

**To:** Rob Young, P.E., Structures Project Manager

*END*

**From:** Eric Denardo, P.E., Geotechnical Engineer

**Date:** July 17, 2024

**Subject:** Plymouth ER P23-1(327) – Geotechnical Data Report

## 1.0 INTRODUCTION

As requested, we have completed our geotechnical and geological subsurface investigation for the proposed replacement of Bridge No. 4 located on VT Route 100A over the Piney Hollow Brook in Plymouth, Vermont. The borings were completed to determine the soil strata and depth to bedrock to aid in design of a replacement structure. Contained herein are the results of our field sampling and testing, laboratory analyses of soil and rock samples, as well as attached boring logs.

## 2.0 FIELD INVESTIGATION

The field investigation was conducted between January 18, and January 29, 2024. Two standard penetration borings and two bedrock probes were drilled to evaluate the subsurface profile to aid in the design and construction of the replacement structure. Approximate boring locations were provided by Rob Young in an email dated October 17, 2023, and final locations were identified at the site by members of the VTrans Drill Unit and Geotechnical Engineering Section during a site visit conducted January 12, 2024. A summary of the boring locations can be found in Table 2.1 as well as on the attached Boring Location Plan.

The values for the Northings and Eastings are based on the Vermont State Plane Grid Coordinate System NAD 83. The elevations for the borings are based on the North American Vertical Datum, NAVD 88. The boring locations were located by a VTrans Survey Crew. The locations of the borings should be considered accurate only to the degree implied by the method used to determine them.

**Table 2.1: Boring Locations**

| <b>Boring</b> | <b>Station</b> | <b>Offset<br/>(ft)</b> | <b>Northing<br/>(ft)</b> | <b>Easting<br/>(ft)</b> | <b>Elevation<br/>(ft)</b> | <b>Bedrock<br/>Elevation (ft)</b> |
|---------------|----------------|------------------------|--------------------------|-------------------------|---------------------------|-----------------------------------|
| B-101         | 123+98         | -8.0                   | 382222.8                 | 1584661.2               | 1231.6                    | -                                 |
| B-102         | 124+42         | 8.6                    | 382261.3                 | 1584689.1               | 1230.9                    | 1221.0                            |
| P-101         | 123+73         | 9.3                    | 382195.7                 | 1584671.6               | 1231.9                    | 1200.9                            |
| P-102         | 124+70         | -6.6                   | 382291.9                 | 1584681.9               | 1230.6                    | 1207.6                            |

The borings were performed in general accordance with AASHTO T206, *Standard Method of Test for Penetration Test and Split-Barrel Sampling of Soils*. During the boring operations for B-101, split spoon samples and standard penetration tests (SPT) were taken continuously to 10 feet (ft) below ground surface (bgs), then at 5 ft intervals to 26 ft bgs where the boring was terminated due to issues with cobbles/boulders shearing the drilling casing. In B-102, samples were taken continuously until bedrock was encountered at a depth of 9.9 ft bgs. Concrete was encountered

approximately 1.4 ft above rock, believed to be in place from construction of the existing bridge. Due to drilling issues during B-101 and limited bedrock core information from B-102, two additional probes were advanced in the alternate corners of the bridge. Bedrock probes P-101 and P-102 were advanced to bedrock without sampling soils. When refusal was encountered, 10 ft of BX rock cores were advanced in each hole to confirm the presence of bedrock.

In the borings, 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 Laboratory for testing and further evaluation. Upon completion of the laboratory testing of select representative samples, the borings logs were revised to reflect the results of the laboratory classification analysis. The attached boring logs display the types of soil strata encountered and include the laboratory test data, SPT data, and any pertinent observations made by the Drilling Crew.

Details of the bedrock coring were recorded on the boring logs when applicable. Cores were then placed in core boxes and returned to the VTrans Construction and Materials Bureau Laboratory for further evaluation and testing, where applicable. The boring logs were revised to reflect the classification and description of the bedrock.

### 3.0 FIELD AND LABORATORY TESTS

The standard penetration resistance of the in-situ soil is calculated as the number of blows required to drive a 2-inch (in) outside diameter (OD) split-barrel sampler 24 in into the soil by a 140-pound hammer dropped from a height of 30 in, in accordance with procedures specified in AASHTO T206. The number of blows required to drive the sampler each 6 in increment is recorded and the Standard Penetration Resistance (N-Value) is calculated as the sum of the blows over the second and third 6-in 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. VTrans has determined a hammer correction value,  $C_E$ , to account for the efficiency of the SPT hammers on its drill rigs. For the borings, an Acker Renegade Track Rig was used. Because this is a new drill rig, a hammer energy correction factor has yet to be determined. As a result, a conservative  $C_E$  value of 1.3, based on a standard value for an automatic hammer, should be used in all soil parameter calculations.

Geotechnical laboratory tests were performed to assist with soil classification and evaluate engineering properties of the soil. Grain size analyses were performed on select representative soil samples in accordance with AASHTO T 88, *Standard Method of Test for Particle Size Analysis of Soils*.

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

Review of the laboratory data, field testing, and boring logs revealed the following information pertaining to the soil strata. It should be noted that groundwater elevations are subject to change. Because groundwater elevations can fluctuate seasonally and are affected by temperature and precipitation, groundwater may be encountered during construction when not previously noted in the logs.

**B-101:** The ground surface elevation at B-101 is approximately 1231.6 ft. Groundwater was not measured during drilling operations.

**Table 4.1: B-101 Soil Strata**

| Depth (Below Ground Surface Elevation) | Soil Profile                            |
|----------------------------------------|-----------------------------------------|
| 0 – 1.0 ft                             | Asphalt Pavement                        |
| 1.0 – 14.5 ft                          | Dense GRAVEL, some Sand, little Silt    |
| 14.5 – 26.0 ft                         | Very Dense SAND, some Gravel, some Silt |

**B-102:** The ground surface elevation at B-102 is approximately 1230.9 ft. Groundwater was encountered after drilling operations on January 18, 2024, at a depth of 4.2 ft bgs corresponding to an approximate groundwater elevation of 1226.7 ft.

**Table 4.2: B-102 Soil Strata**

| Depth (Below Ground Surface Elevation) | Soil Profile                              |
|----------------------------------------|-------------------------------------------|
| 0 – 0.8 ft                             | Asphalt Pavement                          |
| 0.8 – 8.5 ft                           | Very Dense GRAVEL, some Sand, little Silt |
| 8.5 – 9.9 ft                           | Concrete                                  |
| >9.9 ft                                | Bedrock(Quartzite/Phyllite)               |

#### 4.1 Rock Parameters

A summary of the rock core findings are listed in Table 4.3 as well as available in the attached boring logs. Information from the cores indicated medium hard to hard Quartzite and Phyllite to be present at the boring locations. The bedrock had an average rock mass rating (RMR) of 38, indicating poor rock.

Table 4.3: Rock Core Sample Results

| Run Number | Core Size | Depth (ft) | Recovery (%) | RQD (%) | Dip (deg) | Lithologic Description                                                                                                                                                                                                                                                                                                                          | RMR |
|------------|-----------|------------|--------------|---------|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| B-102, R-1 | BX        | 9.9        | 46           | 0       | N/A       | Greenish/gray to white QUARTZITE and PHYLLITE. Run is highly fractured. Minor rust staining on broken pieces. Pieces too broken to get handle on hardness                                                                                                                                                                                       | N/A |
| P-101, R-2 | BX        | 31-34      | 46           | 0       | 40        | Greenish/Gray to white QUARTZITE and PHYLLITE. Run is highly fractured. Minor rust staining on broken pieces. Pieces too broken up to get handle on hardness, slightly weathered.                                                                                                                                                               | 31  |
| P-101, R-3 | BX        | 34-39      | 100          | 82      | 45-50     | Greenish gray to whitish gray muscovite-chlorite-plagioclase-biotite-garnet-PHYLLITE and minor amphibolite and quartzite. Rust staining near joints and amphibole rich zones. Plagioclase & quartz content high through core                                                                                                                    | 50  |
| P-101, R-4 | BX        | 39-41      | 95           | 95      | 50        | Greenish gray to whitish gray muscovite-chlorite-plagioclase-biotite-garnet PHYLLITE. Rust staining near joints                                                                                                                                                                                                                                 | 58  |
| P-102, R-1 | BX        | 23-28      | 72           | 0       | 60-65     | Greenish gray muscovite-chlorite-plagioclase-biotite PHYLLITE with garnet. Some sulfides present. Rust splotches and faint orange staining along fracture surfaces. Core is highly fractured and crumbled. LOW RQD due to this. Unable to determine if mechanical or natural.                                                                   | 25  |
| P-102, R-2 | BX        | 28-33      | 48           | 0       | 60-65     | Gray greenish to gray muscovite-biotite-chlorite-plagioclase-PHYLLITE with garnet. Fine clusters of brassy yellow sulfides present. Rust splotches in areas of sulfides and few popouts. Joints are smooth. Medium hard, slightly weathered. Core highly fractured/crumbled, LOW RQD due to this. Unable to determine if mechanical or natural. | 25  |

## 5.0 CONCLUSION

If you have any questions, or you would like to discuss this report, please contact us via email. Please let us know when more information is available for assistance with foundation analyses and design. Typed boring logs are attached and are available in the CADD design files:

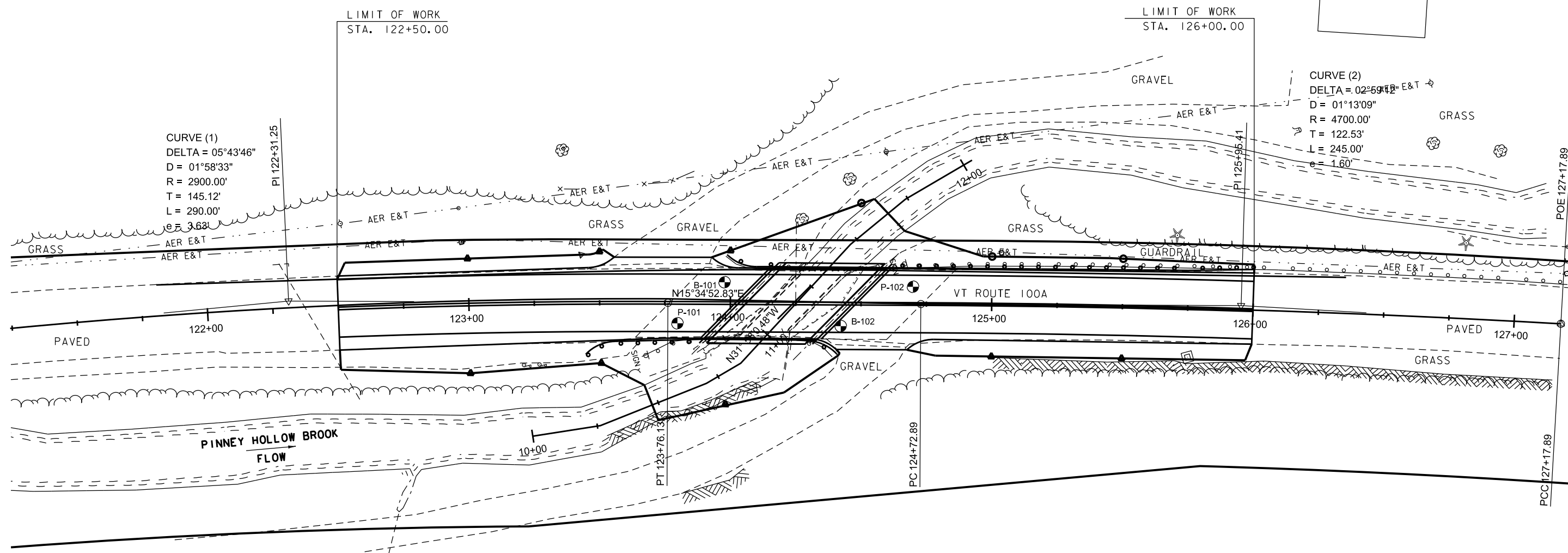
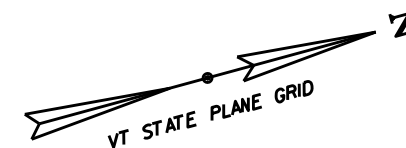
<M:\Projects\23m317\MaterialsResearch>

Attachments: Boring Layout  
Boring Logs (5 pages)

Reviewed by: August Arles, Geotechnical Engineer *ASA*

cc: Read File/MG  
Project File/CEE  
END

[Z:\Highways\CMB\GeotechEngineering\Projects\Plymouth ER 23-1\(327\) BR04\REPORTS\Plymouth ER P23-1\(327\) Subsurface Investigation.docx](Z:\Highways\CMB\GeotechEngineering\Projects\Plymouth ER 23-1(327) BR04\REPORTS\Plymouth ER P23-1(327) Subsurface Investigation.docx)



## BORING LAYOUT

BORING CHART

| HOLE NO. | STATION | OFFSET (FT) | NORTHING (FT) | EASTING (FT) | APPROX. GROUND SURFACE ELEV. (FT) | APPROX. BEDROCK ELEV. (FT) |
|----------|---------|-------------|---------------|--------------|-----------------------------------|----------------------------|
| B-101    | 123+98  | 8.0 LT      | 382222.8      | 1584661.2    | 1231.6                            | -                          |
| B-102    | 124+42  | 8.6 RT      | 382261.3      | 1584689.1    | 1230.9                            | 1221.0                     |
| P-101    | 123+73  | 9.3 RT      | 382195.7      | 1584671.6    | 1231.9                            | 1200.9                     |
| P-102    | 124+70  | 6.6 LT      | 382291.9      | 1584681.9    | 1230.6                            | 1207.6                     |



GREEN INTERNATIONAL AFFILIATES, INC.  
CIVIL AND STRUCTURAL ENGINEERS

PROJECT NAME: PLYMOUTH  
PROJECT NUMBER: ER P23-1(327)  
FILE NAME: \*FILES\*  
PROJECT LEADER: A. TSOUKALAS  
DESIGNED BY: C. WU  
BORING LAYOUT

PLOT DATE: \*\*\*DATE\*\*\*  
DRAWN BY: L. BYERS  
CHECKED BY: S. SACCO  
SHEET SET OF TTLSET



STATE OF VERMONT  
AGENCY OF TRANSPORTATION  
CONSTRUCTION AND  
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BORING LOG

Plymouth  
ER P23-1(327)  
VT100A Bridge 4

Boring No.: **B-101**

Page No.: 1 of 1

Pin No.: 23b758

Checked By: END

Boring Crew: McGinley (VTrans), Andrews (GeoDesign)

Date Started: 1/22/24 Date Finished: 1/22/24

VTSPG NAD83: N 382222.80 ft E 1584661.20 ft

Station: 123+98.00 Offset: -8.00

Ground Elevation: 1231.6 ft

|                  | Casing         | Sampler              |
|------------------|----------------|----------------------|
| Type:            | FJ             | SS                   |
| I.D.:            | 4 in           | 1.38 in              |
| Hammer Wt:       | N.A.           | 140 lb.              |
| Hammer Fall:     | N.A.           | 30 in.               |
| Hammer/Rod Type: | Auto/AWJ       |                      |
| Rig:             | Acker Renegade | C <sub>E</sub> = 1.3 |

Groundwater Observations

| Date | Depth (ft) | Notes |
|------|------------|-------|
|      |            |       |
|      |            |       |
|      |            |       |
|      |            |       |

| Depth (ft) | Strata (1) | CLASSIFICATION OF MATERIALS (Description)                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Blows/6" (N Value) | Moisture Content % | Gravel % | Sand % | Fines % |
|------------|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------|----------|--------|---------|
|            |            | Field Note, Asphalt 0.0'-1.0'                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                    |                    |          |        |         |
|            |            | Visual Description:., Fine to coarse SAND, some fine Gravel, little Silt. Refusal @ 1.6', 50 blows per 0.5'. Weathered rock in end of sampler, brn, Moist, Rec. = 0.5 ft                                                                                                                                                                                                                                                                                                                         | 25-R@1" (R)        |                    |          |        |         |
| 5          |            | Visual Description:., Medium dense, fine GRAVEL, some fine to coarse Sand, little Silt, brn, Moist, Rec. = 0.4 ft                                                                                                                                                                                                                                                                                                                                                                                | 4-5-8-5 (13)       |                    |          |        |         |
|            |            | A-1-a, GRAVEL, some Sand, little Silt, brn/gry, Moist, Rec. = 0.7 ft                                                                                                                                                                                                                                                                                                                                                                                                                             | 8-10-10-10 (20)    | 7.6                | 52.3     | 34.9   | 12.8    |
| 10         |            | Visual Description:., Dense, fine GRAVEL, little fine to coarse Sand, trace Silt, brn/gry, Moist, Rec. = 0.3 ft                                                                                                                                                                                                                                                                                                                                                                                  | 25-10-13-20 (23)   |                    |          |        |         |
|            |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                    |                    |          |        |         |
| 15         |            | Visual Description:., Dense, fine to coarse SAND and fine GRAVEL, little Silt, brn/gry, Moist, Rec. = 0.8 ft                                                                                                                                                                                                                                                                                                                                                                                     | 10-18-15-24 (33)   |                    |          |        |         |
|            |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                    |                    |          |        |         |
| 20         |            | A-1-b, Dense, SAND, some Gravel, some Silt, brn/gry, Moist, Rec. = 0.6 ft                                                                                                                                                                                                                                                                                                                                                                                                                        | 16-17-20-35 (37)   | 12.5               | 32.0     | 43.5   | 24.5    |
|            |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                    |                    |          |        |         |
| 25         |            | Field Note, Light rig chatter from 22.0' - 25.0'.                                                                                                                                                                                                                                                                                                                                                                                                                                                |                    |                    |          |        |         |
|            |            | Field Note, Hard drilling from 25.0' - 26.0'                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                    |                    |          |        |         |
|            |            | Hole stopped @ 26.0 ft                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                    |                    |          |        |         |
| 30         |            | Remarks:<br>1) Driller noted probable rock at about 2' - 3'. Driller advanced casing to 4' for S-2 sample.<br>2) Assumed cobbles/boulders nested in sand clearing from 14' - 19'. Wash water clear to brown in this interval.<br>3) Casing sheared off due to sand heaving/boulders. Extremely hard drilling from 19' - 22'. Unable to advance casing below 22', advanced with roller bit open hole.<br>4) Hard drilling with roller bit from 25' - 26'. Unable to advance roller bit below 26'. |                    |                    |          |        |         |

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<sub>E</sub> 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.



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BORING LOG

Plymouth  
ER P23-1(327)  
VT100A Bridge 4

Boring No.: **B-102**  
Page No.: 1 of 1  
Pin No.: 23b758  
Checked By: END

Boring Crew: McGinley (VTrans), Andrews (GeoDesign)  
Date Started: 1/18/24 Date Finished: 1/18/24  
VTSPG NAD83: N 382261.30 ft E 1584689.10 ft  
Station: 124+42.00 Offset: 8.60  
Ground Elevation: 1230.9 ft

Casing Sampler  
Type: FJ SS  
I.D.: 4 in 1.38 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             |
|----------|------------|-------------------|
| 01/18/24 | 4.2        | 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 % |
|------------|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|---------------------|-----------------------|--------------------|--------------------|----------|--------|---------|
| 0.0        |            | Field Note, Asphalt 0.0'-0.8'                                                                                                                                                                                                                                                                                                                                                                                                                                   |                |                     |                       |                    |                    |          |        |         |
| 2.5        |            | Visual Description: Fine GRAVEL, little fine to coarse Sand, trace Silt. Refusal @ 1.1', 50 blows per 0.5', gry, Moist, Rec. = 0.3 ft                                                                                                                                                                                                                                                                                                                           |                |                     |                       | R@4" (R)           |                    |          |        |         |
| 5.0        |            | A-1-a, Dense, GRAVEL, some Sand, little Silt, brn/gry, Moist, Rec. = 0.7 ft                                                                                                                                                                                                                                                                                                                                                                                     |                |                     |                       | 13-18-19-16 (37)   | 9.2                | 58.7     | 29.0   | 12.3    |
| 7.5        |            | Visual Description: Dense, fine to coarse GRAVEL, some fine to coarse Sand, little Silt, brn/gry, Moist, Rec. = 0.9 ft                                                                                                                                                                                                                                                                                                                                          |                |                     |                       | 13-14-19-38 (33)   |                    |          |        |         |
| 7.5        |            | Field Note, NO RECOVERY, appears to be concrete in end of sampler, Rec. = 0.0 ft                                                                                                                                                                                                                                                                                                                                                                                |                |                     |                       | 12-8-6-4 (14)      |                    |          |        |         |
| 10.0       |            | Field Note, Concrete 8.5'-9.9'                                                                                                                                                                                                                                                                                                                                                                                                                                  |                |                     |                       |                    |                    |          |        |         |
| 12.5       |            | 9.9 ft - 13.5 ft, White-gray, white/gray QUARTZITE and PHYLLITE. Rust staining along rock surfaces. May not be bedrock but boulder under abutment. BX                                                                                                                                                                                                                                                                                                           | R-1            | 46 (0)              | 2 1.4 6.2 7.2         |                    |                    |          |        |         |
| 15.0       |            | Hole stopped @ 13.5 ft                                                                                                                                                                                                                                                                                                                                                                                                                                          |                |                     |                       |                    |                    |          |        |         |
| 17.5       |            | Remarks:<br>1) Unable to advance casing past 8.5'. Core R-1 taken from 8.5' - 13.5'. Gray wash water while coring.<br>2) Losing water at 11.0', bit advanced rapidly from 11.0' - 11.3'. Assumed void or very soft material.<br>3) Top 13" of R-1 core recovery appears to be weathered concrete. Steel pieces in recovery.<br>4) Unable to core R-2 due to potential construction debris at 12'. Core barrel retrieved from R-2 core attempt with damaged bit. |                |                     |                       |                    |                    |          |        |         |
| 20.0       |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                     |                       |                    |                    |          |        |         |
| 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.  $C_E$  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.



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BORING LOG

Plymouth  
ER P23-1(327)  
VT100A Bridge 4

Boring No.: **P-101**  
Page No.: 1 of 2  
Pin No.: 23b758  
Checked By: END

Boring Crew: McGinley (VTrans), Andrews (GeoDesign)  
Date Started: 1/25/24 Date Finished: 1/25/24  
VTSPG NAD83: N 382195.70 ft E 1584671.60 ft  
Station: 123+73.00 Offset: 9.30  
Ground Elevation: 1231.9 ft

Casing Sampler  
Type: FJ N.A.  
I.D.: 3 in  
Hammer Wt: N.A. N.A.  
Hammer Fall: N.A. 30 in.  
Hammer/Rod Type: N.A./AWJ  
Rig: Acker Renegade  $C_E = 1.3$

Groundwater Observations

| Date     | Depth (ft) | Notes             |
|----------|------------|-------------------|
| 01/25/24 | 8.8        | 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 % |
|------------|------------|-------------------------------------------------------------------------------------------------------------------------------------|----------------|---------------------|-----------------------|--------------------|--------------------|----------|--------|---------|
| 2.5        |            | Field Note, Asphalt 0.0'-0.75'                                                                                                      |                |                     |                       |                    |                    |          |        |         |
| 5.0        |            | Field Note, Smooth drilling. Light brown sand in return cuttings.                                                                   |                |                     |                       |                    |                    |          |        |         |
| 7.5        |            |                                                                                                                                     |                |                     |                       |                    |                    |          |        |         |
| 10.0       |            | Field Note, Brown sand in return cuttings. Water loss at 13.0'. Water return at 17.0'.                                              |                |                     |                       |                    |                    |          |        |         |
| 12.5       |            |                                                                                                                                     |                |                     |                       |                    |                    |          |        |         |
| 15.0       |            |                                                                                                                                     |                |                     |                       |                    |                    |          |        |         |
| 17.5       |            | Field Note, Slight resistance from 17.0' - 18.0', assumed cobbles/boulders.                                                         |                |                     |                       |                    |                    |          |        |         |
| 20.0       |            | Field Note, Continued smooth drilling from 18.0' - 19.5'. Brown/Light brown Sand in return cuttings.                                |                |                     |                       |                    |                    |          |        |         |
| 22.5       |            | Field Note, Medium drilling effort with smooth advance at 19.5', water loss to 20.5'. low effort below 20.5' with water return.     |                |                     |                       |                    |                    |          |        |         |
|            |            | Field Note, Medium effort with water return at 23.0', rig chatter at 23.5' with tan wash water return turning brownish gray at 24'. |                |                     |                       |                    |                    |          |        |         |
|            |            | Field Note, Hard effort at 27'. About 1.5' of material in casing. Cleanout core barrel used to confirm material as core R-1.        |                |                     |                       |                    |                    |          |        |         |

Notes:

1. Stratification lines represent approximate boundary between material types. Transition may be gradual.
2. N Values have not been corrected for hammer energy.  $C_E$  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.



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CENTRAL LABORATORY

BORING LOG

Plymouth  
ER P23-1(327)  
VT100A Bridge 4

Boring No.: **P-101**

Page No.: **2 of 2**

Pin No.: **23b758**

Checked By: **END**

Boring Crew: McGinley (VTrans), Andrews (GeoDesign)

Date Started: 1/25/24 Date Finished: 1/25/24

VTSPG NAD83: N 382195.70 ft E 1584671.60 ft

Station: 123+73.00 Offset: 9.30

Ground Elevation: 1231.9 ft

Casing FJ Sampler N.A.  
Type: FJ I.D.: 3 in  
Hammer Wt: N.A. Hammer Fall: N.A. 30 in.  
Hammer/Rod Type: N.A./AWJ  
Rig: Acker Renegade  $C_E = 1.3$

Groundwater Observations

| Date     | Depth (ft) | Notes             |
|----------|------------|-------------------|
| 01/25/24 | 8.8        | 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       |            | Field Note:., Attempted core from 25.5-27.5' appears to be nested cobbles.                                                                                                                                                                                                                                                                                                  |                |                     |                       |                    |                    |          |        |         |
| 30.0       |            |                                                                                                                                                                                                                                                                                                                                                                             |                |                     |                       |                    |                    |          |        |         |
| 32.5       |            | 31.0 ft - 34.0 ft, Greenish/gray to white QUARTZITE and PHYLLITE. Run is highly fractured. Minor rust staining on broken pieces. Pieces too broken to get handle on hardness. Slightly weathered, Poor rock, BX, RMR = 31                                                                                                                                                   | R-2 (40)       | 46 (0)              | 4                     | 7                  |                    |          |        |         |
| 35.0       |            | 34.0 ft - 39.0 ft, Greenish gray to whitish gray muscovite-chlorite-plagioclase-biotite-garnet-PHYLLITE and minor amphibolite and quartzite. Rust staining near joints and amphibole rich zones. Plagioclase & quartz content high through core. Medium hard, Slightly weathered, Fair rock, BX, RMR = 50                                                                   | R-3 (45-50)    | 100 (82)            | 3                     | 5                  |                    |          |        |         |
| 37.5       |            |                                                                                                                                                                                                                                                                                                                                                                             |                |                     | 4                     | 4                  |                    |          |        |         |
| 40.0       |            | 39.0 ft - 41.0 ft, Greenish gray to whitish gray muscovite-chlorite-plagioclase-biotite-garnet PHYLLITE. Rust staining near joints. Medium hard, Slightly weathered, Fair rock, BX, RMR = 58                                                                                                                                                                                | R-4 (50)       | 95 (95)             | 3                     | 4                  |                    |          |        |         |
| 42.5       |            | Hole stopped @ 41.0 ft                                                                                                                                                                                                                                                                                                                                                      |                |                     |                       |                    |                    |          |        |         |
| 45.0       |            | Remarks:<br>1) 3" FJ casing used to probe to assumed bedrock.<br>2) Gray wash water coring R-1 at 25.5', brown wash at 27.5', gray wash at 28'. Continuing casing advance to confirm fracture in rock or cobbles/boulders.<br>3) Wash water turned brownish gray with hard effort at 30.0'.<br>4) Wash turned dark gray at 30.5' with hard effort. Core R-2 taken at 31.0'. |                |                     |                       |                    |                    |          |        |         |
| 47.5       |            |                                                                                                                                                                                                                                                                                                                                                                             |                |                     |                       |                    |                    |          |        |         |

Notes:

1. Stratification lines represent approximate boundary between material types. Transition may be gradual.
2. N Values have not been corrected for hammer energy.  $C_E$  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.



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

BORING LOG

Plymouth  
ER P23-1(327)  
VT100A Bridge 4

Boring No.: **P-102**  
Page No.: 1 of 1  
Pin No.: 23b758  
Checked By: END

Boring Crew: McGinley (VTTrans), Andrews (GeoDesign)  
Date Started: 1/29/24 Date Finished: 1/29/24  
VTSPG NAD83: N 382291.90 ft E 1584681.90 ft  
Station: 124+70.00 Offset: -6.60  
Ground Elevation: 1230.6 ft

Casing Sampler  
Type: FJ N.A.  
I.D.: 3 in  
Hammer Wt: N.A. N.A.  
Hammer Fall: N.A. 30 in.  
Hammer/Rod Type: N.A./AWJ  
Rig: Acker Renegade  $C_E = 1.3$

Groundwater Observations

| Date | Depth (ft) | Notes |
|------|------------|-------|
|      |            |       |
|      |            |       |
|      |            |       |

| 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          |            | Field Note, Asphalt 0.0'-0.6'                                                                                                                                                                                                                                                                                                                                                    |                |                     |                       |                          |                    |          |        |         |
|            |            | Field Note, Brown sandy cuttings.                                                                                                                                                                                                                                                                                                                                                |                |                     |                       |                          |                    |          |        |         |
| 10         |            |                                                                                                                                                                                                                                                                                                                                                                                  |                |                     |                       |                          |                    |          |        |         |
|            |            | Field Note, Increased resistance from 11.0' to 13.0'. Driller noted possible cobbles/boulders                                                                                                                                                                                                                                                                                    |                |                     |                       |                          |                    |          |        |         |
| 15         |            | Field Note, Light brown cuttings in return wash                                                                                                                                                                                                                                                                                                                                  |                |                     |                       |                          |                    |          |        |         |
|            |            | Field Note, Light brown to gray cuttings with hard resistance and slow advance to 21.0'                                                                                                                                                                                                                                                                                          |                |                     |                       |                          |                    |          |        |         |
| 20         |            |                                                                                                                                                                                                                                                                                                                                                                                  |                |                     |                       |                          |                    |          |        |         |
|            |            | Field Note, Driller used 24" cleanout barrel to clear from 21.0' - 23.0'. Sample taken as bagged sample labeled "cleanout"                                                                                                                                                                                                                                                       |                |                     |                       |                          |                    |          |        |         |
| 25         |            | 23.0 ft - 28.0 ft, Greenish gray, Muscovite-chlorite-plagioclase-biotite PHYLLITE, muscovite-chlorite- with garnet. Some sulfides present. Rust splotches and faint orange staining along fracture surfaces. Core is highly fractured and crumbled. LOW RQD due to this. Unable to determine if mechanical or natural. Poor rock, BX, RMR = 25                                   | R-1 (60-65)    | 48 (0)              | 4                     | Top of Bedrock @ 23.0 ft |                    |          |        |         |
|            |            |                                                                                                                                                                                                                                                                                                                                                                                  |                |                     | 8                     |                          |                    |          |        |         |
|            |            |                                                                                                                                                                                                                                                                                                                                                                                  |                |                     | 3                     |                          |                    |          |        |         |
|            |            |                                                                                                                                                                                                                                                                                                                                                                                  |                |                     | 5                     |                          |                    |          |        |         |
|            |            |                                                                                                                                                                                                                                                                                                                                                                                  |                |                     | 4                     |                          |                    |          |        |         |
| 30         |            | 28.0 ft - 33.0 ft, Greenish gray to gray, Muscovite-biotite-chlorite-plagioclase PHYLLITE, Fine clusters of brassy yellow sulfides present. Rust splotches in areas of sulfides and few popouts. Joints are smooth. Core highly fractured/crumbled, LOW RQD due to this. Unable to determine if mechanical or natural.. Medium hard, Slightly weathered, Poor rock, BX, RMR = 25 | R-2 (60-65)    | 72 (0)              | 3                     |                          |                    |          |        |         |
|            |            |                                                                                                                                                                                                                                                                                                                                                                                  |                |                     | 3                     |                          |                    |          |        |         |
|            |            |                                                                                                                                                                                                                                                                                                                                                                                  |                |                     | 4                     |                          |                    |          |        |         |
|            |            |                                                                                                                                                                                                                                                                                                                                                                                  |                |                     | 5                     |                          |                    |          |        |         |
|            |            |                                                                                                                                                                                                                                                                                                                                                                                  |                |                     | 5                     |                          |                    |          |        |         |
|            |            | Hole stopped @ 33.0 ft                                                                                                                                                                                                                                                                                                                                                           |                |                     |                       |                          |                    |          |        |         |

Notes:

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