely dense soil, cemented layer, not softened when wet.
MUCK - Soft organic soil (containing > 10% organic material).
MOISTURE CONTENT - Weight of water divided by dry weight of soil.
FLOWING SAND - Granular soil so saturated (loose) that it flows into drill casing during extraction of wash rod.
STRIKE - Angle from magnetic north to line of intersection of bed with a horizontal plane.
DIP - Inclination of bed with a horizontal plane.

COMMONLY USED SYMBOLS

▽	Water Elevation
◇	Standard Penetration Boring
⊙	Auger Boring
⊖	Rod Sounding
S	Sample
N	Standard Penetration Test
	Blow Count Per Foot For:
	2" O.D. Sampler
	1 1/2" I.D. Sampler
	Hammer Weight Of 140 Lbs.
	Hammer Fall Of 30"
VS	Field Vane Shear Test
US	Undisturbed Soil Sample
S	Blot
DC	Diamond Core
MD	Mud Drill
WA	Wash Ahead
HSA	Hollow Stem Auger
AK	Core Size 1 1/2"
BK	Core Size 1 1/4"
NK	Core Size 2 1/8"
M	Double Tube Core Barrel Used
LL	Liquid Limit
PL	Plastic Limit
PI	Plasticity Index
NP	Non Plastic
w	Moisture Content (Dry Wgt. Basis)
D	Dry
M	Moist
MTW	Moist To Wet
W	Wet
Sol	Saturated
Bo	Boulder
G	Gravel
So	Sand
Si	Silt
Cl	Clay
HP	Hardpan
Ld	Ledge
LT	No Ledge To Depth
CNPF	Can Not Penetrate Further
TLOB	Top of Ledge Or Boulder
NR	No Recovery
Rec.	Recovery
ZRec.	Percent Recovery
ROD	Rock Quality Designation
CBR	California Bearing Ratio
<	Less Than
>	Greater Than
R	Refused (N > 100)
VTSPG	NA083 - See Note 7

<u>COLOR</u>			
blk	Black	pnk	Pink
bl	Blue	pu	Purple
brn	Brown	rd	Red
dk	Dark	tn	Tan
gry	Gray	wh	White
gn	Green	yel	Yellow
lt	Light	mlc	Multicolored
or	Orange		



BORING CHART

HOLE NO.	NORTHING (FT)	EASTING (FT)	GROUND ELEV.	STATION (FT)	OFFSET (FT)
B-101	560010.6	1647077.2	985.8	352+36.6	14.6 LT
B-102	559962.7	1647100.2	981.7	351+97.6	23.3 RT
B-103	560058.9	1647087.7	986.2	352+28.2	14.2 LT
B-104	560035.5	1647119.6	978.5	352+86.6	21.7 RT

GENERAL NOTES

- The subsurface explorations shown herein were made between ----- and ----- by the Agency.
- Soil and rock classifications, properties and descriptions are based on engineering interpretation from available subsurface information by the Agency and may not necessarily reflect actual variations in subsurface conditions that may be encountered between individual boring or sample locations.
- Observed water levels and/or conditions indicated are as recorded at the time of exploration and may vary according to the prevailing rainfall, methods of exploration and other factors.
- Engineering judgment was exercised in preparing the subsurface information presented herein. Analysis and interpretation of subsurface data was performed and interpreted for Agency design and estimating purposes. Presentation of the information in the Contract is intended to provide the Contractor access to the same data available to the Agency. The subsurface information is presented in good faith and is not intended as a substitute for personal investigation, independent interpretation, independent analysis or judgment by the Contractor.
- Pictorial structure details shown on the boring plan layout or soils profile are for illustrative purposes only and may not accurately portray final contract details.
- Terminology used on boring logs to describe the hardness, degree of weathering, and spacing of fractures, joints and other discontinuities in the bedrock is defined in the AASHTO Manual on Subsurface Investigations, 1988.
- Northing and Easting coordinates are shown in Vermont State Plane Grid North American Datum 1983 in meters and survey feet.

PROJECT NAME: CHELSEA
 PROJECT NUMBER: ER P23-1(440)

FILE NAME: s23b796bor.dgn
 PROJECT LEADER: J. GRIFFIN
 DESIGNED BY:
 BORING INFORMATION SHEET

PLOT DATE:
 DRAWN BY:
 CHECKED BY:
 SHEET OF



STATE OF VERMONT
AGENCY OF TRANSPORTATION
CONSTRUCTION AND
MATERIALS BUREAU
CENTRAL LABORATORY

BORING LOG

Chelsea
ER P23-1(440)
VT Route 110 Bridge 13

Boring No.: **B-101**
Page No.: 1 of 2
Pin No.: 23b796
Checked By: AJA

Boring Crew: McGinley, Thurston, Arles, Bacon
Date Started: 5/21/24 Date Finished: 5/22/24
VTSPG NAD83: N 560010.60 ft E 1647077.20 ft
Station: 352+36.6 Offset: 14.6 LT
Ground Elevation: 985.8 ft

Casing Sampler
Type: WASH BORE SS
I.D.: 4 in 1.5 in
Hammer Wt: N.A. 140 lb.
Hammer Fall: N.A. 30 in.
Hammer/Rod Type: Auto/AWJ
Rig: Acker Renegade $C_F = 1.3$

Groundwater Observations

Date	Depth (ft)	Notes
05/21/24	6.4	WT After Drilling
05/22/24	12.6	WT Before Drilling

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	Run (Dip deg.)	Core Rec. % (RQD %)	Drill Rate minutes/ft	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %
		Field Note:., Asphalt 0.0'-2.1'								
2.5		Field Description, brn-gry, Moist, Rec. = 0.95 ft, Loose, Well Graded, SAND, some Silt, little Gravel				4-4-3-3 (7)	13.9			
5.0		Field Description, brn-gry, Moist, Rec. = 0.4 ft, Very Loose, Well Graded, Fine SAND, some Silt, little Gravel				7-2-1-2 (3)				
7.5		Field Description, brn, Moist, Rec. = 0.65 ft, Dense, Well Graded, Fine SAND, some Silt, some Gravel. Lost Water Return @ 7ft, casing advanced quickly from 7.5ft to 8.0ft				3-10-16-11 (26)				
		Dark brown, Moist, Rec. = 0.55 ft, 8.0 ft - 9.3 ft, Well Graded, Fine to Medium SAND, some Silt, little Gravel. Refusal @ 9.3ft (10 blows no movement)				12-4-R@3" (R)				
10.0		Field Description, Assumed Cobbles/Boulders. NX cleanout from 9.7ft-11.7ft. Lost water @ 10.5ft, spun casing to 12ft. Rollercone cleanout 11.2ft-12.01ft.								
12.5		Field Description, Dk/gry-brn, Moist, Rec. = 0.8 ft, Medium Dense, Well Graded, Fine to Medium SAND, some Silt, little Gravel				9-9-4-4 (13)	40.2			
15.0		Field Description, gray, Wet, Rec. = 0.03 ft, Medium Dense, Poorly Graded, GRAVEL, little Sand				2-3-5-3 (8)				
17.5										
20.0		Field Description, gry-brn, MTW, Rec. = 0.4 ft, Poorly Graded, Fine SAND and SILT. Refusal @ 20.5 ft (50 lows/6")				R@6" (R)				
		Field Description, Casing slow to advance @ 20ft, no water return. Punched through assume boulder at 22.0ft								
22.5										

- Notes:
1. Stratification lines represent approximate boundary between material types. Transition may be gradual.
 2. N Values have not been corrected for hammer energy. C_F is the hammer energy correction factor.
 3. Water level readings have been made at times and under conditions stated. Fluctuations may occur due to other factors than those present at the time measurements were made.
 4. "bgs" is used as the shorthand stand in for "Below Ground Surface".



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BORING LOG

Chelsea
ER P23-1(440)
VT Route 110 Bridge 13

Boring No.: **B-101**
Page No.: 2 of 2
Pin No.: 23b796
Checked By: AJA

Boring Crew: McGinley, Thurston, Arles, Bacon
Date Started: 5/21/24 Date Finished: 5/22/24
VTSPG NAD83: N 560010.60 ft E 1647077.20 ft
Station: 352+36.6 Offset: 14.6 LT
Ground Elevation: 985.8 ft

Casing Sampler
Type: WASH BORE SS
I.D.: 4 in 1.5 in
Hammer Wt: N.A. 140 lb.
Hammer Fall: N.A. 30 in.
Hammer/Rod Type: Auto/AWJ
Rig: Acker Renegade $C_F = 1.3$

Groundwater Observations

Date	Depth (ft)	Notes
05/21/24	6.4	WT After Drilling
05/22/24	12.6	WT Before Drilling

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	Run (Dip deg.)	Core Rec. % (RQD %)	Drill Rate minutes/ft	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %
27.5		Field Description, gray, MTW, Rec. = 1.1 ft, Dense, Gap Graded, GRAVEL and Fine				14-20-18-16 (38)	13.3			
30.0		Field Description, gry-brn, MTW, Rec. = 1.45 ft, Very Dense, Well Graded, Fine SAND, some Gravel, little Silt, Gravel in end of sampler, slight rig chatter @ 35ft				10-27-29-29 (56)	14.1			
32.5										
35.0										
37.5		35.5 ft - 40.5 ft, Gray to white, micaceous and carbonaceous METALIMESTONE with interlayered QUARTZITE, Fine grained to Coarse grained. Hard, Unweathered, Good rock, NXDC, RMR = 74	R-1 (70)	103 (100)	2					
40.0					2					
42.5					2					
45.0					2					
47.5					2					
		40.5 ft - 45.5 ft, Gray to white, micaceous, carbonaceous, and phyllitic METALIMESTONE with interlayered phyllitic QUARTZITE, Fine to Coarse grained, some tan discoloration along joints. Hard, Very slightly weathered, Good rock, NXDC, RMR = 74	R-2 (50)	103 (98)	2					
					2					
					2					
					2					
					2					
		Hole stopped @ 45.5 ft								
		Remarks: Hole Ended @ 45.5 ft Hole Collapse @ 7.0 ft No WT After Collapse								

Notes:

1. Stratification lines represent approximate boundary between material types. Transition may be gradual.
2. N Values have not been corrected for hammer energy. C_F is the hammer energy correction factor.
3. Water level readings have been made at times and under conditions stated. Fluctuations may occur due to other factors than those present at the time measurements were made.
4. "bgs" is used as the shorthand stand in for "Below Ground Surface".

BORING LOG CHELSEA ER P23-1 (440).GPJ VERMONT AOT.GDT 7/22/24



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BORING LOG

Chelsea
ER P23-1(440)
VT Route 110 Bridge 13

Boring No.: **B-102**
Page No.: 1 of 2
Pin No.: 23b796
Checked By: AJA

Boring Crew: McGinley, Thurston, Arles
Date Started: 5/15/24 Date Finished: 5/15/24
VTSPG NAD83: N 559962.70 ft E 1647100.20 ft
Station: 351+97.6 Offset: 23.3 RT
Ground Elevation: 981.7 ft

Casing Sampler
Type: WASH BORE SS
I.D.: 4 in 1.5 in
Hammer Wt: N.A. 140 lb.
Hammer Fall: N.A. 30 in.
Hammer/Rod Type: Auto/AWJ
Rig: Acker Renegade $C_E = 1.3$

Groundwater Observations

Date	Depth (ft)	Notes
05/15/24	8.7	WT After Drilling
05/15/24	7.8	WT During Drilling

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	Run (Dip deg.)	Core Rec. % (RQD %)	Drill Rate minutes/ft	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %
5		A-1-a, brn, Dry, Rec. = 0.6 ft, Medium Dense, GRAVEL, some Sand, trace Silt				2-9-9-10 (18)	4.0	60.0	30.2	9.8
		A-2-4, brn, Dry, Rec. = 1.6 ft, Loose, Well Graded, SAND, some Gravel, some Silt				7-4-5-6 (9)				
		A-2-4, brn, Moist, Rec. = 1.1 ft, Medium Dense, Well Graded, SAND, some Gravel, little Silt				4-6-10-11 (16)	14.6	31.6	49.8	18.6
		Field Description, brn, MTW, Rec. = 0.2 ft, Medium dense, Well Graded, SAND and GRAVEL				7-13-8-4 (21)				
10		Field Description, Rec. = 0.0 ft, NO RECOVERY. Gravel in end of sampler. Refusal @ 9.8 ft, 100 blows				9-16-46-R@3" (62)				
		A-2-4, gry-brn, Wet, Rec. = 0.4 ft, Dense, SAND, some Silt, little Gravel				12-16-18-14 (34)	15.6	12.4	60.3	27.3
		Field Description, gry, Moist, Rec. = 1.5 ft, Poorly Graded, Fine to Medium SAND				11-12-21-14 (33)				
		Field Description, gry, Wet, Rec. = 0.8 ft, GRAVEL/BROKEN ROCK				3-26-11-15 (37)	16.5	12.0	64.6	23.4
15		A-2-4, brn-gry, Moist, Dense, SAND, some Silt, little Gravel								
20		A-1-b, gry-brn, Moist, Rec. = 1.2 ft, Dense, SAND, some Gravel, little Silt				10-14-16-36 (30)	13.7	34.5	47.3	18.2
25		A-2-4, gry-brn, Moist, Rec. = 0.5 ft, Very Dense, SAND, some Gravel, little Silt				13-23-R@4" (R)	12.3	25.3	55.0	19.7

Notes: 1. Stratification lines represent approximate boundary between material types. Transition may be gradual.
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4. "bgs" is used as the shorthand stand in for "Below Ground Surface".



STATE OF VERMONT
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CENTRAL LABORATORY

BORING LOG

Chelsea
ER P23-1(440)
VT Route 110 Bridge 13

Boring No.: **B-102**
Page No.: 2 of 2
Pin No.: 23b796
Checked By: AJA

Boring Crew: McGinley, Thurston, Arles
Date Started: 5/15/24 Date Finished: 5/15/24
VTSPG NAD83: N 559962.70 ft E 1647100.20 ft
Station: 351+97.6 Offset: 23.3 RT
Ground Elevation: 981.7 ft

Casing Sampler
Type: WASH BORE SS
I.D.: 4 in 1.5 in
Hammer Wt: N.A. 140 lb.
Hammer Fall: N.A. 30 in.
Hammer/Rod Type: Auto/AWJ
Rig: Acker Renegade $C_E = 1.3$

Groundwater Observations

Date	Depth (ft)	Notes
05/15/24	8.7	WT After Drilling
05/15/24	7.8	WT During Drilling

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	Run (Dip deg.)	Core Rec. % (RQD %)	Drill Rate minutes/ft	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %
30		30.0 ft - 35.0 ft, Grey to white, micaceous, phyllitic, carbonaceous, interlayered METALIMESTONE, PHYLLITE, and QUARTZITE. Fine to Coarse grained, Tan discolorations and rusting along joints and in core. Hard, Slightly weathered, Fair rock, NXDC, RMR = 52	R-1 (30)	67 (48)	1					
35		35.0 ft - 40.0 ft, Grey to white, micaceous, phyllitic, carbonaceous, interlayered METALIMESTONE, PHYLLITE, and QUARTZITE. Fine to Coarse grained, Slight discoloration in joints. Hard, Very slightly weathered, Good rock, NXDC, RMR = 74	R-2 (45)	100 (94)	3					
40		Hole stopped @ 40.0 ft								
45		Remarks: Hole Ended @ 40.0 ft Hole Collapse @ 10.7 ft								
50										

Notes:

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STATE OF VERMONT
AGENCY OF TRANSPORTATION
CONSTRUCTION AND
MATERIALS BUREAU
CENTRAL LABORATORY

BORING LOG

Chelsea
ER P23-1(440)
VT Route 110 Bridge 13

Boring No.: **B-103**
Page No.: 1 of 2
Pin No.: 23b796
Checked By: AJA

Boring Crew: McGinley, Thurston, Arles, Bacon
Date Started: 5/30/24 Date Finished: 5/30/24
VTSPG NAD83: N 560058.90 ft E 1647087.70 ft
Station: 352+86.6 Offset: 14.2 LT
Ground Elevation: 986.2 ft

Casing Sampler
Type: WASH BORE SS
I.D.: 4 in 1.5 in
Hammer Wt: N.A. 140 lb.
Hammer Fall: N.A. 30 in.
Hammer/Rod Type: Auto/AWJ
Rig: Acker Renegade $C_E = 1.3$

Groundwater Observations

Date	Depth (ft)	Notes
05/30/24	11.4	WT After Drilling

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	Run (Dip deg.)	Core Rec. % (RQD %)	Drill Rate minutes/ft	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %
		Field Description, Asphalt 0.0'-0.8'								
2.5		A-1-b, brn/gry, Dry, Rec. = 1.6 ft, Dense, Well Grade, SAND, some Gravel, little Silt				13-12-10-11 (22)	9.2	37.8	46.1	16.1
5.0		A-2-4, brn, MTD, Rec. = 1.6 ft, Medium Dense, Well Graded, SAND, some Gravel, some Silt				12-11-8-9 (19)	11.8	24.8	55.1	20.1
7.5		A-2-4, brn, MTD, Rec. = 1.4 ft, Loose, Poorly Graded, SAND, some Silt, trace Gravel				7-4-3-4 (7)	15.3	11.3	63.8	24.9
10.0		A-2-4, brn, Moist, Rec. = 1.2 ft, Very Loose, Poorly Graded, SAND, Some Silt, some Gravel				1-1-2-3 (3)	13.6	30.7	47.0	22.3
12.5		A-2-4, brn, Moist, Rec. = 1.5 ft, Loose, Poorly Graded, SAND, some Gravel, some Silt. Slight rig chatter at 13'				4-2-3-3 (5)	17.5			
15.0										
17.5										
20.0		Field Description, brn/gry, Moist, Rec. = 1.2 ft, Medium Dense, Poorly Graded, Coarse SAND, little Gravel				5-5-6-6 (11)	13.4			
22.5										
		Field Description, Drk gry/brn, Wet, Rec. = 0.4 ft, Very Loose, Poorly Graded, Coarse SAND, Little Silt				1-2-WOH-5 (2)	24.3			

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BORING LOG CHELSEA ER P23-1 (440).GPJ VERMONT AOT.GDT 7/22/24



STATE OF VERMONT
AGENCY OF TRANSPORTATION
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MATERIALS BUREAU
CENTRAL LABORATORY

BORING LOG

Chelsea
ER P23-1(440)
VT Route 110 Bridge 13

Boring No.: **B-103**
Page No.: 2 of 2
Pin No.: 23b796
Checked By: AJA

Boring Crew: McGinley, Thurston, Arles, Bacon
Date Started: 5/30/24 Date Finished: 5/30/24
VTSPG NAD83: N 560058.90 ft E 1647087.70 ft
Station: 352+86.6 Offset: 14.2 LT
Ground Elevation: 986.2 ft

Casing Sampler
Type: WASH BORE SS
I.D.: 4 in 1.5 in
Hammer Wt: N.A. 140 lb.
Hammer Fall: N.A. 30 in.
Hammer/Rod Type: Auto/AWJ
Rig: Acker Renegade $C_F = 1.3$

Groundwater Observations

Date	Depth (ft)	Notes
05/30/24	11.4	WT After Drilling

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	Run (Dip deg.)	Core Rec. % (RQD %)	Drill Rate minutes/ft	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %
27.5		A-2-4, Drk gry/brn, Wet, Rec. = 1.7 ft, Very Dense, Well Graded, SAND, some Silt, some Gravel				20-19-19-26 (38)	13.9	23.6	55.6	20.8
30.0		A-2-4, Drk gry/brn, Wet, Rec. = 1.0 ft, Dense, Poorly Graded, SAND AND GRAVEL, some Silt				16-18-11-13 (29)	13.4	35.1	35.9	29.0
35.0		A-2-4, Drk gry/brn, Wet, Rec. = 0.5 ft, Poorly Graded, SAND, little Silt. Refusal @ 35.5', 10 blows no movement	R-1 (30)	98 (89)	1	R@6" (R)	23.7		83.0	17.0
37.5		35.5 ft - 40.5 ft, Gray to white, micaceous, carbonaceous, phyllitic METALIMESTONE with interlayered phyllitic QUARTZITE, Fine to Coarse grained. Some joints have faint orange/rust staining on them. Hard, Slightly weathered, Good rock, NXDC, RMR = 71			2					
40.0					1					
42.5					1					
45.0					2					
47.5		Hole stopped @ 45.5 ft								
		Remarks: Hole Ended @ 45.5 ft Hole Collapse @ 13.1 ft								

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BORING LOG CHELSEA ER P23-1 (440).GPJ VERMONT AOT.GDT 7/22/24



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CENTRAL LABORATORY

BORING LOG

Chelsea
ER P23-1(440)
VT Route 110 Bridge 13

Boring No.: **B-104**
Page No.: 1 of 2
Pin No.: 23b796
Checked By: AJA

Boring Crew: McGinley, Thurston, Arles
Date Started: 5/16/24 Date Finished: 5/16/24
VTSPG NAD83: N 560035.50 ft E 1647119.60 ft
Station: 352+70. Offset: 21.7 RT
Ground Elevation: 978.5 ft

Casing Sampler
Type: WASH BORE SS
I.D.: 4 in 1.5 in
Hammer Wt: N.A. 140 lb.
Hammer Fall: N.A. 30 in.
Hammer/Rod Type: Auto/AWJ
Rig: Acker Renegade $C_E = 1.3$

Groundwater Observations

Date	Depth (ft)	Notes
05/16/24	5.3	WT After Drilling

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	Run (Dip deg.)	Core Rec. % (RQD %)	Drill Rate minutes/ft	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %
		A-2-4, brn, Dry, Rec. = 1.5 ft, Loose, Poorly Graded, SAND, some Silt, trace Gravel				1-2-3-3 (5)				
2.5		A-2-4, brn, MTD, Rec. = 1.4 ft, Loose, Poorly graded, SAND, some Silt, trace Gravel				2-2-2-1 (4)	22.3	11.8	67.1	21.1
5.0		Field Description, brn, MTW, Rec. = 0.5 ft, Very Loose. Well Graded, COARSE SAND, some Gravel, trace Silt				1-1-1-5 (2)				
7.5		Field Description, brn, Wet, Rec. = 1.5 ft, Dense, Well Graded, SAND and GRAVEL, trace Broken Rock, trace Silt. Broken Rock/Gravel in end of sampler.				48-12-15-14 (27)				
10.0		A-2-4, brn-gry, MTW, Rec. = 1.5 ft, Medium Dense, Well Graded, SAND, some Gravel, little Silt				9-11-11-15 (22)	16.7	24.1	56.4	19.5
		Field Description, brn, MTW, Rec. = 0.6 ft, Medium Dense, Well Graded, Fine to Medium SAND, some Gravel				10-9-7-8 (16)				
12.5		A-1-b, brn, Wet, Rec. = 1.6 ft, Loose Well Graded, SAND, some Gravel, little Silt				9-5-5-6 (10)	14.7	30.1	55.2	14.7
15.0		Field Description, Drilled through assumed Cobbles/Boulders from 14.5'-15.5'								
17.5										

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BORING LOG

Chelsea
ER P23-1(440)
VT Route 110 Bridge 13

Boring No.: **B-104**
Page No.: 2 of 2
Pin No.: 23b796
Checked By: AJA

Boring Crew: McGinley, Thurston, Arles
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VTSPG NAD83: N 560035.50 ft E 1647119.60 ft
Station: 352+70. Offset: 21.7 RT
Ground Elevation: 978.5 ft

Casing Sampler
Type: WASH BORE SS
I.D.: 4 in 1.5 in
Hammer Wt: N.A. 140 lb.
Hammer Fall: N.A. 30 in.
Hammer/Rod Type: Auto/AWJ
Rig: Acker Renegade $C_E = 1.3$

Groundwater Observations

Date	Depth (ft)	Notes
05/16/24	5.3	WT After Drilling

Depth (ft)	Strata (1)	CLASSIFICATION OF MATERIALS (Description)	Run (Dip deg.)	Core Rec. % (RQD %)	Drill Rate minutes/ft	Blows/6" (N Value)	Moisture Content %	Gravel %	Sand %	Fines %
		A-3, brn-red, MTW, Rec. = 1.4 ft, Poorly Graded, SAND, some Gravel, trace Silt				10-7-8-29 (15)	15.6	28.4	67.7	3.9
22.5										
25.0		Field Description, gry, MTW, Rec. = 0.3 ft, Well Graded, SAND, some Silt, trace Gravel	R-1 (10)	98 (87)	2	R@3" (R)				
27.5		25.3 ft - 30.3 ft, Grey, micaceous, sulfidic, and phyllitic METALIMESTONE, Fine to Medium grained, Green/yellow/orange rusting/discoloration at joints. Hard, Slightly weathered, Good rock, NXDC, RMR = 76			2					
30.0					2					
32.5					2					
35.0					2					
37.5		Hole stopped @ 35.3 ft								
		Remarks: Hole Ended @ 35.3 ft								

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